CIRSE 2021

SUMMIT

SEPTEMBER 25-28
ONLINE

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PART 1

**Abstracts of
Free Papers
sorted by presentation
numbers**

Aortic Intervention

FP-1

Long-term surveillance of sac size assessment in secondary type 1 endoleak

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Purpose: To assess secondary endoleaks and sac size increase during EVAR long-term surveillance.

Materials and Methods: From January 2011 to December 2016, 216 consecutive patients (195 male) underwent EVAR for AAA were retrospectively reviewed. Secondary endoleak was defined as those detected more than 30 days after the procedure and after previous negative imaging. The medium term follow up was 45 months (1-121months). Axial CT was used for sac size assessment. Cross-tabulations were checked with chi-squared test or by Fisher exact test.

Results: Secondary endoleak was present in 55/216 (25%) patients. Secondary endoleak Type2 (E2) was present in 46/55(84%) patients and Type 1(E1) in 9/55(16%). The medium time for secondary endoleak detection was 17.4 months for E1 and 13months for E2, $p<0.0005$ Fisher exact test. 29/55 (52%) patients had an increase of the aneurysmatic sac $p=0.0964$. All patients with secondary E1 presented sac increased. Medium sac enlargement was 17.4mm for E1 and 3mm for E2, $p<0.0001$ Fisher exact test. Among patients with a sac increase, E1 required at least 2 further procedures with an average of 2,334 vs 1,034 of E2, $p=0.0003$.

Conclusion: Secondary E1 detection is a later diagnosis, with significant enlargement of the aneurysmatic sac and requiring further intervention, conferring a necessity for long-term surveillance.

FP-2

Staged hybrid single lumen reconstruction (TIGER) in management of chronic symptomatic complex type B aortic dissection

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Purpose: To report an innovative technique, Staged Hybrid Single Lumen Reconstruction (TIGER) in Management of Chronic Symptomatic Complex Type B Aortic Dissection. TIGER technique was adopted as a tool for total aortic remodelling with true lumen expansion, false lumen regression and complete thrombosis, and stabilization of overall aortic diameter.

Materials and Methods: Aortic dissection cases ($n=5$) were managed by TIGER technique, which included creating a single lumen from the supra celiac, infra-diaphragmatic aorta to both common iliac arteries with open surgical patching of the visceral arteries; followed by TEVAR three months later (mean follow-up 16 months, range: 6-28 months). All had aneurysmal dilation, 60% had acute pan aortic dissection, and 40% had CS-TBAD.

Results: Sixty percentages of the patients required a left subclavian artery chimney graft, while twenty percentages required bilateral subclavian to carotid artery transposition. No spinal drainage was needed, and all patients had intra-operative trans-oesophageal ECHO for wire guidance. There was no aortic rupture or retrograde type A dissection, and no renal, visceral, cardiac, pulmonary, or spinal complications. All, but one patient went off their antihypertensive medication. A hundred percentages of the patients' maintained normal eGFR postoperatively, with accelerated aortic modulation.

Conclusion: Our clinical experience showed that TIGER is effective at the semi acute stage to initiate remodelling and prevent malperfusion, facilitating a straightforward TEVAR at stage 2, which was made easier by avoiding visceral branch stenting. Moreover, the stented aortic segment's length was decreased, avoiding critical shattering, branch dislodgment, and visceral compromise, including spinal ischemia and negative cardiovascular consequences.

Biliary intervention

FP-3

Value of serum score of inflammation in predicting survival of patients undergoing percutaneous transhepatic cholangiography and biliary drainage

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Purpose: The prognosis for patients undergoing percutaneous transhepatic cholangiography (PTC) is poor, and selection of patients unlikely to benefit from active treatment remains imprecise. The aim of this observational study was to assess the value of serum scores of inflammation in predicting the prognosis of patients being considered for PTC.

Materials and Methods: Consecutive patients undergoing PTC between January 2016 and January 2019 in one region were included. Patient and disease characteristics were recorded. A modified Glasgow Prognostic Score (mGPS), Neutrophil-lymphocyte ratio (NLR) and Platelet-lymphocyte ratio (PLR) were calculated, and pathological characteristics including benign versus malignant disease, site of obstruction (intrahepatic versus extrahepatic), pathological diagnoses and staging, were recorded from the electronic patient record.

Results: A total of 223 patients (mean age 71-years, 53% male) were included in our study, 165 (26%) of whom had malignant indications for PTC. Median survival was 82-days in the malignant group and 695-days in the benign group. A high neutrophil-lymphocyte ratio (>5) defined a poor prognosis cohort within the malignant group, with a median survival of 61-days versus 186-days in those with a low neutrophil-lymphocyte ratio (<5), $p=0.002$. Patients with evidence of metastatic disease and a high neutrophil-lymphocyte ratio had the lowest median survival of 45-days, $p<0.001$. Other clinicopathological factors did not significantly stratify survival in patients with malignant disease.

Conclusion: A high neutrophil-lymphocyte ratio identified a poor prognosis group of patients with malignant indications for PTC. If proven reproducible, this may aid decision-making when identifying patients for whom end of life care may be more appropriate.

FP-4

Silicone based PTC simulator

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Purpose: To develop a percutaneous transhepatic cholangiography and drainage (PTCD) simulator with technical and anatomical accuracy that can be used in the set of fluoroscopic and ultrasound guided interventions training, using the same tools as in real life practice.

Materials and Methods: We created a 3D printed silicon liver model with intrahepatic bile ducts based on a manual segmentation of a triphasic computed tomography (CT) scan. The simulation was performed in the angio-suite using all relevant radiological protection, the participants were able to puncture the biliary tree with ultrasound or with fluoroscopic guidance, using different angles of the C-arm. The experience of the participants varied from no previous experience in IR to several years of

experience. For the puncture we used a 20G Chiba needle attached to an extensor tube and a syringe with iodine contrast. After a successful puncture of the biliary tree, the complete workflow of a PTC procedure was performed under the instructions of the authors. The simulator was tested in Switzerland with 20 participants from different hospitals. After using the model, the participants evaluated the simulation through a questionnaire.

Results: The silicone based PTC simulator was significantly better rated in terms of applicability and closeness to reality than our previous efforts. Most of the participants felt better trained for performing a PTC in a real patient after using our model.

Conclusion: This proves the importance of simulation devices to reach and improve medical procedure skills without putting patients at risk.

FP-5

Safety and efficacy of a new fully biodegradable stent for patients with benign biliary obstruction

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Purpose: The management of benign biliary strictures not suitable for endoscopy is controversial. Recently, a new fully biodegradable stent (Archimedes, AMG) has developed. Thanks to its helical design, the bile flow both on the inner and on the outer surface of the device. Aim of our study is to analyze its safety and efficacy in patients with benign biliary obstruction.

Materials and Methods: From January 2020 to January 2021 we treated percutaneously 7 patients (6 males, 1 female, mean age 63.3 years) with symptomatic biliary obstruction (6 bilio-digestive/duct-to-duct anastomosis obstruction, 1 choledocolithiasis). All the patients previously underwent at least one unsuccessful endoscopic or percutaneous (biliary) procedure. Median follow-up was 6 months. We collected intraprocedural data and clinical-laboratoristic data.

Results: We observed a 100% technical success and a 0% intraprocedural complication rate. In one case the first stent was pushed beyond the obstruction: a second stent was then successfully placed. All patients showed a reduction in bilirubin (mean values: 4.35 mg/dL before and 1.12 mg/dL after the procedure) and gamma-glutamyltransferase (mean values: 319.25 U/L before and 154.6 U/L after the procedure) at last follow-up. Six patients (85.7%) showed no one clinical relapse at 2-14 months follow-up. One patient had three episodes of fever, promptly resolved with only paracetamol.

Conclusion: Archimedes stent is a new safe and effective device to treat benign biliary obstructions. Good bile patency seems to be preserved even after its degradation.

FP-6

Percutaneous cross mesh stenting for palliative treatment of perihilar malignant biliary obstructions with a novel metal stent: technical aspects, safety, and clinical outcome

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Purpose: Intrahepatic malignant biliary obstruction (IMBO) often extends to confluence of secondary ducts causing a limited efficacy of conventional stent-in-stent (SIS) or side-by-side (SBS) stent placement techniques. The HILZO Biliary Moving Cell is a novel metallic stent developed for SIS with a smaller cell size designed for crossing through any part of the stent to allow for drainage of more liver segments. We investigated the applicability of the HILZO stent in the palliative treatment of IMBO with secondary biliary confluences involvement.

Materials and Methods: 22 patients with IMBO for primary biliary tumor or metastases were included in this retrospective, single-center study. All patients underwent percutaneous cross mesh stenting (p-CMS) with ≥ 2 HILZO stents deployment. Technical and clinical success, complications, and stent patency were analysed.

Results: Median age was 72 years (range 43 – 89). Cross mesh stenting was technically successful in all cases. P-CMS was performed with 2 stents in 8/22 patients, 3 stents in 11/22 patients and with 4 stents in 3/22 patients. Clinical success was achieved in 21 patients (95.4%), with a median bilirubin blood concentration that dropped from 8mg/dL to 2mg/dL after 7 days, remaining stable at one-month follow-up. Six patients had minor complications. No major complications were reported. Median follow-up was 93 days, with a 95.5% patency rate. Stent dysfunction due to tumor ingrowth occurred in 1 patient

Conclusion: P-CMS with HILZO stents is a safe and an effective method for palliation of IMBO involving secondary confluences.

FP-7

Biliary metal stent patency rate: long term national analysis

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Purpose: To evaluate biliary metal stent patency rate in biliary malignancies related to the frequency of biliary metal stent insertion in the hospital.

Materials and Methods: All reported patients with biliary tract malignancy treated with metal stent insertion in Czechia in 2010-2018 were enrolled in this retrospective analysis. According to frequency of metal stent insertion hospitals in Czechia were divided into 3 groups (over 54; 20-54; less than 20 metal stent implantations). Except metal stent patency rate (log rank test), possible risk factors like age, gender, anatomical location of biliary cancer and its stage were analyzed (uni and multivariate analysis, Cox-regression).

Results: 562 patients with median biliary metal stent patency rate of 4.2 months (95%CI 3.5-4.9) while 106 patients underwent metal stent recanalization and 456 patients died without recanalization. Metal stent patency rate was significantly better in hospitals with 55 and more implanted stents compared to hospitals with 20-54 and less than 20 implanted stents during the study period (median patency 5.8 vs 3.2 vs 3.7 months, $p=0.004$ and $p=0.012$). Worse patency rate was further observed in gall bladder cancer (HR 1.431(95%CI 1.152-1.778), $p=0.001$) and advanced stages of biliary malignancy (HR in TNM stage 2,3 and 4 were 1.447(95%CI 1.044-2.005), 1.257(95%CI 0.885-1.784), and 1.914(95%CI 1.410-2.598)).

Conclusion: Reported biliary metal stent patency rate in biliary cancer was significantly better in hospitals with higher frequency of metal stent implantations.

FP-8

Biliary obstruction in patients with gallbladder cancer: national registry-based analysis

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Purpose: To compare effectiveness of plastic and metal stents insertion on survival in patients with gallbladder cancer.

Materials and Methods: 3741 patients with diagnosis of gallbladder cancer between 2010-2018 were extracted from the databases of The Czech National Cancer Registry. The analysis was supported by data from the National Registry of Paid Health Services and the Death Records Database. 934 and 201 patients underwent plastic drain insertion and metal stent insertion, respectively. Patients treated with surgical procedure

prior or after interventional procedure were analyzed separately. Overall survival after drain/stent insertion and disease diagnosis was assessed. Descriptive statistics and Kaplan-Maier analyses were used.

Results: 577 patients with plastic drain insertion and 128 patients with metal stent insertion were enrolled for survival analyses. The survival after plastic drain and metal stent insertion was 2.7 months (95%CI 2.4-3.0) and 3.2 months (95%CI 2.6-3.7), respectively, $p > 0.05$. The patients with inserted plastic drain followed by surgical treatment survived 3.2 - 15.1 months, patients treated only with plastic drain just 1.7 (95%CI 1.5-2.0) months. Insertion of plastic drain after surgery results in survival of 10.1 - 13.1 months. The metal stent insertion in patients without any additional treatment results in survival of 2.4 (95%CI 0.7-4.2) months.

Conclusion: According to population-based data, the treatment of biliary obstruction in patients with unresectable gallbladder cancer with metal stent insertion is not accompanied with survival benefit compared to treatment with plastic drain. Data gathering from cancer register databases can provide further information on treatment effectiveness.

FP-9

Combined antegrade X-ray interventional and antegrade endoscopic treatment of "difficult" choledocholithiasis

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Purpose: To determine the possibilities of combined use of antegrade X-ray interventional and endoscopic methods of treatment of "difficult" choledocholithiasis

Materials and Methods: Antegrade laser lithotripsy was performed in 31 patients with concrements from 18 to 37 mm.

The average age of the patients was 75.3 ± 10.4 years.

Indications:

Inability to perform endoscopic retrograde lithotripsy and lithoextraction; Ineffectiveness of endoscopic retrograde and antegrade mechanical lithotripsy.

The technique was performed in 2 stages: 1 - the formation of antegrade access to the biliary tract and its decompression by applying percutaneous transhepatic external-internal cholangiostomy; 2-after decompression of the biliary tract and the formation of a manipulative channel on the drainage: an introducer with a diameter of 10 Fr (3.3 mm) is installed in the lumen of the lobar duct after gradual penetration, through which a video endoscope is conducted, inserted into the lumen of the bile ducts. Cholangioscopy is performed, the concretion is visualized, optical fiber is applied to the concretion - X-ray and video lithotripsy are performed under double control.

Results: The duration of the operation is 86.3 ± 15.3 minutes.

Blood loss up to 20 mm

The postoperative day is 8.3 ± 1.5 .

Stay in the intensive care unit for no more than a day

Complications 2 (6.5%): left lobe hematoma is percutaneously drained, acute pancreatitis is conservative

Deaths - 0

Conclusion: This method of treatment of "difficult" choledocholithiasis is feasible, effective and safe, and allows for surgical treatment in patients with a burdened history, severe concomitant diseases, and high operational and anesthetic risk.

Biopsy and drainage

FP-10

Role of contrast-enhanced ultrasonography (CEUS) in percutaneous drainages of abdominal abscesses and inflammatory fluid collections not detectable at B-mode US

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Purpose: Evaluate the role of contrast-enhanced ultrasound (CEUS) as a powerful tool and aid to better identify and define abdominal abscesses and inflammatory fluid collections, otherwise not detectable by Duplex B-mode US, to allow a safer percutaneous drainage

Materials and Methods: We retrospectively considered, from June 2020 to January 2021, 14 patients (medium age 53 years-old, 8M-6F), with CT diagnosis of abscesses and inflammatory fluid collections in paracolic-perisigmoid seat (6), in precoccygeal-presacral site (3) and perirenal-retroperitoneal site (5). In all cases, the identification of the target abscess/fluid collection by B-mode-US was not possible, due to intestinal bloating and gas bubbles into the abscesses, and CE-US (Sonovue, sulfur hexafluoride) was employed to better identify and delineate them to finalise the placement of a percutaneous drainage. We considered a portal-venous and late-venous phase (60-180 sec) to identify them. All procedures performed in angiographic suite, employing Convex probes, followed by fluoroscopic guide and corroboration. We employed CHIBA coaxial 18G needles, stiff 0.035" guidewires and 8-10Fr catheters for the drainage

Results: Technical success achieved in 93% (13/14) patients: in 1 patient with abscess in precoccygeal-presacral site, drainage was not possible due to overlay of non-passable bone structures. In all cases, the target abscess/fluid collection was identified with more accuracy, and in 13/14 patients the placement of a percutaneous drainage was allowed with more precision and safety. In none of the cases major complications such as bleeding or haemorrhage due to injury to abdominal/pelvic parenchyma or great vessels occurred

Conclusion: The elevated rate of technical success, the absence of major complications and the faster performance, suggest the added value of CEUS as an advantageous tool to better identify and delineate abdominal abscesses and inflammatory fluid collections not detectable by B-mode-US, to allow a safer and more precise placement of a percutaneous drainage

FP-11

Role of contrast-enhanced Ultrasonography (CEUS) in percutaneous biopsy of abdominal soft-tissue focal lesions not detectable at B-mode US

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Purpose: Evaluate the role of contrast-enhanced ultrasound (CEUS) as a powerful tool and aid to better identify and define soft tissue tumours in abdominal cavity, otherwise not detectable by Duplex B-mode US, to allow their safer percutaneous biopsy

Materials and Methods: 12 patients (medium age 57 years-old, 5 M 7 F) with radiological (CT/MRI) diagnosis of focal liver lesions (7), focal lesions of the cephalic portion of pancreas (3) and malignant recurrence after duodenum-pancreatectomy in pancreatic loggia (2), have been retrospectively considered between January 2020 and January 2021. In all cases the identification of the target lesion by Duplex B-mode US was not possible and CE-US (Sonovue, sulfur hexafluoride) was employed to better delineate them and finalise their percutaneous biopsy. We

considered an arterial phase (20-25 sec) and a venous phase (60-90 sec) to identify them. In all cases a 18 G vacuum-assisted needle was used

Results: Technical success was achieved in all (12) patients and in all cases the target lesion was identified with more accuracy and the percutaneous biopsy allowed with more precision and safety. In all patients 2 samples were taken and the confirmation of diagnostic biologic material came from the histologic corroboration. In none of the cases the sampling was not possible and in none of the cases major complications such as bleeding or haemorrhage due to injury to abdominal parenchymas or great vessels occurred

Conclusion: The elevated rate of technical success reported, the absence of major complications and the faster performance, confirm the added value of CEUS as advantageous tool to better identify and delineate abdominal soft tissue focal lesions not detectable by Duplex US to allow their safer and faster percutaneous biopsy

FP-12

Diagnostic accuracy and complication rates of CT-guided percutaneous transthoracic needle biopsies: comparison of fine needle aspiration, coaxial core needle biopsy, and their combination

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Purpose: We conducted a retrospective analysis to evaluate diagnostic outcomes and complication rates of CT-guided fine-needle aspiration, core biopsy, and their combination.

Materials and Methods: Hundred and thirty percutaneous transthoracic needle biopsies (PTNBs) performed from November 2016 to November 2018 were included in the study. The accuracy, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of PTNBs for diagnosis of malignancy were compared depending on the biopsy method. All biopsies were performed by the same interventional radiologist. Core biopsies were performed twice with a 20-gauge needle.

Results: There was no significant difference between the compared biopsy methods concerning the effectiveness in detecting a malignancy ($\chi^2 = 4.468$; $p = 0.621$). Sensitivities were 91.7%, 89.4%, and 93.6% for the FNA, CNB, and combined techniques, respectively, while the diagnostic accuracy values were 90.0%, 87.5%, and 92.0% for the FNA, CNB, and combined methods, respectively. While the core needle biopsy method had the lowest specificity (50.0%), the fine needle aspiration method had the highest specificity (83.3%). When biopsy methods concerning complications and anatomical features were compared, there was a significant difference in only the length of the passed parenchyma ($p < 0.001$). CNB followed by FNA did not alter the diagnostic yield. In two of three nondiagnostic biopsy results, surgery revealed an adenocarcinoma/lepidic pattern.

Conclusion: The CNB is a well-established method to diagnose cancer type and subtype. Obtaining two specimens with a 20-gauge cutting needle is sufficient for the diagnosis. The transition from CNB to the combined approach does not increase the diagnostic accuracy.

FP-13

Minimally invasive excision of breast masses under ultrasound guidance: single center's five-year experience on the breast lesion excision system

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Purpose: To investigate the feasibility of percutaneous radiofrequency excision system (BLES) as a primary method of diagnosis and removal of small and indeterminate breast masses.

Materials and Methods: Ninety-six lesions in 95 patients (50.5±8.4 years of age) were treated between 2014-2019. Inclusion criteria were size (<20 mm), depth (>10 mm) and indeterminate/suspicious radiological/clinical findings (92 BI-RADS 0-3, 4 BI-RADS 4). The procedure was performed on outpatient basis under ultrasound (US) guidance using 6 G retriever probe with different basket sizes.

Results: Lesions were between 5-20 mm (12.3±3.8 mm) in length. A 12 mm basket was used in 16, 15 mm basket in 28, and 20 mm basket in 52 lesions. All lesions, except one, were removed at first attempt. A technical complication, retrieval of an empty basket, was occurred in one patient. Accordingly, the resection rate was 98.9% and the technical success rate was 97.9%. All samples were histopathologically adequate for confident diagnosis. Eight-six lesions were histologically benign and ten lesions were neoplastic. Surgical margin was found to be negative in six of the neoplastic cases. Accordingly, complete excision rate was 60%. Four lesions were upgraded to high-risk, one lesion was upgraded to malignant and three lesions were downgraded to benign pathologies. No major complication was encountered. The only minor complication was a self-limited bleeding in two cases with a rate of 1.58%. Patients were followed for a period of 18 months to 7 years and no recurrence was observed.

Conclusion: BLES is an effective and safe alternative to surgical resection and excisional biopsy in suitable lesions.

FP-14

Comparison between CBCT and fusion PET/CT-CBCT guidance for lung biopsies

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Purpose: To establish the feasibility of performing percutaneous biopsy of lung lesions guided by fusion PET/CT-CBCT and to evaluate whether the metabolic information provided by a prior PET/CT scan add incremental benefits for diagnosis.

Materials and Methods: We retrospectively reviewed data from 180 patients who underwent CBCT-guided lung biopsy (group 1-90 cases) or PET/CT-CBCT fusion-guided lung biopsy (group 2-90 cases). Technical and clinical success was calculated. We also evaluated the agreement between biopsy and definitive histology and the possibility to carrying out immunohistochemical and molecular biology analyses.

Results: Technical success was achieved in 84/90 (93.3%) cases for group 1 and 89/90 (98.9%) for group 2 cases ($p = 0.054$). Clinical success was achieved in 80/94 (95.2%) cases for group 1 and 88/89 (98.9%) cases for group 2. Sensitivity, specificity, positive and negative predictive values and accuracy rate were, respectively, 94.5%, 100.0%, 100.0%, 73.3% and 95.2% for group 1 and 98.6%, 100.0%, 100.0%, 94.4% and 98.9% for group 2 ($p = 0.167$). Agreement between biopsy and definitive histology was reached in 85.7% for group 1 and in 96.2% for group 2 ($p = 0.211$). Immunohistochemical and molecular biology investigations were

possible in 66.7% for group 1 and in 77.0% for group 2 ($p = 0.297$). No major complication occurred.

Conclusion: PET/CT-CBCT-guided lung biopsy is a feasible technique. In our retrospective case series, we found a higher clinical success rate, but no statistical difference was found.

FP-15

Comparison between PET/CT - CBCT fusion guided biopsies in areas with different 18F-FDG-PET uptake in large lung tumors: a preliminary experience

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Purpose: The purpose of this study is to demonstrate the correlation between the SUV of a lesion pulmonary and the diagnostic value of the sample taken by percutaneous biopsy PET / CT-CBCT-guided

Materials and Methods: In 10 patients with lung lesions (diameter > 30mm) characterized by an dishomogeneous uptake of 18F-FDG to PET / CT. These patients have been subjected to biopsy sampling in the areas of the lung lesion with the maximum and minimum SUV . Diagnostic effectiveness has been calculated. For each sample obtained the anatomopathologist have reported the percentage of neoplastic, inflammatory and fibrotic cells and analysed the possibility of performing further immunohistochemical or molecular biology investigations.

Results: Nine lesions were found to be malignant, one benign (inflammation). The diagnostic effectiveness was 100% (10/10) for the group of samples in the SUV areas maximum and 70% (7/10) for the group of samples in the areas with minimum SUV ($p = 0.21$). In the first group, higher percentages of neoplastic cells were found by the pathologist, while in the second group the more represented were areas of inflammation and fibrosis. The profile biomolecular was obtained in 100% of cases (9/9) of the first group, while in the second group only in 33.3% of cases (2/6), with a statistical significant difference between the two groups ($p = 0.011$).

Conclusion: The use of the PET / CT-CBCT technique as a guide for percutaneous lung biopsies therefore allows biopsy collection in the areas richer in neoplastic cells, thus obtaining more useful information for the planning of patient-tailored cancer treatments.

Bone, spine and soft tissue intervention

FP-16

Radiofrequency ablation for palliative treatment of osseous metastases results in rapid, significant, and durable improvements in pain relief and quality of life: results from the OPuS One trial

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Purpose: To evaluate the performance and safety of radiofrequency ablation (RFA) for the palliative treatment of patients with painful bone metastases.

Materials and Methods: OPuS One (NCT03249584) was a multicenter prospective trial. 218 subjects with painful bone metastases ($\geq 4/10$ worst pain, Brief Pain Inventory [BPI], at target treated site). RFA was performed under image guidance at one or two locations followed by optional vertebral augmentation. Subjects' pain (BPI) and quality of life (EQ-5D) scores were followed up to 12 months post RFA. Device-, procedure-, and/or therapy-related adverse events (AEs) were collected.

Results: 206 subjects (55% female; mean age, 63.7 years) were treated with RFA. Primary cancers included breast (23%), lung (23%), and kidney (10%). 184 (89%) subjects were treated for thoracolumbar lesions and 22 (11%) subjects for lesions involving pelvic and/or sacrum. Subjects reported significant improvement in worst pain from baseline at 7.8 to 5.5, 4.7, 3.6, 3.2, 2.4, and 2.6 at three days, one week and one, three, six, and 12 months post RFA, respectively ($p < 0.0001$ all visits). Significant improvements were seen in average pain ($p < 0.0001$ all visits), pain interference ($p < 0.0001$ all visits), and quality of life ($p < 0.0001$ all visits). Six AEs were reported with three as serious. 82 deaths were reported during the study, none were related to the device, therapy, and/or procedure. No skeletal related events were reported.

Conclusion: In a large prospective multicenter trial, RFA provided rapid, significant, and durable improvements in pain relief and quality of life up to 12 months.

FP-17

Interobserver delineation variation for bone metastasis treatment planning with MRI guided high intensity focused ultrasound

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Purpose: MR-HIFU is a non-invasive image-guided treatment modality that can be used for pain palliation in patients with painful bone metastases by thermal ablation of nerves in the periosteum. Clinical trials have shown promising results with pain responses improved from 67% to 88% on the NRS pain scale. MR-HIFU targets the metastasis and the surrounding healthy periosteum. However, while MRI allows to target the metastasis it does not allow to visualize the periosteum. Therefore, image interpretation by the radiologist may play a key role in target definition. Currently, a European multi-center randomized clinical trial is ongoing to assess the role of MR-HIFU in pain palliation of bone metastases (FURTHER, H2020). Within FURTHER we studied the interobserver variation for target delineation by means of a retrospective analysis on available data.

Materials and Methods: T1w images from the preparatory trial (Pre-FURTHER, NCT04310410) acquired in treatment position for five patients treated with painful metastasis were used. Radiologists with MR-HIFU experience independently manually segmented the metastatic tumor volume (MTV) and the desired ablation volume (AV). The dice similarity coefficients (DSC) across all observers were calculated per patient for both MTV and AV. The mean and standard deviation across all patients is reported.

Results: Five observers performed the delineations so far. The observed mean MTV was 0.51±/0.15. While the mean observed AV was 0.35±/0.17.

Conclusion: Preliminary results indicate superior agreement for the segmented MTV. Whether and how the variations observed would impact treatment outcome, will be investigated within the FURTHER consortium. Full results will be presented at CIRSE.

FP-18

12-month mortality and morbidity in patients with osteoporotic vertebral compression fractures treated with vertebral augmentation

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Purpose: To investigate the 12-month all-cause mortality and morbidity in patients with osteoporotic vertebral compression fractures (OVCFs) undergoing vertebroplasty/balloon kyphoplasty (VP/BKP) versus non-surgical management (NSM).

Materials and Methods: 19 studies, published between 2010 and 2019, and reporting on mortality and morbidity after VP/BKP in patients with OVCFs were selected. Estimates for each study were reported as Odds Ratios (OR) along with 95% Confidence Intervals (CI) and P-values. Fixed or random-effects meta-analyses were performed. All tests were based on a two-sided significance level of 0.05.

Results: Pooled OR across 5 studies favored VP/BKP over NSM in terms of 12-month all-cause mortality (OR: 0.81 [95% CI: 0.46-1.42]; P = .46). Pooled OR across 11 studies favored VP/BKP over NSM in terms of 12-month all-cause morbidity (OR: 0.64 [95% CI: 0.31-1.30]; P = .25).

Furthermore, 12-month infective morbidity from any origin confirmed the benefit of VP/BKP over NSM (OR: 0.23 [95% CI, 0.02-2.54]; P = .23).

Conclusion: Compared to NSM, VP/BKP reduces the 12-month risk of all-cause mortality and morbidity by 19% and 36%, respectively. Moreover, VP/BKP reduces by 77% the 12-month risk of infection from any origin.

FP-19

Intra-articular application of Sluiter-Teixera Poisson pulsed radiofrequency in symptomatic patients with knee osteoarthritis: focus upon clinical efficacy and safety

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Purpose: To retrospectively evaluate the effectiveness of intra-articular application of Sluiter-Teixera Poisson pulsed radiofrequency (STP PRF) in knee osteoarthritis symptomatic patients with chronic pain refractory to conservative therapies.

Materials and Methods: Institutional database research of two centers identified 39 cases of knee osteoarthritis patients treated with intra-articular STP PRF. Pain prior, one week, one, three, six and 12 months post STP PRF was compared by means of a numeric visual scale (NVS) questionnaire. Cardiovascular and Interventional Radiological Society of Europe (CIRSE) classification system was used for complications reporting. Mean patient age was 71.59±11.99 years, mean body mass index was 30.23±4.69 and male/female ratio was 9/30.

Results: Mean baseline pain score was 8.31 ± 1.70 NVS units. This was reduced to a mean value of 0.90 ± 1.50 NVS units one week post-RF, 1.08 ± 1.53 at one month, 1.54 ± 1.88 at three months, 2.33 ± 2.17 at six months, and 3.23 ± 2.23 at 12 months of follow-up (p<0.01). Pain decrease of more than 4 NVS units was noticed in 35/39 knees (89.7%) at first week, 36/39 knees (92.3%) at first month, 35/39 knees (89.7%) at three months, 32/39 knees (82.1%) at six months and 25/39 knees (64.1%) at one year. There was no recurrence during the follow-up. No complication was observed.

Conclusion: Percutaneous, intra-articular application of STP PRF is an effective and safe technique for chronic pain reduction in patients with knee osteoarthritis. Results seem to be reproducible and long lasting with significant patient satisfaction at 12 months follow-up.

FP-20

Simulation based curriculum for fluoroscopy guided lumbar puncture in a medical student cohort

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Purpose: Spine interventions, such as lumbar punctures (LPs), are common but potentially risky procedures if performed without proper training. It is important for doctors-in-training to practice these technical skills to develop the confidence necessary to perform procedures independently. The purpose of this study was to assess the impact on medical student comfort and knowledge of LPs following a didactic and simulation-based training session.

Materials and Methods: A 45-minute didactic course and 2-hour hands-on simulation training session with a fluoroscopy compatible lumbar spine phantom was designed for a small group of medical students. Twenty senior medical students (MS4) completed the course. A pre-test and post-test were designed to evaluate student's knowledge of lumbar spine anatomy, radiation safety, LP indications and contraindications, and LP technique. Additional questionnaire assessed student's confidence with lumbar spine anatomy, equipment used, and procedure technique

on an incremental 5-point Likert scale. Analysis was preformed using paired T test.

Results: Results from the 20 MS4s who participated in the course demonstrate statistically significant increase (greater than 1.4 points on a 5-point scale across all categories) upon survey of student's level of confidence with regards to anatomy, equipment, and LP technique after completing the course. A statistically significant improvement ($P < 0.001$) in the average post-course test score was observed (91% average, standard deviation 8.8%) as compared to the pre-course test (51% average, standard deviation 13.8%).

Conclusion: Our preliminary results demonstrate education-enhanced simulation training has a favorable impact on medical student learning and should be considered when teaching invasive procedures.

FP-21

Percutaneous cementoplasty of periprosthetic loosening: can interventional radiologists offer an alternative to revision surgery?

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Purpose: To evaluate feasibility and validate both safety and efficiency of radiological percutaneous periprosthetic bone cementoplasty (RPPBC) performed under local anesthesia as an alternative minimally invasive treatment of aseptic implant loosening.

Materials and Methods: In this case series, seven patients (mean age 81 years, range 73 to 89 years, 2 men and 5 women) were enrolled between February 2011 and January 2020 with confirmed aseptic loosening of orthopedic implants. One patient presented with tibial component loosening of an unicompartmental knee arthroplasty, one with glenoid component loosening from a reverse shoulder arthroplasty, one femoral gamma nail, and four presented with pedicle screw loosening after staged posterior lumbar interbody fusion. All patients underwent clinical, biochemical, and imaging assessments to confirm the diagnosis of aseptic loosening. All benefited from RPPBC under dual CT and fluoroscopic guidance. All procedures were performed under local anesthesia by an experienced radiologist. Preprocedural, immediate and 6-month post-cementoplasty pain levels on a visual analogue scale (VAS), and functional outcomes were evaluated. Immediate and 6-month postprocedural CTs were performed to evaluate the treated region.

Results: All RPPBC were well tolerated by patients throughout the procedure. None of the patients suffered from local or systemic infection post-RPPBC, or periprosthetic fractures. No recurrent implant loosening was observed. Six patients were pain free at 6 months. All patients expressed functional improvements during validated outcome score evaluations.

Conclusion: RPPBC appears to be an efficient and reliable treatment strategy for aseptic loosening of orthopedic implants in elderly patients deemed unfit for revision surgery.

FP-22

Efficacy and safety of a new percutaneous interspinous spacer: a multicenter study

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Purpose: To retrospectively evaluate safety and efficacy of a new percutaneous interspinous process device (IPD) (Lobster®, Techlamed, Firenze, Italy) in 255 patients with degenerative lumbar spinal stenosis (DLSS) from 3 different centers.

Materials and Methods: From November 2016 and March 2020, 255 patients (125 male, age 71.2 years old, range 49-91) with neurogenic

intermittent claudication because of DLSS related to mono/bi-segmental lumbar central canal and/or foraminal stenosis were enrolled in the present study.

Clinical outcomes were evaluated using Visual Analog Scale (VAS) and Zurich Claudication Questionnaire (ZCQ) before and at 6-month follow-up. Technical success was defined as correct placement of the IPD demonstrated with computer tomography (CT), performed immediately after treatment; spinoplasty was accomplished in patients with osteoporosis/osteopenia.

Results: A total of 290 levels have been treated (L2-L3=11), L3-L4=90, L4-L5=179) and L5-S1 =10); in 28 patients more than 1 device were implanted in the same session (max 3 IPD); 6 patients required a second implant in different session.

172 prophylactic spinoplasties have been performed in our series (59.3%). We registered 99.6% success rate (257/258), because of spinal process rupture (N=1).

3 devices misplacement has been successfully treated with Lobster® retrieved and new device deployment.

Most patients (N=254, 99.6%) had improvement in symptoms; the mean pre-Lobster VAS score was 7.8; VAS score was decreased to 2.9 at 6-month follow-up ($p < 0.001$).

The mean pre-Lobster ZCQ was 56.4 and the post-Lobster ZCQ was 28.6 ($p < 0.001$).

Conclusion: The Lobster®IPD could be considered a safe and effective totally percutaneous minimally-invasive decompression procedure in DLSS.

FP-23

Magnetic resonance guided focused ultrasound surgery versus external beam radiation therapy for the treatment of painful bone metastases: a phase II trial

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Purpose: To assess the efficacy of MR guided Focused Ultrasound (MRgFUS) for the palliative treatment of painful bone metastases in comparison to external beam radiation therapy (EBRT).

Materials and Methods: This prospective double-arm phase II study was conducted between December 2018 and November 2019. Participants with painful bone metastases were included in the trial and underwent either MRgFUS or EBRT. The primary end point was improvement in self-reported pain score assessed by using Visual Analogue Scale (VAS) 1 month after treatment. Secondary end point was the improvement in VAS at 12-month and quality of life (QoL) assessed by QoL Questionnaire Cancer 15 Palliative Care (C15-PAL) and QoL Questionnaire Bone Metastases 22 (BM22). Statistical analysis was conducted using a per-protocol principle.

Results: 198 study participants were included; 100 participants (mean age, 63.2 years $\pm$ 13.4) underwent MRgFUS and 98 (mean age, 65.3 years $\pm$ 14.5) underwent EBRT. Response rate for the primary endpoint was 55% in the MRgFUS arm and 30% in the EBRT ($p = 0.001$). No significant difference between groups was found for BM22 and C15-PAL. Subtests analysis of C15-PAL for areas of physical function ($p = 0.002$), appetite ($p < 0.001$), nausea and vomiting ($p < 0.001$), dyspnea ($p < 0.001$) and quality of life ($p < 0.001$) showed significant differences in favor of MRgFUS.

Conclusion: MRgFUS in comparison to EBRT showed promising response when used as a palliative treatment in patients with painful bone metastases.

FP-24

Pre-operative embolization in bone and soft tissue pelvic tumors: an experience in tertiary care oncology centre in India

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Purpose: To evaluate the role of preoperative embolization in surgical management of pelvic tumors.

Materials and Methods: Prospective study of 256 patients with large/hypervascular bone and soft tissue pelvic tumors who underwent pre-operative embolization prior to surgical resection between June 2015 to January 2021. Initial angiogram of all possible blood vessels supplying the tumor were obtained, followed by selective distal catheterization of the vessels demonstrating tumour blush. Embolization was achieved using PVA particles with or without gel foam till there was significant reduction in tumor blush. Intra-operative blood loss was calculated as the difference between the volume in the suction container and the sterile irrigation fluid used plus difference between the dry and wet weight of surgical gauges and sponges used. The procedure was performed using GE INNOVA 41001Q in Cathlab.

Results: Mean estimated blood loss in pelvic tumors was 1118 +/-852ml. Estimated blood loss (EBL) increased with increased operating time showing strong positive correlation (r value=0.678, P value<0.0001). Estimated blood loss was more in patients with larger tumors. There was moderate positive correlation between EBL and maximum tumor dimension (r =0.508, P value<0.0001). There was reduction in the mean duration of surgery and ease of resection was better than expected. There was strong positive correlation between hospital stay and EBL(r =0.71, P value<0.001). There were no major complications attributed to pre-operative embolization.

Conclusion: Pre-operative embolization in pelvic tumors reduces the estimated blood loss during surgery leading to better delineation of the tumor margins, improving the ease of resection, reducing the operating time and the number blood transfusions without any significant complications.

FP-25

Pulsed radiofrequency for sciatica and disc herniation: a randomized trial

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Purpose: To determine whether combined treatment using pulsed radiofrequency (PRF) and epidural steroid injection (TFESI) was superior to TFESI alone for acute sciatica due to lumbar disc herniation (LDH).

Materials and Methods: This multicenter, double-blind, randomized trial involved patients with sciatica due to LDH not responsive to conventional medical and/or physical treatment. Patients were randomly assigned to receive a single session of PRF/TFESI, or TFESI alone. The primary outcome was leg-pain intensity (numerical rating scale, NRS, range 0 to 10) at week 1 following treatment; and at week 52 as a secondary time point. Secondary outcomes included Roland Disability Questionnaire for Sciatica and Oswestry Disability Index at 4, 12, and 52 weeks.

Results: Among 289 randomized patients, 145 received PRF/TFESI and 144 underwent TFESI. Baseline NRS was 8.1 ± 1.1 in the PRF/TFESI group and 7.9 ± 1.1 in the TFESI group. At week 1, NRS was 3.3 ± 0.2 in PRF/TFESI group and 5.0 ± 0.2 in TFESI group (adjusted mean difference, 1.67; 95% Confidence Interval [CI] 1.09 to 2.26; $P < 0.001$); at week 52, NRS was 1.5 ± 0.2 in PRF/TFESI group and 2.7 ± 0.3 in TFESI group (adjusted mean difference, 1.19; 95% CI, 0.52 to 1.86; $P < 0.001$). Secondary outcomes were in the same direction as the primary outcome. No adverse events were reported. Eleven patients in the PRF/TFESI group and 24 patients in the TFESI group required further interventional or surgical management.

Conclusion: In this trial of patients with acute sciatica caused by LDH, PRF/TFESI demonstrated faster and more durable control of leg pain over the course of 1 year follow-up as compared to TFESI alone.

FP-26

Clinical and radiologic outcome after positioning of a removable percutaneous interspinous process spacer: a first experience

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Purpose: To evaluate clinical and radiologic outcome of our first series of patients treated with a removable percutaneous interspinous process spacer (IPS) (LobsterProject® Techlamed®) for symptomatic degenerative lumbar spinal stenosis.

Materials and Methods: All patients treated in our two Centres with this IPS during 2019 were retrospectively reviewed. Patients with incomplete clinical or radiological documentation were not included. Procedures were held under profound sedation or general anaesthesia by two interventional radiologists. Patients were clinically evaluated before intervention and at 1-month follow-up with Visual Analog Scale for pain (VAS), Oswestry Disability Index (ODI) and radiologically with MRI or CT scan. Neural foramina were independently measured for each patient on pre- and post-procedural CT scan by two radiologists.

Results: Sixty-one patients were treated in the selected period and fifty-seven were selected (mean age 71.3 ± 9.3 y, range 51-92y, 32 males, 25 females). No procedural complications were reported. Clinical follow-up at 1 month showed a significant reduction of pain (VAS from 83 ± 9 to 29 ± 19 , -65%; $p < 0.001$) and an improvement in functionality (ODI score from $31 \pm 12\%$ to $13 \pm 10\%$, -58%; $p < 0.001$). There were four cases of unsatisfactory positioning (IPS too posterior) without clinical consequences and one case of spinous process fracture that required a percutaneous removal under local anaesthesia. Mean neural foramina area increased from $77 \pm 23 \text{ mm}^2$ to $95 \pm 27 \text{ mm}^2$ (+26%; $p < 0.001$) with very good inter-observer reliability (Cronbach's Alpha=0.899).

Conclusion: This first series of patient treated with this removable percutaneous IPS showed the safety profile of this procedure and the good clinical outcome at 1 month, associated with radiologic increase of foraminal area.

Clinical practice development

FP-27

Virtual reality for teaching image-guided procedures: a pilot study with ultrasound-guided paracentesis

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Purpose: Evaluate self-perceived procedural proficiency (SPP) and comfort (SPC) among trainees who used a virtual reality (VR) teaching module of an ultrasound-guided paracentesis (UGP).

Materials and Methods: A 360° instructional VR module of an UGP was created. Fourteen radiology trainees were randomly assigned to watch the module with a VR headset (VR group) or standard screen (non-VR group). Anonymous pre-/post-module surveys were performed. Data collected includes trainee level, prior experience with UGP, as well as changes in SPP and SPC. Ratings were assessed on a Likert-type scale of 1-9. Trainees were stratified by experience level, with less experience defined as having

performed <3 UGP, and trainee level, with junior trainees defined as PGY-2 or lower. Differences were analyzed using Mann-Whitney U test ($p < 0.05$). **Results:** 1 (7%) 4th year medical student, 1 (7%) post-graduate year 1 resident (PGY-1), 5 (36%) PGY-2, 3 (21%) PGY-3, and 4 (29%) PGY-4 participated in the pilot study. Rated effectiveness of the module in the VR group ($n=7$) was 6.86, compared to 5.86 in the non-VR group ($n=7$; $p=0.516$). Improvement in SPP and SPC did not significantly differ between the VR and non-VR groups (1.29 vs 0.29; $p=0.064$ and 1.71 vs 0.57; $p=0.132$). However, improvements in SPC but not SPP were greater among less experienced trainees ($n=4$) compared to more experienced trainees ($n=3$) (2.75 vs 0.33; $p=0.048$ and 2.00 vs 0.33; $p=0.069$).

Conclusion: A VR teaching module of UGP results is associated with increased self-perceived comfort among less experienced trainees. Further studies examining specific benefits of VR teaching modules are warranted.

FP-28

The impact of COVID-19 on IR practice: results from a global survey

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Purpose: The COVID-19 pandemic had an unprecedented impact on clinical practice and healthcare professionals. We aimed to assess how interventional radiology (IR) services were impacted by COVID-19.

Materials and Methods: 7125 CIRSE members were invited to participate. The survey was designed to assess changes in workflow and clinical management patterns. For this report, interim responses were collected between 17 December 2020 and 8 March 2021. Final results will be presented.

Results: 350 responses (215 complete) were obtained and considered for this analysis. 81.8% ($n=219$) of participants were male and board-certified radiologists (42.6%; $n=115$). 87% ($n=235$) of participants reported to have been involved in the care of Covid-19 positive patients.

The overall IR workload was reported to have remained stable (32.7%; $n=80$), mildly decreased (32.7%; $n=80$) or decreased a lot (15.9%; $n=39$). Decrease in IR services were across the board: non-urgent cases were cancelled for endovascular (aortic 35.5% ($n=22$), peripheral 34.8% ($n=32$)), hepatobiliary 30.7% ($n=35$), elective embolization 23.2% ($n=26$) and endourology 34.3% ($n=24$) procedures. Interventional oncological procedures were the least impacted with 13.5% ($n=14$) cancellations. Moreover, participants reported 56.9% reduced research activities. Regarding work patterns, both interventionalists and associated staff (nurses, technicians) were reported to be more frequently redeployed during the second wave (32.8% and 81.1%, respectively) than during the first wave (11% and 43.6%, respectively).

Conclusion: The COVID-19 pandemic resulted in an overall decrease in IR workload and activities, except for interventional oncology services. We continue to collect responses aiming to develop a better understanding regarding the true impact of the pandemic on IR services and staff.

Dialysis intervention and venous access

FP-29

VOLume flow-guided angioplasty in dysfunctional native arteriovenous fistulas: the VOLA study

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Purpose: To access the use of sequential intraprocedural volume flow (VF) measurements with transcutaneous Duplex ultrasound (DUS) during balloon angioplasty in dysfunctional native arteriovenous fistulas (AVF), as a new functional endpoint in endovascular treatment.

Materials and Methods: This prospective study (clinicaltrials.gov NCT04430478), included 20 consecutive patients (23 lesions; 16 men; mean age 67 ± 16 years) with dysfunctional AVF undergoing fluoroscopically guided, balloon angioplasty between 01/06/2019–01/05/2020.

Primary endpoints were procedural success (achievement of a postprocedural VF value $\geq$ to the baseline steady-state access), quantification of angioplasty outcomes using sequential DUS VF following each dilation and 6-months target lesion re-intervention (TLR)-free rate. Six-month lesion late lumen loss (LLL), correlation of VF values with balloon diameters and QVA measurements were also valued.

Results: Procedural success was 80% (16/20 cases). VF-guidance improved procedural success by 20% (4/20 cases) compared to standard assessment (<30% residual stenosis and palpable thrill). Mean VF increase was $168.5\% \pm 102.5\%$ (range: 24.24%–493.33%). TLR-free rate was 78.3%, 67.3% at 6 and 12 months. Significantly less TLR was noted in cases of procedural success (82.4% vs. 66.7% 6-months; $p=0.041$). Unweighted linear regression detected significant positive relationship between balloon diameter and VF (146.9 ± 42.3 ml/min VF gain per mm of balloon diameter; $p=0.001$, $R^2=0.23$) and a significant negative relationship between LLL and VF decline at follow-up (102.0 ± 34.6 ml/min loss per mm of LLL; $p=0.01$, $R^2=0.35$). Optimal VF cut off value and percentile increase to predict reintervention were 720 ml/min (sensitivity 58.3%, specificity 71.4%) and 153% (sensitivity 66.7%, specificity 85.7%); respectively.

Conclusion: Intraprocedural VF assessment optimized AVF angioplasty and predicted clinical outcomes with reasonable accuracy.

FP-30

Percutaneous arteriovenous fistula creation with the WavelinQ device: a retrospective single-center analysis of 30 patients

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Purpose: To retrospectively evaluate the safety, success and maturation rates of percutaneous arteriovenous fistula (pAVF) creation with the WavelinQ device.

Materials and Methods: From February 2018 to June 2020, 30 pAVF were created in 30 patients. 23/30 patients (70%) were already on hemodialysis

carrying a central venous catheter. Outcome measures were safety, defined as adverse events occurring within the first month of creation, success, defined as the ability to create an anastomosis between the vessels of interest and maturation rates, defined as the ability to perform at least one successful dialysis with the AVF. Secondary outcome measures included procedural complications, secondary procedures, time to cannulation, and AVF survival.

Results: All cases were performed as day procedures. Success was 100% (30/30). Mean follow-up was 547 days (range:14-1071 days). In one case a pseudoaneurysm of the brachial artery was created immediately after sheath removal and in another case, an aneurysm of the AVF anastomosis was observed 17 days post-procedure and AVF was ligated with a covered stent placed in the arterial part. In all, 26/30 AVFs (86.6%) were successfully cannulated. Mean time to cannulation was 61.3 days. Another one failed after maturation during the follow-up period. 15 interventions were needed to achieve maturation (0.58 procedures/AVF). 5 maintenance endovascular interventions were performed during the follow-up period (19.2%). Mean time from cannulation to the end of follow-up was 566.2 days (range:135-1041 days).

Conclusion: Current analysis suggests that percutaneous AVF creation is safe, successfully performed with high maturation rates. Large-scale prospective studies are needed to validate results.

FP-31

Randomised trial comparing drug-eluting balloon to plain balloon for non-maturing dialysis access

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Purpose: To present the results of a randomized trial comparing drug-eluting balloon (DEB) to plain balloon (PB) for the treatment of stenosis in non-maturing arteriovenous fistula (AVF).

Materials and Methods: Newly created non-maturing AVF with at least 1 haemodynamically significant stenosis (>50%) and no prior endovascular treatment were eligible. 42 patients were randomized (1:1) to either DEB or PB after successful crossing of lesion. When there was more than 1 stenosis, the most severe stenosis was chosen as the target lesion and all other lesions treated with standard of care (PB). All patients received 6 months of antiplatelet therapy (dual agents in the 1st month, followed by 5 months of single agent). The primary endpoint was reached when the fistula was used successfully for haemodialysis (FUSH) without any further intervention by 3 months. Other endpoints included target lesion and access circuit patency. The trial was terminated early due to poor accrual.

Results: FUSH was achieved in 12 (57.1%) vs 9 (42.9%) in the DEB and PB arms respectively. Target lesion patency and access circuit primary patency at 12 months were 33.3% in both groups. Access circuit assisted primary patency at 12 months was 81.0% vs 76.2% (DEB vs PB), while access circuit secondary patency at 12 months were 85.7% in both arms.

Conclusion: There was no statistically significant difference in maturation rate between DEB and PB arms for the treatment of stenosis in non-maturing AVF.

FP-32

Prospective single center observational cohort study evaluating the efficacy and durability of a new covered stent (Covera/CRBard/BD) in treating cephalic arch stenosis in av-access

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Purpose: Covered stents are an endovascular option for hemodialysis related venous occlusive disease (VOD). This prospective single center observational cohort study evaluated the efficacy and durability of a

new covered stent (Covera/ CRBard) in treating cephalic arch stenosis to preserve a functional dialysis access circuit.

Materials and Methods: A prospective cohort study was performed on all patients with clinically relevant cephalic arch stenosis, who were treated by placement of covered-stents from June 2017 to September 2020. Demographics, lesions, stentgraft, and av-access patency rates were determined. Complications, reinterventions, and factors influencing their outcomes are reported.

Results: In 38 patients (50% men; mean age 68.6 years, 53-92 years) with cephalic arch stenosis, covered-stents (Covera, CRBard) were used to treat symptomatic clinically relevant stenosis or to enable av-access functionality. The target lesion was accessed via the dialysis access site. The Covera covered-stent (Bard/BD) was implanted in all patients. Technical success was 100%. Access-circuit-primary-patency (ACPP) at 3 months was 92.1% (35/38), at 6 months (ACPP) was 79.41% (27/34). Reported follow up period was 6 months, the study is ongoing for 24 months. Study population mortality was 10.52% at 6 months (4/38). Access-circuit-secondary-patency (ACSP) at 6 months was 99.06% (33/34), all additional procedures for access salvage are reported.

Conclusion: Placement of covered-stents for hemodialysis related stenosis in the cephalic arch is safe, effective in relieving symptoms, and enables excellent midterm functionality of dialysis AV-access circuits. Long term follow up of this prospective observational study will show whether covered stents provide superior long-term results in a real world setting outside clinical studies.

FP-33

Evaluation of drug eluting balloon in arteriovenous fistula stenosis in an experimental animal model

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Purpose: Revalidate arteriovenous fistula in an experimental animal model and evaluate the biological effects of the drug eluting balloon in stenosis.

Materials and Methods: Experimental study without randomization in 2 phases.

Phase 1: Validation of the porcine animal AVF model. 3-month-old female individuals were included. Performing 2 AVFs per individual at the femoral level, lateral-lateral anastomosis technique. Ultrasound control to determine caliber, flow and time of stenosis (4 AVFs).

Phase 2: Once AVF maturation was achieved and stenosis produced, angioplasty (PTA) was performed with a medicated balloon in an AVF and a simple balloon in a contralateral AVF. Follow-up 3 weeks with ultrasound, euthanizing after a month, with sampling for histology (12 AVF)

Results: First Phase: Validation of the animal AVF model. Establishing significant stenosis time in 5 weeks. Flow measurement and caliber with non-significant correlation (Pearson = 0.616) (p = 0.107).

Second Phase: Histological study showed less intimal thickening in the DEB group, not statistically significant.

Conclusion: 1. A feasible and reproducible AVF animal model, makes it possible to perform and determine the treatment of stenosis.

2. Use of the drug eluting balloon does not show significant histomorphometric differences in comparison to classic PTA in the treatment of stenosis in AVF, but it shows a tendency to explore with longer follow-up.

FP-34

Results of a single-center experience with endovascular arteriovenous fistula creation for hemodialysis access using the WavelinQ System

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Purpose: Endovascular AV fistula (EndoAVF) creation is a minimally invasive option for hemodialysis patients. Trials demonstrated the feasibility to create an EndoAVF utilizing the WavelinQ system. This prospective single center observational cohort study investigated the real world clinical outcomes of EndoAVF using the WavelinQ system.

Materials and Methods: A total of 54 patients underwent a planned EndoAVF creation between December 2015 to February 2021. The 6F, 4F and 4F next generation catheter systems were used. Demographics, technical success, procedural complications and AV-access patency rates were determined. Complications, reinterventions, and factors influencing their outcomes are reported.

Results: In 54 patients (74.1% men; mean age 65.6 years, 40-90 years) 47 (87.04%) had a successful EndoAVF creation (radial access in 80%, ulnar access in 90%). Procedure time in successful EndoAVF cases was 90.8 min (57-135 min) for the 6F system, 81.1 min for the 4F (41-159 min) and 56.6 min (32-100 min) for the 4F next generation device. 51 Patients completed follow up at 180 days, primary patency was 33.3% (17/51).

Conclusion: The WavelinQ system for EndoAVF creation is a viable option for hemodialysis access. When successful, patient satisfaction is extremely high. However, compared to initial trials, our real world data show a significant lower primary patency. A substantial portion of our patients required subsequent endovascular and surgical procedures to aid in maturation. The limitations from our study appear not to be technical difficulties in successfully creating the initial EndoAVF, but in achieving maturation. More work on determining factors avoiding the need for reinterventions is required.

FP-35

Percutaneous valvulotomy for the management of valve-related stenosis in dialysis access fistulas and grafts

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Purpose: To evaluate the safety and efficacy of percutaneous valvulotomy in treating valve-related stenosis in dialysis access fistulas and grafts.

Materials and Methods: A single institution retrospective review of patients who had undergone percutaneous valvulotomy to treat clinically significant hypertrophied outflow vein valves or valve-related stenoses from 2010-2020 was performed. Valvulotomy was performed with valvulotome device (LeMaitre, Burlington, MA, USA) followed by balloon angioplasty. Procedural success was defined as successful valve lysis. Clinical success was by adequate follow-up dialysis and resolution valve-related dialysis issues. Primary patency from valvulotomy to the next intervention on the access circuit was determined by Kaplan-Meier analysis. Secondary patency was defined as patency of the circuit with subsequent interventions. Procedure related adverse events were recorded.

Results: 69 patients (32 men and 37 women) were analyzed (63 fistulas, 5 grafts, 1 hybrid). There was a 98.6 % procedural success rate, with one thrombosis requiring surgical intervention. The rate of major complications was 2.8 % (one extravasation with hematoma development and one thrombosed graft requiring surgical thrombectomy). Median primary lesion patency was 11 months (interquartile range (IQR) of 20). Primary patency was 40.6% at one year and 23.2% at two years. Median secondary

patency was 36 months (IQR of 40.5). Median number of subsequent interventions was 2.

Conclusion: Percutaneous valvulotomy is safe and effective in the management of valve-related stenoses in dialysis fistulas and grafts. In this center's experience, there was excellent primary patency, limited need for re-intervention and few complications.

FP-36

IN.PACT AV access randomized trial outcomes through 24 months: demographic Subsets

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General Study Info: The IN.PACT AV Access Study evaluates the safety and effectiveness of the IN.PACT AV drug-coated balloon (DCB) compared to percutaneous transluminal angioplasty (PTA) for the treatment of subjects with de novo or restenotic lesions of native upper extremity arteriovenous dialysis fistulas (AVF). The study is registered on clinicaltrials.gov as NCT03041467.

Purpose: Few trials report outcomes of dysfunctional AVF through 24 months; even fewer report outcomes by demographic subsets.

Methodology: IN.PACT AV Access is an independently-adjudicated, prospective, global, multicenter, randomized, single-blinded study that enrolled 330 participants. Prior to enrollment and randomization, the study required that all lesions were successfully treated with a high-pressure balloon.

Endpoints: Assessments through 24 months included target lesion primary patency, access circuit primary patency, serious adverse events involving the access circuit, and mortality. Target lesion primary patency outcomes will also be reported by demographic subsets, including breakdowns by male and female participants, ethnicity, and race.

Expected Data/Impact on IR: 24-month outcomes, originally presented at Charing Cross in April 2021, will be reviewed. Demographic subsets through 24 months will be reported; improved outcomes with treatment of a DCB were seen in both men and women, as well as in participants of all racial and ethnic backgrounds. This demonstrates the long-term benefits of treatment with DCB to treat lesions in dysfunctional native arteriovenous dialysis fistulas through 24 months.

Embolotherapy (excluding oncology)

FP-37

Short-term results of transcatheter arterial embolization for chronic medial epicondylitis refractory to conservative treatment: a single-center retrospective cohort study

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Purpose: To evaluate the effectiveness and safety of transcatheter arterial embolization (TAE) for chronic medial epicondylitis (ME) refractory to conservative treatment.

Materials and Methods: This retrospective study included 10 patients (14 procedures) who underwent transcatheter arterial embolization (TAE) between May 2018 and April 2020 to treat chronic medial epicondylitis (ME) refractory to conservative treatment at least 3 months. Imipenem/cilastatin sodium (IPM/CS) was used in 12 procedures, and quick-soluble gelatin sponge particle was used in the following 2 procedures respectively as an embolic agent. The visual analogue scale (VAS, 0-10) score and Quick Disabilities of the Arm, Shoulder and Hand (Quick-DASH) scores were assessed at the baseline and post-treatment (1 day, 1 week, 1, 3, 6 months and open period). Successful selective embolization of at least one feeding artery to the hypervascular staining and/or early venous drainage was defined as technical success. The clinical success of the

procedure was defined as a decrease of more than 70% in Quick-DASH scores at 6 months compared to baseline.

Results: The technical success was achieved in all procedures. The clinical success was achieved in 12 of 14 procedures (85.7%). No major complications were observed during follow-up periods. The mean VAS scores were significantly decreased at one-day, one-week, one-month, three-months and six-months (7.6 at baseline versus 3.6, 3.6, 3.6, 3, and 0.9 after treatment; all $P < .01$). The mean Quick-DASH scores at baseline significantly decreased at 1 day, 1week, 1, 3, 6 months after treatment (71.9 vs 48.5, 44, 37.7, 30.2 and 8.4, respectively; all $P < .01$). These improvements were well maintained in 9 patients up to 12 months after the treatment.

Conclusion: TAE effectively and safely relieved pain and promoted functional recovery in chronic ME patients refractory to conservative treatment. TAE may be a feasible treatment option for patients with ME intractable to conservative treatments.

FP-38

SPLINIQ study: splenic artery embolisation after traumatic spleen injury: clinical, imaging, quality of life and costs outcomes

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Purpose: To determine the impact of splenic artery embolisation (SAE) on clinical, MR imaging, quality of life (QOL), and costs outcomes after treatment of traumatic spleen injury.

Materials and Methods: A prospective multi-centre study was conducted on trauma patients, age ≥ 18 y, with splenic injury, who were admitted to the hospital between March 2017 and December 2018. All patients were registered in the database, and patients who gave consent, completed five questionnaires at 1 week, 1, 3, 6 and 12 months after treatment (WHOQOL-Bref; SF-12; EQ-5D-5L; iPCQ; iMCQ). The follow-up period was one year for clinical symptoms, imaging, QOL, and costs. Patients treated with SAE underwent MR imaging at regular intervals during 1 year.

Results: During the inclusion period, 116 patients with splenic injury were admitted to 10 participating hospitals; 50 patients completed all questionnaires, and 24 SAE patients underwent MR imaging.

All one-year follow-up data have been collected of clinical and MR-imaging results, and the questionnaires, including QOL (WHOQOL-Bref), health status (SF-12, EQ-5D-5L), cost-effectiveness (iPCQ, iMCQ). The complete database analysis is currently in process. The results of the prospective SPLINIQ study will be presented.

Conclusion: SAE has advantages in comparison to surgery in terms of clinical and imaging outcome after spleen trauma. Clinical, MR imaging, QOL and costs results will be compared and presented.

FP-39

Embolization of bronchial arteries in controlling hemoptysis: a comparison of polyvinyl alcohol particles versus liquid embolic (n-Butyl-2-cyanoacrylate)

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Purpose: To retrospectively compare Polyvinyl Alcohol Particles (PVA) and n-Butyl-2-cyanoacrylate (NBCA) in the treatment of non-traumatic hemoptysis, researching durability, safety and complications between the embolic agents in bronchial artery embolization (BAE) in a Western population.

Materials and Methods: Medical records from patients with hemoptysis undergoing BAE in the period of 2003-2020 were examined. Patients with a non-traumatic hemoptysis (n= 349, 223 men, median age 58 years, range 14-89) undergoing single or multiple BAE-interventions with PVA-particles (n=292 procedures), NBCA (n=98 procedures) or combination of PVA+NBCA in different vessels (n=33 procedures) were included. Patient characteristics and BAE procedures were analyzed.

Results: Technical success was achieved in 95.5%, 95.9%, and 97.0% in respectively PVA, NBCA and combined PVA+NBCA group ($P = .925$). Complications of any kind were seen in 13.2% (56/423) of all procedures. Minor complications in 12.5% (53/423) and major complications in 0.7% (3/423). Major complications were not statistically different between groups and observed in 0.7% (2/292) in the PVA group, 1.0% (1/98) in the NBCA group ($P = .830$) and none in the combined group. The 1-, 2-, and 3-year hemoptysis-free survival rates for the PVA group were respectively 65%, 55% and 52%, NBCA group 76%, 69% and 61% and the combined PVA+NBCA group 79%, 72% and 65% ($P = .032$).

Conclusion: The hemoptysis-free survival rate after BAE was higher in patients treated with NBCA compared to PVA with no larger amount of complications. The effect may be caused by a higher durability of NBCA.

FP-40

Factors affecting clinical success of thoracic duct embolization: single center experience

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Purpose: To evaluate factors affecting clinical success of thoracic duct embolization to treat chylothorax

Materials and Methods: 49 consecutive patients underwent thoracic duct embolization to control traumatic or nontraumatic chyle leak in our institution were retrospectively reviewed. We analyzed predictive factors for clinical success (defined as removal of drainage tube and/or more than 80% decrease of drain amount within 2 weeks after intervention) using logistic regression model.

Results: Mean age was 55.9 years and 34 (69.4%) males were included. Etiology of chyle leak was idiopathic (nontraumatic) in 6 and traumatic in 43 (esophagectomy (n=17), lobectomy/pneumonectomy (n=11), neck surgery (n=6), vascular surgery (n=5), mediastinal mass excision (n=4)). 17 patients (34.7%) underwent surgical thoracic duct ligation before intervention. Lymphangiographic leak was detected in only 23 patients (46.9%). Peri-procedural pleurodesis was combined for 16 patients (32.7%). Technical success (defined as successful completion of thoracic duct cannulation and embolization) was achieved in 43 patients (87.8%). No major complication occurred after intervention. Clinical success achieved in 38 patients (77.5%) and presence of lymphangiographic leak ($p=0.007$) was the only predictive factor affecting clinical success.

Conclusion: Thoracic duct embolization is safe and effective modality to treat chylothorax. To confirm leaking site during lymphangiography is important to improve clinical success.

FP-41

Long-term outcomes of type 2 endoleak embolization (T2EL)

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Purpose: Evaluate outcome of T2EL embolization in a single tertiary referral centre.

Materials and Methods: A retrospective review of patients who underwent T2EL embolization was performed. We examined relevant imaging and electronic patient records of hospital encounters and vascular MDT outcomes.

Results: Sixty-one patients underwent 82 embolizations for T2EL following EVAR between 2001 and 2020. The mean age was 74 years and 9

were women. The mean time from EVAR to embolization was 43.9 +/- 33.9 months, and the average sac enlargement from the time of EVAR was 13 mm. Fifteen patients (24.6%) required more than one embolization procedure.

Technical success was achieved in 58/82 procedures (71%). Clinical success was achieved in 36/61 patients (59%), defined as stable or reduction in aneurysm sac size at last follow-up. Mean follow-up was 38.6 +/- 30 months.

The target vessels for embolization were the lumbar arteries in 47 (57%), inferior mesenteric artery in 22 (27%), internal iliac artery in 8 (10%) and a combination of supply in 5 (6%). Endoleaks were accessed from a transarterial approach in 61 (74%), direct sac puncture in 17 (21%) and perigraft entry in 4 (5%). Onyx was used in 43%, coils in 29%, onyx with coils in 17%, glue in 5% and vascular plug in 5%.

Complications included vertebral osteomyelitis and transient ischaemic radiculopathy.

Conclusion: Embolisation is effective in arresting sac growth in the majority of patients treated. However, a significant cohort of patients continue to experience sac growth following T2EL embolization and long-term surveillance is warranted.

FP-42

Two-years initial experience with inflammatory embolization in an orthopedic center in Brazil

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Purpose: Osteoarthritis (OA) is the most common joint disease in the population older than 60 years. Inflammatory embolization has emerged as a treatment option for patients refractory to clinical treatment and not yet candidates for joint replacement. These study aims to evaluate our two-year early experience with the technique in different joints.

Materials and Methods: This is a cohort of sequential patients referred to our service by the orthopedic surgeons of a center performing more than 10.000 surgeries per year. Inclusion criteria was no indication for joint replacement with pain > 6 months and no response to conservative treatment. Patient and procedure characteristics and follow up were analyzed. Visual analogue scale of pain was used in the first year of the cohort.

Results: From May 2019 to March 2021, 37 patients with 51 joints were treated. 28 knees, 14 hips, one shoulder and one elbow were submitted to the procedure without previous orthopedic surgery. 6 ankles were treated with previous procedures. Technical success was achieved in 100% of cases. 44 (86,2%) joints were treated with imipenem/cilastatin, 6 (11,7%) with microsphere and one (1,9%) with both. Visual analogue scale of pain and mobility was improved in 32 patients (86,4%) and 5 (13.5%) had no improvement. Two of these patients had fibromyalgia. Mean follow-up was 8,6 months.

Conclusion: Inflammatory embolization is an option for patients with persistent joint pain and no indication for total joint replacement. Selection of patients is paramount for the success. Patients with Fibromyalgia tend to not respond to the procedure.

FP-43

Arterial embolization in hemorrhoidal disease - emborrhoid: should we also embolize the middle rectal arteries?

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Purpose: To assess the efficacy and tolerance of embolization of the superior rectal arteries (SRA) and the middle rectal arteries (MRA) on hemorrhoidal symptoms.

Materials and Methods: Between 2015 and 2018, 50 consecutive patients (32 Men, 18 Women, average age of 53 years (30-76)) suffering from hemorrhoidal pathology in failure of medical treatment were included for hemorrhoidal embolization. The first 25 patients received only SRA embolization. The following 25, embolization of SRA and MRA (SRA + MRA group). Clinical parameters were collected at 12 months using the bleeding score (BSc), visual analogue scale (VAS), quality of life score (QoL), complications were assessed by the classification of Clavien-Dindo.

Results: After a mean follow-up of 12 months, clinical success was obtained in 18 patients (72%) in the SRA group, including 8 patients after a second intervention. In the SRA + MRA group, the clinical success rate was 80% (n = 20) including 4 patients after a second intervention. There was a significantly greater improvement in BSc, VAS and QoL score in the SRA + MRA group (p < 0.05). Two patients who had undergone MRA embolization described post-embolization anal pain, which resolved spontaneously within days. No Clavien-Dindo grade < II complications were observed.

Conclusion: Simultaneous embolization of SRA and MRA in the Emborrhoid procedure appears safe and tends to improve clinical outcomes on hemorrhoidal symptoms.

FP-44

Transradial coil embolization of the rectal arteries for treatment of hemorrhoids (emborrhoid technique): is outpatient ambulatory care management safe and feasible?

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Purpose: To demonstrate safety and feasibility of transradial rectal artery embolization for hemorrhoid treatment as an outpatient ambulatory care procedure.

Materials and Methods: Twelve consecutive patients affected by symptomatic hemorrhoidal disease and anemia with high surgical risk were enrolled in this observational prospective single-center study conducted from August to November 2020 and underwent transradial rectal artery coil embolization.

Results: Technical success was obtained in all patients. At clinical-laboratoristic evaluation, all patients were potentially eligible for discharge after 6 hours. 11/12 patients had increase in hemoglobin levels at the follow-up evaluations. After 4 weeks the number of patients who daily experienced post-defecation bleeding episodes decreased from 10 to 1 patient.

Conclusion: Transradial rectal artery embolization is a safe and feasible treatment option for patients with chronic symptoms of hemorrhoid disease, with a high technical success and a low overall complication rate, improving patient comfort, with prompt symptoms improvement.

FP-45

Results of the CHRYSALIS study: first-in-human use of the CATERPILLAR™ embolization system for peripheral artery embolization

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General Study Info:

Title: Results of the CHRYSALIS Study: First-In-Human Use of the CATERPILLAR™ Embolization System for Peripheral Artery Embolization
Short Title: Results from the First-In-Human Study of the CATERPILLAR™ Embolization System

Registered on clinicaltrials.gov; Identifier: NCT04090320

Purpose: To observe the clinical performance of the CATERPILLAR self-expanding embolization system for peripheral artery embolization.

Methodology: A prospective, single-arm study without formal hypothesis testing was conducted using the CATERPILLAR embolization device, consisting of cobalt-chromium/nickel-titanium fibers with polyurethane/

polyethylene occlusion membranes. Twenty patients (24 arteries) were treated at four sites in New Zealand and Australia and followed for 30-days. An independent medical monitor reviewed adverse events to identify potential safety issues.

Endpoints: Primary endpoints were technical success – peri-procedural occlusion confirmed by angiography – and freedom from device-related serious adverse events (SAEs) at 30 days. Secondary endpoints included time to occlusion, freedom from recanalization or migration, and assessment of adverse events.

Expected Data/Impact on IR: Technical success (i.e., peri-procedural occlusion) was 100% with 91.7% of arteries embolized using one device. Occlusion was rapid – 91.6% of treated sites were occluded within 5 minutes. No devices migrated and no reinterventions were required. Freedom from device-related SAEs was 94.7%, and freedom from device and procedure-related adverse events was 84.2% at 30 days. One patient died unrelated to either device or procedure. In this first-in-human study, the CATEPILLAR device was placed successfully to embolize peripheral arteries with rapid arterial occlusion and no safety concerns. While further experience is required, the CATERPILLAR device appears to be an important advance in safe, successful, and durable vessel occlusion.

FP-46

Genicular Artery embolization Using imipenem/Cilastatin vs. mirosphHere for chrOnic knee pain: a randomized controlled non-inferiority trial - the GAUCHO Trial

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General Study Info:

- the study name (long & short) - GAUCHO Trial - Genicular Artery embolization Using imipenem/Cilastatin vs. mirosphHere for chrOnic knee pain: a randomized controlled non-inferiority trial
- the database where the study is registered (REBEC - ensaiosclinicos.gov.br)
- the identifier (waiting for the number)

Purpose: Genicular artery embolization (GAE) has emerged as a treatment option for patients refractory to clinical treatment and not yet candidates for surgery. There are two embolic agents been used in this setting, imipenem/cilastatin "sand" and microspheres. Our study aims to compare both.

Methodology: This will be a randomized, blind, prospective, single-center clinical trial with a 12-month follow-up. Sample calculation was 20 patients per arm. Patients with knee OA and Kellgren-Lawrence 1 to 3 refractory to clinical therapy are enrolled in this study. WOMAC and KOOS indexes, visual analogue score of pain and a MRI will be performed pre-procedure, with 3 months and 12 months. We have already enrolled 17 patients.

Endpoints: Pain relief after procedure, decrease of inflammation in MRI. To evaluate the non-inferiority between both embolic agents

Expected Data/Impact on IR: By demonstrating non-inferiority, countries were imipenem/cilastatin is not approved for intra-arterial use, will be able to use microsphere as a safe substitute, with similar results and complication rates.

EVAR and TEVAR

FP-47

Preventive abdominal aortic aneurysm sac filling during EVAR with a novel shape memory polymer device

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Purpose: To determine the safety and feasibility of filling an abdominal aortic aneurysm (AAA) sac with a novel space-filling, embolic device at the same time as endovascular aneurysm repair (EVAR), and to determine the ability of the device to promote AAA sac regression and reduce the rate of post-EVAR complications, including type II endoleaks.

Materials and Methods: A prospective, single-arm, safety study. The IMPEDE-FX RapidFill device facilitates the implantation of multiple IMPEDE-FX Embolization Plugs. The implanted devices are comprised of shape memory polymer, a self-expanding, porous, biodegradable, space-filling embolization technology that supports rapid conversion to organized thrombus followed by cellular infiltration and tissue ingrowth. Pre-operative sac volumes were calculated to estimate the required number of devices needed to achieve complete sac filling. Devices were inserted through a guiding catheter after implantation of the EVAR device. **Results:** To date, eight patients undergoing elective infrarenal EVAR underwent concomitant aneurysm sac filling with the shape memory polymer devices, and enrollment is ongoing. The aneurysm sacs outside of the stent graft were completely filled with the devices. No endoleaks have been detected and no serious adverse events related to the device have been observed to date. The patients will be followed for two years. The sac filling technique and aneurysm sac behavior, based on available follow-up data, will be presented.

Conclusion: Initial data demonstrate the preliminary safety and feasibility of AAA sac filling with shape memory polymer devices at the same time as EVAR. Further experience and follow-up data will determine the effect of the device on aneurysm sac behavior.

FP-48

Preliminary results from an Italian national registry on the outcomes of the semi-custom-made Najuta fenestrated aortic arch endograft

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Purpose: Arch pathology represents nowadays one of the last hedges in endovascular approach to aortic aneurysms. Aim of this study was to evaluate the feasibility and preliminary outcomes obtained with a single

model of semi-custom-made fenestrated endograft approved for the treatment of thoracic aortic aneurysms.

Materials and Methods: All patients consecutively treated with the Najuta endograft in eleven

Italian centers were prospectively enrolled in the present study. Anatomical characteristics and perioperative data were retrospectively analyzed. Main outcome was to assess technical success defined as effective endograft deployment with aneurysm exclusion at completion angiography. Secondary outcomes were survival, need for 30-day reintervention, perioperative complications and endoleaks.

Results: During the period 2018–2021 forty patients were enrolled in the study. Mean age was 73.8 ± 5.5 years and 81.1% of the patients were male. Most of the patients received treatment for atherosclerotic aneurysm (85%) and penetrating aortic ulcer (10%). Overall eighty supra-aortic vessels were revascularized through a dedicated fenestration. Technical success was achieved in 97.5% of the procedures. Two cases of stroke and no death were recorded in the perioperative period. No patient needed reintervention within 30 days. Type I endoleak was detected in just one case at 30 days.

Conclusion: These perioperative results suggest how, according to pathology complexity, an endovascular approach with the Najuta system may result safe and effective, especially in patients deemed at high surgical risk. A strict follow-up with high-quality CTA images and long term evaluation of possible late complication is mandatory to confirm these initial experience findings

FP-49

Remodeling of visceral arteries with impact on the renal function post-endovascular repair of type B aortic dissection

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Purpose: To evaluate remodeling of visceral arteries post-endovascular repair (TEVAR) of type B aortic dissection (TBAD) and to investigate interval change in renal volume and estimated glomerular filtration rate (eGFR) vis-a-vis baseline renal artery morphology.

Materials and Methods: All patients of TBAD who underwent TEVAR with a baseline and at least one follow-up CT during the study period were included. Visceral branches (celiac, renal, superior, and inferior mesenteric artery) were classified into 7 patterns depending upon the lumen origin (true/false) and extension of the flap, while occluded vessels were categorized as pattern 8.

Results: 132 branches were analyzed in 25 patients (23 males; mean age: 50.1 years) with a mean follow-up of 386 days. 51 visceral branches were arising from the true lumen without any stenosis. Of the remaining 81 branches, 32 showed favorable remodeling ($p=0.0001$). The highest incidence of favorable remodeling was observed in arteries arising from the true lumen (pattern 2,3: 87.5%) whereas all arteries arising from the false lumen (pattern 4,5: 100%) showed unfavorable remodeling. A statistically significant difference in the interval change in renal volumes was observed between kidneys supplied by true or both lumens (patterns 1,2,3,6,7) and by false lumen or occluded renal artery (patterns 4,5,8) (0.2% vs -16.5%; $p=0.01$); however, no statistically significant difference was seen in the interval change in eGFR.

Conclusion: Visceral arteries arising from true lumen are more likely to undergo favorable remodeling. The kidneys supplied by false lumen or by occluded renal artery suffer significantly more volume loss after TEVAR without significant functional change.

FP-50

The effect of suprarenal graft fixation during EVAR on short- and long-term renal function

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Purpose: The effect of suprarenal fixation (SR) compared to infrarenal fixation (IR) on renal function during endovascular aneurysm repair (EVAR) remains controversial. This study aims to compare the renal outcomes between fixation types in short- and long-term follow-up.

Materials and Methods: Patients undergoing EVAR for infrarenal abdominal aortic aneurysm between 2005 and 2013 were included. Estimated glomerular filtration rate (eGFR) was measured at baseline and during a follow-up of 5 years. A decline in renal function was defined as a $\geq 20\%$ decrease in eGFR. Changes in eGFR were compared between SR and IR groups at 1–7 days, 30 days, and 1–5 years postoperatively. Preoperative renal insufficiency was defined as eGFR < 60 mL/min/1.73 m², and those patients were included in the subanalyses.

Results: A total of 358 patients were included. Among these, 267 (74.6%) had SR and 91 (25.4%) had IR fixation. A decline in renal function occurred more commonly after SR than after IR in 1–7 days postoperatively (13.7% vs. 3.5%, $p=.009$), but no difference was noticed at 30 days and 1–5 years. Regardless of the fixation method, renal function steadily decreased steadily over time after EVAR (estimate -3.13 per a year, 95% confidence interval -3.40– -2.85, $p<.001$). Patients with pre-existing renal insufficiency were included in subgroup analyses, and those with SR were more often found to have a decline in eGFR 5 years postoperatively than their counterparts with IR (59.5% vs 20.0%, $p=.036$).

Conclusion: SR fixation is a safe method for patients with normal renal function. A transient decline in renal function was seen during the first days postoperatively. Longterm results seems to favor IR over SR in patients with pre-existing renal insufficiency.

FP-51

Initial experience of preventive aneurysm sac embolization using a sponge-like non-artifact polymer as an add-on procedure for endovascular aortic repair

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Purpose: To evaluate the feasibility and safety of a sponge-like polyurethane scaffold (IMPEDE-FX Embolization Plug, Shape Memory Medical, Santa Clara, US-CA) for adjunctive AAA-filling during abdominal aortic aneurysm repair (EVAR) for preventive endoleak management.

Materials and Methods: In the first reported retrospective registry, 12 consecutive patients (median 68 [range 62–88] years) with infrarenal abdominal aortic aneurysms (AAA) >50 mm in diameter were treated at two German vascular centers. Prerequisite was healthy non-calcified femoral access to enable a parallel wire approach to the aneurysm lumen during EVAR (8 Altura™/Lombard®; 1 renal Chimney Altura™; 1 fenestrated Altura™; 2 Excluder®-Conformable/Gore®; 1 AFX®/Endologix). Subsequent AAA-filling was performed using IMPEDE-plugs via a 6F-sheath parallel to a previously implanted iliac stent-graft. Patients with thrombosed AAA-lumen underwent targeted aortic side-branch embolization using IMPEDE-plugs.

Results: Technical success was 100%. Nine patients underwent AAA-filling using median 23 [range 15–37] IMPEDE-FX plugs per perfused aneurysm volume (83 mL [31–244 mL]). Five patients underwent targeted embolization for inferior mesenteric, internal iliac or lumbar artery occlusion using 3 [1–6] plugs. EVAR procedure and fluoroscopy times increased by 23 min

and 6min. During follow-up of 6 [3-18] months using contrast-enhanced ultrasound and computed tomography, significant AAA-volume reduction was evident (137ml [56-355ml] versus baseline 160ml [90-442ml]; $p=0.0094$). In four patients, three minor and one intense endoleak type-2 was present with no evidence of aneurysm progression.

Conclusion: First-in-human results of a new AAA-filling device demonstrate a feasible application for proactive aneurysm sac management. An array of multiple IMPEDE-plugs is expected to reduce additional procedure time. Prospective studies are mandatory to evaluate effectiveness of AAA-filling.

Experimental work in IR

FP-52

Magnetic particle imaging: safety and imaging characteristics of endovascular stents

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Purpose: Magnetic particle imaging (MPI) is a new radiation-free tracer-based tomographic method. Especially, due to its high sensitivity and excellent temporal resolution it offers a variety of potential applications for quantitative cardiovascular real-time imaging and the guidance of endovascular interventions. The purpose of this study was to prove the potential and safety of stent lumen visualization with MPI.

Materials and Methods: Twenty-one commercially available stents (diameter: 3-10 mm; length: 11-99 mm; material: stainless steel, nitinol, platinum-chromium, cobalt-chromium) were investigated in vitro. Heating of the stents during 7-minute MPI scans was measured using fiberoptic thermometers. For imaging the stented vessel phantoms and unstented reference phantoms were filled with tracer dilution (Resovist 1:100). The displayed stent lumina were quantified based on a calibrated signal intensity threshold value.

Results: Nine stents did not show any heating. Twelve stents revealed a temperature increase of more than 0.1 K (max. 12.4 K). The diameter had the greatest influence on the heating of the stents. Imaging of the stent lumen was feasible in all phantoms without any material induced artifacts. There were no visual or quantitative differences between the stented phantoms and the reference phantoms (calculated vs. nominal diameter $r=0.98$). Measurement inaccuracy of the lumen quantification was below half the spatial resolution (<0.24 mm).

Conclusion: MPI can overcome the disadvantages of MRI and CT concerning stent lumen visualization and thus has the potential to quantify in stent stenoses noninvasively. In terms of heating it is safe to examine a wide range of metallic stents with MPI.

FP-53

Combination of doxorubicin and antiangiogenic agents in HepaSpheres®: in vitro loading, release and pharmacokinetics in view of a novel therapeutic approach for hepatocellular carcinoma

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Purpose: To assess the possibility of combining doxorubicin with antiangiogenic agents in drug eluting beads for the treatment of liver tumours.

Materials and Methods: HepaSpheres® (50- 100 µm) were loaded with Doxorubicin, Sorafenib, Sunitib and SAP and with the combination of Doxorubicin and Sunitinib and Doxorubicin and SAP. Bead diameter increase, drug release in NaCl 0.9% and human plasma and the in-vitro effect in the proliferation of Huh7 cells were assessed.

Results: Average diameter of loaded beads was 473.7 µm (for Doxorubicin), 553.4 µm (for Sorafenib), 388.4 µm (for Sunitinib) with 515.5 µm (for SAP), 414.8 µm (for the combination of Doxorubicin and Sunitib) and 468.8 µm (for the combination of Doxorubicin and SAP). Release in NaCl 0.9% and human plasma was 10% and 56% for Doxorubicin, none for Sorafenib, 49% and 27% for Sunitib, 25% and 13% for SAP respectively; also it was 20% (Doxorubicin)- 18% (Sunitinib) and 76% (Doxorubicin)- 63% (Doxorubicin) and 18% (Doxorubicin)- 23% (SAP) and 62% (Doxorubicin)-15% (SAP) for their combination in NaCl 0.9% and human plasma respectively. The mean concentration of doxorubicin that led to inhibition of 50% of cellular proliferation was 163.1 nM, of Sunitib 10.3 µM, of SAP 16.7 µM, of Doxorubicin and Sunitinib 222.4 nM and of Doxorubicin and SAP 275 nM.

Conclusion: Doxorubicin can be combined with Sunitib and SAP with satisfactory in vitro pharmacokinetic outcomes. This combination may lead to novel and more effective transarterial treatment for hepatocellular carcinoma aiming to offer both a cytostatic and antiangiogenic effect.

FP-54

First in vivo study of a robotic assistance device for percutaneous, cone-beam computed tomography guided needle placement

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Purpose: To analyse usability, precision, efficacy and safety of a robotic assistance device (RAD) for cone-beam computed tomography (CBCT) guided needle placement in in-vivo experiments.

Materials and Methods: Under ultrasound guidance x-ray dense targets (0.4mm metal spheres) were placed via 22G needles in in-vivo porcine livers. CBCT (Artis zeego, Siemens Healthcare GmbH, Erlangen) of the liver was performed and needle trajectories to the targets were planned using a dedicated software. Trajectories were sent to the RAD (BEC guidoo, Pfullingen, Germany), which positioned a needle-holder along the trajectory, allowing for cooperative insertion of a 19G needle. Control CBCT was performed and needle position relative to planned trajectory and target was analyzed.

Results: In total 52 needles (mean trajectory-length 62.2 ± 6.9 mm, min 34.5, max 88.2) were placed in five porcine livers during 26 interventions. Each intervention was technically successful. Mean absolute deviation of needle tip from target was 6.2 ± 3.3 mm, mean lateral deviation was $3.8 \pm$

2.4 mm. Mean angular deviation of the needle from the planned trajectory was $5 \pm 2,9^\circ$. On average $19:49 \pm 6:56$ min:s were required for the placement of two needles. No difference in interventional time or precision could be found between an experienced interventionalist and novices. **Conclusion:** The presented robotic assistance device allowed for CBCT guided needle placement with acceptable procedural times. Further optimization is required in order to improve targeting precision. In future the system may facilitate image guided percutaneous interventions, such as tumor ablations.

FP-55

The retrograde peroneal artery approach for the treatment of infra-inguinal chronic total occlusions

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Purpose: The aim of this study is to assess the feasibility, safety and effectiveness of retrograde PA access and to provide some technical details on the effective use and management of this retrograde access.

Materials and Methods: We retrospectively analyzed 137 consecutive patients (137 limbs) (84 males [61,3%]; median age, $76,8 \pm 10,9$ years old; range 44-94 years) who underwent endovascular recanalization of infra-inguinal arteries for symptomatic PAD-CLTI using a retrograde PA access in case of a failed antegrade attempt. Two patients (1,5%) presented with Rutherford class 6, 63 (46%) with Rutherford class 5, while 14 (10,2%) were classified as Rutherford 4, 55 (40,1%) as Rutherford 3, and 3 (2,2%) as Rutherford 2. Targeted recanalization vessels included PA (alone or in combination with other infrainguinal arteries) in 54,7% of cases. The target of the recanalization via the PA access was the superficial femoral artery (SFA) and/or popliteal artery in 58 pts (42,3%), the peroneal artery and/or the tibio-peroneal trunk in 25 patients (18,2%), and both segments in 54 pts (39,4%).

Results: The retrograde puncture of the PA was successful in 98,5% cases. The supplemental use of the retrograde approach allowed a successful retrograde lesion crossing in 90,5 % of the patients. In all these cases to deliver adjunctive therapy (including plain balloon angioplasty, drug eluting balloons, bare metal stents, drug eluting stents, atherectomy) was possible.

Conclusion: The retrograde recanalization of infra-inguinal arterial CTO via the peroneal access is a safe and effective bailout technique, useful in the most challenging cases of recanalization of the infra-inguinal vessels.

FP-56

Inhibition of excessive neointimal proliferation in porcine peripheral arteries with different diameters by a single hyper-compliant drug-coated balloon catheter (HCDCB)

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Purpose: Long diseased vessel segments of peripheral arteries may display irregular shapes with different diameters. A single hyper-compliant drug-coated balloon catheter (HCDCB) may cover all lumen diameters and shapes including bifurcations in major peripheral arteries. Our aim was to explore whether a single long HCDCB can replace treatment with conventional drug-coated balloons (DCB), each selected according to the vessel diameter in porcine iliac/femoral arteries.

Materials and Methods: Neointimal proliferation was simulated in proximal and distal segments of porcine peripheral arteries by balloon overstretch and stent implantation. HCDCB were compared to uncoated hyper-compliant balloons (HCB) and commercial DCB in respect of inhibition of neointimal proliferation.

Results: Drug content on HCDCB was similar to drug content of commercial available DCB with $3.5\mu\text{g}$ paclitaxel/ mm^2 balloon surface. Quantitative angiography (QA), optical coherence tomography (OCT) and histomorphometry indicated a significant inhibition of neointimal proliferation by HCDCB vs. uncoated HCB (QA, diameter stenosis: $18.7 \pm 12.3\%$ vs. $30.3 \pm 16.7\%$, $p=0.003$; histomorphometry, area stenosis: $46.7 \pm 9.6\%$ vs. $53.2 \pm 11.5\%$, $p=0.019$ for HCDCB ($n=32$) vs. HCB ($n=30$)). Compared to vessel-diameter adjusted conventional DCB, HCDCB were similarly effective in inhibiting neointimal formation in narrow distal and wider proximal vessel segments (QA, diameter stenosis: $18.7 \pm 12.3\%$ ($n=32$) vs. $22.8 \pm 15.5\%$ ($n=30$), $p=0.257$), indicating a similar antirestenotic effect of HCDCB and DCB.

Conclusion: HCDCB were found to be similar effective as DCB in inhibiting neointimal proliferation in vessel segments with different diameters. A single long HCDCB may allow for treatment of segments with variable diameters, and thus, replace the use of several vessel-diameter adjusted DCB.

GI tract intervention

FP-57

Comparison of the efficacy and safety of transarterial chemoembolization combined with sorafenib and transarterial chemoembolization combined with apatinib in the treatment of advanced hepatocellular carcinoma

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Purpose: The objective of this study was to compare the efficacy and safety of patients with advanced HCC who received either TACE-S or TACE-A.

Materials and Methods: 193 patients with advanced HCC were included into the study between June 2015 and December 2019. Propensity score matching (PSM) analysis was used in the study to reduce selection bias.

Results: Before PSM, the median overall survival (mOS) and median progression-free survival (mPFS) of patients treated with TACE-S were not significantly longer than in patients treated with TACE-A ($P=0.703$, $P=0.514$). TACE-A did not increase the mortality risk compared with TACE-S in the first 12 months (HR: 1.255, 95%CI: 0.796-1.978, $P=0.329$) or after the 12 months mark (HR: 0.832, 95%CI: 0.482-1.436, $p=0.508$). Similarly, TACE-A did not increase the tumor recurrence risk relative to TACE-S in the first 12 months (HR:1.054, 95%CI: 0.744-1.493, $P=0.767$) or after the 12 months mark (HR: 1.730, 95%CI: 0.592-5.049, $P=0.316$). The subgroups analysis showed that TACE-A did not increase mortality risk or tumor recurrence risk relative to TACE-S. After PSM, similar results were presented. The III and IV stage adverse events in the TACE-A group were similar to those in the TACE-S group before PSM.

Conclusion: Patients with advanced hepatocellular carcinoma could get similar survival benefits from treatment with either transarterial chemoembolization plus apatinib or transarterial chemoembolization plus sorafenib.

FP-58

CT fluoroscopy-guided percutaneous gastrostomy: a single center experience in 233 patients

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Purpose: The aim of this study was to examine the feasibility and complication profile of CT guided gastrostomy (CT-PG) in a large cohort, and in patients with relative contraindications. Another focus was the learning process of physicians in their 4th or 5th year of training carrying out the procedure to proof the feasibility of CT-PG.

Materials and Methods: In this single-center study a total of 233 patients were identified retrospectively who received a CT-PG between 2012-2021. Success and complication rates were evaluated. Furthermore, the duration of each procedure was measured to assess safety and performability. Complication rates were evaluated using the Common Terminology Criteria for Adverse Events (CTCAE)-Protocol for procedural complications. In addition, the performance of five interventional radiologists over time was observed. Patients with ascites (as relative contraindication), who received a CT-PG were selected and analyzed separately.

Results: The success rate of CT-PG was 94.4%(220/233). Severe complications, defined as CTCAE Grade 3 or higher occurred in 0.9%(2/233) of all patients. Mild to moderate complications, defined as CTCAE Grade 1/2 occurred in 5.6%(13/233) of all patients. In 6.9%(16/233) CT-PG was performed in patients with ascites and pre-procedure drainage with a success rate of 87.5% (14/16). Interestingly interventionalists' performance speed increased over time after the 4th CT-PG (1st procedure: median speed: 27min; 20th procedure: median speed: 22min).

Conclusion: CT fluoroscopy-guided PG is a safe and easy to learn interventional procedure. Even though there is an ongoing discussion whether CT fluoroscopy-guided PG is contraindicated in patients with ascites, it also seems to be a safe approach in selected patients.

FP-59

Retrospective evaluation of clinical success and complications related to the use of HILZO pyloric/duodenal stent system

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Purpose: The Hilzo pyloric/duodenal stent was introduced into our service in 2018. The purpose of this study is to evaluate if the stent is safe and effective for palliative treatment of gastric outlet obstruction caused by malignant disease.

Materials and Methods: Patients who underwent stenting for malignant gastric outlet obstruction using the Hilzo pyloric/duodenal stent were identified on the radiology information system (RIS). Patients with benign disease, previous stent or surgical gastroenterostomy were excluded. The RIS data and clinical records were evaluated for technical success (correct placement of stent confirmed by fluoroscopy/endoscopy), clinical success (defined as improvement of ≥ 1 of the Gastric Outlet Obstruction Severity Score (GOOSS)) and complications.

Results: 80 patients were identified on the RIS system after exclusion criteria. 58 patients had covered and 22 had uncovered stents. Technical success was 97.5%. Average GOOSS was 0.08 pre-procedure and 1.86 post-procedure. 76 patients (95%) had a GOOSS improvement of ≥ 1 . There were 17 complications (21%) including stent migration (4), re-stenosis (4), stent not fully open (2), perforation (4), biliary stent dislodged (2) and pancreatitis (1). 7 patients (9%) underwent re-stenting. Medial length of survival post-procedure was 69 days.

Conclusion: The Hilzo pyloric/duodenal stent has high technical and clinical success for malignant gastric outlet obstruction with an acceptable complication rate and low re-intervention rate.

FP-60

Baseline interleukin 6 values predict liver decompensation and survival in HCC patients undergoing radioembolization

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Purpose: To confirm the value of previously published baseline interleukin (IL) 6 and IL8 cutoff values to predict survival and liver dysfunction in patients with advanced HCC undergoing Y90 radioembolization.

Materials and Methods: A total of 83 patients (77 male) represented a subset of HCC patients undergoing Y90 radioembolization combined with sorafenib as part of the SORAMIC trial. IL6 and IL8 levels were determined in serum samples collected at baseline. In this study, baseline cut-off values of 6.53 pg/mL and 60.8 pg/mL for IL6 and IL8, respectively, were analyzed to predict overall survival (OS) or liver dysfunction (grade 2 bilirubin increase) after treatment.

Results: Median OS was 12.4 months. In univariate analysis, high baseline IL6 and IL8 were associated with significantly shorter overall survival (7.8 vs. 19.0 months for IL6 and 8.4 vs. 16.0 months for IL8). In addition to IL values, liver cirrhosis, Child-Pugh grade, baseline albumin (<36 g/dL), and total bilirubin (≥ 17 μ mol/L) values were associated with OS. At multivariate analysis, high baseline IL6 was the only independent prognostic factor for OS (HR, 2.35 [1.35-4.1], $p=0.002$).

Predictors of liver dysfunction were high baseline IL6, albumin, and total bilirubin, as found in univariate analysis. In multivariate analysis, high baseline IL6 (HR, 2.67 [1.21-5.94], $p=0.016$) and total bilirubin <17 μ mol/L (HR, 0.27, [0.12-0.58], $p<0.001$) were independently associated with liver dysfunction.

Conclusion: In advanced HCC patients receiving Y90 radioembolization combined with sorafenib, baseline IL6 values proved to be prognostic, confirming previous findings in patients undergoing Y90-radioembolization. IL6 might be useful for patient selection or stratification in future trials.

FP-61

Percutaneous drainage of diverticular abscess. Predictors for long-term adverse outcome: a cohort study

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Purpose: To assess long-term results and identify risk factors associated with adverse outcome of percutaneous management of diverticular abscess.

Materials and Methods: All patients admitted between January 2011 and December 2020 with diagnosis of diverticular abscess were included. Computed tomography (CT)-scan was used for diagnosis (Hinchey I-II) and indication of percutaneous drainage (abscess $\Rightarrow$ 3cm). Initial multipurpose catheters were inserted under CT-guidance, and CT or fluoroscopy

was used for further exchange or additional drains. Long-term adverse outcome was defined as a composite outcome including: Failure of percutaneous treatment (clinical worsening/persistent symptoms >30 days) or long-term complications (fistula, abscess, perforation or stricture). Variables studied were: Clinical features, abscess characteristics (type, size, localization, number, hydro-level), Charlson score, previous episodes and microbiology (abscess and blood). A multivariate Cox proportional hazards regression analysis was performed.

Results: Forty-four patients required percutaneous drainage. Of them, 19 (43.2%) presented long-term adverse outcomes (failure of percutaneous treatment, 5; long-term complications, 14), while 25 (56.8%) patients remained asymptomatic. Median event-free survival was 19.9 months. Event-free survival at 1, 3 and 5-years was 56%, 47%, and 37%, respectively. Mean follow-up was 15.3 ± 19.3 months. In the multivariate analysis, positive blood culture (HR 5.1; CI95% 1.5—17.5; $p < 0.01$) and hydro-level (HR 4.9; CI95% 1.1—22.7; $p = 0.046$) were predictors for adverse outcome. **Conclusion:** Diverticular abscesses may be effectively treated percutaneously, with no symptoms on the long-term. Positive blood cultures and hydro-level in the abscess are risk factors for long-term adverse outcome. Elective surgery may be recommended in this subgroup.

FP-62

Endovascular management of early hepatic artery thrombosis in the first 48 hours post living-donor liver transplantation: feasibility, efficacy and potential risks

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Purpose: The aim of this retrospective cohort study is to assess the feasibility, efficacy and potential risks of endovascular management of early hepatic artery thrombosis (HAT) in the first 48 hrs post-LDLT.

Materials and Methods: The medical records of 730 recipients who underwent LDLT between August 2001 and December 2020 at 3 transplant centres in Egypt were retrospectively reviewed. All cases who had developed early HAT occurring within the first 30 days post-transplant were identified. Endovascular interventions were performed using standard catheter techniques. Thrombolysis was performed using tPA or streptokinase, whereas angioplasty and stent placement were performed if there was an underlying stricture.

Results: Thirty-one patients developed early HAT (4.2%). Definite technical success and 1-year survival rates of surgical revascularization [11/31 cases (35.5%)] were 72.7% & 72.7%, whereas those of endovascular therapy [27/31 cases (87.1%)] were 70.4% & 59.3%, respectively. Endovascular therapy was carried out in the first 48hrs post-transplant in 9/31 cases (29%) [definite technical success:88.9%, 1-year survival:55.6%]. Four procedure-related complications were reported in 3 of those 9 cases (33.3%).

Conclusion: In conclusion, early HAT post-LDLT can be treated by surgical revascularization or endovascular therapy, with comparable results. Endovascular management of early HAT in the first 48hrs after surgery appears to be feasible and effective, but is associated with a relatively higher risk of procedure-related complications, compared to surgical revascularization. Hence, it can be reserved as a second-line therapeutic option in certain situations where surgical revascularization is considered futile, potentially complex or more risky.

Gynaecological intervention (including UFE)

FP-63

Satisfaction of patients with trans-arterial radial access: quality of life in uterine fibroid embolization (SPARQLE trial)

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Purpose: To compare transradial (TR) and transfemoral (TF) access in patients undergoing uterine artery embolization for fibroids (UFE) with respect to pain and quality of life (QOL).

Materials and Methods: A dual-arm, randomized controlled trial of fibroid patients undergoing UFE was conducted at a single institution (NCT03021720). Patients' blinded pre-procedure perceptions regarding TR and TF-UFE including overall pain, access site pain, back pain, anxiety, and difficulty toileting, walking, writing, eating and with self-care were assessed using surveys with visual analog scales (0-10). Post-procedure surveys assessing these patient-reported outcomes were administered within 24-hours and at 1-month post-UFE. Intention to treat analysis was performed.

Results: 40 patients (mean age 43.4 ± 5.71 years) were randomized to the TR group (n=20) or TF group (n=20). Pre-procedure anxiety and perception of overall pain, back pain, difficulty with toileting and walking were worse for TF compared to TR access ($p < 0.05$). However, within 24-hours post-UFE there was no significant difference in pain or QOL between TR and TF groups. TF access was associated with significantly more overall pain (4.06 vs. 1.95) and difficulty with eating/self-care (1.1 vs. 0.1) compared with TR access at 1-month post-UFE ($p < 0.05$). Post-procedure access site pain and difficulty toileting/walking were significantly less than anticipated among TF access patients ($p < 0.05$). TR patients experienced less access site pain and had less difficulty writing than anticipated ($p < 0.05$).

Conclusion: While patients perceived TR-UFE to be associated with significantly less pain and better QOL, there was no significant difference in patient reported outcomes within 24-hours after UFE between TR and TF access.

FP-64

Selective salpingography with tubal catheterization in the treatment of proximal tubal occlusion

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Purpose: Evaluation of the efficacy of selective salpingography (SSG) with additional tubal catheterization (TC) among infertile patients diagnosed with proximal tubal occlusion and analysis of reproductive outcome.

Materials and Methods: The prospective, single-center study between January 2012 and January 2019 included 248 women (age 34.4 ± 4.7 years) without any patent tube diagnosed. SSG was performed with the 5 F Kumpe catheter directed to the proximal tubal opening by tactile sensation. Its position was controlled under fluoroscopy and if correct, a contrast medium was injected to assess the patency and attempt to unblock the tube. In case of persistent obstruction, the radiologically guided tubal catheterization and guidewire recanalization was performed. Reproductive outcomes at minimum of 12 months following the treatment were collected by a telephone survey in patients with at least one patent tube.

Results: Of a total of 399 tubes with confirmed proximal tubal occlusion, 383 successfully restored their patency resulting in a 96% technical success rate. Thirty-five percent of occluded oviducts were treated with SSG and

65% required additional TC. Out of 200 patients included in follow-up, 80 patients conceived which resulted in a 40% overall pregnancy rate.

Conclusion: Selective salpingography and tubal canalization offer minimally invasive and cost-effective alternatives to tubal microsurgery and IVF-ET in women with tubal occlusion with a high technical success rate and promising clinical results. However, careful assessment of fallopian tubes and comprehensive evaluation of partners' reproductive situation prior to therapy are an absolute requirement.

FP-65

Role of contrast enhanced ultrasonography for the evaluation of uterine arteries embolisation as a treatment for symptomatic uterine fibroids

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Purpose: Pelvic MR is currently the gold standard technique to evaluate the radiological outcomes of uterine artery embolisation (UAE) in patients with symptomatic uterine fibroids. The aim of this study is to evaluate the effectiveness of contrast enhanced ultrasound (CEUS) compared to the actual Gold Standard to assess those patients.

Materials and Methods: A comparative prospective study was performed on a sample of 39 patients with symptomatic uterine fibroids treated with UAE in our hospital. CEUS and CEMR were performed before and after percutaneous treatment. Clinical and analytical follow-up at 12 and 24 months data was collected. US and MR findings, need of re-embolization, hysterectomy or other complications were also collected.

Results: 39 patients (mean age 44.4 years, 36-55) were included in our study. 21 (53.8%) completed clinical and analytical follow up at 12 months, and 18 (46.2%) at 24 months. Pre-embolization CEUS was performed on 27 (69.2%), whereas pre-embolization CEMR, post-embolization CEUS, and post-embolization CEMR was performed on 39 (100%). Post-UAE CEUS and CEMR showed identical results detecting persistence of tumoral vascularization (9 patients, 17.9%) and complete tumoral devascularization (30 patients, 82.1%), demonstrating that PPV and NPV of CEUS is 100%. Due to persistence of fibroid symptomatology, 5 patients underwent re-UAE, showing complete tumoral response immediately after. 2 patients had hysterectomy.

Conclusion: CEUS is an effective, safe, cheap and available technique to assess radiological outcomes for UAE in patients with symptomatic uterine fibroids, being CEMR only necessary before the percutaneous technique.

FP-66

Therapeutic ultrasound - another string in the bow for the interventionalist? UK clinical experience of HIFU ablation of symptomatic uterine fibroids

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Purpose: To evaluate the middle-term efficacy and complications of ultrasound-guided high intensity focused ultrasound (USgHIFU) for treatment of symptomatic uterine fibroids in an NHS population.

Materials and Methods: A prospective observational single-centre study at a single university hospital in Oxford, UK. Patients with symptomatic uterine fibroids who declined standard surgical or radiological intervention (UAE) subsequently referred to the HIFU unit were considered for USgHIFU treatment. Clinical evaluation, adverse event monitoring, uterine fibroid symptom and health-related quality of life questionnaire (UFS-QOL) and contrast-enhanced pelvic Magnetic Resonance Imaging (MRI) were performed before and for up to 24 months post-treatment to assess outcomes.

Results: Twelve of 22 referred patients underwent one session of USgHIFU ablation of 14 fibroids overall and received a two-year follow-up. No serious adverse events were reported, but a second-degree skin burn was observed in one patient who had a surgical scar from a previous caesarean section. Mean symptom severity scores (SSS-QOL) improved significantly from 56.5±29.1 at baseline to 33.4±23.3 (p<0.01) at three months, 45.0±35.4 (p<0.05) at one year and 40.6±32.7 (p<0.01) at two years post-treatment. Mean non-perfused volume ratio was 67.7±39.0% in the treated fibroids (n=14) within three months after treatment. Mean volume reduction rates of the treated fibroids were 23.3±25.5% at 3 months post-treatment (p<0.01, n=14), 49.3±23.7% at 12 months (p<0.05, n=8), and 51.9±11.1% at 24 months (p<0.005, n=8).

Conclusion: This study demonstrates efficacy of USgHIFU ablation of uterine fibroids in selected patients with low risk of complications. This non-invasive technology offers HIFU specialists and interventionalists an alternative therapy for symptomatic uterine fibroids and other tumours.

FP-67

Uterine artery embolization in the treatment of postpartum uterine hemorrhage: a single centre experience

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Purpose: To determine the safety and efficacy of Uterine Artery Embolization (UAE) for the treatment of primary postpartum hemorrhage (PPH) and to determine the factors associated with clinical outcomes.

Materials and Methods: This prospective single-center study was institutional review board approved, and informed consent was waived. Outcomes were analyzed in 502 patients who underwent UAE for primary PPH between January 2013 and January 2021. Mode of delivery, causes of bleeding, detailed laboratory and treatment records, and clinical outcomes were recorded. Clinical success was defined as cessation of bleeding after initial session of UAE without the need for additional UAE or surgery. Univariate and multivariate analyses were performed to determine the factors related to clinical outcomes.

Results: The clinical success rate was 91.8% (460 of 502). Among the 42 failed cases, 21 underwent repeat UAE, 18 underwent additional surgery and 3 recovered with conservative management. Overall bleeding control was achieved in 97.0% (487 of 502) of the patients. Overall mortality was 1.8 (9 of 502) after the first (n=3) or second (n=1) session of UAE or additional surgery (n=1). Among the 226 patients with long-term follow-up, 220 maintained a regular menstrual cycle and 16 had successful pregnancies. Univariate analysis showed that cesarean section delivery, disseminated intravascular coagulation (DIC), and massive transfusion of more than 10 red blood cell units were related to failed UAE. Multivariate analysis showed that DIC (odds ratio, 0.35; P=.03) and massive transfusion (odds ratio, 0.11; P<.001) were significantly related to clinical failure.

Conclusion: Uterine Artery Embolization is safe and effective for managing primary Postpartum Hemorrhage. Patients with DIC and massive transfusion were likely to have poor results after UAE.

Imaging

FP-68

A five-year computed tomography follow-up study of proximal aortic neck dilatation after endovascular aortic repair using four contemporary types of endografts

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Purpose: To analyze the progression of proximal aortic neck diameter in patients with asymptomatic abdominal aortic aneurysms and treated by endovascular aortic repair using 4 different, contemporary types of endografts.

Materials and Methods: Retrospective study of 4 cohorts of 30 patients, presenting with asymptomatic abdominal aortic aneurysms and treated with endovascular aortic repair using 4 different types of contemporary endografts, including Endurant® (Medtronic), Excluder® (W.L. Gore), Zenith® (Cook Medical) and Ovation® (Endologix) endograft. Patients' demographics and aortic aneurysm measurements, including proximal neck diameter, were gathered from the patients' electronic medical records and follow-up computed tomography studies, respectively. Diameter measurements were modeled as a function of type of endograft; an interaction test was used for testing whether the evolutions over time were different between the 4 types of endografts.

Results: The progressive increase in proximal neck diameter from pre-operative baseline up to 5 years of follow-up was 1.20 mm for Endurant (P=0.0054), 1.72 mm for Ovation (P=0.0006), 1.14 mm for Excluder (P=0.0102) and 2.83 mm for Zenith (P<0.0001) respectively. Difference in progression in aortic neck diameter was statistically significant between the Ovation and Zenith Cook (P=0.043). Five patients (4%) presented with a late type 1a endoleak: Medtronic (n=1); Ovation (n=2) and Zenith (n=2).

Conclusion: All endografts were associated with a progressive dilatation of the proximal aortic neck over a time interval of 5 years and may be associated with late type 1a endoleak.

FP-69

Correlation of functional MRI with changes in tumor microenvironment following sorafenib and immunotherapy in hepatocellular carcinoma

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Purpose: Previously, few studies have focused on the dynamic monitoring of the tumor microenvironment changes during anti-vascular therapy and immunotherapy. Here, we used serial multimodal structural and functional magnetic resonance imaging (MRI) dynamic early assessment of tumor microenvironmental changes in HCC after treatment with sorafenib and anti-PD-L1 antibody and elucidate the synergistic mechanism.

Materials and Methods: Subcutaneous syngeneic HCC tumors were established in the right flanks of C57/BL6 mice. Mice were longitudinally scanned using T1/T2-weighted MRI, diffusion-weighted (DW) MRI, and magnetic resonance spectroscopy (MRS) 1 day before and on days 7, 14 and 21 after treatment initiation to determine tumor size, necrosis area, apparent diffusion coefficient (ADC) value, and tumor metabolites including lactate. At indicated days later, the tumor-bearing mice were euthanized, and tumor tissues were harvested for further analysis.

Results: We treated 6-week-old C57/BL6 mice with subcutaneous tumor volume of about 80-120mm³ with daily sorafenib gavage or

intraperitoneal injection of anti-PD-L1 antibody every 3 days, and control mice with intraperitoneal injection of isotype-matched IgG antibody every 3 days. Compared to sorafenib or anti-PD-L1 antibody, combination therapy of sorafenib and anti-PD-L1 antibody markedly retarded tumor growth, and led to increases in ADC value. Excessive pruning of tumor vessels by sorafenib resulted in increased tumor hypoxia in the tumor microenvironment, and MRS showed an enhancement of lactate levels.

Conclusion: These imaging methods serve as a unique and non-invasive MRI biomarker for the early dynamic evaluation of tumor microenvironment changes after anti-vascular treatment and immunotherapy for HCC.

FP-70

Value of CT perfusion-parametric maps for the evaluation of type 2 endoleaks after endovascular aneurysm repair

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Purpose: To examine various CT perfusion parameters, regarding their ability to differentiate aggressive from benign type 2 endoleaks (T2ELs) after endovascular aneurysm repair (EVAR).

Materials and Methods: Patients who had undergone an EVAR and diagnosed with a T2EL through a tri-phasic CT angiography (CTA) were subjected to CT perfusion (CTP). Eight different perfusion-parametric maps were generated. Regions of interest were placed on endoleak and endoluminal. Aneurysm-sac volume (ASV) was measured at baseline and 6-months later with CTA and patients were divided into 2 groups according to the change of ASV. Receiver operating characteristic analysis was employed to evaluate each map's ability to discriminate aggressive T2ELs. The effective dose of CTA and CTP was recorded.

Results: Seven patients with T2EL were analyzed. Blood flow (BF) and permeability surface (PS) perfusion-parametric maps were found to have the highest power to discriminate aggressive T2ELs (p<0.05). Patients with sac shrinkage (group A) had lower BF endoleak-to-endoluminal (EE) ratio and higher PS EE ratio compared to those with stable or expanding sac (group B). All other perfusion-parametric maps had lower discriminating power. BF EE ratio cut-off criterion of 0.375 was found to provide 100% sensitivity and specificity. PS EE ratio cut-off criterion of 4.38 was able to provide sensitivity of 100% and specificity of 75%. The mean effective dose of tri-phasic CTA was significant higher compared to CTP (45.5 versus 25.72 mSv, respectively; p<0.05).

Conclusion: BF and PS parametric maps were found to have the highest power to discriminate aggressive from benign T2ELs after EVAR.

Neuro and carotid intervention

FP-71

Clinical results of a MicroNet covered carotid-stent (CGUARD): analysis of 145 patients at two sites

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Purpose: The CGUARD-Stent consists of an inner open-cell nitinol design covered by an outer closed-cell PET design. Due to its structure is characterized by high plaque coverage and conformability. This study aims to assess the procedural and post-procedural (6-month) clinical outcomes of one-size self-adjusting to vessel wall CGuard stent in a prospective registry.

Materials and Methods: In 145 consecutive patients at two sites with symptomatic or high-grade stenosis of the internal carotid artery (ICA) were prospectively recruited and treated with the new double-layer stent (CGuard, Inspire MD) with the one-size self-adjusting to vessel wall technology. All implanted stents had a diameter of 10mm and a length of 30 mm (23.5 %) or 40 mm (76.5 %). The technical success and clinical outcomes were analyzed with 6-month FU.

Results: The patient's mean age was 70.4 ± 9.0 years, and 76.5% were symptomatic. The average stenosis rate was 79.2 ± 8.5 % at a mean lesion. In 145/145 patients, the stent could successfully be implanted. No peri-interventional complications occurred. In one patient (0.7%), intracranial bleeding of the contralateral side was observed two weeks after implantation and led to death. No further peri- or postinterventional minor or major stroke was observed. No in-stent restenosis was found at 6 months duplex ultrasound follow-up.

Conclusion: The clinical results showed that the novel self-adjusting to vessel wall MicroNet covered stent provides excellent procedural and 6-month clinical outcomes.

FP-72

Branch vessel occlusion in aneurysm treatment with flow diverter stent

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Purpose: Flow diverter stent (FDS) placement for treatment of intracranial aneurysms gained growing consensus in the past years. A major concern is the side branch coverage which leads in selected cases to vessel occlusion. However, the lost vessel patency only infrequently is accompanied by a new onset of neurological deficits secondary to ischemic lesions. Our aim was to better understand this phenomenon and to formulate a hypothesis about the causes.

Materials and Methods: Data were reviewed retrospectively from a prospectively maintained database on patients who were treated with at least one FDS between 2009 and 2018 at our institution. From this database we further selected those patients with at least one covered side branch in addition to the parent vessel. Occlusion of covered side branch vessels was defined as absence of flow on angiographic follow-up after 3, 6 and 12 months.

Results: We included 112 patients with 119 aneurysms. A total of 214 branch vessels were covered by a FDS. On follow-up angiography 7/87 OphA (8%), 11/32 PComA (34%), 5/19 A1-Segment (26%), 5/6 ACoA (83%) were occluded. No instance of other vessel occlusion was observed. Out of the patients that showed branch vessel occlusion, only one presented with clinical symptoms (reversible amaurosis in OphA-occlusion).

Conclusion: We conclude that vessel occlusion may occur due to a reduced blood pressure gradient in those vessels with a strong collateral or anastomotic vascularization that refurnishes the same distal vascular territories. Indeed, we detected no fresh brain infarction since distal blood supply was always guaranteed.

FP-73

Final 30-day safety outcomes of Roadsaver dual-layer micromesh carotid artery stent: evidence from a large multicentre European study

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Purpose: The present study aims to further confirm the clinical performance of the dual-layer micromesh Roadsaver stent in carotid artery disease treatment.

Materials and Methods: ROADSaver is an ongoing, prospective, single arm, multicentre, observational study. The study enrolled 2000 patients with a non-occlusive/non-thrombotic carotid stenosis, eligible for elective stenting with Roadsaver stent at 57 centres (13 European countries). Patients are followed up for 12 months. The primary safety outcome is cumulative incidence of any death or stroke up to 30 days post-procedure. An independent Clinical Events Committee adjudicates all deaths, strokes and carotid revascularizations.

Results: Interim analyses of 1242 patients reveal a mean patient age of 70.6 ± 8.8 years (29.9% females and 45.2% symptomatic patients). The mean target lesion length is 17.8 ± 8.4 mm and diameter stenosis (DS) 80.2 ± 13.3 %. Sixty percent of lesions are calcified, 26.1% ulcerated, with majority localized within the internal carotid artery (89.1%). Radial approach is used in 28.3% and embolic protection in 59.8% of procedures. Residual DS (post-stenting) is 6.8 ± 10.0 %. Current 30-day any death or stroke rate is 2.1% in all and 1.1% in patients <75 years old (n=804), with incidence of any stroke 1.8% and 0.9% in the two populations, respectively.

Conclusion: The ROADSaver study offers insights into the contemporary pan-European practice and outcomes of elective CAS with dual-layer micro-mesh device. Preliminary data in a large subset of >1200 patients shows excellent performance of the Roadsaver stent, particularly in <75 years old subgroup. Final 30-day primary endpoint results of 2000 patients will be available for presentation at CIRSE2021.

FP-74

Superselective ophthalmic artery chemoinfusion in the management of retinoblastoma: a tertiary care cancer center experience from India

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Purpose: To examine the treatment outcomes and safety of superselective ophthalmic artery chemoinfusion in the management of retinoblastoma (RB).

Materials and Methods: Single center, retrospective interventional case series of 83 eyes in 70 patients with intraocular RB who underwent OAC using single or multiple drugs which included, Melphalan (0.5 mg/kg, maximum 7.5 mg), topotecan (1 mg/ 2 mg) or carboplatin (15 - 30 mg). Patient selection was done in multidisciplinary tumor board with members from paediatric oncology, ophthalmology, pathology, radiation oncology and interventional radiology. A total of 315 OAC procedures were performed, diagnostic angiography of common carotid, internal carotid and external carotid arteries was performed followed by selective cannulation of the ophthalmic or recurrent ophthalmic artery. The patient was followed up with B-scan and examination under anaesthesia (EUA) to assess response to OAC and decide on further management. Treatment outcomes were evaluated in terms of technical success, tumor control, globe salvage rates and complications.

Results: OAC was employed as primary (n = 33) or secondary (n = 50) modality of treatment. Each eye received mean 3.8 OAC sessions (median: 4; range: 1–9 sessions). The technical success rate was 98.7 %. Globe salvage was achieved in 56 eyes (67.5 %). There were no procedure related mortalities (0%). Retinopathy and vitreous hemorrhage were observed in 7/83 (8.4%) and 8/83 (9.6%) eyes respectively. No cerebrovascular events were observed.

Conclusion: OAC is safe and effective therapy for globe preservation in eyes with RB.

FP-75

Triple neuroprotection during emergency carotid endarterectomy for acute stroke after failed tPA or beyond the 24-hour window of opportunity

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Purpose: To propose an innovative approach called triple neuro-protection (TNP), which encompasses three technical domains - targeted hypothermia, systemic induced hypertension, and barbiturates infusion.

Materials and Methods: From 2002 – 2019, we performed 832 carotid interventions amongst more than 12,000 patients referred to our tertiary vascular services with carotid artery disease. Amongst them, twenty-five patients presented between March 2015 and 2019 with acute dense stroke with either failed tPA or passed the recommended timing for acute stroke intervention. Fifteen (60%) had hemineglect with evidence of acute infarct on MRI brain and a Rankin score of 4 or 5. Ninety-six percent had an 80-99% stenosis on the symptomatic side, and mean ABCD3-I score was 11.35. All patients underwent emergency carotid endarterectomy (CEA) with therapeutically induced hypothermia (32-34°C), targeted hypertension (systolic blood pressure 180-200 mm Hg), and brain suppression with a barbiturate.

Results: There were no perioperative complications and/or mortality. There were no myocardial infarction cases, death, cranial nerve injury, wound hematoma, or procedural bleeding. Mean hospital stay was 8.4 (±9.5) days. All patients had resolution of neurological symptoms, except for three (failed thrombolysis previously). Eighty percent had a postoperative Rankin score of 0 on discharge, and 88% of patients were discharged home with 3 requiring rehabilitation.

Conclusion: We observed positive neurological outcomes and no serious adverse events with TNP during emergency CEA in acute brain injury patients. Based on our favourable experience, we recommend a large-scale study on TNP.

FP-76

Direct transbrachial approach vs rescue transbrachial approach for mechanical thrombectomy in anterior circulation large-vessel occlusion: results from a single center prospective study

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Purpose: Endovascular thrombectomy (EVT) is a standard treatment procedure in patients with acute large vessel occlusion (LVO) stroke. The femoral artery is conventional approach for EVT. However, unfavorable aortic arch anatomy can make catheterization of the carotid artery difficult or even impossible. The transbrachial approach (TBA) is an alternative method to the transfemoral approach (TFA). The aim of our study was to compare direct-TBA (dTBA) versus rescue-TBA (r-TBA) after failure of TFA.

Materials and Methods: From February 2018 to February 2021 we treated in our center 180 patients with EVT for acute LVO stroke. Patients with unfavorable aortic arch anatomy were randomly assigned to direct-TBA or to TFA. Technical aspect (procedure time, time to intracranial access, time to reperfusion), clinical implications, complication rate, and overall outcome were recorded.

Results: 44/180 patients had unfavorable aortic arch anatomy. 20 patients were treated with d-TBA while 24 with TFA and 18 of them treated by r-TBA. In all patients with TBA we were able to successfully perform mechanical thrombectomy.

The total procedure time, time to intracranial access and time to reperfusion was longer in patients treated with r-TBA (median: 82.5 min) than d-TBA (median: 32 min). Local complications were observed in two cases with brachial artery Pseudoaneurysm.

Conclusion: In patients with hostile aortic arch the d-TBA is safe and feasible and should be considered as first line approach. Further comparative studies are needed to determine criteria for selecting the d-TBA approach in this setting.

Oncologic intervention

FP-77

Determination of risk factors for fever after transarterial chemoembolization with drug-eluting beads for hepatocellular carcinoma

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Purpose: To identify risk factors for postembolization fever after transarterial chemoembolization with drug-eluting beads (DEB-TACE) for hepatocellular carcinoma (HCC).

Materials and Methods: In this retrospective study, a total of 188 consecutive patients who underwent DEB-TACE between June 2017 and May 2019 with post-TACE fever were included. The patients were divided into three groups based on the severity of post-TACE fever according to the degrees of body temperature. Potential risk factors for post-TACE fever were primarily analyzed by univariate analysis and multivariate logistics regression.

Results: The univariate analysis showed that the pre-TACE blood urea, the presence of tumor thrombus in portal vein or in vena cava, albumin and small particle size microspheres were more likely to have severe post-TACE fever ($P < 0.001$, respectively). However, in the Stepwise multiple regression analysis, the pre-TACE blood urea and small particle size were independent risk factors of severe post-TACE fever ($P < 0.001$, respectively). Fever was not associated with 20-mo survival ($P = 0.245$) or computed tomography (CT) response ($P = 0.321$) in a univariate analysis. Tumor size ($P = 0.05$), and portal vein thrombosis ($P = 0.042$) were significant predictors of survival in the multivariate analysis. Furthermore, the tumor progression-free interval was closely associated with tumor size > 5 cm ($P < 0.001$) and tumor type (poorly defined) ($P < 0.001$).

Conclusion: In conclusion, Fever has no impact on survival at 20mo or radiologic response. The pre-TACE blood urea and the size of the beads were independent risk factors for postembolization fever in HCC patients. Therefore, these factors should be taken into full consideration for the relief of fever.

FP-78

Early recurrence after radiofrequency ablation for hepatocellular carcinoma: a multicenter retrospective study on definition, patterns and risk factors

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Purpose: To define an optimal cut-off time to distinguish early and late recurrence in hepatocellular carcinoma (HCC) patients after radiofrequency ablation (RFA), and to determine the risk factors and patterns of early recurrence.

Materials and Methods: This retrospective study included HCC patients who developed recurrence after RFA as the primary therapy at three Chinese hospitals from January 2011 to December 2016. The best cut-off time to define early and late recurrence was determined based on

differences in post recurrence survival (PRS). The clinical variables were assessed by univariate and multivariate logistic regression analyses.

Results: A total of 279 eligible patients were included. The optimal cut-off time interval after RFA to differentiate early and late recurrence was identified as 12 months ($P=0.029$). The independent risk factors of early recurrence were multiple tumors, alpha fetoprotein (AFP) levels, gamma-glutamyl transferase (γ -GT), and serum albumin (ALB) levels. A well-discriminated nomogram was constructed to predict risk of early recurrence. The incidence of intrahepatic distant recurrence (IDR) alone and IDR + extrahepatic recurrence (ER) in early recurrence group was significantly higher than those in late recurrence group (80.73% vs. 66.47%, $P=0.009$).

Conclusion: Twelve months was determined as the optimal cut-off time for differentiating early and late recurrence after RFA for HCC patients. The factors affecting early recurrence after RFA were multiple tumors, AFP levels, ALB level, and γ -GT level. Patients in early recurrence cohort were more likely to develop IDR alone or IDR+ER.

FP-79

Slow freeze vs fast freeze cryoablation: local and systemic immune responses in melanoma

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Purpose: Cryoablation could be employed effectively as an in vivo vaccination tool. The purpose of this study was to investigate the impact of freeze rate on immune responses in a murine model of melanoma.

Materials and Methods: Two hundred and sixty-one B16F10 melanoma-bearing mice were assigned to three different experimental groups: a) non-treated, b) cryoablation by slow freeze, c) cryoablation by fast freeze. Flow cytometry analyses were performed in tumors, spleen and lymph nodes (local and distant) post-cryoablation to investigate the immune cells. Balance of necrosis/apoptosis was investigated by H&E and cleaved-caspase-3. A fraction of mice post ablation were subjected to survival analyses, and long-term tumor-free survivors were re-challenged to determine if cryoablation has generated a tumor-specific immunologic response.

Results: Cryoablation by fast freeze was superior to slow freeze in controlling the tumor loco-regionally, and significantly prolonged the survival. Increased levels of tumor necrosis was observed in tumors treated with fast freeze as compared to slow freeze treatment, corroborating the survival data. Re-challenge experiments proved that fast freeze generated tumor-specific immunologic memory that extended the survival of mice after melanoma re-challenge versus naïve mice. Fast freeze elicited better immunogenic responses over slow freeze, with increased CD8⁺T-cells and CD4⁺T-cells in the tumor draining and non-draining lymph nodes.

Conclusion: Fast freeze seems superior to slow freeze in the treatment of tumors, yielding significantly better survival and immune responses. Thus, cryoablation with fast freeze can be used as an in vivo vaccination tool for enhanced antitumor efficacy in combination with targeted immunotherapies.

FP-80

Real-world outcomes of patients treated with transarterial radioembolization for hepatocellular carcinoma: results from CIRT, a large European prospective multi-centre observational study

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Purpose: Trans-arterial radioembolization (TARE) is a treatment option for patients with hepatocellular carcinoma (HCC). Using the data from the European prospective multi-centre observational study CIRSE Registry for SIR-Spheres Therapy, we evaluated the outcomes of TARE in HCC.

Materials and Methods: Patients were enrolled prospectively between Jan 2015 and Dec 2017. Eligible patients were adults treated with TARE with Y90 resin microspheres. Baseline characteristics and treatment-related data were collected with follow-up data every 3 months for 24 months including overall survival (OS), (hepatic) progression-free survival [(h) PFS] and safety data.

Results: 422 patients were prospectively included from 25 sites in 8 European countries. Median age was 68 (range 22-92) and 80.8% were male. The Barcelona Clinic Liver Cancer (BCLC) staging was A (14.0%), B (51.4%), C (33.4%) or D (1.2%). 50.2% of the patients received TARE as first-line treatment, 44.8% received locoregional treatments prior to TARE (surgery 17.1%, ablation 14.7% and/or transarterial chemoembolization (TACE) 23.0%). 10.7% received prior systemic treatment. The investigator-assessed treatment intent was predominantly palliative (57.3%) or tumour downsizing (32.5%). Median OS was 16.5 months (95% CI 14.2-19.3), median PFS was 6.1 months (95% CI 5.7-7.0) and median hPFS was 6.7 months (95% CI 5.9-7.6). 36.7% of the patients experience 311 adverse events, with 9.7% of the patients having 41 (13.2%) grade 3 or higher adverse events.

Conclusion: The results from this large prospective multi-centre observational study show that in the real-world setting, patients with HCC receive TARE as first-line treatment or after alternative locoregional treatments. TARE is well-tolerated with low occurrences of severe adverse events.

FP-81

Does cryoablation failure for renal cell carcinoma increase WHO/ISUP tumoral grade?

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Purpose: To determine if cryoablation failure (incomplete treatment or recurrence) of renal cell carcinoma (RCC) induces changes in the WHO/ISUP grade of the tumor.

Materials and Methods: In this single-institution retrospective review of 375 biopsy proven RCCs treated with cryoablation between 2009 and 2019, MRI follow up identified 41 patients with local control failure. For 14/41 we disposed from pre and post treatment histopathology (image

guided re-biopsy n=10 and/or surgical specimen n=9). Of these, 13 were of clear cell type RCC and one of papillary type. All slides were blindly scored using the WHO/ISUP grading system by an experienced uropathologist.

Results: Baseline tumors were scored grade 2 (n=11, 79%), grade 3 (n=2, 14%) and grade 4 (n=1, 7%).

Post treatment tumors were scored grade 2 (n=8, 57%), grade 3 (n=1, 7%) and grade 4 (n=5, 36%).

WHO/ISUP grade increased in 5/14 patients (36%) and remained unchanged in 9.

All upgraded cases were based on nephrectomy specimens. In 3 patients pre-surgery core needle biopsy was obtained with the same results in 2/3 patients.

Conclusion: To our knowledge this is the first human study demonstrating an histopronostic grade increase after cryoablation failure for RCC in approximately one third of patients. If these results were to be confirmed, they would provide an additional reason to warrant cryoablation success in a single session.

FP-82

The ECLIPSE study: 5-year follow-up of the efficacy of cryoablation on metastatic lung tumors

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Purpose: The primary objective of ECLIPSE was to assess long-term efficacy of cryoablation for local tumor control in patients with pulmonary metastatic disease over the course of five years.

Materials and Methods: ECLIPSE was a prospective, multicenter, single-arm study of cryoablation in subjects with 1 to 5 metastatic lung tumors, each with a diameter of ≤ 3.5 cm, with five years of follow-up. The primary endpoint was local tumor control (per tumor and per subject); additional secondary endpoints were disease-specific and overall survival and quality of life (Karnofsky Performance Score, ECOG Performance Score, and Short Form-12 health survey).

Results: A total of 40 patients with 60 tumors were enrolled across 4 study sites; the 60 tumors were treated during the course of 48 procedures. Of the subjects enrolled, 42.5% were treated for colorectal cancer metastases to the lung. While 42.5% had received previous systemic treatment and 75% had received prior local treatment to other lung metastases, no target tumors treated in ECLIPSE had received locoregional therapy. Kaplan-Meier estimates for freedom from local failure at 3 years were 91.3% per tumor and 87.1% per subject; at 5 years, it was 81.1% per tumor and 74.6% per subject. Disease-specific survival was 74.8% at 3 years and 55.3% at 5 years; overall survival was 63.2% and 46.7% at 3 and 5 years, respectively. Quality of life scores trended upwards over time compared to baseline but were not significant.

Conclusion: Cryoablation is effective for long-term local tumor control in patients with metastatic pulmonary tumors.

FP-83

TACE with drug-eluting beads for treatment of unresectable intrahepatic cholangiocarcinoma: the analysis of efficacy and safety

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Purpose: This preliminary study aimed to evaluate safety, efficacy and factors influencing the prognosis of drug-eluting beads transcatheter arterial chemoembolization (dTACE) with Callispheres beads (CB) for Intrahepatic Cholangiocarcinoma (ICC).

Materials and Methods: A total of 39 unresectable ICC patients who received dTACE treatment with CB were retrospectively enrolled in this preliminary study. Information about tumor response, overall survival (OS), progression free survival (PFS) and the incidence of adverse events were collected. The Kaplan-Meier curve was used to evaluate OS and PFS. Factors influencing the prognosis were determined by Cox's proportional hazards regression model.

Results: Tumor response of 39 unresectable ICC patients was complete response (CR) in 6 patients (15.4%), partial response (PR) in 8 (20.5%), stable disease (SD) in 8 (20.5%) and progressive disease (PD) in 17 (43.6%) at 3-month after dTACE. The median OS and PFS were 11.0-month and 8.0-month respectively. Cox's proportional hazards regression analysis demonstrated that combined treatment and low CA125 level were independent favorable prognostic factors. Besides, common adverse events included transient elevation of aminotransferase, nausea, vomiting, abdominal pain, fever and hyperbilirubinemia in unresectable ICC patients treated by dTACE with CB. Only one patient developed hepatic abscess after dTACE treatment.

Conclusion: dTACE with CB is a safe and effective treatment for unresectable ICC patients, with a low incidence of adverse events and a relative prolonged in terms of survival. Combined treatment and low CA125 level are the two prognostic factors associated with better survival.

FP-84

Percutaneous irreversible electroporation in the treatment of hepatic epithelioid hemangioendothelioma

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Purpose: Evaluate the safety and effectiveness of Irreversible Electroporation (IRE) as a minimally invasive treatment option for Hepatic Epithelioid Hemangioendothelioma (HEHE). HEHE is a rare vascular malignancy with an estimated incidence of 1-2 per million people and can resemble a benign hemangioma or multiple aggressive coalescing tumors similar to angiosarcoma. IRE is a non-thermal ablative modality first used to treat a HEHE patient in 2013.

Materials and Methods: An IRB-approved retrospective review of HEHE patients treated with percutaneous IRE between November 2018 and March 2021 was performed. Seven patients (3 male, 4 female), with median age of 42 years (Range 27 – 72 years) had 19 lesions treated. The average length of stay post procedure was 1.4 days. The median follow-up was 91 days (Range 0 - 460 days). Change in enhancement on follow-up CT or MRI was evaluated to assess response. Complete response was defined as lack of enhancement, partial response was defined as residual enhancement, and new enhancement in the treated zone was defined as local recurrence.

Results: All treated lesions had a response. Fifteen had complete, 3 had a partial response, and 1 had local recurrence on the one year follow-up scan. One patient's complete response for three lesions was based on immediate post-ablation CT. There were no grade III complications or 90-day post-procedure mortality.

Conclusion: This is the largest human experience using an ablative modality to treat HEHE. Currently there is no standard of care for HEHE and IRE offers a safe and minimally invasive treatment option for this rare malignancy.

FP-85

Yttrium-90 radioembolization as a possible new treatment for brain cancer: three-year update on clinical and post-mortem results for proof of concept and safety analysis in a canine model

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Purpose: To evaluate the safety and feasibility of Y-90 endovascular radiosurgery (ER) in the treatment of glioma in a canine model; clinical, post-mortem imaging, and histopathology results to date.

Materials and Methods: Three healthy research dogs (R1-3) and five client-owned dogs with spontaneous, intra-axial brain masses (P1-5) received unilateral Y-90 glass microsphere infusions in the PCA (R1), MCA (R2), or ICA (R3, P1-5), followed by Y-90 PET/CT. P1-4 had serial neurological exams, 1-, 3-, and 6-month MRIs, and then followed indefinitely by our study veterinarians, with post-mortem brain microCT and histopathology.

Results: P1, P3, and P4 had no neurologic deficits on presentation (seizures controlled on antiepileptics and corticosteroids). P2 presented with seizures on corticosteroids. P5 presented with neurologic deficits on antiepileptics and corticosteroids, and passed away 15 hours post-procedure. After resolution of transient post-procedural neurologic deficits (P1-3), P1-P4 remained grossly asymptomatic for a mean of 301 days (range: 53-745) without corticosteroids. P1 is the only remaining living patient; mean survival time (MST) of P1-4 is currently 433 days (range: 154-773). Post-mortem microCT in P5 demonstrated preferential bead deposition surrounding the necrotic tumor core despite hemispheric delivery. Histopathology on P2 and P5 demonstrated glial/astrocytic neoplasms and foci of rarefaction sometimes associated with preserved microspheres in the expected vascular territory. MicroCT and histopathology for P3-4 are pending.

Conclusion: Y-90 ER in the canine brain is technically feasible and caused no permanent neurologic deficits. Four of five patient dogs had favorable dosimetric, radiologic, and clinical outcomes, exceeding the 63-day MST associated with their original diagnosis and symptomatic treatment.

FP-86

Causal effect of locoregional therapy on survival in hepatocellular carcinoma (HCC) patients undergoing orthotopic liver transplantation (OLT): 2004-2017 UNOS registry analysis

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Purpose: The role of locoregional therapies (LRT) in bridging hepatocellular carcinoma (HCC) patients to orthotopic liver transplantation (OLT) has been well-established. In the present study, we evaluate the effect of single-session pre-OLT LRT on survival of HCC patients who underwent OLT.

Materials and Methods: A propensity score-matched, multivariable Cox Proportional Hazard regression was conducted on a retrospective cohort of 18,413 patients registered between 2004-2018 from the United Network for Organ Sharing (UNOS) database with survival as the outcome of interest. Pre-OLT LRTs in this analysis included radiofrequency ablation, cryoablation, transarterial chemoembolization, chemical ablation, radioembolization, external beam radiation, and thermal ablation. Anthropometric and clinical covariates, such as Milan Criteria, Child-Pugh, ECOG, and MELD scores, were used for propensity score matching.

Results: During this study, 4961 HCC patients who underwent single-session pre-OLT LRT were matched to 4961 HCC patients who did not receive any LRT (mean age: 59.12 ±14.53 years; mean number of tumors 1.3 ± 0.6; 22.8% female, 71.2% male). The single-session pre-OLT LRT was associated with Hazard ratio of 0.6444 (p<0.00001; CI: 0.5835-0.7118).

Conclusion: HCC patients who underwent single-session pre-OLT LRT received a significant overall survival benefit.

FP-87

A first in human study of embrace a polyethylene glycol based liquid embolic in the embolization of malignant and benign hypervascular tumors

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Purpose: To evaluate the safety and performance of a novel liquid embolic agent, Embrace HES™, in patients requiring vascular embolization for the treatment of malignant and benign hypervascular tumours.

Materials and Methods: A prospective, single-arm, multicentre study was performed. Technical Success was defined as successful delivery of the Embrace HES with disappearance of >90% of the targeted vascular bed or for portal vein embolization complete occlusion of the target portal branches on post procedure angiography. The volume of Embrace HES, ease of use and administration time were recorded. Subjects were evaluated at 7, 30 and 90-days post embolisation with physical examination, imaging (CT or MRI) and relevant blood tests.

Results: 8 patients (5 male, 3 female) aged from 30-85 years were included comprising of 10 embolisations in 8 lesions (3x renal angiomyolipoma, 4x hepatocellular carcinoma and 1x intrahepatic cholangiocarcinoma). 100% technical success with no target vessel recanalization at 30 days and in all patients that reached 90 day follow up. There were no device related unanticipated severe adverse events. Delivery times were 1-28

minutes (mean 15.1). Total Embrace HES volume injected was 0.4–4.0 mL (mean 1.6). Total fluoroscopy time was 12–26 min (mean 16.9). The average device ease of use score was 3.3 out of 5 on the Likert scale.

Conclusion: In this limited first in human study, the Embrace HES novel liquid embolic was well tolerated, safe, and resulted in a 100% embolization Technical Success. No recanalization was seen at imaging at 30 and 90 days, and tumour responses were as anticipated in this population.

FP-88

Active thaw following percutaneous cryoablation of pulmonary tumors decreases the incidence and grade of hemoptysis

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Purpose: To evaluate the effect of active thaw following the final freeze on hemoptysis following cryoablation of pulmonary tumors.

Materials and Methods: Retrospective single-center cohort study of 60 consecutive cryoablations targeting 95 pulmonary tumors in 47 patients from 2017–2020. Thaw mode following the final freeze of a standard triple-freeze protocol was active in 27/60 sessions (45%, active group) and passive in 33/60 sessions (55%, passive group). We abstracted the incidence and grade of hemoptysis from prospective registries. We graded pneumothorax and hemothorax per Common Terminology Criteria for Adverse Events (CTCAE) v5.0. We quantified immediate post-treatment change on CT (cm³) using segmentation. We compared outcomes between groups using generalized estimating equation models. We developed a parsimonious multivariable model for hemoptysis incidence using a purposeful selection of predefined covariables. We compared local progression-free survival using the Kaplan-Meier method.

Results: Hemoptysis occurred following 26/60 (43%) of all sessions and was mostly self-limited (22/26 Grade 1, 85%). The incidence of hemoptysis was lower in the active group (64% vs. 19%, $p=.002$). The odds of hemoptysis adjusted for immediate post-treatment change were 92% lower in the active group (OR, 0.08 [95%CI, 0.02–0.37], $p=.004$). The odds of hemoptysis > Grade 1 were 79% lower in the active group (OR, 0.21 [95%CI, 0.07–0.64], $p=.006$). Pneumothorax ($p=.60$), hemothorax ($p=.84$), and local progression-free survival ($p=.77$) did not differ between groups.

Conclusion: Active thaw following the final freeze reduces the incidence and grade of hemoptysis following percutaneous cryoablation of pulmonary tumors without adversely affecting procedural complications and local progression-free survival.

FP-89

Doxorubicin-eluting bead transarterial chemoembolization (DEB-TACE) in extra-abdominal desmoid tumors: initial experience

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Purpose: To evaluate the efficacy and safety of Doxorubicin-eluting bead transarterial chemoembolization (DEB-TACE) in extra-abdominal desmoid fibromatosis patients

Materials and Methods: Eleven female patients with symptomatic, progressively enlarging extra-abdominal desmoid tumors were treated with Doxorubicin DEB-TACE after failing or refusing systemic therapy. Six rectus sheath, one chest wall, three axillary, and one upper extremity desmoid tumors are included. The median follow-up period was 92±59 days. Treatment response was assessed by subjective pain score as well as imaging findings in follow-up MRI.

Results: All procedures were technically successful without immediate procedure-related complications. The mean doxorubicin dose per volume of the tumor was 0.2±0.14 mg/mL. All patients experienced temporary discoloration of skin overlying the tumor which improved over time without additional medical treatment. No grade 3 or 4 adverse events were observed. Initial one-month follow-up MRI demonstrated partial necrosis of tumor in all patients (mean necrosis volume of 48.5±30.0%) with an improvement of subjective pain scores in 7 out of 11 patients (63.6%). Additional follow-up (9 patients) revealed further tumor size reduction and improved subjective pain scores in 8 out of 9 patients (88.9%). All enhancing portions of residual tumors after DEB-TACE exhibited a T2 signal intensity decrease (mean 42.11±27.12% in follow-up MRIs, indicating a reduction in cellularity of the tumor).

Conclusion: DEB-TACE may be a safe and effective treatment in symptomatic, non-surgical desmoid patients who fail or refuse systemic therapy.

FP-90

The changing trends of image guided biopsy of small renal masses before intervention: an analysis of European multinational prospective EuRECA registry

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Purpose: This study aims to assess the trends and potential factors influencing the decision to perform image-guided biopsy before cryoablation treatment and compare the histological outcomes of pre-cryoablation biopsy and biopsy at the time of treatment to prevent treating benign SRMs.

Materials and Methods: From December 2014 to October 2020, patients with T1N0M0 SRMs undergoing percutaneous cryoablation from 14 European institutions within the European Registry For Renal Cryoablation (EuRECA) were included for the analysis. The trends of performing image-guided biopsy as a separate session before cryoablation of SRMs were investigated, and the potential factors influencing the decision to perform cryoablation biopsy were analysed using logistic regression models.

Results: 1,050 patients (Median[IQR] age, 69[13], 695 men) were evaluated. The use of pre-cryoablation biopsy has significantly increased from 39%(67/171) in 2015 to 72%(88/122) in 2019 ($p<0.001$). Rates of undiagnosed histology and benign histology are significantly higher in patients undergoing biopsy at the time of treatment (16%[50/313] vs 0.16%[1/636], $p<0.001$). For every 4.5 patients receiving pre-cryoablation biopsy, one less patient receives cryoablation treatment for a non-malignant renal tumor.

Patients more likely to get an image-guided biopsy pre-cryo-ablation	Patients less likely to get an image-guided biopsy pre-cryo-ablation
R.E.N.A.L. nephrometry score 10+ (OR 1.86, 95%CI 1.11-3.10)	Obesity (OR 0.73, 95%CI 0.55-0.98)
Charlson Comorbidity Index >1 (OR 2.11, 95%CI 1.54-2.88)	Old age (70+) (OR 0.47, 95%CI 0.24-0.92)
	Solitary kidney (OR 0.40, 95%CI 0.27-0.61)

Conclusion: Pre-cryoablation biopsies are more likely to lead to confirmatory histological diagnosis than biopsy at the time of cryoablation, thus reducing overtreatment of non-malignant SRMs and should be advocated.

FP-91

Does ramping power protocol reduce complications in patients treated with image-guided microwave ablation for renal tumors?

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Purpose: Subcapsular hematomas is a possible complication of microwave ablation (MWA) of renal tumors, due to the increase of intra-organ pressure. A progressively increasing power of MWA could reduce its incidence. The purpose of this study is to compare the rate of subcapsular hematoma, the overall complications rate and the outcome of patients with small renal tumor treated with ramping power technique MWA with patients treated with standard fixed power protocol MWA.

Materials and Methods: 167 patients were included in the study: 82 patients (group 1) underwent ramping power MWA, starting at 30/40W and gradually increasing power to the desired maximum value basing on tumor size, while 85 patients (group 2) received standard MWA with a fixed power value, based on tumor size. After ablation, all patients underwent contrast-enhanced CT immediately after the ablation and 24h later, to identify results and immediate complications.

Results: Subcapsular hematoma occurred in a significantly lower number of patients in group 1 than in group 2 (1/88 (1.1%) vs 8/93 (8.6%), $p=0.038$). There was no significant difference in the number of overall complications (9/88 (10.2%) in group 1 vs 16/93 (17.2%), $p=0.287$). Complete ablation at 24h was achieved in 83/88 procedures (94.3%) in group 1 vs 85/93 procedures (91.4%) in group 2 ($p=0.915$).

Conclusion: In conclusion, ramping protocol MWA in kidney tumors is associated to a lower incidence of subcapsular hematomas compared to standard MWA, with a similar efficacy.

FP-92

The influence of cholestasis with portal vein embolization (PVE) on future liver remnant (FLR) hypertrophy – the CHOP study: an Aachen Maastricht collaboration

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Purpose: The gold standard to induce Future Liver Remnant (FLR)-hypertrophy is Portal Vein Embolisation (PVE). However, the influence of

cholestasis on this induced hypertrophy remains unclear. In this study, the effect of cholestasis on PVE induced FLR-hypertrophy is examined.

Materials and Methods: Colorectal Liver Metastases (CRLM) or Perihilar Cholangiocarcinomas (pCCA) patients, who had undergone a PVE between January 2016 and December 2019 in Maastricht University Medical Center (MUMC+) or Uniklinik RWTH Aachen (UKA) before a right hemihepatectomy, were included. Bilirubin was used as a clinical marker for cholestasis. Segment II+III volumes before and after PVE were measured as a representation of the FLR via Syngo.via (Siemens). Kinetic Growth Rate (KGR) expressed as a percentages of growth/week and Degree of Hypertrophy (DH) were used to display FLR volume changes.

Results: After exclusions, 53 patients were enrolled (32 CRLM, 21 pCCA). There was a significant increase in segment II+III volume after PVE in both groups ($P<0.001$). The DH was significantly lower in patients with high bilirubin levels before biliary drainage ($p=-0.727$, $P=0.007$). DH and KGR did not significantly differ ($P=0.719$, $P=0.968$ respectively) between drained and undrained PCCA patients. Additionally, no association was found between the diameter of the bile duct before PVE and the KGR or DH.

Conclusion: In this analysis, a negative association between liver hypertrophy and initial bilirubin levels in pCCA patients was found. Neither drainage nor bile duct diameter seemed to influence the level of hypertrophy. Prospective trials are warranted to confirm these findings.

FP-93

Percutaneous image guided cryoablation and radio-frequency ablation versus partial nephrectomy for small renal cell carcinomas: a ten-years, single centre observational study

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Purpose: Long-term evidence comparing cryoablation (CRYO) and radio-frequency ablation (RFA) to partial nephrectomy (PN) for the management of small renal cell carcinomas (RCCs) are lacking. This is the first-ever study to report 10-years long-term evidence on the topic.

Materials and Methods: All patients in the prospective registry (2004-2015) with a solitary, biopsy- or histology-proven T1N0M0 sporadic RCCs undergoing RFA, CRYO or PN were included in this retrospective analysis. The primary outcome is 10-years cancer-specific survival (CSS). Secondary outcomes include overall survival (OS), local-recurrence-free survival (LRFS), metastasis-free survival (MFS), complication rates and change in eGFR peri-operatively.

Results: A total of 296 patients (187 males) were included. 239 patients (81%) had T1a disease, and 57 (19%) had T1b disease. The median follow-up period is 77.4[45] months. A total of 104 (35%), 99 (34%) and 93 (31%) patients had CRYO, RFA and PN, respectively. CRYO and RFA does not have significantly different OS, CSS, LRFS and MFS compared to PN in both T1a and T1b patients. Both the rates and severity of complications did not differ between the three groups. Using linear regression model, the predicted renal function reduction is smaller in CRYO (8.3%) and RFA (12.3%) patients when compared to PN patients ($p<0.01$).

Conclusion: This is the first study to report 10-years follow-up outcome comparing CRYO, RFA and PN. CRYO and RFA have similar oncological durability and better peri-operative outcomes compared to PN in T1a patients; and should be considered as a first-line treatment. More data is needed to evaluate CRYO and RFA for T1b tumours.

FP-94

Towards robot-assisted application of focused ultrasound-induced cavitation

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Purpose: Focused ultrasound (FUS) is a non-invasive therapy in the clinic, however, radiosensitization of FUS-induced cavitation was not sufficiently investigated. Thus, we evaluated the biological effects of combined FUS-induced cavitation and radiation therapy (RT) in human cancer cells, and the feasibility of robot-assisted positioning of FUS-transducer was investigated.

Materials and Methods: Human head and neck (FaDu) glioblastoma (T98G) and prostate cancer (PC-3) cells were treated in 96-well plate using an in vitro FUS-system (IMSaT, Dundee) at 1136W/cm² for 40s. Single-dose RT at 10Gy was applied using X-Rays (Gulmay; 0.76Gy/min). Biological effects were evaluated by clonogenic survival, cell invasion (Transwell-Matrigel assay, Corning), and metabolic activity (WST-1, Roche). A first step for the translation to clinic was made by mounting a FUS-transducer (H-102, Sonic Concepts, USA) to a robotic arm (KUKA AG, Germany). The positioning accuracy of the robot was measured with a custom reference tool and an optical tracking camera (Polaris Vicra, Northern Digital Inc., USA).

Results: The combination of FUS and RT lead to significant ($p \leq 0.05$) higher reduction of clonogenic survival in FaDu (4.7-fold), T98G (6.4-fold), and PC-3 (32-fold) compared to RT alone. The PC-3 cell invasion and metabolic activity were reduced from 52.8% and 81.5% (RT) to 33.3% and 46.5% (FUS+RT). The maximum and mean positioning error of the robot was measured at 2.6mm and 1.1mm respectively.

Conclusion: Our findings demonstrate that FUS is an efficient tool to enhance the radiosensitivity of cancer cells. The presented maximum error of 2.6mm is sufficient for FUS treatments of targets with a size over 3mm.

FP-95

Safety and effectiveness of irreversible electroporation in the treatment of solitary lymph node metastasis near critical structures: first human series

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Purpose: To evaluate the safety and effectiveness of percutaneous irreversible electroporation (IRE) in the treatment of solitary lymph node metastasis. IRE is a non-thermal ablation technology that uses DC current to induce cell death.

Materials and Methods: An IRB-approved, single center retrospective review was performed on 10 patients who underwent IRE of solitary lymph node metastasis between June 2018 - December 2020. Ten patients (Male 5, Female 5), with a median age of 64.5 years (Range 53-78 years) were included. Clinical and imaging follow-up was reviewed on all patients. Treatment failure was defined as a persistent enhancement, increase in size, maintained FDG avidity, or need for repeat treatment. Size changes in the treated nodes were also recorded.

Nine out of 10 patients were treated with systemic chemotherapy treatment prior to ablation. All nodes were within 1 cm from major vasculature (n=5) or bowel (n=5). IRE procedures were performed percutaneously under general anesthesia using CT guidance. Patients were followed up with a combination of PET, MRI, and/or CT and evaluated for changes in FDG uptake, enhancement and size. Median follow-up post-IRE was 280 days (Range 28-846 days).

Results: All patients had effective treatment with no uptake on follow-up PET scans and lack of enhancement on CT and/or MRI. A 37% (Range 14-81%) average size decrease was noted. There were no major

complications, collateral injury to vessels or bowel and no 90-day procedure related mortality.

Conclusion: IRE is a safe and effective option to treat solitary lymph node metastasis.

FP-96

Safety and toxicity of combining percutaneous hepatic perfusion with ipilimumab plus nivolumab in advanced uveal melanoma: phase Ib of the CHOPIN Trial

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Purpose: Establishment of maximum tolerated dose (MTD) of ipilimumab (IPI) and nivolumab (NIVO) with percutaneous hepatic perfusion with melphalan (M-PHP) in metastatic uveal melanoma (mUM) patients.

Materials and Methods: Dose-escalation trial including patients with confirmed measurable hepatic mUM according to RECIST 1.1 and WHO PS 0-1. Exclusion criteria were age >75 years and prior systemic treatment for mUM. IPI and NIVO dose was increased from 1mg/kg and 1mg/kg in cohort 1, to 1mg/kg and 3mg/kg in cohort 2. The M-PHP dose was 3mg/kg (maximum dose of 220mg) in both cohorts. Treatment duration was 12 weeks (4 courses IPI/NIVO and 2 M-PHPs in week 1 and 7). Primary endpoint was safety of IPI/NIVO with M-PHP defined by MTD. Toxicity and best radiological response (BRR) were assessed according to CTCAEv4.03 and RECIST 1.1 and irRECIST.

Results: 7 patients were included (4 men, mean age 61.4 years (range 50-74). Grade III/IV adverse events (AE) were; fever, neutropenia, SIRS, febrile neutropenia and cholecystitis (n=1 each) and hypotension (n=2), most likely related to M-PHP. Immune-related AEs were; myositis (n=2), hepatitis (n=2) and thyroiditis (n=2), all grade I/II. No dose-limiting toxicities or deaths occurred. MTD was defined as IPI 1mg/kg and NIVO 3mg/kg. After median follow-up of 8.0 months, BRR was; 1 complete response, 4 partial response and 1 stable disease (Overall Response Rate 71.4%). Median duration of response was 8.0 months.

Conclusion: IPI/NIVO with M-PHP is safe in patients with mUM. Efficacy of the combination treatment is currently being assessed in our randomized phase II trial (NCT04283890).

FP-97

Results of percutaneous hepatic perfusion with melphalan in patients with unresectable liver metastases from uveal melanoma: a multicenter retrospective study

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Purpose: The purpose of this study was to assess the efficacy of percutaneous hepatic perfusion with melphalan (M-PHP) in patients with unresectable hepatic metastases from uveal melanoma (UM), for which no standard treatment is available.

Materials and Methods: This multicenter (Netherlands and Germany) retrospective study included all patients with unresectable liver-dominant or liver-only metastases from UM who underwent PHP with melphalan (3mg/kg (max. 220mg)) between February 2014 up to December 2019. Main end-points were liver progression-free survival (LPFS) and overall survival (OS). Secondary end-points were radiological response according to RECIST 1.1 and complications according to CTCAE v5.0. Multivariable cox regression analysis was performed to identify prognosis-related variables.

Results: 102 patients (47% male; mean age 59.1 years (range 38-83)) completed a minimum of one M-PHP (median 2 (range 1-5)) and were included for analyses. At a median follow-up time of 14.5 months, median LPFS and OS were respectively 11.0 and 20.0 months. A disease-control rate of 89.2% was reached, including stable disease in 31 patients (30.4%), partial response in 55 patients (53.9%) and complete response in 5 patients (4.9%). Procedure-related 30-day mortality was 1.0% (n=1). Hematological toxicity was the most common adverse event (26% grade III/IV) and was self-limiting in most cases. In the multivariable analysis, patient age, treatment type of the primary tumor, tumor load and number of M-PHP procedures were significantly correlated with overall survival (P<0.05).

Conclusion: M-PHP is an effective, palliative therapy in patients with hepatic UM metastases and has an acceptable safety profile.

FP-98

Thermal ablation compared to partial hepatectomy for recurrent colorectal liver metastases: an Amsterdam Colorectal Liver Met Registry (AmCORE) based study

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Purpose: To assess safety, efficacy and survival outcomes of repeat thermal ablation as compared to repeat partial hepatectomy in patients with recurrent colorectal liver metastases (CRLM).

Materials and Methods: This AmCORE based study of two cohorts, repeat thermal ablation versus repeat partial hepatectomy, analyzed 136 patients and 224 tumors with recurrent CRLM from May 2002 to December 2020. The primary and secondary endpoints were overall survival (OS), local tumor progression-free survival (LTPFS) and disease-free survival (DFS), estimated using the Kaplan-Meier method, and complications, analyzed

using the chi-square test. Multivariate analyses based on cox-proportional hazards regression were used to account for potential confounders.

Results: Quantification of OS, after accounting for potential confounders, demonstrated no significant difference (hazard ratio [HR], 0.986; 95% confidence-interval [CI], 0.517-1.881; p = .966). One-, 3- and 5-year OS were respectively 98.8%, 56.0% and 32.6% for repeat thermal ablation and 93.5%, 70.8% and 36.8% for repeat resection. No differences in complications (p = .183), LTPFS (p = .397) and DFS (p = .942) were found. Mean length of hospital stay was 2.1 days in the repeat thermal ablation group and 4.8 days in the repeat partial hepatectomy group (p = .009). Subgroup analyses identified no heterogeneous treatment effects according to patient, initial and repeat local treatment characteristics.

Conclusion: Repeat partial hepatectomy was not superior to repeat thermal ablation with regards to OS, LTPFS, DPFS and complications, whereas length of hospital stay favored repeat thermal ablation. Repeat thermal ablation should be considered a valid alternative for small-size (0-3cm) CRLM in the treatment of recurrent CRLM.

FP-99

Thermal ablation versus stereotactic ablative body radiotherapy to treat unresectable colorectal liver metastases: a comparative analysis from the prospective Amsterdam CORE registry (AmCORE01)

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Purpose: Thermal ablation and stereotactic ablative radiotherapy (SABR) are well-established techniques to eradicate colorectal liver metastases (CRLM). This study compares the safety, efficacy and long-term oncological outcome of the two treatment methods.

Materials and Methods: This IRB-exempted comparative assessment analyzed all prospectively registered patients (AmCORE registry) treated with radical-intent thermal ablation or SABR alone for unresectable CRLM between 2007 and 2020. Adverse events, local-tumor-progression-free-survival (LTPFS), eventual local control, distant-progression-free and overall survival (OS) were assessed using uni- and multivariate Cox-proportional hazard regression to correct for potential confounders.

Results: Of 737 locally treated patients, 199 patients were included for full analysis: 144 (400 CRLM) thermal ablation; 55 (69 CRLM) SABR. SABR patients were characterized by female sex (p=0.005), higher age (p=0.006), extrahepatic disease at diagnosis (p=0.004) and larger tumors (p<0.001). Patients treated with thermal ablation were more likely to have synchronous disease, higher clinical risk scores (p=0.030) and higher numbers of CRLMs treated (p<0.001). Mortality was zero and morbidity low in both groups: no serious adverse events following SABR (n=0/55) and nine (n=9/144 [6.3%]; all CTCAE grade 3) after thermal ablation. SABR was associated with an inferior OS (median OS 53.0 months vs. 27.4 months; HR=1.29, CI95% 1.12-1.49; p=0.003), LTPFS per-tumor (HR=1.24, CI95% 1.01-1.52; p=0.044) and local control per-patient (HR=1.57, 95% CI 1.20-2.04; p=0.001) and per-tumor (HR=1.89, 95% CI 1.44-2.49; p<0.001).

Conclusion: For the treatment of CRLM, thermal ablation was superior to SABR with regards to OS, LTPFS and local control, albeit at the cost of a limited risk of serious adverse events.

FP-100

Optimised treatment planning of Yttrium-90 radioembolisation using cone-beam CT-derived liver volumetry

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Purpose: Increasingly refined dose calculation for Yttrium-90 radioembolization relies on accurate assessment of tumour and liver volumes. Cone-beam CT (CBCT) represents an alternative to pre-interventional cross-sectional imaging for liver volumetry with the possibility to visualize functional liver lobe anatomy after selective contrast injection. Data comparing these two options, however, is scarce.

Materials and Methods: In this retrospective study, 29 patients with contrast-enhanced CT/MRI and CBCT were included. CBCT was conducted in the late arterial phase after selective contrast injection in the (regular or replaced) right, left and – if present – accessory hepatic arteries. Volumes of liver lobes were determined according to the Couinaud classification (CT/MRI) or to arterial territories (CBCT). Results were compared using non-parametric tests.

Results: Of the 29 patients included, 17 had regular, 8 replaced and 4 accessory hepatic arteries ("medial" hepatic artery supplying segment 4 or accessory left hepatic artery). This resulted in 62 arterial territories. Percentage differences of CBCT related to pre-interventional CT/MRI varied substantially (0–72%): 0–10% in 40 territories (65%), 10–30% in 16 territories (26%), 30–50% in 5 territories (8%) and >50% in 1 territory (2%). Differences were most pronounced in patients with accessory hepatic arteries (median percentage difference 32.5% vs. 9.0%).

Conclusion: CBCT provides substantially more accurate volumetric analysis of hepatic arterial territories than CT/MRI with discrepancies of up to 72%, especially in patients with abnormal arterial supply. It therefore represents a more reliable basis for dose calculation for radioembolisation.

FP-101

Developement of a radiomics features based prediction model to assess response and overall survival in HCCs patients treated with TACE

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Purpose: To determine whether texture features on pretreatment contrast material-enhanced computed tomographic (CT) images can predict lesion Response according to the mRECIST criteria and the overall survival (OS) in patients with hepatocellular carcinoma (HCC) treated with TACE.

Materials and Methods: We retrospectively evaluated 52 patients affected by hepatocellular carcinoma (HCC) treated with TACE from September 2008 - March 2020. CT texture analysis was performed on pretreatment portal venous images. We analysed CT texture first level features (mean, standard deviation, entropy, mean of positive pixels, kurtosis, and skewness). An univariate and multivariate analysis was performed in order to identify Radiomic features predictor of Response and longer OS.

Results: After univariate and multivariate analysis, the Radiomics Features Entropy, Mean of Positive Pixels (mpp), Skewness and Kurtosis were used to divide our population in 2 Risk Class of probability of obtaining

a Complete Response (CR) VS a Partial Response (PR) or a Progressive Disease (PD), and the performance of our model were investigated using ROC curves (AUC0,733; SE 0,0117; 95% CI 0,713 . 0,753; p<.0001). OS was investigated with Kaplan Meier analysis after a Score based on Radiomic Features was constructed for each patient using a multivariate Cox proportional-hazards regression model. An high Radiomic score had a mean OS of 53 months VS 27 months; LogRank p<.0001; HR 2,27

Conclusion: Radiomic features are predictors of both Complete Response and OS in HCCs patients treated with TACE. Texture analysis can help better select which patients will benefit from TACE.

FP-102

Use of GPX embolic device for interventional oncology cases

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Purpose: The GPX Embolic Device is a novel embolic agent designed for embolization procedures including transcatheter embolizations. GPX Embolic Material is a low-viscosity fluid prior to delivery that solidifies in response to physiological ionic strength. The material follows vascular flow and is designed for deep distal penetration of distally-flowing vessels and complex vessel beds. Preclinical studies have demonstrated long-term occlusion without recanalization, and desirable handling characteristics. A clinical study is ongoing to study the use of GPX Embolic Device in the peripheral vasculature, including Interventional Oncology applications. The primary objectives of this study are to evaluate safety and early indicators of performance for the GPX Embolic Device and to provide direction for developing a pivotal clinical trial.

Materials and Methods: This is a single-arm, multi-center, open label, non-randomized, prospective, first in human (FIH) feasibility study evaluating the use of the GPX Embolic Device in the peripheral vasculature. Trial enrollment consists of twenty subjects with various clinical needs appropriate for peripheral embolization, including Interventional Oncology applications.

Results: Early Interventional Oncology case study results will be presented. GPX exhibited good visibility and fully embolized the targeted vessels, including distal occlusion of complex vessels and vessel beds. Target regions were fully occluded at the first angiogram (taken immediately after delivery), and the procedures were considered technical successes. Procedural and follow-up results from these cases will be presented.

Conclusion: Early Interventional Oncology cases with GPX Embolic Device have been promising, with these cases meeting the desired clinical endpoints. A larger pivotal study is planned.

FP-103

Intraprocedural assessment of ablation margins using computed tomography co-registration in primary liver tumor treatment with percutaneous ablation: IAMCOMPLETE study: preliminary results

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General Study Info: clinicaltrials.gov NCT04123340

Purpose: Retrospective studies have shown the potential of ablation margin quantification in the prediction of local tumor progression (LTP) after ablation of hepatocellular carcinoma (HCC). However, a standardized workflow for intraprocedural assessment has not been established

yet. We studied the feasibility of intraprocedural ablation margin quantification, using a standardized intraprocedural scanning protocol and in-house developed software.

Methodology: This was a prospective, single-center study in 20 patients with BCLC 0-A HCC patients that underwent thermal ablation. Intraprocedural pre- and post-ablation contrast-enhanced CT scans were acquired under preoxygenated breath hold in a similar bed position. In-house developed software was used to generate 3D models of the livers, using segmentation of the liver, tumor and ablation area. These models were registered using a rigid registration algorithm to quantify the 3D ablation margins. Inter- and intra-observer variability of tumor delineation in arterial and portal-venous scan phases were captured, as well as of ablation margin quantification.

Endpoints: Up to now, 13 patients (8 men, mean age= 69,2y (45-82)) with 19 tumors (mean diameter=19mm (12-38)) were included, of which 2 patients were infeasible for analysis. Tumor delineation showed good inter- and intra-observer agreement (Volumetric Dice Similarity Coefficient of 0.84). 75% of ablation margin quantifications were performed with less than 2.5 mm difference between observers. Remarkably, a mean difference of 30% in tumor volume was found between arterial or portal venous delineation.

