

Abstracts

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21st European Congress of Trauma and Emergency Surgery

April 24–26, 2022
Oslo, Norway

Congress President
Christine Gaarder
Oslo, Norway

Welcome note

Dear colleagues, dear friends,

The European Congress of Trauma and Emergency Surgery (ECTES) 2020 was to take place in Oslo, on April 26–28, and we had finalised a great programme for what was going to be the most multidisciplinary ECTES to date. Like similar congresses all over the world, the Corona virus outbreak sadly forced us to postpone the Oslo meeting first to 2021 and then to 2022. In the meantime, ECTES 2021 was run as a successful virtual meeting that was well attended.



Finally, ESTES is delighted to welcome you all to the first physical ECTES since 2019, and we do hope to see you soon; at the 21st ECTES from April 24–26, 2022 in Oslo, Norway.

ESTES is focusing on the critically ill and injured surgical patients, with ECTES as the arena bringing personnel groups together in a multidisciplinary environment to improve, optimise, inspire, recruit, and provide possibility for networking and learning from each other. Similar to previous editions of our congress, the ECTES will retain its international character in 2022 by hosting over 40 sessions with numerous speakers from all over the world. ESTES is looking forward to offering a platform to experts in all areas of trauma and emergency surgery. We will host a number of guest symposia including several international scientific societies like IATSIC, DGU, ATLS, ATCN, AO Trauma, and with Brazil as our guest nation.

We are lucky to work in a field that is both diverse and dynamic. Many different innovations and improved treatment strategies have been implemented over the last decades for the benefit of our patients. Our five sections, Emergency Surgery, Disaster & Military Surgery, Skeletal Trauma and Sports Medicine, Visceral Trauma and Polytrauma, as well as the Permanent Education Committee are preparing an exciting and interdisciplinary programme.

Oslo is a city on the rise and a capital world-famous for peace politics, where people with diverse backgrounds exchange ideas and develop modern solutions. Oslo can present pioneering architecture and is surrounded by beautiful nature and sporting. We proudly welcome you to a metropolis so compact that international restaurants and great attractions are always just around the corner.

We are looking forward to welcoming you in Oslo for ECTES 2022.

Christine Gaarder

Congress president ECTES 2022

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Contents

S4 Oral Presentations

Oral Presentation

SKELETAL

OP 01

Prognostic factors and quality of life after pelvic fractures. The Brabant Injury Outcome Surveillance (BIOS) study.

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Introduction: Pelvic fractures might have long-term consequences on Health-related-Quality-of-Life (HRQoL). The main purpose of this study is to provide insight into short-term HRQoL in the first year after pelvic injury and identify short-term prognostic factors of decreased outcome.

Material & methods: This is a prospective, observational, multi-center, follow-up cohort study in which HRQoL and functional outcome was assessed during 12 months follow-up within injured adult patients admitted to 1 of 10 hospitals in the county Noord-Brabant, the Netherlands. Data was collected by self-reported questionnaires at 1 week (including preinjury assessment), and 1, 3, 6 and 12 months after injury. EuroQoL-5D (EQ-5D), Visual Analog Scale (VAS), Merle d'’aubigne Hip score (MAH) and the Majeed Pelvic Score (MPS) score were used. Multivariable mixed models were used to examine the course of HRQoL, prognostic factors for a decreased HRQoL and functional outcomes over time.

Results: 184 patients with pelvic fractures were identified between 2015 and 2016; 71 Tile A, 44 Tile B and 10 Tile C fractures, and 59 acetabular fractures. At pre-injury, 1 week, 1, 3, 6 and 12 months after injury, the mean EQ-5D Index was respectively 0.90, 0.26, 0.45, 0.66, 0.77 and 0.80 and the mean EQ-VAS was respectively 83, 45, 57, 69, 75 and 75. At 6 and 12 months after injury ceiling effects were noticed regarding the different MPS and MAHS dimensions. The pre-injury score was an important prognostic factor for a decreased HRQoL. Females and patients with a higher ISS were associated with a lower score on the EQ-5D VAS ($\beta = -6.66$), ($\beta = -7.09$).

Conclusions: Patients with pelvic fractures experience a reduction of their HRQoL. Most patients do not achieve their pre-injury state of HRQoL within 1 year after trauma. Prognostic factors for decreased HRQoL are a low pre-injury score, higher ISS and female gender. We do not recommend the MAHS and MPS in the mid/long-term follow-up of pelvic fractures.

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OP 02

Predictors for mortality over time in geriatric hip fracture patients

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Introduction: Due to an aging population, the incidence of geriatric hip fractures in older patients has increased in developed countries

over the past decades and will continue to increase in the future. Risk factors associated with mortality after hip fracture include: older age, male sex, cognitive impairment including dementia, living in an institutional care facility, comorbidities and a higher ASA. The significance of these risk factors for mortality is likely to vary during follow-up after hip fracture. These variations play a vital role in prognosis after hip fracture. Identification of the associated effect of time on risk factors for mortality and in-hospital complications could help guide medical decision making and it could enhance personalized treatment plans for patients undergoing hip fracture surgery.

Material & methods: All patients with a hip fracture aged 70 years or above admitted to our hospital between the 1st of January 2016 and the 26th of May 2018 were included in this retrospective study. The primary outcome was mortality after 1 year. Secondary outcomes were mortality after 30 days, 90 days, 2 years, and complications during hospitalization. Kaplan Meier curves for risk factors were generated to measure and visualize the probability of survival over time

Results: A total of 685 patients with geriatric hip fractures were included with a 1-year mortality of 27%. The study population consisted of 190 (28%) males and 495 females with a median age of 85 (80–90), in total 27% of the patients were diagnosed with dementia. The adjusted odds ratios (AOR) found differ over time. Five risk factors for mortality investigated in this study differed over time; age, pre-fracture living situation, dementia, ASA classification and sex.

Conclusions: Five risk factors for mortality and their impact over time with a were visualized for geriatric patients with a hip fracture. The variation in effect observed in these risk factors play a vital role in prognosis. Especially the first 90 days after trauma are critical for the geriatric patient in terms of mortality. Shared decision-making could be supported by using these risk factors for a more tailored medical treatment for geriatric patients with a hip fracture.

Fig. 1

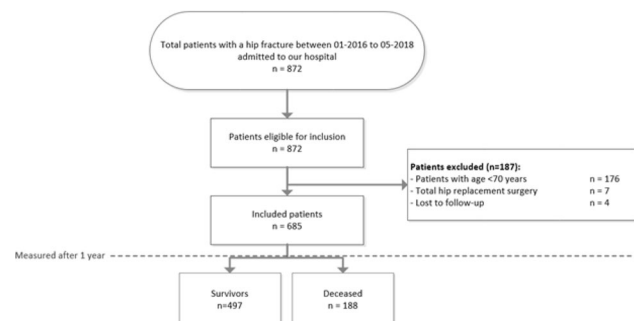
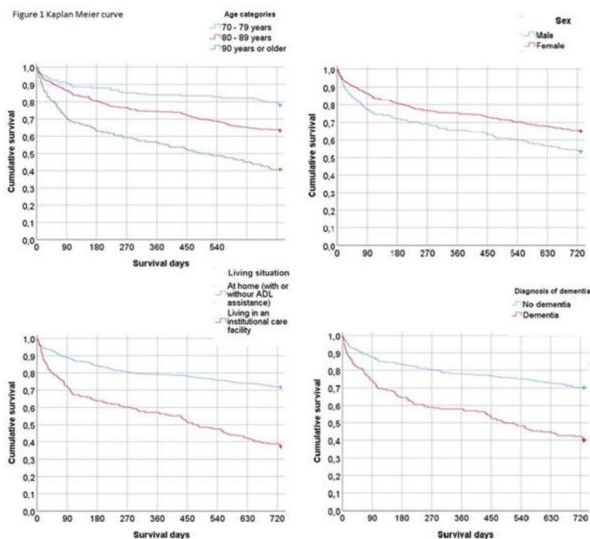


Fig. 2



OP 03

Epidemiology of pelvic fractures in Belgium

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Introduction: Fractures of the pelvis and acetabulum are associated with osteoporosis, and their incidence is rising in older adults. In the last decade an increasing number of these fractures are being operated in older patients in certain regions. The goal of this study was to describe the incidence of pelvic and acetabular fractures in Belgium between 1988 and 2018.

Material & methods: This retrospective, nationwide, population-based study was conducted with the help of the national health insurance database from the Belgian National Institute for Health and Disability Insurance (NIHDI-RIZIV-INAMI). Multiple codes that are used for the reimbursement of the diagnosis and treatment of pelvic and acetabular fractures were linked to the patients' age group, sex and region.

Results: Between 1988 and 2018, 91.317 pelvic and acetabular fractures were diagnosed. The age-adjusted incidence increased from 15,8/100.000 persons per year in 1988 to 29,7/100.000 persons per year in 2006 and to 37,6/100.000 persons per year in 2018. The fracture incidence showed a bimodal incidence, with a small peak in children (particularly boys), and an increasing incidence in older adults, particularly in women. Between 2006 and 2018, 5.957 patients underwent surgical treatment for their pelvic fracture. 2.088 patients underwent an osteosynthesis of the acetabulum and 3869 patients underwent an osteosynthesis of the pelvic ring. There were 3622 osteosyntheses (60,8%) in patients younger than 60 years old and 2335 (39,1%) in patients over 60 years old.

Conclusions: There is an increasing incidence of pelvic and acetabular fractures in Belgium with the majority of these fractures occurring in older people. Younger adults have the highest proportion of surgical treatment, but given the much higher incidence in older adults, there is a considerable amount of operations in older adults too.

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Fig. 1

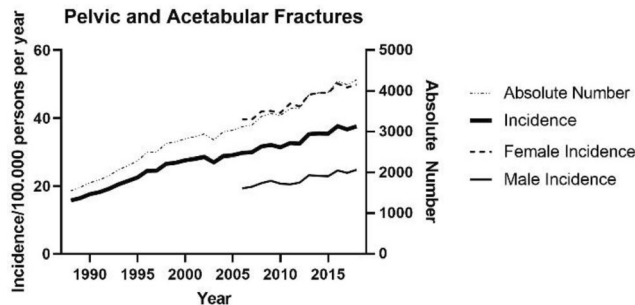
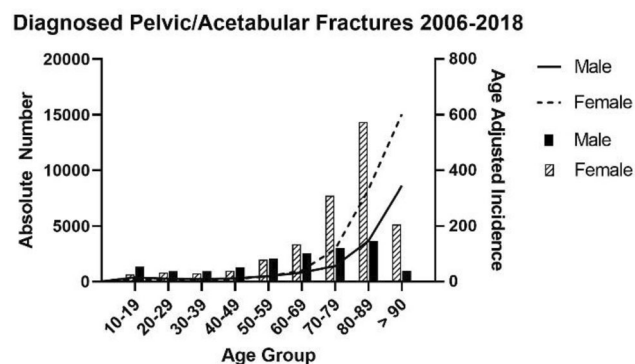


Fig. 2



OP 04

Mode of anesthesia is not associated with adverse outcomes following emergency hip fracture surgery: A population-level cohort study

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Introduction: Hip fractures often occur in frail patients with several comorbidities. In those undergoing emergency surgery, determining the optimal anesthesia modality may be challenging, with equipoise concerning the superiority of either spinal or general anesthesia. In this study we investigated the association between mode of anesthesia and postoperative morbidity and mortality.

Material & methods: This is a retrospective study using all consecutive adult patients who underwent emergency hip fracture surgery in Örebro County, Sweden, between January 1, 2013, and December

31, 2017. Patients were extracted from the National Quality Registry for Hip Fracture (RIKSHÖFT), and their electronic medical records were reviewed. The association between the type of anesthesia and postoperative severe complications (Clavien-Dindo \geq 3a) and 90-day mortality was analyzed using a Poisson regression model with robust standard errors, while the association with post-operative mortality up to 1-year was analyzed using Cox proportional hazards model. All analyses were performed while adjusting for relevant demographic, preoperative comorbidities, specific fracture type, surgical method, as well as other clinical characteristics.

Results: A total of 2437 hip fracture cases were included in the study, of whom 60% received spinal anesthesia. There was no statistically significant difference in the risk of severe complications [adj. IRR (95% CI): 1.24 (0.85–1.82), $p = 0.273$], 90-day postoperative mortality [adj. IRR (95% CI): 0.88 (0.70–1.11), $p = 0.281$], or 1-year postoperative mortality [adj. HR (95% CI): 1.13 (0.96–1.33), $p = 0.155$] when comparing general anesthesia with spinal anesthesia.

Conclusions: The mode of anesthesia used for emergency hip fracture surgery was not associated with either postoperative severe complications or mortality up to 1-year postoperatively.

OP 05

Delirium after hip surgery for proximal femoral fractures in elderly patients: risk factors and clinical outcomes

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Introduction: The most frequent postoperative complication after hip fracture surgery in elderly patients is a delirium¹. Delirium is associated with prolonged hospital admission and impaired functional and cognitive recovery. The aim of this study was to identify risk factors for delirium during admission for hip fracture surgery.

Material & methods: All consecutively admitted patients with a surgically treated proximal hip fracture in two level II trauma teaching hospitals between 1 January 2018 and 11 January 2021 were included in this prospective cohort study. Delirium was diagnosed by an observational judgment by geriatric medicine specialists combined with the Delirium Observation Screening Scale.

Results: In total 2051 patients were enrolled in this study of which 326 patients (16%) developed a delirium during hospital stay. Multivariable logistic regression showed a significant association between delirium and age (OR 1.07, $p < 0.001$), female gender (OR 0.50, $p < 0.001$), dementia (OR 1.63, $p = 0.001$), Parkinson's disease (OR 2.44, $p < 0.001$), KATZ-ADL score (OR 1.07, $p = 0.02$), infection during admission (OR 3.64, $p < 0.001$) and haemoglobin loss (OR 1.20, $p = 0.013$). Patients with a postoperative delirium had a significant longer admission duration (9 (6–14)days versus 6 (4–9)days). Also, patients with delirium had significant higher in-hospital (10% vs. 2%, $p < 0.001$), 30-day (16% vs. 6%, $p < 0.001$) and 1-year mortality (42% vs. 22%), $p < 0.001$.

Conclusions: Risk factors for development of delirium during admission were age, male gender, dementia, Parkinson's disease, KATZ-ADL, infection during admission and haemoglobin loss. Patients with delirium had longer hospital admission and higher in-hospital, 30-day and 1-year mortality.

References: ¹ de Jong L, van Rijckevorsel VAJIM, Raats JW, Klem TMAL, Kuijper TM, Roukema GR. Delirium after hip hemiarthroplasty for proximal femoral fractures in elderly patients: risk factors and clinical outcomes. *Clin Interv Aging* 2019 Feb 26;14:427–435.

OP 06

3D imaging added value in the assessment of displaced intra-articular calcaneal fractures

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Introduction: Surgeons who specialize in calcaneal fracture agree that in most patients surgical managements yield the best result. Functional outcome is largely dependent on preventing complications and restoring anatomy of the calcaneus.

Stephan (2013) described a computational tool that performed several measurements on 3 D reconstruction images of healthy pairs of feet of patients. He found symmetrical values, and therefore he proposed the use of these 3 D measurements to assess the quality of the calcaneal reduction, by comparing the 3 D reconstruction images of the treated bone to its uninjured counterpart. His automated algorithm proposes “to quantify the integrity of the joint surfaces of the calcaneus.” Another study on healthy feet found symmetry (Misselyn 2018). We used one of these measurements, the orientation angle of the posterior subtalar joint facet of the calcaneus (OAC), to assess the reduction quality of calcaneal fractures.

The use of 3 D imaging makes sense: it is very close to the conditions during surgery.

The use of the PTC as anatomical landmark also makes sense: it is a well-known, easily identifiable anatomical structure on 3 D CT images (much harder to recognize on X-ray images) and its congruency must absolutely be restored in order to avoid subtalar osteoarthritis.

The aim of this study is to see if the OAC described by Stephan on healthy feet could be used on fractured calcaneus to assess the quality of the reduction after surgical treatment. After measuring the OAC of the calcaneus after osteosynthesis, a value lower than the uninjured side may imply a worse outcome, while a value close to the uninjured side implies a good outcome.

Material & methods: Bilateral CT scans of fifty-four patients with unilateral displaced calcaneal fracture were obtained before and after osteosynthesis. Orientation angle of the posterior subtalar joint facet (PTC) of displaced intra-articular calcaneal fractures of 54 patients was measured on segmented 3 D images before and after surgery and compared to the uninjured side. This orientation angle (OAC) is the average of every normal vector of each point of the PTC, as compared to the main calcaneal axis (calculated by first principal component analysis). The PTC is a well-known anatomical structure, relatively easy to identify on 3 D imaging.

Results: This OAC angle was low before surgery (mean = 95°, std dev = 6°), statistically significantly different from the uninjured side value, $p < 0.001$. The OAC angle of the operated bone was nearly equal to the uninjured side (mean = 103°, std dev = 5°), without any statistically significant difference between postoperative values and uninjured side values. We found linear correlation between the quality of the reduction when assessed with this OAC and the functional score (AOFAS) (Adjusted $R^2 = 0.62$, $p = 0.04$).

Conclusions: This angle seems to be useful to quantify the quality of the operative reduction of displaced intra-articular calcaneal fractures.

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- Misselyn D, De Buck S, Nijs S, Matricali G, Schepers T. 3D imaging added value in the treatment and diagnosis of displaced intra-articular calcaneal fractures (DIACF): measuring the orientation of the posterior talo-calcaneal facet in the space. *Comput Methods Biomech Biomed Eng*, 2021. <https://doi.org/10.1080/10255842.2021.1946797>

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OP 07

3D assessment of initial fracture displacement of tibial plateau fractures is predictive for risks on conversion to total knee arthroplasty at long-term follow-up

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Introduction: Despite anatomical reconstruction of tibial plateau fractures, early onset osteoarthritis may still occur due to irreversible initial damage to the articular surface. Currently used classification systems and measurement methods are insufficient to assess fracture displacement and inform patients and physicians about prognosis. In this study, a novel 3D measure for fracture displacement is introduced and correlated to risks on conversion to total knee arthroplasty (TKA).