Expected Data/Impact on IR: The proposed standardized workflow allows for an accurate 3D quantification of ablation margins and is considered feasible. Completion of inclusion and analysis is expected before CIRSE 2021.

FP-104

Phase II multi-centre randomized controlled trial to compare FOLFOX6m + monoclonal antibody (anti-EGFR or Bevacizumab) alone or in combination with Irinotecan chemoembolization loaded in polyethyleneglycol beads (Lifepearls-Irinotecan) in patients suffering colorectal metastases limited to the liver and poor-prognosis criteria

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General Study Info: Phase II multi-centre randomized controlled trial to compare FOLFOX6m + monoclonal antibody (anti-EGFR or Bevacizumab) alone or in combination with Irinotecan chemoembolization loaded in polyethyleneglycol beads (Lifepearls-Irinotecan) in patients suffering colorectal metastases limited to the liver and poor-prognosis criteria Protocol Code: LP-IRI-HCPB

EudraCT No.: 2015-005839-40

Background and Rationale: Involvement of the liver by colorectal cancer metastasis (CRLM) causes a significant morbidity sometimes resulting in liver failure and is the cause of death in most patients. Up to 40% of patients with CRC present exclusive liver involvement in the time of diagnosis. Among these, only a 20% present good prognostic characteristics and are candidates for direct resection. Previous works, have shown that regional treatment of the liver metastases improves the local control of the disease.

Objectives: Improving the response rate in CRLM by combining FOLFOX6m + Monoclonal Antibody with intra-arterial LP-IRI

Methodology: Phase II clinical multi-centre randomized with two arms: FOLFOX6m + monoclonal antibody vs FOLFOX6m + monoclonal antibody + LP-IRI. The experimental group will be evaluated through a two-step design following the standard Simon strategy. The control group will help to randomly distribute potential prognostic factors, and for check the feasibility of the null hypothesis of the two steps design.

Endpoints:

- To evaluate the radiologic response rate according to RECIST 1.1 at 6 months
- To determine the safety profile for the combination LP-IRI/FOLFOX6m/ Monoclonal Antibody
- To assess the OS, PFS and LPFS
- To evaluate the R0 rate

Expected Data/Impact on IR: To improve the response rate, PFS, LPFS and OS.

To increase the number of patients downstaged for curative treatments (surgery).

FP-105

COLLISION RELAPSE trial

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General Study Info: COLLISION RELAPSE trial. Recurrent Colorectal Liver Metastases: Repeat Local Treatment +/- Neoadjuvant Systemic Therapy, a phase III prospective randomized controlled trial (Identifier: submitted at NTR, TBA).

Background and Rationale: Distant intrahepatic recurrence develops in 64% to 85% of colorectal liver metastases (CRLM) patients. Repeat local treatment, by thermal ablation or partial hepatectomy, is considered standard of care. Given the presumed worse tumor biology, neoadjuvant systemic therapy prior to repeat local treatment has been suggested to prolong survival and to select responders who will benefit from repeat local treatment.

Objectives: The primary objective is to demonstrate superiority of neoadjuvant systemic therapy followed by repeat local treatment as compared to upfront repeat local treatment in patients with recurrent CRLM.

Methodology: 360 patients will be randomized into: arm A (control group) upfront repeat local treatment with partial hepatectomy and/ or thermal ablation (n=180) and arm B (intervention group) 4 cycles of CAPOX (capecitabine with oxaliplatin) +/- bevacizumab or 6 cycles of FOLFOX/FOLFIRI (5-fluorouracil/leucovorin with oxaliplatin or irinotecan) +/- bevacizumab followed by repeat local treatment (n=180).

Endpoints: Primary endpoint is overall survival (intention-to-treat analysis). Main secondary endpoints are disease-free survival, local- and distant-tumor-progression-free survival, systemic therapy related toxicity, procedural morbidity and mortality, length of hospital stay, assessment of pain and quality of life, cost-effectiveness ratio and quality-adjusted life years.

Expected Data/Impact on IR: We hypothesize that neoadjuvant systemic therapy followed by repeat local treatment is superior to upfront repeat local treatment for the selected patient groups in terms of the primary objective.

Others

FP-106

Image guided cryoablation: predictors to create a successful paradigm shift in treating painful vascular malformations

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Purpose: Complex and painful vascular malformations (Fibro-Adipose Vascular Anomaly (FAVA)) are very challenging to manage and cause relentless pain and discomfort to patient, greatly interfering with quality of life. These lesions are unresponsive to sclerotherapy, physical therapy or conservative management and typically require extensive surgery.

We describe our protocol to successfully treat pain and improve quality of life in these patients using Image-guided percutaneous cryoablation.

Materials and Methods: An IRB approved study in 51 patients with painful vascular malformation (FAVA) who underwent percutaneous cryoablation at 54 sites, from September 2013 to September 2020. Patients were evaluated in a interdisciplinary vascular anomaly clinic than referred to interventional radiology (IR). Pre procedure evaluation and brief pain inventory performed (BPI) in IR. Follow up protocol and evaluation was done to assess outcome using BPI, concurrent symptoms, clinical response and patient satisfaction.

Results: Following cryoablation, there was significant improvement in pain, which dropped by 3 (pain now) to 3.7 (pain in the past 24 hrs.) points. There was less interference of pain to most of the evaluated aspects of patients' everyday social life. Concurrent symptoms like swelling, physical limitations, skin hyperesthesia also improved. Clinical response was greatest at 2 to 5 months follow up after cryoablation with a more acceptable patient satisfaction thereafter. There were no major complications.

Conclusion: Our study is the initial largest series showing that developing a successful cryoablation protocol to treat painful vascular malformations is feasible in interventional radiology.

FP-107

Medical students' perspectives on IR: a European survey from the European Trainee Forum (ETF)

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Submitted on behalf of the CIRSE European Trainee Forum Subcommittee,
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Purpose: To assess pan European attitudes to Interventional Radiology among medical students and help guide future training and recruitment of the best and most talented candidates

Materials and Methods: An online survey was created by members of the CIRSE European Trainee Forum subcommittee and distributed to medical students across Europe.

Results: More than 2700 medical students completed the entire survey. Two thirds of respondents had not received any formal exposure to interventional radiology. 95 % of students felt that there was a bright future for radiology and nearly 1 in 5 stated that they were likely or very likely to pursue a career in IR. There is a lower rate of interest from female medical students. Lack of patient contact and risk of radiation exposure and difficulty accessing the necessary training are some of the main perceived barriers deterring medical students from pursuing a career in IR.

Conclusion: This is the biggest survey in the literature and the first to cover an entire continent. There is persistently low understanding of IR among medical students. More dedicated undergraduate IR mentoring is needed, particularly targeted to female medical students. Lower interest among female medical students can only exacerbate the underrepresentation of female physicians among the ranks of our speciality. We propose several initiatives in response to these findings in our call to action which include more formal teaching in IR, the introduction of medical student webinars and steps to encourage gender equality in IR.

FP-108

Interventional radiology training around the world: mind the gender gap

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Purpose: This study aimed to examine international interventional radiology training standards and perceptions across the world in order to identify possible gender differences to inform recruitment and workforce planning.

Materials and Methods: An anonymous survey was electronically distributed by eight IR national and international societies around the world. Descriptive statistics were used to highlight gender-specific trends, while inter-gender differences were explored using non-parametric Chi-squared and/or Fisher exact tests.

Results: A total of 740 participants were invited to complete the survey, of whom only 608 were eligible; 222 trainees completed the entire survey. Notable inter-gender differences were observed in reported motivation to follow a career in IR with factors such as 'mentoring' and 'influence from senior colleagues' markedly better in male participants. Early exposure in IR training had a positive impact on career choice in participants from both genders with 82.6 and 81.3% in female and male participants, respectively. Work life balance was positively reported in 48.2% of female respondents compared to 45.2% in males. Large proportions across both genders failed to receive reciprocal training by other speciality consultants. Perceived training adequacy in some IR procedures was reportedly lower in female participants; for example only 42.3% of females responded 'ready for complex urological procedures' vs 60.6% in males. All differences observed between genders, exceeded the 0.05 significance level.

Conclusion: The results of this survey successfully capture the international landscape of IR training. Ongoing evaluation is vital to inform recruitment practices and initiatives in order to bridge the apparent gender gap and recruit more women into IR.

FP-109

A global cross-sectional evaluation of teaching and perceptions of interventional radiology amongst undergraduate medical students and junior doctors and the role of a virtual interventional radiology symposium

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Purpose: The field of Interventional Radiology (IR) has seen a consistent lack of medical students' awareness and underrepresentation in undergraduate curriculums worldwide. This study aims to evaluate the status of undergraduate IR teaching and perceptions to IR as a career amongst medical students and junior doctors world-wide. Engagement of the symposium was also evaluated.

Materials and Methods: A cross-sectional study was performed at an international virtual IR symposium. Surveys were distributed to all delegates after the event to evaluate the study aims and outcomes. Likert scales and Chi-square tests were used to compare pre- and post-symposium responses.

Results: 110/163 (67.5%) complete responses from over 25 countries were received. Over 30% of delegates stated that they were exposed

to IR within or outside of their curriculum prior to the event. However, less than 25% of delegates agree that they had enough exposure to be informed about an IR career. The virtual symposium significantly increased knowledge and interests in pursuing IR as a career ($p < 0.001$). Over 95% of delegates rated the contents and engagement of the symposium to be great or excellent.

Conclusion: IR remains underrepresented in undergraduate medical school curricula compared to the CIRSE and BSIR curricula. Despite the lack of hands-on aspects, virtual conferences with lectures, workshops and networking opportunities can be successful in engaging delegates and promoting IR as a career. Virtual events should remain even after the pandemic in hybrid forms to further generate interests among medical students and junior doctors. This symposium's success may provide a framework to facilitate future events.

FP-110

Optimising access and provision of interventional radiology service to patients by utilising a new referral system

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Purpose: In the context of ever-increasing budget constraints carefully balanced against the growing need for value based health care, cost reduction and quality improvement, implementing a consistent IR service across the UK has been a challenge. This study aims to review a set of changes introduced in an IR department at a tertiary centre, including a new referral process to IR and the designation of IR clinical nurse specialists.

Materials and Methods: A qualitative survey was designed and distributed as a single-use web link via the Trust's email network. Responses to questions were based on likert scale and pertained to perceived qualities and improvement of the new referral process. Eligible respondents included members of staff from grades and specialties who have previously referred patients to IR through the new process. Data analysis was performed to identify speciality and grade-specific trends and explore possible differences amongst groups.

Results: Findings from 98 respondents revealed a strong overall satisfaction with the new referral method and support for its continuation. Subgroup analysis by specialty, concluded medical specialties rated the new referral system overall higher than surgical specialties across all aspects: time efficiency, ease of use, peri-procedural support and overall user experience. When looking at respondents by grade, foundation doctors, contrary to clinical nurse specialists, rated the new referral system higher across most aspects.

Conclusion: Micro-policy changes within individual IR departments such as the replacement of an outdated request-based referral system to one which puts IR's in control of vetting and patient flow is one of many changes that reinforce the transformational phase of this specialty.

FP-111

Prospective observational study of pain severity and pain interference outcomes following percutaneous MRI-guided laser ablation or cryoablation of painful peripheral, soft tissue vascular anomalies: 6-month interim analysis

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Purpose: To prospectively evaluate the 6-month pain severity and pain interference outcomes following percutaneous MRI-guided laser ablation and cryoablation of focal painful, peripheral soft tissue vascular anomalies.

Materials and Methods: Patients undergoing clinically indicated MRI-guided laser ablation or cryoablation for focal painful, peripheral soft tissue vascular anomalies (VA) were enrolled in an IRB-approved prospective, observational study after giving informed consent. Patients completed the Brief Pain Inventory (BPI) prior to ablation and 6-months post-ablation. Differences in pain severity and interference outcomes on a 0 to 10 scale (higher number meaning greater severity or interference) were compared using a paired t-test.

Results: 14 patients (12 female, 2 male; mean age 32.1 years) underwent 21 US/MRI-guided and monitored ablation sessions including laser (n=18) and cryoablation (n=3) for treatment of painful slow flow venous (n=12) or venolymphatic (n=1) malformations or hemangioma (n=1) located in the lower extremity (n=9), upper extremity (n=4) and face (n=1). Nine patients (64%) had undergone prior VA therapy including percutaneous sclerotherapy (89%) and/or surgery (44%). Mean ($\pm$ SD) pre-ablation worst pain was 8.0 ± 1.4 and average pain 5.4 ± 1.3 with a significant decrease in worst pain -4.8 ± 3.5 ($p < 0.001$) and average pain -3.3 ± 2.4 ($p < 0.001$) at 6-month post-ablation. There were no major and 2 minor ablation related complications.

Conclusion: These 6-month interim data suggest that MRI-guided laser ablation and cryoablation are safe and provide early significant improvements in pain severity and pain interference outcomes in patients with focal painful peripheral soft tissue vascular anomalies.

FP-112

Clinical and procedural comparative evaluation of MRgFUS Vim ablation in essential tremor and Parkinson's disease

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Purpose: MRgFUS thalamotomy is a novel minimally invasive procedure for symptomatic tremor treatment. Initially approved for patients with ET, it has become increasingly used also in PD tremor

Objectives: To evaluate the procedural and clinical outcome differences in patients with ET and PD treated by unilateral MRgFUS Vim ablation

Materials and Methods: We evaluated 101 patients (46 ET, 55 PD). Clinical scores (CRST for tremor, QUEST for quality of life, MOCA for cognitive assessment) were recorded before treatment and with follow-up at 1 day and 1, 6, and 12 months. Technical parameters were recorded in all procedures. A comparison of all variables was made between the two groups.

Results: In ET patients CRST scores improved by 57.8%, ($p < 0.001$) immediately after treatment. The improvement remained stable at the following 1-month, 6-months, and 1-year follow-up, with mild recurrence of tremor in 2 patients. In PD patients, CRST scores improved by 56.2% at 1 day, 47.72% at 1 month, and 53.9% at 1 year. Tremor reappearance occurred in 4 patients, between the 3- and 6-months follow-up. QUEST and MOCA score changes were not statistically significant between the two groups. Thalamotomy-related complications occurred in 6 ET patients and 6 PD

patients. No statistically significant differences were found between the two groups in terms of technical procedural parameters, except for a higher number of sonications in the PD group.

Conclusion: MRgFUS is an effective treatment for both ET and PD patients, with milder deterioration of tremor and QoL scores improvement in the PD group during the follow-up.

FP-113

Ultrasound guided hepatic hilar nerve block as a novel technique to decrease post-procedural pain after embolization procedures for hepatocellular carcinoma: a clinical trial

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Purpose: This study assesses the efficacy of ultrasound hepatic hilar nerve block as a safe and effective analgesia to patients undergoing transarterial embolization for hepatocellular carcinoma.

Materials and Methods: In this prospective, randomized trial, 76 patients undergoing transarterial embolization (TAE) / chemoembolization (TACE) for hepatocellular carcinoma were enrolled. The control group received standard analgesia for embolization procedures including intraprocedural intraarterial lidocaine and intravenous narcotics; the study group underwent hepatic hilar nerve blockade in addition to the standard analgesia. Intraarterial lidocaine, intravenous and postprocedural oral narcotics, pain scores, patient satisfaction, adverse events, and hospital stay were compared between both groups.

Results: The study group reported less intraprocedural and postprocedural pain at days 1, 7 and 14 ($p < 0.001$). The control group received more intra-arterial lidocaine ($p < 0.001$) and required more amount of intraprocedural and postprocedural narcotic analgesia, in the first two weeks after the procedure ($p < 0.001$), as well as less antiemetics ($p < 0.001$). There were no differences in adverse events, hospital stay and overall patient satisfaction.

Conclusion: Preprocedural ultrasound guided hepatic hilar nerve blocks can result in lower intraprocedural and postprocedural pain in patients undergoing different embolization procedures for hepatocellular carcinoma. Furthermore, they result in lower consumption of intraprocedural and post-procedural analgesia.

Peripheral vascular disease intervention

FP-114

The prelude-BTK study: novel serration angioplasty balloon for below-the-knee arteries

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Purpose: PRELUDE-BTK assessed safety and efficacy of the Serranator® PTA Serration Balloon Catheter in subjects with atherosclerotic disease of the BTK arteries.

Materials and Methods: PRELUDE-BTK is a single arm, prospective, multicenter feasibility study to assess Serranator in subjects with lesions in BTK arteries. Acute angiographic data captured pre-Serranator® inflation vs. post inflation effects with 30 day and 6 month follow up. Subjects had CLTI or severe claudication, de novo stenoses or non-stented restenotic or CTOs with lengths <12 cm and RVD of 2.5 - 3.5mm.

Safety was a composite of MALE and POD, assessed at 30 days. Efficacy was rate of device success with final diameter stenosis $<50\%$ by visual assessment using only the Serranator.

A secondary objective assessed OCT or IVUS pre- and post-treatment in up to 10 subjects to evaluate lesion characteristics and presence of serrations.

Results: Forty-nine subjects enrolled treating 55 lesions, 53 analyzable. Mean pre-treatment diameter stenosis was $81.3\% \pm 17.2\%$ versus post

treatment of $21.8\% \pm 12.7\%$, with 28.3% CTOs ($n=15/53$). Twenty six percent ($n=14/53$) had moderate/severe calcification. One flow limiting dissection resulted in a 1.9% (1/53) bailout stent rate. All OCT/IVUS imaged lesions showed serration effects ($n=10$). There were no CD TLRs at 30-days. Thirty day and 6-month data to be presented.

Conclusion: Acute study endpoints were achieved. PRELUDE-BTK showed exceptional lumen gain in challenging infrapopliteal lesions while minimizing arterial injury. Serranator's mechanism of action was demonstrated by OCT and IVUS showing serrations without significant dissection, allowing for an increase in lumen area.

FP-115

Prospective study of serration angioplasty in the infrapopliteal arteries using the Serranator® device: PRELUDE BTK study

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Purpose: Evaluation of the safety and efficacy of the Serranator® PTA Serration Balloon Catheter in patients with infrapopliteal peripheral artery disease.

Materials and Methods: A prospective, multicenter, single-arm feasibility study enrolled 49 patients with Rutherford Clinical Category (RCC) 3-5, that required treatment of the infrapopliteal arteries above the tibiotalar joint. Primary efficacy outcome was device success - successful insertion, balloon inflation and deflation, and removal of the device(s) with a final diameter stenosis of $<50\%$. The primary safety endpoint, was a composite of major adverse limb events and peri-operative death through 30 days post-procedure. Other outcomes were change in RCC and ankle-brachial index, and wound healing. Patient follow-up occurred at 30 days and six months.

Results: Forty-six patients received treatment with the Serranator device and 55 lesions were treated. Fifty-three lesions were deemed analyzable by the core lab with data and reported hereafter. Device success was 91.7% and freedom from MALE+POD through 30 days was 95.7% . Pretreatment stenosis of 82% was reduced to 21.8% and only one lesion (1.9%) required a bail-out stent for a grade D dissection. The average maximum balloon inflation pressure was 6 atmospheres. Serrations were present in all OCT/IVUS treated lesions ($n=10$) in 9 patients as reviewed by the core laboratory. The RCC score improved by one or more level in 70% of patients at six months with 42% having a score of zero. The 6-month freedom from clinically driven TLR was 97.7% .

Conclusion: Serranator treatment of infrapopliteal lesions showed exceptional lumen gain with minimal evidence of arterial injury and low 6-month CD-TLR.

FP-116

The use of the Torus stent graft for the treatment of advanced superficial femoral artery occlusive disease

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Purpose: The evolving field of endovascular treatment has allowed for the increased use of minimally invasive interventions of the superficial femoral artery (SFA) and proximal popliteal artery, even in the treatment of complex lesions. Currently, there is only one device labeled for endovascular stent grafting in this vascular bed. The objective of this interim analysis was to evaluate the 12-month outcomes observed in the first 30 subjects enrolled in the TORUS2 Trial, which was designed to evaluate

the safety and effectiveness of the novel Torus Stent Graft, and thereby providing another clinical endovascular option for stent grafting.

Materials and Methods: The TORUS 2 Trial is a global, prospective, single-arm, multi-center, clinical investigation. The primary effectiveness endpoint was primary patency through 12 months and the primary safety endpoint was freedom from major adverse events (MAE) through 30 days.

Results: Of the 30 subjects enrolled in the study, 80.0% were male, with a mean age of 68.1 ± 8.9 years. Ankle-Brachial Index was 0.59 ± 0.16 and most subjects were classified as Rutherford 3 (83.3%). The mean lesion length was 18.1 ± 7.4 cm. Technical and procedural success was 100%. Primary patency was 82.1%, and clinically driven target lesion revascularization was 10.7% at 12 months. Freedom from a MAE at 30 days post-procedure was 100%.

Conclusion: The observations from this interim analysis offer promising preliminary safety and effectiveness data on the Torus Stent Graft System for patients with complex femoropopliteal arterial disease. Further data are necessary to confirm the safety and effectiveness of the Torus Stent Graft System.

FP-117

3-year outcomes of the novel Kanshas drug-coated balloon in treatment of femoropopliteal occlusive disease: the first-in-human KANSHAS 1 study results

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Purpose: The present study aims to investigate safety and efficacy of the novel Kanshas paclitaxel DCB in treatment of patients with de novo lesions in superficial femoral and/or popliteal arteries.

Materials and Methods: KANSHAS 1 is an ongoing, prospective, single-arm, first-in human study, which enrolled 50 patients treated with Kanshas DCB at 6 centres in Germany and Belgium. The study initially mandated clinical follow-up up to 2 years, which recently has been extended to 5-years.

Results: Mean patient age at baseline was 69.0 ± 10.5 (32% females). Majority of the patients were claudicants (Rutherford categories 2-4) with mean ankle-brachial index (ABI) of 0.67 ± 0.14 . The mean cumulative target lesion length was 88.6 ± 36.5 mm with a mean diameter stenosis (DS) of $91.0 \pm 9.4\%$. Moderate-severe calcification was present in 20.0% of lesions and 28% of interventions required bailout stenting. Mean residual DS following procedure was $11.2 \pm 7.8\%$. The primary study outcome i.e. composite endpoint of freedom from device- The 3-year follow-up is ongoing.

Conclusion: Currently available data supports excellent safety and efficacy of the Kanshas DCB up to 24 months. Preliminary 3-year outcomes of the KANSHAS1 study will be available for presentation at CIRSE 2021.

FP-118

Safety and efficacy of the Mynx Control vascular closure device in more than 100 consecutive procedures

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Purpose: To present a large single-center prospective study investigating the safety and efficacy of the Mynx Control extravascular closure device in achieving hemostasis after arterial catheterization.

Materials and Methods: Between January 2020 and February 2021, 106 Mynx Control devices were implanted in 98 consecutive patients (61 men; mean age 67.5 ± 16.6 years) who underwent peripheral endovascular procedures. There were 105 femoral and 1 crossover graft puncture. Femoral artery punctures included 64 (61%) antegrade and 41 (39%) retrograde accesses. The primary endpoints were hemostasis success, device failure, and major and minor complication rates up to 30 days.

Results: A 5-F vascular sheath was used in 42 cases (39.6%) [38 (35.8%) 6-F and 26 (24.5%) 7-F]. For critical limb ischemia cases, mean ACT prior to deployment was 223. Overall hemostasis success was achieved in 97 (91.5%) cases. In 6 (5.5%) of those, additional manual compression was necessary due to immediate vessel oozing. Pseudoaneurysm was detected immediately post-deployment in 5 patients, which resolved with immediate thrombin injection. There were 4 (3.7%) cases involving failure to deliver the device adequately. Overall major and minor complication rates were 0.1% (1/106) and 5.7% (6/106), respectively.

Conclusion: The Mynx Control vascular closure device is safe and effective in achieving hemostasis during peripheral angioplasty procedures.

FP-119

BioMimics 3D vascular stent system: MIMICS-3D pan-European real-world registry 2-year results are comparable to drug-based devices even in challenging lesions

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Purpose: Unique, three-dimensional (3D) helical centreline in the BioMimics 3D® Vascular Stent (Vervan, Horsham UK) provides biomechanical stability, promotes swirling blood flow and beneficially elevates wall shear stress in the stented femoropopliteal segment.

Materials and Methods: MIMICS-3D enrolled 507 subjects treated with BioMimics 3D at 23 sites. Mean age was 70 years; 37% diabetic; 40% prior peripheral revascularisation; 24% chronic limb ischaemia (CLI); 38% moderate to severe calcification; 57% chronic total occlusions (CTO); mean lesion length was 127 mm. BioMimics 3D placement followed atherectomy in 7.5% of lesions. DCB was combined with BioMimics 3D in 50% of treated lesions. Technical success for the BioMimics 3D procedure as assessed by the operator was 99%. An independent clinical events committee adjudicates major adverse events (MAE) including death and potential device-related events. The primary safety endpoint is a composite of MAE, comprising death, major index-limb amputation or clinically-driven target lesion revascularisation (CDTLR) through 30 days. Primary outcome measure for effectiveness is freedom from CDTLR through 12 months.

Results: Intent-to-treat freedom from CDTLR at 1-yr and 2-yrs was 91% and 83% respectively and 1-yr and 2-yr primary stent patency (PSVR ≤ 2.0) was 87% and 76% respectively.

Conclusion: Data from MIMICS-3D validate those from other MIMICS investigations into the performance of the BioMimics 3D Vascular Stent System and support the hypothesis that imparting non-planar curvature to the femoropopliteal artery to promote swirling blood flow and increase wall shear stress, results in clinical outcomes that are comparable to those of drug-coated and drug-eluting devices, even in challenging lesions.

FP-120

The Supera interwoven nitinol stent as a flow diverting configuration in popliteal aneurysms

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Purpose: The feasibility of using a compressed interwoven Supera stent as a flow diverter for popliteal aneurysms was recently demonstrated in patients. Popliteal aneurysms have a different hemodynamic environment than cerebral aneurysms, due to their fusiform shape and exposure to triphasic flow. This renders it difficult to determine an optimal flow diverting strategy. To investigate the optimal flow diverter configuration, this study assessed flow profiles and thrombus formation likelihood in in-vitro popliteal aneurysm models.

Materials and Methods: Six models were created and integrated in a pulsatile flow set-up. These models covered a bent and a straight anatomy in three configurations: control, single-lined and dual-lined Supera stents. Two-dimensional flow velocities were visualized by laser particle image velocimetry. In addition, the efficacy of the stent configurations for promoting aneurysm thrombosis was assessed by simulations of residence time and platelet activation.

Results: In both anatomies, the introduction of a flow diverter stent led to a 2-fold reduction of velocities in the aneurysm for single-lined stents, and a 4-fold reduction for dual-lined stents. Forward flow was optimally diverted within the stent, whereas backward flow was generally deflected into the aneurysm. The dual-lined configurations led to residence times of 15-20 seconds, compared to 5-15 seconds for the single stent configurations. Platelet activation potential was not increased by the flow diverting stents.

Conclusion: A compressed Supera stent was successfully able to divert flow in a popliteal aneurysm phantom, supporting its clinical use in terms of its fluid mechanical behavior. A dual-lined configuration demonstrated superior hemodynamic characteristics compared to its single-lined counterpart.

FP-121

Intravascular lithotripsy for the treatment of calcified, eccentric peripheral artery lesions: results from the Disrupt PAD III observational study

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Purpose: To evaluate 'real world' acute outcomes in patients treated with intravascular lithotripsy (IVL) in eccentric, calcified peripheral arterial lesions.

Materials and Methods: The Disrupt PAD III observational study (NCT02923193) is a prospective, multicenter registry designed to assess the acute safety and effectiveness of IVL for the treatment of calcified, stenotic peripheral arteries. In this interim analysis, patients with eccentric lesions were evaluated for acute angiographic safety and effectiveness outcomes as determined by an independent angiographic core lab (ACL).

Results: Patients (N=752; 853 lesions; 19.3% eccentric) were consecutively enrolled from November 2017 to June 2019 across 27 global sites.

The presence of PARC-defined moderate-severe calcium was similar (eccentric (E) 87.9% vs concentric (C) 87.5%, $p=1.0$), while lesion length (E: 57.1 ± 40.3 mm vs C: 103.1 ± 73.8 mm, $p<0.0001$) and diameter stenosis (DS) (E: $67.4\pm 13.9\%$ vs C: $81.9\pm 18.7\%$, $p<0.0001$) were greater in concentric lesions. Pulse delivery was greater in concentric lesions (E: 163.2 ± 87.9 vs C: 184.9 ± 112.1 , $p=0.02$); however, pulse delivery normalized to lesion length was greater in eccentric lesions (E: 4.2 ± 3.7 vs C: 2.7 ± 2.6 pulses/mm, $p<0.0001$). There was no difference in the adjunctive use of atherectomy and/or specialty balloons (E: 21.8% and C: 24.9%, $p=0.48$). Final DS (E: $22.9\pm 11.6\%$ vs C: $24.3\pm 11.9\%$, $p=0.16$) and the rate of serious angiographic complications (E: 0.7% vs C: 1.0%, $p=1.0$) were similar at the end of the procedure.

Conclusion: This study represents the largest 'real world' experience of IVL for the treatment of eccentric, heavily calcified peripheral artery lesions and demonstrated consistently low final residual stenosis with minimal vascular complications in both eccentric and concentric lesions.

FP-122

Quality of life and cost-effectiveness outcomes from a randomized controlled trial comparing drug-coated balloon to conventional balloon angioplasty for below-the-knee arteries in patients with critical limb ischemia

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Purpose: Critical limb ischemia (CLI) from atherosclerotic disease of below-the-knee (BTK) arteries is associated with considerable morbidity and mortality, carrying an economic burden on society if left untreated. Percutaneous transluminal angioplasty (PTA) is the accepted first line treatment for CLI, however, long-term vessel patency is poor. The benefits of DCB in BTK arteries are still unclear. The aim of this study was to examine the cost-effectiveness of a randomized trial assessing whether DCB results in better patency rates than conventional PTA in BTK arteries.

Materials and Methods: An economic evaluation based on an RCT of 138 patients on an intention-to-treat basis with CLI was conducted. Randomized 1:1, 70 participants received DCB and 68 conventional PTA. Costs were calculated from a societal perspective and health outcomes were measured using quality-adjusted life years (QALYs) gained based on EuroQol-5D-3L scores. Resource use and health outcomes were assessed at baseline, and at 3, 6 and 12-months post-intervention using patient questionnaires and de-identified electronic health records. Sensitivity analyses were performed to test the robustness of results.

Results: DCBs were non-superior to PTA in terms of patency at 6 months ($p=0.48$) and the incremental cost-effectiveness ratio (ICER) was \$5 81,083 per QALY gained (\$5 973/0.012 QALYs with substantial variance; only 54% of bootstrap samples met a benchmark threshold of \$76,748 (the average GDP per capita of Singapore over the four years of study).

Conclusion: The use of DCB in BTK arteries in CLI patients conferred no clinical benefit nor was it cost-effective compared with standard care.

FP-123

Ultrasound velocimetry in the stented superficial femoral artery

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Purpose: Quantifying blood flow patterns inside stented vessels is challenging, but clinically important because of the relation between local hemodynamics and stent failure. Current clinical modalities like

phase-contrast-MRI are limited due to metal-related artefacts. High-frame rate contrast-enhanced ultrasound particle image velocimetry (echoPIV) is a novel method for quantifying two-dimensional flow characteristics and may overcome the limitations of phase-contrast-MRI. This study aims to investigate the feasibility of echoPIV for quantifying blood flow inside the stented superficial femoral artery (SFA).

Materials and Methods: EchoPIV data was obtained in twenty patients at the inflow and outflow of a recently placed stent in the SFA. SonoVue microbubbles were used as a contrast agent. Blood flow velocity was quantified by performing PIV analysis after which velocity vector fields were reconstructed. The recordings were scored by 5 observers and classified as unfeasible, or presenting optimal or partial flow quantification. Final agreement for each measurement was reached during a consensus meeting.

Results: 86.8% of the measurements were classified as feasible. In 23.6% flow could be quantified in the entire imaged vessel and throughout the entire cardiac cycle. 63.2% of the measurements led to a partial successful flow quantification because one or multiple limiting issues occurred, including microbubble destruction and shadowing artefacts by calcifications. None of these issues were related to the stent. In 13.2% of the measurements no meaningful blood flow information could be derived from the data.

Conclusion: Blood flow quantification is feasible inside the stented SFA using echoPIV. Cases of partial or unfeasible blood flow quantification were not related to the stent itself.

FP-124

Technical performance and reproducibility following rotational atherectomy of femoropopliteal artery occlusive lesions: analysis of the multicenter MORPHEAS registry

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General Study Info: Technical performance and Reproducibility Following Rotational Atherectomy of Femoropopliteal Artery Occlusive Lesions: Analysis of the Multicenter MORPHEAS Registry
The MORPHEAS Registry for the technical performance and reproducibility of rotational atherectomy

Purpose: Controversy exists surrounding appropriate utilization of atherectomy to treat femoral-popliteal atherosclerosis. Importantly, the existence of different atherectomy devices and lack of technical reports highlighting variables that impact outcomes obscures the ability to assess perioperative performance. Therefore, the purpose of this study was to define patient and anatomic factors that are associated with technical results specific to rotational atherectomy.

Methodology: The non-industry sponsored, Multicentric national Registry of rotational atherectomy in femoral-Popliteal occlusive atherosclerotic disease (MORPHEAS) database was queried. The MORPHEAS investigators included experienced providers at four centers who previously had not utilized rotational atherectomy.

Endpoints: The primary end-point was flow-limiting dissection and/or >50% recoil resulting in stent-placement while a secondary end-point included peripheral thromboembolism incidence.

Expected Data/Impact on IR: 113 patients were enrolled. Only femoropopliteal occlusions were included in the analysis and anatomic distribution and calcification severity are depicted separately. The most common adjunctive therapy was drug-coated balloon angioplasty (84%; n=96). Flow-limiting dissection was identified in 16% (n=18) and thromboembolism occurred in 4% (n=4). Diabetes increased risk of thromboembolism (p=.03) while lesion length ≥ 8.0 cm (p=.07) and SFA-popliteal adductor canal location (p=.01) were associated with flow-limiting dissection. In

multivariable analysis, SFA-popliteal adductor canal occlusion had a 4.7-fold risk of perioperative complications (OR 4.7, 95% CI 1.1-21.0; p=.04). Rotational atherectomy was characterized by reproducible performance among four centers; however, diabetic patients, as well as those with long-segment, heavily calcified SFA-popliteal adductor canal occlusion are at greatest risk of complications.

FP-149

The real-world CONSEQUENT ALL COMERS study: Above and below the knee lesion treatment with DCB angioplasty in an unselected patient population

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Purpose: The CONSEQUENT ALL COMERS (Clinical PMCF on Peripheral Arteries treated with SeQuent® Please OTW study is a prospective, single-arm, multicenter observational study (ClinicalTrials Identifier: NCT02460042) which evaluated the safety and efficacy of a resveratrol-paclitaxel coated peripheral balloon catheter in unselected patients undergoing peripheral interventions for above-the-knee (ATK) and below-the-knee (BTK) lesions.

Materials and Methods: The target lesion revascularization rate (TLR) at 12 months was the primary endpoint complemented with secondary endpoints such as vessel patency, target vessel revascularization (TVR) and all-cause mortality.

Results: A total of 784 consecutive patients (71.3 $\pm$ 10.4 years old, 57.7% male) with 879 lesions were analyzed. Of these 53.3% were claudicants and 46.7% had critical limb ischemia (CLI). The lesion length was 12.0 $\pm$ 9.3 cm and 31.8% were TASC II C/D lesions. There were 1.60 $\pm$ 0.79 DCB's used per patient. The 12-month TLR rates were 6.3% in CLI patients and 9.6% in claudicants (p=0.126). Primary patency rates were 89.9% and 87.1%, p=0.122. The all-cause mortality was 4.3% (28/658). There was no relationship between paclitaxel doses and all-cause mortality (alive: 8668 $\pm$ 6225 μ g vs dead: 8753 $\pm$ 6147 μ g, p=0.940). Our TLR rates (BTK: 7.0 vs ATK: 8.2%, p=0.763), patency rates (88.7 vs 88.6%, p=0.990) and TVR rates (8.8 vs 11.0%, p=0.607) were not significantly different between in patients treated for ATK and BTK lesions.

Conclusion: Low TLR and high patency rates in ATK and BTK lesions demonstrate the efficacy of DCB angioplasty. There is no dose effect to predict all-cause mortality.

Radiation safety

FP-125

The use of automated three-dimensional vascular navigation software reduces exposure to ionizing radiation during prostatic arteries embolization

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Purpose: Prostatic artery embolization (PAE) is a challenging procedure. The use of cone beam computed tomography (CBCT) is an option to facilitate understanding the pelvic vascular anatomy, identifying target arterial branches, and directing the navigation of the microcatheter through three-dimensional (3D) reconstructions. The aim of the present study is to compare radiation exposure during PAE procedures performed before and after the implementation of automated 3D vascular navigation software.

Materials and Methods: This retrospective single center study included patients submitted to PAE in a single dedicated angiograph. Control group patients [body mass index (BMI): 26.4 $\pm$ 3.9] underwent PAE according

to the technique previously described. The patients in the experimental group (BMI: 26.9 ± 2.8) underwent PAE using CBCT with a catheter positioned in the internal iliac arteries, followed by 3D reconstruction. Radiation exposure data was obtained including fluoroscopy time, Dose area Product (DAP) and Cumulative Air Kerma (CAK). Technical success was defined as bilateral embolization of the prostatic arteries.

Results: From October 2017 to February 2020, 52 PAEs were performed, 29 (55.8%) without using the software and 23 (44.2%) using this tool. Technical success was achieved in 52 patients (100%). Mean DAP values ($229.8 \text{ Gy} \cdot \text{cm}^2$ vs. $510.4 \text{ Gy} \cdot \text{cm}^2$, -55.0%) and CAK (1669.9 mGy vs. 3182.1 mGy , -47.5%) were significantly lower in the experimental group ($P < 0.01$ for both). There was no significant difference between the groups for fluoroscopy time ($P = 0.77$).

Conclusion: The 3D navigation software allows a significant reduction in the exposure to ionizing radiation related to the PAE procedure.

FP-126

Provision of radiation protection equipment for UK interventional radiology trainees: national survey findings

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Purpose: To survey the provision of personal radiation protective equipment (PRPE) amongst UK interventional radiology (IR) trainees.

Materials and Methods: An electronic survey was compiled using Survey Monkey and approved by the British Society of Interventional Radiology (BSIR) Council. The survey was sent to all UK IR trainees by email. The survey period was 04/01/21-16/02/21. Data was analysed in Microsoft Excel.

Results: 73 responses were received. 30 UK centres were represented. 62 (85%) participants were senior IR trainees. 70 (96%) did not have a personal lead apron, 67 (92%) did not have a personal thyroid shield and 46 (63%) did not have personal lead goggles. Out of the 27 trainees who had personal lead goggles, 6 (22%) self-funded and 21 (78%) had them purchased by the trust or training scheme. Prescription lead goggles were required but not provided in 26 (41%). Overfit glasses were provided for 23 (31%) trainees. 17 felt their ability to perform a procedure was compromised by overfit glasses. 26 trainees (35%) never or rarely wear lead goggles. Eye Dosimeters were worn by 31 (42%). 18 (25%) had funding requests for PRPE rejected from their trust or training programme. 43 (59%) struggled to find suitable fitting lead aprons. 53 (73%) wear lead aprons for >10 hours/week. Lead aprons contributed to back pain ($n=42$), hip pain ($n=7$), neck/shoulder pain ($n=19$) and knee/ankle pain ($n=8$). 39 (53%) had concerns regarding their PRPE.

Conclusion: Provision of PRPE for IR trainees is suboptimal and additional funding is required to ensure suitable fitting PRPE is available.

FP-127

Radial versus femoral prostate artery embolisation: big difference?

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Purpose: To assess the influence of radial versus femoral routes of access on case time, radiation and contrast exposure in patients undergoing prostate artery embolisation (PAE).

Materials and Methods: This retrospective study included sixty patients in total: $n=30$ in the radial PAE group, and $n=30$ in the femoral PAE group. All cases were performed by one of two senior vascular radiology consultants between May 2018 and January 2021, using the same standardised technique for each approach. Outcome measures included case time (mm:ss), screening time (min:ss), dose area product (DAP, $\mu\text{Gy} \cdot \text{m}^2$), air kirma (mGy), and contrast volume used (mL).

Results: The radial and femoral groups were matched for age (73.2 ± 7.5 vs. 71.3 ± 10.14 , $p=0.41$) and BMI (27.53 ± 5.08 vs. 26.41 ± 3.93 , $p=0.38$), with no significant difference in the type of contrast agent used (visipaque or omnipaque, $p=0.44$).

No significant difference in the outcome measures was found between radial and femoral PAE using the t-test or Wilcoxon test.

However, following linear regression factoring in operator differences, the radial cases were quicker to perform (-22.41 minutes (± 10.69), $p < 0.05$), and used less contrast (-25.99 mL (± 11.29), $p < 0.05$). There remained no significant difference in screening time, air kirma, or DAP with the radial approach.

Conclusion: Our results suggest that radial PAE offers similar patient screening time and radiation dose with lower case time and contrast usage than femoral PAE. Larger multicentre studies would be recommended for further evaluation.

FP-128

Determination of the effectiveness and availability of ultra-low dose protocol in CT-guided transthoracic lung biopsy

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Purpose: To contribute to the creation of a reference dose level without compromise technical success and radiation safety in CT-guided transthoracic biopsy.

Materials and Methods: From November 2017- November 2020, 183 patients were enrolled in this study.

Retrospective, single center, non-randomized.

Scanning parameters were changed in the CT-guided transthoracic biopsy procedure and an ultra-low dose protocol was created.

The effects of the routine protocol and the ultra-low-dose protocol on technical success, biopsy efficiency, radiation dose, complication rates and diagnostic adequacy of histopathological material were compared. The distribution of categorical variables in different groups was compared with Pearson's chi-square test or Fisher's exact test. The bilateral relations between variables were examined with Spearman's correlation analysis. P values less than 0.05 were considered significant.

Results: The mean effective radiation dose was reduced by 96.8% with the UDD protocol ($p < 0.001$).

No significant difference was found between the two groups in terms of complication rates, pathological material adequacy and cellular analysis evaluation criteria.

Conclusion: In this TTB protocol using 80 kV tube voltage and 30 mA tube current, it was found that the effective radiation dose to which the patient was exposed was significantly reduced without compromising patient-procedure safety and histopathological diagnostic performance.

FP-129

Radiation protection and eye dose reduction using a lead visor

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Purpose: In 2018, the new European Directive came into effect with safety standards against the dangers arising from ionising radiation exposure. The biggest change for interventional radiologists was the significant reduction in the annual limit for the lens of the eyes from 150 mSv/year to 20 mSv/year. This reduction poses a serious challenge to the practice of many interventional radiologists with the ever increasing length of ionising radiation procedures. Eye dose levels became concerning for exceeding dose limits in our institute and a solution was required. We describe the use of a radiation protection visor combined with X-ray protective glasses for the reduction of radiation exposure to the eye.

Materials and Methods: MavigTM has designed a visor to provide a high reduction in radiation exposure to the eyes and the facial area. X-ray protective glasses can also be worn underneath. The lead visor was worn for a period of 6 months. The eye dosimeter was worn underneath the X-ray protective glasses. This was then compared with the previous 6 months in which only the X-ray protective glasses were worn alone.

Results: The visor and glasses combination has led to a significant 88% dose reduction with average eye dose of 0.16 mSv per month compared with the average eye dose of 1.36 mSv per month with glasses alone.

Conclusion: Combining the visor with X-ray protective glasses is a safe and effective way of protecting the lens of the eye and decreasing eye dose levels. It allows for continuing work despite the decrease in annual dose limits and increase in work burden.

FP-130

Evaluation of possible effectiveness and detriment of using patient lead drape for reducing staff dose in interventional radiology and its impact in patient dose

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Purpose: To evaluate the usefulness of commercially available scatter reduction drapes on staff exposures in interventional radiology.

Materials and Methods: An anthropomorphic phantom was irradiated on an angiography device in 3 scenarios using a protective drape: no drape, correct and incorrect drape positioning. Different levels of incorrect drape positioning relative to the field of view (FOV) were evaluated: 5% (slightly), 15% (mildly), and 50% (severely), respectively. Real-time dosimeters (positioned on the operator's eye, chest and thyroid) were used to evaluate accumulative dose and dose rates. Additionally, patient exposure was evaluated for all scenarios by obtained dose area product.

Results: The operator doses ranged from 1.52 +/- 0.08 to 44.77 +/- 1.83 µSv next to the operator's eye, from 3.15 +/- 0.04 µSv to 67.89 +/- 2.92 µSv chest, and from 0.43 +/- 0.01 to 16.43 +/- 0.91 over thyroid. In terms of dose reduction, even at mildly obstruction resulted in a dose reduction up to 86% for all dosimeters' positions compared to no drape. For severe obstruction, increased exposure up to 1000% compared to no

drape was observed. Similar order of magnitude was observed in the patient exposure.

Conclusion: The usage of patient lead drape has the potential to reduce staff dose in interventional radiology procedures, even when these are mildly mispositioned obscuring the FOV. Special operator's attention on protective drape positioning is however necessary, since severe obstruction of the FOV results into large increase of both operator and patient exposure.

Renal and visceral artery intervention

FP-131

Long term immune function following splenic artery embolisation for blunt abdominal trauma: the IMMUNE study

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Purpose: To quantify long-term splenic immune function post splenic artery embolisation for blunt trauma.

Materials and Methods: Quantitative splenic immune function was assessed in a previous study at this institution at a median of 6.5 months after embolisation. These patients were invited for longer-term follow-up at a median of 102 months (8.5 years) after embolisation. The median splenic injury grade was American Association for the Surgery of Trauma (AAST) 4. IgM memory B cell levels (percentage of lymphocytes and percentage of B cells) and splenic volume were assessed.

Results: Of the 49 patients who were evaluated previously, 9 patients agreed to return for long-term follow-up. One patient was excluded due to unrelated chronic immune disease. Seven cases were proximal embolisation, with one distal embolisation. IgM memory B cell levels were normal for all patients at long-term follow-up, with significant increases in proportions of IgM memory B Cells compared to previous early follow-up; p=0.02. One patient with low IgM memory B cell levels at short-term had normalised levels at long-term follow up. Splenic volume trended downwards over time (p=0.05), however splenic volume does not correlate with function.

Conclusion: The IMMUNE study quantitatively showed a significant increase in the long-term splenic immune function following embolisation for blunt abdominal trauma when compared to short-term. Therefore, splenic artery embolisation should not be dissuaded by concerns about longer-term immune function, as patients in our cohort quantitatively remained or returned to normal. These data will guide clinical decision making and rationalise future use of antibiotic prophylaxis and vaccination in patients post embolisation.

FP-132

Safety and efficacy of chemosaturation with percutaneous hepatic perfusion of melphalan for metastatic uveal melanoma: an 8-year retrospective study of 250 interventions in 81 patients

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Purpose: Uveal melanoma is the most common primary ocular malignancy in adults. Up to 50% of patients subsequently develop metastatic disease. Metastatic uveal melanoma (mUM) currently has no standard of

care treatment and carries a poor prognosis at 10-25% 1-year survival with liver metastases being a key determinant. Current systemic treatment options are limited. Prior studies of melphalan percutaneous hepatic perfusion (M-PHP) are promising but limited by small sample sizes. We contribute our single centre findings on the safety and efficacy of the procedure in the largest sample population to date.

Materials and Methods: Retrospective analysis of outcome and safety data for all mUM patients receiving M-PHP at our institution. Tumour response and treatment toxicity were evaluated using RECIST 1.1 and Common Terminology Criteria for Adverse Events v5.03, respectively.

Results: A total of 250 M-PHP procedures were performed in 81 patients (median of 3 per patient). The hepatic disease control rate was 88.9% (72/81) and the overall response rate was 60.5% (49/81). After median follow-up of 12.9 months, median overall progression-free (PFS) and median overall survival (OS) were 8.4 months and 14.9 months, respectively. There were no fatal treatment-related adverse events (TRAE). Forty-three grade 3 (29) or 4 (14) TRAE occurred in 23 (28.4%) patients with significant reduction in such events between procedures performed in 2016-20 vs 2012-16 (0.17 per patient vs 0.90 per patient, $p < 0.001$).

Conclusion: M-PHP provides excellent response rates and PFS compared with other available treatments but limited relative OS benefit. With a decreasing side effect profile with experience, combination therapy with systemic agents may be viable to advance OS.

FP-133

Insights from intravascular pressure measurement of renal artery revascularization in patients with fibromuscular dysplasia

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Purpose: The indication of percutaneous renal transluminal angioplasty (PTRA) in fibromuscular dysplasia (FMD) is not well defined. Consequently, the selection of patients who could benefit from it and its effectiveness remain uncertain. The aims of this study were to report the effects of PTRA guided by transstenotic pressure measurements on hypertension 7 months after treatment, assess the impact of pressure measurement to guide treatment efficacy in comparison to visual angiographic parameters, and evaluate the reproducibility and accuracy of the stenosis measurement using a 4F catheter in comparison to a pressure guidewire.

Materials and Methods: This prospective multicentric study analyzed 24 patients with hypertension with RAS due to FMD that required PTRA. Clinical, duplex ultrasound and angiographic indices were collected, and patients were followed up for 7 months (± 1 month). Angiographic indices were measured twice both by a pressure guidewire and a 4F catheter. Assessment of procedural and clinical success of angioplasty was performed for all patients.

Results: Twenty-three patients (96%) had procedural success with a significant decrease in the systolic gradient after angioplasty (26.50 mmHg [16.75-38.75] vs. 0.00 mmHg [0.00-2.00], $p < 0.01$). Three patients (12%) had complications. Twenty-one patients (88%) were clinical responders to angioplasty at follow-up. Visual stenosis assessment were poorly correlated with systolic gradient measurement before and after PTRA (R from -0.05 to 0.41, $p = 0.06$ -0.82). High correlations were found between pressure measurements made by a 4F catheter and guidewire (R from 0.64 to 0.89 $p \leq 0.003$).

Conclusion: Invasive gradient measurement in clinically and echographically selected patients promotes high success rate for PTRA in hypertension due to FMD RAS.

FP-134

Prostatic artery embolisation versus Holmium laser enucleation of the prostate for the treatment of benign prostatic hyperplasia: a randomised controlled clinical trial

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General Study Info: Prostatic artery embolisation versus holmium laser enucleation of the prostate for the treatment of benign prostatic hyperplasia: a randomised controlled clinical trial

Background and Rationale: Transurethral resection of the prostate (TURP) and open prostatectomy (OP) are the gold standard treatments for symptomatic benign prostatic hyperplasia (BPH). Over the last two decades, novel techniques such as PAE and HoLEP have emerged. Literature suggests that these new techniques yield similar results to the gold standard but with less associated morbidity. This trial was set to further support this claim.

Objectives: To assess and compare the efficacy of PAE and HoLEP for the treatment of symptomatic BPH.

Methodology: 234 patients will need to be recruited to ensure rigorous statistical analysis, 117 of whom will undergo PAE and 117 HoLEP. Univariate analysis will be performed on all urological quantifiable variables. Clinical, analytical, and imaging follow up will be performed at 3, 6 and 12 months after the procedure. Statistical analysis will be performed and P values lower than 0.05 will be considered to indicate significant statistical differences.

Endpoints: To evaluate and compare changes in the International Prostate Symptom Score (IPSS) before and after treatment. To assess changes in peak urinary flow, post-void residual volume, International Index of Erectile Function, International Consultation on Incontinence Questionnaire-Short Form between groups. To describe and quantify treatment related complications in both groups.

Expected Data/Impact on IR: We expect to observe a similar clinical and functional improvement in PAE and HoLEP groups and to demonstrate lower number of complications compared to gold standard techniques.

TIPS and portal vein intervention

FP-135

Impact of portal vein stent for survival of malignant stenosis: a propensity score matching historical cohort study

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Purpose: To evaluate the impact of percutaneous portal vein (PV) stent placement for survival of patients with malignant PV stenosis.

Materials and Methods: Two historical cohorts of PV stenosis from two tertiary hospitals were compared in this retrospective study. The medical records of 197 PV stent patients from November 2016 to August 2019 were collected for the stent group. Those of 29 patients with PV stenosis who were treated conservatively from July 2013 to October 2016 were reviewed for the control group. Overall survival was compared between both groups before and after propensity-score matching with the Kaplan-Meier method. Risk factors for survival were estimated by the Cox regression. Procedure-associated adverse events were also evaluated.

Results: The stent group enrolled 100 of 197 patients [median 65 (interquartile range: IQR 58-71) years, men=64]. The control group included 22 of 29 patients [median 69 (IQR 61-75) years, men=13]. A stent was successfully placed in 95% of attempted patients. The median stent occlusion-free survival was 176 (IQR:70-440) days. Overall survival was significantly longer in the stent group than the control group (median

294 vs. 87 days, $p<.001$, $p=0.01$ after matching). Stent occlusion-free survival ($p<.001$) and history of surgery ($p=0.01$) were significant factors affecting survival improvement in stent patients, whereas the presence of symptoms was a poor prognostic factor ($p<.001$). Mild fever and pain ($n=21$), anemia requiring transfusion ($n=2$), and acute thrombosis necessitating re-stent ($n=1$) occurred within 1 week.

Conclusion: PV stent placement is safe and effective in improving survival of malignant PV stenosis patients.

FP-136

Long-term improvement in body composition of cirrhotic patients with sarcopenia after transjugular intrahepatic portosystemic shunt creation

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Purpose: Sarcopenia is a frequent complication in patients with cirrhosis. This study was aimed to evaluate the time-course changes of CT-based body composition in cirrhotic patients after transjugular intrahepatic portosystemic shunt (TIPS) placement.

Materials and Methods: We retrospectively analyzed 224 patients who underwent TIPS procedure between August 2016 and May 2020. Skeletal muscle area (SMA), skeletal muscle index (SMI), subcutaneous fat area (SFA) and subcutaneous fat thickness (SFT) were evaluated through CT images at baseline and at 1-3, 3-6 and 9-12 months after TIPS placement. **Results:** After TIPS insertion, increasing age (HR 1.049, 95%CI 1.023-1.077), higher model for end-stage liver disease (MELD) score (HR 1.118, 95%CI 1.055-1.186) and lower SMI (HR 0.895, 95%CI 0.849-0.945) were identified as independent risk factors for mortality. In patients with sarcopenia, SMA and SMI increased significantly at 3-6 months post-TIPS and maintained a constant level at 9-12 months post-TIPS, while SFA and SFT increased significantly in males but not in females. However, in patients without sarcopenia, no significant difference was found in the variation tendency of SMA, SMI, SFA and SFT. Additionally, the mean ascitic-free weight and body mass index (BMI) increased significantly in sarcopenia patients but nonsignificantly in non-sarcopenia patients at 12 months after TIPS placement.

Conclusion: Sarcopenia was independently associated with the risk of death and could be reversed after TIPS creation. The improvement of weight, BMI, skeletal muscle and subcutaneous fat mass following TIPS was more pronounced in sarcopenia patients compared with non-sarcopenia patients.

FP-137

Endoport RFA followed by stent implantation in the management of HCC patients complicated with portal vein thrombosis

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Purpose: Novel technique of portal vein tumor thrombus percutaneous image guided recanalization is presented

Materials and Methods: 57 patients underwent percutaneous endoport RF treatment attempt. PV tributary is accessed under US in 56 and under CT guidance in 1 case; manipulation by 5 Fr diameter guiding catheter is used to conduct the guidewire across the blocked segment and portography is performed. 15 Watts power was applied for 2 minutes using bipolar endoluminal RF device (Habib™ EndoHPB, EMCision Ltd., London, UK), placed in PV blocked segment over the guidewire. 1 to 3

RF application sessions were performed depending on tumor thrombus extent as shown on portography. After RFA 14 mm vascular stent is implanted and PV patency restoration is documented by portography. Procedure is completed by working track coil&gel-foam embolization.

Results: Procedure was completed in 47 (82.5%) cases; 8 (14.1%) - wire conduction failure; 2 (3.5%) - RF device conduction failure (stenting only performed). PV obstructed segment showed the restored blood flow in 46(93.8%) all 49 completed stenting cases as documented by postprocedure portography, follow-up Doppler and CT studies; this resulted in liver function improvement in 38 (77.6%) of stent positioning success cases. Procedure was complicated by intraperitoneal bleeding in 3 (5.3%) cases; 1 of them (1.8%) died because of polyorgan failure. Recanalized PV patency varied from 3 weeks to 22 months; in 13 cases patients underwent successful TACE procedure after PV recanalization.

Conclusion: PV thrombus percutaneous recanalization by endoport RFA&stenting is effective and should be suggested as a possible treatment option for HCC patients with PVT.

FP-138

Portal and hepatic vein embolization (PVE/HVE) increases resectability in patients with small future liver remnants compared to portal vein embolization (PVE) alone: a DRAGON trials collaborative retrospective analysis

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Purpose: Future Liver Remnant (FLR) - hypertrophy is often induced preoperatively to reduce the risk of Post Hepatectomy Liver Failure (PHLF) after major liver resection in patients with small FLRs. Portal Vein Embolization (PVE) is the current standard to induce FLR hypertrophy. Unfortunately, FLR growth after PVE is slow and sometimes inadequate to allow resection. Combined Portal and Hepatic Vein Embolization (PVE/HVE) is thought to accelerate FLR-hypertrophy. Whether this increases resectability is studied in this analysis.

Materials and Methods: Consecutive PVE and PVE/HVE cases were collected from all DRAGON TRIALS COLLABORATIVE centres who performed >5 PVE/HVE cases between 2016 and 2019. Pre and postoperative liver volumes were assessed using Osirix MD. Resectability, FLR-hypertrophy, and major complications (Clavien-Dindo >IIa) were evaluated using a multivariable analysis.

Results: 7 DRAGON-centres included a total of 199 patients (39 PVE/HVE, 160 PVE). Resectability (90% vs. 68%, $p=0.007$) and FLR hypertrophy (59% vs. 48%, $p=0.02$) was higher after PVE/HVE compared to PVE alone. Major complications and mortality did not significantly differ (3% vs. 16%, $p=0.15$ and 26% vs. 34%, $p=0.55$ respectively).

Conclusion: Resectability rate and liver growth were higher in PVE/HVE compared to PVE alone while mortality and complications were comparable. The coming DRAGON trials (NCT04272931/www.dragontrial.com) will prospectively investigate the superiority of PVE/HVE over PVE.

FP-139

Causal effect of transjugular intrahepatic portosystemic shunt (TIPS) on survival in patients undergoing orthotopic liver transplantation (OLT): 2004-2017 UNOS registry propensity score-matched analysis

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Purpose: The role of TIPS in bridging patients to OLT has been well-established. In the present study, we evaluate the effect of pre-OLT TIPS on clinical outcomes including survival.

Materials and Methods: A propensity score-matched, multivariable Cox Proportional Hazard regression was conducted on a retrospective cohort of 58,539 patients registered between 2004-2018 from the United Network for Organ Sharing (UNOS) database with survival as the outcome of interest. Anthropometric and clinical covariates, such as Child-Pugh, ECOG, and MELD scores, were used for propensity score matching.

Results: The patients were divided into two groups: HCC patients, and non-HCC patients. In the HCC group, 287 patients who received pre-OLT TIPS were matched to 287 patients who did not receive pre-OLT TIPS (mean age 57.65 + 14.14 years; 21.25% female, 78.75% male). TIPS placement had a Hazard ratio of 0.9822 (p=0.855; CI: 0.8108 - 1.99).

In non-HCC group, 1,769 patients who received pre-OLT TIPS were matched with 1769 patients who did not receive pre-OLT TIPS (mean age 54.07 + 19.39 years; 34.03% females, 65.97% male). The TIPS placement in non-HCC patients had a Hazard ratio of 0.926 (p< 0.05; CI: 0.8587 - 0.9986).

Conclusion: In non-HCC patients, pre-OLT TIPS placement had a significant survival benefit, while pre-OLT TIPS placement had no survival benefit in HCC patients.

FP-140

Development and validation of risk prediction models to estimate the risk of overt hepatic encephalopathy after TIPS

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Purpose: Overt hepatic encephalopathy (OHE) is a major complication of transjugular intrahepatic portosystemic shunt (TIPS). This study aimed to develop and validate risk prediction models to identify patients at different risk of OHE within three months after TIPS.

Materials and Methods: We established three models in increasing order of complexity based on a cohort of 276 patients with cirrhosis: core model (age + Child-Pugh class), sarcopenia model (age + Child-Pugh class + sarcopenia), full model (age + Child-Pugh class + sarcopenia + post-TIPS portal pressure gradient [PPG]). Discrimination and calibration were evaluated with c statistic, calibration plot and brier score. These models were validated externally in an independent cohort of 182 patients with cirrhosis.

Results: 61 (22.1%) and 33 (18.1%) cases of post-TIPS OHE were adjudicated in the derivation and validation cohort during follow-up. Sarcopenia was associated with increased risk of the outcome. In the derivation cohort, the core model showed a c statistic of 0.68 (95% confidence interval [CI] 0.61-0.75). Discrimination improved in the sarcopenia model (c statistic

0.73; 95% CI 0.66-0.80). The full model that extended the core model with inclusion of sarcopenia and post-TIPS PPG showed good discrimination (c statistic 0.77; 95% CI 0.71-0.83). All models yielded comparable performance in the validation cohort.

Conclusion: We developed and externally validated two prediction models applied before and after TIPS to estimate the risk of post-TIPS OHE. These tools could aid to select appropriate candidates for TIPS treatment and guide postoperative management.

FP-141

Prediction of colorectal liver metastases patient's response to portal vein embolization and their future liver remnant hypertrophy: a proof-of-concept machine-learning based approach

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Purpose: Portal vein embolization (PVE) is one option offered to patients increasing their anticipated future liver remnant (FLR) volume and determination if a patient would benefit and therefore qualify as a surgical resection candidate is based on predicting the FLR volume and kinetic growth rate (KGR) which are directly correlated to patient outcome after resection. We designed two machine learning (ML) algorithms to more accurately predict the FLR hypertrophy & KGR after PVE.

Materials and Methods: Our network was trained with 33 consecutive selected patients (23M, 10F; mean age 59.4 r 43-78) with colorectal liver metastases planned for PVE before surgery. The mean baseline & follow-up total and left liver volume, and the FLR% pre & post-PVE were 1564.12ml & 1610.4m, 380.7ml & 503.9ml, and 24.4% & 30.7%, respectively. Segmentations were manually performed and reviewed by an experienced radiologist. Lab values and biographical information were collected, and radiomic features were computed. A statistical shape model approach was used to calculate the patient-specific eigenvalues for each liver shape.

Results: The KGR prediction achieved a root mean squared error (RMSR) of 0.350 (23.82 cm³/week). Prediction of a safe resection time point based on a sufficient FLR volume of at least 30% functional remaining liver volume was accurate within a few days (μ : 4.23d; σ : 10.19d). The ML Model successfully predicted candidates for PVE with an average accuracy of 83.2% and a cross-entropy-loss score of 0.361.

Conclusion: This ML-based approach can accurately predict successful PVE candidates and their KGR based on more comprehensive markers at a patient-specific level.

FP-142

DRAGON 2 Trial: international multicenter randomized controlled trial of combined portal and hepatic vein embolization (PVE/HVE) vs. portal vein embolization (PVE) alone

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General Study Info: DRAGON 2 Trial - International Multicenter Randomized Controlled Trial of Combined Portal and Hepatic Vein Embolization(PVE/HVE) vs. Portal Vein Embolization (PVE) alone.

Clinicaltrials.gov
not yet registered

Background and Rationale: Post Hepatectomy Liver Failure (PHLF) is a life-threatening complication which can occur after major liver resections. To minimize the risk of PHLF, Future Liver Remnant (FLR)-hypertrophy is

induced, e.g., by Portal Vein Embolization. Combined Portal and Hepatic Vein Embolization (PVE/HVE), however, might further increase hypertrophy and resectability rates in these patients.

Objectives: This international multicenter randomized controlled trial aims to investigate the superiority of PVE/HVE over PVE alone with respect to resectability.

Methodology: All participating centers who achieved the primary end-point of the DRAGON 1 pretrial are allowed to enroll patients. At least 35 centers worldwide are expected to start in this trial (DRAGON 2). Approximately 300 patients will be randomized (1:1), the final sample size will be calculated by using the results of the DRAGON 1 trial. Trial data will be captured in CASTOR EDC and pseudonymized CT scans will be sent to the coordinating center in Maastricht for volumetry measurements and translational research. The total duration of the trial will be 3 years (2 inclusion, 1 follow-up).

Endpoints: Primary: resection rate

Secondary: Degree of Hypertrophy, Kinetic Growth Rate, Complications, 90-day mortality, 1-year survival.

Expected Data/Impact on IR: We expect the data to be published early 2025. Results of the DRAGON 2 trial might change the current practice and will, hopefully, improve the treatment options for this patient population worldwide.

Urinary tract intervention

FP-143

Does protective coiling of penile collaterals during prostatic artery embolization (PAE) impact erectile function? A propensity-matched analysis

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Purpose: Prostatic artery embolization (PAE) has been proposed as a good option for benign prostatic hyperplasia (BPH) patients who wish to maintain sexual function. Vascular penile anastomoses are an intra-procedural dilemma, and it is unclear if protectively coiling these vessels could negatively impact erectile function. We investigated the impact of coil protection on erectile function.

Materials and Methods: Retrospective analysis of a prospective multicentre PAE study (UK-ROPE study) identified all BPH patients with International Index of Erectile Function (IIEF-15) scores at baseline and within 12 months post-procedure. A propensity-matched analysis (matched for age, baseline IIEF and the use of 5-alpha-reductase inhibitors with logistic regression/nearest neighbour) and paired t-test were used to compare the change in IIEF between those that had penile collateral coiling against a matched group that did not.

Results: 26/216 patients enrolled in the UK-ROPE study underwent coil protection of an accessory pudendal/ penile collateral. After exclusions, 22 propensity-matched pairs were identified. Mean IIEF at baseline for the coiled group was 14.8 +/- 8.3 (out of possible 30) and 14 +/- 7.8 for the non-coiled group. At 12-months follow-up post-procedure, the mean follow-up IIEF score was 15.5 +/- 8.0 for the coiled group and 14.2 +/- 8.2 for the non-coiled group. The difference in IIEF post embolization was not significantly different between the two groups (0.66 +/- 3.8 vs 0.20 +/- 2.0, p=0.64; CI -1.53-2.44).

Conclusion: Protective coil embolization of penile collaterals/accessory pudendal vessels during PAE is unlikely to negatively impact erectile function.

FP-144

Long-term nephrostomies: what is the patient experience?

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Purpose: To assess the patient experience of a long-term nephrostomy, looking at both the procedural elements and the impacts on quality of life; trying to identify any areas for improvement.

Materials and Methods: A single centre, prospective study on a total of 20 patients over a 3 year period (2017-2020) using an eight-point questionnaire: two questions focusing on the exchange procedure itself; one question on the patient experience of community support and then five questions that have been modeled on the EuroQol EQ-5D-5L questionnaire which is widely used in research to assess quality of life impacts. Each question also included an opportunity for free-text comment on why a patient gave a certain score.

Results: All 5 dimensions of the EQ-5D-5L were significantly impacted, with 54% of respondents reporting extreme/severe problems as an aggregate score across all 5 domains. Patient's usual activities were the most affected category, a finding which is echoed in other studies. The procedure was well tolerated, with only 80% of patients reporting no problems. The most common community issue was lack of support from district nurses (15%) and feeling like there was no clear line of contact or follow-up if they were to have any concerns.

Conclusion: A significant proportion of patients report severe/extreme impact on quality of life. Given the morbidity of the group being studied, further work into quality of life for these patients to improve the issues identified would be of huge importance.

FP-145

Technical feasibility of MRI-guided LA and assessment of procedural differences between MRI-guided LA and US-guided TPLA in BPH patients with LUTS

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Purpose: The aim of this study is to evaluate feasibility of MRI-guided laser ablation (LA) as a treatment in benign prostatic hyperplasia (BPH) and to assess pros and cons compared with US-guided TPLA.

Materials and Methods: 44 men (mean age 72.0), affected by moderate to severe LUTS due to BPH with IPSS score ≥ 12 and history of refractoriness, intolerance or poor compliance to medical therapies, were treated with US-guided TPLA. Five more patients, selected randomly and eligible to MRI scan, were treated with MRI-guided in bore LA.

Results: Pros of the MRI-guided technique are the shorter time for 21G introducers positioning and the real time monitoring of thermal damaged area with lower adverse events rate (3% vs 7% of the US-guided technique) by Clavien-Dindo scale. Cons are the higher costs compared with US-guided one. Clinical results, PSA levels, flow rate estimation, US post-voiding volume measurement, sexual function assessment, SHIM and QoL questionnaire were comparable such as volume changes, assessed with 3T mpMRI imaging and automatic segmentation software. Erectile and ejaculatory functions were maintained in all patients.

Conclusion: Clinical monitoring and 3T mpMRI imaging confirming US-guided and MRI-guided LA as safe, manageable and effective treatments for LUTS, with similar results at one year follow-up. The MRI-guided one is quicker, more precise and safer but is more expensive than the US-guided.

Venous intervention and IVC filters

FP-146

Safety and efficacy of the Indigo Aspiration System in patients with acute pulmonary embolism: results from a prospective, single-arm, multicenter IDE study (EXTRACT-PE)

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Purpose: To evaluate the safety and efficacy of aspiration thrombectomy with the Indigo® Aspiration System in patients with acute pulmonary embolism (PE).

Materials and Methods: Patients with acute submassive PE < 14 days in duration were enrolled into a prospective, non-randomized, multicenter trial. The primary efficacy endpoint was reduction in RV/LV ratio from baseline to 48 hours, assessed by computed tomography angiography (CTA). The primary safety endpoint was the rate of major adverse events. Multiple clinical and imaging secondary endpoints were evaluated.

Results: 119 patients (mean age of 59.8±15.0 years) were enrolled at 22 US sites over 17 months. Mean RV/LV ratio reduction at 48 hours was 0.43 (95% CI 0.38-0.47; p<0.0001) corresponding to a 27.3% reduction. The rate of major adverse events was 1.7%. Secondary safety endpoints included rates within 48 hours of: cardiac injury (0%), pulmonary vascular injury (1.7%), clinical deterioration (1.7%), major bleeding (1.7%), and device-related death (0.8%). Rates of any-cause mortality, device-related SAEs, and symptomatic PE recurrence within 30 days were 2.5%, 1.7%, and 0%. Median procedure time was 37.0 min (IQR 23.5-60.0). Two patients (1.7%) received intraprocedural thrombolytics. Mean reduction in systolic pulmonary artery pressures from pre- to post-Indigo and pre- to post-procedure were 4.3 mm Hg (95% CI 2.6-5.9; p<0.0001) and 4.7 mm Hg (95% CI 3.0-6.4; p<0.0001), respectively.

Conclusion: Aspiration thrombectomy with the Indigo Aspiration System reduced intra-procedure pulmonary artery pressure, avoided intraprocedural thrombolytics in 98.3% of patients, was associated with a reduction in the RV/LV ratio at 48 hours, and met its pre-specified safety endpoint.

venography; p<0.0001) endpoints were met. Clinical presentation included 105 PTS (43.2%), 79 NIVL (33%), and 59 aDVT (24%) patients. The 2-year patency rates by ultrasound varied between the patient subgroups (PTS: 86.1%±3.9%; NIVL: 100% ± 0%; aDVT: 84.0% ± 5.8%). The mean change in VCSS from baseline demonstrated clinical improvement through 2 years (PTS: -3.6±3.6; NIVL: -4.8±4.1; aDVT: -4.6±2.7). No core laboratory reported stent fractures through 2 years.

Conclusion: The 2-year subgroup results from the VIVO Clinical Study illustrate outcome differences by clinical presentation after Zilver Vena Venous Stent placement.

FP-147

Zilver Vena Venous Stent in the treatment of symptomatic iliofemoral venous outflow obstruction: VIVO clinical study 2-year subgroup outcomes

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Purpose: The safety and effectiveness of the Zilver Vena Venous Stent was assessed for the treatment of symptomatic iliofemoral venous outflow obstruction under VIVO Clinical Study (NCT01970007). This study update aims to report on 2-year subgroup outcomes.

Materials and Methods: The clinical study included 243 patients (70% female; mean age: 53 ± 15 years) with symptomatic obstruction (inclusion was CEAP "C" classification of ≥3 or VCSS pain score ≥2) of one iliofemoral venous segment. Patients were evaluated by baseline clinical presentation and categorized into post-thrombotic (PTS), non-thrombotic (NIVL), or acute DVT (aDVT) groups. Patency by ultrasound, clinical improvement measured by VCSS, and stent integrity through 2 years was evaluated.

Results: The clinical study cohort (n=243) presented with a mean study lesion length of 98.6±69.8 mm, 23.3% were total occlusions, and 32.5% of patients had stents extended below the inguinal ligament. Primary safety (30-day freedom from MAE rate was 96.7%; p<0.0001) and effectiveness (12-month primary quantitative patency rate was 89.9% by

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PART 2

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FIRST@CIRSE**First data release on endovascular research****501.1**

The novel temporary Spur stent system used in conjunction with a commercially available, paclitaxel-coated balloon: 6-months results of the DEEPER OUS trial

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General Study Info: A non-randomized trial of the Temporary Spur Stent System for the treatment of lesions located in the infrapopliteal arteries outside of the United States (DEEPER OUS)
clinicaltrials.gov: NCT03807531

Purpose: Current endovascular treatment of infrapopliteal peripheral arterial disease (PAD) and critical limb ischemia (CLI) demonstrates high restenosis rates, without any clear alternative to percutaneous balloon angioplasty (PTA). The purpose of the DEEPER OUS trial is to examine the safety and efficacy of the Temporary Spur Stent System in conjunction with a commercially available paclitaxel-coated balloon.

Methodology: This prospective, non-randomized, single-arm, multicenter trial is powered for 100 patients, with a vessel recoil sub-study of up to 35 patients. In-person patient follow up is scheduled through 12 months, with remote visits out to 5 years. Adjudication is provided by angiographic and vascular core labs. Safety oversight is provided by a Data Safety Monitoring Board (DSMB) and Clinical Events Committee (CEC).

Endpoints: The primary safety endpoint is freedom from device and procedure-related death through 30 days post-procedure; the primary efficacy endpoint is patency of treated lesion sites by duplex ultrasound at 6 months. Secondary endpoints include freedom from clinically-driven target lesion revascularization (CD-TLR), wound healing, and freedom from major amputation of the target limb at 6 months.

Expected Data/Impact on IR: Available 6-months data on the primary endpoints will be presented at the 2021 CIRSE conference, as well as vessel recoil sub-study data. Presentation of patency and safety data for this novel device is expected to be of special interest to Interventional Radiologists who encounter the challenges of CLI daily.

501.2

Treatment of venous iliofemoral occlusive disease with the Venovo self-expanding venous stent: 36-months results from the prospective, multicenter VERNACULAR trial

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General Study Info: Short Title: Three-year results from the Prospective, Multicenter Venovo Venous Stent Trial
Registered on ClinicalTrials.gov Identifier: NCT02655887

Purpose: To assess the performance of the Venovo Venous Stent used to treat iliofemoral venous occlusive disease.

Methodology: Investigators at 22 international sites conducted a prospective, multicenter, single-arm study using the nitinol, self-expanding Venovo Venous Stent in 170 patients (93 PTS; 77 NIVL).

Endpoints: Primary endpoints were major adverse events (MAEs) through 30 days and 12-month primary patency tested against prespecified literature-derived performance goals (PGs). Secondary outcomes included the Venous Clinical Severity Score (VCSS) Pain Assessment and CIVIQ-20 Quality-of-Life, both tested for superiority to baseline values.

Expected Data/Impact on IR: Freedom from MAEs through 30 days was 93.5%, non-inferior to a PG of 89% ($p = 0.032$). Primary patency at 12 months was 88.3%, superior to a PG of 74% ($p < 0.0001$). Primary patency at two years was 84.3% (Kaplan-Meier survival estimate) - primary

patency for the PTS subgroup was 77.3% and 95.2% for the NIVL group. There was an overall mean improvement in the VCSS Pain Score from baseline of 1.9 while CIVIQ-20 scores improved 15.6 points from baseline values. No stent fractures were observed through 24 months (Yale Core Lab). The Venovo stent has been used successfully in obstructive ilio-femoral vein lesions with low rates of MAEs and no reported stent fractures. 36-month data will be presented for the first time at CIRSE 2021.

501.3

Prospective first in man study of the Merit WRAPSODY™ endovascular stent graft for treatment of access circuit outflow stenosis in hemodialysis patients

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General Study Info: The Merit Wrapsody Endovascular Stent Graft Prospective Investigation of The Merit WRAPSODY™ Endovascular Stent Graft for Treatment of Venous Outflow Circuit Obstruction In Hemodialysis Patients

Clinicaltrials.gov

NCT03644017

Purpose: To evaluate the safety and effectiveness of the WRAPSODY Stent Graft in treating outflow and central (Brachiocephalic and/or Subclavian) vein stenoses or occlusions in the arteriovenous venous circuit of patients receiving dialysis for end stage renal disease.

Methodology: A prospective study of patients who underwent stent graft placement was conducted at 3 European centers. Data was collected at baseline and at four follow-up visits during the first 12 months and included adverse outcomes or re-intervention. An independent committee reviewed all serious adverse events and interventions for safety concerns or unanticipated adverse events.

Endpoints: Safety events through 30 days and Target Lesion Primary Patency (TLPP) at 6 and 12 months

Expected Data/Impact on IR: Of eighty-three patients recruited, 46 met eligibility criteria and were treated. Mean age was 66.7 years. Primary safety through 30 days was 97.8% (45/46). TLPP at 6-month follow-up was 97.7% (42/43). 39 patients had a working access circuit at 12-months and TLPP appears in excess of 75%. Full data will be available should this be accepted for presentation. Per independent safety committee, there were no safety concerns or unanticipated adverse events through 12 months.

The novel design features and encouraging early clinical data suggest that WRAPSODY has the potential to provide an alternative endoprosthesis with improved patency for the treatment of stenoses or occlusion in the dialysis access outflow circuit.

501.4

Real world evidence of stellarex drug-coated balloon (DCB) for the treatment of infrainguinal disease: final 12-month results from the Stellarex Vascular E-Registry (SAVER)

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General Study Info: Real World Evidence of Stellarex Drug-Coated Balloon (DCB) for the Treatment of Infrainguinal Disease: Final 12-Month Results from the Stellarex Vascular E-Registry (SAVER)

(Clinicaltrials.gov NCT02769273)

Purpose: Several randomized controlled trials (RCTs) have confirmed the superiority of DCBs vs. percutaneous transluminal angioplasty (PTA) for infrainguinal revascularization in patients with peripheral artery disease. Real world registries are important to complement RCTs in their ability to reflect real practice in nonspecified patient populations to understand real world effectiveness and safety, including the potential for rare events detection. The objective of the SAVER Registry is to assess the safety and efficacy of Stellarex DCB in femoral, popliteal, and/or infrapopliteal

arteries in a broad, real-world, claudicant or critical limb ischemia (CLI) patient population.

Methodology: SAVER represents one of the largest multicenter, international prospective registries conducted with an individual DCB under normal clinical practice to treat patients with claudication and CLI. The patient population includes those with Rutherford Clinical Classification (RCC) 2-6 and who are indicated for PTA. Cohort 1 includes patients with RCC 2-3, and Cohort 2 includes RCC 4-6. Hemodynamic, clinical and functional outcomes are evaluated at 12, 24, and 36 months. A clinical events committee provided oversight, including adjudication of clinical events. Additionally, core laboratories analyzed angiographic/duplex ultrasound images.

Endpoints: The SAVER 1-year results include the full cohort of 1962 patients and will be reported with baseline demographics, procedural characteristics and clinical outcomes including mortality, amputation and clinically-driven target-lesion revascularization.

Expected Data/Impact on IR: Will be reported accordingly.

501.5

Evaluating patient perspectives of percutaneously created arteriovenous fistula for dialysis access (EndoAVF) – A multi-centre analysis

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General Study Info: Long Title: Evaluating patient perspectives of percutaneously created arteriovenous fistula for dialysis access (EndoAVF) – A multi-centre analysis

Short title: Patient perspectives of EndoAVF – A multi-centre analysis
ClinicalTrials.gov Identifier: NCT02036671, NCT02682420

Institutional approval: CARMS-16320

Purpose: Patient-reported experience measures are contemporary quality indicators that focus on healthcare delivery processes. While surgical arteriovenous fistulas (sAVF) are preferred for haemodialysis vascular access, fears about surgery and complications often result in refusal/delays. Endovascular fistulas (endoAVF) are now an additional option available to patients. The Vascular Access Questionnaire (VAQ) provides a mechanism for identifying and scoring perceptions in this setting.

Methodology: VAQ responses from participants with WavelinQ created endoAVF were aggregated into early(<1yr) and later follow up(>1yr). Comparisons were made between participants with endoAVF and sAVF at matched follow up periods.

Endpoints: A total of 40 endoAVF and 538 sAVF responses were available for analysis. Median follow up on dialysis of endoAVF was 3yrs (IQR 2.2). The majority of participants with endoAVF (83%) perceived them to be “somewhat easy to use”. Cannulation and concerns of access longevity scored the highest (more concern) in the sub domains. This was significantly lower at 3 yrs and less concerning with endoAVF (4.25 vs 5.1). Overall satisfaction was consistently higher for endoAVFs (96% & 100% satisfied at 1 and 3yrs vs. 85% & 94%). Analysis of open ended components highlighted patient satisfaction with less aneurysmal formation and need for improvement in early cannulation training for both sAVF and endoAVF.

Expected Data/Impact on IR: Patient-reported perspectives of endovascular fistula indicate that they confer higher satisfaction rates. Initial concerns with cannulation and longevity appear to improve significantly after the first year on haemodialysis. A multidisciplinary approach from vascular access planning and creation to cannulation with educational and training support could be beneficial in improving early patient experiences.

501.6

Optimizing dissection repair above and below the knee: pooled analyses from the Tack Optimized Balloon Angioplasty (TOBA) studies

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General Study Info: Optimizing dissection repair above and below the knee: pooled analyses from the Tack Optimized Balloon Angioplasty (TOBA) studies

(Clinicaltrials.gov TOBA II: NCT 02522884; TOBA III: NCT02802306; TOBA-II BTK: NCT02942966)

Purpose: Dissection after angioplasty with plain balloon (POBA) or drug-coated balloon (DCB) is known to negatively impact short and long-term outcomes in above and below the knee lesions. The TOBA studies investigate dissection repair with Tack endovascular system in the femoropopliteal (TOBA II and TOBA III) and infrapopliteal (TOBA-II BTK) arteries following angioplasty.

Methodology: TOBA II, TOBA III and TOBA-II BTK enrolled 213, 201 and 233 patients, respectively. All primary and secondary endpoints were met in each trial and have been reported in peer-reviewed literature. The present analyses investigate peri- and post-procedural characteristics for potential predictors for freedom from clinically-driven target lesion revascularization (CD-TLR) and freedom from major (above-ankle) amputation.

Endpoints: Each patient had at least one core-lab adjudicated post-angioplasty dissection. The average total dissection length per patient was 37.3mm in TOBA II, 39.6mm in TOBA III, and 19.6mm in TOBA II-BTK. A comparison was made to the total length of Tacks deployed in the dissection(s) to determine whether there is a correlation between Tack to dissection length ratio and freedom from CD-TLR (TOBA II, TOBA III), and freedom from amputation (TOBA-II BTK).

Twelve-month Kaplan-Meier rates of freedom from CD-TLR in TOBA II and TOBA III were 86.5% and 97.5% respectively. Ultrasound-derived peak systolic velocity ratio (PSVR) at 6 months were analysed to determine whether there exists a relationship between PSVR and subsequent CD-TLR.

Expected Data/Impact on IR: Data available on 10 September 2021 will be presented at the 2021 CIRSE conference.

FIRST@CIRSE New frontiers

2202.1

IN.PACT global study 5-year outcomes: sex and diabetic subgroups

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General Study Info: IN.PACT Global Study

Purpose: Currently, there are no long-term data available on the use of drug-coated balloons (DCB) for femoropopliteal artery disease in distinct populations such as diabetics and females. This will be the first presentation of 5-year data on diabetic and gender subgroups from a global DCB study.

Methodology: The IN.PACT Global study was a prospective, multicenter, single-arm, real-world study with a total of 1406 participants treated with the IN.PACT Admiral DCB. In this post-hoc analysis, participants were stratified by their sex (Female n=453, Male n=953) and diabetes mellitus (DM) status (DM n=560, non-DM n=842) to assess long-term outcomes in these subgroups.

Endpoints: At baseline, there were notable/remarkable differences in complexity between groups. Among sex the females were older, had

smaller reference vessel diameters (RVD) and more below-the-knee (BTK) disease. The DM compared to non-DM had extensive comorbidities such as hypertension hyperlipidemia, coronary heart disease, carotid disease, obesity, renal insufficiency and BTK disease. Kaplan-Meier estimates of freedom from CD-TLR through 5 years were 69.1% for female and 69.6% for male (log-rank $p=0.602$) and cumulative incidences of major target limb amputation were 1.4% and 1.8% (log-rank $p=0.596$) respectively. By diabetic status, the Kaplan-Meier estimates of freedom from CD-TLR through 5 years were 67.7% and 70.5% (log-rank $p=0.246$) for DM and non-DM sub-groups and cumulative incidences of major target limb amputation were 2.5% and 1.1% (log-rank $p=0.085$) respectively.

Expected Data/Impact on IR: Results from this analysis demonstrate long-term safety of the IN.PACT Admiral DCB as an effective treatment of choice for the management of unique PAD populations.

2202.2

First tumour response results from the prospective multicentre observational study CIREL on irinotecan-eluting transarterial chemoembolisation in colorectal cancer liver metastases

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General Study Info: CIRSE Registry for LifePearl Microspheres (CIREL), <https://clinicaltrials.gov/ct2/show/NCT03086096>

Purpose: Irinotecan-eluting transarterial chemoembolisation (TACE) is a treatment option for the majority of colorectal cancer patients with liver-limited metastases (CRLM), not eligible for curative/resective treatments. The Cirse REgistry for LifePearl microspheres (CIREL) is a prospective, multicentre, observational study on the real-life use of irinotecan-eluting TACE.

Methodology: Eligible patients (≥ 18 years) were treated with irinotecan-eluting LifePearl microspheres following an MDT board decision. Data was prospectively collected for baseline characteristics, treatment intention and safety according to CTCAE 4.03. Follow-up was continued

every 4-8 weeks, for at least 12 months or until end of study, loss to follow-up or death.

Endpoints: Treatment intention was categorised by disease status, previous lines of systemic chemotherapy and concomitant therapies.

Objective response rate, depth of response and tumour shrinkage at $\geq 20\%$ and $\geq 30\%$ will be evaluated based on the Investigators' first and second assessments according to RECISTv1.1.

Expected Data/Impact on IR: 152 patients (93 male; median age 65, range 37-90) were enrolled between February 2018 and August 2020, from 20 sites in 11 countries. They received a median of 2 (range 1-5) treatments per patient.

LP-irinotecan TACE was used in 30% as salvage therapy (after ≥ 3 lines of systemic chemotherapy; progressive disease) and in 28% as intensification treatment with concomitant systemic therapy (after ≤ 2 lines of systemic chemotherapy; progressive disease). Grade 3/4 adverse events occurred periinterventionally in 7% and within 30 days in 11% of patients. 30-day mortality rate was 0.7%.

Early response data according to RECISTv1.1. and updated safety data will be shown at CIRSE 2021.

2202.3

A randomized controlled trial comparing the patency of covered stents and bare-metal stents in patients with chronic mesenteric ischemia

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General Study Info: Covered Stents Versus Bare-Metal Stents in Chronic Atherosclerotic Gastrointestinal Ischemia (CoBaGI); [clinicaltrials.gov; NCT02428582](https://clinicaltrials.gov/NCT02428582)

Purpose: Chronic mesenteric ischemia (CMI) has an incidence rate of 9.2 per 100.000 persons and is caused by atherosclerotic stenosis of ≥ 1 mesenteric artery in the majority of cases. Revascularization is warranted to relieve the incapacitating symptoms of CMI and to prevent acute-on-chronic mesenteric ischemia, which is associated with high morbidity and mortality. Percutaneous mesenteric artery stenting (PMAS) has evolved rapidly and replaced surgery as the preferred treatment, however long-term patency of PMAS is unsatisfactorily low. Covered stents

(CS) have been retrospectively associated with superior patency compared to bare-metal stents (BMS). This study aimed to prospectively assess the patency of CS versus BMS in atherosclerotic CMI patients.

Methodology: A multicenter investigator and patient blinded randomized controlled trial designed to assess the superiority of CS over BMS. Ninety-four patients with a multidisciplinary consensus diagnosis of CMI, based on history, imaging, and when indicated a functional test, were randomized to PMAS with either BMS (Palmaz Blue) or CS (Advanta V12). Computed tomography angiography and routine follow-up visits were performed at 6, 12, and 24 months to assess patency and symptom recurrence.

Endpoints: The primary endpoint was 24-month stent patency, defined as <50% luminal reduction. Secondary endpoints were 6 and 12-month stent patency and 6, 12, and 24-month target lesion reintervention rates.

Expected Data/Impact on IR: The results are expected to show superior patency of CS, providing the required evidence for adaptation of CS as the standard stent for PMAS in CMI patients.

2202.4

Portal and hepatic vein embolization (PVE/HVE) to accelerate FLR hypertrophy – the international multicenter DRAGON 1 trial

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General Study Info: DRAGON 1- Training, Accreditation, Implementation and Safety Evaluation of Portal and Hepatic Vein Embolization to Accelerate Future Liver Remnant (FLR) Hypertrophy

The DRAGON 1 trial

Clinicaltrials.gov

NCT04272931

Purpose: Future Liver Remnant (FLR)-hypertrophy is often induced pre-operatively in patients with Colorectal Cancer Liver Metastases (CRLM) and small FLR to reduce the risk of Post Hepatectomy Liver Failure (PHLF). The current standard to induce FLR-hypertrophy is Portal Vein Embolization (PVE), but combined Portal and Hepatic Vein Embolization (PVE/HVE) might be superior. Safety and feasibility of PVE/HVE in patients undergoing PVE/HVE for colorectal cancer liver metastases will be prospectively assessed.

Methodology: The DRAGON 1 trial is a pretrial accruing in over 50 liver centers worldwide to qualify for the international multicenter randomized controlled DRAGON 2 trial. Work Instructions (WI) are used to train and to standardize technique of PVE/HVE procedures in all centers. The trial was registered on www.clinicaltrials.gov: NCT04272931.

Endpoints: The primary endpoint of the DRAGON 1 trial is the ability for each participating center to recruit 3 patients within 12 months without 90-day mortality due to complications related to the PVE/HVE procedure. Secondary outcomes include: Resection rate, Degree of Hypertrophy (DH), Kinetic Growth rate (KGR), complications, and recurrence.

Expected Data/Impact on IR: Today, 28 patients are enrolled in DRAGON 1. At the 2021 CIRSE Congress we expect to present data of the first 75 included patients.

2202.5

Stereotactic body radiation therapy (SBRT) versus irreversible electroporation (IRE) for the treatment of locally advanced pancreatic cancer: interim analysis of the open-label, randomized, controlled, phase 3 CROSSFIRE trial

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General Study Info: Identifier: NCT02791503 (clinicaltrials.gov)

Purpose: Pancreatic ductal adenocarcinoma (PDAC) is an aggressive disease with dismal prognosis. Stage III tumors, also known as locally advanced pancreatic cancer (LAPC), are unresectable and current palliative chemotherapy regimens have only modestly improved survival. At this stage of disease, ablation techniques such as irreversible electroporation (IRE) and stereotactic body radiotherapy (SBRT) may be of value to further improve survival.

Methodology: In this prespecified interim and futility analysis (65/130 inclusions) of the open-label, randomized, controlled, phase 3 CROSSFIRE trial, we recruited patients with radiologically and histologically proven stage III PDAC. Eligible patients had a maximum tumor diameter of 5 cm and had to be pre-treated with mFOLFIRINOX. Patients were randomly assigned (1:1) to receive percutaneous IRE or SBRT.

Endpoints: The primary endpoint is overall survival from diagnosis and from randomization. Secondary endpoints comprise local tumor progression-free survival (LTPFS), distant progression-free survival (DPFS), (serious) adverse events and quality of life.

Expected Data/Impact on IR: The final results of the interim and futility analysis at 50% of inclusion, available at the end of July 2021, may reveal IRE or SBRT superiority in terms of overall and progression-free survival, and will demonstrate whether IRE and/or SBRT can improve survival over mFOLFIRINOX alone, albeit at the cost of a risk of serious adverse events. Depending on the results, this may further signify the use of additional ablative therapy in the treatment of stage III PDAC and will determine trial continuation or termination.

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PART 3

**Abstracts of
Meet the PI Papers
sorted by presentation
numbers**

Meet the PI Upcoming clinical trials in interventional oncology I

304.1

Effectiveness comparison between percutaneous radiofrequency ablation and partial nephrectomy in T1aN0M0 renal cell carcinoma: a randomized controlled trial

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General Study Info: A randomized controlled trial has been designed as a final degree project to compare clinical, radiological and survival outcomes between Radiofrequency Ablation (RFA) and Partial Nephrectomy (PN) for patients with T1aN0M0 Renal Cell Carcinoma (RCC).

Background and Rationale: The effectiveness of percutaneous RFA in comparison to surgery procedures for the treatment of localized RCC has only been reported through retrospective observational studies, with strongly biased and inconclusive results. No randomised controlled trials have been conducted to assess whether technique can come up with the best outcomes.

Objectives: Evaluate effectiveness of percutaneous RFA versus laparoscopic PN in long survival outcomes, impact in renal function and security outcomes in treatment of patients with less than 4cm T1aN0M0 RCC.

Methodology: A multicentric, prospective randomised controlled trial of 588 participants with a 120 months follow-up is proposed. Eligible patients will be adults with biopsy-proven RCC, T1aN0M0 staged and without significant comorbidities. They will be distributed in a 1:1 ratio to percutaneous RFA CT guided study group versus a laparoscopic PN Control group.

Endpoints:

1. To assess the overall survival rates in 60, 90 and 120 months from the intervention.
2. Define the rates of local/ metastatic progression and cancer-specific survival rates,
3. Evaluate percentage of first treatment complete ablation in the RFA Group
4. Determine absolute change of estimated glomerular filtration rate and serum creatinine before and after the procedure.
5. Notify possible treatment-related complications.

Expected Data/Impact on IR: Providing data in favour of RFA would prove safety, efficiency and effective percutaneous technique for the localized RCC, becoming a Gold Standard technique.

304.2

Irreversible electroporation and nivolumab combined with intratumoral administration of a toll-like receptor ligand as a means of in vivo vaccination for oligometastatic pancreatic ductal adenocarcinoma

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General Study Info: Identifier: NCT04612530 (clinicaltrials.gov)

Background and Rationale: Pancreatic ductal adenocarcinoma (PDAC) is one of the most aggressive neoplasms with a dismal prognosis. Irreversible electroporation (IRE) is an image-guided ablation technique used in the

treatment of unresectable PDAC. In addition to its cytoreductive property, IRE has demonstrated the ability to temporarily alleviate tumor-induced immune suppression. This response may be leveraged by combining IRE with systemic and local immunotherapy, potentially inducing a durable anti-tumor response.

Objectives: The primary objective of this study is to assess safety of the combination IRE + nivolumab (anti-PD1), and CpG (Toll-like receptor-9 agonist) + IRE + nivolumab. Secondary objectives comprise assessments of overall survival, progression-free survival, quality of life, immunological and radiological responses.

Methodology: This is a randomized, controlled, open-label, phase-1 trial. Eighteen oligometastatic PDAC patients will be included with at least stable disease after pre-treatment with FOLFIRINOX. Patients will receive one of three treatments: Arm A (control arm): nivolumab monotherapy; arm B: percutaneous IRE of the primary tumor followed by nivolumab; arm C: intra-tumoral CpG injection followed by percutaneous IRE of the primary tumor and nivolumab.

Endpoints:

Primary: (serious) adverse events.

Secondary: overall survival, progression-free survival, quality of life questionnaires, histopathology, flow cytometry and (PET)-CTs (FDG and PD-L1 tracers).

Expected Data/Impact on IR: We speculate that the combination of IRE and immunotherapy may work synergistically and has the potential to establish an effective and durable anti-tumor response in oligometastatic PDAC patients. Evidence of efficacy may lead to substantial interest in the interventional oncology field, likely instigating an increase in clinical trials combining ablation techniques with immunotherapy.

304.3

Neoadjuvant Atezolizumab and adjuvant Atezolizumab + Bevacizumab in combination with percutaneous radiofrequency ablation of small HCC: the AB-LATE 02 multicenter randomized phase II trial

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General Study Info: Neoadjuvant Atezolizumab and adjuvant Atezolizumab + Bevacizumab in combination with percutaneous radiofrequency ablation of small HCC: a multicenter randomized phase II trial (AB-LATE 02); ClinicalTrials.gov Identifier: NCT04727307.

Background and Rationale: Recurrence (especially intra-hepatic distant) following radiofrequency ablation (RFA) of small HCCs is frequent and cannot be curatively treated in 30-40% cases. Atezolizumab & bevacizumab have become the new standard in advanced HCC. We hypothesized that neoadjuvant atezolizumab and adjuvant atezolizumab/bevacizumab could improve recurrence-free survival in patients with small HCCs treated by RFA.

Objectives: AB-LATE 02 was designed to compare RFS in HCC patients treated by RFA (control arm) versus the following treatment: atezolizumab as neoadjuvant, RFA and atezolizumab plus bevacizumab as adjuvants (experimental arm).

Methodology: AB-LATE 02 is a multicenter randomized phase II trial aiming to compare RFS at 2 years in the experimental arm (Atezo - RFA - atezo/vbev) versus the control arm (RFA alone), according to mRECIST criteria, in patients with small HCC. We expect to enroll 202 patients (1:1 randomization, 3 stratification factors) in 14 centers over 18 months

Endpoints:

- Main endpoint: RFS at 2 year in the experimental vs. control arm

- Secondary endpoints: Overall survival, Health-related Quality of Life, Tolerance and compliance of atezo/bev, incidence of local-, intrahepatic- and extrahepatic recurrence, time-to-recurrence, Translational research
Expected Data/Impact on IR: AB-LATE 02 aims to improve RFS following RFA of small HCCs, and specifically to prevent intra-hepatic distant recurrence not amenable to curative treatment.

304.4

The treatment of breast cancer with percutaneous thermal ablation: a phase 2 screening trial

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General Study Info: The Treatment of Breast Cancer with Percutaneous Thermal Ablation: A phase 2 screening trial
 THERMAC

Registered at <https://www.trialregister.nl/trial/9205> as Trial NL9205

Background and Rationale: Due to screening programs, almost half of the breast tumors are ≤ 2 cm. Percutaneous thermal ablation has the potential to replace surgical treatment and improve the health-related quality of life of these patients. Especially radiofrequency ablation (RFA), microwave ablation (MWA) and cryoablation (CA) are promising techniques. Due to great heterogeneity between previous conducted studies, a formal recommendation on the best technique for a phase 3 study is not possible.
Objectives: The objective is to determine the efficacy rate in terms of complete ablation for thermal ablation (RFA, MWA or CA) for patients with early stage breast cancer to warrant a randomized phase III trial comparing thermal ablation with surgery.

Methodology: This is an open-label randomized phase 2 screening trial. Postmenopausal women diagnosed with cT1N0M0 breast cancer will be included and randomized to RFA, MWA or CA. Surgical resection will be performed 3 months later.

Endpoints: The primary endpoint is the percentage of tumours with complete ablation at pathologic evaluation with CK8/18 and H&E staining. Secondary endpoints are: feasibility in an outpatient setting, degree of immune response, adverse events, patient satisfaction, cosmetic outcome and the predictive value of MRI.

Expected Data/Impact on IR: The most promising technique with a complete ablation rate of at least 85% will be compared to surgical excision in a subsequent phase 3 study. In the end, we expect to achieve an improved health-related quality of life, better cosmetic outcome, and lower health care costs.

Meet the PI

Upcoming clinical trials in interventional radiology I

1004.1

MYCHOICE: The MYoma treatment Comparison study: High intensity image guided focused ultrasound versus standard (minimally) Invasive fibroid care - a (Cost) Effectiveness analysis

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General Study Info: MYCHOICE: The MYoma treatment Comparison study: High intensity image guided focused ultrasound versus standard (minimally) Invasive fibroid care - a (Cost) Effectiveness analysis
 Trialregister.nl: NL8863

Background and Rationale: Uterine fibroids can lead to symptoms of heavy bleeding, bulking and/or fertility problems. Both hysterectomy and myomectomy are surgical treatment options with a high risk of complications. Currently, uterine artery embolization (UAE) is the only reimbursed minimally invasive treatment option in the Netherlands. Magnetic Resonance image guided High Intensity Focused Ultrasound (MR-HIFU) is a safe and non-invasive treatment option. However, a lack of comparative information on long-term (cost)effectiveness of the MR-HIFU treatment compared to the standard of care, keeps the MR-HIFU treatment from being reimbursed.

Objectives: To determine the long-term (cost)effectiveness of MR-HIFU compared to standard (minimally) invasive fibroid care including UAE, myomectomy and hysterectomy.

Methodology: MYCHOICE will be a national, multicenter, randomized controlled non-inferiority trial. The study population consists in brief of women ≥ 18 years, premenopausal, diagnosed with symptomatic uterine fibroids in whom conservative treatment failed or is undesired and eligible for MR-HIFU. The non-inferiority margin is set to 15 points symptom severity score (SSS) reduction on the Uterine Fibroid Symptom - Quality of Life (UFS-QoL) questionnaire (range: 0-100). With an estimated drop-out of 20%, the sample size is 240 patients in 2:1 ratio for MR-HIFU (n=160) and standard care (n=80).

Endpoints: Primary outcomes are quality of life improvement 24 months after treatment (measured by the SSS on the UFS-QoL) and costs (direct health care costs, loss of productivity and patient costs).

Expected Data/Impact on IR: Final results are expected in 2026.

1004.2

Efficacy of dexamethasone in reducing the postembolisation syndrome in men undergoing prostatic artery embolisation for benign prostatic hyperplasia: a single-centre, randomized, double-blind, placebo-controlled trial, the "DEXAPAE" study

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General Study Info:

Long name: Efficacy of dexamethasone in reducing the postembolization syndrome (PES) in men undergoing prostatic artery embolization (PAE) for benign prostatic hyperplasia (BPH).

Short name: DEXAPAE

EudraCT number: 2020-000915-53

Clinicaltrials.gov identifier: NCT04588857

Danish Committee on Health Research Ethics approval: H-20025910

Background and Rationale: PES is a frequent side effect of vascular embolization of solid organs. Although prophylactic corticosteroids are known to reduce the incidence and severity of PES, no trials investigating their efficacy have been conducted in men undergoing PAE.

Objectives: The efficacy of single high dose postprocedural dexamethasone (DEXA) administration in reducing PES after PAE will be evaluated. The main objective is to evaluate the difference in mean postprocedural body temperature and pain, as well as mean quality of life (QOL), with DEXA compared with placebo.

Methodology: This is a single-centre, randomised, double-blind, placebo-controlled superiority trial, formally powered to enrol a total of 60 individuals in two parallel groups with a 1:1 allocation ratio. Participants will be randomized to receive intravenous dexamethasone (24 mg) or placebo (saline), administered immediately following PAE.

Endpoints: The primary endpoints will be postprocedural fever, pain and QOL. The secondary endpoints will include postprocedural nausea, postprocedural medicine usage, laboratory parameters (C-reactive protein, prostate specific antigen), and early PAE results. All endpoints,

except blood tests and early PAE results, will be self-reported by the participants in a diary.

Expected Data/Impact on IR: Reduction in PES may result in fewer hospital admissions, decrease in antibiotics use, and increased quality of life in the early postprocedural course.

1004.3

Effectiveness of focal TULSA therapy in men with prostate cancer (ENFORCE)

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General Study Info: Effectiveness of focal TULSA therapy in men with prostate cancer (ENFORCE)

Background and Rationale: Localized intermediate-risk prostate cancer (PCa) is currently treated with whole gland therapy (radical prostatectomy (RP) or radiotherapy (RT)). The associated adverse events in combination with a relatively high cancer-specific survival have an incredible impact on quality of life (QoL) and healthcare costs. To improve QoL and to reduce treatment burden and comorbidity associated with radical treatment while retaining equivalent cancer control focal therapy (FT) has been developed. MRI-controlled transurethral ultrasound ablation (TULSA) seems a promising technique and is increasingly performed at the request of patients. However, since high quality evidence is lacking, it is not being reimbursed yet.

We therefore aim to perform a high-quality cost-effectiveness multicenter RCT to provide the evidence needed to decide on reimbursement and implementation of TULSA in patients with intermediate-risk PCa.

Objectives: To study the (cost-)effectiveness of MRI controlled focal transurethral ultrasound ablation (TULSA) vs. usual care (RP/RT) in men with intermediate-risk PCa.

Methodology: 356 men with localized intermediate-risk PCa will be randomized to either MRI-guided focal TULSA treatment (n=178) or usual care comprising of RP or RT (n=178).

Endpoints: Primary outcomes are the oncological effectiveness defined as treatment failure, i.e. the need for secondary treatment (RP/RT), and QoL using EPIC-26 questionnaire, both at 12 months. Secondary outcome is the progression-free survival, overall survival, generic HRQOL (EQ5D) and costs.

Expected Data/Impact on IR: TULSA leads to a better QoL, less complications, lower costs and similar oncological effectiveness as compared to usual care.

1004.4

Standardization and long-term follow up of pudendal nerve blocks with Bupivacaine and Triamcinolone acetonide in the management of pudendal neuralgia: a prospective study

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General Study Info: Long Title: Standardization and Long-term Follow Up of Pudendal Nerve Blocks with Bupivacaine and Triamcinolone Acetonide in the Management of Pudendal Neuralgia: a Prospective study

Purpose: Using a prospective design, we propose to investigate the technical and clinical success of the CT-guided pudendal nerve block (PNB) protocol at our institution in the treatment of Pudendal Neuralgia (PN). We will specifically investigate the efficacy of our approach of administering these blocks as a "series of three" injections spaced 6-weeks apart.

Methodology: Clinical outcomes will be measured using the Visual Analogue Scale, PROMIS short form, and Global Response Assessment scale.

Endpoints: The objectives of the study are (1) to evaluate the long-term efficacy of CT-guided PNBs when administered using our "series of three" approach (2) to evaluate technical success of each block using sensory testing (3) to evaluate subjective pain levels immediately before and after each block (4) to work towards development of a reproducible protocol for CT-guided PNBs for treatment of PN.

Expected Data/Impact on IR: We expect to show 100% technical success immediately following each PNB using our current protocol, and progressive long-term improvement in pain scale scores following each sequential block.

Meet the PI

Upcoming clinical trials in interventional oncology II

1704.1

Phase Ib/randomized phase II study combining percutaneous hepatic perfusion with ipilimumab plus nivolumab in advanced uveal melanoma: the CHOPIN trial

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General Study Info: PHP and immunotherapy in metastasized UM. Clinicaltrials.gov identifier: NCT04283890.

Background and Rationale: Uveal Melanoma (UM) metastasizes primarily to the liver and is associated with a poor prognosis. Percutaneous hepatic perfusion (PHP) allows delivery of a high dose of melphalan to the liver with limited systemic toxicity and is effective in patients with liver-dominant or liver-only metastases. In this study, we combine PHP with ipilimumab and nivolumab (IPI/NIVO) with the goal of inducing a synergistic effect to improve disease control.

Objectives: Primary objective is to determine safety and toxicity of PHP with IPI/NIVO in phase Ib and efficacy of combination treatment versus PHP-only in phase II.

Methodology: A prospective, phase Ib and randomized phase II trial. Patients with confirmed measurable hepatic UM metastases according to RECIST1.1 and WHO PS 0-1 are included. Melphalan dose is 3mg/kg (maximum dose 220mg). Phase Ib consists of two dose-escalation cohorts increasing IPI and NIVO dose from 1mg/kg and 1mg/kg in cohort 1, to 1mg/kg and 3mg/kg, in cohort 2. Treatment duration is 12 weeks (4 courses IPI/NIVO and PHP in week 1 and 7). In the randomized phase II part, efficacy of combined PHP plus IPI/NIVO at MTD is compared with PHP-only (2 PHPs performed at 6-weeks interval). Safety and toxicity are assessed according to CTCAEv4.03 and radiological response according to RECIST1.1 and irRECIST.

Endpoints: Toxicity and maximum tolerated dose in phase Ib and progression-free survival at 1 year in phase II. Secondary study endpoints are overall survival, response rate and toxicity.

Expected Data/Impact on IR: Development of an interventional radiology plus immunotherapy treatment for metastasized UM.

1704.2

Evaluating the effectiveness of Yttrium-90 glass microspheres in hepatocellular carcinoma, intrahepatic Cholangiocarcinoma, and metastatic colorectal cancer in current clinical practice: the PROACTIF study

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General Study Info: A Prospective, Post Approval, Multiple Center, Open-Label, Non-Interventional, Registry Study to Evaluate the Effectiveness of TheraSphereTM in Clinical Practice in France (PROACTIF) ClinicalTrials.gov NCT04069468

Background and Rationale: Selective internal radiation therapy (SIRT) using yttrium-90 (Y-90) glass microspheres was recently approved for reimbursement by health authorities in France (HAS) for treatment of unresectable primary and secondary liver tumors. This post-approval study was requested by HAS to further evaluate clinical benefit during the five years immediately following approval.

Objectives: To collect patient outcomes, quality of life (QoL), and safety information on current use of Y-90 glass microspheres in France.

Methodology: PROACTIF is a prospective, open-label, non-interventional, post-approval registry study that includes documentation of QoL (Functional Assessment of Cancer Therapy-Hepatobiliary [FACT-Hep]). The registry includes patients with hepatocellular carcinoma (HCC), intrahepatic cholangiocarcinoma (iCC), and metastatic colorectal cancer (mCRC) who have not opposed data collection and have received TheraSphereTM treatment (Boston Scientific Corporation, Marlborough, MA) between January 2019 and December 2024. Information collected includes clinical, radiological, biological, treatment, dosimetry, and follow-up data. All patients will be followed until death, study withdrawal, or study termination. As reimbursement was initially approved for HCC only, the one-year interim analysis includes only HCC; indications for reimbursement were expanded to iCC and mCRC in 2020, after the first interim analysis was completed.

Endpoints: Overall survival and QoL pre-/post-treatment.

Expected Data/Impact on IR: PROACTIF is designed to contribute to the understanding of how Y-90 glass microspheres are used in real-world clinical practice in France and is currently enrolling patients (300 to date).

1704.3

Prospective multi-center study to evaluate the correlation between safety margin and local recurrence after thermal ablation using image co-registration in patients with hepatocellular carcinoma: PROMETHEUS-study

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General Study Info: Prospective, multicenter study with joined collaboration of the Dutch Society of Interventional Radiology, Dutch Hepatocellular and Cholangiocarcinoma Group and Dutch Oncology Research Platform, to determine optimal ablation margins in patients with hepatocellular carcinoma (HCC).

Background and Rationale: Compared to resection, thermal ablation (TA) of HCC is associated with higher local tumor progression (LTP) rates. To reduce the risk of recurrence ablation margins of >5mm are recommended, but standardized methods to assess margins are lacking.

Objectives: To determine the minimal ablation margin (MAM) required to achieve a LTP rate of <10% in patients undergoing TA for HCC. To analyze the correlation between ablation margins and LTP, and develop cut-off values for margins to define technical success of TA in HCC.

Methodology: Prospective, multicenter, single-arm, non-experimental study in 165 BCLC 0-A HCC patients, or BCLC B patients with a maximum of 2 lesions of 5cm, eligible for TA. All patients will undergo intraprocedural dual-phase contrast-enhanced CT (CECT) before and after ablation under general anesthesia and breath hold or high-frequency jet ventilation (alternatively conscious sedation may be used). Dedicated software (deLIVERed, SAFIR), will be used to co-register pre- and postablation CECT and quantify ablation margin after the procedure. MAM will be correlated with LTP rates and other clinical outcome measures.

Endpoints:

Primary endpoint: MAM that results in 1year LTP <10%.

Secondary endpoints: 1 year LTP at different MAM cut-off values, LTP and overall recurrence rate, disease-free and overall survival, and reproducibility.

Expected Data/Impact on IR: Standardization of ablation margin assessment and establishment of optimal ablation margins based on quantitative analysis using co-registration software.

1704.4

Adjuvant Holmium-166 radioembolization after radiofrequency ablation in early-stage hepatocellular carcinoma patients: a dose-finding study (HORA EST HCC trial)

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General Study Info: clinicaltrials.gov NCT03437382

Purpose: To investigate the biodistribution of Holmium-166 microspheres when administered after radiofrequency ablation (RFA) in BCLC-A hepatocellular carcinoma (HCC) patients. Primary aim was to establish the administration dose to the affected liver segments that resulted in a tumoricidal dose on the hyperemic zone around the ablation area (i.e. target area).

Methodology: In this multicenter, prospective dose-escalation study in patients with HCC lesions 2-5cm, RFA was followed the next day by angiography, cone-beam CT (CBCT) and Tc-99m-MAA SPECT/CT. Tc-99m-MAA was injected into the (sub)segmental artery of the tumor-bearing segment(s). IntelliSpace Portal was used to calculate the volume opacified on CBCT (i.e. treatment volume). Holmium-166-microspheres (Quiremspheres) were administered at day 5-10. SPECT/CT was used to determine dose-distribution. Cohorts up to 10 patients were treated with an incremental dose (60Gy, 90Gy, 120Gy) to the treatment area. Primary endpoint was the treatment area dose that resulted in a target area dose of >120Gy in 90% of the patients. Secondary endpoints were toxicity, local recurrence, disease-free and overall survival.

Endpoints: Twelve patients were treated (male 10, median age: 66(35-79), mean tumor size: 25mm (11-45)). A mean dose of 2.17GBq Holmium-166 was administered. The primary endpoint was not met in 2/2 patients that received 60Gy on the treatment area, but was reached in 9/10 patients that were treated with 90Gy. One grade 3 complication was reported (infection). No local recurrences were found (mean follow-up: 11 months).

Expected Data/Impact on IR: Combined RFA and Holmium-166 radioembolization for HCC 2-5 cm is feasible and safe with a treatment area dose of 90 Gy.

Meet the PI

Upcoming clinical trials in interventional radiology II

2504.1

The BIOPACT RCT, a multi-center, randomized, non-inferiority trial evaluating safety & efficacy of Passeo-18 Lux drug-coated balloon (DCB) of Biotronik compared to the Medtronic IN.PACT Admiral DCB in the treatment of subjects with lesions of the femoropopliteal artery

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General Study Info:

- BIOPACT RCT

- multi-center, randomized, non-inferiority trial evaluating safety & efficacy of Passeo-18 Lux drug-coated balloon (DCB) of Biotronik compared to the Medtronic IN.PACT Admiral DCB in the treatment of subjects with lesions of the femoropopliteal artery

- clinicaltrials.gov

- NCT03884257

Background and Rationale: Although effectiveness and safety of many different DCBs in treatment of PAD are extensively studied, there is a lack of direct head-to-head comparison studies. In order to meet in this unmet need and to avoid potential "class-effects", the BIOPACT RCT was set up.

Objectives: To demonstrate the safety and efficacy of the Passeo-18 Lux DCB for treatment of patients with symptomatic peripheral artery disease (PAD) due to femoropopliteal lesions.

Methodology: 302 patients will be randomized in a 1:1 manner to treatment with either the Passeo-18 Lux DCB or the IN.PACT Admiral DCB for testing of a formal non-inferiority hypothesis. The participants will be followed for 5 years.

Endpoints: Primary efficacy endpoint is freedom from clinically-driven target lesion revascularization (CD-TLR) at 12 months, defined as any reintervention at the target lesion due to symptoms, drop of ABI >20% or ABI >0.15 compared to post-procedural ABI.

Primary safety endpoint is a composite of freedom from device/procedure-related death through 30 days post-index procedure, freedom from major target limb amputation and clinically-driven target vessel revascularization (CD-TVR) through 12 months post-index procedure.

Expected Data/Impact on IR: The investigators expect early results beginning of 2022; extra data on safety and efficacy of Paclitaxel coated balloons, without class effect, and with a long time follow-up will offer more insights in this endovascular area.

2504.2

Clinical outcome and quality of life of multimodal treatment of arteriovenous malformations

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General Study Info: APOLLON, Clinical Outcome and Quality of Life of Multimodal Treatment of Arteriovenous Malformations (German Clinical Trials Register, DRKS00021019).

Background and Rationale: Due to the limited evidence regarding the outcome of AVM treatment and the high morbidity of this Orphan Disease, prospective data is needed.

Objectives: To determine the effectiveness, safety, and clinical outcome including therapy-induced change of health-related Quality of Life (QoL) of multimodal treatment of AVM. Therapy options include conservative management, medical treatment, minimally invasive image-guided therapy, and surgery as well as combinations of the above.

Methodology: APOLLON trial is designed as a prospective, open-label, observational multicenter study with unequal group sizes evaluating changes in self-reported QoL using standardized, age-specific questionnaires (SF-36v2, SF-10). Further assessments include physician-reported signs and symptoms, imaging response, recurrence rate, and treatment-associated morbidity. Additionally, liquid biopsies are obtained to investigate potential biomarkers for therapy response or/and disease progression.

Endpoints: Primary endpoint will be health-related QoL assessed before and 6 months after initiation of treatment, and follow-up will be conducted at 6, 12, 24, 36 months after the last session (completion) of invasive treatment (or after initiation of conservative treatment). Secondary endpoints include safety and clinical as well as imaging outcome after multimodal treatment.

Expected Data/Impact on IR: To generate prospective evidence for minimally invasive treatment concepts with improved patient selection. The multicentre design with the potential to assess larger populations will provide an increased understanding in the dynamics and course of this rare disease.

2504.3

The WavelinQ ArterioVenous Endovascular Fistula (WAVE-GLOBAL) investigation: a prospective, global, post-market, single-arm study

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General Study Info: The WavelinQ ArterioVenous Endovascular Fistula (WAVE-GLOBAL) investigation is announced in [clinicaltrials.gov](https://clinicaltrials.gov/ct2/show/study/NCT04626427) (NCT04626427).

Background and Rationale: Endovascular arteriovenous fistula (endo-AVF) has emerged as a new option for AVF creation performed percutaneously. The procedure extends the sites for anastomosis to the ulnar and radial vessels of the forearm and at the same time allows additional disciplines like interventional radiologists and interventional nephrologists to be involved in AVF creation.

Objectives: The purpose of this investigation is to generate additional clinical evidence on the safety and effectiveness of the WavelinQ™ EndoAVF System when used for endoAVF creation for patients in need for hemodialysis.

Methodology: This is a global, multi-center, prospective, post-market, confirmatory, interventional, non-randomized, single-arm clinical study. Study is aiming to recruit 150 participants with chronic kidney disease requiring hemodialysis.

Endpoints: The primary safety endpoint is device and procedure related serious adverse events at 30 days. The primary efficacy endpoint is the number of post creation interventions at 6 months. Secondary endpoints also include physiological maturation, cannulation success, and cumulative functional patency through 24 months.

Expected Data/Impact on IR: Participants' enrollment begun in December 2020. Results will be announced after the last participant has finished 6-month follow up and subjects will be followed for up to 2 years. This new procedure of creating an endoAVF without the need of surgery gives interventional radiologists the ability to extend the ability of dialysis patient management, formerly restricted to maintenance procedures, and provides chronic kidney disease patients with additional sites for anastomosis creation and therefore not only improving their quality of life but also extending their longevity.

2504.4

Value and viability of augmented reality in interventional and oncology procedures

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General Study Info:

Study name: Azurion AR (Augmented Reality) study)
Netherlands Trial Register: NL9127

Purpose: During image-guided procedures, such as those for interventional radiology, physicians rely on imaging and other data, which is visualized on traditional monitors. These monitors are often not in perfect line of sight, and information on screen cannot always be accessed in a comfortable manner. In addition, controls at the examination table are not always in direct reach for the physician but need to be controlled via

a staff member. The primary purpose of this study is to investigate value and viability of augmented reality (AR) when used in combination with a see-through AR head mounted display.

Methodology: Six physicians participate in our study. Each physician uses the investigational AzurionAR device during at least eight standard interventional/oncology procedures in the angiography suite. The AR application is used in conjunction to the Philips Azurion x-ray system, that performs real-time rendering of Azurion image sources on virtual screens and provides a virtual version of the physical touch screen module used for control. The operator can interact with the investigational AzurionAR device using novel touchless interaction methods. The study evaluates usability and practicality, ergonomics, clinical workflow integration as well as image quality of the virtually presented data.

Endpoints: Participants are asked to fill out short surveys/questionnaires pre- and post procedures and to provide feedback in periodic interviews.

Expected Data/Impact on IR: We expect AR to simplify image-guided interventional radiology/oncology procedures, improve user satisfaction, user experience, ergonomics and workflow via more intuitive user interactions and physician-centered control.

CIRSE 2021

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PART 4

**Abstracts of
Posters
sorted by presentation
numbers**

Aortic Intervention

P-1

Endovascular reconstruction of aortoiliac occlusive disease using uni-body bifurcated endograft

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Purpose: The aim of this study is to investigate the durability and clinical efficacy of endovascular solution using unibody endograft to treat patients with symptomatic Aortoiliac occlusive disease (AIOD)

Materials and Methods: Retrospective analysis of data obtained from procedures performed between 2003-2019 to treat symptomatic patients with AIOD using the Endologix AFX unibody graft. Main endpoints were amputation-free survival and re-intervention rates

Results: 20 patients met the criteria and were included in the study. Majority of cases were males with mean age of 70 ± 10.4 . Eleven procedures were performed for critical limb ischemia (CLI).

nine patients were classified as TASC-II C and 11 patients were TASC-II D. Technical success was achieved in all cases with no recorded rupture iliac access, macro-embolization, or device-related complications. Mean length of Intensive care unit (ICU) stay was 0.75 day while mean hospital post-operative stay was 7.8 days. There were no recorded 30-day mortality cases.

There were no major cardiac or respiratory events, however one patient developed acute kidney injury which was managed conservatively requiring no dialysis.

Immediate improvement in ABPI by at least 0.15 was achieved in 90% of patients. At three years, freedom from recurrence of ischemic symptoms was 95%. Only 12% experienced binary restenosis during follow up with freedom from re-interventions of 90% at three years. Amputation-free survival was 95% at three years.

Conclusion: Unibody endograft is a safe durable option in treating AIOD with shorter hospital and ICU stay. It also preserves the aortic bifurcation allowing easy access for future interventions.

P-2

Pre-operative chronic kidney disease is associated with worse prognostic impact on short-term and mid-term outcomes in patients undergoing fenestrated-branched endovascular repair for pararenal and thoracoabdominal aortic aneurysms

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Purpose: To analyze the association between outcomes after fenestrated-branched endovascular aortic repair (F-BEVAR) for pararenal/thoracoabdominal aortic aneurysms (PRAA/TAAA) and pre-operative chronic kidney disease (CKD).

Materials and Methods: Renal function was calculated as the estimated glomerular filtration rate (eGFR) using the MDRD formula and CKD was defined as $eGFR < 60 \text{ ml/min/1.73m}^2$. The primary endpoints for this study were perioperative acute kidney injury (AKI) and overall survival.

Results: Overall, 202 consecutive patients (mean age 72 ± 8 years; 25% females) underwent F-BEVAR for treatment of PRAA/TAAA during the study period. Of these, 51 had prior history of CKD and no significant differences were found in demographics or major comorbidities as compared to subjects with known CKD. Patients without prior CKD had significantly lower rates of AKI (12% vs 37%, $p < .001$). At 3 years, overall survival was significantly higher in patients without prior history of CKD as compared to those with preoperative CKD (82% vs 57%, $p = .01$). CKD was independently associated with higher odds of perioperative AKI (OR 2.8, 95%CI 1.9-5.8, $p = .03$) and all-cause mortality (HR 3.2, 95%CI 1.2-8.6, $p = .02$).

Conclusion: F-BEVAR is a safe and effective procedure for treatment of PRAA/TAAA in patients with baseline CKD. Although AKI remains a common complication, its occurrence was significantly higher in subjects with preexisting renal function impairment and history of CKD independently predicted its occurrence. Furthermore, CKD was independently associated to poorer survival at mid-term.

P-3

Rupture-free survival rates after intra-arterial embolisation for secondary type Ia endoleak after EVAR

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Purpose: To assess the long-term effectiveness and rupture-free survival rates of intra-arterial embolisation for secondary type Ia endoleak in patients after endovascular aortic repair.

Materials and Methods: Single-centre retrospective study review of all secondary type Ia endoleak embolisations from October 2010 to June 2015 in patients not suitable for conventional treatment. The results of CT, duplex imaging and clinical records were reviewed to assess long term outcomes and rupture-free survival.

Results: Seventeen cases of secondary endoleak Ia were embolised on 16 patients (mean age - 79 years (range 64-96)). One patient required two embolisations. Our records include two patients post FEVAR, one patient post TEVAR and 13 patients post EVAR. 100% immediate technical success was achieved with a combination of detachable coils and Onyx in 3 cases or Onyx alone in 14 cases. Mean imaging follow-up post-embolisation was 20 months (range 0-92 months) and mean final clinical record available at 21 months. Of the 16 patients, 4 showed stable sac size; 6 reduction in sac size and 5 increasing sac size. 1 patient did not have imaging follow up. Of the 16 patients, 12 patients died: 3 were associated with delayed sac rupture and 9 with non-aortic related causes.

Conclusion: Transarterial embolisation is a viable option in the management of secondary Ia endoleak in elderly patients when conventional therapy is not feasible, with low reintervention and rupture rates.

P-4

Anatomical feasibility of currently available endovascular solutions for juxtarenal aortic aneurysms

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Purpose: Endovascular repair of juxta-renal aneurysms (JAAAs) can be achieved by fenestrated endografting (FEVAR), parallel-grafts technique (CHEVAR) and standard abdominal endograft + endoanchors (ESAR). Aim of this study was to evaluate the incidence their feasibility in JAAAs.

Materials and Methods: Patients underwent repair for JAAAs between 2006 and 2019 were retrospectively analyzed. JAAA was defined according with the current ESVS clinical practice guidelines. Preoperative computed tomography angiographies were analyzed to evaluate the anatomical feasibility of: FEVAR (Cook Zenith-platform), CHEVAR (Medtronic Endurant + Atrium Advanta) and ESAR (Medtronic Endurant + HeliFix). Endpoints was to evaluate the anatomical feasibility of these 3 endovascular solutions.

Results: Ninety-nine cases were considered. There were no cases of frank or contained aortic rupture and in all patients at least one arterial access from above was available. FEVAR, CHEVAR and ESAR were anatomically feasible in 93 (94%), 37 (37%) and 27 (27%) cases, respectively ($p < .001$). FEVAR requires endograft design with < 3 , 3 and > 3 fenestrations in 29 (31%), 33 (36%) and 31 (33%) cases. CHEVAR would have required 1 or 2 parallel graft configurations in 12 (12%) and 25 (25%) cases. Among the 14 cases with aneurysm diameter $> 70 \text{ mm}$, the anatomical feasibility

of FEVAR, CHEVAR and ESAR was 13(93%), 4(29%) and 4(29%) cases, respectively ($p < .001$).

Conclusion: FEVAR is more frequently applicable than CHEVAR and ESAR as an endovascular treatment of JAAA. Since this difference is valid also in aneurysms with diameter >70 mm, the issue of a rapid availability of such a graft is of paramount importance. The 6% of cases have not any endovascular solution and require open surgery.

P-5

Mortality in the female population after open or endovascular repair for abdominal aortic aneurysm

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Purpose: Female gender has been associated with higher post-operative morbidity and mortality after abdominal aortic aneurysm (AAA) repair. A systematic review and meta-analysis were conducted to evaluate early mortality after AAA repair, with both endovascular (EVAR) and open repair (OSR) in elective and urgent settings.

Materials and Methods: A data search of the English literature was conducted using PRISMA guidelines. Only studies reporting on 30-day mortality rate of AAA repair with either EVAR or OSR in a female population in either elective or urgent setting, were eligible for this analysis.

Results: A total of 56.982 women (22.995 EVAR vs. 33.987 OSR) were included. A significant reduced short-term mortality was recorded among women that underwent EVAR compared to OSR (OR, 0.25; $p < .001$). A similar outcome in 30-day mortality was found in favor of EVAR for intact cases (OR, 0.34; $p < .001$). Despite that female patients suffering from AAA rupture tended to be treated with OSR (OR 0.21; $p < .001$), EVAR was more beneficial compared to OSR in terms of 30-day mortality (OR, 0.48; $p < .001$).

Conclusion: EVAR is more beneficial than OSR in terms of early mortality in female population either in elective or urgent setting, despite the fact that it is less likely to be offered as a treatment option in emergent setting.

P-6

Imaging and interventions in endoleaks

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Learning Objectives:

- Imaging of endoleaks.
- Indications for treatment and management for each endoleak type.

Background: Endoleak represents blood flow outside stent graft but within the aneurysm sac. Rate of occurrence of endoleaks after EVAR is 15%- 52% and after TEVAR is 21%. CT angiography is the most adopted method for detection of endoleaks.

Classification of Endoleaks:

I (EL1): Attachment site -proximal (type IA)/ distal (type IB)

II (EL2): Collateral vessel

III (EL3): Graft failure

IV (EL4): Graft wall porosity

V (EL5): Endotension

Why endoleaks occur?

⇒Anatomical

•Neck diameter (< 15 mm)/ (> 32 mm)

•Increased angulations ($> 60^\circ$)

•Landing zones with calcifications, thrombus or uneven size

•Large iliac artery

⇒Device

•Oversizing $>20\%$

•Error during planning

•Device fracture or tear

•Chimney/ snorkel

Clinical Findings/Procedure Details: Endoleaks are often asymptomatic. Smoking is a protective factor for type II endoleaks due to narrowing of ostium and coagulation.

When to treat

•Persistent endoleak

•An enlarging sac diameter on serial CT imaging.

•3 feeding/draining arteries.

•Diameter of the feeding collateral artery >4 mm.

•High flow velocities within the aneurysm sac on duplex ultrasound imaging.

Treatment

EL1

•Ballooning

•Palmaz stents

•Chimney/ periscope grafts to extend proximal landing zones.

•Artery bypass combined with stent graft extension.

•Coils and liquid embolic agents (Onyx, NBCA)

EL2

•Percutaneous transarterial /Translumbal embolisation

•Surgery-ligation of feeding arteries.

EL3

•Overlapping a stent graft limb at leakage site.

EL4

•Commonly does not require treatment (Autosealing after cessation of intraprocedure anticoagulant)

EL5

•Stent reinforcement

Conclusion:

•Vigilant to identify multiple leaks.

•Plan properly

•Fenestrated grafts

•Type of endoleak is the best way to manage it.

P-7

Coil embolization of anastomotic pseudoaneurysm of ascending aorta

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Clinical History/Pre-treatment Imaging: A 73-year-old woman referred to our Hospital for chest pain.

Two years before she underwent ascending aorta replacement for Type A aortic dissection with Hemashield tubular graft (n.28).

Clinical examination, ECG and cardiac enzymes were normal.

Angio-CT scan (Fig.1) documented a periaortic hematoma with a pseudoaneurysm (arrowhead) of the proximal anastomosis of the aortic graft at the level of the sino-tubular junction, above the left coronary artery origin (arrow).

Treatment Options/Results: Main treatments included:

-Open surgery (redo)

-Endograft positioning to cover the pseudoaneurysm origin

-Embolization with thrombin or cyanoacrylate glue

-Endovascular plug/coil occlusion of the pseudoaneurysm

Angiographic approach was preferred (Fig.2). With a 6F Cordis INFINITI catheter (AL3 curve) and a Balt Vasco+18 microcatheter the pseudoaneurysm sac was selectively cannulated. A Cerenovus Deltafill18 6x25 coil was then deployed, with good angiographic result.

3 months angio-CT scan was scheduled (still not available).

Discussion: Ascending aorta pseudoaneurysm after cardiovascular surgery is a rare but serious circumstance.

Redo open aortic surgery is the gold-standard therapy.

Endovascular approach could be an alternative solution to surgical reintervention.

In our case, the pseudoaneurysm sac was too small for a vascular plug deployment. Moreover, because of its proximity to the left coronary artery, an additional endograft extension was unfeasible.

Coil embolization is a well known endovascular technique, however its use in ascending aorta pseudoaneurysms treatment has been reported only in 13 patients worldwide.

Take-home Points: In selected patients endovascular coiling of ascending aorta graft pseudoaneurysms can be an effective and safe treatment. Moreover, its failure does not preclude a subsequent rescue surgical treatment.

P-8

Coil embolization of anomalous abdominal systemic artery to the normal basal medial segment of the right lower lung lobe

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Clinical History/Pre-treatment Imaging: We report the case of a 16-year-old girl who comes to our attention for repeated episodes of hemoptysis. A chest angio-CT scan is performed which demonstrates the presence of a rare case of systemic abnormal abdominal vessel affecting the right lower lung lobe in the absence of pulmonary arteries in the involved segment. The aberrant vessel emerges from the abdominal aorta in close proximity to the celiac trunk (fig.1). This is a rare congenital anomaly classified as type I pulmonary sequestration according to Pryce's terminology.

Treatment Options/Results: Systemic arterialization of normal lung without sequestration is a rare congenital abnormality. Patient was informed of the therapeutic options, including observation, surgery, and trans-arterial embolization (TAE). Informed consent was obtained, and coil embolization was done. In the days following the embolization, the patient showed no symptoms. Although proximal occlusion of the aberrant artery was observed, there was no evidence of pulmonary infarction or necrosis in the RLL. Hemoptysis has not recurred for 3 months follow-up.

Discussion: Through a right femoral approach, the aberrant vessel was catheterized by 4F cobra catheter (Optitorque Terumo) and angiography was done (fig. 2A); then a long 12 cm 5 mm soft coil (IDC Boston scientific) was placed (fig. 2B) and complete occlusion of the aberrant arterial blood flow was achieved at the end of the procedure (fig. 2C).

Take-home Points: According with previous reports, TAE can be an effective alternative for the treatment of this rare congenital anomaly.

P-9

A complication of onyx embolisation

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Clinical History/Pre-treatment Imaging: A 79 year old male patient, diagnosed with a Type II Endoleak. Interval CT demonstrated an enlarging aneurysmal sac, with an increase in size from 4.9 cm to 5.5cm.

Treatment Options/Results: Initial trans-arterial embolization was unsuccessful due to an unstable catheter position and inability to advance the wire into the ilio-lumbar artery. The patient was rescheduled for a direct percutaneous puncture.

Direct percutaneous puncture was performed using ExperCT, a posterior approach and a Kellett needle. Contrast and retrograde blood flow confirmed catheter position within the aneurysm sac. Onyx was instilled into the sac with continuous fluoroscopy and progressed well with an enlarging cast until a sudden intra-arterial distal embolization of a small piece of Onyx. Both legs were immediately screened, demonstrating embolised

Onyx in the left distal popliteal artery. The vascular surgeon attended and a subsequent emergency arteriotomy with vein patch was performed.

Discussion: Trans-lumbar, percutaneous approach is a well-recognised method, especially when a trans-arterial approach has failed. Some evidence suggests that recurrence and re-intervention are less frequent with trans-lumbar embolisation, although this is seldom the first choice. Micro-coils, glue, thrombin and Onyx are all appropriate treatment options, with no proven superiority of one agent over the other.

Take-home Points: In this case, subsequent imaging demonstrated that Onyx had reached the arterial circulation by tracking inside the overlap between the limb and main body socket. The authors of this case feel that this was an unusual and significant complication when using Onyx in managing Type II Endoleak.

Biliary intervention

P-10

Percutaneous biliary drainage in patients with non-dilated intrahepatic bile ducts: the importance of peripheral portal vein-oriented puncture

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Purpose: Highlight the role, safety and clinical efficacy of peripheral portal vein-oriented non-dilated bile duct puncture for percutaneous transhepatic biliary drainage, describing execution technique and materials used.

Materials and Methods: Between January 2016 and December 2020 we retrospectively considered 22 patients (12M 10F; medium age 58) affected by benign (8) and malignant (10) bilio-enteric anastomotic stricture and iatrogenic biliary leakage (4). A US-guided percutaneous transhepatic puncture, employing a 21G needle, was performed, along the running course of a peripheral non-dilated bile duct (usually B6 for the right lobe; B3 for the left lobe) or along the respective accompanying portal vein division branch, if the bile duct was too narrow to be clearly visualized. Thus, an insertion angle < 30° between the needle and the bile duct running course was actualized: the needle was then advanced slightly over the portal vein. The needle was moved slightly back, injecting a small amount of contrast agent, to get opacification of the target bile duct, followed by insertion of .018" guidewires. Biliary drainages were then performed employing 5Fr introducer-sheaths and catheters, .035" hydrophilic and stiff guidewires and 8,5Fr catheters for the drainage.

Results: Technical success was 95% (21/22): a right side approach was performed in 14 cases, a left side approach in 8 cases. In 19 patients the drainage was successful in a single-step approach, in the remaining 3 patients a second attempt was necessary. The procedure was successful in 2 cases, but in 1 patient the second attempt failed, probably because of poor compliance of the patient. No major complications reported; we observed as minor complications (13%) only 2 cases of transient hemobilia and 1 case of cholangitis with fever.

Conclusion: Peripheral portal vein-oriented bile duct puncture is safe and effective to perform transhepatic biliary drainage in patients with non-dilated bile ducts.

P-11

Transcatheter arterial embolization for hepatic pseudoaneurysm after endoscopic biliary stenting for malignant biliary stricture

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Purpose: This study aimed to retrospectively evaluate the results of transcatheter arterial embolization (TAE) for hepatic pseudoaneurysm after endoscopic biliary stenting for malignant biliary stricture.

Materials and Methods: Our study included six patients (4 males and 2 females; mean age: 79.5 years) who underwent TAE for hepatic pseudoaneurysm after endoscopic biliary stenting for malignant biliary stricture at our hospital during 2016-2020. We evaluated the following parameters: technical success, clinical success, type of bile duct stent, method of stent placement, time from bile duct stent placement to bleeding, and embolized arteries.

Results: The technical and clinical success rates of TAE were 100% (6/6) and 83% (5/6), respectively. One patient died of liver and heart failure five days after TAE. Four patients had metallic stents, while two patients had plastic bile duct stents. Stent placement involved placement of three uncovered partial stents in the left and right hepatic ducts and common bile duct, a covered stent for the common bile duct, a dual plastic stent for the anterior area-common bile duct, and endoscopic nasobiliary drainage. Median time from bile duct stent placement to TAE was 18.5 days (range: 0–45 days). All six cases of embolized arteries were right hepatic arteries and required coil isolation.

Conclusion: Hepatic pseudoaneurysms are formed only in the right hepatic artery after endoscopic bile duct stent placement. Although TAE is effective in preventing mortality due to blood loss, multiple organ failure may occur, as the target patients are often elderly and/or terminally ill.

P-12

Cholangioscopy and lithotripsy in treating complex biliary calculi: a single centre experience

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Purpose: An increasing number of patients are requiring percutaneous biliary stone clearance due to previous gastric bypass surgery precluding ERCP. Some of these patients have large biliary calculi, which are not cleared by conventional techniques and require cholangioscopy and lithotripsy. We retrospectively evaluated outcomes of percutaneous cholangioscopy / lithotripsy and stone clearance at our Hepatopancreaticobiliary unit.

Materials and Methods: All patients who underwent percutaneous cholangioscopy and electrohydraulic lithotripsy for large of complex biliary calculi at our unit between 2019 and 2020 were included in this study. The size and number of stones were noted alongside technical success of the procedure and complications. All cholangioscopy and EHL procedures were performed with an experienced gastroenterologist.

Results: Thirty-seven patients with an average age of 72 years [43 - 90] underwent percutaneous biliary stone clearance over the study period. 3/37 patients required percutaneous cholangioscopy and electrohydraulic lithotripsy (EHL) due to large stone size in two (26 mm and 20 mm) and a calculus in a choledochal diverticulum in another. All three patients had a single ductal calculus. All biliary calculi were cleared successfully following EHL. 30-day mortality was 0 with no major complications.

Conclusion: Percutaneous cholangioscopy and EHL is safe and effective in the treatment of large / complex biliary calculi with a high level of technical and clinical success.

P-13

Comparing sensitivity of forceps biopsy with brush cytology during percutaneous biliary procedure

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Purpose: Forceps biopsy and brush cytology are used to provide histological diagnosis of biliary strictures during percutaneous biliary interventions. This retrospective study aimed to compare the sensitivity of both sampling techniques.

Materials and Methods: A search was conducted on our Radiology Information System for the preceding 10 years of percutaneous biliary procedures performed in our centre. Cases where malignancy was not suspected were excluded. The stricture site, expected primary and sample results were collected. Samples that were suspicious but non-diagnostic were recorded as negative.

Results: 106 procedures were included. 46 involved brushings and biopsy, 55 involved brushings only and 5 involved biopsy only. The positivity rate of each subgroup was as follows. Overall positive brushings (101 procedures) - 31%. Overall positive biopsies (51 procedures) - 53%. Suspected pancreatic primary- 29% for brushings versus 55% for biopsy. Suspected cholangiocarcinoma - 35% for brushings versus 62% for biopsy. Stricture proximal to biliary confluence - 33% for brushings versus 50% for biopsy. Stricture distal to biliary confluence - 31% for brushings versus 56% for biopsy. For procedures where both were undertaken, the combined positivity rate was 63%.

Conclusion: The sensitivity of forceps biopsy is superior to that of brush cytology overall and in every subgroup but is still only positive in just over half of malignant lesions. When both were performed, the pickup rate was 63% combined. Further study could involve more centres to increase sample size.

P-14

Biodegradable stents in benign biliary stenosis: a single center retrospective study

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Purpose: To evaluate the efficacy and outcome of benign biliary stenosis treated with biodegradable stents in our center.

Materials and Methods: Between October 2016 and November 2020, a total of 13 patients were treated with resorbable biliary stents (9 males, 4 females, with an average of 61,76 years, range 29-76 years). In 3 of them 2 biliary biodegradable stents were implanted. The causes of the biliary structure were post-surgical in 11 cases (4 of them post-transplant) and 2 inflammatory. A 12 months follow-up was evaluated with technical success, complications and outcome data.

Results: Technical success was achieved in 100% of the cases. No immediate complications occurred. During the follow up, 2 (15%) patients suffered episodes of transient cholangitis, and in 2 (15%) patients re-stenosis of the stricture were reported.

Conclusion: The implantation of biodegradable stent to treat benign biliary stenosis is a safe and effective procedure, and can be proposed as first line treatment.

P-15

Early experience of intra-ductal radiofrequency ablation (RFA) to prolong biliary stent patency for malignant strictures

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Purpose: Patients with inoperable malignant strictures of the biliary tract frequently require metallic stent placement to alleviate symptoms associated with biliary obstruction. Stent failure due to tumour ingrowth or biofilm deposition leads to cholangitis and death. Intra-ductal RFA is a proposed method of prolonging stent patency, thereby reducing re-intervention rates and improving quality of life in the palliative setting.

Materials and Methods: Retrospective evaluation of 9 patients who underwent intra-ductal RFA using the ELRA™ (EndoLuminal Radiofrequency Ablation) electrode (Taewoong Medical, South Korea).

Outcomes included demographics, tumour biology and bismuth grade, technique, clinical success, stent patency and survival.

Results: Mean age was 67 years; 6 males; 3 females. Bismuth grade I: 4 patients, II: 1, IIIa: 2, IIIb: 1 and IV: 1. Four patients underwent percutaneous and 5 endoscopic treatment (2 GA and 7 IV sedation procedures). Mean procedure time: 70.3 minutes (40 – 97 minutes) with a mean ablation time of 15:54 mins. Technical success achieved in all cases. Mean calibre increase: 5.38 mm (1.8 – 9 mm). No severe post procedural complications. Mean length of stay: 2.2 days. Secondary intervention for tumour in-growth required in two patients (74 and 197 days post RFA). 30-day mortality: 1/9. Mean survival: 96 days (26 – 258 days) with 7 deaths due to overall disease progression. Two patients remain alive at 212 and 499 days post procedure without requiring further intervention.

Conclusion: This small series indicates intraductal RFA is safe with encouraging preliminary stent patency data for patients with malignant biliary obstruction.

P-16

Safety and feasibility of precautious cholecystoscopy using Spyglass Discover and bipolar electrohydraulic lithotripsy for symptomatic cholelithiasis: a single center experience

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Purpose: A significant number of patients who undergo cholecystostomy tube placement for acute calculus cholecystitis depend on it long-term due to contraindications to cholecystectomy.

We aimed to report technique, safety, and feasibility of cholecystoscopy using the newly introduced Spyglass discover percutaneous cholecystoscope and bipolar electrohydraulic lithotripsy for the management of symptomatic cholelithiasis.

Materials and Methods: This is a retrospective analysis of 11 cases with acute calculus cholecystitis, who underwent cholecystostomy tube placement. Single use flexible 10 F Spyglass discover percutaneous cholecystoscope was used with bipolar electrohydraulic lithotripsy cholelithotripsy and basket assisted stone extraction to clean the gallbladder and biliary ducts from stones. Surgical contraindications were cardiac or pulmonary disease, and cirrhosis. Timing of cholecystostomy, cholecystoscopy, basket stone extraction, complications, time interval between the first cholecystoscopy and removal of cholecystostomy were obtained.

Results: The mean age was 61.48 years, and all patients had a transhepatic cholecystostomy tube. Mean time interval from cholecystostomy to cholecystoscopy and cholelithotripsy was 42 days, after an average of two tube check and exchange sessions. Stone-free gallbladder and cholecystostomy tube removal were achieved in all patients. 8 patients underwent 1 session of cholecystoscopy and cholelithotripsy, while 3 patients with large stones required 2 sessions for complete gallstone extraction. The mean time interval between the first cholelithotripsy session and removal of cholecystostomy was 29 days. All patients tolerated the procedure well, without complications.

Conclusion: Percutaneous cholecystoscopy using Spyglass discover precautious cholecystoscope and bipolar electrohydraulic lithotripsy is a feasible and safe treatment option to remove cholecystostomy tubes in patients with contradiction to cholecystectomy.

P-17

Management of biliary leaks: a single-center retrospective study

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Purpose: Biliary Leak is a serious complication after surgery and Interventional Radiology may be an option when the endoscopic treatment is not feasible. Our goal was to evaluate the usefulness and effectiveness of percutaneous approach in the treatment of post-surgery biliary leaks.

Materials and Methods: We retrospectively considered 38 patients (24M, 14F; mean age 64 years) between January 2018 and December 2020, who previously undergone hepato-biliarsurgery. A challenging percutaneous transhepatic cholangiography (PTC) was performed in patients without biliary dilation. We considered technical and clinical success, related complications and mortality rate

Results: 37 patients underwent percutaneous transhepatic cholangiography (PTC) and in one case a second-step approach was required to successfully catheterize the biliary tree; 38 cholangiographies were in total performed. 32 patients previously underwent hepato-biliary-pancreatic surgery, 6 underwent cholecystectomy.

In 28 cases the placement of a biliary drainage was resolute; in 10 cases a covered stent was released and in 1 case the embolization of a peripheral biliary branch was performed. Technical success was 97% (38/39), while clinical success was achieved in 32/38 (84%); 5 patients underwent a second surgical approach.

Major complications reported post-PTC were: hemobilia (2 cases) and peripheral hepatic artery branch pseudo-aneurysm, solved by endovascular embolization with microcoils. One patient died because of the complications due to sepsis

Conclusion: Interventional radiology represents a safe and effective minimally invasive treatment for biliary leaks in patients not eligible for endoscopic procedures; it prevents sepsis and shows a low rate of major complications and re-intervention

P-18

Percutaneous transhepatic biodegradable biliary stent placement for benign biliary strictures

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Purpose: To assess the safety and effectiveness of biodegradable stents in management of benign biliary strictures.

Materials and Methods: Retrospective observational study that included all adult patients who had biodegradable stent placement for a benign cause of biliary stricture between July 2016 and August 2019. Nineteen patients were included. Seventeen patients had liver transplant. One patient had hepaticojejunostomy due to primary sclerosing cholangitis and one patient had iatrogenic left main bile duct occlusion.

Results: Stents were successfully deployed in all 19 patients (technical success 100%). Patency rate was 90% (17/19) at 6 month and 80% (12/15) at 12 month. Seven patients in the study had stricture recurrence and needed reintervention with mean time-to-reintervention of 418 days (range: 8 - 1155 days). There was one major complication due to cholangitis and sepsis, which required a treatment course with Piperacillin/tazobactam for 10 days. No procedure-related pancreatitis or deaths occurred.

Conclusion: Biodegradable stents are safe and effective treatment option for benign biliary strictures and can achieve long term patency without the need for re-interventions.

P-19

Percutaneous transhepatic biliary biopsy in patients with obstructive jaundice

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Purpose: Our objective was to determine the safety and efficacy of percutaneous transhepatic biliary biopsy in patients with obstructive jaundice.

Materials and Methods: We retrospective reviewed all biliary biopsy cases performed at our institution.

All patients underwent a transhepatic biliary drainage and, in a second-time, the biliary biopsy was performed under fluoroscopic guidance using the Transluminal Biliary Biopsy Forceps Set of Cook®.

Patient demographics, operator, complications and histopathology result were analysed on the hospital's electronic patient record.

Success rate of the technique was assessed.

Results: From March 2016 to March 2021, 26 patients (12 men and 14 women) with a mean age of 70.3 (range 39-88 years) with obstructive jaundice underwent percutaneous transhepatic biliary forceps biopsy after a percutaneous transhepatic biliary drainage.

All 26 procedures were technically successful with no complications related to the biopsy. A mean of 4 samples were acquired.

Fourteen (53.8%) specimens yielded a diagnosis of malignancy or "highly suspicious" of malignancy. Eight (30.7%) samples had non-malignant tissue and four (16%) were non-diagnostic (insufficient sample). Of the 4 non-diagnostic samples, 1 patient had proven adenocarcinoma on endoscopic biopsy and the other 3 patients had images indicating malignancy, two of them had biopsy proven hepatic metastases.

All non-diagnostic samples were performed in the first 2 years (4 of 9), while the next 4 years all the biopsies had enough material. The most common explanation of our results is due to the learning curve.

Conclusion: Percutaneous transhepatic biliary biopsy is a safe procedure with a high accuracy in the diagnosis of malignant biliary obstructions.

P-20

Short-term complications of percutaneous biliary interventions in patients with cholangiocarcinoma in dependence on presence of gastroenteroanastomosis

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Purpose: To analyze short-term complications rate after percutaneous biliary drainage (PTD) in cholangiocarcinoma (CCC) in relation to history of surgically performed gastroenteroanastomosis (GEA)

Materials and Methods: 136 patients with CCC with palliative percutaneous interventions (i.e. PTD, brachytherapy, stent implantations) performed between 2005-2019 were enrolled in this single center retrospective study. Study group consists of patients with GEA performed prior to percutaneous biliary intervention (n=8). Control group consists of 128 patients with CCC without history of any prior hepatobiliary surgical procedure. 30 day complication rate (i.e. biliary leakage, bilioma formation, haemobilia, etc.) after percutaneous intervention was assessed. Complications per patient and complication per procedure in both groups were compared (Chi-Square Test).

Results: A total of 386 percutaneous transhepatic interventions were performed, 27 in GEA and 359 in control group (average 3.37 vs 2.82 per patient). Metal stent was implanted in 88% of patients with GEA and in 54% of control group (p=0.33), brachytherapy was performed in 38% and

43% of patients (p=0.87). Overall complication rate per procedure and per patient was 11.3% and 22.0%, respectively. Significant difference in complication rate per patient was observed (26% vs 10%; p=0.013), on the contrary, complication rate per procedure was not significant (38% vs 21%; p=0.28).

Conclusion: Patients with CCC treated by palliative transhepatic procedures with history of GEA showed significantly higher rate of periprocedural complications.

P-21

Percutaneous treatment of bronchobiliary fistula: report of a successful transhepatic embolization and a decision-making strategy driven by systematic literature review

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Purpose: To propose a simple treatment algorithm for Broncho-Biliary Fistula (BBF) to be used in clinical practice. To date, there is no consensus regarding the treatment strategy: many authors report surgery as the only therapy for BBF; others have successfully used minimally-invasive approaches such as percutaneous or endoscopic drainage and embolization.

Materials and Methods: An exhaustive literature search has been performed, including case reports and series regarding the use of a percutaneous approach in BBF treatment - either as a unique technique or in combination with other non-surgical methodologies. We also reported the case of a woman affected by iatrogenic bronchobiliary fistula secondary to liver thermal ablation, successfully treated with percutaneous drainage plus embolization.

Results: In this case report and literature review, we found that BBF may be successfully treated percutaneously, with a mean 75% reported success rate derived from a combined cohort of 75 patients from 64 published articles. Eight patients (13%) needed multiple non-surgical interventions to heal; overall mortality related to BBF was 9% (7/75) due to massive hemoptysis (2/7), sepsis (1/7) or progressive infection (4/7).

Conclusion: We suggest a progressive 3-step approach for BBF treatment, aimed at considering surgery only after failure of the less invasive treatments or as an early first choice in selected and critically-ill patients. The algorithm includes biliary decompression as the first attempt, followed by percutaneous repair of the fistulous tract as the second attempt. Finally, in case of failure of all minimally-invasive techniques, the third step recommended is surgical resection.

P-22

Superselective chemoembolization for inoperable intrahepatic cholangiocarcinoma: our results

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Purpose: The purpose of this retrospective study was to evaluate adverse events and survival rates of patients with unresectable intrahepatic cholangiocarcinoma (ICC) treated with superselective transarterial chemoembolization with doxorubicin-eluting beads (DEBDOX) under cone beam computed tomography (CBCT) control.

Materials and Methods: Between May 2011 and December 2017, 16 patients (6 male, 9 female; average age, 63.5 ± 13.6 years) were treated with DEBDOX TACE. Four of the patients were operated before embolization and nine of them received systemic chemotherapy. DEBDOX TACE was performed by superselective catheterization of feeding vessels followed by embolization with beads loaded with 50-100 mg of doxorubicin. In all cases, CBCT was used during chemoembolization. Tumor response rates were defined according to mRECIST and RECIST 1.1 criteria.

Results: Overall, 36 procedures were performed (mean, 2.3 per patients). There were 24 minor and only one major complication. Mean overall survival after DEBDOX TACE was 18,2 months (range 1.6 - 54.4 months), with 1- and 2 -year survival of 62% and 23%. Overall survival from time of primary diagnosis was 30.1 months (range 2.4 - 65 months), respectively. **Conclusion:** Superselective DEBDOX TACE performed under CBCT control is a safe and effective method for the palliative treatment of unresectable intrahepatic cholangiocarcinoma, with prolonged overall survival.

P-23

Complications after pancreatic surgery: which is the role of interventional radiology?

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Purpose: To evaluate Interventional Radiology (IR) role in complications management after pancreatic surgery, especially after pancreaticoduodenectomy (PD).

Materials and Methods: A total of 321 patients who underwent pancreatic surgery were reviewed to identify IR procedures performed for surgical complications.

Results: Pancreaticoduodenectomy is the mainstay surgical procedure to treat malignancies of the peri-ampullary region. Although the mortality rate after PD has decreased in the last decades, this technique still remains hindered by high morbidity in 40-50% of cases. In our university hospital, in the last ten years, more than 300 patients underwent PD for pancreatic or biliary malignancies.

121 patients (37,7%) required IR procedures. Of these:

- 54 patients (44,6%) underwent percutaneous drainage of abdominal abscess;
 - 40 patients (33%) received percutaneous biliary drainage;
 - 21 patients (17%) required a therapeutic angiography due to the presence of G.I. bleeding or pseudoaneurysms;
 - 1 patient required the closure of an entero-cutaneous fistula with glue.
- The overall mortality, morbidity and reoperation rates among these patients were respectively 6.9%, 38% and 4,3 %.

A new surgical approach was avoided in 86% of patients receiving IR procedures.

The median postoperative length of stay was 14 days in those patients requiring postoperative radiological interventions, 23 days in those not requiring intervention and 49 days for patients needing reoperation.

Conclusion: Many complications, such as abscess, bleeding and anastomotic leak after pancreatic surgery can be managed effectively using IR procedures, reducing morbidity, hospital stay and the need of a new surgical approach.

P-24

Long-term results of oversized balloon dilatation for benign anastomotic biliary strictures: initial two-center experience with the "ABSinTO" technique

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Purpose: This study aims to describe the procedure and assess the safety, feasibility and long-term patency of the ABSinTO technique (a name given to the technique and selected due to the greenish color of infected bile) for the management of benign bilioenteric anastomotic strictures.

Materials and Methods: This retrospective, two-center study included 16 consecutive cases of symptomatic benign bilioenteric strictures. Dilation of the strictures with 40-50% balloon oversizing was performed after preprocedural assessment of the diameter of the bile duct using CT or MRI imaging and an external bilioenteric drain was placed. Clinical symptoms and laboratory tests were evaluated every 3 months after drain removal, while radiological follow up was performed with MRI at 30 days and CT at 6 and 12 months.

Results: Mean follow-up time was 31.8 ± months. Kaplan-Meier estimated 1, 2- and 3-year patency rates were 88.2%, 82.4% and 82.4 %; respectively. There was one major complication, with a small dehiscence of the biliodigestive anastomosis, which required an extended catheter dwelling time. Minor complications occurred in 2 cases, one small perihepatic hematoma and one segmental thrombosis of left portal branch and none of them required further intervention.

Conclusion: The ABSinTO oversized balloon dilatation single-step technique for the treatment of benign anastomotic biliary strictures was feasible for the treatment of benign bilioenteric anastomotic strictures, and it could present high long-term clinical success and patency rates.

P-25

Percutaneous transhepatic placement of plastic biliary stents: technical description and preliminary results

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Purpose: The present study aimed to describe a novel technique of percutaneous transhepatic (PTH) placement of plastic biliary stents (PBS), report the feasibility and safety of the technique, and present the preliminary results of a pilot study of 32 patients with symptomatic obstructive jaundice (SOJ).

Materials and Methods: This was a prospective, single-arm, single-center, pilot study of a cohort of patients with the diagnosis of benign or malignant obstructive jaundice that underwent PTH placement of a PBS to relieve the obstruction.

Results: Thirty-two patients were included, 16 men and 16 women (age range, 35–88 years). There were 26 malignant and six benign lesions. Cholangiocarcinoma was the most common tumor (n=13, 40.6%), followed by pancreatic adenocarcinoma (n=6, 18.75%) and metastasis (n=5,

15.6%). A total of 35 PBSs were placed in 32 procedures. The bile duct was accessed and drained to the right side in 18 cases, to the left side in 14 cases, and bilaterally in three cases. Technical success was achieved in 100% and clinical success in 93.7% of cases. Using a modified Bismuth-Cortelle classification system, type I was observed in nine patients, type II in nine patients, type III in six patients, and type IV in eight patients. The mean follow-up was 426.1 days for the total sample, and 349.4 days for patients with malignancy. Two complications were observed: transient hemobilia and cholangitis.

Conclusion: PTH placement of a PBS in patients with SOJ is feasible, safe, and effective

P-26

Biliary involvement in liver metastases: long term results of endobiliary biopsy from a single center experience

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Purpose: To investigate long term results of endobiliary biopsy performed with a transluminal forceps set in metastatic biliary involvement.

Materials and Methods: Between September 2014 and June 2019, 25 patients (18 male (72%), mean age 65± 15 years) underwent 26 biliary forceps biopsy procedures with a dedicated set (Cook Medical, USA). All patients presented with obstructive jaundice, suspected malignant, and pre-procedural MR-cholangiopancreatography was obtained. The procedure was performed during percutaneous internal-external biliary drainage positioning, under fluoroscopic guidance. The study's primary endpoints included technical success and complications rates. The study's secondary endpoints were sensitivity, specificity and diagnostic accuracy for the characterization of malignancy.

Results: Technical success rate was 96% (25 cases) with histological diagnosis of phlogistic stenosis in 5 cases, 6 case of pancreatic adenocarcinoma, 8 colon rectal liver metastases, 3 hepatocellular carcinoma and 3 cases of normal biliary mucosa. In 1 case the sample was considered insufficient by the pathologist (1 pancreatic adenocarcinoma) and the procedure was successfully repeated. The 6 to 48 months follow-up showed 5 false negative cases, in particular 2 case of non colon rectal liver metastases (breast and gastric cancer) and 3 metastatic hilar lymph nodes. The statistical analysis revealed a sensitivity of 77%, specificity of 100% and overall accuracy of 80%. The complications rate was 11,5% (3 cases with transient haemobilia).

Conclusion: Transluminal biliary biopsy performed with forceps set is a safe and effective minimally invasive procedure for histological characterization in patients presenting with obstructive jaundice due to non-primary biliary tumor.

P-27

Palliative percutaneous transhepatic placement of plastic biliary stents 7 and 10 French for the treatment of malignant biliary obstruction: a primary patency comparison

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Purpose: Compare the primary patency of 7F vs 10F plastic biliary stents placed by percutaneous transhepatic technique in two cohort of patients that received palliative treatment for malignant biliary obstruction

Materials and Methods: 34 patients who were admitted to a tertiary academic center because of malignant biliary obstruction were enrolled in a retrospective study. Between January/2016 to April/2020, 7F PBS implants were performed and between January/2019 to January /2021, 10F PBS implants were performed

Results: The primary patency was 153.2 days for 7F PBS and 230.3 days for 10F prosthesis, with a statistically significant difference ($P = 0.014$). The average survival time in the group of patients who used the 7F prosthesis was 230.0 days and that of the 10F prosthesis was 242.0 days, with no statistically significant difference ($P = 0.840$). For 7F and 10F groups, stent dysfunctions were found in 7 and 4 patients, respectively (43.7% vs 22%, $P = 0.434$).

Conclusion: 10F plastic stents had a longer duration of patency than 7F which recommends their use in the palliative treatment of patients with biliary obstruction due to malignant biliary obstruction.

P-28

Percutaneous cholecystostomy: applications in the setting of complicated cholecystitis, and management of typical and atypical tube-related complications

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Learning Objectives:

1. Review indications and techniques for percutaneous cholecystostomy (PC) tube placement
2. Present applications of PC in relatively rare variants of complicated cholecystitis
3. Discuss complications of PC and their management through a case series

Background: PC is often the preferred initial intervention for treatment of acute cholecystitis in critically ill or elderly patients due to increased peri-operative morbidity and mortality with laparoscopic cholecystectomy in these groups. Technical and therapeutic success rates of PC are high, approaching 95% and 90%, respectively. While most cases of complicated cholecystitis (e.g., gangrenous) may be treated by routine PC, a number of specialized interventional techniques must be employed to manage serious complications arising in patients with atypical circumstances.

Clinical Findings/Procedure Details: This case series illustrates PC as the initial therapy for cholecystitis complicated by gallbladder wall rupture, gallbladder hemorrhage, cholangiocarcinoma with indwelling biliary stents, prior Roux-en-Y, primary sclerosing cholangitis, and lymphoma with bulky pericholecystic lymphadenopathy. Case-specific techniques are discussed for each case.

Additional cases illustrate various procedure-related complications encountered after PC, including hemorrhage, peritonitis/infection, gallbladder fistula, subcapsular biloma, and catheter malposition. Techniques presented include a variety of drainage approaches, tube introduction or re-introduction methods, and other interventions such as cystic duct embolization.

Conclusion: PC is often performed to treat complicated cholecystitis. Interventionalists must be aware of the complications related to PC and master the skills and techniques necessary to manage both expected complications and those related to anatomic and disease specific issues.

P-29

Percutaneous transhepatic biliary drainage catheters: identification and management of tube related complications

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Learning Objectives:

1. Outline complications related to Percutaneous Transhepatic Biliary Drainage (PTBD)
2. Demonstrate percutaneous management of complications through a case series
3. Offer tips to avoid complications

Background: PTBD is performed in patients with biliary obstruction when Endoscopic Retrograde Cholangiopancreatography (ERCP) fails due to postsurgical anatomy or because of ampullary inaccessibility from gastric outlet obstruction or local tumor growth. PTBD is associated with significant complications which must be recognized and treated appropriately. Peri-procedural complication rates are reported as 7-15%, including bleeding, cholangitis and death. In those requiring long-term drainage, issues related to catheter maintenance arise. These patients need longitudinal care and close clinical follow-up.

Clinical Findings/Procedure Details: This case series illustrates PTBD for biliary obstruction in both benign and malignant etiologies. We show a series of various complications and their management. Peri-procedural complications requiring percutaneous intervention will be shown, including parenchymal and subcapsular hematoma, hepatic artery pseudoaneurysm with hemobilia, portal vein injury resulting in hemorrhage into drainage bag, intercostal injury causing hemothorax, arterioportal fistula, biloma and bilothorax. Case-specific management techniques and tips to avoid complications are discussed with each case. Additional cases illustrate various complications encountered with long-term PTBD therapy including infection, catheter malfunction/malposition/migration and catheter arterial erosion resulting in significant hemorrhage requiring embolization and catheter re-siting.

Conclusion: PTBD is effective in the management of biliary obstruction and leak. To optimally care for these patients, the interventionalist must be aware of the problems arising intra-procedurally, post-procedurally and in the setting long term drainage and must be committed to longitudinal care.

P-30**Biliary complications of liver transplant in pediatric patients: an overview of percutaneous transhepatic cholangiography findings**

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Learning Objectives: Liver transplantation (LT) in children with end-stage liver disease has become an accepted treatment. Complications of the biliary tract after LT remain a common source of morbidity and mortality: many studies reported that biliary complications (BC) in pediatric LT patients decrease graft survival and have an incidence of 10-45%. In pediatric patients percutaneous transhepatic cholangiography (PTC) is often required to confirm a clinical suspicion as well as providing a therapy. The interventional management of BC of LT has led to improved graft and patient survival, obviating surgical revision or re-transplantation in most cases. Hereby a selection of images of PTC cases performed after deceased-donor LT in pediatric patients in a tertiary care Hospital over the last 2 years is illustrated. The aim of this work is to show the variety of BC to underline the main interventional radiology treatments.

Background: Clinical signs of BC are often nonspecific and their recognition requires diagnostic approach through imaging studies. PTC as a diagnostic tool has progressively been overcome by non-invasive tools, such as MR-cholangiography (MRCP). However, in pediatric patients, non-invasive diagnostics are not always conclusive and PTC may be required to confirm a clinical suspicion as well as providing a treatment.

Clinical Findings/Procedure Details: Main PTC findings include anastomotic and non-anastomotic strictures, bile leaks, iatrogenic biliary obstruction and other BC.

Conclusion: A selection of images of PTC cases performed after LT in pediatric patients in the last 2 years is collected from the archives of a large Italian referral center to underline complexity of BC.

P-31**Imaging evaluation and minimally-invasive therapy for pediatric orthotopic liver transplantation rescue**

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Learning Objectives: Review common hepatic transplant complications in the pediatric population.

Illustrate diagnostic findings of transplant dysfunction.

Demonstrate contemporary minimally-invasive techniques to treat vascular and biliary complications.

Background: There are a variety of complications that can occur after hepatic transplantation, most commonly rejection. While rejection is immunologically mediated and medically managed, other common complications are related to mechanical dynamics within the intrahepatic and extrahepatic structures. Vascular complications (commonly anastomotic stenoses) of the hepatic artery, portal vein, inferior vena cava, and hepatic vein are the second most common complication. Complications of the biliary system include stricture, choledocholithiasis, and bile leak. Less common complications can involve the hepatic parenchyma, such as cholangiohepatitis, HCC recurrence, infarct, and abscess.

Familiarity with the appearance of common complications is crucial to the diagnostic and interventional pediatric radiologist. Due to high risks of revision surgery, interventional radiology has become a mainstay of transplant rescue in the setting of post-transplant vascular and biliary complications.