Material & methods: A cross-sectional study was performed including 534 patients treated for a tibial plateau fracture between 2003–2018, with a mean follow-up of 6.7 ± 3.6 years. Fifty-eight (10.8%) patients developed severe posttraumatic arthritis and received a TKA. For each patient, a 3D model was created using the pre-operative CT. The 3D gap area (mm^2) was determined in order to quantify the degree of initial fracture displacement. A critical cut-off value was determined using ROC curves. Multivariate analysis was performed to assess the association of 3D gap area with conversion to TKA. Subgroups with increasing levels of 3D gap area were identified and Kaplan Meier survival curves were plotted to assess native knee survival.

Results: A 3D gap area $\geq 550 \text{ mm}^2$ (critical cutoff value) was independently associated with conversion to TKA (HR 8.4; $p = 0.001$). Four prognostic groups with different ranges of the 3D gap area were identified: excellent (0–150 mm^2), good (151–550 mm^2), moderate (551–1000 mm^2), and poor ($> 1000 \text{ mm}^2$). Native knee survival at 2-year follow-up was 98.4%, 97.8%, 91.4% and 80.3% respectively in the excellent, good, moderate and poor group. At 10-year follow-up knee survival rates were 96.4%, 95%, 75.5%, and 58.5%, respectively.

Conclusions: An quantitative 3D measurement method was developed in order to determine the degree of initial fracture displacement of tibial plateau fractures. 3D fracture assessment could be used as an addition to the current fracture classification methods to identify patients at risk for progressive osteoarthritis and conversion to TKA at follow-up.

Figure Legends: Fig. 1: 3D gap area (red surface) measurement on a 3D fracture model representing total fracture displacement between all fracture fragments at the articular level and the corresponding coronal and sagittal 2DCT slices.

Figure 2: Four subgroups with increasing 3D gap area's and their corresponding 2- and 10-years cumulative risk on conversion to TKA.

Fig. 1

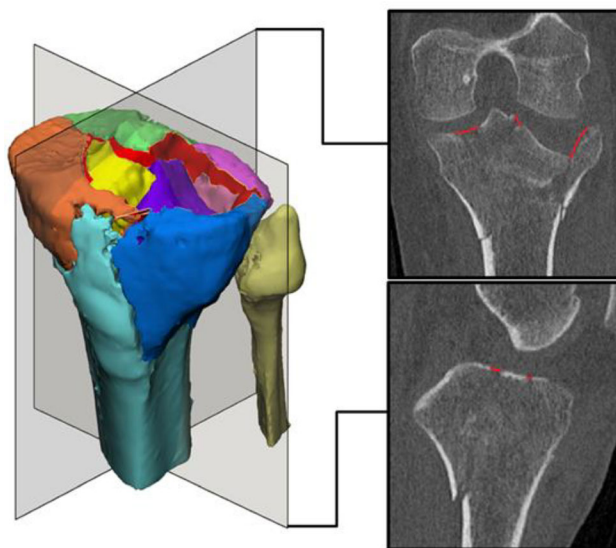
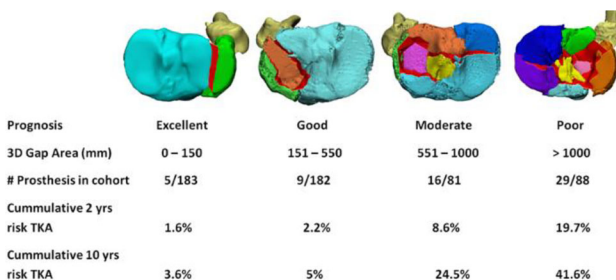


Fig. 2



OP 08

Trans sacral bar vs. SI screw stabilization in FFP IIIc fractures—a biomechanical study on an osteoporotic bone model

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Introduction: Minimal invasive stabilization is a common treatment in patients with insufficiency fractures of the pelvic ring. There are several biomechanical studies investigating and comparing stability of different treatment methods, but there is few information about how the available implants behave in osteoporotic bone. In this study, we compared the stability of two different treatment options for the dorsal pelvic ring in osteoporotic bone models.

Material & methods: A standardized FFP IIIc fracture was generated in 16 osteoporotic bone models. Half of the samples were stabilized with a long semi-threaded SI screw in S1 and an additional full-threaded SI screw reaching towards the promontory of S1. The other half was stabilized with a trans sacral bar and also an additional full-threaded SI in S1. The anterior pelvic ring fracture was addressed with a retrograde transpubic screw in both groups. Each bone model was tested under cyclical axial loading from 25 to 1200 N for 1000 cycles and movement was detected pressure based and visually by separate cameras.

Results: All samples finished the 1000 test cycles. The group stabilized with the trans sacral bar showed less movement on the fracture site under cyclic loading than the group fixated with two SI screws. In both groups new fractures of the sacral ala of the contra lateral side were observed.

Conclusions: The treatment with trans sacral bar provides at least similar stability as a conventional SI screws in FFP IIIc fractures.

OP 09

The effects of optimization of 3D printed, individualized, bone samples for biomechanical testing.

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Introduction: Although the artificial bones (e.g. Sawbones) are easy to handle and not as cost consuming as the cadaver bones, they do not adequately reproduce the unique internal structure and visco-elastic properties of a human bones. We developed 3D individualized bones (3D-IB) with additive manufacturing. These bones were then mechanically tested in four different loading types to compare them with human bones and artificial bones (Composite metacarpals, Sawbones).

Material & methods: Based on CT data from a scan of fresh-frozen metacarpal cadaver bones (MC 2–5) we transformed these data to digital models with three layers in the Standard Tessellation Language (STL) according to the requirements of the additive manufacturing. The polyamid 12 (PA12) was used as a standard material (DuraForm, 3D Systems) to produce 3D-IB. Four different models of 3D-IB were developed with:

1. vertical lammelar structure (PA12V)
2. vertical lammelar structure and a bold cortical layer (PA12V +)
3. fiber-reinforced material (PA12 HST)
4. horizontal lammelar structure (PA12H)

The testing for torsion, pull, bending and shearing were performed at the purposely designed loading set-up. The different 3D-IB were compared with sawbones and cadaver bones.

Results: We tested 45 samples. The force, angle and distance until failure were recorded.

In the bending test the 3D-IBs were more elastic as the Sawbones and similar to human bones. In the shearing test the Sawbones needed twice the force of human bones and 3D-IB to fail. During pull tests the 3D-IBs showed similar pattern of failure to human bones. In the torsion test neither Sawbones nor 3D-IB were similar to human bones. The exact data are shown in the Table 1.

Conclusions: The 3D-IB developed so far differ substantially from the Sawbones usually used for mechanical implant testing and are more similar to the parameters of the human bones. No one type of 3D-IB is perfectly mirroring the properties of the human bone so further development is needed.

Table 1. Bold fonts show the nearest sample results to the cadaver bones.

Mean of maximal force [N]	Torsion	Pull	Bending	Shearing
Sample				
<i>Cadaver bones</i>	245,7	1774,1	426,7	749,1
Sawbones	617,7	3102,1	1629,6	1458,0
PA12V	225,5	1471,2	229,7	805,2
PA12V+	330,6	2970,4	445,8	1306,4
PA12HST	205,3	1317,6	197,7	727,5
PA12H	205,3	1883,1	241,8	816,2

EMERGENCY SURGERY

OP 10

Diagnostics and epidemiology of acute mesenteric ischaemia—a population-based study

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Introduction: The exact incidence of occlusive mesenteric ischaemia (OMI) is unclear, and data mostly comes from retrospective studies based on medical records. These do not include patients that never get diagnosed alive but are diagnosed postmortem. The aim of this study was to analyze the epidemiology and outcomes of OMI within a defined area in Finland.

Material & methods: This retrospective study comprised patients diagnosed with or who died of OMI between 2006–2015 within a health care district serving 1.6 million inhabitants. Key exclusion criteria were venous or non-obstructive ischemia or ischaemia caused by strangulation and ischemic colitis. Patients were identified from electronic records and death certificates by a search for the diagnosis code for AMI or procedure codes for mesenteric vessels.

Results: A total of 470 patients were included in the study of which 151 (32%) were never diagnosed alive. 319 (68%) were diagnosed alive and 239 (51%) underwent interventional treatment. During the 2006–2015 period, the overall incidence rate of AMI was 4.83 (95% CI 4.40–5.29 [LAN1])/100 000/year, and 26.66 (95% CI 24.07–29.45) for those aged 70-years or more. After adjustment for sex and age, the relative difference in the incidence rate between 2011–2015 and 2006–2010 was 1.10 (95% CI 0.91–1.32, p-value = 0.320). Overall, 90-day mortality was 82% in all patients, 78% in patients who were diagnosed while alive, and 70% in patients who underwent interventional treatment. 90-day mortality decreased, being 86% during the first period (2006–2010) and 78% during the second period (2011–2015) (p-value = 0.025), while at the same time proportion of patients diagnosed alive rose from 68 to 77% (p = 0.023).

Conclusions: Diagnosis of OMI remains a challenge as a significant proportion of OMI are not diagnosed alive. Improved diagnostics were associated with improved survival.

Fig. 1

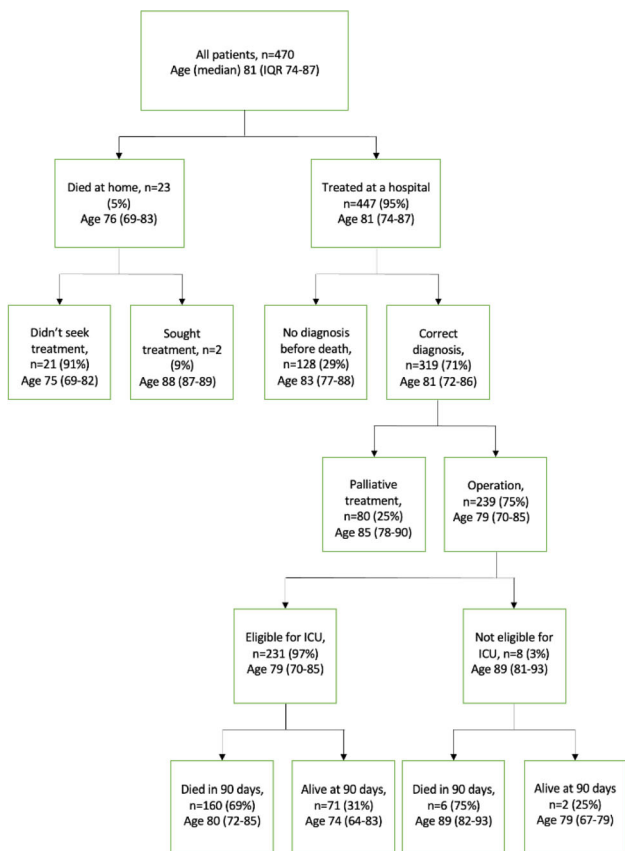


Fig. 2

Table 2. Comparison of basic characteristics, diagnosis, treatment and intervention between time periods in 470 individuals with AMI, n (%)

	2006-2010 (n=206)	2011-2015 (n=264)	p-value
Basic characteristics			
Age, years, median (IQR)	82 (76-87)	81 (71-87)	0.311
Sex, female	139 (67.5%)	152 (57.6%)	0.028
No comorbidities	11 (5.3%)	19 (7.2%)	0.414
Diagnosis and treatment			
Died at home	8 (3.9%)	15 (5.7%)	0.370
No diagnosis of OMI while alive	67 (32.5%)	61 (23.1%)	0.023
Underwent an intervention	104 (50.5%)	135 (51.1%)	0.838
Underwent imaging	99 (48.1%)	169 (64.0%)	<0.001
Intervention			
Laparotomy	110 (53.4%)	136 (51.5%)	0.843
Any revascularization	39 (18.9%)	62 (23.5%)	0.180
Endovascular operation	2 (1.0%)	12 (4.5%)	0.022
Bowel resection	64 (31.1%)	87 (33.0%)	0.561
Open revascularisation	37 (18.0%)	50 (18.9%)	0.712

Abbreviations: IQR – interquartile range, OMI – occlusive acute mesenteric ischaemia

OP 11

Mapping out suitable candidates for intestinal transplantation among acute mesenteric ischemia patients—a population-based study

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Introduction: Acute mesenteric ischemia (AMI) has a high mortality rate due to the development of bowel necrosis. Patients are often ruled outside active care if a large proportion of small bowel is necrotic. With the development of treatment for short bowel syndrome and intestinal transplantation methods, long-term survival is possible even after extensive small bowel resections. This study aims to assess the incidence of short bowel syndrome (SBS) and suitable candidates for intestinal transplantation among patients treated for AMI.

Material & methods: This population-based retrospective study comprised patients under 70 years old who were diagnosed with or died of AMI between 2006 and October 2020 in Helsinki and Uusimaa health care district.

Results: Altogether 711 patients were treated for AMI, of whom 133 (19%) were under 70 years old. Of these, 8 (6%) patients were unfit for operation and 110 (83%) underwent an intervention. Nine (7%) patients needed parenteral nutrition after resection, of which one died and seven were able to resume full enteral nutrition. Only two (2%) patients developed SBS. A total of 16 (12%) patients were ruled outside active treatment due to extensive small bowel necrosis. Of these, six (5%) were potentially suitable for intestinal transplantation.

Conclusions: In this study, SBS was a rare complication of AMI. A notable percentage of patients potentially eligible for intestinal transplantation were ruled outside active treatment extensive small bowel necrosis.

Fig. 1



OP 12

Prospective multicentric study on the rate of occult neoplasia in appendicular plastron. Apeneo.

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Introduction: In recent years, publications have appeared that warn about a high rate of hidden neoplasia in appendicular plastrons, particularly when these present an associated access (25%). However, the data obtained in our center retrospectively do not agree with the latest published data.

OBJECTIVES To determine the rate of hidden neoplasia in the appendicular plastron in Spain.

Material & methods: A multicenter prospective study was carried out in which 14 Spanish hospitals participated. Patients with appendicular plastron with a 12-month follow-up are included. Variables related to previous pathology, form of presentation, treatment received, clinical follow-up and performance or not of interval surgery have been collected and analyzed.

Results: In a period of 1 year, 84 patients have been recruited. At the moment, we have data from 66 patients; the rest are under follow-up. 24 women (36.36%) with a mean age of 51.69 years (SD 20.63). The evolution time upon admission was 13.38 days (SD 12.69). 41 patients presented with leukocytosis. 58 (87.88%) patients were diagnosed by CT. 42 (63.64%) patients presented a collection and 9 (13.64%) patients presented an associated appendicolith. In 10 (15.15%) patients there was a failure of antibiotic treatment. Of the 17 (25.76%) patients who underwent percutaneous drainage, only 1 (5.88%) failed. 9 (13.64%) patients required urgent surgery (7 (77.77%) laparoscopies with 2 (28.57%) conversions, 7 (77.78%) underwent appendectomy and 2 (22.22%) collection drainage). 3 postoperative complications (33.33%), two Clavien Dindo II and one Clavien Dindo I. The pathological anatomy did not show neoplasia in any patient who underwent emergency surgery. A follow-up colonoscopy was performed on 40 patients, of which 4 (6.06%) presented a neoplasm of the cecum or appendix. Of the 57 non-operated patients, 17 (29.83%) presented recurrence of symptoms and 13 (22.81%) patients were readmitted. 23 (40.35%) patients underwent interval appendectomy (all laparoscopic with one conversion) with 4 complications (17.39%), one death from COVID coinfection, one Clavien Dindo IIIb and two Clavien Dindo II. Histological analysis showed 3 appendicular neoplasms (13.04%).

Conclusions: The hidden neoplasm in the appendicular plastron in Spain is not as high as that reported by other European countries. However, it would be necessary to define in which patients interval appendectomy is mandatory and which postoperative tests we must request to follow up patients who do not undergo surgery.

OP 13

Can we anticipate outcomes in emergency surgery with the identification of frail patients?

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Introduction: Increased life expectancy changed the characteristics of patients who require emergency surgery; not only are older but also frailer. Frailty gives an increased risk of postoperative morbidity and mortality, extended stays and dependency 1, 2. The Clinical Frailty Scale (CFS) 3 is a visual and simple scale to classify our patients according to their frailty, and has shown to be useful in emergency surgery patients 4, 5, 6.

The main goal of the current study was to determine the influence of frailty on the postoperative outcomes in emergency surgery, using the CFS as frailty measure.

Material & methods: Our prospective cohort study included all patients who underwent emergency surgery from July 2018 to February 2020. Two groups were defined: frail (CFS \geq 4) and non-frail. All patients were followed 30 days after surgery, registering length of stay, need for nursing facilities at discharge, and their complications, classified according to Clavien Dindo score and the Comprehensive Complication Index.

Results: During the studied period, 387 patients underwent emergency surgery: 48 were identified as frail and 339 as non-frail. As

expected, the frail group was statistically different ($p < 0,05$): the mean age was higher, women were predominant, most patients were on multiple medications, and had higher ASA (Class III or more).

At follow-up, frail patients showed longer hospital stay (7,9 days); higher rate of complications (62%), which were more severe (mean CCI of 35,1); and higher mortality (19%). The differences were statistically significant ($p < 0,05$).

Conclusions: The CFS can help us to identify frail patients and anticipate worse results. Having our frail patients well identified before surgery can lead us to change their therapy plan, as considering non-surgical therapeutic options, less invasive techniques, and involving geriatric services and nursing facilities from the beginning. All these factors can contribute to better results, so we recommend its systematic use.

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OP 15

Frailty clinical scale score as a predictor of mortality in open abdomen strategy. A single center experience.

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Introduction: Open Abdomen (OA) strategy is used in a wide range of challenging intra-abdominal scenarios in critical patients with high mortality and morbidity rates. Recent studies correlated age with mortality in patients undergoing OA strategy. A study from Hewitt et al., showed frail patients have a higher mortality connected to surgical emergency procedures independently from age. The aim of this study was to correlate mortality to frailty clinical scale score in our population undergoing an OA strategy.

Materials & methods: We collected consecutive patients that underwent Open Abdomen Surgery (OAS) from January 2015 to July 2020. Patients were stratified in three groups according to the Clinical Frailty Scale Score (CFSS). Survival time was calculated from the date of OAS to the last follow up or death. The primary endpoint was 30 days mortality. Second endpoints were: One-year overall survival, three years overall survival. Statistics: Chi squared test model, Kaplan Meier curve, Log Rank test, Tarone-Ware test, Cox proportional hazard model. Significance at $p < 0,05$.

Results: 141 patients fit inclusion criteria. Indications for OAS were: 13 (9,3%) for trauma; 91 (64,5%) for non-trauma emergencies; 37 (26,2%) for rescue surgery. The most frequent indication was diffuse peritonitis ($n = 74$; 52,4%). 30-day mortality was 23,4%. Not

significant difference was found between 30 days mortality in the three frailty groups. Highly-frail patients and frail patients had a worse survival compared to non-frail [respectively 63%, 45%, 38%] but only the difference between Non-frail and Highly-frail was significant ($p = 0,025$). Mortality does not correlate to BMI, ICU admission, sex or fascial closure methods.

Conclusions: Frailty clinical scale score is world-wide used in emergency settings. Though, it is still reaching for a scientific validation as predictor of morbidity and mortality. When OA is a surgical option, frail people should not be precluded to this technique but fragility should be taken in account to pursue the best standard of care.

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Fig. 1

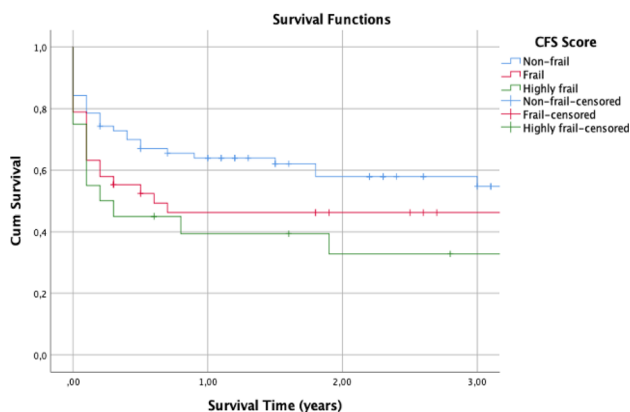


Fig. 2



OP 16

Delayed operation increases the odds of mortality in emergently admitted patients with Empyema: An analysis of 18,033 adult patients

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Introduction: Empyema is associated with significant morbidity and mortality, if not treated properly. The aim of this study was to assess the prevalence and risk factors of mortality in emergency admitted patients with the primary diagnosis of empyema, during the years 2005–2014.

Material & methods: This was a retrospective cohort study. Demographics and clinical data obtained from the National Inpatient Sample, 2005–2014, to evaluate non-elderly adult (18–64 years) and elderly (65 + years) patients with the primary diagnosis of empyema (ICD-9 code 510) who underwent emergency hospital admission. Multivariable generalized additive model (GAM) and multivariable logistic regression model with backward elimination were used to identify association of predictors and in-hospital mortality.

Results: A total of 11,616 non-elderly adults and 6,417 elderly patients were studied. 29.4% in the non-elderly adults were females and 34.7% in the elderly. 280 (2.4%) non-elderly adults (28.9% female), and 511 (8.0%) elderly (32.7% female), died in the hospital. The mean (SD) age of the non-elderly adults was 48 (11) years and elderly 76 (8) years. The mean (SD) age at the time of death of non-elderly adults was 54 (9) years and for elderly 79 (8) years. 30% of the deceased non-elderly adult patients and 9.3% of the survived had a fistula ($P < 0.001$), while, 17% of the deceased and 10.2% of the survived of elderly had a fistula ($P < 0.001$). Mean (SD) modified frailty index in survived and deceased nonelderly adult patients was 1.22 (1.09) and 1.65 (1.06), respectively ($P < 0.001$). Mean (SD) modified frailty index in survived and deceased elderly patients was 1.97 (1.13) and 2.14 (1.15), respectively ($P < 0.001$). 17.2% of the non-elderly adult patients were operated on and 82.8% were not, of which 2.3% and 3% died, respectively. 15.0% of the elderly patients were operated on and 85% were not, of which, 7.9% and 8.6% died, respectively. In the final regression model, time to operation, age, modified frailty index and presence of an associated fistula, were the significant risk factors for mortalities in all patients with operation. In patients who were not operated, age significantly increased the odds of mortality. In elderly patients with no operation, presence of an associated fistula significantly increased the odds of mortality.

Conclusions: Delay in operation, age, presence of a fistula and modified frailty index were the common risk factors of mortality in operated patients with the primary diagnosis of empyema admitted emergently. In elderly patients who did not undergo an operation and were diagnosed with an empyema, having an associated fistula also significantly predicted higher odds of mortality.

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Fig. 1**Table 1.** Backward logistic regression analysis to evaluate the associations between mortality and different factors in emergency admitted patients with the primary diagnosis of empyema and undergoing an operation. Mortality was the dependent variable. NIS 2005-2014.

	Adult Patients with Operation		Elderly Patients with Operation	
	OR (95% CI)	P	OR (95% CI)	P
Time to Operation, Days	1.049 (1.017, 1.081)	0.002	1.037 (1.008, 1.067)	0.012
Empyema with Fistula	4.081 (2.966, 5.615)	<0.001	2.169 (1.605, 2.932)	<0.001
Age, Years	1.053 (1.035, 1.071)	<0.001	1.060 (1.046, 1.074)	<0.001
Modified Frailty Index Score	1.151 (1.012, 1.309)	0.03	1.146 (1.047, 1.255)	0.003
Sex, Female				
Invasive Diagnostic Procedure				
Race	Removed Via Backward Elimination		Removed Via Backward Elimination	
Income Quartile				
Insurance				
Hospital Location				

Fig. 2**Table 2.** Backward logistic regression analysis to evaluate the associations between mortality and different factors in emergency admitted patients with the primary diagnosis of empyema and not undergoing an operation. Mortality was the dependent variable. NIS 2005-2014.

	Adult Patients, Not Operated		Elderly Patients, Not Operated	
	OR (95% CI)	P	OR (95% CI)	P
Age, Years	1.039 (1.005, 1.073)	0.024	1.054 (1.023, 1.086)	<0.001
Modified Frailty Index Score	1.283 (0.985, 1.672)	0.07	1.145 (0.938, 1.397)	0.2
Empyema with Fistula			1.927 (1.133, 3.275)	0.015
Sex, Female				
Invasive Diagnostic Procedure				
Race	Removed Via Backward Elimination		Removed Via Backward Elimination	
Income Quartile				
Insurance				
Hospital Location				
Length of Stay, Days				

OP 17**ESTES SnapAppy Audit—The “State of the Appendix” in 2021.**

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Introduction: Performance improvement in acute care surgery requires continuous cyclical re-evaluation of diagnostics, operative decision-making, and perioperative care. The contemporary management of appendicitis exhibits great heterogeneity for such a common condition. Snapshot audits are prospective observational studies of strictly controlled consecutive patient cohorts, with simultaneous time-bound patient accrual and follow-up across multiple centers. Observing pragmatic “real world” unvarnished differences in epidemiology and clinical practice patterns across different healthcare systems, outside of a randomized clinical trial setting, provides granular data that is both illuminating in terms of the nuances of clinical practice, as well as hypothesis-generating for further study.

Material & methods: We undertook a prospective observational cohort study (ClinicalTrials.gov Registration: NCT04365491), simultaneously accruing in 69 centers across 14 countries from November 1st 2020–August 31st 2021 with a 3-month consecutive case inclusion with a 90-day follow-up from admission date, under the umbrella of ESTES. The study collected only routine, anonymized data with no change to clinical care pathways.

Results: Four-thousand five hundred eighty adult patients [2,532 male (55%), median (IQR) age 36 (25–51) years, admitted for the treatment of acute appendicitis. Just 1.8% of patients were SARS-CoV-2 (COVID-19) positive at time of admission. A positively-skewed distribution of symptom duration was observed, with over 70% of patients presenting within 48 h of onset of symptoms. Appendectomy was performed in 4,358 patients (95.2%), and within 24 h of presentation in 83.4%. Laparoscopic appendectomy was converted to open in 2.7%, while 9.4% of procedures were performed open. Antibiotics were administered on admission in 96.5%, while post-operative antibiotics were continued in 59.6%. A histologically-normal appendix was seen in 3.4% and neoplasm in 1.5%. Wide heterogeneity in operating surgeon seniority, technique for controlling the mesoappendix and the appendix base were observed.

Conclusions: Snapshot audit has proven successful in advancing the scientific mission of ESTES. Real-world granular data update our epidemiologic understanding of this common surgical condition and demonstrate variable practice patterns and adherence to the WSES Jerusalem guidelines. The current data will be used as hypothesis-generating for future ESTES implementation science initiatives.

OP 74**Massive transfusion scores validation in a nationwide trauma registry**

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Introduction: An early delivery of blood products when massive transfusion protocols (MTP) are triggered is mandatory to improve trauma patient's survival. Scores predicting massive transfusion (MT) have already been described (1). The aim of our study is to compare scores for predicting MT and identify the best trigger for MTP.

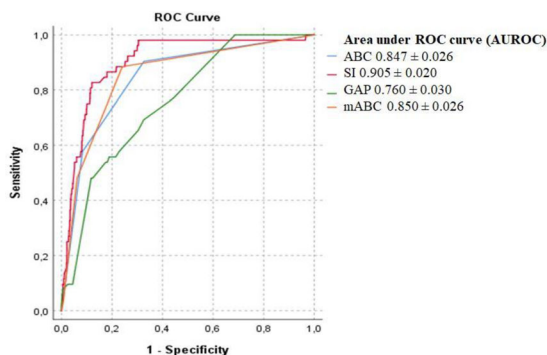
Material & methods: Multicentric retrospective study from the Trauma Registry of the Spanish Surgeons' Association. Severe trauma patients (Injury Severity Score [ISS] ≥ 15), admitted to 18 different Level 1 Trauma Centers, from January 2017 to September 2021 were included. Demographic and clinical information was recorded, and predictive scores for MT were assessed.

Results: 1894 patients were included. Mean age was 46.7 ± 18.9 years, 1459 (77.0%) were male. Median ISS was 20 (IQR 15). In 3.2% of the patients a MT (defined as ≥ 10 units of packed RBC) was necessary, while a MTP was triggered in 12.4%. Surgery was performed in 63.9%. The overall mortality was of 9.2%. Predictive scores for MT were compared: GAP (Glasgow Coma Scale, Age, systolic blood Pressure), Shock Index (SI), Assessment of Blood Consumption (ABC) and mABC (modified ABC). AUROC for GAP was 0.760 ± 0.030 , SI 0.905 ± 0.020 , ABC 0.847 ± 0.026 and mABC 0.850 ± 0.026 (Fig. 1), showing differences between IS (best score), GAP (worst score) and the others, $p < 0.05$. Best cut-off points were calculated. SI ≥ 0.8 better predicts MT with a sensitivity 91.5%, specificity 67.3%, positive and negative predictive values 9.2% and 99.9%.

Conclusions: SI, ABC and mABC are all good scores for predicting MT in our population. Appealing by its simplicity, we recommend SI as the best trigger for MTP. Protocols should be standardized to improve the accuracy of MTP activation for trauma patients.

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Figure 1 MT scores AUROC



TSACO

OP 18

Consistent in the cold zone. Deep-frozen platelets in the Dutch armed forces

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Introduction: The Dutch armed forces have been using $-80\text{ }^{\circ}\text{C}$ deep-frozen platelets (DTC) for transfusion in operational medicine since 2001. The aim of this study was to investigate the quality of DTCs over a 20 years period to reveal product production was consistent and in compliance with European quality requirements.

Material & methods: This was a prospective cross-sectional quality analysis performed for all DTCs from 2001 until 2021. Pre-freeze and post thaw quality (up to six years) was determined by comparing product content and product recovery with both the European guidelines for frozen and liquid stored platelets (minimum recovery of 50% of the original platelet product and a platelet count of $> 200 \times 10^9$).

Results: From 2001 until 2021 pre-freeze and post-thaw quality control data of 1759 thawed DTC units was available ($n = 1100$ transfused, $n = 417$ for training, $n = 242$ for quality control). Of the thawed products, 97.9% meet the European guideline of 50% recovery. For platelet content, 98.5% of the products exceeded the minimum $> 200 \times 10^9$. After thaw median product content was 302×10^9 [Interquartile range (IQR) 75] and median product freeze-thaw recovery was 74% [IQR 15]. Duration of frozen storage did not affect product content or recovery significantly if frozen beyond 0.5 years (short) up to six years (long). Short stored products show a significantly ($P < 0.001$) lower product content and recovery (290×10^9 [69] and 70% [11] compared to long stored platelets (311×10^9 [76] and 77% [14]).

Conclusions: DTCs used by the Dutch Armed Forces are compliant to European guidelines. Platelet recovery and content was stable from 0.5 up to six years of frozen storage, suggesting expansion of the current shelf life to beyond four years.

OP 19

Development of care pathways and mortality at the Norwegian national burn center from 1984 to 2020

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Introduction: The Norwegian National Burn Center was established in Bergen in 1984 at Haukeland University Hospital and is the country's only burn center to manage patients with severe burns. From the start, the burn center established a local quality registry where key parameters for these patients were registered. In total, the registry included care pathway data on 2964 patients until January 1st, 2021. The registry does not include data on elective reconstructive surgery, re-admissions, and patients treated at the center for non-burn-related diagnoses. The quality registry data were reviewed to compare patient care pathways, treatment results, and mortality in different time periods since the burn center opened 37 years ago.

Material & methods: The quality registry contains pseudonymous data, including length of stay, the body surface area burned (%TBSA), health status at discharge, age, sex, and county of residence. Burn severity and mortality rates in different time periods were evaluated by comparing Baux scores (patient age + %TBSA). The regional ethics committee (REK) approved the project, December 15th, 2020.

Results: There was a significant increase in the total number of patients from the five years 2006–2010 ($n = 384$) until 2016–2020 ($n = 706$). In this latter period, most of the increase were patients

between 0–2 years, whereas the patients' age distribution was relatively stable from 1986 to 2010. Though there were minor gender variations in some periods, men were overrepresented at 67.5% overall (2003 of 2964 patients were men). Analysis of percentage burned surface area (%TBSA) showed a more significant increase in the patient group from 0–4%, increasing threefold the last ten years of the study. On the contrary, there was a decline of patients with > 20% TBSA, especially in the latest five-year period. Although admissions nearly doubled from 2006–2010 to 2016–2020, the total accumulated length of stays in the same periods did not increase accordingly, thus reducing the average length of stay. When considering Baux score categories in the latest 30-year period, 1991–2020, 68% had low Baux scores (below 60), and only 165 of 2549 patients (6.5%) had a score of ≥ 100 . In the latest ten years (2011–2020), there was a marked increase in survivability for patients with Baux scores ≥ 100 , with 29 out of 60 patients surviving. Despite the increased number of patients, the overall mortality rate declined from 10.9% (1986–1990) to 3% (2016–2020).

Conclusions: The number of admissions increased over the last ten years, whereas the overall mortality rate declined. Simultaneously, patients with severe burns have improved survivability, specifically for patients with Baux scores above 100.

OP 20

Immune cell characteristics of femoral shaft fracture hematoma following different reaming techniques—a large animal model

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Introduction: The content of early fracture hematoma (FH) dictates the outcome of fracture healing. Different reaming protocols for intramedullary nailing (IMN) of long bone fractures are available. However, the impact of reaming strategies on immune cell characteristics in early fracture hematoma is unclear. We hypothesized that the application of Reamed Irrigation and Aspiration (RIA)-techniques is associated with enhanced immune cell content of FH.

Material & methods: Twenty-four adult male pigs standardized unilateral fracturing of the femoral bone. Animals were exposed to different protocols of IMN. Fractures were treated with conventional reamed femoral nailing (RFN); unreamed femoral nailing (UFN); reaming with a reamer irrigator aspirator device (RIA). Fracture hematoma was collected 6 h after reaming and immune cells were studied by flowcytometry. FH-cell apoptosis and neutrophil receptor expression (Mac-1/CD11b and Fc γ RIII/CD16) were studied.

Results: All animals survived the observation period. Apoptosis-rates of FH-immune cells were significantly lower in group RIA ($3.50 \pm 0.53\%$) when compared with non-RIA groups: (group UFN $12.50 \pm 5.22\%$, $p = 0.028$ UFN vs. RIA), (group RFN $13.30 \pm 3.18\%$, $P < 0.001$, RFN vs. RIA). Moreover, RIA-FH showed lower neutrophil CD11b/CD16 expression when compared

with RFN (mean difference of 43.0% MFI, $P = 0.02$; and mean difference of 35.3% MFI, $P = 0.04$, respectively).

Conclusions: This experimental study reveals that utilized reaming strategies influence immunologic cellular FH-content. Reamed Irrigation-Aspiration-augmented protocols are associated with decreased FH-immune cell apoptosis and reduced activation of FH-neutrophils and thereby with optimized FH-immune cell content. This underlines the important role of IMN in optimizing local cellular immune homeostasis during the formation phase of early fracture hematoma.

OP 21

Lipidomic analysis shows significant changes in circulating Di- and Triglycerides after intramedullary reaming in a porcine Polytrauma model with a femur fracture.

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Introduction: Fat embolism is a reoccurring complication in patients with acute trauma and long bone fractures. Caused by the intravasation of bone marrow fat, it often occurs during intramedullary reaming and nailing. New methods of analyzing the circulating lipid profile are gaining attention in the field of trauma. Several lipid subgroups show high concentration in bone marrow fat. In this study, we investigated the posttraumatic and post-interventional Intravasation of 233 specific lipids in a well-established porcine polytrauma model with a femur fracture.

Material & methods: 54 male Pigs (Swiss landrace) weighing 50 ± 5 kg underwent general anesthesia for 6 h. Pigs were split in 3 groups: polytrauma (PT), monotrauma (MT) and sham (S). MT received an isolated femoral shaft fracture, while PT received an additional blunt chest trauma with lung contusion, a grade II (AAST) liver laceration and controlled hemorrhagic shock (mean arterial pressure (MAP) 30 ± 5 mm Hg for 60 min). After resuscitation, we used different means of intramedullary reaming and nailing (Syn-ream (SR), Reamer-Irrigator-Aspirator System (RIA) and introduction without reaming (NO)). Venous blood was taken regularly from baseline (B) to 6 h post trauma. Lipid concentrations and lipid composition were investigated using mass spectrometry. 233 specific lipids were analyzed.

Results: We organized lipids into 17 subgroups based on molecular characteristics. Total lipid concentration showed a significant ($p < 0.01$) decrease after polytrauma and remained low over the course of observation. Di- and Triacylglycerols (DAGs and TAGs) initially follow this trend but then show a significant increase right after intervention: (95.8 ± 52.4 to 235.2 ± 202.6 nM/ml ($p = 0.01$) and 241.5 ± 171.6 to 583.8 ± 620.9 nM/ml ($p = 0.036$)).