Clinical Findings/Procedure Details: In this exhibit we demonstrate the diagnostic and intraprocedural imaging for five representative cases: portal vein stenosis treated by venoplasty, hepatic vein stenosis treated by venoplasty, hepatic artery stenosis treated by angioplasty, transhepatic catheter placement across a biliary stricture, and embolization for splenic artery steal syndrome.

Conclusion: Liver transplantation remains the treatment of choice for pediatric patients with liver failure for whom no other treatment is available. Early recognition of complications which portend poor outcomes post transplant and identification of those amenable to percutaneous and/or endovascular treatment is crucial for minimizing postoperative morbidity and graft loss.

P-32**Interventional radiology in management of bile duct injuries**

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Learning Objectives: To discuss the role of interventional radiology in diagnosis and management of bile duct injuries.

Background: Bile duct injuries are uncommon but potentially devastating complications that occur after biliary tract surgeries such as laposcopic cholecystectomy, gastric or hepatic resection, bilio-enteric anastomosis or after liver transplantation. Postoperative complications include biliary stenoses, biliary leaks, fistulas, cholangitis or abscess formation. Endoscopic intervention is though the initial route for its management; however in inaccessible, complex cases percutaneous trans-hepatic approach is of extreme importance for its diagnosis and treatment.

Clinical Findings/Procedure Details: In this essay, we will provide an illustration of the classification system for the bile duct injuries.

We will then discuss the imaging options for diagnosis of these injuries such as ultrasound, CT, MRI and percutaneous transhepatic cholangiography.

Indications, technique and principles of percutaneous interventions in these cases will be discussed.

Percutaneous interventions included biloma and abscess drainage, transhepatic biliary drainage, dilation of bile duct strictures and stent placement to maintain ductal patency.

Procedure related complications and their management is then reviewed.

Conclusion: Percutaneous management of bile duct injuries is a safe and effective tool which provides quick alleviation in complex cases which are inaccessible endoscopically or are not favourable for surgical repair.

P-33

Cholangioscopy using SpyGlass™ in the management of biliary complications after pediatric liver transplantation

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Learning Objectives: Establish the Spyglass cholangioscopy as a device for the treatment of critical and impassable stenosis of the bile duct in patients with transplant history.

Present the experience of the transplantation service in pediatric population with post-transplant biliary complications managed by Spyglass cholangioscopy.

Background: Single operator cholangioscopy and pancreatoscopy allow the endoluminal approach under direct vision of the biliary tree for the study of malignant and benign pathology with less morbidity and complication rate, offering the possibility of diagnosis and treatment in a single operative time. The SpyGlass™ is a flexible 10 Fr device with 4-way tip deflection that allows use in adult and pediatric patients.

Clinical Findings/Procedure Details: Spyglass device was used for the treatment of critical and impassable stenosis of the bile duct in patients with a history of liver transplantation who required cholangioscopy and who were refractory to percutaneous management. Using Spyglass cholangioscopy by percutaneous approach, it was possible to successfully cross the stenosis area and insert biliary derivation.

Cholangioscopy was performed by an experienced gastroenterologist endoscopist with the patient under general anesthesia. The SpyGlass cholangioscope (Boston Scientific, Natick, MA) was used. Which is composed of a 10 Fr diameter fiber optic sight, tip deflection in 4 directions, 1.2 mm working channel.

Conclusion: In the biliary tree, cholangioscopy allows diagnosis and treatment in the same endoscopic time. It is considered to be useful for approaching malignant and benign pathology, facilitating the visualization of endoluminal lesions and redirection of guides in critical stenosis; offering a therapeutic option for the removal of stones or taking biopsies

P-34

Benign biliary strictures non responsive to percutaneous bilioplasty in pediatric patients after split liver transplantation: preliminary experience using novel biodegradable biliary stents

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Clinical History/Pre-treatment Imaging: 23 mo/o female and 19 mo/o male, underwent split liver transplant (segmenti II and III) for biliary atresia. Diagnosis of biliary strictures 12 and 7 months after transplant and subsequent placement of percutaneous external-internal biliary catheters. The strictures were unresponsive to 3 and 4 serial sessions of percutaneous bilioplasty respectively.

Treatment Options/Results: Through a percutaneous sheath a 8F biodegradable biliary stent (BDBS) was deployed in every patient. After 4 and 5 months of follow-up both patients have normal liver function tests, no episodes of cholangitis and no biliary duct dilatation at liver sonography performed at 3 months.

Discussion: BDBS degrade via hydrolysis, they have a helicoidal shape to facilitate bile flow on the outer surface. Further studies and longer follow-up are needed to confirm the effectiveness of BDBS in percutaneous management of benign biliary strictures in pediatric patients after liver transplant.

Take-home Points: BDBS seems promising in the treatment of benign biliary strictures unresponsive to standard bilioplasty.

P-35

Treatment of large bilomas following laparoscopic surgical microwave ablation of central hepatic lesions

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Clinical History/Pre-treatment Imaging: A 61-year-old man with meta-static colorectal cancer underwent laparoscopic microwave ablation of a 4cm lesion at the hepatic hilum and smaller lesions in the left lobe. One-month after ablation he presented with jaundice and hyperbilirubinemia. MRI revealed large bilomas.

Treatment Options/Results: The patient was referred to IR. A long-term plan was formulated involving external drainage of the bilomas to be followed by internalization and eventual removal. Initially a single external biloma drain was placed under CT-guidance. Additional procedures, including a GI rendezvous, were required to create a pathway for internal drainage and to maintain adequate biliary drainage over the course of 4 months. Isolation occurred as the bilomas scarred down requiring a left internal-external biliary drain (IEBD). The patient later did well with 2 capped IEBDs. We externalized and then removed the right IEBD, we plan to do the same with the left soon.

Discussion: We present a complex case of biloma formation following ablation of central liver lesions. Ablation of central lesions should be avoided, as it is associated with increased frequency of complications, including biloma formation. Management of complex biliary cases requires patience and planning such that each procedure facilitates the subsequent interventions needed to achieve the desired endpoint. Different types of strategies for complex biliary intervention will be expanded upon in the full case report.

Take-home Points:

1. Ablation of central liver lesions should be avoided
2. Biliary drainage and reconstruction must be a thought-out stepwise process
3. There are a variety of tools and strategies to optimize biliary drainage

P-36

Percutaneous antegrade short cholangioscope-aided extracorporeal shock-wave lithotripsy, cholangioplasty, and biliary decompression for acute perforated cholecystitis and septic shock secondary to choledocholithiasis

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Clinical History/Pre-treatment Imaging: A 67-year old male presented with two weeks of abdominal pain and developing sepsis (WBC 50k cells/mm³, total bilirubin 6.5 mg/dL, lipase 777 U/L). CT demonstrated choledocholithiasis, severe biliary ductal dilatation, and perforated gallbladder (Figure 1). Clinically, patient was in cholangitis-associated septic shock.

Treatment Options/Results: Endoscopic retrograde cholangiopancreatography was unable to be performed due to unavailable

gastroenterologist. Patient was taken urgently to the interventional radiology suite. Percutaneous transhepatic cholangiogram demonstrated perforated gallbladder with small residual gallbladder neck, short dilated cystic duct, and marked biliary ductal dilatation secondary to obstructive choledocholithiasis (Figure 2A). Transhepatic transcholecystic internal/external biliary drain was placed for biliary diversion/decompression. Two weeks later, percutaneous antegrade cholangioscopy-aided extracorporeal shock-wave lithotripsy and cholangioplasty was performed (Figure 2B,2C). Following intervention, cholangiography demonstrated no residual common bile duct stones or obstruction (Figure 2D). Patient has recovered from his acute illness, and is currently awaiting cholecystectomy.

Discussion: Choledocholithiasis treatment varies according to subspecialist skills and availability. Percutaneous intervention is indicated for patients with high risk for complications, altered anatomy, heavy stone burden, and unsuccessful or unavailable endoscopic/surgical treatment. Our case highlights the importance of the interventional radiologist maintaining technical competence with cholangioscopy, lithotripsy, and basket retrieval for choledocholithiasis and choledocholithiasis.

Take-home Points: Early biliary decompression in septic shock improves patient morbidity/mortality. Cholangioscopy-aided antegrade treatment for choledocholithiasis is a vital skill for interventional radiologists, and is indicated in select patients.

P-37

Right hepatic duct and small bowel loop neo-anastomosis image guided percutaneous formation in case of right duct system post-surgery obstruction

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Clinical History/Pre-treatment Imaging: Patient with papilla of Vater tumor underwent laparoscopic pancreatoduodenal resection. During surgery high gallbladder duct insertion (in hepatic duct confluence) has been revealed and biliary tree was transected above the confluence. Left side anastomosis was formed successfully, but the right duct has been clipped with the intention to perform right side PTBD after surgery.

Treatment Options/Results: In post-surgery period right side PTBD has been performed enabling to decompress the right duct system. CT with contrast injection via the drainage catheter has been performed and percutaneous anastomosis has been planned. The procedure was performed under CT guidance with intravenous contrast and air injected via PTBD drain. Coronal MPR image enabled to find a possibility to conduct 18G puncture needle so, that needle traverses liver tissue, nicely seen gas containing duct, a bit of liver tissue again and finally reaches a lumen of small bowel isolated loop, fixed in liver hilum on previous surgery. After needle and advanced wire adequate position in bowel lumen documentation by additional CT run patient was transferred to cathlab and covered biliary stent has been implanted over the existing wire using conventional technique. Drainage catheter has been withdrawn in 2 weeks after right duct and bowel loop neo-anastomosis showed to be fully patent.

Discussion: Complete biliary obstruction, which is not possible to manage conducting the wire through the strictured segment needs surgical reconstruction, which might be challenging and traumatic.

Take-home Points: Complete biliary obstruction might be managed low-invasively by percutaneous image guided bilio-entero-neo-anastomosis percutaneous formation on out-patient basis.

P-38

Combined percutaneous and laparoscopic treatment of a benign post-cholecystectomy biliary stricture

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Clinical History/Pre-treatment Imaging: We report the case of a 45-year-old man with persistent jaundice, nausea and abdominal pain six months after a laparoscopic cholecystectomy. MR cholangiography showed a right hepatic duct benign stricture, adjacent to the surgical clip used for cystic duct occlusion. It also revealed right intrahepatic bile ducts dilatation and the presence of a biliary tree anatomic variant consisting in a low insertion of the right hepatic duct into the common hepatic duct.

Treatment Options/Results: To avoid a major surgery intervention consisting in a Roux-en-Y hepaticojejunostomy, we decided, after a multidisciplinary briefing, to perform a combined percutaneous-laparoscopic treatment. The patient firstly underwent an external biliary drainage implantation, then, in the operating theater, the external drainage was removed over an Amplatz guidewire. The surgeon identified the guidewire above the stenosis, and used it to restore the continuity of the biliary tree, overcoming the inflammatory stricture. Finally an internal-external biliary drainage was implanted. A few weeks later, two attempts of 7 mm cutting balloon biliary dilatation were performed obtaining a complete restoring of the right bile duct patency.

Discussion: Iatrogenic injury following cholecystectomy is the most common cause of benign biliary stricture, and Roux-en-Y hepaticojejunostomy is the treatment of choice. In this case, considering the age of the patient, the absence of comorbidities and the high location of the stricture, we opted for a less invasive multidisciplinary therapeutic strategy.

Take-home Points: According to stricture's location and patient's age and comorbidities, our combined percutaneous and laparoscopic approach may be considered as an effective option to treat post-cholecystectomy benign biliary strictures avoiding major surgery interventions.

P-39

Noble modified rendezvous technique for reconnection of transected common bile duct

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Clinical History/Pre-treatment Imaging: A 60-year-old woman, who had cholecystectomy and partial hepatectomy for gallbladder cancer one year before, admitted to our hospital because of right hypochondria. The CT scan revealed large biloma associated with common bile duct (CBD) rupture. Subsequently percutaneous drainage for the biloma and percutaneous transhepatic cholangial drainage (PTCD) were placed. However, exacerbated dilation of intrahepatic bile ducts and complete CBD transection were found on follow-up CT scan after a few months. Endoscopic retrograde biliary drainage was unsuccessful because of postgastrotomy deformity of stomach. We attempted conventional rendezvous technique to reconnect the transected CBD. But it was failed because of severe stenosis and flexion of CBD.

Treatment Options/Results: We replaced the drainage tube for the biloma with an 8 french sheath. One guide wire was inserted endoscopically (wire A) and another wire was inserted through the PTCD tube (wire B). Both were barely advanced into the biloma and pulled out through the sheath using a snare. The PTCD tube was routed out through the sheath along wire B. After removal of the wire B, the wire A was inserted retrogradely from the end of the PTCD tube and pulled out through the intrahepatic duct via the transected site. Finally, a covered stent was inserted and the post-stenting course was uneventful.

Discussion: Rendezvous technique is commonly performed for reconnection of transected CBD. Although severe stenosis made it difficult in our current case, we could overcome with modified rendezvous technique using percutaneous drainage route.

Take-home Points: We present the modified rendezvous technique for reconnection of CBD with movies.

P-40

Percutaneous intrahepatic biliary reconstruction following penetrating trauma

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Clinical History/Pre-treatment Imaging: A 17 year old male had a right upper quadrant penetrating injury. An 8cm liver laceration close to the hilum causing haemorrhage and a bile leak was seen on CT. Laparotomy and embolisation controlled the haemorrhage. The bile leak was controlled with a percutaneous drain. The bile leak persisted despite the drain and common bile duct (CBD) stent placed during an ERCP. Percutaneous transhepatic biliary drainage (PTBD) performed 5 weeks after injury demonstrated some obstructed disconnected right ducts with a leak which could not be joined to the remaining biliary tree using an antegrade approach.

Treatment Options/Results: During a further PTBD a retrograde CBD puncture was performed which revealed a previously unrecognised additional stricture to the main right duct. Both the leaking and obstructed right ducts were joined together using a combination of sharp recanalisation to the leaking ducts and the retrograde puncture for the main right stricture, which then enabled placement of multiple plastic stents. Following this, the biliary fistula healed and the intrahepatic strictures resolved. MRI at 10 months demonstrated no biliary dilatation or parenchymal atrophy.

Discussion: Endoscopic and antegrade percutaneous techniques failed to resolve biliary fistula. The retrograde approach is useful when an antegrade approach fails. A new intrahepatic track can be created allowing disconnected ducts to be joined with sharp recanalisation. Without successful treatment the biliary fistula would have required surgery and the stricture on the right may have led to right lobe atrophy.

Take-home Points: Retrograde CBD puncture and intrahepatic sharp recanalisation were used to successfully treat the intrahepatic injuries.

P-41

Interventional radiology management of a patient with hepatolithiasis in the caudate lobe and biliary strictures following multiple surgical interventions

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Clinical History/Pre-treatment Imaging: We present the case of a 36 years old patient, with previous cholecystectomy in 1990, followed by choledocholithiasis in 2017, which required ERCP with calculi extraction. Evolution was not favorable, with repeated cholangitis-episodes requiring surgical intervention with choledocholithotomy (suspicion of hepatolithiasis, despite negative findings on imaging). Hepato-jejunal Roux-en-Y anastomosis was performed.

Two years after, the patient returns with cholangitis and multiple images of hepatolithiasis and abscess formation in the caudate lobe as evidenced by follow-up-imaging (Fig-1).

Treatment Options/Results: After the surgical approach was deemed unfeasible, percutaneous biliary drainage was opted for, with subsequent

bilioplasty and percutaneous lithotripsy procedures undertaken one month after placement of biliary drainage catheter.

Discussion: Intrahepatic stones or hepatolithiasis are represented by calculi formed proximal to the confluence of the right and left main biliary ducts.

Some patients benefit from a primary percutaneous approach when it comes to biliary lithiasis. This includes patients with surgically altered upper gastrointestinal anatomy or difficult-to-reach stones (intrahepatic/associated stenosis).

In case of biliary sepsis/peri-biliary abscesses, biliary decompression with internal/external drainage can be life-saving.

Take-home Points:

Main percutaneous techniques in hepatolithiasis:

- balloon dilatation of strictures;
- balloon impingement of stones;
- stone extraction and/or fragmentation.

P-42

Biliary percutaneous rendez-vous to treat hepatic-jejunal anastomosis dehiscence after duodenocephalo-pancreatectomy: a case report

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Clinical History/Pre-treatment Imaging: In January 2020 a 70-year-old male underwent a duodeno-cephalo-pancreatectomy due to pathologically confirmed pancreatic head adenocarcinoma.

3 days after surgery a re-laparotomy was performed, due to a hepatic-jejunal anastomosis (HJA) dehiscence.

Owing to an increase of serum direct bilirubin levels occurred in the next two days (9 mg/dL), a Magnetic Resonance cholangiopancreatography (MRCP) was executed, revealing a complete stenosis of the HJA with an upstream small complete biliary leak (Fig.1).

Treatment Options/Results: A percutaneous drainage (8 Fr) was positioned into the biliary tree and a hydrophilic wire was positioned into the biloma, as it was not possible to pass the biliary stenosis.

The afferent jejunal loop was then punctured and the biloma was reached, passing through the jejunal dehiscence.

A snare loop catheter was then advanced through the afferent jejunal loop into the biloma: the transhepatic hydrophilic wire was then captured and pulled into the jejunal loop.

Finally, the transhepatic biliary drainage was positioned into the jejunal loop, completing the biliary rendez-vous, recreating the HJA connection.

Discussion: Bile anastomotic leaks after pancreatic surgery are a serious complication. Partial injury can usually be managed with a combination of percutaneous and/or endoscopic techniques. However, the management of complete HJA dehiscence is very challenging.

Take-home Points: Biliary percutaneous rendez-vous could be used to treat HJA dehiscence in order to avoid a new surgical approach.

Biopsy and drainage

P-43

Percutaneous nephrostomy for nondilated renal collecting system with ultrasound and fluoroscopic guidance: the results of a 10-year experience

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Purpose: This study aimed to evaluate technical success rate, complications, and radiation doses of ultrasound and fluoroscopy-guided

percutaneous nephrostomy (PCN) in patients with nondilated renal collecting system.

Materials and Methods: Over a 10-year period, 50 patients were referred for PCN of 60 kidneys with nondilated renal collecting system. The patients included 22 males and 28 females with a mean age of 63.2 years (range, 35–87 years). The most common reason for PCN in these patients was postoperative ureteral leaks and/or fistula (21/50 patients). PCN was performed under ultrasound and fluoroscopic guidance. During PCN, intravenous contrast media or diuretics were not used. Technical success rate, complications, procedure time, and radiation exposure of the procedure were retrospectively evaluated.

Results: Ultrasound and fluoroscopy-guided PCN for nondilated renal collecting system showed a success rate of 83.3% (50/60 kidneys) in the initial attempt. Four PCNs were repeated and successful after the initial PCN failure. There was one major complication of bleeding that required transfusion in 1.9% (1/54) PCNs and there were minor complications of transient gross hematuria through the PCN catheter in 31.5% (17/54) PCNs. Mean duration of the procedure was 15.97 ± 7.81 min and median fluoroscopy time was 4.2 min (range: 1.2–15.3 min). Median dose area product and cumulative dose were $345.37 \text{ Gy}\cdot\text{m}^2$ (range: 42.57–1659.76 $\text{Gy}\cdot\text{m}^2$) and 46.9 mGy (range: 7.7–267.8 mGy), respectively.

Conclusion: Ultrasound and fluoroscopy-guided PCN for nondilated renal collecting system was feasible with acceptable technical success rate, complication rate, procedure time, and radiation exposure.

P-44

Radiation exposure and outcome in CT fluoroscopy guided interventions with new 320-detector row CT

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Purpose: To retrospectively compare the radiation exposure, efficacy and adverse effects of CT fluoroscopy (CTF)-guided interventional procedure on a new 320-detector row CT (Aquilion ONE/Prism Edition) (Prism) which is equipped with the deep learning reconstruction (DLR) and new filtration technology and that of CTF-guided interventional procedure on a 320-detector row CT without the DLR and new filtration technology (Aquilion ONE/Vision Edition (Vision)) as the control.

Materials and Methods: We investigated 137 CT fluoroscopy-guided interventional procedures (119 patients over 2 years) in terms of technical success rates, clinical success rates, complications, scanner settings, overall patient radiation doses (dose-length product [$\text{mGy}\cdot\text{cm}$]).

Results: Overall technical success rate was 97% (133/137). The clinical success rate of biopsies was 93% (79/85). There was no significant difference in the technical success rate, clinical success rate of biopsies, and major and minor complication between the Prism and Vision group. The median total radiation dose was $588 \text{ mGy}\cdot\text{cm}$ in the Vision group. The median total radiation dose was $245 \text{ mGy}\cdot\text{cm}$ in the Prism group. The total radiation dose was significantly lower in the Prism group.

Conclusion: CTF-guided interventional procedure on the Prism reduces total radiation dose without degradation of performance in CT-fluoroscopy-guided interventional procedure.

P-45

Full-cylinder versus side-notch ultrasound-guided renal biopsy: is 16-gauge necessary?

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Purpose: Ultrasound-guided renal biopsy remains an essential procedure in the modern interventional radiology department. While 16-gauge needles have been favored in the literature due to their safety and efficacy profile, previous studies have generally only assessed the efficacy of

automated side-notch biopsy devices. We hypothesized that 18-gauge tri-axial full-cylinder core needles (BioPince Full Core) may provide similar rates of adequate glomerular sampling compared to larger side-notch 16-gauge needles (Bard MaxCore) with a lower complication rate.

Materials and Methods: This study was performed as a retrospective chart review of all adult patients who underwent ultrasound-guided, non-focal native renal biopsy at a single academic center interventional radiology department over a 3-year period, utilizing either 18-gauge Biopince or 16-gauge Bard MaxCore devices. Primary endpoints included rates of complications and sub-optimal glomerular sampling.

Results: Out of a total of 160 biopsies performed on 156 patients, more overall complications were seen in the 18-gauge group compared to the 16-gauge group (30.6% vs. 6.1%, $p < 0.001$). The rate of major complications did not differ significantly between the 18-gauge and 16-gauge groups (11.7% vs. 4.1%, $p = 0.152$). An increased rate of suboptimal glomerular sampling was seen in the 18-gauge group compared to the 16-gauge group (17.1% vs. 0%, $p < 0.001$).

Conclusion: These data suggest that smaller 18-gauge needles utilizing a full-cylinder core mechanism may be less effective at glomerular sampling compared to 16-gauge side-notch devices, and are associated with more complications. Thus, the use of automatic side-notch 16-gauge devices likely remains the safest and most effective strategy for ultrasound-guided native renal biopsy.

P-46

CT-fluoroscopy guided biopsy of lung lesions and comparison at a 1 cm cut-off: diagnostic sampling and complication rates from a large single centre

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Purpose: To evaluate the diagnostic outcome and complication rate of CT-fluoroscopy-guided core biopsies of lung lesions $\leq 1 \text{ cm}$ and $> 1 \text{ cm}$.

Materials and Methods: 583 CT-fluoroscopy-guided lung interventions including core biopsies, performed by two radiologists between January 2018 and February 2020, were analyzed retrospectively. 180 interventions were excluded: lesions $> 5 \text{ cm}$, canceled/non-biopsy/extrapulmonary procedures, and incomplete recorded information. Patients' demographic and lesion characteristics and procedural characteristics and their impact on overall pneumothoraces (overall, requiring any intervention and solely requiring drain insertion) were extracted and analyzed by univariate analyses. All covariates with or close to statistical significance ($p < 0.10$) were analyzed by binary logistic regression was performed.

Results: The rate of successful diagnosis (benign or malignant) in all biopsied lesions, $\leq 1 \text{ cm}$, and $> 1 \text{ cm}$ were 93.5%, 90.1% and 94.7%, respectively ($p = 0.103$). However, on binary logistic regression analysis, considering needle depth and number of acquired samples (1 sample or more), the rate of successful diagnosis of lesions measuring $\leq 1 \text{ cm}$ versus $> 1 \text{ cm}$ was statistically significantly different ($p = 0.038$).

The rate of pneumothorax (overall, requiring intervention) and hemoptysis were not different between the lesions $\leq 1 \text{ cm}$ and $> 1 \text{ cm}$. On binary logistic regression, hemoptysis rates were lower in lesions $\leq 1 \text{ cm}$ compared to $> 1 \text{ cm}$ (2.0% vs. 7.3%; $p = 0.032$).

The presence of emphysema remained significant for pneumothorax ($p < 0.001$), pneumothorax requiring intervention ($p < 0.001$) and pneumothorax requiring drain ($p = 0.006$) with binary logistic regression.

Conclusion: Core biopsy with CT-fluoroscopy of lesions $\leq 1 \text{ cm}$ compared to larger lesions $> 1 \text{ cm}$ yields an acceptable diagnostic sampling rate without significant increases in complication rates.

P-47

Percutaneous core biopsy of subpleural lung lesion: 292 procedures from a tertiary medical center

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Purpose: To compare the diagnostic performance and pneumothorax rate of percutaneous core biopsy on the subpleural lung lesion to those on the non-subpleural lesion.

Materials and Methods: 292 consecutive patients (29-90 years, mean 68.4 years; M:F=202:90) who underwent percutaneous lung biopsy between March 2019 and March 2020 were retrospectively reviewed. The shortest distance (SD) between the target lesion and the parietal pleura was measured and patients were divided into two groups; subpleural (SD equal to or less than 10 mm) and non-subpleural (SD more than 10mm) groups. The differences between the two groups on pathologic results and immediate postprocedural cone beam computed tomographic images were analyzed.

Results: The mean of SD was 5.9 mm (range 0-74 mm). 227 patients (77.7%) had subpleural lung lesion and the remaining 65 patients (22.3%) had non-subpleural lesion. Non-diagnostic pathology was observed in 31 patients (10.6%), of which 25 patients (11.0%) in the subpleural group and 6 patients (9.2%) in the non-subpleural group. Scanty pneumothorax was observed in 45 patients (19.8%) in the subpleural group, whereas 16 (24.6%) in the non-subpleural group. Moderate to large pneumothorax was observed in 17 (7.5%) in the subpleural group, whereas 5 patients (7.7%) in the non-subpleural group. There was no statistical significance between the two groups on nondiagnostic pathology ($p=0.681$) and overall pneumothorax rate ($p=0.685$).

Conclusion: Diagnostic performance and pneumothorax rate of the percutaneous core biopsy on the subpleural lung lesion are comparable to those on the non-subpleural lung lesion.

P-48

Plugged core biopsy of the liver: safety and impact on major bleeding events

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Purpose: To evaluate the safety and impact of biopsy tract plugging with gelatin sponge slurry on major bleeding events in percutaneous liver biopsy.

Materials and Methods: 302 consecutive patients (158 females, 144 males; median age, 63 years) receiving computed tomography-guided core biopsy of the liver in coaxial technique (16/18 Gauge) with and without biopsy tract plugging with gelatin sponge slurry were retrospectively reviewed (January 2013 to May 2018). Clinical and procedural parameters as well as laboratory results and complications were recorded. Complications were rated according to the common criteria for adverse events (NCI-CTCAE).

Results: The study cohort was dichotomized into a plugged (71%; $n=214$) and an unplugged (29%; $n=88$) biopsy tract group. Major bleeding events were only observed in the unplugged group (0.7%; $n=2$, $p=0.027$), whereas minor bleedings (4.3%; $n=13$, $p=0.265$) were observed in both groups (plugged, 3.6%, $n=11$; unplugged, 0.7%, $n=2$). Analysis of biopsies with adverse events showed a significant association between number of needle-passes and overall ($p=0.038$; odds ratio: 1.395) as well as minor bleeding events ($p=0.020$; odds ratio: 1.501). No complications associated with gelatin sponge slurry were observed.

Conclusion: Biopsy tract plugging with gelatin sponge slurry is a technically easy and safe procedure that may increase safety of biopsy procedures of the liver.

P-49

Factors associated with unplanned repeat radiological guided drainage procedure

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Purpose: The need for repeat drainage procedures is common, but little is known about the impact and predictors of the need for repeat procedures. The aim of this study was to identify risk factors associated with the need to repeat procedures.

Materials and Methods: Consecutive image guided drainage procedures in adult patients at Auckland District Health Board from 01/01/2019 to 01/03/2020 were included. Images and reports of those with repeat procedures were reviewed by an interventional radiology fellow to identify those who had unplanned repeat procedure. Statistical analysis was performed with STATA 13.

Results: A total of 862 drainage procedures were performed in 552 patients. 389 had a single procedure and 163 had a total of 473 procedures (mean 3.0 ± 1.7 , range 2 to 10). Unplanned repeat procedures were performed in 73 cases (8.5% of all procedures). The type of drain was associated with the need for unplanned repeat procedure, with significantly higher rates amongst patients having nephrostomy, and lower rates amongst those with chest drainage procedures. Referral from surgical services and inpatient status were also associated with higher need for repeat procedures. On multivariate analysis the best predictors of unplanned repeat drainage procedure were nephrostomy associated with higher risk (adjusted odds ratio 1.83 (95% CI 1.05 to 3.21, $P=0.032$), and chest drainage associated with lower risk (adjusted odds ratio 0.25 (95% CI 0.07 to 0.86, $P=0.028$)).

Conclusion: Patients undergoing nephrostomy are at particularly high risk for needing unplanned repeat procedure, further innovation may help to improve outcomes in these patients.

P-50

Assessment of viscosity of drainage fluids

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Purpose: Percutaneous Drainage is the primary treatment for intraabdominal abscesses. Reliable scientific data on the viscosity of bodily fluids other than blood is extremely scarce. In order to facilitate a more evidence-based discussion on which drainage should be used in which patient and which type of fluid, two main factors should be considered (fluid to be drained and size and configuration of the catheter). The aim of this study was therefore to gain insights into the range of viscosities that can be found in typical drainage fluids from clinical routine.

Materials and Methods: We collected 20 samples of fluid collections attained during routine CT-guided percutaneous Drainage. The viscosity of the samples was examined in the Chemical Department using a zwickiLine 2.5kN from ZwickRoell.

Results: In total 15 samples were acquired through 8F catheters, 2 through 10F and 3 through 12 F catheters. 15 Fluids were described as purulent, 5 as serous. The measured viscosities of the CT-guided Drainages ranged from 1.2 to 4.6 mPa*s. All samples had a higher viscosity than water (1.2 to 4.5 fold), but lower viscosity than glycerine (1277 mPa*s).

Conclusion: Beside drainage-related factors like minimal internal diameter and size of the side holes, the viscosity of the fluid to be drained is a key factor to be considered in percutaneous drainage placement. In a next step we will characterize different drainage catheters using model fluids in a standardized setup.

P-51

Percutaneous needle biopsy of retroperitoneal lymph nodes under CT guidance at tertiary care centre

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Purpose: To evaluate diagnostic yield of percutaneous CT guided biopsy of retroperitoneal nodes at a tertiary care center.

Materials and Methods: From January 2013 to December 2015, 60 percutaneous biopsies were performed from retroperitoneal lymph nodes. 33 were male and 27 were female. Median age was 45 years (Range 15 to 82 years). Statistical analysis in evaluation of efficacy of node biopsy was calculated according to standard definitions of sensitivity, specificity, PPV, NPV and diagnostic yield.

Results: Over all sensitivity of CT guided biopsy was 0.82, specificity was 0.69, PPV was 0.9, NPV was 0.52 and diagnostic yield was 0.8. Metastatic disease was seen in 27 out of 60 cases, lymphoma in 14 out of 60 cases. Molecular analysis and lymphoma subtypes were possible in all cases. Only one complication was encountered.

Conclusion: Percutaneous CT-guided biopsy performed in patients with retroperitoneal lymphnodes had a high accuracy in establishing the correct diagnosis including histological subtyping. Simultaneously, the complication rate was very low.

P-52

Evaluation of complication rates in CT-guided percutaneous transthoracic lung biopsy

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Purpose: The aim of our study was to retrospectively evaluated the incidence of complications such as pneumothorax, hemoptysis and parenchymal hemorrhage in patients following CT-guided percutaneous transthoracic lung biopsy.

Materials and Methods: We have assessed the relation between the incidence of pneumothorax, hemoptysis and parenchymal hemorrhage due to biopsy, and age, sex, lesion localization and lesion size and pathology results. We have also compared the diagnostic value of Fine-Needle Aspiration (FNA) and the core biopsy.

Results: Between 2016 and 2019, a total of 179 cases were included in the study. There were 133 (74.3%) men and 46 (25.7%) women, with a mean age of $64.13 \pm \text{years} \pm 14.24$ (range, 2-90 y). Complications occurred in 21.2% (38/179) of patients. The rate of pneumothorax, parenchymal haemorrhage, hemoptysis and pneumothorax with parenchymal hemorrhage was 15.1% (27/179), 3.3% (6/179), 1.1% (2/179), 1.7% (3/179), respectively. The diameter of the lesion correlated with the development of complications, was more likely to occur in patients with lesion size of less than 3.55 cm ($P = 0.002$). Complication rates for core biopsy and FNA were 15.7% and 11.1%, respectively ($p = 0.586$). Core biopsy was superior to FNA in diagnosis of thoracic lesions. The non-diagnostic rates for core biopsy and FNA was found 39.3% and 5.6%, respectively ($p = 0.001$).

Conclusion: Pneumothorax and parenchymal hemorrhage are the most common complications in patients after CT-guided percutaneous biopsy. A lesion size < 3.55 cm is identified as a risk factor for complications. The core biopsy provides high diagnostic accuracy than FNA.

P-53

CT-guided 21-gauge fine needle biopsy of lung lesions: diagnostic performance for histological and molecular characterization, and complications

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Purpose: CT-guided percutaneous biopsy represents an essential element of the diagnostic algorithm of pulmonary nodules; moreover, mutation studies on specimens have become just as important as the diagnosis of cancer, due to the availability of targeted therapies.

The aims of this study were: to assess the diagnostic performance of 21-gauge FNA for histologic and molecular characterization; to ascertain the complications rate of this procedure; to analyze patient/lesion/procedure-related factors influencing diagnosis and complications.

Materials and Methods: We included 828 patients (731 outpatient and 97 inpatient procedure) undergoing CT-guided pulmonary biopsy with 21-Gauge Chiba needle (January 2017- April 2020). No pathologist on-site was present.

Diagnostic results and complications were related to patient (emphysema, prior chest surgery/RT, supine/prone position), lesion (size, solid/subsolid, excavation/necrosis, fissures contact) and procedure parameters (breath-holding/freely breathing, muscle thickness, bone contact, needle-pleura angle, lesion-pleura distance).

Results: Cytologic specimens were obtained in 97.7% of patients and formalin fixed in 57.1%. 704/828 procedures were diagnostic (85.1% accuracy). Accuracy after re-biopsy (25 cases; 2.8%) was 88%.

Only lesion size (>15 mm) correlated with diagnostic result.

Specimens were adequate for molecular analysis in 96.7%. Complications occurred in 43% of patients (severe with hospitalization: 5.7%), resulting related to: previous surgery/RT, position, breathing, lesion size/appearance/depth, fissures/bone contact, muscle thickness and radiologist' years of experience.

Conclusion: Lung biopsy with 21-Gauge needle represents the optimal compromise between diagnostic results (without need for on-site evaluation) and complications, being also adequate for molecular analysis. Low rate and severity of complications make this technique ideal for patients affected with lung tumor, often affected by comorbidities.

P-54

Targeted liver biopsy - how accurate are we? An institutional experience of ultrasound guided targeted liver biopsy at a tertiary referral centre

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Purpose: Targeted liver biopsy provides a large volume of workload for interventional radiologists.

Obtaining an accurate tissue diagnosis has significant treatment implications for patients.

This also forms an important part of patient consent; it is important to quantify re-biopsy rates.

We aimed to provide an institutional experience by correlating all targeted liver biopsies performed at our institution from January 2016 to present.

Materials and Methods: All patients who underwent targeted liver biopsy from January 2016 to January 2021 were analysed.

Data collection parameters included: Pre-procedural lesion size on cross sectional imaging; Site of lesion - side and segment; age and sex; underlying medical condition.

Exclusion criteria included: Non targeted biopsies or patients with an established diagnosis.

Imaging and demographic data was correlated with histological outcomes.

Results: We included 455 procedures carried out over a 5 year period at our institution.

In total, 83.5% of liver biopsies were diagnostic.

Right lobe of liver lesions in segment VII were the least likely in terms of segmental region to yield a diagnostic outcome.

Size of the lesion had a statistically significant impact on biopsy success.

Lesions < 2 cm transverse diameter on cross-sectional imaging demonstrated a 56% positive result. ($p < 0.05$)

Conclusion: Liver biopsy is a common procedure in daily IR practices throughout the world.

It is helpful when consenting patients and discussing cases at MDT to have a figure of diagnostic accuracy prior to undertaking biopsy.

P-55

Aspiration of pneumothorax post CT guided percutaneous transthoracic lung biopsy: 10-year outcomes from a large single centre

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Purpose: CT-guided percutaneous transthoracic biopsy (CT-PTLB) is a minimally invasive and quick method of tissue diagnosis for lung lesions. The procedure carries risks of pneumothorax and drain insertion, however there is little published information about the impact pneumothorax aspiration.

Materials and Methods: CT-PTLB reports from January 1, 2010 to October 1, 2020 at a large single tertiary center were screened for aspiration performed post CT-PTLB. Patient demographic information, procedural notes, imaging findings and outcomes were extracted. Statistical analysis with Chi-squared, Fisher exact test and student t-test were used. Values of $p < 0.05$ were considered significant. Binary logistic regression of variables with $p < 0.1$ were performed.

Results: 102 eligible patients were identified, including 35 women, 51 patients with emphysema and mean age was 65.4 years. Significant factors reducing success of aspiration and requiring drain insertion included patient age ≥ 60 years ($p = 0.012$, OR 10.00), upper lobe location ($p = 0.003$, OR 6.15), emphysema ($p = 0.028$, OR 3.13), needle depth ≥ 2 cm ($p = 0.005$, OR 4.00) and axial pneumothorax size ≥ 3 cm ($p < 0.001$, OR 16.00). Only pneumothorax axial size ≥ 3 cm remained significant on binary logistic regression ($p = 0.025$).

Conclusion: In pneumothoraces post CT-PTLB, the pneumothorax axial size ≥ 3 cm is an important variable for likelihood of aspiration success. Although small pneumothoraces can be successfully aspirated, larger pneumothoraces still have a 50% rate of success. Attempting aspiration or an intermediate maneuver with a small catheter can be useful before committing to a drain. This potentially reduces prolonged drain insertion and admission. Overall, aspirating pneumothoraces post CT-PTLB is a worthwhile endeavour to reduce drain insertion.

P-56

Complications of CT-guided lung nodule biopsy in the over 70s: 10 year institutional review

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Purpose: Studies suggest that older patients are less likely to undergo invasive diagnostic testing of lung nodules compared to younger patients. CT-guided lung biopsy is the investigation of choice for peripheral lung

nodules to determine management. Our objective was to investigate the institutional rate of complication post CT-guided lung nodule biopsy.

Materials and Methods: A retrospective review was performed of major complications (pneumothorax, pneumothorax requiring chest drain, pulmonary haemorrhage) for all completed CT-guided lung biopsies from November 2011- June 2020 inclusive. Data was obtained via National Integrated Medical Imaging System (NIMIS) accession number. Descriptive and Chi-squared test were performed using SPSS version 25.0

Results: Data was obtained for all CT guided lung biopsies performed in our institution from November 2011 to June 2020 inclusive. 465 procedures were included for analysis with a patient age range of 26-91, mean age 68.2 (± 10.1). 223 were female and 242 were male. 22 cases did not proceed due to a number of factors including inability to breath hold or reduction in nodule size. 443 procedures were included for complication analysis. Overall complication rate for pneumothorax was 59/443 (13.3%) of which 15 (3.3%) required a chest drain. Pulmonary haemorrhage was recorded for 67/443 (15.1%) cases. There was no significant difference regarding complication rates between those over and under 70 years old.

Conclusion: Major complication rate in UHW for CT-guided lung biopsies is lower than international figures. There was no difference in complication rates in those over and under 70, with trend towards higher rates of chest drain placement in older patients.

P-57

Percutaneous cholecystostomy in acute cholecystitis in high surgical risk patients

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Learning Objectives: Highlight the role of percutaneous cholecystostomy in high surgical risk patients

Background: Acute cholecystitis is a common surgical disease and the number of patients with such problem is increasing as the population ages. Its standard treatment has been for many years cholecystectomy in the acute phase, but many of these patients are elderly, with many comorbidities, not suitable for surgery, while laparoscopic cholecystectomy is the gold standard treatment in young, fit patients. Once acute cholecystitis has been confirmed in high surgical risk patients (ASA III/IV), conservative treatment with antibiotics and percutaneous cholecystostomy is considered the best treatment, especially in patients unresponsive to broad-spectrum antibiotics. Cholecystostomy can be a definitive treatment, not just a bridge, and is considered as an effective alternative to surgery, although most authors recommend delayed cholecystectomy

Clinical Findings/Procedure Details: Diagnosis of acute cholecystitis is confirmed correlating clinical (right-upper quadrant tenderness/Murphy sign) and laboratory findings (leukocytosis, CRP) with US-study demonstrating: enlargement, gallstones/sludge, thickened wall (> 3 mm) with color-Doppler signal increase, pericholecystic fluid, and/or sonographic Murphy's sign. In cases of doubts, a CT-study for confirmation and staging is performed. In angiographic suite, under conscious sedation and local anesthetics, US-guided puncture of the gallbladder, with Convex-probe, employing a right transhepatic percutaneous approach, followed by fluoroscopic guide and corroboration is performed, preferably through a small brim of the liver, employing CHIBA 18G needle, stiff 0.35" guidewire, and 8-10 Fr catheters for the drainage. Patients' outcome is evaluated clinically and by laboratory (CRP and leucocytes): the drainage can be removed some days later, when a fluoroscopic study demonstrates that the cystic duct is open with a free passage to the duodenum

Conclusion: Percutaneous cholecystostomy is safe and clinically effective in high surgical risk patients affected by acute cholecystitis; it can be considered as a valid definitive treatment in these patients, as an alternative to cholecystectomy

P-58

The role of IR in intestinal failure and multivisceral transplantation

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Learning Objectives:

- Recognise the role of interventional radiology (IR) in multivisceral transplantation
- Discuss pre-operative visceral embolisation to reduce intra-operative haemorrhage
- Highlight the post-operative complications managed by IR

Background: Intestinal failure is defined as the inability to maintain adequate nutrition and/or fluid balance via the enteric system. The management is complex and multi-faceted, ranging from Total Parental Nutrition (TPN) to multivisceral transplantation (MVTx), which often includes small bowel plus liver transplantation (LI-Tx) or isolated small bowel transplantation (SBTx). A limited number of UK centres perform these, requiring IR as part of the multidisciplinary team.

Clinical Findings/Procedure Details: Intestinal failure patients commonly require central venous line placement, which is associated with complications such as thrombosis and stenosis. These often require complex endovascular venous reconstruction to allow ongoing TPN and consideration for transplantation.

TPN-associated liver disease is common, requiring transcutaneous or transjugular liver biopsy to plan for LI-Tx or MVTx. Large volume intra-operative haemorrhage secondary to porto-systemic collaterals poses a significant risk of mortality. Pre-operative visceral embolisation is a successful procedure to reduce this.

Vascular post-operative complications include haemorrhage, pseudoaneurysm, thrombosis, and stenosis. Non-vascular complications include anastomotic leak, intra-abdominal collection / infection. Less commonly, neoplastic complications such as post-transplant lymphoproliferative disorder or immunosuppression-related neoplasia can arise. A team of experienced diagnostic and interventional radiologists are crucial in diagnosing and managing these complications.

Conclusion: We demonstrate that IR is vital at multiple points in the multivisceral transplantation patient pathway.

P-59

Interventional radiology paracentesis clinic: an important safety net for the community

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Learning Objectives:

- 1) Discuss the current state of recurrent ascites management
- 2) Provide an algorithm for management of malignant and cirrhotic ascites
- 3) Discuss role of routine quality of life and symptom assessment in determining treatment approach

Background: Recurrent ascites in end-stage malignancy and liver disease carries a poor prognosis of 1-6 months. There are varying approaches for management of ascites, however in actual clinical practice, most patients are managed with serial large volume paracentesis (LVP) which requires them to live with the discomfort of having their abdominal fluid reaccumulate until there is a safe window for repeat drainage and places them at risk for electrolyte disturbances and hypotension.

Clinical Findings/Procedure Details: In this exhibit, we propose an algorithmic approach to the evaluation of patients with recurrent ascites that aims to provide direction on the appropriate specialist referral and most appropriate course of therapy (TIPS, PVS, LVPs, or tunneled peritoneal catheter) based on the patients' symptom burden, goals of care,

social support structure, and prognosis. We will also present validated tools for monitoring changes in quality of life and symptom control that can be incorporated into standard patient evaluation and inform clinical decision-making.

Conclusion: In the absence of social guidelines, there is high variability in the management of symptomatic refractory ascites which adversely impacts patients' outcomes and quality of life. By adopting a standardized approach to patient evaluation and workup, IR physicians can capture patients who may benefit from specialist referral for life-prolonging therapy and provide appropriate and adequate palliation for this complex patient population.

P-60

How to transform the inaccessible collections in percutaneous drainage: the role of multiple imaging methods

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Learning Objectives: The aim of our work is to identify alternative imaging methods and drainage techniques that may improve access to deep-seated collections.

Background: A large part of the routine practice of interventional radiologists is the placement of percutaneous drainage catheters. The simultaneous use of multiple imaging methods such as US, fluoroscopy and Cone Beam CT with contrast media can allow percutaneous drainage of less accessible collections, thus eliminating the need for laparotomy or relaparotomy in frail and compromised patients.

Clinical Findings/Procedure Details: We described 20 difficult percutaneous drainage in critically patients to avoid acute unplanned surgical reoperation. 8 perirectal collections secondary to anastomotic leak in colorectal surgery. 8 fluid collections at the resection margin of the pancreatic stump after distal pancreatectomy. 2 spontaneous splenic abscess. 2 abscess of distal psoas muscle. All drains were placed in the angiosuite using three imaging methods such as US, fluoroscopy and Cone Beam CT with contrast medium. Alternative approaches (eg, transgluteal, transvaginal, transrectal) can be used to facilitate drainage of deep-collections that are inaccessible via more traditional routes. Other factors that may improve the accessibility of collections include modifications in patient positioning.

Conclusion: The simultaneous use of more imaging techniques in the angiosuite and the use of alternative routes can allow percutaneous drainage of less accessible collections, thus eliminating the need for surgery.

P-61

Transjugular liver biopsy primer

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Learning Objectives:

1. Review indications, contraindications, and technique for transjugular liver biopsy (TJLB)
2. Demonstrate reasons for technical failure through a case series with strategies to increase success
3. Review and show examples of major and minor complications of TJLB

Background: TJLB allows liver tissue sampling in patients with contraindications to percutaneous biopsy. Hemodynamic pressure measurements aid its diagnostic value, particularly in the setting of organ transplantation. TJLB is generally a successful and well-tolerated procedure with few absolute contraindications. Most complications are minor with major complications occurring in 0.6% of patients. Technical failure occurs in approximately 0.9-3.9% of cases, most commonly due to failed hepatic vein access.

Clinical Findings/Procedure Details: This case series shows techniques to increase TJLB success. To improve appropriate, stable hepatic vein selection, the use of reverse curve catheters, longer/larger sheaths, and "buddy wires" will be demonstrated. TJLB from a femoral approach is feasible and will be outlined. Failed transjugular access due to SVC occlusion and TJLB from a left jugular approach will be shown. Examples of major and minor complications and their management will be illustrated. Case examples include inadvertent renal biopsy, intrahepatic hematoma, arteriportal fistula, capsular rupture and hepatic artery pseudoaneurysm causing hemobilia.

Conclusion: Several strategies can be employed to allow stable access in patients with difficult hepatic venous anatomy, thereby improving technical success in TJLB. An understanding of procedural complications with prompt identification and management is necessary. Despite procedural modifications, in some cases, percutaneous liver biopsy may ultimately be required.

P-62

Transjugular liver biopsy

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Learning Objectives: Description of transjugular liver biopsy (TJLB) indications, contraindications, techniques, outcomes and potential complications that can arise from the procedure.

Background: Liver biopsy is the gold standard for evaluation of acute and chronic liver disease. TJLB was first performed by Hanafy in 1967 and consists by obtaining liver tissue through a rigid cannula introduced into one of the hepatic veins typically from jugular venous access. It is indicated in patients with diffuse liver disease requiring a biopsy and either have a contraindication to percutaneous biopsy or require hemodynamic evaluation as part of their diagnostic workup.

Clinical Findings/Procedure Details: Under local anesthesia, the internal jugular vein is accessed and the hepatic vein is cannulated. Transvenous biopsy is obtained from the hepatic parenchyma adjacent to the hepatic veins. A 20mm length specimen containing 11 complete portal tracts is the minimum requirement for a good quality sample. Simultaneous measurement of the hepatic venous pressure gradient can be performed which aids evaluation of the risk of decompensation, efficacy of treatment of portal hypertension and esophageal variceal formation. Major complications are rare; minor complications may appear in up to 7%.

Conclusion: TJLB is a safe technique when significant ascites or coagulopathy precludes a percutaneous approach. Adjunctive diagnostic hemodynamic procedures can be performed in the same setting and it potentially obviates the need for platelets and plasma-based blood products that may increase portal hypertension.

P-63

Intracavitary urokinase in percutaneous drainage of hematomas

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Learning Objectives:

- Review of the etiology and indications for drainage of abdominopelvic hematomas.
- Description of the approach technique and the interventional procedure.
- Assess the usefulness of fibrinolytic treatment through the drainage catheter in abdominopelvic hematomas.

Background: Percutaneous drainage with an image guide catheter is the standard treatment for abdominal abscesses, and the use of intracavitary fibrinolytic agents is intended to solve specific situations in which the

technique is not successful, such as viscosity and septate collection, these being the main causes of failure. These characteristics are common in blood-type collections, which is why there is a need for new techniques.

Clinical Findings/Procedure Details: Guarantees have been demonstrated in their use, without evidence of associated bleeding complications, but these studies have been performed using control groups with great heterogeneity in terms of the structure of the collection. For this reason, we propose a selective review of the use of intracavitary urokinase in superinfected blood collections or those with a mass effect on adjacent structures.

Conclusion: The use of urokinase as an adjunct for percutaneous drainage of collections reduces the length of hospital stay, the days of treatment and the total costs, without bleeding complications. We do not have studies that evaluate the efficacy of fibrinolytic treatment, exclusively in hematomas, being an open field for future research.

P-64

Common options and overlooked alternative for drainage of inaccessible presacral abscess: a case report

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Clinical History/Pre-treatment Imaging: A 55-year-old patient with history of recurrent paravertebral abscesses previously treated with antibiotic therapy was referred to our institution experiencing lower back pain and weakness in both lower extremities. CT revealed pyogenic spondylodiscitis along with left facet joint destruction and presacral abscess located in ventral sacral surface.

Treatment Options/Results: Due to inaccessible abscess location, it was decided to perform CT-guided percutaneous transsacral abscess drainage. An 8G bone marrow biopsy needle was used to penetrate the sacrum and create a path for drainage catheter placement. Using the Seldinger technique 8 Fr drainage catheter was inserted into abscess cavity. Neither early nor late procedure-related complications occurred. Sixteen days after drainage procedure, the catheter was withdrawn as patient condition improved and the outflow of pus had reduced considerably.

Discussion: In our case report transosseous approach was successfully performed and is considered rare case as there are only few of them described in scientific literature. Analogical CT fluoroscopy-guided transsacral drainage technique was performed in Tokai University Hachioji hospital. In comparison to our case there are lot of similarities including abscess localization, risk of adjacent structures damage and technique of catheter positioning. As in our case, all procedures were successful, neither early nor late procedure-related complications occurred.

Take-home Points: Despite rarely used, CT fluoroscopy-guided transsacral drainage approach is considered to be minimally invasive and in some cases the only viable option for drainage of pyogenic spondylodiscitis of the lumbosacral junction.

P-65

Massive hemothorax after lung biopsy: a rare case of non intercostal artery origin

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Clinical History/Pre-treatment Imaging:

► 81 year old patient underwent CT guided lung biopsy for a right upper lobe mass.

► The patient 4 hours later developed hypovolemic shock, a rare complication after CT guided lung biopsy and was rushed to the CT department for an Angio CT.

►The CT showed not the “expected” intercostal artery trauma but a rather unusual finding. There was an active extravasation of contrast media from the tumor through the needle track to the pleural cavity.

Treatment Options/Results:

►The treatment options were open thoracic surgery or embolisation. Due to the rapid deterioration of the clinical status of the patient and after consulting with the thoracic surgeons the endovascular embolisation was qualified as the best treatment option.

►Via the right common femoral vein we catheterized the branches of the pulmonary artery that were transected by the stylet of the biopsy gun using a Cobra 2 diagnostic catheter. Then using a 2.4F microcatheter we managed to embolise the bleeding vessels using multiple micro-coils 4 and 6 mm in diameter. In addition we assisted the coils with gelfoam for a quicker embolisation result.

►The patient recovered well.

Discussion:

►Hemothorax after lung biopsy is very rare complication <0.4%.

►The origin of the hemorrhage is usually an intercostal or internal mammary artery.

►Trauma of a pulmonary artery branch during lung biopsy leads most commonly to hemothorax and not hemothorax.

Take-home Points:

►Pre-treatment angio-CT is mandatory.

►Endovascular treatment can be an alternative to open surgery.

►Late onset of a fatal complication is rare but exists.

P-66

Congenital splenic cyst treated with percutaneous sclerosis using alcohol and polidocanol

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Clinical History/Pre-treatment Imaging: We report a percutaneous treatment case of a large congenital symptomatic splenic cyst in a 57-years-old female patient using alcohol and polidocanol. Diagnosis was established based on US, MR and CT findings.

Treatment Options/Results: Direct percutaneous US-guided puncture of the esofitic cyst of the lower pole was performed under local anesthesia; a 6 Fr pig-tail drainage catheter was placed in the cavity; mdc fluoroscopy was performed. 250 ml of serous liquid was extracted; a sample was collected for microbiologic study. In the proportion of about the 10% of the aspirated fluid volume, polidocanol (12 ml of 2%) before and ethyl alcohol (10 ml of 95%) after injection, separately, and re-aspirated after 10 minutes. The patient was asked to turn on the right side and then on the left one to allow the distribution of the sclerotizing agent into the cyst. Immediately afterward, the cyst has practically disappeared. The catheter was left in place and removed after a fluoroscopic control (5 days after) that showed complete resolution of the cyst. Any adverse event was observed. The follow-up US control performed 2 months later showed a residual scar.

Discussion: Percutaneous sclerotherapy is a valid alternative to surgery; however, the ideal sclerosing agent has not been defined. We report of a splenic cyst successfully treated with sclerotherapy using together polidocanol and alcohol. The use of these substances jointly leads to decrease the dose of alcohol used, reducing risk of adverse events.

Take-home Points: Sclerotherapy using polidocanol plus alcohol injection is feasible and effective for treatment of splenic cysts

P-67

Renal oncocytoma vs chromophobe: limits of biopsy

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Clinical History/Pre-treatment Imaging: A patient (46-years old) entered Emergency department for abdominal/flank pain. Abdominal UltraSound revealed renal mass, with enlarged paracaval lymphnode. Contrast-enhanced CT showed right renal tumour and lymph node metastasis.

The scintigraphy was negative; a biopsy was planned.

Treatment Options/Results: UltraSound-guided renal biopsy revealed benign tissue, referable to oncocytic histotype.

In a second moment, CT-guided renal lymphnode biopsy was conducted, showing oncocytic cells with evident nuclear polymorphism.

Nevertheless, because of node metastatic involvement, a nephrectomy and renal node dissection were carried out.

After surgery, surgical resection specimens revealed hybrid oncocytic/chromophobe histotype.

Discussion: Renal oncocytomas are rare benign epithelial renal tumors, accounting for less than 5% of all solid renal neoplasms.

On CT, they are well-demarcated lesions and may show a central stellate non-enhancing scar.

Oncocytoma and Chromophobe RCC imaging may overlap, but it is important to differentiate them from each other, as Chromophobe is a malignant tumour with potential for metastases.

Preoperative biopsy may not be diagnostic because oncocytoma and chromophobe RCC can show overlapping histological features, so radical nephrectomy comes to be the treatment of choice, also for oncocytoma, especially with malignancy features as nodal involvement.

Definitive diagnosis of renal oncocytoma is then established postoperatively.

Take-home Points:

- In renal neoplastic lesions, sometimes imaging could be not conclusive; also, the biopsy can be useless;

- A synergistic management must be preferred, by oncology-urology-radiology physicians, to obtain a better clinical outcome.

Bone, spine and soft tissue intervention

P-68

Transcatheter arterial embolization of abnormal neovessels in arthritis models of the knee of swine

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Purpose: To embolize abnormal neovessels in arthritis models of the knee of swine using two kinds of embolic materials, and compare the embolic effects and tissue damage in the knee.

Materials and Methods: We created arthritis models of 12 knees in 6 female swine by intra-articular injection of the papain. According to the embolic material, 6 swine (12 knees) were divided into two groups of 3 swine (6 knees) each: imipenem/cilastatin (IPM) group and soluble gelatin sponge (SGS) group. Abnormal neovessels in the knees were embolized using IPM or SGS. Three days after embolization, we compared the embolic effects on angiography and the tissue damage on histopathologic examinations.

Results: Obvious abnormal neovessels appeared in 12 of 12 knees. The abnormal neovessels were embolized successfully, and disappeared 3

days after embolization in all 12 knees of both groups. In histopathological evaluation, synovitis changes such as synovial thickening and inflammatory cell infiltration were observed in all 12 knees of both groups. However, there was no skin or muscle necrosis in either group, and no significant difference between the two groups.

Conclusion: SGS is as safe as IPM for embolization of abnormal neovessels in the knee of swine.

P-69

Cardiovascular effects of high-volume injection (21 – 60 mL) of polymethyl methacrylate during stabilization of spine and pelvic fractures in cancer patients

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Purpose: To assess cardiovascular and hemodynamic changes associated with percutaneous injection of high-volume (> 20mL) polymethyl methacrylate (PMMA)

Materials and Methods: A retrospective study of cancer patients treated with high volume percutaneous cementoplasty of > 20mL PMMA in one procedural setting. All procedures were performed under general anesthesia. Data collected included total PMMA volume, BP, HR, oxygen saturation, body temperature, administration of IV fluid and vasopressors in relation to PMMA injection time.

Results: 45 cementoplasty procedures were performed in 40 patients (19:21 M: F) for metastatic lytic tumor (30), primary lytic tumor (3), and cancer-associated sacral insufficiency (7). Location of treatment was pelvic in 36 procedures and spinal in 9 patients. General anesthesia with endotracheal intubation in 38 procedures and total intravenous anesthesia in 7 procedures. Mean PMMA volume injected was 39.5 mL (range 21-60 mL). No changes in oxygenation or body temperature were observed. Transient decreases in systolic BP were observed in 23 procedures (range 1-23 mmHg, mean 8.3), with corresponding increases in HR ranging from 1-25 Bpm (mean 6.1 bpm). None of these incidences required use of vasopressor medication. Transient increases in systolic blood pressure were documented in 22 procedures (range 1-70 mmHg, mean 16.5). No procedure was delayed or canceled due to these alterations with no permanent clinical sequelae. All hemodynamic changes resolved within 60 minutes of PMMA injection.

Conclusion: Percutaneous injection of high volume (21-60 mL) PMMA for cement stabilization of fractures in cancer patients can be safely performed in one procedural setting. Hemodynamic changes during injection are transient and manageable.

P-70

Hybrid transarterial embolization and percutaneous sclerotherapy as salvage treatment for aneurysmal bone cysts

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Purpose: The aim of this study was to evaluate safety, outcome and quality of life after hybrid transarterial embolization and percutaneous sclerotherapy as salvage treatment in non-resectable aneurysmal bone cysts (ABC).

Materials and Methods: In this retrospective single center study n=16 consecutive patients (f=9, m=7; age: 17 (6-25) years) undergoing hybrid transarterial embolization and percutaneous sclerotherapy for

non-resectable ABC were included. 9/16 patients had history of previous therapies, all of them with no treatment response. Grade of mineralization was assessed by a five-point Likert-scale. ABC lesion response was assessed by mRECIST and volumetry. Quality of life was analyzed using Musculoskeletal Tumor Society (MSTS) Score and 36-Item Short Form Survey (SF-36) health questionnaire.

Results: No adverse events were observed after hybrid interventional procedures containing transarterial embolization and percutaneous sclerotherapy. All patients showed either partial or complete response to interventional treatment. Mean contrast enhanced lesion volume significantly decreased compared to baseline. Grade of mineralization significantly improved compared to baseline. MSTS and SF-36 showed a significant Quality of Life improvement leaving most patients without relevant constraints. 14/16 patients did not need further ABC therapy. No patient showed ABC recurrence.

Conclusion: Hybrid transarterial embolization and percutaneous sclerotherapy is a minimal-invasive, safe and effective treatment option in non-resectable ABC. Treatment decreased lesion size, fostered bone mineralization and significantly improved patients' quality of life.

P-71

Stereotactic image-guided microwave ablation of malignant liver lesions: analysis of guiding precision and post ablation volume

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Purpose: To analyse guiding precision of a stereotactic, computed tomography (CT)-based navigation system for percutaneous thermal ablation of malignant liver lesions and to evaluate sufficient volumetric lesion-to-ablation-zone overlap.

Materials and Methods: Stereotactic image-guided microwave ablation (SMWA) was conducted in patients with malignant liver lesions after interdisciplinary tumor board decision. All procedures were performed in general anesthesia. After an initial planning scan, MWA-probes (Emprint, Medtronic, Minneapolis, USA) were placed using a targeting system (CAS-one, Cascination AG, Bern, Switzerland) in apnea. Lesion volumes were measured in the planning scan. Probe positioning precision and ablation zone volumes were measured in the post interventional scan.

Results: In 13 patients (mean age 73y, 10 males) 28 primary or metastatic lesions (18 colorectal and 4 breast cancer metastasis, 5 hepatocellular carcinomas) were treated during 15 SMWA procedures with no major complications. Mean lateral deviation (LD) of the needle to the planned trajectory was $2.72 \text{ mm} \pm 1.79 \text{ mm}$, mean angular error (AE) was $1.83^\circ \pm 1.38^\circ$. Repositioning of the needle was necessary in 8 of 28 lesions (28.57%). Mean lesion volume was $3.458 \pm 5.069 \text{ cm}^3$; mean ablation zone volume was $37.177 \pm 35.272 \text{ cm}^3$. On average ablation zone volume was 975.101% larger than pre-ablation lesion volume.

Conclusion: SMWA allows for precise percutaneous placement of ablation-probes, which is essential in order to ensure a sufficient safety margin. We are currently investigating the correlation between real ablation volume and the manufacturer's predictions.

Keywords: liver metastasis; thermal ablation; stereotaxy.

P-72

Efficacy of percutaneous laser disk decompression (PLDD) using Ho: YAG Laser - a 1-year follow-up

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Purpose: To evaluate the effectiveness of Laser Disk Decompression (PLDD) using Ho: YAG laser in patients with low back pain or sciatica symptoms attributed to contained disk herniation.

Materials and Methods: A total of 20 patients who met the criteria of PLDD underwent treatment between 2018-2020. 11 patients were male

(55 %) and 9 were female (45 %). Mean age was 40 years old (range from 23 to 70). 18 patients underwent one level PLDD and 2 patients two level PLDD. 13 patients were treated at L4-L5 level and 7 at the L5-S1 level. The severity of the pain was measured by the Numeric Visual Scale (NVS) and the Oswestry disability index (ODI) at 1-, 3-, 6- and 12 months after treatment. The size of the hernia was also measured at the same intervals.

Results: Mean baseline pain score before treatment was $9, 2 \pm 0,8$ NVS units. This was reduced to a mean value of $1,6 \pm 1$ at one year. Mean scores of disability depending on ODI were 28 ± 6 before treatment and 16 ± 4 at 1 year. Mean baseline size of the hernia before treatment was $6 \text{ mm} \pm 2$ and was reduced to a mean size of $2,8 \pm 1$ at 1 year. No patients received additional surgical treatments. No major complications occurred.

Conclusion: PLDD using Ho : YAG Laser is a safe and effective method that can be used in patients with pain caused by disc protrusion.

P-73

Combination of percutaneous screw fixation and cimentoplasty for lytic bone metastases: feasibility, safety and clinical outcomes

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Purpose: to evaluate feasibility, safety and efficacy of a combination of screw fixation and cimentoplasty for lytic bone metastases.

Materials and Methods: In this single-center prospective study, we reviewed all consecutive percutaneous screw fixation under assisted CT guidance for palliation and fracture prevention of lytic bone metastases from July 2019 to February 2021. The primary endpoint was technical success and the safety of the procedure. Secondary endpoints were the early analgesic effect of the procedure and its impact on quality of life.

Results: Technical success was achieved in 23/23 cases (100%). No major complication attributable to the procedure was noted. The mean pain scored significantly decreased at the initial follow-up (8 ± 2 vs. $2 \pm 2,9$). Opioid doses were significantly lower after procedure 110 ± 143 vs. $76 \pm 108 \text{ mg/d}$ ($p < 0,05$). The mean EQ5D score was significantly lower at the early post-procedure consultation $40\% \pm 15$ vs. $60\% \pm 12$ ($p < 0,05$).

Conclusion: Combination of percutaneous screw fixation and cimentoplasty for lytic bone metastases is safe and feasible and is efficient to reduce pain, decrease the risk of fracture and the consumption of analgesics, and increase the quality of life at 4 weeks after the procedure.

P-74

Magnetic resonance guided focused ultrasound surgery for the treatment of oligometastatic prostate cancer bone metastasis: can sound waves downstage cancer spread?

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Purpose: To assess Magnetic Resonance guided Focused Ultrasound Surgery (MRgFUS) ability to downstage patients with oligometastatic prostate cancer bone metastasis using a single treatment session.

Materials and Methods: Patients were eligible if they had accessible bone metastasis and could safely undergo MRgFUS (InSightec, Israel). Baseline measurable characteristics included dynamic contrast enhanced MRI study (Gd-BOPPA, Bracco; GE 750 3T magnet) with semiquantitative perfusion analysis, PSA level (ng/ml) and choline PET (SUV). Measurable variables were obtained at treatment time, 3 months, 12 months and 24 months follow-up.

Results: 18 patients fulfilled the inclusion criteria and safely underwent MRgFUS procedure of metastatic bone ablations. Lesions were located in the pelvis (11), scapula (3) and long bones (4). At baseline all lesions showed a significant DCE perfusion (highly vascular) with mean perfusion reduction of 88% at 3 months follow-up (CI: 100-50; $p < 0,001$) stable at subsequent follow-up scans. Similarly PSA levels decreased from a mean

baseline of 19 (ng/ml) to 7.1, 2.9 and 2.1, at 3-12 and 24 months respectively. SUV values showed similar trend with reduction from baseline (mean 8.9 to 3.0, 2.3 and 1.7: $p < 0,001$). No treatment-related adverse events were reported during the study.

Conclusion: MRgFUS is a non-invasive procedure that can obtain nearly complete bone ablation in patients with oligometastatic prostate disease. The technique features a radiation-free approach that can significantly reduce risk of toxic effects in oncological patients.

P-75

Management of bone GCT relapse: review of the literature of the surgical treatment compared with the experience of a single center's interventional radiology

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Purpose: To suggest the possibility of treating giant cell tumor of bone (GCTB) relapse via radiofrequency ablation (RFA) as primary approach considering the advantages of minimally invasive procedure over surgery. The relapse's rate after surgery in literature is 19% ca. A further surgical intervention could lead to complications, long-time to recover impaired life quality. A viable alternative to manage the relapse could be interventional radiology that is able to ensure high effectiveness rate with a faster recover and minimum complications.

Materials and Methods: We analyzed 7 international surveys on GCTB surgical treatment showing the following data regarding the relapse. Considering a mean number of 100 patients followed for 5 years, the maximum relapse rate was of 37%, the minimum 7%, with a mean relapse rate of 19%.

Our study includes 4 patients with lower limb GCTB relapse after surgery managed with CT guided thermoablative treatment using RFA. Post-procedure follow-up was performed by MRI and clinical examination every 6 months.

Results: Only one patient needed a further procedure within 2 months, while the remaining subjects showed no sign of relapse with an average follow up of 28 months (minimum 6, maximum 85 months).

All patients were monitored with a standardized MRI imaging follow up protocol.

No complications were recorded. Full recovery was obtained after 20 days of crutches.

Conclusion: RFA, in our preliminary experience, has proven to be an effective treatment of GCTB relapse, bringing promising results and displaying its enormous potential. Further studies are needed

P-76

Vertebral augmentation for vertebral compression fractures: a retrospective comparative study with four different techniques

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Purpose: To evaluate 4 different vertebral augmentation techniques in VCF: Kyphon-Balloon-Kyphoplasty (KBP), SpineJack (SJP), Tektona Vertebral-Elevation-System (TKT) and Vessel-X (VSX).

Materials and Methods: This retrospective analysis reports outcomes of vertebral augmentation procedure (VAP) for 120 painful patients (30 patients/group) without neurological deficit, treated by VAP for VCF type A1, A2 and A3 (Magerl classification) in 2 centers between Feb-2014 to July-2018.

Technical success was defined as correct accomplishment of procedure demonstrated with CT.

Clinical assessment was evaluated with Visual Analogue Scale (VAS) preoperatively, immediately post procedure and at 12-month follow-up. Peri and post-operative complications were reported. Fluoro time and procedure time were registered.

A cost analysis was performed.

Results: A total of 136 VCFs was treated with 100% of technical success: 34BK, 35SPJ, 37TKT and 30VSX. We experienced a balloon bursting during BKP, with any impact on the success of the procedure or the patient's clinical outcome.

Mean pre-operatively VAS was 8.3, 8.6, 7.6 and 8.3 in BKP, SPJ, TKT and VXS, respectively; immediately after the procedure VAS dropped to 2.7, 2.9, 2.8 and 2.8 in BKP, SPJ, TKT and VXS, respectively ($p < 0.01$); after 12 months VAS was 2.4, 1.7, 2.7 and 2.2 in BKP, SPJ, TKT and VXS, respectively.

No symptomatic cement leakages were reported.

The average fluoro time/level (minutes) was 5.2, 4.4, 3.9 and 6.1 in BKP, SPJ, TKT and VXS, respectively.

The total operating cost/level (EUR) 4374.93, 5340.64, 3191.59 and 3672.45 in BKP, SPJ, TKT and VXS, respectively.

Conclusion: Long-term pain reduction has been demonstrated in all the patients, SPJ showed better results at 12-month follow-up; TKT was the cheapest procedure with the lowest fluoro time/level.

P-77

Radiofrequency ablation in osteoid osteomas of typical and atypical presentations

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Purpose: To evaluate technical, clinical success and complications of radiofrequency ablation in osteoid osteomas with typical and atypical presentations

Materials and Methods: We Prospectively reviewed 280 patients (age range: infant to 40 years) in whom radiofrequency ablation (RFA) was performed between October 2015 and January 2021 for osteoid osteomas with typical and atypical presentations. Atypical presentations included atypical sites like clavicle, talus, cervical vertebra, acetabulum and in atypical age like infants. Following preprocedural evaluation and imaging, all patients underwent RFA of osteoid osteomas under CT guidance. We evaluated for technical success of the procedure, pain relief, recurrence and any complications of the procedure. The procedure was done using RITA equipment.

Results: Technical success was achieved in all patients, with intranidal localization of the needle and complete ablation. Successful pain relief was achieved in all patients within 1 day to 1 week. Immediate complications included a 5 cases of minor thermal skin burn of about 1cm which subsided on its own. Another 7 patients with osteoid osteoma of proximal shaft of left femur developed pain in the lateral aspect of lower half of thigh following radio frequency ablation which subsided in two weeks. During follow up, 8 patients developed recurrence after 6 months which was treated with repeat RFA.

Conclusion: Radiofrequency ablation is a relatively safe, minimally invasive, and effective method for the management of osteoid osteomas with few complications.

P-78

Sustained pain relief and quality of life improvement following MRI-guided high intensity focused ablation of osteoid osteoma

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Purpose: Osteoid osteoma is a benign, painful bone tumor that predominantly afflicts children and adolescents. Standard of care definitive treatment is CT-guided radiofrequency ablation (RFA). RFA has high success rates, but is invasive and exposes patients and operators to ionizing radiation. Magnetic resonance imaging-guided-high-intensity focused ultrasound (MR-HIFU) allows for completely non-invasive ablation without radiation exposure.

Materials and Methods: Nine subjects with radiologically confirmed osteoid osteoma refractory to NSAIDs underwent MR-HIFU ablation under an IRB-approved clinical trial (NCT02349971). Patients were closely followed for one year and assessed for pain relief, quality of life improvement, and adverse events. Analgesic requirement, Visual Analog Scale (VAS) pain scores, and patient-reported quality of life assessments were collected. Imaging response was evaluated at one year with final follow at 5 years.

Results: Nine patients (7M, 2F; 16±6 years) were treated. Median pre-treatment VAS score (w/NSAIDs) was 6 and decreased to 0 by day 7 and remained at 0 at the 1-year follow up (w/o NSAIDs). Complete pain relief (VAS=0) was observed in 75% of patients at 1-year with the remaining 2 patients reporting VAS score of 1. This difference in VAS score between pre-treatment and at 1-year follow-up was significant (Wilcoxon, $p=0.0078$). Overall, pain relief, analgesic requirement, and quality of life all showed significant and sustained improvements at one year and were sustained at 5 year follow up. No serious adverse events were observed.

Conclusion: MR-HIFU ablation is a safe and noninvasive definitive treatment option for painful osteoid osteoma, providing durable pain relief and positive changes in quality of life metrics.

P-79

Cryoneurolysis for pelvic pain: when, how and where!

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Learning Objectives:

1. Review the mechanism, technique and feasibility of image guided cryoneurolysis for pelvic pain disorders.

2. Illustrate the cryoneurolysis techniques for different pelvic nerves.

Background: Opioid epidemic has cost the U.S. more than trillion dollars and has cost many lives. Chronic intractable pain drastically impacts the quality of life for a significant number of patients. Pelvic pain is a particularly debilitating condition, which is grossly misunderstood and often underdiagnosed. Pelvic pain disorders have been historically treated with analgesic medications (opioids and non-opioids); each with their own side effects especially when used long term. New methods are being investigated and employed to effectively manage these complex disorders. Interventional radiologists can play an important role in managing these conditions and are well suited owing to their skillset and expertise.

Utilizing advanced imaging, particularly cross-sectional imaging is a vital instrument to optimally diagnose, safely plan and treat these complex conditions, and promptly recognize the complications. Cryoneurolysis is being increasingly employed to effectively treat a variety of chronic refractory pelvic pain conditions. A thorough understanding of the indications, goals, technique, benefits, risks associated with cryoneurolysis is critical to safely and effectively treat these disorders.

Clinical Findings/Procedure Details: We will include representative cases of pudendal, anococcygeal, ilioinguinal, genitofemoral, hypogastric and sacral cryoneurolysis to illustrate the anatomical landmarks, optimal cryoprobe selection, positioning and procedural techniques.

Conclusion: Interventional cryoneurolysis is a safe and effective treatment option for chronic, refractory and debilitating pelvic pain disorders. It's a rapidly evolving area where interventional radiologist can employ their knowledge and skills to help these patients.

P-80

Drill-assisted biopsies of focal bone lesions: experience in a university hospital

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Learning Objectives: Describe the diagnostic efficacy, sample quality, complications and technical considerations of biopsies of drill-assisted biopsies of focal bone lesions in a university hospital.

Background: The first and most decisive step in the diagnostic approach and treatment of focal bone lesions is a biopsy. It is well known and proven that percutaneous bone biopsy of focal lesions is preferred to open biopsy. The use of the image-guided motorized system to perform bone biopsies is a novel method, still of limited use, few references briefly describe the procedure. No bibliographic references were found that describe the use of this technology in Argentina.

Clinical Findings/Procedure Details: We show the results and the technical details of this procedure performed from Oct-2017 to Dec-2020. A total of 44 procedures, the patients have an average age of 62.3+/-14.9yrs, the average time inside CT room was 21.5+/-10mins, an average of 1.7 punctures per procedure was performed, in all cases was obtained enough material. Most of the bone lesions were located in the spine 43%. The average length of the samples was 2.2+/-1.8cm. The 9% of the patients presented pain at the puncture site which was resolved with oral analgesics. The diagnostic spectrum of focal bone lesions shows a predominance of neoplastic pathology with 50%, plasma cell neoplasia with 36% of the tumors and infections 34% of total procedures. The microbiology spectrum shows *S. aureus* (33.3%) predominance.

Conclusion: The use of drill-assisted biopsies of focal bone lesions is a well-established, cost-effective diagnostic method. Benefits outweigh risks even when is used by professionals in training

P-81

Computed tomography guided multifidus muscle block in low back pain: anatomical study and technical points

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Learning Objectives: Computed tomography (CT) guided injections play an important role in the field of pain interventions. In this study the detailed anatomical study of multifidus muscle can help in understanding the proper position of the needles to gain the best results in patients suffering from chronic low back pain (LBP).

Background: Multifidus muscle degeneration is considered one of the missed findings for radiologists and spine physicians in MRI studies for lumbosacral region. The degree of degeneration is directly related to

severity of pain symptoms and duration of low back pain. Understanding the etiology, pathogenesis and multiple factors affecting LBP is important to predict clinical improvement after multifidus muscle block.

Clinical Findings/Procedure Details: In this technique, all patients are asked to lie in prone position. After sterilization and injection of subcutaneous local anesthetic (2% lidocaine), 22G spinal needles are positioned on each side of the spinous process of lower lumbar levels. Serial CT images are taken where the needles are simultaneously advanced towards the muscle fiber. Injection of a mixture of long standing anesthetic and corticosteroid is performed after confirming the position of the needle tips.

Conclusion: CT guided multifidus muscle block is a simple and safe minimal invasive technique to alleviate pain for patients with chronic LBP, however it is advisable to perform this technique in addition to CT guided facet joints and foraminal injections.

P-82

Intervertebral body implant loosening: when interventional radiology saves the day

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Clinical History/Pre-treatment Imaging: We report here a case of neurologically threatening intervertebral implant loosening in a 55-year-old man. He was initially treated for an aggressive vertebral angioma of L2 with neurological symptoms by arterial embolization followed by partial vertebrectomy with anterior column reconstruction using an intervertebral implant of L2 and posterior and lateral instrumental fusion from L1 to L3. Twelve years later, he presented with debilitating back pain at the level of the vertebral reconstruction. CT demonstrated implant loosening with neurologically threatening posterior mobilization of the implant into the vertebral canal.

Treatment Options/Results: Despite the lack of data specific to revision surgery, it is to be expected given its complexity, that recovery is lengthy and that severe complications are frequent. The implant loosening was successfully treated by percutaneous cementoplasty using dual CT-fluoroscopic guidance under local anesthesia. Surgeons were on standby and ready to intervene in the advent of complications. In case of failure, revision surgery could be performed.

Discussion: The typical long-term complications encountered with the use of intervertebral implants are subsidence, pseudarthrosis and implant loosening. In most cases, implant subsidence is asymptomatic and does not require reintervention, whereas implant loosening and mobilization usually require reintervention. This case report highlights the potential of dual guided percutaneous cementoplasty under local anesthesia and multidisciplinary teams to treat spinal instrumentation loosening and thus avoid a dangerous revision surgery.

Take-home Points: Cementoplasty is well fitted to stabilize and prevent further mobilization of spinal instrumentation after implant loosening and should be considered as a possible first-line treatment option in this subset of patients.

P-83

Dual-energy computed tomography cMap shows disc destruction in a patient with pyogenic spondylodiscitis: implications for biopsy-guidance

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Clinical History/Pre-treatment Imaging: An 80-year-old man was admitted with systemic signs of infection, two weeks after decompression of L4-S1 for symptomatic spinal canal stenosis. He was discharged

asymptomatically post-surgery and only reported mild back pain at readmission.

Magnetic resonance imaging (MRI) showed signs of pyogenic spondylodiscitis at L3/4 new to earlier preoperative MRI.

Treatment Options/Results: Computed tomography (CT) guided biopsy was performed with an unenhanced dual-energy computed tomography (DECT) planning scan at 135/80kVp. Collagen maps (cMaps) were reconstructed using a collagen-specific gradient of 1.1. cMap revealed pronounced loss of collagen in the L3/4 disc. Staphylococcus epidermidis was later identified from the biopsy.

Discussion: Computed tomography (CT) accurately detects endplate destruction, but not soft-tissue involvement. Dual-energy computed tomography (DECT) visualises connective tissue components by exploiting collagen's spectral properties.

In this patient [1], DECT cMap revealed the extensive destruction of the disc. DECT has added value compared with conventional CT for diagnosing spondylodiscitis, especially when MRI is unavailable or contraindicated. Thus, DECT-guided biopsy may facilitate the isolation of a causative pathogen when addressing the inflamed disc compartment.

[1] Pohlen et al., 2020. 10.35100/eurorad/case.16622. <https://www.eurorad.org/case/16622>

Take-home Points: DECT cMaps can accurately visualize the intervertebral disc (IVD) and indicate inflammatory damage, as shown in this patient with pyogenic discitis.

If MRI is contraindicated or unavailable, DECT cMaps represent a valuable diagnostic alternative.

DECT-guidance may facilitate biopsy route planning, potentially increasing the microbiological yield.

P-84

Arterial cement leakage during vertebroplasty to the aorta, left renal artery, left kidney and left lower limb arterial system

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Clinical History/Pre-treatment Imaging: A 53 y.o. female with History of right breast cancer treated with lumpectomy and chemoradiation with newly developed metastatic lesions to the thoracolumbar vertebrae, more involving L1 vertebra, she was referred to the IR department for CT guided Vertebroplasty of L1 vertebra for pain control.

Treatment Options/Results: Percutaneous Vertebroplasty of L1 vertebra. During the procedure, some cement material leaked to one of the paravertebral vessels which though to be on of the lumbar veins, however a focus of cement was noticed within the aorta.

CT scan of the abdomen and pelvis and both lower limbs was done to assess the extension of the cement leakage. Arterial Cement Leakage to the aorta, left kidney and left lower limb arteries was confirmed.

Discussion: To discuss the risk factors of cement leakage, types of cement leakage and their possible complications and how to deal with them

Take-home Points: Arterial cement leakage is rare but possible, how to deal with it and how to manage the clinical situation

Clinical practice development

P-85

Provision of trauma interventional radiology services during a pandemic: is IR an essential hospital service? Analysis of trauma procedures at a level 1 centre during the first wave of COVID-19

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Purpose: The world health organisation declared a global pandemic on 12 March 2020. In many countries this led to the cessation of non-essential hospital services. In some circumstances, this also included recruitment of specialty services perceived to be less critical, into front-line critical care services. It is unknown whether hospital administrators consider interventional radiology (IR) an essential service.

Materials and Methods: This study retrospectively assessed the number and type of IR procedures performed on trauma patients at a Level 1 Trauma centre from 16 March to 31 May 2020, a period where the local government implemented "first wave" lockdown measures. These procedures were then compared to the procedures performed during the same time period in 2019.

Results: During the shutdown, 40 trauma IR procedures were performed including 22.5% after-hours, compared with 32 procedures in 2019 of which 21.9% were after-hours. Of the total procedures performed, 82.5% were considered either emergent or urgent in 2020, compared with 78.2% in 2019. Insertion of IVC filter was the most common procedure and motor car accident the most common mechanism of injury in both years.

Conclusion: During a global pandemic when hospital services are at a bare minimum, IR remained an essential life-saving service for trauma patients with an observed increase in 25% of total trauma IR workload. Protection of IR services both in- and after-hours should be considered as an essential service in the event of future waves of COVID-19 and/or a future pandemic.

P-86

Overview of corporatization and consolidation of radiology practices

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Purpose: Changing regulatory requirements and decreasing reimbursements have served as a catalyst for consolidation and corporatization in radiology. An understanding of corporatization and business terminology is necessary for the current practice environment.

Materials and Methods: A review of the current literature was performed to identify articles related to the corporatization of radiology, practice ownership models, and consolidation trends in radiology.

Results: Corporatization of pathology and anesthesia services has paved the way for radiology practices. Relative to Australia, consolidation in the US markets is only in its early stages. Academic, independent, and multispecialty groups are affected to varying degrees by corporatization, with the greatest impact on independent groups. The expedited pace of the corporatization of radiology practices can be attributed to: increased liquidity of capital markets, decreased reimbursement with the necessity

of economies of scale to remain profitable, and increased regulatory requirements which may be better served by a central corporate entity. Additionally, healthcare has been increasingly viewed as an attractive investment and given the high practice valuations, the sale of a practice can be very profitable to senior partners. Between corporatized groups, there can be differences in culture and business models that may differ in radiologist autonomy, governance of the practice, and centralization. Alternatively, the advantages of corporatization can be had through strategic partnerships with independently owned private groups and can decrease the chances of being displaced by a large corporate group.

Conclusion: As corporatization of practices continues in the coming years, foundational knowledge of emerging practice models will be vital to a successful practice.

P-87

The Kardashian index of interventional radiologists

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Purpose: The purpose of this study was to calculate the K-index of IRs worldwide and look for a relationship between social media and scientific influence. The K-index directly compares a researcher's number of Twitter followers with the expected number of followers that would be expected based on the number of citations of the researcher.

Materials and Methods: 1000 IRs were randomly selected from the SIR database. Twitter, Scopus, and Healthgrades databases were used to collect the appropriate data. The K-index was calculated by using the formula: $K\text{-index} = Ft/F$, where Ft = number of followers on Twitter, and F = expected number of followers based on the number of citations (C) they have. $F\text{ factor} = 43.3 (C) 0.32$.

Results: Of the 1000 IRs, 177 (17.7%) had a Twitter account. 854 (90.3%) IRs were male, while 92 (9.7%) were females. Females IRs were more likely to have a Twitter account (19.6%) compared to their male counterparts (18.3%). IRs with a Twitter account had a higher mean number of publications (23.4 vs 16.8), citations (592.9 vs 433.4), and h-index (6.7 vs 5.1), versus IRs without a Twitter account. The mean K-index was 4.1. There was a moderate negative correlation between the age and K-index of IRs on Twitter ($r = -0.338$). There was a weak negative correlation between H-index and K-index ($r = -0.183$).

Conclusion: The majority of IRs on Twitter are predominantly men and have a low k-index (<2). The physicians with more influential research work do not necessarily have a greater Twitter following and vice versa.

P-88

A novel simplified percutaneous distal axillary artery access technique for complex endovascular interventions

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Purpose: To assess the safety and effectiveness of upper extremity access with percutaneous closure of the axillary artery for complex endovascular aortic and cardiac interventions.

This technique involves proximal axillary artery manual control during closure without the requirement for subclavian occlusion balloon placement or femoral wire access support.

Materials and Methods: 34 patients were included.

Ultrasound guided percutaneous micropuncture and fluoroscopy were combined with the off-label use of two Perclose ProGlide (Abbott Vascular, Santa Clara, California) devices for endo-arterial closure.

Primary technical success was defined as successful arterial access and closure without evidence of persistent bleeding or arterial occlusion requiring secondary interventions (covered stent placement, conversion to open).

30 days and 6 months outcomes were recorded.

Results: Mean age was 81.2 years (SD ± 6.7), 25 patients were male (73.5%). 18 (52.9%) complex aortic interventions including fenestrated and branched endografts and 16 (47.1%) transcatheter aortic valve implantation procedures were performed.

Prevalence of co-morbidities and frailty were significant.

Percutaneous access was successful in all patients.

After dilatation, sheath sizes ranged between 10-22 Fr (M 16 Fr).

Primary technical success was achieved in 29/34 (85.3%); 5 patients required a short (22-38mm) covered stent to achieve successful closure. No further procedures or open conversions were required.

None of the patients were discharged with neuro-vascular deficits related to the access site.

All patients were alive at 6 month follow-up with no mid-term complications observed.

Conclusion: This simplified technique enables large sheath arterial access for patients with limited access options.

Despite complicated patients, technical feasibility, success rates and outcomes were acceptable.

P-89

A 10-year retrospective review of management and outcomes of pseudoaneurysms at a tertiary referral centre

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Purpose: Pseudoaneurysms are uncommon but potentially life-threatening. Treatment may involve a variety of interventions including observation and follow-up, manual compression, ultrasound-guided thrombin injection, and endovascular and surgical techniques. Current treatments are largely based on observational data and there is no consensus on management. This study aimed to provide further evidence for guiding clinical decisions regarding visceral artery pseudoaneurysm and peripheral artery pseudoaneurysm management.

Materials and Methods: We performed a retrospective review of patients diagnosed with visceral artery pseudoaneurysms and peripheral artery pseudoaneurysms at a tertiary hospital (2010–2020), and described the incidence, management, and outcomes from this cohort.

Results: There were 285 patients in total included in this study. 86 patients were diagnosed with a visceral artery pseudoaneurysm. 199 patients were identified with a peripheral pseudoaneurysm. 78% of visceral artery pseudoaneurysms were managed via an endovascular approach. 43% of peripheral artery pseudoaneurysms were managed conservatively. The median time from diagnosis to intervention was <9 hours for visceral artery pseudoaneurysms and 24 hours for peripheral artery pseudoaneurysms. There was no change in survival outcomes with respect to time from diagnosis and intervention. All pseudoaneurysms receiving intervention were treated successfully.

Conclusion: Pseudoaneurysms may be treated with a high degree of success using an endovascular approach. The nature and timing of intervention should be based on a case-by-case basis, however not all pseudoaneurysms require intervention and conservative management may be successfully employed as in a minority of patients in our cohort, particularly for smaller, and peripherally located pseudoaneurysms.

P-90

The impact of 1 year of Covid-19 pandemic in our interventional radiology unit

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Purpose: To describe our experience during a whole year in an interventional radiology unit in a hospital in Spain that was severely affected by the COVID-19 pandemic.

Materials and Methods: Between 13th March 2020 to 13th March 2021 (1 year), a prospective observational study was conducted in 83 consecutive patients (median age: 49 years; range 21-94 years); 45 males/ 38 females), with a confirmed diagnostic of COVID-19; who underwent 84 all-type interventional radiology procedures. We describe the measures taken to reorganize the work and protective measures, as well as the repercussions of the situation on our unit's overall activity and activity in different phases.

Results: Technical and clinical success in 96.43 and 82.14 %, respectively. During the follow-up, 68 patients still alive and 15 died because of the baseline disease. No related-complications from the procedures occurred. Our activity dropped only 12 % compared to the same period in 2019.

Conclusion: Coronavirus disease outbreak has represented a challenge in our daily work with an overall reduction in the number of procedures. However, learning from our own experience and the recommendations of the Spanish and European radiological society (SERVEI and CIRSE) this study confirms that interventional radiology continuum of care can be safely performed also during the pandemic, following dedicated measures and protocols, taking care of all patients.

P-91

Association of Spetzler-Martin grade to 2D-echocardiogram findings of high-output heart failure in patients with brain arteriovenous malformations who underwent four-vessel angiography in a tertiary specialty medical center

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Purpose: Brain arteriovenous malformations (AVMs) are abnormal connections between the arterial and venous systems without normal intervening capillary bed. These lesions cause significant morbidity resulting to high-output heart failure (HOHF). This study aims to associate the Spetzler Martin Grade (SMG) of brain AVMs to 2d-echocardiogram findings of HOHF, specifically doppler-estimated right ventricular systolic pressure (DERVSP) and cardiac index (CI), to aid in prompt endovascular, surgical, radiosurgical, and medical treatments.

Materials and Methods: Research protocol was submitted to the Institutional Review Board and a waiver of informed consent was acquired. Medical records of adult subjects with brain AVM who underwent 4-vessel angiography from January 1, 2013 to January 31, 2020 were enrolled. Forty-nine out of 151 subjects were included in the study. Simple linear regression and binary logistic regression analysis were performed to determine the association of SMG to 2D-echo findings of HOHF. Shapiro-Wilk test was utilized to test the normality of continuous variables.

Results: Results revealed significant association between the SMG and elevated DERVSP (13/49, p-value 0.014). Out of the 13 subjects, 6 had SMG of 4 (46.2%) and 4 had SMG of 5 (30.8%). Eleven patients (84.6%, p-value 0.02) had brain AVM with deep draining veins. No significant association was found between the SMG and CI.

Conclusion: In conclusion, brain AVMs with higher SMGs and presence of deep draining veins associate well with an elevated DERVSP in 2d-echocardiogram. These parameters aid in prompt recognition and management of HOHF, leading to increased survival.

P-92

Use of the MynxGrip vascular closure device (VCD) in non-coronary peripheral arterial interventions

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Purpose: Contrary to coronary interventions in peripheral interventions antegrade as well as retrograde arterial accesses are used. We wanted to study the efficacy and the complication and failure rates of the MynxGrip VCD in such patients and to identify risk factors for VCD failures.

Materials and Methods: 386 patients had a MynxGrip VCD during the study period. Data were retrieved from the RIS and KIS system and analyzed retrospectively. 45.16% had severe vascular disease (Fontaine grade III and IV). One third of the patients had an antegrade or retrograde or cross-over access. Sheath sizes were mostly 5F or 6F. Risk factors for PAD (diabetes, hypertension, smoking status) and bleeding (antiplatelet therapy, Marcumar, NOAC, Statines, Heparine, thrombolysis) and procedural details (puncture site and direction, attempts) and complications and failures were protocolled and statistically analyzed (Chi-Square Test and multiple regressions).

Results: The failure rate of the system was 6.93%, the complication rate 6.48% and the rate of complications with therapeutical consequences 2.07%.

Patients with a failed VCD attempt and those with a more severe arteriosclerosis had a higher risk, but this was not statistically significant.

Only patients with diabetes had a statistically significantly lower complication rate. Neither the direction of the arterial puncture nor the other potential predictors, except the additional use of thrombolytic medications during the procedure, resulted in a significantly higher complication rate. There were no intravascular complications.

Conclusion: The MynxGrip VCD can safely be used in ante- and retrograde arterial puncture sites in peripheral interventions.

P-93

Virtual reality for procedural training in radiology: evaluation of trainee perceptions

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Purpose: Virtual reality (VR), an immersive simulation that creates the perception of being present within a non-physical world, has the potential to enhance procedural training. This study examines radiology trainee perceptions of procedural training and VR in interventional radiology (IR).

Materials and Methods: An anonymous survey of radiology residents and fellows at two academic centers was performed. Information collected includes training level, professional interests, self-perceived procedural competence and comfort, exposure to VR, and willingness to use VR for learning IR procedures. Ratings were assessed on a scale of 1 to 5 from lowest to highest, respectively. Comparisons between training levels were performed (one-way ANOVA, p<.05).

Results: A total of 56 survey respondents with the following training levels: 8 (14.3%) fellows, 10 (16.1%) PGY-5, 16 (28.5%) PGY-4, 11 (19.6%) PGY-3, and 11 (19.6%) PGY-2. Top subspecialty interests include IR (50%), abdominal imaging (46.4%), and neuroradiology (26.8%). Mean self-perceived procedural competence and comfort level during IR procedures was 2.39/5 and 2.54/5, respectively. The rated quality of procedural training was 2.84/5. ANOVA analysis by trainee level demonstrated a difference

in self-perceived procedural competence and comfort but not quality of procedural training ($p=0.0025^*$; 0.0297^* ; 0.0706). Trainees reported little experience with VR (1.48/5), with 66.1% not having experienced any simulation training for procedures. The overwhelming majority of respondents, 98.2%, were open to utilizing VR simulations with 76.8% reporting that VR could be useful for teaching radiology procedures.

Conclusion: Radiology trainees report low self-perceived procedural competence and comfort during IR procedures, and feel that VR can be useful for improving procedural learning.

P-94

Attitudes and perceived obstacles among female trainees conducting research in interventional radiology

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Purpose: To assess the differences in attitudes, perceptions, and aspirations between female and male trainees interested in IR with regards to their experience in research.

Materials and Methods: A cross-sectional survey study was conducted among medical student, resident, and fellow trainee members of the Society of Interventional Radiology in the summer of 2020. Items assessed included demographic information, past research experience, attitudes towards research, mentorship experience, and career aspirations. Descriptive statistics were calculated. Comparative analysis was performed using Fischer's exact analyses and student's t-tests, with $P<0.05$ deemed to be statistically significant.

Results: A total of 151 trainees completed the survey, for a response rate of 21%. Of those, 49% were male and 21% were female. Male and female respondents reported similar levels of research experience. Both genders ranked demanding work and academic schedules, lack of funding, and teaching obligations as the greatest obstacles towards conducting research. Male residents and fellows were more likely to believe that research was important to advance the field of IR (3.81 vs. 3.51 out of 4, $p=0.04$) and feel encouraged by their institution to conduct research compared to their female counterparts (3.16 vs. 2.79 out of 4, $p=0.02$).

Conclusion: While female and male respondents reported similar levels of research experience and similar obstacles to conducting research, women felt less encouraged to conduct research. Our results contribute toward understanding the gender disparities within IR and highlight areas for potential intervention.

P-95

Evaluating virtual percutaneous drain management during COVID-19 deferral of non-essential procedures: patient and provider experiences

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Purpose: In response to physical distancing recommendations issued during the COVID-19 pandemic, non-essential, scheduled procedures were deferred at our institution's Interventional Radiology (IR) clinic. The purpose of this study was to evaluate the experience of both patients and providers for whom regularly scheduled drain management visits were

conducted virtually and determine the proportion of drains requiring further intervention.

Materials and Methods: 136 percutaneous procedures were deferred during March-April 2020, including 55 chronic drain management visits. Internally validated surveys were administered to patients and providers to identify advantages and disadvantages of the virtual care model, evaluate their experience, and assess willingness to incorporate virtual visits in their future care.

Results: 20.4% of patients submitted a complete survey, endorsing key advantages of virtual visits notable for improved access to appointments during COVID-19 (81.8%). All patients were interested in future virtual visits, while only 18.2% preferred virtual visits to traditional office visits. Providers found that virtual visits improved clinic access (100%) and preserved effective communication (83.3%), yet no providers preferred virtual visits to office visits. During the deferral period, 5 drains (9.1%) required further intervention with mean time to follow up 33.1 ± 25.5 days.

Conclusion: Our results indicate that virtual visits offer unique advantages for drain management, representing an opportunity for integration into traditional care models. Vigilant and frequent re-evaluation of the advantages and challenges of virtual visits is essential to ensure equitable utilization as this care model achieves growing popularity among IR outpatient clinics.

P-96

Assessing interventional radiology providers' experiences with telephone-based virtual visits during the COVID-19 pandemic

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Purpose: As the COVID-19 pandemic has limited access to in-person care, this study aims to assess providers' experiences with telephone-based virtual visits in interventional radiology (IR).

Materials and Methods: This study enrolled interventional radiologists and advanced practice providers (APPs) who conducted telephone-based visits during COVID-19. Participants completed an internally-validated survey assessing visit types and which ones were best suited for the telephone-based visit, the utility of virtual visits, providers' experiences (rated on a 10-point-Likert scale, where 10=best possible experience), and providers' perceptions of patients' care experiences and access to care.

Results: The study included 10 providers who had follow-up visits with 97 patients. 54% of follow-up visits were for drain assessments, 23% were for interventional oncology, 15% were for venous intervention, and 8% were for TIPS. Most respondents (66.7%) stated that drain follow-up visits were best suited for the telephone-based platform. 60% expressed that telephone-based visits were equally as helpful, and 90% indicated they would like the option of telephone-based follow-up visits in the future. Provider experience averaged 7 ± 1.37 on a 10-point Likert scale. All providers perceived that telephone-based virtual visits improved the patients' care experiences, and 60% perceived it increased access to the IR clinic, mostly by providing appointments during COVID-19.

Conclusion: Most providers preferred the option of telephone-based virtual visits in the future and found it improved patient access to care. Telephone-based virtual visits in IR have transformed the standard of care during the COVID-19 pandemic and may shape the future of IR in the years to come.

P-97

Observational study on healthcare workers protection in the angio suite during the Sars-Cov 2 pandemic: a 1 year experience in Novara

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Purpose: Since the first case of Coronavirus Disease 2019 (COVID 19) in Italy, all the hospital facilities had to reform their daily activities. Amidst them, the Interventional Radiology Department in the "Azienda Ospedaliera Universitaria" of Novara had to create a dedicated protocol for the patient's management during the pandemic.

Materials and Methods: The time interval between March 2020 and March 2021 was divided into three different periods and we reported the evolution of our safety protocol, the changes in our daily activities and the rates of Sars-Cov2 infection among the healthcare workers (HCW) of the AngioSuite. Personnel who had positive partners/family members or who had established close contacts of another nature outside the workplace were excluded from the study, in order to reduce any BIAS.

Results: A total of 35 HCWs served in 355 patient procedures on Sars-Cov2 + patients from February 2020 to March 2021. During the year there was a reduction in the morbidity rate first from 7.9% to 1.4% and then currently reaching 0%.

Conclusion: Dedicated routes, elevators, establishing Filter Areas and a clear demarcation between clean and contaminated areas, Dressing and undressing procedures, Cleaning procedures and the obligation to always wear a surgical mask during the working shift are essential to prevent in-hospital infection. The vaccines' arrival seems to further reduce the risk for healthcare workers, but it is still necessary to take docile precautions in view of the new mutations of the virus.

P-98

Comparing patient satisfaction of telemedicine versus in-person interventional radiology clinic encounters: a single-site cross-sectional study

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Purpose: Interventional radiology clinics in the U.S. have historically been in-person (IP), which was reflected in practice compensation. Centers for Medicare & Medicaid Services (CMS) reimbursed providers less for Telemedicine (TM) unless patients met stringent rural criteria. During the COVID-19 pandemic, CMS pivoted, encouraging TM by offering equivalent reimbursement for TM and IP. The goal of this study was to determine if our patients preferred TM or IP encounters.

Materials and Methods: All patients seen IP or via TM in the IR clinic over a 2-month interval were contacted by phone and asked standardized questions including: overall satisfaction (scored 1-5), ease of engagement, ease of family/caretaker involvement, information communication efficacy, and modality preference. Results were compared using Fischer's and Student's T-tests.

Results: Of the 67 patient interactions, 54 completed the survey: 46 were seen via TM and 8 were IP. There were no significant differences between the groups (e.g. patient satisfaction TMmean=4.77, IPmean=4.75; P=0.9) and no significant difference in overall preference (57% preferred TM; P=0.06). Of note, 17 (31%) of patients reported they preferred TM visits

due to travel-related issues, while 11 (20%) reported they preferred IP for the face-to-face connection.

Conclusion: While some situations require IP examination, many IR clinic appointments may be successfully completed via TM. We encourage this option to remain available for patients post-pandemic, especially for those who face logistic burdens to obtaining health care.

P-99

Radial access for interventional radiology procedures: a neuro and body single center experience

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Purpose: Aim of our study was to evaluate radial arterial access (RA) as first choice approach for both neuro and body endovascular interventions and to assess advantages and limitations of routinely RA as an alternative to traditional femoral and humeral puncture.

Materials and Methods: Patients who underwent interventional radiology (IR) procedures in our tertiary center between July 2019 and February 2021 were retrospectively collected; only patient suitable for RA puncture were included and for each patient procedural characteristics, technical success and post-treatment complications were evaluated.

Results: 161 patients underwent RA (79 males, median age 67 years±14), 92 were treated by neuro-interventional radiologists and 69 by body-interventional radiologists.

Body procedures included diagnostic angiography (n=36), trans-arterial-chemoembolization (n=12), bleeding or post-EVAR endoleak embolization (n=12), visceral aneurysm embolization (n=6) and visceral angioplasty (n=3).

4Fr (n=89), 5Fr (n=10) and 6Fr (n=29) sheaths were used and 4Fr distal radial access (DRA) from anatomical snuffbox were also performed (n=33). Technical success rate of RA and DRA was 96,3 %: in 4 cases a severe arteriopathy limited the target vessel catheterization and 2 patients required conversion to femoral and humeral access due to technical limitations (i.e. catheters length).

No complications on RA and DRA sites were reported during follow up.

Conclusion: Our experience showed that RA is a valid approach to the majority of IR procedures increasing patient comfort and reducing access site complications; however specific body IR technical developments are needed to make RA a first choice approach.

P-100

Radial access for abdominal embolization: a promising or limited approach?

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Purpose: Radial arterial (RA) puncture is a percutaneous access commonly used in neuro and hemodynamic endovascular interventions; our aim was to study the rising role of RA in body endovascular procedures, especially for elective and emergency embolization, to highlight potential advantages and limitations.

Materials and Methods: We retrospectively collected all patients who underwent interventional radiology (IR) elective or emergency embolization in our center between July 2019 and February 2021; we included only patients treated by means of RA puncture as first choice access and we evaluated procedural features, technical success and post-procedural complications.

Results: 30 patients underwent RA access (19 males, median age 70 years±6) a third of which required an emergency visceral embolization; the technical success rate was 93,3%: in two cases the complex vessel anatomy limited the selective catheterization.

The interventions included conventional trans-arterial-chemoembolization (n=13), visceral bleeding embolization (n=10), visceral aneurysm embolization (n=5) and post-EVAR endoleak embolization (n=2); the procedures were performed selecting the appropriate embolic agents for each case (coils, micro-coils, particles, liquid agents and gelfoam). 4Fr (n=20), 5Fr (n=5) and 6Fr (n=5) sheaths were used; two patients required a combined femoral and humeral access due to technical limitations (i.e. catheters length).

No complications on RA access sites were reported during follow up.

Conclusion: RA access resulted a safe and effective approach for both elective and emergency therapeutic embolization; no complications were encountered using the wide variety of embolic agents.

Our experience seems to confirm the potential role of RA access in body IR, even though technical improvements especially dedicated materials are wished.

P-101

Interventional radiologist involvement in advanced care planning discussions for Medicare patients from 2015-2019

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Purpose: Since 2015, the Center for Medicare and Medicaid Services (CMS) has allowed Advanced care planning (ACP) events to be billable for Medicare patients with the hope of increasing the number of patients with advanced care directives. The role of Interventional Radiology in ACP, as dictated by Medicare billing, remains incompletely evaluated.

Materials and Methods: Billing data from the CMS Physicians/Supplier Procedure Summary (PSPS) Master Files from 2015 to 2019 were evaluated for ACP billing codes 99497 and 99498. Physician specialty codes were used to identify DR/IR (30/94) and other physicians. Place of service codes were used to determine office versus inpatient setting.

Results: The number of billed ACP discussions by IR throughout the study period was 170, all of which were billed as initial discussions in the office setting. By year, IR billed for 0, 9, 27, 30 and 104 ACP discussions from 2015 to 2019. While primary care physicians accounted for the majority of billed ACP events (69.7%) many other non-primary care specialties contributed or billed for these discussions.

Conclusion: Interventional Radiologists bill for low numbers of ACP discussions which may relate to minimal ACP discussions, lack of billing, or a combination. Given that IR has many interactions with very ill or terminal patients the opportunity to be increasingly involved in ACP represents an interesting topic of discussion especially as IR aims to become a more clinically oriented specialty.

P-102

Implementation of vacuum assisted excision for the management of benign and high-risk lesions

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Purpose: To describe the impact of the implementation of VAE in terms of management and outcomes compared to a cohort before implementation, with special focus on high-risk lesions.

Materials and Methods: A single centre retrospective cohort study with two cohorts: 'before' and 'after' implementation of VAE was conducted. All patients with a benign or high-risk lesion excised by VAE or surgical excision (SE) in the period from January 2016 up to 2019 were included in the

study. Excision, complication and upgrading rates were compared using Chi-square or Fisher's exact test between the two cohorts. Re-excision and recurrence rates were compared using a log-rank test.

Results: A total of 103 surgically excised lesions in the before, and 216 lesions in the after cohort (of which 98 SEs and 118 VAEs) were included. After implementation, high-risk lesions were significantly more often managed with SE (34/49, 69%) than VAE (15/49, 31%) ($p < 0.001$). Re-excision, recurrence, and complication rates were comparable between the two cohorts (respectively 3.9% versus 3.7%, $p = 0.924$; 2.9% versus 1.9%, $p = 0.754$; 4.4% versus 6.7%, $p = 0.595$). Even after excision of high-risk lesions by means of VAE, re-excision, recurrence and complication rates were comparable in the before and after cohort.

Conclusion: VAE can be implemented safely and effectively for both benign as high-risk breast lesions. Although follow-up time in the after cohort was shorter and absolute numbers for high-risk lesions were small, the results of this study can be used for further development of guidelines and prospective study protocols.

P-103

Cost effectiveness and cosmetic outcome of vacuum assisted excision for the management of benign and high-risk lesions

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Purpose: To evaluate the impact on direct health care costs and cosmetic outcome of the implementation of vacuum assisted excision as a management option for benign and high-risk breast lesions.

Materials and Methods: This was a retrospective cohort study, data was collected from electronic patient records in the period between January 2016 and December 2019. VAE was introduced in our large teaching hospital as a treatment for benign and high-risk lesions in July 2017. Cosmetic outcome was measured with the BCTOS-cosmetic subscale and presented as an unweighted mean score. Health care costs were presented as median (IQR) and the difference between the cohorts (VAE and SE, before and after implementation of VAE) was evaluated using a Mann-Whitney U test.

Results: No significant difference was found for mean cosmetic outcome between the before (median 1.44) and after cohort (median 1.38, $p=0.914$), nor between the VAE (median 1.35) and SE cohort (median 1.44, $p=0.802$). The total direct health care costs were significantly lower for patients managed after implementation of VAE compared to the before cohort (median costs €3332,88 and €2287,59, respectively) ($p<0.001$). Total costs were lower for patients initially managed with VAE (median €1554,50), compared to patients initially managed with SE (median €3469,78, $p<0.001$). Even after correcting for differences in baseline characteristics, the difference between VAE and SE remained significant ($\beta=-0.65$, $p<0.001$).

Conclusion: Implementation of VAE led to decreased health care related costs for patients with benign and high-risk breast lesions. A better cosmetic outcome after VAE could not be demonstrated, but the majority of patients who underwent both procedures preferred VAE.

P-104

Dedicated interventional radiology residency as a novel pathway to recruit residents

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Purpose: Interventional Radiology (IR) is an expanding field of modern medicine. Currently a complete residency in Diagnostic Radiology (DR) is

required prior to fellowship in IR. Our aim was to assess the interest and motivation to enter a dedicated IR residency program among medical students and junior non-radiology residents in Israel.

Materials and Methods: A total of 100 medical students, interns and junior non-radiology residents completed an online survey on possible interest in a dedicated IR residency. The survey was distributed widely via social media to assess interest in a dedicated IR residency and to address preference in one of several possible training routes. These routes include: a stepwise DR residency followed by a two-year IR fellowship; a shortened DR program followed by an extended four-year IR program and an option of a career change program from other medical specialties with training in DR and IR.

Results: We found substantial interest and motivation in a dedicated IR residency in Israel. 49/100 (49%) of survey participants showed deep interest in a dedicated IR program. Of several possible suggested training routes, the shortened DR with extended IR program was found to be the most attractive, by 53/100 (53%) of respondents.

Conclusion: Our survey showed that there is a strong interest in a dedicated IR residency. Due to a shortage of practicing IRs and based on the results of our survey, the Israeli Society of IR (ILSIR) has initiated steps in the establishment of a dedicated IR residency in Israel.

P-105

Role of interventional radiology in patients with SARS-CoV-2 infection: our experience

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Purpose: To evaluate the role of interventional radiology (IR) in patients hospitalized with SARS-CoV-2 infection (COVID-19).

Materials and Methods: Retrospective review of hospitalized patients with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection that underwent one or more IR procedures from February 2020 to March 2021

Results: 39 patients underwent interventional radiology treatment for a total of 91 procedures. The median age of IR patients was 73 years (range 38–87 years); 13 patients (33.3%) were female. The most commonly performed IR procedures were abdominal drainage (26%), nephrostomies (24%), arterial embolization for bleeding (19%), other vascular procedures such as arterial stenting for peripheral artery occlusive disease and venous access placing/removing (13%), thoracentesis/chest tube placement (10%) cholecystostomy tube placement (5%). Remaining 3% of activity was interventional consulting and bedside lung US.

Conclusion: Interventional radiology shows a pivotal role in patients with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection performing a very wide variety of procedures, necessary for patients healthcare.

P-106

Clinic of radiology with patient ward and direct coding/billing responsibility: key performance indicators (KPIs) of a German hospital that offers the full spectrum of interventional radiology (IR)

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Purpose: To analyze Key Performance Indicators (KPIs) of a Clinic of Radiology (Radiology) with patient ward and direct coding/billing responsibility that offers the full spectrum of Interventional Radiology (IR).

Materials and Methods: Radiology offers a 24/7/365 service with all types of elective and emergency treatments such as TEVAR and EVAR, emergency embolization of hemorrhage and CT-guided drainage. The Radiology team treats patients accommodated in the beds on a dedicated ward that is organized by Radiology. Referring physician management, case documentation, interventional treatment, coding, controlling and billing are the essential responsibilities of Radiology. Different KPIs that originated from the controlling of our hospital (Radiology-KPIs) were presented and compared with the nationwide standard (InEK-cost-matrix-KEPIs).

Results: During four reference years, the case-mix-index of Radiology increased steadily (from 1.1 to 1.5). Accordingly, the cases featured markedly increased complexity over time. In reference year #1 (reference year #2), Radiology-KPIs "staff, material and infrastructure costs" were -22.2% (-21.4%), +16.9% (-7.4%) and -30.5% (-21.8%) compared with the InEK-cost-matrix-KPIs. The data translate into an annual cost advantage of several hundred thousand Euros to the benefit of Radiology which generated promising deadweight effects for the hospital.

Conclusion: KPIs of Radiology with patient ward and direct coding/billing responsibility that offers the full spectrum of IR are extremely promising. We believe that major explanations are the highly specialized services - ranging from diagnosis over treatment to aftercare provided by one hand with optimized workflow, information flow and transparency - that result in high patient satisfaction and connection. In the future, more hospitals may utilize this concept as adjustment screw to maintain competitive edge.

P-107

A new clinical care pathway for the management of acute spinal compression fractures: early experience and preliminary results

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Purpose: To present our experience developing and introducing a new clinical care pathway (CCP) for the management of acute spinal compression fractures (ASCFs) in a tertiary referral university teaching hospital receiving more than 300 ASCF referrals annually. ASCFs are the most common fragility fractures. They are associated with decreased mobility and quality of life and with increased morbidity, mortality and risk of future fragility fracture. There is no established CCP for ASCFs, 65% of which are undiagnosed and undertreated.

Materials and Methods: The ASCF CCP was developed by a multidisciplinary team involving orthopaedics, interventional radiology, ED, primary care, anaesthetics, orthogeriatrics, local trauma coordinators and administrative staff with the primary aims of reducing hospital admissions, length of stay and readmission rates and with the secondary aims of increasing access to bone health assessment, community physiotherapy and where

appropriate, early vertebroplasty. The ASCF CCP was introduced for a 3 month trial period from January 2021-March 2021.

Results: Primary and secondary outcomes from January-March 2021 with 90 day follow up are compared with June-September 2020. In June-Sept 2020, 64 patients were referred with ASCF. 53% were admitted to hospital with an average length of stay of 9.7 days. 31% had osteoporotic blood work-up. In the 90 day follow up period 32% had a further fracture and 10% developed ASCF complication.

Conclusion: We have demonstrated the significant burden ASCFs represent from both individual patient and healthcare systems' perspectives. We anticipate that this CCP will prove an important early step towards improving the management of this complex condition.

P-108

Day case procedures in interventional radiology

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Purpose: To demonstrate the rationale for broadening the remit of day case procedures in Interventional radiology (IR), and report our successful implementation of this approach.

Materials and Methods: Retrospective observational study of procedures performed as day cases in our centre.

Results: Between April 2015 – March 2021 we performed 148 ultrasound guided microwave ablations for Hepatocellular carcinoma (HCC) with a high proportion as day cases. Between January 2020 and March 2021 we performed 33 Transarterial chemoembolisation procedures, many as day cases in part due to increased hospital pressures secondary to COVID. We discuss our patient and procedure selection.

Conclusion: Providing selected procedures in selected patients in a 'day case' model allows increased efficiency and, in light of the COVID 19 pandemic, reduced risks to patients.

Many IR procedures such as TACE and ablation of liver HCC can be performed safely as day cases.

P-109

The role of intravascular ultrasound (IVUS) in interventional radiology

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Learning Objectives: To illustrate the versatile utility of IVUS in Interventional Radiology

Background: Intravascular ultrasound (IVUS) is an imaging technique that uses a small transducer mounted on the tip of a catheter to image the internal architecture of vessels thereby gaining deeper insights into the lesion and enabling treatment tailored to the characteristics of the lesion.

Clinical Findings/Procedure Details: A 9Fr Phillips Volcano PV 0.035 IVUS catheter was used in a wide range of procedures including central and iliac venous reconstruction, AV fistula treatment, Transjugular Intrahepatic Portosystemic Shunt (TIPS) deployment / revision and peripheral arterial intervention. IVUS was also used in situations where contrast administration was contraindicated and where accurate stent deployment was mandatory.

Conclusion: The VIDIO study by Gagne et al showed that IVUS is more sensitive for assessing iliofemoral venous stenosis compared to venography and frequently led to revised treatment plans and improved clinical outcomes. IVUS is a useful adjunct to conventional angiography and aids in portal vein access during TIPS and precise stent deployment.

P-110

Genicular artery embolization for osteoarthritic pain in the veteran population

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Learning Objectives:

- Etiologies, therapeutics, and challenges treating veterans with knee pain
- Launching a new treatment program within a large government health system
- Early experiences treating veterans with GAE

Background: Osteoarthritis (OA) is the leading cause of disability amongst service members. Veterans have double the rate of OA, and experience chronic pain in greater frequency and severity compared to non-veterans. Additionally, veterans often have medical comorbidities that preclude surgery, and, as a result, frequently suffer from chronic uncontrolled knee OA pain. The Veterans Health Administration is the largest integrated health care system in the United States, serving approximately 9 million people. Introducing new programs in this large government system presents specific challenges. This exhibit discusses lessons learned from successfully launching a genicular artery embolization (GAE) service in a Veterans Administration hospital (VAH).

Clinical Findings/Procedure Details: A query of VAH providers who prescribe knee injections was performed. Information regarding GAE was provided to these providers and VAH orthopedic surgeons. Challenges include provider and patient education, establishing referral processes, pre-approval for intra-arterial use of imipenem/cilastatin, obtaining appropriate catheters, and longitudinal follow-up. Each patient underwent a standardized workup for GAE. Ten out of 11 patients are non-surgical candidates with pain refractory to conservative management. Average body mass index of patients is 42.0 +/- 10.4. On average after GAE, patients (n=3) experienced a 7-point reduction in their reported pain score on a scale of 10.

Conclusion: Veterans disproportionately suffer from uncontrolled severe knee OA. Launching a GAE service line in the VA is challenging but is needed in this underserved population.

P-111

Practice-based algorithm for perioperative management of antiplatelets and anticoagulants in non-emergency percutaneous procedures

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Learning Objectives: To standardise information regarding required discontinuation of anticoagulants and antiplatelets prior to image-guided interventions in elective and non-emergency cases, to avoid delays and use of additional resources to revert coagulation parameters; facilitate planning and scheduling of procedures; orientate referring specialties, reducing need for additional discussions.

Background: Management of anticoagulants - antiplatelets in patients undergoing image-guided interventions is complex due to the wide range of procedure, patient demographics, drug therapies and comorbidities. While the evidence level behind decisions to suspend these agents pre-procedurally is low, some recommendations are available. Nevertheless, at local level, many departments do not have dedicated policies and rely on individual discussions for each case: therefore, variations in practice due to operator preferences exist.

Clinical Findings/Procedure Details: An algorithm for anticoagulants - antiplatelet discontinuation was developed following literature search in March 2020 comprising Medline, CINAHL, EMBASE, Cochrane Library, using relevant keywords in the title, abstract and subject descriptors: anticoagulant, antiplatelet, percutaneous, image-guided, intervention.

The so created flowchart was improved after local departmental discussion. A laminated poster was made available in the IR department and an electronic copy uploaded onto the local hospital intranet.

Conclusion: The newly created flowchart was found to be a positive implementation (analogue scale 1-5) with a mean 4.7 (SD 0.5) after anonymised survey filled by IR consultants (n 7), IR nurses (n 11), radiographers (n 11) and doctors of other specialties (n 9). As a quality improvement project for clinical practice, it has facilitated the referral and scheduling process of our IR department with very good effect.

P-112

Intraoperative nerve monitoring and image-guided interventional radiology procedures

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Learning Objectives: To describe the use of intraoperative nerve monitoring as a tool to prevent iatrogenic peripheral nerve injury during vascular embolization and thermal ablation procedures.

Background: Intraoperative Nerve Monitoring (IONM) includes a group of electrophysiological modalities that can be used to provide intraoperative assessment of the integrity of neural structures to prevent iatrogenic nerve injury. Recently, IONM has been used during thermal ablation of tumors and vascular malformation embolization procedures.

Clinical Findings/Procedure Details: Neurophysiologists use several modalities to stimulate and measure responsiveness of at-risk neural pathways. IONM includes somatosensory evoked potentials (SSEPs), motor nerve conduction studies (MNCSs), and transcranial motor evoked potentials (TcMEPs). SSEPs monitor sensory pathways and MNCSs monitor peripheral motor nerve integrity. When, in some cases, a proximal stimulation point cannot be accessed, TcMEPs can be used as an alternative to MNCSs when monitoring the integrity of motor pathways. Alert criteria for IONM have been formulated by the American Clinical Neurophysiology Society and the American Society of Neuromonitoring, and vary by modality. The interventional radiologists can be guided to avoid further embolization/ablation in each region as soon as signal changes occur. Knowing when to abort can limit long-term nerve damage. For high flow arterio-venous malformation (AVM) embolization, provocative testing using IV lidocaine may be able to predict a negative impact on nervous structures prior to definite treatment with sclerosing agents and avoid nerve damage altogether.

Conclusion: IONM is a neurophysiologic technique that should be adopted by IR providers during high-risk interventional procedures to minimize iatrogenic nerve injury.

P-113

Interventional radiology techniques for percutaneous retrieval of intravascular foreign bodies

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Learning Objectives: To illustrate the main techniques currently applied for percutaneous retrieval of intravascular foreign body, providing a simplified tool with different interventional possibilities, adaptable to different clinical situations.

Background: The presence of an intravascular foreign body represents a well-known risk of serious complications. Since 1964, a variety of endovascular techniques and devices have been developed and used to approach this clinical situation, such as loop snares, baskets, balloon catheters, grasping forceps, and tip-deflecting wires. Nowadays, a percutaneous approach in the retrieval of an intravascular foreign body is widely accepted as the first-line technique. While surgery is usually proposed as a second treatment option.

Given the wide range of possible intravascular foreign body and endovascular devices, a preoperative multidisciplinary team discussion with a preliminary diagnostic imaging evaluation is mandatory, in order to choose the most appropriate method and technique for each patient with intravascular foreign body.

Clinical Findings/Procedure Details: The aim of this poster is to describe, in a schematic and valuable way, the main endovascular materials and techniques for intravascular foreign body retrieval, in order to provide the operator with a clear range of options that can be used in this peculiar setting.

Conclusion: In most cases, intravascular foreign bodies represent a challenging clinical situation. Therefore, a good knowledge of materials and techniques for intravascular foreign body percutaneous removal allows performing the procedure with higher technical and clinical success.

P-114

Putting parallax into practice with simulation-based training

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Learning Objectives: To understand the principles of parallax in relation to interventional radiological (IR) procedures through simulated practice.

Background: Fluoroscopic-guided needle placement using principles of parallax is a core competency requirement under the CIRSE training curriculum.

Historically, use of parallax was particularly common for biliary and urological interventions. However, advancements in and greater reliance upon ultrasound guidance have diminished the regular use parallax for more basic procedures.

Nevertheless, parallax remains a vital skill for a range of more complex but less frequently encountered procedures, ranging from difficult biliary punctures, transjugular intrahepatic portosystemic shunt (TIPS), and sharp central venous recanalisation.

Parallax is often not intuitive to the new IR trainee and simulation offers a safe and non-time pressured means for practice, prior to performing on a patient.

Clinical Findings/Procedure Details: In this educational poster, we will present:

An overview of the principles of fluoroscopic-guided needle placement with parallax, using a series of instructional videos and animations.

An example of a low cost, homemade simulator, and how simulation training can be used to practice parallax and guide needle navigation.

Clinical examples of IR procedures where parallax can be applied.

Conclusion: Fluoroscopic-guided needle navigation with parallax is a vital skill for interventional radiologists. Low-cost homemade simulators can help new trainees gain confidence in the use of parallax before application in real-life case scenarios.

P-115

Radial access for neurointerventional procedures: how to shorten the learning curve with a workflow chart

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Learning Objectives: The focus of this educational work is to help shortening the learning curve for those centers now approaching with

trans radial access (TRA) for Neurointerventions. We present anatomical considerations and management in multiple TRA procedures organized in a workflow chart.

Background: Large randomized trials have shown a significant morbidity and mortality decrease with the TRA over the transfemoral access (TFA). However, this approach is not routinely used by Neuroradiologists due to unfamiliarity with this access especially for lack of experience. In our single center with almost 2 years experience and more than 100 cases we identified the challenges that we encountered in our learning curve and how we ended up solving them. We mixed our experience with a careful review of the literature comparing techniques and tips and tricks of other centers.

Clinical Findings/Procedure Details: We evaluated whether each type of Neurovascular procedure was suitable for TRA and described how we managed it creating a detailed workflow chart that summarizes our actual modus operandi. Starting with the patient selection for each specific procedure analyzing the anatomy of the arch with the angio CT. Then the radial artery (RA) access site (pulsatility, diameter of the RA); patient preparation (position, pharmacological) and choice of the patient/procedure related materials (introducer sheath, catheters, wires, specific devices).

Conclusion: Our experience showed that TRA is a valid approach to the majority of Neuro vascular procedures; however the learning curve should be shortened avoiding failures and complications. We provided a workflow chart we think could be useful for those now embracing this promising approach.

P-116

Application of organ displacement techniques in interventional radiology: pictorial review

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Learning Objectives: To evaluate the utility and effectiveness of organ displacement techniques to facilitate safe access for image-guided percutaneous interventions

Background: To overcome several technical challenges in percutaneous procedures, different protective methods have been developed to limit risk of complications like hemorrhage, bowel perforation, non-target organ injury, and pneumothorax. The most frequently used techniques like hydrodissection, carbodissection and balloon interposition can potentially create "windows" for access to challenging lesions in percutaneous biopsy and can physically separate sensitive structures, reducing risk of thermal injury to surrounding structures in percutaneous ablation.

Clinical Findings/Procedure Details: Procedure details:

Organ displacement was performed using the following equipment: 20-gauge Chiba needle (Cook Medical), IV extension tubing, a 10-mL Luer-lock syringe and Armada PTA balloon (Abbott Vascular). Under CT guidance, the 20-gauge needle tip was positioned adjacent to the targeted structure and 0.9% saline or 5% Dextrose with non-ionic contrast solution was injected based on the procedure until satisfactory fluid deposition and displacement is achieved. Under fluoroscopy guidance balloon displacement technique was used in ablation to protect adjacent non -target critical structures.

Conclusion: Organ displacement techniques described above are effective in providing safe access for image guided percutaneous interventions.

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Interventional radiology in infants, children and adolescents: part I with "transarterial treatments"

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Learning Objectives:

-To bring Interventional Radiology in infants, children and adolescents into focus

-To demonstrate that Interventional Radiology in the aforementioned collective is feasible, safe and effective

Background: In the field of Pediatric Radiology, different societies describe potential solutions for "optimizing the quality of care," "intensifying education and training," and "increasing public awareness". In regards of aforementioned issues, the German Society of Pediatric Radiology combines hope for further development as soon as possible (Mentzel H et al. RoFo 2020; 192: 531). To what extent Interventional Radiology as a friendly discipline can provide support shall be aim of this two-part pictorial review.

Clinical Findings/Procedure Details: In this part I, the pictorial review contains "transarterial treatments" that have been performed in patients ≤16 years of age. Detailed information about patient history, indication, technique as well as technical and clinical outcome and follow-up are presented. The following five "transarterial treatments" are outlined: pharmacomechanical recanalization in patient #1 (4-month old) with acute thrombotic occlusion of the transplant hepatic artery, embolization of an arterio-portal fistula in patient #2 (2-year old) with uncontrolled malabsorption, EVAR in patient #3 (13-year old) with traumatic aortic dissection and hemorrhage, intraarterial DOTATOC-therapy before radical oncologic resection in patient #4 (14-year old) with metastasized pancreatic cancer, and repetitive balloon-angioplasty and pharmacomechanical recanalization in patient #5 (16-year old) with repetitive stenosis and thrombosis of an aortobirenal bypass due to mid-aortic syndrome.

Conclusion: In infants, children and adolescents, different types of "transarterial treatments" are feasible, safe and effective. Completion of this work is done in part II with "percutaneous and transvenous treatments".

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Interventional radiology in infants, children and adolescents: part II with "percutaneous and transvenous treatments"

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Learning Objectives:

-To bring Interventional Radiology in infants, children and adolescents into focus

-To demonstrate that Interventional Radiology in the aforementioned collective is feasible, safe and effective

Background: In the field of Pediatric Radiology, different societies describe potential solutions for "optimizing the quality of care," "intensifying education and training," and "increasing public awareness". In regards of aforementioned issues, the German Society of Pediatric Radiology combines hope for further development as soon as possible (Mentzel H et al. RoFo 2020; 192: 531). To what extent Interventional Radiology as a friendly discipline can provide support shall be aim of this two-part pictorial review.

Clinical Findings/Procedure Details: In this part II, the pictorial review contains "percutaneous and transvenous treatments" that have been performed in patients ≤16 years of age. Detailed information about patient history, indication, technique as well as technical and clinical outcome and follow-up are presented. The following five "percutaneous and transvenous treatments" are outlined: thoracic duct embolization in patient #6 (7-month old) with postoperative chylothorax, percutaneous drainage in patient #7 (2-year old) with periprosthetic collection after open aortic repair, PTCD in patient #8 (3-year old) with cholangiosepsis, RFA in patient #9 (4-year old) with osteoidosteoma, and pulmonary artery embolization in patient #10 (15-year old) with hemoptoe and hemorrhagic shock.

Conclusion: In infants, children and adolescents, different types of "percutaneous and transvenous treatments" are feasible, safe and effective. In synopsis with part I "transarterial treatments" it becomes clear that Interventional Radiology has potential to play an increasingly important role in the interdisciplinary management of patients ≤16 years of age.

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IR department workflow in COVID-19 pandemic

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Learning Objectives:

1. To discuss the precautions to be taken by the Intervention Radiologists while managing patients in Covid-19 Pandemic.

2. To discuss the precautions while intervening in patients affected with COVID-19 Pandemic.

3. To discuss about various guidelines to be followed in low and high risk intervention procedures in COVID-19.

4. To discuss about methods of disinfecting instruments/ work place used for Intervention in COVID-19 Pandemic

Background: COVID-19 Pandemic has shaken the background of global health care system. Among Radiologists, the Intervention Radiologists are at the greatest risk of contracting the infection themselves, being mostly in contact with the patients.

Clinical Findings/Procedure Details: An explicit review of guidelines to be followed in Intervention Radiology department in COVID-19 Pandemic is presented. Precautions to be taken while performing low as well as high risk Intervention procedures are discussed. Guidelines for performing bedside Intervention Radiology procedures are outlined. After performing any procedure on patients affected by COVID-19, the guidelines for cleaning ultrasound probe/ machine and cath lab are discussed. Correct methods of wearing personal protective equipment are discussed as well

Conclusion: Intervention Radiologists are at maximum risk of contracting COVID-19 infection from the patients among Radiologists. Appropriate guidelines customized for each Intervention Radiology department should be strictly adhered with in order to limit the spread of COVID-19 infection.

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COVID-19 and MIS-C, a year in review: global contributions of interventional radiology to the care of adult and pediatric patients

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Learning Objectives:

-Demographic, clinical and radiographic findings of the SARS-CoV2 virus (COVID-19)

-General demographic, clinical and radiographic findings of Multisystem Inflammatory Syndrome in Children (MIS-C)

-Supportive interventions performed within the Adult IR department

-Supportive interventions performed within the Pediatric IR department

-Novel procedures, algorithms and clinical roles managed by IR

Background: Following discovery of novel SARS-CoV-2 in Wuhan, China in December 2019, the subsequent spread of severe respiratory and inflammatory symptoms has changed the way we live our lives and in turn deliver healthcare. With rapid rise to pandemic status, and hospitals in cities around the world rapidly surpassing capacity, physicians and health care workers across disciplines were tasked with providing supportive care, optimizing limited inpatient/ICU occupancy, and mitigating mortality of COVID-19 and MIS-C patients.

Clinical Findings/Procedure Details:

-Anesthesia/Sedation Trends

-Trend to minimally invasive alternatives preferred due to droplet and anesthesia risk (Cholecystostomy vs Cholecystectomy)

-Central Venous Catheter Placement

-Pleural Drainage

-IVC Filter Placement

-Thrombolysis/Thrombectomy

-Novel Uses of IR

Conclusion: Internationally, interventional radiologists play a unique and important role in the service of COVID-19 and MIS-C patients. Innately minimally invasive approach, ability to perform procedures without general anesthesia, and flexibility to offer procedures at the bedside, cements IRs role as a critical service line in the unique clinical setting created by this global pandemic.

Reflection on the early and continuous contributions by IR to the care of patients with COVID-19 and MIS-C will help to inform innovation in caring for patients in future emergencies and adapting to continuously evolving clinical needs.

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Transarterial chemoembolization in hepatocellular carcinoma assisted by super-transient embolizer-the autologous blood clots to preserve the non-tumor feeding artery

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Clinical History/Pre-treatment Imaging: A 71-year-old male who was a hepatitis B carrier and had under went multiple times TACE. HCC in S7 liver dome was found by follow up CT.

Treatment Options/Results: The HCC tumor vessels from right inferior phrenic artery (IPA) was suspected. On concerning the anticoagulation effect of heparin, which will enter the patient inadvertently after TACE started, we prepared the blood clots before puncture and divided it into 1ml syringes. Small caliber tumor vessels from right IPA root was found in DSA. After superselection the superior branch of right IPA and no tumor stain was found, we embolized it with blood clots. Besides, it was injected with pure contrast to prevent heparin effect. After confirmed the major IPA was occluded, we performed TACE in right IPA root. The follow up DSA showed total obliteration of tumor stains and resolution of blood clots. The non-targeted right IPA was patent and preserved. Besides, the total procedural time was < 2 hours without complaint of epigastralgia, which is often seen during IPA embolization.

Discussion: See take-home points

Take-home Points: The pre-procedural prepared blood clots play a role as super-transient embolizer which can preserve non-targeted vessels, reduce the procedural time and increase patient's satisfaction.

Beware the anticoagulation effect of the heparinized saline which entered into patient inadvertently.

The blood clot is more easily to be formed in smaller syringe.

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Off-label covered stent-graft repair of bilateral common carotid artery pseudoaneurysms

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Clinical History/Pre-treatment Imaging: A 52-year-old woman with cardiac ischemic disease, COPD, in regular hemodialysis program and atrial fibrillation, noticed growing neck masses 2-weeks after chiropractic manipulation. Examination showed bilateral hard pulsating masses. No history of recent fever or jugular catheters, blood cultures and auto-immune study normal. Computed tomography angiogram

revealed bilateral common carotid false aneurysms with thrombus: left with 56x53mm and right with 33x32mm.

Treatment Options/Results: She was treated with a BeGraft® 10x57mm covered stent in the left carotid and a VBX® 7x79mm in the right carotid 2-months later through femoral puncture and after cerebral protection device placement. Bilateral distal overdilation with a larger balloon was performed due to endoleak in an area of calcification, with minor endoleak at the end of the procedure.

1-year follow-up revealed stent patency with bilateral external carotid artery occlusion, with thrombosed right aneurysm with 13x17mm and left aneurysm with 28x45mm. No symptoms of jaw claudication or other complications. The patient kept apixaban and clopidogrel.

Discussion: Common carotid artery pseudoaneurysms are rarely seen with no report of bilateral carotid pseudoaneurysms and must be considered in the presence of cervical swelling. They should be treated due to the risk of rupture and embolization. Conventional surgery is preferred.

Take-home Points: This case shows that endovascular repair can be a minimally invasive long-term efficient treatment for carotid aneurysms without serious compression symptoms, especially in patients with multiple comorbidities. Covered flexible stent-grafts might be used off-label safely in carotids. An oversize balloon might be needed for good apposition, especially in calcified or tortuous vessels.

Dialysis intervention and venous access

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Radial and ulnar artery angioplasty as stand-alone management and also in conjunction with concomitant venous stenosis in dysfunctional haemodialysis arteriovenous autogenous distal fistulas: our experience

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Purpose: To show our experience in donor artery angioplasty in dysfunctional haemodialysis arteriovenous autogenous distal fistulas.

Materials and Methods: During the past fifteen years we prospectively analyzed 110 dysfunctional distal fistulas (103 radial-cephalic and 7 ulnar-basilic) that showed lesions in the donor upper-arm artery which were treated by endovascular techniques. Mean age of fistulas was 30 months (range:0-264 months). Thirteen immature fistulas (11,8 %) were treated prior to the need for dialysis therapy. The main reason for dysfunction was low flow and/or arterial collapse (n:54;49 %). To reach arterial territory, the most frequent approach was the retrograde puncture of the vein (n:100; 91 %). Median follow-up was 36 months, with a range of 1 month to 162 months.

Results: A total of 274 stenosis (110 arterials with 164 concomitant perianastomotic and/or distal anastomotic veins) were treated. Flow measurement changed from 293 ml/min. pre angioplasty (range:0-1200) to 518 ml/min. post angioplasty (range:100-1500). There had been failures to cross four arteries with severe calcifications (3,6 %). At 6, 12, 24 and 36 months, respectively, primary patency rates +/- standard errors of the estimate were 83% +/- 4, 63% +/- 6, 37% +/- 6 and 26 % +/- 5; secondary patency rates were 90% +/- 3, 79% +/- 5, 55% +/- 6 and 40% +/- 6. Eighty-one fistulas (77%) were functional at the end of the follow-up.

Conclusion: Endovascular therapy for arterial lesions in autogenous distal haemodialysis arteriovenous fistulas is safe, with low rates of technical failure and good patency rates.

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Cephalic arch stenosis treatments and its clinical implications in the failing haemodialysis access

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Purpose: In the settings of arteriovenous accesses, stenoses at the cephalic arch pose are challenging; cephalic arch stenosis (CAS) occurs in over 70% of brachiocephalic fistulas. While stent grafts (SG) superiority in treating CAS is known, many centres still use plain balloon angioplasty (PBA) as first-line treatment.

Materials and Methods: Analysis on individual interventions of SG and PBA to evaluate success, rupture rates, primary patency (PP); separate cumulative analysis for access to calculate post-intervention assisted primary patency (PAPP). Multivariate analysis performed with Cox regression for individual interventions. For PAPP, Kaplan-Meier model to compare PBA and SG groups. In both models, the event was defined as loss of access, tunnelled central vein insertion or switch to alternative access, peritoneal dialysis. Censorship applied to ongoing use, death and renal transplant. A p value <0.05 was significant.

Results: 96 patients (99 accesses) underwent 192 interventions between 2009-2020. SG had higher rate of success (<30% residual stenosis), 93.8% vs 61.7% in PBA (p<0.001). Rupture occurred in 10/114 (8.8%) PBA cases, none in SG (p<0.001). SG had better PP than PBA (75% vs 64% at 6/12, p>0.05). For PAPP, SG group (n47) had 574 median days, PBA (n51) 217 days (p=0.001). However, accesses stented after first PBA intervention performed better than primary CAS stenting (PAPP 311 median days vs 92 days, p=0.1).

Conclusion: CAS is a difficult condition to manage. While SG are superior to PBA, our findings suggest that many other factors related to inflow and conduit characteristics play a role in access longevity and viability.

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Success rate and complications of angioplasty in patients with cardiac pacemaker without lead extraction: a single tertiary center experience in Saudi Arabia

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Purpose: To assess the safety and effectiveness of the central venous angioplasty in patients with central venous occlusion and implanted cardiac electronic devices without lead extraction.

Materials and Methods: A retrospective study was used to evaluate the effectiveness of 37 central venous angioplasty procedures for 16 patients with implantable cardiac electronic devices without lead extraction.

Results:

- Technical success was achieved in 95% (n= 35/37) and Clinical success was achieved in 89% (33/37).
- One procedure failed recanalization of chronic total occlusion of the left subclavian vein, and the patient required fistula embolization due to severe arm swelling.
- Another procedure failed initially to recanalize long segment occlusion involving the right SCV/BC and SVC in a patient with a history of Hickman line and left-sided CIED. This was successfully recanalized and angioplastied on a subsequent session.
- No lead fracture or dislodgment was documented in any procedure.
- No procedure-related complication was documented within two weeks after the angioplasty. Six-month primary patency was achieved in 62% (23/37) of the procedures. Ten patients (66%) required an average of 1.4 reinterventions (range 1-4 interventions) during the follow-up time with a mean time to reintervention of 318 days (5-1380 days).
- Two patients required early re-intervention within 10 days due to catheter dysfunction

Conclusion: The findings of this study support the existing evidence on the safety and effectiveness of balloon angioplasty without lead extraction.

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Endovascular declotting of thrombosed AVF and AVGs: a systematic review and meta-analysis

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Purpose: Access thrombosis is a major complication of haemodialysis arteriovenous fistulas and grafts. Endovascular therapy has largely replaced surgery and has become the mainstay treatment in recent years. Endovascular therapy however consists of a wide variety of techniques which can be classified into thrombolysis-dominant and thrombectomy-dominant procedures. The aim of this systematic review and meta-analysis was to evaluate and compare the effectiveness and safety of thrombolysis-dominant and thrombectomy-dominant interventions.

Materials and Methods: This review was conducted in accordance with the PRISMA guidelines. Pooled proportions and subgroup analysis were calculated for primary and secondary patency rates, technical success, clinical success, major and minor complications rates.

Results: The systematic searching of three databases identified a total of 6492 studies of which 14 studies were included for analysis after review. A total of 1035 patients comprising of 426 (41%) and 609 (59%) patients who underwent thrombolysis-dominant and thrombectomy-dominant procedures respectively were analysed. There were no significant differences between thrombolysis-dominant and thrombectomy-dominant procedures in technical success, clinical success, major and minor complications rates. No significant differences were also observed in the 3-months, 6-months and 12-months primary and secondary patency rates between thrombolysis-dominant and thrombectomy-dominant procedures. Subgroup analysis of AVF and AVG however did report a significantly higher rate of major complications within the AVF group (p = 0.0248), but did not demonstrate significant differences in patency, technical success, clinical success or minor complications rates.

Conclusion: Our meta-analysis suggests that thrombolysis-dominant and thrombectomy-dominant procedures are similarly effective and safe. AVFs are however subjected to higher major complications compared to AVGs.

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Patency after endovascular stenosis treatment of dysfunctional dialysis access: dialysis center experience

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Purpose: To assess patency of dysfunctional hemodialysis vascular access (HVA) after endovascular stenosis treatment in a dialysis center.

Materials and Methods: From January 2015 to December 2020, 60 patients with malfunctioning arteriovenous dialysis accesses underwent endovascular stenosis treatment were retrospectively reviewed: 48 arteriovenous fistula (AVF) and 12 arteriovenous graft (AVG). Endovascular treatment was classified in percutaneous transluminal angioplasty (PTA) or PTA and drug-eluting balloon angioplasty (DEB) or angioplasty and stent. Patency of the HVA was considered time from endovascular procedure till last dialysis session.

Results: Anastomotic/perianastomotic stenosis was treated in 54 patients, venous outflow stenosis in 7 and central vein stenosis in 7. All patients with central vein stenosis also treated anastomotic/perianastomotic stenosis and 3 patients with venous outflow stenosis also treated anastomotic stenosis. The median patency of HVA after all endovascular treatments was 13 (0.03-43) months. No differences were observed when considering AVF or AVG patency. According to type of endovascular treatment, the median patency was 7,1 (0.3-35) months for PTA, 21,2 (2.9-43,1) months for PTA and DEB and 5,6 (0.03-27,1) months for stent, $p=0.0154$ Mann Whitney. **Conclusion:** In our experience, patency after PTA and DEB was superior than PTA alone. Stent placement should be also considered in selected cases.

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Recombinant tissue plasmin activator vs. urokinase to restore patency of occluded subcutaneous venous access devices (ports): a retrospective comparative study

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Purpose: To compare the efficacy of recombinant tissue plasmin activator (rtPA) and urokinase in restoring function to occluded subcutaneous venous access devices (ports).

Materials and Methods: Between 04/2016 and 01/2021, 208 patients were treated with either 2 mg rtPA ($n=102$) or 40.000 IU urokinase ($n=106$) after angiographic studies revealed port thrombosis. The thrombolytic was injected into the port and follow-up was conducted the following day. If the control showed residual thrombus, an additional dose of thrombolytic was applied. Endpoints of successful treatment were free aspirability and injectability of the port and the absence of thrombotic material around the catheter.

Results: Ports were freely injectable in 98% (rtPA) vs. 98,1% (urokinase) of cases and aspirable in 85,3% vs. 94,3% of cases ($p=0,03$). No difference between the rate of residual thrombus (25,5% vs. 25,5%) was observed.

When residual thrombus was present ports were significantly less often aspirable ($p=0,001$). Ports treated with urokinase were more likely to be aspirable in the presence of residual thrombus (57,7% vs 81,5%), though that difference was not statistically significant.

Implantation side or vessel had no effect on the success of the treatment. Patients across both groups were predominantly female (70,6% vs. 75,5%) and treated for gynecological tumors (31% vs 45%).

Conclusion: While comparable in restoration of injectability and rate of residual thrombus, urokinase leads to fully functioning, e.g. aspirable port systems than rtPA significantly more often.

Port thrombosis seems to be more frequent in women treated for gynecological cancers, though this is only an observation in this retrospective study.

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A new approach for preserving a safe and functional access in patients with dialysis-associated steal syndrome

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Purpose: To report the endovascular Banding with angioplasty of forearm arteries as an option for preserving a functional access in patients with dialysis-associated steal syndrome (DASS).

Materials and Methods: Between 1 January 2018 and 30 October 2020, eight patients underwent Endovascular 'Banding' with Angioplasty of forearm arteries for the treatment of DASS. Six patients presented with finger ulcerations and/or gangrene. The distribution of access types is as follows: 6 brachiocephalic AVFs, 2 brachiocephalic AVFs.

The first step in our technique consists of performing angioplasty of forearm arteries.

Then a banding of the proximal part of the fistula by four silk knots (a modified MILLER procedure) was performed for all our patients.

Results: Technical success was achieved in all procedures with total relieve of symptomatology and healing of amputation stump.

There were no bleeding complications. No infections have been reported at the cut down site. The average follow-up is 6.7 months, we have noted thrombosis of a single access.

Conclusion: Successful treatment of the DASS mandates that the surgeon recognize the disparity that exists between the resistances of the peripheral circulation and the fistula. We thought that the ideal intervention for DASS should result in prompt resolution of the steal symptoms with preservation of a functional AV access and the treatment of the distal arteriopathy in the same time.

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Long term fistula outcomes in a tertiary UK hospital

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Purpose: Our aim was to provide a minimum of 5 year follow up on all fistulas created in 2015 by reporting primary failure rates as well as primary patency, assisted primary patency and post intervention assisted primary patency rates for matured fistulas.

Materials and Methods: All fistulas created in 2015 were retrospectively reviewed through electronic patient records to identify which fistulas matured, any interventions carried out and when the fistula failed. Patients who died, underwent renal transplant or were switched to peritoneal dialysis were censored. Diabetic status and type of fistula created was also recorded.

Results: 102 fistulas were reviewed. Primary failure (failure to mature) was 22.5%, $n=23$. Majority of fistulas were brachiocephalic (47%, $n=47$), and these were most likely to mature (91%, $n=43$).

By the end of the 5 year follow up period, majority of matured fistulas were censored (63%, $n=50$) due to high number of deaths (44%, $n=35$) and transplants (35%, $n=28$).

Primary patency (time to intervention) of the 79 matured fistulas was 64% and 26.3% at 1 and 4 years respectively, with a median of 511 days. Assisted primary patency (time to failure) was 87.5% and 55.7% at 1 and 4 years, median of 1587 days. Postintervention assisted primary patency (time from intervention to failure) was 75.7% and 31% at 1 and 4 years, median of 642 days.

Conclusion: Access to dialysis on a "fistula first" basis confers significant challenges to clinicians, with primary failure rates comparable to those reported in the literature.

High numbers of deaths and transplants highlight the importance of censoring patients when measuring outcomes.

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Use of peripherally inserted central catheters in low GFR patients: a single institution retrospective study

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Purpose: To identify the rate of PICC placement in patients with chronic kidney disease (CKD) stage 3B or greater (glomerular filtration rate [eGFR] <45 mL/min/1.73 m²).

Materials and Methods: Retrospective study of 2825 adult patients (male 51.2%, female 48.8%) who had PICC insertion between Jan 2017 till Dec 2019. Collected data included gender, GFR value at the date of insertion, accessed vein and side, ongoing or subsequent dialysis, death within one year of the insertion date.

Results: PICC insertion was done in 26.7% (724/2709) with GFR value less than or equal 45mL/min/1.73m². Ongoing dialysis was documented in 10.2% (198/1946) and subsequent dialysis in 6.5% of patients during one year after insertion. The overall death rate during one year post PICC insertion was 38.7% (1094/2825) which was significantly higher in low GFR patients (413/724, 57%) compared to patients with GFR>45 mL/min/1.73m² (632/1985, 31.8%) [p value <.0001, odds ratio 2.84 (95% confidence interval 2.38-3.38)]. The rate of subsequent dialysis initiation during one-year post PICC insertion was 5.9% (98/1657). This was significantly higher in patients with GFR≤ 45 mL/min/1.73m² but not previously on dialysis (59/310, 19%) compared to patients with GFR>45 who required dialysis during one year post insertion (39/1347, 2.9%) [p<.0001, odds ratio 7.88 (95% confidence interval 5.14-12.07)].

Conclusion: PICC insertion in patients with CKD remains common in practice. More rigorous measures should be followed in order to better adhere to clinical practice guidelines and reduce the unnecessary insertions to preserve veins for future AVF creation.

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The successful hemodialysis arteriovenous fistula matures hemodynamically in seven days: noble wish or fact?

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Purpose: To assess ultrasonographic time-related alterations of selected hemodynamic and anatomic parameters during maturation of autogenous arteriovenous fistulae (AVF).

Materials and Methods: We conducted an observational prospective study (ClinicalTrials.gov identifier:NCT0473687) of consecutive patients referred to for AVF creation. The investigated variables were brachial artery lumen diameter(dBA), volume flow rate(VF), efferent vein lumen diameter(dEV) and vein wall thickness(tEV), assessed by ultrasound. Measurements were conducted daily in the first week and repeated at day 14, 21, 30, 60 and 90 after AVF creation. Points of interest included significant changes (and average values) of each parameter within consecutive measurements during follow-up. The time point at which each parameter reached its maximum value was also recorded

Results: 83 patients were initially enrolled (59 males, mean age 67±34 years). Three patients (3.6%) with primary AVF failure and 3 patients (4.8%) who underwent maturation assisted interventions were excluded from analysis (unassisted maturation rate, 91.6%). Measurements were completed in 76 AVF (45 brachiocephalic, 31 radiocephalic). Average dBA and

VF reached maximum on day 7 (5.64 ± 0.85mm and 1,039 ± 531ml/min, respectively) and did not alter significantly during follow up. Average dEV and tEV maximum values were observed on day 14 (5.82 ± 0.90mm and 0.493 ± 0.102mm, respectively), with non-significant changes thereafter. A constant ratio between tEV and dEV was observed during the maturation period for all AVF (0.08 ± 0.001).

Conclusion: Hemodynamic and anatomical response of the functionally mature AVF was completed by day 7 and for the arterial limb and the venous limb, respectively. These findings may contribute on decision making concerning timing of assisted maturation interventions, reducing catheter dependency time.

P-133

Identifying predictors for early primary stent reintervention in arteriovenous graft outflow stenting for dialysis access patients

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Purpose: An increasing number of patients utilise arteriovenous-grafts (AVG) for dialysis access. While reducing the requirement for central catheters, a common limitation is the formation of venous stenosis (VS) and thrombosis. Pre-thrombosis insertion of stent-graft is the preferred treatment, but the optimal sizing is uncertain. We aim to assess technical features of AVG-outflow stent placement and identify predictors of early primary stent re-intervention (PSR).

Materials and Methods: Patients from the local AVG database were assessed (n=80). Data included stent dimensions, position (juxta-anastomotic or in-graft) and outflow vein diameter. Clinically directed PSR was recorded. Statistical analysis was performed with chi-squared test.

Results: Patients with vein diameter at least 50% greater than the stent, had a 10.5% PSR rate within 6 months compared to 41% (p=0.014) if the stent more closely approximated the size of recipient vein. Where the stent extended from graft into vein, the PSR rate within 6 months was 23.8% versus 70.6% for those deployed in juxta-anastomotic position (p=0.003). Those with at least 100mm of stent deployed had a 6 month PSR rate of 30.6% versus 34.1% for shorter lengths (p=0.7).

Conclusion: Our data confirms variability in technique for AVG-outflow stenting and criteria which may influence durability of intervention including operator technique and anatomical features. Both the stent to recipient vein diameter ratio and anastomotic stent positioning demonstrated statistical significance in predicting reintervention. We propose that these can be investigated further to provide an evidence base for optimum venous outflow stenting technique.

P-134

Indigo System vacuum-assisted mechanical thrombectomy for the treatment of acutely thrombosed arteriovenous fistulas and grafts

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Purpose: The purpose of this study is to evaluate the safety and efficacy of the mechanical thrombectomy with the Indigo System in the treatment of acutely thrombosed arteriovenous fistulas and grafts.

Materials and Methods: A retrospective search of endovascular procedures performed from November 2018 to June 2020 was conducted. Inclusion criteria were acute arteriovenous fistula or graft thrombosis that underwent endovascular mechanical thrombectomy with Indigo System (Penumbra, Alameda, California).

The following information was collected: gender; age; fistula modality; fistula location; treatment modality and outcomes.

Definitions for success and patency were based on the Quality Improvement Guidelines for Percutaneous Image-Guided Management of the Thrombosed or Dysfunctional Dialysis Circuit.

Results: From November 2018 to June 2020, 26 procedures were performed in 22 patients (63% male, average 68 years).

Clinical and anatomic success was achieved in 23/26 cases (88%). Treatment of the underlying stenosis with percutaneous transluminal angioplasty was done in 25/26 cases. Covered stents were used in five cases (19%), three of them due to residual stenosis and two due to venous rupture after angioplasty. A low dose (0.5 – 10 mg) of recombinant tissue plasminogen activator (rtPA) was used in five patients during the procedure. No technical or device-related complications were observed.

Mean follow-up was six months. The 6-month primary, primary assisted and secondary patency rates were 71%, 86% and 93% respectively. The 12-month primary, primary assisted and secondary patency rates were 71%, 72% and 80% respectively.

Conclusion: Vacuum assisted mechanical thrombectomy of arteriovenous fistulas and grafts with Indigo System is safe and effective, providing good short-term patency rates.

P-135

Jet-I lysis free haemodialysis access thrombectomy: early case experience

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Purpose: To evaluate the safety and efficacy of Jet-i thrombectomy in treatment of thrombosed haemodialysis access.

Materials and Methods: A retrospective review of consecutive patients with thrombosed haemodialysis access who underwent Jet-I thrombectomy between December 2019 and March 2021 included. Demographics, access characteristics, procedural details, adjunctive therapies, outcomes and complications recorded.

Results: Fifteen procedures done in 13 patients (M:F = 6:7). 7 fistulae (7 patients, 3 radiocephalic, 3 brachiocephalic and 1 brachioabasilic) and 8 grafts (6 patients, 3 brachioaxillary, 3 femoral loop, 1 brachiocephalic interposition and 1 HeRo). Mean patient age was 62.9 years (27-85). The average time to intervention was 4.8 days (1-12 days). Technical success was achieved in 14 procedures (93.3%). Thrombus burden clearance was >95% in 13, 50-95% in 1, and <50% in 1 procedure. One technical failure (thrombus clearance <50%) had a thrombosed fistula for 12 days before the procedure. The underlying stenosis was treated with angioplasty in 11 instances and stent insertion in 6 instances. Thrombus clearance assistance in 8 procedures (53%) (balloon trawling in 7, tPA in 2 and mechanical thrombectomy in 1). Clinical success (1 or more successful dialysis) was achieved in 11 out of 14 procedures (78.6%). Minor complications (13.3%) include minor extravasation and late access site bleeding, both managed conservatively. The mean procedure time was 110.5 minutes with a mean fluoroscopy time of 16.3 minutes.

Conclusion: JETi thrombectomy in dialysis access occlusion is safe and effective and carries short procedural time and minimal/no thrombolytic agent use.

P-136

Transradial approach for malfunctioning hemodialysis access intervention: retrospective analysis of four years single-center experience

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Purpose: Interventions on malfunctioning hemodialysis access are classically performed with a direct puncture into the fistula. An alternative is the retrograde transradial approach (TRA), which offers the advantage of visualizing both the arterial and venous limbs as well as any juxta-anastomotic stenosis, all through one access. The purpose of this study is to evaluate the usefulness and safety of this approach.

Materials and Methods: From June 2016 to December 2020, 161 fistulograms were performed on 94 patients with clinical suspicion of malfunctioning hemodialysis access, 91 of which were TRA procedures in 63 patients, which we analyzed in a retrospective study.

Results: All the transradial punctures were successful.

Anatomic and clinical success was achieved in 92% of the cases. The post-interventional primary patency rates were 84%, 56% and 26% at 1, 6 and 12 months, respectively. The post-interventional secondary patency rates were 91%, 83% and 58% at 1, 6 and 12 months, respectively.

The complication rate was 3%. No major complications occurred. No transradial punctures resulted in perioperative radial artery thrombosis or postoperative clinical hand ischemia.

Conclusion: Treatment of malfunctioning hemodialysis access via a transradial approach was safe, and was associated with lower rates of complications. This approach may be particularly attractive for treatment of thrombosis and juxta-anastomotic stenoses.

P-137

Sharp recanalization of central venous occlusion in hemodialysis patients: a potpourri of clinical cases

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Learning Objectives:

- To provide an overview about the indications and tools of sharp recanalization technique for central venous occlusion in hemodialysis patients.
- To describe the different approaches to percutaneous sharp recanalization of the central venous occlusions using various clinical vignettes

Background: Central venous occlusions are developed frequently in patients on chronic hemodialysis. These occlusions can be symptomatic and associated with increased bleeding from the arteriovenous fistula after cannulation, upper extremity and facial swelling in addition to increased fistula thrombosis. Various international guidelines have recommended angioplasty as the preferred therapy for central venous stenosis/occlusion. Conventional intervention includes traversing the occlusion with a guidewire followed by angioplasty and stenting of the occluded venous segment. However, the conventional method can fail due to the difficulty in traversing the guidewire through the occlusion. To increase the success rate of angioplasty, sharp recanalization technique can be used. It basically based on using puncturing the occluded vein with a needle or sharp stiff wire allowing the wire to traverse through the occlusion and then performing angioplasty and stenting.

Clinical Findings/Procedure Details: The poster will pictorially review the sharp recanalization of central venous occlusions focusing on

- Clinical indications
- Selection of the sharp tool
- Relevant anatomical and technical issues illustrating helpful tips and tricks.

- Potential complications and management

Conclusion: The sharp recanalization technique is an effective alternative to conventional intervention failed in central venous occlusion as it facilitates the angioplasty and stenting of the occluded veins.

P-138

Image guided peritoneal dialysis catheter placement

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Learning Objectives:

1. Review the evidence and rationale for the placement and management of PD catheters by interventional radiologists
2. Outline the technique for image-guided peritoneal dialysis catheter placement
3. Identify the common complications following image-guided peritoneal dialysis catheter placement

Background: Peritoneal dialysis (PD) is a form of renal replacement therapy (RRT) used to treat patients with end-stage renal disease (ESRD). Although traditionally performed by surgeons, percutaneous image-guided PD catheter placement by interventional radiologists (IR) is becoming more commonplace. The demand for PD is anticipated to increase in the future, and IR is strategically situated to improve access to PD for patients with ESRD.

Clinical Findings/Procedure Details: We outline the preprocedural patient evaluation, image-guided insertion technique for percutaneous tunneled PD catheters as well as their optimal positioning. Comparative studies between an image-guided percutaneous approach and laparoscopic approach has shown a similar or slightly lower complication rate, faster patient recovery, and decreased cost with the former approach. Procedure specific complications such as inadvertent bowel puncture, infection and long term mechanical problems are discussed. Evaluation of complications of tunneled PD catheters such as migration, catheter kink and obstruction, and catheter leak can be evaluated in the angiography suite.

Conclusion: Percutaneous PD catheter placement by interventional radiologists is a cost effective, minimally invasive, and at least an equivalent alternative to traditional surgical placement of tenckhoff catheters via laparoscopy in patients with ESRD.

P-139

Thrombectomy devices in thrombosed hemodialysis arteriovenous fistulae

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Learning Objectives:

1. Overview of different thrombectomy devices in treating thrombosed arteriovenous fistulae.
2. Comparison of clinical outcomes, success and patency rates.

Background: Autogenous arteriovenous fistulas (AVFs) have been endorsed as the vascular access of choice in patients with end-stage renal disease.

AVFs thrombosis is the leading cause of permanent access loss. Salvage of thrombosed fistulas is essential and achievable with endovascular techniques including balloon maceration, catheter-directed / ultrasound-assisted thrombolysis and pharmacomechanical thrombectomy. Clinical success of declogging is achieved in 80%-90% of acutely thrombosed mature AVFs with primary patency rates 5%-50% at 6 months and 10%-20% at 1 year.

Clinical Findings/Procedure Details: Thrombectomy devices are used in declogging AVFs supplementing other techniques with the advantage of shortening procedure time and avoidance of lytic agents where contraindicated. Proper selection of material for patients aid in technical and clinical success and minimizing potential complications.

Mechanical thrombectomy devices can be broadly divided based on mechanism: hydrodynamic (AngioJet rheolytic system), rotational (Arrow-Terrotola percutaneous thrombectomy device, Aspirex and Cleaner) or vacuum-assisted (Indigo). A retrospective analysis by Yang et al showed that rotational mechanism is more time-saving with a higher immediate success rate and secondary patency rate. However, the long-term patency results were not different.

Conclusion: Percutaneous mechanical thrombectomy is a key element in declogging AV fistulas and can potentially reduce the procedure time and obviate the need for thrombolysis. The choice of device depends on several factors including efficacy, thrombus burden, cost, and operator experience.

P-140

IR to the rescue: the comprehensive role of interventional radiology with hemodialysis patients

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Learning Objectives:

To outline:

- The role of Interventional Radiology in securing tunneled and non-tunneled venous access for hemodialysis (HD) and sequence of access choice.
- The role of Interventional Radiology in cases of difficult venous access.
- The role of Interventional Radiology in troubleshooting malfunctioning existing venous accesses.
- The role of Interventional Radiology in treatment of central venous occlusion.
- The role of Interventional Radiology in creation of arterio-venous fistulas.
- The role of Interventional Radiology in treating malfunctioning arterio-venous fistulas.

Background: At the end of 2015, there were 687,093 people with End stage Renal Disease (ESRD) in the United States, defined in the US Renal Data System, and the incidence of ESRD is expected to increase in the coming 10 years. Interventional radiologists play an integral role in the management of hemodialysis patients, from securing temporary access for hemodialysis (HD) till the management of malfunctioning arterio-venous fistulas (AVFs) and grafts.

Clinical Findings/Procedure Details:

1. Choice of HD venous access.
2. Options in difficult venous accesses:
 - * Alternative access
 - Trans lumbar HD access
 - Transhepatic HD access
 - Intercostal HD access
 - * Recanalization of occluded veins
3. Trouble shooting malfunctioning venous access:
 - Thrombosis
 - Fibrin sheath
 - Stenosis
4. Management of central venous occlusion.
5. Image guided A-V fistula creation and follow up.
6. Management of thrombosed A-V fistulas/grafts.

Conclusion:

- IR plays an integral role in securing and troubleshooting venous access for HD patients.
- IR is now playing a role in creating A-V fistulas with non-invasive image guided methods
- IR plays a role in attempting to salvage thrombosed A-V fistulas/grafts.

P-141

Misplaced central venous line into vertebral artery: endovascular management of iatrogenic vertebral artery injury

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Clinical History/Pre-treatment Imaging: History

70 year old post oesophagectomy and gastric pull-up for cancer. Postoperative complication of pleural empyema with intensive care stay. 4 lumen central venous line placed in intensive care under ultrasound guidance.

Line blood arterial therefore CT scan was performed. Line traversed internal jugular vein and entered left vertebral artery directly at the level of C7. Line tip within the aortic arch. Patient transferred to interventional and neurointerventional radiology centre for removal of line.

Treatment Options/Results: Combined discussion between general and neurointerventional radiologists regarding approach.

Options:

- 1) Remove line and press, however likely thrombus, high risk of antegrade emboli and delayed pseudoaneurysm formation.
 - 2) Place covered stent, however high risk of occlusion +/- embolisation.
 - 3) Embolise vertebral artery via contralateral vertebral, however risk compromising patent vertebral/only posterior circulation supply.
 - 4) Embolise damaged left vertebral artery directly via misplaced central venous line, need to establish contralateral vertebral artery adequate.
- Option 4. Selective contralateral vertebral artery angiogram adequate. Coil embolisation of left vertebral artery performed via misplaced line with temporary balloon occlusion of left subclavian artery preventing antegrade flow.

Discussion: Removal of misplaced line with successful occlusion of damaged artery. No evidence of distal cerebral embolisation at time of procedure.

Patient slow to regain consciousness. MRI head - subacute left cerebellar infarct. No brain stem infarct.

Take-home Points:

- 1) Central venous line placement requires adequate US skills.
- 2) Iatrogenic vertebral artery injuries are rare; with any treatment main aim is to prevent posterior circulation embolisation.
- 3) Treatment should be multi-disciplinary and tailored to individual injury.

P-142

Challenging endovascular treatment of a cephalic arch stent fracture in brachiocephalic arteriovenous fistula

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Clinical History/Pre-treatment Imaging: A 49-year-old female with end-stage renal disease via right upper extremity brachiocephalic fistula presented with mild swelling of her upper extremity. Two years previously, she underwent placement of a balloon expandable stent in the cephalic arch.

US Duplex showed decrease of the fistula flow, with severe stenosis of the cephalic arch.

Treatment Options/Results: The angiogram showed a fracture of the stent with migration of the proximal part in the humeral vein. After several attempts, we cross the two segments of the stent. We had a rupture of the first balloon during its inflation, so we have used a 7 mm scoring balloon to dilate the cephalic arch. After prolonged inflation, we were able to have an acceptable result with reappearance of a good thrill.

Discussion: The use of stents to treat recurrent cephalic arch stenosis has been increasing due to low primary patency rates of balloon angioplasty and an increasing body of evidence demonstrating superior patency rates of stents. Despite appropriate sizing and accurate deployment of the stent,

central stent fracture and migration may result in jailing of the axillary vein. Relative mobility of the cephalic arch segment and external compressional forces from the clavicopectoral and deltopectoral fasciae may contribute to stent fracture and migration.

Take-home Points: The long-term risk of stenting in such tortuous region is the fracture of stent with stenosis or thrombosis of the vascular access, for this we don't recommend stent the cephalic arch. Drug eluting balloons are a good alternative to stenting in such cases

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Endovascular removal of a dislodged Supera stent from a dialysis access arterio-venous graft

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Clinical History/Pre-treatment Imaging: A 61-year-old female patient with multiple vascular access issues underwent creation of Left Brachio-Basilic tapered arteriovenous graft. The graft subsequently became thrombosed and the patient underwent thrombolysis and deployment of a 4.5mm x 6.0 cm Supera™ stent at the arterial inflow site. The patient underwent several thrombolysis procedures before the sentinel event when the stent was inadvertently dislodged by retrograde balloon trawling.