In MT, DAGs and TAGs show significant increases after fracture and remain elevated for 4 h: (148.9 ± 63.6 (B) to 211.7 ± 77.7 nM/ml (2 h) ($p < 0.01$) and (366.4 ± 207.8 (B) to 552.8 ± 343.3 nM/ml (2 h) ($p = 0.01$)).

SR and NO showed significant ($p < 0.05$) increase of circulating DAGs and TAGs after intervention in most groups (MT/MT + PT), while RIA did not.

Conclusions: Our data clearly suggests significant changes to circulating lipid composition after trauma and treatment. Furthermore, we showed a significant decrease of intravasation of DAGs and TAGs by using RIA. Lipidomic analysis in our standardized porcine

polytrauma model help understand the role of lipids in acute trauma and treatment. Collation with data from the clinical setting is needed.

OP 22

Optimizing the use of advanced bleeding control techniques in military environments: a Delphi consensus study

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Introduction: Truncal and junctional hemorrhage are the most common causes of potentially survivable deaths in combat casualties. The use of advanced bleeding control techniques in combat zones has the potential to improve the outcome of these patients. This study aimed to establish consensus on the optimal use of advanced bleeding control techniques in military environments.

Material & methods: An international expert panel of military physicians was selected to complete a three-round Delphi survey. Consensus was reached with $\geq 70\%$ agreement and a response rate of at least 70%.

Results: Thirty-two experts from 10 different nations participated in the Delphi process. They reached consensus on the preferred contents of a standard bleeding control toolbox and the locations where it should be available, which providers should be allowed to use invasive and non-invasive bleeding control techniques and their training requirements, and on certain indications and contraindications for resuscitative endovascular balloon occlusion of the aorta (REBOA) in military environments. There was no consensus on the indications for REBOA in military settings in patients with chest injuries, axillary injuries or penetrating neck injuries in combination with thoraco-abdominal injuries. The panel agreed that there should be international registries and guidelines on bleeding control care in military environments.

Conclusions: Consensus was reached on the contents of a standard bleeding control toolbox, where it should be available, providers allowed to use advanced bleeding control techniques and their training requirements, potential indications for REBOA in military environments, and the need for international registries and guidelines.

OP 23

Do we need to repeat CT in mild brain-injured patients on blood thinners?

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Introduction: Mild head injury is a common reason for admission to the ED. CT is liberally used, mainly on high-risk patients. In our Hospital, a 12 h CT is used to identify the onset of a secondary brain hemorrhage on patients under antiaggregating or anticoagulation therapy. Most of these CT come normal. This study aims to evaluate the need for control CT in this subset of high-risk patients.

Material & methods: This is a prospective observational study of patients with mild head trauma (GCS 14- 15) admitted to our emergency department between January and June 2018.

Results: A total of 343 patients were included in the study, 149 (43.4%) were under blood thinners therapy, and 194 (56.6%) were not (control). There were no differences between the groups regarding the existence of traumatic brain injury on admission CT. A total of 10 patients (6.1%) exhibited intracranial lesions in control CT without the need for surgery. On subgroup analysis, despite the higher prevalence of traumatic brain injuries in the first or control CT in patients on antiaggregating (36.6%, 12.3%), the difference to the patients under anticoagulation (32.7%, 5.7%) was not statistically significant. On multiple logistic regression, GCS at admission, age, Charlson Comorbidity Index, amnesia, and headaches were associated with secondary bleeding as seen on control CT.

Conclusions: The incidence of secondary bleeding in patients on blood thinners is rare. These results do not support the need for a control CT in this group of high-risk patients. The use of this surveillance method should be reconsidered and further studied.

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EMERGENCY SURGERY

OP 24

The effect of a clock's presence on trauma resuscitations in a Dutch level-1 trauma center

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Introduction: Interventions performed within the first hour after trauma increase survival rates. Literature showed that measuring resuscitation times contributes to insights and improvement of the resuscitation process¹. Therefore, time awareness potentially strengthens the reduction of time in acute trauma care². However, despite ATLS protocol renewal, empiric data is limited. This study

examines the in-hospital trauma resuscitation times in a Dutch level-1 academic trauma center.

Materials & methods: A prospective observational double cohort study was conducted three months before and after placing a visible clock in the trauma resuscitation room. Trauma patients above 15 years old presented at the trauma resuscitation room during weekdays between 9.00 AM and 9.00 PM were included. Time until diagnostics (chest X-Ray, FAST, or CT scan), time until therapeutic intervention, and total resuscitation time were measured manually with a stopwatch. Patient characteristics and information regarding trauma- and injury type were collected. Times before and after trauma clock implementation were compared.

Results: In total, 100 patients were included. Median time until diagnostics was 8.1 min (IQR 2.4) before vs. 7.5 min (IQR 2.0) after clock implementation ($p = 0.064$). Median time until CT scan and mean total resuscitation time (including CT scan) were 25.2 min (IQR 4.3) and 47.6 min (SD 24.3) before vs. 25.2 (IQR 10.1) and 48.3 (SD 16.3) after trauma clock implementation ($p = 0.559$, $p = 0.881$). For polytrauma patients (Injury Severity Score ≥ 16) specifically, these were 23.5 min (SD 4.5) and 57.5 min (SD 29.3) before vs. 20.2 min (SD 2.2) and 50.1 min (SD 15.4) after trauma clock implementation ($p = 0.107$, $p = 0.373$).

Conclusions: This study provides insights into the duration of different phases of the trauma resuscitation of trauma patients. The presence of a trauma clock shows a trend for a shorter time until diagnostics.

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OP 25

Trauma patients with COVID infection and positive CT findings are associated with more pulmonary complication

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Introduction: Polytrauma patient with additional SARS-CoV 2 infection may be associated with increased complication rate. Both factors alone are known for a large number of complications. It was our interest to find out whether the combination of both factors has an impact on the inpatient course. The main goal of this study was to analyze the clinical course of trauma patients with COVID infection and a positive CT finding.

Material & methods: This is a retrospective in-hospital study. Data were collected by a review of medical records. Monotrauma and polytrauma patient with positive infection of SARS-CoV 2 were include into our analysis. Radiological changes associated with SARS-CoV 2 were screened. The outcome parameters were: pulmonary complication during admission, pulmonary embolism, pleural fluid, pneumonia, mortality, length of stay and readmission < 30 days.

Results: In total 48 patient were included. Trauma patients in the age-adjusted matched-pair analysis with SARS-CoV-2 typical changes in CT findings showed significantly more pulmonary complications in general and significantly more pneumonia (complications: 56% vs. 11%, $p = 0.046$ /pneumonia 44% vs. 0%, $p = 0.023$). in addition. Similarly, polytrauma patients with SARS-CoV-2 infection showed a

significantly higher rate of pulmonary embolism than monotrauma patients (20% vs. 3%, $p = 0.049$)

Conclusions: The results of our study show that the changes in CT findings of trauma patients with SARS-CoV-2 infection is a good indicator of further inpatient outcome. Similarly, polytrauma patients with SARS-CoV-2 infection are shown to be at significantly increased risk for pulmonary embolism.

OP 26

A Virtual reality room of error to improve situational awareness and patient safety in surgery and emergency medicine

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Introduction: Medical errors are among the 5 most frequent causes of death. However, although potential risks are well-known by health-professionals, especially in stressful situation, they remain undiscovered and uncorrected due to impaired situational awareness.

A "room of error" is an innovative possibility to train situational awareness. It is a simulation room prepared as a clinical room containing hidden errors and potential risks which have to be discovered by health professionals.

During the pandemic, simulation training was highly reduced due to hygienic and other restraints.

The aim of the present work was to develop a Virtual Reality (VR) based serious game targeted on improving the situational awareness of health-professionals in surgery and emergency medicine.

Material & methods: Four different rooms (operation room, emergency room, intensive care room, normal ward) were designed in VR with its complete interior. In each room, 10 errors were implemented representing the different categories of medical errors defined in the taxonomy of incident types by the world health organization, and further, representing frequent errors.

Health-professionals were trained in the room of error. Each had 10 min in each room to identify the hidden errors. Afterwards a questionnaire was administered.

Results: By now, a total of 45 health-professionals (11 physicians, 18 nurses, 16 medical students) completed the questionnaire. All evaluated the room of error as highly realistic and easy to use. They judged the hidden errors to be relevant for their daily work and rated to be better prepared in identifying potential errors and risks in their future work.

Conclusions: The VR room of error represents a practical, low-threshold possibility to train health professionals identifying hazards of patient safety, teach their power of observation and situational awareness. In comparison to a simulated room of error, VR is more realistic due to its high level of immersion. Furthermore, it is independent of room capacities, pandemic restrictions and can be used 24/7.

OP 27

Laparoscopic subtotal cholecystectomy for acute cholecystitis using a linear stapler: preliminary results of retrospective analysis of technical feasibility and postoperative outcomes

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Introduction: Laparoscopic subtotal cholecystectomy (LSC) for acute cholecystitis (AC) is nowadays accepted as an effective surgical strategy when the Calot's triangle cannot be adequately dissected due to severe fibrosis or inflammation. Several surgical techniques have been developed with heterogeneous results. The use of a laparoscopic stapler seems a promising approach, particularly in emergency settings, but data on technical feasibility and postoperative outcome are currently lacking.

Material & methods: Retrospective analysis of prevalence and morbidity of urgent stapler-LSC (S-LSC) for AC, performed in five Italian Centers between 2010–2020.

Results: During the study period, 5516 urgent laparoscopic cholecystectomies were performed for AC. Among these 125 (2.3%) were LSC, comprising 32 (25.6%) S-LSC. In the analyzed group, the median patient age was 62 years [IQR 54–78] and median time interval between symptoms onset and surgery was 5 days [3–9]. At intraoperative exploration, AC presented as AAST grade > 2 in 37.5% and > 3 in 21.9%. The median operative time was 147 min [117–162] and no cases of biliary or vascular injuries were recorded. The median postoperative length of stay was 8 days [5–12], with no 30-days mortality. Reoperation was never required, only three patients (9.4%) underwent percutaneous drainage of intrabdominal abscesses, while for the others only Clavien-Dindo ≤ 2 complications occurred. No cases of biliary leak were recorded. At a median follow up of 24 months [12–54], none of the patients developed any episode of pancreatitis, obstructive biliary complication or remnant AC.

Conclusions: In addition to the techniques already described by Strasberg et al., S-LSC seems a feasible, effective and safe surgical approach with good short- and long-term outcomes.

OP 28

Laparoscopic approach for the treatment of acute small bowel obstruction: how to predict safety, feasibility and outcomes

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Introduction: Acute intestinal obstruction is one of the most common surgical emergencies. The small bowel obstruction (SBO) is the most common cause (76%) and adhesions represent the most frequent etiology (65%) in literature. Laparoscopy still has no defined and validated role as surgical treatment.

Material & methods: We reviewed medical records of patients with intestinal obstruction and, within these ones, patients with SBO undergoing NOM vs operative treatment, and in particular laparoscopy, in the last 5 years. Data obtained included demographics, clinical and radiologic presentations, intraoperative outcomes, and postoperative course.

Results: During the observation period (January 2016–March 2021) 207 patients were admitted for SBO. NOM was performed in 53 (25.6%) of patients. 154 patients underwent surgery and 49 were

successfully treated laparoscopically. Conversion to laparotomy rate was 41%.

The median postoperative stay was significantly different between patients who underwent laparoscopic approach and those ones who underwent laparotomy: 6 days (IQR 4–9) in the first group vs 8.5 days (IQR 6–13) in the second one ($t = 3.305$, $p = 0.019$). No statistically significant difference in the length of hospital stay between laparotomies ab initio vs converted cases was found.

In order to find a predictive model of successful laparoscopy, we analyzed, in cases who underwent conversion to laparotomy, if any statistical variable (previous laparoscopies or laparotomies, number of previous operations, etiology, history of peritonitis and/or intestinal obstruction) was predictive of failure of the laparoscopic attempt. Previous surgery for peritonitis and/or intestinal obstruction significantly related with conversion rate ($X^2 = 4,509$, $p = 0,034$).

Conclusions: Laparoscopy is safe and feasible in the management of acute SBO in selected patients. We need further prospective and randomized studies to identify a predictive model for effective laparoscopic treatment of SBO.

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OP 29

Long-term follow-up after laparoscopic management of small bowel obstruction: does the minimally invasive procedure reduce the recurrence of the disease?

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Introduction: Small bowel obstruction (SBO) is a common surgical emergency. Thirty years have passed since the first reported case of laparoscopic adhesiolysis were done by Bastug DF. However widespread acceptance of laparoscopy in the management of SBO was limited due to the lack of supporting evidence of its superiority over an open approach and concerns regarding its real benefits. Currently laparotomy is accepted as the standard surgical intervention for SBO, although laparotomy itself is an independent risk factor for SBO. The aim of this study is to compare laparoscopy and laparotomy for the treatment of not extensive adhesive small bowel obstruction with a special focus on the incidence of recurrence of the disease and the quality of life in the long-term.

Material & methods: A retrospective analysis of patients treated for adhesive SBO at our institution between January 2012 and December 2016 was made by a comprehensive search of a prospectively

maintained database of emergency procedures. Open adhesiolysis were compared with laparoscopic adhesiolysis. Morbidity and mortality, operative time, length of stay and subsequent re-admission to hospital and re-operation were compared between groups. A long-term follow-up of this cohort of patients was performed: Gastrointestinal Quality of Life Index (GIQLI) questionnaire has been used to assess the quality of life of the patients.

Results: A cohort of 365 patients with adhesive SBO was identified: patients with dense/matted adhesions and patients who required bowel resection were excluded from the study. Of the 172 remaining patients fifty one were lost to follow-up, the minimum follow-up period was 4 years (median 6,4 years). The patients that completed the follow-up were 121: 74 (61%) underwent open procedure and 47 (39%) underwent laparoscopic procedure. Within the laparoscopic group 5 (10%) underwent conversion to open procedure. The mean operative time was shorter for laparoscopic group (94 min vs. 97 min, $p = 0,35$) as mean length of stay (7 days vs 10 days, $p = 0,066$). The overall complication rate was significantly lower in the laparoscopic group ($p < 0,005$), in particular for severe complications (Clavien-Dindo 3 or higher). At very long-term follow-up we found a significant higher re-admission and re-operation rate for small bowel obstruction in the patients treated with open procedure (4,7% vs 12,6%, $p < 0,005$). Moreover GIQLI scores at follow-up were markedly worse in patients treated with laparotomy ($p < 0,005$), in particular for the subscales of GI symptoms and emotional status, while there were no differences for physical and social subscales.

Conclusions: In a significant proportion of patients treated with laparotomy adhesive disease could relapse leading to the need for re-interventions and affecting the quality of life with a variety of chronic symptoms such as abdominal distension, pain and nausea. Laparoscopy could limit adhesions formation. Our study support the benefit of minimally invasive management of SBO in the long-term.

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OP 30

Emergency laparotomy in the elderly—discharge outcome

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Introduction: Abdominal emergency surgery (ES) in elderly is associated with high mortality and long hospital stay. Moreover, data regarding maintenance of autonomy following ES admission among older adults are lacking. The aim of this study was to compare the outcomes of elderly patients following explorative laparotomy or multiple abdominal intervention.

Materials & methods: Patients aged 65 years and over following emergency laparotomy (EL) between 1.1.2017 to 31.12.2019 were included. The primary outcome of interest was in-hospital mortality and discharge home. Data collected included preoperative diagnosis, number of laparotomies, facility where patient initially presented with surgical pathology (emergency department, surgical floor, internal medicine facility, etc.), discharge destination and mortality. Patients underwent single laparotomy were compared to group with multiple interventions.

Results: Overall, 200 patients underwent EL, of whom 59 patients (30%) needed more than one abdominal intervention. The median age was 78 (65–101) years and 40% (79 pts) were ≥ 80 . The indication for EL were bowel obstruction (91; 46%), ischemic bowel (32; 16%), hollow viscous perforation (46; 23%) and other (31; 15%). 59 patients (30%) died at their index admission. 37 patients (63%) presented not from emergency department or surgical ward required multiple interventions. The mortality rate at multiple interventions group was 58% (N = 34). Only 14 patients (24%) in this group were discharge home, in contrast to the 95 (67%) from the single laparotomy group ($p = 0.0018$). Patients with ischemic bowel had the highest mortality (22 of 32 patients; 69%).

Conclusions: Elderly patients that underwent single EL are more likely to be discharge home. Elderly patients who present from non-surgical departments with ES pathology and require EL had dismal outcome. This study provides important information to support and help improve the planning for care of older patients who present with intra-abdominal emergencies.

OP 31

Post traumatic changes of circulating lipids in a porcine polytrauma model

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Introduction: Posttraumatic release of pro-inflammatory mediators is a one of the factors developing systemic inflammatory response that increases comorbidities and mortality of severe traumatized patients. Lipidomics is a new research method analyzing specific lipids, that has revealed new lipid-based inflammatory mechanisms responsible for several pathophysiological conditions [1]. However, only a few studies using this technology have been reported yet in the field of trauma. In the current study, we investigated the posttraumatic changes of 233 specific lipids in circulation of porcine polytrauma model.

Material & methods: 54 male pigs were split in polytrauma (PT), monotrauma (MT) and sham group. PT received a combined injury of blunt chest trauma, a liver laceration, controlled hemorrhagic shock, and femoral shaft fracture. MT received an isolated femoral shaft fracture. After 60 min animals received resuscitation and fracture stabilization. Venous blood was taken regularly from baseline until 6 h post trauma. 233 specific lipids were analyzed using mass spectrometry.

Results: Acylcarnitines showed a significant increase at resuscitation phase only in PT. Three subgroups (Diacylglycerols, Triacylglycerols, and Phosphatidylethanolamines) increased significantly in MT after trauma and in PT 2 h after trauma.

Conclusions: Our results suggest that circulating lipid composition was significantly changed after trauma and treatment. Corresponding factors might be the posttraumatic intravasation of lipids from bone

marrow and damaged tissue, a response to posttraumatic cytokine storm or the onset of a hypermetabolic state. Individual pathways have yet to be investigated and collation with clinical data is needed.