Treatment Options/Results: Retrograde trawling of the arterial limb was performed with 5.5F Fogarty balloon (Edwards Lifesciences). The arterial limb stent was noted to be dislodged. Initial attempts to retrieve stent with a snare were unsuccessful. The stent was then secured using a pair of Jawz™ Endomyocardial biopsy forceps (Argon Medical Devices) and collapsed into an 8F sheath and removed intact.

Discussion: Explantation of dislodged or damaged stents typically involve snares or balloons. If unsuccessful, open surgical explantation is usually the only option available.

Take-home Points: This case study represents successful first in kind, off label use of the endomyocardial biopsy forceps for retrieval of a Supera™ stent via an endovascular approach.

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Transcatheter approach for recanalization of chronic central venous occlusion with inside-out system for hemodialysis access

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Clinical History/Pre-treatment Imaging: We report a case of a 71-year-old male patient with malfunctioning translumbar catheter for hemodialysis with central venous occlusion (CVO) of bilateral innominate veins. The patient was referred to interventional radiology department for recanalization of occluded right brachiocephalic vein with inside-out system for hemodialysis access.

Treatment Options/Results: After right femoral vein puncture, collateralized occlusion of right external iliac vein was verified, without any possibility to recanalize from antegrade approach, so left femoral vein was cannulated and large bore inside-out catheter was tried to advance through tortuous anatomy of left iliac vein with no success. Crossover recanalization of occluded right external iliac was futile.

As last option we catheterized right sided collateral from contralateral approach and were able to cannulate it under fluoroscopy. After predilatation, 14Fr guiding sheath was successfully advanced into vena cava inferior and afterwards blunt recanalization was accomplished with Surfacter inside-out system followed by tunnelled catheter placement and withdrawal of translumbar catheter. After 3 months, catheter patency is with no issue.

Discussion: Revascularization of chronic total vein occlusion is critical for patient survival, especially in patients with multiple exhausted dialysis

access. In our case we were able to gain vascular access through transcollateral approach in patient with excessive CVO and so demonstrate feasibility of inside-out revascularization technique.

Take-home Points: Inside-out catheter system may be a useful tool in recanalization of CVO in patients with exhausted conventional dialysis access even in unfavorable anatomy through transcollateral approach.

P-145

First case of totally percutaneous arteriovenous dialysis fistula made in Treviso General Hospital

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Clinical History/Pre-treatment Imaging: A 77 years old male patient requiring hemodialysis was admitted to the Interventional Radiology Unit after a clinical and Doppler Ultrasound evaluation made by a dedicated Nephrologist in our Institution.

This patient wasn't suitable for a traditional arteriovenous surgical Radio-Cephalic fistula since he didn't have a proximal Cephalic vein in the wrist where the surgical fistula should be made.

Treatment Options/Results: The patient had good diameter (> 2mm) radial comitans (deep veins running parallel to the radial artery). He did have a good perforating vein (connecting the deep venous system to the superficial venous system) in the proximal tract of the forearm close to the site of the Fistula we wanted to create.

Discussion: After an accurate selection we enrolled this patient for a totally percutaneous arteriovenous fistula made with WavelinQ EndoAV (BD). The system has 2 catheters one placed through the radial artery and the other through the biggest radial comitans. Those two catheters had magnets to attract each other and markers to orient them properly. Under fluoroscopy the two catheters were aligned and once in the correct position we generate a radiofrequency burst that created a channel between the radial artery and the adjacent deep vein. We injected contrast medium from the radial artery to check the fistula which had an excellent immediate split flow and provided a great output to the cephalic and basilic veins at 10 days follow up.

Take-home Points: In very selected patients unsuitable for traditional surgical radio cephalic fistula this totally percutaneous technique seems to be a good option.

Embolotherapy (excluding oncology)

P-146

Efficacy, safety and outcomes of transcatheter arterial embolisation with n-butyl cyanoacrylate glue for non-variceal gastrointestinal bleeding: a systematic review and meta-analysis

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Purpose: We performed a systematic review and meta-analysis of published studies to assess the efficacy, safety, and outcomes of transcatheter arterial embolisation (TAE) with N-butyl cyanoacrylate (NBCA) for the treatment of non-variceal gastrointestinal bleeding (GIB).

Materials and Methods: A literature search using MEDLINE/PubMed, EMBASE, and SCOPUS databases was performed for English-language studies published from January 1980 to December 2019 and including patients who had TAE with NBCA for non-variceal GIB. Technical success, clinical success, 30-day rebleeding, 1-month overall and major complications, and 30-day mortality were evaluated. The estimated overall rates were calculated with their 95% confidence intervals, based on each study rate, weighted by the number of patients involved in each study.

Results: Fifteen studies with 574 patients were included. For upper GIB (331 patients), the technical success rate was 98.8% (95%CI, 97.1%-99.7%) and the clinical success rate was 88.0% (77.5%-95.5%). Thirty-day rebleeding and 30-day mortality rates were 12.5% (4.8%-23.2%) and 15.9% (8.3%-25.3%), respectively. One-month overall and major complications occurred in 14.3 % (2.8%-32.6%) and 2.7% (0.6%-6.1%) of patients, respectively. For lower GIB (243 patients) the technical success rate was 98.8% (95%CI, 95.3%-99.9%) and the clinical success rate was 78.0% (68.3%-86.3%). Thirty-day rebleeding and 30-day mortality rates were 15.7% (11.2%-20.8%) and 12.7% (0.7%-36.1%), respectively. One-month overall and major complications occurred in 13.0 % (3.8%-26.7%) and 8.6% (3.4%-15.8%) of patients, respectively.

Conclusion: TAE with NBCA is safe and effective for treating non-variceal GIB, with a high clinical success rate and very low major complication rate.

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Role of transcatheter endovascular embolization in non-operative management of high-grade blunt hepatic trauma and incidence of post-traumatic complications

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Purpose: Evaluate feasibility, safety and clinical efficacy of selective hepatic artery endovascular embolization in hemodynamically stable patients with high grade liver blunt trauma (AAST>III)

Materials and Methods: Between January 2018-January 2021, we retrospectively considered 38 patients (24M-14F; medium age: 38) with blunt trauma of abdomen and liver injury, all of them hemodynamically stable. All injuries studied by CT of abdomen and classified considering AAST-grades: (22)III, (11)IV, (5)V. We considered for each patient: percentage of hemoglobin value lowering, presence of vascular lesions, such as pseudoaneurysm and/or arterio-venous fistula, the entity of hemoperitoneum, and the evidence of contrast blush on CT. All patients underwent selective endovascular embolization of hepatic artery and embolic agents used were: coils, PVA, Gelfoam. We considered as success of procedures the absence of active bleeding at post-embolization angiogram and at follow-up CT of abdomen, with significant improvement of serum hemoglobin values, and as complications related to procedures the rebleeding rate, the incidence of hepatobiliary complications related to hepatic trauma during follow-up and the rate of eventual subsequent liver resections

Results: In 34 patients (90%) selective hepatic artery embolization was successful, with no evidence of rebleeding at follow-up and significant improvement of serum hemoglobin values, while 4 patients (10%) died during follow-up: 2 for hemorrhagic shock after the embolization and the other 2 because of trauma complications of multiple systems. Among the 34 surviving patients, 4 (12%) developed hepatobiliary complications: hepatic abscess in 2 patients, biloma in 1 and perihepatic fluid effusion in 1. All the hepatobiliary complications were successfully managed by image-guided percutaneous drainage; none of the patients underwent hepatic resection

Conclusion: Endovascular embolization is feasible, safe and clinically effective in high grade blunt liver injuries, not only to stop bleedings, but also to reduce the rate of hepatic resections and hepatobiliary complications related to hepatic trauma

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Successful endovascular treatment of intercostal arterial bleedings

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Purpose: To assess effectiveness of endovascular embolization of intercostal iatrogenic and traumatic arterial bleedings

Materials and Methods: Retrospective analysis of 30 patients over a period of 6 years (January 2015-January 2021) with evidence of active bleeding and hemothorax/extra-pleural hematomas detected by MDCT. Etiology was traumatic in 16 cases, iatrogenic in 14. These findings were confirmed by angiography, afterwards the patients underwent endovascular embolization. Technical success was meant as absence of arterial blushes at the final angiographic control, clinical success as recovery of clinical-laboratoristic parameters

Results: The preliminary study of vascular anatomy achieved with MDCT simplified angiographic catheterism of intercostal arteries involved. Microcoils were used in all cases, 3 patients underwent a second angiography with PVA embolization because of the presence of collateral feeders supplying the bleeding. Technical success rate was 100%, clinical one was 91%. 30-day mortality was 12% because some patients arrived in very critical conditions and were affected by other comorbidities. No complications were observed during and after the procedures. In 33% of cases patients needed a surgical evacuation of hematomas

Conclusion: Endovascular embolization is a valuable, safe and effective treatment for intercostal bleedings and should be considered as a valid alternative to surgical approach

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Splenic artery embolization after delayed splenic rupture following blunt trauma: is non-operative management still an option in this cohort?

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Purpose: Delayed presentation after blunt splenic trauma is usually the result of delayed splenic rupture (DSR). There are numerous guidelines to help guide management of blunt splenic trauma. However, many of these don't include delayed rupture as part of their recommendations for non-operative treatment due to insufficient evidence surrounding the use of splenic artery embolization (SAE) for this cohort of patients.

Materials and Methods: This single-centre retrospective study assessed the outcomes of patients who were treated with SAE greater than 48 hours after the blunt injury for DSR. There were 232 patients during the 10-year time-period from 1 January 2009 to 1 January 2019 and 34 underwent SAE for DSR.

Results: SAE was performed on a median injury grade of AAST 4.5 at a median of 4.5 days after the injury (range 2-28, IQR 5.5). This included 61.8% treated between days 2-5, 23.5% days 6-10, 2.9% days 11-15, and 11.8% after day 15. Technical success was achieved in 100%. Proximal embolization was used in 29 (85.3%) and pushable coils in 31 (91.5%). 32 patients achieved splenic salvage (94.1%) at a median follow-up time of 11.48 months (range 0.23-116.23, IQR 30.7). There were 3 re-bleeds and 2 went on to splenectomy.

Conclusion: Treatment with SAE after DSR for high-grade injuries results in a high rate of splenic salvage even when using predominantly proximal embolisation and with low-cost pushable coils. Major guidelines may consider the evidence behind delayed treatment when providing updated treatment recommendations, with subsequent positive benefits for long-term preservation of immune function after splenic salvage.

P-150

Prostate artery embolization (PAE) in patients who previously failed minimally invasive urological surgical treatments for lower urinary tract symptoms: technical feasibility, safety, and outcomes

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Purpose: To describe the technical feasibility, safety, and outcomes of prostate artery embolization (PAE) in patients who have previously undergone urological procedures for the treatment of lower urinary tract symptoms (LUTS).

Materials and Methods: In a retrospective review, ten patients (mean age 65.4 years; range 48-78) with benign prostatic hypertrophy (BPH) who previously underwent urological MIST with a recurrence of LUTS (mean IPSS 24.4) who subsequently underwent PAE at our institution were identified. Medical records were reviewed for post-MISTs course, pre- and post-IPSS / QOL scores, procedure details, and post-PAE clinical course.

Results: 10 patients were identified who had return of LUTS after urological procedures. 5 of these patients had no relief of symptoms from MIST. All patients had an enlarged prostate (86.2 mean grams, range 65-120 grams) with a mean IPSS score of 24.4 +/- 4.55 (range 15-29). Bilateral prostate artery embolization via a transradial (5 patients) or transfemoral (5 patients) approach was technically successful in all cases (100%). At initial follow up (mean 35 days post procedure), all patients reported improvement in their LUTS with IPSS scores decreasing by 16.9 (range 6-24) and quality of life scores improved by 3.3 (range 1-5). No major complications were experienced by patients.

Conclusion: Regardless of prior urological procedures for BPH-induced LUTS, including those that leave behind foreign bodies such as prostatic urethral lift needles, PAE is technically feasible, safe and effective.

P-151

Balloon-occluded retrograde transvenous obliteration (BRTO) of gastric varices using foam sclerosant and a reduced balloon inflation time: feasibility and efficacy

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Purpose: Balloon-occluded retrograde transvenous obliteration (BRTO) is performed for secondary prevention of gastric variceal bleeding, as an alternative to TIPS. However, there is significant heterogeneity in how BRTO is performed, including how and how long to occlude the outflow venous shunt amongst other variables such as variceal size, flow rate, agent used, and preparation technique. We propose a method using foam sclerotherapy and reducing balloon occlusion to as little as 30 min, with assessment of the efficacy of this shorter balloon inflation time.

Materials and Methods: Retrospective single-centre analysis of BRTO procedures between July 2015 and February 2019 for isolated gastric varices in a non-acute setting, where inflation time was 2 h or less.

Results: Six patients underwent BRTO with a short inflation time, with a mean age of 66 years. The median balloon inflation and thus 3% atoxysclerol foam contact time was 30 min (range 30-60 min). Four of the 6 patients showed complete resolution of varices, while 2 of the 6 showed a partial response. Mean follow-up was 27 months. There were no patients who did not show a response to treatment and no episodes of clinically significant upper gastroin- testinal bleeding.

Conclusion: This technique using a shortened balloon occlusion time resulted in complete or partial clinical and technical success in all patients and suggests that the threshold for initiation of gastric variceal thrombosis may be below 30 min. This timepoint may provide a balance between adequate balloon inflation, angiography room efficiency and hospital resource allocation with resultant procedural cost implications.

P-152

The role of combined therapy with foam sclerotherapy and coil embolization in the treatment of varicocele after microsurgical repair failed in pediatric patients: phlebography findings and clinical-radiological results

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Purpose: To assess the safety and clinical and radiological outcomes in pediatric patients of combined therapy with foam sclerotherapy in the most distal region of the pampiniform plexus and coil embolization of the spermatic vein in the treatment of varicocele after the microsurgical repair failed.

Materials and Methods: A total of 18 patients who had previously undergone varicocele surgery on the left side were referred to our Unit during a 48-month period between January 2016 and February 2019; in all cases a subinguinal microscopic approach had been performed 12 months previously. All procedures were performed in the interventional radiology suite, with support from the anesthetic team.

Results: All procedures were performed to the management of recurrent varicocele following suprainguinal spermatic vein ligation in pediatric patients.

Combined therapy with coil embolization and foam sclerotherapy was used in every case. The immediate technical success rate was 100% and there were no intraprocedural complications.

Conclusion: Combined therapy with foam sclerotherapy and coil embolization is effective in the treatment of recurrent varicocele in pediatric patients who have failed suprainguinal spermatic vein ligation, since it allows embolization of collateral and redundant vessels and may have certain advantages over other therapeutic options. The careful study of the phlebographic findings can help us understand why in some cases the microsurgical approach has failed in patients with high collaterally of venous drainage.

P-153

Trans-hepatic embolization with bleomycin-Lipiodol mixture under CT fluoroscopy guidance for giant hemangioma

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Purpose: Giant hepatic hemangiomas can cause treatment required complications, which the best treatment method is still controversial. The purpose of this study is to determine the safety, efficacy, and rule of

trans-hepatic embolization with Bleomycin-Lipiodol Mixture (B/L) under CT fluoroscopy guidance for treatment of giant hepatic hemangioma.

Materials and Methods: between 2018 and 2020, trans-hepatic embolization with B/L under the guidance of CT fluoroscopy done for 22 giant hemangiomas. The follow-up was carried with contrast-enhanced MRI at one month and an average of 15 months. Desired response defined as at least 50% reduction in volume or at least 25% reduction in index size on imaging and improvement in pain intensity. The visual analog scale (VAS) used to describe pain intensity before and in the last imaging session.

Results: 55% of patients had a reduction of at least 50% in volume and 46% of patients had a reduction of at least 25% in index size of hemangioma in the final study up. There was a significant reduction in the mean pain intensity. No major complications were seen except for subcapsular B/L leakage during injection in 4 patients. The average length of hospitalization and average duration of intervention time was 4 hours and 17 minutes, respectively. The average total effective dose (ED) and fluoroscopy (ED) were 3.132 mSv and 0.451 mSv, respectively.

Conclusion: CT fluoroscopy-guided trans-hepatic embolization is an effective, safe, and minimally invasive method.

P-154

A comparison of 300-500micron vs 100-300 plus 300-500micron permanent microspheres in patients with long term urinary catheters treated with prostate artery embolization (PAE)

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Purpose: Audit of clinical practice comparing the use of 100-300 plus 300-500micron (Group 1) vs 300-500micron permanent microspheres (Group 2) in achieving long-term urinary catheter independence following prostate artery embolization (PAE).

Materials and Methods: Retrospective analysis of patients undergoing PAE with urinary catheters treated with either 100-300 plus 300-500micron (Group 1, n=18), or 300-500micron permanent microspheres (Group 2, n=18). Long-term catheter independence was evaluated.

Results: 36 patients were audited. There was no significant difference between age (median 78 (62-93)), prostate volume (mean=175ml), and time with catheter (mean=7.6months) between the two groups. Catheter independence at a median follow-up of 35 days (range 13 – 367 days) was 72.2% and 87.5% for Group 1 and 2 respectively (p>0.05). Complications for Group 1 were 2 simple urinary tract infections, and 1 case of spontaneously resolving penile pain. In Group 2, one patient had a femoral access site haematoma, treated conservatively.

Conclusion: PAE is a safe and effective procedure for achieving long-term catheter independence. There was no significant difference in catheter removal when using either 100-300 plus 300-500micron (Group 1) or 300-500micron permanent microspheres (Group 2).

P-155

Factors associated with symptomatic neurologic complication due to a solitary pulmonary arteriovenous malformation

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Purpose: To evaluate factors associated with symptomatic neurologic complication due to a solitary pulmonary arteriovenous malformation (PAVM).

Materials and Methods: Between February 2004 and December 2020, 76 consecutive patients were diagnosed with a solitary PAVM by CT. Fourteen of the 76 patients had symptomatic neurologic complication (neurologic group), and all 14 patients had ischemic stroke. The remaining

62 patients had no neurologic symptom (control group). Medical records and CT images were reviewed, and the relationships of the following factors to symptomatic neurologic complication were compared between the two groups: sex; age; presence of hereditary hemorrhagic telangiectasia (HHT); location of PAVM (upper or middle lobe vs lower lobe); type of PAVM (simple vs complex); size of feeding artery; size of sac; and sac-to-feeding artery ratio.

Results: There was no difference in sex, age, presence of HHT, location of PAVM, and type of PAVM between the two groups. The median size of the feeding artery of the neurologic and control groups was 4.6 and 3.2 mm, respectively ($p = 0.012$). The median size of sac of the neurologic and control groups was 11 and 6.8 mm, respectively ($p = 0.0087$). In addition, the median of sac-to-feeding artery ratio of the neurologic and control groups was 2.5 and 2.0, respectively ($p = 0.045$).

Conclusion: The size of the feeding artery and sac of PAVM and the sac-to-feeding artery ratio may be associated with symptomatic neurologic complication due to a solitary pulmonary arteriovenous malformation.

P-156

Using intraoperative nerve monitoring to minimize iatrogenic peripheral nerve injury during embolization of high-flow vascular malformations

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Purpose: To assess intraoperative nerve monitoring's efficacy as a method to minimize iatrogenic peripheral nerve injury during embolization of high-flow vascular malformations (HFVM).

Materials and Methods: The authors retrospectively derived a study cohort of 21 symptomatic patients (mean age 25.4±17 years; range 2–65 years) with peripherally located HFVM who underwent 80 image-guided endovascular (53/80 sessions) or percutaneous (29/80 sessions) embolization sessions performed between 2012 to 2021.

Results: The mean clinical and image follow-up durations were 34.1±28.6 months and 36.2±28.9 months (range: <1 – 91.4 months). Peripheral sensory nerve activities were monitored by somatosensory evoked potential (SSEP; N=72 sessions). Motor nerve activities were monitored by transcranial motor evoked potentials (TcMEP; N=35 sessions) or motor nerve conduction studies (MNCS; N=33 sessions). Intraoperatively, monitored nerve signal abnormalities were observed in 46.4% (32/69) of SSEP, 17.1% (6/35) of TcMEP, and 34.4% (11/32) of MNCS recording sessions. Of the IONM sessions with a signal abnormality, signal recovery was noted in 11.4% (3/26) SSEP, 40% (2/5) TcMEP, and 28.6% (2/7) MNCS sessions. The overall complication rates were 29% (10/35 sessions) for ethanol and 5% (2/44 sessions) for non-ethanol embolization, and the observed difference is statistically significant (P -value= 0.004). Non-neurologic (minor) complication rates were 20% (7/35 sessions) for ethanol and 2% (1/44 sessions) for non-ethanol embolization (P -value= 0.019). Transient neurologic complications were observed in 11% (4/35 sessions) of ethanol and 2% (1/44 sessions) of non-ethanol embolization sessions (P -value= 0.165). No patient developed a major or permanent neurologic complication.

Conclusion: IONM may improve the safety of embolization of HFVM by preventing permanent neurologic injury.

P-157

Carbon dioxide-enhanced angiography for obscure lower gastrointestinal bleeding

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Purpose: Transcatheter arterial embolization (TAE) is an important treatment for lower gastrointestinal bleeding. However, bleeding is sometimes obscure in angiography using iodinated contrast media. In this study, we evaluated usefulness of carbon dioxide-enhanced angiography for obscure lower gastrointestinal bleeding.

Materials and Methods: Fourteen patients, 9 males and 5 females, with a median age of 76.5 years (range, 36–88), underwent this procedure between October 2015 and June 2020. In all patients, extravasation was confirmed by contrast-enhanced CT. However, bleeding was not visualized in angiography with iodinated contrast media. Location of the angiography was as follows: the right colic artery in 6, sigmoidal artery in 4, and ileocolic, middle colic, left colic, and superior rectal arteries in one each. Immediately after the angiography, the carbon dioxide-enhanced angiography was performed at the same location.

Results: In 8 of 14 cases (57%), extravasation was visualized in the carbon dioxide-enhanced angiography, and then TAE was performed. In the remaining 6 cases, extravasation was not visualized. In 3 of the 6 cases, however, extravasation was observed in angiography with iodinated contrast media after the carbon dioxide-enhanced angiography, and then TAE was performed. Conservative treatment was performed in the remaining 3 cases. There was no complication related to the carbon dioxide-enhanced angiography.

Conclusion: Carbon dioxide-enhanced angiography appears to be useful for obscure lower gastrointestinal bleeding.

P-158

Intraoperative neurophysiologic monitoring to minimize iatrogenic peripheral nerve injury during embolization of low-flow vascular malformations

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Purpose: To assess the efficacy of intraoperative neurophysiologic monitoring (IONM) as a method to minimize iatrogenic peripheral nerve injury during embolization of low-flow vascular malformations (LFVM)

Materials and Methods: With IRB exemption and HIPAA compliance, we derived a study cohort of 49 patients with LFVMs including venous malformation (VM), lymphatic malformation (LM), and mixed vascular malformations (MVM) treated with percutaneous embolization using sclerosants such as Ethanol, Sotradecol, Bleomycin, and Doxycycline (LM) performed from 2004–2019 and who received IONM for lesions that are adjacent to one or more peripheral nerve(s)

Results: In the study cohort of 49 patients (mean age 30.1±2.3 years, range 5–71; 61% female). The mean follow-up was 5.56±3.8 years (range <1–14.8 years). VM constituted 74% of the lesions, while 17% were LM and 4% were MVM. Including re-treatments, 84 sessions were performed with a total of 319 sites treated. Intraoperatively, abnormal neurophysiologic findings were noted in 35% (29/84) of treatment sessions and 9.5% (8/84) of all sessions were terminated prematurely due to significant electrophysiologic changes. Ethanol was the sclerosant used in all early terminated sessions. The overall complication rate was 3.6% (3/84). Minor non-neurologic complication rate was 2.4% ($n = 2/84$, superficial skin burn). One patient, 1.2% (1/84) of sessions, developed transient facial

muscle weakness that resolved without additional treatment. No patient developed major complications or long-term neurologic impairment

Conclusion: Intraoperative neurophysiologic monitoring may improve the safety of low-flow vascular malformation embolization by providing a real-time assessment of any ongoing damage and preventing irreversible peripheral nerve injury

P-159

Shape memory polymer vascular plugs

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Purpose: To determine the safety and efficacy of a shape memory polymer-based vascular plug for peripheral vasculature embolization.

Materials and Methods: A prospective, single-arm, first-in-human study at a center in New Zealand. The IMPEDE Embolization Plug is a pushable embolization device comprising a shape memory polymer plug, a distal nitinol and platinum/iridium helical anchor coil, and a proximal radiopaque marker. Shape memory polymer is a porous, space-filling embolization technology, engineered to exist in two stable shapes. The porous polymer is crimped into a compressed shape for catheter delivery. Upon exposure to the warm, aqueous environment of a blood vessel, the polymer self-expands to its original shape and offers a porous scaffold that supports stable clot formation, followed by cellular infiltration and tissue ingrowth.

Results: Ten patients with an average age of 59 years were implanted with the study device. Vessels embolized include an internal iliac artery, profunda artery branch, inferior mesenteric artery, subclavian artery, accessory renal artery, and testicular vein. No serious adverse events related to the study device and/or procedure were observed through 30 days post-procedure. Acute technical success was achieved in all cases where an IMPEDE Embolization Plug was fully deployed into the vasculature, and vessel embolization was achieved. No patients experienced recurrent clinical symptoms for the original complaint needing vessel embolization, through 30 days post-procedure.

Conclusion: The small study demonstrated the safety and efficacy of the IMPEDE Embolization Plug to embolize vessels in the peripheral vasculature. Further experience and longer-term follow-up will assess long-term outcomes.

P-160

Two-step splenic artery embolization for management of symptomatic sinistral portal hypertension: a 10-year experience

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Purpose: There is currently no consensus concerning the treatment of sinistral portal hypertension (SPH), the purpose of this study is to explore the long-term outcomes and safety of splenic artery embolization (SAE) to treat SPH.

Materials and Methods: This retrospective study included 39 SPH patients who received SAE treatments between August 2009 and May 2019. All of them were detected with esophageal, gastric or ectopic varices by endoscopy or enhanced CT scan, and had symptoms or signs of upper gastrointestinal (GI) bleeding and (or) postprandial fullness. In all patients, 17 received 2-step complete SAE procedure, 19 received only the first step of 2-step protocol, namely, partial splenic embolization (PSE) procedure, the other 3 patients received 1-step complete SAE procedure. Symptom control rates, complications and symptomatic recurrence rates were observed and analysed after the treatments.

Results: All the procedures were performed successfully. After the procedures, the symptoms of all patients disappeared quickly, and the main complications were post-embolization syndromes, 27 patients (69.2%)

developed low-grade fever, 24 (61.5%) developed abdominal pain and 4 (10.3%) developed nausea or mild vomiting. During the long-time follow-up, varicose veins gradually reduced detected by enhanced CT scan, liver function parameters and platelet count were maintained in the normal range, only 1 patient who received PSE treatment developed upper GI rebleeding 7 months after the procedure.

Conclusion: This study confirmed the long-term efficacy and safety of SAE treatment for SPH, Two-step complete SAE procedure might be able to reduce the risk of complications.

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Transarterial embolization of external carotid vascular district haemorrhages: preliminary results with ethylene-vinyl alcohol copolymer (onyx)

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Purpose: The purpose of this study is to review the performance of ethylene-vinyl alcohol copolymer (Onyx), a liquid embolic agent, in the treatment of acute bleeding from the external carotid district in terms of safety and effectiveness.

Materials and Methods: 16 transarterial embolization of external carotid artery district haemorrhage, performed using Onyx, were retrospectively reviewed. Inclusion criteria were a positive angiographic study for bleeding (contrast extravasation or the detection of an aneurysm/pseudoaneurysm) from the external carotid vascular district where an attempt of embolization with only Onyx-18 or Onyx-34 was performed. Onyx-18 was used in 11 cases, Onyx-34 in 4 cases and in only 1 case both Onyx-18 and Onyx-34 were used. Technical and clinical success, bleeding recurrence and complications rate were analyzed.

Results: Causes of hemorrhage included neoplasm n=8 (50%), idiopathic n=7 (44%) and trauma n=1 (7%). Oropharyngeal bleeding were treated in 44%, epistaxis in 31%, hematemesis/hemoptysis in 19% and hematoma in 6% of the cases.

Technical and clinical success were 100% and 88% respectively. Two patients died due to poor general conditions: both patients were suffering from advanced stage erosive cancer. Only one patient re-bled within the first 48 hours and it was successfully re-treated with tamponade. There were no major complications, such as cerebral or intestinal ischemia, or deaths attributable to the treatment.

Conclusion: This series showed that transarterial embolization with Onyx is a safe and effective treatment for patients with intractable external carotid hemorrhage.

P-162

How to perform transarterial embolization for transient- or non-responders with splenic injury in blunt trauma?

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Purpose: To clarify the difference in strategy of transarterial embolization (TAE) due to hemodynamics with regards to splenic injury.

Materials and Methods: This is a retrospective single-center study of 17 patients who underwent emergency TAE for splenic injury from January 2011 to December 2020. Of 17 patients, 11 were transient- or non-responders, 6 were responders. We examined the technical success rate, clinical success rate and mortality. We investigated proximal/distal embolization and embolic agents for transient- or non-responders in comparison to responders. Fisher's exact test were performed; $p < 0.05$ was indicated a significant difference. Statistical analysis was performed using R (3.2.3).

Results: Technical success rate was 100%. Clinical success was 82.4%, in detail, rebleeding was 2 in 11 transient- or non-responders and 1 in 6 responders. One (5.9%) non-responder died due to portal vein injury instead of TAE success. Proximal embolization was significantly higher in transient- or non-responders (63.6% vs. 0%, $p = 0.03$). Using N-Butyl-2-cyanoacrylate (NBCA) for embolic agent was significantly higher in transient- or non-responders (54.5% vs. 0%, $p = 0.04$).

Conclusion: Proximal embolization and using NBCA should be considered in transient- or non-responders with splenic injury after blunt trauma.

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Proximal splenic embolization versus distal splenic embolization for management of arterial injuries of the spleen

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Purpose: To compare the clinical outcomes of proximal versus distal splenic artery embolization for management of distal vascular splenic injuries secondary to blunt splenic trauma.

Materials and Methods: All patients who underwent splenic artery embolization for arterial injuries (such as active haemorrhage, pseudoaneurysm or AV fistula) from January 2009 to January 2019 were included. Patients where a tandem embolization was performed or those that demonstrated no acute vascular injury on angiography were excluded. Patient demographics, injury type/ AAST grade (1994 and 2018 classifications), technique of embolization and outcomes were collected. Complications and any splenectomy during a 30-day follow up period were recorded.

Results: Two-hundred and thirty-two patients who underwent SAE were identified. One-hundred and thirty six patients had an embolization performed for a distal vascular injury including active arterial bleeding, pseudoaneurysm or arteriovenous fistula during the study period. Mean age was 41 (range 16-84). Mean AAST grade was 4 (range 3-5). Mean injury severity score was 22. pSAE was performed in 79.4% (n=108) and dSAE was performed in 20.6% (n=28). Major complications occurred in 12 patients (pSAE n=12, 11.1%; dSAE n=0, $p>0.05$), 6 of whom required splenectomy (P n=6, 5.6%; D n=0, $p>0.05$). Overall, there was no significant difference in outcomes between the two groups as a whole or when based on AAST grading.

Conclusion: Proximal embolisation is non-inferior to distal embolisation for patients with a distal vascular injury. Where rapid haemostasis is needed or where selective distal embolisation cannot be achieved, practitioners could consider the benefits of a quick yet technically and clinically efficacious proximal embolisation location.

P-164

Penile arterial anatomical variants and incidence in 27 cases of non-ischaemic priapism

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Purpose: Priapism is defined as a prolonged erection persisting (>4 hours) in the absence of sexual stimulation. Non-ischaemic priapism (NiP) is the least common subtype (5% of cases) and is almost exclusively seen after perineal injury leading to intracorporeal arterio-venous fistulation (AVF). If conservative management fails, transarterial embolization of the AVF is recommended. Appreciation of the highly variable angiographic anatomy of the penis is required to effectively embolise penile AVFs.

Materials and Methods: All distal Internal Pudendal Artery (IPA) catheter digital subtraction angiograms (DSA) from patients who underwent embolization for NiP (2004 and 2019) were reviewed by 2 Vascular Interventional radiologists. Droupy Classification of penile anatomy, intrapenile arterial anatomical variants and source of AVFs were recorded.

Results: 41 distal IPA DSAs reviewed.

24 AVFs were in the crura; 2 at penoscrotal level and 1 patient had additional bulbar AVF.

Number of embolisations required to achieve detumescence was: 1 (13 cases); 2 (7 cases); ≥3 (4 cases).

Classical anatomy was only seen in 27%

73% patients had Droupy 2 classification Accessory pudendal artery (APA) most commonly arising from prostatic/obturator arteries

50% had Transverse root collaterals (TRC)

51% had Accessory Cavernosal arteries (ACa)

An ACa fed the AVF in 13 cases (54%)

An APA fed the AVF in 8 cases (33%)

Conclusion: We observed a higher frequency of APAs than published in literature (73% vs 33%). This is thought to be due to increased penile perfusion secondary to presence of AVFs. Appreciation of variant anatomy, especially TRCs (seen in 50%) is imperative when planning embolisation.

P-165

The quality reserve of digital variance angiography in prostatic artery embolization

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Purpose: In previous clinical studies focusing on lower limb interventions, Digital Variance Angiography (DVA) provided higher contrast-to-noise ratio (CNR) and better image quality than Digital Subtraction Angiography (DSA). Our aim was to investigate whether the previously reported quality reserve can be observed also in Prostatic Artery Embolization (PAE) procedures.

Materials and Methods: The retrospective observational study enrolled 30 patients (mean ± SD age 68 ± 12, range 58-87 years) undergoing PAE at our institution between May and October of 2020. Altogether 104 acquisitions were included in the analysis. DSA and DVA images were generated from the same raw series. The CNR values were calculated, and the image quality was evaluated by 3 experienced readers in a randomized blinded survey, using a 5-grade-Likert-scale. Data were expressed as median and interquartile ranges (IQR) and analyzed by the Wilcoxon signed-rank test.

Results: DVA images provided 4.1 times higher CNR than DSA images, the median (IQR) CNR values were 29.5 (19.5-45.4) and 7.2 (4.9-11.1), respectively, $p<0.001$. DSA images received significantly higher Likert score than DSA images, the median (IQR) values were 4.33 (4.00-4.67) and 3.67 (3.00-4.00), respectively, $p<0.001$.

Conclusion: Our data show that DVA, compared to DSA, has significantly higher CNR and enhanced image quality also in PAE procedures. This quality reserve of DVA might provide an opportunity for the reduction of radiation exposure and/or iodinated contrast media in PAE, however, the validation of these dose management capabilities requires further clinical studies.

P-166

Do different embolisation techniques make a difference in outcomes of hepatic arterial embolisation for acute haemorrhage?

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Purpose: To evaluate the efficacy of different embolisation techniques employed in hepatic artery embolisation for acute haemorrhage.

Materials and Methods: A search for "hepatic angiogram" & "embolisation" on Radiology Information System was performed. Episodes of hepatic arterial embolisation for acute haemorrhage between October-2015 to September-2020 were included. Angiographic images, pre- and post-procedure imaging and radiological reports were retrospectively reviewed. Patients' demographic and clinical parameters were collected from electronic medical records. Statistical analyses were performed using IBM®SPSS®26.0.

Results: 66 patients underwent at least one attempted hepatic arterial embolisation (HAE) for acute haemorrhage during the study period. Median age was 62.5 years. Total of 72 HAEs were performed. Majority of cases (51.4%) were iatrogenic haemorrhage. Pre-procedure CT demonstrated active extravasation in 45.8% and pseudoaneurysm in 27.8% of cases. Embolisation technique including inflow-only embolisation (47.2%), particles/liquid embolisation with or without coils (18.1%), 'front and back door' coil embolisation (12.5%), stent graft (12.5%) and sac/tract embolisation (8.3%). Technical success was achieved in 68 HAEs (94.4%). Clinically, early complete control and partial control of haemorrhage was achieved in 72.2% and 16.7% of cases respectively. Ongoing bleeding was seen post 11 HAEs (15.3%). 6 patients underwent further interventional procedures and 1 had surgery. There is significant statistical correlation between embolisation techniques and technical success ($tb = -0.257$; $p = 0.044$), but not with early clinical success ($tb = -0.172$; $p = 0.123$) or ongoing bleeding ($tb = -0.016$; $p = 0.896$).

Conclusion: Satisfactory haemorrhage control can be achieved by different embolisation techniques for acute hepatic haemorrhage, therefore can be considered when 'front & back door' embolisation is not readily possible.

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Radiopaque beads for prostate artery embolization (PAE): illuminating non-target embolization

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Purpose: To evaluate detectable non-target embolic particle deposition (NTD) during PAE and the safety and efficacy of using radiopaque particles for this procedure.

Materials and Methods: Patients from two sites > 40 y.o., with prostates > 50 g in size and medically refractory moderate to severe lower urinary tract symptoms (LUTS) were enrolled. Bilateral PAE using 40-90 μ m LC Bead LUMI™ (Boston Scientific Corporation, Maple Grove, MN) was performed. Non-contrasted CT before and 3 months after PAE assessed for NTD. Follow-up occurred at 3, 6, and 12 months. Random coefficients growth models assessed for significant change from baseline in International Prostate Symptom Score (IPSS), Quality of Life (QoL), International Index of Erectile Dysfunction (IIEF), peak urinary flow rate (Qmax), and post-void residual (PVR).

Results: In 10 analyzed patients, significant improvement in IPSS, QoL, and Qmax was demonstrated at all time points ($p < 0.05$). No significant trend in PVR or IIEF was seen. Only minor adverse events (SIR A/B classification) were reported. NTD was noted in all 10 patients (ex. in the rectum,

bladder, penis or seminal vesicles), correlating at times anatomically with post-procedural symptoms (such as rectal pain or penile ulceration). In some patients, post-embolization symptoms lacked an NTD correlate, and select patients remained asymptomatic despite NTD.

Conclusion: Preliminary data supports the safety and efficacy of this radiopaque embolic in PAE. NTD rate was high, seen in all analyzed subjects, and correlating with minor post-procedural adverse events in some patients. In other patients, NTD did not seem to correspond with reported symptoms or lead to any side effects.

P-168

Prospective evaluation of patients with neuropathic breast and axillary pain after interventional pain therapy

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Purpose: To evaluate initial results and to demonstrate the technique of transarterial microembolization (TAME) in patients suffering from neuropathic breast and/or axillary pain.

Materials and Methods: After breast surgery with axillary dissection and trauma TAME was performed in two consecutive patients suffering from neuropathic pain. In the first case a 53-year-old female was suffering from neuropathic pain after breast surgery and axillary dissection with adjuvant radiotherapy nine years ago. In the second case, a 40-year-old female suffered from neuropathic pain in the left breast and lateral thorax after trauma in her youth. Clinical and pain assessment was performed pre- and post-interventionally.

Results: In both cases a transradial approach was chosen. TAME was performed with 100% technical success. The dorsal thoracic and the circumflex scapular artery originating from the subscapular artery were found to be relevant for pain. After superselective catheterization a hypervascularization was observable, which induced pain correlating well with the familiar chronic pain sensation. Embolization of the microvessels was performed with Imipenem/Cilastatin 500 mg diluted in iodinated contrast medium (Imeron® 300, Bracco Imaging, Italy). The skin around the axilla and lateral thorax showed redness post-interventionally, which disappeared after 4 to 6 hours. Both patients reported significant pain relief within the first day after intervention, with pain reduction in the mean visual analog scale (VAS) from initially 8 to 1.5.

Conclusion: TAME is a novel therapy to reduce persistent chronic pain in several locations. Our initial experiences are encouraging and suggest that TAME offers an adjunct therapeutical benefit for patients suffering from neuropathic breast or axillary pain.

P-169

Impact of embolic location in proximal splenic artery embolisation (PSAE) following blunt splenic injury (BSI)

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Purpose: PSAE can be performed in stable/metastable patients with Association for the Surgery of Trauma (AAST) grade III-V splenic injury. PSAE reduces splenic perfusion but maintains viability via collateral circulation. The hypothesized ideal location is between the dorsal pancreatic artery (DPA) and great pancreatic artery (GPA).

This study compares outcomes of embolic location in PSAE following BSI.

Materials and Methods: Retrospective review of PSAE for BSI (2015-2020). Embolisation location defined as: Type I, proximal to DPA; Type II, DPA-GPA; Type III, distal to GPA. Data collected on technical/clinical success, post-embolisation pancreatitis and splenic perfusion. Statistical significance between groups ascertained using χ^2 test.

Results: Fifty-eight patients underwent 59 PSAE: Type I (7); Type II (27); Type III (25).

Technical success was 100%. Clinical success was 100% for Type I/II embolisation and 88% for Type III: one reintervention and two splenectomies for ongoing instability. The result for Type II embolisation was significant compared to Type III ($p=0.02$). No episodes of pancreatitis occurred post-embolisation.

Where post-procedural imaging was obtained, splenic perfusion remained 100% in Type I/II embolisation and 94% in Type III. Result for Type II embolisation was significant compared to Type I/III ($p=0.01$).

Conclusion: PSAE between the DPA and GPA was achieved in 46% of cases. Technical success was 100% throughout. Clinical success was significantly higher for Type II embolisation compared to Type III. Splenic perfusion was significantly higher after Type II embolisation compared to Type I/III. The results support the hypothesized ideal location for embolisation as between the DPA and GPA.

P-170

Endovascular treatment of hemorrhagic pancreatic pseudocyst and correlation with preoperative radiological findings

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Purpose: The aim of this study was to analyze the results of endovascular embolization (EVE) in hemorrhagic pancreatic pseudocyst (HPP) treatment and correlation with preoperative computed tomography (CT) findings.

Materials and Methods: In retrospective single center study patients with EVE due to HPP included.

Potential source of bleeding on CT was correlated to EVE site. Postembolization laparotomy incidence, hospitalization length, radiological changes of HPP on follow-up CT were analyzed.

Results: 52 patients were included: 80% - male, 20% - female, mean age 49 years. Pseudoaneurysm found on CT in 27% ($n=14$), 73% ($n=38$) - exact bleeding site was not detectable leading to empirical EVE.

HPP of pancreatic head often lead to EVE of a. gastro-/pancreaticoduodenalis (46%, $p>0.05$). Pancreatic body HPP- EVE of a.lienalis - 79% ($p<0.05$) or a. gastrica sinistra 14% ($p>0.05$); a.gastrica sinistra+a.lienalis - 7% ($n=1$). Pancreatic tail HPP- EVE a.lienalis in 84% ($p<0.05$);

EVE was performed with coils: median length of pushable coils - 56 cm, detachable coils- 105 cm.

Median hospitalization- 23,3 days. Median HGB on admission 10,68g/L. After EVE 11 patients underwent laparotomy for pancreatic necrectomy. No laparotomies due to rebleeding detected. On follow-up CT ($n=32$) 3% had no visual changes in HPP, 3%- enlargement of the HPP, 25%- reduction of HPP size, 63% resolution of HPP.

Conclusion: Statistically significant correlation between HPP in pancreatic body/tail on CT and EVE of a. lienalis was found. Preoperative CT plays important role before empirical EVE. EVE of HPP serves as a primary minimally invasive treatment option for clinical stabilization.

P-171

Endovascular repair of iatrogenic arterial injury in ECMO patients

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Purpose: Extracorporeal membrane oxygenation (ECMO), a modified cardiopulmonary bypass mechanism of life support, has seen extended use and increasing applications over the last 2 decades and most notably in 2020 during the COVID-19 pandemic. We present a case series of patients who developed iatrogenic arterial injury due to the placement of large bore venous ECMO cannula and then went on to have emergency endovascular treatment.

Materials and Methods: We performed a 6-month retrospective audit at our institution, a tertiary centre for ECMO, for referrals for iatrogenic vascular injury.

Results: 5 patients (2 of which were known to be suffering from Covid-19) suffered from iatrogenic arterial injury during either large bore ECMO or central venous cannula insertion.

3 ECMO cases involved inadvertent injury of the right subclavian artery during jugular ECMO cannula insertion. All 3 cases developed an arterial-venous fistula (AVF) between the right internal jugular vein and subclavian artery. 2 cases were treated with balloon expandable covered stents. The third case used vascular access via a misplaced central venous catheter to deploy an Amplatz vascular plug across the fistula successfully excluding it. Two further cases of right carotid and vertebral artery injury, both of which developed AVF, were treated with balloon covered stents.

All arterial injuries were successfully treated with no related complications.

Conclusion: We have seen an increase in the incidence of iatrogenic arterial injury due to venous ECMO cannula placement during the Covid-19 pandemic. Different endovascular techniques are available to treat these conditions. We present pictorial review of the patients' injuries and endovascular management.

P-172

Transpedal lymphangiography (TL) in the treatment of postoperative lymphatic leakage (pLL) – a 25-year experience in 355 patients

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Purpose: To report our experience with transpedal lymphangiography (TL) in the treatment of postoperative lymphatic leakage (pLL).

Materials and Methods: The prospective digital database of our institution was searched for all patients undergoing TL in the treatment of pLL. Study goals were analyses of patient characteristics, technical results, complications, and clinical success. Independent risk factors of TL clinical failure were assessed by using univariate and multivariate logistic regression analyses.

Results: Between 03/1993 and 09/2018, 355 patients were identified. pLL resulted from different surgical procedures (e.g. oncologic surgery or cardiovascular surgery) and persisted after standard conservative management (e.g. parenteral nutrition). The location of pLL varied markedly (e.g. chylothorax or chylous ascites). The median interval between

causal surgery and TL was 27 days. Technical success rate of, the median amount of injected iodized oil used for, and major complication rates of TL were 88.5%, 10.0 ml, and 0%, respectively. The clinical success rate of TL was 42.6%. A daily pLL output volume >500 ml/d ($p=0.003$), a volume of iodized oil ≤ 10.0 ml ($p=0.035$), and the morphological proof of iodized oil extravasation ($p=0.006$) were the independent risk factors for TL clinical failure.

Conclusion: TL is feasible, safe, and effective in the treatment of pLL. Owing to its promising safety and tolerability profile, TL should be used as a first-line intervention after clinically ineffective standard conservative management. After TL clinical failure, second-line lymphatic interventions such as percutaneous sclerotherapy with ethanol or embolization with glue are highly recommended to increase the clinical success.

P-173

Prostate artery embolization using the seque microcatheter: initial experience addressing safety and efficacy

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Purpose: To describe the initial experience regarding efficacy and safety of Prostatic Artery Embolization (PAE) using the anti-reflux SeQure microcatheter.

Materials and Methods: This is a prospective, single-center investigation that included 10 patients undergoing PAE using the SeQure microcatheter (Guerbet, Paris, France) for treatment of lower urinary tract symptoms (LUTS) attributed to benign prostate hyperplasia (BPH). Baseline and 3-month efficacy endpoints were obtained for all patients, and included prostate-specific antigen (PSA), uroflowmetry, pelvic Magnetic Resonance Imaging (MRI) and clinical assessment using the International Prostate Symptom Score (IPSS) questionnaire and the IPSS-Quality of life (QoL) item. Complications were assessed using the modified Clavien-Dindo Classification for PAE.

Results: Ten patients entered statistical analysis and presented with significant LUTS improvement after PAE, as follows: mean IPSS reduction of 88.7% (2.3 vs. 20.7, -18.4, $P < 0.001$), mean QoL reduction of 75.9% (1.3 vs. 5.4, -4.1, $P < 0.001$), mean prostatic volume reduction of 32.6% (75.8 cm³ vs. 112.5 cm³, -36.7 cm³, $P < 0.001$), mean peak urinary flow (Qmax) increase of 238.0% (22.5 mL/s vs. 6.6 mL/s, +15.8 mL/s, $P = 0.02$) and mean PSA reduction of 64.9% (2.2 ng/mL vs. 6.1 ng/mL, -3.9 ng/mL, $P < 0.001$). One patient (10%) needed transurethral resection of the prostate (TURP) 3 months after PAE due to a ball-valve effect. Non-target embolization was not observed in the cohort.

Conclusion: This initial experience suggests that PAE using the SeQure microcatheter is safe and effective for the treatment of LUTS attributed to BPH.

P-174

Characterization of severe life-threatening haemorrhage in COVID-19 patients

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Purpose: The purpose of this study is to analyse the characteristics of the patients with COVID-19 and severe haemorrhage.

Materials and Methods: Single centre retrospective observational study. Inclusion criteria were positivity for SARS-COV-2 confirmed through PCR in patients with active bleeding demonstrated by Angio-CT and hemodynamical instability, who underwent angiography at our hospital between April 11th2020 and January 11th2021.

Technical success was defined as absence of contrast extravasation and clinical success as achievement of hemodynamical stability without rebleeding within 30 days.

Results: 10 patients (age r:48-81 years) 50% females. 80% were previously admitted to ICU due to severe SARS-COV-2 disease. 3 patients associated pulmonary embolism. 90% of the patients had anticoagulant therapy with LMW heparin.

Of a total of 10 patients, 9 demonstrated direct or indirect signs of active bleeding and required trans-arterial embolization. Most used embolic agent was PVA particles (6 patients) combined with cyanoacrylate in 3 patients.

Most frequent bleeding site was iliopsoas/retroperitoneal haemorrhage (50%).

Technical and clinical success was achieved in 100% and 66,6% respectively, 3 patients required surgery and there was no death related to rebleeding. The embolization agent used in these 3 patients were coils (1), PVA + Glubran (1) and Onyx (1).

Conclusion: Since the beginning of the pandemic we have seen more cases of spontaneous severe haemorrhage associated with heparin treatment.

In our experience the most common bleeding site was iliopsoas/retroperitoneal haemorrhage associated with anticoagulation. We couldn't find association between the embolic agent and achievement of clinical success.

Endovascular treatment is a safe and effective minimally invasive alternative.

P-175

Endovascular treatment of internal iliac artery aneurysms

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Purpose: To evaluate the outcomes of endovascular treatment of internal iliac artery aneurysm (IIAA).

Materials and Methods: IIAs treated between January 2010 and December 2020 were retrospectively reviewed. Outcome data were analysed according to technical details of endovascular procedure.

Results: Thirty-one IIAs were treated in 26 patients with mean age of 73.5 years. Fourteen aneurysms were isolated IIAs. Endovascular techniques were: sac entrapment by embolisation of proximal inflow and distal outflow segments ($n = 4$), stent-graft placement across IIA origin combined with embolisation of distal IIA branches ($n = 26$), and stent-graft placement across IIA origin without embolisation ($n = 1$). Endoleak occurred in 11 IIAs (35%), six of which were associated with sac enlargement. The incidence of endoleak was lowest when embolisation involved the main trunk of IIA, while it was highest when embolisation was performed in gluteal arteries or when gluteal artery was not embolised ($p = 0.008$). Review of angiograms acquired during the initial endovascular procedure revealed that antegrade opacification of non-embolized IIA branches on post-embolisation angiography and, in particular, antegrade opacification of the anterior division and/or obturator artery after embolisation were significantly associated with endoleak development ($p = 0.002$). Femoral artery pseudoaneurysms were reported in two patients. The mean follow-up period was 33.8 months, during which time there was no documentation of aneurysm rupture or aneurysm-related mortality.

Conclusion: Endovascular treatment of IIAA is a feasible and safe procedure, but may be associated with endoleaks. Proper execution of embolisation techniques, especially with regard to the anatomical site of embolisation, may improve clinical outcome.

P-176

Bleeding complications in COVID-19

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Purpose: To retrospectively analyse the outcome and features of spontaneous bleeding embolisation in COVID19 patients in a region at a high level of exposure and incidence.

Materials and Methods: Demographic, clinical history and procedural data of COVID19 patients suffering from bleeding complications and treated by endovascular embolisation by interventional radiologists at one institution from March 2020 to December 2020 were retrospectively reviewed. Data (imaging reports, procedural reports, nurse notes, discharge summary reports) were collected consulting the Electronic Patient Record system (EPR) of the hospital and cleaned and stored in a Microsoft Excel database.

Results: The final population was made up of 9 patients (mean age 77,4 y.o., 4 male, 5 female).

The patients were all hospitalized before the endovascular treatment and in therapy with low molecular weight heparin. The haemoglobin loss represented the main alert and was deemed the trigger to perform a CT study. The bleeding was demonstrated at CT in all patients. The most common site of bleeding encountered were iliopsoas muscle (3), rectus abdominis (2), gastrointestinal tract (2), bleeding of a visceral aneurysm in hepatic artery previously treated (1), intercostal artery (1). The patients were treated by endovascular embolization of the site of bleeding. Embolic agents used: glue, coils, gelfoam. All the procedures were technically successful. 4 patients died because of complications due to COVID19.

Conclusion: Our impression on the interventional management of COVID-19 bleeding is that in spite of the technical success of embolisation procedures, the event itself may be a negative prognostic factor and further data should be collected to better understand this condition.

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Comparing of the evolution of spontaneous soft tissue hematomas (SSTH) in patients with COVID-19 and non-COVID-19, who were subjected to embolization

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Purpose: To compare and review the evolution of COVID-19 and non-COVID-19 patients subjected to embolization after bleeding since the COVID-19 pandemic onset, on March, 2020.

Materials and Methods: From March 2019 to February 2020, there have been 95 urgent embolization procedures performed on 83 patients, with an increase in the number of patients with multiple instances of bleeding or new episodes of bleeding after embolization, that in some cases lead to the patient's death.

This number represents almost twice the amount of procedures performed in 2019.

Retrospective comparison of the evolution of COVID-19 vs non COVID-19 bleeding patients, both subjected to embolization, by matching patients with similar characteristics in terms of anticoagulant treatment received and bleeding with spontaneous soft tissue hematomas (SSTH), mainly in abdominal and lumbar muscles.

Results:

	No COVID-19	COVID-19
Total patients	10	10
Anticoagulant treatment	6	9
Re- embolization	4	5
Cirrhosis	4	0
Mortality	5 (50 %)	5 (50 %)
Cause related mortality	4 (40%)	4 (40%)

Conclusion: According to the data presented, the development of SSTH combined with anticoagulant treatment in patients infected with COVID-19 can be a potentially life threatening condition, and difficult to control, although it is important to note that the evolution is similar to that of patients with similar characteristics, regardless of the COVID-19 infection. We acknowledge that the small number of patients is a limiting factor in the study.

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Radioembolization of unresectable hepatocellular carcinoma: initial experience at a single center

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Purpose: The aim of this study is to evaluate the role of radioembolization (RE) for treatment of unresectable hepatocellular carcinoma (HCC).

Materials and Methods: A retrospective study of patients who underwent RE for unresectable HCC from April 2015 to March 2021 in our hospital was performed. Demographic features, tumour characteristics, biochemical and clinical toxicities, imaging response according to mRECIST, time to progression (TTP), overall survival (OS) and treatment associated complications were analysed. TTP and OS were estimated by the Kaplan-Meier method and data were stratified according to clinical and procedural parameters.

Results: Twenty patients (80% male, mean age 68y, 76% BCLC stage B and 24% BCLC stage C) underwent 25 REs (22 Yttrium-90 [13 resin, 9 glass-based] and 3 Holmium-166) in our hospital. Median clinical follow-up was 10 (1-39) months. Objective response rate was 67% (including complete and partial response). Median TTP (from first RE to HCC disease progression) was 8.6 months [95% CI 5.6-11.6]. During the study follow-up, 11 patients died (median OS 12.8 months [95% CI 6.2 – 19.4]). Median OS was 13 months for BCLC-B patients and 9.5 months for BCLC-C patients. Two serious complications were noted: one radioembolization-induced liver disease (REILD) and one cholangitis related to a new biliary stricture development.

Conclusion: RE is safe in carefully selected patients suffering from HCC, with low although potentially life-threatening complication rates. By applying an adequate and meticulous technique, RE has been proven to be as effective as other currently available treatments.

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Endovascular treatment of a pancreaticoduodenal artery aneurysm related with coeliac axis occlusion

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Learning Objectives:

1. Learn the most important etiologic factors at inferior pancreaticoduodenal artery (IPDA) aneurysm formation
2. Learn the indications of the treatment of IPDA aneurysms
3. Learn the technique for the endovascular management of IPDA aneurysms

Background: Sutton-Kadir syndrome is a rare, yet well known condition which is related with coeliac axis stenosis/occlusion. Different surgical and interventional treatment approaches have been described for the treatment of inferior pancreaticoduodenal artery (IPDA) aneurysms related with this error.

Clinical Findings/Procedure Details: A 73 years old male patient admitted to the vascular surgery clinic with abdominal pain. An IPDA aneurysm (2.5 cm) was detected in computed tomography angiographic (CTA) images of the patient. Since treatment of IPDA aneurysms are indicated independent from their size, the endovascular approach was preferred over surgical techniques for the treatment of the aneurysm. Aneurysm was treated successfully with the stent-assisted coiling technique. A self expandable closed cell carotid wallstent and detachable coils were used to exclude this aneurysm and no residual aneurysm was detected at the 6 months control CTA images.

Conclusion: Treatment of IPDA aneurysms are indicated after initial diagnosis independent from their sizes, and if treated under qualified hands, the endovascular approach should be the preferred option with a high technical success rate for IPDA aneurysms.

P-180**Pulmonary sequestrations: the role of interventional radiology**

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Learning Objectives: Highlight the role of interventional radiology in pulmonary sequestrations

Background: Pulmonary sequestration is a congenital malformation characterized by dysplastic pulmonary tissue receiving blood supply by aberrant systemic arteries, not in communication with tracheobronchial tree. There are 2 types: intralobar and extralobar. The first is a dysfunctional pulmonary tissue covered by visceral pleura with venous drainage into pulmonary veins, while the second has independent pleura and systemic venous drainage. Usually, extralobar type becomes symptomatic in the first weeks of life, because of the presence of left-to-right shunt, whereas intralobar type is more frequently diagnosed in adults affected by recurrent pneumonia and hemoptysis, which can also be massive and fatal. Surgical resection represents the gold standard treatment, but recently endovascular embolization proved to be a valid and effective minimally invasive therapeutic option for symptomatic cases

Clinical Findings/Procedure Details: Imaging must demonstrate abnormal arterial vessels and pathologic venous drainage to the pulmonary sequestration and must exclude the presence of other diseases. Gold standard is still angiography, but CT-angiography is the most non-invasive method daily used: it provides an accurate study of pathologic lung parenchyma and airways. Angiography keeps a role in therapeutic approach, since endovascular embolization is a valid minimally invasive alternative therapeutic choice. Many different embolic agents have been described, alone or in association, but it is important to embolize also the sub-segmentary vessels of the malformation, to prevent post-procedural complications, such as belated migration of embolic agents, with non-target vessels embolization, and the opening of collateral circles and shunts

Conclusion: Endovascular embolization is an effective and safe minimally invasive alternative for the treatment of pulmonary sequestration; non-invasive imaging is fundamental to establish the diagnosis and for an adequate pre-procedural planning

P-181**Transcatheter endovascular embolization in non-operative management of high-grade traumatic spleen injury**

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Learning Objectives: Highlight the role of endovascular embolization in high-grade traumatic spleen injuries (AAST>III) in hemodynamically stable patients

Background: Spleen is the parenchymatous organ mostly involved in blunt abdominal trauma and, in 10% of cases, its rupture is delayed, between 48h-10 days from trauma. Due to its rich vascularization, traumatic injuries of spleen can be also fatal for patients, with profuse bleedings, hemoperitoneum and hemorrhagic shock, and, thus, it is essential to promptly recognize and treat blunt traumatic injuries when traumatic vascular lesions are present. Nowadays, the management of hemodynamically stable patients with high-grade (AAST>III) spleen injuries is non-operative, to save the organ and its precious immunitary function, and to reduce the rate of laparotomies, with the late and immediate related complications: endovascular embolization is currently part of this non-operative management

Clinical Findings/Procedure Details: Hemodynamically stable patients with blunt abdominal trauma undergo a preliminar CT-study to identify, quantify and stage eventual traumatic splenic injuries, the presence of vascular lesions, such as pseudoaneurysms or arterio-venous fistulas, and hemoperitoneum. The management of splenic AAST I-III lesions is conservative, with watchful observation, while AAST IV-V lesions, and cases with evidence of vascular lesions, active bleedings and hemoperitoneum >300 ml, are managed non-operatively, with the adjunct of endovascular embolization of splenic artery. The latter must be performed proximally, with no evidence of vascular lesions and/or active bleedings, otherwise it must be performed distally, selectively, in presence of pseudoaneurysms, arterio-venous fistulas or active bleedings. The embolic agent mostly employed is represented by coils. Distal embolization has more probability to induce splenic infarctions and abscess, which can be, however, easily managed percutaneously

Conclusion: Endovascular embolization is feasible, safe and effective in high-grade blunt spleen injuries, not only to stop bleedings, but also to save the organ, to reduce the rate of laparotomies, lowering the percentage of late and immediate complications related to surgery, such as sepsis

P-182**Diagnosis and embolization of pulmonary AVM : single center experience**

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Learning Objectives: To determine the efficacy and safety of embolization in patients with pulmonary arteriovenous malformations and comparison with different embolization devices

Background: Pulmonary arteriovenous malformations are abnormal direct connections between the pulmonary artery and pulmonary vein that result in a right-to-left shunt. Embolization is an endovascular intervention based on the occlusion of the arteries feeding the pulmonary arteriovenous malformations, thus eliminating the abnormal shunt between right and left.

This is a single center retrospective analysis conducted on 10 patients with pulmonary AVM and treated by endovascular embolization, between June 2019 and December 2020 for recurrent hemoptysis episodes

Clinical Findings/Procedure Details: All patients underwent an urgent CT scan that allowed for the identification and localization of the AVM. A diagnostic angiography was then performed which showed: 4 AVM with feeder coming from the bronchial, 4 from the pulmonary and 2 from accessory bronchial arteries. The embolic materials used were: microspirals, plugs, embospheres and Onyx, alone or in combination with each other. The choice depended on the operator's experience and the characteristics of the malformation. Technical and clinical success was observed in all patients but two interventions were required for persistence of both the malformation and the clinic (reduced oxygen saturation) at the clinical-instrumental follow-up performed one month later

Conclusion: Pulmonary AVM embolization is a minimally invasive procedure that avoids the risks associated with general anesthesia and minimizes the loss of lung parenchyma

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Abdominal wall bleedings: successful inferior epigastric artery embolization

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Learning Objectives: Assess efficacy of endovascular embolization in rectus muscle bleedings after surgery or trauma and spontaneous bleedings in patients in therapy with anticoagulants

Background: Retrospective analysis (January 2016-January 2021) of 17 patients (9 F, 8M; average age: 66 years; range: 32-86 years) with huge hematoma of rectus muscles and active bleedings detected by MDCT. All patients underwent a preliminary diagnostic angiography of inferior epigastric artery and, in case of arterial blush, a transcatheter embolization was performed. Technical success was considered as the absence of bleeding signs at the final angiographic control, the clinical success was meant as laboratory parameters recovery and no bleeding detected later at MDCT follow-up

Clinical Findings/Procedure Details: Active bleeding was detected by angiography in 10 patients, in 4 patients just angiographic indirect signs were detected as spastic/tortuous vessels or abnormal impregnation. In 3 patients no angiographic pathologic findings were found. In 13 cases the etiology was iatrogenic, spontaneous in the remaining 4. One patient underwent a second procedure for recurrence, 18 angiographies in total performed. 3 patients had bilateral hematoma supply. Agreement between CT and Angiography findings was 82%. Embolic agents used were microcoils (13), NBCA (3), Spongel (2), PVA (2) and Amplatzer Micro-Vascular-Plug (2). 1 patient after embolization died because of multi-organ syndrome failure. Technical success rate was 100% (17/17), clinical success 88% (15/17)

Conclusion: Endovascular treatment is an effective minimally invasive treatment for rectus muscles bleedings, with high success rate and minimal complications. Surgical approach keeps its role in case of failure of endovascular treatment and for evacuation of massive hematomas after embolization

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COVID-19 patients coagulation dilemma: between the thrombosis and bleeding

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Learning Objectives: Show how to deal with two main complications in COVID-19 patients, thrombosis (pulmonary embolism) and bleeding.

Background: In our Hospital Center we experienced, as well as the rest of the world, two complications with high mortality rate in COVID-19 patients, the pulmonary embolism (PE) and bleeding. The first one is related to

thrombogenic state in those patients and the second one is explained by the anticoagulation treatment applied in some patients.

Pulmonary embolism occurred in 16.5% of patients with COVID-19 and bleeding rates depends on anticoagulation status.

Clinical Findings/Procedure Details: The PE and bleeding sources are usually diagnosed by Angio-CT. The treatment for PE is done by catheter aspiration thrombectomy system, and the bleeding complications are solved with selective arterial catheterization and embolization. We will review with details the technical consideration related to interventional treatment used for both main complications.

Conclusion: The COVID-19 patients can experience severe complications related to coagulation as the PE and bleeding. We demonstrate that Interventional Radiologist can apply safe and effective techniques to treat those special situations in COVID-19 patients.

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Histopathologic illustration of different interventional radiology embolic materials

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Learning Objectives: To display the histopathologic appearance and changes of embolic materials used in interventional radiology (IR).

Background: There are diverse embolic materials with different characteristics including absorption time, penetrations degree and with permeant or temporary occlusion. There is no perfect embolic material that is suited for all circumstances. Selection of the embolic material depends on the wanted clinical outcome.

Clinical Findings/Procedure Details: This image-based educational abstract will histopathologically evaluate the appearances and changes of different IR embolic materials like polyvinyl alcohol embolic agent, gelatin foam embolic agent like Gelfoam, glue embolic agents like Glubran2, tris-acryl gelatin microspheres like Embospheres and the appearance of post embolization resection of hepatocellular carcinoma lesions, post transarterial chemoembolization resection and post radioembolization resections.

Conclusion: Recognizing the histopathologic appearance of different IR materials will aid to further understand the mechanism of action for these treatment materials. In addition to the tissue reaction and the inflammatory response to these materials.

P-186

Pulmonary embolism, current therapies' state: role of the endovascular approach

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Learning Objectives: To review current state of pulmonary embolism therapy, with a focus on endovascular therapies

To evaluate the role of ultrasound assisted thrombolysis and mechanical thrombus aspiration.

Background: Pulmonary embolism (PE) is a frequent cause of emergency department access, with a high mortality rate if not adequately treated, especially in patients who are hemodynamically unstable at presentation. Therapeutic options include: surgical embolectomy, systemic thrombolysis and two endovascular approaches.

The American Heart Association classify PE in three risk categories, being Intermediate-risk pulmonary embolism defined by the absence of hypotension, but the presence of right ventricle (RV) dysfunction or strain.

Clinical Findings/Procedure Details: Intermediate risk PE therapy remains controversial, recently catheter-based interventions have been used in this group of patients.

The introduction of Catheter-directed thrombolysis, allowing a significant reduction of R-tPA dose, has been proved to reduce bleeding risk if compared to systemic thrombolysis. The efficacy and the 90 days mortality rate remain similar as shown in recent studies. The use of ultrasound assisted thrombolysis, although showing promising results in in vitro studies, has not been proven yet to be more efficient than systemic thrombolysis and catheter thrombolysis alone.

The second intravascular approach available, which allow to avoid the use of thrombolytic drugs and has been associated with a significant reduction in the RV/LV ratio, is represented by mechanical clot aspiration.

Conclusion: Ultrasound assisted thrombolysis and aspiration thrombectomy may allow an improvement in intermediate risk PE patients' outcome, but prospective controlled data from adequately powered trials is needed for a broad application of these techniques.

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Intercostal artery embolization: indications, techniques and outcomes

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Learning Objectives:

1. Discuss clinical indications for Intercostal Artery Embolization (IAE)
2. Describe techniques and embolic agents used in IAE
3. Review outcomes of IAE

Background: Indications for transcatheter embolization of one or more intercostal arteries include traumatic and iatrogenic injuries associated with hemothorax and clinical deterioration, treatment of malignancies with parasitized intercostal supply and inflammatory processes with collateralized flow from intercostal branches. Although case reports have been published, few studies have investigated the techniques and outcomes of IAE.

Clinical Findings/Procedure Details: We present a series of 24 IAE cases. Cases of iatrogenic injury were related to thoracentesis, percutaneous cholecystostomy, transhepatic cholangiography, and liver biopsy. Two cases of post traumatic hemorrhage following penetrating (gunshot wound) and blunt (anticoagulated patient fall) trauma are detailed. We used IAE to redirect flow during a shunt study prior to Y-90 radioembolization of hepatocellular carcinoma. Additional examples include embolization of intercostal supply in patients with hemoptysis, retroperitoneal hematomas, and in the treatment of an endoleak after endovascular thoracic aneurysm repair. Both radial and femoral approaches were employed, and particulates, coils, glue and microvascular plugs (often in combination) were used for embolization.

Conclusion: IAE is a minimally invasive procedure indicated in the management of traumatic arterial injury and in the treatment of malignancies and inflammatory processes with parasitized flow from these branches. A variety of embolics can be used with high clinical and technical success, providing excellent outcomes for this infrequently performed but clinically important intervention.

P-188

Transcatheter embolization of non bronchial systemic to pulmonary shunt in patients with massive haemoptysis using N-Butyl cyanocrylate (NBCA, Glue)

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Learning Objectives: To share our experience with selective transcatheter embolization treatment of non bronchial systemic to pulmonary shunts (NBSPS) in patients with massive haemoptysis, using N-buty cyanocrylate (NBCA) also known as glue. To discuss definitions and causes of massive haemoptysis. To discuss the characteristic Imaging findings of NBSPS. To discuss the technical and clinical success of trans catheter embolization treatment using NBCA in these patients.

Background: NBSPS is a well recognized cause of massive and recurrent haemoptysis especially in patients with Tuberculosis (TB) and its sequelae. TCE is now widely regarded as the most effective nonsurgical treatment of patients with massive or recurrent haemoptysis].

Clinical Findings/Procedure Details: We performed a retrospective analysis of 110 patients (93 males and 17 females, age range, 42-92 years.) who underwent BAE for massive hemoptysis between September 2014 and July 2019. The study was approved by the institutional review board. 14 patients had angiographically demonstrable large volume non bronchial systemic to pulmonary and broncho-pulmonary shunts. The underlying etiology was TB and its sequelae in all 14 patients. Devascularization of the abnormal culprit vessels and exclusion of the shunts were achieved in all 14 patients with large volume NBSPS using NBCA (100% technical success).

Conclusion: The presence of large volume NBSPS precludes the use of particulate embolic agents in order to avoid non-target embolization. NBCA may be the most suitable and most effective embolic agent proven to reduce recurrence in these patients.

However both the operator and patients should be aware of the rare but unforgiving consequences of non-target embolization.

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Segmental arterial mediolysis of the splanchnic arteries: diagnostic features and interventional therapy

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Learning Objectives: To expand knowledge about diagnostic features of segmental arterial mediolysis and to show how interventional radiologists could treat this rare disease.

Background: Segmental arterial mediolysis (SAM) is a rare vascular pathology characterized by alterations of medium-sized and large-sized abdominal splanchnic vessels without any underlying etiology (atherosclerotic, inflammatory, infectious or autoimmune). SAM affects mainly middle-aged and elderly patients (incidence of 1/100.000 inhabitants per year); it is clinically heterogeneous and symptoms may be nonspecific, varying from asymptomatic forms to potentially life-threatening conditions.

Clinical Findings/Procedure Details: Segmental arterial mediolysis is characterized by stenoses, fusiform aneurysm, dissections and occlusions of the vessels involved. Even if the etiology of SAM is still unknown, its pathophysiology and histological alterations have been extensively

studied; the “mediolysis process” consists of non-inflammatory degeneration and lysis of the smooth muscle layer of the outer media of the arterial wall leading to aneurysmatic and stenotic alterations of splanchnic arteries. Diagnosis and management of SAM are very complex since the heterogeneous clinical forms of presentation with multiple visceral arteries involvement and parenchymal alterations, make it a challenge for the physicians. Embolization of vessels involved allows to treat acute bleedings and prevent further complications.

Conclusion: In patients with clinical suspicion of SAM and radiological signs of acute or chronic abdominal bleeding, endovascular therapy is a mini-invasive, safe and extremely reliable interventional procedure and appears to be the first choice treatment when conservative therapies fail. Interventional radiologists play a crucial role in performing timely diagnosis and endovascular therapy to treat pathological vessels and visceral vascular alterations due to segmental arterial mediolysis.

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Management of post partum haemorrhage

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Learning Objectives: To understand

- 1) The aetiology and pathophysiology of post partum haemorrhage (PPH)
- 2) Clinical presentation of PPH
- 3) Management of PPH, including medical therapy, surgical options and interventional options

Background: PPH is the most common cause of post-partum mortality worldwide. Primary PPH is defined as loss of blood > 500 ml within the first 24 hours. There are a variety of causes and management options including medical, surgical and interventional options and it is important for the interventional radiologist to be familiar with these.

Clinical Findings/Procedure Details: The most common causes of PPH include uterine atony, trauma during delivery (which may be due to instrumentation), retained placenta, coagulopathy or placental abnormalities. The radiologist may play an important role in antenatal assessment of placental abnormalities such as placenta accreta with antenatal ultrasound or MRI and such patients may have pre-planned interventional radiology support during delivery but most cases of PPH are unpredictable. Uterine atony may respond to uterotonic agents such as oxytocin, ergometrine and misoprostol. Tranexamic acid, blood products and fluid resuscitation play an important role in resuscitation.

There are various surgical techniques such as Bakri balloon, B-Lynch sutures, uterine or internal iliac artery ligation or hysterectomy. Selective arterial embolisation can play an important and life saving role and may obviate the need for hysterectomy preserving fertility.

Conclusion: PPH is the most common cause of postpartum mortality. There are many treatment options available but the interventional radiologist can play an important role and should be familiar with the management algorithm of these patients.

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Middle meningeal artery embolization for chronic subdural hematomas: procedural review with tips and tricks for the interventional radiologist

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Learning Objectives: The purpose of this education exhibit is to review the pathophysiology, presentation, and treatment options for chronic recurrent subdural hematoma (cSDH). Understand the critical aspects of middle meningeal artery (MMA) embolization including anatomic considerations, variant anatomy, embolization particle selection, and patient follow up.

Background: SDHs are projected to be the most common cranial neurosurgical disease among adults. Upwards of 30% of these patients experience chronic and recurrent subdural hematomas. Emerging evidence suggests chronic SDH form secondary to an inflammatory response which induces production of angiogenic factors, promoting neovascularization with fragile, leaky membrane capillaries. These capillaries form connections to distal dural middle meningeal artery branches resulting in chronic seepage of arterial blood products. MMA embolization is a promising technique which has shown efficacy in treating initial and recurrent chronic SDHs.

Clinical Findings/Procedure Details: Preoperative considerations will be discussed. Technical details involving catheter and access choices and embolic agent will be detailed. Anatomy of the MMA will be reviewed with images depicting common and variant anatomy as well as the typical cotton wool-like staining of the distal MMA branches. Technical pearls will be described to aid readers with identifying important vessels, including petrosal branches and ophthalmic collaterals, to avoid non-target embolization. Complications, common pitfalls, post-operative care will also be discussed in this exhibit.

Conclusion: Our single-center results demonstrate MMA embolization's promising results and low overall recurrence rates. MMA embolization is a safe and effective therapy for those patients suffering from chronic recurrent subdural hematomas. Interventional radiologists are well suited to adopt MMA embolization into clinical practice.

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Embolization of a ruptured renal angiomyolipoma in intensive care unit in a critically ill patient with SARS-COVID 19 respiratory infection and difficult mobilization due to ECMO and CRRT

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Clinical History/Pre-treatment Imaging: 60 y/o male, hospitalized for a critical respiratory infection in our SARS-COVID 19 intensive care unit (ICU). Patient under mechanical ventilation by tracheostomy access, venovenous extracorporeal membrane oxygenation (ECMO) and continuous renal replacement therapy (CRRT). Severe bleeding in the urinary system requiring blood transfusion. An ultrasound showed a 2 cm bleeding solid lesion, likely angiomyolipoma, in the left kidney.

Treatment Options/Results: Left kidney angiography was performed directly in ICU due to the very difficult mobilization of the patient. A portable C-arm with flat-panel detector system and a power injector were transported in ICU. The patient was transferred from his bed to a radio-lucent stretcher which allowed the generator of the C-Arm to be placed underneath the patient (not possible using our standard intensive care beds). The procedure was performed showing a solid mild hypervascular, bleeding, lesion in the left kidney. Subsequent embolization was successfully performed, after selective catheterization with a microcatheter, using polyvinyl alcohol particles.

Discussion: In the context of pandemic, the management of some vascular lesions, in critical patients with difficult mobilization due to ECMO and CRRT, may be performed through interventional radiological procedures performed directly in ICU, avoiding the need of patients' transportation in the radiology unit, that may reduce the risk of virus aerosolization and health care provider contamination.

Take-home Points: In selected patients some interventional radiology procedures should be performed directly in the SARS-COVID 19 ICU.

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Endovascular management of spontaneous hepatic rupture on HELLP syndrome

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Clinical History/Pre-treatment Imaging: A primigravid woman was admitted at 28 weeks of gestation for right upper quadrant pain. Her laboratory tests revealed thrombocytopenia and increased liver enzymes. Her blood pressure was 70/40 mmHg with anemia. Transabdominal ultrasound performed on admission revealed a dead foetus.

Treatment Options/Results: An emergency caesarean section was performed immediately. On opening the peritoneum we encountered an unexpected gush of blood that raised the suspicion of a concomitant hepatic rupture, along with haemolysis-elevated liver enzyme-low platelet count (HELLP) syndrome. After quickly delivering the stillborn foetus, we searched the intra-abdominal cavity to identify the source of bleeding. A sub-capsular haematoma of the right hepatic lobe and rupture site were identified and packed. After four hours, the patient underwent transcatheter embolisation because of persistent haemorrhage. Selective hepatic angiography showed extravasation in the branch of the right hepatic artery. Transcatheter embolisation was performed. The patient was stabilized after endovascular treatment.

Discussion: The standard management in cases diagnosed with HELLP syndrome with an anticipated hepatic rupture is an emergency caesarean section followed by immediate exploratory laparotomy. Thus, we recommend the intervention in the form of an emergency cesarean section with transcatheter embolisation or exploratory laparotomy to be the first line of treatment in refractory cases.

Take-home Points: A spontaneous hepatic rupture should be considered as a potential diagnosis in pregnant patients with a sudden onset of right quadrant pain accompanied by manifestations of hemodynamic shock. In patients with a spontaneous hepatic rupture with HELLP syndrome and hemodynamic instability, endovascular embolisation offers successful, life-saving management to stabilize and control acute bleeding.

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Index case of a pulmonary artery pseudoaneurysm secondary to COVID-19 treated with endovascular embolisation

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Clinical History/Pre-treatment Imaging: A 74-year-old gentleman was admitted to hospital with COVID-19 pneumonia and was transferred to intensive care for ventilation. An initial CT pulmonary angiogram (CTPA) revealed segmental pulmonary emboli on a background of COVID-19 pneumonia and anticoagulation was commenced. A second CTPA two weeks later showed an 8mm left upper lobe pulmonary artery pseudoaneurysm. Three days later, the patient developed life-threatening haemoptysis and a subsequent CTPA showed interval enlargement of the pseudoaneurysm to 17mm.

Treatment Options/Results: Anticoagulation was withheld. Catheter pulmonary artery angiography was performed via the right common femoral vein. The left pulmonary artery was cannulated. Initial angiograms confirmed a small pseudoaneurysm arising from a left upper lobe pulmonary artery branch. This was selectively cannulated and embolised with an 8mm Amplatzer IV plug and satisfactory post-procedure angiographic result was obtained. The patient remained free of haemoptysis one-week after the procedure.

Discussion: Pulmonary artery pseudoaneurysms (often called Rasmussen aneurysms) are uncommon and are associated with a poor prognosis if not promptly identified and treated. These are usually detected incidentally or in the event of rupture during investigation for life-threatening haemoptysis. Several studies have demonstrated a relationship with COVID-19, endothelial dysfunction and pulmonary vasculitis which we propose as the likely aetiology in our case for pseudoaneurysmal development.

Take-home Points: We present an index case of a pulmonary artery pseudoaneurysm strongly associated with COVID-19.

Early recognition and intervention via targeted endovascular embolisation is crucial for management.

Challenges of managing COVID-19 related complications: anticoagulation for pulmonary thrombosis vs. the bleeding risk of a potential pseudoaneurysm.

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Combined transarterial and direct puncture approach for embolisation of post-traumatic pseudoaneurysm arising from a branch of distal superficial femoral artery

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Clinical History/Pre-treatment Imaging: We report a case of a 86-year-old woman sustained a blunt trauma to the thigh. Two weeks later she was admitted with increasing pain and swelling in the right thigh.

A contrast-enhanced CT scan showed traumatic pseudoaneurysm arising from a small branch of distal superficial femoral artery.

Treatment Options/Results: We performed an urgent transarterial arteriography that confirm the pseudoaneurysm arising from a small branch of the distal superficial femoral artery. Conventional endovascular treatment was not possible due to severe elongation and tortuosity of right iliac artery territory.

A second attempt was made to treat the pseudoaneurysm percutaneously under ultrasound and fluoroscopic guidance, the pseudoaneurysm was punctured with a 22-gauge needle, contrast was injected through the needle and we were able to visualise the pseudoaneurysm. A total of 0.3cc of human thrombin was slowly injected into the pseudoaneurysm controlling the entire procedure with fluoroscopy guidance. Final angiography showed complete occlusion of the pseudoaneurysm.

Discussion: The management of pseudoaneurysms depends mostly on their location and size.

Several strategies for treatment of pseudoaneurysms have been described, in our case due to the impossibility of performing an endovascular treatment, we performed a successful percutaneous embolisation of a superficial femoral artery pseudoaneurysm under combined endovascular, ultrasound and fluoroscopic guidance.

Take-home Points: Combined angiographic and fluoroscopy-guided direct percutaneous embolisation of superficial femoral artery pseudoaneurysms can be considered a feasible and effective treatment approach.

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Ultrasound guided percutaneous treatment with thrombin-gelatin of high-flow posttraumatic priapism associated with urethrorrhagia in an adolescent patient

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Clinical History/Pre-treatment Imaging: A 16-year-old boy was admitted to the emergency unit presenting tumescence of the penis and urethral bleeding after suffering trauma to the pelvis 5 days earlier in a

bicycle accident. US it revealed a bulky corpora cavernosa and the presence of 2 dilated cystic lesions in both corpora cavernosa with vascular flow inside. One connected by the neck to the right cavernous artery, and a characteristic “yinyang” sign was observed under color examination, suggesting a pseudoaneurysm with an arteriocavernous fistula. The second one appeared as a round sac connecting the neck with the spongy body from the urethral artery, with high-speed monophasic color flow.

Treatment Options/Results: Under direct US guidance, with access from the ventral side of the penis, to fill the cavity with thrombin.

Discussion: The spongy body injury was addressed with the intent to achieve thrombosis of the pseudoaneurysm and resolve urethral bleeding. A low dose of thrombin was carefully injected through a 16-gauge needle as far away from the neck as possible. Complete thrombosis of the cavity occurred in a few seconds. At this time, injection was stopped and the needle was withdrawn.

Take-home Points: Is fast and inexpensive, does not involve exposure to radiation, and has already been described for the treatment of arterial pseudoaneurysms in multiple locations, could be considered as an alternative to transcatheter embolization in selected cases.

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Treatment of a diffuse abdomino-pelvic venous malformation in an adult with Klippel-Trenaunay syndrome using systemic sirolimus therapy

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Clinical History/Pre-treatment Imaging: A 38-year-old female with KTS presented with a large intra-abdominopelvic venous malformation associated with bloating, indigestion, pain, and exercise intolerance. She failed multiple sclerotherapies, which included 9 sessions of percutaneous embolization using ethanol and Sotradecol of the intra-abdominopelvic venous malformation for symptom control. Despite technically successful interventions, the patient remained symptomatic with minimal pain relief.

Treatment Options/Results: At the age of 43, she was started on sirolimus, and the dosage was titrated weekly to a final dose of 2.2 mL PO daily (1mg/mL suspension). The patient tolerated the medication with mild side effects (headache, weight gain). The sirolimus' efficacy was captured radiographically by the considerable size reduction noted on 6-month and 1-year MR scans (Abdomen: 4.5 cm x 13.5 cm from 8.1 x 20.2 cm; Pelvis: 10.8 cm AP x 11.5 cm Transverse from 15.4 cm x 12.8 cm). Long-term surveillance scans demonstrated unchanged lesion size and fatty tissue replacement representing a sustained response to continued therapy.

Discussion: Sirolimus, an mTOR inhibitor, attenuates pathological PIK3CA/AKT/mTOR (PAmT) signaling and normalizes defective cell proliferation and recruitment. We present a case of treatment-refractory intra-abdominopelvic venous malformation in an adult with Klippel-Trenaunay syndrome (KTS) that demonstrated excellent clinical and radiographic responses to sirolimus. Our experience bolsters the literature on how to use sirolimus to manage treatment-refractory venous malformations. It also highlights the importance of understanding the molecular pathways and genetic mutations in congenital vascular syndromes.

Take-home Points: Sirolimus is an effective targeted therapy for treatment-resistant venous malformations in patients with KTS.

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Long-term post-embolic evolution of a complex pulmonary AVM with immunohistochemical correlation

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Clinical History/Pre-treatment Imaging: Hereditary Hemorrhagic Telangiectasia (HHT) is an autosomal dominant vascular condition associated with multiple arteriovenous malformations (AVMs), including gastrointestinal, brain, and pulmonary (PAVMs). Approximately 15-50% of HHT patients develop PAVMs, which are recurrent in childhood and complete in early adulthood. We describe an otherwise healthy and active 32 year old man with molecularly confirmed HHT and significant disease burden including bilateral PAVMs since childhood, brain AVMs, and severe recurrent epistaxis who developed a left upper lobe (LUL) pneumatocele in a complex PAVM and subsequent aspergilloma secondary to recurrent hemoptysis. The LUL complex PAVM developed collateral systemic artery reperfusion with branches from the left subclavian artery, and the patient underwent LUL systemic artery embolization. However, the patient then experienced an episode of nocturnal epistaxis with significant blood found in the left lung and no arterial source of bleeding found on head CTA. This raised suspicion for spontaneous bleeding from the pneumatocele.

Treatment Options/Results: As only small vessel arterial connections remained after the patient's previous LUL systemic artery embolization, further embolization was not a viable option. In the context of life-threatening hemoptysis and aspergilloma development in the pneumatocele, a LUL lobectomy was performed to cure both the pneumatocele and fungal infection.

Discussion: Arterial, venous, and parenchymal tissues were collected and will be stained for endoglin localization in relation to PTPN14, a genetic modifier of vascular malformations.

Take-home Points: Although there is no reported association between PAVMs and pulmonary cysts, this case demonstrates potential for a pneumatocele to develop after numerous embolizations and its associated life-threatening bleeding risk.

P-199

Ethanol embolization of a lingual arteriovenous malformation via the triaxial microballoon system

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Clinical History/Pre-treatment Imaging: A 26-year-old male presented with recurrent hemorrhage from lingual mass. Angiography demonstrated a diffuse blush in the right tongue, which consist with fine multiple, non-dilated high-flow shunts supplied by right lingual and facial arteries.

Treatment Options/Results: Under general anesthesia through tracheostomy tube, a 5-F guiding catheter was advanced to the orifice of the right lingual artery (LA). Then, a 2.8-F microballoon catheter with a 0.027-inch inner diameter was advanced into the intermediate portion of the LA, and a 1.9-F non-taper microcatheter was further advanced into the distal portion of the LA. Embolization with 50% mixture of ethanol and non-ionic contrast was performed under microballoon occlusion to control blood flow and reverse normal arteries flow direction. With two ethanol embolization (the total volume of the mixture: 40mL), approximately 90% of arteriovenous malformation (AVM) devascularization with partially improved initial symptoms and no significant sequelae was achieved.

Discussion: A lingual AVM is extremely rare and may cause life threatening hemorrhage. Absolute ethanol was reported as an effective embolic agent

to AVM but few reports were available regarding ethanol embolization of a lingual AVM. To avoid tissue necrosis, transarterial embolization with diluted ethanol was performed using the triaxial microballoon system, which allowed peripheral occlusion of LA, result in effective blood flow control and reverse normal arteries flow direction.

Take-home Points: Ethanol embolization using the triaxial microballoon system can be considered as a safe and effective treatment option for a symptomatic lingual AVM.

P-200

A safe and effective alternative treatment for recurrent parastomal variceal bleeding with direct percutaneous parastomal access and embolisation with interlock coils and PHIL

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Clinical History/Pre-treatment Imaging: A 73-year-old male presented with recurrent bleeding from parastomal varices requiring multiple transfusions. His past medical history includes NASH cirrhosis with portal hypertension, AP resection for rectal cancer, coronary artery stenting and previous oesophageal variceal banding. Trial of terlipressin induced severe cardiac chest pain.

A triple-phase CT showed liver cirrhosis, features of portal hypertension, dilated IMV and multiple parastomal varices.

Treatment Options/Results: Treatment options discussed at the multidisciplinary team meeting included endoscopic banding, TIPSS, transportal or direct puncture parastomal varices embolisation.

As the patient was well between episodes, without haemodynamic compromise, it was felt direct percutaneous access and parastomal varices embolisation would reduce patient morbidity and mortality.

US guided percutaneous puncture of the main parastomal varix was performed. Venogram demonstrated retrograde filling of the IMV into the parastomal varices. The IMV was coil embolised to occlude the inflow and to prevent non-target embolisation. 25% and 30% PHIL (Precipitating Hydrophobic Injectable Liquid) was used to embolise the parastomal varices. No complication occurred. After 4 months the patient had no further bleeding or transfusions.

Discussion: Over a quarter of patients with portal hypertension develop a degree of parastomal varices. Parastomal varices bleeding, although rare, can be life-threatening and challenging to treat. Direct percutaneous access of the parastomal varices and embolisation with a combination of interlock coils and PHIL offers a safe and effective alternative to other treatment options.

Take-home Points: This case demonstrates a safe and effective alternative to treat recurrent parastomal varices bleeding by direct percutaneous access and embolisation with interlock coils and PHIL.

P-201

Two cases of congenital bronchial artery malformation coexisting with a high flow fistula to the pulmonary artery; embolization under flow control with bidirectional balloon occlusion

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Clinical History/Pre-treatment Imaging: Two patients presented with abnormal chest x-ray findings. Contrast enhanced CT (CECT) of them demonstrated tortuous and dilated bronchial arteries (BA) communicating with the pulmonary artery (PA). Embolization was scheduled based on the diagnosis of congenital bronchial artery malformation (CBAM).

Treatment Options/Results: Bidirectional approach, from PA as well as from BA, was planned because of tortuosity of BA, coexisting BA aneurysms with multiple inflows, and high flow shunt based on angiography

for both patients. In case 1, bidirectional balloon occlusion of BA, one of which was retrogradely from the PA through the fistula and the other was antegradely, was performed. Subsequently, bidirectional coil embolization followed by antegrade glue embolization was performed. In case 2, the catheterization from PA into BA failed. Consequently, antegrade glue embolization with bidirectional BO, one of which was performed by blocking the fistula with balloon occlusion of PA, and the other was antegradely, was performed. CECT several weeks after embolization demonstrated complete occlusion of CBAM in both patients.

Discussion: CBAM with a fistula to PA are extremely rare. Embolization of distal BA to occlude possible inflows and prevention for migration of embolic material into PA are crucial in this condition. The retrograde access into BA in conjunction with antegrade access will allow us to perform safe and reliable embolization. The occlusion of PA to close the fistula may be also useful as an alternative method for flow control.

Take-home Points: Bidirectional BO in embolization of CBAM with high flow fistula to PA will allow us to accomplish safe and reliable embolization.

P-202

Large pulmonary artery pseudoaneurysm after CardioMEMS implantation

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Clinical History/Pre-treatment Imaging: An 80-year-old male patient with Heart Failure with reduced Ejection Fraction (HFrEF; EF 20%) and past medical history of right coronary artery ST-elevation myocardial infarction underwent CardioMEMS HF system implantation for recurrent shortness of breath. He developed hemoptysis and dyspnea during the procedure, which was managed with furosemide. However, post-procedure, the patient had down-trending hemoglobin and multiple episodes of hemoptysis, for which he was transferred to a tertiary-care center.

Treatment Options/Results: The patient's computerized tomographic angiography (CTA) showed a 3.4 cm pseudoaneurysm with active extravasation from the superior segmental branch of the left pulmonary artery due to injury during device placement. The decision to embolize the pseudoaneurysm was made after a multi-disciplinary team meeting and discussion with the patient.

Discussion: The pseudoaneurysm location and measurements were confirmed with intra-operative selective angiograms, and the decision to perform coil embolization across the pseudoaneurysm neck was made. A 2 mm coil was placed in the distal pulmonary artery branch beyond the pseudoaneurysm neck, a 40 mm x 6 cm detachable ruby framing coil was placed within the aneurysm sac, and a 3 mm x 1.2 cm coil was placed in the proximal aspect of the inflow feeding artery along with multiple additional 2mm packing coils. The final left pulmonary angiogram showed complete stasis and no further filling of the pseudoaneurysm sac.

Take-home Points: CardioMEMS device placement procedure can be associated with pulmonary artery injury, and it essential to understand the mechanisms of injury, its prevention, and management.

P-203

Emergency embolization of ruptured giant renal angiomyolipoma in young patient with tuberous sclerosis

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Clinical History/Pre-treatment Imaging: Renal angiomyolipoma (AML) is a uncommon benign renal neoplasm, often found incidentally. Due to the tumor vessels architecture, management of renal AML bleeding are challenging. A 24-year-old-female-patient affected by tuberous-sclerosis was transferred to our trauma-center due to acute distress with

a tenderness of palpation of the left flank after car accident. She had a pulse rate of 105-beats/min, blood-pressure of 96/56 mmHg, hemoglobin of 9.2g/dL, platelet-count of 280.000/ μ L, and with normal coagulation parameters. c.e. CT was performed and a giant bilateral renal AMLs was revealed with a massive retroperitoneal hematoma and active bleeding from left renal tumor

Treatment Options/Results: After multidisciplinary consultation, considering the young age of the patient, tumor size and the cause of bleeding, patient was referred to our interventional radiology department for TAE. A preliminary aortogram was made to exclude polar renal artery or proximal renal capsular artery bleeding. After, left renal artery angiography was performed using a 5-Fr catheter in order to detect bleeding-feeder-vessels (BFV). Super selective approach to BFV was obtained using a 2.4-Fr microcatheter. Embolization of subcapsular bleeding was performed with microsphere 100-300 μ m and after a BFV legation was obtained with coils, obtaining complete occlusion of bleeding spots. After 48h c.e. CT showed absence of bleeding with initial resorption of the retroperitoneal hematoma without signs of tumor necrosis or immediate changes in AML size. Patient was dismissed after 1 week.

Discussion: In this case, due to normal coagulation parameter, we opted for particles and coils

Take-home Points: Embolization with glue it is preferred when there are coagulation disorders

P-204

Endovascular embolization in the management of gastric arteriovenous malformation: an uncommon cause of upper gastrointestinal hemorrhage

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Clinical History/Pre-treatment Imaging: An 11 yr old female, known case of congenital heart disease with liver cirrhosis, presented with complaints of recurrent hematemesis and melena. Her hemoglobin was 5.3 gm/dl and coagulation profile was deranged. After initial stabilization, she underwent upper gastrointestinal (GI) endoscopy which revealed altered blood and mild to moderate erosive gastritis in body and fundus of stomach. She developed another episode of hematemesis and was in shock, then she was referred to Interventional Radiology.

Treatment Options/Results: Under fresh frozen plasma cover, patient underwent abdominal angiography which initially revealed arteriovenous malformation (AVM) in proximal stomach with feeders from left gastric artery and drainage into left gastric vein. Angioembolization was performed with mixture of polyvinyl alcohol particles of 355-500 μ m size and Gelfoam slurry. Patient's general condition improved after the procedure. On three months follow-up, patient had no further complaints of hematemesis or melena and her hemoglobin was also within normal range.

Discussion: AVM is a congenital lesion which originates due to failure of embryonic plexus to develop into mature capillary bed, resulting in persistent connections between artery and veins through a nidus. Gastric AVM is a rare cause of upper GI hemorrhage, and mostly seen in elderly people, contrary to our case. Minimally invasive techniques like endoscopy and angioembolization can be used to manage this condition effectively.

Take-home Points: Angioembolization can be utilized in the management of Gastric AVM, if endoscopy fails to diagnose or treat the lesion.

P-205

Acquired arteriovenous fistula associated with deep venous thrombosis treated with venous reconstruction and simultaneous arterial and venous stenting

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Clinical History/Pre-treatment Imaging: 59-year-old male was referred to the IR clinic for symptoms of debilitating swelling, pain, and discoloration of his left lower extremity associated with a history of multiple DVTs managed with anticoagulation. Pre-operative CT scan revealed complex left groin arteriovenous fistula (AVF) with associated significant edema and varices involving the left leg.

Treatment Options/Results: Multidisciplinary discussion confirmed limited surgical options. Left pelvic arteriography showed complex left groin AVF with poor arterial runoff. Venography revealed left CFV occlusion with patent outflow centrally. Peripheral venography after crossing the occlusion revealed venous arterialization with flow towards the foot. The CFV occlusion was recanalized and stented. Coil embolization and covered stenting was performed for the arterial segment. Resultant improved arterial runoff and reversal to patent cephalad venous outflow. Successful reduction of arteriovenous fistulization with plans of further staged treatment with liquid embolics. Upon serial follow-up over 22 months, the patient continued to improve clinically without any significant residual swelling or discomfort.

Discussion: Acquired AVFs are commonly caused by iatrogenic injury, trauma, or neoplasm. Deep vein thrombosis is a rare cause of acquired AVF thought secondary to venous hypertension and post-thrombotic syndrome. After venous recanalization and restoration of normal arterial/venous flow directionality, the patient has continued to improve clinically, and thus further targeted embolization has been deferred.

Take-home Points:

-DVT is an uncommon etiology for acquired AVF

-Although targeted embolization of the nidus is the mainstay of treatment of most AVFs, interventions for DVT-associated AVF aimed at relieving venous hypertension have the best long-term results

P-206

Successful embolization of pancreaticoduodenal artery pseudoaneurysm after emergency ulcer surgery due to a bleeding duodenal ulcer

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Clinical History/Pre-treatment Imaging: A 49-year-old male was admitted to ER with upper gastrointestinal bleeding due to duodenal ulcer, a duodenotomy with direct control of the bleeding site was performed. He was discharged after 6 days and readmitted to hospital for severe abdominal pain and coffee-ground emesis. A CT scan revealed a large pseudoaneurysm between the duodenum and the pancreatic head.

Treatment Options/Results: We performed an urgent transarterial arteriography that confirm the pseudoaneurysm from the anterior and posterior pancreaticoduodenal arcades. Superselective catheterization and coil embolization of both arteries was performed. The patient recovered well after embolization and blood transfusion.

Discussion: Pancreaticoduodenal artery pseudoaneurysm are extremely rare (1-2% of all visceral aneurysm). Pseudoaneurysms occur as a result of damage to the wall of an artery and can occur after abdominal trauma, pancreatitis, iatrogenic injuries, penetrating duodenal ulcers

and malignancies, and they often rupture into the gastrointestinal tract causing massive hemorrhage.

Our patient rapidly developed a 8 cm pseudoaneurysm and urgent endovascular angiography and embolization was performed successfully.

Take-home Points: We report a case of successful transcatheter arterial embolization of a pancreaticoduodenal artery pseudoaneurysm (PSA). Pancreaticoduodenal artery pseudoaneurysm is extremely rare and its rupture can cause a life-threatening hemorrhage which demands prompt intervention.

The endovascular management is a safe and very effective option with a high success rate and few complications eliminating the need of surgical intervention/reintervention.

P-207

Giant parapharyngeal high-flow arteriovenous malformation causing airway compromise: emergency embolo-sclerotherapy via an endovascular-only approach

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Clinical History/Pre-treatment Imaging: A 42-year-old female presented to A&E bleeding from the left ear. She had a 10-year history of a complex, large left-sided parapharyngeal arteriovenous malformation (AVM) causing symptoms of dysphagia, sleep apnoea and left-sided deafness. A contrast-enhanced CT of the neck demonstrated an 11x10x10cm, left parapharyngeal high-flow AVM drawing from left carotid artery with early fistulation to left jugular vein, threatened airway obstruction and dilated vessels adjacent to the left external auditory canal.

Treatment Options/Results: Following MDT discussion, she underwent tracheostomy. Emboloscclerotherapy under general anaesthetic was carried out taking a right femoral approach to selectively access the left ECA branches supplying the nidus. Transarterial sclerosis was carried out using 3% STS foam, dehydrated ethanol and gelfoam without percutaneous intervention.

The patient's symptoms of dysphagia and dyspnoea had significantly improved with significant devascularisation of the nidus radiologically. She was discharged with follow up.

Discussion: Treatment approaches to AVM aim to shut down the fistulating nidus by means of embolization and sclerosis of the endothelial cells. Angiography is required to display the nidal anatomy. Direct trans-arterial access is rarely possible, thus percutaneous puncture is often performed. Cervical AVMs are challenging due to their proximity to vital structures whilst surgery carries a high risk of intra-operative bleeding. Here, it was possible access the nidus via a trans-arterial approach without requiring percutaneous access.

Take-home Points: This case demonstrates an endovascular-only approach to a complex large HFAVM without complications and excellent symptomatic and radiological improvement after the first therapy. It also demonstrates the utility of elective tracheostomy for treatment of cervical AVM.

P-208

Percutaneous embolization of pulmonary artery pseudoaneurysm with detachable coils in association with non-adhesive liquid embolizing agent (Squid)

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Clinical History/Pre-treatment Imaging: A 46 years old male, at the preoperative chest X-ray for appendicitis was detected a nodular lesion at the lower left pulmonary lobe. To complete characterise the nodule, a contrast enhanced computed tomography (CE-CT) was performed showing a vascular lesion of 20 mm, suspected for pseudoaneurysm.

The patient, 10 years before, suffered from an atrioventricular block treated with a temporary pacemaker positioned through a femoral access; subsequently a definitive one was placed, no complications reported during the follow up.

Treatment Options/Results: The diagnostic angiography detected a flattening of the vascular wall conditioning a voluminous pseudoaneurysm in the distal portion of the tributary branch. A 2.9F microcatheter was advanced in the tributary vessel and 4 detachable coils were landed inside the sac (16-18mm Penumbra Inc). The feeding artery was embolized through an ethylene vinyl alcohol copolymer agent (Squid Peri 18, Emboflu). When the Squid started flowing back to the proximal part of the feeding vessel, the microcatheter was pulled out.

Discussion: The final angiographic control showed the exclusion of the pseudoaneurysmal sac; this finding was confirmed by the CE-CT after 40 days.

Take-home Points:

- Pulmonary artery pseudoaneurysms are rare but often lethal; no cases of PAPs embolisation using a recent ethylene vinyl alcohol copolymer agent (Squid) in association with detachable coils have been previously mentioned in literature.

- The use of Squid in association with a CE-CT scan reconstructed by SEMAR software has reduced artifacts. Those artifacts could cause severe limitations in discriminating the efficacy of the embolization procedure.

P-209

Pulmonary AVM embolization using the MVP™ micro vascular plug

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Clinical History/Pre-treatment Imaging: Male patient 56-year-old suffering from Hereditary Hemorrhagic Telangiectasia (HHT) who came to our attention for a pulmonary arteriovenous malformation.

Clinical history begins with the onset of neurological symptoms for which he went to the emergency department of another hospital where he underwent a brain CT scan that highlights the presence of a brain abscess. After performed cardiological investigations, which excluded a patent foramen ovale (PFO) or an atrial septal defect (ASD), which could justify cerebral events due to paradoxical embolism, a subsequent angio-TC showed the presence of a pAVM at the postero-basal segment of the left lower lobe.

Treatment Options/Results: We performed the AVM embolization using the MVP™ micro vascular plug system (Medtronic).

We achieved technical success, showing an immediate stasis in the feeding artery above the microvascular plug after its detachment; the procedure was short and no complication occurred.

The Angio-CT follow-up one month after the procedure showed complete embolization of the feeding vessel, size reduction and thrombosis of the AVM and return to a normal caliber of the venous efferent branch.

Discussion: We decided to use this device because of the very peripheral location of the AVM, supra-diaphragmatic, with an unfavorable origin of the afferent branch from the left pulmonary artery, and due to the small diameter of the afferent branch itself, approximately 4-5 mm.

Take-home Points: In conclusion, the MVP™ (Medtronic) appears to be safe and effective for the treatment of small PAVMs with tortuous feeding artery, in remote locations, where use of other traditional devices may be technically challenging.

P-210

A rare case of laryngeal schwannoma in young female: an interventional aid

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Clinical History/Pre-treatment Imaging: A 24 year young female patient presented with noisy breathing for seven years and change in voice for three years. On local examination there was a growth in right aryepiglottic fold, right arytenoid cartilage. Right vocal cord was not seen. Pooling of saliva was seen in right pyriform fossa.

Treatment Options/Results: MRI Images were done using Siemens Skyra 3 Tesla MRI Scanner. The interventional procedure was done in cathlab using GE Innova 41001Q machine.

Discussion: MRI neck showed well defined, intensely enhancing lesion involving hypopharynx, right aryepiglottic fold and extending upto right vocal cord. The patient is planned for preoperative embolization, to minimize intraoperative blood loss. Using 4F head hunter catheter right external carotid artery was accessed and angiogram showed an area of contrast blush in subglottic region. The right ascending pharyngeal artery was super selectively catheterized with 2.4F microcatheter and angiogram showed area of contrast blush which was subsequently embolized with 150 to 250 micron size polyvinyl alcohol particles. Post embolization angiogram showed significant reduction in the flow to the lesion. Next day patient underwent Transoral Robotic Excision of the lesion without any complications. Histopathological diagnosis of the excised lesion came as laryngeal schwannoma.

Take-home Points: Laryngeal Schwannomas are rare, benign neurogenic tumors. They are slow growing, encapsulated, submucosal lesions in the larynx. Aryepiglottic fold is the most common anatomical site. Preoperative embolization is a valuable adjunct to surgical resection.

P-211

Recanalize to embolise

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Clinical History/Pre-treatment Imaging: A 73-year old man presented to the emergency department with sudden onset abdominal pain and shock.

Treatment Options/Results: Following resuscitation, he had a CT, which showed active bleeding from the right lobe of liver with a large subcapsular haematoma. Incidentally, his coeliac artery was chronically occluded. He was referred for angiography and embolization. A superior mesenteric artery (SMA) angiogram was initially performed via a right femoral approach, confirming coeliac artery occlusion with retrograde filling from the GDA (Fig 1). The GDA and pancreaticoduodenal arcade were so tortuous, that a decision was made to attempt embolization following recanalization of the coeliac trunk. A SOS catheter was positioned adjacent to the coeliac artery origin and a microcatheter/wire were used to successfully cross the coeliac artery occlusion into the hepatic artery (Fig 2). Angiography confirmed active bleeding from a right hepatic artery branch, which was selectively catheterised and embolised with 250-350 µm PVA particles. The patient stabilised and had an uneventful recovery. Subsequent imaging revealed a hepatocellular carcinoma as the underlying lesion.

Discussion: Chronic coeliac artery occlusions may make hepatic angiography and embolization difficult or impossible due to the tortuous collateral network from the SMA. A microcatheter may sometimes be successful in the recanalizing such occlusions to allow an easier access into the hepatic arteries.

Take-home Points: Coeliac artery recanalization may allow an easier access route into the hepatic arteries for elective and emergency hepatic

embolization procedures, which may otherwise be more difficult via a tortuous collateral network from the SMA.

P-212

Successful doxycycline sclerotherapy as treatment option for chronic lymphocele after axilla dissection: a case report

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Clinical History/Pre-treatment Imaging: A 67-year old patient underwent axilla dissection for lymphnode metastases of malignant melanoma in 04/2020 and developed a postoperative lymphocele. A 6 French drainage was implanted to drain the lymphocele into an external bag and compression therapy was initiated. No improvement was observed after 6 months with a daily drainage output of 500-2000 ml, so the patient was referred for sclerotherapy.

Treatment Options/Results: Doxycycline sclerotherapy was performed under US/fluoroscopy guidance. After contrast application in the drainage to rule out any communication with the deep vein system, the whole lymphatic fluid was manually aspirated. An US-guided lymphocele puncture was performed using a 23 G needle and 300 mg doxycycline were installed. The drain tube was sealed up for 24 hours after needle removal. This procedure was repeated 3 times over an 8 weeks period. The lymphatic fluid output reduced to <50ml a day, US showed a significant reduction of the lymphocele, so drainage was removed. Postinterventional follow-up showed no recurrence of the lymphocele.

Discussion: Sclerotherapy is a valuable treatment option for chronic lymphoceles. Current literature suggests to use 95% alcohol/povidone-iodine for sclerotherapy of lymphoceles with success rates of up to 98 %. However, using 95% alcohol for sclerotherapy in superficial areas sets the patient at high risk for developing skin necrosis, which is why we used doxycycline with similar reported efficiency rates. Depending on the lymphoceles' size, repetitive sclerotherapies can be necessary for complete treatment as in this case.

Take-home Points: Doxycycline sclerotherapy is an effective therapy option for chronic lymphocele after axillary lymph node dissection.

P-213

Pancreatic arteriovenous malformation embolization with ethylene-vinyl alcohol

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Clinical History/Pre-treatment Imaging: Female 60 year-old patient. Consulted in the ER with one week epigastric pain related to meals, irradiated to the left hypochondrium, with night component. Increased whites (14.000/ml). Serum amylase and hepatogram were normal. Initial abdominal CT and MR with contrast showed an ill-defined lesion in the pancreatic neck with contrast enhancement.

Abdominal Doppler ultrasound suggested the lesion corresponded to a vascular malformation which was confirmed by a CT-angiography, which showed a nidus in the neck and body and early filling of the portal vein.

Treatment Options/Results: Right femoral artery access with a 5Fr sheath. Celiac trunk angiogram was performed with a Simmons I 5Fr hydrophilic catheter and showed a arteriovenous malformations with multiple arterial pedicles, a fine capillary network and multiple draining veins tributaries of the portal vein.

Using a Progreat 2.7 and Rebar 18 catheters the great pancreatic artery and three branches of the gastroduodenal artery where catheterized and embolized with 4 ml of EVOH (Onyx 18) in total.

Control celiac trunk angiography showed complete occlusion of the embolized arteries and a very small caudal vascularized remanent of the nidus.

Discussion: Pancreatic AVMs are considered a rare and uncommon disease, with few cases presented in the literature. Transarterial embolization is a valuable and effective treatment. Ethyl-vinyl alcohol appears to be safe and effective, presenting better penetration into the AVM nidus, allowing longer embolization injections.

Take-home Points: In our case, EVOH proved to be effective, with almost complete AVM exclusion from the systemic vascular network and with no reported major complications related to distal organ embolization.

P-214

Distal radial artery approach for prostate artery embolization

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Clinical History/Pre-treatment Imaging: A 65-year-old male presented with lower urinary tract symptoms (LUTS) secondary to benign prostatic hyperplasia. His International Prostate Symptom Score (IPSS) was 14/35 (moderate symptoms) and his quality-of-life (QoL) score was 4/6 (mostly dissatisfied). The prostate volume was estimated at 60cc on MRI. LUTS were refractory to medical treatments and the patient refused surgery and asked for a minimally invasive alternative treatment.

Treatment Options/Results: PAE was performed via a left distal transradial approach (DTRA) under local anaesthesia on an outpatient basis. The left distal radial artery was punctured in the anatomical snuffbox under ultrasound guidance. Selective embolization of the each side prostatic artery was performed with 250 microns microspheres using the PERFeCTED technique. A dedicated distal radial compression device was left 45min in total. At 3 months after PAE, LUTS improved dramatically with an IPSS score of 4/35 and QoL score of 1/6. No recurrence of the LUTS were observed at one year follow-up.

Discussion: DTRA is an alternative to conventional TRA and should limit the risk for radial artery occlusion leading to possible hand ischemia. It improves patient's comfort and allows for shorter recovery time after the procedure. However, a vessel diameter >2mm and a patient's height < 170cm are recommended to use the DTRA for PAE with the current devices.

Take-home Points: Left DTRA is a safe and feasible method for performing PAE.

Patient's height has to be taken into consideration to prevent limitations due to catheters length.

DTRA at the anatomical snuffbox allows for short compression times at the access site.

EVAR and TEVAR

P-215

Onyx cast fragmentation after embolization of endoleaks

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Purpose: Endoleaks are common following EVAR and the liquid embolic material Onyx has been widely used in their treatment. We report our experience of long term morphological changes of Onyx casts on surveillance imaging.

Materials and Methods: We identified 10 patients over 10 years who underwent Onyx embolization in our institution. Morphological changes of Onyx casts were assessed on surveillance radiographs and CT scans. Relevant outcome data and sequelae were obtained via electronic patient records.

Results: 12 procedures were performed on 10 cases, 9 for type 2, 1 for a type 1a endoleak. 5 cases showed evidence of Onyx fragmentation on

follow up imaging ranging from a single fracture to gross fragmentation with migration of fragments. Of these 5, 3 had achieved primary success but 2 went on to develop recurrence of endoleak. Onyx volume ranged from 4-46.5ml (median 10.5ml) per patient with larger volumes demonstrating the most marked fragmentation on follow up. Follow up ranged from 9 months to 8 years (median 2.25 years).

Conclusion: To our knowledge, this is the first report of Onyx fragmentation after endoleak embolization. If long term morphological stability of the Onyx cast is necessary to maintain aneurysm seal, then Onyx may not offer a permanent solution to some patients with post-EVAR endoleaks. Our study cannot ascertain whether the observed changes were the cause or the effect of ongoing aneurysm growth, persistent endoleak and/or other forces acting on the solidified polymer, but it raises important questions on the use of Onyx in this setting.

P-216

100% endovascular treatment for rAAA is possible and used-experience from the last 15 years

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Purpose: Analysis results of a single dedicated endovascular center for EVAR in rAAA.

Materials and Methods: Retrospective analysis of all rAAA admission to Örebro University Hospital from 2009-2020 (total endovascular period).

Results: Data collected and being analyzed.

All rAAA procedures were done by Endovascular means from 2009 until today.

Conclusion: 100% EVAR for rAAA is possible and center dependend. (more to come after ready analysis)

P-217

Long-term outcome results after endovascular aortoiliac aneurysm repair with the bifurcated Gore® Excluder® endoprosthesis

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Purpose: To report the long-term outcome of patients presenting with an aortic, aortoiliac or isolated common iliac aneurysm treated with the Excluder bifurcated endoprosthesis. Furthermore, potential differences in late outcome between original and low permeability endoprosthesis were analyzed.

Materials and Methods: Retrospective analysis of a prospectively collected data of 182 patients who underwent endovascular aneurysm repair with the Excluder endoprosthesis between June 1998 and October 2015 in an academic, tertiary care center for aortic disease. Patients were followed-up for 3 to 20 years (mean follow-up of 6.9 years). Primary endpoints are overall survival and reintervention-free survival. Secondary endpoints are device-related complications, endoleaks and reinterventions.

Results: Overall survival at 5, 10 and 15 years was 72.8%, 42.1% and 12.2% respectively, with no aneurysm-related mortality. Freedom from type I endoleak at five years was 94.8%. No new type I endoleak was detected beyond the 5-year follow-up mark. No type III endoleak was identified. Reintervention-free survival was 83.6%, 66.7% and 66.7% at 5, 10 and 15 years of follow-up.

There was a significant difference in intervention-free survival between the original versus low permeability endoprosthesis group (p=.029) and after the 5-year mark, low permeability endoprosthesis had significantly fewer new, device-related complications (p=.002) or endoleaks (p=.005).

Conclusion: Endovascular aneurysm repair using the Excluder endoprosthesis is effective and durable on long-term follow-up, with acceptably low device-related complications and reinterventions. Low permeability endoprosthesis was associated with significantly fewer new device-related complications and endoleaks after 5 years of follow-up.

P-218

Association between length of stent graft and spinal cord ischemia after endovascular repair of type B aortic dissection: myth or a reality?

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Purpose: To examine the association between length of stent graft and occurrence of spinal cord ischemia (SCI) after thoracic endovascular aortic repair (TEVAR) for type B aortic dissection

Materials and Methods: A retrospective study was conducted of 38 patients (mean age 52 ± 15 years; 35 men) with type B aortic dissection who underwent TEVAR. Patients were stratified into two groups on the basis of stent graft length (SGL): Group A ($SGL \leq 200$ mm; $n=19$) and Group B ($SGL > 200$ mm; $n=19$). Mean SGLs were 200mm in Group A and 277 ± 27 mm in Group B. All procedures were performed under general anesthesia and with strict blood pressure monitoring. Preoperative CSF drain was instituted in two patients in Group B who had hypoplastic/atretic left vertebral artery.

Results: There was no significant difference in vertebral artery dominance between Group A and B. One patient in Group B who also had bilateral internal iliac artery occlusion, developed delayed post-operative neurological deficit referable to SCI which completely resolved after institution of CSF drainage. However, the incidence of SCI was not significantly different between Group A and Group B ($p=0.634$).

Conclusion: Despite the use of long SGL during TEVAR and concomitant left subclavian artery coverage in Group B, there was low risk of SCI. Hence, longer aortic coverage (beyond 200 mm) may be instituted when necessary for better aortic remodelling, as threshold for SCI is high in cases of aortic dissection.

P-219

Efficacy of thoracic endovascular aortic repair for late chronic aortic dissection with aortic remodeling

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Purpose: To evaluate the use of thoracic endovascular aortic repair (TEVAR) for late chronic aortic dissection with aortic remodeling.

Materials and Methods: Seventeen patients with late chronic (more than 1 year after initial onset) Type B aortic dissection or residual dissection after open repair for type A aortic dissection were performed TEVAR for aneurysmal degeneration between 2012 and 2019. Changes of aortic diameter and perfusion status of the false lumen were analyzed with computed tomography.

Results: Median diameter of preoperative thoracic aorta was 58 (range, 38-79)mm. Median time from onset of the dissection to TEVAR was 53 (range, 13-160) months. Shrinkage of the aneurysm diameter was observed in 9 cases, stabilization in 4, enlargement in 4, and the aneurysm enlargement was prevented in 13 cases (76%). In 8 of 9 cases with shrinkage, aneurysm remodeling was observed in CT at 6 months after TEVAR. Complete thrombosis of the false lumen was observed in 4 cases and aneurysm enlargement was controlled in all cases. Whereas the false lumen in the abdominal region remained patent in 6 of 9 cases

of reduction. Reintervention was performed in 5 cases including open operation in 1, endovascular treatment in 4 cases.

Conclusion: TEVAR for late chronic dissection appears to be feasible, and may contribute to control aneurysm enlargement. Complete thrombosis of the false lumen in visceral segment does not seem to be essential to control aneurysms. Aneurysmal degeneration is expected at early phase after TEVAR even in the late chronic cases.

P-220

Early experience of the Alto endograft for anatomically challenging infrarenal AAA at a UK tertiary vascular centre

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Purpose: To share our initial experience using the Alto endograft (the next generation Ovation endograft with polymer-filled sealing rings and a new integrated moulding balloon), for endovascular aneurysm repair (EVAR) of infrarenal abdominal aortic aneurysms.

Materials and Methods: Retrospective analysis of Alto EVAR cases performed between November 2020 and March 2021. Data collected included patient demographics and co-morbidities, aneurysm-related parameters, operative details including complications, length of stay and follow-up scan (where available), obtained from patient and radiology information systems and multidisciplinary meeting notes.

Results: The Alto endograft was implanted in 14 patients considered unsuitable for conventional EVAR or open surgical repair. Mean age was 75 years (range 54-83), mean aneurysm diameter 66 mm (range 58-100), mean neck length 25 mm (range 9-57), mean neck diameter 23 mm (range 16-31) and mean beta angle 40° (range 0-75). Technical success (device delivered and deployed) was achieved in 100%. There was one each of intraoperative Type1A endoleak (resolved with bare-metal stent) and Type3 endoleak (resolved with moulding). Mean length of stay was 4.5 days (range 2-16). 8 patients had one-month follow-up CT (no Type1/Type3 endoleaks, or other complications requiring re-intervention).

Conclusion: All 14 patients were considered at our AAA multidisciplinary team meeting to be unsuitable for conventional EVAR (aortic neck/bifurcation diameter, neck length/angle, access vessel diameter/tortuosity). Our early experience confirms that these challenging anatomical characteristics were addressed by the Alto endograft, thus expanding the range of patients who can be treated, due to its low profile delivery system, trackability and proximal polymer-filled sealing rings, and that it is safe.

P-221

Modified parallel graft technique using the VBX stent graft in the treatment of complex aneurysms of the iliac territory: initial experience

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Purpose: Aneurysms of the iliac territory very often represent a challenge for endovascular treatment because of their complexity. We describe the modified parallel graft technique using the new GORE® VIABAHN® VBX Balloon expandable endoprosthesis (VBX stent graft) for the treatment of such lesions.

Materials and Methods: A retrospective review of common iliac and internal iliac artery aneurysms treated with the VBX stent graft (alone or with modified parallel graft technique) in our center between March 2019 and December 2020 was performed. None of the cases were manageable with regular EVAR, IBE or conventional stent graft.

Anatomical characteristics, demographics, procedure details, patency and complications were reviewed.

A follow-up CTA scan was performed at least 9 months after each procedure evaluating the patency of the stents and the internal iliac arteries, aneurysm diameters and the presence of endoleaks.

Results: 8 patients with 14 iliac aneurysms were treated with the modified parallel graft technique using the VBX stent. Two intraoperative endoleaks were reported at the end of the procedures with resolution in the CTA control scan. At follow up, permeability of the stents was preserved as well as the patency of the internal iliac arteries. No growth of the treated aneurysms was observed.

Conclusion: The modified parallel graft technique using the VBX stent graft seems to be a safe and effective procedure for the treatment of iliac aneurysms not manageable with regular endovascular treatment. Larger sample sizes and longer follow-ups are necessary to validate these results in the long term.

P-222

Early experience of the Heli-FX EndoAnchor system in a high volume UK centre

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Purpose: To assess the safety, technical success and short term outcomes of Heli-FX EndoAnchor (Medtronic) deployment in thoracic and abdominal endovascular aortic aneurysm repair (TEVAR/ EVAR).

Materials and Methods: Single institution, retrospective study of all EndoAnchor procedures from 01/02/2017 to 15/02/2021. Clinical information, indication and outcome data were retrieved from the hospital radiology information system and electronic medical records.

Results: A total of 205 EndoAnchors were deployed over 46 procedures (median 8, range 3-10); 29 procedures were primary interventions (at initial stent graft deployment) and 17 were secondary (previously deployed stent graft). Primary intervention group: 4 TEVARs and 25 EVARs. Indications were hostile neck (n=24), hostile distal landing zone (n=2) (All TEVAR) and intra-operative type 1 endoleak (n=3). Secondary intervention group: 5 TEVARs and 12 EVARs. Indications were: Graft migration (n=7), seal zone expansion: proximal (n=3) or distal seal (n=3) without proven endoleak and type 1 endoleak (n=4). For the secondary EndoAnchor procedures, the median time from index procedure was 27 months (3-108). Median time to deploy EndoAnchors was 22 minutes (8-46). Technical success per procedure was 98% with one case of EndoAnchor applicator failure with no deployment. 30-Day mortality rate was 0%. The overall adverse event rate was 4% (n=2) with one type 1a endoleak requiring further intervention and one case of delayed EndoAnchor migration without any clinical significance.

Conclusion: EndoAnchors are a safe procedure with excellent technical success rate and good early clinical outcomes.

P-223

Chimney evar with Viabahn VBX in unruptured and ruptured juxtarenal abdominal aortic aneurysms

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Purpose: In the treatment of pararenal abdominal aortic aneurysms and aortic pathologic processes, chimney endovascular aneurysm repair (CHEVAR) represents an alternative technique for urgent cases. The aim of this study is to evaluate the preliminary outcomes of the Gore® Viabahn® balloon-expandable endoprosthesis (VBX) as chimney grafts (CG) for kidney perfusion during CHEVAR

Materials and Methods: Between April 2018 and February 2021, data from patients undergoing CHEVAR were prospectively collected. Anatomical, procedural, and postoperative data of patients treated with VBX as

chimney grafts (CGs) were analyzed. The primary end point was clinical success, defined as freedom from procedure-related mortality, persistent type IA endoleak, occlusion or high-grade stenosis (>70%) of CGs, and any chimney technique-related secondary procedure for the entire follow-up period.

Results: We performed 15 consecutive CHEVAR with the Endurant stent graft and Viabahn VBX. A total of 24 chimney grafts (CGs) were implanted. All 24 targeted chimney vessels were cannulated successfully. No case of renal ischemia were observed. Median follow-up was 18.5± 5.2 months. No death was observed during follow-up. Primary and secondary freedom from persistent type IA endoleak rates were 85% respectively. We observed patency in all CGs stent. The rate of reinterventions related to the chimney-technique was 15% (n = 1). The estimated cumulative primary patency and freedom from persistent type IA-endoleak were 100% and 85.3%.

Conclusion: The elective use of CHEVAR with the Endurant stent graft and Viabahn VBX in our series showed favorable midterm clinical results, which are similar to the published results of other total endovascular modalities.

P-224

Real-life endoleak management in an academic center

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Purpose: To show the post-EVAR endoleak (EL) treatment results in an academic university center.

Materials and Methods: In a retrospective review of the last 5 years, a total of 24 patients (22 males; 2 females), mean age 80 years (range 68-92) were embolised. 22 bifurcated and 2 aorto uni-iliac stent graft were used to treat the AAA with an average aneurysmal sac of 71 mm (range 43-110). One type Ia and 23 type II endoleaks were treated in 31 treatment sessions. Transarterial access was chosen in 20 patients, percutaneous access in 3 and transcaval puncture in 1. Embolic agent was chosen base on operator preference (14 onyx, 5 coils, 1 amplatzer, 1 cyanoacrylate, 3 onyx+coils). Follow-up contrast enhancement CT was performed at 1, 6 and 12 months.

Results: 77% patients presented aneurysmal growth and 23 % presented persistent endoleak for more than one year. The mean time between EVAR and EL embolisation was 41,9 months. The mean follow-up was 28,3 months. Technical success was 100%. Clinical success was 87,5 %. EL persisted despite successful embolisation in 3 patients, 1 treated with onyx, 1 treated with coils and 1 treated with cyanoacrylate. No major complications, except for one asymptomatic Onyx migration into a subsegmental lobar artery. Non-related endoleak treatment mortality at 30 days was of 8,3%.

Conclusion: Endoleak embolisation has a high technical success. The clinical success depends on different variables despite a correct embolisation treatment. According to this data, no single embolic agent demonstrates better results.

P-225

Endoleaks diagnosis after stent-graft aortic repair, dual-energy CT comes in

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Learning Objectives:

- To evaluate the role of Dual-Energy CT in EVAR follow-up
- To illustrate the different dual-energy postprocessing techniques utility in endoleak diagnosis

Background: Endovascular aortic repair (EVAR) with stent-graft placement is an established treatment of aortic aneurysm. Endoleak is a common complication, reported in almost 20% of all EVAR. Only 25% of them need treatment at 3 years. Follow-up after EVAR is essential to detect endoleak and aneurysm sac expansion, which has been linked to increased rupture risk. There is general consensus on the treatment of type II in case of evidence of sac expansion (>5mm/year).

Clinical Findings/Procedure Details: EVAR patient must follow a strict follow-up after the procedure to ensure absence of leaks and sac expansion. CT-angiography is the prevalent follow-up modality because it allows precise sac measurement and assessment of endoleak type. Dual-energy CT (DECT) can be useful to improve the detection of endoleaks while allowing dose reduction.

Virtual non contrast images could avoid a non contrast phase scanning of the patient, allowing dose reduction without affecting detection rate as shown in a recent study.

Iodine content map can help the radiologist to visualize the endoleaks and to distinguish it from hyperdense embolic materials.

Virtual low voltage images lead to creation of a virtual scanning at low and monoenergetic keV (usually 40-50Kev) therefore increasing iodine attenuation, leading to a more accurate endoleak detection.

Conclusion: DECT has an emerging role in multiple diagnostic application. While requiring further investigation its post processing reconstructions could improve endoleaks detection rate and dose reduction in patient with EVAR.

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Type 2 endoleaks diagnosis and management: the dilemma

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Learning Objectives: To review the diagnostic accuracy of imaging tools used for type 2 endoleaks detection.

To describe technical modalities of type 2 endoleaks embolization depending on the anatomy of the artery supplying the endoleak and the available route to access the endoleaks.

Background: Type 2 endoleaks are the most common following endovascular aneurysm repair. Their natural history can vary with some demonstrating a self-limited or indolent course and others cause the aneurysm sac enlargement up to rupture.

Clinical Findings/Procedure Details: Diagnosis is challenging because anatomy, endoleak size and obesity play a role in standardizing optimal follow-up protocols. The combined approach of computed tomography angiography (CTA) and Doppler and contrast-enhanced ultrasound (CEUS) is the gold standard. The treatment of type 2 endoleaks is mandatory when a significant sac size increase, commonly considered as at least 5 mm over 6 months, is demonstrated. The aim of treatment is to obliterate the endoleak cavity through its embolization. There are several technique modalities to have it depending on anatomy and the available route to access the endoleaks.

Conclusion: Type 2 endoleaks and their management represent a controversial issue. Thanks to imaging modalities and interventional radiology, their dynamic evolution is under surveillance and, if necessary, candidate to endovascular treatment.

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Prone ContrAST EnHancement Computed Tomography Angiography (PASHA) protocol to diagnose concealed endoleak and aortic sac hygroma

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Learning Objectives: To discuss a novel diagnostic technique, 'Prone contrAST enHanced computed tomography Angiography' (PASHA) to detect and classify concealed ELs.

Background: Standard 4-phase supine computed tomography angiography (CTA) scans are unable to detect smaller fabric tear (<1-2 mm) following EVAR, which are erroneously interpreted as type IV or V EL. Here, we propose a novel diagnostic technique, 'Prone contrAST enHanced computed tomography Angiography' (PASHA) that uses time-resolved four-phase CTA protocol to detect and classify concealed ELs.

Clinical Findings/Procedure Details: We performed a PASHA technique after continuous sac expansion following primary EVAR. Standard 4-phase CTA could not identify the EL source; however, PASHA protocol successfully diagnosed the concealed EL. PASHA protocol uses prone position during standard 4-phase CTA, which displaces the aorta anteriorly by approximately 5 mm, shortening the anterior cortex distance and allowing fluid transudation due to gravity with maximal EL enhancements. First, the patient lies in a prone position during the standard 4-phase CTA. Then, contrast medium (60 ml) is injected in a superficial vein (5.0 mL/sec) with the help of a 16-gauge needle, followed by 100 ml saline bolus. After 13 seconds, first phase scanning images are obtained. Subsequently, scanning takes place at 60, 90, and 180 seconds to visualize the contrast's inflow/outflow followed by image reconstruction (0.9 mm sections) from the primary data sets.

Conclusion: PASHA is a multi-phase positional CTA technique that enhances the degree of contrast infiltration into the aortic sac when micro-leaks are present, increasing the EL detection rate following EVAR and strategically map successful future intervention.

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A review of the management of endoleak and associated complications

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Learning Objectives:

- To better understand the efficacy of interventional radiological (IR) in the management of endoleak following endovascular aneurysm repair (EVAR).
- To better understand and identify potential complications, and improve future practice.
- To better identify factors that may contribute to adverse outcomes pre-operatively.

Background: Endoleak is a common complication following EVAR, affecting 20-40% of patients on follow-up, with Type II endoleak being the most commonly encountered form. Some endoleaks are unavoidable whilst others are a combination of graft deployment and patient selection. Eliminating endoleaks can be challenging, with multiple treatment choices and techniques available. The aim of treatment being to eliminate the aortic branches at their junction with the aneurysm and the nidus. Surgical options are available but endovascular techniques are generally preferred in the first instance given their minimally invasive nature.

Clinical Findings/Procedure Details: We collated the regional caseload of secondary interventions following EVAR across two centres performing EVAR. We report the total numbers of cases, the types of endoleak being managed, the rates of specific types of intervention, and rates and types

of complications, in particular; cases requiring subsequent procedures whether radiological intervention or surgery.

Conclusion: Interventional radiology offers multiple treatment options in the management of endoleak. These techniques require advanced endovascular skills but as reported, these techniques are not however without significant risk. Patient selection remains paramount in helping to mitigate against this known complication of EVAR. Careful multi-disciplinary team discussion must be made prior to initiating any treatment in order to gain the most successful outcomes in this cohort.

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EVAR GORE salvage fabric technique (ARAFAT) to salvage EVAR fabric fatigue and graft failure

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Learning Objectives: To discuss EVAR GORE SalvAge Fabric Technique (ARAFAT), an innovative management protocol to seal material graft failure due to type IIIb endoleak (EL).

Background: EVAR GORE SalvAge Fabric Technique (ARAFAT) is an innovative management protocol to seal material graft failure due to type IIIb endoleak (EL) in patients who are mainly at high risk for open conversion. **Clinical Findings/Procedure Details:** The ARAFAT principle relies on the use of polytetrafluoroethylene (PTFE) and realignment of polyester stent-graft for sealing the microleaks and aortic sac hygroma, resulted due to polyester filtration. We employed EVAR GORE SalvAge Fabric Technique (ARAFAT) following type IIIb EL to salvage previous EVAR with polyester-based stent-graft.

First, an oversized EXCLUDER[®] aortic cuff (GORE[®], Flagstaff, Arizona, USA) is deployed into the previously implanted polyester-based stent-graft. This is followed by simultaneous deployment of an EXCLUDER[®] iliac extension, as necessary, in double-barrel configuration from the main cuff. A minimum of 2 cm of a distal seal zone is provided to promote stability. Patients who had the original stent-graft with the iliac limbs in a ballerina configuration; or any conventional configuration, ARAFAT is suitable. We routinely extend the landing area to the external and internal iliac arteries by using bilateral branched iliac GORE[®] VIABAHN[®] VBX Balloon Expandable Endoprosthesis through the left superficial femoral artery and the left transaxillary approach.

Conclusion: ARAFAT technique helps to realign the graft for better spiral arterial flow. We successfully employed ARAFAT technique as a fully functioning protocol to overcome apparent challenges in managing material fatigue graft failure EL in high-risk patients.

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A case of N-butyl-2 cyanoacrylate cast formation at the common iliac artery after embolization of a type II endoleak guided to the internal iliac artery using EnSnare

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Clinical History/Pre-treatment Imaging: A 73-year-old man had undergone endovascular aneurysm repair (EVAR) for an abdominal aortic aneurysm (AAA) seven years ago and coil embolization for a type II endoleak three years ago. The patient presented with abdominal pain one month ago, and a computed tomography (CT) scan showed enlargement of the aneurysm and a recurrence of the type II endoleak. Endovascular embolization of the type II endoleak was planned.

Treatment Options/Results: A sheath was inserted into the right femoral artery, and a microcatheter was inserted into the orifice of the inferior mesenteric artery via the superior mesenteric artery. Angiography showed small vessels in the wall of the aneurysm sac, and an endoleak due to vasa vasorum was suspected. These vessels were embolized selectively using 25% N-butyl-2 cyanoacrylate (NBCA). On the post-embolization fluoroscopic images, formation of an NBCA cast, presumably via the collateral arteries, was identified in the left common iliac artery. The NBCA cast was grabbed by the EnSnare and guided to the internal iliac artery. **Discussion:** During endovascular treatment of a type II endoleak, NBCA is often used as an embolization material, and it may form a cast in the iliac artery via the collateral vessels. When this adverse event occurs, guiding the cast into the internal iliac artery using an EnSnare can prevent lower limb ischemia.

Take-home Points: An NBCA cast can form at the common iliac after a type II endoleak embolization. In such cases, guiding the cast to the internal iliac artery using an EnSnare can be an option to prevent complications.

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The use of a commercially available peri-interventional filter catheter for TEVAR in a patient with a stenosed coral-reef aorta

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Clinical History/Pre-treatment Imaging: A 60-year-old woman presented with upper back pain and refractory arterial hypertension. Computertomography revealed a 5 cm wide false aneurysm at the proximal descending aorta. The lumen of the distal thoracic aorta was highly narrowed by extensive coral-reef like calcifications (Figure 1, arrows).

Treatment Options/Results: An endovascular approach was considered favourable to treat the symptomatic false aneurysm. However, the introduction of an aortic endoprosthesis might release calcified plaque fragments from the stenotic segment. A solution was found by using a commercially available peri-interventional filter catheter (Capturex[®], Straub Medical AG, Switzerland). In general anaesthesia, the filter catheter was introduced via a contralateral percutaneous femoral access and deployed just distal to the narrowed coral-reef aortic section. Via the ipsilateral surgical femoral access, a balloon-expandable stentgraft was introduced along the expanded filter and deployed at the coral-reef stenosis (Figure 2, arrows). Then, an aortic endoprosthesis was introduced and deployed without problems across the false aortic aneurysm. Finally, the filter was collapsed and removed via its sheath. A 12 x 5 x 3 mm calcified plaque was found in the filter.

Discussion: In the present case, the use of a peri-interventional filter catheter enabled safe manipulations in an excessively calcified aorta for transfemoral placement of an endoprosthesis. Although, a small gap between the filter struts and the vessel wall might be effected by the passing introducer sheath, relevant emboli were obviously caught as the patient remained free of embolic symptoms.

Take-home Points: The peri-interventional filter system represents a valuable tool to prevent distal embolisations during endovascular aortic procedures.

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Ruptured internal iliac aneurysm treatment with turned around EVAR iliac limb stent graft

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Clinical History/Pre-treatment Imaging: A 78y male patient with multiple comorbidities presenting with abdominal pain for a week. In a CT-Scan he showed bilateral AII-Aneurysms (7.5cm left, 6.5 cm right). Rupture of the right, retroperitoneal hematoma and active bleeding.

Treatment Options/Results: Ipsilateral cannulation of right IIA with RIM, long 6F Sheath and cannulation of superior gluteal artery, plug embolization of SGA (12mm AVP II Terumo). Coil embolization of two branches of internal pudendal artery with pushable Microcoils (Cook). Extracorporeal opening of a stent-graft (Medtronic (10/24)), refolding and "resheathing" after a 180° turnaround. Then Implantation of the stent-graft in CIA and EIA and Ballooning (Reliant AB 46). Angiographic control and vessel closure with Proglides and StarcloseSE (Abbott).

Discussion: We preferred an endovascular approach due to comorbidities and high surgical risk. We had not enough volume coils for a coiling of the aneurysm and no iliac side branch EVAR of the shelf. We want to avoid an complete bilateral EVAR to maintain the left CIA for future treatment of left IIA aneurysm, so we decided to use an iliac limb that we unfold, turned around and refold before implantation and a selective Coiling of internal branches for backdoor occlusion.

Take-home Points: The unfolding, refolding /resheathing of an EVAR stent-graft is a possible treatment option in case of vesseldiameter mismatch in emergency cases. It needs training and minimum of two handy interventionalists. Then it is a feasible alternative use of stent graft fitting.

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Periinterventional endoleak identification during DSA guided EVOH embolization of type-II-endoleak after EVAR using contrast-enhanced ultrasound (CEUS): a case report

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Clinical History/Pre-treatment Imaging: In the postoperative course after EVAR, a 84 year old male developed a type-II-endoleak via a lumbar artery confirmed by CTA. As transfemoral embolization with access through the iliofemoral arteries is often time-consuming due to vessel tortuosity and associated with higher failure rates, we performed a percutaneous EVOH (Ethylene-Vinyl-Alcohol-Copolymer/Onyx) embolization of the endoleak via a transabdominal access due to the sac configuration.

Treatment Options/Results: After endoleak localization by contrast-enhanced ultrasound (CEUS) using i.v.-injection of 2.4ml sulphur hexafluoride microbubbles, the aneurysm sac was punctured transabdominally under sonographic guidance using a Chiba needle. Needle position and endoleak site were confirmed using fluoroscopy and DSA after contrast application. After successful endoleak embolization with 7.5ml EVOH, the entry site was embolized with 0.5ml Onyx. Due to artifacts in postinterventional CTA, CEUS was used for follow-up imaging showing no residual vascularization of aneurysm and confirming a successful type-II-endoleak treatment.

Discussion: For successful Onyx embolization in type-II-endoleak CEUS is a highly valuable, mobile imaging tool allowing not only a periprocedural localization of endoleak sites, but also a CEUS-guided puncture of the aneurysm sac. Therefore, intervention time is shortened as less punctures of the aneurysm sac are necessary. As image quality of post-embolization CTA/MRA is highly reduced due to artifacts caused by embolization material, CEUS was used for peri- and postinterventional

imaging. Thereby, we could not only monitor the size, but also exclude any remaining vascularization of the aneurysm.

Take-home Points: The use of periprocedural CEUS can optimize DSA-guided EVOH embolization which is a safe treatment option for type-II-endoleak after EVAR.

P-234

Spinal cord ischaemia after elective EVAR

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Clinical History/Pre-treatment Imaging: 70 year-old, male patient with a medical history of hypertension and Chronic Obstructive Pulmonary Disease, who presented with a 56 mm asymptomatic infra-renal abdominal aortic aneurysm (AAA). After initial workup, criteria for endovascular aneurysm repair (EVAR) were met.

The patient was submitted to percutaneous EVAR using a bifurcated endograft with supra-renal fixation under local anaesthesia. The standard technique was performed and no intra-operative complications were noted. Hemodynamic stability and adequate anticoagulation were kept throughout the procedure.

Final angiography revealed complete exclusion of the AAA, preserving both internal iliac arteries and no endoleaks.

Treatment Options/Results: Immediately after surgery, the patient referred rapid and progressive onset of paraparesis.

Urgent MRI showed anterior medullary infarct between T11 and L1. Cerebrospinal fluid drainage was promptly started, mean arterial pressure was kept above 100 mmHg and dexamethasone 10mg 6/6h was prescribed.

The patient partially improved, maintaining a grade 2 motor function in both lower limbs.

Referral to a rehabilitation unit was made to ensure the best possible outcome.

Discussion: A long aortic coverage by an endograft, intra-operative hypotension, occlusion of the left subclavian artery or internal iliac arteries are considered as potential risk factors for spinal cord ischaemia. Embolic complications can also occur through guidewire manipulation of the sac thrombus.

Take-home Points: Spinal cord ischaemia is reported as a rare entity but it is a possible complication even after elective pEVAR.

Pathophysiology is multifactorial but a causative risk is uncertain and thus difficult to prevent.

Further insight into possible methods to prevent and treat spinal cord ischaemia is needed

P-235

CT-guided sac aspiration as a management of endotension after endovascular aortic aneurysm repair, implicated with high-level IL-6 content: a case report

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Clinical History/Pre-treatment Imaging: A 80-years-old male with infrarenal AAA measured 50mm in diameter underwent endovascular aortic repair (EVAR). The aneurysm sac gradually grew over a year (55mm in diameter) after the EVAR without any evidence of endoleaks on contrast enhanced CT, which indicates endotension. MR images acquired at admission showed high signal intensity content both on T1 and T2 weighted images, suggesting accumulation of methemoglobin-rich fluid.

Treatment Options/Results: CT-guided sac puncture in prone position under local anesthesia was conducted. 30 ml of cloudy brown colored liquid was simply aspirated. The needle was withdrawn without injecting

anything within the sac. Patient were discharged uneventfully without inflammatory reactions. Biochemical analysis of the content of the sac revealed marked elevation of Interleukin-6 (IL-6) level (5030 Pg/ml). CT acquired 1 year after aspiration showed substantial sac shrinkage (diameter 45mm).

Discussion: Endotension is a rare complication of EVAR, which is caused by variety of mechanisms and its management tend to be complex and difficult. IL-6 is known as an inflammatory mediator associated with aortic aneurysmal generation. Sac shrinkage after a simple aspiration of high-level IL-6 contents indicates that IL-6 can be related with a cause of endotension in this case.

Take-home Points: Successful management of endotension was achieved by a simple sac aspiration of high-level IL-6 contents. Elevation of IL-6 within the sac might be related with a cause of endotension in particular cases.

P-236

Hemiarch F-TEVAR with inside (insitu) fenestration of left common carotid (CCA) and left subclavian artery (LSA) in case aneurism Z2 zone

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Clinical History/Pre-treatment Imaging: The patient was admitted with acute chest pains.

After excluding myocardial infarction and CT, was revealed aneurysm of Z2 zone with diameter 48 mm.

risk factors:

atherosclerosis cholesterol > 4,8 mmol/l

arterial hypertension > 160/90 mm.Hg

Treatment Options/Results: We performed TEVAR in Z1 with hi heart rate pacing. After TEVAR in Z1 we have performed insitu fenestration of left CCA and LSA. We used electro cautery in dielectric solution for fenestration. The result was follow up to 6 months.

Discussion: The use of insitu fenestration has demonstrated efficacy, minimal invasiveness and could be a treatment option and alternative to open surgery for aortic arch aneurysm and its branches. The patient safely transfers the postoperative period and reduces hospitalization time.

Take-home Points: Surgical treatment with bypass aortic arch branches remains the gold standard for the treatment of the aortic arch pathology but associated with high rates complications. Using of fenestrated or branched TEVAR and Chimney technology can be attractive treatments for diseases of the aortic arch but they have the high cost, and custom made stent-grafts inability to wait for a few weeks production delay. That's why, we making insitu fenestration was used for patients with thoracic aneurism. Our emergency center conducted this treatment in 19 cases, with maximal follow up 30 months.

P-237

Use of 3D printing in a case of short neck AAA to create outside fenestration EVAR

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Clinical History/Pre-treatment Imaging: The patient was admitted with stomach ache. CT showed abdominal aortic aneurysm 68mm. the neck of AAA was less than 2mm, small aortic lumen (about 16mm) and iliac lumen was about 4,7-4,5mm. Also patient had lower paraplegia as a result of an accident more than 15 years ago.

Treatment Options/Results: Decision was performed outside fenestration EVAR. From ct was get stl object and printed 3d model of neck of AAA on photopolymer DPL-printer. Next step was outside fenestration with

thermal cutting and marking of graft. In kidney's artery was implanted bridge-graft. The result was follow up to 6 week's.

Discussion: Using a 3D model allows us to perform fenestration with good precision. The use of outside fenestration has demonstrated efficacy, minimal invasiveness and could be a treatment option and alternative to open surgery for abdominal aortic aneurysm and its branches. The patient safely transfers the postoperative period and reduces hospitalization time.

Take-home Points: Surgical treatment with bypass branches remains the gold standard for the treatment of AAA but associated with high rates complications. Chimney technology associated with hi risk of gutter endoleak. Using of custom made fenestrated or branched EVAR can be attractive treatments for diseases of AAA but they have the high cost, and custom made stent-grafts inability to wait for a few weeks production delay. That's why, we making outside fenestration with 3d printing was used for patients with short neck AAA.

P-238

Isolated iliac artery aneurysm in association with congenital pelvic kidney treated with iliac branch device: case report

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Clinical History/Pre-treatment Imaging: Association of abdominal aortic aneurysm with congenital pelvic kidney is rare and association with isolated iliac artery aneurysm is not yet described in the literature. A 75-year-old man was admitted for the treatment of an asymptomatic left common iliac artery aneurysm (CIA), and a left pelvic kidney. The congenital pelvic kidney was supplied by three small superior polar arteries that emerged from the proximal non-aneurysmal portion of the CIA and the main artery that arose from the internal iliac artery.

Treatment Options/Results: We had favorable anatomy to preserve all of the blood supply to the pelvic kidney using an Iliac Branch Device (IBD), without an aortic stent graft. A computed tomography angiography was performed 1 and 6 months after the procedure and demonstrated complete exclusion of the aneurysm and preservation of all renal arteries.

Discussion: The aim of surgical treatment of iliac aneurysm is to avoid rupture and preserve renal function in this particular case. In patients with iliac artery aneurysm endovascular repair may be considered as first line therapy. In our case, we had favorable anatomy to preserve all of the blood supply to the pelvic kidney using an IBD.

Instruction for use of IBDs recommend the use of a proximal bifurcated aortic device. However, when an adequate sealing zone is found in the CIA, an isolated iliac branch implant could be a treatment option.

Take-home Points: Treating patients with an association of iliac artery aneurysms and pelvic kidneys can be a challenge. The use of IBDs is a safe and effective alternative.

P-239

Stent graft repair of an eroded left subclavian bypass graft in a patient treated with hybrid TEVAR

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Clinical History/Pre-treatment Imaging: We report a case of a 68 year old male, hypertensive with incidentally detected fusiform aneurysm involving the descending thoracic aorta just distal to the left subclavian artery origin. Patient underwent hybrid TEVAR procedure with total arch debranching followed by endovascular placement of two overlapping stent grafts without any peri-procedural complications. He presented two months later with a non-tender midline anterior chest wall swelling. CT

aortogram left subclavian surgical graft disruption with pseudoaneurysm and surrounding hematoma

Treatment Options/Results: Infection as a cause of graft disruption was ruled out. Emergency repair of disrupted left subclavian graft was done by endovascular placement of stent graft within the disrupted segment through a left brachial artery surgical cut down access.

Discussion: On retrospective analysis of the immediate post procedure CT, one of the sternal sutures were seen in close contact with the anterior aspect of the left subclavian graft. Hence a provisional diagnosis of a focal full thickness defect of the surgical graft with an adjacent pseudoaneurysm secondary to abrasive injury caused by the adjacent sternal suture was made. The sternal sutures adjacent to the stent graft were surgically removed to prevent recurrence. Patient was stable at six months follow up with no endoleak or recurrence of mediastinal collection.

Take-home Points:

- 1) Delayed onset pseudo aneurysms are commonly due to graft infection. However if clinical picture is not suggestive of infection mechanical factors must be ruled out.
- 2) Sternal wires/sutures can be a source of trauma to debranching grafts particularly if they are displaced/broken.

P-240

Ischemic lumbar plexopathy after endovascular embolization of a type II endoleak using N-butyl-2-cyanoacrylate

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Clinical History/Pre-treatment Imaging: The patient was an 81-year-old man who underwent endovascular aortic repair (EVAR). An enlarging abdominal aortic aneurysm post-EVAR with type II endoleak was detected on the preoperative CT images (Fig. 1).

Treatment Options/Results: Although we considered translumbar embolization, the patient took an antiplatelet drug following percutaneous coronary intervention, and we decided to perform transarterial embolization. Because the use of a triaxial system was not able to advance to the aneurysm, a mixture of NBCA-lipiodol with a high-diluted solution (5%) was injected from the iliolumbar artery via lumbar arteries into the aneurysm sac. Fourteen hours after the embolization, the patient complained of both sensory and motor impairment in his right leg. T2-weighted MR images showed high-signal-intensity areas in the right iliolumbar, external obturator, pectineus, quadriceps femoris, sartorius, and adductor longus muscles (Fig. 2). This finding suggested denervation of these muscles due to ischemic lumbar plexopathy. Six months after the embolization, the lumbar plexopathy still remains.

Discussion: We report a rare case of ischemic lumbar plexopathy in a patient who presented after endovascular treatment of a type II endoleak following EVAR. The major cause of ischemic lumbar plexopathy is the impedance in the blood supplies such as the lumbar, iliolumbar, and lateral sacral arteries. These rich collaterals usually protect the lumbar plexus from ischemic injury. We speculated nonselective embolization impeded the rich collaterals and caused significant ischemic neurological injury.

Take-home Points: Extensive care must be taken while embolizing of the feeding arteries of type II endoleak, which may supply not only the spinal cord but peripheral nerve.

P-241

Intraoperative aortic injury-endovascular repair to rescue

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Clinical History/Pre-treatment Imaging: A 17 year old female presented with a large posterior mediastinal mass lesion with abdominal extension extending from D4 to D12 and encasing thoracic and abdominal aorta. The biopsy was conclusive neuroblastoma. After receiving neoadjuvant chemotherapy she underwent debulking surgery. However, the thoracic aorta was injured during surgery resulting in significant blood loss.

Treatment Options/Results: The bleeding was controlled by compression and rent closure was attempted by vascular surgery team however it was unsuccessful. The ABG performed serially was suggestive of worsening acidosis hence endovascular bail out procedure was considered. The incision line was extended to midline and arterial access was obtained via right common iliac artery. This was followed by endovascular stent graft placement in the surgical operation theatre under guidance of C-arm fluoroscopy marking the extent of the aortic tear externally. A 22 mm x 112 mm Valiant stent graft (Medtronic Inc., USA) was placed. There was immediate cessation of bleeding. Arteriotomy site was closed using 7-0 prolene. Patient was extubated 3 days postoperatively and safely mobilized. Post operative CT aortogram showed no evidence of endoleak.

Discussion: Although open surgical repair remains the traditional treatment for aortic injury Aortic graft placement enables safe and effective treatment of patients in critical conditions, and is associated with shorter operating times, minimal additional blood loss, and lower fluid requirements

Take-home Points: Intraoperative injuries of descending thoracic aorta can be successfully treated with endovascular stent graft placement safely depending on site of injury with shorter operative time thus minimizing the blood loss.

P-242

Endovascular aneurysm repair using the periscope technique to preserve renal blood flow in a patient with shaggy aorta

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Clinical History/Pre-treatment Imaging: A 70-year-old male, who had had a resection of sigmoid colon cancer, was diagnosed with an enlarged abdominal aortic aneurysm (AAA) while receiving chemotherapy for liver metastasis. We performed a computerized tomography angiography that showed a 50mm infrarenal AAA with shaggy thoracic aorta. To preserve a moderate renal function during chemotherapy, flow to the subpolar renal artery ought to be maintained.

Treatment Options/Results: The main body of the stentgraft was positioned below the level of the right subpolar branch of renal artery. The self-expanding periscope graft (PG) was subsequently advanced via the femoral artery to the right subpolar branch of renal artery and deployed from the renal artery to the aortic bifurcation. During the insertion of the balloon catheter to the PG, the aortic extension body was then delivered and deployed below the level of the both upper renal arteries.

A contrast-enhanced CT showed that there was no endoleak from the gutter space, the PG was patent, and optimal renal function was maintained.

Discussion: We conducted EVAR using the periscope technique to preserve renal blood flow.

The standard chimney technique could not be performed due to the shaggy aorta.

The PG was sandwiched between the aortic extension and the main body in this report.

The advantage of this method is that sufficient overlap can be obtained up to the terminal aorta and expected to minimize the gutter leak.

Take-home Points: Periscope technique during EVAR could be a potential option to preserve renal blood flow in patients with infrarenal AAA and shaggy aortic calcification.

Experimental work in IR

P-243

Initial outcomes of the prostatic artery occlusion in comparison with prostatic artery embolization for the management of benign prostatic hyperplasia in a canine model

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Purpose: To compare the technical efficacy and safety of prostatic artery occlusion (PAO) using Onyx® liquid embolic agent with prostatic artery embolization (PAE) in a canine model.

Materials and Methods: 15 adult male beagles underwent PAO (n=5) with Onyx-18 or PAE (n=10) with microspheres (300-500 µm). After procedures, all dogs were followed-up for 1 month. MRI evaluations were performed immediately before and 1 week, 2 weeks and 1 month after procedure. Prostate volume (PV) and prostate ischemia were documented and statistically analyzed between groups.

Results: Technical success was obtained in all animals. After interventions, the mean PV significantly decreased at 2 weeks and 1 month in both groups. Reduction rate of PV was 24.79% and 52.85% at 2 weeks and 1 month, respectively, in PAO-group; and 37.91% and 55.57% in PAE-group; no significant difference was noticed between groups at either time point. However, at 1 week post-intervention, the mean PV significantly increased from 16.28mL to 27.87mL (+64.33%) in PAO-group, but slightly decreased from 19.69mL to 19.22mL (-2.38%) in PAE-group. There was a significant increase in the mean prostate ischemia induced by PAO in comparison with PAE at 1 week (11.53 cm³ vs 4.34 cm³, respectively). No major complications were observed in any dogs during 1 month follow-up except one animal with PAO displaying transient haematuria and acute urinary retention due to non-target embolization of the urinary bladder wall during the first week after intervention.

Conclusion: PAO with Onyx-18 is technically feasible and has comparable efficacy and safety regard to PAE.

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Safety advantage of micro-biopsy compared to conventional EMB in swine

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Purpose: Endomyocardial biopsy (EMB) is an endovascular biopsy method, primarily used to detect graft rejection after cardiac transplantation and to investigate unexplained heart failure. To improve safety and flexibility of the EMB procedure, we recently developed a miniaturized biopsy device and analysis method referred to as micro-EMB. The purpose of the present study was to compare frequencies of acute major complications between EMB and micro-EMB in the right ventricle of swine.

Materials and Methods: 20 mixed breed Yorkshire-Swedish farm pigs (median 39 kg, range 33 – 48 kg) were subjected to either micro-EMB with

an in-house 0.4 mm micro-EMB device (n = 10), or EMB with a standard 5.5 F Cordis Biopsy Forceps (n = 10). The biopsies were taken from various parts of the right ventricular wall, including the free wall. The experiment was terminated either upon a major complication, such as tamponade, or a maximum of 30 biopsies without any major complication. The frequencies and character of the severe complications were compared on group level between the two groups.

Results: After a maximum of 30 consecutive biopsies, no animal suffered from a major complication in the micro-EMB group, whereas six animals in the EMB group (60 %) acquired cardiac tamponade (p = 0.003, Chi-square test) but no other major complications. Survival analysis further highlighted these differences (p = 0.004, log-rank test).

Conclusion: In the employed animal model, micro-EMB has a superior safety profile over conventional EMB with a preserved effectiveness, despite being tested in healthy animals with relatively low risk.

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Partially deployed Supera stent removal: is it feasible and when? Six-case experience

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Purpose: We present three cases of partially deployed Supera stents retrieval together with some considerations on the feasibility of this manoeuvre.

Materials and Methods: Case 1, Rutherford 4 patient with popliteal occlusion, recanalized endovascularly by a mix of antegrade and retrograde access. Angioplasty by 5.5 mm balloon was done and decision made to deploy a 5.5x200 mm Supera stent. Because of the presence of unrecognised focal highly calcific plaque not responding to standard angioplasty, the stent was deployed massively elongated at that level. The stent was pulled out when already deployed for roughly three centimetres, additional angioplasty by 6mm high pressure balloon was performed at that level, followed by nominal deployment of new Supera stent.

Results: The retrieval of the partially deployed Supera stent was successful in 2/3 cases.

Conclusion: Supera stent structure is very elastic and resistant to traction. Retrieval of this stent when partially deployed is technically feasible. Important factors affecting the success of this manoeuvre are the percentage of the stent already deployed (ideally should be <30%), the proximity of a sheath and the amount of atherosclerotic disease through which the stent is dragged. High pressure balloon angioplasty is useful to be performed at the level of the most calcific lesions in order to achieve correct luminal gain.

P-246

Electrically-guided re-entry during challenging infrainguinal chronic total occlusions recanalisation: first in vivo experience

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Purpose: We present the first in human deployment of a novel, electrically-guided re-entry device.

Materials and Methods: The SFA-POP occlusion was engaged in a sub-intimal fashion, and reentry was achieved at the level of the tibioperoneal trunk but recanalization of the Posterior Tibial Artery (PTA) was not successful. An ePATH re-entry catheter (Pathfinder Medical Ltd, London, UK) was introduced over the 0.014 antegrade wire and positioned subintimally

in the mid POP, and the retrograde wire, parked in the true lumen of the POP, was exchanged to the 0.018 ePATH target wire (Pathfinder Medical, London, UK). The needle was deployed and the 0.014 wire was advanced into the true lumen of the popliteal artery on the first attempt. The previously occluded segment was then angioplastied and stented.

Results: Immediate clinical improvement to the patient's rest pain was noted. The patient underwent further treatment on his contralateral leg and was then discharged. Tissue loss at the level of the right foot was completed healed at 10-week follow-up, and a biphasic right dorsalis pedis pulse was present at 6-month follow up.

Conclusion: The ePath re-entry catheter has been demonstrated to be safe and effective in achieving reentry in this complex infrainguinal arterial recanalization. This low cost and innovative electric guided re-entry technology is a promising solution and may potentially find application in different clinical scenarios, such as re-entry in iliac or aortic chronic total occlusions, deep venous arterialization, percutaneous fem-pop bypass, and endovascular creation of arteriovenous fistula for dialysis.

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REPOB (Re-Entry by Puncturing Outback into Balloon) technique in the treatment of infra-inguinal chronic total occlusions

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Purpose: We describe an endovascular technique called "re-entry by puncturing Outback® into balloon" (REPOB) to increase the technical success of sub-intimal recanalization of CTO.

Materials and Methods: This technique can be used once a bidirectional approach to the CTO is achieved. An Outback re-entry device is passed over the antegrade access wire and a balloon sized 1:1 with the vessel diameter is passed over the retrograde access wire or vice versa. The balloon is inflated to nominal to burst pressure, the Outback is orientated towards it and the needle deployed under fluoroscopic guidance. The burst of the balloon proves the success of the communication between the two different lumens. The 0.014 wire coming from the Outback needs to be pushed into the burst balloon for few cm in order to allow a safe retrieval of the latter till a safe intraluminal space. We used this technique in 25 cases. The artery to be recanalized was the Superficial Femoral Artery in 13 cases, Popliteal artery in 8 cases, CIA in 2 cases, EIA in 1 case and Peroneal artery in 1 case.

Results: Technical success was 96% with no significant complication recorded.

Conclusion: REPOB is a useful and safe technique, increases re-entry rate and helps re-entering at precise location without losing patent artery both proximally and distally in sub-intimal recanalization.

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The retrograde use of the Outback re-entry device for the treatment of challenging infra-inguinal chronic total occlusions

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Purpose: We present our experience with retrograde, infrainguinal recanalizations using the Outback re-entry catheter in challenging chronic total occlusions.

Materials and Methods: We report data from a retrospective multicentre registry of high-volume centers with extensive experience in complex retrograde recanalizations. Eligibility criteria included retrograde infrainguinal use of the Outback re-entry catheter where both conventional antegrade and retrograde recanalization had been unsuccessful. Procedural outcomes included technical success as well as safety.

Results: 45 patients underwent retrograde, infrainguinal recanalization attempts with the Outback re-entry catheter between February 2015 and August 2020. Thirty (66.7 %) patients had history of open vascular surgery in the index limb. In 4 patients (8.9 %), recanalizations were challenging due to previous surgical removal and/or ligation of the proximal superficial artery. Retrograde access site of the Outback catheter was the femoropopliteal segment in 31 (68.9 %) patients and crural vessels in 14 (31.1 %) patients. The re-entry target sites were common femoral artery in 31 (68.9 %) patients, superficial femoral artery in 9 (20.0 %) patients, popliteal artery in 1 (2.2 %) and below-the-knee arteries in 2 (4.4 %) patients. In 4 patients (8.9 %), the needle of the re-entry device was targeted to an inflated balloon, inserted via the antegrade route. The Outback re-entry catheter was placed in 19 (42.2 %) cases and sheathless in 26 (57.8 %) cases. Technical success was achieved in 91.1 % patients.

Conclusion: Retrograde use of the Outback re-entry catheter in infrainguinal chronic total occlusions provides effective and safe endovascular adjunct, when conventional antegrade and retrograde recanalization attempts have failed.

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The use of the retrograde approach in femoropopliteal chronic total occlusions revascularisation: literature review and technical considerations

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Purpose: The endovascular treatment of femoropopliteal lesions is an integral part of managing patients with peripheral arterial disease. The antegrade approach is the most widely used technique with good evidence for its safety and efficacy. However, crossing a lesion, particularly chronic total occlusions (CTO), can be technically challenging and so the retrograde approach is increasingly used to maximise the chances of procedural success. The objective of this systematic review is therefore to assess the safety and effectiveness of the ipsilateral retrograde approach to femoropopliteal lesions.

Materials and Methods: A systematic review conforming to the PRISMA standards was undertaken. MEDLINE, EMBASE and The Cochrane Register were searched between 1st January 1988 and 1st January 2020. Full-text, English language peer-reviewed articles pertaining to peripheral arterial disease, endovascular intervention and access site were included.

Results: A total of 8,599 papers were screened, of which 38, involving 1,940 patients undergoing 2,184 retrograde procedures were included. A retrograde approach was used as the primary access route in 45.1% (648/1,438) of procedures with relevant data. Primary technical success was achieved in 87.9% (1,920/2,184, 63.5%-100%) with a reported complication rate of 11.1% (235/2,117, 0% - 27.1%).

Conclusion: The ipsilateral retrograde approach to femoropopliteal lesions has good primary technical success and a low rate of complications, and has a promising role as a bailout, or even a primary access technique in complex lesions.

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Intravascular embolization in 4 cases of intralobar pulmonary sequestration: a new treatment perspective?

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Purpose: To evaluate endovascular embolic treatment as an alternative therapeutic option to surgery in patients suffering from intralobar pulmonary sequestration.

Materials and Methods: Four symptomatic patients (two with hemoptysis and two with recurrent inflammatory events) with intralobar pulmonary sequestration were treated and a systematic review of the literature on this congenital anomaly was performed. The embolization of the aberrant arteries occurred in two cases by means of metal spirals and in two cases by a liquid embolizing agent (Easyx).

Results: The procedure was shown to be effective in selectively reducing arterial inflow to pathological lung tissue, causing necrosis and progressive involutionary fibrosis. The intra and periprocedural complications were analyzed, as well as the long-term results obtained with clinical and radiological evaluation (TC at 1 and 6 months later). The only complication found was reported by patients treated with embolic fluid, such as a pleuritic-like pain that is limited over time. Embolization is therefore a less invasive and safer therapeutic alternative than surgical resection where morbidity and complications are greater.

Conclusion: Endovascular treatment has been shown to be a valid and effective therapy in patients suffering from intralobar pulmonary sequestration, a result that is in line with the current literature.

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A rat benign esophageal stricture model induced by mucosal resection

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Purpose: The purpose of this study was to establish a rat model of benign esophageal stricture induced by mucosal resection.

Materials and Methods: Sixteen male Sprague Dawley rats weighing 300-350g were randomly divided into two groups. Group A rats underwent a 1-cm three-fourth mucosal resection through a 3-mm incision in the distal esophagus under direct visualization via a laparotomy. Group B rats underwent a 3-mm incision of the muscularis propria layer in the distal esophagus via a laparotomy without mucosal resection. Necropsy with histologic assessment was performed at 2 weeks after the operation.

Results: The median dysphagia score was significantly higher in group A than it was in group B (3 vs 0, $P = 0.001$). The mean weight gain was significantly lower in group A than it was in the group B (-17.1% vs 11.1%, $P = 0.008$). Gross examination showed that esophageal stricture had been induced in all rats in group A. The mean degree of mucosal constriction was significantly higher in the group A than it was in group B (48.8% vs 4.8%, $P = 0.001$). Histological evaluations revealed that the number of nascent microvessels per unit area in the submucosal layer was significantly higher in group A than it was in group B (15.1 vs 3.8, $P = 0.005$), and the median damage score for the muscularis propria was significantly higher in group A than it was in group B (3 vs 0, $P = 0.009$).

Conclusion: The established rat benign esophageal stricture model induced by mucosal resection is simple, safe, and reproducible.

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Lymphangiography via the popliteal lymph node in a rabbit VX2 thigh tumor model

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Purpose: To evaluate the feasibility of lymphangiography via the popliteal lymph node in a rabbit VX2 thigh tumor model and to develop an animal model for retroperitoneal lymph node metastasis.

Materials and Methods: A rabbit thigh VX2 tumor model was created by implanting VX2 tumor tissues in the right thigh at 12 weeks of age in nine female Japanese white rabbits weighing 2.0-3.0 kg. rabbits were randomized into three groups according to day of lymphangiography after the tumor implantation: 1, day12; 2, day15; 3, day 19. The lymphatic system was visually evaluated on a 4-point scale (1, poor; 2, fair; 3, good; 4, excellent). One week after the lymphangiography, the presence of metastasis in the lumbar lymph nodes was pathologically examined.

Results: Lymphangiography was successfully performed in all rabbits. In the day12 and day15 groups, the mean visual score of the lymphatic system from the femoral lymphatic vessel to the thoracic duct were > 3.0 . In the day19 group, the mean visual score of the femoral lymphatic vessel to the lumbar lymphatic trunk were > 3.0 and the cisterna chyli and the thoracic duct were < 3.0 . Lymph node metastasis was detected in all rabbits in the day12 and day19 group, 2 out of 3 rabbits in the day15 group.