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OP 32

Kinetics and function of neutrophil subsets in severely injured trauma patients and the link with infectious complications

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Introduction: The innate immune system in trauma patients is in a precarious state. Neutrophils, the most abundant cells of the white blood cell pool, are affected by tissue injury. At homeostasis there is a homogeneous pool of circulating neutrophils patrolling the body for danger- and pathogen associated signals. However, trauma directly changes this situation and additional neutrophil subsets appear in the bloodstream. These subsets can be discriminated based on their surface markers: CD16 and CD62L. These subsets showed differences in functionality, thus they might play a role in the occurrence of infectious complications in multi-trauma patients. Therefore it is necessary to know how this subset profile develops over time and how the subsets function against pathogens.

Material & methods: Multi-trauma patients were included who were admitted to the trauma bay of the UMC Utrecht. Patients were 18–80 years of age, were not pre-existing immunocompromised and were expected to stay on the ICU for > 48 h. Blood was drawn right after admission (day 0), at day 3, 6, 10 and 15. Flow cytometry was used to analyze blood neutrophils. A panel with antibodies against surface markers (e.g. CD16 and CD62L) was used. Additional functional analyses were performed with the blood neutrophils.

Results: A specific pattern of occurrence and disappearance of neutrophil subsets in the circulation occurred over time after injury. During the first day, neutrophils low in CD16 appeared, thought of as younger neutrophils. Those CD16low neutrophils disappeared from the circulation during the first days. At day 10 there was a noteworthy rise in CD62Llow neutrophils, that have been associated with a higher activation status. Also, the antibacterial function of CD62Llow neutrophils was lacking.

Conclusions: These results of neutrophil kinetics in trauma patients are very relevant in order to understand the occurrence of inflammatory and infectious complications in vulnerable multi-trauma patients.

SKELETAL

OP 33

Pelvic ring fractures treated with the Illuminoss patient conforming implant system

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Introduction: Evaluation of the first 40 patients with an anterior pelvic ring fracture treated with the IlluminOss® system.

Material & methods: 40 patients were included in this single center retrospective observational study, all treated with the IlluminOss® polymeric rod. The implant is introduced through a 4 cm incision over the os pubis and positioned in the rames superior up to the acetabular dome across the fracture. 10 patients also had a sacral fracture.

Median age 76 years (46–96 yr). 85% female. 29 patients had a fall from standard height, 5 unknown, 4 multi-trauma and 2 due to metastatic bone disease.

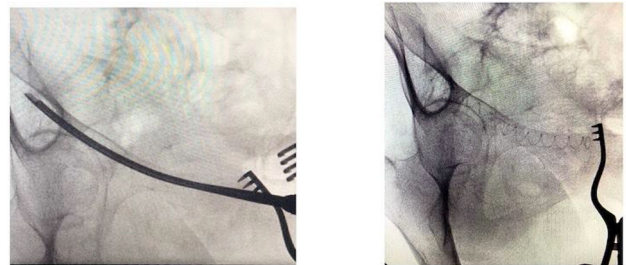
All patients had a pre-operative CT scan. 18 patients a concomitant sacral fracture. Rommens classification: 1^{ab}-14, 2^{bc}-17, 3^c-4, non-unions 3, MBD 1, acetabular fracture 1.

50% ASA 2, 50% ASA3. Average stay in hospital 11 days (1–25 days)

Results: VAS score dropped 50% at the first post-operative day (mean pre-op 3.4 to 1.7 post-op). All patients were able to mobilize on day one after surgery. 21 patients were discharged to their homes, 19 patients went to rehabilitation center. 26 patients returned to pre-trauma ambulation and ADL.

Conclusions: The IlluminOss® system appears to be a promising surgical technique for the treatment of fragility fractures of the pelvic ring in the elderly patient

Fig. 1



OP 34

Computed tomography-based L1 bone mineral density in Dutch trauma patients—are North American reference values valid in Europe?

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Introduction: Opportunistic screening for bone mineral density (BMD) of the first lumbar vertebra (L1) using computed tomography (CT) is increasingly used to identify patients at risk for osteoporosis. An extensive study in the United States has suggested sex-specific normative values of CT-based BMD across all ages. The aim was to validate North American reference bone mineral density (BMD) values for the Dutch trauma population.

Material & methods: All trauma patients aged 16 or older, admitted to our level-1 trauma center during 2017, who underwent a CT scan of the chest or abdomen at 120kVp within 7 days of hospital admission, were retrospectively included. BMD measurements in HU were performed manually in L1 or an adjacent vertebra. Student's *t*-tests were performed to compare the Dutch mean BMD value per age group to the North American reference values. Linear regression analysis and Pearson's correlation rho (ρ) were performed to assess the correlation between BMD and age.

Results: In total, 624 patients were included (68.4% men, aged 16–95). Mean BMD decreased linearly with 2.4 HU per year of age ($\rho = -0.77$). Sex-specific analysis showed that BMD of

premenopausal women was higher than BMD of men at these ages. Dutch mean BMD values in the age groups over 35 years were significantly lower than the North American reference values.

Conclusions: Our findings indicate that using North American BMD thresholds in Dutch clinical practice would result in overdiagnosis of osteoporosis and osteopenia. Dutch guidelines may benefit from population-specific thresholds.

OP 35

Healthcare utilization and satisfaction with treatment before and after direct discharge from the Emergency Department of simple stable musculoskeletal injuries in the Netherlands

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Introduction: To evaluate healthcare utilization and satisfaction with treatment before and after implementing direct discharge (DD) from the Emergency Department (ED) of patients with simple, stable musculoskeletal injuries.

Material & methods: Patients with simple, stable musculoskeletal injuries were included in two Dutch hospitals: OLVG and Sint Antonius (SA), before (pre-DD-cohort) and after implementing DD (DD-cohort). With DD, no routine follow-up appointments are scheduled after the ED visit, supported by information leaflets, a smartphone application and a telephone helpline. Outcomes included: secondary healthcare-utilization (follow-up appointments and X-ray/CT/MRI); satisfaction with treatment (scale 1–10); primary healthcare-utilization (general practitioner (GP) or physiotherapist visited, yes/no). Linear regression was used to compare secondary healthcare-utilization for all patients and per injury. Satisfaction and primary healthcare-utilization were analysed descriptively.

Results: A total of 2,033 (OLVG = 1,686; SA = 347) and 1,616 (OLVG = 1,396; SA = 220) patients were included in the pre-DD-cohort and DD-cohort. After DD, the mean number of follow-up appointments per patient reduced by 1.06 (1.13–0.99; $p < 0.001$) in OLVG and 1.07 (1.02–0.93; $p < 0.001$) in SA. Follow-up appointments reduced significantly for all injury subgroups. Mean number of follow-up X-rays per patient reduced by 0.17 in OLVG ($p < 0.001$) and 0.18 in SA ($p < 0.001$). Numbers of CT/MRI-scans were low and comparable. In OLVG, mean satisfaction with treatment was 8.1 (pre-DD-cohort) versus 7.95 (DD-cohort), versus 7.75 in SA (DD-cohort only). In OLVG, 23.6% of pre-DD-cohort patients visited their GP, versus 26.1% in the DD-cohort, versus 13.3% in SA (DD-cohort only).

Conclusions: This study performed in a large population and additional hospital confirms earlier pilot results, i.e. that DD has the potential to effectively reduce healthcare utilization, while maintaining high levels of satisfaction.

OP 36

Effect of transverse versus longitudinal incisions on anterior knee pain after tibial nailing (TRAVEL); a multicenter randomized trial with 1 year follow-up

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Introduction: Anterior knee pain is common after tibial nailing and its origin is poorly understood. Literature suggests it may be related to infrapatellar nerve injury. The aim of this study was to compare the effect of a transverse (potentially infrapatellar nerve sparing) incision for insertion of a tibia nail versus a longitudinal incision on anterior knee pain.

Material & methods: Adult patients with a tibial shaft fracture to be treated with an intramedullary nail were randomized to a transverse ($n = 68$) or longitudinal incision ($n = 68$) in multiple centers. The primary outcome measure was kneeling pain based on a Numeric Rating Scale (NRS). Secondary outcome measures included knee pain during daily activities, functional outcome (Short Musculoskeletal Function Assessment (SMFA) and Lower Extremity Functional Scale (LEFS)), quality of life (Euro-QoL-5D, EQ-5D), activity resumption, complications, reoperations, and direct and indirect costs until one year after trauma.

Results: At 12 months the estimated marginal mean for kneeling pain was 2.4 (95% CI 1.6–3.2) in the transverse incision group and 3.7 (95% CI 3.0–4.5) in the longitudinal group. Regression analysis showed no significant difference between both groups over time ($P = 0.239$ at 12 months). Knee pain scores for daily activities, functional outcome scores, and quality of life were also comparable between the groups. Signs of infrapatellar nerve injury were found less often after a transverse incision (16% versus 53%; $P < 0.001$). The total (direct and indirect) costs per patient were €10,468 in the transverse incision group and €11,066 in the longitudinal incision group. Loss of productivity accounted for 67% and 52% of the total costs, respectively.

Conclusions: In this multicenter randomized controlled trial with 12 months follow-up, we found no significant relation between a transverse and longitudinal incision for insertion of a tibia nail and the occurrence of anterior knee pain. Knee pain during daily activities, functional outcome, quality of life, activity resumption and number of complications and reoperations were also similar. Loss of productivity was the main cost driver for patients treated with an intramedullary nail. Use of a transverse instead of a longitudinal incision for tibial nailing is advised to avoid iatrogenic injury to the infrapatellar nerve.

OP 37

Is Primary pantalar arthrodesis a solution for non-reconstructible tibial pilon fractures?

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Introduction: Review the results after primary pantalar arthrodesis with Intramedullary Nailing for severely tibial pilon fractures, non-reconstructibles according to articular fractures treatment principles. Assess time-to-heal and fuse (fracture and arthrodesis) and intra and postoperative complications.

Materials & methods: The retrospective study was performed on 47 pilon fractures operated at UCL Hospital Brussels, (October 2011-

January 2020) out of which 42 had open reduction and internal fixation and 5, with severe comminution of the articular surface received primary pantalar arthrodesis with an intramedullary nail.

These were reviewed, regarding age, sex, injury type, previous musculo-skeletal conditions, need for temporary external fixation, time to second surgery (nailing), arthrodesis type (open/arthroscopic), bone grafting/additional soft tissue reconstruction, complications, time to bone healing, need for revision surgery, radiological alignment of the hindfoot.

The average period of follow up was **12 months** (6.5–22)

Out of the 5 patients with primary arthrodesis, 1 had high-energy (good bone stock) and 4 low energy trauma (poor bone quality).

Provisional external fixation was needed in 4 cases.

1 case with severe post-traumatic soft tissue loss needed a free flap 2 cases had arthroscopic tibio-talar arthrodesis, 3 were operated with an open technique.

1 autograft from iliac crest and 1 allograft were used.

All fixations were performed with an intramedullary nail.

Results: No intraoperative problems were recorded, 1 delayed healing of surgical wound was encountered.

No postoperative infection was recorded.

Average time to bone healing was **21 weeks** (19–24).

No revision surgery or additional procedures were needed to obtain healing of tibio-talar joint and fracture itself, one revision of subtalar joint (postero-lateral approach, autologous bone graft and additional screw fixation) was needed

Conclusions: Primary pantalar arthrodesis with fracture reduction and stabilisation is a valuable option for selected cases (severely comminution of joint surface in pilon fractures, poor bone stock), when failure of anatomic reduction and stable internal fixation is highly predictable.

References: Beaman DN, Gellman R. Fracture reduction and primary ankle arthrodesis: a reliable approach for severely comminuted tibial pilon fracture. *Clin Orthop Relat Res.* 2014 Dec;472 (12):3823–34. Al-Ashhab ME. Primary Ankle Arthrodesis for Severely Comminuted Tibial Pilon Fractures. *Orthopedics.* 2017 Mar 1;40 (2):e378–e381. Tarkin IS, Fourman MS. Retrograde Hindfoot Nailing for Acute Trauma. *Curr Rev Musculoskelet Med.* 2018 Sep;11 (3):439–444.

OP 38

Operative strategy of atypical irreducible posterolateral quadrant dislocation in proximal tibial fracture with entrapment of the popliteal tendon

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Introduction: Lateral tibial plateau fractures are commonly seen in central trauma units whereas the posterolateral fractures of the tibial plateau are relatively rare. Additionally, an irreducible posterolateral quadrant dislocation (PLQD) is unfrequently. To our knowledge this fracture pattern is not specifically described in the literature. Achieving an anatomical reduction using a standard anterolateral approach is impossible. Therefore, we present four atypical cases where PLQD was irreducible because of an entrapment of the popliteal tendon.

Material & methods: We performed a retrospective single center cohort review at our trauma unit. During a period of 10 years we performed surgery on 555 proximal tibia fractures (AO 41) while we only stated 4 cases of an irreducible PLQD with entrapment of the popliteal tendon (0.7%). The mean age was 52.3 years, two female patients with a partial intraarticular fracture (AO 41-B3) and two male patients with a complete intraarticular fracture (AO 41-C3).

Computertomography images were used to classify the fracture types after initial stabilization with a knee bridging external fixator. In all cases we performed open reduction and internal fixation with locking compression plates (LCP) using a transfibular approach. Intraoperatively the interposition of the popliteal tendon was located, looped with a rubber band and with tension on the tendon the fragment could be reduced anatomically.

Results: In all four cases an anatomical restoration of the joint line was possible after releasing the entrapped popliteal tendon. Clinical and x-ray follow-up was done at six and twelve weeks and one year after surgery in the outpatient department. No complications like infection, re-operation or non-union were recorded. One patient was lost to follow up one year postoperatively, the remaining 3 patients presented with a healed fracture and no limitation in range motion.

Conclusions: PLQD is often challenging to reduce anatomically. As these cases have shown, we recommend reducing these fractures through a transfibular approach to have visual insight into the fracture zone for releasing the entrapped popliteal tendon. Thus, an awareness of this fracture pattern such as we reported in the present cases, is important for all surgeons treating proximal tibial fractures.

OP 39

Measuring intracompartmental pressures for the chronic exertional compartment syndrome: challenging commercially available devices and their respective accuracy

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Introduction: The measurement of intracompartmental pressures is used to evaluate the indication for surgical treatment of the chronic exertional compartment syndrome. Recently, the commonly used Stryker device became unavailable in Europe, forcing physicians to look for alternatives. The aim of this study was to compare the accuracy of manometers and needles available for intracompartmental pressure measurement.

Materials & methods: An experimental compartment simulation model was developed to compare four different terminal devices (Compass manometer, Stryker device, Meritans transducer, and arterial line) and 22 needle types (Fig. 1). First, all possible device/needle combinations were introduced in rubber ports at the bottom of a water column. The water column was gradually drained three times for each device/needle combination and pressures were recorded by two researchers. This procedure was repeated after placement of a sample of homogenous porcine gluteal muscle tissue. Statistical analyses were performed using the water height as reference pressure.

Results: When measuring the fluid column only, all Intraclass Correlation Coefficients were found to be ≥ 0.980 , indicating good

resemblance to the reference pressure (table 1). After addition of muscle tissue to the experimental set up, the accuracy of the Stryker device and arterial line remained the same. The accuracy of the Compass manometer and Meritans transducer became less. Excellent reliability was only found for 7 out of 22 needles when combined with the Stryker device and for 3 out of 22 needles when combined with the arterial line.

Conclusions: The four terminal devices tested were all accurate when measuring pressure in a water column, however only the Stryker device and an arterial line were accurate when measuring pressure in a porcine gluteal muscle model and only in combination with some of the tested needles.

FIGURE 1 Test chamber set-up and an overview of the experimental set up with for different terminal devices. The test chamber set-up consisted of a graduated transparent cylinder and a transverse column with five rubber ports, four ports were in use throughout the experiment: 1. Compass UniversalHg; Iskus Health, Ltd., Dublin, Ireland, 2. Stryker Intracompartmental Pressure Monitor System; Stryker, Kalamazoo, Michigan, 3. Meritans DTXPlus® Disposable Transducers; Merit Medical Systems, Jordan, Utah & IntelliVue MX500 monitor; Philips, Eindhoven, the Netherlands, 4. Xtrans® system; CODAN, Lensahn, Germany & IntelliVue MX500 monitor; Philips, Eindhoven, the Netherlands

TABLE 1 Overview of the reliability for all terminal devices when installed with the different types of needles in the fluid column without and with a sample of porcine gluteal muscle after calculating the Intraclass Correlation Coefficient (ICC) and the respective confidence interval (CI). Excellent reliability with CI > 0.900 is represented in green, good reliability with CI 0.900–0.750 in yellow, moderate reliability with CI 0.750–0.500 in orange, and poor reliability with CI < 0.500 in red.

Fig. 1

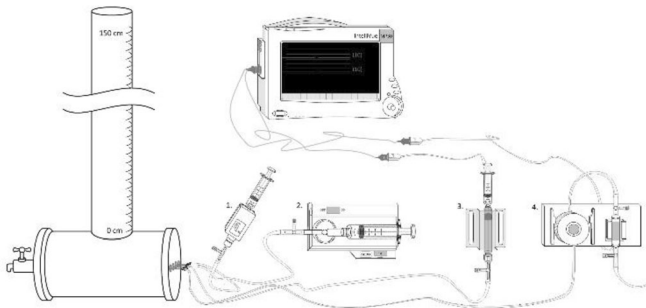


Fig. 2

	Compass		Stryker		Meritans		Arterial line	
	Without muscle sample	With muscle sample	Without muscle sample	With muscle sample	Without muscle sample	With muscle sample	Without muscle sample	With muscle sample
Catheters								
Sil. Catheter, C2Ds	0.999 (0.998-1.000)	0.997 (0.974-1.000)	1.000 (0.999-1.000)	1.000 (0.975-1.000)	0.998 (0.976-1.000)	0.999 (0.983-1.000)	0.999 (0.983-1.000)	0.999 (0.978-1.000)
ViaSia Safety Pro, 22 gauge, BD	0.999 (0.978-1.000)	0.997 (0.971-1.000)	1.000 (0.999-1.000)	0.997 (0.972-1.000)	0.998 (0.981-1.000)	0.999 (0.979-1.000)	0.999 (0.979-1.000)	0.999 (0.973-1.000)
ViaSia Safety Pro, 20 gauge, BD	0.999 (0.977-1.000)	0.997 (0.969-1.000)	1.000 (0.999-1.000)	0.999 (0.983-1.000)	0.999 (0.983-1.000)	0.999 (0.979-1.000)	0.999 (0.979-1.000)	0.999 (0.973-1.000)
ViaSia Safety Pro, 18 gauge, BD	0.999 (0.996-1.000)	0.998 (0.981-1.000)	1.000 (0.999-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)
ViaSia Safety Pro, 16 gauge, BD	0.999 (0.996-1.000)	0.997 (0.979-1.000)	1.000 (0.999-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)
ViaSia Safety Pro, 14 gauge, BD	0.999 (0.995-1.000)	0.997 (0.979-1.000)	1.000 (0.999-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)
ViaSia Safety Pro, 12 gauge, BD	0.999 (0.995-1.000)	0.997 (0.979-1.000)	1.000 (0.999-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)
Intracade, 18 gauge, Vygon	0.999 (0.995-1.000)	0.997 (0.979-1.000)	1.000 (0.999-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)
Intracade, 16 gauge, Vygon	0.999 (0.996-1.000)	0.997 (0.979-1.000)	1.000 (0.999-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)
Intracade, 14 gauge, Vygon	0.999 (0.996-1.000)	0.997 (0.979-1.000)	1.000 (0.999-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)
Intracade, 12 gauge, Vygon	0.999 (0.996-1.000)	0.997 (0.979-1.000)	1.000 (0.999-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)	0.999 (0.989-1.000)
Straight needles								
Meritans needle, 25 gauge, BD	0.999 (0.978-1.000)	0.997 (0.971-1.000)	0.999 (0.992-1.000)	0.999 (0.974-1.000)	0.997 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)
Meritans needle, 23 gauge, BD	0.999 (0.978-1.000)	0.997 (0.971-1.000)	0.999 (0.992-1.000)	0.999 (0.974-1.000)	0.997 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)
Meritans needle, 21 gauge, BD	0.999 (0.978-1.000)	0.997 (0.971-1.000)	0.999 (0.992-1.000)	0.999 (0.974-1.000)	0.997 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)
Meritans needle, 18 gauge, BD	0.999 (0.978-1.000)	0.997 (0.971-1.000)	0.999 (0.992-1.000)	0.999 (0.974-1.000)	0.997 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)
Meritans needle, 16 gauge, BD	0.999 (0.978-1.000)	0.997 (0.971-1.000)	0.999 (0.992-1.000)	0.999 (0.974-1.000)	0.997 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)
Meritans needle, 14 gauge, BD	0.999 (0.978-1.000)	0.997 (0.971-1.000)	0.999 (0.992-1.000)	0.999 (0.974-1.000)	0.997 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)
Meritans needle, 12 gauge, BD	0.999 (0.978-1.000)	0.997 (0.971-1.000)	0.999 (0.992-1.000)	0.999 (0.974-1.000)	0.997 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)
Stryker foot up, 21 gauge, Pajtek	0.999 (0.978-1.000)	0.997 (0.971-1.000)	0.999 (0.992-1.000)	0.999 (0.974-1.000)	0.997 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)
Stryker foot up, 20 gauge, Pajtek	0.999 (0.978-1.000)	0.997 (0.971-1.000)	0.999 (0.992-1.000)	0.999 (0.974-1.000)	0.997 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)	0.999 (0.972-1.000)
Side-ported needles								
Side-ported needle, C2Ds	0.999 (0.998-1.000)	0.998 (0.989-1.000)	1.000 (0.999-1.000)	0.999 (0.991-1.000)	0.999 (0.991-1.000)	0.999 (0.991-1.000)	0.999 (0.991-1.000)	0.999 (0.991-1.000)
Side-ported needle, C2Ds	0.999 (0.998-1.000)	0.998 (0.989-1.000)	1.000 (0.999-1.000)	0.999 (0.991-1.000)	0.999 (0.991-1.000)	0.999 (0.991-1.000)	0.999 (0.991-1.000)	0.999 (0.991-1.000)
Side-ported needle, Stryker	0.999 (0.998-1.000)	0.998 (0.989-1.000)	1.000 (0.999-1.000)	0.999 (0.991-1.000)	0.999 (0.991-1.000)	0.999 (0.991-1.000)	0.999 (0.991-1.000)	0.999 (0.991-1.000)

OP 40

Accuracy of devices available for the measurement of intracompartmental pressures; a cadaver study.

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Introduction: The indication for surgical treatment of the chronic exertional compartment syndrome is evaluated by measuring intracompartmental pressures (ICP). The validity of these invasive ICP measurements are increasingly questioned in the absence of a standardized test protocol and uniform cut-off values. The aim of the current study was to aid in standardization of the test protocol of ICP measurements, thereby supporting the physician's choice in the selection of appropriate manometers and needles.

Materials & methods: A compartment syndrome was simulated in embalmed above-knee cadaveric leg specimen. Four different terminal devices (Compass manometer, Stryker device, Meritans transduce, and arterial line) were tested with 22 different needle types. Legs were pressurized after introduction of the four terminal devices in the anterior compartment, using the same needle type (Fig. 1). Pressure was recorded at a 30-s interval for 11 min in total. Before and after pressurization the intravenous bag of saline was weighed.

Results: A compartment syndrome was simulated successfully in all 22 legs, with ICP values exceeding 100 mmHg in 17 of the 22 legs (77%). In the other five legs, a smaller built up of pressure was seen, although maximum ICP was in between 70 and 100 mmHg. The Intraclass Correlation Coefficient was above 0.700 for all possible needle types (table 1). Excellent to good reliability was seen in 16 out of 22 instrumental setups (73%). The mean volume of saline infusion required in runs that exceeded 100 mmHg (309 ± 116 ml) was significantly lower compared to the legs in which 100 mmHg was not achieved (451 ± 148 ml; p = 0.04).

Conclusions: The ICP recordings of the four terminal devices were comparable, when tested with a standardized pressurization model in a human cadaver model. None of the included terminal devices or needle types were found to be superior. The results provide evidence for more divers material selection when logistic choices for ICP measurement devices are warranted.

FIGURE 1 Example of a limb with the experimental setup installed, using the Stryker side-ported needle. The four different terminal devices are: 1. Xtrans® system; CODAN, Lensahn, Germany & IntelliVue MX500 monitor; Philips, Eindhoven, the Netherlands, 2. Meritans DTXPlus® Disposable Transducers; Merit Medical Systems, Jordan, Utah & IntelliVue MX500 monitor; Philips, Eindhoven, the Netherlands, 3. Stryker Intracompartmental Pressure Monitor System; Stryker, Kalamazoo, Michigan, 4. Compass UniversalHg; Iskus Health, Ltd., Dublin, Ireland

TABLE 1 Overview of change in calf circumference, the amount of saline infusion needed, the maximum pressurization, and the Intraclass Correlation Coefficient (ICC) with the respective confidence interval (CI) after running the decay model per needle type per cadaver leg.

Fig. 1



Fig. 2

	A calf circumference (centimeters)	Saline infusion (ml)	Maximum Pressurization		ICC (95% Confidence Interval)*
			>100 mmHg	<100 mmHg	
Catheters					
Slit Catheter, C2Dx	1	222	X		0.834 (0.593-0.932)
Venflon Safety Pro, 22 gauge, BD	1	401		X	0.968 (0.898-0.988)
Venflon Safety Pro, 20 gauge, BD	4	378	X		0.996 (0.984-0.999)
Venflon Safety Pro, 18 gauge, BD	1	347	X		0.996 (0.990-0.998)
Venflon Safety Pro, 17 gauge, BD	2	420	X		0.893 (0.809-0.948)
Venflon Safety Pro, 16 gauge, BD	1	302	X		0.990 (0.969-0.996)
Venflon Safety Pro, 14 gauge, BD	4	308		X	0.863 (0.696-0.941)
Intramule, 18 gauge, Vygon	2	358	X		0.994 (0.976-0.998)
Intramule, 16 gauge, Vygon	1	448	X		0.896 (0.607-0.965)
Intramule, 14 gauge, Vygon	3	647		X	0.992 (0.984-0.997)
Intramule, 13 gauge, Vygon	2	564		X	0.948 (0.897-0.976)
Straight needles					
Microlance needle, 25 gauge, BD	2	248	X		0.881 (0.790-0.943)
Microlance needle, 23 gauge, BD	2	222	X		0.877 (0.765-0.943)
Microlance needle, 21 gauge, BD	3	335		X	0.855 (0.717-0.934)
Microlance needle, 18 gauge, BD	1	145	X		0.943 (0.732-0.982)
Microlance needle, 16 gauge, BD	2	116	X		0.994 (0.977-0.998)
Sonoplex facet tip, 22 gauge, Pajunk	3	347	X		0.838 (0.722-0.920)
Sonoplex facet tip, 21 gauge, Pajunk	4	417	X		0.919 (0.840-0.963)
Sonoplex facet tip, 20 gauge, Pajunk	0	234	X		0.978 (0.956-0.990)
Side-ported needles					
Side-ported needle, C2Dx	3	526	X		0.989 (0.973-0.995)
Sonoplex Sprotte tip, Pajunk	1	157	X		0.890 (0.777-0.950)
Side-ported needle, Stryker	1	370	X		0.998 (0.993-0.999)

* Excellent reliability with CI >0.900 is represented in green, good reliability with CI 0.900-0.750 in yellow, moderate reliability with CI 0.750-0.500 in orange, and poor reliability with CI <0.500 in red.

OP 41

Profiling the microRNA fingerprint of the human fracture hematoma

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Introduction: As soon as a fracture occurs, a fracture hematoma (fxh) is formed. fxh plays an important role in fracture healing and, under normal circumstances, aids in generating an environment in which a variety of cells orchestrate processes inducing fracture healing. MicroRNAs (miRNAs) may influence these processes. The aim of this study was therefore to determine the miRNA signature of human fxh in normal fracture healing and examine potential influences of clinical parameters on those miRNA expression levels.

Material & methods: fxh was harvested during fracture surgery of long bones. miRNAs were isolated, transcribed, analyzed by means of qPCR arrays, and validated in the study population. Qiagen fibrosis- and inflammation qPCR arrays were used based on a broad literature study on fracture healing and osteogenesis. Subsequently, possible targets of regulated (> twofold) miRNAs were determined using Qiagen Ingenuity Pathway Analysis.

Results: In total, fxh was harvested from 61 patients (mean age 52 ± 19; 32♀). From the array data, a selection of twenty most regulated miRNAs, 10 up- and 10 down-regulated, was validated in the study population. Expression levels of seven out of these 20 miRNAs correlated to several clinical parameters (Fig. 1). The time interval between trauma and surgery influenced the expression of three miRNAs, other three miRNAs were expressed in a patient age dependent manner and one based on the severity of trauma. In silico target analysis revealed 260 mRNA targets for 14 out of the 20 validated miRNAs.

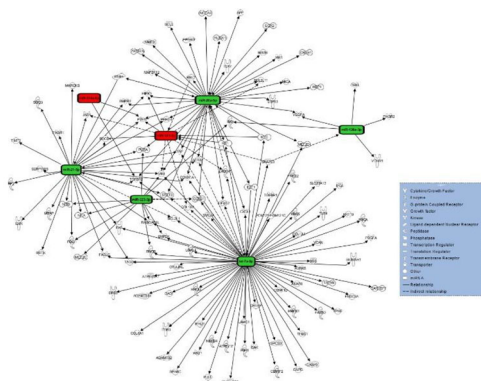
Conclusions: This study portrayed the regulatory role and importance of miRNAs in human fxh, linked to key processes in fracture healing. The expression levels of seven validated miRNAs correlated with several clinical parameters and showed to be involved in multiple processes that are important in the fracture healing cascade, such as, angiogenesis mineralization. These data broaden our view on potential therapeutic implications of miRNAs in fracture healing.

FIGURE 1 In silico target analysis, performed with Qiagen Ingenuity Pathway Analysis (IPA) software, of 7 miRNAs whose expression was dependent on the time interval between trauma and surgery, patient age, or severity of trauma. Green color represents upregulated miRNA expression,

References:

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Fig. 1



VISCERAL TRAUMA/POLYTRAUMA/GENERAL

OP 42

Hemorrhage and vascular injuries in civilian public mass shootings—A systematic literature review

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Introduction: Several mass casualty shootings (MCS) have occurred in recent years. The aim of this review was to investigate haemorrhage and vascular injuries after MCS to further improve the management.

Material & methods: A systematic review of all published literature was undertaken in Medline, Embase and Web of Science upon the 22nd of February 2021 according to the PRISMA guidelines (1). Literature on MCS (≥ 3 people shot, not including shooter), vascular injuries, and haemorrhage were included. The search identified 2884 studies; 37 were eligible for inclusion in the analysis.

Results: The shooting of 2093 people at 45 separate events were described. Most common injury locations being: extremity 27.3% (197/722) followed by chest 23.0% (166/722) and abdomen 20.6% (149/722). The median number of operations and operated patients per event was 14 (IQR 10–86) and 9 (7–30), respectively. The median use of blood products was 277 units (IQR 256–280) per event. Vascular injuries ranged from 8%–29%, extremity vascular injury being most common. A total of 899 deaths were reported. The dominating causes of death were head injury in 29.4%, thoracic injury in 29.4%, and haemorrhagic shock or vascular trauma in 23.5% from 9 separate events. 8.2%–10% of all deaths involved specific vascular injuries; thoracic aorta (18%) followed by carotid (6%) and abdominal aorta (5%).

Conclusions: Mass casualty shooting injuries are mainly located to the torso followed by the extremity. Vascular injuries vary from different events but about one quarter of deaths is related to haemorrhage involving central large vessel injuries. The data is sparse but further understanding of these injuries may improve outcome.

References:

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OP 43

Interobserver variability of Abbreviated Injury Scale (AIS) for quantifying local injury severity, assessment of surgical priorities and expected outcome in multiple injured patients

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Introduction: The injury severity score (ISS) continues to represent a key factor in assessing anatomic injury severity scoring and is based on the abbreviated injury scale (AIS). The advantages and disadvantages of the ISS and the AIS have been assessed in several studies. Thus, the aim of this work was to assess inter-observer variability of the AIS as well as the surgical priority and expected outcome of polytraumatized patients based on the rated AIS.

Material & methods: A web-based survey using SurveyMonkey® consisting of 35 questions related to the scoring of patients with multiple injuries was shared via E-Mail to members of the European Society of Trauma and Emergency Surgery (ESTES) between 28th of February 2018 and 28th of July 2019. Participants were asked for demographics age, sex, level of specialty training, trauma case load, working experience, surgical specialty and were then asked to rate the AIS of 10 fictive injured patients. Furthermore, participants were asked to rate the surgical priorities of the assessed body regions. Out of 10 presented cases in the survey, we picked the two most frequently answered cases for further analysis.

Results: 102 participants (82% male) participated in this survey. 79.8% (79) of the participants were trauma surgeons. 46 Residents, 44 Attending and 10 times a Head of department undertook the survey (N = 100). The mean work experience in years was 11.8 and the mean case load of polytraumatized patients per month was 11.9. 80% of the participants stated, that they were working in a level-1-trauma center. Out of 10 presented cases in the survey, the two most frequently answered cases were further analyzed. In case 1, 63% of the ratings differed from the pre-defined score according to AIS 2015® (68% in case 2). Trauma surgeons had a significant smaller number of wrong answers compared to their orthopaedic colleagues in case 1 (p = 0.038), but not in case 2 (p = 0.730). In both cases, no correlation between working experience or trauma case load and correct AIS-ratings was seen. The mean calculated ISS in case 1 was 59.5 (SD 14.0), whereas the pre-defined ISS was 66. In case 2 the mean calculated ISS was 49.8 (SD 14.2), whereas the pre-defined ISS was 57. All respondents identified the displayed patients as polytraumatized.

Conclusions: AIS and the directly connected ISS are overly rater dependent scoring tools with only questionable adequacy as classifiers for summarizing injury severity. However, inter-rater variability for the surgical priorities were relatively low and a relatively high agreement on injury severity and expected outcome was seen.

OP 44

Trauma scores for decision making in polytrauma: one might not fit all.

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Introduction: Trauma is one of the leading causes of mortality and morbidity worldwide. Trauma scores allow to compare different trauma populations. They can also be valid allies in decision making and therefore should be selected carefully for our purpose. Scores have been shown to perform differently in relation to different outcomes [1], and to be influenced by patients' age [2]. Some suggest the need for a score covering multiple physiological systems [3] such as the recently introduced Clinical Grading System (CGS). In our study, we compared ISS, NISS, CGS, RTS, TRISS predictivity of mortality and morbidity in different age groups.

Material & methods: This was a retrospective study on 369 polytrauma patients. We used Receiver operator Characteristic (ROC) curves for the prediction of Mortality, Hospitalization, Prolonged Hospitalization and ICU for each score through four age groups.

Results: TRISS and RTS were the best predictors of mortality (AUC 0,973 and 0,930). Hospitalization was best predicted by NISS and ISS (AUC 0,864 and 0,862). ISS performed best in predicting ICU (AUC 0,902) and NISS in predicting long hospitalization (AUC 0,773). Predictivity decreased over 80 years of age for mortality, over 65 years of age for morbidity. CGS showed the best ability to predict ICU over 65 years (AUC 0,798).

Conclusions: TRISS and RTS predict mortality better while morbidity is better predicted by anatomical scores. CGS is especially suited to predict ICU allocation in elderly patients.

References:

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Fig. 1

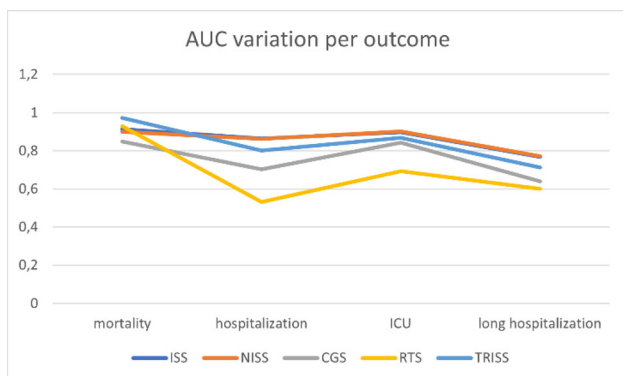
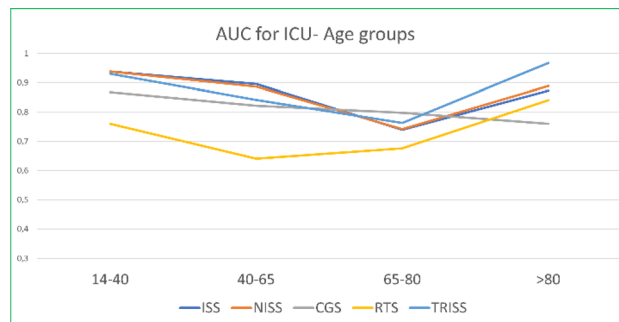


Fig. 2



OP 45

Incidence and severity of electric scooter related injuries in a tertiary referral center in Rome.