Conclusion: Lymphangiography via the popliteal lymph node is feasible in a rabbit VX2 thigh tumor model. The rate of retroperitoneal lymph node metastasis was found to be high after 19 days or later from implantation of VX2 tumor tissue.

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Cloud-based e-simulation with skill assessment for remote resident and IR fellow training in endovascular interventions

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Purpose: Endovascular simulators allow safe and comprehensive training for novices and skills enhancement for practicing IRs. Currently, because of the Pandemic with "social distancing", clinical education and hands-on training can be accomplished only remotely. There is a need in additional way of training, as a bridge to the physical simulator and the patient. Our aim was to duplicate physical simulator's features to the interactive cloud-based e-simulation platform.

Materials and Methods: Cloud-based interactive E-simulation program was created for remote endovascular simulation. The desktop software was transformed to a dedicated cloud service that allows trainee to remotely connect with the simulation session using personal computer. It allows stepwise practice of complete endovascular procedure using standard keyboard and mouse. The virtual reality simulation comprises fluoroscopic screen, vital signs monitor, endovascular tools and contrast injection, thus creating an entire procedure flow in a variety of patient anatomies.

Results: The software comprises entire simulation package besides the physical tool manipulation and deployment, all replaced by PC controls. The system provides cognitive training of every procedure step and prepares to future hands-on simulator training. Furthermore, e-simulation can be used for remote demonstration and training on new devices. The simulation can be practiced under real-time remote supervision which allows evaluation of performance.

Conclusion: Remote cloud-based e-simulation is timely and feasible. Various patient and procedure setups provide a comprehensive procedure experience based on the real patient's imaging file. It also allows self and

remote proctor guided evaluation of the acquired skills in the safe environment. Further evaluation using validated questionnaires is underway.

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Modified technique of computed tomography (CT)-guided percutaneous gastrostomy tube placement in a level 3 hospital: a case series

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Learning Objectives: Modified techniques of radiologically guided percutaneous endoscopic gastrostomy (PEG) tubes can be availed of in non-tertiary centres with limited resources.

Background: Gastrostomy tube insertion is indicated in patients that are incapable of conventional oral nutrition and therefore require enteral feeding to meet their nutritional requirements. Central nervous system dysfunction, post-surgical anatomical changes and malignancy particularly head/neck cancer are common indications for enteral nutrition. Endoscopically and fluoroscopically guided techniques are the more most common techniques used. However in candidates who are unsuitable for conventional methods, radiologically inserted gastrostomy (RIG) tubes are carried out. In hospitals with limited resources to manage major complications and given that higher mortality outcomes are associated with RIG tube insertion, it is not always a practical alternate solution.

Clinical Findings/Procedure Details: In our level 3 hospital we have utilised a modified technique using computed tomography (CT) guidance to insert a guidewire, and therefore facilitating PEG tube insertion in complicated cases. We identified 4 cases in our institution where conventional technique of PEG tube insertion was not possible. CT guidance was utilised for insertion of PEG tubes. The technique had multi-departmental input from both radiology and general surgery. No complications occurred in this cohort and the success rate was 100%.

Conclusion: Our modified technique of CT guided PEG tube placement is a safe and effective alternative method. This case series demonstrates that interventional radiologists can play an important role in complicated gastrostomy tube insertion in a level 3 hospital and by doing so, more invasive procedures or transfer to other centres is avoided.

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Reducing potential contamination risk from emissions from an underwater seal chest drain bottle

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Learning Objectives: Understanding the potential risks from emissions from an underwater seal bottle.

Background: Pleural content enters an underwater seal bottle (USB) and displaces the gas in the bottle chamber. The emissions from exhaust/suction port on the USB are an aerosol and pose a potential risk to patients and staff. The viral load in pleural fluid from COVID 19 infection is high. This prompted an assessment of the risk.

Clinical Findings/Procedure Details: Locally available materials were used to add a viral filter to the exhaust/suction port of a standard USB. A disposable anti-viral filter from an anaesthetic machine was attached to a single-chamber USB. The filter was connected to the USB with a 22mm to 6mm stem connector, 2.5cm of 6mm oxygen tubing and 2 cable ties. A comparison was then performed with a USB with and without a filter. Fluorescein dye was added to the water in the chamber. Room air at 5L/min was passed through the drain and a piece of black card was placed 3cm above the vent and left for 2 hours before being photographed under ultraviolet light.

Staining was only seen from the fluorescein dye on the USB without a viral filter indicating aerosol is emitted from the bottle and this is significantly reduced with a viral filter. Following this a policy was introduced to add a viral filter to the bottles.

Conclusion: Pleural drains are a source of aerosol contamination and pose a potential risk to staff and patients. Addition of a viral filter does reduce aerosol emissions.

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TEGUS: an e-proctoring solution

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Learning Objectives: Define the challenges and environmental impact with in-person proctoring, especially during the COVID-19 pandemic.

Describe the TEGUS Medical e-proctoring solution

Illustrate cases where we have used the TEGUS e-proctoring solution

Background: There have been exceptional changes to the way that doctors have worked during the COVID-19 pandemic. Patients who have been eligible for novel procedures during the pandemic may have been disadvantaged by our reduced ability to travel to provide in-person proctoring. Consequently, patients have had to have their treatment delayed or an alternative treatment sought.

A possible solution to this quagmire is the use of a secure e-proctoring solution. The TEGUS system delivers a low latency (<1s), secure video link which is controlled remotely by the proctor and enables real-time visualisation of all elements of the procedure, with direct communication with the operator achieved with the use of an earpiece. This is in contrast to commonly used ad-hoc solutions such as mobile devices where, in general, there may be issues with security, latency and a guaranteed connection.

Clinical Findings/Procedure Details: Examples will include introduction of in-house training, as well as successfully performed novel procedures using the TEGUS e-proctoring solution with regional and transnational proctoring solutions.

We demonstrate:

- System setup requirements
- Remote proctoring of endoAVF formation in the NHS, Europe and the Middle East.
- Indirect supervision of trainees by consultants.

Conclusion: We have found TEGUS a secure and reliable e-proctoring solution for new procedures, challenging cases and in-house training.

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Transcatheter mitral valve replacement in a patient with previous mechanical aortic valve replacement

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Clinical History/Pre-treatment Imaging: A 79 y.o female with mixed rheumatic mitral valve disease characterized by severe MR and moderate MS and a previous mechanical AVR was referred for transcatheter mitral valve replacement (TMVR) following an aborted redo-sternotomy due to porcelain aorta. Her STS was 4.28% and EuroSCORE II was 12.75% for MV repair.

Treatment Options/Results: IntrepidTMVR was performed via trans-apical approach through a left anterior mini-thoracotomy under TOE guidance. A 46mm Intrepid valve was deployed with excellent acute haemodynamic result with trivial residual MR and no impingement of the LVOT nor interruption to the function of the mechanical aortic valve.

Discussion: Her symptoms improved from NYHA Class 3 to 1. At 3 months, her six-minute walk distance improved from 150m to 320m. At 12 months, there was trivial residual MR without change in the trans-mitral gradient.

There was also reduction in LVED diameter from 60mm pre-TMVR down to 46mm post TMVR.

Take-home Points: To date there is limited experience with respect to Intrepid TMVR in the context of a previous mechanical aortic valve. We hereby describe the successful implantation of the Intrepid TMVR in a patient with mixed rheumatic mitral valve disease in the context of a previous mechanical aortic valve replacement with porcelain aorta.

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Electrochemotherapy as primary treatment option for anorectal melanoma – case report

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Clinical History/Pre-treatment Imaging: 78 y old female presented complaining of anal itching, pain and mild fresh blood on stools during recent 5 months. Digital rectal examination (DRE) revealed painful partially fixed 1,5 cm width and 3,5 cm long lesion in anal area. Biopsy confirmed primary anal melanoma.

Whole body PET/CT showed FDG avid anal lesion without distant spread, MRI of the pelvis showed hypervascular tumor infiltrating submucosal tissue (pic. 1).

Treatment Options/Results: Radical surgery was discussed as the treatment of choice albeit is highly traumatizing option with potential decrease in quality of life. Alternatively, electrochemotherapy (ECT) with intravenous bleomycin was considered as a less harmful option with potential cure effect or as a bridging procedure to less invasive local excision.

Patient was treated with ECT (pic. 2) with i/v bleomycin under general anesthesia and was dispatched home two days after the treatment. Two weeks after patient came back complaining of constipation and mild pain. DRE – lesion markedly decreased in size and stiffness, and only small mucosal tear was found.

Discussion: ECT is a well-established effective palliative treatment for superficial melanoma, although its role in deep-seated tumors is under investigation. Surgery of anal melanoma is traumatizing treatment of choice related to anal sphincter injury or abdominoperineal resection although general prognosis is poor thus less aggressive treatment alternatives may be beneficial.

Take-home Points: ECT is less aggressive local treatment for anal melanoma with clinical benefit regarding quality of life and potential cure of local lesion.

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Endovascular treatment for hypothenar hammer syndrome in a 14 year old boy

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Clinical History/Pre-treatment Imaging: A 14 yo boy without relevant medical history or traumatic events, presented with intermittent pain over the hypothenar eminence, paresthesia in fourth and fifth right fingers and a pulsatile hypothenar mass in the clinical examination was found. With these findings a Hypothenar hammer syndrome (HHS) was suspected. MRI and US were performed, showing a 20mm long and 5 mm wide, partially thrombosed distal cubital arterial aneurysm, located at the hook of the hamate with thickening of the tunica media layer.

Treatment Options/Results: Hypothenar hammer syndrome includes two different presentations: thrombosis and aneurysm.

In case of thrombosis without aneurysm or in asymptomatic patients a conservative treatment is preferred. Described surgical treatments in patients with HHS and aneurysms include: resection of the involved

segment of the ulnar artery with end-to-end anastomosis, or arterial ligation.

Our patient had right arm angiograms appreciating permeability of the palmar arches as well as permeability of the aneurysm and its efferent branches. Finally embolization of the aneurysm was performed with controlled release coils (7 in total).

The final arteriography showed correct devascularization of the aneurysm and correct permeability of the hand circulation through the palmar arch.

Discussion: HHS has been widely described in the literature but we have failed to find any report relating to endovascular repair apart from endovascular fibrinolysis.

This case report shows an endovascular treatment option in case of aneurysmatic HHS.

Take-home Points: US and MRI are the first diagnosis tools in HHS. Endovascular treatment can be a successful and less invasive option for aneurysmatic HHS.

GI tract intervention

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Preliminary data for a novel stent design in the management of malignant oesophageal obstruction: Hilzo fully covered oesophageal stent

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Purpose: Preliminary data for a novel stent design in the management of malignant oesophageal obstruction: Hilzo fully covered oesophageal stent.

Materials and Methods: A multi-institutional retrospective review in four oncology centres was performed during a 5-year period (2015-2020) identifying all patients who underwent placement of a Hilzo oesophageal stent for the management of malignant oesophageal obstruction. Patient notes, imaging and reports of each procedure were reviewed for demographics, lesion and tumour specific characteristics. Primary outcome was improvement in symptoms of dysphagia using the Mellow-Pinkas dysphagia score. Secondary outcomes were peri-procedural mortality, 30-day mortality, tumour overgrowth/restenosis, stent migration, stent compression/failure-to-expand, worsening dysphagia of unidentified cause and procedure related complications.

Results: A total of 58 patients met the inclusion criteria for this study and were analysed. Median follow up was 151 days (range 6-627). The median dysphagia score improved from 3 to 1. Improvement was noted on 78% of the cases reporting dysphagia data. The 30-day mortality rate was 16%. No major complications were noted related to the procedure. Minor complications included chest pain/odynophagia/heartburn in 15(26%) of patients which all settled with symptomatic management. Secondary outcomes were: Tumour overgrowth/restenosis 13(22%), stent migration 9(16%), stent compression/failure to expand 3(5%) and worsening dysphagia of unidentified cause 4(7%).

Conclusion: The Hilzo stent performed within a range found for other oesophageal stents. Hilzo stent insertion improved dysphagia scores with no major complications reported.

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Review of turnaround of cancer patients requiring oesophageal stenting following implementation of a new e-referral and e-vetting system

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Purpose: To evaluate the e-referral and e-vetting pathway of oesophageal stent insertions and post-stent dysphagia scores.

Materials and Methods: Retrospective analysis of 62 consecutive patients (50M, 12F) referred for oesophageal stent insertion procedures from June 2019 to June 2020 in the same department. Only 4 individuals were excluded due to stent abandonment (n=2), removed, not replaced (n=1), under aged 18 years old (n=1).

Results: Over the 12 month period, referral rates were variable at an average of 4 cases per month. 76% of requests were vetted within 48 hours. 74% of patients had coordinated contrast swallow test and stent insertion requests on patient records. 13 individuals did not have a contrast swallow test. Of the remaining patients the average waiting time for a contrast swallow test was 6.5 days. The average waiting time for oesophageal stent insertion was 12 days including outpatient referrals. Minor complications were reported in 19% of patients, and no major life threatening complications reported. 19 patients had no record of pre-stent dysphagia score. Of the remaining 43 patients, no one reported worse dysphagia post-stent insertion. 76% of these patients had an improved dysphagia score or stable, and 14% were unknown.

Conclusion: The e-vetting system resulted in the majority of patients being vetted within 48 hours. However fewer patients had their contrast swallow tests and stent insertions within 48 hours. Post-procedure, there is a small proportion of individuals who reported minor complications post-stent insertion and 76% of individuals had a stable or improved dysphagia score post-procedure.

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Outcomes of minimally invasive enterocutaneous fistula plug placement

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Purpose: To report the outcomes of the Biodesign Fistula Plug as an alternative treatment for enterocutaneous fistulas by presenting our institutional experience from 2013 to 2020.

Materials and Methods: A retrospective review of patients who underwent endovascular placement of the Biodesign enterocutaneous fistula plug between 1/1/2012 and 7/1/2020. Patient demographics were obtained including age at the time of the procedure, etiology, location of the fistula, history of malignancy, prior chemotherapy or radiation, and history of prior surgery or other interventions. Patient follow-up was performed through 7/2020 to evaluate for fistula closure, complications, or subsequent treatments.

Results: There were 26 patients who underwent 35 Biodesign Fistula Plug placements during the study period. Of these 7 procedures were successful, defined as closure of the fistula, and 28 procedures were unsuccessful, defined as persistent fistula output or requiring further intervention on the EC fistula. There were 26 major complications, SIR

classification C=19, D=3, E=2 and F=2. No statistically significant risk factors were found predicting fistula plug failure although there was a trend towards patients with malignancy having unsuccessful plug placement (p=0.057). The average number of procedures for patients with successful closure was 1.4 versus 4.22 for those with unsuccessful closure.

Conclusion: Enterocutaneous fistulas are complex and morbid with no good treatment options. Our experience with the Biodesign fistula plug which is the largest series to date demonstrates this can be successful in select patients however should be used with caution due to high rate of failure and complications including two patient deaths.

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Image guided percutaneous pancreatic duct drainage: indication, technique, results

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Purpose: To present the image guided percutaneous duct drainage (PPDD).

Materials and Methods: Image guided PPDD was performed to 99 patients with pancreatic duct malignant (69 cases) and benign (30 cases) obstruction. Among them was one pancreatic fistula case with non-dilated PD. In 86 patients the indication for PD percutaneous drainage was pancreatitis and recently revealed or rapidly advancing diabetes (exception – pancreatic fistula patient); in the rest 13 pancreatic cancer cases PD was drained by surgeon's request before pancreato-duodenal resection. PPDD was performed under combined - US&fluoroscopy (56), CT&fluoroscopy (36 cases), CT only (7) guidance. Puncture was performed by 18 G (59 cases), 22 G needle (15 cases) or co-axially used 18 and 22, 17 and 18 or 14.5 and 18 G needles (25 cases), allowing to conduct the guidewire in PD. Finally 6 to 8.5 Fr diameter locking-loop drainage catheter was placed under the real-time fluoroscopy guidance over the wire.

Results: Drainage was successful in 98 (98.9%) cases, including non-dilated PD in post-biopsy pancreatic fistula case. Clinical improvement was documented in all successful drainage cases (elimination or alleviation of pancreatitis, dramatic improvement of glycemic control in recently revealed/advanced diabetes cases). Pancreatic fluid discharge varied between 150-1200 ml/day.

Conclusion: PPDD is safe and effective; it should be considered in symptomatic patients with obstructed PD and might be suggested as a preventive measure for possible post-resection pancreatico-jejunal anastomosis leak. Mature drainage track might be used for "second-line" interventions.

P-264

A new regional service for radiation strictures after radical treatment for oesophageal cancer: initial experience

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Purpose: To evaluate early outcomes of a new centralised regional service with a structured protocol for managing patients with limiting dysphagia due to radiation induced strictures post-concurrent chemoradiation for oesophageal cancer.

To improve on national dilatation guidelines, which do not specify a treatment algorithm.

Materials and Methods: Under the auspices of the regional multi-disciplinary-team the radiology department of the supra-regional cancer centre was agreed as a centralised referral point.

All patients had CT and biopsies to rule out tumour recurrence prior to commencing the dilation programme.

Serial balloon-dilatations at 3mm increments were undertaken at weekly/fortnightly intervals to a minimum of 18mm, followed by additional steroid injections and temporary stenting (metal then biodegradable) if strictures recurred. Maximum initial dilatation was 9/12/15mm for filiform, complex and simple strictures respectively. Procedures were performed under sedation by the IR nurses.

This Quality Improvement project received IRB approval. We report patient outcomes following 1year of service.

Results: 12 Patients (50% male) with a median O'Rourke dysphagia grade of 3 (2-4) were referred.

Median number of dilatations was 4 (2-18). 4 stents (1 biodegradable) were placed in 2 patients. 1 patient had prolonged pain, no perforations occurred.

4 developed local recurrence, 2 metastatic disease. One died from unrelated causes.

5 disease-free patients improved to dysphagia 1 (1-2). 3 gastrostomies could be removed.

The first 2 patients are having treatment intervals exceeding 2 months.

Conclusion: Our data supports centralised management for radiation strictures, the protocol so far appears safe and effective.

The added surveillance had a high detection rate for early cancer recurrence.

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The usefulness of provocative angiography with pressure injection of contrast media for embolization in patients with gastrointestinal diverticulum bleeding

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Purpose: We assessed the efficacy and safety of provocative angiography with pressure injection of contrast media for embolization in patients with lower gastrointestinal diverticulum bleeding.

Materials and Methods: We retrospectively assessed 17 patients (14 males, 3 females, median age 64 years) with angiography for lower gastrointestinal diverticulum bleeding. Of the 17 patients, we found localized bleeding in 8 (47%) patients and no bleeding in 9 (53%) by the conventional angiography. In 5 patients (group A) of the 9 patients with no bleeding, we performed the provocative angiography with pressure injection of contrast media from branches of suspected bleeding arteries based on the preoperative CT angiography. In the remaining 4 patients (group B), we decided to select follow-up without embolization.

Results: All 8 patients, in whom the localized bleeding were detected by conventional angiography, achieved hemostasis by superselective embolization or embolization due to vasospasm. In 4 patients in the group A, we could detect the bleeding point by provocative angiography, and we performed superselective embolization at the level of the vasa recta. In the group A, we could not detect bleeding point in one patient, who did not show rebleeding on follow-up examinations. All 4 patients in the group B showed rebleeding on follow-up and underwent re-angiography. There were no complications related to provocative angiography with pressure injection of contrast media.

Conclusion: The provocative angiography with pressure injection of contrast media may be a safe and useful method for successful embolization in patients with lower gastrointestinal diverticulum bleeding.

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Flow relevant stenosis of the celiac artery is an independent risk factor for postoperative pancreatic fistula: results of a retrospective, multicentre, international cohort study

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Purpose: Postoperative pancreatic fistula (POPF) is the most feared complication after pancreatic resections. We studied whether the presence of a flow relevant stenosis of visceral arteries was associated with a higher morbidity and mortality rate.

Materials and Methods: All consecutive patients who underwent a pancreaticoduodenectomy in two university hospitals between 1 January 2010 and 31 December 2019 were included. Flow relevant stenosis was defined as a stenosis $\geq 70\%$ in the first 3 cm of coeliac artery (CA) or superior mesenteric artery (SMA) on a CT-scan. Univariate and multivariate analysis were performed to study the association between stenosis of CA, stenosis of SMA, sex, age, BMI, and ASA score in relation to major complications including death, POPF, bleeding, and ischemia.

Results: 837 patients were included in the analysis, of whom 128 patients (15,3%) presented with a flow relevant stenosis of the CA and 28 patients (3,3%) with a flow relevant stenosis of the SMA. In both univariate and multivariate analyses, the presence of flow relevant stenosis of the CA ($p=0.004$, OR 1.98, 95% CI 1.24–3.17) and male gender ($p<0.001$, OR 2.03, 95% CI 1.37–3.02) were significantly associated with the occurrence of clinically relevant POPF. No statistically significant difference was found in relation to major complications, bleeding and ischemia.

Conclusion: Flow relevant stenosis of the CA is often occurring and an independent risk factor for POPF. Preoperatively, the CT-scan should be reviewed for the presence of flow relevant stenosis of the CA, and if present treated.

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Outcomes of radiologically inserted gastrostomy (RIG) at Nottingham University Hospitals

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Purpose: Retrospective evaluation of percutaneous radiological inserted gastrostomies (RIG), clinical success and complication rates. Furthermore, review the utilisation of cone beam CT and re-intervention rate a tertiary centre.

Materials and Methods: Retrospective analysis of all patients underwent percutaneous RIG insertion in Nottingham between January 2017 to January 2020. We reviewed indications, technical success, number of T fasteners, application of cone beam CT, reintervention, complication and mortality rates.

Results: Total number of 270 patients included.

The most common indication was neurogenic dysphagia (51%) and the second was Head and neck malignancy (47%).

Three T Fasteners were used in the majority of cases (67%) with no clear relationship between this and developing a complication identified.

152 patients (56.3%) had cone beam CT to confirm position and 83 patients (30.7%) had pre-op CT to confirm safe access.

Early complications occurring in the first 24 hrs included minor bleeding (1.8%), severe bleeding (0.3%) and gastric wall perforation (0.3%).

Late complications occurring up to day 30 included tube occlusion (2.2%), Rig site infection (0.7%) and tube dislodgement (0.7%).

Overall 50 patients needed replacement due to tube dislodgement which was documented as the indication for re-intervention in 29 patients (11%). Multifactorial 30 day mortality rate was 9% with no direct relationship to the procedure.

Conclusion: Our experience confirms that RIG is safe procedure with low overall complication rate (8.5%), only 4 patients (1.5%) developed a major complication.

Although, cone beam CT is an effective way of ensuring procedure success, it was not associated with reduced post-operative complication rate.

P-268

A 13-year review of primary radiologically inserted buttons gastrostomy in a single center

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Purpose: A Radiologically Inserted gastrostomy (RIG) is a method of providing enteral feeding in patients who cannot maintain nutrition orally. The aim of this study is to assess whether the use of a primary button gastrostomy is a safe and effective method of RIG insertion.

Materials and Methods: Using our Picture Archive and Communication System and electronic patient charts we identified all patients who underwent primary button gastrostomy over a 13-year period with at least a 1-year follow-up period (range 1 - 14 years).

Results: A total of 742 patients underwent a primary button RIG insertion during this period. An overall success rate of 96.5%. Major complications was recorded in 0.9% and minor complications in 5.5%. A 30-day mortality was recorded in 24 patients (3.2%), mortality was directly related to the RIG insertion in only 2 patients (0.3%). Indications for RIG insertion included neurological disorders 70%, oesophageal/head and neck malignancy 22% and other indications in 8%.

Conclusion: Primary button RIG insertion is a procedure that has a high success rate and low morbidity and mortality. We believe it's a safe and effective alternative to a long gastrostomy tube as the initial feeding tube and negates the need for a return to the IR suite for secondary button RIG insertion.

P-269

Improved treatment success in lower gastrointestinal bleeding when computed tomography angiography is performed prior to primary endovascular intervention

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Purpose: To evaluate the impact of computed tomography angiography (CTA) on mortality, hospitalization length of stay (LOS), and successful treatment of lower gastrointestinal bleeding (LGIB) using primary endovascular intervention (PEI).

Materials and Methods: Using ICD-9 codes, we identified all LGIB encounters and associated diagnostic and therapeutic procedures in 2005-2015 United States National Inpatient Sample databases. Focusing on CTA, we excluded encounters involving nuclear scintigraphy. LGIB encounters that were treated by interventional radiology (IR) first with PEI (angiography/embolization[RD1] [AV2] [AV3] [RD4]) and were not re-treated with

another IR or non-IR intervention were classified as successfully treated. Differences in mortality, LOS, and successful LGIB treatment were assessed with Chi-Square Test, ANOVA, and Student's T-Test.

Results: Our inclusion/exclusion criteria yielded 5,983 LGIB encounters treated with PEI. Of these, 144 involved CTA before PEI. Primary endovascular therapy definitively treated LGIB in 3,686 (61.6%) encounters. Pre-angiography use of CTA utilization was associated with a greater incidence of successful PEI (102 (70.8%) vs 42 (29.2%); odds ratio 1.53, p=0.021). There was no significant difference in LOS (8.3±9.6 vs 7.7±8.8 days; p=0.5) or mortality (7 (6.9%) vs 289 (8.1%); p=0.7) between encounters involving vs. not involving CTA prior to PEI.

Conclusion: CTA utilization before primary endovascular intervention for LGIB is associated with a higher incidence of successful treatment but does not impact LOS nor incidence of mortality.

P-270

Radiological stent placement of gastric leak post sleeve gastrectomy: efficacy, imaging features and post-procedure complications

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Purpose: Laparoscopic sleeve gastrectomy (SG) is the most commonly performed bariatric procedure. The primary and insidious early post-SG complication is the gastric leak (GL). Our aims are to describe the radiological stent placement technique, to compare endoscopic and radiological stent placement, to illustrate normal diagnostic features and summarize the incidence of complications after stent placement and removal.

Materials and Methods: This is a single centre retrospective study of 595 patients undergoing SG between 2011 and 2019. Inclusion criteria were: patients who developed GL after SG treated with gastroesophageal stent placement (self-expandable fully covered double-bump metal stent) by endoscopy or interventional radiology; availability of medical history and imaging studies; follow-up time after stent removal. The rates of technical success, clinical success and complications after stent placement and removal were collected and compared between the two methods of stent positioning.

Results: A total of 17/595 (2.8%) patients developed a radiologically diagnosed GL after SG. The type II-III GLs (15/17) were treated with endoscopic or radiological stent placement. 9/15 (60%/Group A) patients underwent gastroesophageal stenting by interventional radiology and 6/15 (40%/Group B) were treated with endoscopic stent placement. Stent migration occurred in 22% and 27% for Group A and B respectively. Post-extraction stenosis was the main late complication.

Conclusion: Gastro-esophageal stent placement performed by interventional radiologists is a valid "mini-invasive" treatment for GL. CT scan is the main radiological technique to identify stent placement complications. UGI series are the first radiological procedures used to detect late complications after stent removal. Physicians should be familiar with radiological findings after stent placement.

P-271

Retrospective analysis of 2 different types of percutaneous radiologic gastrostomy (PRG), evaluation of outcomes and complications

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Purpose: Patients at risk of malnutrition often receive enteral feeding by PRG placement. Different sizes and locking mechanisms exist. The aim of this study is to retrospectively compare a 12Fr pigtail and a 14Fr balloon tube with respect to technical success, 30-day mortality and (tube-related) complications within 180 days.

Materials and Methods: 261 consecutive patients with PRG placement between January 2016 and June 2020 (150 pigtail and 111 balloon) were included. Primary outcomes were placement success, 30-day mortality, number of (tube-related) complications and days to first complication within 180 days. Data was retrospectively obtained from PACS-system and electronic health records.

Results: The technical success rate was very high in both groups and did not significantly differ ($p=0.125$). Mortality after PRG placement was very low and never related to the placement. The average number of complications within 180 days after initial PRG placement was lower in the balloon-group compared to the pigtail-group (0.62 vs. 0.90 $p=0.032$) and the number of days between initial placement and first complication was higher ($p=0.007$).

Conclusion: Results demonstrate that the 14Fr balloon tube performs superior to the 12Fr pigtail tubes with respect to tube-related complications, while technical success remains high and (procedure-related) 30 day mortality low.

P-272

Percutaneous transesophageal gastrostomy (PTEG) for decompressing purposes in advanced abdominal malignancy: retrospective study with safety, efficacy and followup

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Purpose: To evaluate the safety and efficacy of PTEG in patients with advanced abdominal malignancy in relieving their symptoms of abdominal distension, nausea and vomiting & their postprocedural follow up.

Materials and Methods: A total of 10 patients (7 F & 3 M) with an average age of 58.7 yrs (range 42-73 yrs) was included in the study with varied pathology in the abdominal cavity including metastatic ovarian cancer(4), metastatic adenocarcinoma(2), appendiceal malignancy(2), endometrial cancer(1) and peritoneal carcinomatosis(1). All the patients had contraindications to the standard percutaneous radiologic gastrostomy placement. Patients were followed up until their death or until the catheter removal for symptom relief. Immediate and late complications were searched in EMR.

The procedure was accomplished using techniques which have been described in earlier studies using a combination of fluoroscopic and ultrasound guidance. The esophagus was accessed from the left neck and a long 14fr cope-loop catheter was placed in the fundus.

Results: Technical success was achieved in 9/10 patients. The average length of time the gastrostomy was in place ranged from 12 -117days(av-72). All except one patient had succumbed to their disease. One patient had catheter removed after 105 days. All patients had complete relief of their symptoms with resolution of nausea, vomiting & distension. No major complications were noted.

Conclusion: In patients with advanced abdominal malignancy precluding traditional safe access into stomach, PTEG is a safe and efficient option with no major complications and achieves significant symptomatic relief.

This improves the quality of life tremendously for these patients at the final stages of their terminal illness.

P-273

Percutaneous direct puncture embolisation of bleeding parastomal varices using a Glubran2:Lipiodol mixture

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Purpose: Parastomal varices develop in 50-80% of patients with surgical stomas and concurrent portal hypertension. Stomal variceal haemorrhage mortality is estimated at 3-4% per episode. There is no established consensus on optimal first line treatment. Restoration of normal portal pressure should be the goal, but comorbidities often limit treatment options.

Materials and Methods: Retrospective review of our institution's experience with percutaneous parastomal variceal embolisation between 2018-2021.

Results: Three male and three female patients were treated (mean age 55; range, 39-65). Aetiology of cirrhosis was PSC in four, decompensated alcoholic hepatitis in one, and myelodysplasia in one. Two patients were also previously treated for colorectal liver metastases.

US guided retrograde micropuncture access into the dominant SMV tributary penetrating the abdominal wall was performed in each case using the 3Fr inner portion of a 5Fr micropuncture introducer. Flow dynamics were assessed with digital subtraction angiography followed by embolisation using Glubran2:Lipiodol (1:2-1:5) in all patients. Adjunctive coil embolisation on the SMV side was required in two patients and manual outflow compression in one patient. Mean procedure time was 33 minutes (range 26-53). Of the five patients discharged from hospital, four patients had no recurrence of bleeding at the time of publication (mean follow up 294 days; range 105-491). One patient was lost to follow up. Two patients died, due to factors unrelated to the embolisation procedure.

Conclusion: In selected patients, percutaneous parastomal variceal embolisation can be performed quickly and effectively via percutaneous 3Fr access, with minimal procedure related risk.

P-274

Minimally invasive cystogastrostomy in the surgical treatment of postnecrotic pancreatic cysts

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Purpose: To develop minimally invasive methods of surgical treatment of pancreatic cysts using percutaneous and combined laparoscopic cystogastrostomy.

Materials and Methods: Analysis of treatment of pancreatic cysts in 59 patients aged 30-85 years, mean age 53.61 ± 9.96 years. The patients were divided into two groups. In the first group (32 patients), the first stage is percutaneous external through pancreatic drainage of the pancreatic cyst under the control of ultrasound and radiography, the second stage is the introduction of drainage into the lumen of the stomach under the control of endoscopy. In the second group (27 patients), the first stage was percutaneous external drainage under ultrasound and X-ray control, and the second stage was laparoscopic immersion of the drainage into the lumen of the stomach.

Results:

Group 1

The first stage - 29.7 ± 5.2 minutes, the second stage-up to 20 minutes.

Average day in hospital - 5.2

Resuscitation day no more than 1.

Complications 15.6%: 6.3% - I Cl-Dingo, 9.4% - II Cl-Dingo

Lethality - 0

Group 2

The first stage is 14.6 ± 3.65 minutes,
the second 61.1 ± 13.95 minutes.

The average day in the hospital is 5.77.

Resuscitation day no more than 1

Complications: 11.1%: 3.7% (II CI-Dingo), 3.7% (III CI-Dingo), 3.7% (V CI-Dingo)

Conclusion: External drainage of pancreatic cysts with subsequent immersion of the drainage into the stomach by laparoscopic method: an alternative, safe and effective method of surgical treatment of pancreatic cysts

P-275

Comparison of N-butyl cyanoacrylate-glue VS other embolic agents in arterial embolization (TAE) of acute upper gastrointestinal bleeding (AUGB)

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Purpose: To compare complications and to evaluate clinical success with N-butyl cyanoacrylate-glue (NBCA) VS other embolic agents used in TAE of AUGB in a two-year cohort.

Materials and Methods: Patients with AUGB, embolized between 2018–2020 in our institution with NBCA and other embolic agents (coils, ethylene-vinyl alcohol copolymer (EVOH), gelatin sponge, coils + NBCA, Coils + microspheres, Coils + EVOH), were retrospectively analyzed. Variables such as age, bleeding aetiology, bleeding source, instability duration, need for blood transfusion, previous endoscopy treatment, clinical success ratio, rebleeding ratio, complications ratio were analyzed. A descriptive analysis of the sample was carried out based on the characteristics of each variable and a bilateral parametric comparison between cohort treated with glue versus other embolic agents cohort.

Results: 25 patients with AUGB were included. 15 were embolized with glue and 10 with other embolic agents. Mean age was 62.3 years (CI 95%:56.4–68.3), male 18(72%), malignant aetiology in 9/25 patients (36%), most common cause of bleeding was peptic ulcers 9/25 (36%), Left gastric artery was the most frequent source of bleeding (8/25) 32%, mean instability duration was 3.44 hours (CI: 1.8–5.03), primary endoscopy treatment in 12 patients (48%), clinical success rate of 92%, overall complications ratio of 10%, a rebleeding ratio of 8%.

All these variables showed no significant statistical differences ($p > 0.05$) between glue and other embolic agents cohorts.

Conclusion: Based on no significant statistical differences between both groups in demographics, aetiology, efficacy and complications, we can conclude that NBCA is an effective, safe, fast, and low cost embolic agent in TAE for patients with AUGB.

P-276

Fluoroscopic guided balloon dilation for pediatric esophageal strictures

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Learning Objectives: To describe the indications, techniques and complications after fluoroscopic guided balloon dilatation for benign esophageal strictures in infants and children.

Background: Esophageal strictures in children are commonly seen as a developmental abnormality with esophageal-atresia tracheo-esophageal-fistula complex (pre-operative or post-operative) and uncommonly due

to accidental corrosive ingestion in older children. Fluoroscopic guided balloon dilation has been increasingly used in these children as it has several advantages over endoscopic dilation.

Clinical Findings/Procedure Details: Under general anesthesia, an esophagogram is performed to demonstrate the stricture. A guidewire is carefully advanced to cross the stricture and balloon dilation is performed over the guidewire. Check esophagograms are performed to demonstrate technical success and to rule out iatrogenic perforation. We also describe our experience in infants with post operative esophageal strictures after corrective surgery for esophageal-atresia tracheo-esophageal-fistula complex (n=8) in the past 18 months.

Conclusion: Fluoroscopic guided esophageal dilation is a safe procedure for treatment of benign esophageal strictures in infants and children.

P-277

After percutaneous gastrostomy, should I be worried?

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Learning Objectives: To describe how a percutaneous gastrostomy (PG) is performed, in order to understand both the normal and the pathological radiological findings after its placement.

Background: Patients who need a PG suffer from either esophageal or neurological disorders that prevent proper oral nutrition and are not candidates for long-term NGT.

A PG consists in inserting a catheter in the gastric chamber through the abdominal wall. It is often performed under conscious sedation and on an outpatient basis.

Clinical Findings/Procedure Details: Complications can occur, ranging from infection to severe peritonitis. They can be fatal, as they often appear in pluripathologic patients that are already very weakened.

We show both the findings we can assess as normal, and those that correspond to secondary complications of the procedure, such as wrong positioning of the tube, wall abscess, peritonitis, hollow viscera perforation, or bleeding.

Conclusion: Computed tomography (CT) is the diagnostic method of choice for assessing patients with abdominal symptoms after a gastrostomy placement.

Familiarity with the potential complications, techniques for their prevention, and strategies for treatment will help interventional radiologists to successfully manage all possible outcomes.

P-278

Transcatheter embolization of visceral artery pseudoaneurysms

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Learning Objectives: To determine the incidence and sites of visceral artery pseudoaneurysms (VAPA).

To evaluate the role of interventional radiology in the management of visceral artery pseudoaneurysms.

Background: VAPAs are uncommon but potentially life threatening vascular abnormalities. They result from disruption of intimal and medial layers of the arterial wall due to inflammation, infection, trauma, neoplasm or iatrogenic injury. About 22% of VAPA present with rupture causing significant hemorrhage and is associated with high rates of mortality.

We will discuss the various techniques of embolization and embolic materials used and determine the technical success, safety and outcome of procedure.

Clinical Findings/Procedure Details: Patients having preliminary diagnosis of VAPA on CECT abdomen and/or doppler ultrasound were evaluated from January 2018- December 2019.

26 patients(19: males and 7: females) underwent endovascular embolization. Mean patient age was 32 years(21-57years) and mean size of pseudoaneurysm was 28 mm(7mm-53mm).

Splenic artery was involved in 12 cases(46.1%), gastroduodenal artery in 6(23%), inferior pancreaticoduodenal artery in 2(7.6%), superior mesenteric artery in 2(7.6%), left gastric artery in 2(7.6%), gastropiloric artery in 1(3.8%) and hepatic artery in 1 case(3.8%). Embolization coils was used in 22 cases and glue(NABA) in 5 cases.

Technical success was seen in 25 cases(96.1%) with complete resolution of symptoms in 23 cases(88.4%). 2 patients were taken for re-embolization. Complication rate was 7.6%.

Follow up doppler ultrasound and/or CT angiography(0-60days) showed exclusion of flow in sac in 96.1% cases.

Conclusion: Transcatheter embolization is a safe, effective and minimally invasive tool for the management of visceral artery pseudoaneurysms with good technical and clinical success rates.

P-279

How to spot incidental findings of the increasing clinical problem of GI stent failure

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Learning Objectives: To recognise the subtle changes on diagnostic imaging indicating GI stent failure

To understand the clinical implications of deteriorating function

To be able to advise on strategies for stent revision and the urgency thereof

Background: Patient survival after palliative stenting is dramatically increasing with improved oncological palliation. For oesophageal stenting this has increased 5-6fold over the last 15years, reaching 12-18months with further treatment. Re-intervention rates exceed 60% after 6months and structural failure from nitinol corrosion is an emerging, but still under-recognised problem. Signs of this can be identified on incidental CT and radiographic studies, which are frequently undertaken for oncological follow-up. However awareness is still very poor.

Clinical Findings/Procedure Details: Initial consequence of corrosive attack from gastric acid is loss of the two key properties "superelasticity" and "shape memory" of the nitinol skeleton. Stents may collapse and fail to maintain luminal patency.

More extensive corrosion leads to a ragged appearance on CT and broken or displaced wires may be identified on radiography. Finally stents can buckle, disrupt and shear into pieces. Paying attention to the number of stent markers allows identification of stent transection.

Perishing of the stent membrane will allow tumour ingrowth, rendering these stents unremovable and hindering re-intervention. This is readily identified on CT.

Conclusion: Cancer patients Increasingly outlive their palliative stents. A knowledge of the imaging signs of device failure is key for early identification, to allow stent revision/exchange at a point where this can still be done safely and the patient has not yet come to harm from recurrent obstruction.

P-280

Pseudoaneurysms of gastrointestinal tract (Git) endovascular treatment and management

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Learning Objectives: Most common causes of the GI pseudoaneurysms. Various interventional techniques for the management of pseudoaneurysms.

Complications associated with post intervention management of pseudoaneurysms.

Background: Gastrointestinal tract pseudoaneurysms occur mostly as a result of inflammation, infection, iatrogenic and trauma.

Owing to high risk of rupture, they require early treatment to prevent lethal complications. Knowledge of the various approaches of embolization of pseudoaneurysms and different embolic materials/ stent grafts used in the management of visceral artery pseudoaneurysms is essential for successful and safe management.

There are several endovascular methods that an operator may choose to treat GI artery aneurysms, and selection of the appropriate technique depends on the type and size of aneurysm and the anatomy of the affected artery.

We review and illustrate the various endovascular techniques used in the treatment of gastrointestinal tract pseudoaneurysms their benefits and risks.

Clinical Findings/Procedure Details: We have managed and treated pseudoaneurysms in most major branches of the celiac trunk and the superior mesenteric artery using different embolization techniques using endovascular approach. Keeping adverse sequelae of coil embolization in mind, we have used stent grafts in a few cases to maintain the patency of the artery to the visceral organs supplied by the artery. We are presenting the satisfactory outcomes of our experience in this case series.

Conclusion: Stents and coils should be used with precision in gastrointestinal arteries as any margin for error can only be rectified by a open laparotomy / laparoscopy in these subset of patients.

P-281

Imaging and management of hydatid cysts: what the interventional radiologist needs to know

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Learning Objectives:

- 1) To gain an understanding of the epidemiological, clinical and imaging features of hydatid cyst disease
- 2) Gain an overview of the WHO classification of hydatid cyst disease
- 3) Understand the different management options including interventional treatments available

Background: Hydatid cyst disease is common in many parts of the world, particularly in tropical and lower resource settings, and has characteristic imaging features. Radiologists and other clinicians working in non-endemic areas may have limited experience of diagnosis and treatment of hydatid disease. The radiologist plays an instrumental role in diagnosis, staging and treatment of the disease.

Clinical Findings/Procedure Details: We outline the epidemiology and clinical features of hydatid disease. Ultrasound, plain film, MRI and CT can all play a role in work up but ultrasound is the main imaging modality in diagnosis. The World Health Organisation Informal Working Group for Echinococcosis (WHO-IWGE) has devised a classification system to help delineate if the lesion is in an active, transitional or inactive stage. Treatment is dependent on imaging findings including the location, WHO-IWGE stage, size, complexity and number of cysts.

Medical management includes treatment with anti-parasitic drugs such as Albenadazole/Praziquantel. Surgical management aims to remove cyst

intact without spillage. Interventional treatments include PAIR (puncture, aspiration, injection, re-aspiration), large bore catheter treatments such as drainage or use of ablation devices.

Conclusion: Hydatid cyst disease is common in many tropical and lower resource settings. Ultrasound plays an important role in the assessment, particularly in assessing the WHO-IWGE stage. The interventional radiologist can play a major role in percutaneous treatments of these patients.

P-282

Imaging and management of amoebic abscesses

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Learning Objectives: To learn about:

- 1) Epidemiological and clinical features of amoebic liver abscesses
- 2) Imaging features on ultrasound, CT and MRI
- 3) Management including interventional treatment options

Background: Amoebic liver abscesses are common and are particularly common in tropical and lower resource settings. Amoebic abscesses have different clinical and imaging features compared to bacterial abscesses but there is overlap and diagnosis can sometimes be challenging. There are a variety of investigation and management options including interventional options.

Clinical Findings/Procedure Details: Amoebic abscesses are common across the world but are particularly more prevalent in tropical and lower resource settings. Clinical characteristics are different to bacterial abscesses, there may be a longer history with symptoms of diarrhoea, fever and abdominal pain. Patients with bacterial abscesses are more likely to present with frank sepsis and are often seen post-cholecystitis or after surgery/instrumentation of the hepato-pancreato-biliary system. There is significant overlap in imaging features between amoebic and bacterial liver abscesses but amoebic abscesses are more likely to be solitary and more likely to be subcapsular and involve the right liver lobe. Often medical management with Metronidazole or other anti-parasitic agents is successful in treatment but interventional radiological options may need to be considered. Diagnostic aspiration may yield a classical anchovy paste appearance. Ultrasound guided aspiration/drainage are also important options if medical management fails, in large abscesses or in a high risk location for rupture.

Conclusion: Amoebic abscesses have some clinical and imaging features which can help differentiate from bacterial abscesses. The interventional radiologists can play an important role in diagnosis and treatment.

P-283

Percutaneous transesophageal gastrostomy (PTEG): an interventional radiologist's guide for an uncommon procedure

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Learning Objectives: Many patients needing long term nutrition or gastric decompression demonstrate contraindications for traditional percutaneous gastrostomy tube placement. Percutaneous transesophageal gastrostomy/jejunostomy (PTEG/J) placement is a minimally invasive alternative well suited for these patients. This exhibit will review indications for PTEG/J, detailed procedural techniques, and long term considerations after placement.

Background: Percutaneous gastrostomy is a well-established procedure for patients needing long-term nutrition or malignant obstruction decompression. Contraindications for placement, chiefly esophageal obstruction, advanced gastric cancer, history of partial or total gastrectomy, massive ascites, interposed organs, or diaphragm paralysis often precludes the classic approach. Percutaneous transesophageal gastrostomy (PTEG/J) is a seldomly used technique that allows for access via an

esophagostomy and may be used in patients with contraindications for gastrostomy placement.

Clinical Findings/Procedure Details: We use a case-based, pictorial review of 3 cases performed at our institution to detail the critical procedural aspects of PTEG/J placement. The use of fluoroscopy and ultrasound will be reviewed. A rupture-free balloon catheter is typically advanced into the esophagus. The balloon is punctured under ultrasound guidance via a left cervical approach. A guidewire is advanced into the stomach with subsequent dilation of the tract. The catheter is advanced and position confirmed with contrast opacification. Readers of this exhibit will learn pre-procedure planning, anatomy considerations, technical aspects, and imaging landmarks. Complications, common pitfalls, and post-operative care will also be discussed.

Conclusion: PTEG offers a safe, effective, and technically viable alternative for enteric access in patients with contraindications to traditional gastrostomy. Interventional radiologists are well suited to incorporate PTEG into their clinical practice.

P-284

"Backdoor entry" into bleeding gastro-duodeno-pancreatic trunk in cases of celiac stenosis/thrombosis

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Learning Objectives: To evaluate the need, usefulness, technical and clinical success of backdoor/retrograde access of bleeding vessels in cases of acute upper gastrointestinal hemorrhage (UGIH) with difficult/failed front-door access.

Background: Upper gastrointestinal bleeding is a common and potentially life threatening medical condition with an estimated mortality of 10%.

Pseudoaneurysm of the gastroduodenal artery (GDA) occurs in cases of chronic pancreatitis, postsurgical and peptic ulcer disease. They may be asymptomatic, present with intermittent bleed or present with catastrophic rupture.

Quick access of bleeding vessel is of paramount importance in such situations, which can be complicated by celiac artery vasospasm, stenosis or thrombosis.

In such cases retrograde access via the gastro-duodeno-pancreatic trunk can be taken to reach the selective bleeder.

Clinical Findings/Procedure Details: Retrospective review of 7 patients who underwent endovascular embolization for acute UGI hemorrhage using backdoor/retrograde access between August 2018 - December 2020 was done. All the cases were followed up clinically till hospital discharge. Backdoor entry was used due to severe spasm of celiac axis in 3 cases, celiac stenosis/thrombosis in 2 cases, dissection of celiac axis in 1 case and tortuous anatomy in 1 case.

Technical success was achieved with immediate cessation of bleeding in all 7 patients (100%).

Clinical success (stabilization of hemoglobin, no hemorrhage in NG tube) was achieved in 6/7 patients (85.7%). 1 patient had rebleeding. None of the patients developed bowel ischemia.

Conclusion: The use of backdoor/retrograde access of bleeding vessels in cases of acute UGI hemorrhage with difficult/failed front-door access is a safe and viable option with high technical and clinical success and without significant complications

P-285

Endovascular treatment of unique colonic arteriovenous malformation with dual supply from superior and inferior mesenteric arteries

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Clinical History/Pre-treatment Imaging: A 72-year-old male presents with a dual supply superior and inferior mesenteric artery (SMA/IMA) colonic arteriovenous malformation (AVM). This AVM resulted in ascites and portal hypertension requiring weekly paracenteses and transfusions due to varices. Contrast enhanced CT demonstrated an AVM surrounding the sigmoid colon with dual supply via the SMA and IMA. The IMA was engorged to near the same size of adjacent aorta. The tortuous draining vein encompassed most of the left hemiabdomen, draining to the main portal vein (MPV). Radiology was consulted for possible intervention, as he was deemed non-surgical.

Treatment Options/Results: The patient underwent super-selective SMA/IMA coil embolization. SMA angiography demonstrated an engorged Arc of Riouan communicating with the IMA and the sigmoid AVM. Selective coil embolization of the distal vessel was completed. Next, the IMA was selected and arteriography demonstrated multiple engorged vessels supplying the AVM. Selective coil embolization was performed in the branches identified and arteriography demonstrated a marked reduction in arterial flow to the AVM. Thirty days after embolization there remained no persistent symptoms and he required no additional paracentesis.

Discussion: A non-surgical candidate presenting with hepatic venous congestion due to a colonic AVM with dual arterial supply, paired with massive veins draining to the MPV, was a unique and challenging case. Endovascular embolism of arterial supply resulted in symptom resolution and no need for paracentesis at short-term follow-up.

Take-home Points: Our experience shows super-selective endovascular coil embolization of the arterial inflow can provide a safe approach to symptom treatment in the setting of dual supply colonic AVM.

P-286

Perforated gangrenous GB after cystic artery pseudoaneurysm embolization

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Clinical History/Pre-treatment Imaging: A 75 years-old woman presented with upper abdominal pain. Acute on top of chronic calculous cholecystitis with CBD stones was diagnosed by US and MRCP. Patient had anemia, leukocytosis and raised CRP. Then, massive attacks of melena and hematemesis had developed with unstable hemodynamic conditions.

Treatment Options/Results: Urgent conventional DSA angiography showed cystic artery pseudoaneurysm (CAP) which was selectively embolized using glue. The patient was stabilized and bleeding was controlled. Right hypochondrial pain had developed after 1-week. Perforated gangrenous GB with subhepatic abscess was diagnosed by US and CT. Percutaneous transhepatic drainage of the abscess was successfully done under US guidance due to risky surgical intervention. Patient was discharged from hospital 10-days after that.

Discussion: CAP is a rare complication of cholecystitis. Conventional DSA angiography was preferred than CT angiography in this case for detection of bleeding site and embolization at the same time due to the unstable condition of the patient. Open cholecystectomy is the treatment of choice in cholecystitis-related CAP. Transarterial embolization is considered as a temporary treatment to stabilize the patient and avoid an emergency laparotomy. GB ischemia is a worrisome complication after embolization, and post-embolization cholecystectomy is recommended if possible. The perforated GB was treated successfully with percutaneous drainage

which raises the suspicion about the need for cholecystectomy after cystic artery embolization.

Take-home Points: Transarterial embolization should be considered in hemodynamically unstable patients to control bleeding. post-embolization elective cholecystectomy is recommended to avoid post-embolization GB ischemia. However; percutaneous drainage of perforated gangrenous GB is an effective treatment in surgically unfit patients.

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Systemic infarction after percutaneous transhepatic variceal obliteration with glue injection

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Clinical History/Pre-treatment Imaging: A 44-year-old man with liver cirrhosis secondary to autoimmune hepatitis was admitted for recurrent esophageal variceal bleeding and rectorrhagia since four years ago. Physical examination was unremarkable without a history of refractory ascites. Considering the patient's medical history, he became a candidate for transjugular intrahepatic portosystemic shunt (TIPS); however, he did not agree to undergo this procedure. Thus, percutaneous transhepatic variceal obliteration (PTVO) was suggested, for which he provided consent.

Treatment Options/Results: Percutaneous ultrasound-guided transhepatic puncture was performed under general anesthesia. Splenoportography and mesenteric venography were normal with no collateral circulations. Subsequently, embolization for gastroesophageal varix was performed; first with a glue-lipiodol concentration of 25% (1:3) and then 50% (1:1). Twelve hours after the procedure, the patient developed neurological symptoms of left-side weakness, dysarthria, left eye ptosis and fecal incontinence. Follow-up CT demonstrated glue-lipiodol mixture particles in bilateral brain hemispheres and in midbrain, liver, spleen and both lungs. Contrast echocardiography did not show an intracardiac shunt. Finally, the patient recovered within 2 months with conservative therapies.

Discussion: Ectopic embolization after PTVO with glue is a rare complication which may result from the portosystemic and portopulmonary anastomoses. In the present case, lower glue concentration (25%) with a bolus of dextrose (Sandwich technique) resulted in emboli, maybe due to decreased glue contact with plasma and increased glue polymerization time which helps the mixture to move further and cause ectopic occlusion of distant vessels.

Take-home Points: Before performing PTVO, precise evaluation with splenoportography and selecting the appropriate glue-Lipiodol ratio and injection technique may help prevent unexpected complications.

P-288

Acute physiological stress in a case of segmental arterial mediolysis involving the right gastroepiploic artery

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Clinical History/Pre-treatment Imaging: A 67-year-old Lithuanian woman presented with symptoms of general weakness, pain and vomiting. Her symptoms were thought to be secondary to her hyponatraemia as a result of her medication including spironolactone and

hydrochlorothiazide. She was later transferred to intensive care unit for inotropic support. Her haemoglobin level had dropped significantly, and a CT thorax, abdomen and pelvis demonstrated a large haematoma abutting the stomach with haemorrhagic fluid in the pelvis. CT angiogram demonstrated a markedly abnormal right gastroepiploic artery adjacent to the haematoma with areas of dilatation, stenosis and a discrete pseudoaneurysm. A diagnosis of segmental arterial mediolysis (SAM) was made.

Treatment Options/Results: She was transferred to the Interventional Radiology suite where transfemoral catheter angiograms confirmed that the right gastroepiploic artery contained areas of stenosis and aneurysmal dilatation. The coeliac axis, superior and inferior mesenteric arteries were otherwise unremarkable. A microcatheter was manipulated into the right gastroepiploic artery and successfully coiled.

Discussion: Segmental arterial mediolysis (SAM) is a non-inflammatory, non-atherosclerotic vascular disorder of unknown aetiology. It is a rare but important cause of spontaneous intraabdominal haemorrhage characterised by vessel stenosis, occlusion and aneurysms. We describe a case in a patient with an unusual presentation. This is only the second case in the literature to describe embolization of the right gastroepiploic artery in the context of SAM.

Take-home Points: Segmental arterial mediolysis is an important differential for cases of spontaneous intra-abdominal haemorrhage. A multidisciplinary team approach including interventional radiology, vascular surgery and general surgery is recommended for a good clinical outcome.

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Large atypical gastric dieulafoy lesion arising from an accessory splenic artery

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Clinical History/Pre-treatment Imaging: A 58 year-old woman with a history of a gastric ulcer and gallstone pancreatitis presented after multiple episodes of melena. Work-up revealed significant anemia. After initial resuscitation, upper endoscopy was performed.

Treatment Options/Results: Endoscopy revealed a 9mm-diameter fundal mucosal protrusion resembling a type I isolated gastric varix (Fig 1a), and no ulcers or active hemorrhage. Given lack of any history of chronic liver disease or splenic vein thrombosis, IR consultation was obtained. Computed tomography angiography (CTA) revealed a vascular nest composed of a tortuous submucosal accessory splenic artery (Fig 1b), arising from the left inferior phrenic artery and perfusing the superior splenic pole (Fig 1c) consistent with a Dieulafoy lesion. Microvascular plug embolization was performed. One-month CTA demonstrated near-complete flow cessation without splenic infarction (Fig 1d).

Discussion: Dieulafoy lesions are tortuous dilated submucosal arterioles, accounting for ~1-2% of acute gastrointestinal hemorrhages. They generally arise from gastric artery branches and appear as <3mm mucosal defects within 6cm of the gastroesophageal junction. Clinically, they cause intermittent profuse GI bleeding, often with hemodynamic instability. This case is atypical given its large size, origin from an accessory splenic artery, and endoscopic resemblance to a varix.

Take-home Points: In the absence of known history of cirrhosis or portal hypertension, endoscopic finding of a gastric varix should be evaluated further with endoscopic ultrasound, IR consultation, and CTA to identify arterial lesions. Management should include transarterial embolization as opposed to endoscopic treatment, as the latter can result in catastrophic bleeding complications.

P-290

New record in oesophageal cancer survival illustrates the growing problem of device failure

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Clinical History/Pre-treatment Imaging: In April 2018 a 68-year-old male with a T4bN3M0 SCC of the mid/lower oesophagus was referred for radiologic stenting (2°-3° dysphagia).

Treatment Options/Results: A distal 13.5cm "Ella-HV+" anti-reflux stent was overlapped with a 10cm partially-covered Cook "Evolution" stent. After chemo-radiotherapy dysphagia returned in December 2018. Tumour ingrowth through the bare proximal head of the "Evolution" precluded exchange. An 8.5cm "Ella-HV+" was deployed with 50% overlap but migrated proximally through a "soap bar" effect. It was replaced with a 15cm "Ella-HV+" in May 2019 with complete resolution of symptoms. In March 2021 restaging CT showed migration of the original two stents into the stomach, but the last "HV+" stent still in the upper oesophagus (Fig.1). The patient was asymptomatic with a performance status of 1, but in view of the risk of complications all stents were removed using combined endoscopy/fluoroscopy. This was complicated by degradation of the nearly 3-year-old stents as removal sutures had become detached and the HV+ lay upside-down with the proximal end impacted in the antrum (Fig.2). The silicone covering on the initial stents had completely perished, however only minor wire fractures were seen.

A large oesophageal lumen was found, no further stents inserted and the patient is currently symptom-free.

Discussion: Life expectancy after oesophageal stenting is improving remarkably. Stent degradation increases risk and jeopardises removal. Maintained follow-up and increasing awareness by the GI-radiologists is essential.

Take-home Points: Patients increasingly outlive their stents
Oesophageal obstruction may resolve with treatment
Stent failure needs to be looked out for
Stents will increasingly need to be changed

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Right gastric artery embolization: an effective treatment in gastric antral vascular ectasia

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Clinical History/Pre-treatment Imaging: We present a 68 years old female patient with diagnosis of gastric antral vascular ectasia (also known as watermelon stomach), who presented chronic upper gastrointestinal bleeding.

She had multiple endoscopic treatment failures and surgery was not possible due to multiple comorbidities.

Treatment Options/Results: Treatment options are:

- 1) Medical
 - 2) Surgery. antrectomy
 - 3) Endoscopic treatment with banding and argon plasma coagulation
- In very few cases embolization of right gastric artery was described as an effective treatment when the other options fail.

Discussion: Gastric antral vascular ectasia (also known as watermelon stomach) is a rare pathology characterized by the presence of red spots in the antral mucosa in endoscopic studies.

Various treatments have been reported: medical, endoscopic and surgical options. Nevertheless, cases have been reported in which despite multiple endoscopic procedures recurrent bleeding persists.

Transarterial embolization for GAVE treatment is rarely reported and results have not been yet well established. Angiographic findings may be subtle.

Terawaki et al. performed successful transarterial embolization and they have reported it was effective, as blood flow reduction in antrum improves venous ectasia.

Complications are infrequent when the right gastric artery is occluded.

Take-home Points: Gastric antral vascular ectasia (also known as watermelon stomach) is a rare but significant cause of acute or chronic blood loss in elderly patients.

Therapy for GAVE syndrome includes pharmacological, endoscopic or surgical approaches.

Treatment with transarterial embolization of the right gastric artery has been reported as effective in cases where other treatments have failed. In our case, we observe satisfactory results without complications.

P-292

Endovascular management of a rare case of pseudoaneurysmogastric fistula

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Clinical History/Pre-treatment Imaging: A 36 year old male with complicated alcoholic acute pancreatitis 1 month ago, presented with 3-4 episodes of massive hematemesis since 2 days

Examination showed signs of hypovolemic shock, low BP(90/50 mmhg), tachycardia(125 bpm) and low hemoglobin 6.1 d/dl. Nasogastric tube was placed which showed drainage of 350cc of blood clots.

CT angiography revealed a 18 x 8mm sized splenic artery pseudoaneurysm(SAP) in close approximation to the greater curvature of stomach with perigastric hematoma and blood clots in the stomach.

Treatment Options/Results: Patient was taken for emergent coil embolisation under local anaesthesia.

Superselective cannulation of the splenic artery(SA) showed a large bilobed narrow neck 25 x 10mm sized pseudoaneurysm in distal portion of SA with active extravasation of contrast into the stomach.

Embolisation of SA was done using sandwich technique with two 8mm x 14cm coils.

Post embolisation angiogram revealed successful occlusion of the SA with exclusion of the pseudoaneurysm.

Discussion: SAP accounts for 20% of visceral artery pseudoaneurysms with 37%-47% risk of rupture and mortality rate of 90%.

Pseudoaneurysmogastric fistula is a rare consequence of pseudoaneurysms eroding into the lumen of stomach. They cause significant hemodynamic instability and warrant urgent intervention.

Therapeutic options include open surgical, endoscopic or endovascular management. Endovascular management is preferred as a minimally invasive alternative with high success rates.

Take-home Points: Intra gastric rupture of splenic artery pseudoaneurysms is a rare complication which can present with catastrophic GI bleeding.

Early diagnosis and intervention is crucial for patient survival with endovascular embolisation being a safe and effective technique in its management.

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Double access retrograde revascularization of an occluded superior mesenteric artery through the riolano's arch

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Clinical History/Pre-treatment Imaging: A 79 year old female patient with "angina abdominis", was admitted to the Interventional Radiology unit after a CT scan that showed a calcified occlusion of the ostium of superior mesenteric artery (SMA).

Treatment Options/Results: CT scan, also showed a calcified suboccluded celiac trunk.

Direct revascularization of SMA was unsuccessful due to the impossibility to engage the ostium of the SMA with any catheter.

Discussion: Angiography of the inferior mesenteric artery (IMA) was performed showing the patency of Rioloano's arch and a retrograde revascularization of the SMA till its proximal tract.

After pushing forward the catheter through the IMA gaining centimeters a microcatheter was coaxially introduced and pushed through the Rioloano's arch navigating till the proximal SMA occlusion. The occlusion was retrogradely crossed with a CTO 300cm wire gaining the abdominal aorta. A 6F radial approach was performed and a MPA catheter was introduced from the above in the abdominal aorta facing the coming up CTO wire. This one was snared and pulled inside the MPA catheter while pushing this one through the occluded ostium of the SMA.

A new 300cm 0014 wire was placed in SMA from the MPA catheter than was predilated the stenosis and placed a 6x25mm balloon expandable stent.

Take-home Points: The final angiogram showed the complete revascularization of the SMA.

No periprocedural complications occurred and the patient was discharged the second day.

The patient had completely resolved the "angina abdominis".

Retrograde approach through the Rioloano's arch is an option if direct revascularization of the SMA is not possible.

P-294

Percutaneous image guided management of chronic calculous pancreatitis, complicated with peripancreatic cystic mass formation, biliary stricture and jaundice

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Clinical History/Pre-treatment Imaging: MRI in patient with history of chronic calculous pancreatitis, abdominal pain and recently revealed jaundice showed multiple stones related dilation of pancreatic duct (PD), biliary hypertension and peripancreatic cystic mass.

Treatment Options/Results: Percutaneous transhepatic biliary drainage has been performed enabling to decompress the biliary tree. Second step was percutaneous pancreatic duct drainage, enabling to manage the acute pancreatitis. Parapancreatic cystic mass has been drained under CT guidance. Balloon assisted percutaneous descending litholapaxy (BAPDL) has been attempted unsuccessfully to PD stones. After that removable metal stent has been implanted in PD strictured segment. Finally removable metal stent has been positioned in CBD also. Treatment enabled to eliminate the jaundice and clinic of acute pancreatitis.

Discussion: Chronic calculous pancreatitis can lead to dangerous complications, such as portal vein thrombosis, pancreatic pseudocyst formation, biliary obstruction etc. The management of this pathology is challenging; surgical treatment is traumatic and frequently leads to significant morbidity and even mortality. Endoscopic approach in such cases is characterized by high rate of failures.

Take-home Points: The implementation of the new percutaneous image guided low-invasive procedures in chronic calculous pancreatitis management looks promising. The first step in such procedures is PD percutaneous drainage.

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Stent graft exclusion of hemosuccus pancreaticus from erosive pancreatic calculus: endovascular management and considerations

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Clinical History/Pre-treatment Imaging: A 72-year-old male with recurrent upper GI bleeding presented with anemia. Colonoscopy was unremarkable, and CT abdomen revealed signs of chronic pancreatitis. EGD and EUS visualized mild persistent oozing from the pancreatic orifice, confirming hemosuccus pancreaticus. An angiogram revealed an 8 mm saccular pseudoaneurysm arising from the main splenic artery near a pancreatic calculus, distal to the dorsal splenic takeoff.

Treatment Options/Results: IR performed two stent graft exclusions with preserved flow to the main splenic and dorsal pancreatic arteries, complicated by a moderate groin hematoma. Hospital course following procedure was unremarkable.

Discussion: Hemosuccus pancreaticus (HP), or bleeding from the pancreatic duct, is a rare etiology of upper gastrointestinal bleeding. Most cases are associated with chronic pancreatitis.¹ HP typically arises from a ruptured pseudoaneurysm created between a pseudocyst and the splenic artery, and rarely from pancreatic calcifications and/or calculus eroding the artery, such as in our patient.² HP is intermittent and often self-resolving, posing a serious challenge for IR's in its early recognition.³

Take-home Points: Although IR's rightfully evaluate the bowels for occult bleeds, one must not overlook the pancreaticobiliary tracts, particularly with a history of pancreatic disease. Endovascular management of HP has begun to replace surgery as first-line therapy.⁴ Covered stent exclusion of the aneurysm preserves spleen perfusion, but the size and tortuosity can pose significant technical barriers. While technically straightforward, coiling demands embolization of both inflow and outflow to prevent retrograde perfusion, risking spleen ischemia.⁵ Still, it remains unclear whether stenting or coiling afford greater clinical outcomes in the management of HP.

Gynaecological intervention (including UFE)

P-296

Perioperative prophylactic internal iliac artery balloon occlusion (IIABO) in placental implantation abnormalities

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Purpose: We aimed to evaluate the safety and efficacy of prophylactic IIABO in patients with placental implantation abnormalities.

Materials and Methods: The study group consisted of 13 patients, including three patients with placenta previa totalis, seven patients with placenta increta, and three patients with placenta percreta. Prophylactic IIABO was performed in all patients. The assayed variables of this study were: estimated blood loss, number of red blood cell transfusions, the length of the hospital stay for mother and child, intervention time, balloon inflation time, surgical time, and fetal absorbed dose.

Results: The median estimated blood loss was 700 ml $\pm$ 598.8 ml, the median number of red blood cell transfusion units was 0 $\pm$ 0.75, and only two patients required uterine artery embolization. The uterus was preserved in eight patients (61.5%), with an average intra-hospitalary

stay of 6 $\pm$ 3.2 days. The average fetal radiation dose was 4.67 mGy. No complications were attributed to IIABO placement.

Conclusion: The prophylactic use of IIABO in placental implantation abnormalities is an effective and safe method of controlling perioperative bleeding during cesarean section and hysterectomy. Indications should be strictly controlled, and interdisciplinary planning and management are mandatory.

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Intra-uterine device associated infection post uterine artery embolisation

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Purpose: Uterine artery embolisation (UAE) is a minimally invasive treatment for symptomatic fibroids. There is limited evidence regarding the impact of having an intrauterine device (IUD) in situ during UAE on the occurrence of post procedural infection. Following a case of severe sepsis requiring hysterectomy in a patient with an IUD in situ, we conducted a review of practice. The aim was to assess the impact of an IUD in situ on the odds of procedure-related infection within one year post UAE.

Materials and Methods: We conducted a retrospective analysis of all UAEs performed between February 2016 and February 2021. Using data from electronic patient records, episodes of infection within one year post UAE and details of required management were recorded.

Results: 129 UAEs were performed. Of these, 17 patients had an IUD in situ during UAE. 1/17 (6%) patients with an IUD experienced procedure-related infection within one year, compared with 10/112 (9%) non-IUD patients (Odds ratio 0.64, p=0.68). The patient with an IUD in situ had severe sepsis requiring 11 days of inpatient intravenous antibiotics and hysterectomy due to pyomyoma. In comparison, cases of infection in the non-IUD group required an average of 3 days of intravenous antibiotics and none required hysterectomy.

Conclusion: Our review of practice found no significant impact of having an intra-uterine device in situ during uterine artery embolisation on the number of cases of infection within one year post procedure. However, the only case of severe infection requiring hysterectomy occurred in the patient with an IUD in situ.

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Reproductive outcomes following cesarean scar pregnancy in women after uterine artery embolization and curettage

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Purpose: To assess the reproductive outcomes in women with cesarean scar pregnancy following uterine artery embolization and curettage.

Materials and Methods: The women received combined treatment for cesarean scar pregnancy between December 2012 and December 2017 were continuously followed up. Postoperative recovery, ability to conceive, time to pregnancy, and the outcomes of subsequent pregnancies were recorded. SPSS17.0 was used for statistical analysis.

Results: There were 158 patients with cesarean scar pregnancy undergoing the combination therapy in our hospital during this period. Follow-up data were available in 127/158 (80.4%) of women. A total of 37 out of 127 attempted to become pregnant; 23 of the 37 (62.2%) women conceived spontaneously. In 18 of the 23 women (78.3%), pregnancies were intra-uterine and appeared normal; 3 women (13%) received abortion treatment because of ectopic pregnancy or no heartbeat, and two women (8.2%) had a recurrent ectopic scar. Re-pregnancy rates were 30.4%, 34.8%, 30.4% and 4.3% in the first, second, third and fourth years after combined treatment, respectively. The average interval between pregnancy and the combined treatment was 18.8 months (5-39 months). The rate of pregnancy in women with normal menstrual quantity was higher than

in those with decreased menstrual quantity (81.3% VS 47.6%; $P=0.037$). In spite of this, excluding the women received abortion treatment, the last rate of pregnancy in women with normal menstrual quantity was not higher than in those with decreased menstrual quantity statistically (62.5% VS 38.1%; $P=0.141$).

Conclusion: Women can have normal pregnancy again after treatment with uterine arterial embolization combined with curettage for scar pregnancy.

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Transradial versus transfemoral access for uterine artery embolization: analysis of radiation, cost and ancillary parameters

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Purpose: Transradial access (TRA) has become more popular in body intervention procedures, but has not been ubiquitously adapted. This study was designed to compare transradial to transfemoral access (TFA) in uterine leiomyoma patients who underwent uterine artery embolization (UAE).

Materials and Methods: In this study, 172 UAE procedures conducted at our institute from October 2014-June 2020 were retrospectively analyzed. The transradial access group included 96 procedures while the transfemoral access group included 76. Peak skin dose (PSD), fluoroscopy time, procedure time, materials cost and administered contrast volume for each procedure were evaluated for statistical differences between the two groups.

Results: All cases were technically successful without major complications. The average PSD presented with no statistical difference between TRA and TFA (2,498 mGy vs. 2,001 mGy, $P>0.05$). The average fluoroscopy time also showed no statistical difference (26 min vs. 23 min, $P>0.05$). Similarly, the average in suite procedure time revealed no statistical difference between TRA and TFA (104 min vs. 94 min, $P>0.05$). The average materials cost also presented no statistical difference (\$2,481 vs. \$2,061, $P>0.05$). Lastly, the average volume of contrast utilized between the two groups showed no statistical difference (144ml vs. 128 ml, $P>0.05$).

Conclusion: With respect to many pertinent parameters, TRA was evaluated as an equally efficacious alternative to TFA in UAE procedures. Given the increased patient preference of TRA over TFA as described in literature, this study's findings further augment the claim that TRA should be considered more often, whenever viable, as an option in the UAE treatment of uterine leiomyomas.

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Prospectively collected patient outcomes following uterine artery embolization for symptomatic uterine fibroids: 10 years experience in an Irish tertiary referral centre

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Purpose: Uterine fibroids are common, benign neoplasms which frequently affect women of reproductive age. Symptoms include dysmenorrhea, pressure effects, and subfertility. This study aims to validate the use of uterine artery embolization which provides a minimally invasive, fertility sparing alternative to myomectomy and hysterectomy.

Materials and Methods: A prospective follow-up survey was performed on the patients who underwent uterine artery embolization for symptomatic uterine fibroids between the years 2010 and 2020 in Galway University Hospital. Retrospectively collected measurements from MRI imaging were also analysed. Inclusion criteria required each patient to have a pelvic MRI of the pelvis pre-embolization, and one year post-embolization. Pre-embolization, and post-embolization uterus and

largest lesion volume were calculated, quality of life improvement was assessed via a survey interview.

Results: 130 patients were included. 73% reported menorrhagia as their main symptom followed by dysmenorrhoea and abdominal distension. Mean severity of symptoms prior to procedure was 8.5/10 and 1.9/10 post procedure.

Mean uterus size pre-procedure was 612 ml and 278 ml post procedure (52% reduction). Mean largest lesion size was 213 ml reducing to 87 ml post procedure (60% reduction)

Less than 6.5% reported no improvement in symptoms, 13.5% had a partial response, 20% significant improvement and 60% a complete response. 93% of patients responded that their quality of life had improved and would recommend the procedure.

65% of patients underwent a superior hypogastric block for pain control. Pain was reported as adequately controlled in 80% of patients.

Conclusion: Fibroid embolisation is a safe and effective treatment with high satisfaction rates amongst patients.

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Red flags interventional radiologists need to recognise and pitfalls to avoid in the assessment of a patient's pelvic MRI when assessing their suitability for uterine artery embolisation; a pictorial review

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Learning Objectives: To familiarise IRs with the MRI appearances of conditions contraindicating Uterine artery embolisation (UAE) and to identify conditions that should be primarily diverted to gynaecology. To provide IRs with a structured technique to systematically review pelvic MRI.

Background: Part of an Interventional Radiologist's evaluation of a patient referred for consideration of UAE includes reviewing their MRI to confirm the diagnosis of fibroids and / or adenomyosis and the appropriateness of embolisation. In addition, conditions should be identified that may contraindicate the procedure, lead to potential complications or which should be referred to gynaecology. As per Omary, 2002, MRI has a substantial effect by changing diagnoses and anticipated treatment plans in approximately one in five women.

Clinical Findings/Procedure Details: In addition to the standard assessment of fibroid suitability, it is important to identify other conditions which may coexist, e.g. adenomyosis and endometriosis, that will have an impact on outcomes requiring discussion with the patient. UAE may be indicated specifically for Adenomyosis; however, it is vital to be able to distinguish endometrial carcinoma from the latter. A thorough evaluation of the endometrial cavity is essential. The IR should be able to recognise signs of active pelvic inflammatory disease. One needs to be able to recognise complex adnexal lesions with malignant potential, or those that require gynaecological input prior to UAE.

Conclusion: This pictorial review will illustrate critical findings on pre-embolisation MRI, particularly red-flag lesions, helping IRs to avoid potentially disastrous outcomes.

P-302

Embolotherapy: a maternal life saviour and uterus preserver in postpartum haemorrhage

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Learning Objectives: To study the vascular anatomy pertinent to postpartum haemorrhage.

To enumerate the indications, contraindications, efficacy and complications of transarterial embolization in postpartum haemorrhage.

To discuss various embolic agents used and procedural technique of transarterial embolization.

To review various clinical conditions associated with postpartum hemorrhage and their management by transarterial embolization.

Background: Postpartum haemorrhage (PPH) is a life threatening condition defined as blood loss of 500 ml or more within 24 hrs after birth. It is the leading cause of maternal death worldwide predominantly in low-income countries. When maternal bleeding is not controlled by conservative measures, transarterial embolization (TAE) or surgery is performed. TAE scores over surgery as it is a minimally invasive, rapid procedure with faster recovery and can be performed without general anaesthesia. Besides it preserves uterus and keeps chances of future pregnancy a possibility.

Clinical Findings/Procedure Details: Review of literature regarding vascular anatomy, indications, contraindications, complications, embolic agents, procedural technique and efficacy of TAE relevant in management of PPH has been performed in the current study. Besides, cases of different clinical conditions related to PPH viz. uterine atony, cervical tear, morbidly adherent placenta, uterine arteriovenous fistula (AVF), uterine arteriovenous malformation (AVM) with pseudoaneurysm etc. and their treatment by TAE have been discussed.

Conclusion: Being minimally invasive, rapid, repeatable with less complications and uterine preservation, TAE should be considered as first-line therapy for management of PPH. Interdepartmental co-ordination between Obstetrician and Interventional Radiologist is an essential prerequisite to avoid unnecessary delay in undertaking TAE.

P-303

Not all bleeding is fibroids: the importance of imaging in women's health clinic

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Learning Objectives:

1. Discuss the differential diagnoses for heavy menstrual bleeding (HMB) and pelvic pain.
2. Show the significant impact of imaging on the correct diagnosis and treatment of female pelvic pathology.

Background: Uterine artery embolization (UAE) is an effective treatment for uterine fibroids, postpartum hemorrhage, and adenomyosis. Significant overlap in the clinical presentations of multiple pelvic pathologies make imaging critical in appropriate patient selection. Many patients present to clinic with HMB or pelvic pain with a diagnosis of fibroids, but have undergone an incomplete workup, typically excluding pelvic MRI. MRI not only allows for better characterization of fibroids (location, number, size, enhancement), but also identifies concomitant adenomyosis, malignant contraindications to UAE, and other pelvic pathologies that would not be treated appropriately with embolization.

Clinical Findings/Procedure Details: Through a case series, we will highlight the impact of imaging in the treatment of patients presenting with HMB and/or pelvic pain. Examples of cervical cancer, cervical stenosis with hematometra, endometrial cancer, leiomyosarcoma, adenomyosis,

and fibroids (large central, pedunculated and degenerated) will be shown as etiologies for HMB. Alternative diagnoses causing pelvic pain will be presented including May-Thurner, hydrosalpinx, and ovarian cancer.

Conclusion: Pelvic pain and HMB are the two most common complaints seen in women's health clinic. It is of paramount importance that IR physicians understand the various pathologies, request and review appropriate imaging, and work in interdisciplinary teams to expedite the treatment of patients presenting with this unique set of diagnoses with significant overlap in clinical presentation.

P-304

Emphasizing the interventional radiologist's role in postpartum hemorrhage

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Learning Objectives:

1. Classify postpartum hemorrhage (PPH) and its etiology
2. Discuss PPH treatment algorithms and review embolization outcomes
3. Outline clinical and technical considerations in percutaneous management of obstetrical hemorrhage

Background: Postpartum hemorrhage is the most common cause of maternal death worldwide. Variable access to interventional services has led to inconsistent interventional radiology (IR) involvement in obstetrical treatment guidelines. When medical and surgical therapies fail to control PPH, hysterectomy is typically performed. While hysterectomy is necessary for some forms of obstetrical hemorrhage, early and deliberate IR involvement is key to timely hemostasis and uterine preservation for many others.

Clinical Findings/Procedure Details: We will present percutaneous management in the following primary PPH cases: uterine atony, abnormally invasive placenta, and birth trauma. Special attention is paid to technical tips, such as alternative bleeding sources to consider and the value of initial pelvic angiography. Though controversial, prophylactic occlusion balloon use in patients with invasive placenta will be discussed. Cases of secondary PPH, such as retained products and uterine arteriovenous fistula (AVF), will also be included. Unique technical approaches, such as percutaneous embolization of uterine AVF and percutaneous thrombin injection of ovarian and uterine artery pseudoaneurysms, will be shown.

Conclusion: Familiarity with the pathophysiology and obstetrical management of PPH will help interventionalists play a more active role in the treatment of these patients. Improving our clinical success by implementation of a variety of percutaneous techniques will allow us to advocate for early IR involvement and uterine preservation in a majority of patients.

P-305

Fallopian tube recanalisation: an evidence-based review

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Learning Objectives:

1. Learn the pathophysiology of proximal fallopian tube occlusion.
2. Understand the technique of fallopian tube recanalization (FTR)
3. Review the complications and success rate of FTR

Background: Tubal disease is the cause of subfertility in about 30% of women, out of which 10–25% of cases are due to proximal fallopian tube obstruction (FTO). Proximal FTO can be caused because of obstruction by blood products, debris, minor adhesion, or sinus isthmica nodosa or secondary to tubal spasm. FTR has shown potentially reverse proximal FTO and improve fertility.

Clinical Findings/Procedure Details: A pre-procedural hysterosalpingogram (HSG) is then performed to visualize the site of obstruction. The cervix is then cannulated with a balloon catheter that is inflated with 2 ml of diluted contrast agent. HSG is performed again to confirm the

blockage, post which the blocked tube is cannulated with an angled tip multipurpose catheter. After this, selective salpingography is performed to further confirm FTO. A hydrophilic guidewire is then inserted all the way until the wire reaches the peritoneal cavity on the side of the tubal block. In the end, a selective salpingogram is performed again to confirm tubal patency and contrast spillage in the peritoneum. In a study of 20 patients by Thurmond AS et.al, 58% of patients conceived within one year of the procedure, without any assisted reproductive methods. Al-Omari et al. showed a pregnancy rate of 41% within the first year following FTR. **Conclusion:** FTR should be considered in patients with documented proximal FTO, before trying options like IVF and embryo transfer.

P-306

Venous compression syndromes as a cause of chronic pelvic pain: what IRs need to know

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Learning Objectives: Through a case series: discuss the clinical presentation, evaluation, diagnosis and management of pelvic venous disorder (PeVD) with emphasis on the role of venous compression syndromes

Background: Chronic pelvic pain (CPP) affects up to 40% of reproductive-age women, with approximately 50% remaining undiagnosed and untreated for years. CPP is defined as non-cyclical pelvic pain lasting at least 6 months. PeVD is a known cause of CPP. This spectrum of diseases results in pelvic venous insufficiency from dilated incompetent intra- and extrapelvic veins (primary PeVD) with or without associated venous compression (secondary PeVD). Endovascular treatment of PeVD improves symptoms in 80-90% of patients with low complication rates. With secondary PeVD, clinicians must recognize venous compression syndromes involving the left renal and common iliac veins. Nutcracker syndrome causes increased left renal vein pressure with reflux into the left ovarian vein due to its compression between the superior mesenteric artery and aorta. May-Thurner Syndrome (MTS) may result when the left common iliac vein is compressed against the spine by the right common iliac artery, resulting in drainage of the lower extremity through pelvic collaterals.

Clinical Findings/Procedure Details: This case series will highlight the clinical presentation, imaging workup, and endovascular management of Nutcracker and May-Thurner Syndromes presenting as CPP in 4 women. Imaging evaluation emphasizing pertinent anatomy and image-guided techniques used to successfully manage CPP from venous obstruction will be demonstrated.

Conclusion: To successfully treat CCP in PeVD, interventional radiologists must understand the pathophysiology and management of venous compression disorders.

P-307

A pictorial review on uterine artery interventions

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Learning Objectives: Uterine artery embolization (UAE) is a safe procedure done for various benign conditions like uterine fibroid, post-partum haemorrhage, gestational trophoblastic disease, scar ectopic, adenomyosis. Balloon occlusion of uterine arteries is also performed to prevent bleeding in cases of adherent placenta. Knowing about indications and contraindications of UAE as well as their results helps in selecting proper candidates for the procedure.

Background: Results of UAE in various conditions according to literature are variable. As per the available literature on fibroid, UAE is comparable

to myomectomy in results of pain, menorrhagia and with results pertaining to fertility, myomectomy is preferred.

UAE is helpful in reducing bleeding and pain in adenomyosis. In cases of abnormal invasive placenta, balloon occlusion helps in reducing bleeding and reducing the rates of hysterectomy. Proximal balloon occlusion of aorta and common iliac arteries have better results than distal balloon occlusion of internal iliac artery and uterine artery.

Clinical Findings/Procedure Details: UAE is performed under local anaesthesia after femoral artery puncture followed by selective cannulation and embolization of bilateral uterine arteries various materials depending on the condition being treated. Proper patient selection, patient counselling, techniques in UAE, intra procedural and post procedural pain management, various embolization agents and results of UAE in various conditions will be highlighted.

Conclusion: UAE is a safe and effective treatment option in various benign conditions like fibroid uterus, scar ectopic and uterine arteriovenous malformations. When performed as a part of preoperative embolization in adherent placenta, intraoperative bleeding is decreased and thereby makes surgery safer and easier.

P-308

Super-selective uterine artery embolization as treatment to control gynaecological bleeding in patients after miscarriage

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Learning Objectives: To describe our experience in the treatment of gynaecological acute or chronic bleeding after miscarriage through super-selective uterine artery embolization (UAE) as a less invasive treatment which reduces the need of radical procedures leaving the possibility of future pregnancy.

Background: Etiology of abnormal bleeding after miscarriage is various: retained product of conception, incomplete miscarriage, coagulopathies or uterine arteriovenous malformation (UAVM).

Transvaginal US, MDCT and MRI are important to assess the source of bleeding, the extent and its vascularity: hypertrophic and serpiginous vessels or vascular lacunae usually located in uterine fundus can be detected. Depending on clinical severity, treatment options vary from medical to surgery (dilation and curettage, hysterectomy, uterine artery ligation, endometrial ablation).

Massive bleeding or intraperitoneal haemorrhage are potentially life-threatening and require prompt treatment.

Super-selective UAE could be an excellent option to control uterine bleeding preserving fertility.

Clinical Findings/Procedure Details: 5F unilateral femoral artery access under local anaesthesia is performed to study both uterine arteries, localize the bleeding structures and evaluate whether there is a dominant supply to them.

Super-selective catheterization of uterine artery is necessary to skip cervical and vaginal branches. Embolization is obtained using 700-900 µm microspheres (Embospheres) and gelatin sponge. The endpoint of embolization is contrast stasis avoiding reflux.

Final angiography is performed to demonstrate correct embolization and absence of complications.

Clinical and US follow-up is recommended to evaluate persistence of bleeding.

Conclusion: Super-selective UAE is a safe and effective treatment to control abnormal gynaecological bleeding in patients after miscarriage reducing the need for radical treatment without impairing fertility.

P-309

Emergency embolisation of a massive life-threatening placenta percreta bleeding following delivery by Cesarean section

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Clinical History/Pre-treatment Imaging: A 30-year-old woman, gravida 2, para 1, with one previous uncomplicated CS delivery. Had planned CS delivery at 37w6d. The delivery was smooth. However, the mother started bleeding profusely and emergency hysterectomy was needed, inspection demonstrated the earlier noted placenta percreta in fact placenta accrete located in the broad ligament. Both iliac arteries were compressed, and the interventional radiologist (PNML) was called for an emergency UAE.

Treatment Options/Results: It was not technically possible to remove the placental mass in the broad ligament. Using selective angiography, the anterior division of the right internal iliac artery, the uterine artery remnant showed a "uterine-like" mass. (Image 1). Embolization was performed with Gelfoam particles until stasis in the uterine artery with coil placement. The patient was discharged at 12 days after delivery. There were no readmissions and MRI showed further mass reduction of 92% at 3 months (Image 2).

Discussion: The dorso-laterally localised placenta percreta is difficult to diagnose with ultrasound and therefore often presented in an emergency setting. Treatment options are elective surgical removal of the uterus with the involving placental tissue, conservative management, or recently embolization prior to delivery. This is the first published case treated by selective UAE of the remaining placenta with rapid recovery of the patient without complications.

Take-home Points: Gelfoam Embolization (EmboCube 5.0 mm x 25mg, Merit, ©) and additional coil give good results in placenta accrete embolization.

After emergency hysterectomy the uterine artery is still patent and can be embolized.

P-310

Preoperative embolization in a cervical ectopic pregnancy: a valuable option for uterus preservation

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Clinical History/Pre-treatment Imaging: A 31-year-old primiparous female was admitted to the emergency room for vaginal bleeding that started 3 days earlier with progressive worsening. The patient had no relevant past history.

A transvaginal ultrasound was performed and β -hCG levels measured leading to the diagnosis of a cervical ectopic pregnancy.

Treatment Options/Results: Considering patient age and her desire to preserve fertility, conservative treatment using methotrexate was attempted. There was no response to systemic methotrexate, but a progressive β -hCG decrease was observed after its intra-amniotic injection. However, there was no involution of the trophoblastic tissue and the uterine hemorrhage episodes persisted. Surgical removal was programmed and, to minimize the risk of an acute hysterectomy due to uncontrolled hemorrhage, preoperative embolization was also performed. Using a right transfemoral access the left uterine artery was identified and CBCT performed, showing neovascularization dependent of the left cervico-vaginal artery. After its catheterization, embolization was performed using embospheres 500-700 μ m until near stasis. The trophoblastic tissue was removed with curettage and vacuum aspiration with minimal blood loss. There were no complications, and the patient was discharged within 48 hours.

Discussion: Cervical ectopic pregnancy are rare cases with a reported incidence of 1:1000 to 1:95000 pregnancies and little data is available regarding pre-surgical embolization.

Similar to fibroid embolization particle size above 500 μ m seem a suitable size with reduced risk of non-target ovary embolization. However, more data is necessary to understand the real impact on fertility.

Take-home Points: Preoperative embolization by interventional radiologists can be detrimental to uterus preservation in young patients.

P-311

Endovascular management of massive hemorrhage post abdominal pregnancy

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Clinical History/Pre-treatment Imaging: A 32-year-old female Gravida 4 with 2 living issues was diagnosed with secondary abdominal pregnancy. She was referred to us in an intubated state and shock post exploratory laparotomy at 32 weeks gestation with the delivery of a live baby and retained placenta. CT angiography revealed retained placenta outside the uterus in the right iliac fossa with supply from bilateral uterine arteries. No aberrant arterial supply was noted.

Treatment Options/Results: The patient was planned for uterine artery embolization (UAE) followed by removal of the abdominal packing.

The right uterine artery was accessed through the right femoral access and the placental bed was embolized using Gelfoam-PVA slurry. The right uterine artery was embolized using NBCA glue and coils while the left uterine artery was embolized using gel foam and NBCA glue.

The patient was hemodynamically stable post-procedure and was discharged after removal of the packing in stable condition.

Discussion: UAE is an effective and safe procedure to minimize post-partum haemorrhage. It can be life-saving in ectopic abdominal pregnancies which may present with massive life-threatening bleeding. Gelfoam and PVA particles are the usual embolization material used in UAE, however a combination of Gelfoam, NBCA glue and coils can be used safely as shown in our case.

Take-home Points: UAE is a life-saving procedure in patients with massive bleed due to retained placenta following abdominal pregnancy. A multidisciplinary approach with the availability of interventional radiologist can salvage such complex condition with good clinical outcome.

P-312

Post abortion gynecological hemorrhage: a case report of super-selective uterine artery embolisation (UAE) in a young patient to control bleeding and preserve fertility

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Clinical History/Pre-treatment Imaging: 31 years-old female with recent previous abortion presented to emergency department with acute uterine bleeding, mild anemia and abdominal pain.

MDCT showed an intramural mass with serpiginous structures and vascular lacunae in uterine fundus, suggesting the diagnosis of uterine arteriovenous malformations (UAVMs).

Considering the young age of the patient and her wish to preserve fertility, a selective uterine artery embolization (UAE) was proposed as first option of treatment.

Treatment Options/Results: Patient underwent bilateral diagnostic angiography by a 5F right common femoral artery access showing large

vascular lacunae within myometrium of uterine fundus, supplied by both hypertrophic uterine arteries.

According to patient wish and the major vascular supply from right uterine artery, a super-selective embolization of right uterine artery, distal to the origin of cervical and vaginal branches, was performed using 700-900 microns Embosphere. Final angiography confirmed successful embolization of right uterine artery.

Clinical and US follow-up demonstrated no recurrence of hemorrhage.

Discussion: Acquired UAVMs are a rare (1-2%) cause of bleeding after abortion, but potentially life-threatening and require prompt treatment. Doppler US is the first imaging modality that shows serpiginous vessels and increased blood flow.

CT-angiography localizes bleeding feeder vessels and entity of hemorrhage.

Moreover it has a key role in planning the treatment.

Treatment differs according to clinical status, ranging from medical to surgery.

Selective UAE could be a good alternative to radical treatment in patients with desire of future pregnancies.

Take-home Points: Super-selective UAE is an excellent option to control acute bleeding after abortion, which reduces the need for radical surgery and could still permit pregnancy after procedure.

Imaging

P-313

Lower limb interventions with digital variance angiography (DVA)

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Purpose: Digital Variance Angiography (DVA), compared to Digital Subtraction Angiography (DSA), provided higher contrast-to-noise ratio (CNR) and improved image quality (IQ) in non-selective lower limb interventions. Our aim was to evaluate the potential benefits of DVA in selective lower limb angiography and to compare the performance of the conventional DVA1 versus the recently developed DVA2 algorithm.

Materials and Methods: From November 2019 to May 2020, 112 iodine contrast media (ICM) angiograms from 15 peripheral artery disease (PAD) patients and 40 CO₂ angiograms from 13 PAD patients were collected. DVA files were retrospectively generated from the same source files as DSA images. The CNR and IQ of DSA, DVA1 and DVA2 images were compared. The visual evaluation was performed by 6 radiologists from two different institutions using a 5-grade Likert scale.

Results: Both DVA algorithms produced similar, at least 2-fold increase in CNR values, and significantly higher IQ scores compared to DSA, independently from the contrast agent used. Overall IQ scores for DSA, DVA1 and DVA2 using ICM were 3.61 ± 0.05 , 4.30 ± 0.04 and 4.33 ± 0.04 . Using CO₂, scores were 3.10 ± 0.14 , 3.63 ± 0.13 and 3.38 ± 0.13 , respectively.

Conclusion: DVA provides higher CNR and significantly better image quality in selective lower limb interventions using either ICM or CO₂. Comparing the DVA algorithms, DVA1 is the preferred method with both contrast agents. It provides identical or better IQ than DVA2, whilst requiring shorter processing time. DVA can potentially assist the intra-operative decision-making process and its quality reserve might allow dose management (radiation and/or ICM reduction).

P-314

Tailored protocol for thoraco-abdominal CT imaging: how can be optimized?

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Purpose: We investigated the ionizing radiation dose, quantity of contrast medium, image quality, and diagnostic performance in patients undergoing thoraco-abdominal computed tomography (CT) imaging with high-iodinated contrast medium using age- and body mass index (BMI)-based protocols.

Materials and Methods: We enrolled 40 consecutive patients undergoing routine thoraco-abdominal CT imaging for both vascular and non-vascular issues, with a previous CT examination performed within 3 months. Every patient underwent a tailored CT-scan protocol, stratified by age and BMI, designed to obtain the best combination of radiation and contrast medium dose, and a good image quality. Two protocols were established, based on radiation reduction (patients <60yo) or CM reduction (patients >60yo or with high risk for renal failure). Previous CT examinations performed with standard protocols represented our standard of reference. Images and parameters were quantitatively and qualitatively evaluated and compared with standard of reference by two blinded experienced radiologists.

Results: All CT examinations were technically adequate, without significant differences in terms of image quality and diagnostic performance when compared with standard of reference. Tailored protocols were able to obtain in the radiation reduction group, a reduction of radiation dose >50%, with a concomitant reduction of contrast medium dose of about 15%, whereas in the CM reduction group, a reduction of radiation dose of about 35% with a concomitant reduction of contrast medium dose of >30% was obtained.

Conclusion: Knowledge of CT technical parameters and how they impact on the diagnostic performance is mandatory to optimize and tailor the best CT protocol for every patient, based on their characteristics.

P-315

Volumetric MDCTA analysis for calculation and classification of active non-cerebral, non-gastrointestinal bleeding

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Purpose: To evaluate the feasibility of Multi-Detector Computed Tomography Angiography (MDCTA) volumetry for the quantification and classification of acute hemorrhage.

Materials and Methods: This retrospective, single-center, study included consecutive patients with MDCTA positive for active bleeding (non-cerebral, non-gastrointestinal), between January 2020 and June 2020. Outcome measures included the quantification of active extravasation at the arterial and parenchymal phase using volumetry analysis, the calculation of active bleeding rate and bleeding grading, identification of independent predictors of mortality and correlation between volumetric analysis, various clinical features and the decision to proceed with an intervention.

Results: The analysis included 30 patients (17 females; mean age 70.0 ± 16.0 years). Volumetric analysis resulted in excellent inter-observer variability (interclass correlation coefficient 0.999 for arterial and 0.919 for venous volume measurements). Mean volume of contrast extravasation was 1.06 ± 1.09 ml and 3.07 ± 2.48 ml at the arterial and parenchymal phases,

respectively. Mean bleeding rate was 6.95 ± 7.82 ml/min. High bleeding volume at arterial phase (grade 4 bleeding) was the only independent predictor of 30-day mortality (HR 1383.58; $p=0.042$). There was a positive correlation between bleeding volume at arterial phase ($r_s = 0.340$; $p=0.033$) and arterial bleeding rate ($r_s = 0.381$; $p=0.019$) with the decision to proceed with an intervention. Bleeding volume of 0.6ml was the cutoff value for the prediction of intervention (sensitivity 96.3%; specificity 66.7%).

Conclusion: Quantification and grading of acute hemorrhage was feasible using MDCTA volumetric analysis, with excellent inter-observer agreement. The specific bleeding grading system could optimize decision making and predict clinical outcomes.

P-316

Needle guidance in computed tomography with the patient mounted puncture cube system: preliminary experience in splanchnic nerve radiofrequency ablation

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Purpose: To describe preliminary clinical experience with a newly available aiming navigation system for Computed Tomography (CT) - guided punctures. The "Puncture Cube System" (PCS) consists of a patient mounted self-adhesive cube and a dedicated software which recognizes the cube in the planning scan allowing for needle guidance.

Materials and Methods: The PCS was used in 5 patients undergoing CT-guided splanchnic nerves neurolysis. The mean patient age was 71.6 years (range 54-81 years; male/female ratio: 5/0). Procedure time (time from the moment patient was placed on CT table until the moment he/she was taken to recovery room), amount of scans (from the scanogram taken until the last scan with needle/electrode removed) were recorded. Complications were classified and graded according to the CIRSE reporting system.

Results: Technical success (i.e. positioning of the needle on the desired location) was obtained in all cases. Needle placement was accurate, only in one patient needle orientation needed slight correction. Mean procedure time was 12.4 min (8-19 min); on average four CT scans were performed to control correct positioning and precise needle placement. There were no complications or material failure reported in the present study.

Conclusion: Punctures with the PCS in this initial case series were accurate and required less time corrections of the needle path. This result was most evident for double oblique access routes. More prospective and comparative studies with larger patient samples are necessary for verification of this system as well as for drawing broader conclusions.

P-317

Predictability of response to transarterial chemoembolization with degradable starch microspheres (DSM-TACE) of liver metastases: the role of radiomics

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Purpose: To investigate the effectiveness and predictability of success of DSM-TACE in patients affected by inoperable liver metastases with CT texture analysis (CTTA).

Materials and Methods: A retrospective single-center study design was performed on 12 patients (8 men and 4 women; median 58 years, range 48-71) affected by liver metastases (19 lesions). A suspension of 75 mg of doxorubicin and 7.5 ml of a degradable starch microsphere

(EmboceptS) was administered intra-arterially up to 2 times with a 3 weeks-interval. Baseline and follow-up contrast enhanced computed tomography (CECT) was assessed at 1 month after "complete treatment" measuring the density of each lesion according to CHOI criteria. Measures of heterogeneity were obtained in post-processing by placing a VOI on the entire lesion and CTTA parameters were correlated with density using machine learning algorithms (WEKA).

Results: According to CHOI criteria, imaging follow-up revealed a partial response in 16 lesions, stable disease in 2 and progression in 1 lesion. In CTTA, machine learning analysis with a decision tree classifier revealed higher performances for detecting responsive metastases (83% of lesion correctly identified; ROC area = 0.9) with sensitivity and specificity of 100 % and 80% respectively.

Conclusion: DSM as embolic agent for TACE is safe and well tolerated and it provides a valid treatment of liver metastases; CTTA approach combined with machine learning could be effective in predicting of response to treatment of liver metastases.

P-318

Impact of celiac trunk calcification on clinical outcome in patients undergoing liver transplantation

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Purpose: Post-operative complications after liver transplantation contribute to a 90-day mortality rate of up to 10.6%. To improve post-operative outcomes, adequate arterial perfusion of the transplant is essential. Aim of this study is to investigate risk factors on pre-operative imaging of the celiac vessels and their impact on clinical outcome.

Materials and Methods: A retrospective, monocentric study was conducted on patients undergoing liver transplantation between January 2018 and December 2019 with an available preoperative, non-contrast-enhanced CT. Calcifications of the celiac artery (CA) and the visceral aorta (VA: aorta from aortic hiatus to superior mesenteric artery) were determined by using the Agatston method (cut-off values: CA >50 mm³, VA >100 mm³). Sex, age and visceral calcification were compared to major complications (MC) (Clavien-Dindo $\geq 3b$), 90-day mortality rate (MR) and early allograft dysfunction (EAD) by using logistic regression analysis ($p < 0.05$). Additionally, the corresponding odds ratios (OR) were calculated.

Results: A total of 54 patients were investigated of whom 9 had a relevant calcification of the VA alone and 10 of VA and CA combined (cVCA). Sex and age were not strongly associated with an increased risk of MC ($p=0.396$, OR=0.606; $p=0.743$, OR=1.007, respectively), MR ($p=0.133$, OR=3.487; $p=0.350$, OR=0.975) or EAD ($p=0.859$, OR=0.960; $p=0.124$, OR=0.853). Similarly, patients with VA or cVCA calcification showed no relevant increased risk of MC ($p=1.0$, OR=1.0; $p=0.315$, OR=2.130, respectively), MR ($p=0.375$, OR=2.286; $p=0.999$, OR=0.0) or EAD ($p=0.856$, OR=0.813; $p=0.469$, OR=1.950).

Conclusion: Visceral calcification is not associated with MC, MR or EAD following liver transplantation.

P-319

Utilization of hybrid CT-angiography for combined CT and fluoroscopic procedures in interventional radiology

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Purpose: Traditional interventional suites are designed for CT or fluoroscopy only procedures. This study's purpose was to quantify case volume and utilization of hybrid-CT angiography (Angio-CT) procedures at a

tertiary care academic medical center in order to understand the role of combined fluoroscopic and CT-guided procedures.

Materials and Methods: A retrospective analysis was performed on all procedures performed in a dedicated Angio-CT room from its installation in June 2018 until August 2019. Cases in which both CT and fluoroscopy were utilized were recorded to identify the number of procedures that may not readily be performed in a conventional angiography suite. These cases were divided into two procedure types; one in which the procedure was performed in a single session utilizing each modality (fluoroscopy and CT) and another in which both modalities were utilized for a single intervention.

Results: 1109 total cases were performed in the Angio-CT suite during the study period. 115 (10.4%) procedures utilized both CT and fluoroscopy. 48 (41.2%) patients within this cohort underwent greater than one procedure (i.e. bundling of a lymph node biopsy and chest port placement) that required the use of both modalities and facilitated treatment in the same room. Dual modality imaging for single procedures was utilized for complex interventions, most commonly venous recanalization (n=7), TARE/TACE (n=22), and non-hepatic embolizations (n=10).

Conclusion: Combination fluoroscopy and CT-guided interventions were utilized in approximately 10% of procedures in an Angio-CT suite. Combination imaging was relevant for both procedure bundling (i.e. performing CT-only and fluoroscopy-only procedures) and the performance of advanced procedures.

P-320

Feasibility of quantitative 2D angiography using lower radiation dose fluoroscopic image acquisitions

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Purpose: Quantitative DSA (qDSA) can be used to calculate arterial velocities on 2D-DSA images but currently requires high frame rates resulting in higher radiation doses. The purpose of this study was to assess the feasibility of computing arterial velocities from lower radiation dose 2D fluoroscopic images utilizing a validated qDSA technique.

Materials and Methods: A qDSA technique was utilized to compute velocities from DSA (35.0 µGy/s) and fluoroscopic (1.5 µGy/s) imaging series. In vitro validation was performed by comparing DSA and fluoroscopic derived velocities in a vascular bifurcation phantom over seven different flow rates. A pulsatile waveform was generated to mimic cardiac pulsatility and iodinated contrast material was injected at 2.5 ml/s for 8 s. Linear regression, Pearson's correlation coefficient, and Bland-Altman were used to assess the correlation and precision between DSA and fluoroscopic velocities.

Results: Computed average velocities ranged from 13.6 to 63.7 cm/s and 13.3 to 68.63 cm/s for DSA and fluoroscopy, respectively. In vitro validation showed a strong correlation between DSA and fluoroscopic velocities over the range pulsatile flow rates (slope = 0.9895, 95% CI [0.98,1.04], Pearson's $r = 0.995$, $p < .0001$). Bland-Altman analysis of the DSA and fluoroscopic velocities demonstrated a mean bias of -0.01 cm/s with 95% limits of agreement of [-3.47, 3.27] cm/s.

Conclusion: It is feasible to compute accurate velocities with fluoroscopic imaging in an in vitro model. The strong agreement with the validated qDSA velocities is promising for reducing radiation exposure during quantitative angiography to facilitate clinical translation.

P-321

Are we walking past venous disease on routine CT imaging, and should it be one of our review areas?

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Purpose: Deep venous disease especially if untreated has a significant burden on both patient and society. Management and referral pathways are improving but this entity is frequently overlooked by non-specialists. Patients with venous disease are frequently investigated for other reasons where evidence of venous disease may go unnoticed.

Materials and Methods: All patients who underwent venous intervention (including venography, intravenous ultrasound, thrombolysis/thrombectomy, venoplasty and stenting) between 2008 and 2021 and who had a CT Abdomen/Pelvis imaging at least one month prior to intervention were identified. This cohort's prior CT imaging was reviewed by a vascular interventional radiologist to assess for evidence of unreported venous disease.

Results: We identified 154 patients who underwent venous intervention for IVC/iliofemoral disease with relevant CT imaging. The mean interval time from the first CT to intervention was 2.2 years (1 month – 10 years). Mean CTs performed per patient was 4.3 (1 – 22). 65% of reviewed CT scans showed some evidence of venous disease. The most common sites of disease were the left common and external iliac veins (53 % and 51%). Relevant venous clinical information was provided in 10% of these orders and the presence of venous pathology or the venous system was mentioned in 14% of radiology reports.

Conclusion: Venous disease is frequently unreported by consultant radiologists. This study highlights the importance of good clinical history when ordering imaging and the need to include venous disease in the radiologist's review areas checklist.

P-322

Augmented reality in the Angiosuite 2.0: a case based approach

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Purpose: Augmented Reality (AR) is increasingly used to plan, execute and control different types of image-guided interventions. The purpose of this work is to outline a case series of interventions that have been performed in a real-world setting applying second-generation AR techniques (AR 2.0).

Materials and Methods: The prospective digital database of the Clinic of Radiology was searched manually to identify interventions that have been performed applying AR 2.0. The search was restricted in terms of time interval (2014-2020) and angiosuite (Artis Zeego Q). The case descriptions included patient history, indication for and type of intervention, the advantage of AR 2.0 in planning, execution and/or controlling the intervention, specific technical issues and/or procedural and clinical outcome.

Results: Representative interventions applying AR 2.0 such as stent/stent-graft implantation, embolization of endoleak/hemorrhage/tumor/hypersplenism/vascular anomaly or lymphatic and biliary interventions were outlined. There were neither technical or clinical failures nor complications associated with AR 2.0. Current limitations are issues of work-flow (e.g. big image data pre- and post-processing and human/angiosuite interaction) and intelligent perception/virtual rendering (e.g. intra-procedural realignment of static and dynamic segmentations) that should be addressed in the near future.

Conclusion: AR 2.0 is feasible, safe and effective. Today, different types of percutaneous and transvascular interventions can be performed applying AR 2.0 with the intention to reduce procedure time, amount of contrast

material and radiation exposure. Furthermore, AR 2.0 is considered as a decisive step to enter a new level of precision in Interventional Radiology that results not only in high patient satisfaction but standardization and cost-effectiveness.

P-323

Where is the atrial-caval junction? A prospective review of opinion amongst radiology residents

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Purpose: There is often a disagreement on the exact landing site for peripherally inserted central venous devices.

It is generally accepted that the tip of such devices be placed at the atrial-caval junction given the lower complication rate associated with this anatomical location.

This location on imaging (in a supine position) is open to interpretation. Our aim was to prove this learning point for IR trainees.

Materials and Methods: 25 separate images acquired fluoroscopically during central venous catheter placement were acquired and printed. A range of patients undergoing central venous catheter placement were selected.

The master line was drawn by three senior IR consultants who had to agree on each image.

11 radiology residents reviewed the images.

Each person drew a line at the point they would estimate the A-C junction and deploy the catheter tip.

Results: The appropriate site was agreed on each case by three experienced Interventional Radiology Consultants prior to trainees reviewing the images.

There was a large variation amongst trainees with most trainees siting the catheter high/proximal.

Significant Variability (> 1.5 cm) from the master line was demonstrated in 72% of cases (SD 0.7).

Agreement (defined as within 1 cm from master line) was seen in only 16% of cases with senior trainees demonstrating a statistically higher accuracy than junior trainees ($p < 0.01$)

Conclusion: Catheter placement is an important IR learning point that we should establish early in our training.

Accurate placement of intravascular devices leads to fewer complications. Significant variability in image interpretation at our institution demonstrates an area for improvement.

P-324

Intravenous iodinated contrast material and acute kidney injury: contrasting local practice with the latest evidence-based guidelines

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Purpose: The risks of contrast induced kidney injury have been historically overestimated. Acute kidney injury is associated with negative patient outcomes however intravenous contrast is usually coincident and rarely the cause of kidney injury. Concerns regarding risks from contrast in patients with chronic kidney disease results in these patients being denied imaging and procedures, having delays for pre-hydration, and having sub-optimal non-contrast imaging, with risks of missed diagnoses. Local hospital contrast protocols were reviewed to assess concordance with recent evidence and up-to-date guidelines.

Materials and Methods: Recently published guidelines, including the 2020 Consensus Statements from the American College of Radiology and the National Kidney Foundation, are reviewed and compared with the current protocols of Irish and Northern Irish radiology departments.

Results: Current contrast protocols were obtained from 13 hospitals on the Island of Ireland in May-June 2020. All hospitals use the old terminology "Contrast Induced Nephropathy" instead of the preferred "Contrast associated Acute Kidney injury (CI-AKI)". 4/13 (31%) assess serum creatinine to measure renal function. 1/13 requires intravenous prehydration for all patients with eGFR 45-60 and 5/13 require it for all patients eGFR 30-45. 8/13 (61.5%) alter prehydration cut-off level in patients with diabetes mellitus. 8/13 (61.5%) require metformin to be stopped with eGFR 30-60, despite metformin not increasing risk of CA-AKI.

Conclusion: Current contrast protocols of most Irish hospitals do not match the most up-to-date evidence-based guidelines. Frequent review and audit of protocols is encouraged to ensure that practices match the best available evidence.

P-325

Pictorial review of right adrenal venography during adrenal venous sampling for primary aldosteronism

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Learning Objectives:

- Review right adrenal vein (RAV) anatomy and catheterization technique.
- Review the variability of RAV venograms and typical mimickers.

Background: Technical success in adrenal vein sampling (AVS) in the evaluation of primary aldosteronism is often hampered by the inability to obtain diagnostic samples from the right adrenal vein. Variability in RAV anatomy and venographic appearance is expected.

Clinical Findings/Procedure Details: The experience of over 60 right adrenal venograms from a single operator over 4 years is presented. Brief review of right adrenal vein anatomy is presented prior to a pictorial review containing a variety of diagnostic right venograms confirmed by cortisol selective indices. An adrenal nodule can occasionally be detected during venography. Mimickers opacifying the liver parenchyma are also presented.

Conclusion: Increased familiarity with the variability of the right adrenal venograms and its mimickers will increase AVS diagnostic rates.

P-326

Gossypibomas and other retained foreign objects (RFO's): imaging, interventional management and prevention

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Learning Objectives: Gossypibomas and RFO's: any surgical sponge, instrument, tool or device unintentionally left in the patient after surgery. they are a preventable adverse event that causes severe morbidity in patients and increases the cost of medical care. The surgical checklist, including that of gauzes and sponges, applied pre- and post-operatively is, at this time, the gold standard to avoid this adverse event.

Background: Risk factors for RFO's:

- Emergency surgery
- Unexpected change in type of operation
- Obesity
- Multiple surgical teams
- High estimated blood loss
- Change in nursing staff during procedure
- Poor communication in the OR
- Increased duration of the surgery

Clinical Findings/Procedure Details: The role of interventional radiology is very limited but we can play an important role for:

- Diagnostic aspiration under imaging guidance.
- Percutaneous drainage of abscesses resulting from the RFO's.
- Percutaneous removal of small retained objects.

•Management of the complications resulting from the surgical removal of RFO's.

Conclusion: A gossypiboma and RFO's are a preventable adverse event that causes severe morbidity in patients and increases the cost of medical care. The surgical checklist, including that of gauzes and sponges, applied pre- and post-operatively is, at this time, the gold standard to avoid this adverse event.

Significant challenge : they are difficult to prevent and to diagnose.

Familiarity with findings in the different imaging modalities is essential. In clinical practice CT is the imaging technique of choice.

The role of Interventional Radiology is limited but in some cases can help to diagnose, drainage, removal or management of the complications resulting from the surgical removal of RFO's.

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Utility of IVUS in interventional radiology

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Learning Objectives: To illustrate the versatile utility of IVUS in Interventional Radiology

Background: Intravascular ultrasound (IVUS) is an imaging technique that uses a small transducer mounted on the tip of a catheter to image the internal architecture of vessels thereby gaining deeper insights into the lesion and enabling treatment tailored to the characteristics of the lesion.

Clinical Findings/Procedure Details: A 9Fr Phillips Volcano PV 0.035 IVUS catheter was used in a wide range of procedures including central and iliac venous reconstruction, AV fistula treatment, Transjugular Intrahepatic Portosystemic Shunt (TIPS) deployment / revision and peripheral arterial intervention. IVUS was also used in situations where contrast administration was contraindicated and where accurate stent deployment was mandatory.

Conclusion: The VIDIO study by Gagne et al showed that IVUS is more sensitive for assessing iliofemoral venous stenosis compared to venography and frequently led to revised treatment plans and improved clinical outcomes. IVUS is a useful adjunct to conventional angiography and aids in portal vein access during TIPS and precise stent deployment.

P-328

A pictorial and technical comparison of CTV, MRV, ultrasound and IVUS in quantifying thrombus burden in acute and chronic iliofemoral DVT

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Learning Objectives: The main goal is to provide a pictorial representation of the main modalities used to diagnose and treat acute central DVT as an important educational tool.

Important factors include vessel diameter, extent of thrombus (i.e propagation into distal vessels, contralateral DVT etc.) and accurate interventional planning.

Imaging provides the key to appropriate management of acute and chronic central DVT.

Background: Biologically it has been described that iliofemoral DVT is a distinct phenotypic entity compared to distal leg thrombus.

Hence imaging should be tailored to the site of DVT, the acuity and if there is a requirement for intervention.

We compare images from a range of patients who underwent each modality to give a pictorial comparison of quantifiable thrombus burden.

Clinical Findings/Procedure Details: A cohort of patients with a range of imaging modalities performed for workup of either an acute or chronic presentation of DVT were chosen from the University Hospital Galway IR venous database of patients 2017-2021.

Each scan was reviewed by a senior consultant, fellow and post fellowship resident.

Parameters documented included vessel diameter, thrombus extent, interventional plan based on modality.

Review was performed independently and pictorial representation of findings was subsequently established collaboratively.

Conclusion: IVUS is superior to CTV and ultrasound in assessment of vessel diameter and predicting extent of luminal stenosis as demonstrated (pictures provided).

This is helpful for informing treatment options and demonstrating post treatment recanalization.

CTV and Ultrasound are open to subjectivity, interuser variability and are less reliable techniques for planning intervention.

MRV is an excellent emerging modality however availability remains a major issue.

P-329

Management of a patient suffering from a popliteal artery entrapment syndrome (PAES)

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Clinical History/Pre-treatment Imaging: 45yo man with no comorbidity and 100 mts left calf claudication, left foot nocturnal paresthesias and a small lesion at the apex of the 1st left toe.

USDoppler: left popliteal artery occlusion.

DSA: Hunter's canal occlusion of SFA, P3 rehabilitation of PA, PTA and peroneal artery patency.

Treatment Options/Results: Femoro-popliteal junction angioplasty and stenting (6x40 mm).

DSA in foot hyperextension: popliteal artery P2 occlusion and flow recovery upon return to rest position.

angio-MRI in hyperextension: dislocation of the proximal tract of the left lateral gastrocnemius head and luminal left popliteal artery reduction compared to the right one.

Vascular Surgery: subarticular popliteal artery compressed by the lateral gastrocnemius head which was sectioned to allow periarterial tissues debulking. USD: no popliteal artery flow changes during left foot flexion-hyperextension.

Discussion: Popliteal artery entrapment syndrome (PAES) is a rare vascular disease, common in young males, without any comorbidities, caused by an abnormal calf muscle compression, usually the gastrocnemius muscle. USD, MRI and possibly DSA are useful for the diagnosis.

Long-term pressure on the popliteal artery can cause narrowing, chronic insult and inflammation resulting in stenosis and/or occlusion; symptoms are pain and cramping worsening with physical activity.

In such cases the stenosis must be corrected with either endovascular or surgical procedure.

Take-home Points: It is critical to think about rarities down on the differential list whenever you come across a patient.

Young males with calf claudication, without real risk factors, must be investigated for a popliteal artery entrapment syndrome.

P-330

Embolisation of bleeding pulmonary artery pseudoaneurysms (PAP) within a leiomyosarcoma pulmonary metastasis

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Clinical History/Pre-treatment Imaging: A 46-year-old female presented with shortness of breath, fever and pleuritic chest pain without any haemoptysis. Her previous history included high grade uterine

leiomyosarcoma, total abdominal hysterectomy and abdominal metastases resections. Recent staging CTs showed stable pulmonary nodules. She had a recent pulmonary embolism (PE) and was on anticoagulation. She was dyspnoeic and tachycardia at 110 bpm. Bloods were normal. A CTPA was performed to review for acute PE.

Treatment Options/Results: CTPA demonstrated;

Right middle lobe pulmonary artery pseudoaneurysm (PAP) surrounded haematoma and pulmonary haemorrhage and a small volume right haemothorax

Second unchanged right middle lobe PAP

No PE

New pulmonary nodules in keeping with disease progression.

Multidisciplinary discussion with oncology, respiratory, cardiology and cardiothoracics deemed right middle lobectomy high risk and IR embolisation decided to be the safest option.

She was brought for the department for emergency embolisation. Right CFV access with sheath placed in the main pulmonary artery via right atrium and right ventricle. Angiograms demonstrated two PAPs as per CT with no active bleeding. Both PAPs were embolised with 8 mm Amplatzer plug IV. Good embolic result.

Discussion: Causes of PAPs include;

Trauma

Infection including TB

Vasculitis including Bechet's disease

Neoplasms

Causes of left to right shunting

Take-home Points: This case demonstrates a rare cause of pulmonary haemorrhage from a PAP within a leiomyosarcoma metastasis and how IR can provide a safe alternative to right middle lobectomy with lower risk of morbidity and mortality.

Post embolisation the patient's symptoms improved rapidly and she was discharged the next day.

P-331

Porto-pulmonary shunt in a cirrhotic patient

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Clinical History/Pre-treatment Imaging: A 75-years-old male patient with alcohol-related cirrhosis came to our attention for the execution of a hepatic chemoembolization of a multifocal hepatocarcinoma of the right hepatic lobe.

The evaluation of the CT images highlighted the unusual finding of a vascular anomaly with the formation of a shunt between the portal vein and the left pulmonary vein.

Treatment Options/Results: The chemoembolization procedure occurred without complications. A splenoportography was performed and was confirmed the presence of the shunt between the portal vein and the branch of the left pulmonary vein.

Following this finding, neurological and cardiological examinations were performed. In particular, there were no signs of encephalopathy and no changes in the right heart chambers. Therefore it was decided to keep the patient in clinical and radiological follow-up.

Discussion: Portal hypertension is caused by an increase in resistance to portal outflow and by a growth in splanchnic blood flow. Patients with liver cirrhosis frequently develop a wide variety of spontaneous portal-systemic shunts (SPSS) as a complication of long-standing portal hypertension.

Although the development of SPSS is common in cirrhotic patients, the finding of a porto-pulmonary shunt is very rare as not described in the literature.

Take-home Points: Portal-systemic shunt is a common finding in Patients with hepatic cirrhosis. Instead other type of shunt, like in this case with

a pulmonary vein, is very uncommon. Furthermore always remember that this particular type of shunt can be caused on overload of the right heart whereby the patient needs clinical monitoring during time and cardiological follow-up.

P-332

A rare case of intracranial aneurysm in paediatric population with pseudocoarctation of aorta and multiple thoracic vascular anomalies

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Clinical History/Pre-treatment Imaging: Intracranial aneurysms (IA) in children are rare. However, high index of suspicion of underlying vascular conditions which predispose the aneurysm occurrence is important. The underlying vascular anomalies, such as pseudocoarctation, often presented with haemodynamics alteration leading to hypertension and other sequelae such as aneurysms, dissections or rupture. We described a case of 16-year old girl presented with spontaneous subarachnoid haemorrhage (SAH) secondary to ruptured anterior cerebral artery saccular aneurysm demonstrated on admission plain Computed Tomography (CT) brain and CT Angiography (CTA). Subsequent cerebral angiogram showed a right-sided aortic arch (RAA) with a large aneurysmal dilatation of the right subclavian artery (RSA) with associated pseudocoarctation of aorta proximal to the RSA ostium. A cross-sectional CTA of the neck and upper thorax confirmed these findings and revealed common origin for both common carotid arteries (CCA) and also an aberrant left subclavian artery (ALSA) which is normal in calibre. On further evaluation, we noticed she has a short stature with small fingers and toes, short neck and micrognathia raising the clinical suspicion of Turner's syndrome.

Treatment Options/Results: Patient underwent craniotomy for aneurysm clipping.

Discussion: Intracranial aneurysms (IA) in children are uncommon. Two main hypotheses of the pathogenesis of paediatric IA is due to luminal or haemodynamic factors such as high blood flow, shear stress and turbulent flow or due to abluminal factors, such as morphological abnormality of the vessel wall, defective vessel wall responses, exogenous risk factors, or systemic disease.

Take-home Points: Surveillance of the underlying vascular anomalies in paediatric with intracranial aneurysm is important to prevent associated complications.

P-333

Central venous access in conjoined twins

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Clinical History/Pre-treatment Imaging: 12 day old omphalopagus conjoined twins with shared liver/bowel and complex vascular anatomy identified on third trimester fetal MRI. Twin B's functioning heart supplied Twin A's vascular bed. Secondary to poor peripheral IV access and complex vascular anatomy, pediatric IR was consulted for venogram and image guided tunneled central line placement.

Treatment Options/Results: Treatment alternatives included re-attempting peripheral IV access or surgical placement of central venous line, which was deemed to be high risk given uncertain venous anatomy and tenuous status of the twins. Under general anesthesia, and with the assistance of sonographic and fluoroscopic guidance, central venous access was successfully obtained in the twins with both central lines terminating in each twin's right heart allowing for reliable and effective delivery of

medications and fluids. Additionally, several venograms allowed further insight into their complex shared venous anatomy.

Discussion: Given the rare incidence of conjoined twins and the even more rare occurrence of them surviving long after birth, there is a general paucity of experience of central venous access in these unique situations. Additionally, given their often complex vascular anatomy and tenuous access, Interventional Radiology can often have both a profound therapeutic and diagnostic value to these patients.

Take-home Points:

-Prenatal and early life imaging are critical in establishing a safe and effective approach on establishing venous access in conjoined twins with complex shared anatomy.

-Sonographic and fluoroscopic will often delineate anatomy while confirming central line placement.

Neuro and carotid intervention

P-334

Flow diversion for reconstruction of intradural vertebral artery dissecting aneurysms causing subarachnoid hemorrhage – a retrospective study from four neurovascular centers

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Purpose: Dissecting aneurysms (DA) of the posterior intracranial circulation manifesting with subarachnoid hemorrhage (SAH) are associated with significant morbimortality, especially in case of rehemorrhage. Timely and sufficient reconstruction of the affected vessel is paramount, in particular if a hemodynamically dominant vertebral artery is impacted or the DA exhibits a significant size and high-risk morphology. Reconstructive options for the most part include stent-assisted coiling and flow diversion (FD). The latter is technically less challenging and does not require catheterization of the highly fragile aneurysm. Our study aims to report a multicentric experience with flow diversion for reconstruction of DA in the setting of acute SAH.

Materials and Methods: Our retrospective study investigated 31 patients (mean 48 years) from four neurovascular centers (Leipzig, Stuttgart, Halle/Saale, Zwickau), who suffered from subarachnoid hemorrhage from rupture of a dissecting aneurysm of the posterior intracranial circulation.

Results: The following flow diverting stents (FDS) were implanted: p64, p64MW_HPC, PED, p48MW(HPC), SVB, Silk+. Out of 31 patients, 25 were treated with FDS only, in six further patients additional devices (coils, bare metal stent, liquid embolization material) were required for sufficient reconstruction of the vessel. 22 patients showed moderate or complete recovery (GOS4-5), three kept severe disability (GOS2-3). Six patients died related to the severity of the initial SAH.

Conclusion: Reconstruction of posterior circulation DA in acute SAH with FDS is a promising and feasible approach, however, the severity of the condition is reflected by high rates of overall morbimortality, even despite technically successful endovascular treatment.

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Early multicentre experience with the novel LVIS EVO stent for treatment of intracranial aneurysms

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Purpose: This study aims to evaluate the feasibility and safety of the novel LVIS EVO stent when used for stent-assisted coiling or flow-diversion treatment of intracranial aneurysms.

Materials and Methods: A retrospective, multicentre study was conducted including patients who had intracranial aneurysms treated with the LVIS EVO stent across three Australian neurovascular centres between February 2020 and September 2020. Short-term technical and clinical outcomes were evaluated.

Results: 22 LVIS EVO stents were successfully implanted to treat 15 aneurysms in 15 patients; 11 by stent-assisted coiling, four by flow-diversion. The population included ruptured aneurysms (20%), giant aneurysms (up to 35mm dome height), and aneurysms of multilobed and blisterlike morphology. There were no failed deployments and no device-related peri-procedural complications. There were two cases of peri-procedural symptomatic thromboembolic complications but no mortality. At early radiological follow up, ten patients had complete occlusion, four patients had small neck remnants, and one patient who was managed with flow diversion had residual aneurysm.

Conclusion: Early experience with the LVIS EVO stent in this complex, heterogeneous cohort demonstrated good safety and feasibility for stent-assisted coiling as well as flow-diversion of intracranial aneurysms.

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Prognostic value of brain atrophy in patients with essential tremor treated with MRgFUS thalamotomy: a VBM study

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Purpose: The purpose of our study was to analyse data from our experience to evaluate the correlation between periprocedural technical findings, instrumental MRI findings, clinical outcome scores (Accumulated Thermal Dose and Area), Supratentorial Grey Matter (ST – GM), White Matter (ST – WM), Cerebral Spinal Fluid (ST – CSF) and their possible predictive value in the MRgFUS Thalamotomy.

Materials and Methods: Thirty patients were addressed to the MRgFUS Thalamotomy. Pre-treatment T1-Weighted Sequences BRAVO were manually oriented and automatically segmented in WM, GM and Cerebral Spinal Fluid (CSF) using the Statistical Parametric Mapping software (SPM 12). For each subject, ST-Total Grey Matter (GM), White Matter (WM), Cerebral Spinal Fluid (CSF) and Total Intracranial Volume ((ICV) were computed.

Results: In the pre-treatment and procedural settings, ST-GM was significantly positively correlated with the Accumulated Thermal Dose ($p < 0.001$, $r^2 = 0.630$) whereas the ATD temperature negatively correlated with ST-CSF and ST-TIV ($p < 0.001$, $r^2 = -0.553$ and $r^2 = -0.571$ respectively). Interestingly, Accumulated Thermal dose Area negatively correlated with ST-WM and ST-TIV ($p < 0.001$, $r^2 = -0.983$ and $r^2 = -0.969$).

Conclusion: The role of supratentorial brain atrophy has never been explored and the contribution of this anatomical part to the propagation of the ultrasound could be relevant for the outcome of the MRgFUS Vim thalamotomy. WM has an attenuation rate of 1.5 higher than the GM. The

difference in the Accumulated Thermal Dose may therefore be explained by the different acoustic properties of normal brain tissues interposed between the transducers and the target.

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Endovascular treatment of intracranial aneurysms in small peripheral vessel segments – efficacy and intermediate follow-up results of flow diversion with the Silk Vista Baby low-profile flow diverter

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Purpose: Background and Purpose: Low-profile flow diverter stents (FDS) quite recently amended peripheral segments as targets for hemodynamic aneurysm treatment, however, reports on outcomes, especially later than 3 months, are scarce. This study therefore reports our experience with the novel silk vista baby (SVB) FDS and respective outcomes after eight and eleven months with special respect to specific adverse events. **Materials and Methods:** 44 patients (mean age 53 years) harbouring 47 aneurysms treated with the SVB between 06/2018 and 12/2019 were included in our study. Clinical, procedural and angiographic data were collected. Follow-ups were performed on average after three, eight and eleven months, respectively. Treatment effect was assessed using the O'Kelly Marotta (OKM) grading system.

Results: Overall, angiographic follow-ups were available for 41 patients / 45 aneurysms. Occlusion or significant reduction in aneurysmal perfusion (OKM: D1, B1-B3 and A2-3) was observed in 98% of all aneurysms after eight months. Only 2% of the treated aneurysms remained morphologically unaltered and without an apparent change in perfusion (OKM A1). Adverse events in the early post-interventional course occurred in seven patients, out of them mRS-relevant morbidity at 90 days related to FDS treatment was observable in two patients. One death occurred in context of severe SAH related to an acutely ruptured dissecting aneurysm of the vertebral artery.

Conclusion: The SVB achieves sufficient occlusion rates of intracranial aneurysms originating from peripheral segments, which are comparable to prior established conventional FDS with acceptably low complication rates. However, alteration of a hemodynamic equilibrium in distal localizations requires special attention to prevent ischemic events.

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An intra-patient comparison of the long-term patency regarding carotid endarterectomy vs carotid artery stenting

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Purpose: We aimed to evaluate the long-term outcome of carotid endarterectomy (CEA) and carotid artery stenting (CAS) in patients who underwent both procedures on different sides.

Materials and Methods: In this single-center retrospective study, 117 patients (men, N=78; median age at CEA, 64.4 [IQR, 57.7–72.2] years; median age at CAS, 68.8 [IQR, 61–76] years) with significant ($\geq 50\%$) internal carotid artery stenosis who had CEA on one side and CAS on the other side (2001–2019) were included.

Results: Except for age ≥ 80 years ($P=0.033$), there was no significant difference in the presence of atherosclerotic risk factors at the time of CEA and CAS. While the prevalence of heavily calcified stenoses on the operated side, predominantly echogenic/echogenic plaques and suprabulbar lesions on the stented side were significantly higher ($P<0.001$, $P=0.011$, and $P<0.001$, respectively). Restenosis rates were 10.4% at 1 year, 16.6%

at 2 years, 22.3% at 5 years, and 33.7% at the end of the follow-up (at 11 years) for CEA, while these were 11.4%, 11.4%, 14.7%, and 17.2%, respectively, for CAS. Cox regression analysis revealed a significantly higher risk of restenosis (HR, 1.80; 95% CI, 1.05–3.10; $P=0.03$) for CEA compared to that for CAS. After adjusting for relevant confounding factors (diabetes mellitus, calcification, plaque echogenicity, and lesion location), the estimated effect size materially did not change, although it did not remain statistically significant (HR, 1.86; 95% CI, 0.95–3.65; $P=0.07$).

Conclusion: Intra-patient comparison of CEA and CAS in terms of restenosis tilts the balance toward CAS.

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Symptomatic and asymptomatic carotid artery carotid artery stenting: a single center experience

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Purpose: The purpose of this study is to evaluate the efficacy and safety of carotid artery stenting for treatment of carotid stenosis and explore possible causes for complications.

Materials and Methods: Retrospective study was conducted on carotid artery stenting procedures performed in Vilnius University hospital Santaros Clinics between January 15, 2015 and February 17, 2021. We looked into patient demographics, laboratory tests, radiological examinations and the parameters of the stenting procedure. The outcomes analyzed were periprocedural complications, mortality and restenosis rates. Significance was set at $p<0.05$.

Results: A total of 191 stenting procedures were performed. 21 (11%) patients had complications after the procedure - 4 (2.1%) patients developed neurological complications, including 2 (1%) strokes, and 10 (5.2%) patients had local complications. One patient (0.5%) died during periprocedural period. Patients who developed neurological complications were older (70.8 ± 9.4 vs 77.8 ± 4.9 years, $p<0.03$) and had more concomitant diseases (Chi squared $p<0.05$). Recent usage of new generation double mesh stents ($n=38$) had the tendency to reduce complication rate - no neurological complications, lower local complication rate, no restenosis after 6 months follow up, however these findings, except lower procedure time, were not statistically significant at this point.

Conclusion: Carotid stenting has low complication rate and mortality. Older age and comorbidity may be associated with higher risk of complications. Further research is required to assess the impact of new generation double mesh stents on the neurological complication rate and restenosis rate following carotid artery stenting.

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Two years of experience with two unequal workhorses - the Silk Vista Baby and the p48MW(HPC) - low profile flow diverters for treatment of cerebral aneurysms arising from small peripheral segments and bifurcations: a comparison

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Purpose: The establishment of low-profile flow diverting stents (FDS), notably the Silk Vista Baby (SVB) and the p48MW(HPC), enhanced endovascular treatment of peripheral cerebral aneurysms significantly. Related to the novelty of both FDS, a specific comparison of the devices' features and an empirically driven guideline are lacking. This study aims to compare the performance and outcomes of the SVB with the p48MW(HPC).

Materials and Methods: The study cohort comprises 108 patients (average age of 56 years), who were either treated with the SVB or the p48MW(HPC) between June 2018 and March 2021.

Results: Sixty patients received the SVB and 48 the p48MW(HPC). Aneurysms treated with the SVB mostly arose from the anterior cerebral artery (ACA:56.9%), aneurysms treated with the p48MW(HPC), mostly arose from the middle cerebral artery (MCA:55.1%). At second follow-up (8.8months vs. 10.9months), complete aneurysm occlusion was observed in 64.4% after SVB implantation vs. 27.3% post p48MW(HPC)-treatment. Only 1.7% vs. 6.8% of the aneurysms remained morphologically unaltered. Adverse events with persisting neurologic sequelae at last follow-up were comparable (5.0% vs. 4.2%).

Conclusion: Both devices are safe and feasible in the treatment of distal cerebral aneurysms. The SVB achieves earlier complete occlusions and allows treatment of the oftentimes particularly demanding anatomy of the ACA-AcomA-complex. The hemodynamic changes caused by p48MW(HPC) are less sudden and manifest over a longer period, benefiting the treatment of MCA-bifurcation aneurysms by avoiding thromboembolic complications of side branches and small perforators. The hydrophilic coating of the p48MW allows early reduction of the dual antiplatelet medication if necessary.

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Long-term clinical and ultrasound follow-up results of the dual-layer stent in carotid artery disease: results from the V-Road study

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Purpose: To evaluate technical aspects and clinical results of a large real-world population of patients treated with dual-layer Roadsaver (Terumo Corp, Tokyo) carotid artery stent (CAS) from a single center.

Materials and Methods: From January 2018 to January 2021, we enrolled both symptomatic and asymptomatic patients. Carotid stenosis was revealed by Doppler ultrasound and multidetector CT. Distal embolic protection device (Epifilter, Boston; Spider FX, Medtronic) and proximal embolic protection device (Flowgate, Striker) were chosen case by case. All stent were released with a push and pull technique in order to maximize radial force and reducing stent misposition to carotid wall. Intraprocedural IVUS evaluation was performed in selected patients. All patients underwent duplex ultrasound and neurological evaluation at 24 hours and at 30 days

Results: 152 patients underwent CAS receiving a Roadsaver stent. Forty six patients underwent emergency carotid artery stenting with or without initial additional intracranial thrombectomy while 106 patients were asymptomatic.

Technical success was achieved in all cases. In 21 patients a non-significant residual stenosis < 30% has been reported. No major complications during or after the procedure occurred. Intraprocedural IVUS evaluation revealed an optimal rate of good stent apposition without signs of plaque prolapse. All the neurological examinations performed 24 h and 30 days after the procedure in asymptomatic patients were negative. Duplex ultrasound showed stent and external carotid artery patency in all cases both before discharge and at 30-day follow-up. Only one case of in-stent restenosis was observed.

Conclusion: Roadsaver stent seems to be durable. Further studies with longer-term outcome are necessary to confirm our results.

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Comparison of tractography-based direct and atlas-based indirect targeting of the ventral intermediate (vim) nucleus in MRgFUS thalamotomy

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Purpose: To comparatively evaluate direct and indirect targeting of the Vim in MRgFUS thalamotomy.

Materials and Methods: Patients requiring targeting repositioning during unilateral MRgFUS ablation were retrospectively evaluated. For each patient i) indirect coordinates; ii) the coordinates related to a clinical response in terms of a tremor reduction; iii) direct coordinates, identified on the dentatorubrothalamic tract (DRTT) at the postprocessing of DTI data, were calculated. The agreement between direct and indirect coordinates compared to clinically effective coordinates was assessed using the Bland-Altman test and intraclass correlation coefficient (ICC).

Results: 21 patients were included in this study. In comparison to indirect targeting, direct targeting showed inferior error values on the RL and AP coordinates (0.019 vs. 0.079 and 0.207 vs. 0.221, respectively) and higher error values on the SI coordinates (0.263 vs. 0.021). The agreement between measurements was higher for tractography along the AP and SI planes and lower along the RL planes.

Conclusion: Indirect atlas-based targeting represents a valid approach for MRgFUS thalamotomy. The direct tractography approach is a valuable aid in assessing the possible deviation of the error in cases where no immediate clinical response is achieved.

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MRgFUS thalamotomy for the treatment of essential tremor (ET) and Parkinson's disease (PD) tremor: long term follow-up at a 2 years

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Purpose: To report our experience in the treatment of ET and PD tremor using MRgFUS thalamotomy.

Materials and Methods: Between February 2018 - December 2020, we treated 103 patients (79 males, 24 females, mean age 67.7 years with disabling and refractory tremor (45 ET, 58 PD tremor, mean duration of symptomatology 13.4 years). by unilateral Vim ablation using MRgFUS. Clinical evaluation was performed using the Fahn-Tolosa-Marin scale (FTM) for tremor and the QUEST score for quality of life, assessed before treatment, immediately after treatment and with follow-up at 6 months, 1 year and 2 years. Instrumental MRI evaluation was performed with the same follow-up interval.

Results: Treatment was effective in 100 out of 103 patients (97.08%). FTM scores decreased from mean values of 31.2 to 10.7 immediately after treatment. In patients followed-up at six months (47 patients), we found a minimal increase in mean FTM values due to the reappearance of tremor in 6% (6) patients (mean FTM 15.7 vs. 13.8, p<0.005). At 1 year (62 patients) and 2 years (35 patients), clinical evaluation showed a substantial stability of treatment effects. QoL evaluation showed substantial improvement (76.4%, 79.6% and 83.1% reduction of the QUEST score at 6, 12 and 24 months respectively). Mild side effects and complications,

resolving within 6 months occurred in 8% (8) patients. Severe, long-standing complications (hemiplegia) occurred in 1% (1) patients.

Conclusion: MRgFUS thalamotomy is a safe and effective treatment option for tremor in patients with ET and PD.

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Meta-analysis of early outcome of carotid revascularization in retrospective case series

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Purpose: Most data in carotid stenosis treatment arise from randomized control trials (RCTs) and cohort studies. The aim of this meta-analysis was to compare 30-day outcomes in realworld practice from centers providing both modalities.

Materials and Methods: A data search of the English literature was conducted, using PubMed, EMBASE and CENTRAL databases, until December 2019, using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis statement (PRISMA) guidelines. Only studies reporting on 30-day outcomes from centers, where both techniques were performed, were eligible for this analysis.

Results: In total, 15 articles were included (16,043 patients). Of the patients, 68.1% were asymptomatic. Carotid artery stenting (CAS) did not differ from carotid endarterectomy (CEA) in terms of stroke (odds ratio (OR) 0.98; 0.77–1.25; I2 = 0%), myocardial ischemic events (OR 1.03; 0.72–1.48; I2 = 0%) and all events (OR 1.0; 0.82–1.21; I2 = 0%). Pooled stroke incidence in asymptomatic patients was 1% (95% CI: 0–2%) for CEA and 1% for CAS (95% CI: 0–2%). Pooled stroke rate in symptomatic patients was 3% (95% CI: 1–4%) for CEA and 3% (95% CI: 1–4%) for CAS. The two techniques did not differ in either outcome both in asymptomatic and symptomatic patients.

Conclusion: Carotid revascularization, performed in centers providing both CAS and CEA, is safe and effective. Both techniques did not differ in terms of post-procedural neurological and cardiac events, both in asymptomatic and symptomatic patients. These findings reiterate the importance of a tailored therapeutic strategy and that “real-world” outcomes may only be valid from centers providing both treatments.

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Heparin administered via flush fluids during endovascular thrombectomy for acute ischemic stroke

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Purpose: Heparin may have a significant effect on outcome of endovascular treatment (EVT) for acute ischemic stroke. However, amounts of heparin administered via flush fluids is largely unknown. We aim to reveal some important (and unknown) variables around the use of heparinized flush during EVT in the Netherlands.

Materials and Methods: We have set out an online survey in all 17 comprehensive Dutch stroke centers with relevant questions regarding heparinized flush during EVT: concentration, number of infusion bags, dripping rate, etc. Twenty-nine interventionists completed the survey.

Results: Most of the interventionists (n = 18) estimated their dripping rate at 1 drip (approximately 0.05 ml) / second, followed by 1 drip per 2 seconds (n = 10), 2 drips per second (n = 2) and 1 drip per 5 seconds (n = 2). Sixteen interventionists (62 %) use 3 infusion bags during the procedure, 9 (31 %) use only 2 infusion bags and 8 (28 %) use 1 bag. Heparin concentration ranged from 0 IU/L (n = 7) to 25.000 IU/L (n = 2). Maximum amount of heparin administered by flush fluids was more than 20.000 IU/hr.

Conclusion: In long lasting EVT procedures, the amount of heparin administered by flush fluids can be significant with potential effect on outcome.

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Endovascular management of craniofacial arteriovenous malformations

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Learning Objectives: To classify craniofacial arteriovenous malformations and discuss the indications, techniques and agents used for its embolization.

To discuss procedure related complications and their management.

Background: Arteriovenous malformations (AVMs) are uncommon, locally aggressive, high flow malformations caused by errors in the endothelial development. About 50% of them are located in the craniofacial region. Clinical presentation of AVMs depends upon the anatomic location, size and age of the patient with symptoms ranging from asymptomatic to swelling, disfigurement, pain, hemorrhage, or rarely functional impairment and congestive heart failure.

Treatment of AVMs is challenging. Surgical resection was the mainstay of treatment earlier. However, due to torrential intraoperative hemorrhage and frequent recurrences, endovascular management has now gained importance.

Clinical Findings/Procedure Details: In this essay, we will describe the clinical and angiographic system of classification of AVMs and discuss the indication for their endovascular management.

Principles and techniques of embolization (transarterial, direct puncture or combination) of AVMs of cheek, lip, pinna, scalp, etc. will be discussed in a case base manner.

Review on the use and choice of embolic agents such as glue, onyx, PHIL, coils, particles, sclerosants etc. will be provided.

Intra-operative and post-operative complications, their prevention and treatment will be discussed.

Lastly, role of multidisciplinary approach in management of complex AVMs will be highlighted.

Conclusion: Endovascular management is an integral component in the management armamentarium for craniofacial AVMs.

Understanding of the embolization techniques and embolic agents is necessary for safe and effective embolization.

Multidisciplinary approach consisting of preoperative embolisation with surgical excision should be adopted to achieve best treatment outcome.

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Traumatic extracranial carotid artery injuries: imaging and endovascular management

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Learning Objectives: To illustrate the imaging features of traumatic injuries of the extracranial carotid artery.

To discuss the role of endovascular therapy in management of these injuries.

Background: Traumatic extracranial carotid artery injuries (TCAI) are rare and constitute about 22% of all cervical vascular injuries. They result from

blunt, penetrating or iatrogenic trauma and are associated with high morbidity and mortality.

They may present as dissection/intramural hematoma (60% cases), pseudoaneurysm (25% cases), carotico-jugular fistula (4%- 7% cases), or active bleeding (4% cases).

Management of these lesions varies from medical therapy to endovascular or open surgical repair, depending on the severity of the lesion.

Traditionally, surgical ligation or grafting was preferred, however owing to its high rates of mortality (20-40%) and morbidity, endovascular procedures have now gained more acceptance as a less invasive alternative.

Clinical Findings/Procedure Details: In this essay, we will discuss the imaging spectrum and endovascular management of TCAI.

Duplex ultrasound, computed tomography angiography and digital subtraction angiography findings of TCAI are discussed along with grading of these carotid injuries.

Indication, principle, techniques for endovascular management of these lesions is then discussed in a case based manner with emphasis on grade III - grade V lesions (pseudoaneurysms and carotico-jugular fistulas). Stent graft placement is the commonly performed endovascular procedure with coiling reserved for selected cases.

Lastly, procedure related complications and post procedure medical management consisting of anti-platelet and anti-coagulation therapy is reviewed.

Conclusion: Endovascular management of TCAI is a safe, effective and minimally invasive treatment method which significantly reduces the risk of neurologic and life-threatening complications.

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The role of transarterial embolisation in the treatment of epistaxis

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Learning Objectives:

-To understand the vascular anatomy of the internal and external carotid arteries and the role of transarterial embolisation in treating posterior epistaxis.

-To pictorially review generic protocols including necessary selective angiograms, identification of important collateral pathways and arterial variants, and technical and equipment considerations with attention to utilised embolisation agents.

Background: Spontaneous epistaxis is often idiopathic, but the aetiology can be broadly divided into local and systemic causes. The vessels commonly involved in posterior epistaxis are branches of the external carotid artery predominantly the internal maxillary artery (IMA), and also the facial artery.

Embolisation has excellent success rates in treatment of epistaxis refractory to non-endovascular therapies and surgery. Advantages of embolisation are it can be done under local anaesthesia, pre-treatment diagnostic angiography, achieving more distal embolisation and shorter hospitalisation times. Numerous retrospective studies have shown better primary success rates of endovascular embolisation to surgical techniques such as IMA ligation.

Clinical Findings/Procedure Details: Conventional pre-treatment angiograms of the carotid arteries will be presented through our local experience. Important collaterals and anastomoses, arterial variants, as well as specific angiographic signs will be highlighted. Other procedural considerations including equipment choice, the selection of appropriate microcatheters and embolic agents will be discussed. We will showcase our local experience through a variety of cases as well as highlight potential complications related to embolisation.

Conclusion:

-Transarterial embolisation has a major role in the treatment of refractory posterior epistaxis not suitable for surgical management.

-A thorough understanding of craniofacial vascular anatomy and embolisation technique is essential to plan and deliver safe treatment.

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Stellate ganglion cryoneurolysis for treatment of refractory ventricular tachycardia? Review of two patients

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Learning Objectives: To demonstrate the safety and efficacy of stellate ganglion cryoneurolysis in the treatment of patients with refractory ventricular tachycardia.

Background: Ventricular tachyarrhythmias are associated with increased risk of sudden cardiac death. The sympathetic nervous system plays a critical role in the maintenance of cardiac rhythms, especially ventricular tachycardia (VT) and represents a target for intervention. The stellate ganglion (SG) is composed of sympathetic nerve fiber fusion at the level of the inferior cervical and first thoracic ganglia. Percutaneous SG blockade has demonstrated efficacy in treating medically refractory VT in >50% of patients. However, its benefit is limited by short duration of effect. Cryoneurolysis of the nervous system has gained momentum in pain management. SG cryoneurolysis represents a promising permanent treatment option in patients with refractory VT.

Clinical Findings/Procedure Details: Our first patient was a 64 year old male with cardiomyopathy and prior VT, who presented with cardiac arrest. He subsequently developed medically refractory VT, and IR performed SG blockade followed by SG cryoneurolysis 24 hours later. There were significantly decreased VT episodes and no complications.

Our second patient was a 58 year old male with cardiomyopathy, congestive heart failure, prior LVAD, AICD, and refractory VT resulting in cardiac arrest. He underwent initial SG blockade and subsequent CT-guided SG cryoneurolysis 48 hours later. No complications from ablation. Significantly decreased VT episodes were noted.

Conclusion: Although a paucity of literature exists and further sample sizes are required, our limited case series highlights proof of concept and safety profile for SG cryoneurolysis for patients with refractory VT.

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Validity of various methods of evaluating balloon occlusion test of internal carotid artery

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Learning Objectives: To describe various methods in evaluating the efficacy of balloon occlusion test of internal carotid artery hence identifying the patients at risk of major neurological complications following parent artery occlusion

Background: Balloon occlusion test is very important before parent artery occlusion of the internal carotid artery in management of various pathologies like giant aneurysms, head and neck tumors and carotico-cavernous fistulae. This is a literature review discussing various adjunct techniques in evaluating the efficacy of balloon occlusion test and increasing its sensitivity.

Clinical Findings/Procedure Details: Balloon occlusion test is performed on the same day or few days before parent artery occlusion under mild sedation. Complaint endovascular balloons are placed proximal to the predetermined site of parent artery occlusion. Balloons are inflated temporarily for about 20 minutes to occlude the lumen. Clinical examination is performed every 5 minutes to access the neurological status of the patient. Other adjunct techniques like venous phase delay assessment and somatosensory evoked potential are also evaluated simultaneously. Hypotensive challenge can be used to identify patient at risk of complications. One should also be aware of other adjunct less commonly used techniques available in evaluating the efficacy of BOT like stump pressure measurements, transcranial Doppler, perfusion evaluation with SPECT, XRay angiographic perfusion analysis using complex softwares

and motor evoked potentials. If the patient is found to have passed the BOT, parent artery occlusion is performed

Conclusion: BOT results can be predicted by various adjunct techniques and it is important to formulate a protocol in increasing the sensitivity of BOT avoiding neurological complications

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Balloon occlusion test with near infrared spectroscopy (NIRS) device for pre-operative assessment at skull base carotid body tumor

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Clinical History/Pre-treatment Imaging: Patient with a lump of the left neck side was diagnosed as glomus tumor at computerized tomography images. Pre-operative DSA demonstrated that the tumor was fed by multiple arterioles arising from the internal carotid artery. Surgical team needed to learn the clamping time before surgical operation. Near infrared spectroscopy (NIRS) is a reliable and validated technique to monitor cerebral oxygenation and have been used safely at many surgical procedures. The typical range of rSO₂ is 55-80% and a 20 % drop from individual rSO₂ baseline are commonly refers to a problem.

Treatment Options/Results: Patient's cerebral oxygenation was monitored with a NIRS device after balloon occlusion of the left carotid artery. There was a 8% percent drop at rSO₂ after initial balloon occlusion which disappeared after a couple of minutes. Balloon kept inflated for 30 minutes and rSO₂ values of the patient were recorded. Patient's cognitive response was assessed during the procedure. Patient tolerated the procedure well and rSO₂ values were stable during balloon occlusion. Patient was well without any deficits after surgery.

Discussion: Feasibility of simultaneous NIRS and angiography has been demonstrated for intracranial circulation. This report demonstrates pre-operative neuroimaging with NIRS assistance which can provide additional prognostic information before glomus tumor surgery.

Take-home Points:

1. NIRS is a feasible and reliable non-invasive method to monitor cerebral oxygenation.
2. Innovation of different diagnostic tools to interventional procedures may enhance procedure reliability.
3. NIRS could be used during balloon occlusion as a reliable pre-operative neuroimaging device and could verify blood oxygenation in a mathematical model.

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Carotid web - an important cause of stroke in young people

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Clinical History/Pre-treatment Imaging: A 40-year-old female smoker presented with acute unilateral right sided headache and neck discomfort. Her regular medications included a selective serotonin reuptake inhibitor and propranolol. On examination she had facial asymmetry, left hemiparesis and sensory deficit with mild dysphasia and an NIHSS score of four. Computer tomography of the brain confirmed an evolving right middle cerebral artery territory infarct. Computer tomographic angiography (CTA) of the neck vessels revealed a "flap like projection into the lumen of the right internal carotid artery". Magnetic resonance angiography revealed "high signal at the posterior wall of the proximal right internal carotid artery". The patient was discharged and made an excellent functional recovery.

Treatment Options/Results: Re-imaging by CTA at 4 months showed persistence of the defect. These findings were highly suggestive of a right

proximal internal carotid artery web; rendering the patient at significant risk of recurrent stroke. She underwent a right carotid endarterectomy to remove the web with a patch closure. Stenting would not have been an appropriate treatment due to her young age, as it has inferior long-term outcomes. She made a full recovery.

Discussion: Carotid web is an increasingly recognised cause of ischaemic stroke in young patients, as it can cause significant stenosis. However it is difficult to confirm on imaging, particularly duplex ultrasound, hence the need for multiple modalities.

Take-home Points: Carotid web is hard to diagnose radiologically, particularly on duplex imaging. Awareness as a cause of stroke in young people is key. Patients remain at risk of recurrent stroke despite best medical therapy.

P-353

Pipeline Flex embolization device with shield technology for recurrent LVIS stented cerebral aneurysm: a case report

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Clinical History/Pre-treatment Imaging: A 68-year-old female was previously treated for an impending ruptured 16-mm right internal carotid-posterior communicating aneurysm with coiling. The aneurysm was retreated with stent-assisted coiling using a LVIS stent. Follow-up angiogram 4 months later showed regrowth and recurrence of aneurysm.

Treatment Options/Results: We decided to treat the recanalized aneurysm by flow diversion using Pipeline Flex Embolization Device with Shield Technology (PEDS). PEDS was introduced and positioned so that it overlapped the previous stent. Good wall apposition was confirmed by contrast enhanced Dyna CT, final angiography depicted the flow stagnation into aneurysm. The post-operative course was uneventful and she was discharged without neurological deficit 1 week later. Follow-up angiogram at 7 months showed total occlusion of the aneurysm. And the aneurysm remains complete occlusion on MRA at 12 months.

Discussion: The Pipeline Flex Embolization Device with Shield Technology (PEDS) is an updated version of the Pipeline Embolization Device (PED) which has been modified to include a surface phosphorylcholine biocompatible polymer. The PED for recurrent previously stented cerebral aneurysms with Enterprise or Neuroform stent was controversial, because several reports indicated the PED was not effective enough for previously stented cerebral aneurysms. On the other hand, there have been no reports of the use of the PEDS in the management of recurrent previously LVIS stented cerebral aneurysms. This is the first report of treatment with the PEDS for recurrent previously LVIS stented cerebral aneurysm.

Take-home Points: The PEDS may become treatment option for recurrent previously LVIS stented cerebral aneurysms.

P-354

Successful balloon angioplasty in symptomatic intracranial carotid artery stenosis refractory to conventional medical treatment

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Clinical History/Pre-treatment Imaging: We selected six patients with recurrent hemodynamic transient ischemic attacks due to an intracranial artery stenosis (ICAS) of the distal internal carotid artery (ICA), refractory to conventional therapy, for treatment with balloon angioplasty without stenting. Neuroimaging showed a combination of severe ICAS in the supraclinoid segment of the ICA, with poor antegrade blood flow of the

anterior circulation leading to hemodynamic hypoperfusion without compensation due to a lack of integrity of the circle of Willis.

Treatment Options/Results: Initially patients received conventional medical treatment. If attacks persisted and/or neurological condition deteriorated, treatment with balloon angioplasty was considered in a multidisciplinary panel. All patients were treated successfully, no acute neurological symptoms occurred in the follow-up period ranging from 3 weeks to 1 year. In one patient, treatment was complicated by the occurrence of a carotid-cavernous fistula which necessitated placement of a flow diverting stent.

Discussion: For patients suffering symptomatic intracranial artery stenosis refractory to conventional medical treatment, balloon angioplasty with stenting belongs to the possibilities. However, this treatment should be considered only in patients with severe symptoms, unresponsive to medical treatment, as trials of stent-angioplasty have shown a significantly higher risk for stroke or death in comparison with medical treatment.

Take-home Points:

- Balloon angioplasty can be a successful method for the treatment of patients with acute recurrent neurological deficits due to hemodynamic symptomatic ICAS of the distal ICA refractory to medication.
- Selected cases should be presented to a medical center with experience in balloon angioplasty for intracranial lesions.

P-355

Direct aspiration thrombectomy in the management of procedural thromboembolic complication related to brain aneurysm treatment

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Clinical History/Pre-treatment Imaging: A 54-year-old woman with a history of hypertension was admitted to our hospital for elective endovascular treatment of two intracranial left internal carotid artery (ICA) aneurysms. She was prepared for the intervention using the dual oral antiplatelet therapy since the placement of flow-diverting stent was planned.

Treatment Options/Results: During the intervention, thromboembolic occlusion of the left middle cerebral artery (MCA) was noticed. This complication was successfully managed using already placed distal access catheter in the left ICA, intended for the support of opening the flow-diverting stent. The distal access catheter was placed in the M1 segment of the left MCA, with the tip in contact with the clot. The thrombus was manually aspirated, and flow was completely restored. Then, the flow diverting stent was placed over the origins of two left ICA aneurysms and the flow-diversion effect was evident on the final angiograms. Control CT showed no signs of pathologic densities and the patient was discharged without any neurological symptoms.

Discussion: The experience and evidence of the direct thrombus aspiration using a distal access catheter as a type of mechanical thrombectomy technique for managing thromboembolic complications during endovascular aneurysm treatments is still limited and little literature is available regarding this topic.

Take-home Points: Direct thrombus aspiration using a distal access catheter as a type of mechanical thrombectomy technique is a safe and effective method for managing thromboembolic complications. This case should encourage the use of distal access catheter already positioned for aneurysm treatment to perform zero-delay direct thrombus aspiration in thromboembolic complications during endovascular aneurysm treatments.

P-356

Complex high-flow transverse sinus and trocula dural arteriovenous fistula presenting with parkinsonism and pulsatile tinnitus

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Clinical History/Pre-treatment Imaging: A 69-year-old male with a one-year history of intermittent headaches, pulsatile tinnitus, rapid cognitive decline, and quickly progressive parkinsonism treated with Carbidopa-Levodopa with little improvement. The patient experienced an abrupt worsening of symptoms, which led to a prompt MRI that showed subcortical and deep white matter right-hemispheric T2 FLAIR signal and increased diffusion-weighted signal consistent with ischemia.

Treatment Options/Results: Suspicious MRI changes suggestive of dAVF include:

- dilated vessels
- vascular enhancement
- flow void clusters

Digital-subtraction angiography – gold standard

Treatment options:

- endovascular embolization (transarterial, transvenous or direct puncture approach)
- microsurgery (beneficial in terms of fistula recurrence)
- stereotactic radiosurgery (1-3 year latency period)

Discussion: Dural arteriovenous fistulas (dAVF) are abnormal connections between branches of arteries and veins or venous sinuses in the dura mater.

This patients' response to transarterial embolization highlights how ischemic changes reverse upon treatment of the fistula. Pulsatile tinnitus is common in fistulas draining into the transverse or sigmoid sinus; headache and bruit are unrelated to the drainage pattern. The pathophysiology of dAVFs remains unclear.

Reversible parkinsonism and rapidly progressive dementia is a rare syndrome related to dAVFs, the majority of which include transverse-sigmoid sinus fistulas. Transarterial embolization treatment in this case addressed the hemodynamic effects caused by the dAVF correcting the arterial steal phenomenon resulting in the reversal of MRI and clinical findings of ischemia.

In conclusion, transarterial embolization is a minimally invasive therapeutic option for symptomatic dAVF.

Take-home Points: Quickly progressive parkinsonism should raise a suspicion of dAVF.

Return of fistula-associated tinnitus may suggest recurrence.

Oncologic intervention

P-357

Clinical efficacy of drug-eluting bead transcatheterarterial chemoembolization combined with sorafenib in the treatment of advanced hepatocellular carcinoma

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Purpose: To explore the therapeutic efficacy and clinical safety of drug-eluting bead transcatheter arterial chemoembolization (DEB-TACE) combined with Sorafenib in patients with advanced hepatocellular carcinoma (HCC).

Materials and Methods: 60 patients with advanced HCC admitted to our hospital from March 2017 to April 2019 were randomly assigned into group A (D-TACE) or B (D-TACE combined with Sorafenib). Therapeutic

efficacy and adverse events were recorded by follow-up data every three months after treatment. Disease control rate (DCR) and objective response rate (ORR) in both groups were calculated based on 16-month follow-up records.

Results: Six months after treatment, DCR and ORR in group A were 80.78% and 35.64%, respectively, and 96.09% and 59.7% in group B. The median PFS in group A and B was 7.05 and 9.5 months, respectively ($p < 0.05$). No significant differences in the adverse event incidence (fever, abdominal pain, nausea and vomiting) after embolization were found between the two groups ($p > 0.05$). The incidence of hypertension, hand-foot syndrome, and proteinuria in group B was significantly higher than those in group A ($p < 0.05$). Adverse events were all alleviated after symptomatic treatment.

Conclusion: The therapeutic efficacy of TACE combined with Sorafenib in HCC treatment is higher compared to TACE alone, which may be related to the inhibition of tumor angiogenesis. TACE combined with Sorafenib can improve the PFS of HCC patients.

P-358

Predictors and patterns of recurrence after radiofrequency ablation for treating hepatocellular carcinoma within up-to-seven criteria: a multicenter retrospective study

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Purpose: To determine the risk factors and patterns of recurrence after radiofrequency ablation (RFA) for hepatocellular carcinoma (HCC) meeting the up-to-seven criteria and to develop a nomogram to predict the recurrence free survival (RFS).

Materials and Methods: This retrospective study included 481 HCC patients meeting the up-to-seven criteria and who received RFA as the primary therapy at three Chinese hospitals from January 2013 to December 2016.

Results: The recurrence rate was 50.7% (244/481). Age > 60 years, male gender, and multiple tumors were independent risk factors of recurrence. The incidence of early and late recurrence was 68.03% ($n=166$) and 31.97% ($n=78$), respectively. Seven patterns of spatial recurrence were identified: local tumor progression (LTP) alone ($n=18$, 7.38%), intrahepatic distant recurrence (IDR) alone ($n=136$, 55.74%), extrahepatic recurrence (ER) alone ($n=21$, 8.61%), IDR+ER ($n=45$, 18.44%), LTP+IDR ($n=16$, 6.56%), LTP+ER ($n=4$, 1.64%) and LTP+IDR+ER ($n=4$, 1.64%). The 1-, 2-, 3- and 5-year RFS and overall survival (OS) rates were 79.63%, 65.23%, 51.03%, 38.74%, and 99.17%, 93.95%, 85.87%, 69.54%, respectively. A well-discriminated and calibrated nomogram was constructed to predict the probability of RFS.

Conclusion: The factors affecting recurrence after RFA were age, gender, and the number of tumors. IDR was the most common type of recurrence after complete ablation. An individualized surveillance and prevention strategy for HCC patients meeting the up-to-seven criteria after RFA should be developed based on the probability of RFS as predicted by the nomogram.

P-359

Using the aMAP risk score for predicting late recurrence of hepatocellular carcinoma after radiofrequency ablation: a multicenter retrospective study

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Purpose: To evaluate the potential association between age-male-ALBI-platelets (aMAP) score and late recurrence of hepatocellular carcinoma (HCC) after radiofrequency ablation (RFA) and develop a nomogram to predict the prognosis.

Materials and Methods: HCC patients who developed late recurrence after RFA at three Chinese hospitals from January 2011 to December 2016 were included as a training cohort, while patients treated at Affiliated Cancer Hospital of Zhengzhou University between January 2012 and December 2016 were included as an external validation cohort. The optimal cut-off value for aMAP score was determined by X-tile software to discriminate performance of recurrence-free survival (RFS). The multivariate Cox proportional hazards model based on significant prognostic factors of RFS was used to construct the nomogram.

Results: A total of 339 eligible patients were selected. Patients were divided into low-risk (aMAP score < 64.2), medium-risk (aMAP score = 64.3-68.6) and high-risk (aMAP score > 68.7) groups by X-tile plots. The prognostic factors affecting RFS were number of lesions and aMAP score. A well-discriminated nomogram was developed to predict the 3-, 4- and 5-year RFS with C-index of 0.793 (95% CI: 0.744-0.842). The t-AUCs of the nomograms for predicting 3-, 4- and 5-year RFS were 0.808, 0.820 and 0.764, respectively. The model was then tested with data from an external validation cohort. The calibration curve showed optimal agreement between the predicted and observed values.

Conclusion: aMAP score is an independent prognostic factor for late recurrence of HCC after RFA. Our nomogram based on aMAP score could predict RFS for patients with late recurrence of HCC who undergo RFA and be offered to interventional oncologist to improve their abilities to assess patient prognosis.

P-360

Repeat radiofrequency ablation in safe in recurrent de-novo renal cell carcinoma in VHL patients

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Purpose: Local ablation of sporadic T1a renal cell carcinoma (RCC) is an effective and well established, nephron sparing alternative to surgery. Multifocal, metachronous RCC are a common problem in von Hippel-Lindau (VHL) disease, requiring particular effort to preserve renal function. The goal of this study is to assess the safety and long term efficacy of radiofrequency ablation (RFA) of renal tumours in VHL patients.

Materials and Methods: All VHL patients receiving repeat RFA for metachronous de novo RCCs from 2013-2019 were included in this retrospective study. Safety, technical success, progression free survival, overall survival and renal function were analysed.

Results: A total of 9 patients (4 male, 5 female, 46.8 +/- 11.4 yrs.) fulfilling the inclusion criteria were identified from our database. In these patients a total of 18 RFA treatments were performed to treat 21 RCCs (cT1a = 16; cT1b = 5). In 4 treatments bland transarterial particle embolization was performed within 24h prior to ablation. Mean tumor diameter was 29 +/- 9

mm. Eight patients had previous undergone total (n=2) or partial (n=6) nephrectomy. In all patients complete ablation was achieved. During 36.4 $\pm$ 20.3 follow-up there were no local recurrences. Overall, there were 3 minor complications (pneumothorax (n=1), vesical tamponade (n=1), skin burn (n=1)). During follow-up mean eGFR decreased from 65.7 ml/min to 47.2 ml/min. Dialysis was avoided in all patients.

Conclusion: Percutaneous RFA is safe and effective for repeatedly treating recurrent RCCs in VHL patients. Even after total or partial nephrectomy repeated treatments preserve sufficient renal function to avoid dialysis.

P-361

Non-curative thermal ablation of liver metastasis to control progression of advanced GEP-NEN

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Purpose: Multifocal metastatic liver disease is a common problem in gastroenteropancreatic neuroendocrine neoplasms (GEP-NEN). Progression of GEP-NEN usually requires the start or escalation of systemic therapy. While thermal ablation in liver metastases from GEP-NEN is well established, it is usually used in curative intent. Here, we retrospectively assessed whether the use of RFA and MWA in a non-curative intent is beneficial for patients with a single progressive liver metastasis and otherwise stable disease.

Materials and Methods: Patients with multifocal liver metastases from GEP-NEN, who received RFA or MWA of a single progressive liver metastasis and otherwise stable disease, were included in this retrospective study. Safety of the procedures and progression free survival (PFS) were evaluated for assessing the effectiveness of this therapeutic approach.

Results: Thirteen consecutive patients (male=10) who received a total of 16 ablations for progressive GEP-NEN liver metastases were identified from the hospitals database. Overall, a single ablation procedure resulted in a median progression free survival of 48 weeks. Start or change of systemic therapy could be delayed up to 28 months after one or two ablations. Two patients did not benefit from a local ablation and needed an escalation therapy within a few months. Ablation procedures were well tolerated. There were 3 minor complications (asymptomatic portal vein branch thrombosis (n=1); pleural effusion with mild dyspnoea (n=2)). There were no major complications or long-term sequela.

Conclusion: RFA and MWA are well suited to delay escalation of/to systemic therapy in patients with a single progressive liver metastasis and otherwise stable disease of GEP-NEN.

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Oncological treatment of colorectal liver metastases: single-center long-term evaluation over three decades years using different interventional techniques such as LITT, MWA and TACE

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Purpose: To retrospectively evaluate the development and technical progress in interventional treatments of colorectal liver metastases regarding survival rates.

Materials and Methods: Between 1993 and 2020 2,145 patients with colorectal liver metastases were treated in 7,035 sessions using transarterial chemoembolization (TACE), microwave ablation (MWA) or laser-induced thermotherapy. Therapy results were evaluated using the survival rates of the Kaplan-Meier estimator and log-rank test for comparison of the groups.

Results: Median survival in the LITT group (n=574) was 690 days and 633 days for combined LITT+TACE (n=347). 1-, 3- and 5-year survival rates were 79.1%, 27.4% and 10.1% for LITT only treatment. Results for

combined LITT+TACE treatments were 74.9%, 19.9% and 7.2%. Median survival in the MWA group (n=67) was estimated infinite, considering a 5-year survival probability of 75.7%. Median survival time for combined MWA+TACE (n=152) was 1516 days. 1-/3-/5-year survival probability rates in the MWA group were 91%, 79.7%, 75.7%, whereas combined MWA+TACE values were 81.6%, 57.7% and 49.2%. Median survival time in the TACE-only group (n=1005) was 475 days. 1-/3-/5-year survival probability rates were 57.8%, 39.1% and 37.7%.

Conclusion: Treatments with MWA-only resulted in the best median survival time, followed by combined MWA+TACE treatment. Survival rates of MWA and MWA+TACE treatments were significantly higher compared to TACE only therapy and both LITT groups.

P-363

Percutaneous implantation of a microcatheter-port system for hepatic arterial infusion chemotherapy of unresectable liver tumors: technical feasibility, functionality, and complications

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Purpose: To evaluate the feasibility and safety of percutaneously implanted arterial port catheter systems for hepatic arterial infusion of chemotherapy (HAI) in patients with unresectable liver malignancies.

Materials and Methods: From October 2010 to August 2018, arterial port catheters for HAI were percutaneously implanted in 43 patients with unresectable liver malignancies. Three different catheter placement techniques were compared: a conventional end-hole catheter placed in the common hepatic artery (technique 1, n=16), a side-hole catheter with the tip fixed in the gastroduodenal artery (technique 2, n=18), and a long-tapered side-hole catheter with the tip inserted distally in a segmental hepatic artery (technique 3, n=6).

Results: Catheter implantation was successful in 40 (93%) of the 43 patients. Complications related to catheter placement were observed in 10 (23%) patients; 5 (83%) of the 6 major complications were resolved, as well as all 4 minor complications. Catheter migration and occlusion occurred in 9 (22.5%) patients. Catheter migration was more frequent with technique 1 (n=6) than with technique 2 (n=1), although the difference was not significant (P=0.066).

Conclusion: Percutaneous arterial port catheter implantation for HAI is highly feasible and carries a low risk of complications.

P-364

Nomogram based on neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio to predict recurrence in patients with hepatocellular carcinoma after radiofrequency ablation

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Purpose: To investigate the prognostic value of pre-procedure neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR), and construct a nomogram to predict disease-free survival (DFS) in patients receiving radiofrequency ablation (RFA) for hepatocellular carcinoma (HCC) within Milan criteria.

Materials and Methods: The data of 515 patients of HCC within Milan criteria receiving RFA were retrospectively collected. The patients were divided into two groups: the training group (n=382) and the validation group (n=133). Several preprocedural variables were analyzed in the two groups to determine the prognostic factors.

Results: The median DFS time of the training and validation group was 28.4 months and 24.5 months, respectively. Multivariate analyses showed that number of lesions, alpha-feto protein (AFP) levels, NLR and PLR were independent risk factors of DFS. According to the time dependent receiver

operating characteristic curve (t-ROC), the optimal cut-off value of the NLR and PLR was 1.55 and 75.30, respectively, with sensitivity of 0.737 and 0.648 and specificity of 0.541 and 0.508, respectively. The area under curve (AUC) of the t-ROC curves for the NLR was 0.662 and PLR was 0.597. The DFS was significantly higher in the NLR $\leq$ 1.55 group compared to NLR $>$ 1.55 group and the PLR $\leq$ 75.30 group compared to PLR $>$ 75.30 group in both training and validation dataset. Nomogram was developed based on the prognostic factors indicated by the Cox regression to predict 1-, 2-, 3- and 5-year DFS probabilities.

Conclusion: The cut-off value of the NLR and PLR was 1.55 and 75.30. This new nomogram based on NLR and PLR may provide good and individualized prediction of recurrence for HCC patients within Milan criteria after RFA.

P-365

Irreversible electroporation for small hepatocellular carcinoma: single-center experience

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Purpose: Irreversible electroporation (IRE) is non-thermal ablation technique. We aim to evaluate its safety and efficacy in treating small hepatocellular carcinomas (HCC) that are not amenable for thermal ablation, due to anatomical proximity to important structures.

Materials and Methods: We included patients who underwent IRE at our institution (November 2014- August 2020). All cases were discussed at the HCC multidisciplinary meeting. We analyzed data up to 15/2/2021. Study outcomes include: treatment response, recurrence-free survival and adverse events.

Results: Twenty-nine procedures were performed for 27 patients with solitary lesions. Mean age was 65 years. Commonest aetiology was HCV (37%). Seven patients (26%) were treatment-naïve in terms of locoregional and systemic therapies. Mean tumor size was 19.7mm (range: 10-32mm). IRE indications were proximity ($<$ 5mm) to main portal vessels (41.4%), gall bladder (34.5%), main hepatic veins (17.2%), colon and diaphragm (3.45% each).

Complete response was achieved in 25 cases (86.2%). Median follow-up time for these lesions was 19 months. Local recurrence occurred in 10 cases (40%) after a median time of 8 months. Median local recurrence-free survival was 24.5 months.

There was no procedure-related death or any mortality within 30 days of treatment. Two patients (6.9%) developed subcapsular haematomas, one of them was associated with haemothorax. Two patients (6.9%) developed mild segmental biliary dilatation. One patient (3.4%) developed transient partial portal vein thrombosis. All adverse events resolved conservatively.

Conclusion: IRE is likely safe and effective alternative ablation technique for small HCC that are not amenable to standard thermal ablation. Randomized trials comparing it to other locoregional modalities are recommended.

P-366

Value of ¹⁸F-FDG PET/CT in diagnosing residual or recurrent hepatocellular carcinoma after D-TACE

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Purpose: Objective To investigate the value of ¹⁸F-FDG PET/CT in diagnosing residual or recurrent tumors after drug-eluting-bead chemoembolization (D-TACE) in hepatocellular carcinoma (HCC) patients

Materials and Methods: From February 2018 to November 2019, 38 patients who had undergone D-TACE firstly were included in this study. Diagnostic accuracy of ¹⁸F-FDG PET/CT was investigated, as well as receiver operator characteristics (ROC) was performed to assess the value

of tumor-to-liver ratio of standard uptake value (SUV ratio) in detecting residual or recurrent HCCs (rHCCs).

Results: The sensitivity, specificity and accuracy of ¹⁸F-FDG PET/CT in diagnosing rHCCs were 91.89% (34/37), 91.67% (22/24), and 91.80% (56/61), respectively. When the cutoff value was 1.49, Ratio SUV had the best diagnostic value in detecting rHCCs with the sensitivity of 92.8%, specificity of 95.9%, and an AUC value of 0.991 (95%CI, 0.985 ~ 0.999).

Conclusion: ¹⁸F-FDG PET/CT has higher diagnostic value in detecting rHCCs after D-TACE, and SUV ratio value can be used as an efficient index to differentiate rHCCs.

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Bronchial carcinoid tumors embolization prior to treatment: our ten-year journey

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Purpose: Bronchial carcinoid tumors are rare neuroendocrine tumors, considered low to intermediate-grade depending on their histology. Symptoms are often related to compression and obstruction of the bronchial tree. Not all patients are surgical candidates, and endobronchial manipulation of these tumors can result in massive bleeding given its hyper-vascular nature. We assess the safety and feasibility of embolization before treatment and its outcome regarding intraprocedural bleeding.

Materials and Methods: Retrospective analysis of all the patients who underwent embolization 24 to 48 h before treatment between October 2010 and February 2021 in one tertiary center was made. Data were obtained from our clinical database including 12 patients, (9 males and 3 females) with a mean age of 64.75 years (17 – 82 years). Indications for prophylactic embolization were noted. Clinical outcome and complications including bleeding severity, if present, were evaluated.

Results: The indications for embolization were: hemorrhage during a biopsy or previous endobronchial resection attempt (n=8), hemoptysis (n=1), bronchial arteries hypertrophy (n=1) and wasn't specified in 2 patients. All embolizations were performed with polyvinyl alcohol particles, adding micro-coils in 2 patients and n-butyl-2-cyanoacrylate plus ethiodized oil in 2 other patients. The embolization procedure was technically successful in all patients, without immediate or late complications. Just two of the 12 patients presented a negligible intraprocedural hemorrhage after embolization. The treatment intention was palliative in 8 patients, and resulted curative in 4 patients, with no evidence of recurrence to date.

Conclusion: Bronchial carcinoid tumors embolization prior to treatment is feasible, safe, and may reduce intraprocedural bleeding.

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SIRT using MIRD model: impact on injected activity and toxicity

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Purpose: The aim of this study is to evaluate impact of MIRD on activity calculation, liver toxicity and OS after SIRT for HCC with high-activity injection.

Materials and Methods: One hundred thirteen consecutive patients of one tertiary center treated by SIRT for HCC were included from 2014 to 2018.

Usual clinicobiological parameters (eg. biological liver function), tumor characteristics, dosimetric data and volumes (total liver, targeted tumor and non tumoral liver) calculated from CE-CT were recorded before treatment and every 3 months.

We evaluated liver toxicity by bilirubin absolute variation and CTAEC as prognosis factors of survival using CART.

Results: The mean planned injected activity using MIRD model was 2.04 GBq (95%CI: 1.87-2.1) compared with 1.03 GBq (95%CI: 0.92-1.14) if BSA model had been used ($p < 0.0001$).

Median (1st-3rd quartile) bilirubin level change at 3 months compared to baseline was 3 $\mu\text{mol/l}$ (-1 ; 12.5) ($p < 0.001$), corresponding change in % was 25% (-14 ; 87). According to CTAEC v5 classification 14 (12.4%) grade 3 and 2 (1.8%) grade 4 toxicity events were observed at 3 months. The CART analysis identified 4 groups with significant different OS ($p < 0.0001$) based on 3-months bilirubin, baseline bilirubin serum level and age. Two-years OS (95%CI) was respectively 0% (0-0) for group 1; 17% (3-41) for group 2; 58.2% (37-75) for group 3 and 71% (53-83) for group 4.

Conclusion: Three-months bilirubin, baseline bilirubin serum level and age are significant predictive factors of overall survival and should be taken into account during planification of high-dose SIRT using MIRD.

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Low complication rates in Clavien-Dindo and CIRSE scales at ipsilateral access portal venous embolization (PVE) for preoperative hypertrophy

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Purpose: Portal venous embolization (PVE) is a minimal invasive pre-operative strategy that aims to increase future liver remnant (FLR) in order to facilitate extended hemihepatectomy. We analyzed our data retrospectively regarding complications and degree of hypertrophy (DH).

Materials and Methods: 88 PVE were performed either by particles / coils ($n=77$) or by glue / oil ($n=11$), and 7 additionally by right hepatic vein embolization (HVE) by Coils or occluders. All complications were categorized by the Clavien- Dindo (CD) and the CIRSE classification.

Results: In 88 patients (median age 68 years) there was one intervention with a biliary leak and subsequent drainage (complication grade 3 CD), one with prolonged hospital stay (grade 2 CD, grade 3 CIRSE) and 13 complications grade 1 CD, but no complications of grade 4 or higher neither in Clavien- Dindo nor in CIRSE classification. The median relative increase in FLR was 47% (SD 35%). The mean pre-intervention standardized FLR rose from 23% (SD 10%) to a post-intervention standardized FLR of 32% (SD 12%). The degree of hypertrophy (DH) was 09,3% (SD 5,2%) and the kinetic growth rate (KGR) per week was 2,06 (SD 1,84).

Conclusion: PVE and, if necessary, additional sequential HVE were safe procedures with a low rate of complications and facilitated sufficient preoperative hypertrophy of the future liver remnant

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Microwave ablation for colorectal pulmonary metastases: systematic review

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Purpose: Radiofrequency ablation (RFA) for colorectal cancer pulmonary metastases (CRCPuM) has been studied since 2000 and shown to be safe. Recently, microwave ablation (MWA) has grown in popularity for CRCPuM. However, short to long-term efficacy of MWA have yet to be understood.

Materials and Methods: A systematic review of the literature was conducted in accordance with the PRISMA statement. A literature search

was conducted using Pubmed, EMBASE, Medline, Scopus and Cochrane databases in December 2019. Studies adopting microwave ablation therapy for colorectal pulmonary metastasis were included.

Results: A total of 323 lesions were ablated in 186 patients across 6 studies. Post MWA, local control or complete remission was achieved in 144 of the 186 patients (77.4%), with residual or progressive disease in 70 (37.6%), which was superior than RFA. The median overall survival post-ablation in MWA was less superior than RFA and so was post-ablation disease free survival rate. The rate of complications post MWA is higher than RFA particularly with pneumonia and pulmonary haemorrhage.

Conclusion: MWA is an alternative method of treatment for CRCPuM. MWA has competitive theoretical properties and local recurrence rate, particularly in larger tumours compared to RFA. Although RFA has a favourable overall survival rate and safety profile. Longer term randomised controlled trials are required to understand MWA compared to RFA.

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Prediction of therapeutic response of hepatocellular carcinoma to CalliSpheres drug-eluting bead transcatheter arterial chemoembolization based on pretherapeutic dynamic CT and textural findings

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Purpose: The objective of our study was to assess the value of CT texture analysis for prediction of therapeutic response of hepatocellular carcinoma to CalliSpheres Drug-Eluting Bead TACE with pretherapeutic dynamic CT.

Materials and Methods: 40 patients with Hcc received D-TACE admitted to Shandong Cancer Hospital from April 2018 to December 2019 were analyzed retrospectively. The short-term efficacy of patients was evaluated according to mRECIST criteria. Patients with CR and PR were good prognosis group(A), and those with SD and PD were poor prognosis group (B). CT enhanced texture technology was used to analyze CT axial enhanced images, draw the tumor boundary, and obtain two groups of texture analysis mean, entropy, skewness, kurtosis and non-uniformity layer by layer. Draw the (ROC) curve of the subjects' working characteristics to analyze the predictive value of various texture parameters for D-TACE treatment of liver cancer.

Results: Of the 40 patients, 26 remission, 8 stable, 6 progress. The mean value of group A was higher than that of group B, while the entropy and inhomogeneity of group A were significantly lower than those of group B ($P < 0.05$). There was no difference in skewness and kurtosis between the two groups ($P > 0.05$). Tumor CT mean, entropy and non-uniformity all have certain value in predicting the short-term risk of tumor progression after D-TACE, and their AUC are 0.785, 0.694 and 0.761 respectively.

Conclusion: The enhanced CT texture analysis technique has an important predictive value for the risk of short-term tumor recurrence in patients with HCC after D-TACE, which needs further investigation.

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Safety and efficacy of RFA versus MWA for cT1a renal cell carcinoma: a propensity score analysis

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Purpose: To compare microwave ablation (MWA) to radiofrequency ablation (RFA) for the treatment of renal cell carcinoma (RCC) in terms of safety and efficacy.

Materials and Methods: Patients with a T1a (≤ 4 cm) RCC treated by RFA or MWA in two referral centers were retrospectively analyzed. Patient records were evaluated to generate mR.E.N.A.L. nephrometry scores. Local tumor progression (LTP) was considered, when a new (recurrence) or residual tumor enhancement within/adjacent to the ablation zone was objectified. Differences in LTP (residual + recurrence) between ablation techniques were assessed with Cox proportional hazards models and propensity score (PS) methods. Complications were scored according to the Clavien-Dindo classification.

Results: In 188 biopsy proven T1a RCCs, 87 RFAs and 101 MWAs were performed. Median tumor size was 2.6 cm for both RFA and MWA ($p=0.165$). Primary efficacy rate was 91% (80/87) for RFA and 91% (92/101) for MWA. 16 patients had residual disease (RFA ($n=7$) and MWA ($n=9$)) and 9 patients developed recurrence after RFA ($n=7$) and MWA ($n=2$). LTP was significantly worse for higher m.R.E.N.A.L. nephrometry scores (size >3 cm, endophytic lesions, nearness to the collecting system <7 mm). No difference in LTP was found between RFA and MWA in a model with inverse probability weighting using PS ($p=0.66$) and in a PS matched dataset ($n=78$; $p=0.67$). 28 (14.9%) complications (grade I-IVa) occurred after 14 RFAs and 14 MWAs.

Conclusion: No differences in efficacy and safety were observed between RFA and MWA. LTP was found worse for tumors with higher m.R.E.N.A.L. nephrometry scores.

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Initial multicenter clinical experience with liver microwave ablation using an antenna with full water cooling and AntiphaseTM technology

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Purpose: Significant variability exists among the different MWA equipment, thus comprehensive understanding of data and critical appraisal of the efficacy and safety profile of each ablation system is required. We reported early clinical evaluation with Surgnova Dolphi system.

Materials and Methods: 47 patients (23 women) with 54 liver tumors (11 HC; 43 metastases) measuring 17.36 ± 6.7 cm in largest dimension (LD) and 14.2 ± 6.17 mm in smallest dimension (SD) were treated over 10 months in two cancer centers. MWA were performed under US only ($n=11$), CT+US ($n=18$), CT+angiography ($n=3$), or robotic ($n=12$) guidance. The 15G antenna used is water-cooled distal to the MWA emission point, with monitoring and compensation of the reflect power in real time, and incorporates patented choke ring (AntiphaseTM).

Results: The ablation zone on imaging obtained within 1 month after MWA measured 34.47 ± 12.37 in LD and 26.84 ± 7.47 mm in SD in the axial plane. The sphericity index (SI) of ablation zone (LD/SD) was 1.28 ± 0.26 , with only two SI ≥ 1.5 . LD, SD, SI were 40.4 ± 9.31 , 32.4 ± 5.12 , 1.24 ± 0.17 at 100W for 10min, 38.16 ± 10.77 , 27 ± 5.88 , 1.38 ± 0.12 at 100W for 8 min, and 28.6 ± 6.1 , 23.75 ± 3.97 , 1.18 ± 0.26 for 80W for 5min. Among the 45 tumors with 1 month follow-up, ablation margins were <5 mm in 8 tumors, 5 to 10 mm in 24 tumors, and >10 mm in 16 tumors. The only grade3 complication was a stress ulcer hemorrhage unrelated to any thermal injury.

Conclusion: Early Initial multicenter clinical experience with a new MWA is promising with low SI, and high reproducibility obtained through a 15G antenna.

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A novel systemic inflammation response index (SIRI)-based nomogram for predicting the recurrence of early-stage hepatocellular carcinoma after radiofrequency ablation

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Purpose: To explore the prognostic value of the systemic inflammation response index (SIRI) in the patients with early-stage hepatocellular carcinoma (HCC) after radiofrequency ablation (RFA).

Materials and Methods: The prognostic value of SIRI was evaluated in a primary cohort ($n=403$) and then further validated in an independent test cohort ($n=140$). A novel preoperative prognostic nomogram was constructed from a multivariate analysis and validated in an external validation cohort.

Results: The optimal cutoff value of SIRI for patient stratification into a low SIRI group and a high SIRI group was 1.36. Survival analysis showed that the median overall survival (OS) and recurrence-free survival (RFS) were significantly higher in patients with a low SIRI compared to those with a high SIRI. The alpha-feto protein (AFP), SIRI, tumor number and size were independent predictors of RFS based on multivariate analysis. The nomogram that included the SIRI, tumor number, tumor size, AFP could more accurately determine the prognosis of HCC patients than BCLC stage. In addition, the dynamic changes in post-RFA SIRI also had prognostic significance and patients with a reduction in the SIRI by $>75\%$ had a better prognosis.

Conclusion: Preoperative SIRI was an independent prognostic indicator of RFS in early-stage HCC patients after RFA. The nomogram that included the SIRI, tumor number, tumor size, AFP may assist clinicians in identifying patients with a high recurrence risk and in choosing the optimal individualized treatment strategy.

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Prognostic significance of systemic immune-inflammation index-based nomogram for early stage hepatocellular carcinoma after radiofrequency ablation

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Purpose: the purpose of the study is to explore the prognostic value of systemic immune-inflammation index based on lymphocyte, neutrophil, and platelet counts in patients with hepatocellular carcinoma (HCC) after radiofrequency ablation (RFA).

Materials and Methods: We retrospectively evaluated the prognostic value of the SII in training and validation cohorts, and then established

an effective nomogram for HCC after RFA based on SII. The C-index, and area under the time-dependent receiver operating characteristic curve (t-AUC) were used to evaluate the discrimination and calibration value of the nomogram.

Results: An optimal cut-off value for the SII of 324.55×10^9 stratified the patients with HCC into high- and low-SII groups. Univariate and multivariate analyses revealed that SII was an independent predictor for overall survival (OS) and recurrence-free survival (RFS). SII was an independent prognostic factor for early-stage HCC with normal α -fetoprotein (AFP) levels. The t-AUC of the SII was higher for OS and RFS than for neutrophil-lymphocyte ratio (NLR) and platelet-lymphocyte ratio (PLR). A high preoperative SII was associated with multiple tumors, larger tumors, and higher levels of AFP. A well-discriminated and calibrated nomogram was constructed to predict the probability of 1-, 2-, 3-, and 5-year RFS with C-indexes of 0.80, which was significantly higher than that obtained with other prognostic clinical indexes.

Conclusion: The SII is an independent prognostic factor affecting the survival outcomes of patients with early-stage HCC. The comprehensive nomogram based on SII presented in this study is a promising model for predicting RFS and OS in HCC patients after RFA.

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Worsening sarcopenia status at 1 month after transarterial radioembolization (TARE) for advanced hepatocellular carcinoma (HCC), is able to predict patients who will experience disease progression

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Purpose: To demonstrate correlation between sarcopenia modifications measured before and after 1 month from TARE treatment and its induced local response rate.

Materials and Methods: For this retrospective, single center study, we evaluated 86 patients with HCC treated with TARE.

Sarcopenia status was measured using the PMI. The PMI was calculated according to the formula: $PMI [mm/m^2]: [(minor\ diameter\ of\ left\ psoas + major\ diameter\ of\ left\ psoas + minor\ diameter\ of\ right\ psoas + major\ diameter\ of\ right\ psoas)/4]/height\ in\ m^2$.

Population was divided in two groups according to the delta value of Psoas Muscle Index (PMI) measured at the time of TARE and one month after TARE: a group in which the delta PMI was stable or increased (No-Sarcopenia Group; n=42) vs. a group in which the delta-PMI decreased (Sarcopenia Group; n=44).

Patient response was evaluated at 1, 3 and 6 months after TARE treatment with CT/MRI.

Results: When the radiological response of the tumor was evaluated according to the mRECIST criteria, the two groups were similar in terms of rates of complete response (P=0.42), partial response (P=0.26), and stable disease (P=0.59). Progressive disease (PD) was more commonly observed in the Sarcopenia Group (38.6% vs. 11.9%; P=0.006).

Conclusion: Worsening of sarcopenia status measured 1-month after TARE is able to predict patients who will undergo disease progression.

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Refining prognosis in chemoembolization for hepatocellular carcinoma: Immunonutrition and liver function

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Purpose: A combination of the Albumin-Bilirubin (ALBI) grading and the Prognostic Nutritional Index (PNI) has recently been identified as a highly predictive system for patients with hepatocellular carcinoma (HCC) undergoing tumor ablation. This study aimed to evaluate this combination's promising results in treatment naïve patients undergoing TACE treatment.

Materials and Methods: Between 2010 and 2020, 280 patients who met the inclusion criteria were retrospectively identified. Lymphocyte count, serum albumin, and bilirubin levels were recorded to calculate both scores; further established risk factors entered multivariate analysis. Influence of ALBI grade and PNI on the median overall survival (OS) was assessed. In the next step, ALBI and PNI were combined, and the prognostic ability of this combined approach was compared to existing scoring systems (BCLC, HAP, mHAP-II).

Results: Both ALBI grade 2-3 and a low PNI were highly predictive for median OS (ALBI grade 1-3: 39.0 vs 16.3 vs 5.4 months, $p < 0.001$; High vs low PNI: 21.4 vs. 7.5, $p < 0.001$). Combination of both resulted in an OS of 39.0, 20.1, 10.3, and 5.4 months ($p < 0.001$). With a Concordance Index (C-Index) of 0.69, the ALBI-PNI outperformed each individual score (C-Index = 0.65 respectively 0.64) and was also better than BCLC, HAP and mHAP-II (C-Indices 0.66, 0.60 and 0.59).

Conclusion: The combination of ALBI and PNI was superior to each score alone and to other established scoring systems in prognosis prediction. Therefore, the easy-to-calculate ALBI-PNI might be a promising stratification tool for patients with HCC undergoing TACE, reflecting both immunonutritive status and liver function.

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Percutaneous liquid nitrogen cryoablation for metastatic lesions: feasibility and preliminary results

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Purpose: To assess safety and efficacy of cryoablation using a liquid nitrogen-based cryogenic system in cancer patients with metastatic lesions.

Materials and Methods: Between April 2017 and December 2020, 40 patients (26 females, 14 males, mean age 63, range 31-82) underwent 47 cryoablations for metastatic lesions. Lesions were localized in bone structures (19/47; 40%), soft tissues (18/47; 38%) and parenchymal organs (10/47; 21%). Histological diagnosis included 6/47 (13%) breast carcinoma, 7/47 (15%) colorectal cancer, 3/47 (6%) lung carcinoma, 6/47 (13%) melanoma, 10/47 (21%) renal cell carcinomas (RCC), 11/47 (23%) sarcoma and 4/47 (9%) others. The inclusion criteria consisted of symptomatic metastatic patients with either contraindication to other treatments or in oligometastatic patients to delay further treatments. All treatments were performed in a dedicated angiography room setting in patients under general anesthesia using a liquid-nitrogen based Prosense Cryosurgical system (IceCure Medical Ltd, Caesarea, Israel) under CT or US guidance.

Results: Primary technical success and technical efficacy were reached in 43/47 cases (91%). An average of 2.2 cryoablation cycles was performed with a mean procedure time of 40 minutes (range 10-136 minutes). Minor adverse events (AEs) were reported in 7/47 lesions (15%). No major or severe adverse events were reported. At a mean follow up of 13 months,

local tumor progression occurred in 18/47 lesions (38%), requiring further systemic treatments.

Conclusion: Image-guided cryoablation is a clinically safe and effective treatment option for metastatic patients and can be effectively used to delay systemic therapies, maintaining disease control and quality of life. A longer follow-up is needed to obtain stronger survival outcomes.

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Treatment results of superselective intraarterial infusion chemotherapy and concomitant radiotherapy for head and neck squamous cell carcinoma

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Purpose: This study aimed to evaluate the treatment outcomes of superselective intraarterial infusion chemotherapy and concomitant radiotherapy for head and neck squamous cell carcinoma (SCC).

Materials and Methods: We retrospectively investigated the data of 45 patients (Stage II: 4, Stage III: 11, Stage IV: 30) (tongue, maxillary sinus/ethmoid sinus, middle/hypopharyngeal, and oral cavity = 16, 14, 10, and 5, respectively) with head and neck SCC treated with superselective intraarterial infusion chemotherapy and concomitant radiotherapy from August 2006 to December 2020. The mean age of the patients was 65.3 years (male: female = 28:17). The treatment schedule consisted of intraarterial chemotherapy (cisplatin, 100 mg and docetaxel, 40 mg) and radiotherapy (total: 60 Gy).

Results: With a mean follow-up of 44 months (range: 5–156 months), the objective response rate was 100% (CR: PR= 71.1%: 28.9%). The 5-year disease-specific survival rates for all diseases, tongue, maxillary sinus/ethmoid sinus, middle/hypopharyngeal, and oral cavity were 86.7%, 87.5%, 92.9%, 80%, and 80%, respectively. Of six patients who died of the primary disease within 5 years, four were at stage IV. The remaining two patients were at Stage II and Stage III, respectively, although they had poorly differentiated cancers. Although the adverse events of G3 or higher were observed in 33.3%, all of which were treated only with symptomatic treatment.

Conclusion: Treatment of head and neck SCC with superselective intraarterial infusion chemotherapy and concomitant radiotherapy showed a high response rate and survival rate regardless of the site of the primary lesion. It is considered a useful treatment method for head and neck SCC.

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Optimization of image acquisition for histotripsy target prediction using cone beam CT and fluoroscopy

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Purpose: Histotripsy is limited by reliance on ultrasound for targeting. Cone-beam CT (CBCT) and multi-angle fluoroscopy of the therapy transducer can accurately predict treatment targets. We sought to evaluate the effect of fluoroscopy imaging parameters on histotripsy target prediction accuracy.

Materials and Methods: Prior to treating ex vivo bovine liver, fluoroscopy images (projection angles -128-129°) of the histotripsy therapy transducer were obtained. Pairs of images were selected and analyzed for 1) separation angle (90-0°) between the two images and 2) Field of View (FoV) of the x-ray images, which was varied by cropping images (27-100%). A CBCT was obtained post-treatment. The target prediction was determined based on 3D to 2D pose estimation using a 3D point cloud model of the transducer. The relationship between separation angle and target center accuracy in terms of 50th (10th, 90th) percentiles was evaluated at different transducer positions (9200 pairs of images). Additionally,

target center accuracy was evaluated based on percentage of therapy transducer within the FoV from 0 to 93% (144 FoVs, 124 pairs of images).

Results: Submillimeter 0.99mm (0.51, 1.76) target prediction accuracy was seen for 30-90° angular separation. Target accuracy was within 0.68mm (0.25, 1.55) with at least 40% of transducer within the FoV.

Conclusion: Histotripsy targets were accurately predicted by CBCT and fluoroscopy over a wide range of paired fluoroscopy angles and with only a portion of the therapy transducer in the FoV. This will facilitate clinical translation of a C-arm based histotripsy targeting workflow by affording increased freedom in device and gantry positioning.

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Efficacy and safety of transarterial chemoembolization using CalliSpheres® microspheres versus conventional transarterial chemoembolization in unresectable intrahepatic cholangiocarcinoma

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Purpose: This study aimed at comparing the efficacy and safety of drug-eluting beads transarterial chemoembolization (DEB-TACE) using CalliSpheres® microspheres (CSM) with conventional TACE (c-TACE) in the treatment of unresectable intrahepatic cholangiocarcinoma (ICC).

Materials and Methods: The medical records of 89 patients diagnosed with unresectable ICC and subjected to DEB-TACE with CSM or c-TACE from January 2016 to January 2019 were retrospectively reviewed. Tumor response in the two groups was assessed using the modified Response Evaluation Criteria in Solid Tumors (mRECIST). The overall survival (OS) in the patients of both groups was also evaluated. All adverse events were recorded and evaluated according to the National Cancer Institute Common Terminology Criteria for Adverse Events (version 4.0).

Results: A total of 89 patients were included in the analysis: 40 were subjected to DEB-TACE with CSM and 49 to c-TACE. The disease control rate (DCR) of the patients in the DEB-TACE group was significantly higher than that in the c-TACE group (P = 0.003). The median time to progression (TTP) was 4.0 months and 2.0 months in the DEB-TACE and c-TACE group, respectively (P = 0.098). The median OS was 10.0 months and 6.0 months in the DEB-TACE and c-TACE group, respectively (P = 0.006), and the multivariate analysis revealed that DEB-TACE was an independent prognostic factor for OS. Five adverse events occurred in five patients in the DEB-TACE with CSM group and three adverse events were observed in three patients in the c-TACE group.

Conclusion: DEB-TACE with CSM produced encouraging results in the treatment of unresectable ICC, with acceptable adverse effects.

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Drug-eluting bead transarterial chemoembolization (DEB-TACE) versus conventional transarterial chemoembolization (cTACE) in colorectal liver metastasis: efficacy, safety and prognostic factors

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Purpose: To comparatively evaluate Drug-eluting Bead Transarterial Chemoembolization (DEB-TACE) and Conventional Transarterial Chemoembolization (cTACE) for efficacy, safety and related prognostic factors in the treatment of colorectal liver metastasis (CRLM).

Materials and Methods: This study retrospectively analyzed 75 patients with CRLM administered DEB-TACE (n=36) or cTACE (n=39) between January 2016 and December 2017. Local control, survival outcome and complications were compared between the two groups. Univariate and

multivariate analyses of prognostic factors affecting progression-free survival (PFS) and overall survival (OS) were performed.

Results: Median follow-up in the two groups was 10.49 months (range, 0.5-22). Median PFS and OS in the DEB-TACE group were 10.0 months and 13.0 months, respectively, and 6.0 months and 8.5 months in the cTACE group, respectively ($p=0.009$ and $p=0.008$). The 3-, 6- and 12-month survival rates in the DEB-TACE group were 100.0%, 94.4%, and 55.6%, respectively, and 92.3%, 71.8%, and 35.9% in the cTACE group, respectively. The 3-month survival rate ($p=0.083$) showed no significant difference between the two groups, but significant differences were found in 6-month and 12-month survival rates ($p=0.008$ and $p=0.030$). Univariate and multivariate survival analyses showed that treatment method, tumor size and tumor number were important prognostic factors affecting PFS and OS.

Conclusion: DEB-TACE has advantages over cTACE in prolonging PFS and OS in CRLM patients. Treatment method, tumor number and tumor size are important prognostic factors affecting PFS and OS. However, further multicenter and prospective trials are needed to confirm a deeper comparison between DEB-TACE and cTACE in CRLM patients.

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Immunonutritive scoring in patients with hepatocellular carcinoma undergoing transarterial chemoembolisation: prognostic nutritional index or controlling nutritional status score?

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Purpose: Both immunonutritive scoring systems, the Prognostic Nutritional Index (PNI) and the Controlling Nutritional Status (CONUT) score, proved their predictive ability in various cancer entities, including hepatocellular carcinoma (HCC). This study aimed to perform the first evaluation of the CONUT score for patients undergoing transarterial chemoembolisation (TACE) and to compare both scores in their ability to predict median overall survival (OS).

Materials and Methods: Between 2010 and 2020, we retrospectively identified 237 treatment naïve patients with HCC who underwent initial TACE at our institution. Both scores comprise the albumin level and total lymphocyte count. The CONUT additionally includes the cholesterol level. Both scores were compared with established risk factors using multivariate regression analyses regarding median OS. Furthermore, subgroup analysis was performed on recommended TACE (BCLC A & B) candidates.

Results: A high CONUT score and low PNI were associated with an impaired median OS (8.7 vs 22.3 months, $p<0.001$, respectively 6.8 vs 20.1 months, $p<0.001$). In multivariate analysis only the PNI remained an independent prognostic predictor ($p=0.003$), while the CONUT score lost its predictive ability ($p=0.201$). For recommended TACE candidates both, CONUT and PNI were able to stratify patients regarding their median OS (10.2 vs 24.0 months, $p<0.001$ respectively 6.6 vs 19.4 months, $p<0.001$). However, only the PNI was an independent prognostic factor ($p=0.012$).

Conclusion: While both scores were able to stratify patients regarding their median OS, only the PNI remained an independent prognostic factor. Therefore, PNI should be preferred when evaluating the nutritional status of patients undergoing TACE.

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3D quantitative ablation margins for prediction of ablation site recurrence in stereotactic image-guided microwave ablation of colorectal liver metastasis: a multi-center study

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Purpose: To investigate 3D quantitative ablation margins (3D-QAM) as a metric together with other known influencing factors to predict ablation site recurrence (ASR) within one year after stereotactic microwave ablation (SMWA) for colorectal liver metastasis (CRLM).

Materials and Methods: Data from a prospective multi-centre study of patients undergoing SMWA for CRLM were analysed. Using a previously developed metric for 3D-QAM computation, ablation margins were retrospectively assessed in co-registered pre- and post-ablation CT scans. The discriminatory power and optimal cut-off values for percentage of tumour surface coverage in relation to ablation margin were assessed using receiver operating characteristic (ROC) curves. Multivariable logistic regression analysis using generalized estimating equations was applied to investigate the effect of the 3D-QAM metric on one year ASR, accounting for other known influencing factors.

Results: Overall technical success, primary technique efficacy and one year ASR rates in 168 treated CRLM in 98 patients were 97.6%, 78.6% and 16.7%. Ten of the 66 (15.2%) tumours analysed using the 3D-QAM metric developed ASR. ROC analyses identified that a 1mm margin for more than 23% of the tumour surface had the optimal discriminatory quality. In multivariable analysis, 3D-QAM $>23\%$ of $<1\text{mm}$ margin (OR 21.67 [CI 2.48, 165.21] $p=0.003$) and tumour diameter (OR 1.13 [CI 1.01, 1.27] $p=0.035$) turned out to be the only significant predictors of one year ASR.

Conclusion: 3D-QAM represents the most important factor predicting ASR within one year after SMWA of CRLM, which allows accurate determination of insufficient ablation margins.

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sABLATE: a simplified ABLATE score for prediction of complications and outcome in percutaneous thermal ablation of renal lesions

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Purpose: To evaluate the performance of a simplified-ABLATE score (sABLATE) in predicting complications and outcome in respect to RENAL, mRENAL and ABLATE scores.

Materials and Methods: This study included 136 renal lesions in 113 patients (M:F ratio=2.5; mean age 70.8 years). 98 tumors underwent cryoablation at San Raffaele hospital between 01/2015 and 03/2020, 37 microwave ablation at San Paolo or Policlinico hospitals between 07/2016 and 03/2020. RENAL, mRENAL, ABLATE and sABLATE scores were calculated for each lesion using preprocedural imaging. Data regarding

complications and follow-up were registered. Mann-Whitney U test, ROC analyses, and logistic regression analyses were used for complications. Cox-regression analyses were performed for outcome

Results: Mean diameter of renal tumors was 23.2mm. Mean and median RENAL, mRENAL, ABLATE and sABLATE scores were 6.8 and 7, 6.9 and 7, 5.3 and 5, and 3.5 and 3, respectively. During a mean follow-up of 21.9 months (range 1-73) we registered 7 complications, 3 cases of residual disease and 10 of local tumor progression. Mann-Whitney U test p-values for complications for RENAL, mRENAL, ABLATE and sABLATE were 0.51, 0.49, 0.66 and 0.05, respectively. ROC analyses for complications showed an AUC for RENAL, mRENAL, ABLATE and sABLATE of 0.57, 0.57, 0.55 and 0.71 respectively. HR and p-values of Cox-regression analyses were 1.30 and 0.36 for RENAL, 1.33 and 0.35 for mRENAL, 2.16 and 0.01 for ABLATE, 2.29 and 0.004 for sABLATE.

Conclusion: sABLATE performs better than the other scores in predicting complications. ABLATE and sABLATE were associated with outcome, with sABLATE performing better.

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Sorafenib versus apatinib both combined transarterial chemoembolization for hepatocellular carcinoma with portal vein tumor thrombosis: a comparative retrospective study

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Purpose: To compare the efficacy and safety of transarterial chemoembolization (TACE) combining with sorafenib or with apatinib for hepatocellular carcinoma (HCC) patients with portal vein tumor thrombosis (PVTT).

Materials and Methods: From June 2015 to March 2020, a total of 89 consecutive advanced HCC patients with PVTT who received the treatment of sorafenib-TACE (S-TACE) or apatinib-TACE (A-TACE) in our center were enrolled. The overall survival (OS), time to progression (TTP), tumor response, and adverse events in the two groups were compared.

Results: There were 32 and 41 patients in the S-TACE group and A-TACE group, respectively. The median follow-up was 10.0 months (range, 3.0-36.0 months) in the whole study. The median OS (11.0 vs 10.0 months, $P=0.419$), median TTP (5.0 vs 6.0 months, $P=0.073$), and tumor response ($P=0.529$) between the S-TACE group and the A-TACE group were not significantly different. The adverse events related to sorafenib or apatinib were tolerable.

Conclusion: S-TACE and A-TACE exhibited comparable prognosis for HCC patients with PVTT, which provide another effective and safe method of A-TACE for these patients except for conventional S-TACE.

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Percutaneous computed tomography-guided microwave ablation of T1a renal cell cancer: the impact of tumor size on the progression survival rates

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Purpose: International guidelines advocate application of percutaneous ablation for renal cell cancer (RCC) with a diameter ≤ 3 cm. The purpose

of the present study is to compare efficacy, safety and progression rates between two different size groups of T1a RCC.

Materials and Methods: Institutional database retrospective research identified 57 patients with a biopsy proven solitary T1a RCC (T1aN0M0); all patients underwent percutaneous CT-guided microwave ablation. Mean patient age was 70.4 years. Mean tumor size was 2.5 cm. Lesions were classified in Group A (diameter ≤ 3 cm, $n=42$) and Group B (diameter 3.1-4 cm, $n=15$). Kaplan – Meier survival estimates for events were graphed and Cox regression analysis was conducted.

Results: Concerning all included T1a RCCs, primary local tumor control (LCT) was 94.7% and secondary LCT rate was 100%. There was no statistically significant difference on primary LCT between the two groups ($p>0.005$). Cox regression analysis between the two groups showed no statistically significant difference regarding tumour progression. Two patients (3.5%) from Group 3 had a second ablation at one year due to tumor recurrence. One patient (1.7%) from Group 4 developed metastasis. Grade I self-limited complications were recorded to four (7%) patients (three from Group 3 and one from Group 4). The mean survival time from the last ablation was 35.4 months.

Conclusion: The results of the present study indicate that microwave ablation is a safe and efficacious technique for the treatment of T1a RCCs irrespective of the lesion's diameter without any compromises upon safety and progression.

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Flex dose: a new frontier for TARE treatment

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Purpose: Background

Hepatocellular carcinoma (HCC) is the most common primary liver malignancy and is a leading cause of cancer-related death worldwide. Transarterial radioembolization (TARE) with yttrium 90 (90Y), is a safe and effective treatment in case of unresectable HCC.

Materials and Methods: From January 2020 to November 2020, 4 patients affected by HCC with TARE (SIR-Spheres) has been treated adopting the new Flexdose delivery program. Following this protocol, the interventional radiologist is able to split different amount of dose in one or more pathological vessel using a variable number of microsphere and adapting the procedure on Patient characteristic. A 6 months CT scan follow up was performed to evaluate the tumor response to treatment with mRECIST criteria.

Results: 4 patients treated and included in the study. TARE with SIR-Spheres was successfully performed in all of patients (technical success 100%). A complete response (CR) to treatment was observed in 4/4 patients (100%) but two Patients reported progression of disease (PD) due to portal venous thrombosis. We did not observe PD of the target lesion treated. Any complications due to treatment was reported.

Conclusion: According to our experience, TARE has an important role in the management of Patients affected by intermediate stage HCC. Flex Dose delivery program is able to spare large amount of healthy liver through the selective catheterism and delivery dose in pathological vessels. As a consequence, Flex dose delivery program could increase the cohort of Patients eligible for TARE.

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Current implementation and interventional radiologists' perception of palliative interventional procedures for the patients with refractory cancer pain: a nationwide questionnaire study in Japan

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Purpose: The demand for palliative interventional procedures for the patients with cancer pain refractory to drug treatments has been growing. This study was aimed to clarify the current implementation and interventional radiologists' perception of palliative interventional procedures in Japan.

Materials and Methods: A cross-sectional, questionnaire-based physician survey was performed in 2020. A self-administered questionnaire regarding palliative interventional procedures (celiac plexus nerve lysis (CPN); percutaneous vertebroplasty (PVP); transarterial embolization (TAE)) was mailed to all the board-certified interventional radiologists (IRs) in Japan (n=1,087).

Results: A total of 554 IRs (51.0%) completed the questionnaire. The mean age of the respondents was 48.2 years, and 92.1% of them were male. Each procedure was recognized as effective by the following percentages of the respondents: CPN, 58.5%; PVP, 54.9%; TAE, 28.0%. Rates of the respondents who answered "they currently perform the procedure" and "they don't perform but willing to perform in the future" were: CPN, 18.1%/50.2%; PVP, 22.6%/48.4%; TAE, 51.4%/66.1%. Rates of respondents who performed each procedure at least once over the 3 years were: CPN, 9.0%; PVP, 5.3%; TAE, 25.7%.

Conclusion: More than half of the respondents recognized palliative interventional procedures as effective; however, delivery of these procedures by IRs may be insufficient in Japan. Given a perception of the future implementation of palliative interventional procedures by the respondents without current experience, development of training and delivery systems of palliative IR in cooperation with palliative care specialists and pain specialists may be required to facilitate the utilization of IR in this field.

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Transarterial chemoembolization in treatment-naïve and recurrent hepatocellular carcinoma: a propensity-matched outcome and risk signature analysis

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Purpose: The purpose of this study was to evaluate the efficacy and safety of transarterial chemoembolization (TACE) in the treatment of

patients with treatment-naïve hepatocellular carcinoma (TN-HCC) and recurrent HCC (R-HCC). In addition, risk signature analysis was performed to accurately assess patients' recurrence and survival.

Materials and Methods: This retrospective study assessed the consecutive medical records of TN-HCC and R-HCC patients from January 2014 to December 2018. In order to reduce the patient selection bias, propensity score matching (PSM) analysis was applied. Conditional inference tree was used to establish a risk signature.

Results: A total of 401 eligible patients were included in our study, including 346 patients in the TN-HCC group and 55 patients in the R-HCC group. Forty-seven pairs of patients were chosen after the PSM analysis. After the PSM analysis, there was no significant difference in the ORR and DCR between the two groups ($P > 0.05$), the median OS and PFS in the R-HCC group were inferior to those in the TN-HCC group (OS: 24 months vs. 33 months, $P = 0.0035$; PFS: 10 months vs. 12 months, $P = 0.01$). The conditional inference tree divided patients into different subgroups according to tumor size, BCLC stage, and TACE sessions and shared different hazards ratio to recurrence or survival.

Conclusion: Patients with R-HCC treated with TACE achieved satisfactory results, although survival after the PSM analysis was not as good as in the TN-HCC group. In addition, risk signature based on conditional inference tree analysis can more accurately predict the recurrence and survival in both groups of patients.

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Efficacy of drug-eluting beads transarterial chemoembolization plus apatinib compared with conventional transarterial chemoembolization plus apatinib in the treatment of unresectable hepatocellular carcinoma

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Purpose: Transarterial chemoembolization (TACE) combined with apatinib is used with good efficacy in the treatment of unresectable hepatocellular carcinoma (HCC). However, the type of TACE that most benefits patients with HCC is unclear. The aim of the study was to compare the efficacy and safety of drug-eluting TACE plus apatinib (D-TACE-A) with those of conventional TACE plus apatinib (C-TACE-A) for the treatment of unresectable HCC.

Materials and Methods: We retrospectively reviewed 187 consecutive patients who received TACE plus apatinib in our institution from January 1, 2017, to July 1, 2019. Among them, 91 patients received C-TACE-A, and 96 patients received D-TACE-A. The primary endpoint was overall survival (OS), and the secondary endpoints were progression-free survival (PFS) and the disease control rate (DCR). Propensity score matching (PSM) was used to reduce selection bias.

Results: Before PSM, the median OS was 15 months and 13 months ($P = 0.480$) in the C-TACE-A and D-TACE-A groups, respectively. The median PFS was 7 months in the C-TACE-A group and 7 months ($p = 0.677$) in the D-TACE-A group. After PSM, there was no statistically significant difference in median OS and PFS between the two groups. In the subgroup analysis, after adjusting, D-TACE-A increased the mortality risk in patients with BCLC stage C ($P = 0.011$) but lowered the tumor recurrence risk compared with C-TACE-A in patients with Child-Pugh B ($P = 0.001$) and cirrhosis ($P = 0.004$).

Conclusion: Patients with unresectable HCC treated with D-TACE-A might not show better survival outcome compared with patients treated with C-TACE-A. Advanced HCC patients without cirrhosis may receive greater survival benefits from C-TACE-A than D-TACE-A.

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Multiantenna microwave-ablation vs. singleantenna microwave-ablation as curative treatment for HCC of at least 3 cm

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Purpose: To compare CT-guided Multiantenna Microwave-Ablation (MAMWA) to Singleantenna Microwave-Ablation (SAMWA) for Microwave-Ablation (MWA) of HCC with at least 3 cm in terms of primary technical efficacy and procedural safety.

Materials and Methods: 70 Patients with HCC and a maximum tumor diameter of at least 30 mm, who underwent CT-guided stereotactic percutaneous MWA either with MAMWA or SAMWA between January 01 2017 and January 31 2021 were included. Primary endpoint was primary technical efficacy, secondary endpoints were rate of adverse events, procedure time and DLP.

Results: 33 Patients (31 male, mean age 66 years, mean max. tumor diameter 41 mm) underwent MAMWA and 37 Patients (29 male, mean age 66 years, mean max. tumor diameter 39 mm) underwent SAMWA. 30 out of 33 patients (90.9 %) in the MAMWA-group showed complete ablation and no residual vital tumor in follow-up contrast-enhanced MRI after 6 weeks. Accordingly, primary technical efficacy in the SAMWA group was 73.0 % (27 out of 37 patients). Binary logistic regression analysis showed that MAMWA was a significant positive predictor of complete ablation ($p = 0.035$, OR 5.33, 95 % CI 1.13-25.14) and maximum tumor diameter was a significant negative predictor ($p = 0.013$, OR 0.92, 95 % CI 0.86-0.98). There were no significant differences in complication rates, procedure time and DLP between the two groups.

Conclusion: For CT-guided MWA of HCC larger than 3 cm, MAMWA seems to be superior to SAMWA in terms of primary technical efficacy while maintaining a low risk of adverse events as well as comparable procedure times and DLP.

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CT-guided radiofrequency ablation of osteoid osteoma: initial experience in Georgia

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Purpose: Purpose of the study was to evaluate the efficacy of the first cases of the RFA of osteoid osteoma in Georgia.

Materials and Methods: From 2017 to 2021 years 30 patients (21 males and 9 females) with osteoid osteoma underwent CT-guided radiofrequency ablation at our department. The age range was 7-25 years, 29 of them had single lesion and 1 had two lesions. Efficacy of the procedure(s) was assessed by the evaluation of VAS score following 48 hours and 5-6 months after the procedure.

Results: 28 Patients showed complete disappearance of the pain after 48 hours following the procedure which lasted at least 6 months (till the next follow up).

In one patient the pain remained for several days after procedure. The reason for the persistence of the pain appeared to be a second nidus of the osteoid osteoma, which was not identified prior to the RFA procedure and was ablated on the next procedure. After the second RFA the patient was discharged with no pain and remains so till present.

In the second case the pain was reduced by 6 points on the VAS scale, but persisted for the several weeks during the procedure, the reason was not evident on the follow up clinical and imaging studies.

Conclusion: Our cases of the osteoid osteoma RFA is the initial experience in the country. We consider this cases successful as we achieved at least 93% efficacy which is comparable to that in the world.

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Percutaneous ablation of renal masses >4cm

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Purpose: To describe our experience with renal mass thermal ablation in lesions >4 cm.

Materials and Methods: Our IRB-approved database of percutaneous renal ablations was retrospectively reviewed for patients with tumors >4 cm but ≤7 cm in maximum diameter undergoing percutaneous renal mass ablation between February 2008 and November 2020. A total of 38 lesions were ablated percutaneously. Median patient age was 72 years. Procedural details and laboratory values were reviewed.

Results: A total of 13 renal microwave ablations and 25 cryoablations were performed percutaneously. The average maximum diameter of the masses was 4.6 cm; 4.8 cm in the microwave group and 4.5 cm in the cryoablation group. Mean Charlson comorbidity index was 7.4; 7.7 in cryoablation and 6.9 in microwave ablation. Mean probe number was 4.2 in cryoablations and 2.5 in microwave ablations. Major complication rate was 3/38, 8%; all of which were after cryoablation. Mean pre-procedure creatinine and eGFR were 1.5 and 40.3, respectively and post-procedure were 1.5 and 47.3, respectively. Median inpatient length of stay was one day. Local recurrence occurred in 3/38 cases, 8%; all three occurred in the cryoablation group. Pathology showed clear cell renal cell carcinoma (n=17), papillary renal cell carcinoma (n=5), oncocytic neoplasm (n=6), angiomyolipoma (n=4), metastatic disease (n=1) and nondiagnostic or not obtained (n=5).

Conclusion: Percutaneous thermal ablation of renal masses >4 cm using both cryoablation and microwave ablation is a safe and effective method for treatment of renal masses.

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Can microwave ablation of HCC modulate systemic inflammation and immunity? An analysis of factors affecting neutrophil-to-lymphocyte ratio and correlation with local tumor progression

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Purpose: Microwave ablation (MWA) has been shown to induce changes in the immune landscape after treatment of Hepatocellular Carcinoma (HCC). In our study, we aim at identifying which technique- and disease-related factors may predict pre- and post-treatment kinetics of neutrophil-to-lymphocyte-ratio (NLR) as well as their impact on local tumor progression (LTP).

Materials and Methods: From October 2018 to August 2020, 141 consecutive patients underwent percutaneous or intraoperative MWA of 164 HCCs with a 2450Hz/100W generator (Emprint, Medtronic). Of these, 129 nodules (112 patients) met inclusion criteria for analysis (follow-up >6 months, technique efficacy). Data were collected regarding technique-, disease- and tumor-related features, as well as neutrophil-to-lymphocyte ratio prior to therapy, upon discharge and at 1-month follow-up. Correlation analysis was performed by chi-square and point-biserial correlation. Analysis of LTP-free survival was performed through Cox regression.

Results: After a median follow-up of 22 months, LTP occurred in 28 nodules (21.7%). At univariate analysis, risk factors for LTP included subcapsular location (HR=2.52, $p=0.016$), percutaneous approach (HR=3, $p=0.038$), NLR increase at 1 month (HR=2.87, $p=0.023$). Upon multivariate analysis, NLR increase was the only independent predictor of LTPFS (HR=2.6 $p=0.049$). Factors associated to 1-month NLR increase were percutaneous approach ($p=0.013$), amount of delivered energy ($r_{pb}=-0.4$, $p=0.001$) and threshold growth ($p=0.044$).

Conclusion: Our data support the role of the balance between systemic inflammation and immunity in development of LTP after MWA, as NLR increase in response to ablation was the only independent predictive factor. Furthermore, technique-related factors seem to influence change in NLR, reinforcing the concept of immune ablation.

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Radiomics-based prediction of future portal vein tumor infiltration at initial HCC diagnosis

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Purpose: Portal vein infiltration (PVI) is a complication of HCC and leads to classification as BCLC C. TACE therapy is no longer recommended in HCC patients with PVI as systemic therapy is the treatment of choice. Our aim was to investigate whether radiomics analysis using imaging at initial diagnosis can predict occurrence of PVI in the course of disease.

Materials and Methods: Between 2010-2017, we retrospectively identified 200 patients with HCC and PVI out of our HCC cancer registry with an in-house, contrast-enhanced, multiphase CT-scan at initial diagnosis. Of these, 49 patients presented initially without CT-detectable PVI but developed it in the course of disease. Using propensity score matching accounting for size and number of lesions, growth type, arterial enhancement pattern, Child-Pugh stage, AFP levels, and subsequent therapy, we matched 49 patients with HCC who never developed PVI to those with PVI in the course of disease. We then trained a random forest classifier on this matched set.

Results: Using an 80:20 split between training and validation dataset, the sensitivity of this machine learning classifier to detect development of PVI was 90% and specificity was 70% in the validation dataset. Moreover, applied onto patients with PVI at initial diagnosis, sensitivity was 91%, and onto all patients without PVI, specificity was 73%.

Conclusion: Radiomics feature extraction has the ability to detect aggressive HCC morphology likely to result in future PVI. Thus, an additional radiomics evaluation at initial diagnosis might be a valuable tool for the interventional radiologist to identify TACE patients at risk for PVI during follow-up.

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Local progression-free and overall survival following percutaneous microwave and cryoablation of sarcoma lung metastases

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Purpose: To compare survival following percutaneous microwave and cryoablation of sarcoma lung metastases.

Materials and Methods: Bi-institutional retrospective cohort study of 27 patients (16 females; median age 64 years; ECOG performance score 0-2) who underwent 39 computed-tomography (CT)-guided ablations

(21 microwave [MWA], 18 cryoablation; median 1 session per patient, range 1-4) of 65 lung metastases (median 1 tumor per patient, range 1-12; median tumor diameter 11 mm, range 5-33 mm; 9% central location) from sarcoma between 2009-2021. We graded prospectively collected complications according to Common Terminology Criteria for Adverse Events (CTCAE) v5.0. Two radiologists independently assessed follow-up CT scans for local progression. We used the Kaplan-Meier method to estimate local progression-free survival (LPFS) and overall survival. We assessed differences in LPFS by ablation modality, tumor size, and tumor location using log-rank testing.

Results: Primary technical success was 97% for both MWA and cryoablation. Complications (CTCAE Grade ≤ 3) occurred in 17 sessions (43.6%), including 9 chest tube placements (23.1%). No complications $\geq$ Grade 4 occurred. Median follow-up was 23 months (range 1-102 months). LPFS at 2-years was 87.9% after MWA vs. 89.5% after cryoablation ($p=0.81$). LPFS for tumors with maximum diameter ≤ 1 cm was 100% at 2- years vs. 76.9% for tumors >1 cm ($p=0.03$). OS at 1-, 2-, and 3-years was 100%, 89.2%, and 82.3%, respectively.

Conclusion: High and comparable primary technical success, LPFS and OS support the use of MWA and cryoablation for the treatment of sarcoma lung metastases, especially for small tumors. Although complications were common, they were readily manageable and not life-threatening.

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Pleural products following microwave-ablation of liver malignancies

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Purpose: To determine the incidence of pleural products after microwave-ablation (MWA) of liver malignancies and to identify risk factors for the occurrence of pleural products after MWA.

Materials and Methods: A total of 765 tumor lesions in all liver segments in 509 consecutive ablation procedures (mean patient age 64 years, ranging from 15 to 85 years, 82.9 % male) from January 01 2011 to December 31 2020 were included in the study.

Results: New or progredient pleural products occurred in 229 cases (45.0 %), with 77 cases (15.1 %) showing a pleural product before MWA. Mean diameter of the pleural product was 0.68 cm, ranging from 0.2 cm to 12.3 cm (SD 1.25 cm). In 16 cases (3.2 %), treatment of the pleural product was necessary (11 chest tubes, 3 pleural punctures, 2 times additional surgery). 52 other complications (10.2 %) occurred. Mean proximity of the ablated tumor lesions to the diaphragm was 1.72 cm, ranging from 0.00 cm to 11.15 cm (SD 1.95 cm). Binary logistic regression analysis identified proximity of the tumor lesion to the diaphragm of less than 1.5 cm as highly significant positive predictor for the occurrence of a pleural product following MWA ($p < 0.001$, OR 3.32, 95 % CI 2.292-4.808).

Conclusion: Pleural products appear to occur frequently after MWA of liver tumors but relatively rarely require therapy. Proximity of the tumor lesion to the diaphragm of less than 1.5 cm seems to be a positive predictor for the occurrence of a pleural product following MWA.

P-399

Segmental Yttrium-90 transarterial radioembolization with resin microspheres is safe and effective for localized hepatocellular carcinoma

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Purpose: Several studies have reported improved safety and efficacy of glass yttrium-90 (Y90) transarterial radioembolization (TARE) for localized hepatocellular carcinoma (HCC) when delivered segmentally. We sought to characterize segmental TARE with resin radiomicrospheres.

Materials and Methods: This retrospective study included patients with HCC who received resin Y90-TARE to ≤ 2 segments over 8.6 years. Baseline and follow-up imaging RECIST 1.1 and mRECIST assessments were performed by 3 fellowship trained abdominal radiologists. Kaplan-Meier analysis was used to evaluate cumulative imaging outcomes. Patients were censored at death, loss to follow-up, transplantation, or upon additional oncologic treatment.

Results: Twenty-six patients were treated, with median age of 68 years. Twenty-two patients had documented Child A (17) or B (5) cirrhosis, mostly from hepatitis C infection (13) or alcohol (6). Median tumor size was 2.9 cm. Stasis was reached in 19 of 32 infusions. Only one CTCAE grade 2 and no grade 3 or higher adverse events occurred within 30 days of treatment. Median follow-up was 10.9 months. Twenty-one patients (81%) experienced mRECIST objective response, and 16 (62%) had complete response (CR). Sixteen patients (62%) experienced RECIST objective response, and 2 (8%) had CR. Median times to mRECIST objective and complete responses were 1.8 and 3.2 months. Median time to RECIST response was 4.8 months. Median time to progression was 20 months.

Conclusion: Segmental Y90-TARE with resin microspheres for localized HCC is safe and yields response rates similar to those reported with glass microspheres.

P-400

Transradial versus transfemoral arterial access in Yttrium-90 microspheres radioembolization for hepatocellular carcinoma

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Purpose: Transradial access (TRA) has become more popular in body intervention procedures, but has not been ubiquitously adapted. This study was designed to compare transradial to transfemoral access (TFA) in hepatocellular carcinoma (HCC) patients who underwent Yttrium-90 labeled microspheres radioembolization.

Materials and Methods: A total of 244 hepatocellular carcinoma patients underwent 337 radioembolization procedures at our institute from May 2014 to May 2020. The transradial access group included 188 patients (252 procedures) while the transfemoral access group had 63 patients (85 procedures). The recovery time, fluoroscopy time, contrast volume, peak radiation dose, and equipment cost for each procedure were all evaluated for statistical differences between the two groups.

Results: TRA reported significantly shorter recovery times than TFA (111.7 min vs. 165.6 min, $P < 0.01$). Similarly, TRA presented significantly shorter fluoroscopy times (16.1 min vs. 19.7 min, $P > 0.05$) versus TFA. TRA also showed significantly lower contrast volume usage compared to TFA (69.2 ml vs. 75.2 ml, $P < 0.05$). No statistical difference was present in the overall radiation exposure between the two groups (880.2 mGy vs. 995.1 mGy, $P > 0.05$). The average procedural equipment cost was significantly lower for TRA versus TFA (\$1632.33 vs. \$2013.12, $P < 0.01$). Post-procedure recovery evaluation showed no major complications in TRA while TFA reported one pseudoaneurysm.

Conclusion: With respect to many pertinent parameters, TRA was evaluated as being more advantageous than TFA. The results of this study suggest that TRA should be considered more often, whenever feasible, as an option in the Yttrium-90 treatment of HCC patients.

P-401

Responses and predictive factors of radioembolization for hepatocellular carcinoma: a large single center series

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Purpose: To evaluate responses and tumor features affecting objective response rate to radioembolization in patient with hepatocellular carcinoma (HCC).

Materials and Methods: From September 2009 to July 2019, 217 consecutive patients who underwent ⁹⁰Y radioembolization for treatment-naïve HCC in a single tertiary center were retrospectively reviewed. Tumor response at 3 months and 6 months after treatment was determined per modified Response Evaluation Criteria In Solid Tumors. Progression-free survival (PFS) was analyzed using Kaplan-Meier Method. Tumor factors affecting objective response (complete response (CR) or partial response (PR)) rate including size, margin (encapsulated or infiltrative), location (right, central, or left), multiplicity, lobar distribution (unilobar or bilobar), and grade of portal vein invasion (none/branch/major) were evaluated using logistic regression.

Results: Mean age of the patients was 62.6 years and 41 females (18.9%) were included. 30.9% were BCLC-A, 30.0% BCLC-B, and 39.2% BCLC-C. 29% had portal vein invasion. Objective response rate was 44.4% (CR, 12.0%; PR, 32.4%) at 3 months and 52.4% (CR, 16.6%; PR, 25.8%) at 6 months. PFS rate was 60.8% at 6 months and median PFS was 8.5 months. Larger tumor size, infiltrative margin, bilobar distribution and portal vein invasion were predictive factors suggesting poor outcome.

Conclusion: Characteristics of the tumor including size, margin, distribution and portal vein invasion can affect response after radioembolization. These criteria could be taken into consideration to improve the selection of patients for radioembolization.

P-402

Transradial versus transfemoral arterial access in DEB-TACE for hepatocellular carcinoma: analysis of radiographic parameters

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Purpose: Transradial access (TRA) has become more popular in body intervention procedures, but has not been ubiquitously adapted. This study was designed to compare transradial to transfemoral access (TFA) in hepatocellular carcinoma (HCC) patients who underwent Drug Eluting Bead Transarterial Chemoembolization (DEB-TACE).

Materials and Methods: In this study, 146 DEB-TACE procedures conducted at our institute from June 2015- May 2020 were retrospectively analyzed. The TRA group included 90 procedures while the TFA group included 56. Peak skin dose (PSD), fluoroscopy time, administered contrast volume, total procedure time and equipment cost data for each procedure were evaluated for statistical differences between the two groups.

Results: All cases were technically successful without major complications. The average PSD presented with no statistical difference between TRA and TFA (1578.9 mGy vs. 1383.0 mGy, $P > 0.05$). The average fluoroscopy time also presented with no statistical difference between TRA and TFA (26.8 min vs. 24.8 min, $P > 0.05$). The average administered contrast volume was significantly higher for TRA versus TFA (162.6 ml vs. 113.1 ml, $P < 0.05$). Similarly, TRA also reported a significantly higher total procedure time versus TFA (139.7 min vs. 106.1 min, $P < 0.01$). However, TRA amounted to a significantly less expensive average procedural equipment cost versus TFA (\$6666.9 vs. \$6393.9, $P < 0.01$).

Conclusion: With respect to many pertinent parameters, TRA and TFA DEB-TACE had comparable results in this study. Notably, TRA was far less expensive than TFA. Given the increased patient preference for TRA as described in literature, this study's findings further bolster the rationale to utilize TRA more often, whenever viable, in the DEB-TACE treatment of HCC patients.

P-403

Latest-generation cone-beam computed tomography: comparison with multi-detector computed tomography for post-embolization imaging in hepatic transarterial chemoembolization

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Purpose: To evaluate image quality, radiation dose and tumor volumetry of intra-procedural cone-beam computed tomography (CBCT) compared with postprocedural multidetector computed tomography (MDCT) in patients undergoing hepatic conventional transarterial chemoembolization (cTACE).

Materials and Methods: 114 patients (64 female; mean age, 57 ± 14 years), who had undergone cTACE receiving CBCT and MDCT were retrospectively enrolled. Qualitative image quality (IQ) was compared using 4-point Likert scales; Lesion to liver contrast (LLC) and contrast-to-noise-ratio (CNR) was compared for quantitative evaluation of IQ. Tumor volumes were measured semi-automatically and compared with MRI. Effective doses were measured using an anthropomorphic phantom.

Results: Qualitative IQ of CBCT was rated comparable to MDCT with a mean score of 3.1 ± 0.4 compared to 2.8 ± 0.7 (p=0.37). Evaluation of LLC showed significant differences between CBCT and MDCT (mean scores, 3.2 ± 0.7 vs 2.8 ± 0.4; p<0.001). CNR evaluation showed significant higher values for CBCT compared to MDCT (3.65 ± 1.3 vs. 3.11 ± 1.8, p<0.001). No significant differences were found regarding tumor volumetry (mean volumes: CBCT, 27.0 ± 17.4 mm³; MDCT: 26.8 ± 16.0 mm³; p=0.66) in comparison to T2-weighted MRI (25.92 ± 17.62 mm³). Effective doses were 3.2 ± 0.61 mSv (CBCT) and 2.5 ± 0.33 mSv (MDCT) (p<0.001).

Conclusion: Latest-generation intraprocedural CBCT enables superior assessment of Lipiodol distribution compared to MDCT and allows for robust volumetric tumor measurements and immediate complication control. Therefore, it may improve patient safety and outcome as well as clinical workflow compared to postprocedural MDCT in hepatic cTACE.

P-404

Abscopal effect following transarterial radioembolization: a systematic review

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Purpose: The abscopal effect is gaining importance in modern oncology as the link between local irradiation and the immune-mediated systemic anti-tumor effect is becoming more apparent. The study aims to systematically review the literature published on the abscopal effect occurring as a consequence of Transarterial radioembolization.

Materials and Methods: A systematic review was performed following PRISMA guidelines till August 2020. The search strategy was based on the terms "abscopal effect," "interventional radiotherapy," "radioembolization," and "TARE." The primary outcome of the review was clinical or radiological evidence of the abscopal effect.

Results: Two case reports and one retrospective chart review were included in the analysis. 89 patients were included across three studies, out of which 3 (3.06%) showed confirmed presence of the abscopal effect. Patient demographics included two females (66.67%), one male (33.33%), the mean age of 55.66 years (median 44 years). Primary tumor was in the breast for two patients (66.67%), and lung for one patient (33.33%). All three patients underwent TARE with Y90 microspheres (SIRspheres), two patients underwent TARE to the right lobe of the liver, and one patient underwent TARE of both the lobes, the median radiation dose was 1.44 GBq. The median time for the abscopal effect was 43 days, and for follow-up was 8 months. Sites of abscopal effect in these cases were extrahepatic metastasis (2/3; 66.67%), and liver metastases (2/3; 66.67%).

Conclusion: Abscopal effect is a rare phenomenon that was identified in three immunotherapy naïve cases that underwent radioembolization. The synergy between radiotherapy/ immunotherapy offers a chance to develop new therapies.

P-405

Ablative therapies versus partial nephrectomy for small renal masses: a systematic review and meta-analysis of observational studies

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Purpose: Management of small renal masses (SRMs) has been constantly debated. This review aims to compare oncological outcomes in patients undergoing ablative therapies (AT) vs partial nephrectomy (PN) for solitary T1a or T1b SRMs.

Materials and Methods: Medline, EMBASE, Cochrane CENTRAL and conference proceedings were searched on the 15th July 2020 for comparative studies respective to our research question. The Cochrane RoB 2.0, ROBINS-I tool and the GRADE approach were used to assess any risk of biases and certainty of evidence in the included studies. The review is registered on PROSPERO (CRD42020199099).

Results: 1,748 records were retrieved. 32 observational studies and 1 RCT integrating 74,946 patients were included. Serious confounding bias were found in included studies as patients undergoing AT patients are significantly older than PN patients (MD 5.70, 95% CI 3.83- 7.58). In T1a patients, AT patients have significantly worse overall survival (HR 1.64, 95% CI 1.39-1.95). Local recurrence-free survival is similar with PN in patients with longer than five-years follow up (HR 1.54, 95%CI 0.88-2.71). AT Patients also have similar cancer-specific survival (CSS), metastatic-free, disease-free survival; significantly fewer post-operative complications (RR 0.72, 95%CI 0.55-0.94) and smaller decline in estimated glomerular filtration rate post-operatively (MD: -7.42, 95%CI -13.1- -1.70) than those undergoing PN. In T1b patients, while CSS was found to be similar between the two groups of treatments, evidence contradicted for other oncological outcomes.

Conclusion: AT has similar oncological outcomes and superior perioperative outcomes compared to PN. More long-term high-quality PSM cohorts are needed to confirm the superior profile of AT.

P-406

Same day resin-based Y90 radioembolization with SPECT/CT: an opportunity to improve care for patients with liver cancer during the COVID-19 pandemic and beyond

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Purpose: The COVID-19 pandemic has made it more challenging for patients to undergo Y-90 radioembolization (RE). Same Day Y-90 RE provides an opportunity to minimize logistical challenges and infection risk associated with COVID-19, thus improving patient access. We describe the use of same day Y-90 RE with routine pre- and post-treatment SPECT/CT in order to optimize therapy.

Materials and Methods: All patients were selected for Y-90 RE through a multidisciplinary tumor board, and were screened and tested for COVID-19 infection per institutional protocol. A same day procedure was developed, consisting of angiography, imaging, and Y-90 resin particle delivery. Routine SPECT/CT after Tc-99m-MAA administration was performed for assessment of arterial supply, personalized dosimetry, and extrahepatic activity. Y-90 bremsstrahlung SPECT/CT was performed for confirmation of particle delivery, by utilization of energy windowing to limit signal from previously administered Tc-99m-MAA particles.

Results: A total of 14 patients underwent same day Y-90 RE between March and June 2020. Mean lung shunt fraction was 6.13% (range 3.5-13.1%). Y-90 RE was performed for a single lesion in 7 patients, while the remaining 7 patients had treatment of multifocal lesions. The largest lesion measured 8.3 cm. All patients tolerated the procedure well and were discharged the same day.

Conclusion: Same day Y-90 RE is feasible, providing an opportunity to increase convenience while mitigating infection risk and logistical challenges associated with the COVID-19 pandemic. We recommend consideration of SPECT/CT for personalized dosimetry, especially among patients with complex malignancies, for the potential to improve outcomes and eligibility of patients to undergo same day Y-90 RE.

P-407

Role of EBUS TBNA in mediastinal staging of NSCLC patients- experience of a tertiary care centre

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Purpose: Primary objective- To evaluate the diagnostic yield of EBUS-TBNA compared to the gold standard of mediastinoscopy. Secondary objective- To correlate endosonographic lymph node characteristics with histopathology and/or cytology reports.

Materials and Methods: A retrospective study of data of patients with NSCLC who underwent EBUS TBNA from January 2017 to December 2019 at TMH was carried out.

Patient inclusion criteria - EBUS TBNA performed in patients with biopsy proven, potentially resectable NSCLC. No distant metastases confirmed with PET/CT and MRI Brain.

Data analysed- EBUS TBNA on site reports, final cytopathology reports, mediastinoscopy/VATS (surgical mediastinal sampling). EBUS TBNA reports were compared to surgical mediastinal sampling reports to assess the diagnostic performance. Endosonographic features of the nodes were also assessed and compared to the final HPR/cytology reports to see if any significant correlation exists.

Statistical analysis

The EBUS-TBNA performance in diagnosing malignancy was calculated according to standard definitions of sensitivity, specificity, PPV and NPV. Chi-square test and Fischer exact test were used to examine the association of two or more categorical variables (such as node size with cytology). P value <0.05 was considered statistically significant.

Results: 200 patients had undergone EBUS-TBNA. 39 were female, 161 were male. Median age 59 years. Sensitivity of EBUS TBNA was 82.6%, specificity 96.18%, NPV 91.3%, PPV 91.94% and accuracy 91.5%. Significant correlation (p value < 0.05) was found between endosonographic features lymph node cytopathology.

Conclusion: EBUS TBNA is a safe procedure which is complementary and not competitive with more invasive procedures like mediastinoscopy. Endosonographic features have a significant correlation with lymph node cytopathology.

P-408

Safety and efficacy of percutaneous radiofrequency ablation for small juxtacardiac liver tumor by using expandable multitined electrodes

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Purpose: To evaluate the safety and efficacy of percutaneous radiofrequency ablation (RFA) for small juxtacardiac (JC) liver tumor by using expandable multitined electrodes.

Materials and Methods: Electronic records were searched for hepatic RFA. From January 2006 to December 2016, this study retrospectively analyzed 259 small liver tumors (size <3 cm) including both primary and metastatic tumors which were treated by RFA using expandable electrodes with 52 JC liver tumors (the distance between tumor margin and cardiac border <10 mm) and 207 non-juxtacardiac (NJC) liver tumors (the distance between tumor margin and cardiac border >10 mm) in 234 consecutive patients (163 men, 71 women; mean age: 63.2 ± 9.8 years of age). The rate of complication, technical success, and local tumor recurrence were evaluated.

Results: Median length of follow-up was 37.22 months (range 0.03-138.61 months). No significant difference was observed in the mean tumor's diameter, rate of major complications, technical success and local tumor recurrence between JC and NJC liver tumors (16.6 ± 5.5 cm vs. 17.1 ± 5.9 cm, p=0.538; 5.8% vs. 2.9%, p=0.390; 86.3% vs. 89.3%, p=0.538; 19.0% vs. 27.5%, p=0.259, respectively). No significant difference of local recurrence-free survival rate was observed with p=0.358. Hemopericardium was observed in 2 patients with JC liver tumors which was not found in the any patients with NJC liver tumors.

Conclusion: Using of expandable multitined electrodes for percutaneous RFA of small JC liver tumors has no significant difference in the rate of complications and local tumor control as compared with NJC liver tumors.

P-409

High intensity focused ultrasound (HIFU) for treatment patients with locally-advanced high risk prostate cancer: 12 years follow-up

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Purpose: The aim of our study was to investigate ultrasound ablation for the treatment of patients with locally-advanced high risk prostate cancer (PC). High-Intensity Focused Ultrasound showed a successful treatment

for locally PC. Here we explored the effectiveness of the HIFU treatment for locally-advanced high risk prostate cancer.

Materials and Methods: 143 patients with locally-advanced prostate cancer were treated in our center by HIFU between September 2007 and October 2016. An Ethical Committee approval has been obtained. Every patient was available for oncology follow-up. The median age was 68.2 (65-81) years, mean prostate volume – 53.9 (18-73) cc., stage T3N0M0, Glisson score 7-9, PSA before treatment 27.5 (10.2-81.5) ng/ml. Mean follow-up time were 108 months (60-150).

Results: The median PSA level 12 months after HIFU treatment were 1.5 (0-23.4) ng/ml, at 84 months after HIFU treatment – 8.1 (0.9-33.7) ng/ml. 12-year overall survival rate were 80.2 %. The 12-year follow-up showed that patients with locally-advanced PC had 32.8 % progression.

Conclusion: HIFU therapy showed good results of treatment for locally-advanced prostate cancer. 12-years disease-free survival rates were 67.2 %.

P-410

To evaluate the role of interventional radiology (IR) in the management of post pancreatectomy complications in terms of preventing relook laparotomy and 90 day mortality rate

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Purpose: To evaluate the role of interventional radiology (IR) in the management of post pancreatectomy complications in terms of preventing relook laparotomy and 90 day mortality rates.

Materials and Methods: DESIGN: An audit of prospective maintained electronic medical data.

Duration of study: January 2012 -December 2018. All patients who required image guided interventions for the management of post pancreatectomy complications will be identified and reviewed.

Results: 758 patients underwent pancreatic surgeries during the 5 year study period of which 206 patients (27.17%) developed post-pancreatectomy complications. Of the 758 patients reviewed, post pancreatectomy haemorrhage was seen in 6% (46/758), intra-abdominal collection in 22.5% (173/758) and biliary complications (leak/stricture) in 9.7% (31/758). Primary image guided intervention was performed in 43.3% with PPH, 85% with intra-abdominal collection and in 58% with biliary complications. 90 day mortality in patients with PPH is 17.39%, intra-abdominal collection is 8.1% and biliary complications is 25.8%. 90 day mortality in patients who underwent image guided intervention for PPH is 38.46%, intra-abdominal collection is 6.12% and for biliary complications is 27.78%. IR played a role in 53.85% of patients with PPH, 91.84% of patients with intra-abdominal collection and 88.89% of patients with biliary complications in preventing re-exploration.

Conclusion: IR procedures are safe and effective and the synergistic role of interventional radiologist provides minimally invasive approach in the management of post pancreatectomy complications while reducing the need for re-operation thereby reducing recovery time and preventing morbidity associated with re-look laparotomy.

P-411

MRI-guided laser ablation short term follow-up of low grade unifocal prostate cancer

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Purpose: The aim of this study was to evaluate the technical feasibility, safety and effectiveness at 12 months follow-up of MRI-guided laser

ablation (LA) as a treatment option in patients with focal prostate cancer in active surveillance.

Materials and Methods: 5 patients (mean age 69.9, range 54-85) with histopathologically proven unifocal low grade prostate cancer ≤ 2 cm were treated with LA performed under 1.5T MRI guidance via Dyna-CAD system, through 21G needle introducers and local anesthesia. Ablations were performed using diode laser operating at 1064 nm, with 2 fibers and pull back technique according to tumor size. Patients follow-up consisted in clinical examination, PSA level measurement and prostate 3T mpMRI at 1, 3, 6 and 12 months and in bore MRI guided biopsy at 12 months. Primary endpoints were the technical success and safety of MRI-guided LA. Secondary endpoints were the evaluation of clinical and MRI findings during follow-up.

Results: All patients were dismissed on the same day of treatment. The IPSS and SHIM did not significantly change after treatment. Mean operation time was 38.2 minutes (range 32.6-42.5), mean ablation time was 21.7 minutes (range 18.3-26.8), mean energy deployed was 3606 J (range 3212-3804), mean hospital stay 246 minutes (range 130-340) and mean catheterization time 261 minutes (range 120-340). At 1-, 3-, 6- and 12-months follow-up, prostate mpMRI showed neither evidence of local residual disease nor recurrence. MRI guided biopsies were negative for prostate cancer.

Conclusion: MRI-guided LA is feasible and safe in the treatment of focal low grade prostate cancer, showing promising results at 1 year.

P-412

Role of transarterial embolisation in neuroendocrine liver metastases: retrospective analysis of factors affecting outcomes

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Purpose: To evaluate safety and efficacy of transarterial embolisation (TAE) for liver neuroendocrine tumour (NET) metastases and to analyse factors affecting outcomes.

Materials and Methods: A retrospective study (July-2003 to November-2019) was conducted on TAEs performed for NET liver metastases. Patient demographics, tumour parameters, metabolic markers, embolisation techniques, complications, symptom response and survival data were analysed using IBM®SPSS®26.0. Correlations between symptom improvement and clinical/procedural factors were examined. Time-to-recurrence (TTR), Symptom Progression Free Survival (SPFS) and Overall Survival (OS) analyses, comparing prognostic factors were performed using Kaplan-Meier with logrank test and Cox-regression-hazard-model.

Results: Ninety-Eight TAEs were performed on 66 patients. Embosphere® microspheres were the commonest embolisation agent used. The median hospital-stay was 6 days (0-94 days). Carcinoid crisis occurred in 22% of cases in early post-embolisation period. Symptom improvement was reported after 57.1% of TAEs. Symptoms recurred in 51% of cases (Median TTR: 773 days post-TAE). Estimated 1-year, 3-year and 5-year SPFS were 51.5%, 25.3% and 15.5% respectively. Difference between pre & post-TAE 5-HIAA levels and mRECIST response significantly correlate with symptom improvement. Minimum embolisation particle size and carcinoid crisis were significant factors affecting TTR at univariate analysis. Carcinoid crisis and mRECIST response were significant factors affecting SPFS during multivariate analysis.

Conclusion: Transarterial embolisation of NET liver metastases offers good carcinoid symptom-control and acceptable safety profile. Post-TAE carcinoid crisis and mRECIST response correlates with symptomatic outcomes. Further controlled studies will allow evaluation of individual factors on post-TAE outcomes.

P-413

Evaluation of the accuracy of a virtual parenchymal perfusion algorithm applied in the planning of transarterial radioembolization for hepatocellular carcinoma

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Purpose: To evaluate anatomical consistency and volumetric precision of a cone-beam computed tomography-based virtual parenchymal perfusion (VPP) algorithm used for the planning of trans-arterial radioembolization (TARE).

Materials and Methods: We included all patients treated by TARE for hepatocellular carcinoma (HCC) between September 2017 and December 2019. Work-up procedure included at least one nonselective dual-phase cone-beam-computed tomography (DP-CBCT). ^{99m}Tc macro aggregated albumin particles (^{99m}Tc-MAA) uptake on single-photon-emission computed tomography (SPECT) was considered as the ground truth for the evaluation. Semi-quantitative evaluation was based on the ranking of consistency of both hepatic territories and portal vein tumoral involvement. Inter-reader agreement was evaluated using kappa-coefficient. For quantitative evaluation, volume-based metrics (absolute volume error and the Pearson correlation between the two volumes) were computed after extraction of virtually enhanced territory meshes.

Results: Thirty-three patients were included in whom 52 CBCT were performed. For the semi-quantitative evaluation of the anatomical consistency, there was a good overlap between the actual ^{99m}Tc-MAA uptake and the virtual enhancement in 73.1% and 75% of cases. The kappa coefficient was 0.86. For portal vein involvement, there was a good overlap of 58.3% and 66.7% for the two readers, respectively, with a kappa coefficient of 0.82. The quantitative evaluation of the volumetric precision showed a good correlation between volumes of virtual and actual enhancements (volume error at 0.46±0.78 [0.01–3.55], R² Pearson factor at 0.75, p-value < 0.01).

Conclusion: VPP algorithm is reliable and accurate in the evaluation of vascular territories targeting during TARE. The evaluation of portal vein tumoral involvement coverage is however less precise.

P-414

Fiscal effect of growth of interventional oncology in a tertiary center in the year of the pandemic

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Purpose: To evaluate growth on IO in a tertiary academic hospital center in a period of increased marketing and brand recognition amid the pandemic.

Materials and Methods: Volumes in IO, including thermal ablation, radioembolization, chemoembolization, venous access in cancer patients are compared from fiscal year 2019 (July 2018-June 2019) and 2020 (July 2019-June 2020). Baseline interventional procedures affected by the pandemic are also reviewed. Fiscal comparisons and technical strategic challenges are addressed.

Results: From fiscal year 2019 to 2020, there was a 60 percent increase in volume of radioembolization, 80% increase in overall thermal ablation (different organs including liver, kidney, bone), while other IR procedures decreased significantly due to the effect of the pandemic. This increase in volume and radioembolization and thermal ablation in face of decreasing overall IR volume resulted in a 7.3-million-dollar surplus in overall revenue. The challenge to the increase in volumes in these types of complex procedures include increase in room time and more intense support from staff, resulting in more overtime, and more expertise training

for staff. There was also significant increase in the use of CT-hybrid room and cone beam CT.

Conclusion: Increase in IO procedures can significantly increase revenue despite a decrease in other IR volumes. However, this will require more staff training and more staffing as a result.

P-415

MR-Guided cryoablation of low to intermediate grade primary prostate adenocarcinoma

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Purpose: To demonstrate the short term effectiveness and feasibility of MR-guided cryoablation for treatment of primary adenocarcinoma of the prostate with 2 year follow-up.

Materials and Methods: This is an IRB approved retrospective review of newly diagnosed prostate cancer patients treated from January 2018 to December 2018 with MRI guided cryoablation of localized intermediate and low grade prostate cancer. In these 12 patients, index lesions ranged from 7-21mm (mean 14mm) in maximum dimension. PSA ranged from 2-16.7ng/mL. Three patients had Grade group 1 (3+3) lesions, 8 patients Grade group 2 (3+4), and 1 patient Grade group 3 (4+3). A MRI compatible urethral warming catheter (Boston Scientific, Minneapolis, MN) was used to prevent urethral thermal damage during the ablation.

Results: All 12 patients with primary prostate cancer were successfully treated with MR-guided cryoablation. Over 2 year follow-up, 2 patients developed new cancer in the remaining prostate (out of field) at 13 and 14 months post-ablation. Both were treated with whole gland radiation. Two patients had worsening erectile function subsequently treated with sildenafil. Two patients had no decrease in PSA but no evidence of residual tumor on MRI with one patient undergoing a negative prostate biopsy and the other patient scheduled for biopsy. The pre-treatment PSA average was 7.7ng/mL and after treatment PSA average remained < 3.5ng/mL. No change in urinary continence was seen patients.

Conclusion: This small series of MR-guided cryoablation for primary prostate adenocarcinoma demonstrates feasibility, short term efficacy and safety of this approach for management of localized prostate adenocarcinoma.

P-416

Retrospective comparison between percutaneous microwave ablation and cryoablation for the treatment of primary and metastatic tumors in the lungs

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Purpose: Evaluate retrospectively local tumor control, time to tumor progression, and survival rates among patients with primary and metastatic tumors in the lungs, who have undergone ablation therapy with microwave ablation (MCW) and cryoablation (CRYO).

Materials and Methods: In 30 patients, 42 lesions (mean size: 15.4 mm) were treated using MCW (35 nodules) or CRYO (7 nodules), from October 2015 to September 2020. 33 metastases from colorectal cancer, and 9 from other strains. Survival rates were calculated from the time of the first ablation session, with the use of Kaplan-Meier and log-rank tests.

Results: Local tumor control at 6 months was achieved in 32 of 35 lesions (91.4%) treated with microwave, 7 of 7 lesions (100%) treated with cryoablation. The mean follow-up for the microwave group was 28.10 months

and 6.8 months for cryoablation, so we could not compare the 2 groups in an extended time, however local tumor control at 12 months was 82.8 % (29 of 35) in lesions treated with MCW.

Technical success was achieved in 34 of 35 procedures (97.1%) treated with MCW and 7 of 7 (100%) treated with CRYO.

The overall survival in the MCW group was 79% (19 of 24) and 85 % (6 of 7) in the CRYO group.

Conclusion: MWA and CRYO can be used as therapeutic options for primary and lung metastasis. Although we could not find statistically significant differences in local tumor control at 6 months, we need further follow-up to conclude the differences and advantages between these two approaches.

P-417

Combined embolisation and microwave ablation for T1b renal masses: preliminary experience

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Purpose: To evaluate the safety, efficacy and potential role of combined treatment of RCC > 4 cm (T1b) through renal artery embolisation (RAE) and microwave ablation (MWA) in patients unfit for or refusing surgery.

Materials and Methods: From August 2020 five patients (aged 32-83 years; mean 65,6 years) underwent to combined procedure for T1b renal mass (maximum diameter 41 – 55 mm; mean 45,8 mm); selection criteria were surgery refusal (1 patient), surgery unfitness (2 patients) and solitary kidney (2 patients). Each procedure was performed in single-session; after femoral 4F access, renal arteriography and embolisation of each tumour vessels were performed using as embolic material NBCA-MS (Glubran 2) with high-dilution rate. Later, CT-guided biopsy and MWA with 2,450-MHz system (Emprint) were done using spontaneous lesion hyperdensity as target. Contrast-enhanced CT with triphasic protocol was used to evaluate final result. Variables related to patients (age, sex, comorbidities), lesions (size, vascularization, necrosis, RENAL score) and procedures (number of feeding vessels, patient position on CT, size of needle and number of samples for biopsy, number of placements for MWA, procedure time and complications) were assessed.

Results: Each procedure lasted less than 5 hours (mean length 3.5 hours), with a mean of two embolized vessels and without non-target embolisation or access complications. Biopsy before ablation were successful in all cases; a mean of 2.5 antenna placement were needed during MWA. One bleeding represented the only complication, due to incomplete pre-MWA embolisation. Mean hospital stay was 3 days.

Conclusion: Combined embolisation and MWA is a safe and possible alternative for T1b renal mass.

P-418

Transcatheter arterial embolization of hypervascular bone metastases prior to surgical management: predictors of intraoperative blood loss

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Purpose: To investigate the effectiveness of preoperative transarterial embolization (TAE) of hypervascular upper/lower extremity and pelvic bone metastases, and factors predictive for operative bleeding.

Materials and Methods: Research Ethics Board approved this single-centre retrospective study of patients who had TAE prior to operative management of osseous metastases from 1999-2019. Patients who had TAE of metastases within the upper/lower extremity or pelvic bones within 24-hours of surgery were included. Angiographic and patient

records were reviewed. Technical success was defined as >70% reduction of tumor blush. Clinical outcomes were determined by the effect on intraoperative estimated blood loss (EBL) and transfusion requirements.

Results: 77 patients (59 male, 18 female; mean age 63.5±10.4 years) underwent pre-operative TAE for osseous metastases. The primary malignancies were renal cell carcinoma (74%), thyroid carcinoma (14.3%), and other (11.7%). Tumor location included upper extremity (36.4%), lower extremity (44.2%), and pelvis (11.7%). Technical success was achieved in 88.3% of cases. Regression analysis identified number of vials of polyvinyl alcohol particles (p<0.05) and number of arteries embolized (p<0.05) as being predictive of EBL. Analysis of variance identified tumors located in the pelvic bones to be at risk of higher intraoperative blood loss (p<0.05). Mean EBL for pelvic metastases was 1793mL versus 568mL for extremity metastases; 60% of patients with pelvic metastases required blood transfusion compared to 22% with extremity metastases (p<0.05).

Conclusion: Transarterial embolization of upper/lower extremity hypervascular bone metastases is beneficial for minimising intraoperative blood loss. Pelvic location of metastases, however, is associated with a higher risk of intraoperative blood loss despite TAE.

P-419

Role of locoregional treatments in patients with kidney graft neoplasm (< 4 cm): literature review and results of a multidisciplinary consensus conference

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Purpose: Kidney transplanted patients undergo strict follow-up which allows the early detection of graft neoplasms. In these patients, "nephron-sparing" nephrectomy represents the treatment of choice. However, some patients are not suitable for surgery (age, comorbidities, renal function, tumor site/histology). Locoregional treatments can represent a valid alternative in terms of efficacy and safety in these patients to preserve graft function and avoid dialysis. We report the results of a literature review and of a Consensus Conference.

Materials and Methods: In January 2020, a Multidisciplinary Consensus Conference on kidney transplant was held. It was divided in five phases: systematic literature review, expert opinion evaluation, consensus discussion, voting, results. Systematic literature review was performed on the main databases (PUBMED, Web of Science, Scopus) according to the PRISM guidelines. A panel of experts voted the affirmation on the role of locoregional treatments as an alternative to surgery using a scale ranging from 1 -strongly disagree- to 10 -strongly agree-. The vote was considered "strong" if casted by more than 75% of the voting.

Results: Among 331 literature articles on the topic, 21 were chosen which highlighted how locoregional treatments have good disease control without impairment of renal function. 85.7% of the voting gave a vote ≥7 to the affirmation.

Conclusion: Consensus Conference results showed a strong agreement on the use of locoregional treatments as an alternative to partial nephrectomy, in accordance to the systematic literature review results. Safety and efficacy represent the main advantages of locoregional treatment for kidney graft neoplasms.

P-420

Retrospective review of percutaneous thermal ablation for T1a renal tumours: analysis of factors influencing outcomes

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Purpose: Percutaneous thermal ablation is an established therapeutic modality in the management of T1a renal tumours. We performed this

study to evaluate safety profile and therapeutic outcomes of percutaneous thermal ablation service, especially for T1a renal tumours, at our tertiary care institute.

Materials and Methods: A retrospective study (May 2006 to April 2020) was performed of percutaneous image guided thermal ablations for T1a renal tumours. Data on patients' demographic, tumour characteristics, ablation techniques, complications, tumour response and survival outcomes were analysed using IBM®SPSS®26.0. Time-to-recurrence (TTR), local-recurrence-free survival (LRFS) and overall survival (OS) were calculated using Kaplan Meier estimator.

Results: Eighty-two patients underwent ablation for T1a renal tumours during the study period. The mean maximum tumour dimension was 29.5mm. Ninety-two index lesions were ablated. 7 index lesions were ablated more than once. A total of 101 renal ablations (50 cryoablations, 25 Radiofrequency and 25 Microwave) were attempted, with overall technical success rate of 99% (100/101).

Primary and secondary effectiveness of ablation was 93.5% and 98.9% respectively. Tumour recurrence occurred in 7 cases in the study period. The 1, 3 and 5 year OS were 98.7%, 88.9% and 80.9%. The estimated 1, 3 and 5 year LRFS were 98.8%, 85.4% and 72.6% respectively. No significant difference was seen in TTR ($p=0.974$) or LRFS ($p=0.820$) among different ablation modalities.

Conclusion: Percutaneous Image-guided thermal ablation is a safe and effective treatment option for T1a renal tumours, offering low recurrence rates and good survival rates, comparable to more radical surgical treatments.

P-421

Comparative assessment of Y90 radioembolization for primary and metastatic tumors within the liver: results from the RESIN (Radiation-Emitting SIR-spheres in Non-resectable liver tumors) registry

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Purpose: To systematically compare the utilization pattern, safety and oncological outcomes between metastatic colorectal cancer (mCRC), metastatic non-CRC (m-nonCRC) and hepatocellular carcinoma (HCC).

Materials and Methods: 1445 patients with HCC, mCRC or m-nonCRC were treated with Y90 radioembolization at 42 United States hospitals between February 2016 and March 2020. Patient demographics, tumor characteristics, prior therapies, treatment intention and approach were compared between the three groups. Hepatotoxicity and cancer survival probabilities were assessed in each group at one year after treatment.

Results: Overall, 32% of patients were treated for liver-dominant m-nonCRC metastases, compared to 34% for mCRC and 34% for HCC. Y90 was primarily utilized as a palliative procedure for m-nonCRC and mCRC (86%, 83%, respectively, $p < 0.001$), after failed chemotherapy and other locoregional therapies. By comparison, Y90 was frequently chosen as a first-line therapy (38%, $p < 0.001$) for HCC. The most common Y90 delivery approach for m-nonCRC and mCRC was a whole-liver approach (52%, 53%, respectively); while right lobar (54%) Y90 delivery was more commonly used to treat primary HCC. Y90 radioembolization for HCC achieved the highest one-year overall survival (OS, 68%) and progression-free survival (PFS, 48%) when compared to m-nonCRC and mCRC (OS = 61%, 59%, PFS = 42%, 38%, $p = 0.04$, 0.002 respectively). The overall incidence of grade 3 or higher hepatotoxicity was low (16%) and there was no significant difference between the three groups ($p = 0.72$).

Conclusion: Real-world data revealed that Y90 radioembolization is frequently utilized for palliative treatment of liver metastases of non-CRC origin, offering favorable treatment response and safety profile.

P-422

Real-world utilization of Y90 radioembolization for non-colorectal liver metastases: treatment patterns, safety and oncological outcomes from the RESIN (Radiation-Emitting SIR-spheres in Non-resectable liver tumors) registry

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Purpose: This study aimed to characterize the real-world utilization, safety and treatment outcomes of Y90 radioembolization for non-colorectal (non-CRC), liver-dominant metastatic disease.

Materials and Methods: Within the RESIN registry, 452 patients with liver-dominant metastases from 12 unique non-CRC primary malignancies were treated with Y90 radioembolization. Patient demographics, tumor characteristics, prior therapies, treatment intention and approach, rates of hepatotoxicity, and cancer survival probabilities were analyzed.

Results: The most common primary malignancies were neuroendocrine (37%), breast (21%), and pancreatic (11%) cancers. Y90 radioembolization for non-CRC liver metastases was most commonly performed as a palliative procedure (86%) and using a whole-liver (49%) approach. There was no significant difference in the delivered Y90 activity between different cancer types ($p = 0.77$). The highest one-year overall survival (OS) and progression-free survival (PFS) were achieved for neuroendocrine and ovarian tumors (OS = 88% and 90%, PFS = 63% and 70%, respectively, $p < 0.001$), and the lowest one-year OS and PFS were observed for esophageal, melanoma and lung cancer (OS = 19%, 20%, 21%, respectively, and PFS = 19%, 12%, 18%, respectively, $p < 0.001$). Post-treatment adverse events did not significantly differ by primary cancer type, and there was a low incidence of grade 3 or higher hepatotoxicity (16% overall, $p = 0.52$).

Conclusion: Our study demonstrates the favorable safety and oncological benefits of Y90 radioembolization for diverse non-CRC primary cancers with liver-dominant metastases. Improved knowledge of the safety and expected oncological outcomes associated with each cancer type would provide a useful point of reference for oncologists and cancer patients.

P-423

Percutaneous thermal ablation of liver metastases in patients with metastasized sarcoma: safety, recurrence rate and factors affecting progression free survival

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Purpose: To determine the role of radiofrequency (RFA) and microwave ablation (MWA) in the management of liver metastases in patients with metastasized sarcoma (i.e. GIST, leiomyosarcoma, liposarcoma) and to assess safety, local recurrence and progression-free survival (PFS) in these patients.

Materials and Methods: A total of 44 patients with a mean age of 61 years (SD 13 years) underwent ablations of 84 liver metastases. Of 84 lesions, 60 were treated with MWA, the remaining 24 with RFA. Mean tumour diameter was 24 mm (SD 14 mm, range 7-77 mm). Follow-up imaging was performed using contrast enhanced CT, contrast enhanced MRI and/or PET-CT. Progression free survival (PFS) and local recurrence free survival were calculated based on relapse of disease on imaging.

Results: Three patients (3/44, 6.8%) suffered from complications (2x pneumothorax, 1 large hematoma) which required longer hospital stay. Local recurrence occurred in 8/84 (9.5%) of lesions treated, with a median time to local recurrence of 230 days (95% C.I. 35-463 days). A majority of patients (34/44, 77.2%) showed evidence of progressive disease somewhere in the body during follow-up. Median PFS in this study was 418 days (95% C.I. 215-654 days). No differences were found when comparing PFS in RFA versus MWA ($P=0.40$).

Conclusion: Percutaneous thermal ablation of liver metastases in patients with metastasized sarcomas is a safe procedure with a low complication rate. In this study local recurrence was a rare event (8 out of 84 lesions, 9.5%). There were no differences in PFS between RFA and MWA.

P-424

A review of practice in percutaneous cryoablation therapy for renal cell carcinoma: a technologist guide

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Learning Objectives:

1. Discussing the epidemiology and mechanism of Renal Cell Carcinoma
2. Highlights the technique and principles for Cryoablation & Post ablation imaging and potential complication.

Background: RCC is the most common type of kidney cancer in adults. The traditional treatment was partial nephrectomy. With the help of advanced imaging, RCC is now often detected in earlier stages, allowing for the utilization of nephron-sparing therapeutic percutaneous ablative techniques. Cryoablation is a technique that eventually results in tissue necrosis, has become the standard nephron-sparing option for RCC.

Clinical Findings/Procedure Details: Cryoablation is performed by inserting a cryoprobe into the tumor. The probe rapidly removes heat from the tissue by means of Joule-Thompson effect, in which rapid expansion of a gas results in a change of temperature. A heat sink is produced near the antenna tip that cools the probe to temperatures of -160°C or colder. Heat is transferred from the tissue into the cryoprobe via passive thermal diffusion. Slow freezing produces intracellular ice crystals and fast freezing induces extracellular ice crystals. Both processes induce cell death by different cellular mechanisms. In addition, freeze-thaw cycles can induce cellular dehydration, vascular thrombosis and membrane rupture. The number of cryoprobes inserted can also be varied, on the size and shape of a lesion. In contrast to MWA and RFA, cryoablation allows direct visualization of the approximate ablation zone, a so-called ice ball that can be visualized in three planes under direct visualization.

Conclusion: Cryoablation is a reasonable minimally-invasive treatment option, providing favorable oncologic and safety outcomes compared to surgical and surveillance approaches.

P-425

Management of liver tumors during the first wave of COVID-19 pandemic: the added value of selective internal radiation therapy

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Learning Objectives: To analyse the role of selective internal radiation therapy (SIRT) in liver cancer patients' management in the context of coronavirus-2019 (COVID-19) pandemic.

Background: COVID-19 pandemic has modified oncologic patients' management. Delays in screening, diagnoses, referrals, resection, transplantation and follow-up were reported, and systemic treatments' regimens were modified, with increased use of orally, self-administered medications and remote consultations. In this context, liver-directed therapies offer integrative tools for tumor control. SIRT is safe and effective in patients

with radiosensitive tumors, as monotherapy or in combination with systemic treatments.

Clinical Findings/Procedure Details: In our University Hospital, the first wave of COVID-19 (March-May 2020) witnessed a 38.8% reduction in number of patients referred to our weekly Multidisciplinary Liver Tumor Board compared to 2019. Conversely, the number of patients treated with SIRT increased by 63.6%, to overcome reduced availability of curative treatments (transplantation, resection, ablation) and difficult management of systemic therapies. The role of SIRT will be described in:

- 1) Hepatocellular carcinoma
 - a) Early-stage: SIRT offers a curative approach and may bridge patients to transplantation;
 - b) Intermediate-stage: SIRT effectively controls tumor progression with reduced side effects and retreatments, and allows tumor downstaging for transplantation;
 - b) Advanced-stage: SIRT effectively controls intrahepatic macrovascular invasion, with better quality-of-life compared to systemic treatment.
- 2) Intrahepatic cholangiocarcinoma

SIRT controls tumor progression in unresectable patients and allows downstaging to resection.
- 3) Metastatic lesions

SIRT is indicated in selected chemorefractory patients and patients requiring a period of chemo-holiday.

Conclusion: During COVID-19 pandemic, SIRT offers a valid tool for safe, tolerable and efficient tumor control in different clinical scenarios.

P-426

Preoperative embolization of vascular tumors of head and neck: an update

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Learning Objectives: To enumerate the common vascular tumors of head and neck and discuss various techniques and agents used in pre-operative embolization.

Describe relevant functional vascular anatomy to avoid procedure related complications.

Background: Management of vascular tumors of the head and neck is challenging and requires a multidisciplinary approach.

Transarterial embolization of these vascular tumors can be used as an adjunctive therapy prior to surgical resection or as a palliative therapy in patients who are ineligible for surgery.

Embolization causes devascularization of the tumor and reduces blood loss during surgery, decreases the operative time and provides a clean operative field allowing complete resection of the tumour and thereby decreasing morbidity and mortality.

Clinical Findings/Procedure Details: In this essay, we will discuss the common vascular tumours of head and neck which require preoperative embolization such as juvenile nasopharyngeal angiofibroma, paraganglioma, meningioma, hemangiopericytoma etc.

We will then study the functional vascular anatomy and the anastomotic pathways between external carotid artery and internal carotid artery or vertebral artery.

Current methods, principles and techniques of embolization by transarterial route, direct puncture and combination method will be discussed. Review on the use of various embolic agents such as polyvinyl alcohol particle, onyx, glue, gelfoam etc. will be provided.

Lastly, procedure related complications, their prevention and management will be discussed.

Conclusion: Preoperative embolization is an important adjunct to surgery in the management of vascular tumours of head and neck.

Understanding of the functional vascular anatomy, embolization techniques and agents is necessary for safe and effective embolization.

P-427

The utility of ultrasound fusion with other imaging modalities in discerning inconspicuous liver tumours: a single-center experience

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Learning Objectives: To investigate the utility of Fusion Imaging (FI) in successful targeting of inconspicuous liver tumours.

Background: Percutaneous image-guided biopsy and ablation are commonly performed procedures in management of liver tumours. Ultrasonography (US) provides safe and reliable real-time imaging guidance in a vast majority of cases. However, some lesions are inconspicuous, have poor sonographic windows and intervening lung/bowel make navigation a technically arduous process and may compromise safety of the procedure. FI marries the advantages of superior contrast resolution of CT and MRI with that of US imaging. We sought to analyze selected cases from our institution's experience across eight years to determine the usefulness of FI. The pre-procedure considerations, technical challenges and potential pitfalls will be discussed to shed light on the utility of FI in tackling tricky hepatic lesions.

Clinical Findings/Procedure Details: Cases that required fusion were identified based on their pre-procedural imaging characteristics that predicted for lesions with poor conspicuity. Firstly, pre-acquired images of the CT or MRI within six weeks were imported into the local US unit. Plane registration was then performed using a fixed reference plane followed by point registration using common anatomical landmarks such as vascular bifurcations (portal and hepatic venous confluences) and/or organ contours. Further refinements using additional reference points were conducted to increase the accuracy to landmark the lesion.

Conclusion: This pictorial essay will arm readers with information regarding ultrasound FI in their daily practice of treating liver tumours.

P-428

The role of pediatric interventional radiology (IR) in the management of rare paraneoplastic tumors

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Learning Objectives: To review the clinical presentation, cross-sectional imaging findings, and role of IR interventions in the management of rare paraneoplastic tumors such as Castleman disease (CD) presenting as paraneoplastic pemphigus.

Background: CD is a heterogeneous group of well-known, but poorly reported lymphoproliferative disorders presenting in children and young adults. Patient's with unicentric Castleman disease are typically asymptomatic. Diagnosis is therefore most commonly made when the region of enlarged lymph nodes is incidentally discovered on physical exam or imaging studies.

Clinical Findings/Procedure Details: We report cases where Castleman disease was considered clinically, however the diagnosis clinched through histologic sampling of mucocutaneous lesions (noted to be paraneoplastic pemphigus). Paraneoplastic pemphigus is associated with Castleman disease approximately 18% of the time. We will discuss the integral role of pediatric IR in both diagnosis through tissue sampling and management through placement of central venous access and preoperative embolization of characteristically large feeding vessels to reduce intraoperative bleeding. We will also discuss the anesthetic advantages of mediastinal mass interventions by IR than common surgical approach.

Conclusion: Pediatric interventional radiology contributes safe and efficacious options to the multidisciplinary management of paraneoplastic tumors required in contemporary clinical practice.

P-429

Percutaneous management of recurrent head and neck cancer: current role and evolving principles in the multidisciplinary setting

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Learning Objectives: Understanding the role of percutaneous interventional radiological management of recurrent head and neck (H&N) cancer in the context of a multidisciplinary setting which consists of surgery, radiation therapy, as well as established and evolving systemic therapies that may impact current practice

Background: Management of recurrent H&N cancer is complex, with attention to the preservation of function and minimal treatment-related morbidity. The favored treatment modalities in local recurrence previously treated with radiotherapy are surgical resection, and if unresectable, for chemotherapy as definitive treatment, or as a prelude to resection if there is good tumor response. Unfortunately, some of these patients are too frail for major surgery or to withstand the toxicity of chemotherapy. There is a gap for effective local therapy without the morbidity of surgery, toxicity of re-irradiation, and systemic side effects of chemotherapy. Percutaneous interventions have the potential to bridge that gap as well as provide palliative symptomatic treatment for patients that have exhausted all treatment options.

Clinical Findings/Procedure Details: The poster will look at thinking process behind the surgical principles, treatment considerations in radiotherapy as well as the current systemic chemo-immuno-therapy in treatment of recurrent H&N cancer. Through this understanding we will be able to illustrate cases that will identify the treatment gap and how IR can plug that gap.

Conclusion: In the multidisciplinary setting involving the treatment of complex recurrent H&N cancer, percutaneous management now plays a viable and effective role with a foothold in this team-based approach.

P-430

Audit of single centre compliance to the CIRSE 2020 guidelines for thermal liver ablation

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Learning Objectives:

1. To assess the compliance of liver ablations performed against the 2020 guidelines published by CIRSE
2. To assess for significant delay in performing liver ablations, increasing risk of disease progression

Background: All patients undergoing liver ablation at the Churchill Hospital between 03/09/2019 - 04/09/2020 were assessed against the 2020 CIRSE guidelines for thermal ablation of liver lesions. Standards included 100% requiring prior MDT discussions, appropriate pre-procedural imaging, bloods and follow up imaging. Targets applied of a 5% and 25% major and minor immediate complication rate respectively. All ablations were performed by one experienced consultant interventional radiologist with a Solero 2i applicator. The procedure was performed under general anaesthesia with high frequency jet ventilation supervised by a consultant anaesthetist.

Clinical Findings/Procedure Details: 41 thermal liver ablations were performed in total. 39 patients were involved and 2 required repeat ablations. 25 males and 14 females with overall mean age 72 (median 72, range 37-85). 100% had an MDT prior to ablation and appropriate imaging within 3 months before. Mean number of days from MDT to

first ablation was 94 days. 95% had CIRSE recommended bloods prior (FBC and coagulation). 2 patients had clotting only. Mean days from bloods to procedure was 39. Major complication rate of 2.4% (one grade 3 complication). 97% technical success on the 24hour post-procedural imaging. 77% of patients had appropriate follow up imaging.

Conclusion: Good immediate outcomes for ablations. However, the need to minimise the average length of MDT to procedure was identified alongside standardised post-procedural follow up imaging beyond 3 months.

P-431

Preoperative embolisation of bone metastases: our experience

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Learning Objectives: The aim of this study is to assess the procedural success rate, intraoperative complications and estimated blood loss following preoperative embolisation of hypervascular bone metastases. Furthermore we aim to assess the relationship between the 'devascularisation grade' and the estimated surgical blood loss.

Background: Orthopaedic management of metastatic bone lesions may be indicated for palliative pain-management. Due to the often hypervascular nature of these lesions it is common practice to perform preoperative embolisation to reduce the intraoperative blood loss and number of blood transfusions required.

Clinical Findings/Procedure Details: We identified 34 patients who underwent preoperative embolisation of bone tumours within our trust over a 5 year period. Of these 32 went on to have surgery as planned (two patients were considered too unwell to tolerate an anaesthetic). By far the most common pathology was renal cell carcinoma metastases (n=27), however metastatic transitional cell carcinomas, thyroid carcinomas and juvenile nasopharyngeal angiofibromas were also embolised.

The procedural complication rate was low, with one patient having a small non-target embolisation and the remainder experiencing no intraoperative complications. There were 16 Grade 1 (>75% reduction in tumour blush), 8 Grade 2 (50-75% reduction) and 7 Grade 3 (<50% reduction) embolisations.

Intraoperative blood loss was recorded in 20 cases and averaged 1159ml (range 270-3200ml). 8 patients required intraoperative or post-operative transfusion. No statistical significance was found for blood loss/requirement for transfusion and devascularisation grade.

Conclusion: Preoperative embolisation of bone metastases is a safe and effective procedure which should be considered to reduce intraoperative blood loss and the requirement for peri-operative transfusion.

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The added value of transcatheter CT hepatic angiography (CTHA) in percutaneous liver tumor ablation

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Learning Objectives: This pictorial review provides eight clinical cases from three renowned institutions, MD Anderson (Houston, Texas), Gustav Rusy (Paris, France) and Amsterdam UMC (Netherlands), with the intent to demonstrate the added value of real-time transcatheter-guided computed tomography hepatic angiography (CTHA) liver tumor ablation.

Background: Essential factors affecting the success of thermal ablation are the ability to optimize tumor and surrounding structure visualization, needle targeting and ablation zone confirmation. Recent studies show a

superior local tumor progression-free survival and local control by using CTHA in percutaneous thermal ablation of liver malignancies.

Clinical Findings/Procedure Details: The clinical illustrations highlight the ability to improve detectability of the initial liver tumor, detect additional tumors intraoperatively, identify surrounding critical vascular structures, detect vanished tumors after induction chemotherapy, differentiate local tumor progression (LTP) from non-enhancing scar tissue, and to promptly detect and respond to liver hemorrhage.

Conclusion: Although at the cost of adding a minor intervention, CTHA-guided liver tumor ablation minimizes complications, reduces the number of repeat ablations and improves the local oncological outcome of patients with liver malignancies. We recommend to adopt CTHA as a potential quality-improving guiding method within the (inter)national standards of practice.

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Radiological findings after percutaneous ablation of small renal masses: a pictorial essay

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Learning Objectives: To discuss the typical imaging features of renal tumours following percutaneous ablation, illustrating normal findings, residual disease and complications appearance on contrast-enhanced CT, MRI and US (CEUS).

Background: Due to the increasing use of imaging tests, the detection of renal masses has steadily increased, with a significant number of cases of malignant renal cell carcinomas that might require additional procedures or interventions.

Although the primary management options include surgery, nowadays the use of ablative treatment (AT) to treat small tumours is affirmed.

Clinical Findings/Procedure Details: Several are the different techniques used to ablate renal cancer; in our University-hospital in the last 20 years more than 300 patients underwent AT, i.e. radiofrequency ablation (47%), cryoablation (31%), microwave ablation (22%) and electrochemotherapy (1%), performed under CT and US guidance.

MRI, CT and CEUS imaging patterns following the procedure are illustrated, helping radiologist to correctly identify the presence of residual or recurrence tumour from normal evolution of AT.

Moreover, a detailed explanation of imaging features of possible complications that may occur after AT, e.g. perinephric hematomas, hematuria and urinary leak, is provided.

Conclusion: Nowadays a detailed knowledge of post-ablation imaging of small renal masses is fundamental for radiologists, being focal ablative therapies widespread and widely recognized as an effective treatment.

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Image-guided marking techniques: how to improve the odds of lesion localization

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Learning Objectives: The evolution of the imaging modalities, the treatment strategies and the surveillance protocols for cancer patients has led to the increased discovery rate of small size lesions, which are often difficult to treat because of their small size and/or profound location.

Furthermore, the respiratory movements and organ motion/deformation can impede their precise targeting.

Background: Precise marking of lesions using image-guided techniques is essential, as imprecise targeting of a tumor can result in either insufficient excision/treatment with an increased risk of recurrence, or excessive removal of healthy tissue. Different localization methods currently exist and are variably used depending on lesion location, operator's personal experience and available technologies. The image guidance modality used should be the one that allows precise lesion identification and certain targeting.

Clinical Findings/Procedure Details: Most frequent indications include localisation of impalpable lesions before surgical resection (i.e. hook-wire localization of pulmonary nodules before video-assisted thoracoscopy) and definite marking with coils of liver metastasis before neoadjuvant therapy. Other indications include marking of hepatocellular carcinomas before thermal ablation, of bone lesions before surgical excision, and of different visceral tumors (lung, seminal vesicles, liver, and kidney) before stereotactic radiotherapy.

Conclusion: We herein give a synthesis of the existing image-guided localization techniques that can be used per organ, precise their indications and review literature results and complications. We further give some details on the techniques used and emphasize the role of each localization procedure on the treatment algorithm.

P-435

Massive air embolism with fatal outcome during lung radiofrequency ablation of a small peripheral nodule

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Clinical History/Pre-treatment Imaging: A 54-year-old nonsmoking woman was referred for percutaneous Radiofrequency (RFA) because of a pulmonary metastasis (primary tumor endometrial stromal sarcoma) located on the periphery of lateral basal segment of the lower in the left lung.

Treatment Options/Results: After discussion on a tumor board, pulmonary RFA was chosen, in view of the indolent behavior of the disease, oligometastatic, with good response to hormone therapy. CT scan for planning the procedure revealed important pulmonary subsegmental atelectasis (lower and posterior fields). There was no resolution of atelectasis after recruitment maneuvers performed by the Anesthesiologist. The patient was switched to the right lateral decubitus position, allowing the visualization of the nodule. A standard procedure was started under fluoroscopic guidance. Gas was noted inside the thoracic aorta before the nodule was punctured and radiofrequency was applied. Large amount of blood was noted in the orotracheal tube. The needle was immediately removed, the patient was placed in the supine position (airway injury was suspected) and tube replacement was performed. Massive amount of gas in the arterial system was visualized at CT (no more than 5 minutes elapsed). Trendelenburg position and 100% oxygen were offered but the patient developed cardiorespiratory arrest and death.

Discussion: Air embolism, although rare, is a potentially fatal complication and should be readily recognized. Its incidence is well known after transthoracic percutaneous biopsies (0.001% to 0.003%). During lung RFA is much less reported.

Take-home Points: Air embolism is an exceedingly rare complication, but it should always be remembered when the lung RFA procedure does not go as planned.

P-436

Transcatheter arterial embolization for management of upper gastrointestinal bleeding due to duodenal gastrointestinal stromal tumor

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Clinical History/Pre-treatment Imaging: A 42 years old male, known case of duodenal gastrointestinal tumor (GIST) presented with complaints of melena for the last 3 days. Patient underwent urgent upper gastrointestinal (GI) endoscopy which revealed a large hematoma in first part of duodenum, so the bleeding point cannot be localized. Thereafter he underwent contrast-enhanced computed tomography which showed the duodenal tumor, but did not reveal any active extravasation or any vascular lesion.

Treatment Options/Results: Patient was referred to Interventional Radiology where he was urgently taken up for transcatheter arterial embolization (TAE). Tumor blush from superior pancreaticoduodenal artery was embolized using polyvinyl alcohol particles of size 90-180 µm. Gastroduodenal artery (GDA) was further embolized by two coils of varying sizes. Post-embolization angiogram revealed disappearance of tumor blush along with mid and distal GDA occlusion. On follow-up next day patient's general condition improved and melena stopped after 8 hrs of procedure. On one month follow-up, patient had no recurrence of melena.

Discussion: GI bleeding is the most common presentation of GIST. If endoscopic interventions fail to control the bleeding, then TAE is done. Surgery may be attempted in those patients where bleeding is not controlled by less invasive treatment options. TAE can also be done as a pre-operative procedure or for palliative management.

Take-home Points: For GIST related GI bleeding, TAE can be done to achieve urgent hemostasis as well as for preoperative or palliative management.

P-437

Ruptured hepatocellular carcinoma following transarterial hepatic chemoembolization

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Clinical History/Pre-treatment Imaging: A 77-year-old man with chronic lymphocytic leukemia (CLL). On a follow-up non-contrast computed tomography (CT) scan, an abnormality was depicted within the left hepatic lobe. Diagnosis of HCC was confirmed by percutaneous biopsy. After the case was reviewed by a multidisciplinary tumor board, the patient was referred for transarterial embolization.

Treatment Options/Results: Selective transarterial embolization of the segmental branches of hepatic segments II and III using 75-µm LC Beads loaded with 150 mg of doxorubicin.

Discussion: The Society of Interventional Radiology defines the major complication following TACE or transarterial embolization as any complication requires hospital admission for treatment, unplanned upgrading of the level of care, extended hospitalization, permanent adverse sequelae, or leading to death. Tumor rupture following TACE/TAE is very rare, yet is a life-threatening complication.

Different theories have been suggested to explain the mechanism of tumor rupture following TACE/TAE. Nishida et al (2018) hypothesized that tumor rupture may be secondary to increased intra-tumoral pressure caused by internal necrosis. These changes can be maximized when complete embolization of the feeding artery. Zhu et al (2004) presume the tumor rupture is due to degradation of the elastin and collagen fibers

by the inflammatory mediators released owing to necrosis and vascular injury caused by the chemotherapeutic agent.

Take-home Points: HCC rupture following TACE/TAE is a rare, life-threatening complication that should be suspected in lesions with risk factors for tumor rupture, particularly large subcapsular exophytic lesions involving the left hepatic lobe. Emergent diagnosis and management of the condition is required to avoid adverse outcomes and increased mortality.

P-438

Medulla compression by L1 metastasis from hypovascular renal cancer: imaging findings and endovascular treatment

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Clinical History/Pre-treatment Imaging: A 77-year-old man, formerly treated for bladder cancer, performed a scintigraphy as a follow-up, revealing a hypercaptating lesion on L1.

A contrast-enhanced CT was performed, showing a right renal cancer and the L1 metastasis. Thus, a nephrectomy was planned.

In the meantime, the patient had developed neurological symptoms, so a medulla MRI was performed, revealing a lumbar medullary compression by the L1 metastasis.

An angiography with lesion embolization was planned.

Treatment Options/Results: The selective catheter angiography of the aorta and of the lumbar arteries did not reveal any hypervascularization of the L1 metastasis.

Nevertheless, we decided to perform selective arterial embolization, by hypothesizing that an arterial-feeding reduction will also lower the mass effect on medulla.

The lumbar artery was selectively embolized by a mixture of Lipiodol and Glubran; post-embolization images revealed complete vascular occlusion. The next days, there was an improvement of the neurological symptoms, so the nephrectomy could be conducted.

The histological analysis of surgical resection specimens revealed papillary renal cell tumour.

Discussion: Renal-cancer bone metastases are very common (about 32%); 28% of these develop medulla or nerve-root compression with neurological symptoms.

Renal-cancer metastasis often presents hyper-vascularization, benefiting from arterial embolization.

However, also in less vascularized metastases, as in our case, the arterial embolization represents a valid therapeutic strategy, reducing the mass effect and compression-related neurological symptoms.

Take-home Points:

- Spine metastases may have mass effect on medulla, with neurological symptoms.
- The arterial embolization represents a therapeutic strategy also in less-vascularized lesions, reducing lesion growth and mass effect.

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Transrectal needle ablation in the genitourinary tract: description of a novel technique

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Clinical History/Pre-treatment Imaging: Male patient, 58 years old, diagnosed with colorectal cancer and liver metastasis diagnosed 5 years ago. The primary tumor (colorectal) and liver lesions were resected in two stages. PET-TC shows a FDG capture lesion measuring 2.5 x 1.5 cm located in the left seminal vesicle (SUV max = 5.67 / SUV late = 8.86). No further lesions were detected outside the seminal vesicle. In the pelvic MR we better define the dimensions of the lesion and anatomical relationships. Percutaneous biopsy guided by endocavitary ultrasound was performed and confirmed to be a moderately differentiated adenocarcinoma (grade 2 histological) with tubuloacinar pattern and papillary foci infiltrating the seminal vesicle. After multidisciplinary discussion (Tumor Board) a minimally invasive treatment was chosen with percutaneous ablation guided by transrectal ultrasound outside the hospital environment due to the pandemic COVID-19 and an immunocompromised patient.

Treatment Options/Results: PET with 30 days shows no more evidence of anomalous FDG uptake in the tumor area in the left seminal vesicle demonstrating complete response.

Discussion: US-guided thermal ablation has been accepted as an alternative treatment for liver and thyroid tumours, because these organs provide a good sonic window. However, US cannot be used so readily to guide the treatment of renal and adrenal tumours using radiofrequency ablation.

Take-home Points: US guidance is useful for ablation in the treatment of GU tract diseases. Radiologists should be familiar with the basic principles and various techniques of US-guided GU interventions. As such, radiologists can improve the diagnostic or therapeutic outcomes of US-guided procedures conducted in the GU organs.

Others

P-440

Determination of the optimal ratio of N-butyl cyanoacrylate-Lipiodol-Iopamidol (NLI) as a new liquid embolic material

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Purpose: To determine the optimal ratio of NLI as a new liquid embolic material.

Materials and Methods: In vitro, 16 kinds of NLI were prepared at ratios of 1:1:1 (NLI111), 1:2:1 (NLI121), 1:3:1 (NLI131), 1:4:1 (NLI141), 2:1:1 (NLI211), 2:2:1 (NLI221), 2:3:1 (NLI231), 2:4:1 (NLI241), 3:1:1 (NLI311), 3:2:1 (NLI321), 3:3:1 (NLI331), 3:4:1 (NLI341), 4:1:1 (NLI411), 4:2:1 (NLI421), 4:3:1 (NLI431), and 4:4:1 (NLI441). It was evaluated whether each NLI can be injected through a microcatheter, and viscosity of each NLI was measured for 30 minutes. In vivo, 15 wide neck aneurysms were created on both the common carotid and external iliac arteries of four female swine. Under balloon occlusion, 7 aneurysms were embolized with NLI141, and 8 aneurysms were embolized with NLI231. We performed angiography to evaluate adhesion of NLI to the balloons or microcatheters and migration of NLI.

Results: In vitro, injection of NLI through a microcatheter was impossible when the Iopamidol concentration of NLI was 20% or more. As the Iopamidol concentration of NLI increased, its viscosity increased over time for 30 minutes. Only NLI141 and NLI231 could be injected through a

microcatheter, and their viscosity increased in 30 minutes. In vivo, adhesion between NLI and the balloons/microcatheters was not observed in either group. NLI migration was found in 6/7 aneurysms in the NLI141 group and 0/8 aneurysms in the NLI231 group.

Conclusion: The optimal ratio of NLI is 2:3:1 for balloon assisted embolization of wide neck aneurysms in swine.

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Interventional oncological treatment of HCC: single-center long-term evaluation over three decades using interventional techniques

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Purpose: To retrospectively evaluate the development and technical progress in interventional treatments of hepatocellular carcinoma (HCC) regarding survival rates.

Materials and Methods: Between 1993 and 2020 1,046 patients with HCC were treated in 3,287 sessions using transarterial chemoembolization (TACE), laser-induced thermotherapy (LITT) and microwave ablation (MWA). Therapy results are evaluated using the survival rates of the Kaplan-Meier estimator and log-rank test for comparison of the groups.

Results: Median survival of patients in the LITT group (n=92) were 593 days (LITT only) and 959 days (LITT+TACE). 1-, 3- and 5-year survival rates were 64.0%, 24.0% and 20.0% for LITT only treatment, and 83.6%, 40.3% and 14.9% for combined LITT+TACE. Log-rank test showed no significances in survival rates between these two groups (p-value=59.6). In the TACE only group (n=618) a median survival of 474 days was documented. 1-, 3-, 5-year survival rates were 58.1%, 34.7% and 30.2%. Median survival time in the MWA group (n=336) was estimated as infinite, equivalent with a 10-year survival rate of 75%. Estimated median survival time for MWA+TACE was 1,505 days. In the MWA group the 1-, 3-, 5-year survival rates were 91.2%, 76.9% and 75.0%, whereas in the combined MWA+TACE group they were 83.3%, 55.7% and 48.3%.

Conclusion: Treatment with MWA-only resulted in the best median survival, followed by combined MWA+TACE. Survival rates of percutaneous thermal ablation combined with TACE are significantly higher vs. TACE only therapy. Survival rates show significantly better results of MWA versus LITT. TACE vs. LITT and combined LITT+TACE were not significantly different regarding survival rates.

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Oncological treatment of breast cancer liver metastases: single-center long-term evaluation over 3 decades using different interventional techniques

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Purpose: To retrospectively evaluate the development and technological progress in interventional oncological treatments of breast cancer liver metastases regarding survival rates

Materials and Methods: Between 1993 and 2020 1,136 patients with breast cancer liver metastases were treated in 3,441 sessions using transarterial chemoembolization (TACE), laser-induced thermotherapy (LITT) or microwave ablation (MWA). Therapy results were evaluated according to the Kaplan-Meier estimator for survival rates and the log-rank test for comparison of the groups.

Results: Median survival times in the LITT group (n=212) were 831 days for LITT only and 793 days for combined LITT+TACE (n=215). 1-, 3- and 5-year rates were 81.6%, 37.7% and 23.1% for LITT only treatment, and 77.7%, 36.7% and 20% for combined LITT+TACE. Median survival time in the MWA group (n=17) was 2,285 days, for MWA+TACE (n=143) 1,479

days. 1-/3-/5-year survival rates in the MWA group were 94.1% (all values), whereas combined MWA+TACE were 83.9%, 61.1% and 50.9%. Median survival in the TACE only group (n=545) was of 491 days. 1-/3-/5-year survival rates were 58.1%, 42.1% and 40.3%.

Conclusion: Treatments with MWA-only resulted in best median survival time, followed by combined MWA+TACE. Survival rates of MWA and MWA+TACE treatments are significantly higher vs. TACE-only therapy and both LITT groups.

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Computed tomography guided transcatheter approach in the management of refractory autophony: the role of interventional radiology in the treatment of patulous eustachian tube

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Purpose: Patulous Eustachian tube is a rare but important condition which causes debilitating autophony and can lead to significant psychosocial problems and even suicide. This is a difficult condition to treat with a number of procedures described in the literature with varying success rates. At the Great Western Hospital in Swindon, a CT guided approach has been used for the last 7 years with great success.

Materials and Methods: The procedure is carried out under unenhanced CT imaging. Using an aseptic technique and local anaesthesia, a needle is placed within the tissue immediately adjacent to the lateral Eustachian tube wall. A silicone elastomer suspension implant is injected. The suspension should sit in the fat of the parapharyngeal space deep to the pterygoid muscles at the skull base which then acts as support for medialisation of the lateral wall of the Eustachian tube and thus closing its lumen.

Results: Treatment was immediately effective for all patients. At 6 months follow up 92% had improved or complete resolution of symptoms. Side effects were transient and included: One patient developed otitis media with effusion and did require a unilateral grommet, One other patient developed a painful trigeminal neuralgia which settled spontaneously.

Conclusion: Computer tomography guided, transcatheter approach to manage refractory autophony in the treatment of patulous eustachian tube is well tolerated and effective. The procedure is quick and performed under aseptic technique and local anaesthesia, unlike the endoscopic treatment alternative. This is a good interventional radiology alternative where there is no other current gold standard treatment available.

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Interventional radiology in the Coronavirus disease 2019 pandemic: impact on practices and wellbeing

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Purpose: To report the impact of the coronavirus disease 2019 (COVID-19) pandemic on interventional radiology (IR) using validated assessment tools.

Materials and Methods: A 78-question survey was distributed over a 25-day period. The survey consisted of demographic and practice environment queries. Anxiety symptoms were evaluated using the Generalized Anxiety Disorder-7 (GAD-7) screener, and coping strategies were assessed using the Brief-Coping Orientation to Problems Experienced (Brief-COPE) questionnaire. Statistical analyses were conducted using ANOVA, F-test, Chi-squared analysis, and multivariate proportional odds models.

Results: There were 422 respondents including 333 (78.9%) attending interventional radiologists and 89 (21.1%) interventional radiologists-in-training, in total representing 15 countries. A large majority (n=391; 92.7%) reported performing a procedure on a patient with confirmed COVID-19 infection. Cancellation or limitation of elective procedures were reported by 276 (65.4%) respondents. Many respondents (n=177; 41.9%) had a measurable level of self-reported anxiety with an overall mean GAD-7 score of 4.64 ± 4.63 . Factors associated with reporting anxiety included female gender ($p=0.045$), increased call coverage ($p=0.048$), lack of adequate departmental adjustments ($p<0.0001$), lack of adjustments in a timely manner ($p<0.0001$), and utilization of dysfunctional coping strategies ($p<0.0001$).

Conclusion: The COVID-19 pandemic induced practice alterations and high rates of self-reported anxiety in IR. Female gender, increased call coverage, lack of adequate or timely departmental adjustments, and dysfunctional coping strategies were associated with increased anxiety levels. Understanding the negative impact of the pandemic on practices and mental health may guide appropriate future preparedness and wellbeing support.

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The effect of a virtual journal club on interest in academic IR amongst medical students and trainees

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Purpose: Interventional radiology (IR) is an innovative specialty with a growing evidence base. Journal clubs have been shown to be an effective method in improving Radiology trainees' critical appraisal skills. Following establishment of a new monthly virtual journal club, the attendees were surveyed to ascertain if participation influenced their interest in academic interventional radiology.

Materials and Methods: A monthly virtual journal club was co-organised by the British Society of Interventional Radiology Trainees (BSIRT) and IR Juniors (IRJ) groups. The sessions were held on the Zoom platform. Scientific papers presented were chosen based on a consensus amongst BSIRT and IRJ members and presented by a trainee. An optional feedback survey assessing trainees interest in academic interventional radiology was sent to all attendees immediately after each session closed.

Results: A total of 53 responses were obtained from 137 attendees across two journal club sessions (response rate 38.7%). Survey responses consisted of 37.7% medical students, 26.4% pre-radiology trainee and 32.1% radiology/IR trainee. Only 18.8% (n=10) of respondents reported that their local IR department had a regular journal club. A total of 88.6% (n=47) 'strongly agreed' or 'agreed' that the sessions were a good way of keeping up with latest evidence; 77.3% (n=41) agreed/strongly agreed that they learned how to critically appraise; 75.4% (n=40) agreed/strongly agreed that they were more likely to consider a career in academic IR.

Conclusion: A virtual monthly journal club is an effective method of increasing interest in academic interventional radiology amongst medical students and trainees.

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Factors affecting radial artery diameter: an international multicentre prospective study

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Purpose: A prospective multicentre study which aims to assess the effects of topical glyceryl trinitrate (GTN), subcutaneous lidocaine/ glyceryl trinitrate (GTN) and patient sex on radial artery (RA) diameter.

Materials and Methods: A total of 123 patients were included in the study, 63 males and 60 females. The right RA diameter was measured, topical GTN cream was applied and the RA remeasured after one hour. In addition to this, the left RA diameter was measured pre and post lidocaine/ GTN subcutaneous infiltration. Further comparison was made between male and female RA baseline diameter.

Results: A total of 123 patients were included in this study from three centres. A total of 63 males and 60 female patients were assessed, there was a statistically significantly larger RA diameter in male patients Vs female (2.20 mm Vs 2.46 mm $p < 0.00001$).

Right RA diameter was measured pre and post topical GTN cream application, a total of 47 patients were included in this group. There was a statically significant greater RA diameter post topical GTN application (2.75mm Vs 2.83mm p is $< .00001$). The left RA diameter was measured pre and post lignocaine/ GTN subcutaneous infiltration. This demonstrated a statistically significantly greater RA diameter post infiltration (2.34mm Vs 2.67mm p is < 0.00001 , $n = 123$).

Conclusion: This prospective multicentre study demonstrates male patients have a significantly greater RA diameter. The application of topical GTN cream and subcutaneous lidocaine/ GTN causes significant increase in RA diameter which will aid RA cannulation. Centres should consider using both in routine practice.

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Using carboxyangiography during embolization in patients with venous pathology

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Purpose: To propose an alternative method of vascular imaging without iodine in patients with varicocele and ovaricovaricocele.

Materials and Methods: 38 venous embolizations by using an automatic injector of carbon dioxide into the venous bed were performed, including 17 patients with varicocele and 31 with ovaricovaricocele. 12 patients with ad chronic kidney disease (CKD).

Results: Complete success was achieved in the treatment of 27 patients, including 10 with CRF. Partial success (1.5-20ml) was achieved in 9 procedures, including 2 with CKD. Complete failure (more than 20 ml) occurred in 2 cases. However, all the surgeries were carried out successfully and completely.

Conclusion: According to our experience, there is no much difference in the vascular bed imaging between using traditional angiography and while using CO₂. However, during first interventions doctors had to get used to the new style of angiograms. The usage of CO₂ as the only contrast substance in patients with varicocele and ovaricovaricocele is a safe and effective method. It may be especially important for patients with concomitant chronic kidney disease, which significantly worsens the course of CKD. In average, interventions with the usage of CO₂ require 12 minutes more in comparison with traditional contrast agents. A special training programme for doctors is needed for using an automatic injector.

P-448**Global overview of COVID-19 impact on interventional radiology service delivery and training**

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Purpose: To assess the impact of COVID-19 pandemic on interventional radiology (IR) service delivery and training across the globe

Materials and Methods: A systematic review of studies published between 1 January 2020 and 15 January 2021 was performed according to the PRISMA guidelines.

Results: A total of 14 studies met the inclusion criteria: four from Europe, nine from North America one from Asia.

IR caseload reduced between 16.8-80%, with elective activity affected more than emergency work. Trainees also experienced a 11-51.9% reduction in case volumes and many were redeployed to critical care. Outpatient/day units were utilised more to preserve time-sensitive procedure capacity, particularly related to oncological interventions. Overall, the impact on IR services was less compared to other medical procedural or surgical specialties.

IR departments re-organised operations and personnel, and many continued to offer 24/7 services and support critical care areas through redeployment of staff. The majority of studies did not report any gross issues with protective equipment availability and the majority reported following the local or national guidelines from governing body or radiology society.

Conclusion: The COVID-19 pandemic reduced case volumes and training opportunities. IR departments showed flexibility and resilience in service delivery. The lessons learned offer insights into how services and training can be reorganised to ensure that IR continues to thrive.

P-449**Interventional radiology (IR) telephone clinics and pre-operative assessment during the Covid-19 pandemic: a UK single centre experience**

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Purpose: To evaluate patient satisfaction with telephone consultations as an alternative to traditional face-to-face clinics.

Materials and Methods: All IR patients undergoing an elective endovascular procedure from August 2020 to December 2020 were retrospectively contacted and asked to answer a telephone questionnaire. They were asked a range of questions to qualify patient satisfaction (graded from 0-dissatisfied to 5-very satisfied) of the new practice of pre-procedural telephone consultation and assessment clinics which had to occur in light of the Covid-19 pandemic.

Results: A total of 18 out of 20 patients accepted our invitation to participate in the questionnaire. The two patients who did not take part in the questionnaire provided comments and feedback via an alternative method. The majority of patients were satisfied (4/5) or very satisfied (5/5) (88.9%) with the teleconsultation. Similarly, most patients were either satisfied (4/5) or very satisfied (5/5) with correspondence received following the teleconsultation (94.4%). Our final outcome measure showed 17 out of 18 participants (94.4%) would recommend our IR telephone consultation service.

Conclusion: Overall, we have shown a high level of patient satisfaction with IR teleconsultations and telephone pre-operative assessment clinics at our institution during the Covid-19 pandemic. We believe that this new practice represents a feasible long-term alternative to the more traditional face-face attendance. However, larger prospective studies are recommended to directly compare patient satisfaction between teleconsultations and traditional face-to-face clinics.

P-450**Analysis of failed therapy evaluations in radioembolization of primary and secondary liver cancer**

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Purpose: The aim of this study was to analyze patients' characteristics and reasons for not performing planned transarterial radioembolization (TARE) in liver cancer after ^{99m}Tc-labelled macroaggregated albumin (^{99m}Tc-MAA) evaluation.

Materials and Methods: In this retrospective single-center cohort all patients undergoing ^{99m}Tc-MAA evaluation prior to planned TARE for primary or secondary liver cancer between 2009 and 2018 were analyzed. Patients were assigned to either "TARE" or "no TARE" group. Patients' characteristics, arising reasons for not performing the planned TARE treatment as well as predictive factors for occurrence of these causes were analyzed.

Results: 436 patients [male=248, female=188, median age 62 (23-88) years] with ^{99m}Tc-MAA evaluation prior to planned TARE were included in this study. 148 patients (33.9%) did not receive planned TARE. Patients with a hepatic tumor burden >50%, no liver cirrhosis, no previous therapies and a higher bilirubin were significantly more frequent in "no TARE" compared to "TARE" group. Main reasons for not performing TARE were extrahepatic tracer accumulation (n=70, 40.5%), non-target accumulation of ^{99m}Tc-MAA (n=27, 15.6%) or a hepatopulmonary shunt fraction of more than 20% (n=23, 13.3%). Independent preprocedural parameters for not performing planned TARE were elevated bilirubin (p=0.021) and creatinine (p=0.018) and lower MELD score (p=0.031).

Conclusion: A substantial number of patients are precluded from TARE following ^{99m}Tc-MAA evaluation, which therefore shouldn't be refrained from in pretreatment process. A preceding careful patient selection is needed especially in patients with high hepatic tumor burden and alteration in lab parameters.

P-451**Clinical and genetic manifestations of patients with GDF2 mutations associated with hereditary hemorrhagic telangiectasia**

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Purpose: To characterize the clinical and genetic presentations of patients with HHT associated with GDF2 mutation or deletion.

Materials and Methods: The authors retrospectively derived a study cohort of 4 patients (mean age 21±14.84 years; range 3-37 years) with HHT-like clinical presentations and were found to have a novel GDF2 mutation (N=2) or deletion (N=2).

Results: Two patients had GDF2 missense mutations that have not been annotated as pathogenic variants. The two mutations were located in exonic sequences of the GDF2 locus, which encodes the BMP9 protein (p.Val403Ile; p.Glu355Gln). The other two patients had interstitial deletions larger than five megabases between 10q11.22 to 10q11.23.

The clinical characteristics of the cohort are detailed in Table 1.

Patient	Sex	Age	Clinical Criteria	Telangiectasias	Cerebro-spinal	Cardiac	Epistaxis	Comorbidities
1	f	37	2	Face, chest, stomach, and forearms	None	Paroxysmal supra-ventricular tachyarrhythmias, mitral valve regurgitation	Childhood-onset (resolved at presentation)	Diabetes mellitus and asthma
2	m	32	3	None	Frontal AVMs ruptured status-post surgical repair at the age of 9 years	None	Childhood-onset; refractory disease	None
3	f	13	1	None	None	Supra-ventricular tachyarrhythmia (resolved)	Childhood-onset (resolved at presentation)	Degenerative changes at L4-L5 on spinal MRI, mild intellectual disability, and ADHD
4	m	0	2	None	Multiple capillary telangiectasias in the supra and infratentorial brain	Right ventricular hypoplasia, large posterior ventricular septal defect, and secundum atrial septal defect.	Childhood-onset (resolved at presentation)	Severe eczema, developmental delay, and hypotonia

Conclusion: Patients with a mutation in the GDF2 gene leading to BMP9 endoglin deficiency are at risk for a rare variant of HHT.

P-452

Quality assurance for radiographically guided port implantations with forearm access - a retrospective analysis risk factors

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Purpose: Port implantations at the forearm are associated with an increased risk of relevant vein thrombosis. Therefore, with this study we sought to identify the responsible risk factors to improve technical quality of the method.

Materials and Methods: This is a retrospective analysis of 313 patients with port implantation at the forearm in 2019. Further, all complications within the last 4 years were included. Then, exploratory statistics were conducted comprising Cox-Regression and Kaplan-Meier-Analyses.

Results: Mean age was 60 ± 14 years. 232 (74%) of the patients were female. No early infection was observed. 29 late infections occurred and 43 cases of thrombosis. In only 9% of the cases of thromboses hospital admission was necessary. Median interval to the diagnosis of thrombosis was 23 day, IRQ (16-75). Mean interval to regular port explantation was 227 ± 128 days. There was no effect of occurrence of thrombosis of the interventionalist, the assistance nor of several technical aspects. However, there was a significantly lower risk of thrombosis of the mainly used port compared to replacement ports, HR: 0.34[0.172,0.674], $p = 0.002$. Age was a significant risk factor for late infections, HR: 3.35[1.84,6.07], $p < 0.0001$.

Conclusion: The main risk factor for adverse outcome after radiographically guided port implantation at the forearm is the type of the implanted port system. The reason for that might not be the material itself but the experience of a team with a certain port system. Age is a risk factor for late complications.

P-453

Efficacy of combined mechanic and medical local thrombolysis - a head to head comparison of ultrasound-assisted medical thrombolysis versus the gold standard

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Purpose: This study seeks to evaluate the improved efficacy of ultrasound-assisted medical thrombolysis in comparison to the gold standard of sole medical thrombolysis or conventional local thrombolysis, respectively.

Materials and Methods: Sixty-nine sets human blood were evaluated each comprising a control tube, a tube just treated with medical lysis and a tube treated with ultrasound-assisted medical thrombolysis. All tubes were kept under physiological conditions. Except for the control in all tubes 5mg of rt-PA was administered over the predetermined treatment interval. After a short term(6h) and long-term(24h) lysis interval the thrombus was weighted.

Results: Conventional and ultrasound-assisted lyses were both effective and led to a significant reduction of the thrombus mass; conventional lysis led to a mean reduction of 32% and ultrasound-assisted lysis led to a mean reduction of 41% ($p < 0.001$ for both). Further, thrombus burden was significantly lower after ultrasound-assisted thrombolysis compared to the gold standard ($p = 0.001$). Further, the better efficacy of ultrasound-assisted thrombolysis was mostly already apparent at early phases during thrombolysis and did further mildly increase over time ($r = 0.24$; $p = 0.047$).

Conclusion: Ultrasound-assisted medical thrombolysis is significantly superior to the gold standard of sole/conventional local medical thrombolysis. This important treatment benefit is already apparent at an early timepoint of treatment and slightly further increases during treatment. Therefore, ultrasound-assisted medical thrombolysis preferred over the gold standard whenever available.

P-454

Exploring medical students' views on virtual medical education during a time of pandemic

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Purpose: There is a lack of Radiology teaching and exposure amongst medical students in the UK and internationally. In order to address this paucity during the COVID-19 pandemic, aspects of medical education such as didactic teaching and rotations have had to be delivered virtually. Medical students' views on virtual teaching are limited yet vital in improving medical education during these times.

Materials and Methods: The UK Radiology Finals Conference (UKRFC) delivered online Radiology teaching sessions via Zoom webinars to international medical students. Sessions on interpreting common radiographs and CT scans were taught by UK Radiology trainees. Post-event feedback questions focussed on exploring students' views on virtual teaching and used a mixture of open-ended, multiple-choice and Likert-scale questions.

Results: Of the 208 delegates, 55% preferred virtual teaching (vs face-to-face teaching); 41% agreed that virtual teaching was more effective (vs face-to-face teaching) while 39% were indifferent towards either. A virtual teaching conference was preferred for its 'Convenience' (90%), 'Flexibility' (75%) and 'Cost' (64%), but the main drawbacks were 'Webinar Fatigue' (63%), 'Difficulty Concentrating' (53%) and 'Lack of Engagement' (36%). Feedback for the UKRFC was overall very positive as 83% of delegates rated it 8 out of 10, and there was a statistically significant increase in delegate confidence in interpreting scans after each session ($p < 0.001$).

Conclusion: While there is a lack of consensus about the preferred method of delivering didactic teaching, it is important to consider the views of medical students in order to maximise the benefits of virtual education while improving on the drawbacks.

P-455

Management of uncomplicated total knee arthroplasty chronic pain and stiffness utilizing cooled radiofrequency ablation: a single institution pilot study

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Purpose: To establish the clinical efficacy, technical feasibility, and safety profile of cooled radiofrequency ablation in percutaneous image-guided treatment of chronic pain and stiffness in the setting of uncomplicated total knee arthroplasty.

Materials and Methods: This retrospective pilot study includes a total of 19 consecutive patients experiencing persistent chronic pain after total knee arthroplasty, without underlying hardware complications, that failed conservative care. Patients initially underwent anesthetic blocks of the genicular nerve branches to determine C-RFA candidacy. After adequate response to the anesthetic blocks (>50% immediate pain relief), patients were subjected to cooled radiofrequency ablations 2-3 weeks later. Treatment response was evaluated utilizing clinically validated questionnaires (KOOS: Knee injury and Osteoarthritis Outcome Score) and Visual Analog Score (VAS) in order to assess pain severity, stiffness, functional activities of daily living and use of pain medication. Follow-up outcome scores were collected up to 1 year after C-RFA procedure.

Results: The average age of the subjects was 70.5 years. A total of 19 knees were treated. The mean total KOOS score improved significantly from baseline at 36.2 ± 14.1 to 61.9 ± 26.5 at 12 months after treatment ($p < 0.0001$), with significant improvement in mean pain score from 36.5 ± 15.2 to 72.45 ± 25.2 ($p < 0.0001$) and mean stiffness score from 47 ± 21.9 to 68.5 ± 24.9 ($p < 0.0001$). No complications were reported.

Conclusion: Image-guided genicular nerve cooled radiofrequency ablation is safe and efficacious in treating chronic pain/stiffness in the setting of uncomplicated TKA.

P-456

Tremor relapse after MRgFUS VIM thalamotomy: comprehensive analysis in a historical prospective case control study

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Purpose: To identify possible relevant factors for tremor relapse after treatment with tMRgFUS.

Materials and Methods: We identified all cases of tremor recurrence among the patients treated in the period February 2018-December 2020. The analysis of imaging and procedural factors we selected a control group matched for clinical and demographic characteristics.

Among the procedural factors we analyzed: SDR, number of active elements and sonications, skull surface area, maximum duration of sonication, energy and power, accumulated thermal dose at the end of the treatment. For the imaging evaluation, we measured the size of the thalamotomy lesions with follow-up at 24hrs and 1,3,6 and 12 months.

For the evaluation of the DRTt, a tractographic reconstruction was performed before and after treatment; DTI parameters were also recorder.

Results: 77% of patients with tremor relapses were Parkinson's disease patients.

With regard to procedural and imaging factors, we observed that patients with relapse showed a significantly higher SDR than the control group. Patients with relapse a lower power was reached during sonications. The number of target shifts during treatment were significantly higher in patients with tremor recurrence. We found larger lesions in the 1 year control in patients with better outcomes than to patients with relapse. In the tractographic evaluation we found an eccentric position of the DRTt in patients with tremor relapse.

Conclusion: The most relevant determining factors for tremor relapse after MRgFUS thalamotomy appears to be the tremor from Parkinson's disease and inaccurate thalamic targeting. The size of the thalamotomy lesion can influence the outcome of the treatment.

P-457

Mentorship in interventional radiology: addressing obstacles to pursuing research and innovation

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Purpose: The purpose of this study is to assess the attitudes and perceived obstacles of trainees pursuing interventional radiology (IR) research.

Materials and Methods: In this IRB-approved prospective study, a 27-item survey was sent to medical students, residents and fellows who are members of the SIR Resident and Fellows section and SIR Medical Student section between July and September 2019. Items assessed included attitudes and perceived barriers to performing IR research, and experience with mentorship in IR. Survey-weighted descriptive summaries were computed for all categorical variables. Fischer's exact

tests were performed to analyze differences between trainees with and without a mentor in IR.

Results: A total of 106 trainees (~20%) responded to the survey. 100% of respondents agreed that conducting research is important to advancing the field of IR. However, 46.2% of respondents reported that they do not have enough time to engage in research. Further deterrents to pursuing IR research included lack of institutional support (41.5%), increased clinical demands (67.9%), and lack of research experience (35.8%). Respondents who had a mentor were more likely to pursue IR as a career compared to those without mentorship (98.6% vs 41.0%, $p < 0.0001$). Respondents who had a mentor were also more likely to pursue IR research compared to those without mentorship (32.5% vs 14.4%, $p < 0.0001$).

Conclusion: Though many institutional and personal obstacles remain to performing IR research, mentorship is essential in addressing these deterrents. Efforts to develop robust IR mentorship programs is essential to encourage a future of innovation and research in IR.

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Endovascular embolization results in treatment of I-IV grade traumatic spleen rupture: single centre study

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Purpose: Splenic artery embolization (SAE) is commonly used for low-grade traumatic spleen rupture (TSR) (I-II), however hemodynamically stable patients with high-grade TSR (III-V) could also benefit from SAE. The purpose of this study was to:

1. evaluate etiology and injury grade of TSR;
2. analyze association between injury grade (IG) and inflammatory parameter change after SAE.

Materials and Methods: In this retrospective single center study patients undergoing SAE for TSR from 2014 to 2020 were included. IG assessed with American Association for Surgery of Trauma (AAST) scale. Blood sample analysis performed on admission and on 1st, 4th, 7th, 10th hospitalization day.

Results: 20 patients included, mean age: 45.30 years. TSR etiology: 50% - polytrauma, 35% - fall from height, 15% - forensic trauma. According to AAST scale: 5% - I IG, 15% - II IG, 45% - III IG, 35% - IV IG. SAE was performed with coils. In 87% of cases proximal SAE performed from bifurcation to middle of the artery. In 13% additional superselective distal SAE performed. Compared to admission, on 10th day after SAE absolute leukocyte count and C-reactive protein (CRP) percentual changes were: I IG leukocytes: +627%, CRP: +217% ($p < 0.05$), II IG leukocytes: -29.6%, CRP: +77% ($p < 0.05$), III IG leukocytes: +55.2%, CRP: +1093% ($p < 0.05$), IV IG leukocytes: -39%, CRP: +93% ($p < 0.05$). One patient developed splenomegaly that required splenectomy; no other significant complications were recognized.

Conclusion: The dominant cause of TSR in Latvia- polytrauma. SAE can be considered as alternative to splenectomy in hemodynamically stable patients with low and high-grade TSR with minor complication risk

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Long term persistence of pulmonary arteriovenous malformations after treatment with the microvascular plug

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Purpose: To summarize long-term follow-up and expanded single center experience of the Micro Vascular Plug (MVP) for embolization of pulmonary arteriovenous malformations (PAVMs) in patients with Hereditary Hemorrhagic Telangiectasia (HHT).

Materials and Methods: This retrospective study was approved by the IRB, including all patients with a clinical or genetic diagnosis of HHT treated with MVPs from Sept 2014-Jan 2021. MVP selection was based on feeding artery size (MVP-3: < 3 mm, MVP-5: 3-5 mm). Inclusion criteria included a simple PAVM (a single feeding artery) treated with an MVP. Exclusion criteria included revision of outside-treated PAVMs and complex PAVMs (multiple segmental feeding arteries). Persistence was defined as less than 70% reduction in sac size on most recent follow-up CT.

Results: A total of 116 PAVMs in 37 patients with HHT were treated with MVPs. Average age: 41 ± 18 , with 55% female. Average feeding artery diameter: 2.53 ± 0.92 , with 96 PAVMs treated with the MVP-3 and 20 PAVMs treated with the MVP-5. Average pre-procedure sac size: $7\text{mm} \pm 3.6$. Successful MVP detachment occurred in 99% of cases, with delayed migration in one case. Technical success was 87.1%. 13 PAVMs required coils for additional stasis, and 2 PAVMs had persistent perfusion without coil placement. Average time of treatment to most recent imaging: 861 days. Average sac reduction: 83%, with persistence in 27 out of 116 treated PAVMs.

Conclusion: In conclusion, the current analysis extends our previous report and demonstrated continued safety and long-term technical success of MVP in the treatment of PAVMs. The MVP with PFTE coating may reduce long term persistence.

P-460

The role of dynamic-contrast MR lymphangiography in the imaging of primary lymphatic disorders

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Purpose: Dynamic-contrast MR lymphangiography (DCMRL) is a novel lymphatic imaging technique that allows visualization of the central lymphatics following ultrasound-guided injection of gadolinium-based contrast agent (GBCA) into the inguinal lymph nodes.

This study describes our experience of DCMRL in adults with primary lymphatic disorders.

Materials and Methods: Retrospective review of all patients who have undergone DCMRL using a 3T MRI. Technical success, complications and imaging findings (obstruction/leak/reflux) were recorded. Underlying lymphatic diagnoses and the impact of DCMRL on subsequent management were ascertained.

Results: 15 patients underwent DCMRL. Mean(range) age was 35(16-60). 5 patients had primary lymphoedema secondary to a known syndrome (2 Noonan, 2 yellow nail, 1 WILD). 2 patients had a generalized lymphatic dysplasia (four limbs, facial and internal lymphatic abnormalities). 2 patients had predominantly systemic/visceral involvement. 4 patients had lympho/lymphovascular malformations and 2 had late onset unilateral primary lymphoedema.

11 studies were technically successful (depicting abdominal and thoracic lymphatics). 3 studies were partially successful (depicting abdominal lymphatics). 1 study failed to depict the central lymphatics, however, reflux was identified into the scrotum/thigh, therefore, was of diagnostic value. 3 patients experienced mild pain after GBCA injection. No other complications were observed.

A lymphatic abnormality was demonstrated in 11 patients. 3 studies demonstrated reflux and 2 leakage. In 3 cases, DCMRL provided additional therapeutic options by identifying potential sites for lymphatic embolisation.

Conclusion: DCMRL can identify obstruction, leakage and reflux within the central lymphatics as well define anatomical relationships. This provides important diagnostic information and can inform therapeutic options by identifying sites for lymphatic embolisation.

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Ultrasound-guided needle positioning for nodal dynamic contrast-enhanced MR lymphangiography – do we need more than plain b-mode sonography?

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Purpose: To evaluate validation of injection needle position in groin lymph-nodes for dynamic contrast-enhanced MR-lymphangiography (DCE-MRL) by sonography-guided injection of physiological saline.

Materials and Methods: 80 patients (47 female, mean age 43.1 years) referred for DCE-MRL were reviewed. An adequate needle position was evaluated by injecting saline-solution and observation of consecutive lymph-node distension by ultrasound followed by DCE-MRL. Transpedal interstitial MRL was performed if no inguinal nodes were identified. The rate of inguinal node detection was recorded. MR-lymphangiograms were evaluated regarding primary technical success (i.e. enhancement of draining lymphatics) and secondary technical success (i.e. lymphatic enhancement after needle repositioning). MRL was clinically successful when enhancement of central lymphatics and/or lymphatic pathologies was seen.

Results: 177 groins were evaluated by ultrasound for 92 MRL-examinations. Lymph nodes were identified in 171/177 groins (96.6%). After puncture lymph node distension was seen in all 171 cases on saline injection. Subsequent MR-contrast injection showed enhancement of draining lymphatics in 163/171 cases (95.3%) (primary technical success). In 6/171 cases (3.5%) in-bore needle retraction was performed with subsequent adequate lymphatic enhancement (secondary technical success). In 2/171 nodes (1.1%) in one patient no lymphatic enhancement was achieved despite repeated needle repositioning. Overall 169/171 (98.8%) contrast injections were technically successful. In all 6 groins without identifiable inguinal nodes transpedal MRL was successful. 91/92 MRL-examinations (98.9%) were clinically successful without complications.

Conclusion: Confirming an adequate nodal needle position for DCE-MRL by sonographically controlled saline injection is a straightforward and reliable technique leading to a high success rate of DCE-MRL.

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IR in trauma - what role do we play? A retrospective single centre experience

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Purpose: A retrospective review of all major trauma cases was performed at a Major Trauma Centre. The purpose is to determine the proportion of patients who require Interventional Radiology (IR) vs the Operating Theatre (OT) for acute haemorrhage control transferring directly from the Emergency Department (ED).

Materials and Methods: A retrospective review was undertaken of all major trauma cases (over 10,000) over a 4 year period (2017 - 2021), requiring immediate transfer from the ED to either OT or IR. Data collected included:

- Total number of patients who attended IR vs OT
- Mechanisms of injury including patterns of injury more frequently dealt with in IR
- Breakdown of procedures performed in IR & OT in order to gain haemorrhage control
- Effects of CT findings & patient haemodynamics on triage [ongoing]

Results: A total of 733 patients required immediate transfer from ED to either OR or IR.

685/733 patients attended the OT:

- 384 required damage control laparotomy
 - 108 received neurosurgery
 - 60 received control of limb haemorrhage
 - 60 received orthopaedic surgery
 - 36 received airway management
 - 24 received control of head/neck haemorrhage
 - 12 received ophthalmological surgery
 - 48/733 patients attended IR:
 - 37 patients received embolisation (predominantly splenic and pelvic);
 - 9 received TEVAR stent grafting
 - 2 received neurointervention
- The ratio of blunt:penetrating in the two groups was 40:60 OT and 85:15 IR.
- Conclusion:** IR is essential in the management of acute traumatic haemorrhage in approximately 10% of patients; and particularly in the management of blunt trauma.

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Extended student-led research project (ESREP): review of radiological liver interventions in children post liver transplant in a quaternary liver centre

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Purpose: ESREP represents an opportunity for year 4 and 5 medical students to develop and deliver a piece of research in an area of medical interest supervised by a clinical supervisor. The aim of our project was to identify all the radiological liver interventions undertaken post liver transplant in children at Leeds Children's Hospital, UK.

Materials and Methods: This was a retrospective audit. All paediatric patients who underwent liver transplant were identified. Each patient's radiology and clinical record was then checked to see if they had any radiological intervention related to their transplant whilst under the paediatric team.

Results: During the study period May 2000 – December 2020 there were 342 transplants performed in 292 patients. 258 patients had 1 transplant, 28 had 2 transplants and 6 had 3 transplants. The average age at transplant was 65.2 months. 47% patients were female and 53% male. 1 patient was lost to follow-up and in a further 10 patients the records could not be found. Of the remainder, 255 currently have good graft function and 26 have now deceased. In total, there were 481 radiological interventions: 212 biopsies, 66 hepatic artery interventions, 51 portal and 28 hepatic vein interventions, 68 percutaneous transhepatic cholangiograms, 13 ERCPs, 40 drainage procedures and 3 TIPSS interventions. The first intervention was performed in November 2005 and numbers have significantly increased since then.

Conclusion: This student-led project has shown the increasing role paediatric interventional radiology is playing in post liver transplant management and no doubt improving graft survival.

P-464

Intranodal CT lymphangiography using water-soluble iodinated contrast for the imaging of the central lymphatic system

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Purpose: To evaluate the feasibility of intranodal CT lymphangiography (ICTL) imaging in patients with thoracic lymphatic disorders.

Materials and Methods: Five patients (all women, 68.2y [range, 53-83]) with contraindications to MR imaging underwent ICTL. 25G needles were placed in the bilateral inguinal lymph nodes under ultrasound guidance, and water-soluble iodinated contrast was injected. CT fluoroscopy was used to monitor the opacification of the cisterna chyli to determine the

timing of the CT scan. After ICTL, the thoracic duct (TD) was catheterized, and lymphangiography through the thoracic duct catheter was performed. Imaging findings of ICTL and the subsequent lymphangiography were then compared and analyzed.

Results: Intranodal injection of water-soluble contrast was successful in all patients. The central lymphatics were opacified in 4/5 patients, demonstrating abnormal pulmonary lymphatic flow from the thoracic duct into the lung parenchyma. In 1/5 patients, the thoracic duct injection showed successful ligation of the thoracic duct. The time elapsed from contrast injection to visualization of the thoracic duct ranged from 2-27 minutes. ICTL and the lymphangiography findings matched well.

Conclusion: ICTL can sufficiently delineate central lymphatic anatomy and can be used as a substitute to the technically and logistically challenging DCMRL. Wider availability of CT can further bolster the dissemination of lymphatic imaging.

P-465

Open, laparoscopic, and focal prostate cancer therapies among Medicare patients from 2010 to 2018: an analysis of procedure volume, specialty involvement, and cost

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Purpose: Many treatment options currently exist for prostate cancer. Therapies include open prostatectomy, laparoscopic prostatectomy, and focal therapies (cryoablation, HIFU, photodynamic, IRE). There has been increasingly interest in the use of focal therapies to treat patients with localized prostate cancer, an area of potential interest to the Interventional Radiology community. Minimal data exists on patterns in overall procedure volume, specialty involvement, and cost.

Materials and Methods: This study utilized data derived from publicly available databases provided by the Center for Medicare and Medicaid Services (CMS). Billing data from the CMS Physicians/Supplier Procedure Summary (PSPS) Master Files from 2010 to 2018 were obtained. The billing codes 55840, 55866, 55873, and 55899 were used. Therapies such as HIFU and photodynamic therapy do not have individual billing codes for the years analyzed and are billed under 55899-other prostate procedures.

Results: The total number of represented procedures increased from 29,123 to 32,460 during the study period. The number of open prostatectomies decreased from 3,288 to 2,232 while laparoscopic prostatectomies increased from 20,057 to 27,212. Prostate cryoablations decreased from 4,309 to 1,831 (rate decreased from 9 to 3.1 prostate cryoablations per 100,000 Medicare patients ($p < 0.01$)). Specialty analysis in 2018, showed IR performed 1.4% of prostate cryoablations with Urology performing over 95%. IR performed less than 1% of uncategorized/other prostate procedures in 2018. Mean submitted charge for a laparoscopic prostatectomy was 5,108 versus 10,213 for prostate cryoablation.

Conclusion: Interventional Radiology performs a small proportion of the decreasing number of prostate cryoablations among Medicare patients and currently plays a minimal role in prostate cancer therapy.

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Specialty involvement, cost analysis, and changes in utilization of bone ablation therapies among Medicare patients: a trend analysis from 2010 to 2018

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Purpose: In the appropriately selected patient, percutaneous bone ablations have demonstrated promising outcomes. Minimal data exists

on the procedural volume, specialty involvement, and costs of percutaneous bone ablations.

Materials and Methods: This study utilized data derived from publicly available databases provided by the Center for Medicare and Medicaid Services (CMS). Billing data from the CMS Physicians/Supplier Procedure Summary (PSPS) Master Files from 2010-2018 were obtained. The billing codes 20982 and 20983 were used corresponding to radiofrequency and cryoablation of bone tumors. Microwave ablations are included under radiofrequency ablations. The rate of ablation procedures was calculated per 100,000 Medicare patients. The Mann-Kendall test was used to analyze for statistically significant trends.

Results: The total number of bone ablations for Medicare patients increased from 181 to 1,801 per year during the study period. The overall rate increased from 0.4 to 3 bone ablations per 100,000 Medicare patients ($p < 0.01$). In 2018, 85% or 1,543 ablations were radiofrequency/microwave ablations with the remaining representing cryoablations. By specialty radiology performed 73.3% of total bone ablations in 2018 increasing their share from 68% in 2010. The next most frequent providers of bone ablations in 2018 were neurosurgery (11.3%) and orthopedic surgery (6.8%). The mean submitted charge for a bone ablation was 4,901.7 (179.2-54,175).

Conclusion: The increase in case volume and utilization rate of bone ablation procedures suggest continued acceptance of ablation as an effective therapy for specific bone tumors in appropriately selected patients. Radiology continues to perform the majority of bone ablations with an increasing share of these treatments over the study interval.

P-467

Adrenal vein sampling for adrenal Cushing's disease: single-center experience with an emerging critical technique

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Purpose: To study use, technical success, adverse events, and initial outcomes of adrenal vein sampling (AVS) for adrenal Cushing's (AC) disease.

Materials and Methods: From 2019 to 2021, 10 patients underwent AVS for corticotropin-independent adrenal hypercortisolism for lateralization and surgical candidacy at a single-center multi-site institution. IRB-approved retrospective analysis was performed. Samples were drawn for aldosterone, cortisol, and epinephrine. Technical success was defined as adrenal-to-peripheral epinephrine difference meeting diagnostic criteria. Clinical success was defined as symptom-improvement following surgery (if lateralization criteria met).

Results: All AVS for AC disease were performed by single operator. Technical success was 7/10 (70%). 3 did not meet criteria: 2 met criteria only on 1 side and 1 did not meet criteria on either side but did undergo bilateral adrenalectomy with left partial sparing due to symptom severity. All patients showed increased epinephrine relative to peripheral even if criteria were not met. The other patients were offered repeat AVS; 1 declined and the other pending. 4 lateralized; 3 underwent surgery with symptom improvement and 1 postponed due to COVID-19. 3 patients met criteria for bilateral disease; 2 underwent medical optimization with mixed results and 1 was lost to follow-up. No adverse events were documented.