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Introduction: The electric scooter is increasingly becoming a popular mode of transportation, especially in the central areas of large cities. Despite its use has been rising rapidly and many rental programs has been implemented, in Rome there are still no regulations for their use. The aim of this study is to analyze the types of injuries associated with the use of electric scooters, their incidence and its trend over time.

Material & methods: A retrospective analysis of patients presented to the emergency department for injuries associated with electric scooter between September 2019 and September 2021 was done.

Results: During 24 months a total of 186 patients were admitted in the emergency department due to electric scooter associated injuries: 151 (81,2%) were riders of the scooter and 35 (18,8%) were non-riders. Mean age was 31 years (range 16–69), 109 were males and 77 were female. Interestingly there is a constant increase of cases over time: the number of cases was 46 in the first 12 months of the study and 140 in the following 12 months (an increase of more than three times in one year). Usually patients presented to the emergency department in the evening: 94% of patients arrived between 6.00 p.m. and 1.00 a.m. with a plateau around 10.00 p.m. The large majority of patients did not use helmet.

The mean Injury Severity Score (ISS) was 4,1 (range 2–50) because the majority of patients had contusions/abrasions, minor wounds and/or minor head injuries and has been discharged home within 12 h, thirty nine patients (20,9%) had ISS > 9. The most frequent injuries involved the head (45,1%), the face (26,8%) and the upper limbs (43%), lower limbs (21,5%), chest (10,7%) and abdomen (8%) are involved less frequently.

42 Patients (22,5%) required admission in the hospital (5 in intensive care unit), 36 required an operation. There have been no mortality but 4 patients had permanent disability at discharge. Factors with higher likelihood of hospital admission included presentation to the hospital in the late evening/night (after 11 p.m.) (OR 2.17, p < 0,05), loss of consciousness (OR 1.75 p < 0,01), transport to the hospital by helicopter (OR 4.12, p < 0,05) and use of anticoagulant or antiplatelet drugs (OR 5.17, p < 0,01).

Conclusions: The increasing popularity of electric scooter has been rising the rate of injuries associated with this mode of transportation:

the number of injuries and the types of injuries (with head injuries representing the main form of injury) show the urgent need for regulation of this mode of transport.

References:

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OP 46

Gunshot injuries in Central Europe—Epidemiology, management and outcome in Germany, Switzerland and Austria—an analysis based on the TraumaRegister DGU®

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Introduction: Unlike many other types of weapons, firearms are of special interest due to their high lethality and criminal value. There is lacking data on the epidemiology of gunshot wounds in Central Europe in a clinical context and especially the clinical (resuscitation) management as well as the outcome of victims with sustained firearm injuries. Thus, the aim of this study was to review the current legal frameworks on firearms in Germany, Austria and Switzerland and secondly to retrospectively analyze the epidemiology of gunshot wounds, prehospital and clinical management as well as the outcome.

Material & methods: All patients with sustained gunshot injury in the period from 1st January 2009 to 31st December 2019 who were transferred to a level 1 or 2 trauma center in Germany, Switzerland and Austria were analyzed retrospectively regarding trauma mechanism, injury severity, injured body region and mortality, using data from the TraumaRegister DGU® (TR-DGU).

Results: In total, there were 111 gunshot victims in Austria (A), 102 in Switzerland (S) and 1099 in Germany (G) during the respected time period. The mean injury severity score (ISS) was 25 (A), 31.5 (S) and 23.4 (G). Almost 60% of all patients with gunshot wounds died in Austria, 52% in Switzerland and 42% in Germany. Overall, more than 50% of the gunshot injuries were due to suspected violent crime in the age group of 0 to 40 years. The incidence of suspected suicide increased rapidly from the age of 40 to up to 93.6% in patients aged above 80 years. Accidental gunshot wounds had a peak in patients aged < 20 years (27.3%) and showed a steady decline with advanced age. The highest mortality in accidental gunshot wounds was seen in Austria (25%) followed by Switzerland (14.3%) and

Germany (11.2%), whereas death in suspected suicide occurred most often in Switzerland (82.1%), followed by Austria (75.3%) and Germany (63.7%). Most of the gunshots to the head were due to suspected suicide (83.4%), whereas gunshots to the body stem and the extremities were mainly due to suspected crime (51.3%–73.6%).

Conclusions: Overall, gunshot wounds are rare, but there is evidence that gun laws may have an impact on gunshot wounds with suicidal intent.

OP 47

Resuscitative endovascular balloon occlusion of the aorta with distal resuscitation (reboa-dr)—proof of concept for a novel resuscitative technique

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Introduction: Ischemia–reperfusion injury (IRI) following Resuscitative Endovascular Balloon Occlusion of Aorta (REBOA) remains the major determinant for maximal duration of aortic occlusion. Techniques for mitigating this IRI including partial or intermittent balloon deflation, and partial pREBOA catheter under development, remain predicated on acceptable physiological hemodynamics above the balloon prior to any deflation. We describe a novel technique using REBOA with Distal Resuscitation (REBOA-DR) and hypothesize that this can be utilized to infuse resuscitative fluids into the distal aorta during complete occlusion to potentially mitigate distal ischemia and aid in earlier identification of major vascular injury.

Material & methods: Six (6) Yorkshire pigs weighing approx. 70 kg underwent an exploratory laparotomy and splenectomy, followed by hemorrhage of 25% estimated total blood volume to induce hemorrhagic shock. A > 50% circumference injury was created in the iliac artery. A REBOA catheter was deployed in Zone I of the aorta through a 7-french sheath in the femoral artery contralateral to the injury to assess effects of extravasation and perfusion distal to this injury. Resuscitative crystalloid solution and contrast were infused alongside REBOA catheter through the single sheath in a pressurized retrograde fashion via a rapid infuser connected to sheath side-port.

Results: Fluoroscopic images and videos showed proof-of-concept evidence for REBOA-DR where resuscitative solution is infused alongside a REBOA catheter via a single femoral arterial sheath. Infused contrast-laden resuscitative solution is noted to reach the renal and celiac vessels below the inflated REBOA balloon in zone I of the occluded aorta (Fig. 1). At the site of the iliac artery injury, evidence of flow is noted in the artery distal to injury despite extravasation of contrast (Fig. 2).

Conclusions: REBOA-DR provides an opportunity to perfuse distal organs during aortic occlusion without a need for additional arterial access. Resuscitative solution extravasation can potentially aid in localization of major vascular injury in the abdomen while affording partial limb perfusion. Application of REBOA-DR technique for reducing IRI and earlier intraoperative identification of injuries with limb perfusion await elucidation.

Fig. 1

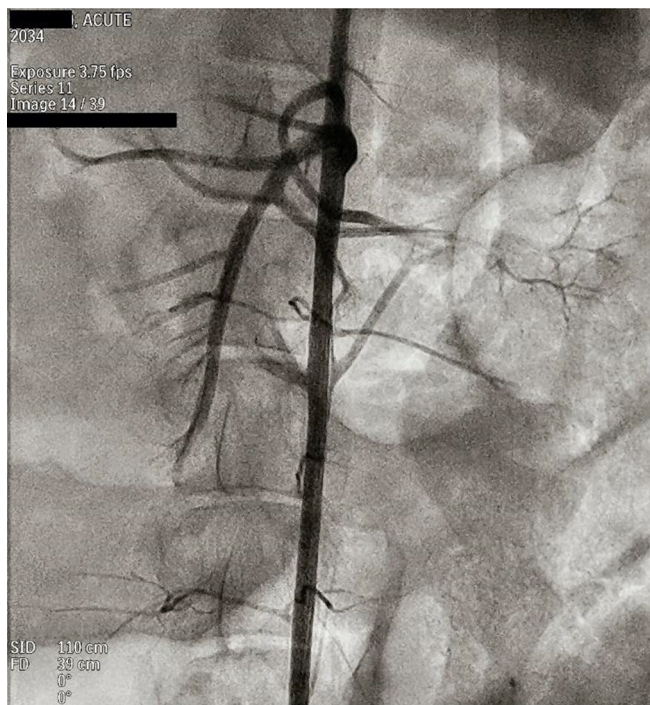
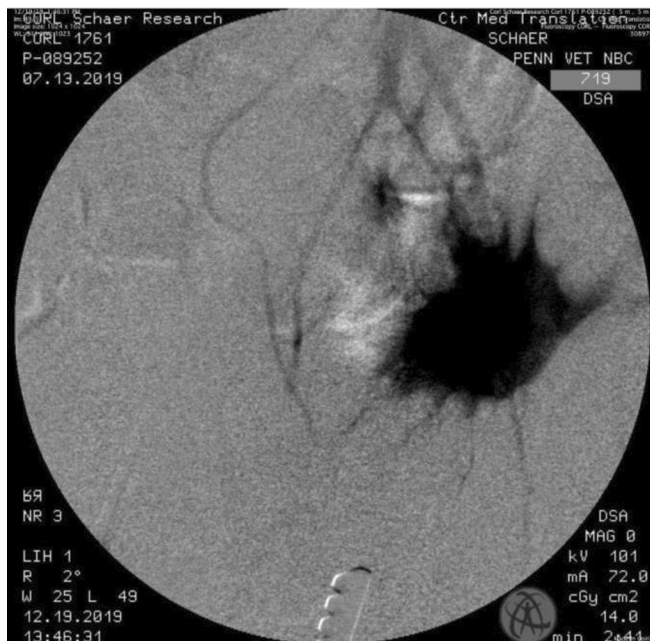


Fig. 2



OP 48

A severe isolated injury is a high-risk entity for resource use and mortality: A Dutch national observational study

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Introduction: The Berlin polytrauma definition (BPD) has proven to be a valuable way of identifying patients with at least a 20% risk of mortality, by combining anatomical injury characteristics with the presence of physiological risk factors (PRFs). Severe isolated injuries (SII) are excluded from the BPD, even though, they concern approximately 50% of patients with an injury severity score (ISS) ≥ 16 .

Objectives: This study aims to describe the characteristics, resource use and outcome of patients with SII according to their injured body region, as well as the prevalence of physiological risk factors and their association with mortality. Furthermore, to adjudicate whether it is justified to exclude SII patients from trauma definitions like the BPD.

Material & methods: This retrospective observational study includes data from the Dutch National Trauma Registry between 2015 and 2019. SII patients were defined as those with an injury with an Abbreviated Injury Scale (AIS) score ≥ 4 in one body region, with at most minor additional injuries (AIS ≤ 2). We performed an SII subgroup analysis per AIS region of injury. Multivariable linear and logistic regression models were used to calculate odds ratios (ORs) for SII subgroup patient outcomes, and resource needs. Finally, the association between the PRFs described in the BPD and mortality was analyzed.

Results: A total of 10,344 SII patients were included; 47.8% were admitted to the ICU, and the overall mortality was 19.5%. Compared to all other body regions the adjusted risk of death was highest for external (2.6, CI 2.0–3.4) and for head SII (2.0, CI 1.8–2.3). Patients with SII to the abdomen (2.3, CI 1.9–2.7) and thorax (2.0, CI 1.8–2.3) had a significantly higher risk of ICU admission. The highest adjusted risk of disability was recorded for spine injuries (10.1, CI 8.1–12.6).

The presence of ≥ 1 PRFs was associated with a mortality rate of at least 15% for thoracic SII, 17% for spine SII, 22% for head SII and 49% for external SII.

Conclusions: A severe isolated injury is a high-risk entity and should be recognized and treated as such. Injuries in the external region, head, spine, and thorax have a high impact on medical resources and pose a significant risk of death. The addition of PRFs to the anatomical injury criteria improves the identification of patients with SII at risk of worse outcomes.

Table 1 Patient characteristics of patients with severe isolated injuries to the anatomical region of the head, thorax, spine, abdomen, extremity or external.

Figure 1 Mortality of severe isolated injury patients who sustained injuries in the region of the head, thorax, abdomen, or extremities versus the presence of PRFs

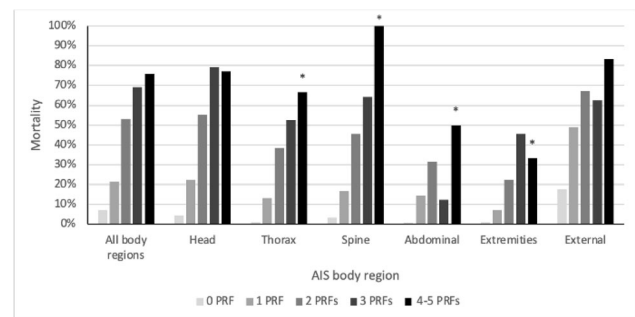
Fig. 1

Table 1. Linear and logistic regression coefficients, 95% confidence intervals, and p-values for interactions between anatomical injury location and mortality, ICU admission, ICU LOS, GOS.

Body region	Coefficients*									
	Mortality (OR)	p-value	GOS (OR)	p-value	ICU admission (OR)	p-value	ICU LOS (beta)	p-value	Hospital LOS (beta)	p-value
Head**	2.04 (1.80–2.32)	<0.001	1.02 (0.90–1.15)	0.688	0.87 (0.79–0.95)	<0.001	1.22 (0.65–1.78)	<0.001	-0.37 (-0.99–0.26)	<0.001
Thorax	0.61 (0.48–0.78)	<0.001	0.44 (0.36–0.53)	<0.001	2.05 (1.81–2.32)	<0.001	-0.79 (-1.53–-0.49)	0.037	-0.24 (-1.11–0.53)	<0.001
Spine	1.28 (0.95–1.73)	0.107	10.10 (8.12–12.36)	<0.001	1.39 (1.16–1.66)	<0.001	6.47 (5.34–7.59)	<0.001	5.19 (4.99–6.42)	<0.001
Abdomen	0.93 (0.58–1.49)	0.790	0.51 (0.38–0.68)	<0.001	2.28 (1.87–2.78)	<0.001	-1.96 (-3.01–-0.91)	<0.001	-1.06 (-2.33–0.20)	0.100
Extremities	0.58 (0.36–0.93)	0.025	1.83 (1.27–2.68)	<0.001	0.87 (0.53–0.85)	<0.001	-1.63 (-3.13–-0.09)	0.038	5.87 (4.76–7.08)	<0.001
External	2.60 (2.02–3.38)	<0.001	0.81 (0.59–1.13)	0.221	0.84 (0.65–1.08)	0.175	1.22 (-2.38–1.12)	0.030	4.61 (4.09–5.18)	<0.001

*Coefficients were calculated reference to all severe isolated injury patients with exclusion of the investigated region and were adjusted for systolic blood pressure, age, and Glasgow Coma Score.
 ** Adjusted for systolic blood pressure and age due to collinearity with GCS.
 Abbreviations: ICU, Intensive Care unit; LOS, Length of stay; GOS, Glasgow Outcome Score.

Fig. 2



*Percentages are possibly biased due to low prevalence (n<10).

OP 49

WHO-ICRC triage tool: accuracy and usability of a new triage tool for disaster settings

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Introduction:

Primary objective: To measure the reliability and practicality of a new primary Triage model proposed by WHO-ICRC and compare it with two other primary Triage algorithms (START and SIEVE), during a major accident.

Secondary objective: to measure the predictive capacity of the new triage model in relation to patient outcome with respect to the Revised Trauma Score (RTS) and Injury Severity Score (ISS).

Assumption: The COVID-19 pandemic has dramatically re-proposed the need to have a triage system capable of dividing patients into priority and urgency categories in maxi-emergency. To date, the most widely used international systems in the event of a traumatic event are the START and SIEVE algorithms. WHO and ICRC have recently proposed a new primary triage model, targeting low-resource systems. Material & methods: During a MACSIM training event (MASS Casualty SIMulation) aimed at 77 Emergency Medicine residents (MEU), training was offered on the 3 triage methods under study and on the MACSIM simulation system. The doctors, randomly divided into two groups (n1: 40, n2: 37), had the task of performing primary triage, simulating being at the gates of the PS, using the SIEVE algorithm (group 1) and WHO-ICRC (group 2) on 40 MACSIM patient cards, projected consecutively for a time of 20 s. The 40 MACSIM patients had already been previously assessed using the START triage model (20R, 9G, 11 V) and the RTS and ISS scores, used as a reference for the study. Participants in the study carried out their triage assessment using suitably prepared cards. In the end, they were also asked for subjective feedback, regarding the ease of use of the triage system they used compared to START triage (triage faster, more accurate, easier to learn, easier to apply).

Results: SIEVE and WHO-ICRC were very consistent with the START model with respect to the primary assessment. In the study in question, there was a slight tendency of the SIEVE model to overestimate all degrees of priority. The WHO-ICRC model occasionally underestimated the GREEN code (p3). As for the feedback, the participants reported a greater accuracy of the WHO-ICRC model than the START but found the SIEVE easier to learn, to apply and faster to execute.

Conclusions: WHO-ICRC is a valid alternative to international algorithms. It should be noted that this protocol provides for the assignment of the BLUE CODE, as opposed to the SIEVE and START models. Therefore, for statistical purposes, it was considered as RED (p1). Furthermore, the WHO-ICRC triage is designed for a reality setting with limited resources, difficult to apply to the European reality. Another consideration to be made is that the participants in the study were all doctors: this could have led to a tendency to make “diagnoses” and therefore give an incorrect value to the primary triage. It is interesting, in the future, to repeat the study with nurses and paramedics.

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OP 50

Pediatric burns from 2015–2019 at OUS—scalding still a common issueL. M. Svendsen¹¹University of Oslo, Klinikk for hode, hals og rekonstruktiv kirurgi, Oslo, Norway.

Introduction: The goal of this study was to create an overview of pediatric burn injuries, with a special focus on scald burns among children < 18 years of age. By examining the mechanisms of significant scald burns, the aim was to discover insight into prevention strategies.

Material & methods: Medical records for children < 18 years of age, who were admitted with burn injuries between January 2015 and December 2019, were identified through the Oslo universitetssykehus (OUS), DIPS system. Demographic data and details of the circumstances and mechanism of injury were some of the variables extracted from the medical records.