Conclusion: AVS is increasing exponentially. 1/5 patients with hypertension may have primary hyperaldosteronism and need AVS (Brown 2020). A lesser known use is for lateralization with AC. Different from conventional AVS, epinephrine is used for a reference standard. Patients who demonstrate lateralization are candidates for surgery and experience symptom relief. Bilateral disease remains challenging. Further study in this setting warranted.

P-468

Temporal and geospatial variations among the female interventional radiology physician workforce in the United States

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Purpose: To analyze the temporal trends and state-wise geospatial variations in Vascular and Interventional Radiology (VIR) female physician workforce in the United States.

Materials and Methods: The State Physician Workforce Data was accessed for years 2015, 2017, and 2019. The variables collected for each state included total active female physicians, total female physicians per specialty, and total female physicians per 100,000 population in VIR. Comparative data were obtained for otolaryngology (ENT), general surgery (GS), interventional cardiology (IC), neurosurgery (NSG), ophthalmology (OP), orthopedic surgery (OS), plastic surgery (PS), thoracic surgery (TS), vascular surgery (VS) and urology (UR). The annual growth rate for female physicians in each state was computed for each specialty.

Results: From 2015 to 2019, the total active female physicians in the United States grew by 3.82% per year. 34.61% of total physicians are female, and out of the specialties analyzed, ophthalmology has the highest number of female physicians at 22.14%, whereas females made up only 3.04% of VIR workforce. The annual growth rate of female physicians was highest in VS (12.61%) which was followed by IR (7.80%), IC (7.48%), NSG (7.15%), UR (6.12%), PS (5.02%), TS (4.51%), OP (4.09%), ENT (3.86%) and OS (3.28%). The state of Massachusetts has the highest proportion of women in VIR at 19%. Utah had the highest growth rate in the number of female VIR physicians at 16.55%.

Conclusion: Female VIR physicians make up a small fraction of the VIR workforce, but their numbers have increased at a faster rate than most surgical specialties except vascular surgery.

P-469

Ultrasound-guided radiofrequency ablation for symptomatic benign thyroid nodules

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Purpose: The aim of this retrospective study is to evaluate the safety and efficacy of ultrasound (US) guided percutaneous radiofrequency ablation (RFA) in the treatment of symptomatic benign thyroid nodules.

Materials and Methods: 152 patients with symptomatic benign thyroid nodules underwent RFA sessions in our hospital between June 2014 and June 2018. All patients declined or were not eligible for surgery. Thermal tissue necrosis was done using internally cooled 18G radiofrequency electrodes via US-guided percutaneous parathyroid approach by using a free-hand, moving-shot technique under local perithyroidal anesthesia and/or neuroleptic anesthesia (NLA). Nodule volume, US pattern, thyroid function, symptom score (visual analogue scale, 0-10 cm), cosmetic grading score (4-point scale) and complications were evaluated before treatment and at 1, 6 and 12 months.

Results: 171 RFA sessions were performed in 152 patients who had symptomatic benign thyroid nodules. Nineteen patients underwent a second RFA session. At 1 and 12 months, mean overall nodule volume reduction rates were $\geq 50\%$ in 152 patients and $\sim 83\%$ in 114 patients, respectively. Compressive symptoms resolved or significantly improved in all patients. Complications that observed were transient voice change in two cases (1,3%) and a nodule rupture (0,7%).

Conclusion: Our results, that are alike international medical data, confirm that RFA is an effective and safe outpatient treatment option in patient with benign symptomatic thyroid nodules.

P-470

Ultrasound-guided radiofrequency ablation of locally recurrent thyroid cancer

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Purpose: The purpose of this prospective study is to evaluate the efficacy and safety of ultrasound(US)-guided Radiofrequency Ablation (RFA) for treating recurrent papillary thyroid cancer (PTC).

Materials and Methods: Seven patients with 12 locoregional recurrent PTCs, age 25-89, underwent RFA in our hospital between June/2014 and January/2019. Patients had been re-operated a lot and were high risk for another operation. The patients fulfilled the following criteria: not more than four tumors; confirmed recurrence by US-guided fine needle aspiration biopsy or thyroglobulin (Tg) measurement of needle washouts; no metastasis beyond the neck; more than a six-month follow-up period. RFA was performed using internally cooled 18G and 19G radiofrequency-electrodes using a free-hand, moving-shot and hydrodissection technique, under local anesthesia and/or neuroleptic anesthesia. Follow-up included size change on US and Tg level at 1, 6, and 12 months and every 6-12 months thereafter. Any complications were reported during follow-up.

Results: During follow up a reduction of recurrent tissue volume was observed and also the mean serum thyroglobulin level decreased in all patients. Three patients had 3 tumors that completely disappeared. One patient with recurrence in supraclavicular lymph-node had absolute reduction after 1 and 3 years follow-up. There were no delayed complications associated with RFA during the follow-up period.

Conclusion: RFA seems to be an effective minimally invasive therapy alternative to 'berry picking' surgery for the treatment of locally recurrent PTC in cases of surgical ineligibility and when radioactive iodine are not indicated.

P-471

Evaluation of patients' knowledge about interventional radiology at the largest federal university from Brazil

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Purpose: Quantitatively and qualitatively analyse a patient's knowledge about Interventional Radiology (IR). Identify trends and possible strategies for dissemination and better population awareness about the specialty.

Materials and Methods: A cross-sectional, quantitative and qualitative study. Data collected from a questionnaire aimed at identifying the knowledge about basic IR concepts, degree of satisfaction with the specialty, and the best ways to disseminate it. The sample comprised 238 patients.

Results: 71.8% of participants reported not knowing the specialty of the professional who would perform their procedure, and among those who claimed to know, only 12.9% answered it correctly (Interventional Radiologist). Still, 70.2% did not know what the specialty was about. 77.3% of respondents, however, reported a preference for minimally invasive image-guided procedures instead of video laparoscopic or open surgery. Approximately 94% of respondents agree that the specialty should be more widely disseminated, and believe that its minimally invasive techniques could benefit other patients.

Conclusion: Despite the high prevalence of patients' lack of information about IR, most of them prefer being submitted to minimally invasive procedures, and reported that the specialty should be more publicized.

P-472

Old but gold in non-stimulated adrenal venous sampling for primary hyperaldosteronism: revisiting discontinued sampling sites and assessing their value for correct lateralization in the scenario of missing data from an adrenal vein with logistic regression analysis

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Purpose: In adrenal venous sampling (AVS) for primary aldosteronism (PA), unsuccessful cannulation of an adrenal vein can lead to inconclusive findings. The value of partial data and additional sampling sites merit further investigation.

Materials and Methods: All patients who underwent non-stimulated, bilaterally selective AVS for PA between November 2008 and January 2017 were included. Sampling was performed in both adrenal veins, the infrarenal inferior vena cava (iIVC) as well as in the suprarenal IVC (sIVC) and the left renal vein. Hormone measurements were analyzed as predictors of correct lateralization with univariable and multivariable logistic regression analysis.

Results: Of 59 included patients, 16 had an aldosterone producing adenoma (APA) on the left side, 15 had an APA on the right side and 28 patients were diagnosed with idiopathic hyperaldosteronism. The aldosterone/cortisol ratio in the sIVC stood out as discriminator of unilateral and bilateral disease with an OR of 7.74 ($p=0.01$) and was the most important predictor in highly significant multivariable multinomial logistic regression models ($p<0.001$) for missing data from either adrenal vein. If data from the right was missing, an APA on the left or the right side could be predicted with an area under the curve (AUC) of 86% and 87% respectively, for missing data from the left side the AUCs were 89% and 96%.

Conclusion: Given its value for lateralization of disease in case of missing data from either adrenal vein, we advocate for the integration of the sIVC into the canon of standard sampling sites and for the processing of partial data with regression analysis.

P-473

Perception of interventional oncology among medical students at University of Rwanda

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Learning Objectives: To assess perception of Interventional oncology amongst medical students and how we can heighten its recognition among them.

Background: We asked 96 medical students through a Google form survey.

Clinical Findings/Procedure Details: 66% responded that they have no clue about Interventional oncology as the sub-speciality is still not available in our country (Last year in 2020 there was the introduction of Interventional cardiology in one of the biggest hospital in Rwanda). 9% students considered a career in Interventional Oncology. 72% have no interest or any idea of pursuing a career in Interventional Oncology. 24 percent related the rejection to the fear of radiation risk (which is also one of the reason most of Medical students reject general Radiology). On the last question students requested emphasizing on Mentorship programs that would attract students in Interventional Oncology.

Conclusion: Medical students perception of Interventional Oncology is strong poor which can be attributed to inadequate knowledge about this speciality and fear for radiation risk thus mentoring is highly recommended.

P-474

The role of interventional radiology in venous blood sampling revisited

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Learning Objectives: Venous blood sampling (VBS) was a routine procedure to localize endocrine tumors, before the advent of "noninvasive" imaging. Lately, with CT Scanners, smaller endocrine tumors can be found. VBS was no longer included in the teaching of new interventional radiologists (IRs). Most young IRs do not learn or get exposure to such important studies. There is a serious gap of knowledge and inability to make or suggest the appropriate diagnostic tests in special circumstances.

Background: There are IRs with little experience in VBS. We encountered instances of colleagues unaware of these "obsolete" studies and, therefore, VBS must be "resuscitated." Some of these procedures we review are: inferior petrosal sinus VBS and sinography, VBS and venography of neck and mediastinal veins in hyperparathyroidism, portal vein and tributaries VBS in pancreatic tumors, VBS from hepatic veins, adrenal VBS and venography in aldosteronomas and hyperaldosteronism, retroperitoneal, IVC and tributary veins in pheochromocytoma, gonadal VBS and venography in hyperandrogenism, and renal veins in HTN.

Clinical Findings/Procedure Details: Radiologists, IRs, and clinicians alike must be aware of the role of VBS and venography in the evaluation of some special conditions, when the clinical and laboratory evidence suggests the presence of an endocrine tumor, and a complete workup, including "noninvasive" imaging methods are nondiagnostic.

Conclusion: IRs and clinicians must know the role of VBS and venography in the workup of patients, when clinical and laboratory evidence suggesting an endocrine tumor and a full workup are nondiagnostic. VBS are important procedures to diagnose endocrine tumors when "conventional" studies fail to localize the tumor(s). VBS is rapid, simple, safe, and easy to perform. VBS must be "resuscitated," learned and included in the training of IRs.

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The applications of peripheral nerve blockade in interventional radiology

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Learning Objectives:

1. Principles and benefits of peripheral nerve blocks (PNB).
2. Clinical applications and techniques of the most commonly used PNBs.

Background: Regional anaesthesia via PNB renders procedures more tolerable, reducing the requirement for periprocedural narcotics and their adverse effects, namely respiratory depression, cardiovascular compromise and delirium.

PNB involves the administration of local anaesthesia to a peripheral nerve supplying the target tissue(s) dramatically reducing/eradicating periprocedural nociceptive stimuli. Nerve localisation is under image guidance using ultrasound (US), fluoroscopy or computed tomography (CT), often in combination.

There are many targets for PNB, a representative sample of which shall be discussed.

Clinical Findings/Procedure Details: Phrenic Nerve Block:

This can be used to paralyse the diaphragm during CT-guided lung biopsies. Anaesthetic is injected around the nerve at the anterior surface of the anterior scalene muscle under US guidance.

Intercostal nerve block

A recent systematic review (Chen, 2021) demonstrated a significant difference in postoperative pain scores after percutaneous nephrolithotomy using this block versus control.

Paravertebral Block

This technique targets the spinal nerve roots and sympathetic chain in the paravertebral space, and has many applications, including gastrotomies, biliary procedures and percutaneous radiofrequency ablation of hepatic tumours.

Superior Hypogastric Nerve Block

The hypogastric nerve block is an adjunct to uterine artery embolisation to help alleviate post-embolisation syndrome, and has been shown to reduce the requirement for opiate analgesia and antiemetics.

Conclusion: PNB is an underused analgesic technique that can reduce the need for sedation and postoperative opiates, and their attendant risks. We have covered just a few of its many evolving applications.

P-476

Endovascular resuscitation and trauma management - emerging multidisciplinary concept for hemodynamic instability

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Learning Objectives: In the last 15 years, there is increased use worldwide of methods for hemorrhage control by endovascular /hybrid methods. Both traumatic and non-traumatic hemorrhage is being treated by minimal-invasive methods and endovascular tools as endografts, embolization, balloons etc. This concept is named EVTm-EndoVascular resuscitation and Trauma Management.

Background: The Concept of EndoVascular resuscitation and Trauma Management is based on different tools, used in a multidisciplinary matter, to be used during and after resuscitation in bleeding and non bleeding patients. It is based on increasing experience in trauma and non trauma patients and being used globally by many centers. Implementation of the concept might decrease mortality and morbidity in patients needing or near-need for resuscitation.

Clinical Findings/Procedure Details: The EVTm concept is based on several important points as described below:

1. Multidisciplinary team approach from admission
2. use of endovascular and hybrid tools including aortic balloon occlusion, endografts, embolisation agents, extra-corporal circulation and other tools in parallel to surgery
3. operating in one place with minimal transfer of the patient (open and endo surgery in the same suite)
4. Avoiding opening new cavities and using endovascular methods as adjuncts.
5. Using aortic balloon occlusion (REBOA) as part of primary survey if needed
6. Arterial and venous femoral access during primary survey on admission and others means to decrease mortality and morbidity

Conclusion: The EVTm concept is spreading and now established as a method to decrease mortality and morbidity in trauma and non-trauma bleeding and resuscitation patients. Its use, in a multidisciplinary way, might benefit patients.

P-477

US-VAE: the bridge between diagnostic and therapeutic interventions in breast imaging

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Learning Objectives: The aim of this study was to review technical considerations, indications, and factors behind the effectiveness of

ultrasound-guided vacuum-assisted excision (US-VAE) of B3 breast lesions, based in our Institution experience.

Background: In recent years, there has been an increasing use of US-VAE not only for diagnostic purposes but also for therapeutic ones, usually for B3 breast lesions, with effectiveness rates ranging from 70-100%. Its use for Carcinoma Ductal in Situ (CDIS) is still limited, with development of invasive carcinoma estimated between 15-20%.

Clinical Findings/Procedure Details: BAV was initially used to improve diagnostic accuracy for percutaneous biopsy due to larger cores obtained when compared to conventional procedures. However, it has been done recently with the aim of complete removal of some breast lesions, being less invasive, with less time of the procedure, with faster discharge of the patient and better cosmetic results when compared to surgical excision. The rate of complications is also low, ranging from 0% to 9%, including hematoma, infection and very rarely pneumothorax and skin lacerations. One of biggest challenges of the procedure is a long-term complete removal, according to the literature related to the size of the lesion – more successful for lesion with less than 2 cm – and operator's experience. Criterious selection of the lesions and imaging re-evaluation after 6 months improved the management of these patients.

Conclusion: In conclusion, US-VAE is a safe and effective option for removal of selected B3 breast lesions, that spares surgical interventions and provides adequate tissue samples for a confident diagnosis guiding subsequent management.

P-478

Percutaneous drainage: bigger calibre... less complications

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Learning Objectives: The aim of our work is to analysed the possible relation that small drainage catheter calibre can be associated to more clinical complications.

Background: A large part of the routine practice of interventional radiologists is the placement of percutaneous drainage catheters. Usually, the drainage diameter is chosen based on the density and viscosity of the material to be drained. It is a widespread belief that smaller calibre drainage results in less invasiveness of the manoeuvre with consequent lower clinical complications.

Clinical Findings/Procedure Details: We analysed 100 percutaneous drainage procedures in various body districts with liquids composed by different viscosity: ascites, pleural effusions, abscesses, complicated haematomas.

50 drains catheter were 8 Fr in diameter and 50 were 10 Fr in diameter. Eighteen of the 8 Fr catheters were dislocated or were squeezed causing pain, bleeding and incomplete evacuation of the collection requiring revision and repositioning. We also observed peri-catheter leaks that caused skin inflammation with associated itching and discomfort.

The larger calibre catheters (10 Fr) did not present any complications of those described above, allowing a rapid resolution of the symptoms and greater comfort for the patient. Large catheters may have more difficulty to pass through thicker tissues.

A substantial difference was noted between 8 Fr and 10 Fr.

Conclusion: The least invasiveness, intended as the only stable access that does not require revisions and leads to the rapid resolution of symptoms, is obtained with large-gauge drains (10 Fr ideal).

The shape of the holes must also be evaluated in the effectiveness of the draining power.

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Interventional radiology as a linchpin in the management of arterial pseudoaneurysms: the unpredictable volcanoes

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Learning Objectives: To discuss the etiopathogenesis and clinical features of pseudoaneurysm.

To study the use of various imaging modalities in the management of pseudoaneurysm.

To review the different minimally invasive treatment techniques based on features of the lesion.

Background: Pseudoaneurysm is a commonly encountered vascular abnormality which may affect any vessel like the carotid, limb and visceral arteries. The most dreaded and high risk complication of pseudoaneurysm is its rupture leading to catastrophic events like massive hemorrhage, shock and death; therefore it requires immediate treatment. With the development of various minimally invasive interventional radiology techniques, surgical modalities have been replaced by them in being the initial treatment of choice owing to their low risk of complications and faster recovery.

Clinical Findings/Procedure Details: The high prevalence of arterial pseudoaneurysm may be attributed to traumatic (including iatrogenic) and inflammatory causes. Conventional angiography is the gold standard for diagnosis of pseudoaneurysm, but other non-invasive imaging modalities like ultrasonography with Doppler, computed tomographic angiography and magnetic resonance angiography are also useful. Knowledge of different interventional radiological techniques is an essential prerequisite in successful treatment of pseudoaneurysm. A literature review about various endovascular, percutaneous and endoscopic ultrasound interventions used in the treatment of pseudoaneurysm has been presented here.

Conclusion: Early diagnosis and treatment of pseudoaneurysm are critical owing to their life threatening complications on rupture. Interventional Radiology offers various minimally invasive treatment modalities for pseudoaneurysms which are safe, rapid, have minimal complications and faster recovery rates.

P-480

Imaging and interventional radiological percutaneous treatment of bronchial artery haemorrhage

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Learning Objectives: To describe endovascular techniques in the management of non-responsive to traditional medical therapy or massive hemoptysis due to bronchial arteries pathology, with emphasis on diagnostic evaluation and therapeutic treatment.

Background: Hemoptysis is an expectoration of blood from respiratory tract. Massive hemoptysis (>300 ml blood in 24h) is considered a life threatening condition which requires a quick diagnosis and prompt care. Respiratory tract bleeding may be due in the majority of instances to bronchial artery pathology.

Diagnosis is made by bronchoscopy, chest computed tomography (CT), and angiography.

CT is used to localize the bleeding and identify the cause of hemoptysis. Percutaneous endovascular embolization of bronchial arteries is the first line treatment in non-responsive to traditional medical therapy or massive hemoptysis.

Clinical Findings/Procedure Details: The aim of this paper is to describe hemoptysis due to bronchial artery pathology in the following sub-chapters:

a) definition, b) pathophysiology, c) MD-CT imaging diagnosis, d) discuss the possible management with emphasis on transcatheter embolization, e) and possible complications associated with transcatheter embolization.

Conclusion: Massive hemoptysis requires urgent treatment. Interventional Radiologists play an essential role that goes from the diagnosis to the possible definitive treatment through transcatheter embolization.

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Interventional radiology point of view in rectus sheath hematoma: from diagnosis to endovascular embolization

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Learning Objectives: To describe the role of Interventional Radiology in the management of active haemorrhage in Rectus sheath, with emphasis from diagnostic evaluation to the endovascular therapeutic phase.

Background: Arterial haemorrhage related to Rectus sheath trauma and/or anticoagulant therapy is relatively rare, but when it occurs rapid diagnosis and therapeutic intervention is crucial. It is due to a damage of epigastric artery or by direct muscular tear.

Rectus sheath hematoma must be placed in differential diagnosis for each patient presenting with acute abdominal pain, especially in patients with certain predisposing factors.

As all emergency clinical situations, an accurate diagnosis of Rectus sheath hematoma can lead to a faster treatment, with consequent reduction in mortality rate.

Interventional radiology can have a major impact on the management of Rectus sheath hematoma. Transcatheter angiography directly confirms arterial injury, and by transcatheter embolization it is possible a rapid and definitive closure or repair of damaged arterial vessels.

Clinical Findings/Procedure Details: The aim of this paper is to describe Rectus sheath hematoma in the following sub-chapters: a) the definition, b) classification, c) imaging diagnosis of vascular lesions, d) and discuss the management with emphasis on transcatheter embolization.

Conclusion: Transcatheter embolization provides a rapid, safe and effective treatment for Rectus sheath hematoma. This gives to interventional radiologists a primary role in this acute and life threatening situation, especially in patients unresponsive to medical therapy and in cases of haemodynamic instability.

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Endoluminal balloon dilatation to remove a stuck port-a-cath

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Learning Objectives: To describe indications and technique of endoluminal balloon dilatation as a treatment in stuck Port-a-cath.

Background: Port-a-cath is a type of central venous catheter designed to allow repeated access to the venous system and can be used for a long time in cancer and non-cancer patients. Its surgical removal is usually a straightforward procedure performed under local anesthesia, but this can be complicated by the presence of tight fibrin adhesions between the catheter and the vessel wall preventing catheter removal, especially in long-term placement. In these cases, attempted forceful removal can lead to catheter fragmentation, embolization, vessel damage or right atrial tear. There are many alternatives to open surgery. Endoluminal balloon dilatation is an interventional technique to remove a stuck catheter. It involves balloon dilatation within catheter lumen, enlarging the lumen and stretching the catheter wall, breaking any adherent fibrin sheath. In such a way, the catheter can be removed.

Clinical Findings/Procedure Details: The aim of this poster is to describe the technique of endoluminal balloon dilatation as an interventional technique to remove a stuck Port-a-cath.

Conclusion: Stuck catheter can present a significant challenge and have previously required complex procedures to remove them. Endoluminal balloon dilatation is a technically less invasive method for removing stuck Port-a-cath, and should be the first line option for these patients.

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A single institution case series of traumatic pelvic bleedings managed with transarterial EVOH copolymer embolization

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Learning Objectives: To describe and illustrate, in our experience, the use of EVOH copolymer (Ethylene vinyl alcohol, known as Onyx[®]) as embolic material in post-traumatic pelvic bleedings.

Background: Several embolic agents are nowadays available to treat pelvic bleedings with peculiar pros and cons. There is worldwide growing experience in applications of EVOH copolymer outside of its usual neurovascular applications, including embolization of traumatic arterial injuries.

Clinical Findings/Procedure Details: Management of traumatic pelvic haemorrhage is often complex with interventional radiologists playing the well established role of avoiding unnecessary surgery. Aim of IR procedures is to recognise with DSA the source of bleeding (previously demonstrated with CTA) and to embolize it in a fast, effective and durable fashion. Particularly in the anterior division branches of the internal iliac artery (because of their collateral network with contralateral artery) and in the corona mortis variant, we usually obtain these results using high viscosity EVOH copolymer. This is a nonadhesive liquid embolic agent dissolved in dimethyl sulfoxide, suspended in tantalum which make it radio-opaque. Once the contrast extravasation or false aneurysms are recognized after superselective catheterization with a DMSO compatible microcatheter, Onyx has the potential to persistently block the blood flow in the injured artery; the rebleeding via retrograde and/or collateral flow (which is frequent in this anatomical district) is effectively prevented given its penetration and filling properties. Operator experience and

slow manual injection rate are necessary to prevent reflux and nontarget embolization.

Conclusion: Onyx is a useful, effective and safe embolic material in the management of pelvic arterial injury after trauma.

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Endovascular embolization of varicoceles with n-butyl cyanoacrylate (NBCA) glue through antecubital vein access

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Learning Objectives: Antecubital vein access in embolization of varicoceles allows a faster mobilization and a better tolerability of the procedure; use of NBCA glue proved to be a fast, efficient and safe technique.

Background: Varicoceles are abnormally dilated veins within the pampiniform plexus due to reflux of blood in the internal spermatic vein (ISV). Etiology is multifactorial. Diagnosis is based on Doppler US. Treatment could be endovascular or surgical.

Clinical Findings/Procedure Details: From January 2020 to February 2021, 80 patients were subjected to endovascular treatment of varicoceles using NBCA. All patients were previously subjected to a doppler and spermogram. An antecubital access was used for the placement of a 5 Fr introducer. A 5Fr Multipurpose Catheter is used to reach the left renal vein. Injections of contrast may be needed, while the patient performs a Valsalva maneuver, to ensure seating of the catheter tip in the ISV, and to identify reflux through incompetent valves. A catheterization of the VSI was performed using hydrophilic guide 035 angled Terumo up to the prefunicular tract. 5 mL of 5% dextrose solution is used to clean the catheter from residual contrast, to prevent the glue from sticking inside the catheter and to push the glue after the injection with progressive catheter retraction. A 1:2 mixture of NBCA and Lipiodol (Ultrafluid Guerbet) were used for embolization of the spermatic vein. All procedures were successful. No microcatheter was used. There were no complications.

Conclusion: Endovascular treatment of varicoceles with antecubital vein access and NBCA glue, is a fast, effective and safe technique.

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IR complications and audit of Informed consent process

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Learning Objectives: Gaining informed consent before the procedure is a mandatory part of modern clinical practice. The aim of this study was to identify how often complications relating to Interventional procedures were discussed in detail with the patient prior to the procedure.

Background: A retrospective analysis of the prospectively collected data over 5 years between 2015- 2019 amounting to 173 complication cases and their consent forms were examined from the electronic medical records (EMR). Exclusion criteria's like consent done by other speciality colleagues, combined procedures with surgical specialties, patients with dementia and consent form not available on electronic medical records. A final dataset of 100 complication cases related to IR procedure was reviewed. The patient's procedure consent form was examined to identify whether or not the complication they experienced had been discussed as a possible risk. Other parts of the consent form relating to need for blood transfusion and the need for further procedures were also examined.

Clinical Findings/Procedure Details: 39% of patients who experienced a complication did not have the complication documented as a potential risk on the consent form. 14% of patients required a blood transfusion but

were not consented for this. 42% of patients required a further procedure or operation but were not warned of this.

Conclusion: Consent is more than paper work. The model of gaining informed consent on the day of procedure is no longer valid. Better education, the use of IR clinics, patient information sheets and other resources is essential.

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An algorithmic approach to lymphocele treatment

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Learning Objectives:

1. To compare available minimally invasive treatment methods
2. To develop an algorithm for optimal management of lymphoceles

Background: Lymphoceles are lymph-filled collections which develop as a result of lymphatic vessel disruption, commonly after retroperitoneal surgeries including post kidney transplants and lymph node dissection in urogenital malignancies. If lymphoceles persist, they can become infected or compress adjacent structures and cause symptoms such as pain, urinary frequency and lower limb edema. Symptomatic lymphoceles should be treated to relieve symptoms and prevent functional compromise of vital adjacent structures. There are variable options for treating postoperative lymphocele, however, no management algorithms have been suggested so far.

Clinical Findings/Procedure Details: We reviewed treatment options including:

- 1- Percutaneous aspiration
- 2-Catheter drainage
- 3-Sclerotherapy
- 4-Lymphangiography and glue embolization
- 5-Developed an algorithm for managing lymphocele

Conclusion: Asymptomatic lymphoceles do not require intervention unless symptoms appear during follow-up or if they persist beyond 3 months post-surgery. Percutaneous catheter drainage should be considered as a first-line treatment only for infected lymphoceles. Sclerotherapy has comparable success rates to surgery and most recurrences resolve with an additional round of sclerosis. Lymphoceles with volume higher than 150mL should be scheduled for multiple session outpatient sclerotherapy. In case of sclerotherapy failure or complications, other options such as adjuvant lymphangiography with N-butyl cyanoacrylate embolization or laparoscopic surgery, depending on availability and patient criteria, should be considered.

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Distal transradial access (dTRA) as a preferred approach for non-coronary endovascular procedures in interventional radiology (IR)

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Learning Objectives: Readers will learn the technique, room set-up, feasibility and advantages of dTRA as an alternative to standard transradial (TRA) and transfemoral access (TFA) for IR endovascular procedures.

Background: Radial access is commonly utilised in coronary interventional procedures and is being selected with increasing frequency by interventional radiologists. Technical and procedural success has been established across a range of endovascular procedures with particular

patient benefits including early ambulation and reduced puncture site complications compared to TFA; however, as the design of most interventional suites favours right TFA, the standard left TRA is associated with positional and equipment challenges, limiting penetration of the technique to the wider IR community.

Clinical Findings/Procedure Details: dTRA, preferably via the left anatomic snuffbox, further increases the utility of TRA, providing positional versatility for the operator in comparison to the standard left transradial approach. As the patient and operator assume the same relative positions as for TFA, dTRA overcomes most of the issues associated with the standard left TRA approach arising from suite design, e.g. table orientation, screen positioning and limitations in reach of image intensifiers / detectors. In addition, dTRA is associated with reduced haemostasis time, reduced risk of radial artery occlusion and other access-site complications compared to traditional TRA and TFA. The technique, patient and operator positioning and optimal room set-up will be clearly described.

Conclusion: dTRA should be considered as an alternative access site for interventional procedures, the adoption of which will further increase the reach of radial access to the Interventional community with consequent patient benefits.

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US guided percutaneous thrombin injection for embolization of iatrogenic femoral pseudoaneurysm

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Learning Objectives: To acknowledge relevance of femoral artery pseudoaneurysm following endovascular treatment and potential damage of missed diagnosis

To learn indications of percutaneous injection of thrombin for pseudoaneurysm treatment

To learn technique for embolization of femoral pseudoaneurysm with thrombin injection

Background: Iatrogenic pseudoaneurysm (IP) is a frequent complication of arterial intervention.

Incidence is 0.2-5% and it is increasing due to widening fields of endovascular procedures.

Risk factors for IP include multiple arterial access attempts, utilization of larger sheaths and periprocedural anticoagulant/anti-platelet medication. Complications of untreated IPs are rupture, infection and limb ischemia.

Clinical Findings/Procedure Details: Patients with an IP may develop in the punctured area ecchymosis, swelling or bruit on auscultation. US-doppler/CTA can demonstrate IPs and estimate the neck size.

Surgery is the historical treatment of IP, but it is an invasive procedure and carries a higher rate of morbidity compared with percutaneous techniques.

Ultrasound-guided compression is a non-invasive technique, but is painful and has a limited success rate.

Interventional radiology treatment, such as endovascular repair and ultrasound-guided percutaneous thrombin injection (UPTI), has reached a main role in management of IPs.

Endovascular repair utilizing a covered stent has a high risk of stent thrombosis and subsequent re-intervention.

UPTI is a relatively safe, quick and effective treatment. This procedure is preferred in patients on anticoagulation and in small (maximum diameter of 3.3 cm) and short-neck (maximum 3.4mm) pseudoaneurysm.

Conclusion: Interventional radiology has a main role in minimally invasive therapy of IP; UPTI is a safe, quick and effective treatment.

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Percutaneous puncture of blood vessels: why might ultrasound be used?

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Learning Objectives:

- The aim of this work is:
- To gain knowledge of the main femoral vessel anatomy
- To know how to perform the vessel puncture by means of anatomical references
- To know how to perform the puncture with ultrasound guidance
- To show some examples of complications.

Background: We present different cases of complications. The patients came from many hospitals and various medical-surgical departments, including our own: Interventional Radiology.

Some were due to femoral artery catheterization for diagnostic and therapeutic procedures, to implant central vein catheters or central vein tunneled catheters for hemodialysis.

In some cases, the puncture was performed with ultrasound guidance, and in others with anatomical references.

Clinical Findings/Procedure Details: Some of the complications were completely asymptomatic and were resolved with conservative treatment. On the other hand, some cases needed surgical repair. None of the patients died as a result of the complications, which included pseudoaneurysms, (with or without hematoma), arteriovenous fistulas and misplaced catheters.

Conclusion: Ultrasound is essential to perform a blood vessel puncture. The anatomical references were very helpful, and still are, but whenever possible we would recommend ultrasound-guided puncture. Nevertheless, due to certain physical conditions of some patients like obesity, the ultrasound may not be completely free from complications.

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Long-loop technique as bailout method for repositioning dislodged port-catheters

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Learning Objectives: Catheter-dislocation in central-venous port-systems may occur in about 3% of patients. Repositioning of dislodged catheters by hooking with a pigtail-catheter or catching the tip of catheter with a goose snare represent standard techniques. In cases of a failure of these methods, e.g. in case of chronic thrombosis of the vein in which the catheter tip is dislodged, we propose a wire-assisted, long-loop repositioning technique.

Background: We retrospectively analyzed all repositionings of dislodged port-catheters at our institution between January 2016 and 2021. We selected all cases in which we applied a long-loop-technique, after unsuccessful attempts with pigtail-catheter or goose snare. We collected patient data, port-a-cath type, venous access of the port-a-cath, site of the dislocated catheter, type of catheters used in the repositioning process, fluoroscopy time and radiation dose.

Clinical Findings/Procedure Details: In a typical case, after achieving a contralateral transfemoral access, a pigtail-catheter was placed over the port-catheter with a standard 0.035" guidewire. The wire was then snared using the goose snare, thus creating a "long Loop". Repositioning of the port-catheter was achieved by pulling down both ends into the upper superior cava vein. A total of 4 patients (age 56,8 ± 6,4, M:F 3:1) underwent port repositioning with this long-loop technique. We used a bi-transfemoral access in all patients. Success rate of the procedure

was 4/4 (100%). The average fluoroscopy time was 32 ± 7,5 minutes. The average radiation dose was 3320 ± 1699 cGycm².

Conclusion: A long-loop technique with bi-transfemoral access as salvage method for repositioning dislodged port-catheters was effective in our case series.

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This is NOT the right adrenal vein

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Learning Objectives:

- 1- Briefly review indications for Adrenal Vein Sampling (AVS)
- 2- To recognize characteristic imaging appearance of what is NOT the adrenal vein.
- 3- Review imaging characteristics (such as emissary vein) which suggest cannulated vein is the right adrenal vein.
- 4- Review what characterizes an "Adequate" sample during AVS

Background: Primary hyperaldosteronism (PA) is the most common cause of secondary hypertension in middle age adults. PA also confers a higher risk of heart failure and stroke than hypertension for other reasons. AVS is needed to localize aldosterone production, regardless of cross sectional imaging findings. AVS can be a challenging procedure with some reports stating a 70% of samples being non-diagnostic mostly secondary to challenges in cannulating, recognizing and sampling the right adrenal vein.

Clinical Findings/Procedure Details: The right adrenal vein has a variable appearance by venography. One of the only reliable venographic findings is visualization of an inferior emissary vein, but this is variably present. Recognizing what is not the right adrenal vein is another fruitful strategy in AVS. Injection showing "glandular staining" often denotes injection into a hepatic vein rather than the adrenal vein. Communication with other intrahepatic collaterals or back-flow into the portal vein are other signs that the injected vein is an accessory hepatic vein. Intercoastal veins can have a characteristic, coursing along ribs.

Conclusion: Characteristic venographic findings are seen in structures that are near but are not the right adrenal vein. Knowing these will encourage the operators to search for other candidate veins.

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Pancreaticoduodenal arcade as an alternative route for cTACE in a patient with celiac artery stenosis due to median arcuate ligament compression

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Clinical History/Pre-treatment Imaging: We report a case of a 85-year-old male patient with HCV related liver cirrhosis and HCC located in segment VIII. Combined therapy using hepatic arterial embolization (cTACE) performed to augment visualization of HCC prior to hepatic ablation (Mw) was performed.

Treatment Options/Results: CT showed extrinsic compression of the celiac axis by a median arcuate ligament that caused severe stenosis of the celiac axis. Due to the impossibility of catheterizing the celiac trunk, a superior mesenteric artery angiography was performed and showed retrograde blood supply of the celiac trunk and its branches through anterior and posterior pancreaticoduodenal arcades. Superselective catheterization and embolization of segmental arterial branches feeding the tumor was performed. Microwave ablation of HCC (marked with lipiodol) was successfully performed the next day.

Discussion: Celiac axis compression caused by the median arcuate ligament syndrome is a rare entity. Severe compression of the celiac axis develop a collateral pathway via the pancreaticoduodenal arcades that communicate the superior mesenteric artery with the celiac branches. When the usual access through celiac trunk cannot be obtained, an alternative and challenging approach is possible via the superior mesenteric artery to the hepatic artery proper, by dilation of the pancreaticoduodenal arcade and the gastroduodenal artery.

Take-home Points: The aim of this report is to describe an alternative and challenging access via collateral pathways when the vascular anatomy of the celiac trunk is unfavorable.

When the celiac axis is stenotic/occluded, selective catheterization of collateral vessels may be required. Collateral pathways can be the only routes for vascular catheterization and embolization of hepatic tumors.

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Lung congenital malformations: a rare case of intralobar pulmonary sequestration in a young female treated with coil embolization before surgery

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Clinical History/Pre-treatment Imaging: A 20 years-old female was admitted to emergency department presenting with hemoptysis, fever and cough.

Lab tests revealed neutrophilic leukocytosis and in range hemoglobin. Chest radiograph showed an oval opacity of the right lower lobe. Further investigation with MDCT-scan described a 10 cm consolidation with its own bronchial supply, two systemic feeding arteries and a pulmonary venous drainage.

Imaging tests and clinical evaluation suggested the diagnosis of intralobar pulmonary sequestration (ILS).

Treatment Options/Results: Diagnostic angiography was performed to better evaluate systemic arterial supply showing a hypertrophic diaphragmatic branch and a bronchial branch feeding the sequestration directly from aorta.

After super-selective catheterization, coil embolization was successfully performed as bridging therapy to guarantee a safer surgery. Final angiography confirmed effective embolization.

Then the patient underwent VATS right lower lobe lobectomy.

Discussion: Pulmonary sequestration is a lung congenital malformation which can be divided in two groups: intralobar and extralobar sequestration (ELS). ILS is the most frequent form and typically occurs in late childhood/adolescence. ILS lacks pleural investment, typical of ELS form. Chest X-ray can be useful as primary investigation but need confirmation with MDCT-scan.

Angiography is not part of routine investigations but is considered the gold standard in determining arterial supply. Coil embolization could be useful to perform a safer surgery by reducing bleeding risk.

Take-home Points: Interventional Radiology could be useful either in diagnosis (angiographic evaluation of arterial supply) and in treatment of pulmonary sequestration (coil embolization). Particularly, it could have a key role as bridging therapy before surgical treatment.

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Coarctation of the aorta presenting as a vascular anomaly of the anterior abdominal wall in an 11 year old child

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Clinical History/Pre-treatment Imaging: An 11 year old patient was referred to our institution with a one year history of pulsatile mass in the upper abdomen. There was no history of trauma and previous medical history was unremarkable. An ultrasound had shown the mass being a dilated tortuous epigastric artery. MRI of the upper abdomen showed bilateral prominent and tortuous epigastric arteries with no deep connections. An opinion was requested to confirm the diagnosis and perform embolization as there was concern from case reports of massive haemorrhage following abdominal trauma. She was discussed at our vascular anomalies (VAs) multi-disciplinary meeting (MDM). Concern was raised that the appearances may be due to an underlying aortic stenosis. MRI of the aorta was subsequently performed which confirmed the presence of a marked aortic coarctation.

Treatment Options/Results: The patient was referred to the paediatric cardiology team. Clinical assessment revealed systemic hypertension and weak femoral pulses. She underwent stenting of the coarctation. Subsequent chest xray showed stable position of the stent with characteristic rib notching.

Discussion: Although coarctation of the aorta is usually diagnosed in neonates, presentation can be delayed. These patients will develop collateral pathways if left untreated. Common sites are the intercostal, internal thoracic and epigastric arteries. Similar appearances may be seen in other cases of aortic stenosis.

Take-home Points: VAs are usually diagnoses of exclusion. Unusual and complex VAs should be discussed at the MDM prior to intervention. Prominent superficial vessels providing collateral pathways should not be mistaken for VAs as embolization of such vessels could be catastrophic.

P-495

Ultrasensitive gelatin sponge embolization of arterio-cavernous fistula in a pediatric patient without trauma: a case report

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Clinical History/Pre-treatment Imaging: A 17-year-old patient visited our clinic with stiffness of the penis and loss of complete erection without significant pain for ten days. Doppler study shows significant increased peak systolic velocity in both sides of cavernosal artery and left sided arterio-cavernous fistula with turbulent flow. Since the patient did not describe a history of trauma, contrast enhanced tomography(CECT) images and cavernosal blood gas samples were taken, which showed contrast blush within the left corpora cavernosa and arterial blood gas parameters, respectively. All of the results was confirmed diagnosis of high flow priapism(HFP).

Treatment Options/Results: High flow priapism can be managed conservatively, with minimal invasive interventional techniques or surgically. In our case embolization was planned upon failure of conservative treatment with compression and cold application.

Although CTA and doppler study revealed left sided findings, left internal iliac artery angiography showed no significant findings. Right internal iliac artery angiography showed contrast pooling on the left cavernosal artery, due to anatomical variations of arteries. The tip of the microcatheter was placed at the leakage point ultrasensitively and gelatin sponge slurry was injected until the blood flow through fistula completely stopped. Post-procedure images confirmed occlusion of the fistula and preserved normal cavernosal blood flow. Patient regained normal erectile function after one week.

Discussion: In case of arterio-cavernous fistula, ultraselective embolization of fistula without compromising normal cavernosal blood flow might be safer and preferable method to avoid long term erectile problems.

Take-home Points: Gelatin sponge embolization is a safe and effective technique for younger patients.

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Fishing out an Amulet device from the aortic arch with an IVC retrieval device

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Clinical History/Pre-treatment Imaging: A 77 year old male underwent elective LAA closure with an Amplatzer Amulet device (Abbott, MN, USA) under 3D transesophageal echocardiographic guidance for secondary stroke prevention. Following the procedure, he developed transient neurological deficits and a CT Chest demonstrated the Amulet device had embolised to the aortic arch.

Treatment Options/Results: Right femoral arterial access with a 18Fr sheath was established which extended into the infrarenal abdominal aorta. Despite multiple attempts the device could not be rotated or grasped to allow engagement of the 30mm GooseNeck Snare (Medtronic, MN, USA) on the distal end-screw of the device. The snare was exchanged for an angulated ALN IVC Filter retrieval device (ALN Implants Chirurgicaux, PACA, France) which was used to grasp and remove the Amulet device, facilitating intact retrieval. The patient recovered well post-operatively.

Discussion: Amulet device embolisation is an infrequent complication of LAA closure and an endovascular approach is the preferred management. A unique, off-label, approach was utilised involving the ALN IVC filter retrieval device. Its hooked prongs can easily engage the body of the device and thus circumvent the difficulties encountered with the use of a snare. Whilst this device can confer advantages for difficult retrieval, there is a risk of vessel dissection or perforation and a multidisciplinary approach is recommended with specialists who are familiar with its use to reduce the risk of iatrogenic injury.

Take-home Points: We describe a unique, off label use of an ALN IVC filter retrieval device to remove a LAA closure device from the aortic arch when traditional methods of retrieval have failed.

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Superior vena cava stent migration: successful SVC to IVC bridge stenting

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Clinical History/Pre-treatment Imaging: A 67-year old man represented with chest pain, dyspnoea and palpitations 2-weeks post stenting for malignant SVC-obstruction. Contrast-enhanced CT at presentation showed a large left upper lobe lung primary (SCC), extensive mediastinal disease and subtotal occlusion of the SVC. CTPA was performed on representation showing inferior migration of the stent into the right atrium, below the stenosis.

Treatment Options/Results: Established endovascular management for SVC stent migration include retrieval, repositioning or anchoring. Retrieval/repositioning can be achieved through loop-snare, balloon and/or wire assisted techniques.

In this case, retrieval/repositioning superiorly was not possible due to tumour above and high risk of intrapericardial rupture while inferiorly would risk displacing the stent further into the heart. An overlapping anchoring SVC stent was not an option due to symptomatic ectopics and palpitations.

Overlapping bare metal stents (20x100mm and 20x140mm) were used to bridge from the SVC to IVC through the migrated stent via through-and-through jugular-femoral access achieving clinical and radiological success. Reported previously in case reports [9,10], we endorse this as a safe and effective option.

Discussion: Primary endovascular stenting is widely accepted as the first line treatment for symptomatic malignant SVC stenosis [11]. Technical success has been reported in 95-100% [1,2,3] and relief of obstruction at presentation in 87-100% [4]. Minor complications are reported in 3.4%, major complications in 4% and mortality in 2% [1,3,4,5,6]. SVC stent migration is rare (2%) but carries potentially catastrophic clinical sequelae necessitating urgent intervention.

Take-home Points: Bridge stenting is a valid option for the treatment of malignant SVC obstruction, especially as a bail-out technique in the setting of SVC stent migration.

P-498

Thyroid gland microwave thermoablation: successful treatment of thyrotoxic crisis

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Clinical History/Pre-treatment Imaging: A 56 old male patient with thyrotoxic crisis, suppressed TSH (0.004 mU/L), elevated free T3 and T4 (7.09, 40.18 pmol/L respectively) was admitted.

The pre-treatment ultrasonography showed an enlarged, diffusely inhomogeneous, hypervascularized thyroid gland compressing the trachea, internal jugular veins.

Treatment Options/Results: As medication was not satisfactory to suppress the thyroid storm and surgery could not be performed due to the unstable state of the patient, ultrasound guided microwave thermoablation (MWT) was initiated in the larger left lobe with transisthmic approach. A 15 cm long TATO antenna (Terumo) was used at 40Ws with "overlapping technique". Net ablation time was two hours. Post-treatment ultrasonography scan showed 60% hypo-devascularisation. Treatment of the right lobe was performed twelve days later, approximately 60% ablation was achieved during an hour long ablation at 40Ws.

Follow-up blood tests showed decreasing, normalized T3- and T4 values (4.05, 9.54 pmol/L on the sixth day after the first, 3.79, 10.88 pmol/L one day after the second treatment). TSH remained suppressed.

Discussion: Thyrotoxic crisis is a potentially life-threatening state, in which pharmacological and surgical treatments are not always sufficient/available. Thyroid gland MWT seems to be a low-risk alternative to treat thyroid storm. For effective results large ablation zones are necessary with long ablation times due to the hypervascularized gland.

Take-home Points: Thyroid thermoablation is a low-risk therapeutic alternative in thyrotoxic crisis.

Large ablation zone is needed for successful treatment.

P-499

Endovascular management of iatrogenic radial artery pseudoaneurysm: a novel application of a standard technique for a relatively rare lesion

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Clinical History/Pre-treatment Imaging: A 52 years old male, known case of diabetes mellitus and hypertension, came with pain and gradually progressive pulsatile swelling in right distal forearm. Pre-gangrenous changes were noted in index finger with non recordable oxygen saturation. On enquiry, patient gave a history of transradial coronary angiography

for ischemic heart disease, three weeks prior to presentation and was started on ticagrelor. Ultrasound Doppler showed two wide neck radial artery pseudoaneurysms in close proximity to each other.

Treatment Options/Results: Patient underwent endovascular covered stent graft placement leading to exclusion of pseudoaneurysms. Follow-up ultrasound next day depicted good flow across the stent graft with no signs of recanalization of the thrombosed pseudoaneurysm sacs. On follow up after 3 months, ultrasound showed that thrombosed pseudoaneurysms had nearly disappeared with normal flow noted across the stent graft and resolution of the pre-gangrenous changes in the index finger.

Discussion: Radial artery pseudoaneurysm is a rare, but serious complication of transradial interventions. The predisposing factors are multiple puncture attempts, inadequate post procedural hemostasis, antiplatelet/anticoagulant therapy, hypertension and large sheath size. Being minimally invasive, endovascular repair by covered stent graft may be preferred over surgical repair of these lesions.

Take-home Points: Endovascular repair by covered stent graft may be used as an initial treatment option or preferred over surgical repair, when other methods like ultrasound guided compression or thrombin injection fail to treat radial artery pseudoaneurysm.

Pre-procedure angiogram shows two different size pseudoaneurysms in radial artery at distal forearm

Post-procedure angiogram shows exclusion of both pseudoaneurysms with improved flow in distal radial artery

P-500

Lipiodol embolisation for the treatment of refractory chylous ascites and chylothoracies in a HIV patient with drug resistant mycobacterium avium complex infection

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Clinical History/Pre-treatment Imaging: A 32-year-old man presented with abdominal distension and difficulty in breathing. Imaging revealed large bilateral pleural effusions and ascites (Figure 1). Biochemical analysis determined fluid aetiology as lymphatic. Despite repeated high output drainages, the patient experienced recurrent chylous ascites and chylothoracies.

Importantly, the patient had a background of drug resistant HIV infection, with a CD4 count of 24 cells/mm³, and a resultant drug resistant Mycobacterium Avium Complex (MAC) infection.

Treatment Options/Results: Ascending lymphangiography was performed as a diagnostic and therapeutic intervention. Under ultrasound and fluoroscopic guidance, water soluble contrast and 5 ml of Lipiodol was injected via the inguinal lymph nodes bilaterally (Figure 2). Subsequent fluoroscopic and 24-hour serial delayed CT scans did not demonstrate a contrast leak (Figure 3). The patient did not experience any further large volume ascites or pleural effusions.

Discussion: Chylous ascites and chylothoracies are very rare late complications of the immune reconstitution inflammatory syndrome (IRIS) which is seen in patients with HIV and MAC. Accordingly, there can be a diagnostic delay and therapeutic dilemma. It is postulated that the etiology is related to the granulomatous infiltration of the lymphatic system which subsequently becomes obstructed and leads to lymphatic leak. Historically, management has been either medical or surgical. In refractory cases, Lipiodol instillation and embolisation provides a minimally invasive treatment option.

Take-home Points: Lipiodol lymphangiography can be both diagnostic and therapeutic. It can circumvent the need for surgery in cases of refractory high-volume ascites and chylothoracies.

The utility of this management entity is proven in traumatic and atypical infection scenarios.

P-501

Percutaneous transhepatic lymphangiography and embolization with n-butyl-2-cyanoacrylate glue for refractory hepatic lymphorrhea

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Clinical History/Pre-treatment Imaging: A 62-year-old man with a medical history of chronic alcoholic hepatitis underwent pancreaticoduodenectomy for an intraductal papillary mucinous neoplasm of the head of the pancreas. However, massive ascites was observed on postoperative day (POD) 7 after surgical drain removal. Conservative therapies and ascites drainage did not improve the condition. The ascites was non-chylous and had low triglyceride levels. Additionally, the surgical procedure did not extend around the aorta, leading to a strong suspicion of hepatic lymphorrhea (HL) as a cause of refractory ascites.

Treatment Options/Results: Percutaneous transhepatic lymphangiography was performed after massive ascites drainage on POD 49. The area around the anterior branch of the portal vein was punctured with a 21-gauge needle under ultrasound guidance, and the lymphatic vessels were successfully visualized using nonionic contrast under fluoroscopy. Four milliliters of lipiodol was injected, leading to leakage and accumulation in the hepatic hilum to block the n-butyl-2-cyanoacrylate (NBCA) glue entering the peritoneal cavity. Next, 12.5% NBCA glue (2.5 mL) was administered to achieve embolization of the injured hepatic lymphatics around the hepatic hilum. The ascites decreased markedly with no observed recurrence.

Discussion: HL is an extremely rare complication that can cause refractory ascites. Percutaneous transhepatic lymphangiography is needed for the diagnosis of HL instead of intranodal lymphangiography. Although NBCA glue is widely used in various cases of vascular embolization and other lymphatic leak treatments, there have been no reports of its use for post-surgical HL.

Take-home Points: Percutaneous transhepatic lymphangiography followed by NBCA glue embolization may be an effective treatment option for post-surgical HL.

P-502

Embolization of bronchial artery with microaneurysms in a pregnant COVID-19 patient with massive hemoptysis: a case report

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Clinical History/Pre-treatment Imaging: A 26-year-old 21-week pregnant woman was internalized with worsening anemia due to persistent hemoptysis beginning one week after COVID-19 infection. After worsening of clinical status and massive hemoptysis, contrast enhanced tomography (CECT) was performed to obtain detailed information. CECT shows segmental distribution of ground-glass opacities and interlobular septal thickening without bronchial artery dilatation, which is consistent with alveolar hemorrhage.

Treatment Options/Results: In order to reduce fetal radiation exposure, patients abdomen was covered using lead shielding. Angiographic images demonstrate multiple microaneurysms, bronchopulmonary shunts and parenchymal contrast blush of right intercostobronchial trunk. To prevent inadvertent embolization of the placenta, which is a possible complication particularly with small particle use in this case due to microaneurysm and shunt formation, larger particles (>500 microns) were preferred. After embolization, hemoptysis stopped and her clinical situation improved. After 4 days, patient discharged.

Discussion: In order to explain possible reasons of bleeding, the patient was consulted hematology and rheumatology departments. Since no other cause was found, microaneurysms were attributed to COVID-19.

Microaneurysm and COVID-19 relation is still unclear but there might be several mechanisms, including the direct destruction to the artery wall by the viral infection or through the increased inflammatory cytokines. **Take-home Points:** Covid-19 has shown to be associated with microangiopathic changes which can lead to microaneurysms or pseudoaneurysms that can result in hemoptysis. Although radiation exposure during pregnancy is harmful, in cases where other methods are not successful, bronchial embolization is an effective treatment option that can be used in life-threatening hemoptysis.

P-503

Coil embolisation of a pulmonary artery-bronchial fistula associated with intra parenchymal pseudo aneurysm, endovascular approach and bronchoscopy monitoring

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Clinical History/Pre-treatment Imaging: A 62 year old man with a heavy background of right upper lobe squamous cell carcinoma was admitted with massive haemoptysis. CT showed a large right upper lobe lesion with infiltration of mediastinum and airways. A right pulmonary artery pseudoaneurysm slightly bulging into the right main bronchus was seen, suspicious for a pulmonary artery bronchial fistula.

Treatment Options/Results: A combined endo tracheal and angiographic approach was done. Right pulmonary artery angiogram showed a now occluded neck to the pseudoaneurysm which was selectively cannulated. Framing and packing coils were deployed. Contrast was endoscopically noted without bronchial bleeding. As the coils were entering the lung parenchyma, packing back to the neck was done carefully. No new bleeding was noted.

A bronchial stent was inserted 6 weeks later and one coil protruding into the bronchus was seen.

A 3 month CT follow-up did not show any residual pseudoaneurysm. Patient died 1 month later of his progressive illness.

Discussion: Only 3 cases of endovascular management of bronchial-pulmonary artery fistula reported with different techniques including pulmonary artery stenting. Our case is the only one reported treated with only coils.

No data are available regarding the risk of pulmonary embolism after stenting. Anticoagulation required after stenting increases the risk of bleeding in patients with severe haemoptysis.

Management with coils only, facilitates further management. This preserves pulmonary circulation in patients with already compromised respiratory function.

Take-home Points: Coil only embolisation of uncommon pulmonary artery bronchial fistula is feasible and facilitates further management as it does not require anticoagulation in patient with recurrent bleeding.

P-504

A twin armamentarium for single stage endovascular closure of large type II abernathy malformation with hepatopulmonary syndrome

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Clinical History/Pre-treatment Imaging: 13-year-boy presented with progressive dyspnoea, cyanosis & intermittent hematochezia since 4-years of age. Pallor and grade-IV clubbing was present with room air SpO₂ 62%. Laboratory tests revealed anaemia (Hb:7g/dL), mildly raised ALP 155 IU/L. Contrast echo suggested extracardiac shunt. Doppler ultrasound showed small main portal vein (MPV). CT angiography revealed type II extra-hepatic

portosystemic shunt (Abernathy malformation), in form of large portosystemic shunting channel (PSC) connecting superior mesenteric and splenic veins, draining into left internal iliac vein. Left IIV was draining into was draining into left IVC via left common iliac vein, and finally into right IVC via intercommunicating vein. MPV and its branches were small. Inferior mesenteric vein (IMV) was confluent with SMV on right side of PSC channel. (Fig 1)

Treatment Options/Results: After confirming adequacy of portal radicles and normal mean portal venous pressure (8mmHg), single stage endovascular embolisation (SSEE) of PSC was done via the right jugular approach using 26mm AMPLATZER-Septal-Occluder (ASO) and 16mm AMPLATZER-Vascular-Plug (AVP) plug with 30% and 40% oversizing respectively (Fig 2)

After 2 weeks, hematochezia subsided. At 4-month follow-up, dyspnoea subsided, SpO₂ gradually normalized to 97% with complete thrombosis of PSC.

Discussion: We choose to use ASO and AVP-II rather than multiple detachable coils, which would prolong duration of procedure thus increasing radiation dose and cost factor apart from added risk of coil migration. SpO₂ normalizes gradually after SSEE in hepatopulmonary syndrome (HPS) due to portal plasticity.

Take-home Points: Morphologic and hemodynamic evaluation of Type-II AM is critical for planning SSEE for appropriate technical approach and selection of embolising devices.

P-505

Cryptogenic stroke associated with mechanical thrombectomy for pulmonary embolism in a patient with patent foramen ovale

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Clinical History/Pre-treatment Imaging: We report a case of worsening cryptogenic stroke post mechanical thrombectomy (MT) for PE in a patient with patent foramen ovale which was diagnosed angiographically during MT. A 66 year – old lady was admitted for sub-massive PE with left lower limb deep vein thrombosis (DVT) and recent stroke, the diagnosis of which were confirmed on CT pulmonary angiogram (CTPA) and CT brain. Patent foramen ovale was found incidentally when the pulmonary vein was cannulated in the process of MT as demonstrated on pulmonary venogram.

Treatment Options/Results: The procedure was successful with no complications encountered throughout. However, her level of consciousness dropped the following day post procedure, and a repeated CT brain showed acute infarcts involving bilateral middle cerebral artery (MCA) territories and midbrain. Her condition unfortunately deteriorated further and she expired shortly after.

Discussion: The occurrence of cerebral vascular accident pre-intervention could be attributed to presence of PFO as the patient has already suffered a recent stroke upon presentation to us with PE and left lower limb DVT. We postulate that the recurrence of stroke post intervention is likely to be associated with paradoxical embolism during mechanical thrombectomy as symptoms onset occurred shortly after the procedure.

Take-home Points: Cryptogenic stroke as a complication of mechanical thrombectomy for PE in patients with patent foramen ovale has been rarely reported. Despite its rarity, we would suggest examining patients for PFO prior to MT particularly in patients with concurrent PE and ischemic stroke in view of high prevalence of PFO in patients with cryptogenic stroke.

P-506

Interventional radiology in times of COVID-19: management of vascular complication of extracorporeal membrane oxygenation (ECMO) in a patient with COVID-19 infection

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Clinical History/Pre-treatment Imaging: We report a case of a 46-year-old male patient with severe COVID-19 infection underwent initiation of extracorporeal membrane oxygenation (ECMO). A subclavian artery pseudoaneurysm with active extravasation was discovered on control CT. **Treatment Options/Results:** Urgent angiography was performed and demonstrates a right subclavian artery pseudoaneurysm between the origin of common carotid and vertebral arteries with no active extravasation. The patient underwent placement of a Viabahn VBX 10x29mm stent over the vascular injury which resulted in complete exclusion of the pseudoaneurysm.

Discussion: The outbreak of Coronavirus disease 2019 (COVID-19) remains a worldwide pandemic with a high mortality rate among patients requiring mechanical ventilation.

Acute respiratory distress syndrome (ARDS) is a common complication of COVID-19, and extracorporeal membrane oxygenation (ECMO) can be a salvage therapy in this patients with cardiopulmonary failure.

Although ECMO is a lifesaving treatment modality, patients requiring this type of support are subject to multiple complications. Major complications of ECMO include vascular, hemorrhagic complications, neurological, renal, and infection.

Take-home Points: The utilization of ECMO for critically ill patients with cardiopulmonary failure is increasing. Although these procedures can be lifesaving, vascular complications play a major role in successful outcomes. Understanding the different types of ECMO circulation and associated potential vascular complications is vital for successful management of these patients.

P-507

Endovascular management of iatrogenic post-orchidectomy testicular arteriovenous fistula and pseudoaneurysm

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Clinical History/Pre-treatment Imaging: A 46 year old man presented to our centre with significant left iliac fossa pain. He had undergone left inguinal orchiectomy 4 weeks previously for testicular seminoma and was due to commence adjuvant chemotherapy for large-volume retroperitoneal disease. CT scan demonstrated a fistula between the remnant left testicular artery and vein with pseudoaneurysm formation and surrounding haematoma.

Treatment Options/Results: MDT discussion - consensus was that urgent treatment was required in view of symptomatology, evidence of recent haemorrhage and potential risk of further bleeding due to chemotherapy-related thrombocytopenia. All specialties agreed that first-line treatment should be endovascular.

The left testicular vein was successfully accessed via a right internal jugular vein approach and microcatheter access gained across the fistula into the feeding left testicular artery. The arterial inflow, aneurysm sac and venous outflow were sequentially embolised with coils resulting in complete exclusion of the fistula and pseudoaneurysm. 3-month follow up CT demonstrated continued exclusion of the fistula with resolution of surrounding haematoma.

Discussion: To our knowledge, this is the first case of post-orchidectomy arteriovenous fistula described in the literature. We present this case to

illustrate the utility of transvenous embolisation in achieving a minimally-invasive cure, and review the literature regarding endovascular management of similar conditions.

Take-home Points: Many novel presentations can be successfully treated with application of established endovascular techniques. For successful treatment of an arteriovenous fistula, occlusion of the arterial inflow is highly desirable. Crossing the fistula from the venous side is a useful approach if the lesion is anatomically conducive.

P-508

Thoracic duct interventions for plastic bronchitis in adult

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Clinical History/Pre-treatment Imaging: We described a case of a 70-year-old patient with IG G kappa Multiple myeloma who was diagnosed with plastic bronchitis. She underwent to bronchoscopy without significant improvement of her clinical symptoms. TDE was performed demonstrating multiple technical challenges. The patient progressed satisfactorily with improvement of her clinical picture. The purpose of this report is to review thoracic duct interventions as an emergent alternative in this potentially fatal disease.

Treatment Options/Results: Treatment modalities include mucolytics and chest physiotherapy, and in the most severe cases bronchoscopy to remove the casts and aerosolized urokinase or r-TPA. Interventional treatments have been described in children and can range from thoracic duct embolization or stenting.

Discussion: Plastic bronchitis is a rare and underdiagnosed disease in the adult population characterized by the formation and expectoration of bronchial casts of amorphous material, which can be potentially fatal because airway obstruction. This condition usually occurs in the postoperative period after the Fontan operation for congenital heart disease, after heart transplantation or cardiac surgery, CABG in adults. Casts are classified as type I when constituted by inflammatory cells and accompany diseases such as asthma and pneumonias; and type II when acellular. Lymphangiogram and access of the thoracic duct, although challenging, can offer definite treatment alternatives to alleviate the symptoms of plastic bronchitis, chylothorax or chyloptysis. This report pretends to enhance the value of this intervention.

Take-home Points: Interventional radiology can offer a treatment alternative to plastic bronchitis using TDE.

Peripheral vascular disease intervention

P-509

Mechanical rotational thrombectomy in long femoropopliteal artery- and bypass- occlusions: risk factors for peri-procedural peripheral embolization

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Purpose: To examine lesion characteristics influencing technical outcome and peri-procedural peripheral embolization (PPE) during percutaneous mechanical rotational thrombectomy (PMT) of long femoropopliteal artery and bypass occlusions.

Materials and Methods: Retrospectively, sixty-five consecutive patients (43 male, mean-age 70±12y; Rutherford-category I-III), undergoing PMT with acutely/subacutely occluded femoropopliteal arteries/bypasses were included. Occlusions (mean-length 217±98mm) were treated by PMT followed by percutaneous-transluminal angioplasty(PTA) plus drug-coated-balloon(DCB) or PTA plus stenting/stentgrafting. Technical success was defined as residual stenosis<30%. Follow-up included duplex ultrasound and ankle-brachial-index(ABI) after 12-months. Endpoints were technical success, complications, improvement of Rutherford-category, ABI and patency(re-stenosis<50%). The influence of lesion-length, duration and thrombus-density (measured in pre-interventional computed-tomography-angiography) on technical success and PPE was analyzed.

Results: Technical success after PMT alone was 18%(n=12/65), after additional means 92%(n=60). N=4(6%) underwent bypass-surgery and n=1(2%) amputation. In 11%(n=7) PPE occurred. During 12-month follow-up, n=3/60 patients(5%) were lost to follow-up. ABI increased from baseline 0.5±0.12 to 0.81±0.14(p=0.001) and Rutherford-category by at least one level in n=57 patients at 12-month follow-up(clinical-success=88%). 12-months primary patency was 57.4% (95% CI: 45.8 to 68.9%) and secondary patency 75.0% (95% CI: 59.8 to 72.3%). As risk factors for PPE, we identified lesion length >200mm (15%; n=6/39)(OR 4.5; 95% CI: 0.5-40) (p=0.014) and thrombus density ≤45HU (20%; n=2/10)(OR 3.0; 95%CI: 0.2-38.9)(p=0.05). No significant relation between risk factors and technical success was found.

Conclusion: PMT followed by PTA or implantation of stent(grafts) appears to be effective and safe for revascularization of acute/subacute long occlusions. Thrombus-density ≤45 HU and lesion length above 20cm represent risk factors for PPE during PMT.

P-510

"Kissing" stents in the treatment of aorto-iliac disease – complications and outcome

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Purpose: "Kissing" stents or angioplasty is an established endovascular management for stenosis at the aortic bifurcation, but not without its detractors. The aim of this study was to review local practice and collect outcome data with particular regard to stent occlusion and especially when an asymptomatic limb was treated.

Materials and Methods: 106 patients undergoing aortic bifurcation intervention from Jan 2015 to Nov 2020 were retrospectively reviewed. Only those with involvement of at least one common iliac artery (CIA) ostium (<1cm from the bifurcation) and undergoing bilateral CIA intervention were included.

Results: Patients were followed-up for a mean period of 29 (±19 SD) months. The distribution of lesions by TASC-II classification were as follows: A, 49%; B, 40%; C, 6%; D, 5%. In 53% of cases, the indication for percutaneous therapy was limited to one side. Procedural success rate was 97% (103/106). In 3% (3/106) of cases an ischaemic event occurred in an asymptomatic limb in the iliac territory (due to late > 30 days] stent thrombosis). In three other asymptomatic limbs, progression of downstream disease necessitated infra-inguinal intervention. 72% (76/106) of all patients were free of recurring ischaemic leg events recurrent claudication, stent occlusion, amputation or vascular re-intervention by the end of the study period. No cases of amputation arose from bifurcation stenting.

Conclusion: "Kissing" stent deployment is a safe and effective strategy for the treatment of aorto-iliac bifurcation disease, even when symptoms may be unilateral in distribution.

P-511

Is there an additive risk of warfarin therapy on the development of critical limb ischemia for end-stage renal disease patients on hemodialysis?

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Purpose: To assess whether warfarin therapy is an incremental risk factor for the development of critical limb ischemia (CLI) amongst adult end-stage renal disease (ESRD) patients on hemodialysis therapy.

Materials and Methods: Retrospective case control cohort study of adult ESRD patients on hemodialysis. Hemodialysis patients on warfarin were matched to a warfarin naïve control group. We recorded demographics (age, gender), dialysis vintage, whether warfarin was utilized, and whether imaging or clinical evidence of CLI developed. Other risk factors of CLI were noted, including diabetes mellitus (DM), smoking, stroke, left ventricular (LV) dysfunction, hypoalbuminemia and prior CLI. The two groups were compared with regards to factors predictive of CLI and the rate of CLI.

Results: A total 327 hemodialysis patients were included with 94 subjects on warfarin (50 males, median age 71) and 233 patients in the control group (139 males, median age 66). In the warfarin group, CLI developed in a total of 16 subjects (17%), after exclusion of CLI pre-warfarin therapy. On the other hand, 36 subjects in the control group (15.5%) developed CLI. Higher rates of comorbidities were noted in the warfarin group, such as stroke (50% Vs. 36.5% in the control group) and long-standing hypoalbuminemia (50% Vs. 15%). Fisher's exact test demonstrates no incremental increase in CLI amongst hemodialysis patients on warfarin (OR 0.74).

Conclusion: No statistically significant association links warfarin therapy with the development of CLI amongst ESRD patients on hemodialysis. Within the limitations of this study, it appears warfarin does not add incremental risk for CLI beyond known classic risk factors.

P-512

Effectiveness of the MynxGrip vascular closure device in achieving popliteal vein haemostasis following venous thrombolysis

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Purpose: We set out to report our experience in using the MynxGrip Vascular closure device in patients undergoing venous thrombolysis to treat the venous access point upon completion of treatment.

Materials and Methods: This was a single-centre retrospective study investigating the effectiveness the Mynx Grip vascular closure device to achieve hemostasis of the popliteal vein following venous thrombolysis procedures. Additional manual compression was applied to the wound site for one minute. We recorded: patient demographics, size of sheath used, size of mynx used for vein closure, activated clotting time and additional heparin used. Our main outcome measure was technical success and complications rate.

Results: A total of 9 patients (mean age=39 years, n=5 males) met the inclusion criteria and were included in the study. All patients had a 9 Fr sheath used for venous thrombolysis for at least 24 hours infusion prior to the deployment of the closure device. Additional heparin during the procedure was given to all patients (mean=6000 units, range=5000-9000). To achieve haemostasis, the 6/7Fr MynxGrip vascular closure device was used in all cases. The mean activated clotting time (ACT) at closure was 380 secs (range 229-358 secs). Technical success was 100%, No immediate or late post-op complications were reported.

Conclusion: The MynxGrip vascular close device is a safe and effective method for achieving venous haemostasis in high risk patients.

P-513

A new vascular intervention strategy in the post-covid era: our first experience in Russia

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Purpose: To propose an alternative method of vascular imaging without iodine in patients with critical limb ischemia (CLI). To acquaint with the first experience in Russia (carried out by us) in implementing the technology 0-iodine.

Materials and Methods: Diagnostic and treatment interventions were performed to 104 patients with critical lower limb ischemia. According to the ultrasound investigation, stenosis or occlusion of the arteries were located below the inguinal fold. 104 diagnostic procedures and 71 treatment interventions were performed. All interventions were carried out with CO2 special software for angiography system. The introduction of carbon dioxide into the arterial bed was performed by using an automatic injector CO2 "Angiodroid".

Results: Complete success (less than 1.5 ml of iodine) was achieved in 83 out of 104 diagnostic procedures - often 0 iodine, and 64 out of 71 interventions. Partial success (1.5-20ml) was achieved in 17 diagnostic and 6 interventional procedures. Complete failure (more than 20 ml) in 5 cases. However, all the surgeries were carried out successfully and completely.

Conclusion: Replacing the use of iodine with CO2 as the only contrast substance in CLI patients is a safe and effective method. This technique plays a special role for patients with concomitant chronic kidney disease and after COVID-19, which significantly worsens the course of CKD. To implement the 0-iodine technique, it is necessary to complete the training programme at the CathLab. To make it possible we created a special course and started to teach other CathLab specialists.

P-514

Subtent-technique for revascularization of in stent occlusions using interwoven nitinol stents

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Purpose: To evaluate feasibility, safety and efficacy of subintimal revascularization of femoropopliteal in-stent occlusions using interwoven nitinol stents.

Materials and Methods: Six patients (4 male, median age 80 years; interquartile range (IQR) 66-86) suffering from peripheral artery disease (PAD) (Rutherford-category III in n=3, category V in n=3) underwent revascularization of total in-stent occlusions of the femoropopliteal segment. Median lesion length was 150 mm (IQR 88-363). After an intraluminal guidewire probing of the lesion had ultimately failed, a subintimal approach with reentry in a patent vessel segment distally to the in stent occlusion was performed. The lesions were then pre-dilated by plain-old-balloon angioplasty (POBA) with consecutive stent-crush followed by implantation of an interwoven-nitinol stent and post-dilation (POBA). Follow-up included clinical visits, duplex ultrasound and ABI at 3, 6 and 12 months. Endpoints were technical success (residual stenosis<30%), complications, improvement of Rutherford-category/ABI, patency (re-stenosis<50%), limb salvage (freedom from major amputation) and survival.

Results: Technical success was 100%. No complications were recorded. Rutherford-category improved in all patients, ABI increased from median 0.44 to 0.82. Primary patency at 3, 6 and 12 months were 100%, 83% and

44% (95%CI: 8.837 – 12.915). Two patients underwent target lesion revascularization during follow-up by bypass at 6 and 9 month, one patient rejected revascularization of target lesion. No major amputation or death was observed during follow-up.

Conclusion: After a failed intraluminal approach, subintimal revascularization of femoropopliteal in-stent occlusions (subtent-technique) using interwoven nitinol stents proved to be feasible, safe and effective with satisfying outcomes up to 12 months follow-up.

P-515

Infrainguinal angioplasty outcomes in a tertiary UK hospital

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Purpose: Advancements in endovascular treatments for chronic limb ischaemia (CLI) are being implemented at a very fast rate, requiring significant resources when there is little meaningful published real-world data in angioplasty long term outcomes. Our aim is to provide real-world outcome data which can help put into context the benefits of these new emerging techniques.

Materials and Methods: All infrainguinal primary angioplasties for critical limb ischaemia (Rutherford 4-6) from September 2016 to 2018 were automatically pulled from electronic patient records. Similarly, a list of all amputations performed from September 2016 to 2020 was also pulled along with diabetes status, renal function and mortality data. Rutherford score was obtained by going through individual patient records.

Datasets were cross referenced using R and amputation free survival, overall survival and limb salvage rates were calculated.

Results: 294 infrainguinal primary angioplasties for CLI were performed. The majority (n=221, 75.2%), were for tissue loss (Rutherford 5 and 6). The majority of amputations (78.6%, n=22) occurred in the first 150 days with a limb salvage rate of 88.8%. This dropped to 86.7% at 1 year and 84.3% at 4 years.

Amputation free survival was 72.8%, 67.7% and 53.7% and overall survival was 84%, 77.6% and 63% at 1, 2 and 4 years respectively.

Conclusion: Our results demonstrate the very poor comorbid status of patients presenting for primary angioplasty, and how this can result in falsely reassuring limb salvage rates (84.3% at 4 years as opposed to 53.7% amputation free survival).

P-516

Interpretable machine learning for predicting amputation following lower extremity infra-inguinal endovascular procedures: a NSQIP cohort study

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Purpose: Lower extremity peripheral artery disease (PAD) is a common condition associated with significant morbidity and mortality especially when requiring surgical or endovascular intervention. The goal of this study is to build a machine learning model that may enhance short-term major amputation outcome prediction in patients with PAD undergoing endovascular interventions

Materials and Methods: In this IRB-approved retrospective study, we utilized the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) general and targeted databases

to collect preoperative clinical and laboratory information on the 2008 patients who underwent lower extremity endovascular procedures for PAD between 2014 and 2017. Our primary outcome of interest was 30-day ipsilateral major amputation of the affected limb. Using a 4:1 split, we developed and tested a machine learning model to predict the occurrence of 30-day amputation following infra-inguinal endovascular procedures. We present performance and interpretability metrics using Shapley Additive exPlanations (SHAP). As a final test, we compared the performance of our chosen model to a logistic regression model built on a modified Rutherford-based classification scheme present within the ACS-NSQIP database.

Results: A machine learning model built using an extreme gradient boosting algorithm achieved an AU-ROC of 0.85. The most important features of the model were white blood cell count, serum creatinine, partial thromboplastin time, alkaline phosphatase level, and hematocrit. The proposed multifactorial machine learning model performed significantly better than the Rutherford-based model (DeLong's test, $p < 0.001$).

Conclusion: This machine learning model may aid in clinical management decisions in patients affected by PAD.

P-517

Prospective, post market clinical follow-up (PMCF) study of the Rotarex® S Catheter for Mechanical Atherectomy and Thrombectomy (MATH): 6-month interim analysis

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Purpose: To evaluate Rotarex® S for removal of acute, subacute, and chronic arterial occlusions in peripheral - native arteries, - stented arteries, or - native or artificial bypasses.

Materials and Methods: Patients enrolled in this prospective, multi-centre, multi-national, non-randomized, observational study were treated with the Rotarex® S Catheter as a standalone device or with adjunctive therapy. Patency was evaluated by colour-coded Doppler sonography or angiography. Walking improvement and Quality of Life was assessed by EQ5D 3L Questionnaire and by Vasculi Quality of Life Questionnaire (VQ-6) respectively.

Results: One-month and 6-month follow-up results of 220 patients with thrombotic, thromboembolic, and atherothrombotic occlusions will be evaluated and presented. Device-related adverse events and device malfunctions will be presented as "freedom from major adverse events (MAE)" defined as clinically driven target lesion revascularization (TLR), any death and any unplanned major amputation of the index limb. Performance will be analysed by determining technical and procedural success and clinical outcome by freedom from Target Vessel Revascularization (TVR), clinical category improvement in the Rutherford Class, and Hemodynamic success as improvement in ABI. Clinical benefits will be analysed using the "walking improvement" and "Quality of Life" assessments.

Conclusion: The 6-month interim analysis will be presented for the first time at CIRSE-2021. The contribution of the PMCF Rotarex study team (T. Fuss, R. de Graaf, S. Heller, R. Löffroy, L. Maiwald, N. Malyar, M. Mirandola, V. Palmiste-Kallion, D. Scheinert, J. Tessarek, F. Wolf and T. Zeller) is acknowledged.

P-518

To evaluate the performance of the Aspirex® S catheter in the removal of venous occlusions in patients with acute thrombotic or thromboembolic occlusion in native veins, stented veins, or native or artificial bypasses

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Purpose: To evaluate the performance of the Aspirex® S catheter in the removal of venous occlusions in patients with acute thrombotic or

thromboembolic occlusion in native veins, stented veins, or native or artificial bypasses.

Materials and Methods: Patients enrolled in the post-market clinical follow-up (PMCF) study P-MAX (Post Market Aspirex) were treated with the Aspirex® S catheter in a prospective, non-randomized, multicentre, multinational observational study. Patency was evaluated by colour-coded Doppler sonography or angiography. Clinical outcomes were evaluated at 1 month with the Venous Clinical Severity score (VCSS), the clinical, etiologic, anatomic and pathophysiologic (CEAP) score, and the venous disability score (VDS).

Results: One-month results on up to 80 patients with acute thrombotic or thromboembolic occlusions will be evaluated and presented. Analysis will be done on safety by assessing device-related adverse events and device malfunctions, on performance by determining technical success and procedural success, on clinical outcome after 1 month by assessing primary patency and re-intervention rate, and on clinical benefit through improvement in the VCSS, CEAP and VDS score.

Conclusion: Data on the performance of the Aspirex® S catheter will be presented for the first time at CIRSE 2021. The contribution of the P-MAX study team (T. Heller, R. Löffroy, G. O'Sullivan, M. Brodmann, C. Erbel, H. Jalai, O. Schlager and P. Rabuffi) is acknowledged.

P-519

Outcome of percutaneous mechanical rotational thrombectomy with Rotarex in patients with acute and chronic lower limb ischemia

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Purpose: To evaluate efficacy and safety of percutaneous mechanical rotational thrombectomy (PMRT) with Rotarex (Straub Medical AG, Switzerland) in different types of occlusions.

Materials and Methods: In this retrospective study we identified 29 occluded arteries of 26 patients (age range 40-90, mean 72; Rutherford category II-VI) that underwent PMRT using Rotarex. We evaluated the characteristics of lesions (acute/chronic, in-stent/native vessel, short/middle/long) and any additional treatments performed (percutaneous transluminal angioplasty - PTA, stenting or intravascular fibrinolysis). Technical success was defined as residual stenosis <30%. Clinical success was defined as improvement of Rutherford category and patency on duplex ultrasound after 1 month.

Results: Technical success was 100% while clinical success was 96,5% for 1 case of limb amputation. We observed 1 complication (a tibioperoneal trunk injury). PMRT was followed by PTA in 23/29 occlusions, stenting in 5/29 occlusions and intravascular fibrinolysis in 1/29 occlusion. PTA was used in 4/23 (17,4%) acute ischemias, 19/23 (82,6%) chronic ischemias, 3/23 (13%) short lesions, 8/23 (34,8%) middle lesions, 12/23 (52,2%) long lesions, 6/23 (26,1%) in-stent lesions and 17/23 (73,9%) native vessels. Stenting was performed in 2/5 (40%) acute ischemias, 3/5 (60%) chronic ischemias, 2/5 (40%) middle lesions, 3/5 (60%) long lesions, 1/5 (20%) in-stent lesion and 4/5 (80%) native vessels. The only occlusion treated with intravascular fibrinolysis was acute, long, in-stent lesion.

Conclusion: Rotarex is equally effective in both acute and chronic occlusions with low complication rates. Its use drastically reduces stent implantation reserving it for the failure of PTA while in acute thrombosis it allows to avoid intravascular fibrinolysis almost totally.

P-520

Clinically driven target lesion revascularization (CD-TLR) in patients with CLI treated with overlapping EES stents for below the knee long segment lesions

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Purpose: Evaluate clinical outcomes in patients with critical limb ischemia and long-segment (>38mm) infrapopliteal lesions treated with everolimus-eluting coronary stents (EES) with prior failed angioplasty (PTA).

Materials and Methods: We reviewed outcomes in patients with long-segment lesions treated with EES after failed PTA between 01/2009 – 09/2018. The primary endpoint was a composite of freedom from death from any cause through 30-days, and freedom from target limb major amputation and CD-TLR through 12-months analyzed via the Kaplan-Meier method. Log-rank test was used to compare differences between Rutherford groups (Rutherford 4 and 5 compared to Rutherford 6).

Results: Sixty-three patients (age 73.6±11.2, 4 female 53 male), with sixty-five treated limbs met inclusion criteria. Thirty-seven Rutherford 4 or 5 limbs were included, and 28 Rutherford 6 limbs were included. Mean lesion length was 103.1±52.6mm [44.0-380mm]. The mean number of stents used was 2.8; range [2-10 stents] with a mean stent diameter of 3.4mm; range [2.5-4.0mm]. There were 11 deaths, 8 major amputations, and 7 CD-TLRs. Freedom from the composite endpoint was 70.6% for all patients. Rutherford 4 and 5 had a 84.6% freedom compared to Rutherford 6 with a 52.5% freedom from composite endpoint (HR 4.0, 95%CI 1.5-10.6, p=0.0059).

Conclusion: In patients with CLI, placement of multiple EES in long-segment infrapopliteal lesions with prior failed PTA is a durable treatment option, with Rutherford 4 and 5 patients demonstrating markedly better outcomes as measured by freedom from death from any cause through 30-days, and freedom from target limb amputation and CD-TLR through 12 months compared to Rutherford 6 patients.

P-521

Outcome of percutaneous sclerotherapy of venous malformations of the hand: a multicenter trial

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Purpose: The purpose of this study was to evaluate the safety and outcome of percutaneous sclerotherapy for treating venous malformations (VMs) affecting the hand.

Materials and Methods: A retrospective, multicenter trial of 29 patients with VM of the hand, treated with 79 percutaneous sclerotherapies using gelified ethanol and/or polidocanol. Clinical and imaging findings were reviewed to evaluate technical and clinical success, VM size reduction, and complication rates. Substratification analysis was performed with respect to Puig's classification, used sclerosant, and injected volume of the sclerosant. Statistical testing, including Pearson's chi-squared test and Mann-Whitney U-test, were performed using SPSS with p<0.05 considered significant.

Results: Patients were treated for pain (82.8%), swelling (72.4%), functional limitations (62.1%), cosmetic disfigurement (27.6%), and blood coagulopathy (20.7%). The mean number of procedures per patient was 2.7 (range, 1-10). Terminal follow-up (mean=9.2 months) revealed mostly partial relief of symptoms (78.9%) while 3 patients (15.8%) presented as

symptomfree and 1 patient (5.3%) with no improvement. Post-treatment imaging revealed partial response (VM size reduction≥20%) in 94.1 % and complete response (VM size reduction=100%) in 1.5 % corresponding to an overall objective response rate of 95.6%. Post-procedural complications occurred after 5/79 sclerotherapies (6.3%), entirely resolved by conservative means. No significant difference between Puig's classification or used sclerosant and clinical success (p=0.85, p=0.11) or complication rates (p=0.66, p=0.69) were found. The complication rates were not depending on the sclerosant volume injected (p=0.76).

Conclusion: Percutaneous sclerotherapy using gelified ethanol and/or polidocanol is both effective and safe for treating VMs of the hand.

P-522

Outcome of image-guided embolization of arteriovenous malformations of the hand using EVOH: a multicenter trial

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Purpose: To evaluate safety and outcome of image-guided embolization for treating arteriovenous malformations (AVMs) affecting the hand using ethylene-vinyl alcohol copolymer (EVOH).

Materials and Methods: A retrospective, multicenter trial of 14 patients with AVMs of the hand, treated with 33 image-guided embolization sessions using EVOH was conducted. Clinical history and imaging findings were assessed to evaluate clinical success, lesion devascularization, and complication rates. Substratification analysis was performed with respect to the injected volume of the embolic agent and the anatomical involvement of different compartments of the hand (wrist, carpus, fingers, wrist and carpus, carpus and fingers). Statistical testing by Pearson's chi-squared test and Mann-Whitney U-test was conducted using SPSS while p<0.05 considered significant.

Results: Patients were treated for pain (92.9%), local bleeding (28.6%), and skin ulceration (42.9%). The mean number of procedures per patient was 2.4 (range, 1-5). Post-treatment imaging revealed partial response (AVM size reduction≥20%) in 92.9 % and complete response (AVM size reduction=100 %) in 7.1% corresponding to an overall objective response rate of 100%. Follow-up (mean=21.7 months) after treatment revealed mostly partial relief of symptoms (73.7%) while 5 patients (26.3%) presented with no improvement. Peri- and post-procedural complications occurred in 9.1% and 27.2%, respectively, in two cases resolved with post-treatment resection. The improvement of symptoms was significantly depending on the anatomical involvement of different compartments of the hand (p=0.02). No significant difference between the embolic agent volume injected and the complication rate was found (p=0.22).

Conclusion: Image-guided embolization using EVOH-based liquid embolic agents is effective and safe for treating AVMs of the hand.

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Retrograde revascularization of below-the-knee-arteries in patients with critical limb ischemia: plantar-arch versus transpedal approach

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Purpose: To compare retrograde plantar-arch and transpedal-access approach for revascularization of below-the-knee-arteries in patients with critical limb ischemia after a failed antegrade approach.

Materials and Methods: Retrospectively we identified 115 consecutive patients who underwent retrograde revascularization after a failed antegrad approach. In 67/115 patients (58.3%) retrograde access to the target vessel was achieved via the femoral access and the plantar-arch (PLANTAR-group); in 48/115 patients (41.7%) retrograde revascularization was performed via a transpedal-access (TRANSPEDAL-group). The technical success was defined as successful crossing of the plantar-arch (PLANTAR-group); intravascular placement of the pedal-access-sheath (TRANSPEDAL-group). Endpoints were procedural success (residual stenosis <30%), limb salvage, procedural complications, amputation/death. Correlation between vascular calcification and technical/procedural-success was tested.

Results: Technical success was achieved in 50/67 (75%) (PLANTAR-group) and 39/48 (81%) (TRANSPEDAL-group) patients ($p=0.1$). Procedural success was obtained in 23/67 (34%) (PLANTAR-group) and 25/48 (52%) (TRANSPEDAL-group) patients ($p=0.04$). In 14/49 (29%) (PLANTAR-group) cases with present calcification technical success was not achieved ($p=0.04$). In the PLANTAR-group 33/44 (75%) patients with present calcification procedural success was not attained ($p=0.026$). In the TRANSPEDAL-group correlations between calcification and technical/procedural-success was not observed ($p=0.2/p=0.4$). In the PLANTAR-group minor complications occurred in 13/67 (19%), in the TRANSPEDAL-group in 4/48 (8%) patients ($p=0.08$). Limb salvage at 12(18) months was 90%(82%)(PLANTAR-group) and 84%(76%)(TRANSPEDAL-group), ($p=0.46$). Survival at 12(18) months was 94%(86%)(PLANTAR-group) and 85%(77%)(TRANSPEDAL-group), ($p=0.098$).

Conclusion: Procedural success was significantly higher using the transpedal-access approach. Calcifications at pedal-plantar-loop and target-lesion significantly influenced technical-/procedural failure using the plantar-arch approach. No significant difference between both retrograde techniques in terms of feasibility, safety, and limb salvage/survival was found.

P-524

Low access site complication rates of ultrasound-guided brachial artery access for interventional angiography

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Purpose: The current literature on the use of brachial artery access is controversial. Some studies found increased puncture site complications, others found no higher complication rates than in patients with femoral or radial access. The purpose of this study was to determine the impact of ultrasound (US)-guidance on access site complications.

Materials and Methods: This is a single-center retrospective study of all consecutive patients with brachial arterial access for interventional procedures. Complications were classified into minor complications (conservative treatment only) and major complications (requiring surgical intervention). The brachial artery was cannulated in the antecubital fossa under US-guidance. After the intervention, manual compression or closure devices, both followed by a compression bandage for 3 hours, either achieved hemostasis.

Results: A total of 75 procedures in 71 patients were performed in the study period using brachial access. Access was successful in all cases (100%). Procedures in different vascular territories were performed: neurovascular (11/14.7%), upper extremity (36/48%), visceral (20/26.7%), and lower extremity (12/16%). Sheath size ranged from 3.2F to 8F (mean: 5F). Closure devices were used in 17 cases (22.7%). In total, six complications were observed (8.0%), four minor complications (5.3%, mostly puncture site hematomas), and two major complications, that needed surgical treatment (2.7%). No brachial artery thrombosis or upper extremity ischemia occurred.

Conclusion: Exclusive use of US-guidance resulted in a low risk of brachial artery access site complications in our study compared to the literature.

US-guidance has been proven to reduce the risk of access site complications in several studies in femoral access. In addition, brachial artery access yields a high technical success rate and requires no additional injection of spasmolytic medication. Sheath size was the single significant predictor for complications.

P-525

Usage of contemporary drug-eluting stent by Japanese interventional radiologists for femoropopliteal in-stent restenosis lesions: COMBAT-ISR study

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Purpose: To report results of the COMBAT-ISR study of the Eluvia paclitaxel-eluting stent in femoropopliteal In-Stent Restenosis (ISR).

Materials and Methods: The prospective, single-arm, Japanese multicenter (14 hospitals) study (UMIN Clinical Trials Registry: UMIN000036174) enrolled 36 patients, 38 limbs (mean age 73.1 ± 9.6 years; 23 men) with symptomatic ISR (Rutherford categories 2 to 5) in the femoropopliteal artery. Mean lesion length was 23.3 ± 8.7 cm, and 13 (34.2%) of lesions were totally occluded. The primary endpoint is primary patency at 12-month follow-up. Secondary endpoints are technical success rate, major adverse events (MAEs) included all-cause death and stent thrombosis through 1 month and target limb major amputation and target lesion revascularization (TLR) through 12 months.

Results: Technical success was 100%. Stent thrombosis occurred in one patient and no death within one month. The Kaplan-Meier estimate of primary patency was 86.7% at 12 months. The MAEs rate was 5.6% (2/36) (stent thrombosis and TLR). No death and target limb amputations occurred through 12 months.

Conclusion: COMBAT-ISR study results showed that patients whose femoropopliteal ISR were treated with the Eluvia drug-eluting stent sustained high patency and low MAE rates through 12 months.

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Safety and efficacy of aspiration thrombectomy of periprocedural distal embolization with the SOFIA-Catheter in the lower extremities

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Purpose: The Sofia Catheter is well established in intracranial thrombectomy, however there are only few studies regarding its application in peripheral arteries. Our aim was to evaluate the immediate efficacy and safety of aspiration thrombectomy with the Sofia-Catheter in acute periprocedural thromboembolism of the lower limb.

Materials and Methods: We retrospectively analyzed patients with acute periprocedural embolism of the lower limb who underwent aspiration thrombectomy with the Sofia-Catheter between January 2017 and December 2020. Primary endpoints were technical success rate defined as complete aspiration of thrombus and periprocedural complications. Patient history, lesion characteristics and procedural parameters were analyzed.

Results: 33 patients (mean age 70.1 y, range 56-82, 23 male) and 45 vessels (4 popliteal, 41 crural) were treated. Mean vessel diameter was 2.6±0.7 mm; mean thrombus length was 32.9±22.6 mm. Mean aspiration time was 17.3±12.5 minutes. Vacuum pump assisted aspiration was performed in 28 (62.2%), manual aspiration in 13 (28.9%) and a combination of both aspiration methods in 4 (8.9%) cases. All patients had peripheral arterial disease and were initially treated for acute or chronic iliofemoral lesions. Primary technical success rate was 75.6%, primary assisted technical success rate was 82.2%, partial recanalization was achieved in 6.7% of cases. In 11.1% of vessels embolectomy was unsuccessful or insufficient. 2 (4.4%) cases of downward embolization occurred. We recorded no cases of perforation or dissection and no major complications occurred.

Conclusion: Percutaneous aspiration thrombectomy with the Sofia Catheter provides safe and successful recanalization of acute periprocedural distal embolism of popliteal and crural arteries.

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How critical is critical limb ischaemia? A quality improvement project reviewing our cases and outcomes

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Purpose: Guidelines published in 2019 by the Vascular Society of Great Britain and Ireland (VSGBI) provide targets for treatment of patients with critical limb ischaemia (CLI). Wider literature indicates CLI has a 25% mortality and 30% amputation rate at 1-year with 60% mortality at 5-years. Our aims: determine how often we meet these targets, how this affects outcomes and propose improvements to our practice where required.

Materials and Methods: All patients undergoing endovascular intervention for CLI over 4 years were included. Data was collected retrospectively from electronic records and included demographic, admission, imaging, procedural and outcome data.

Results: Data analysis is ongoing. Preliminary results are outlined. 424 patients underwent endovascular treatment for CLI. 265 were male. Average age 72.

Six modes of presentation were identified. 184 were acute vascular "on-call" referrals with 39% of them meeting all VSGBI targets. Overall outcomes in this group were 28% amputation and 36% mortality rate. In those that met the targets vs those that didn't, amputation rates were 20% vs 33% and mortality rates 29% vs 42% respectively.

39 patients were new referrals to vascular out-patient services. 9 (23%) met all targets with 0% amputation and mortality. In those that didn't meet the targets, 10% underwent amputation and 43% have died. The remaining 201 patients were already under follow up in vascular out-patients and the targets are difficult to accurately apply.

Conclusion: Preliminary data indicates that meeting the VSGBI targets impacts on outcomes. Change in practice will be required to meet targets and deliver better outcomes for our patients.

P-528

Treatment of complex femoro-popliteal artery disease with Supera stent: results of a multicenter retrospective study

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Purpose: Even though many types of stents have been tested in superficial femoral artery (SFA) and popliteal artery (PA), the vast majority of these devices have provided an unsatisfactory outcome. The Supera peripheral stent is a device specifically designed for treating atherosclerotic lesions of the femoro-popliteal segment.

The aim of this multicenter retrospective study was to describe the effectiveness of Supera stents in the management of femoral-popliteal atherosclerotic lesions and to critically analyze our findings in the current literature.

Materials and Methods: In this study we enrolled only patients with a severe chronic obstructive arterial disease, treated with endovascular revascularization and Supera stent implantation in the femoro-popliteal axis. We retrospectively analyzed the Ecocolor Doppler follow-up at 12-24 and 36 month. The primary patency, primary patency assisted and TLR were described statistically analyzed.

Results: Between April 2015 and January 2020, 105 endovascular procedures on 99 patients for femoro-popliteal stenting with Supera were performed in four Italian hospitals. The median follow-up was 39 months (range 6-72), with primary patency rate of 83.1%, 74.3% and 69.5% at 12, 24 and 36 months after the procedure. The primary patency assisted was 89.9%, 76.8% and 73.4% in the same period, while the freedom from TLR values were 92.7%, 91.5% and 89.5% at 12, 24 and 36 months after the procedure, respectively. The mortality rate recorded at 12 months from the Supera implantation was 2.8% (3 out of 99 patients enrolled).

Conclusion: Supera stent showed an excellent safety, effectiveness profile and high durability for the treatment of PAD patients with femoro-popliteal artery disease.

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Vascular procedures during the COVID-19 pandemic at a high volume Eastern European interventional radiology department

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Purpose: The purpose of this study was to assess the impact of the COVID-19 outbreak on trends in hospital admissions and workflow parameters of diagnostic and therapeutic procedures at the largest tertiary vascular center in Hungary.

Materials and Methods: A retrospective analysis of all diagnostic angiographies and therapeutic interventions was carried out. The first wave of the COVID-19 pandemic occurred approximately from March 15 until

June 1 in Hungary. We have compared the same period (between March 15 and June 1) of 2019 to 2020. Electronic medical records were reviewed for the clinical status of the patients and treatment-related information.

Results: The total number of diagnostic angiographies and therapeutic interventions in 2020 (N = 233) decreased significantly (P = 0.046) compared to 2019 (N = 373). The ratio of Fontaine stage I–II cases to Fontaine stage III–IV cases for both diagnostic angiographies and therapeutic interventions was significantly lower (OR = 2.11, P = 0.007 and OR = 3.22, P < 0.001) in 2020 (0.36 and 0.27) than in 2019 (0.77 and 0.89). There was also a negative change (P = 0.049) in the number of supra-aortic and other vascular therapeutic interventions in 2020 (N = 16 and N = 21) compared to 2019 (N = 39 and N = 37). During the examined period neither the patients nor the personnel showed any sign of infection relating to the severe acute respiratory syndrome coronavirus 2.

Conclusion: Treatment of patients with advanced peripheral arterial occlusive disease during the COVID-19 pandemic has been successfully implemented in our clinic.

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3D fusion imaging in endovascular peripheral artery interventions

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Purpose: This study was designed to evaluate the feasibility of endovascular guidance by means of live fluoroscopy fusion with computed tomography angiography (CTA).

Materials and Methods: Fusion guidance was evaluated in 20 endovascular peripheral artery interventions in 20 patients. All had received preinterventional diagnostic CTA. Time for fluoroscopy with CTA coregistration was recorded. Feasibility of fusion guidance was evaluated according to the following criteria: for every procedure the executing vascular surgeons recorded whether 3D road-mapping provided added value (yes vs. no) and whether PTA and/or stenting could be performed relying on the fusion road-map without need for diagnostic contrast-enhanced angiogram series (CEAS) (yes vs. no). Precision of the fusion road-map was evaluated by recording maximum differences between the position of the vasculature on the virtual CTA images and conventional angiography.

Results: Average time needed for image coregistration was 5 ± 2 min. Three-dimensional road-map added value was experienced in 20 procedures in 20 patients. In half of the patients (11/20), intervention was performed relying on the fusion road-map only, without diagnostic CEAS. Excluding three patients with inordinate movements, mean difference in position of vasculature on angiography and CTA road-map was 1.86 ± 0.95 mm, implying that approximately 95% of differences were between 0 and 3.72 mm (2 ± 1.96 standard deviation).

Conclusion: Fluoroscopy with CTA fusion guidance for peripheral artery interventions is feasible. By reducing the number of CEAS, this technology may contribute to enhance procedural safety.

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Primary retrograde tibio-pedal access for revascularization of severe lower limb peripheral arterial disease: a safe and effective alternative?

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Purpose: Primary retrograde Tibio-Pedal access (pTPA) is an alternative access for revascularization when a primary antegrade approach is considered unsuitable or difficult e.g. recent intervention, infected or heavily scarred groin and patient factors such as obesity and inability to lie flat. **Materials and Methods:** All angioplasties in a single institution were reviewed over a 3-year period (January 2018 – 2021). Clinical notes and PACS images were reviewed to record: case selection criteria (indication for pTPA, crural vessel patency, infraginal/infrapopliteal TASC classifications), technical outcomes (requirement for subsequent antegrade approach, complications) and outcomes (visual assessment of angiography post procedure) and follow up indices (re-intervention rates and major amputation rates).

Results: 48/627 patients treated with angioplasty had pTPA. All cases had ≥ 2 patent crural vessels on pre intervention duplex. 85% of cases were carried out under local anaesthetic.

32 (66.7%) were technically successful

10 (20.8%) required additional antegrade common femoral artery access

6 (12.5%) cases were abandoned after initial angiography

Dorsalis pedis access in (71%); posterior tibial artery (19%).

Infraginal TASC classification (A: 19% B: 38% C: 22% D: 22%) and infrapopliteal TASC classification (A: 44% B: 9% C: 22% D: 25%).

No early access-site complications

Follow-up was a median 5 months

TVR rate was 15.6% at mean 6.4 months.

3 patients required major amputations

Conclusion: pTPA is a feasible, safe and effective approach for revascularization in carefully selected patients where a primary antegrade approach is relatively contraindicated.

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Transpedal accesses for complex lesions of the superficial femoral artery

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Purpose: Endovascular revascularization is an established approach for limb salvage in critical limb ischemia. However, failure rate of antegrade recanalization in complex SFA occlusions is as high as 20%. We report a series of 45 patients who underwent retrograde pedal access and recanalization of SFA chronic total occlusions.

Materials and Methods: This is a retrospective review of prospectively maintained data for all patients who underwent ultrasound-guided percutaneous pedal access for retrograde endovascular treatment of SFA occlusions between 2019 and 2020. All patients had undergone prior unsuccessful attempts at antegrade revascularization. Pedal vessel access was followed by angioplasty with selective stenting and completion angiogram. Patients were followed up with duplex ultrasound to evaluate for patency. Median follow-up was 12 months.

Results: A total of 45 patients underwent retrograde tibial recanalization. Eighty-one percent of the patients presented with Rutherford category 4, 5, or 6 critical limb ischemia. Retrograde pedal access was successful in

95% of the patients (dorsalis pedis = 22, posterior tibial = 23). Retrograde revascularization was achieved in 39 patients using balloon angioplasty and additional stent placement in 6 patients. Revascularization failed in 1 patient (33%). There were no pedal access site complications. At 1 year, limb salvage was $85 \pm 8\%$ with amputation-free survival of $95 \pm 2\%$. **Conclusion:** Early outcomes for ultrasound-guided retrograde pedal access show that it is safe, with low 30-day mortality, and a low rate of MACE. Freedom from MALE and limb salvage are both high at 1-year follow-up. This technique expands revascularization options after failed conventional endovascular antegrade approaches.

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Paclitaxel and mortality in patients with claudication and de novo femoropopliteal lesions: a historical cohort study

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Purpose: A recent meta-analysis, mostly including patients with claudication and de novo femoropopliteal lesions but also with recurrent stenoses and critical limb ischemia, has shown a significant excess mortality in patients treated with PCD.

Objective: To compare the mortality rates of patients with claudication and de novo femoropopliteal lesions treated with and without paclitaxel coated devices (PCD).

Materials and Methods: Comparison of two historical cohorts of patients presenting with claudication and de novo femoropopliteal lesions treated with and without PCD at our institution between 2008 and 2018.

Results: After review of 5219 arteriograms in patients presenting with peripheral artery disease, 700 consecutive patients were included consisting in 72.6% of male (n=508). Mean age was 68.1 ± 8.5 years. 45.7% of the patients (n=320) had a treatment including a PCD. Mean femoropopliteal lesion length was 123 ± 91 mm including 44.6% of occlusions. Patients of the control group were censored at crossover to paclitaxel when applicable. Mortality rates at 1, 2 and 5 years were 4.6%, 7.5%, 19.4% and 1.6%, 6.2%, 16.6% in the non-PCD and PCD groups respectively. The relative risks of death when using PCD were 0.35 (p=0.03), 0.83 (p=NS) and 0.86 (p=NS) at 1, 2 and 5 years respectively.

Conclusion: There was no excess mortality in patients with claudication and de novo femoropopliteal lesions treated with paclitaxel coated devices at 1, 2 and 5 years of follow-up.

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Clinical outcomes after percutaneous peripheral intervention of below the knee arteries: comparison between balloon expandable drug eluting stents and self-expandable peripheral stents

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Purpose: Peripheral arterial disease is a common circulatory problem in the elderly, in severe cases it can lead to Critical limb ischemia. Rarely, stents are used in the calf arteries to achieve successful endovascular revascularization treatment. In this study, we compared the long-term patient's outcome after using two stents, Onyx (Resolute Onyx™ drug-eluting stent, Medtronic, Minneapolis, MN, USA) a zotarolimus-eluting stent or Xpert-Pro (Xpert Pro™ Peripheral Self Expanding Stent System, Abbot, Santa Clara, CA, USA).

Materials and Methods: In this single-center, retrospective study, we collected data on all patients who underwent below-the-knee (BTK) endovascular treatment between 2012-2020. We explored the effect of patient demographics, medical history and clinical status on long term

patient outcome. The primary endpoints were the need for reintervention, amputation rate and 1-year survival.

Results: During the study period, 563 patients underwent endovascular treatment. Of them, 64 patients were treated with one of the two specific stents. There was no significant difference between the two patient groups (types of stents) in age, gender, background diagnoses, background medications and ABI indexes before and after the procedure. In terms of long term outcome, there was no significant difference between the two groups in the need for reintervention (11% vs. 15%, p=0.9), amputation rate (25% vs. 31%, p=0.86) and 1-year survival (16% vs. 12%, p=0.93).

Conclusion: In below knee angioplasty procedures there is no significant difference in long-term patient outcome between Resolute Onyx™ drug eluting stent and the novel nitinol Xpert-Pro Peripheral Self Expanding Stent.

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Safety and efficacy of hydrodynamic thrombectomy with the AngioJet System in acute and subacute mid and long segment femoropopliteal artery occlusions

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Purpose: Hydrodynamic thrombectomy with the AngioJet-system is an interventional approach in acute arterial occlusions of the lower limb, particularly when immediate restoration of blood flow is demanded. There is only few data on the application in mid and long segment femoropopliteal occlusions.

Materials and Methods: Acute and subacute femoropopliteal occlusions treated with the AngioJet-system between March 2017 and May 2019 were enrolled. Primary and secondary technical success rates ($\leq 30\%$ residual stenosis), periprocedural complications, lesion characteristics and procedural parameters were analysed.

Results: 36 patients (mean age was 72,2 years, 18 female) and 37 occlusions (26 native vessels and 11 bypass occlusions) treated with the AngioJet-system were enrolled. Mean vessel diameter was $5,7 \pm 1,1$ mm, mean occlusion length was 265 ± 147 mm, mean occlusion age was $8 \pm 10,3$ days. Primary success rate using the AngioJet-system alone was 0,5%. Secondary success was achieved in 73 % by addition of balloon and stent angioplasty due to underlying stenosis in 65 % and residual thrombus in 35%. Additional aspiration was used in 26% of the successful cases. Restoration of blood flow in the treated segment could be established in 81% of all cases. Mean intervention time was 87,2 minutes. There were nine cases of distal embolization, four dissections and one acute re-occlusion.

Conclusion: If immediate restoration of blood flow is demanded, the AngioJet-system is a potent device in reducing thrombus mass in mid and long segment femoropopliteal artery occlusions. There is a high demand for adjunctive therapies mostly due to underlying atherosclerotic diseases and a relatively high rate of complications.

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Safety and efficacy of rotational thrombectomy for treatment infrarenal arterial occlusions in a large single-center cohort

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Purpose: To evaluate the safety and efficacy of rotational thrombectomy (RT) for treatment infrarenal arterial occlusions in a large single center-cohort.

Materials and Methods: This retrospective study included 397 consecutive interventions in 294 patients between 04/2010 and 12/2019. All patients received RT (Rotarex®S, Straub Medical AG) of infrarenal arterial occlusions of native vessels, in-stent occlusions, and bypass-grafts. Complications, technical success and clinical success were assessed.

Results: Symptoms were acute, subacute, and chronic in 47.5%, 22.2%, and 30.3% respectively. Rutherford categories three (23.5%) and four (32.1%) were most prevalent. Target lesions were in pelvic 7.1%, pelvic/femoral 5%, femoral 59.4%, femoral/BTK 27%, and BTK arteries 1.5%. Target lesion characteristics were: length > 20 cm 61.5%, after bypass surgery 14.9%, and previous stenting 41.4%. RT device size was 6F 88.6% and 8F 11.4%. Additional lysis after RT was necessary in 24.2% of cases. Subsequent plain balloon or DCB PTA was performed in 89.5% of cases. Technical and clinical success rates were 90.9% and 90.4%, respectively, with an improvement of ankle-brachial-index from 0.33 ± 0.29 to 0.81 ± 0.25 . Symptom-free walking distance of more than 200m was reported in 78.1% of cases after treatment. Complications occurred in 38.8% of cases with peripheral embolization being most common 22.4% of cases, of which 65.2% needed further treatment. Dissections and perforations occurred less frequently in 9.6% and 2.7% of cases, respectively. RT was directly associated with 6.8% of complications.

Conclusion: RT is a safe and efficacious procedure for treatment of acute, subacute and chronic thrombotic occlusion of infrarenal arterial occlusions of native vessels, in-stent occlusions, and bypass-grafts.

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Predicting and comparing wound healing and technical success rates of Infrapopliteal angioplasty for chronic limb threatening ischemia –between WIFI, TASC II, GLASS and ANGIOSOME concepts

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Purpose: The objective of this study was to predict and compare the wound healing and the technical success rates of infraopliteal angioplasty for chronic limb threatening ischemia between the TASC II, WIFI, GLASS and ANGIOSOME concepts.

Materials and Methods: A retrospective analysis of 60 patients who underwent Infrapopliteal angioplasty for CLTI between January 2019 to December 2020 were included in the study. Primary endpoints were wound healing, limb salvage rates and technical success of the procedure. The secondary outcome variables were patency, amputation free survival rates and major adverse cardiac events. Followups were at 6 weeks, then every 3 months for 1 year and every 6 months thereafter.

Results: Mean followup period was 6months. The technical success rate was 92%. Ulcer healing rate was faster in the WIFI 0–1 groups than WIFI 2–3 groups (42 days vs 65 days $P < 0.05$). The limb salvage rates at 6 months were similar among patients revascularised based on angiosome concept and those not based on the angiosome concept with no statistical significance. Technical success was higher for GLASS I-II groups compared to GLASS 3–4 groups (100% vs 88%).

Conclusion: The preliminary analysis suggest that the angiosome concept no more had significance in predicting wound healing and limb salvage rates. The WIFI and GLASS concepts were superior in predicting wound healing and limb salvage rates. The GLASS model was superior to TASC II model in predicting the technical success. Further detailed analysis is under process

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Blood flow quantification in complex stent configurations of the aortic bifurcation by ultrasound velocimetry

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Purpose: Accurate 2-dimensional blood flow visualization has been demonstrated near the aortic bifurcation in healthy volunteers with ultrasound velocimetry, or echoPIV [1]. Disturbed flow patterns may influence stent patency and real-time flow quantification could therefore improve treatment outcome. A previous in vitro study comparing the kissing stent (KS) with the "Covered Endovascular Reconstruction of Aortic Bifurcation" (CERAB) configuration showed varying flow dynamics, that could explain clinical performance differences [2]. This study aims to investigate flow dynamics in the KS and CERAB configuration, using echoPIV.

Materials and Methods: In an ongoing prospective clinical study, high frame rate contrast-enhanced ultrasound images are obtained at the aortic inflow region of the stents in 20 patients who were recently treated with a KS or CERAB configuration. Subsequently, PIV analysis is performed on the ultrasound images and the obtained blood flow velocity fields are used to quantify flow disturbance parameters, such as flow complexity and vorticity. Clinical 2- and 5-year follow-up will be performed to investigate the influence of these flow parameters on stent patency.

Results: Several preliminary cases are presented showing unique flow features in both stent configurations that can be quantified with flow complexity and vorticity. In these cases, the inflow of the CERAB configuration showed less disturbed flow compared to KS, although statistically significant results were not (yet) obtained.

Conclusion: Accurate 2-dimensional quantification of blood flow disturbances is feasible in complex stent configurations, using flow complexity and vorticity. Future follow-up studies will show if these flow parameters correlate to stent patency.

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Impacts on major bleedings procedures during 2020 COVID-19 pandemic

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Purpose: SARS-CoV2 infection is a systemic condition characterized by an increased inflammatory response with evidence of consequent prothrombotic state caused by massive cytokines releasing.

Therefore, during last year, pharmacologic thromboprophylaxis was increasingly performed to reduce thrombotic events. Direct association between SARS-CoV2 and major bleeding events is still unknown and should be determined.

Materials and Methods: We reviewed our Interventional Radiology Department cases comparing urgent embolization procedures before and after SARS-CoV2 pandemic onset, to verify if during the pandemic years these procedures increased.

Results: In 2019, 121 urgent embolizations were performed; in 2020, 117. Amongst all of 2020 cases, only seven of them were SARS-CoV2 positives and five of them were under thromboprophylaxis.

Conclusion: During the last pandemic year, despite the widespread use of thromboprophylaxis related to SARS-CoV-2 treatment, our Institute did not show an increase in embolization procedures. It is to be considered that about 220 patients were admitted to the COVID intensive care unit and, despite all of them were anti-coagulated, no increase in major bleedings was observed.

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Comparative analysis of the use of bioactive coated stents and bare metal stents in atherosclerotic lesions of the superficial femoral artery

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Purpose: To compare the results of treatment of patients with atherosclerotic lesions of the superficial femoral artery (SFA) using bioactive coated stents (BioCS) based on titanium oxynitride and bare metal stents (BMS).

Materials and Methods: We reviewed the clinical data of 123 patients (81 male, 42 female; mean age $67,3 \pm 7,5$ years) treated for chronic limb ischemia due to stenosis or occlusion of SFA at single center (2014-2017). Outcomes were analyzed in patients who had primary intervention using BioCS (n = 54) or BMS (n = 69). End points were freedom from restenosis, reinterventions, level of nitric oxide (NO) in the blood (N=24 mmol/l) and patency rates.

Results: The mean (+/-SD) length of the treated segment was $120,7 \pm 78,3$ mm in the BioCS group and $98,3 \pm 46,3$ mm in the BMS group. Patients treated by BioCS had higher freedom from restenosis (87,0% vs 60,9%; $P = 0.001$), reintervention (85,2% vs 65,2%; $P = 0.001$), and better primary patency at 24 months (83,4% vs 62,4%; $P = 0.001$) than for BMS. The blood NO level at 3 days, 6 and 12 months after the operation was 20,2, 13,9 and 9,9 mmol / l in the BioCS group, compared to 11,8, 8,4 and 7,5 mmol / l in the BMS group.

Conclusion: In this nonrandomized study, the use of bioactive coated stents increases the patency of the construct by suppressing endothelial dysfunction.

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FEMORABLE preliminary study: common femoral artery intravascular lithotripsy and drug-coated balloon (DEB) angioplasty

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Purpose: To evaluate the safety and feasibility of treating calcified common femoral artery (CFA) stenosis using an intravascular lithotripsy (IVL) system associated with drug-coated balloon (DCB) angioplasty.

Materials and Methods: We enrolled 10 patients (mean age $77,0 \pm 9,6$ years; 7 men); in a prospective, nonrandomized study. All patients had moderate to severe CFA calcifications evaluated at Computed Tomography angiography (CTA). Patients were treated with the Shockwave Medical Peripheral IVL System and sirolimus-DEB angioplasty and followed for 30 days with clinical and ultrasound evaluation every week and CTA at 30 days. Technical success was defined as IL- device lesion crossing and IL-balloon expanding. Safety endpoint was evaluation of major adverse events through 30 days defined as death, myocardial infarction, need for emergency surgical revascularization of the target artery. The primary effectiveness outcome was acute reduction in the percent diameter stenosis.

Results: IVL catheter delivery was successful in all cases. Major adverse events at 30 days was 0%. The acute reduction in percent diameter stenosis of target lesions was 65,5%. All patients achieved residual diameter stenosis $\leq 50\%$. None of the subjects experienced thrombus formation, abrupt closure, distal embolization, or perforation. There were no device-related complications.

Conclusion: The early results of this pilot study demonstrated that calcified, stenotic common femoral arteries can be safely and successfully treated with intravascular lithotripsy associated with DEB angioplasty.

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Two-dimensional perfusion angiography in endovascular treatment of chronic limb-threatening ischemia (CLTI), comparison with non-invasive methods for assessing microcirculation

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Purpose: Evaluation of the efficacy of two-dimensional perfusion angiography in endovascular treatment in patients with Chronic Limb-Threatening Ischemia (CLTI), the effect of 2DPA parameters on the volume of surgery, long-term clinical results. Comparison of the correlation of results of two-dimensional perfusion angiography (2DPA) with transcutaneous oxygen perfusion (tcPO2) and ankle-brachial index (ABI) in the long-term period, comparison of large clinical points.

Materials and Methods: The experience of endovascular treatment of 48 patients with critical lower limb ischemia was analyzed. This single-center study was designed as a prospective, non-randomized study. Patients with CLTI were included and classified according to Rutnerford criteria. For all patients transcutaneous oxygen tension (tcPO2) and both ankle-brachial index (ABI) were measured before intervention and at 30-day follow-up. Revascularization was performed according to the angiosomal principle. All patients underwent intraoperative perfusion angiography before revascularization and after angioplasty of the femoropopliteal segment and 1-3 bellow-the-knee arteries. Based on the data obtained, a decision was made on the volume of revascularization. In the case of a sufficient increase in the perfusion of the foot tissues in patients with collateral blood flow, no further attempts were made to restore antegrade blood flow to the target angiosome.

Results: In the postoperative period (3 months), 90% of patients showed a direct correlation between changes in perfusion angiography parameters and tcPO2 levels, large clinical endpoints.

Conclusion: Two-dimensional perfusion angiography is a reliable method for intraoperative assessment of foot tissue perfusion, allowing to determine the volume of revascularization and predictors of clinical outcomes.

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Interventional radiology treatment of spontaneous bleeding in patients with SARS-CoV-2 infection in anticoagulation therapy: single center experience at 1 year from COVID-19 outbreak

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Purpose: To review our experience in interventional radiology (IR) treatment of acute bleeding in COVID patients, evaluate recurrence rate, comparison to current medical literature and investigate for coagulation-associated complications.

Materials and Methods: We retrospectively identified COVID patients who underwent IR embolization procedures during the last 12 months. Medical records were reviewed to investigate coagulation profile and

anticoagulation therapy status, severity of lung involvement on CT scan, site of bleeding, duration of IR procedure and recurrence bleeding rate. Technical and clinical success were defined respectively as freedom from repeating embolization and bleeding-related mortality at 30 days and freedom from repeating embolization and mortality from any cause.

Results: An amount of 18 procedures were performed in 14 patients (median age 72; range 38 - 87y; M=8;F=6). We observed recurrence of bleeding in only 1 patient (7%). Technical and clinical successes were 94% and 80% respectively. Pre-procedural and procedural time was longer in comparison with non-COVID patients' procedures. Furthermore there was a need to organize sanitification and particular scheduling to perform IR activity, including activation of dedicated paths to move COVID patients safely from their ward to angiographic suite. There was no significant correlation between severity of lung infection in CT scan and bleeding risk.

Conclusion: Among COVID patients, spontaneous bleedings are common, also considering the need of anticoagulant therapy. Interventional radiology treatment is a precious tool thanks to its minimally invasive approach, safety and efficacy in preventing bleeding recurrences. However in COVID patients the procedure is considerably longer and with significant impact on IR department organization and productivity.

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Aspiration thrombectomy with the Indigo System for acute lower limb ischemia: our experience

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Purpose: to assess the short-term technical success and the safety of the IS in a series of patients undergoing vacuum-assisted catheter direct thrombus aspiration (IS-CDTA) for acute lower limb ischemia (ALLI) and to analyse which parameters may affect the outcome.

Materials and Methods: All procedures using the IS-CDTA for ALLI performed in a single centre Interventional Radiology Unit from February 2016 to March 2020 were analysed retrospectively. Technical success was defined as the achievement of nearly-complete or complete revascularization (TIMI grade 2/3) and was considered as a good outcome.

Variables potentially correlated with the IS-CDTA outcome were analysed. **Results:** 33 procedures were performed in 29 patients. The technical success was 70%.

The median time between symptoms insurgency and IS-CDTA was significantly shorter in patients with good IS-CDTA outcome (10 hours; IQR 2.75-48) compared to those with poor IS-CDTA outcome (168 hours; IQR 36-336) ($p = 0.003$). No statistically significant differences were found between the two groups regarding ATK vs BTK ($p = 0.34$), native vessel vs graft ($p = 0.25$), occlusion nature ($p = 0.28$) or Rutherford score ($p = 0.80$).

Conclusion: IS-CDTA is a valid option for a rapid and percutaneous treatment of ALLI. Our experience indicates that the time elapsing from the symptoms insurgency and the endovascular procedure is the best positive predictor of the outcome.

P-545

Nontraumatic intraluminal recanalization of difficult below-the-knee total occlusions using combination of IVUS catheter tip and long supporting vascular sheath

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Purpose: Evaluate safety and effectiveness of combining IVUS tip and a supporting sheath tip in the tibial artery to treat total occlusion

Materials and Methods: Fourteen patients underwent conventional antegrade crossing techniques for tibial artery CTO using weighted tip wires and crossing catheters. All had failed. The proximal calcium cap was confronted by the tip of an IVUS catheter, after a 5 F long supporting sheath was placed in the tibial artery. The IVUS tip was used to push against the CTO with the support of a Command wire (Abbott) inside, while intraluminal status of the crossing was confirmed by the live IVUS recordings. The IVUS tip was then pushed forward with firm pressure all the way down to the ankle. This was followed by additional atherectomy and angioplasty.

Results: Fourteen patients had average age of 73 (range 61-91), 2 smokers, 9 with left leg lesions, 12 are diabetic each underwent conventional contralateral access antegrade crossing techniques; and novel techniques using a 5F supporting sheath tip in the target below-the knee vessel and an IVUS catheter tip as the main recanalization device pushing inferiorly. Live IVUS recordings demonstrate intraluminal status. 13 patients were technically successful with a patent target tibial vessel at the end of the procedure. 10 patients had 6-months patency based on ultrasound, and 3 had re-occlusion. 1 patient had extravasation during the procedure; 0 had post-op hematoma in the calf.

Conclusion: Using an IVUS tip with a supporting long sheath in the target vessel is a safe and effective novel approach to recanalize difficult tibial CTO.

P-546

Utilisation of image guidance to enhance safety of deployment of the Mynx Control Vascular Closure Device

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Learning Objectives: To understand the steps involved in utilisation of ultrasound and fluoroscopic guidance in use of the Mynx Control vascular closure device, and to understand the benefits and value of employment of imaging guidance in this setting,

Background: The Mynx Control device (Cardinal Healthcare, Dublin, Ohio, USA) allows for entirely extravascular arteriotomy closure. It features an intravascular balloon, inflated intraluminally and retracted against the arteriotomy during deployment of an extravascular polyethylene glycol sealant plug. The manufacturer's instructions recommend this be performed 'on feel' alone, but we use imaging guidance to enhance safety.

Clinical Findings/Procedure Details: Utilisation of fluoroscopic guidance involves balloon inflation within the arterial lumen with a mixture of 1ml contrast and 1ml normal saline. Under fluoroscopic screening, the device and sheath are retracted as one until the balloon is flush with the arteriotomy. Use of a magnified view allows identification of calcific plaque. Ultrasound scanning in longitudinal section demonstrates the sheath and inflated device within the arterial lumen, which are then retracted until the balloon is flush against the arteriotomy. Ultrasound has the added advantage of showing the extravascular plug following deployment, confirming satisfactory placement of the plug, and also allowing for detection of early complications such as haematoma formation.

Conclusion: These techniques add an extra level of confidence and safety in device utilisation as they facilitate the operator's visualisation

of the crucial steps of device deployment. There are no drawbacks to use of imaging in this setting. We suggest that practitioners consider adopting these techniques when using this device.

P-547

Iliac artery aneurysms: is it important to preserve the hypogastric artery during endovascular repair?

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Learning Objectives: To describe the main features of iliac artery aneurysms.

To describe the importance of preserving the hypogastric artery (flow distal pelvic circulation) during endovascular repair.

To describe the new endovascular treatment options to preserve the hypogastric artery during endovascular repair.

Background: Iliac artery aneurysms (IAA) constitute a special entity because of the difficulty of their repair due to the complex anatomy of the iliac vessels.

Classically, the treatment of iliac aneurysms (isolated or associated with aortic aneurysms) very often required hypogastric artery (HA) embolization.

However, this sacrifice could carry sequelae such as thigh and buttock claudication, sexual and bladder dysfunction, colon ischemia, and buttock necrosis.

Clinical Findings/Procedure Details: The symptoms of buttock claudication and the most feared complications of pelvic ischemia make the preservation of HA an attractive addition to aneurysm repair.

Nowadays, new endovascular treatment options have been developed to allow HA preservation: bell-bottom technique, sandwich technique (parallel graft), banana technique ("U" graft), and iliac branch device (IBD). In this review, we describe and illustrate all these techniques discussing their indications and showing cases of each one.

Conclusion: Iliac artery aneurysms pose a challenge in endovascular aneurysm repair, classically involving hypogastric artery embolization. New endovascular treatment options for the preservation of hypogastric arteries are safe, effective and avoid symptoms of pelvic ischemia.

P-548

Role of interventional radiology in the management of arterial injuries of drug addicted patients

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Learning Objectives: To describe more common vascular complications seen in drug addicted patients as well as trip and tricks to solve them: from transcatheter arterial endovascular treatment to surgery.

Background: Interventional radiology could allow to manage vascular complications in patients with drug addiction, as definitive procedure or as a temporizing measure in conjunction with surgery. The vast majority of patients shows injuries of the lower extremity blood vessels; the common femoral artery is the most common site of repeated injury which leads to the formation of pseudoaneurysms. Arteriovenous fistulae and hematomas with contrast extravasation due to adjacent arterial vessels rupture could coexist too.

Clinical Findings/Procedure Details: Common femoral artery pseudoaneurysm appears as a pulsatile mass, usually with skin and soft tissue infections, with or without peripheral vascular compromise. Imaging is necessary to establish the diagnosis; to localize and characterize pseudoaneurysm; to identify associated complications; to map relevant vascular anatomy for treatment planning. Computed tomography angiography

(CTA) is the current imaging modality of choice. Endovascular treatment and/or surgery are utilized to treat pseudoaneurysm depending on the patient's clinical condition. Furthermore, the technical modalities of the endovascular treatments are always based on morphofunctional features of the lesions, the possibility to perform selective/superselective catheterization of the injured artery and the availability of different devices (covered stent, glue, coils, plugs, particles).

Conclusion: The management of vascular complications in drug addicted patients is still controversial. However, endovascular treatment is an alternative to surgery especially in patients with severe co-morbidities and consequently high risk of mortality.

P-549

The role of CDT and stent implantation in protection of PTS after iliofemoral vein thrombosis complicated with IVCS

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Learning Objectives: The purpose of this study was to objectively assess the morbidity of post-thrombotic syndrome (PTS) in iliofemoral vein thrombosis treated with catheter-directed thrombolysis (CDT) and stenting under the protection of inferior vena cava (IVC) filter

Background: It has been reported that there are approximately 20–50% of all patients with an iliofemoral vein thrombosis treated by anticoagulation and compression stockings will subsequently develop PTS. Catheter-directed thrombolysis reduce the incidence of PTS. But because of the complicated iliac vein compression, there were many DVT patients suffered PTS.

Clinical Findings/Procedure Details: A total of 422 patients who underwent CDT and IVC filter insertion for iliofemoral vein thrombosis and were found stenosis in the iliac vein after CDT were included in this study. Among them, 133 patients suffered PTS diagnosed via Villalta scale. Comparison with patients without stent implantation and without filter withdrawal, patients with stent implantation and with filter withdrawal had a less risk of PTS, but patients with a history of trauma or surgery had a more risk of PTS. Cox regression found that stent implantation and filter withdrawal were the preventive measure to prevent PTS. Compared with DVT in the right lower extremity, thrombosis in the left or in the bilateral lower extremity tends to PTS.

Conclusion: In patients with iliofemoral vein thrombosis and IVCS, stent implantation to solve the residual obstruction after CDT might play an important role in preventing PTS. Compared with DVT in the right lower extremity, thrombosis in the left or in the bilateral lower extremity tends to PTS.

P-550

Assessment and management of intermittent claudication

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Learning Objectives: To learn about:

- 1) Clinical assessment of intermittent claudication.
- 2) Role of imaging
- 3) Management options including conservative, surgical and interventional options.

Background: Intermittent claudication is a common complaint that is referred to the vascular interventional radiology clinic and is mainly caused by peripheral vascular disease. Clinical and imaging work up play an important role in deciding management. The interventional radiologist can play an important role in assessing these patients in clinic, reviewing the imaging and in treatment. There are conservative, surgical and interventional treatment options available.

Clinical Findings/Procedure Details: Intermittent claudication is usually due to peripheral vascular disease but spinal claudication is an important differential diagnosis that may need to be excluded either clinically or by MR imaging. Risk factors to assess include smoking, diabetes and age some of which could be optimised as part of the conservative management. Clinical assessment of pulses and ankle brachial pressure index can be made in clinic. Ultrasound, MR Angiography and CT Angiography are the most common imaging modalities used to assess peripheral vascular disease and possible targets for intervention.

Symptoms may improve with conservative options alone including smoking cessation, antiplatelet agents, statin therapy, cilostazol or pentoxifylline. Further management depends on imaging findings but may include interventional options such as angioplasty/stenting or surgical options such as surgical bypass graft.

Conclusion: Intermittent claudication is an important and common presentation in the vascular interventional radiology clinic and it is important for interventional radiologists to have an understanding of the clinical, imaging and therapeutic aspects in managing this presentation.

P-551

Transradial access: a primer for interventional radiologist in training

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Learning Objectives:

- To describe transradial vascular access highlighting anatomical and technical aspects, the procedural planning, the radioprotection, the indications and contraindications, the anaesthetic protocol;
- To illustrate procedure step-by-step with special focus on tips and tricks and training curve;
- to review the most recent literature and extreme distal-Transradial access (dTRA)

Background: Since transradial artery access has gained great popularity among cardiologists for percutaneous coronary angiography and intervention, many interventional radiologists look at this vascular access route with renewed interest. It has many potential advantages (in case of obese patient or patients with coagulopathies) and could be considered as a safe and effective alternative to standard Transfemoral access.

Clinical Findings/Procedure Details: The knowledge of the arterial anatomy of the district is essential to choose the right point of puncture (2-3cm proximal to the radial-styloid). Barbeau-test and measurement of radial artery (>2mm) are essential. Ultrasound pre-evaluation is crucial to rule-out omega-loops, coiling or variants. An anaesthetic protocol is always instituted to reduce spasm and pain. Dedicated material should be always used and chosen properly on the basis of the procedure target. Angio-theatre is prepared with a focus on radioprotection, with the left arm of the patient abducted at 90°. At the end of the procedure, the patent hemostasis protocol is instituted. Some Tips&Tricks are useful in the management of the procedure to avoid vasospasm and reduce pain.

Conclusion: Transradial access is associated with a lower rate of access-site complication and may be preferable in some patients. A modern IR should be able to perform it when possible

P-552

Evaluating pelvic congestion syndrome (PCS) and the role of pelvic vein embolization (PVE)

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Learning Objectives: To provide an educational overview of Pelvic Congestion Syndrome (PCS).

Background: PCS is a difficult diagnosis to establish. There is currently no definitive diagnostic criteria for PCS, and many of its characteristic imaging findings may be seen in asymptomatic patients.

Clinical Findings/Procedure Details: PCS commonly presents in multiparous women of reproductive age as pelvic pain of at least six months that worsens with standing and activity, and is relieved by lying down. Diagnosis can be made by a combination of clinical presentation and imaging.

Notably, there is no standardized protocol for imaging. Some providers initially investigate with pelvic vein ultrasonography, others start with CT/MRI. There is no diagnostic cutoff measurement for ovarian vein dilation that defines PCS, but observation of characteristic findings with presence of clinical symptoms suggests the diagnosis. Characteristic imaging findings include dilated, tortuous veins with sluggish blood flow.

Venography is diagnostic and therapeutic for PCS, as Pelvic Vein Embolization may be performed concurrently. PVE is well-tolerated and minimally invasive, but should only be performed after diagnostic venography demonstrates lack of compressive etiologies of PCS, such as Nutcracker syndrome and May-Thurner syndrome, as these are relative contraindications. No randomized trials currently exist comparing PVE with surgical interventions.

Conclusion: There is significant heterogeneity in diagnosis and management of PCS. Further research is needed to standardize protocols for both. Knowing the clinical presentation and general imaging findings can help evaluate and identify patients for endovascular treatment.

P-553

Hybrid approach for the treatment of critical limb threatening ischemia (CLTI) related with Buerger disease

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Clinical History/Pre-treatment Imaging: 39 years old male admitted to cardiovascular surgery with claudication at short distance (50 m) walking. At DSA images left popliteal artery was occluded and normal anatomic vascular distribution was lost below the knee. Since normal vascular anatomy could not be demonstrated at angiography, patency of a distal by-pass graft was predicted to be very low.

Treatment Options/Results: Patient was discussed to be treated with endovascular-first approach rather than a surgical operation. Patient's posterior tibial artery and plantar arch was recanalized successfully with balloon angioplasty over an antegrade access. Unfortunately, a flow limiting dissection was diagnosed at popliteal region and the dissected segment didn't respond to long (3 min)/ low pressure balloon angioplasties. A femoro-distal by-pass grafting using a transposed saphenous vein graft was decided by the vascular consensus rather than stenting the popliteal region in a young patient. Patient was symptom free at 1 year control with normal ABI values, after a successful hybrid procedure. **Discussion:** Hybrid approaches with multimodal teamwork is very important for successful patient management especially at patients with complicated vascular pathologies.

Take-home Points:

1. Thromboangiitis obliterans is a vasculitis affecting young males.
2. Surgical approaches with a distal by-pass is the classical option for salvage.

3. Endovascular recanalization has been described and could be preferred for selected patients
4. Hybrid approaches with surgical by-pass should always be remembered in complicated cases.

P-554

Endovascular treatment of acute arterial thrombosis of lower extremity due to COVID-19: three case reports

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Clinical History/Pre-treatment Imaging: A middle aged three male patients with proven COVID-19 diagnosis presented to the emergency department with leg pain, paleness and bruising. Peripheral CT angiography of the lower extremity showed superficial femoral artery acute thrombosis in all cases.

Treatment Options/Results: Each patient was quickly placed on a catlab and 5000 Unite heparin was administered intravenously. In each patient, the arcuate artery was passed using V-18, Nitrex 0.14 wires and a navicross 0.18 guiding catheter. Then, in each patient, a total of 10 ml of Actylise (for each leg) was gradually and evenly given throughout the thrombus from the arcuate artery to the SFA. Subsequently, angioplasty with a balloon catheter was performed. A Gragg-McNamara catheter was placed over the same wire, with one end ending at the run-off tibial artery and the other end at the SFA. Continuous heparin infusion was made through the catheter (APTZ range 80-120 sec) within 24 hours and 5 ml of Actylise was given as a bolus through the same catheter every 5 hours. Control angiograms were taken after 24 hours. The procedure was terminated when direct filling was observed in the arcuate artery through the run-off artery. Technical and clinical success was considered 100%.

Discussion: Arterial occurs in approximately 4% of critically ill COVID-19 patients. It often presents symptomatically and can affect multiple arteries. However, sometimes severe thromboses may require intervention.

Take-home Points: The timely intervention for COVID-19 patients shows dramatically excellent outcome.

P-555

Percutaneous deep foot vein arterialization with fluoroscopic guidance only

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Clinical History/Pre-treatment Imaging: A 77-year-old man with hypertension, hypercholesterolemia, type 2 diabetes and hypertrophic heart disease presented with gangrene on the right foot and small toe lesions. A color-Doppler was performed with evidence of femoral and popliteal arteries patency and occlusion of the tibial arterial vessels.

Treatment Options/Results: The attempt of percutaneous transluminal angioplasty (PTA) of the tibial arteries was unsuccessful due to the heavy calcifications and the absence of distal target vessels.

Therefore, we performed a percutaneous deep vein arterialization (p-DVA), through an ipsilateral antegrade approach we created an arterial-venous connection between the popliteal artery and vein. To obtain the connection we used the GoBack Crossing Catheter 2.9Fr (Upstream Peripheral Technologies Ltd, Israel) with fluoroscopic guidance.

After crossing the competent valves of the deep leg veins and of the lateral plantar arch, devalvulation was obtained by performing venoplasty with a non-compliant balloon. Then, we placed a covered balloon-expandable stent at the level of the arterial-venous connection and four covered self-expandable stents along the deep leg veins with the aim of excluding collaterals and keeping the valves open.

Successful p-DVA was performed without any procedural complications.

Discussion: In recent years, several studies have been published on the arterialization of the deep veins of the leg. There are therefore many techniques for creating the arterial-venous connection.

In this clinical case, the procedure was performed exclusively with antegrade arterial access and with a fluoroscopy-guided re-entry system. No procedural complications were experienced.

Take-home Points: Percutaneous deep vein arterialization can be considered an alternative treatment in patients with "no-option" CLI.

P-556

Endovascular treatment of a hepatic artery injury with a covered stent after endoscopic removal of a common bile duct stent

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Clinical History/Pre-treatment Imaging: 45-year-old male patient with primary sclerosing cholangitis, liver cirrhosis (Child-Pugh B), listed for liver transplantation, currently suffering from anemia. During routine endoscopic stent exchange, a blood clot was noted at the tip of the 10 Fr common bile duct (CBD) plastic stent. Upon stent removal, immediate, jet-like bleeding from the papilla was observed and the patient became hemodynamically unstable (figure 1).

Treatment Options/Results: Pre-endoscopic CT-imaging showed the proximal hook of the CBD stent protruding into the right hepatic artery. Angiography via right femoral access confirmed active extravasation from the proximal right hepatic artery. The injury was covered using a 5 x 22 mm balloon expandable stent graft (BeGraft, Bentley, Germany). Final angiography showed a patent stent and no further active extravasation (figure 2). Postinterventional course was uneventful.

Discussion: Arterial injury due to biliary stent is a rare complication and usually presents as pseudoaneurysm. In this case a frank arterial rupture occurred upon CBD stent removal. Commonly hepatic artery injuries are treated by coil embolization. Given the underlying liver disease and a relatively proximal injury we used a stent graft in order to preserve the artery. Laparotomy with ligation of the artery would have been an alternative treatment option.

Take-home Points:

- Endovascular treatment of hepatic artery injury due to biliary stent is safe, fast and effective.
- Blood clots on a CBD stent should raise suspicion of vascular injury and initiate diagnostic work up.
- Review and knowledge of diagnostic imaging is often crucial for understanding clinical scenarios and executing a successful intervention.

P-557

Subintimal treatment using GoBack, a new low profile re-entry device available up to BTK: a case report

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Clinical History/Pre-treatment Imaging: We reported a case of an 85-year-old diabetic patient with a bailout stent placement at the origin of superficial femoral artery (SFA) 5 months before. CT-Angiography showed complete occlusion of the SFA subject of the previous stenting, complete occlusion of the distal SFA and popliteal artery with flow through collateral circulation of anterior tibial artery (ATA), only pervious vessel up to the foot.

Treatment Options/Results: Using a direct stent-puncture antegrade approach, a subintimal recanalization of the SFA and popliteal artery was performed, achieving intraluminal re-entry at the ATA using a GoBack Catheter 2.9 Fr (Upstream Peripheral Technologies). After distal re-entry,

the procedure was completed with the angioplasty of the SFA and popliteal artery and a placement of 6x150 mm self-expandable stent, post-dilated with 4 mm drug-eluting-balloon (DEB) in the popliteal artery and 6 mm DEB in the SFA, between the two stents. Final results showed recanalization of the entire fem-pop axis and direct Doppler flow on the pedis artery up to the forefoot.

Discussion: Only a few cases were reported about using re-entry systems (Outback LTD, Cordis) for complete subintimal treatment in tibial arteries. Though we used Outback in similar cases, the greater dimension (6Fr) may condition its application in smallest vessels. This successful case using GoBack represents a potential indication for distal vessels. We think this re-entry technique in the proximal tibial arteries may be less risky than direct puncture of the pedis artery in delicate one vessel condition.

Take-home Points: GoBack can be a useful tool for crossing and re-entry in smallest vessels.

P-558

Arteriovenous fistula's post below the knee (BTK) angioplasty treated with coil embolisation via venous route

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Clinical History/Pre-treatment Imaging:

CASE 1:

57 year old gentleman with ulceration on ankle and foot with necrosis. Angiography showed stenosis in the distal anterior tibial artery and dorsal pedis artery.

CASE 2:

59 year old diabetic gentleman with rest pain and tissue loss. Angiography showed distal SFA and complete popliteal artery occlusion which could not be crossed antegradely.

Treatment Options/Results:

CASE 1:

Distal ATA and dorsalis pedis stenoses were treated with 2.5 mm PTA using pedal plantar loop technique which resulted in arteriovenous fistula along the deep perforating artery which was treated with 3 mm microcoils in to the venous channel.

CASE 2:

Distal SFA and popliteal occlusion was crossed after retrograde anterior tibial access. Popliteal occlusion was treated with 5 mm Supera stent. There was a high-grade arteriovenous fistula between anterior tibial artery and vein. The CFV vein was accessed retrogradely and anterior tibial AV fistula was treated with 6 mm coils. 6 week duplex scan showed patent stent with no DVT.

Discussion: Arteriovenous fistula is a potential complication after below the knee angioplasty when utilizing SAFARI and pedal plantar loop techniques. Most of these fistulas are low grade and can be treated conservatively. There is no evidence to suggest if treating them results in better outcome. We report two cases treated with coil embolisation. One of these was a high-grade fistula treated with coil embolisation via venous route.

Take-home Points: AV fistula is a potential complication post BTK angioplasty.

These can be treated with coil embolisation via venous route especially if the fistula is high grade.

P-559

Delayed surgical bypass graft rupture post angioplasty treated successfully with a covered self-expanding stent

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Clinical History/Pre-treatment Imaging: A 65 year old man with a femoropopliteal bypass vein graft created 4 months prior. Severe stenoses

discovered at both anastomoses during ultrasound follow up. Sequential 3mm x 4cm, 4mm x 4cm and 5mm x 4cm balloon angioplasties performed with a good angiographic result. The patients was discharged with no immediate complications. Five days later the patient presented with sudden onset pain and swelling in the medial thigh. CT angiogram demonstrated a contained rupture in the proximal graft with contrast extravasation.

Treatment Options/Results: Contralateral left CFA retrograde approach, angiography confirmed aneurysmal dilatation of the proximal graft with contrast extravasation secondary to a localised graft rupture, in addition to distal stenoses. Careful access into the graft and across the lesion using an 0.018 inch wire. 5mm x 10cm covered self expanding stent was deployed across the abnormality with 4mm balloon postdilatation. Good outcome achieved with complete exclusion of the rupture retaining patency of the graft.

Discussion: Delayed rupture post graft angioplasty is a rare complication that requires early investigation and treatment. The patient underwent surgical revision of the proximal graft less than 6 weeks prior to angioplasty rendering the graft fragile, although this was not communicated to the IR team. Careful selection of appropriately sized balloons at initial angioplasty is essential.

Take-home Points: Consider delayed rupture in patients presenting with pain post angioplasty of bypass grafts.

Aim to delay endovascular treatment for at least 6 weeks after surgical intervention.

Covered self expanding stents are safe and effective in the treatment of contained graft ruptures and pseudoaneurysms.

P-560

Chronic totally occluded peripheral artery disease: endovascular-open surgery hybrid treatment

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Clinical History/Pre-treatment Imaging: A 50 year old smoker male patient presented to our Department with ischemic right leg pain and necrotic wound of foot. Peripheral CT angiography shows CTO from external iliac artery to tibial arteries in both extremities. Since the occluded lesion was very long and chronic, the chance of surgical and endovascular treatment was very low.

Treatment Options/Results: Endovascular treatment was decided for the patient whose complaints increased despite medical treatment. The occluded CFA was punctured under USG guidance, and a 0.35 Glide wire was sent to the AA under USG control. Then a 6 Fr sheath was placed in the left brachial artery and the wire included from the femoral artery was removed from the brachial sheath with the aid of Snare. A 90 cm 6 Fr sheath was placed over the existing glide wire and an 8x150 cm self expandable stent was placed from the CIA to the DFA. After 5 days, a bypass graft was placed between the DFA and the PTA. Later, the patient's leg was rescued with 3 finger amputation and necrectomy.

Discussion: Peripheral arterial disease is a circulatory problem causing a reduced blood flow through the arteries. It is one of the most common causes of extremity amputations.

Take-home Points: Long segment chronic occlusions sometimes have no chance of both surgical and endovascular treatment. Especially in severe chronic occlusions, it is impossible to pass to the occluded artery from the normal artery. In this patient, puncturing directly from the occluded segment helped us to perform endovascular stenting.

P-561

Endovascular management of long segment chronic total occlusion of superficial femoral artery using vascular mimetic stent

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Clinical History/Pre-treatment Imaging: A 62 years old male, known hypertensive, chronic smoker [nearly >20 cigarettes /day for >40years], former alcoholic for 25 years, left since three years, came with complaints of left lower limb intermittent claudication. Ultrasound Doppler revealed chronic total flush occlusion of superficial femoral artery [SFA] with its reformation at distal part. Patient's Ankle Brachial Index [ABI] was 0.5.

Treatment Options/Results: Right sided retrograde transfemoral & left sided retrograde tibio-pedal access was taken and double length stiff wire parked across the occluded segment. Then over the wire balloon angioplasty done using 6 x 80 mm balloon, followed by deployment of 5.5 x 150 mm self-expandable vascular mimetic stent [SuperaTM]. Post procedure angiogram revealed good flow across the stent & improved flow in the below knee arteries. On next day, follow up Ultrasound Doppler showed good triphasic flow across the stent and in below knee arteries, which was also seen in two months follow up with improved ABI.

Discussion: SFA is the most common site of lower extremity arterial occlusions. Nowadays for long segment SFA occlusion, vascular mimetic stent is preferred over bypass surgery in long segment occlusions, heavily calcified and across the joint lesions due to its intrinsic properties.

Take-home Points: Endovascular Management of Long Segment Chronic Total Occlusions of SFA using vascular mimetic stent [SuperaTM] is a preferred modality of treatment with satisfactory outcomes and a promising alternative for surgical intervention.

P-562

A case of successful blood flow restoration with using intrathrombotic thrombolysis in bilateral lower limb arteries thrombosis in a patient with COVID 19

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Clinical History/Pre-treatment Imaging: In November 2020, a 63-year-old man was admitted to the Sergiev Posad hospital with complaints of shortness of breath, fever and weakness. sPO2 on admission 90%. COVID 19 test positive. CT affects 65% of the lung tissue as ground glass. The patient was admitted to the therapeutic department. On the second day after hospitalization, he noted pain in the legs and partial loss of mobility and sensitivity in the fingers. An ultrasound examination revealed: signs of thrombosis of the arteries of the lower extremities

Treatment Options/Results: Angiography revealed signs of critical thrombosis of the right iliac artery and thrombotic occlusion of the lower leg arteries on the right and left sides. A perfusion catheter with micropores was inserted inside the thrombosed arteries and thrombolysis with alteplase was started for 6 hours with good angiographic effect, then the catheter was repositioned in the left leg and thrombolysis was also performed for 6 hours with a good clinical result. The patient was discharged on the 16th day and without amputation and improvement of CT picture in the lungs.

Discussion: COVID 19 increases the number of thromboembolic complications and intrathrombotic thrombolysis can be an effective treatment option.

Take-home Points: COVID 19 and thrombosis

P-563

Endovascular treatment of traumatic AV fistula in patient with erectile dysfunction: case report

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Clinical History/Pre-treatment Imaging: A 40-year-old man presented with erectile dysfunction that had persisted since perineal trauma few months ago. The patient reported problems with short duration of erection and insufficient penile tumescence. Clinical examination revealed no visible signs of penile injury, nevertheless, the patient was referred to arteriography due to suspicion of post-traumatic vascular damage.

Treatment Options/Results: Angiography of the left iliac artery revealed the presence of arteriovenous fistula, supplied by two branches of pudendal arteries. We performed an endovascular embolization with microcoils to exclude AVF from circulation. Few months after initial procedure the patient reported that although erectile function significantly improved after endovascular intervention, the erection was still inadequate. Therefore, we performed another therapeutic embolization, which restored erectile function to normal.

Discussion: Arteriovenous fistula is an abnormal communication between the artery and the vein, which can be congenital or acquired, mostly due to trauma.

Traumatic AVF between internal iliac vessels has been described as causing erectile dysfunction, which is defined as a persistent failure to initiate and maintain an erection for sexual satisfaction.

Diagnosis of abnormal connection between vessels is based on angiography.

Rapid development in endovascular techniques, in which we use embolic agents to block anomalous blood flow, has allowed safe, effective and less invasive alternative to surgery.

Take-home Points: In contrast to arteriogenic and venogenic impotence, arteriovenous fistulas represent a rare cause of erectile dysfunction, seldom described in literature.

The symptoms were successfully resolved after endovascular embolization.

P-564

Left subclavian artery pseudoaneurysm involving the vertebral artery origin treated by placing two stents with periscope technique

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Clinical History/Pre-treatment Imaging: 48-year-old female patient with a history of previous left subclavian artery stenting with acute onset of subclavicular pain for which she goes to the emergency department where she undergoes CT angiography which highlights the presence of large pseudoaneurysm in the subclavian stent site near the origin of the vertebral artery

Treatment Options/Results: We performed a double arterial access, right femoral and left humeral. Via humeral access we put a 0.014 inch wire in the vertebral artery in order to secure the vessel origin during the subclavian treatment. We excluded the pseudoaneurysm using a balloon expandable stent graft and subsequent we deployed a coronary stent in the vertebral artery. Final angiographic control showed complete exclusion of the pseudoaneurysm and vertebral artery patency

Discussion: Although subclavian disease involving vertebral artery origin is rare, endovascular treatment is feasible, safe and provides favorable long-term results

Take-home Points: In selected cases the periscope technique can be a viable option for experienced radiologist

Radiation safety

P-565

Factors influencing the occupational eye lens dose during fluoroscopic guided interventions: a phantom study

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Purpose: By simulating a fluoroscopic-guided intervention, the protective capabilities of two differently equipped safety glasses and the influence of the viewing directions and body heights on the eye lens dose were evaluated. Additionally, the effect of variable magnification levels on the arising scattering dose was determined.

Materials and Methods: A phantom head, replacing the operators head was positioned at different heights and rotated in steps of 20 degrees in the horizontal plane. Thermoluminescent dosimeters (TLD), placed in the left orbit of the phantom were used to detect the eye lens dose under protected and completely exposed conditions. In a second step, radiation dose values under increasing magnification levels were determined.

Results: Different eye levels and changing head alignments resulted in a wide range of dose reduction factors (DRF) from 1.1 to 8.5. Increasing the vertical distance to the eye lens, DRFs markedly decreased for both types of glasses. Significant differences between the two types of protection glasses were observed. Increasing magnification levels with consecutively decreasing FOV-size provoked radiation dose reductions between 47% and 83%, respectively.

Conclusion: Both types of safety glasses reduced the eye lens dose effectively. However, the protective effect was significantly depending on the eye level and viewing direction. The efficacy ranged from promising to underwhelming. Therefore, wearing safety glasses may convey a false sense of safety for the medical staff. On the other hand, the application of magnification modes reduced the quantity of scattering dose significantly. To reduce radiation risks revised designs of protective eyewear are necessary.

Renal and visceral artery intervention

P-566

The cost to perform splenic artery embolisation following blunt trauma: analysis from a level 1 Australian trauma centre

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Purpose: Splenic artery embolisation (SAE) has been shown to be an effective treatment for haemodynamically stable patients with high-grade blunt splenic injury. However, there are no local estimates of how much treatment costs. The purpose of this study was to evaluate the cost of providing SAE to patients in the setting of blunt abdominal trauma at an Australian level 1 trauma centre.

Materials and Methods: This was a single-centre retrospective review of 10 patients who underwent splenic embolisation from December 2017 to December 2018 for the treatment of isolated blunt splenic injury, including cost of procedure and the entire admission. Costs included angiography costs and post-procedural costs.

Results: During the study period, patients remained an inpatient for a mean of 4.8 days and the rate of splenic salvage was 100%. The mean

total cost of splenic embolisation at our centre was AUD\$10,523 (range of \$4826-\$16,836). The use of a plug as embolic material was associated with increased cost than for coils. Overall cost of patients requiring ICU was mean AUD\$11,894. Overall cost for those not requiring ICU was mean AUD\$7325 and median AUD\$8309.8.

Conclusion: Splenic embolisation is a low-cost procedure for management of blunt splenic injury. The cost to provide SAE at our centre was much lower than previously modelled data from overseas studies. The use of ICU for monitoring after the procedure significantly increased cost and necessity may be considered on a case-by-case basis. Further research is advised to directly compare the cost of SAE and splenectomy in an Australian setting.

P-567

Packing technique with or without remodeling for endovascular coil embolization of renal artery aneurysms: safety, efficacy and mid-term outcome

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Purpose: The endovascular treatment of renal artery aneurysms (RAAs) has lower morbidity and shorter stay lengths compared to surgical repair. Here, we describe coil packing with or without remodeling and assess outcomes and complications.

Materials and Methods: We retrospectively identified the 19 consecutive preventive endovascular RAA coil embolizations done in 18 patients at our center in 2010-2020. Patient and aneurysm characteristics, technical success rate, complications, and recurrences were recorded.

Results: Mean patient age was 63±13 years. The RAA was >1.5 cm in 11 cases and, in 4 cases, the aneurysm-to-parent artery size ratio was >2. Simple coiling was performed for 11 (57.9%) aneurysms, stent-assisted coiling for 7 (36.8%) aneurysms, and balloon-assisted coiling for 1 (5.3%) aneurysm. Technical success rate was 100%. Complete definitive RAA exclusion was achieved with a single procedure for 17 (89.5%) aneurysms, whereas 2 (10.5%) aneurysms required a repeat procedure. Four minor complications occurred but resolved with no long-term consequences. No major complications occurred during the mean follow-up of 41.1±29.7 months. Coil embolization by sac packing or remodeling proved very safe and effective.

Conclusion: Together with the known lower morbidity and shorter stay length compared to open surgery, these data indicate that this endovascular procedure should become the preventive treatment of choice for RAAs.

P-568

Nonoperative management of shattered kidney after blunt trauma: preservation of kidney by superselective renal artery embolization

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Purpose: To assess the clinical effectiveness and the ability of superselective embolization of the renal artery as nonoperative management to promote preservation of traumatic shattered kidneys.

Materials and Methods: Between December 2015 and November 2019, 26 patients who had American Association for the Surgery of Trauma grade V traumatic shattered kidneys were identified. Among them, a retrospective review was conducted of 16 patients who underwent superselective renal artery embolization for shattered kidney. The mean age was 41.2 ± 15.7 years, and the average follow-up duration was 138.2 ± 140.1 days. Patient

data including procedure details and clinical outcomes were reviewed, and the volume of preserved kidney was calculated.

Results: Bleeding control was achieved in 13 (81%). The kidney preservation was achieved in 11 (79%). There was no mortality, and the duration of intensive care unit stay was 1.5 days. The average volume of remnant kidney was $122.3 \pm 66.0 \text{ cm}^3$ (70%) on the last follow-up computed tomography. The estimated glomerular filtration rate was not significantly changed after superselective renal artery embolization.

Conclusion: Superselective renal artery embolization using a microcatheter for the shattered kidney effectively controlled hemorrhage in acute stage trauma and enabled kidney preservation.

P-569

Endovascular embolization of gastro-intestinal angiodysplasias (GIA): a single center experience

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Purpose: Gastrointestinal angiodysplasias (GIA) are the most frequent vascular malformations of the digestive tract, causing up to 50% of occult gastrointestinal (GI) hemorrhages. When endoscopy fails or is unfeasible, endovascular embolization represents a valuable treatment option. Aim of this study is to report on a single center experience in the endovascular treatment of GIA

Materials and Methods: Single center retrospective analysis of 9 patients affected by GIA and treated by endovascular embolization, using different embolizing agents (microspheres, coils and EVOH based liquid) between January 2020 and December 2020 for acute bleeding and/or melena and/or occult blood stool

Results: On DSA examination, active bleeding was proved in three cases (33,3%); in the remaining 66,6% indirect signs of bleeding were identified. Superselectively embolization with microcatheter was performed to reduce the risk of complications, especially non target embolization. The technical success rate was 100%, while clinical success was achieved in 7 patients (77,7%)

Conclusion: In this serie endovascular embolization proved to be a safe and effective approach to localize and control GI bleeding due to angiodysplasia. In patients not suitable for endoscopic management, endovascular embolization could be considered as valuable alternative

P-570

Renal artery embolization (RAE) using 3 kinds of embolic materials in swine

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Purpose: To embolize renal arteries of swine using ethanol and N-butyl-2-cyanoacrylate (NBCA), which are common embolic materials in renal ablation, and compare the degree of renal damage.

Materials and Methods: Three groups of embolic materials were prepared: diluted ethanol (ethanol : Lipiodol=1:2) (A group), concentrated ethanol (ethanol : Lipiodol=2:1) (B group), and NBCA (NBCA : Lipiodol=1:9) (C group). Three swine were assigned to each group. Three different embolic materials were used to embolize the unilateral renal artery. After two days, the kidneys were removed and fixed in 10% formalin solution to determine the macroscopic necrosis rates and for histologic examination.

Results: The necrosis rates of the kidneys were $50.3 \pm 7.4\%$ in the A group, $100 \pm 0\%$ in the B group, and $100 \pm 0\%$ in the C group. The necrosis rates in the B and C groups were higher than that in the A group. Histologically, renal tubules were damaged in the necrotic areas. In addition, glomeruli were damaged in the A and B groups, while they were preserved in the C group.

Conclusion: Concentrated ethanol and NBCA are effective embolic materials in RAE for renal ablation in swine.

P-571

Pre-intervention computed tomography improves performance of catheter-based therapy in patients with blunt or penetrating abdominopelvic trauma

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Purpose: Computed tomography (CT), computed tomography angiography (CTA), and catheter-based intervention (CBI) play key roles in the management of arterial injury in patients with abdominopelvic trauma; however, there remains little data to optimize their integration into trauma algorithms. The purpose of this study is to evaluate the potential benefits of CT and CTA for guiding CBI in patients with abdominopelvic trauma.

Materials and Methods: A retrospective review of all patients who underwent arteriography $\pm$ embolization in the setting of blunt or penetrating abdominopelvic trauma (01/2010 - 08/2020) at an urban Level 1 trauma center was performed. Demographic data, imaging, CBI metrics, laboratory values, and patient outcomes were analyzed.

Results: 190 patients underwent CBI. Prior to CBI, 104 underwent CT, 19 underwent CTA, and 67 went directly to the OR without CT. Arteriography alone was performed in 47 patients, empiric embolization was performed in 30 patients, and embolization based on evidence of arterial injury was performed in 113 patients. The incidence of non-therapeutic CBI was significantly reduced by pre-procedural CT/CTA (37.9% vs. 55.2%, $p = .03$). The positive predictive value of CTA for treatable arterial injury at CBI was 92.3%. Prior CT/CTA was associated with a significant reduction in contrast administered ($80 \pm 41 \text{ mL}$ vs. $114 \pm 52 \text{ mL}$, $p < .001$) compared to patients who did not undergo CT prior to CBI. No significant differences in mortality or renal function were observed.

Conclusion: CT or CTA prior to CBI for patients with abdominopelvic trauma may reduce unnecessary interventions and can enable improved procedure metrics and patient outcomes.

P-572

Endovascular repair of visceral artery aneurysms and pseudoaneurysms in 159 patients: twelve year's experience of clinical technique

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Purpose: The purpose of this study was to evaluate the therapeutic efficacy and safety of endovascular treatment for patients with visceral and renal artery aneurysms (VRAAs). Twelve years of experience with interventional procedures and treatment options in our center were also worth discussing.

Materials and Methods: From January 2009 to December 2020, clinical data of 159 consecutive patients with VRAAs were retrospectively analyzed. Patients' demographic and clinical data were recorded, and the safety and efficacy of endovascular therapy were evaluated. In addition, interventional procedures were also described.

Results: A total of 159 patients underwent angiography, and 154 patients were successfully treated with endovascular therapy, with a technical success rate of 96.9%. Of the 154 patients with successful endovascular therapy, 3 patients died within 30 days of treatment, with a 30-day mortality rate of 1.9%, and the remaining patients were clinically successful, with a clinical success rate of 98.1%. Fifty-seven patients underwent

emergency interventional treatment due to ruptured aneurysm, and the remaining 51 patients were successful except for 5 patients who were transferred to surgical treatment after operation failure and 1 patient who died after intervention. There were statistically significant differences in hemoglobin before and after emergency treatment (78.5 ± 22.0 g/dL vs 93.8 ± 15.0 g/dL, $P=0.00$).

Conclusion: Endovascular treatment of VRRAs is safe and effective and can significantly improve the symptoms of patients, especially those with ruptured aneurysms. Meanwhile, the selection of endovascular treatment methods and materials is of great significance for the future interventional treatment of VRAAs.

P-573

Single-center experience with endovascular treatment for splenic artery aneurysms in mid-to long-term follow-up: a retrospective study

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Purpose: To reveal a single-center experience with endovascular treatment for splenic artery aneurysm (SAA) and analyze the safety and efficacy of the operation in mid-to long-term follow-up.

Materials and Methods: From July 2010 to December 2019, 49 patients (21 males, 28 females; mean age, 52.4 ± 11.5) were enrolled in the study. Baseline and SAAs characteristics were collected. Parent artery coil embolization or combined with sac coil embolization of SAAs, graft-stent implantation or bare-stent-assisted coil embolization were performed to treat SAAs. Adverse events and follow-up data were reviewed.

Results: The average diameter of 49 patients' aneurysms was 3.2 ± 2.5 cm (range, 1.0-13.6 cm). Individual-tailed technique was conducted, 100% technical successful rates were achieved. No reintervention procedure was performed in all patients. No major treatment-related adverse events were observed, and no expansion or rupture of aneurysms occurred in follow-up period (mean, 45.9 ± 27.3 ; range, 7-113 m).

Conclusion: Individual-tailed endovascular treatment for SAA was safe, effective and minimally invasive, as evidenced by high technical success rates and satisfactory outcomes in mid-to long-term follow-up period.

P-574

Endovascular treatment of active arterial bleeding after liver transplantation

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Purpose: Liver transplantation carries the potential for severe complications that can significantly impact the procedure's overall success. Due to recent advancements in interventional radiology effective treatments for these conditions have been developed. In this paper, based on our experience, it has been propounded that endovascular intervention may turn out safe and effective.

Materials and Methods: Our analysis included 74 adult patients who received an orthotopic liver transplant from deceased donors between 2019-2021. Diagnosis of arterial bleeding was established by clinical examination, laboratory tests, and Angio CT examination. Every patient underwent angiography of the culprit artery with subsequent coil or glue embolization. We analyzed prevalence and source of active arterial bleeding and efficacy of endovascular treatment. Clinical success was defined as cessation of bleeding without further surgical or endoscopic intervention.

Results: Severe arterial bleeding occurred in 7 patients (10%). In 5 patients, bleeding was directly associated with liver transplantation. In 2 patients, bleeding was caused by extrahepatic interventions (sphincterotomy; PiCCO catheter insertion). The causative arteries were identified as phrenic (2) hepatic (2), superior mesenteric (1), gastroduodenal (1), femoral (1).

Endovascular treatment was successful in 6 out of 7 patients. One patient required relaparotomy and surgical treatment.

Conclusion: The most common complications after liver transplantation are vascular complications. Active arterial bleeding is one of the most severe, life-threatening complications post liver transplantation. Interventional radiologic techniques may be considered as safe and effective management of arterial bleeding in these cases.

P-575

Short term outcomes of percutaneous intervention for transplant renal artery stenosis: a 15-year, retrospective comparison between stenting and angioplasty

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Purpose: Transplant Renal Artery Stenosis (TRAS) is a serious vascular complication usually occurring within the first 6 months following transplant and is associated with graft loss. It is commonly linked with a rise in serum creatinine as well as refractory hypertension and hence early intervention is performed to restore normal graft function. We compared the short-term outcomes between angioplasty and stenting.

Materials and Methods: A RIS search was performed to identify all TRAS interventions over a 15-year period. Procedure report and imaging were evaluated which were combined with pre- and short-term (1-3 months) post-procedural serum creatinine levels to determine whether there was a clinical difference between the two interventions.

Results: A total of 91 interventions were identified over a 15-year period. 11 patients were found to have no focal stenosis on angiography and were therefore excluded. A further 17 were excluded for insufficient data. There were 4 failed procedures, 1 due to high grade stenosis, 3 for tortuous vessels. 1 demonstrated completely absent renal perfusion. 58 patients were included in the comparison which included 12 stents and 46 angioplasties. The mean short-term reduction in creatinine in patients undergoing stenting was 41.6% compared to 23.8% with angioplasty ($p=0.03$).

Conclusion: Both interventions are effective for the management of TRAS as demonstrated by a 94.5% success rate over a 15-year period. Stenting was found to have a statistically significantly higher reduction in post-procedural creatinine compared to angioplasty alone and we therefore recommend, where possible, patients with TRAS should be managed with stenting.

P-576

Stent-graft placement for hepatic arterial bleeding is safe, effective and provides time to treat causative medical condition

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Purpose: To evaluate technical and clinical results of stent-graft placement in patients with bleeding from the hepatic artery (HA).

Materials and Methods: All patients intended and treated with stent-graft deployment for bleeding from the HA at single center from January 2012 to May 2020 were retrospectively identified, and procedural details, risk factors for rebleeding, stent-graft occlusion and mortality were analyzed.

Results: Twenty-seven patients (19 men) with a mean age of 68.8 ± 10.1 (range, 53-85 years) were identified, and 25 patients underwent 26 stent-graft implantation procedures. The technical success rate was 92.8%. Three patients (out of 25) had rebleeding (88% clinical success). Intensive-care need before the procedure ($p=0.013$) and smaller stent-graft size (≤ 4 mm,

$p=0.032$) were related to clinical failure. Twenty-two patients had follow-up imaging. No stent-graft migration was encountered. The stent-grafts maintained patency in 10 (45.4%) patients at the most recent imaging. Placement of stent-graft distal to the bifurcation of the HA ($p=0.012$) was the only significant risk factor for stent-graft occlusion. A trend for occlusion was noticed in male patients ($p=0.105$) and patients with multiple stent-grafts ($p=0.110$). The 30-day and in-hospital mortality rate of patients with the successful procedure was 8% and 24%. None of the patients were lost due to hemorrhagic shock. In-hospital mortality was associated with the intraabdominal septic source ($p=0.010$) and need for revision surgery ($p=0.001$).

Conclusion: Stent-grafts are effective in the emergent treatment of hepatic arterial bleeding. Mortality is mainly related to the general condition of the patient, and stent-grafts offer time to treat underlying medical problems sufficiently.

P-577

Relationship between mesenteric vessel angle and outcomes following mesenteric stenting

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Purpose: Endovascular therapy has become the main modality of treating atherosclerotic mesenteric arterial disease. However, no robust data exists on long term outcomes following stenting, or what factors may relate to long term successful outcomes. The purpose of this study was to assess if there was any relationship between the mesenteric vessel angle, and the mortality and re-intervention rate.

Materials and Methods: Retrospective analysis of patients who underwent stenting of the coeliac axis or superior mesenteric artery between 2007 and 2015 was performed. Patients were identified from departmental records, electronic patient record, and hospital PACS system. Patients who had an available pre-procedure CT angiogram were taken forward and had the angle between the aorta and the SMA/coeliac axis measured. Follow-up data was obtained, which included subsequent weight loss, post-procedure abdominal pain, re-intervention, and mortality.

The working hypothesis was that an angle of less than 50° increased the mortality/re-intervention rate, and angle greater than 50° was favourable.

Results: Eighteen patients underwent mesenteric stenting between 2007 and 2015. Of these, 10 patients (mean age 65.6 years) had a pre-procedure CT angiogram, from which the coeliac/SMA angle was calculated.

Angles ranged between 21.1° and 125° (mean 53.7°). Nine patients reported abdominal pain following stenting, (mean duration 10 months), with no relationship with mesenteric angle and pain demonstrated.

Re-intervention was required in 4 patients, and 2 patients were alive at the time of data collection, (mean survival of 39.9 months), and a single 30-day mortality.

Conclusion: Mesenteric angle is not a predictor of outcomes; a larger cohort study may yield more informative data.

P-578

Endovascular repair of splenic artery aneurysm in elective and emergency settings

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Purpose: This retrospective single-centre study evaluated the reliability of different endovascular treatment strategies for splenic artery aneurysms (SAA) or pseudoaneurysm (SAPA) in elective and emergency settings.

Materials and Methods: From July 2013 to March 2021, 25 procedures for SAA or SAPA have been performed. The following data from the medical records were collected: demographics, aneurysms' features, diagnostic workup (CT, MRI) interventional approach and post-procedural follow-up (clinical and imaging assessment).

Results: Twenty asymptomatic patients (mean age 57 y, SD=13) underwent an elective procedure after incidental SAA diagnosis (mean diameter 3 cm, SD=1); 5 patients were treated with an emergency procedure for ruptured aneurysms, mean follow up time 6 months.

The overall success rate was 100%: in the elective group, 11 patients were treated by coil embolization, 7 by coil embolization plus sclerosants agents, 2 with covered stenting. Two patients experienced major complications, i.e. coeliac trunk dissection and pancreatitis, 3 suffered from post embolization syndrome and 9 developed splenic infarction that in 3 cases involved more than one-third of the spleen. The average hospitalization was 3 days (SD=3); no death occurred in this group.

In the emergency group, there was one trauma patient; 4 had non-traumatic aetiologies. Three underwent complete aneurysm exclusion with sclerosants agents; two underwent complete splenic artery occlusion by coil embolization. One underwent splenectomy. Two patients died due to unrelated causes.

Conclusion: Endovascular repair of splenic aneurysms is feasible both in elective and emergency settings, yielding high success rates and short hospitalization; a non-negligible rate of complications is observed.

P-579

Successful endovascular embolization of visceral artery aneurysms: technical and anatomical considerations

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Learning Objectives: Highlight principles and technique for an effective endovascular embolization

Background: Visceral artery aneurysms are very rare, with an incidence of 0.1%-2%, mostly asymptomatic, but symptoms, when present, are vague and not specific. Recent advances in abdominal imaging led to an increased frequency in their detection, thus frequently incidental. CT-angiography represents the most non-invasive method daily used, although angiography is still the gold standard. Even if asymptomatic, aneurysms should be repaired if the diameter is >20mm, to avoid the high risk of rupture. Surgery is the gold standard therapy, with a mortality rate, however, of 5% for elective repair, compared to 40% for ruptured aneurysms; endovascular embolization, instead, represents a safe and effective minimal invasive alternative, with success rates reported between 75%-100%, morbidity rates between 14%-25% and mortality rates boarding on 0%, even in emergency

Clinical Findings/Procedure Details: Endovascular treatment can be carried out using different techniques and different devices, but the choice of the right embolization strategy depends on the site, the diameters and morphology of the aneurysms. Embolization is commonly performed with

coils and/or cyanoacrylate(glue),and sometimes,in selected cases,with stent-graft implantation,but it is essential to exclude both in-flow and out-flow tracts,to reduce the risk of late post-procedural anterograde and retrograde reperfusion of the sac.In case of saccular aneurysms,where it is recommended to fill the sac,it is fundamental,moreover,to avoid an excessive rise of intraluminal pressure,to avoid the intraprocedural rupture

Conclusion: Endovascular embolization is a feasible,effective,and minimally invasive alternative for treatment of visceral artery aneurysms,with lower morbidity,mortality,and higher success rate compared to surgery. However,an effective embolization requires not only the complete filling of the aneurysmal sac,but also the complete exclusion of its in-flow and out-flow tracts and vessels,to reduce the risk of arterial anterograde or retrograde reperfusion

P-580

Retrograde recanalization of the superior mesenteric artery: an alternative approach for chronic mesenteric ischemia

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Learning Objectives: Anatomical review of collateral pathways connecting superior mesenteric artery (SMA) with the rest of the mesenteric circulation. To describe a different approach for recanalization of symptomatic chronically occluded SMA.

Background: Endovascular management and treatment of chronic mesenteric ischemia has taken a very important role in last years. Stent placement has been recognized as a minimally invasive procedure with good long-term results.

Anterograde endovascular recanalization of stenotic/ occluded mesenteric arteries is an established technique to treat symptomatic chronic mesenteric ischemia and now is considered the first approach over open surgical management.

If anterograde endovascular recanalization of occluded SMA fails, an endovascular retrograde transcollateral way can be used. It is usually performed through the pancreaticoduodenal arcade, the most common collateral pathway connecting celiac trunk and SMA.

Clinical Findings/Procedure Details: The purpose of this presentation is to describe the technical aspects of the endovascular retrograde approach procedure as an additional technique of endovascular management of chronic mesenteric angina.

We present different cases of retrograde recanalization of the SMA using the pancreaticoduodenal arch with good angiographic and clinical results. This technique increases the complexity of the procedure due to the anatomical tortuosity of the collateral vessels. Nevertheless it is a less invasive approach than surgical treatment.

Conclusion: Retrograde transcollateral recanalization of the SMA in patients with chronic mesenteric ischemia is a safe and effective approach when anterograde management fails

P-581

Renal graft embolization as a treatment for graft intolerance syndrome

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Learning Objectives: Comparison between allograft embolization and surgical removal in terms of complications and other associated morbidity and mortality.

Background: Surgical graft nephrectomy might be considered as the only or best treatment for early graft failure (especially in the first 3 months

after transplantation) or in the exceptional cases of graft malignancy or localized infection.

In late graft failure, the procedure is usually performed as treatment of acute rejection or graft intolerance syndrome, and it was reported to be responsible for high morbidity (17–60%) and mortality (0.7–14%) rates because it is often performed in patients who are already on dialysis and suffering from malnutrition, anaemia and inflammation. This observation made it necessary to look for other less invasive options like embolization of the nonfunctioning renal graft

The efficacy of percutaneous embolization was 84.37%.

The main complication, secondary to the procedure, was hematoma at the puncture site, postembolization syndrome and postembolization nephrectomy

Clinical Findings/Procedure Details: It is characterized by fever, graft pain, hematuria, and anemia.

All renal graft embolizations were performed through a percutaneous femoral artery approach by the insertion of microspheres of polyvinyl alcohol followed by insertion of stainless steel in the renal artery and its branches when necessary. The use of prophylactic antibiotics and steroid therapy is recommended to reduce the risk of postembolization syndrome and infectious complications.

Conclusion: Graft embolization results in complete resolution of symptoms in >80% of cases and that this procedure is associated with significantly less complications than surgical graft removal in patients with graft intolerance syndrome.

P-582

From (almost) head to toe: navigating trauma management via transradial access

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Learning Objectives:

1. Discuss feasibility and safety of transradial access (TRA) for management of trauma.
2. Illustrate TRA advantages in specific clinical scenarios.

Background: Trauma accounts for 10% of all deaths and is the leading cause of death in people younger than 45. Unrecognized hemorrhage is the most common cause of early mortality in up to 30–40% of cases. Expertise in imaging and transcatheter interventions give Interventional Radiologists a pivotal role in trauma care. Early intervention to stop hemorrhage will prevent associated morbidity and mortality. Traditionally, interventions were performed via transfemoral access with access site complications of up to 10%. TRA is well tolerated with a technical success rate of 98% and complication rate of 2.5%. The radial artery is a superficial, compressible vessel and patent hemostasis can be easily achieved with low access site complication rates, particularly in obese and coagulopathic patients. TRA is an attractive option in patients with pelvic fractures and binders due to lack of optimal access to the femoral artery. Radial artery injury is rarely clinically significant with proper patient selection.

Clinical Findings/Procedure Details: We will highlight the advantages of TRA via a case series including traumatic arterial injuries in the liver, spleen, kidney and pelvis. Embolization in settings of coagulopathy, morbid obesity and in patients with pelvic binders will be shown.

Conclusion: TRA is a safe and effective option for the treatment of traumatic arterial hemorrhage with lower access site complication rates, especially in patients with obesity, coagulopathy and/or pelvic binders.

P-583

Common and uncommon complications following renal transplantation: what IRs need to know

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Learning Objectives: Discuss the clinical presentation, evaluation, diagnosis, and management of renal transplantation complications

Background: Kidney transplantation is the treatment of choice for end stage renal disease. However, complications can compromise graft function. Complications may be vascular or urologic and relate to bleeding or development of perinephric fluid collections. Vascular complications (up to 16%), especially thromboses, can be serious and lead to transplant loss. Ultrasound is often diagnostic, but CTA/MRA provide greater anatomical delineation. Post-transplant ureteral strictures (up to 3%) results from ischemia with most occurring distally near the anastomosis. Despite hydronephrosis, patients are usually asymptomatic because the graft is denervated. Lymphoceles are the most common peri-transplant fluid collection (0.5-20%). Although small collections may resolve, larger ones often require drainage and/or sclerosis.

Clinical Findings/Procedure Details: Our case series outlines clinical presentation, imaging workup, and percutaneous/endovascular/endourological management of post-transplant complications. Examples of lymphocele, ureteral anastomotic leak, renal mass in a transplant, and transplant necrosis will be shown with their corrective interventions. Management of obstruction caused by perinephric hematoma, nephrolithiasis, ureteral anastomotic stricture, and ureteral herniation into the scrotum will be presented. Vascular cases will include a transplant renal artery stenosis (elevated creatinine, tardus parvus waveforms) successfully treated with angioplasty, an anastomotic pseudoaneurysm, and a rare case of vascular torsion diagnosed by arteriography and treated surgically.

Conclusion: Successful management of post-renal transplant complications is a multidisciplinary task, and IRs must be familiar with symptoms, multi-modality imaging, know when to employ minimally-invasive interventions, and when to consult surgical colleagues.

P-584

Renal artery fibromuscular dysplasia: radiological diagnosis and therapeutic options

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Learning Objectives:

- To summarize the most characteristic radiological findings in renal artery fibromuscular dysplasia (FMD).
- To describe the advantages and the limitations of the imaging techniques used for FMD diagnosis and follow-up.
- To reaffirm the catheter-directed angiography (CDA) as a diagnostic and a therapeutic tool.

Background: Fibromuscular dysplasia is a rare non-inflammatory vasculopathy, generally affecting women under 35. The most common symptom is hypertension. Although it can affect any artery, FMD often appears in the renal arteries, unilaterally in 60-75% of the cases and bilaterally in 35%. Imaging plays an essential role. The knowledge of the typical findings will help reduce a delay in its diagnosis and will guide clinicians into specific management.

Clinical Findings/Procedure Details: We reviewed 13 cases with severe hypertension and confirmed diagnosis of renal fibromuscular dysplasia.

They were all women, aged between 2 and 77 years old. The right renal artery was the most affected (8 cases), and in 4 patients it associated a renal aneurysm.

Three of the patients had extrarenal involvement and in one of them an intracranial hemorrhage was the first symptom.

We analyzed the most relevant clinical, laboratory and radiological data, as well as the patients' management and evolution. Some of them were treated with percutaneous transluminal angioplasty (PTA), and only 1 case required a renal endoprosthesis.

Conclusion: FMD typically affects younger patients and usually has a good prognosis. Knowledge and identification of this condition is essential in the work-up of patients with renal artery stenosis. Treatment of choice is PTA, which is only indicated in symptomatic patients.

P-585

Endovascular techniques to approach true visceral artery aneurysms

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Learning Objectives: The vast majority of true visceral artery aneurysms can be managed endovascularly. Proper pre-procedure imaging work-up and understanding the anatomy and efferent branches is essential in formulating a treatment plan. Multiple techniques are at the disposal of the operator but it can be difficult to decide the optimal approach. Understanding the techniques of stent-assisted coiling, balloon remodeling techniques and the use of stent-grafts is the main focus of this educational presentation and to describe the basis of each technical approach according to the anatomy and vascular territory.

Background: Visceral artery aneurysms are uncommon in clinical practice but may have serious clinical outcomes. Endovascular management is a safe effective alternative option to traditional surgical procedures.

Clinical Findings/Procedure Details: Excluding the aneurysm from the circulation and restore the normal flow through the parent artery is the aim of endovascular treatment.

Endovascular treatment options include covered stent placement or transarterial embolization. Techniques such as stent-assisted coiling and balloon-remodelling techniques will be described with case examples. Recent endovascular techniques including multi-layer flow diverting stents, double-layer micromesh stents, double-lumen balloons, and microvascular plugs have also become available with high rates of technical success.

Conclusion: Although true visceral artery aneurysms are rare, they are potentially complex to treat. Management is based on localization of the aneurysm and identification of the anatomic determinants to treat these lesions to prevent aneurysm rupture. Different endovascular techniques are safe especially with the technological developments in embolization and understanding of embolization techniques.

P-586

Percutaneous coil-embolization of a pseudoaneurysm of the inferior pancreaticoduodenal artery due to pancreatitis

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Clinical History/Pre-treatment Imaging: 54-year old male admitted with dyspnea, cough and chest pain for three weeks. History of alcohol abuse. Lab results and CT imaging showed acute pancreatitis and a pseudoaneurysm of the inferior pancreaticoduodenal artery.

Treatment Options/Results: Initial attempt at endovascular embolization of the pseudoaneurysm was unsuccessful: it was not possible to selectively catheterize the feeding vessel. Using a 22G Chiba needle

US-guided transgastric puncture of the pseudoaneurysm was performed. DSA confirmed correct needle position and the pseudoaneurysm was embolized through the needle using two Ruby coils (8mm x 40cm and 12mm x 60cm). Unfortunately the second coil dislocated partially outside of the aneurysm, potentially ending intragastric. Gastroscopy however showed no evidence of intragastric coil. Follow up CT showed complete embolization of the pseudoaneurysm.

Discussion: Pseudoaneurysms are a common complication of pancreatitis and usually can be treated effectively and safely by endovascular embolization. In case endovascular embolization fails, a percutaneous approach is a viable option. Commonly different embolic materials such as fibrinogen, glue or onyx can be used. We opted to use coils to avoid dislocation of embolic material into the superior mesenteric artery potentially resulting in bowel ischemia. Even though one coil partially dislocated outside of the aneurysm we were able to fully embolize the aneurysm. The partially dislocated coil did not cause further problems for the patient.

Take-home Points: Pseudoaneurysms are a common complication of pancreatitis.

Endovascular treatment of pseudoaneurysms is effective and well tolerated with low complication rates.

In case endovascular treatment fails a percutaneous, ultrasound and fluoroscopy guided approach is a viable option.

P-587

Successful endovascular combined treatment of a rare giant unstable hypogastric artery aneurysm in a very young patient

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Clinical History/Pre-treatment Imaging: 16-year-old boy, affected by genetical collagenopathy, previously surgically treated for abdominal aorta aneurysm, with acute pain and beating at left groin. CT examination showed a huge saccular aneurysm of 62 mm maximum diameter of left hypogastric artery, with presence of clots mixed with thrombus in its lumen, showing fringed and irregular wall profile

Treatment Options/Results: A selective angiography was performed and confirmed CT findings: left hypogastric artery was dilated and tortuous, ending directly into the huge aneurysm sac. An endovascular exclusion of the aneurysm was performed by transcatheter embolization employing multiple metallic coils, but final angiography showed residual patency of the first segment of left hypogastric artery, dilated and tortuous. A left common femoral access was performed and a stent-Graft (9x59mm) was positioned into left common-external iliac axis, covering left hypogastric artery ostium. Final angiography showed complete exclusion of both left hypogastric artery and the huge aneurysm

Discussion: The only employment of metallic coils has not proven to be effective alone, as the first segment of hypogastric artery, dilated and tortuous, not only was completely patent but also completely exposed to the high pressure of aortic blood flow, and the release of other coils was not safe as there was the risk of embolizing iliac common artery too. The employment of stent-Graft, instead, allowed to definitively and safely seal hypogastric artery ostium and the in-flow of the aneurysm, preserving common-external iliac axis

Take-home Points: Transcatheter endovascular embolization is an effective and minimally invasive technique in the treatment of visceral aneurysms. An effective embolization requires not only the filling of the sac but the exclusion of in-flow and out-flow tracts of the aneurysms, to avoid late revascularization

P-588

Successful endovascular treatment of massive hematuria due to ureteroarterial fistula secondary to ureterocutaneostomy

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Clinical History/Pre-treatment Imaging: 76 year-old man, with bilateral ureterocutaneostomy after cystectomy, presented to our emergency department for gross pulsatile hematuria from left ureterocutaneostomy. CT scan revealed left ureterohydronephrosis, diffuse hematic hyperdensity of left urinary tract and left ureterocutaneostomy adherent to left external iliac artery, with evidence of a small pseudoaneurysm in the touch point with the indwelling ureteral stent, thus showing ureteroarterial fistula

Treatment Options/Results: Digital subtraction angiography, through a left transfemoral approach, confirmed a small pseudoaneurysm of left external iliac artery, at the intersection with the respective ureteral stent. After placement of 7Fr introducer-sheath at left common femoral artery access, the endovascular exclusion of ureteroarterial fistula was performed releasing a balloon-expandable covered stent (9x59mm) into left external iliac artery. The Urologist immediately replaced left ureteral catheter in the angiographic suite: no pulsatile and massive hematuria appeared, final angiography performed during these maneuvers confirmed the absence of both pseudoaneurysms and contrast agent extravasations into left ureterocutaneostomy

Discussion: Uretero-arterial fistula is associated with pelvic irradiation, malignant disease and previous pelvic-abdominal surgery, but the most common risk factor is the presence of a chronic indwelling ureteral stent. It can be potentially lethal, mortality rates are 10%-13%, with 22% mortality associated with hemodynamic instability: hematuria can be very variable, from intermittent to hemorrhagic shock. Open surgery is often difficult, because of patients' history of pelvic intervention; nowadays, stent-graft is considered the treatment of choice, without further adjuvant ureteral therapy. For these reasons, we decided for endovascular placement of a covered stent into left external iliac artery: the procedure was successful, and after 14 months, the patient is still asymptomatic

Take-home Points: Endovascular placement of covered stents is a feasible, clinically effective minimally invasive treatment of choice for ureteroarterial fistula, representing a valid alternative to open surgery

P-589

Complex visceral stenting following type A aortic dissection

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Clinical History/Pre-treatment Imaging: A 77 yo woman underwent cardiac surgery in order to treat a type A aortic dissection, extended down to iliac-femoral district; she was treated with interposition of a synthetic vascular graft.

Few days later she developed abdominal pain and distention with serum lactates increase.

Angio-CT showed a severe shrinkage of both celiac trunk (CTr) and superior mesenteric artery (SMA) origins, determined by an enlarged false lumen compression with a consequent malperfusion syndrome.

Treatment Options/Results: Treatment options were aortic fenestration and visceral vessels stenting.

We chose to attempt CTr and SMA stenting.

Left humeral approach was mandatory due to acute origin of both vessels; left subclavian artery was spared from dissection.

Anatomy was very complex, eventually it was possible to understand the correct true lumen/false lumen (TL/FL) anatomy; two bare metal stents of proper size and length were released inside the true lumen.

Clinical symptoms and laboratory analysis improved; angio-CT showed proper positioning of the stents.

Unfortunately, patient died two weeks later due to fungal lung infection. **Discussion:** The major trouble was to understand the anatomy, since the dissection extended deeply into the vessels; even if the road from the subclavian artery was inside the true lumen, TL/FL connections were present in both CTR and SMA origins, so selective angiogram of both were acquired.

Take-home Points: Aortic dissection is a really challenging pathology, and a deep knowledge of the altered vascular anatomy prior to endovascular manoeuvres is necessary.

Confidence with different vascular access is helpful.

P-590

Successful coagulation of a left gastric artery pseudoaneurysm by percutaneous computed tomography (CT) guided thrombin injection

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Clinical History/Pre-treatment Imaging: Visceral artery pseudoaneurysms are common complications of pancreatitis that carry a high mortality rate. Early detection and treatment of the pseudoaneurysm is imperative due to a high mortality rate following rupture. The splenic artery is the commonest artery involved. Gastric artery pseudoaneurysms are less common with less than 50 cases reported in the literature. A 58 year old female was referred to the Interventional Radiology (IR) department with a left gastric artery pseudoaneurysm secondary to acute pancreatitis.

Treatment Options/Results: Initial Digital Subtraction Angiography revealed the pseudoaneurysm which was embolised with 300 microns of polyvinyl alcohol and two coils. 24 hours post-procedure, a CT was performed which revealed a blush of contrast enhancement within the pseudoaneurysm sac, consistent with unsuccessful embolisation. Using a combination of ultrasound and CT, a 22 gauge Chiba needle was advanced percutaneously via a transhepatic approach. 2.5 ml of Human thrombin was injected directly into the pseudoaneurysm. A repeat CT demonstrated complete occlusion of the left gastric artery pseudoaneurysm.

Discussion: Endovascular administration of particles and metallic coils are frequently used to treat pseudoaneurysms. Ultrasound or CT guided injection of thrombin has become a well recognised treatment for a variety of peripheral and visceral pseudoaneurysms and is often performed following a failed attempt of routine endovascular embolisation.

Take-home Points: We report the case of a patient affected by a pseudoaneurysm of the left gastric artery treated with a CT guided percutaneous thrombin injection directly into the pseudoaneurysm. This demonstrates that percutaneous coagulation can be an adjunct or an alternative to endovascular embolisation.

P-591

First report of endovascular treatment of superior mesenteric arteriovenous fistula (SMAVF) using an Amplatzer vascular plug type II

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Clinical History/Pre-treatment Imaging: A 57 years old man with history of colon adenocarcinoma surgically resected, was diagnosed with an high flow fistula between the superior mesenteric artery and superior mesenteric vein (SMAVF), during routine follow up CT-imaging. To prevent the development of portal hypertension, the patient was scheduled for endovascular treatment.

Treatment Options/Results: Endovascular coils embolization emerged as the first line treatment in SMAVF due to lower morbidity and complication rate compared to surgery. In our case, the SMV was severely

dilated, and only a single feeder of the fistula was evident on CT. To reduce the risk of coil migration, an Amplatzer II plug was deployed via a transfemoral approach, after selective catheterization of the origin of the right colic artery stump, with good morphological result (Image 1b). After 48 h the patient developed abdominal pain, due to SMV thrombosis and partial vein thrombosis (Image 1c). NOAC therapy was promptly started (Apixaban). At 3-months follow up clinical evaluation the patient became asymptomatic, with resolution of portal vein thrombosis confirmed by CT-imaging (Image 1d).

Discussion: This is the first report of an Amplatzer II deployment for SMAVF treatment, with only another case of an Amplatzer IV reported. The deployment of a microvascular plug is highly effective in excluding a SMAVF from the circulation but carries a consistent risk of thrombosis, needing oral anticoagulation.

Take-home Points: Deployment of microvascular plugs is a safe, fast and effective method to treat a SMAVF. Further studies are warranted to evaluate the risk of splenic vein thrombosis compared to standard treatment with coils.

P-592

Endovascular resolution of concomitant coeliac artery pseudoaneurysm and dissection

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Clinical History/Pre-treatment Imaging: A 49 year old male with no past medical history presented to the emergency department with severe epigastric pain radiating to the back. CT showed a dissection flap and 5mm lobulated pseudoaneurysm at the coeliac trifurcation and patient was admitted for close observation. CT 2 and 6 days later showed enlargement of the pseudoaneurysm to 12mm with extension of the dissection past the gastroduodenal artery resulting in stenosis at the common hepatic artery (CHA) origin.

Treatment Options/Results: A multidisciplinary discussion with input from hepatobiliary surgeons indicated that open repair would be challenging given the location of the pseudoaneurysm. Furthermore, a surgical approach would require tying off the coeliac trunk and its branches. An endovascular approach was preferred given the risk of rupture if left untreated. The left gastric and splenic arteries were cannulated and coil embolised to prevent backflow. A 6mm x 2.5cm self-expanding stentgraft (Viabahn®Gore®) was placed from the coeliac artery to the CHA, excluding the pseudoaneurysm. Follow-up CT 48 hours later demonstrated successful embolization, patent stent graft and successful exclusion of the pseudoaneurysm.

Discussion: Complex visceral aneurysms and dissections present challenges to interventionists and surgeons alike and both may be reluctant to intervene in such cases. Although technically challenging and potentially risky, endovascular approaches are often the 'least worst' option with the utility of IR in such cases shown here.

Take-home Points: Complex visceral aneurysms are potentially life-threatening with poor outcomes after open repair. Inter-disciplinary/MDT discussions are advised. Endovascular repair offers a safe treatment option without the inherent risks of major surgery.

P-593

Splenic vein aneurysm: description of an astonishingly rare entity with an endovascular transhepatic approach to management

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Clinical History/Pre-treatment Imaging: An 83-year-old male with prior cardiac and aorto-bifemoral by-pass surgery presented with left upper quadrant pain in the absence of clinical or biochemical trauma,

infection or pancreatitis. A CT (Figure 1) abdomen and pelvis yielded the presence of a 4.7 cm splenic vein aneurysm (SVA).

Treatment Options/Results: Due to potential rupture risk, treatment was agreed via a minimally invasive endovascular approach. Under ultrasound and fluoroscopic guidance, portal vein branch access was performed via segment VI of the liver with subsequent splenic vein access acquired. Coils were initially deployed within the aneurysm followed by a 12 mm balloon expandable covered stent placed across the aneurysm neck. Completion venography demonstrated successful exclusion of the SVA with in-line splenic vein flow retained (Figure 2).

Discussion: The pathophysiology of SVA's is poorly understood; they can be congenital or acquired. Diagnosis is usually incidental, however, patients can present with acute rupture, thrombosis or abdominal pain. Historically SVA's have been largely managed with open surgery requiring costly, protracted in-patient admission. In this case, the patient was discharged after 24 hours of bed rest with no complications highlighting the advantage of an endovascular approach to management.

Take-home Points: SVA's are a very rare entity that are mostly incidentally diagnosed; the frequency of detection may be increasing given the increasing volume of imaging performed.

We describe a percutaneous transhepatic endovascular approach for the successful exclusion of SVA's which are traditionally managed with surgery.

P-594

Inferior mesenteric artery pseudoaneurysm: imaging and endovascular management

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Clinical History/Pre-treatment Imaging: A 58-year-old male presented with small bowel obstruction requiring emergency laparotomy comprising of adhesiolysis and small bowel resection. His medical history included historic laparotomies, chemotherapy treated Hodgkins lymphoma, type 2 diabetes and asthma.

Post operatively the patient experienced episodes of hypotension with abrupt anaemia refractory to blood transfusions. Initial CT abdominal angiogram and re-evaluation laparotomy revealed mesenteric haematoma but no active bleeding point. Upon further acute haemoglobin drop, repeat CT abdominal angiogram demonstrated focal nodular enhancement in the arterial phase of a proximal branch of the inferior mesenteric artery (IMA) consistent with a pseudoaneurysm. (Figure 1)

Treatment Options/Results: Emergency angiography with embolization was clinically agreed. Via right femoral artery approach the IMA was selectively catheterised. Angiography confirmed the presence of an IMA sigmoid branch pseudoaneurysm with retrograde filling from the marginal artery of Drummond and active bleeding. (Figure 2) Utilising a microcatheter, embolization coils were deployed across the neck of the pseudoaneurysm. Post-embolization angiogram confirmed successful exclusion of the pseudoaneurysm with preservation of the marginal artery of Drummond and distal sigmoid colon perfusion. (Figure 3)

Discussion: IMA pseudoaneurysms are very infrequently encountered, specifically recognised as the rarest of visceral artery aneurysms. In this case, aetiology was likely inflammatory or traumatic post abdominal surgery.

Take-home Points: Mesenteric haematoma should always raise suspicion of underlying vascular anomaly. Judicious use of CT angiogram during clinical instability will help guide targeted intervention. Historically, IMA aneurysms have been treated surgically, however, they can be effectively managed with endovascular embolization with maintenance of colonic perfusion.

P-595

Covid-19 as a new aspect to consider in follow-up?

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Clinical History/Pre-treatment Imaging: In 2010 a 74 year-old man was incidentally found to have an 85- mm hepatic artery aneurysm at the origin of the common hepatic artery, involving the proper hepatic artery distal to the gastroduodenal origin. Due to the origin of the GDA from the sac, the aneurysm was treated with a bare multilayer stent in order to allow the exclusion of aneurysms from circulation while preserving collaterals. The use of the Multilayer stent was satisfactory and a 7-year follow-up showed shrinkage of aneurysmatic sac and patency of collateral vessels. In 2020 patient had COVID-19 and suddenly, during hospital-stay, experienced haemoglobin loss. CT showed rupture of aneurysmatic sac and bleeding.

Treatment Options/Results: To treat the bleeding, an emergent endovascular procedure was performed. A covered stent was deployed in-stent in order to exclude the sac and stop the bleeding.

Discussion: Growing data about the association between coronavirus infection and coagulopathy have emerged, anticoagulant therapy with low molecular weight heparin (LMWH) has become part of the medical therapy in hospitalized patients, to reduce the risk of venous thromboembolism. This approach, however, may increase the risks of spontaneous bleeding, especially in elderly patients with comorbidities. In our case, in spite of the well-controlled and followed-up condition, Covid19 and LMWH triggered an unexpected event. Our knowledge about coagulopathy and management of patients with Covid19 and previous IR intervention may represent an interesting aspect to analyse and verify in future.

Take-home Points:

- Our knowledge about IR interventions management and COVID19 is uncertain
- Follow-up of COVID19 patients may be unpredictable

P-596

Massive haemoptysis secondary to mycotic pulmonary artery aneurysm in invasive aspergillosis

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Clinical History/Pre-treatment Imaging: A 52-year-old man, presented with 3 week history of infective symptoms and mild haemoptysis. Past medical history included non-small cell carcinoma of the right lung in chemotherapy treatment and a chronic right upper lobe cavity. CT scan on admission confirmed complex cavitary consolidation of the right and middle lobes. He developed massive haemoptysis requiring intubation and ventilation. CT pulmonary angiogram revealed a 32 mm middle lobe pulmonary artery (PA) aneurysm which was successfully embolized. Sputum cultures, aspergillus antigen and rapidity of clinical progression suggested a diagnosis of subacute invasive aspergillosis, prompting treatment with Isavuconazole. Bronchoscopy showed blood ooze from middle lobe even after embolization. Unfortunately, patient continued to deteriorate and succumbed to profound septicemia.

Treatment Options/Results: Embolization of the PA aneurysm was performed on the same day of the haemoptysis using 5mm and 7mm Micro Vascular Plugs with good results.

Discussion: Angioinvasion is an important characteristic of invasive aspergillosis. In more than 90% of the cases, haemoptysis is from bronchial or systemic arteries. Haemoptysis originating from pulmonary circulation constitutes less than 10% of the cases. CT angiogram is superior to arteriography in detection of bleeding from bronchial and non-bronchial systemic arteries. Pulmonary vascular embolization remains an important intervention in order to control the haemoptysis. On-going bleeding after arterial embolization carries high mortality, as was the case with the subject under discussion.

Take-home Points: Haemoptysis originates from bronchial arteries in >90% of patients whilst <10% of the cases are from pulmonary circulation. Pulmonary vascular embolization remains an important intervention in order to control the massive haemoptysis

P-597

Endovascular treatment of a symptomatic, complex coeliac artery aneurysm: a case report

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Clinical History/Pre-treatment Imaging: We report the case of a 75-year-old, male patient suffering from increasing abdominal pain. CTA revealed an aneurysm of the coeliac artery involving the proximal part of the common hepatic artery (maximal 1,7 cm) and a second aneurysm of the splenic artery (maximal 5,0 cm), partially thrombosed.

Treatment Options/Results: Embolization of the splenic and left gastric artery and exclusion of the aneurysms of the celiac and hepatic artery with stent graft was scheduled.

Through a transfemoral access, a coil embolization of the splenic artery aneurysm was performed, maintaining a sufficient perfusion of the splenic artery through collaterals. By accessing the hepatic artery, there couldn't be gained enough stability to deploy the stent due to the configuration of the aneurysm. Therefore, the contralateral femoral artery was punctured and a 5F-shepherd hook catheter placed in the superior mesenteric artery, 2.4F-microcatheter was introduced in the celiac artery through the pancreaticoduodenal arcade. Firstly, the left gastric artery was coiled; thereafter the microguidewire was caught with a snare from the first introducer sheath towards the proper hepatic artery, creating a loop. Because of the improved stability given by the loop, it was possible to insert the first introducer sheath deeply in the common hepatic artery. Finally, two stent grafts were placed to cover the aneurysm in the common hepatic and coeliac artery.

Discussion: This case illustrates an approach towards a complex anatomy due to the visceral aneurysms, which could aid in similar cases.

Take-home Points: Exclusion of a complex coeliac artery aneurysm using an additional access through the pancreaticoduodenal arcade.

P-598

Renal artery aneurysm successfully treated with dual layer carotid stent

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Clinical History/Pre-treatment Imaging: 58 years old female, with previously known colorectal cancer, was diagnosed with left renal artery aneurysm (RAA). In last three years the saccular aneurysm grew from 15mm to 25mm, which was confirmed on her last contrast enhanced CT scan. Although symptom free, her multidisciplinary team indicated intervention because of the primary disease.

Treatment Options/Results: The risk of rupture in RAAs becomes high when they reach above 30cm diameter. Treatment options for visceral aneurysms are endovascular and surgical approach. Endovascular techniques include: coiling, assisted coiling, covered stents, flow modulators etc. In our case we went for an unusual, off-label option for treating saccular RAA, using novel dual layer carotid stent, Roadsaver(Terumo), 6x25mm. Due to its micromesh(375-700µ) it can act as covered stent. The immediate result was reduced flow in the sac. On 3rd and 6th month follow-ups CT showed complete thrombosis of the aneurysm with 100% stent patency. Discrete upper pole cortical renal ischemic changes were seen, due to covering of small branches of renal artery - completely asymptomatic.

Discussion: RAAs are rare, being 2nd most common visceral aneurysms. Treatment threshold is around 25mm, but also rapid grow in short period could require intervention as in our case where malignancy made it even more challenging. To our knowledge, treating visceral aneurysms with this particular stent is extremely rare, still we chose it successfully.

Take-home Points: RAAs are potentially life-threatening, and endovascular approach is always preferred over surgery. Sometimes, our choice depends very much on the available material and the technique we feel most confident with.

TIPS and portal vein intervention

P-599

Effect of aspirin administration on transplant-free survival after transjugular intrahepatic portosystemic shunt (TIPS) placement: a retrospective multicenter analysis

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Purpose: To evaluate the effect of aspirin (acetylsalicylic acid) administration on transplant-free survival in patients with transjugular intrahepatic portosystemic shunt (TIPS).

Materials and Methods: Data from all patients receiving TIPS at three German university liver centers between 2013 and 2018 (n=814) were retrospectively reviewed. N=587 patients were stratified depending on aspirin administration after TIPS (aspirin cohort, n=163; no-aspirin cohort, n=424) and subdivided into a matched cohort after propensity score matching. Primary endpoint of the study was transplant-free survival at 12 months after TIPS. Secondary endpoints included occurrence of hepatic encephalopathy (HE), recurrence of primary TIPS indication and TIPS re-intervention rates in 12-months follow-up.

Results: Aspirin administration improved transplant-free survival 12 months after TIPS (aspirin cohort, 90.8% vs. no-aspirin cohort, 76.6%; p<0.001). HE occurred more frequently in the aspirin cohort (p<0.001). Frequency of recurrence of primary TIPS-indication (p=0.612) and TIPS re-intervention rates (p=0.406) were not affected by aspirin administration.

Conclusion: This retrospective multicenter study provides first data demonstrating a beneficial effect of aspirin administration on transplant-free survival in TIPS patients without impairment of TIPS function.

P-600

Portal and hepatic vein embolization prior to major hepatectomy

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Purpose: To analyze safety and effectiveness of simultaneous portal and hepatic vein embolization (PHVE) or sequential hepatic vein embolization (HVE) compared to portal vein embolization (PVE) for future remnant liver (FRL) hypertrophy prior to major hepatic surgery.

Materials and Methods: Patients undergoing PVE, PHVE or HVE at our tertiary care center between 2018 and 2020 were retrospectively included. FRLV, standardized FRLV (sFRLV) and sFRLV growth rate per day were assessed via volumetry.

Results: 36 patients (f=15, m=21; median 64.5y) were included, 16 patients received PHVE and 20 patients PVE, of which 4 received sequential HVE. Significant increase of FRLV was achieved with both PVE and PHVE compared to baseline ($p < 0.0001$). sFRLV growth rate did not significantly differ following PHVE ($2.2 \pm 1.2\%/d$) or PVE ($2.2 \pm 1.7\%/d$, $p = 0.94$). Left portal vein thrombosis (LPVT) was observed after PHVE in 6 patients and in 1 patient after PVE. Sequential HVE showed a considerably high growth rate of $1.42 \pm 0.45\%/d$ after PVE.

Conclusion: PHVE effectively induces FRL hypertrophy but yields comparable sFRLV to PVE. Sequential HVE further induces hypertrophy after insufficient growth due to PVE. Considering a potentially higher rate of LPVT after PHVE, PVE might be preferred in patients with moderate baseline sFRLV, with optional sequential HVE in non-sufficient responders.

P-601

Frequency of portosystemic shunt in patients without liver dysfunction

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Purpose: To evaluate frequency of portosystemic shunt (PSS) in patients without liver dysfunction.

Materials and Methods: Of 262 patients who underwent adrenal venous sampling for primary aldosteronism since Jan. 2011, 258 with normal liver and renal function were enrolled. In all patients, enhanced CT using MDCT was obtained before AVS during expiration and hunger to provide axial CT images with 1-mm thick slices from the diaphragm to upper pelvis. Definition of presence of PSS was confirmation of visible continuity between the portal venous system (PVS) and the systemic vein on enhanced axial CT images while referring to coronal and sagittal multiplanar reconstruction images. PSSs were classified into the five groups; shunt from PVS like splenic vein (SV) to left inferior phrenic or left adrenal veins (SV-LIPV/LAV group), to left renal vein (LRV) or left gonadal vein (GnV) (SV-LRV group), from superior mesenteric vein (SMV) to right renal vein (RRV), right GnV or inferior vena cava (IVC) (SMV group), from inferior mesenteric vein (IMV) to GnV or IVC (IMV group) and the other group.

Results: Presence of PSS was found in 79/258 (31%). Frequency of SV-LIPV/LAV, SV-LRV, SMV, IMV and the other groups were 42 (16%), 31 (12%), 13 (5%), 5 (1.9%) and 1 (0.4%), respectively, as there was some overlapping. In SMA group, SMV-GnV or RRV was 10 and SMV-IVC 3. In IMV group, IMV-IVC was 3 and IMV-GnV 2. The other group had a route from duodenal vein to IVC.

Conclusion: 31% of patients without liver dysfunction may have some PSSs.

P-602

The potential benefits of underdilation of 8-mm covered stent in transjugular intrahepatic portosystemic shunt creation

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Purpose: Hepatic encephalopathy (HE) is a major complication of transjugular intrahepatic portosystemic shunt (TIPS) creation. This study was aimed to determine whether underdilated TIPS with 8-mm polytetrafluoroethylene (PTFF)-covered stents could reduce the risk of HE and liver damage yet maintain clinical and hemodynamic efficacy.

Materials and Methods: This non-randomized controlled study included 134 patients treated with TIPS from March 2017 to November 2019. All the TIPS procedures were created using 8-mm covered stents, and according to the diameter of expansion balloon catheters, the patients were divided into two groups, an underdilated group (6-mm balloon catheter, $n = 73$) and a control group (8-mm balloon catheter, $n = 61$).

Results: The Kaplan-Meier analysis indicated that the cumulative incidence of overt HE (OHE) in underdilated group was significantly lower than control group during the follow up (11.0% vs. 29.5%, Log rank $P = 0.007$), but no statistical differences were found towards variceal rebleeding, shunt dysfunction and survival between groups. In multivariate analysis, the independent risk factors for OHE were identified as age ($HR = 1.036$, 95%CI = 1.003-1.069, $P = 0.032$), Child-Pugh score ($HR = 1.519$, 95%CI = 1.212-1.905, $P < 0.001$) and group assignment ($HR = 0.291$, 95%CI = 0.125-0.674, $P = 0.004$).

Conclusion: Underdilated TIPS with 8-mm PTFF-covered stent could reduce the incidence and severity of HE and the risk of liver function impairment compared to completely dilated TIPS, but not increase the risk of variceal rebleeding, shunt dysfunction and death.

P-603

Utility of ultrasound surveillance following transjugular intrahepatic portosystemic shunts (TIPS) for refractory ascites in detecting shunt dysfunction

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Purpose: To investigate the role of ultrasound surveillance for patients treated with refractory ascites in predicting TIPS dysfunction.

Materials and Methods: All TIPS for refractory ascites between 01/01/2007-31/08/2019 were included. TIPS procedural details and all subsequent ultrasounds were reviewed. Patients had a baseline ultrasound 3-30 days after TIPS, surveillance ultrasounds at 6 and 12 months post-procedure and annually thereafter. All ultrasounds were grouped into baseline, routine surveillance or symptomatic presentation and the TIPS was classified as normal or abnormal based on the ultrasound. Venograms were the gold standard to assess TIPS dysfunction.

Results: A total of 162 patients were included and 449 ultrasounds were performed (median of two scans per patient (range 0-16)) over a median (range) follow-up of 27.7 months (2.6-140). 162 (36%) were baseline studies, 66 (15%) were interval symptomatic studies and 221 (49%) were surveillance studies. 34 (21%) patients had TIPS dysfunction, with 22 requiring re-intervention for occlusion ($n = 12$) or stenosis ($n = 10$). The median (range) time to TIPS dysfunction was 49 days (3-1386). Out of the 22 patients requiring re-intervention, 8 were detected on the baseline scan and 12 presented symptomatically with worsening ascites ($n = 10$) or variceal haemorrhage ($n = 1$). US correctly predicted TIPS dysfunction in 5 out of

221 surveillance scans (2%), subsequently confirmed on venogram, with 2 patients requiring re-intervention. Median (range) time to abnormal TIPS diagnosis in the surveillance group was 486 days (70-1469).

Conclusion: Routine ultrasound surveillance following TIPS for refractory ascites was not effective at detecting TIPS dysfunction and clinical follow-up alone detects the majority of these cases.

P-604

Left gastric vein image guided percutaneous transhepatic embolization for variceal bleeding management

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Purpose: To present the image guided percutaneous management of esophageal varices bleeding in cases of endoscopic management failure.

Materials and Methods: Left gastric vein (LGV) Image guided percutaneous transhepatic embolization was performed to 6 patients with portal hypertension induced variceal hemorrhage, to whom the endoscopic management attempts failed. 3 of them had advanced liver cirrhosis with encephalopathy episodes. In the rest 3 cases patients had advanced HCC complicated with PV thrombosis; those patients the same time underwent VesOpen procedure (portal vein thrombus recanalization by endoluminal ablation, followed by stent implantation).

PV tributary was accessed under real-time US guidance by 18G trocar needle and after introducer sheath positioning in PV system 5Fr advantage catheter was manipulated to reach the LGV. Embolization was performed using 0.035 inch diameter coils. In 2 cases microcatheter technique and accordingly 0.018 inch diameter coils were used. After the embolization completion transhepatic working track was embolised by coil&gel-foam.

Results: Technical success has been achieved in all cases as shown by intraprocedural contrast injection. The bleeding was suspended completely in 5 (83.3%) cases; in the rest 1(16.7%) case the episode of endoscopically manageable recurrent hemorrhage has been detected in a week after LGV embolization.

Conclusion: LGV percutaneous transhepatic embolization is safe and effective in intractable variceal hemorrhage management; it should be routinely suggested as a possible treatment option when traditional endoscopic ligation fails to stop variceal bleeding and TIPS is not feasible for any reason.

P-605

Balloon-puncture-technique for transsplenic portal vein recanalization-transjugular intrahepatic portosystemic shunt placement

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Purpose: To evaluate the feasibility, safety and effectiveness of portal vein recanalization (PVR)–transjugular portosystemic shunt (TIPS) placement using a transsplenic access combined with a balloon-puncture-technique.

Materials and Methods: Between 03/2017 and 02/2021, a total of 215 patients received TIPS procedures. Out of these, 14 patients with portal hypertension and main portal vein occlusion were planned for transsplenic PVR-TIPS placement. A balloon catheter was introduced through the splenic vein and placed in an intrahepatic portal vein segment. Afterwards, the balloon was inflated and served as needle target. The TIPS needle was inserted via a conventional transjugular access and the right liver vein was catheterized. After successful balloon-puncture, a

guidewire was advanced through the TIPS needle in the balloon or in the portal vein. The guidewire was captured at the splenic access site. Thereafter, a conventional TIPS placement was performed. Feasibility, safety and effectiveness with procedural characteristics such as technical success, clinical significant complications and balloon puncture time (BT), procedure time (PT) and fluoro-time (FT) were evaluated.

Results: Transsplenic PVR-TIPS using balloon-puncture-technique was technical feasible in 12 of 14 patients (48 years, 6 men). Transsplenic PVR-TIPS was not possible in two patients, because no intrahepatic portal vein branches could be identified at the time of intervention. No clinically significant complications occurred within 48 hours of the intervention. The BT was 32±27min, the PT was 158±54min and the FT was 42±21min.

Conclusion: Transsplenic PVR-TIPS using a balloon-puncture-technique is a feasible, safe and effective approach when conventional TIPS techniques are not an option.

P-606

Prevalence of blood diversion of spontaneous portosystemic shunts requiring treatment in liver transplant

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Purpose: Spontaneous portosystemic shunts are commonly found in cirrhotic patients. These collateral vessels sometimes have a very large caliber, draining a significant amount of blood out of the cirrhotic liver. The possibility of blood diversion with its negative effects on liver transplantation (OLT) is not frequently, but requires surgical or endovascular management to preserve portal prograde flow and save the graft. The purpose of this study is to assess the prevalence of spontaneous portosystemic shunts requiring post or intraoperative treatment for blood diversion in liver transplant.

Materials and Methods: Electronic records from all 485 consecutive liver transplants from January 2017 to December 2020 were retrospectively reviewed. 23 patients underwent OLT without cirrhosis were excluded. Portal flow assessments were performed either before or after reperfusion based on local clinical practice.

Results: The prevalence of spontaneous portosystemic shunts that require post or intraoperative treatment for blood diversion to the graft is 0.65% (3/462). With an exact binomial CI of 95%, the percentage estimate of these shunts are 0.13-1.89%. Spontaneous portosystemic shunts treated were splenorenal, porto-esophageal and mesenteric-caval.

Conclusion: Spontaneous portosystemic shunt that requires surgical or endovascular treatment to preserve portal prograde flow is rare (0.65%). The knowledge and management of this situation is crucial to save the graft. Further studies will be needed to estimate the pre-operative risk in patients with voluminous portosystemic shunts.

P-607

How controlled is the expansion of VIATORR CX?

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Purpose: To investigate and compare the physical properties of the new generation Gore VIATORR Controlled Expansion Endoprosthesis (VCX) and of the predecessor VIATORR stent in an in vitro experimental setup.

Materials and Methods: A total of 12 stents (8 VCX; 4 VIATORR; GORE, Flagstaff USA) were examined. Radial resistive force (RRF) and chronic

outward force (COF) were assessed using a radial force testing machine (RX-650, Machine Solutions Inc., Flagstaff, AZ, USA). To assess COF and RRF of the VCX above 8 mm, balloon expansion was performed between cycles.

Results: RRF and COF of the VCX drop overproportionally (approximately 50 %) at an external diameter of 8.6 mm. The predecessor VIATORR stent without the "controlled expansion" feature shows continuous COF to a diameter of 10 mm. Expansion with an 8 mm balloon catheter did not effect COF or RRF. Expansion with a 9 mm balloon catheter shifted the drop of COF and RRF to 8.8 mm; expansion with a 10 mm balloon catheter to 9.7 mm. The previous version of the VIATORR stent only showed an increase in RRF and COF following expansion with a 10 mm balloon catheter.

Conclusion: The VCX shows an abrupt and overproportional decrease of COF and RRF at an external diameter of 8.6 mm, thus passive expansion to its nominal diameter of 10 mm is not to be expected. By means of balloon dilatation the physical properties of the stent can be altered, enabling customized TIPS creation. The previous VIATORR stent shows continuous COF and RRF.

P-608

Transfemoral recanalization of occluded TIPS

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Purpose: To report the safety and efficacy of percutaneous transfemoral venous recanalization of occluded intrahepatic portosystemic stents (TIPS) in cases where the transjugular approach is not feasible.

Materials and Methods: Between 2000 and 2020, 81 patients underwent TIPS revision due to complete occlusion; of these 8 underwent recanalization via a percutaneous transfemoral venous access. In all 8 patients a prior recanalization attempt via a typical transjugular approach was not successful. TIPS were recanalized using reverse curve catheters; after configuring the catheter in the IVC the tip of the catheter was drawn back to cannulate the liver-vein ostium/the occluded TIPS. While maintaining tension on the catheter to ensure support a guidewire was used to manipulate through the occlusion, followed by balloon angioplasty performed via the femoral access. In case PTA did suffice an additional stentgraft was placed via a jugular access. Primary technical success defined as successful crossing of the occlusion. Secondary technical success was defined as the rate of successful TIPS recanalization. Periprocedural complications were evaluated to assess procedural safety.

Results: In 8/8 patients transfemoral venous TIPS recanalization was successful (primary technical success 8/8; secondary technical success 8/8). In 3 patients PTA sufficed, 5 patients required additional stent placement to restore TIPS flow. No procedure-related complications were observed.

Conclusion: The transfemoral venous approach is a safe and efficient alternative for TIPS recanalization in cases where the transjugular approach is not feasible.

P-609

Causes of TIPS dysfunction and technical failure

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Learning Objectives: Highlight the main causes of TIPS dysfunction

Background: Transjugular intrahepatic portosystemic shunt (TIPS) is the percutaneous creation of a conduit from the hepatic vein to the portal vein that is used to manage consequences of portal venous hypertension

(variceal hemorrhage, hematemesis and refractory ascites). While the primary technical success rate of TIPS placement is high, complications can occur, due to TIPS dysfunction with recurrence of portal hypertension complications, and can significantly alter patient prognosis

Clinical Findings/Procedure Details: Optimal initial stent position influences the probability of TIPS dysfunction, considering both caudal and cephalic end of the stent. Caudal end of the stent has to be parallel to vascular wall of portal branch chosen: the angle between the tangent line of the caudal end of the stent and the vascular wall of the portal vein must be less than 20°. The cephalic end of the stent has to be extended exactly until the hepato-caval junction, covering in its entire length both the intrahepatic tunnel and the suprahepatic vein. Other recognized causes of shunt dysfunction include iatrogenic dissection of the portal vein during TIPS creation, resulting in inflow disease and shunt thrombosis, more often early. In the end, kinking of the stent may be seen after peripheral punctures of the portal vein, with resultant reduction in the TIPS diameter that can cause hemodynamically significant stenosis and an increased portosystemic gradient

Conclusion: TIPS dysfunction is responsible for recurrence of portal hypertension and its complications; in this way, it is mandatory for interventional radiologists to know which are the main causes during the execution of procedures to significantly lower the probability of technical failure

P-610

Successful portal vein embolization: technical and anatomical considerations

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Learning Objectives: Highlight the role of pre-surgical portal vein embolization in oncologic patients who are candidates to right hepatectomy, describing the embolization technique and embolic agents to employ in consideration of portal tree anatomy

Background: Portal vein embolization is employed in oncologic patients, with massive involvement of the only right liver lobe, candidates to hepatectomy, to induce adequate compensative hypertrophy of the left lobe (FRL), extend surgical criteria and lower the risk of post-surgical liver failure. It can be performed in hepatopathic patients with estimated FRL < 40% after hepatectomy and in normal liver patients with estimated FRL < 30%. Candidates undergo preliminary CT-volumetric study of the liver to decide the correct embolization strategy, in consideration of the anatomy and eventual anatomical variants of portal tree. Then, patients undergo percutaneous US-guided puncture of portal vein with a 21G-CHIBA needle with subsequent catheterism, employing 5Fr introducer-sheath and catheters. After portography, the different branches of right portal vein are catheterized selectively and superselectively employing microcatheters. Different embolic agents have been reported to perform the procedure, mostly employed in association: coils, PVA, Amplatzer Vascular-Plug, Lipiodol, Gelfoam, cyanoacrylate (glue) and ONYX. It is essential to embolize as distal as possible right portal division branches, to avoid reperfusion due to collateral circles and shunts, and avoid reflux of embolic agents in left portal system

Clinical Findings/Procedure Details: Adequate compensative hypertrophy of the left lobe at CT-volumetric study 1 month after portal vein embolization

Conclusion: Portal vein embolization is safe and clinically effective, with a high technical and clinical success to extend surgical criteria in oncologic patients candidates to right hepatectomy; it is strictly necessary to know portal tree anatomy and the possible anatomical variants for a correct choice of embolic agents and embolization strategy to employ

P-611

Hemorrhoidal vein embolization for rectal varices in patients with portal hypertension: a single-institution experience

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Learning Objectives: The aim of this study was to assess the safety and effectiveness of hemorrhoidal vein embolization of rectal varices in patients with portal hypertension.

Background: One of the most clinically serious manifestations of portal hypertension is the development of portosystemic shunts in the form of gastrointestinal varices. Although bleeding from rectal varices is a rare complication in patients with portal hypertension, their rupture can be life-threatening.

Clinical Findings/Procedure Details: We reviewed the treatment outcomes in 6 patients with rectal varices who were at risk of rupture due to portal hypertension. All had undergone hemorrhoidal vein embolization at our institution. The procedure was performed using coils, ethanolamine oleate (EO), 50% glucose and n-butyl-2-cyanoacrylate after an occlusion balloon catheter was inserted into the inferior mesenteric vein via the intrahepatic portal- or the ileocolic vein under radiologic guidance.

The initial puncture was via the percutaneous transhepatic approach in 5 patients. One patient required the ileocolic vein approach via laparotomy of the abdomen under general anesthesia because of portal venous occlusion due to a tumor thrombus. The procedures were successful in all patients and resulted in the obliteration of rectal varices. The median post-procedural observation period was 549 days (range 140 -1511 days); follow-up CT studies confirmed persistent varices obliteration in all patients. Postoperatively, one patient suffered procedure-related hepatic arterial hemorrhage that was controlled by transcatheter arterial embolization.

Conclusion: Hemorrhoidal vein embolization in patients with rectal varices due to portal hypertension is safe and effective.

P-612

Congenital extrahepatic portosystemic shunt-interventional treatment

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Learning Objectives: Understand the embryology, classification systems, imaging, clinical presentation and treatment options of congenital extrahepatic portosystemic shunts (CEPS).

Background: CEPS develops because of abnormal involution of the vitelline veins that embryologically constitute the portal vein. There are two types of CEPS. Type 1 shunts show complete shunting of blood from the portal system to systemic circulation with absence of the intrahepatic portal vein. Liver biopsy is indicated for confirmation of diagnosis of Type 1 shunt. Type 2 shunts demonstrate partial shunting of blood from the portal system to systemic circulation with an intact intrahepatic portal vein. CPSS may be asymptomatic or presented with varying degrees of encephalopathy, refractory hypoxemia, porto-pulmonary hypertension, hepatopulmonary syndrome or heart failure. Signs of portal hypertension such as varices, ascites, and splenomegaly are commonly absent.

Clinical Findings/Procedure Details: Type 1 shunts are more commonly seen in females and are associated with other anomalies. Type II CEPS are more common in boys with less association with congenital anomalies. Primary diagnosis is usually done on doppler ultrasonography. CT and MR Angiography are useful in classifying Abernethy malformations and detecting other associated anomalies. Conventional angiography is useful when other investigations are inconclusive and for endovascular treatment.

Conclusion: Radiological familiarity with this rare congenital condition will help in making an early diagnosis and initiate prompt treatment. Management depends on the type of shunt and intrahepatic portal vein

radicles. Definitive management of Type 1 shunts is liver transplantation and of Type 2 shunts is surgical or endovascular occlusion of the shunt.

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Interventional radiology in portal hypertension

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Learning Objectives:

1. Discuss clinical conditions leading to Portal Hypertension and the types of portal hypertension
2. Different options available for diagnosing and managing Portal Hypertension.
3. Various endovascular & non-vascular procedures available for managing complications of Portal Hypertension.

Background: Portal Hypertension could be due to prehepatic, hepatic or post hepatic causes. Cirrhosis is the commonest etiology of portal hypertension in the Western world and constitutes approximately 85-90% of the cases. Interventional radiology plays an important integral role in diagnosing the types of portal hypertension along with diagnostic imaging. By measuring the hepatic venous pressure gradient, the types of portal hypertension can be differentiated and a concurrent transjugular liver biopsy will yield material for analysing the degree of cirrhosis. Interventions play a major role in managing clinically significant portal hypertension such as ascites, splenomegaly, varices and encephalopathy.

Clinical Findings/Procedure Details: Interventions for complications of Portal Hypertension

Common vascular interventions include

1. Transjugular intrahepatic portosystemic shunt
2. Retrograde Variceal Obliteration- Balloon occluded, Coil assisted, Plug assisted
3. Transhepatic Variceal obliteration

Common Nonvascular Interventions include

1. Paracentesis, tunneled Peritoneal Catheter
2. Peritoneovenous shunt (Denver shunt)

Conclusion: Different Interventions for managing the portal hypertension forms an important skill which Interventional radiologist should possess so that the complete clinical management of the patient can be efficiently done in coordination with our hepatobiliary physicians.

By completing this abstract the radiologist can elucidate the different modalities available for diagnosing and managing Portal Hypertension. The procedural steps, indications, various tips and tricks for each procedure will also be discussed in detail with illustrative examples.

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Portosystemic encephalopathy: what IR needs to know

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Learning Objectives: To review the etiology, physiology, and treatment of portosystemic encephalopathy. We describe patient selection, IR techniques with procedural tips, risks and results for clinically effective and technically successful treatment of medically refractory portosystemic encephalopathy.

Background: Portosystemic encephalopathy (PSE) is a neuropsychiatric syndrome that can be associated with spontaneous portosystemic shunts in the absence of intrinsic hepatocellular disease or in patients with cirrhosis and portal hypertension with created or spontaneous portosystemic shunts. Patients with either spontaneous or created portosystemic shunts and PSE have a therapeutic target.

Clinical Findings/Procedure Details: Spontaneous portosystemic shunts are identified by CT or MR. Patients with transjugular intrahepatic portosystemic shunts, spontaneous splenorenal shunt (SRS), recanalized (para) umbilical veins, and spontaneous portocaval shunts were included. Successful management options we show include TIPS reduction/occlusion, BRTO, BATO, and splenic artery embolization. We highlight the technical details and describe the ideal candidate for each approach. We discuss the clinical concerns related to therapy.

Conclusion: Historically, hepatic encephalopathy has been clinically challenging. Noninvasive and IR imaging can lead to a diagnosis with a percutaneous treatment option. Transcatheter embolization of pathologic physiologic shunt, TIPS, or splanchnic artery is feasible and effective as adjunctive or curative treatment strategies for portosystemic encephalopathy in patients refractory to medical management.

P-615

Hepatic and portal-based refractory encephalopathy: evaluation, assessment, and treatment of portosystemic shunts in the adult and pediatric population

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Learning Objectives:

- Discuss various etiologies of hepatic and portal-based encephalopathy, including congenital, acquired, and iatrogenic etiologies.
- Discuss the evaluation, assessment, and management of both intra- and extra-hepatic portosystemic shunts, including iatrogenic TIPS shunts.
- Summarize current literature surrounding the management of hepatic and portal-based encephalopathy.

Background: For many patients, the etiology of encephalopathy can be broad and difficult to identify. Certain portal and hepatic based etiologies of encephalopathy are increasingly being discovered secondary to the increasing utilization of cross-sectional imaging and a deeper understanding of a patient's clinical presentation. Once identified, medical management often remains the first-line therapy to these patients. However, given advances in both technical approaches and available equipment, intervention involving both intra-hepatic and extra-hepatic portosystemic shunt can be successfully performed in patients who remain refractory to medical management. Additionally, identification, assessment, and management of certain portosystemic shunts can help prevent further issues extending beyond encephalopathy, which include catastrophic hemorrhage and high-output cardiac failure.

Clinical Findings/Procedure Details: We propose an in-depth discussion of the imaging and clinical presentation surrounding patients with refractory portal and hepatic based encephalopathy. Specifically, we will discuss the evaluation, assessment, and management of both intra- and extra-hepatic portosystemic shunts from an interventional perspective, which includes embolization techniques of competing portosystemic shunts, as well as management strategies surrounding iatrogenic transjugular intra-hepatic portosystemic (TIPS) shunt creation.

Conclusion: Interventional Radiology plays a critical role in treating patients with hepatic and portal-based portosystemic shunts. Knowledge surrounding the evaluation, assessment, and management of portosystemic shunts remains of critical importance to clinicians treating patients plagued by refractory encephalopathy.

P-616

Percutaneous retrieval of an infected Viatorr stent after TIPS placement

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Clinical History/Pre-treatment Imaging: A 67 year-old-female with liver failure and intractable ascites, underwent uneventful TIPS with an 8cm x10mm Viatorr covered stent for management. Thereafter, she went home. Few weeks later, she developed recurrent sepsis impossible to eradicate, despite aggressive antibiotic and antifungal therapy.

Stent fabric contamination was strongly suspected and therefore, percutaneous removal of the stent was decided.

Treatment Options/Results: Therefore, the suspected infected "in situ" stent was removed percutaneously. By a right internal jugular venous approach, using a 25 mm Amplatz loop snare, the Viatorr stent was grabbed tightly and vigorously pulled out from the liver, using a relatively strong pulling force. The patient continued aggressive antibiotic and antifungal therapy.

Slowly she improved almost completely and went home.

About 2.5 years later she was doing well. The ascites had improved.

Discussion: TIPS is a well-established procedure. Its indications are well described. The procedure is safe and free of major complications, usually related to the expertise of the operators. We have done thousands. Many thousands TIPS are done every year in USA and the world.

Few instances of attempts at retrieval have been reported, for other reasons, mainly during the initial procedure due to stent migration, embolization or misplacement.

Contamination of the metal may occur but is not clinically significant.

To the best of our knowledge, this is the only worldwide reported patient surviving after the percutaneous removal of a proven infected TIPS Viatorr stent many weeks after insertion.

Take-home Points: We report a case of a successful percutaneous removal of infected covered stent placed for management of intractable ascites.

P-617

Complications of porto-splenic stenting in the setting of necrotising pancreatitis

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Clinical History/Pre-treatment Imaging: 53-year-old male with severe necrotising pancreatitis and protracted hospital stay required 3 open laparotomies; cystogastrostomy, pancreatic necrosectomy and adhesiolysis. Splenic vein thrombosis and upper gastrointestinal bleeds (UGIB) ensued. Multiple endoscopies and mesenteric angiograms showed no bleeding focus. Significant UGIB persisted and repeat endoscopy showed non-bleeding oesophageal varices. Porto-splenic shunt inserted, decompressing the left-sided portal hypertension (LSPH) and bleeding stopped for 14 months. LSPH and significant UGIBs recurred secondary to portal stent thrombosis. Endoscopy showed non-bleeding varices and stent erosion into gastric lumen.

Treatment Options/Results: Splenic embolisation versus surgical stent removal and splenectomy was deemed a safer option to reduce LSPH and minimise UGIBs. Embolisation of splenic artery and previously undiscovered splenic artery pseudo-aneurysm resulted in haemostasis to date (26 months). Stent fistulation has been managed conservatively and no morbidity has occurred to date.

Discussion: Splenic vein thrombosis and LSPH is a rare and life-threatening cause of UGIB. Stent insertion is a known treatment option. In our case, a single anti-platelet (clopidogrel) was commenced post stenting. Unfortunately, in-stent thrombosis occurred 14 months later. There is no

clear consensus in the literature for the use of anticoagulation therapy in porto-splenic stenting.

Take-home Points:

1. Porto-splenic stenting is an option for splenic vein thrombosis and left-sided portal hypertensive UGIB.
2. Thrombosis and subsequent migration of porto-splenic stent into surrounding structures is a possible complication
3. The consensus on anticoagulation therapy in porto-splenic stenting is unclear.
4. UGIB from in-stent thrombosis and subsequent left-sided portal hypertensive UGIB can be managed effectively via splenic artery embolisation.

P-618

Large portosystemic shunt embolisation in a patient with recurrent hepatic encephalopathy

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Clinical History/Pre-treatment Imaging: Patient with a history of gastric adenocarcinoma, under study for thrombopenia, presented chronic liver disease of unknown cause with portal hypertension and recurrent grade IV hepatic encephalopathy, refractory to medical treatment. Cross-sectional imaging demonstrated stigmata of chronic liver disease and a large spontaneous portosystemic shunt from the right portal vein to the right adrenal vein.

Treatment Options/Results: Under ultrasound-guidance, the right portal vein was catheterized. The portosystemic shunt was occluded successfully with a vascular plug. Due to portal hypertension, the hepatic tract was embolised with another endovascular occluder. After the intervention, a significant neurologic improvement was noticed. Esophageal varices remained stable, still, the patient developed moderate ascites and hepatic hydrothorax managed with medical therapy.

Discussion: Hepatic encephalopathy is a reversible cognitive disturbance that may occur in patients with a portosystemic shunt. The portosystemic shunt allows the passage of nitrogenated substances from intestinal digestion through systemic veins to the brain without being cleared by the liver. This case report describes embolisation of large portosystemic shunt with vascular plug as a minimally invasive approach to treat successfully recurrent hepatic encephalopathy refractory to conventional medical treatment. The use of a vascular plug device to close spontaneous shunts was preferred to coils because it can be more accurately placed in the vessel, has a lower risk of migration, and faster time of occlusion.

Take-home Points: Plug-assisted obliteration for large portosystemic shunt embolisation is an effective treatment that should be considered in selected patients with medically refractory hepatic encephalopathy.

P-619

Endovascular treatment of persistent congenital intrahepatic portosystemic shunts in a two-year-old girl with vascular plug

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Clinical History/Pre-treatment Imaging: Two-year-old girl with persistently elevated liver enzymes and ammonia levels without spontaneous resolution of intrahepatic shunts.

US at birth: dilatation of intrahepatic portal vein (PV) bifurcation with abnormal vessel connecting with IVC.

CT: no other shunts identified.

Portovenography: another shunt between left PV and a left accessory suprahepatic vein is identified.

Treatment Options/Results: We perform two steps endovascular treatment using vascular micro plugs from a right internal jugular vein approach. First, the left portosystemic shunt was closed with a 6mm vascular plug. In a new venographic series, another shunt is identified from the right PV. Closure is performed with a 6mm vascular plug. In a second step, shunt from PV bifurcation to IVC is closed with a vascular plug of 10 mm length with ends in PV and IVC. No post-procedure complications related to portal hypertension.

Post procedure CT: complete closure of the shunts.

Normalization of ammonia and liver enzymes.

Discussion: Congenital intrahepatic portosystemic venous shunts (CIPSVS) are rare vascular malformations associated with multiple congenital abnormalities and can progress to long-term multisystem complications. Its treatment is indicated in organic involvement or persistence after 1-2 years. Endovascular embolization should be considered, making them potentially reversible.

Take-home Points: CIPSVS is a rare vascular malformation and can lead to long-term complications. Its treatment is indicated in case of organic involvement or persistence after 1-2 years. Endovascular embolization should be considered making them potentially reversible. A definitive diagnosis of the shunt using angiography can map the vascular anatomy and assess how blood flow dynamics change with temporary shunt occlusion.

P-620

Coil-in-plug technique using the Amplatzer Vascular Plug II to occlude a portosystemic shunt

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Clinical History/Pre-treatment Imaging: The coil-in-plug (CIP) technique was developed to augment the effectiveness of embolization. This report demonstrates two cases of embolizing high flow and large caliber portosystemic shunts causing hepatic encephalopathy, where the CIP technique with multilayer AVP II was effectively employed.

Treatment Options/Results: After deployment of an AVP II advanced from a guiding sheath in the entrance of the portocaval shunt (case 1) and the exit of splenorenal shunt (case 2) demonstrated persistent blood flow, a 2.2-F microcatheter was inserted into the central lobe of the plug introduced by a 0.014-inch penetration wire with a tip load of 10/12-g preceded through the mesh of the proximal disc and central lobe in a parallel fashion before detachment of the plug. The internal space of the central disc was tightly embolized using detachable and pushable coils in each case. The symptom of encephalopathy improved after the procedure in both the case.

Discussion: To occlude large-diameter and high-flow vessels, detachable coils are frequently used under flow control by an inflated balloon. The procedure still has a risk of coil migration and high cost burden of the detachable coils. On the other hand, AVP is resistant to distal migration if a 30-50% oversized plug is used. Coil embolization inside the AVP II allows dense and packed embolization and reduces the number of coils required.

Take-home Points: The CIP technique with the AVP II was possible using high tip loaded wire to achieve complete occlusion of the large-caliber portosystemic shunts.

P-621

TIPS reduction for encephalopathy: hourglass method using covered ePTFE balloon expandable stent

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Clinical History/Pre-treatment Imaging: 54-year-old patient with a history of liver failure caused by exotoxic cirrhosis underwent the TIPS procedure in 2010 for bleeding esophageal varices. In December 2020 he manifested alterations state of consciousness and epileptic seizures. Ammonium was 117 umol/L (range 0-45 umol/L). No episodes of hyperammonaemia in post TIPS follow-up.

Ultrasound and CT scan revealed the patency of the shunt.

Hepatic encephalopathy was not controlled with conventional medical therapy. A Multidisciplinary medical team decided to perform venography to measure the gradients and evaluate the possibility of a shunt reduction.

Treatment Options/Results: The venous gradient was 12 mmHg. It was therefore decided to place a covered ePTFE balloon expandable stent 11/59, within the midportion of the TIPS stent, using the "hourglass" method. The stent was inflating at 10 mm in the proximal and distal ends, and at 5 mm in its middle portion.

At the end of the procedure, the gradient was 21 mmHg. After one month, the patient no longer presented episodes of encephalopathy (ammonium values lower than 45 umol / L).

Discussion: In cases of refractory encephalopathy, shunt reduction can be achieved with:

- definitive occlusion of the shunt.
- dedicated reducing stent.
- parallel method.
- hourglass method.

Take-home Points: The hourglass method is a valid option in the treatment of overflow encephalopathies in patients with TIPS refractory to medical therapy.

This method can be considered in urgent cases, when the dedicated reducing stent is not available. In fact, covered ePTFE balloon expandable stent is a device commonly found in interventional radiology departments.

P-622

A microcatheter transected a double balloon catheter during BRTO

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Clinical History/Pre-treatment Imaging: A 70-year-old female presented with gastric varices. She was treated with sclerotherapy using balloon-occluded retrograde-transvenous obliteration (BRTO).

Treatment Options/Results: The lower left phrenic vein was selected by double-balloon catheter (CANDIS® Medikit) with a right femoral vein approach. The varices were classified as Hirota Grade 2. It was difficult to use a 5Fr catheter near the vein for the down grade technique. Therefore, we used a microcatheter to advance into the varices. The microcatheter is LIGHHOUSE® (PIOLAX) in preparation for embolization of the collateral circulation. A double-balloon catheter was placed along the microcatheter that was advanced through a flexed and meandering vein.

A double-balloon catheter followed by a microcatheter was advanced through the flexed tortuous vein. There was strong resistance when advancing the microcatheter again, so it was removed. Then, the tip of the microcatheter ruptured, and the tip migrated into the varicose vein when angiography was performed. BRTO was subsequently performed as usual, and it was completed without major complications.

Discussion: The microcatheter (LIGHHOUSE) had an external marker. The marker was likely caught in a highly bent double balloon catheter and ruptured.

Take-home Points: Care should be taken when inserting a microcatheter into a bent double-balloon catheter, as use of a catheter with an external marker may result in transection.

P-623

Ectopic variceal embolization and retrograde SMV recanalization for upper gastrointestinal bleeding using hybrid angio-CT guidance

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Clinical History/Pre-treatment Imaging: A 56-year-old man with prior enterectomy for small bowel hemangiolympangioma presented with gastrointestinal bleeding requiring massive transfusion protocol. Computed tomography (CT) of the abdomen (Figure 1) demonstrated bleeding jejunal varices secondary to chronic flush occlusion of the superior mesenteric vein (SMV).

Treatment Options/Results: Double balloon endoscopy confirmed bleeding jejunal varices refractory to endoscopic treatment. Under hybrid angio-CT guidance, the portal vein (PV) above the SMV occlusion was accessed through a transhepatic venous approach. After unsuccessful attempt at wire-catheter recanalization of the occlusion, the SMV inferior to the occlusion was percutaneously accessed (Figure 2) and microcoils were used to embolize the jejunal varices. Next, a Rosch-Uchida needle from the PV was used to target a microsnare deployed in the SMV. Through-and-through access was achieved and covered stents were deployed to bypass the occluded SMV and create an intrahepatic portosystemic shunt. Hemostasis was immediately achieved and durable at 6-month follow up.

Discussion: Ectopic variceal bleeding, defined as bleeding from non-gastric and non-gastroesophageal varices, only accounts for 5% of variceal bleeding. The associated mortality however may be as high as 40%. In the case of SMV occlusion, hybrid angio-CT technology enables direct access of the mesenteric varices for embolization and extra-anatomic bypass of the occlusion.

Take-home Points: Bleeding ectopic varices, although infrequent, is associated with high risk of mortality. Hybrid angio-CT facilitates direct access of ectopic varices, embolization, and complex recanalization procedures.

P-624

Successful challenging combined rescue TIPS and portal vein recanalization

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Clinical History/Pre-treatment Imaging: 56 year-old woman with primary biliary cirrhosis presented to our emergency department for massive hematemesis due to esophageal varices with failure of previous endoscopic therapeutic approach; her portal hypertensive syndrome was complicated by porto-mesenteric thrombosis accompanied by evidence of early signs of intestinal ischemia. Clinically she was hemodynamically unstable.

Treatment Options/Results: After us-guided percutaneous internal right transjugular approach, the median hepatic vein was catheterized and the trans-hepatic puncture of portal vein was performed. After catheterism of main portal vein a flebography was performed confirming the presence of large gastroesophageal varix with concomitant superior mesenteric vein complete thrombosis and partial thrombosis of main portal vein trunk. Firstly, after angioplasty of intrahepatic tunnel, the shunt was created releasing 2 overlapped partially covered stents, followed by aspiration of thrombosis with Angiojet. Final flebographic controls showed improved vascular patency with no opacification of gastroesophageal

varix. Follow-up imaging at 3 and 6 months showed patency of porto-systemic shunt and the only referred symptom was a transient vague abdominal pain

Discussion: Portal thrombosis is a potentially fatal condition in symptomatic patients who can not assume anticoagulants due to their bleeding conditions. Interventional radiology represents an effective minimally invasive life-saving alternative to surgery

Take-home Points: The combined TIPS-thromboaspiration can be considered an effective therapeutic approach to improve the clinical outcome of cirrhotic patients with hematemesis due to variceal bleeding with concomitant portal vein thrombosis. Endovascular aspiration of thrombosis is effective not only to recanalize portal vein but also to guarantee an adequate in-flow to porto-systemic shunt, avoiding tips thrombosis

P-625

Percutaneous transhepatic angioplasties of portal vein anastomosis in pediatric liver transplantation

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Clinical History/Pre-treatment Imaging: 18 month old male patient Transplanted for congenital biliary atresia of the left liver lobe from a living donor. With altered liver function tests, a Doppler ultrasound was performed, observing signs of portal hypertension, the study was expanded due to suspicion of stenosis. An angiography scan reveals severe portal vein anastomotic stenosis.

Treatment Options/Results: The lesion was verified by direct portography and portal vein angioplasty was performed. A micropuncture of the left peripheral portal branch is performed under ultrasound guidance, channeling it. Direct catheter portography was performed, showing severe stenosis at the level of the end-to-end portal anastomosis. The stenosis is crossed with a hydrophilic guide and a new portography is performed from the superior mesenteric vein, appreciating the path of the portal stenosis and varicose veins in the gastric area. Thrombi are not visible. After placing 5000UI of heparin, successive dilation is performed with a 4 and 5mm balloon catheter. Upon adequate control, opening of the portal vein with patency of the portal venous system. No signs of bleeding. The catheter is removed after embolization of the hepatic parenchymal tract with gelfoam. The patient recovered satisfactorily with declining liver function tests. At 1-year follow-up, the patient retains liver function and preservation of the liver graft.

Discussion: Percutaneous interventional procedures have gained worldwide acceptance to alleviate portal hypertension symptoms and preserve the graft, due to their minimal invasiveness, as well as low complication and high success rates.

Take-home Points: Transhepatic portal vein interventions are feasible, safe and useful to preserve organ function and avoid re-transplantation.

P-626

Successful trans-splenic approach for TIPS and portal vein recanalization

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Clinical History/Pre-treatment Imaging: 59 year-old cirrhotic patient, already treated with TIPS for worsening portal vein hypertension, comes to our emergency department for vague abdominal pain. A CT exam showed TIPS thrombosis: a percutaneous internal transjugular approach was performed to attempt the recanalization of the already created porto-systemic shunt, which proved to be unsuccessful

Treatment Options/Results: Afterwards, a percutaneous trans-splenic approach was realized with placement of a visceral 6 Fr introducer-sheath: flebography showed thrombosis of both superior mesenteric vein and TIPS, with patency of inferior mesenteric vein and evidence of large gastroesophageal varix. TIPS recanalization was performed employing .035" guidewire and angioplasty 8x10mm, followed by release of 3 overlapping partially covered stents into the recanalized tract. Final flebography showed successful TIPS patency and satisfactory caval outflow; the larger gastroesophageal varix was catheterized and embolized releasing a metallic coil. The patient assumed anticoagulants after the procedure and follow-up imaging at 3 and 6 months showed patency of the implanted stents and TIPS

Discussion: Trans-splenic TIPS recanalization is an effective alternative approach to overcome portal vein thrombosis in case of transjugular approach failure; moreover, it can determine the eventual eligibility of patients to liver transplant

Take-home Points: Trans-splenic approach represents a safe and effective treatment for portal vein and TIPS recanalization

P-627

Endotipsitis: a not so uncommon complication

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Clinical History/Pre-treatment Imaging: A 65 year old man with antecedent of enolic cirrhosis presented with important ascites and peripheral edema. He was afebrile and had no signs of bacteriemia.

He had been recently admitted for spontaneous bacterial peritonitis (SBP) and repeated episodes of bacteriemia, ascitic descompensation, severe acute alcoholic hepatopathy and grade 2 hepatic encephalopathy. CT and ultrasound revealed TIPS thrombosis. Blood tests didn't reveal signs of acute infection

Treatment Options/Results: Mechanical thrombectomy and recanalization of TIPS with a 10F Rotarex® device was performed through transjugular approach. Immediately after the procedure, the patient presented bacteriemia and fever with positive blood cultures for *Klebsiella Pneumoniae* (KP).

The previous recurrent episodes of bacteriemia were also due to KP, so the diagnosis of endotipsitis was established and high dose antibiotic treatment was introduced.

The patient was discharged ten days later with prolonged oral antibiotic treatment as chronic profilaxis of SBP and endotipsitis treatment.

Discussion: Endotipsitis is a well-known complication with high morbidity and mortality, but few cases are reported in the literature. Diagnosis is made if clinically significant bacteriemia and TIPS thrombosis are present. Sustained bacteriemia in an apparently normal TIPS and no other obvious focus of infection must arise the suspicion.

In our case, the presentation was thrombosis of TIPS without signs of infection. However, immediate bacteriemia after manipulation produced by the same microorganism as in previous admissions, made the diagnosis.

Take-home Points:

- Endotipsitis carries high morbidity and mortality.
- Thrombosed TIPS and signs of bacteriemia make the diagnosis.
- Patients diagnosed with endotipsitis must be rapidly treated with prolonged antimicrobial therapy.

P-628

Percutaneous transhepatic treatment of a unique portal vein malformation with portal hypertension in a pediatric patient

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Clinical History/Pre-treatment Imaging: We report the case of an 8-year-old female without relevant clinical history that presented to the emergency department with severe portal hypertension and acute variceal bleeding. A singular abnormality in the portal venous system was suspected at color doppler Ultrasound and confirmed with CT angiography. Peculiar imaging findings were not pathognomonic for any of the known congenital and acquired portal vein anomalies: absence of the extrahepatic portal vein; evidence of a patent spleno-mesenteric confluence draining into a dilated left gastric vein; evidence of a single large mesenteric venous collateral draining into the intrahepatic right portal branch; a patent intrahepatic portal system; and absence of any intra or extrahepatic congenital porto-systemic shunt.

Treatment Options/Results: The patient underwent endoscopic ligation of varices and subsequent Ultrasound guided percutaneous transhepatic portography. A 10-mm non compliant balloon angioplasty was performed to treat the stenotic confluence between the mesenteric collateral and the right intrahepatic portal bifurcation. Portal pressure was significantly reduced and no varices bleeding recurrence occurred.

Discussion: Anomalies of the portal venous system can be congenital or acquired, the latter being related to thrombosis or iatrogenic alterations. These conditions can be clinically silent for years and then manifest abruptly causing severe clinical emergencies. Prompt non-invasive imaging characterization allowed to understand the singular vascular abnormality and mini-invasive interventional radiology management resolved portal hypertension and variceal bleeding.

Take-home Points: Non-invasive imaging knowledge and interpretation is crucial to understand uncommon vascular malformations. Diagnostic imaging should always guide interventional procedures

P-629

Venous mesenteric ischemia, beyond systemic anticoagulation

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Clinical History/Pre-treatment Imaging: A 67 years old man with a medical history of hypertension arrived at the ER With acute abdominal pain. Initial CT showed acute superior mesenteric vein(SMV) thrombosis, also the main portal trunk and the right portal branch were involved and associated with circumferential jejunal wall thickening and congestion without pneumatosis or pneumoperitoneum at CT. Finally, the patient was diagnosed of acute venous mesenteric ischemia (VMI)

Treatment Options/Results: VMI accounts for less than 5% of all acute mesenteric ischemia and is classically treated with systemic anticoagulation. Surgery is usually indicated in the presence of complications. In our patient in absence of signs of peritonitis or bowel complication, a direct transhepatic portal vein(PV) approach with a 10F introducer was performed. Venography showed extensive thrombosis of the entire SMV, ileo-colic, jejunal branches and partial PV thrombosis. Aspiration thrombectomy through a Penumbra Indigo CAT8 and a 10-Fr Aspirex device was carried out in SMV, the jejunal branches as well as the main PV. Finally restoration of antegrade flow to the portal system with patency of at least 70% of initial thrombosis was observed. The introducer tract was embolized with Lipiodol / Glubran solution.

Discussion: Once SMV thrombosis is known, anticoagulation is needed and the main objective is to avoid transmural infarction and necrosis,

leading in those cases to surgery. Mechanical thrombectomy has demonstrated encouraging results in recent years with high clinical and technical success rates.

Take-home Points: Mechanical thrombectomy leads to faster restoration of blood flow to SMV and avoids surgical resection.

Embolization of the percutaneous tract is mandatory.

P-630

Bailout DIPSS in acute Budd Chiari syndrome (BCS) presenting with acute liver failure and hepatic encephalopathy: a shunt road less travelled

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Clinical History/Pre-treatment Imaging: A 44-year-old gentleman presented with jaundice, acute abdominal distention and marked tenderness in the right hypochondrium. Liver Function Test (LFT) showed elevated total bilirubin (3.4 mg/dl), ALT (632 IU/L), INR (3.4). Ultrasonography revealed thrombosis of all three hepatic veins with patent IVC with slow flow in the main portal vein suggestive of acute BCS. The patient had features of grade 2 Hepatic encephalopathy (HE) also.

Treatment Options/Results: In view of BCS with acute liver failure (ALF) and HE, he was placed on liver supports. Since coagulopathy made anticoagulation and thrombolysis at risk and liver transplant donor was not available, decision for emergency direct portosystemic shunt (DIPSS) was made in multidisciplinary meet. Emergency DIPSS was done under GA and covered stent deployed in the liver. The patient recovered within 3 days with improving LFT and sensorium.

Discussion: In acute BCS, anticoagulation is the line of management; however, in cases of ALF wherein anticoagulation cannot be done and transplant is not available, DIPSS may be attempted. In acute BCS, the cause of liver dysfunction is at the post sinusoidal level which results in liver congestion. Shunt decreases congestive hepatomegaly with improvement even in low grade HE.

Take-home Points:

- In selected cases of BCS with ALF where anticoagulants are contraindicated DIPSS seems to improve outcome.
- Prospective RCTs are needed to evaluate the role of endovascular intervention and liver transplantation among BCS patients with ALF.

P-631

Flood syndrome: endovascular management of spontaneous rupture of an umbilical hernia due to long-standing ascites

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Clinical History/Pre-treatment Imaging: We report a case of a 56-year-old patient with a history of alcohol-related liver cirrhosis and massive ascites refractory to medical therapy with sudden and spontaneous perforation of his hernia leading to drainage of ascitic fluid from the abdomen (Flood Syndrome). We performed a transjugular intrahepatic portosystemic shunt (TIPS) to relieve portal pressures and subsequent intraabdominal pressure.

Treatment Options/Results: We performed a transjugular intrahepatic portosystemic shunt (TIPS) to relieve portal pressures and subsequent intraabdominal pressure. This in turn lessens the congestive pressure in veins in the intestine reducing production of ascites. The patient had resolution of symptoms following successful TIPS and was seen again by the surgery team to have an umbilical hernia repair.

Discussion: Umbilical hernias are common in patients with cirrhosis of the liver and ascites. However, spontaneous rupture of the hernia is a rare

complication. A search of the literature shows that patients have been managed both operatively and nonoperatively for this condition. We present a case of spontaneous rupture of an umbilical hernia in a patient with cirrhosis and ascites which was managed successfully with transjugular intrahepatic portosystemic shunt (TIPS) followed by hernia repair.

Take-home Points: We report a rare case of Flood syndrome, which is a spontaneous rupture of an umbilical hernia in a patient with cirrhosis and ascites which was managed successfully with TIPS placement followed by umbilical hernia repair.

P-632

Portal vein recanalization, TIPS placement, and embolization of bleeding peri-biliary varices in the setting of chronic portal vein occlusion

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Clinical History/Pre-treatment Imaging: A 29 yo female with history of biliary atresia status post left-lobe liver transplant experienced recurrent life-threatening hemobilia following biliary drain placement for cholangitis. The bleeding persisted after exhaustive diagnostic evaluation and empiric partial hepatic artery embolization. Large peri-biliary varices in the setting of chronic main portal vein (MPV) occlusion were suspected as source of bleeding.

Treatment Options/Results: Cholangioscopy was performed through biliary drain access demonstrating large peribiliary varices. After percutaneous trans-splenic access, portal venography showed chronic near-occlusive MPV with nearly all portal directed through aforementioned varices emptying into intrahepatic portal veins. Blunt recanalization of the MPV with TIPS placement was performed followed by coil embolization of 2 SMV shunts to redirect nearly all portal flow through the recanalized MPV and TIPS.

Discussion: This case illustrates peri-biliary varices as a cause of hemobilia. It showcases the use of cholangioscopy as a diagnostic tool in this setting. The treatment approach presented several challenges unique to the portal system and post-transplant patient. The complex nature and location of the bleed precluded covered stenting within the biliary system. Further, stenting the portal vein was avoided as further re-transplant may be necessary if the patient continued to bleed. Intervention as titled was thus pursued in order to halt acute bleeding while providing new recanalized hepatopetal flow.

Take-home Points: Bleeding peri-biliary varices should be considered as cause of hemobilia.

Direct visualization with cholangioscopy can help in the diagnostic workup of hemobilia.

Recanalization of chronically occluded MPV and/or TIPS placement may be required to accommodate flow following embolization of large shunts.

P-633

Successful balloon-occluded antegrade transvenous obliteration of rectal varice: a case report

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Clinical History/Pre-treatment Imaging: A 75-year-old male with non-alcoholic-steatohepatitis-induced cirrhosis presented with a three-day history of severe rectorrhagia due to rectal varices. Ultrasound showed partial thrombosis of the portal vein and complete thrombosis of superior mesenteric vein (SMV). CT confirmed US findings. Colonoscopy identified ectopic rectal varices with the red color sign grade 3,4 with fresh blood.

Treatment Options/Results: Trans-jugular intrahepatic portosystemic shunt (TIPS), and Endoscopic injection sclerotherapy (EIS) have been reported as treatments. Due to contraindications, TIPS procedure was unlikely, he underwent balloon-occluded antegrade transvenous obliteration (BATO), an endovascular technique used successfully for esophageal varices. Under general anesthetics, portography of portal vein showed antegrade flow down to the inferior mesenteric vein (IMV) at the junction of the splenic vein to the port vein and superior rectal vein, a balloon catheter implanted at proximal of that to cause an occlusion. A 3:2:1 ratio of air/sodium tetradecyl sulfate/lipiodol as sclerotic agents were injected. The balloons were kept inflated for 3 hours. CT was done to assess clinical response. Then coil was used to lower the chance of recurrence.

Discussion: Despite of the low prevalence (0.5%-5%) of massive hemorrhage of rectal varices, there is no specific guideline established for the management. Other methods have relatively multiple contraindications and high recurrence rate. BATO is less invasive and can be done in patients with poor hepatic reserve and encephalopathy, and has low rebleeding rate.

Take-home Points: BATO is an alternative method with less complication and effective in the complete obliteration of rectal varices.

P-634

Transjugular intrahepatic portosystemic shunt (TIPS), aspiration thrombectomy and catheter-directed thrombolysis in acute portal vein thrombosis (PVT)

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Clinical History/Pre-treatment Imaging: A 46-year-old male patient was admitted to our hospital with acute PVT. Thrombosis involved the superior mesenteric vein (SMV), the extrahepatic portal vein (PV) and the intrahepatic PV branches. The patient had only mild symptoms with slight abdominal pain and fever.

Treatment Options/Results: Puncture of the PV was performed from the right liver vein via a transjugular access. Due to PVT, the correct position of the needle could not be verified by aspiration of blood. Therefore, a 0.035 inch hydrophilic was carefully advanced after puncture of the PV. The route of the guidewire matched the course of the PV; thus, a catheter was advanced over the guidewire. Angiography verified the position of the catheter in branches of the SMV. Subsequently, an 8-10mm x 6 cm GORE VIATORR CX TIPS endoprosthesis was implanted. Aspiration thrombectomy of the PV and SMV was performed. Due to remaining thrombus, a infusion catheter was placed in the SMV and thrombolysis was started.

Discussion: Acute PVT is a rare disease. If untreated, it can lead to portal hypertension and intestinal ischemia. Different treatment options exist, with anticoagulation being the standard treatment. Complete recanalization of the PV is only achieved in 34-45% of patients with anticoagulation therapy. The experience in endovascular techniques is still limited. Nevertheless, due to the excellent results of endovascular techniques, they are a promising treatment option.

Take-home Points: TIPS in combination with thrombectomy is an alternative treatment method in acute PVT, especially in extensive thrombosis. Prospective studies comparing the different treatment methods are necessary to elucidate their benefits.

P-635

Percutaneous transhepatic angioplasty and stenting in portal vein stenosis by paracoccidioidomycosis: case report

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Clinical History/Pre-treatment Imaging: A 40-year-old male patient with a history of 8 kg weight-loss and dyspepsia of 6 months of evolution. The abdomen contrast-enhanced CT revealed splenomegaly, mild ascites, collateral circulation, dilated intrahepatic biliary duct and common hepatic duct, with hepatic hilum and peripancreatic adenomegaly, which generated portal vein stenosis. A liver and adenomegaly biopsy were performed. Samples were negative for neoplastic cells, and positive for *Paracoccidioides brasiliensis*.

Treatment Options/Results: Percutaneous transhepatic angioplasty of the portal vein was executed to treat portal vein stenosis. A portal venogram displayed main portal vein stenosis. Stenosis was passed through and two self-expandable stents (WALLSTENT® - Boston Scientific) were placed across the stenosis. After angioplasty, a venogram showed normal caliber at the site of stenosis and disappearance of most of the collaterals. The procedure itself ended without complications, even up to this date, two years after.

Discussion: Main portal vein stenosis has multiple causes but is most commonly seen as a postoperative complication, especially after anastomosis in liver transplant.

There is limited literature on the role of angioplasty and stenting in patients with non-surgical extrahepatic benign causes of portal vein stenosis.

Percutaneous stent placement proved to be an effective option, with less morbidity in the treatment of patients.

Take-home Points: Percutaneous stent placement proved to be an effective option, with less morbidity in the treatment of patients with non-surgical extrahepatic benign causes of portal vein stenosis.

P-636

Transjugular intrahepatic mesenteric shunt (TIMS) followed by transjugular intrahepatic portosystemic shunt (TIPS)

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Clinical History/Pre-treatment Imaging: A 35-year old woman with hepatic fibrosis, portal hypertension and ulcerative colitis was referred to IR for TIPS creation to enable portal decompression prior to subtotal colectomy and J-pouch reconstruction. CT imaging showed chronic portal vein thrombosis (PVT) with obliteration of the main portal vein. Due to PVT, a transplenic approach was undertaken.

Treatment Options/Results: Transplenic portography showed a remnant origin consistent with the main portal vein. This was used for shunt creation with a therapeutic portosystemic gradient achieved. However, a subsequent CT scan showed the shunt had been created between the middle hepatic vein and an extrahepatic mesenteric vein rather than the portal vein, resulting in a transjugular intrahepatic mesenteric shunt (TIMS). The TIMS remained functional for 4 months but thrombosed after elective subtotal colectomy; attempts at recanalization were unsuccessful. Because ongoing portal decompression remained necessary for future J-pouch creation, a new TIPS was created using transhepatic targeting of the portal system followed by transjugular access and recanalization of the main portal vein. This TIPS remains functional 16 months later.

Discussion: Transplenic and transhepatic techniques have extended the spectrum of PVT patients amenable to TIPS creation. However,

intraprocedural portography may identify other mesenteric veins amenable to shunt creation. An extrahepatic mesenteric vein was used for initial shunt placement in this patient, although unfavorable geometry in this patient led to early shunt failure. A new TIPS was created which achieved durable portal decompression.

Take-home Points: Transplenic and transhepatic access may be used for portosystemic shunt creation when PVT is present, including extrahepatic target veins.

Urinary tract intervention

P-637

The Hub Suture: a novel technique for securing a nephrostomy tube to reduce drain dislodgement

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Purpose: Nephrostomies are commonly performed procedures, associated with a risk of bleeding, infection and renal injury. Dislodgement of nephrostomies is a common occurrence. The Hub Suture is a locally conceived alternative fixation method. It consists of four knots with two points of contact between suture and drain. The aim of the Hub suture is to reduce the number of nephrostomies that are dislodged.

Materials and Methods: An ex-vivo test was performed to assess four different drain fixation methods; no external fixation, adhesive dressing fixation, adhesive dressing and wrap-around suture, adhesive dressing and Hub Suture. The horizontal force required to dislodge a drain secured by each method was calculated using a force Newton (N) meter. A retrospective audit of all nephrostomy insertions performed at Royal Berkshire hospital between 1/1/2019 - 31/12/2019 was conducted to evaluate how many nephrostomies were dislodged. All nephrostomies performed after 15/5/2020 were sutured in place using the "Hub Suture" method. A re-audit was then performed to evaluate how many nephrostomies were dislodged between 15/5/2020 - 31/12/2020.

Results: The ex-vivo test revealed 21.6 N of force was required to dislodge un-sutured locked drain with or without adhesive dressing. The wrap-around suture required 29.4 N. The Hub suture required more than 49.1 N of force to dislodge the drain, and the drain only dislodged when the suture material fractured.

The initial audit showed 21 out of 131 nephrostomies were dislodged (16%) using conventional drain fixation methods. Following introduction of the Hub suture, only 1 out of 73 nephrostomies were dislodged (1%).

Conclusion: A nephrostomy secured with a Hub suture requires a far higher force to remove than other fixation methods tested. By incorporating a Hub Suture for fixation, the rate of dislodgement, in our series, was markedly reduced. A Hub suture should be considered to secure all percutaneous drains.

P-638

Postembolization syndrome after prostatic artery embolization: a systematic review

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Purpose: Postembolization syndrome (PES) is the most common side effect of vascular embolization of solid organs. The syndrome is

characterized by influenza-like symptoms, pain, nausea, and in the case of prostatic artery embolization (PAE), dysuria and transient worsening of lower urinary tract symptoms (LUTS). The purpose of this review was to determine the incidence of PES and its individual components after PAE.

Materials and Methods: A systematic review with a pre-specified search strategy for PubMed, Embase, Web of Science and Cochrane Library was performed according to PRISMA guidelines (PROSPERO ID: CRD42020164472). Studies in English regarding PAE in humans with 10 or more participants were eligible for inclusion. No restrictions on participant demographics or PAE technique were imposed. Due to study heterogeneity meta-analysis was not possible. The results for overall PES frequency and individual PES components were presented as median [interquartile range, (IQR)].

Results: The search returned 378 references, of which 32 studies with a total of 2,116 patients met the inclusion criteria. Overall median PES frequency was 25.5% [12.5 – 45.8]. The most frequent individual PES components were dysuria/urethral burning and local pain, with a median frequency of 21.7% [13.8 – 33.3] and 20% [5.4 – 29.4], respectively. Most outcome measured were characterized by a marked lack of uniformity.

Conclusion: This systematic review showed a lack of consistency in reporting the symptoms of PES after PAE across studies. A more uniform reporting system is warranted to better discriminate PES from infection, minimizing hospital admissions and antibiotic overuse.

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Intravesical prostatic protrusion does not influence the efficacy of rostatic artery embolization

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Purpose: To compare the outcomes of prostatic artery embolization (PAE) in patients with different intravesical prostatic protrusion (IPP) grades.

Materials and Methods: This retrospective single-center study included 128 patients (aged 50–86 years) who underwent PAE from 2013 to 2017. IPP grades were classified as follows: grade I (<10 mm), grade II (10–19 mm), and grade III (20 mm). Nineteen patients (14.8%) had grade I [mean IPP 7.8 mm, prostatic volume (PV) 64.1 cm³], 77 (60.2%) had grade II (mean IPP 14.9 mm, PV 87.0 cm³), and 32 (25%) had grade III (mean IPP 26.2 mm, PV 132.6 cm³), P<.01. The outcomes, including PV, international prostate symptom score (IPSS), and quality of life (QoL), were compared between the IPP grades at the 12-month follow-up. Clinical failure was defined as IPSS >7 or QoL >2.

Results: IPP decreased (I: 8.2%, II: 27.3%, and III: 38.7%, P=.01), and all other endpoints improved (P<.01). Adjusted covariance analysis, considering baseline PV as a confounding factor, showed no correlation between the 12-month outcomes and baseline IPP. Clinical failure was observed in 17/128 patients (13.3%) and was similar in prevalence among the IPP groups (P=.20). Minor complications occurred in 43 patients (33.6%) and major in 3 (2.3%). There were statistical differences in the complications between IPP grades II and III (P<.01).

Conclusion: PAE was similarly effective in all the IPP grades at the 12-month follow-up, and there was no difference in the clinical failure between the groups. Complications in IPP grade III were more frequent than those in IPP grade II.

P-640

Transperineal laser ablation of the prostate for benign prostatic hyperplasia

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Purpose: This study evaluates the safety and efficacy of transperineal laser ablation of the prostate (TPLA) as an ultrasound-guided percutaneous laser ablation therapy to treat lower urinary tract symptoms (LUTS) due to benign prostatic hyperplasia (BPH). We describe an early series of 12 patients receiving TPLA as treatment for LUTS/BPH.

Materials and Methods: Patients with LUTS from BPH completed the International Prostate Symptom Severity Score, Sexual Health in Men and Quality of Life questionnaires (IPSS, SHIM, and QoL, respectively) both before and after TPLA. The TPLA procedure involved transrectal ultrasound guidance during transperineal placement of up to four 21 gauge needles in the peri-urethral transitional zone region 1 cm away from the urethra and the bladder. 300 um laser fibers were positioned just past the needle tips. The Echolaser XVG system (Elasta srl, Calenzano, Italy) delivered power to each probe at 3-5 watts. Each ablation required deposition of 1800 Joules per fiber which was repeated after fiber pull-backs depending on the size of the gland. A urinary catheter was left in place for 2-4 days after the procedure.

Results: Average energy emitted during ablation was 12.8 kJ with an average ablation time of 17.6 minutes. Three-month follow-up demonstrated significant IPSS improvement with an average decrease in score of 9.8 points (pre-procedure average of 18.45 +/-6.6 and post procedure average of 7.6 +/-6.1). There were no significant effects on erectile function or complications other than limited hematuria.

Conclusion: TPLA is a safe outpatient approach to treating symptomatic BPH and results in significant improvement in LUTS at lower cost and morbidity compared to traditional therapies.

P-641

Five-year experience and outcomes of percutaneous antegrade renal transplant ureteric stenting and balloon stricturoplasty for benign ureteric strictures

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Purpose: To report outcomes of staged percutaneous nephrostomy, balloon stricturoplasty and 3 month temporary antegrade ureteric stenting in the management of benign renal transplant ureteric strictures.

Materials and Methods: Retrospective data was collected between 2015 and 2020, using hospital databases. Technical success, complications, re-intervention rates and outcomes were analysed.

Results: 37 patients underwent procedures between 2015 and 2020. The median interval from transplant to nephrostomy was 138 days. There was 100% success at nephrostomy placement. Following nephrostomy insertion median reduction in creatinine was 97µmol/L (p<0.005), and mean percentage reduction in creatinine was 42%.

All strictures were located at the vesicoureteric junction. Antegrade stenting failed in 8% (3/37).

The major complication rate following nephrostomy insertion was 14% (5/37), due to nephrostomy dislodgement requiring reinsertion (n=3) and infection requiring hospitalisation (n=2). The complication rate of patients undergoing stricturoplasty and stenting was 5% (2/37), which were all minor complications.

Median patient follow up was 37 months. Of the 34 cases who successfully underwent stenting, 62% (21/34) had successful treatment, with no need

for further repeat intervention or surgery. 38% (13/34) required repeat intervention. 6 (18%) subsequently required surgical ureteric reimplantation attempts. There was no graft loss or patient death within 30 days following intervention. 15% (5/34) developed graft failure in the follow up period, biopsy confirmed only one patient developed graft failure resulting from obstruction.

Conclusion: Ureteric stricture dilatation and antegrade stenting has a low complication rate and when successful, 82% of patients avoided reimplantation surgery.

P-642

Interventional radiology management of ureteral iatrogenic leakage after gynecologic surgery

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Purpose: To evaluate safety, efficacy, and reliability of interventional radiology procedures in the treatment of gynecologic iatrogenic urinary leaks.

Materials and Methods: Under ultrasound (US) and fluoroscopy guidance, an attempt to place ureteral stent and nephrostomy was carried out in the same session through an antegrade percutaneous approach. At the end of any procedure a fluoroscopic control and a cone-beam CT scan (CBCT) were performed to check the correct placement and functioning of nephrostomy and DJ stent.

In cases of difficult ureteral stent placement through the single antegrade approach the collaboration of Urologists was requested to perform a rendez-vous technique, combining retrograde approach.

Results: Restoration of the integrity of ureter was achieved in 12/15 patients. In 1/15 patients despite leakage resolution at 6 month-follow up (FU) it was decided to surgical management due to refractory mid ureteral stenosis and in 2/15 patients surgery was needed due to ureterovaginal fistula.

No major complications were recorded overall minor complications occurred in 4/8 patients.

Conclusion: Percutaneous minimally invasive treatment of iatrogenic ureteral lesions after gynecological surgery is a safe and effective option.

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Antegrade double J stent implantation as an alternative to retrograde approach: experience of the first 150 cases in a single center in Brazil

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Purpose: Our objective was to present the clinical result, including technical success and complications of the first 150 cases of double J stent antegrade implant (DJSA) performed in a research center in interventional radiology in Brazil.

Materials and Methods: Retrospective review of the electronic medical records of patients who underwent DJSA between January 2016 and August 2020. All patients included in this retrospective study were referred to the department of interventional radiology (IR) for the treatment of ureteral obstruction. The urology service referred to the IR service if the retrograde implant failed, or if the urology service was not available. Patients were classified into two main groups: malignant neoplasia and non-neoplastic disease.

Results: Of the 150 procedures, 143 were performed with technical success (95.3%) and there were failures in 7 (4.7%), with 2 DJ catheter migrations, with unsatisfactory urinary drainage, verified 24 h after the procedure, and 5 failures technicians for non-progression of the catheters. Our complication rates were 8% (12/150), with 2 classified as major and 10 classified as minor. The major complication (perirenal hematoma) required blood

transfusion and prolonged hospital stay. Minor complications occurred in ten patients (low back pain was the most frequent cause).

Conclusion: In the absence of any clinical contraindications and in view of the availability of an interventional radiologist team, the DJSA can be adopted as a routine approach for the treatment of benign or malignant ureteral obstruction, especially for cases where there is a failure in the antegrade approach by the urology team.

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Percutaneous ablation in renal cell carcinoma: when, what, how and why should we use?

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Learning Objectives: To review clinical and technical considerations to percutaneous ablation of renal cell carcinoma (RCC) and to discuss potential complications.

Background: Nowadays, with the rising incidental detection of renal cell carcinomas (RCC) with cross-sectional imaging, minimally invasive nephron-sparing therapies became the standard of care. Besides partial nephrectomy remains the gold standard, percutaneous renal ablation represents a valid treatment option for patients with stage T1a RCCs, namely indicated in the presence of comorbid conditions that would increase the risk the surgical intervention, single functioning kidney, impaired renal function (GFR<60 ml/min per 1.73 m²) and more than one small renal tumor.

Clinical Findings/Procedure Details: RCCs in Stage T1a (≤ 4 cm in greatest dimension, limited to the kidney) present the best scenario for percutaneous thermal ablation. However, patient age, life expectancy, comorbidities, renal function, and the risk of metachronous lesions also influence the technical and functional outcomes. Radiofrequency ablation, cryoablation, and microwave ablation are all appropriate modalities; the choice is made based on preprocedural assessment and operator experience. Adjunctive techniques (as fluid, air or CO₂ dissection and preoperative embolization) are sometimes required for an optimum outcome. Complications of renal mass ablation have a low incidence and are classified according to the Clavien–Dindo system from I to V.

Conclusion: Percutaneous image-guided renal ablation represents a safe and effective nephron-sparing therapy of T1a RCCs, with excellent long-term outcomes (with an improvement of quality of life and life expectancy of patients) and low complication rates.

P-645

Percutaneous image guided cryoablation of small renal masses in the Northern Ireland Cancer Centre

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Learning Objectives: To review image-guided small renal mass percutaneous cryoablation, evaluating demographic and technical aspects as well as efficacy, safety and follow up.

Background: Electronic and imaging records of 165 consecutive patients who underwent cryoablation for small renal cell carcinoma in the Northern Ireland Cancer Centre between November 2016 and November 2020 was undertaken. Patient demographics and comorbidities, tumor morphology, technical success and patient outcomes were reviewed.

Clinical Findings/Procedure Details: A total of 178 T1 renal lesions were treated using ultrasound and CT guided cryoablation with mean follow up of 12.2 months (range 2-31 months). The mean age of the patients

was 68.6 years (range 39-90 years). The average size of the lesions treated measured 2.7 cm (range 1.2-6.1cm).

Concurrent biopsy and adjunct techniques were performed in 85% and 18% of cases respectively. There were major complications (Clavien-Dindo grade >III) in 3% of cases. There was increased complication rate with lesions that crossed >2 polar lines, located in the upper renal pole as well as increased number of ice probes used.

Multimodality follow up included triple phase CT, MRI and contrast enhanced US. There was an average increase in creatinine levels of 5 ummol/L on follow up renal function tests. The mean hospital stay was 0.47 days (range 0-17 days). Primary control (imaging absence of residual non-ablated disease, disease recurrence or metastatic disease) was achieved in 95% of patients, increasing to 98% after the 2nd treatment.

Conclusion: Image guided percutaneous cryoablation is a safe and effective technique for treating small renal lesions with excellent renal function preservation.

P-646

Prostatic artery embolization: intraprocedural monitoring with contrast-enhanced ultrasonography

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Learning Objectives: To demonstrate the technique, findings, contribution and limitations of intraprocedural, contrast-enhanced ultrasonographic (CEUS) monitoring of prostatic artery embolization (PAE).

Background: CEUS is a flexible, safe and affordable modality, suitable for the study of early perfusional changes that occur in parenchymal organs during interventional procedures. Thanks to these features, CEUS is utilized for intraprocedural monitoring of PAE, albeit not as a standard procedure.

Clinical Findings/Procedure Details: Transabdominal CEUS with the standard (intravenous) route of administration of the echo-enhancer can be performed in the angiography suite, shortly after injection of the embolic material, to demonstrate the prostatic infarcts which appear post embolization. In case of inadequate infarction despite apparent angiographic flow stasis in PA, a re-evaluation of flow with angiography and a search for additional feeders should be considered. Transabdominal CEUS of the prostate can also be performed during injection of diluted echo enhancer through the microcatheter, to confirm that the selected artery actually feeds the prostate. Enhancement of neighbouring organs can be appreciated, if a non-prostatic branch has been selected, or when parts of these organs share the same arterial supply with the prostate. This technique could prevent some cases of non-target embolization. However, CEUS has many of the limitations of conventional ultrasound and cannot be applied to all PAE patients.

Conclusion: CEUS appears to be a feasible adjunctive modality for intraprocedural monitoring of PAE, with many clinically relevant findings.

P-647

Percutaneous nephrostomy in the non-dilated system: the role and technique of utilising DynaCT needle-tracking software in securing successful access

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Learning Objectives: Indications for percutaneous nephrostomy (PCN) insertion in a non-dilated pelvicalyceal system.

The role and optimal technique of using DynaCT needle-tracking software as an adjunct to established techniques, increasing the success rate of accessing a non-dilated system

Background: PCN is a frequently indicated procedure, typically used to decompress an obstructed renal collecting system. PCN may be indicated in a non-dilated system, particularly in the setting of:

Distal ureteric fistula/leak

Refractory Haemorrhagic cystitis

Calyceal access for removal of complex stones in a non-dilated system

Acute non-dilated renal failure

Clinical Findings/Procedure Details: PCN in a non-dilated collecting system can be technically challenging; however, there are a number of techniques which can be implemented to maximise success rates. We describe the optimal use of DynaCT's needle tracking software during PCN in non-dilated systems, utilising its soft tissue and 3D imaging capabilities intraprocedurally to facilitate uncomplicated calyceal puncture. Its use will be described in the context of previously documented techniques including standard calyceal puncture with ultrasound-guidance using anatomic landmarks or microbubble contrast-enhancement, fluoroscopic techniques such as puncture following intra-procedural IV pyelography, the two-needle puncture and double contrast techniques. Other approaches, including CT-guidance and combined procedures with urology providing endoureteric access will be described for context.

Conclusion: PCN insertion in a non-dilated system can be of significant benefit to the patient- in particular for urinary diversion in the setting of a distal ureteric fistula/leak. Dyna-CT has a role in increasing the procedure's success rates.

P-648

Renal transplant complications: the role of the interventional radiologist

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Learning Objectives: Understand the surgical technique and types of anastomosis in kidney transplantation

Review common and not so common complications after renal transplant
 Detect and analyze useful imaging findings in the diagnosis of complications after transplantation

Describe the interventional radiologist role in the management of complications associated with renal transplantation

Background: Kidney transplantation is the treatment of choice in patients with end-stage renal disease over peritoneal dialysis and hemodialysis. The increase in this type of surgery has improved the style and quality of life of patients, however, there is the possibility of developing complications, therefore role of the interventional radiologist is important to detect and offer minimally invasive management of such complications for an adequate patient outcome.

Clinical Findings/Procedure Details: Surgical technique in kidney transplant

Complications:

- Vascular: renal artery stenosis and thrombosis, renal vein thrombosis, and iliac artery stenosis; pseudoaneurysm; arteriovenous fistula
- Renal parenchyma: infection/abscess; rejection
- Collecting system: ureteral obstruction/stenosis
- Perinephric: urinoma, hematoma, lymphocele

Conclusion: Knowing, identifying, and analyzing each possible complication after kidney transplantation is part of the role of the interventional radiologist, however much of its strength lies in offering a minimally invasive treatment which is increasingly being accepted by other physicians and by the patients themselves, to give an alternative besides surgery, and an early solution to the complication that is presented.

P-649

Uretero-iliac fistula – the overlooked diagnosis? A one in four case report with treatment via the endovascular route

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Clinical History/Pre-treatment Imaging: A 64-year-old female patient with a history of pelvic radiotherapy for endometrial cancer with relapse 5 months ago was admitted for massive macroscopic haematuria. A double J stent had been placed for the first time in the left ureter four years ago due to renal congestion. Contrast-enhanced CT detected a peri-nephric and iliopsoas hematoma on the left with no obvious bleeding source.

Treatment Options/Results: Via a right retrograde common femoral approach, diagnostic angiography of the left renal and left pelvic arteries showed no source of active bleeding. After crossover maneuver and placing the catheter next to the double J stent manual contrast injection revealed a uretero-iliac fistula with retrograde filling of the ureter and renal pelvis. Endovascular treatment consisted in implantation of a balloon-expandable covered stent (6x29 mm) in the left external iliac artery successfully excluding the fistula.

Discussion: Uretero-iliac fistula poses a rare, but life-threatening condition in literature. However, in only four consecutive months four cases of uretero-iliac fistula were diagnosed at our department, indicating a higher occurrence than the so far worldwide reported approximate 200 cases. All our patients had in common a prolonged use of ureteral catheters and either a pelvic radiotherapy or a history of vascular or cancer surgery.

Take-home Points: Uretero-iliac fistula is a difficult to diagnose pathology that increased attention should be paid to in the case of macroscopic haematuria especially if there has been prolonged use of ureteral catheters, pelvic radiotherapy, or vascular/cancer surgery. Endovascular stent placement is a safe and easy treatment option.

P-650

IR assisted cystoscopic recanalisation of an occlusive urethral stricture in a 1-year-old child with previous ano-rectal malformation

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Clinical History/Pre-treatment Imaging: Patient A was born with an ano-rectal malformation consisting of an imperforate anus and rectovesical fistula. As part of the workup he had a micturating cystogram which had shown the rectovesical fistula but an otherwise normal urethra. He successfully underwent a posterior sagittal anorectoplasty (PSARP). However, at the time of surgery, it was difficult to pass a urethral catheter and so a supra-pubic catheter was sited. Subsequent cystogram and retrograde urethrogram showed a stricture at the junction of the posterior and penile urethra with no contrast passing through the stricture. Attempted urethrotomy via cystoscopy was unsuccessful.

Treatment Options/Results: The patient underwent a combined IR/urology procedure. A scope was passed through the cystostomy into the proximal urethra followed by a guidewire under fluoroscopic guidance to probe the urethral passage. There was no route through the stricture. A scope inserted from the penile end identified the guidewire indenting a membranous structure (Fig 1). A small incision was made in the membrane using a deflux needle passed through the scope, allowing the guidewire passage through the membrane to achieve through and through access (Fig 2). After sequential dilatation, a 10Fr urethral catheter was successfully sited.

Discussion: To the best of our knowledge, a combined IR/urology approach to an occlusive paediatric urethral stricture has not previously

been described. In this case, it prevented the need for urethroplasty a significant open procedure with increased risks.

Take-home Points: Collaborative working amongst specialities with simple but innovative techniques should always be considered as this may obviate more complex procedures.

Venous intervention and IVC filters

P-651

Bleomycin for percutaneous sclerotherapy of venous and lymphatic malformations: a retrospective study of safety, efficacy and mid-term outcomes in 26 patients

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Purpose: Percutaneous sclerotherapy is used to treat venous and lymphatic vascular malformations, which can cause significant discomfort and/or disfigurement. The purpose of this study is to describe the bleomycin sclerotherapy technique and to evaluate its clinical and radiological efficacy and safety.

Materials and Methods: We retrospectively identified consecutive patients with venous malformations (VMs) and lymphatic malformations (LMs) who underwent bleomycin sclerotherapy in 2011-2020 at our institution. We collected the clinical and radiological success rates, complications, and recurrences separately in the VM and LM groups.

Results: We identified 26 patients, 15 with VMs and 11 with LMs. The significant volume reductions obtained were 45% in the VM group and 76% in the LM group ($P=0.003$ and $P=0.009$, respectively). Significant reductions in discomfort/pain and in cosmetic disfigurement were obtained in both groups. An overall improvement was reported by 69% and 82% of patients in the VM and LM groups, respectively. No major complications occurred during the mean follow-up of 51 ± 34 months in the VM group and 29 ± 18 months in the LM group. A recurrence developed within 2 years in 23% of patients.

Conclusion: Bleomycin is clinically and radiologically effective for the treatment of venous and lymphatic malformations, with a high level of patient safety.

P-652

Braided nitinol stent for chronic iliofemoral venous disease – the real-world BLUEFLOW registry

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Purpose: In patients with previous iliofemoral deep vein thrombosis (DVT) chronic persistent venous outflow obstruction (CVOO) is still frequent and post-thrombotic syndrome is a common complication. Thus, we aimed to evaluate effectiveness and safety of a novel nitinol braided venous stent for treatment of CVOO.

Materials and Methods: Consecutive patients who underwent venous recanalization with the blueflow Venous stent for non- or post-thrombotic CVOO were eligible for inclusion in our retrospective, single arm, single center, observational study. Effectiveness outcomes were primary patency and change in the revised venous clinical severity score (rVCS) and the clinical score of the comprehensive classification system for chronic venous disease (CEAP) at 6- and 12-month follow-up. Safety outcomes were recurrent DVT, clinically driven target vein revascularization, index limb major amputation, or death.

Results: A total of 67 participants (50.7% female, aged 46.7 ± 18.1 years) who underwent blueflow Venous Stent implantation between were enrolled. Twelve-month primary patency was 91.7% in non-thrombotic, and 72.6% in post-thrombotic disease (log-rank $p=0.14$). Median rVCS

improved from 8 at baseline to 4 at 12 months ($p < 0.001$) with a substantial clinical improvement of ≥ 2 points in 86.1%. No significant association of rVCS improvement with thrombotic pathogenesis could be found. Median clinical CEAP score improved from 3 (IQR: 3–3) to 2 (IQR: 3–2), $p > 0.001$. No safety signal occurred.

Conclusion: blueflow Venous Stent implantation for the treatment of iliofemoral CVD was associated with promising patency and clinical improvement over the short-term.

P-653

Short-term efficacy and safety of ClotTriever mechanical thrombectomy of ilioacaval and iliofemoral deep vein thrombosis

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Purpose: To determine the safety and efficacy of ClotTriever mechanical thrombectomy of subacute/chronic ilioacaval and iliofemoral deep vein thrombosis (DVT).

Materials and Methods: Between August 2019 and March 2021, 16 patients (3 male, average age 58, range 22–84 years) with ilioacaval ($n=10$) or iliofemoral ($n=6$) DVTs underwent Inari® ClotTriever® mechanical thrombectomy as the primary method to relieve subacute/chronic lower extremity venous thrombosis.

Average blood loss, stent use, thrombolytic use, adjunct thrombectomy, anticoagulation, complications, and patency/symptomatology (at 1 month) were documented. Malignancy and COVID-19 status were noted. 31% of these patients were COVID-19 positive and 44% had known malignancies at the time of the procedure.

Results: All procedures were technically successful (100%) at restoring lower extremity venous patency with minimal blood loss and without significant procedure-related complications. Confirmed re-occlusion within 1 month occurred in 25% of cases. The cases with re-occlusion were either COVID-19 positive or had known malignancy, and one case was unable to tolerate anticoagulation. 8 (50%) interventions required stenting due to likely vessel damage related to chronic thrombosis. Thrombolysis was performed in 19% of the cases. Adjunct thrombectomy was performed in 19% of cases. 38% of these cases were performed with proximal embolic protection. Of the patients with 1 month follow up, 78% reported improved/resolved symptoms.

One complication occurred and was likely related to the patient's critical status and unrelated to device use.

Conclusion: Single session ClotTriever mechanical thrombectomy is a safe and effective method for removing thrombus and restoring short-term patency to subacute/chronic ilioacaval and iliofemoral DVTs. Further investigation is required to establish longer-term data.

P-654

Re-audit of IVC filter retrieval practice at a tertiary vascular centre

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Purpose: Long-term placement of retrievable IVC filters is associated with complications, therefore removal should be carried out as soon as the patient is no longer at risk of pulmonary embolism. Following a previous audit at our institution which showed that only 58% of eligible patients underwent attempted IVC filter retrieval, an IVC filter database was introduced. The primary aim of this 're-audit' was to measure its impact on filter retrieval rates. Secondary aims were to analyse indications, dwell time and complications.

Materials and Methods: Retrospective audit of IVC filter retrievals over a 3-year period (2017–2020) using the IVC filter database and electronic hospital records. Comparison with previous audit (2013–2017) was performed. Audit targets were set at 100% attempted retrieval rate and 80% retrieval success rate.

Results: 98 IVC filters were inserted during the audit period. Indication was planned major surgery in patients with confirmed venous thromboembolism, in 55%. 33 patients were excluded from analysis (death, failure to attend appointments, decision to leave the filter in permanently, or ongoing clinical review). Of the 65 remaining eligible patients, filter retrieval was attempted in 60 (92%), with a retrieval success rate of 100% (58% and 95% respectively in previous audit). An advisory on filter retrieval was present in 80% of procedural reports (70% in the previous audit). Mean dwell time was 177 days. Complication rate was 3%.

Conclusion: The introduction of an IVC filter database maintained by the Interventional Radiology department was associated with a significant improvement in filter retrieval rate (92% vs 58%).

P-655

Legacy IVC filter project: an institutional, hospital wide multidisciplinary approach to addressing chronic indwelling IVC filters

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Purpose: Chronic indwelling inferior vena cava filters (IVCF) are associated with significant complications. Current guidelines recommend removal as soon as clinically appropriate. The aim of this study was to retrospectively review the outcomes of a hospital-wide multidisciplinary quality initiative to manage unretrieved chronic indwelling IVCF placed at a single institution.

Materials and Methods: Multidisciplinary project to identify and contact all patients with chronic indwelling IVCF from 2008–2016. Deceased patients and those with documentation of IVCF removal were excluded. Eligible patients were sent a letter describing their indwelling IVCF and current recommendations for IVCF retrieval due to possible complications. Patients were offered clinic visits with interventional radiology or vascular surgery to evaluate for possible filter removal. Patient demographics, IVCF specifics, response rate, clinic follow up, retrieval rate, and complications were analyzed.

Results: Of 1083 patients, 317 were deemed eligible and contacted. The letter response rate was 32% (101/317). Of the patients who responded, 75% (76/101) were seen for follow up and 61% (62/101) underwent new imaging evaluation. Using a combination of standard and advanced techniques, 36 chronic indwelling IVCF were successfully retrieved (36/38 attempted) with a 95% success rate. Retrieved IVCF had a median dwell time of 103 months. There were no procedural complications during filter retrieval.

Conclusion: An institutional, multidisciplinary quality initiative resulted in identification and recapture of patients with chronic indwelling IVCF while demonstrating high IVCF retrieval success rates. Results validate that an institutional effort is feasible to increase the retrieval of chronic indwelling IVCF.

P-656

Aspiration thrombectomy versus catheter-directed thrombolysis in initial endovascular treatment of iliac venous thrombosis

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Purpose: To compare the disease-free rate of aspiration thrombectomy as an initial approach for endovascular treatment of iliac venous thrombosis compared to catheter-directed thrombolysis.

Materials and Methods: We retrospectively analyzed 141 patients (male 51, female 90, mean age 61.8 years) who underwent endovascular procedures to treat iliac venous thrombosis from January 2007 to

December 2019 in one tertiary medical center. For a comparative analysis, the patients were divided into two groups based on types of the initial treatment; group A had catheter-directed thrombolysis first, and group B had aspiration thrombectomy first. Homogeneity tests between the groups were performed on sex and age by using Chi-square test and t-test, respectively. Contrast-enhanced computed tomography (CT) examinations of every patients covering the iliac veins were evaluated and disease-free intervals of all cases were estimated according to the method of Kaplan-Meier and compared by log-rank test.

Results: There was no heterogeneity in distributions of the sex (Chi-square test; $p=0.430$) and age (t-test; $p=0.271$) of the patients in each group. Overall disease-free rates at 24 months were 45.4% in A group and 15.7% in B group (Kaplan-Meier analysis). The differences between cumulative survival rates were significantly different (log-rank test; $p=0.001$).

Conclusion: The disease-free rate of aspiration thrombectomy as an initial approach for endovascular treatment of iliac venous thrombosis is lower than that of catheter-directed thrombolysis.

P-657

Complication and retrieval rate of IVC filters: a retrospective single centre audit at a trauma centre

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Purpose: VTE is a significant cause of morbidity and mortality. IVC filters provide VTE prophylaxis in a select group of patients. Advances in filter design have caused a shift in practice. As more filters are inserted complications have become more widely recognised. We present our evaluation of the major and minor complication rates of insertion and retrieval of IVC filter from 2015-2020 within a large teaching hospital.

Materials and Methods: Gold standards were based on data from a previous paper looking at IVC filter insertions and retrievals across three UK centres ($n=516$) over 12 years (Hammond et al., 2009) and the BSIR IVC filter registry (Uberoi, BSIR 2013):

Significant insertion complications: $<0.4\%$

Significant retrieval complications: $<1\%$

Removal of device within 3 months in $\geq 80\%$, where indicated for removal In line with the literature, major complications were defined as death, major bleeding requiring intervention or pulmonary embolism (excluding delayed).

We used CRIS to find all IVC filter insertions and removals at our centre between 2015-2020 and audited a representative sample (one third) of these.

Results: We analysed 147 cases of IVC filter insertion and 84 of retrieval. The major complication rates were 1.4% for insertion and 1.2% for retrieval. Minor complications most commonly encountered were tilting and blocked access. Post-insertion 28-day mortality was 8%, broadly in line with previous studies, reflecting the patient cohort.

Conclusion: Audit of our local IVC filter practice demonstrated 1.4% and 1.2% major complications for insertion and retrieval, in line with previous studies.

Filter tilting complicates around 5% of insertions and 10% of retrievals.

P-658

A systematic review of the safety and efficacy of stenting of the inferior vena cava

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Purpose: Stenting of the IVC is a procedure growing in popularity for treatment of acute and chronic obstructions, however there are no devices currently licensed for use in the IVC and systematic reviews on

the topic are lacking. This study aimed to undertake a systematic review of the literature and metanalysis to determine the safety and efficacy of IVC stenting in adult patients.

Materials and Methods: The Medline and Embase databases were searched for studies reporting outcomes for safety and effectiveness of IVC stenting for any indication in series of 10 or more patients. Reference lists of included studies were also searched.

Results: Twenty-three studies were included describing outcomes for 1,177 patients. Indications for stenting were malignant IVC syndrome (208 patients), thrombotic disease (575 patients), Budd-Chiari syndrome (364 patients) and IVC stenosis post liver transplantation (30 patients). The male: female ratio was 2.2:1 and the median age ranged from 30-61. The studies were too heterogenous for a formal metanalysis. Technical success ranged from 85%-100%, primary patency from 45-87% and cumulative patency from 77-97%. Major complications were rare, with pulmonary embolism, stent migration and major bleeding reported in 0.002%, 0.009% and 0.006% patients respectively. Symptomatic improvement was inconsistently reported.

Conclusion: Stenting of the IVC has a high rate of technical success with low incidence of serious complications. Primary patency is variable in a heterogenous patient group, however cumulative patency is acceptable regardless of the indication for stenting. Standardisation of outcome measures for symptom improvement is required to fully evaluate treatment effects.

P-659

A single center 9-year experience in IVC filter retrieval: the importance of an IVC registry

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Purpose: To evaluate Inferior vena cava (IVC) filter retrieval practices over a 9-year period at an academic hospital with a prospectively maintained database. A primary aim of assessing retrieval rates with secondary endpoints including insertion indications, retrieval plans, dwell time, failed retrievals and causes of permanent filters.

Materials and Methods: An IVC filter registry was maintained prospectively within our institution. We reviewed cases between August 2011 and June 2020, following filter status, retrieval plans, and eventual retrieval date. The validity of the database was compared with a Picture Archiving and Communication System and electronic patient records.

Results: 343 patients had IVC filters inserted. Three filter types were used, Celect (Cook Medical) in 189, Gunther Tulip (Cook Medical) in 65, ALN (ALN) in 89. 196 filters were retrieved, 103 were made permanent, 31 died before retrieval, and 13 were yet to be retrieved. Retrieval rates were 85% overall (78% for GT, 93% for Celect and 83% for ALN). The mean dwell time for successful retrieval was 59 days with the majority of insertions (85%) removed in under 100 days. Failed retrieval occurred in 23 patients, 43% were retrieved at second attempt and 57% were unsuccessful. 13 (4%) patients were loss to follow up, of those 9 (69%) had unspecified retrieval plans at the time of insertion.

Conclusion: A prospective database transfers the responsibility of filter retrieval onto the Interventionalist implanting the device and allows for areas of clinical improvement to be identified. Improved retrieval practices contribute to therapeutic outcomes and reduces medicolegal repercussions.

P-660

Percutaneous transluminal angioplasty for symptomatic hepatic vein-type Budd-Chiari syndrome: feasibility and long-term outcomes

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Purpose: To determine the feasibility, clinical effectiveness, and long-term outcome of percutaneous transluminal balloon angioplasty (PTBA)±stenting in hepatic vein (HV)-type Budd-Chiari syndrome (BCS).

Materials and Methods: We retrospectively identified 51 patients (31 female, mean age 27.2±9.1 years) with symptomatic short segment (≤ 30 mm) HV-type BCS who underwent PTBA±stenting between October 2014 and January 2019. Data on the baseline characteristics, technical success, clinical success, complications, and long-term outcomes were analyzed.

Results: Technical success rate was 94.1% (48/51). Thirty-two patients underwent PTBA and 16 patients underwent HV stent. Clinical success rate was 91.7% (44/48) 4 weeks following angioplasty. The mean follow-up duration was 40.1±16.8 months (CI 35.2–45, range 8.8–81.67 months). Nine patients underwent reintervention (5 underwent HV stent insertion and 4 underwent TIPS), six due to restenosis/occlusion of the HV (4 patients were primarily managed with PTBA and 2 with HV stent) and 3 patients with clinical failure (refractory ascites/collaterals despite patent HV). The mean primary patency duration was 64.6±19.9 months (CI 58.5–70.8, range 1.2–81.7 months). The cumulative 1-, 2-, and 5-year primary patency rates were 85.4, 74.5, and 58.3%, respectively. The cumulative 1-, 2-, and 5-year secondary patency rates were 93.8, 87.2, and 75%, respectively. The cumulative 1-, 2-, and 5-year survival rates were 97.3, 94.6, and 92.8%, respectively. Intraoperative bleeding and subcapsular hematoma occurred in 2 patients managed through combined transhepatic-transjugular approach. Clinically insignificant subsegmental pulmonary embolism occurred in 3 patients.

Conclusion: Percutaneous transluminal angioplasty±stenting is an effective and feasible method for endovascular management in patients with HV-type BCS with good long-term patency and survival rates.

P-661

Endovascular techniques for the treatment of superior vena cava syndrome

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Learning Objectives:

1. Define Superior Vena Cava Syndrome (SVCS)
2. Discuss etiologies, diagnosis, and management
3. Demonstrate percutaneous treatment techniques

Background: SVCS results from obstruction of the SVC causing increased upper body venous pressure. Obstruction is due to malignancy in 60% with the remaining cases due to venous stenosis, thrombosis, or inflammatory processes such as fibrosing mediastinitis. Signs and symptoms are related to hemodynamics of elevated venous pressures which may ultimately result in respiratory and central nervous system compromise. Symptoms develop over days to weeks with illness progression dependent upon venous collateral formation. Cross sectional imaging is paramount in diagnosis and treatment planning. Therapeutic options include medical management, radiation, endovascular reconstruction and rarely, surgery. Etiology and symptom severity will determine the best approach for management in each case, but endovascular treatment has become the treatment of choice in the most severe cases.

Clinical Findings/Procedure Details: The gamut of percutaneous treatments for SVCS in both benign and malignant etiologies will be shown.

Interventions ranging from simple balloon venoplasty of a stenosis to complex recanalization and reconstruction using guidewire, radiofrequency wire, or sharp techniques frequently requiring multiple access sites will be demonstrated via case series. Uncovered and covered stent use were employed. Complications including stent thrombosis, stent maldeployment, and SVC rupture will be presented.

Conclusion: Endovascular reconstruction has evolved as first line therapy in the treatment of SVCS. Pre-procedural cross sectional imaging and meticulous planning will lead to the best outcomes. Follow-up is paramount and re-intervention is often necessary.

P-662

What are the endovascular therapy options for superior vena cava syndrome?

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Learning Objectives: To illustrate the management of Superior Vena Cava (SVC) syndrome, with emphasis on indications and techniques of endovascular revascularization (thrombolysis, percutaneous transluminal angioplasty, stenting, and combination of these techniques).

Background: SVC has a critical role in maintaining venous return to the heart from head – neck – upper arms. Its stenosis/occlusion is a source of considerable hemodynamic morbidity.

It can be caused by benign or malignant processes: nowadays, thanks to the improvement of oncological and radiotherapy therapies, the oncological etiology has been reduced. However, the incidence of SVC syndrome caused by iatrogenic etiology, such as multiple catheterizations in dialysis patients, has increased.

The diagnosis of SVC syndrome is primarily clinical. Computed tomography (CT) may be used to identify the etiology, severity and site of obstruction; venography represents the diagnostic gold standard, and it's performed before endovascular treatment.

When the patient has been evaluated clinically and by imaging, therapeutic options range from medical, endovascular, to surgical therapy.

Clinical Findings/Procedure Details: The aim of this paper is to describe SVC syndrome in the following sub-chapters: a) definition, b) classification, c) imaging diagnosis of vascular lesions, d) and discuss the management with emphasis on endovascular procedures.

Conclusion: Endovascular techniques in SVC syndrome provide a safe and effective treatment in symptomatic cases, with a less aggressive approach than surgery.

Furthermore, in dialysis patients, they guarantee the preservation of venous supply and function of arteriovenous fistulas for longer.

P-663

Endovascular treatment for superior vena cava syndrome secondary to cardiac implantable devices leads

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Learning Objectives:

Definition of Superior Vena Cava Syndrome

Signs and Symptoms

The main causes of Superior Vena Cava Syndrome

Treatment

Background: Superior Vena Cava Syndrome (SVCS), is caused by obstruction of the superior vena cava with the following signs and symptoms:

difficulty breathing, headache, facial swelling, venous distention in the neck and distended veins in the upper chest and arms, migraines, large decrease in lung capacity.

As we know, in the majority of the cases, the SVCS is produced by malignant tumors, directly compressing or invading the SVC wall. In the recent years the non-malignant causes has been growing due to more and more cardiac devices implantation.

Clinical Findings/Procedure Details: In the past, the treatment of this pathology was thrombolysis, and in severe cases transvenous leads extraction (TLE) or surgical extraction followed by surgical repairment, which greatly increased the mortality of these patients. In the last decades the treatment of choice is the endovascular approach. For many years the TLE followed by balloon venoplasty was the better outstanding option. In the recent years more and more technics was developed to cross the lesions like venous stenting preceded by predilatation with compliants or noncompliants balloons and even recanalisation therapies like those used for arterial angioplasties by right femoral or right brahial veins punctures.

Conclusion: SVCS is an encountered condition at patients with cardiac implantable devices. New endovascular techniques can resolve this pathology in almost all patients. In a prevention for these complications new devices like leadless pacemakers and subcutaneous ICDs were developed for some suitable patients.

P-664

Endovascular management of accidental arterial placement of central venous catheters

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Learning Objectives: To understand the principles of and current evidence on endovascular management of accidental arterial placement of central venous catheters (CVC)

Background: Accidental arterial catheterisation is a rare but serious complication of CVC placement.

The ongoing COVID-19 pandemic has resulted in a substantial increase in patients requiring intensive care admission and CVC placement. Consequently, the number of observed CVC placement related complications has also increased.

Open surgical access is challenging in the case of subclavian, brachiocephalic and aortic injury, particularly in these critically ill patients, in whom endovascular management may be preferable

Clinical Findings/Procedure Details: In this educational poster we will present:

Endovascular options in terms of closure devices and stent grafting
Anatomical and technical considerations for safe and effective endovascular treatment, with particular focus on preventing cerebrovascular events.
Considerations for bailout management in case of closure device failure.
Latest evidence on endovascular management.

Conclusion: Endovascular treatment of accidental arterial placement of CVC should be considered particularly in critically-ill patients and when surgical access is challenging.

Successful endovascular management requires a multidisciplinary approach with careful pre-procedural planning and imaging. Bailout options including stent grafting and open surgery should be available in case of treatment failure with closure device.

P-665

Pharmacomechanical catheter directed thrombolysis using Merit Fontaine 5F catheter in deep vein thrombosis: study of eight treatment cases and procedure evaluation

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Learning Objectives: To understand the technique, benefits, and safety of pharmacomechanical catheter directed thrombolysis (PCDT). Assessing treatment effectiveness using patient's follow-up data.

Background: PCDT is one of the interventions used in management of an acute proximal Deep Vein Thrombosis (DVT). As a relatively novel minimally-invasive procedure it is often not a modality of preference in favour of more conventional, non-invasive management. While combining pharmacologically mediated thrombus resolution with its immediate removal, PCDT allows patients to be discharged home with patent vessels in a short-term hospitalization. As the two most prevalent complications of DVT: Pulmonary Embolism (PE) and Post Thrombotic Syndrome (PTS), are associated with remaining thrombus, PCDT is being considered to prevent them. Given its potential benefits, effectiveness and safety of PCDT should be further inspected.

Clinical Findings/Procedure Details: A two-step PCDT procedure was conducted on 8 patients hospitalized in University Clinical Center in Gdańsk. Initiated with obtaining venous access and local administration of Actilyse (alteplase) as a thrombolytic agent via Merit Fontaine 5F catheter. Followed by intravenous mechanical thrombus removal day after. In four cases a venous stent was implanted during the second-step procedure. Control phlebography showed sufficient restoration of vessels patency in all cases. Each patient was discharged within 4-7 days with prescribed anticoagulants, compression stockings and a referral for a follow-up appointment. No negative feedback or complications were reported.

Conclusion: PCDT allows quick and effective management of acute proximal DVT, which is a potentially life-threatening condition. Providing thrombus removal, PCDT seems to be preventive against future DVT's complications such as PE or PTS.

P-666

Thoracic outlet syndrome: presentation, etiologies, and interventional radiologist's role

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Learning Objectives:

1. Review the clinical manifestations of thoracic outlet syndrome as well as the pertinent physical exam findings
2. Review the different etiologies
3. Discuss Interventional Radiology's role in the management of this disorder

Background: Thoracic outlet syndrome (TOS) is an all-encompassing term applied to the obstruction of vascular and nervous structures as they cross the thoracic outlet. Patients may present with neurogenic complaints, upper extremity claudication/arterial insufficiency, and most commonly, acute axillo-subclavian venous thrombosis. Patients presenting with primary axilla-subclavian thrombosis, colloquially named Pagett-Schroetter Syndrome, are typically young otherwise healthy athletic individuals. Extrinsic compression resulting in chronic venous stasis accompanied with an acute inciting event or repetitive trauma is the presumed cause of the vascular subtypes of this disease. Classically Interventional Radiology is involved in the diagnostic and early treatment paradigm of this disorder with venography/arteriography and thrombolysis/thrombectomy.

Clinical Findings/Procedure Details: This case series illustrates imaging findings and endovascular interventions on a series of patients presenting with venous thoracic outlet syndrome. We will review relevant anatomy, technical tips, tricks and troubleshooting. Additionally, we will be highlighting post-operative management and complications, including hemothorax and lymphatic injury.

Conclusion: TOS is a syndrome affecting young healthy individuals. It is imperative for the Interventional Radiologist to understand the clinical manifestations, physical exam findings, as well as their role in the multidisciplinary effort to manage of these patients. Chronic disability and poor quality of life may result from untreated or improperly treated cases.

P-667

Endovascular role for management of pelvic congestion syndrome as rare presentation of May-Thurner syndrome

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Learning Objectives:

- 1- definition of May-Thurner syndrome and pelvic congestion syndrome.
- 2- Relationship between May-Thurner syndrome and pelvic congestion syndrome.
- 2_ Endovascular management for pelvic congestion syndrome as a rare presentation from May-Thurner syndrome.

Background: May-Thurner syndrome (MTS) is a rare clinical syndrome, which refers to the compression of the left common iliac vein by right common iliac artery and vertebral body. The result patient likely to get a deep vein thrombosis (DVT) in left leg, and may this thrombus break away and move through the bloodstream to lungs to pulmonary arteries causing pulmonary embolism.

PCS is characterized by pain as well as by the presence of pelvic and vulvar varicosities, and it is a frequently underdiagnosed cause of chronic pelvic pain.

one of rare MTS presentation is pelvic congestion syndrome.

Clinical Findings/Procedure Details: The chronic occlusion of left common iliac vein lead to pelvic collateralization via retrograde flow through the internal iliac veins and cross-pelvic collaterals which appear as pelvic and vulvar varicosities, presented as pelvic congestion syndrome.

We discuss the role of endovascular therapy for patients presenting with MTS causing pelvic congestion syndrome by treating the underlying anatomic abnormality.

Conclusion: PCS is often caused by primary venous insufficiency, but in rare cases, can be caused by MTS. In these patients, it is important to treat the underlying anatomic abnormality to relieve the symptoms. Showing the importance of endovascular management in these patients.

P-668

Embolic agents in male varicocele embolization

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Learning Objectives: To present the state of art about the different classes of embolic agents suitable for the treatment of male varicocele.

Background: Scrotal varicocele represents a relatively frequent pathological condition in the young-adult population, with important implications on quality of life and a significant impact on fertility.

Traditionally, the resolutive treatment of this pathology was based on surgery, but in recent decades endovascular embolization has taken hold on this topic.

Endovascular approach offers the advantages of causing less patient discomfort, rapid recovery, a lower cost and a lower recurrence rate in comparison to surgery.

Clinical Findings/Procedure Details: We classified embolic agents, used in male varicocele, on the basis of their physical state in solid and liquid agents.

Solid agents include devices that provide mechanical embolization; they are distinguished in coils, vascular plugs and balloons. Liquid embolic agents include tissue adhesives, also known as glues (NBCA, or NBCA-MS) and sclerosing agents prepared as foam or liquid (e.g. polidocanol, sodium tetradecyl sulfate, sodium morrhuate), the latter often used in combination with coils and/or balloons (sclero-embolization).

For each embolic agent we described the mechanism of action and the different methods of preparation and injection. Advantages and disadvantages for each agent, complications, success-rate a relapse-rate was also provided.

Conclusion: Endovascular treatment of varicocele appears to be effective, well tolerated and with a low rate of recurrence. The choice of sclerosing agent and technique depends on the preferences of the operator. Our experience shows that sclerosant injection with OB is preferred over diagnostic catheter.

P-669

Endovascular treatment of nutcracker syndrome

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Learning Objectives: Provide, through images from our archive, a review of endovascular therapy for nutcracker syndrome (NS).

Background: Entrapment of the left renal vein (LRV) between the aorta and the superior mesenteric artery (SMA) can cause congestion of the LRV, resulting in pelvic or scrotal varicocele, and a defined set of signs and symptoms (including flank pain, hematuria, proteinuria) that fall below the definition of NS. Surgical treatments are invasive and include renal vein bypass, transposition of the LRV, transposition of the SMA, gonad-caval bypass, while conservative treatment is recommended in patients with modest symptoms. Recently, endovascular treatment has taken on a prominent role.

Clinical Findings/Procedure Details: A preliminary angiographic study of the LRV is performed, with evidence of dilatation of the hilar region, possibly associated with ectasia of the collaterals and gonadal veins, and stenosis at the aorto-mesenteric angle and relief of a significant pressure gradient (> 3 mmHg). After confirmation of NS, under road-mapping guidance with a long sheath and over a stiff-wire a self-expandable stent nitinol is placed at the LRV stenosis. Regarding the size of the stent, oversizing by 20% of the vessel diameter is indicated for engaging the stent at the level of the first order branch of the renal vein; no benefit is recognized from primary venoplasty. Stent migration is the most frequent complication, while other rarer but possible complications are venous thrombosis, ab extrinsic stent restenosis and vessel perforation.

Conclusion: The interventional treatment of NS is effective, well tolerated by the patient, with lower operative risk, more rapid remission.

P-670

Percutaneous intravascular foreign body retrieval: tools and techniques

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Learning Objectives: To review the various tools and techniques available for the safe and effective percutaneous retrieval of intravascular foreign bodies (FB).

Background: To minimize patient morbidity, percutaneous endovascular FB retrieval should usually be attempted prior to considering surgical options. As the call for removal of retrievable vena cava filters continues to increase, knowledge of the various endovascular techniques available for FB repositioning and removal becomes even more valuable.

Clinical Findings/Procedure Details: Attempted retrieval of lost guidewires, catheter fragments, and misplaced/dislodged embolization coils has a very high success rate. Successful removal of retained pacing leads, misplaced/migrated stents, and angioplasty balloon fragments is less likely but still possible in the majority of patients. Use of a safety wire and a large sheath can be very helpful. The most versatile device used for retrieval is the loop snare. A pigtail catheter can be used to safely reposition a migrating wire or catheter fragment from a cardiac chamber or pulmonary artery into the inferior vena cava prior to removal using a snare device. When the hook of a filter is embedded in the caval wall, then a modified loop snare technique that has been called the hangman technique can be used for successful retrieval. Forceps, balloons, baskets/cones, and laser sheaths have also been used for filter removal. Many of the above techniques will be illustrated in this Educational Electronic Poster.

Conclusion: Percutaneous retrieval of intravascular foreign bodies is safe and usually effective. The most commonly used retrieval device is a loop snare.

P-671

Endovascular treatment of complex mediastinal vascular malformations: report of two cases

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Clinical History/Pre-treatment Imaging: We report the cases of two female patients that presented with epigastric pain and thickening of the esophageal mucosa with underlying serpentine vessels at upper gastrointestinal endoscopy. The angiotomography revealed varicose mediastinal vessels, mainly periesophageal, without signs of portal hypertension, leading to the diagnostic hypothesis of arteriovenous malformation.

Treatment Options/Results: In both cases, aortography failed to confirm any arterial feeders. Subsequently, venographies confirmed connections with azygos, left atrium and right pulmonary vein for the first case and with azygos, left phrenic and left pulmonary vein for the second. Inflows and outflows were embolized, frequently changing the flow direction due to the embolizations because of the low pressure of the system. Venous catheterism was the approach for both cases, with an additional transseptal access for case B. Angiographic control demonstrates a satisfactory result, without opacification of the inflows and good retention of the contrast.

Discussion: ISSVA Classification recognizes the anomalies of major named vessels, and the presented cases are consistent with a venous malformation (VM), specifically persistent embryonic veins with complex abnormalities. Management of VMs is challenging and we dealt with rare cases. Treatment usually is made with sclerotherapy, which was not an option because of the large vessels involved and the increased risk of complications.

Take-home Points: Angiography is the gold standard to evaluate vascular malformations flow and also allow further treatment. Use of coils in the treatment of VMs is a good option in cases with large vessels and considerable flow, and it showed to be an effective treatment option for the presented cases.

P-672

COVID-19 infection with upper limb phlegmasia cerulea dolens

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Clinical History/Pre-treatment Imaging: A 61-year-old gentleman with a background of hypertension and COPD presented to our emergency room with sudden onset of right hand pain and swelling. Examination revealed oedema, paraesthesia, purple discoloration and pulselessness. Initial diagnosis was ischaemia and a CT angiogram was requested. This demonstrated patent, tapering, right upper limb arteries. On vascular review phlegmasia cerulea dolens (PCD) was diagnosed. Duplex confirmed extensive thrombus causing complete occlusion of the all the right upper limb veins and collaterals. PCR testing was positive for COVID-19

Treatment Options/Results: Pharmacomechanical thrombectomy of the outflow basilic, axillary and subclavian veins was undertaken using tissue plasminogen activator (tpa) and Angiojet™. This was successful in restoring flow with minimal residual thrombus. A subclavian vein narrowing was successfully ballooned to 8mm. Catheter directed thrombolysis and systematic heparin infusion were administered overnight to promote complete lysis with a good result. Unfortunately, the radiological success did not match the clinical outcome as the hand became gangrenous and eventually amputated.

Discussion: PCD of the upper extremity is a serious complication of DVT that usually occurs in patients with significant comorbid conditions such as advanced malignancy. It has only been described a handful of lower limb cases in the context of COVID-19. This is the first COVID-19 case of PCD of the upper limb

Take-home Points: The triad of swelling, cyanosis and pain is characteristic of PCD and should not be mistaken for arterial ischaemia. The pattern of immune thrombosis state associated with COVID results in rare and unusual thromboembolic clinical presentations

P-673

Bizarre inferior vena cava anatomy as a cause of massive deep vein thrombosis

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Clinical History/Pre-treatment Imaging: A 43 yo male athletic patient without any previous pathological conditions experienced worsening orthostatic dyspnea and bilateral legs swelling.

Ultrasound and angio-CT of the abdomen showed bilateral massive deep vein thrombosis (MDVT) with dilatation of infrarenal inferior vena cava (IVC) and bilateral iliac-femoral axis; only a circumscribed subsegmental pulmonary embolism (PE) was detected.

Treatment Options/Results: A peri-interventional caval filter (Capturex, Straub Medical) was released in the suprarenal IVC from jugular approach. Bilateral venous groin access from which catheter-directed mechanical thrombectomy (Aspirex S 10 F, Straub Medical) was performed.

The procedure was stopped when both a satisfactory bilateral iliac-femoral recanalization and increasing blood loss of the patient (about 700 ml) were assessed.

Infusive fibrinolytic therapy was then started from the femoral access. The next day, a caval-CT and a phlebography highlighted the presence of a "hard to classify" caval malformation, in our opinion related to an incomplete fusion of the different embryological segments of the iuxta-renal IVC.

Complete venous recanalization was achieved.

Patient was discharged with no symptoms, under oral anticoagulant therapy.

Discussion: MDVT such as this case need to be treated promptly due to extremely high risk of massive PE, unlikely complete recanalization of medical therapy alone and the consequent risk of post-thrombotic syndrome sequelae.

Take-home Points: When treating MDVT, pulmonary protection is mandatory; Capturex is the most effective intraprocedural caval filter due to tight mesh design.

The bizarre caval anatomy we observed seemed to be both causal of MDVT and protective for PE.

P-674

Mechanical thrombectomy for postpartum endometritis-related iliofemoral thrombosis

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Clinical History/Pre-treatment Imaging: A 32-year-old woman presented 14 days after C-section with fever, aches, fundal tenderness, and right-sided pelvic pain. Tests indicated leukocytosis, with WBC 11.7. CT imaging demonstrated an occlusive right iliofemoral DVT and gonadal vein thrombosis. Endometritis was suspected. Heparin and ampicillin-sulbactam were initiated, however pain worsened following anticoagulation. Doppler ultrasound revealed occlusive thrombus in the right external iliac and common femoral veins.

Treatment Options/Results: Mechanical thrombectomy with ClotTriever was selected due to worsening pain on anticoagulation and contraindication to catheter-directed thrombolysis. Right popliteal vein access was obtained, and intravascular ultrasound (IVUS) defined thrombus and showed marked wall thickening of the right common and external iliac veins. Four passes with ClotTriever were performed. During thrombectomy the patient became febrile with rigors and tachycardia; demerol, cefazolin, and IV fluids were administered. Balloon angioplasty was performed and IVUS demonstrated patent lumen with persistent mural thickening but no residual thrombus. Post-thrombectomy venogram revealed wide patency and brisk transit through the previously-thrombosed segment. Symptoms resolved within 48 hours of the procedure. The patient was discharged on Lovenox and remains symptom-free.

Discussion: DVT cranial to the inguinal ligament warrants intervention to prevent post-thrombotic syndrome. This patient had septic thrombophlebitis related to postpartum endometritis and became transiently septic during the procedure despite minimal ClotTriever manipulation. Alternative thrombectomy methods such as rheolytic thrombectomy are much more disruptive and have the potential to cause profound sepsis in this patient population.

Take-home Points: In a patient with DVT related to active infection and a contraindication to thrombolysis, ClotTriever removed thrombus and prevented profound sepsis.

P-675

Spontaneous hepatic subcapsular hematoma with secondary thrombosis of inferior vena cava: thrombectomy and IVC filter

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Clinical History/Pre-treatment Imaging: Female patient, 40 years old, with no morbid history. Consultation in the emergency department for pain in the right upper quadrant. Echotomography and computed tomography showing extensive hepatic subcapsular hematoma without active bleeding although compression of the inferior vena cava. Tratamiento inicial no fue quirúrgico neither intervencional radiology. After a month of follow-up, he had abdominal pain, showing thrombosis of the inferior vena cava on computed tomography.

Treatment Options/Results: The patient was referred to the interventional radiology department, where it was planned install a vena cava filter over the renal veins, endovascular thrombolysis and drain the hepatic subcapsular hematoma to decrease the compression of the inferior vena cava and thus increase the outflow.

Angiographic control the next day without signs of inferior vena cava thrombosis, so 6 days later the vena cava filter was removed. Control at 5 months shows no signs of new thrombosis or significant compression of inferior vena cava.

Discussion: Spontaneous hepatic haemorrhage is a rare condition and was historically poorly recognized and infrequently diagnosed in patients presenting with shock, capsule of Glisson and the liver parenchyma and frequently located around the right lobe (about 75 % of cases). Conservative therapy (defined as active resuscitation with blood product replacement) results in control of bleeding in almost half of the patients. In this case, the patient had the complication of inferior vena cava thrombosis secondary to compression thrombosis, which was resolved with interventional radiology techniques without surgery.

Take-home Points: Treatment of complication hepatic subcapsular hematoma can be carried out with innovative techniques of IR

P-676

May-Thurner stent-associated contralateral DVT treated with mechanical thrombectomy, stent rupture, and ilio caval reconstruction

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Clinical History/Pre-treatment Imaging: A 22-year-old postpartum female was treated with anticoagulants for left lower extremity DVT. Three months later, she represented with left lower extremity DVT, attributed to smoking and contraception, and underwent pharmacomechanical thrombolysis, left iliac venoplasty and stenting. She remained on anticoagulation for 18 months, then discontinued.

Three years later she presented with symptoms and noticeable discoloration on the right. Ultrasound and CT venogram revealed extensive contralateral right lower extremity DVT to the level of the stent, which completely covered the right common iliac vein. Therapeutic heparin was initiated with minimal benefit.

Treatment Options/Results: The patient was brought to the interventional suite and placed supine in frog-leg position in preparation for mechanical thrombectomy with the ClotTriever System. Right internal jugular (IJ) and bilateral popliteal accesses were established, and a 12F sheath was advanced from the IJ beyond the iliac confluence. While thrombus was being extracted from the right iliac vein, the IJ sheath was used to protect the ClotTriever basket from the existing stent. Simultaneous balloon angioplasty followed by bicaval kissing stent reconstruction were then performed. The patient experienced rapid resolution of lower extremity pain and edema.

Discussion: Precise placement of iliac venous stents is necessary in May-Thurner patients. The lesion must be covered, however, this predisposes the patient to future contralateral iliofemoral thrombosis, as with this patient who presented 3 years after initial stenting.

Take-home Points: Mechanical thrombectomy and ilio caval reconstruction was successfully performed through an existing stent. Care must be taken to avoid entanglement of the ClotTriever thrombectomy device in existing stents and filters.

P-677

FlowTriever pulmonary embolectomy after recent single lung transplant

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Clinical History/Pre-treatment Imaging: A 69-year-old man with interstitial lung disease presented for scheduled pulmonary rehabilitation following single left lung transplant 10 weeks before. He reported acute exertional dyspnea and difficulty walking into the hospital. Oxygen saturation was near 80%. CTA showed large thrombus burden in the transplanted left pulmonary arteries (PAs) with suspected impending pulmonary infarct, but no right heart strain.

Treatment Options/Results: Due to risks associated with the transplanted lung and lack of pulmonary reserve, the case was referred to interventional radiology to consider catheter-directed therapy for pulmonary embolism (PE). Pulmonary angiography confirmed a large embolus in the main left PA, extending into the lower lobe, with no right lung involvement. PA pressures (PAP) were relatively normal (25 mmHg). To extract the thrombus, FlowTriever mechanical thrombectomy was pursued. Volume-controlled aspirations with the 24F Triever24 in the left lobe successfully removed thrombus including one large, organized thrombus. On-table heart rate and blood pressure improved (73 to 64 bpm; 100/56 to 115/61 mmHg) with perfusion restored to the left lung. An IVC filter was placed due to a small amount of lower-extremity thrombus.

At 3-week follow-up, ventilation-perfusion scan revealed normal perfusion of the treated lung.

Discussion: Lung transplant recipients are at high risk for PE and subsequent pulmonary infarction. Despite presentation with normal PAPs and no right heart strain, the extent of thrombus burden and lack of pulmonary reserve led to aggressive treatment with FlowTriever.

Take-home Points: FlowTriever quickly removed thrombus, restored lung perfusion, normalized hemodynamics, and avoided thrombolytics in a lung transplant patient.

P-678

IVUS and fluoroscopy guided complex IVC filter retrieval and ilio caval reconstructionJ. Kim, E. Knavel Koepsel, M. Woods, P. Laeseke
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Clinical History/Pre-treatment Imaging: A 69 year old male underwent a failed retrieval attempt of a chronically embedded Cook Select IVC filter at an outside hospital 5 months prior to presentation. He now presented with worsening scrotal and lower extremity edema from a long segment stenosis of his infrarenal IVC and both common iliac veins secondary to the filter.

Treatment Options/Results: The IVC filter was successfully retrieved using fluoroscopic and intravascular ultrasound (IVUS) guidance. Initial venogram demonstrated an embedded filter with severe caval stenosis and multiple collaterals. On IVUS, the filter hook was noted to be embedded within eccentric chronic clot and scar tissue (Figure). The tines were visualized penetrating through the caval wall and with severe caval narrowing and significant chronic clot. During the retrieval, the relationship of the forceps to the apex and hook of the filter could be monitored in real-time. The forceps were used to free the filter hook. Post retrieval, IVUS was utilized to evaluate the size and landing zone of the bare metal stent used to treat his IVC stenosis. Additional stents were placed in the bilateral iliac veins. After stent placement, stent patency and inline flow were confirmed on IVUS and venography (Figure).

Discussion: The forceps and state of the filter (embedded filter hook and strut penetration) could be well visualized IVUS.

Take-home Points: Standard IVC filter retrievals may not benefit from IVUS, but it is feasible to use IVUS during complex retrievals to guide

retrieval techniques (eg, forceps) in real-time and subsequent venous reconstruction.

P-679

Retrieving the unseen: thinking outside the box

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Clinical History/Pre-treatment Imaging: Gentleman with a background of infertility and left sided varicocele. Planned for varicocele embolization.

Treatment Options/Results: Right femoral vein access with venogram confirming left sided varicocele and a collateral vein arising from the mid segment. Successful coil deployment in the distal left testicular vein. Whilst attempting to place coil within the proximal segment, the coil self-detached proximal to distal radio-opaque marker of the pusher assembly, and unravelled. Whilst attempting to retrieve, the coil fractured in layers leading to microfilaments which were not fluoroscopy visible. CT confirmed an unravelled coil in the left testicular vein with microfilaments extending from the coil to the right femoral vein. A second procedure via jugular venous access resulted in partial fragments retrieval. Post-procedure CT demonstrated fractured dislodged coil fragments, with one fragment extending from the IVC to the right heart and another fragment in the pulmonary vein. As microfilaments were not fluoroscopy visible, via right femoral venous access a new "spooling" technique was devised. Whereby the snare catheter was spun in the locations identified on CT to wrap the microfilament threads around the snare, thereby retrieving all the fragments.

Discussion: Non-targeted deployment is a known coil's use complication, however self-detachment in this manner had not been previously encountered in our centre. One of the challenging aspects was that the fractured fragments were not fluoroscopically visible but were radiopaque on CT, however the spooling technique enabled successful retrieval.

Take-home Points: Be creative in thinking when using standard endovascular equipment for achieving a unique goal.

P-680

Renal cell carcinoma with extensive caval thrombosis: combined management, endovascular and open surgical technique with the use of a temporary atrial caval filter (Capturex)

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Clinical History/Pre-treatment Imaging: The most common cause of neoplastic thrombotic infiltration of the inferior vena cava is renal cell carcinoma, with a reported rate of 4% to 10%. Despite higher risks of perioperative complications compared to typical radical nephrectomy, surgical resection and tumor thrombectomy in patients with renal cell carcinoma and tumor thrombus offers a potential survival advantage. We present a case of a patient with massive RCC with extensive tumor thrombus involving inferior vena cava (IVC).

Treatment Options/Results: Prior to surgical resection, a renal artery embolization (RAE) was performed in order to reduce the risk of intraoperative bleeding. Subsequently, we performed a combined endovascular and open surgical approach, consisting in nephrectomy, liver derotation and vena cava thrombectomy, with the support of a temporary inferior vena cava filter, positioned at the atrial-IVC junction in order to protect against thromboembolism during the procedure.

Discussion: Due to the extension of the tumor in the retrohepatic tract of the IVC up to 2 cm from the right atrium, the use of Capturex device has allowed us to perform the cavotomy more safely, reducing the high risk of pulmonary embolism. Capturex has an internal 6 Fr shaft that allowed us to insert telescopically an additional catheter through which an intraoperative phlebography was performed, without moving the filter.

Take-home Points:

- The use of a novel temporary caval filter (Capturex) have reduced the risk of intraoperative thromboembolic dissemination.
- Capturex, in addition to its protective function, allow to perform other diagnostic or interventional procedure thanks to its 6 Fr working channel.

P-681

Inferior vena cava obstruction: endovascular stenting as palliative treatment in a non-surgical oncologic patient

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Clinical History/Pre-treatment Imaging: 73 years-old male with previous pancreatic adenocarcinoma treated with duodeno-cephalo-pancreatectomy (DCP) and chemotherapy presented with abdominal distension, swollen legs, scrotal edema and dyspnea. Abdominal ultrasound showed diffuse ascites, peritoneal carcinosis and liver metastasis.

MDCT-scan described a polilobular mass infiltrating and sub-occluding inferior vena cava (IVC) at renal veins confluence suspected for recurrence of primary malignancy.

Because of disease stage and comorbidities, multidisciplinary team (MDT) agreed for IVC endovascular stenting as palliative treatment of choice.

Treatment Options/Results: Patients underwent diagnostic cavography by a 9F right common femoral vein access that showed IVC occlusion and hypertrophic right lumbar plexus and azygos system.

IVC recanalization was performed via angioplasty balloon and subsequently VBX stent-graft positioning.

Final cavography confirmed right stent placement and IVC recanalization with normalized trans-stent pressure gradient.

48 hours after treatment, clinical improvement was shown with reduction of general edema.

Discussion: IVC compression can be caused by primary or metastatic neoplastic disease of near organs (renal, pancreatic and hepatic malignancies). IVC compression can cause IVC syndrome due to reduced venous return to the heart: lower limbs edema, ascites, tachycardia, hypotension, till altered mental status and death.

US or MDCT could be useful to identify IVC syndrome etiology (IVC compression or IVC occlusion e.g. thrombosis)

Treatment options varies from surgery, chemotherapy, radiation or endovascular stenting.

IVC stenting could be a palliative treatment in non-surgical patients to increase the patency of IVC and alleviate symptoms.

Take-home Points: Endovascular stenting for IVC occlusive disease is a safe, effective, palliative treatment with low morbidity in non-surgical oncologic patients.

P-682

Endovascular repositioning for a spontaneous delayed migration of port catheter tip into the right jugular vein

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Clinical History/Pre-treatment Imaging: A 10-year-old boy who was diagnosed with acute myeloid leukemia and required chemotherapy treatment. Port-catheter was inserted intra-operatively by the vascular surgeons and post-operative chest x-ray confirmed the normal position of the catheter tip in the superior vena cava (SVC). Chemotherapy was commenced through the port which was used also for administration of other medications. Two months later, routine chest x-ray incidentally

discovered migration of the catheter tip into the superior part of the right jugular vein reaching to the level of the skull base.

Treatment Options/Results: As the patient was on ongoing chemotherapy, preservation of the port was needed. Endovascular repositioning was decided. Under conscious sedation, single right femoral vein puncture was performed, A 5-Fr pigtail catheter was inserted over a 0.035-inch guide wire and advanced to the right jugular vein to hook the migrated catheter tip. After few trials, successful repositioning of the catheter tip into the SVC was achieved. The port catheter maintained its normal position after two months of follow up.

Discussion: Migration of port catheter is a recognized complication; however, delayed migration is quite uncommon, and the underlying mechanism is not clearly understood. In asymptomatic patients without other complications, preservation of the central line is preferred. Open surgical retrieval may be indicated when the catheter is broken or after failure of percutaneous retrieval.

Take-home Points: Endovascular management of migrated central venous catheters is a safe and minimally invasive procedure that allows maintaining the functioning line and decreases the need of invasive surgical approaches.

P-683

Unrecoverable IVC filter with extensive chronic thrombus and venous congestive symptoms

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Clinical History/Pre-treatment Imaging: 53-year-old male with prior history of:

1. Acute complicated diverticulitis (2018)
- PO Sigmoidectomy + descending colostomy + Hartmann procedure
2. Intermediate-risk of pulmonary embolism
- Heparin-induced thrombocytopenia
3. Deep vein thrombosis in the left tibial, popliteal, and femoral veins
- IVC filter placement (2018)
- PO of two failed IVC filter removal attempts (2018 and 2019). Second attempt (2019) led to a chronic thrombosis of the IVC with formation of collateral venous circulation and congestive venous symptoms.
4. Obesity grade 2

Treatment Options/Results: It was decided to perform angioplasty of both, the IVC and the filter and stent placement inside the filter. Patient has presented clinical improvement. Subsequent controls will be carried out to assess patency of the inferior vena cava.

Discussion: We present a case of a complex removal vena cava filter, which on its second attempt in 2019 formed a thrombus that remained and spread despite anticoagulant treatment, conditioning after one year congestive venous symptoms to the patient. Unusual treatment with IVC angioplasty and stent placement across the filter, in order to reduce the symptoms.

In complex cases of IVC filter removal with chronically obstructed IVC placing a stent along the filter is a safe option that reduces the patient's symptoms; however, it should not be our first therapeutic option and should be reserved for difficult cases.

Take-home Points: IVC filters should be removed as soon as the patient status and criteria allow them.

Complex cases of IVC filter removal with chronically obstructed IVC, placing a stent across the filter is a safe option

P-684**Catheter directed thrombolysis in case of IVC and renal vein thrombosis****B. Jeevanandham***Radiology and Interventions, SRM Medical College and Hospital, Bodinayakanur, IN*

Clinical History/Pre-treatment Imaging: 32 year old with history of right loin pain and hematuria. He had history of right leg deep vein thrombosis 1 year back and on oral anticoagulant therapy.

On ultrasound right kidney was edematous with no caluli / hydronephrosis. Doppler showed normal right main renal flow however, no flow was identified in main and segmental renal veins.

Patient had elevated D-Dimer of 2400 and INR of 2.2 with increased prothrombin time. CECT showed thrombus in left lower pulmonary artery with no right ventricle strain.

CT confirmed the right renal vein thrombosis with partial non occlusive thrombus in IVC.

Treatment Options/Results: Patients creatinine was raised from 0.7 to 1.3 on 3rd day. Since worsening renal function parameters, it was decided to do thrombectomy of RVT.

Chronic thrombosis of right common and superficial femoral veins were observed.

Hence left common femoral vein was accessed.

Right renal vein was accessed using cobra catheter. Maceration of thrombus was done with 0.5 mg of alteplase and 4 mm balloon. Mechanical thrombectomy was done with guiding catheter.

Post procedure venogram showed patent right renal vein with good flow and resolution of IVC thrombus was also noted.

Patient renal functions were improved with normalization of creatinine.

Discussion: Percutaneous catheter-directed thrombectomy with or without thrombolysis for acute renal vein thrombosis is associated with a rapid improvement in renal function and low incidence of morbidity.

Take-home Points: Percutaneous treatment for acute renal vein thrombosis with thrombectomy and thrombolysis can be done in clinically warranted situations.

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