Results: 370 admissions to OUS during the 5-year study period involved children with burn injuries. 271 were ≤ 3-years of age and a majority (57.2%) of these children were males. Injuries typically occur during the winter months, in the child's home with the mother present. The most common mechanism of injury was scald burns (78.9%) in both age groups ≤ 3-years (88.2%) and > 3-years of age (53.5%). First aid was initiated at the site of injury in 65.9% of the reported cases. Few patients were transferred to Haukeland universitetssykehus (HUS). 22.2% of the children were given Dormicum® or Ketalar® when arriving at OUS for assessment of the depth and extent of the burn, and wound cleaning. The mean TBSA expressed as % was 4.73 and 69.8% had TBSA ≤ 5%. 64.1% of the children had superficial dermal IIa burn injuries mainly on their torso, 11.4% was in need of a partial thickness skin graft and 27.0% received antibiotics primarily because of a wound infection. Average hospital stay was 13 days and a little over 1/3 of the children had a follow-up session and the majority of these children had superficial, small burns.

Conclusions: Current prevention strategies don't adequately address the most common mechanism of scald injury requiring hospitalization. Many of the incidents could have been avoided. An objective of this study was to provide information to potentially target scald prevention programs or strategies. Prevention programs are important to improve awareness and decrease the incident of pediatric scald burns. The information can for example be incorporated into the «Helsestasjonsprogrammet 0–5 år» to make parents and caregivers more aware. This study aims to increase knowledge about scald injuries, what devastating effects they can have, how to avoid them, first aid, and how the treatment takes place at the hospital.

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VISCERAL TRAUMA

OP 51

Contrast enhanced computed tomography abdomen reduces non-therapeutic surgery in patients with penetrating abdominal trauma: a randomised controlled trialS. Kaur¹, D. Bagaria², A. Kumar², P. Priyadarshini², N. Chaudhary², S. Sagar², A. Gupta², B. Mishra², M. Joshi², A. Kumar², S. Gamanagatti², K. Dev Soni², R. Aggarwal², S. Vishnubathla², S. Kumar²¹All India Institute of Medical Sciences, General Surgery, Jodhpur, India²All India Institute of Medical Sciences, Surgical Disciplines, New Delhi, India

Objective: This study of stable patients with AASW compared CECT based SNOM and diagnostic laparoscopy.

Introduction: Penetrating abdominal trauma was traditionally managed by mandatory exploration which led to high rates of non-therapeutic surgery. Diagnostic Laparoscopy is less invasive, however general anesthesia is required, and risk of iatrogenic injuries persists. Image guided selective non-operative management avoids surgery altogether.

Material & methods: This prospective two-armed randomized study was conducted between April 2019 and February 2021. Hemodynamically stable patients with AASW were randomized to diagnostic laparoscopy (DL) and CECT based management. Exclusion criteria included hemodynamically unstable patients, evisceration or peritonitis, gunshot injuries, concomitant injuries requiring surgery. Primary outcome was length of hospital stay. Secondary outcomes were rate of non-therapeutic surgery, length of ICU stay and rate of complications.

Results: One hundred six patients were randomized: 52 patients in DL group and 54 patients in CECT group. Demographics and clinical parameter were comparable. Mean length of stay was similar in both groups (3.5 days vs 3 days, p = 0.423). Rate of non-therapeutic surgery was significantly lower in CECT group (17.4% vs 65.4%, p = 0.0001). NOM based on CECT findings was successful in 93.8% of patients, 2 patients required delayed surgery.

Conclusions: This study did not find any difference in length of hospital stay in patients undergoing DL or CECT. However, there was a significant reduction in non-therapeutic surgery by using CECT to evaluate these patients. Use of CECT as a screening tool did not lead to significant increase in missed injuries.

OP 52

Management of renal and ureter trauma: the importance of retroperitoneal confinementT. Nijdam¹, R. Spijkerman¹, R. Meijer², L. P. H. Leenen¹, F. Hietbrink¹¹UMC Utrecht, Trauma Surgery, Utrecht, Netherlands²UMC Utrecht, Urology, Utrecht, Netherlands

Introduction: Renal injury is the most frequently encountered urogenital trauma, mainly caused by blunt trauma mechanism. Non-operative management (NOM) for blunt low-grade renal trauma results in high success rates. However, no consensus exists on the management of high-grade renal injuries. The presence of urinary extravasation from the collecting system might be considered essential for decision making. We hypothesize that patients with minimal

urinary extravasation and retroperitoneal confinement can be treated without the need for open surgical intervention, or even percutaneous or endoscopic procedures.

Material & methods: All patients with renal injury presented to our level one trauma center from 01–2007 to 12–2018 were retrospectively included. Baseline characteristics, data regarding complications and mortality were collected from the electronic patient registry. Patients were grouped based on renal injury and the type of management. Interventions consisted of renal angio-embolization, JJ-stenting, percutaneous nephrostomy catheter, laparotomy with packing, or nephrectomy.

Results: A total of 293 patients with renal injury were included with a median age of 32 years (20–55) and a median ISS of 20 (13–29). From the 293 included patients, 29 patients (10%) were admitted with a high grade renal injury. A total of 277 patients received non-interventional treatment without the need for interventions. Initially, 16 patients required immediate intervention for their renal injury (group B, of which 12 had a high grade injury). Six patients were treated primarily with angio-embolization for active hemorrhage on imaging. Furthermore, 15 patients showed urinary leakage on CT-scan with retroperitoneal confinement in 13 out of 15 patients, of which ten patients were treated without an intervention (C) and 5 patients with urinary leakage (D) underwent immediate intervention. In 2 out of the 10 patients without primary intervention for their urinary leakage, secondary procedures were needed.

Conclusions: Hemodynamic stability dictates treatment in terms of laparotomy, angio-embolization or non-operative management. In hemodynamic stable patients with urinary leakage, retroperitoneal confinement dictates treatment in terms non-interventional management, which comes with satisfying success rates of 80%. Non-interventional management in hemodynamic stable patients with renal injuries results in a high renal salvage rate, regardless of renal injury severity.

Fig. 1

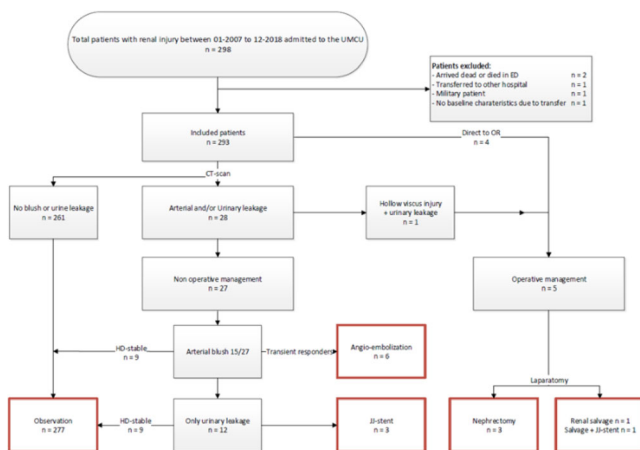


Fig. 2

Supplement 2. Patients with urinary extravasation on CT-scan

Patient	Renal pelvis dissection	Renal injury grade	Follow-up in months	Gerota's fascia	Unilateral injury	Arterial contrast blush	Treatment	Successful treatment/Re-intervention	Comment
1	Yes	2	3	Intact	Suspected	No	NIM	Yes	-
2	Yes	2	2	Intact	No	No	NIM	Yes	-
3	Yes	3	2	Intact	No	No	JJ-stent	Yes	-
4	Yes	4	6	Intact	Proximal	No	JJ-stent	Yes	-
5	Yes	4	2	Perforated	No	No	JJ-stent	Yes	Lap. for hollow viscus injury
6	Yes	3	2	Intact	No	No	NIM	Yes	-
7	Yes	4	12	Intact	No	No	NIM	Yes	-
8	Yes	4	14	Perforated	No	No	NIM	Lap + Packing	-
9	Yes	4	2	Intact	No	No	Embolization	Yes	-
10	Yes	4	14	Intact	No	Yes	JJ-stent	Yes	Persistent uteroma
11	Yes	3	12	Intact	No	Yes	NIM	JJ-stent	Persistent uteroma
12	Yes	3	2	Intact	Suspected	No	NIM	Yes	-
13	No	3	Other hos.	Intact	Proximal	No	NIM	Yes	-
14	Yes	2	Other hos.	Intact	Suspected	No	NIM	Yes	-
15	Yes	2	Other hos.	Intact	No	No	NIM	Yes	Persistent UPI-stenosis

OP 54

Management of Pseudo-aneurysms in splenic trauma

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Introduction: Splenic injury is prevalent in trauma. Although splenectomy was the previous mainstay of management, there has been a shift non-operative management (NOM) including embolization. The formation of pseudoaneurysms (PSA), delayed bleeding and delayed rupture can all lead to failure of NOM2. Interventional Radiology (IR) embolization is now an integrated part of the NOM reducing the risks mentioned above. The aim of this study was to look at the incidence and management of PSAs at our institution and whether PSA is associated with failure of NOM.

Materials & methods: This was a single centre retrospective study from a Major Trauma Centre. All adult trauma patients (blunt and penetrating) who sustained a splenic injury between January 2014 and September 2019.

Results: 226 patients with splenic injury were identified. Of these, 169 were managed non-operatively, with 41 receiving IR embolisation. NOM was successful in 98.8% of cases.

Overall, there were 19 cases of PSA (8.4%) in our cohort, with a median time of diagnosis of 2.4 days from injury. 3 patients with PSA underwent splenectomy. 11 patients with PSA underwent IR embolization, with no complications reported. Persistent PSA, defined as PSA seen on imaging post IR, was seen in 6 patients. One of these patients required further IR intervention, 3 had resolution of PSA on follow up and 2 did not have further imaging but remained clinically well. 5 patients with PSA were managed conservatively. Of these, half had follow up imaging, with all imaging confirming PSA resolution.

Conclusions: NOM was successful in 98.8% of cases (compared to 80% success rate in the literature). Embolisation of PSA is associated with immediate thrombosis in only 58% of patients. However, PSAs may also auto-thrombose with time. Aggressive pursuit of PSAs in our institution is associated with a highly successful rate of NOM in splenic injury.

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OP 55

Direct Peritoneal Resuscitation (DPR) as an adjunct treatment to management of abdominal catastrophes due to trauma and sepsis: Initial experience with 29 patients

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Introduction: Damage control surgery (DCS) has been successfully applied in major intra-abdominal trauma and abdominal catastrophe. Previous studies using direct peritoneal resuscitation (DPR) as an adjunct to management of patients undergoing DCS have shown

promising results. The aim of this study was to report our initial experience in patients managed with DPR as adjunct technique in patients that underwent DCS.

Material & methods: We studied 29 patients between August 2020 and July 2021 in our institution. DPR consisting of peritoneal lavage with DIANEAL PD-2 D 2.5% was used, and the patient outcomes were evaluated.

Results: The median (interquartile range: IQR) age was 63 (55.5–71.5) years; 69% were male, and median (IQR) body mass index was 30.1 (25.4–38.6) kg/m². The majority (62%) of patients required DCS due to peritonitis or septic abdomen. Median (IQR) APACHE IV score was 46.5 (32–60.8) and Acute Physiology Score (APS) was 34 (25–50.5) on DPR initiation. Median (IQR) duration of DPR was 5 (2–8) days and primary abdominal closure was achieved in 25 patients (86%). The most frequent complication was surgical site infection recorded in 8 patients (27.6%). Frequency distribution of other complications and outcomes are presented in Table 1. Overall, 21 (72.4%) patients were either discharged home or transferred to rehab center/nursing home. Overall postoperative mortality was 27.6%.

Conclusions: In this study of 29 patients, we achieved an 86% rate of definitive abdominal closure at the index hospitalization. Further well designed, and controlled multi-institutional investigations are needed to confirm the efficacy of DPR.

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Fig. 1

Table 1. Frequency distribution of complications and outcomes of DPR.

	Total Number of Patients = 29
Duration of DPR, days, Median (IQR)	5 (2-8)
Post DPR Hospital Length of Stay, days, Median (IQR)	39 (16-62)
Total Hospital Length of Stay, days, Median (IQR)	44 (20-69)
Abdominal Closure, N (%)	25 (86%)
Complications	
Postoperative bleeding, N (%)	4 (13.8%)
Surgical Site infection, N (%)	8 (27.6%)
Fascia dehiscence, N (%)	6 (20.7%)
Intra-abdominal abscess, N (%)	7 (24%)
Pneumonia, N (%)	7 (24%)
Urinary Tract Infection, N (%)	1 (3%)
Deep Vein Thrombosis, N (%)	1 (3%)
Disposition, N (%)	
Home	9 (31%)
Rehabilitation facility	9 (31%)
Nursing home	3 (10.4%)
Mortality (including hospice)	8 (27.6%)

OP 56

Disturbances of functional connectivity between default mode network and cerebellar structures in patients with mTBI in acute stage.

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Introduction: Mild traumatic brain injury (mTBI) occupies one of the first places in children injuries. Among all brain networks at the resting state, the Default Mode Network (DMN) is the most widely studied network. The aim of this study is to examine functional connectivity in normal-appearing cortex in acute period of mTBI using rsfMRI.

Material & methods: 34 MR negative participants were studied in age from 12 to 17 years (mean age—14.5 years). Group of patients consisted of 17 children with mild traumatic brain injury in acute stage. 17 age-matched healthy volunteers comprised control group. All studies were performed at Phillips Achieva 3.0 T MRI scanner using 32-channel head coil. fMRI data were processed using functional connectivity toolbox CONN. Seed-based analysis was performed in order to reveal disturbances in functional connectivity. Statistical processing was performed using Statistica 12.

Results: DTI analysis didn't show any changes in values of apparent diffusion coefficient (ADC) and fractional anisotropy (FA) between two groups. No statistically significant differences in correlation strength between DMN parts were observed in two groups. Intergroup seed-based analysis revealed statistically significant ($p < 0,05$) difference in neural correlations between DMN parts and flocculus (cerebellum structural part): positive link in control group and negative link in group of patients.

Conclusions: One of the most common symptoms of mTBI is dizziness as a result of impaired movements coordination. Flocculus as an essential cerebellum part plays an important role in the vestibulo-ocular system which is involved in the learning of basic motor skills in the brain. Flocculus aids in the synchronization of eye and motor functions in order for the visual field and the motor skills to function together. Our results show that mTBI appears to be a possible reason of connectivity malfunction in normal-appearing vermis.

OP 57

The effects of patient age on treatment intensity and mortality in Traumatic Brain Injury (TBI)

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Introduction: Ageing is associated with worse treatment outcome after traumatic brain injury (TBI). This association may lead to a self-fulfilling prophecy that affects treatment efficacy. The aim of the current study was to evaluate the role of treatment bias in patient outcomes by studying the intensity of diagnostic procedures, treatment, and overall 30-day mortality in different age groups of patients with TBI.

Materials & methods: Included in this study was patients consecutively admitted to Oslo University Hospital with TBI, aged ≥ 15 years, with a cerebral CT showing intracranial signs of trauma, during 2015–2018. As a measure of management intensity in different age groups, we made a composite score, where placement of intracranial pressure monitor, ventilator treatment, and evacuation of intracranial mass lesion each gave one point. Main outcome variable was 30-day mortality.

Results: A total of 1,571 patients with TBI fulfilled the inclusion criteria. The median age was 58 years, 70% were men, and 39% were ≥ 65 years. Head injury severity was mild in 45%, moderate in 28%, and severe in 27%. Increasing age was associated with less management intensity, as measured using the composite score, irrespective of head injury severity. Multivariate analyses showed that the following parameters had a significant association with an increased risk of death within 30 days of trauma: increasing age, severe comorbidities, severe TBI, Rotterdam CT-score ≥ 3 , and low management intensity.

Conclusions: The present study indicates that the management intensity of hospitalised patients with TBI decreased with advanced age and that low management intensity was associated with an increased risk of 30-day mortality. This suggests that the high mortality among elderly TBI patients may have an element of a self-fulfilling prophecy.

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OP 58

Management of traumatic brain injury in patients with DOAC therapy—are the new oral anticoagulants really safer?

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Background: In recent years “new“ direct oral anticoagulants (DOAC) gradually replaced other antithrombotic therapies. International literature agrees on an increased mortality for traumatic brain injury (TBI) patients using vitamin K antagonists (VKA), but there isn’t sufficient data on the influence of DOAC on the outcome of TBI. **Methods:** We retrospectively analyzed data from patients who presented with head trauma using antithrombotic therapy. Outcome parameters were presence of pathologies on the initial CT, occurrence of delayed intracranial hemorrhage, surgical intervention and death. **Results:** In total we reviewed data of 1169 patients. 92.7% had a mild TBI, 5.7% moderate TBI and 1.5% severe TBI. 456 patients used DOAC and 713 patients used VKA, antiplatelet therapy or prophylactic doses of low molecular weight heparin at the time of trauma. The groups showed no significant differences in age, injury mechanisms or GCS at presentation. Patients with head trauma and DOAC therapy without other antithrombotic medication had pathological findings on CT in 4.9%, patients with VKA in 4.8% and patients with antiplatelet therapy in 10.6%. There was a statistically significant difference in occurrence of CT pathologies between DOAC alone compared to ASS (4.9 vs. 10.5%, $p = 0.04$). Delayed intracranial hemorrhage after an initial negative CT during in-house observation occurred in 0.2% of the DOAC group, 0.9% in the VKA group and 0.9% in the antiplatelet group. Head trauma related surgery was performed in 0.7% of the DOAC group, 0.9% of the VKA group and 1.3% in the antiplatelet group. Death due to the head trauma occurred in 0.7% of the DOAC group compared to 0.4% of the VKA group and 0.2% of the antiplatelet group. **Conclusions:** Our data suggests a comparable risk for pathological CT findings, delayed intracranial hemorrhage, surgical interventions and death after blunt head trauma for patients with DOAC compared to VKA but a lower risk for pathological CT findings compared to platelet inhibitors. It is known that VKA increase mortality, so our data suggests that similar caution should be used when treating patients with head trauma and DOAC.

OP 59

The value of metabolites, lipoproteins, and vitamins in the assessment of nutritional status in severely injured patients during Intensive Care Unit admission

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Introduction: Objective measurement of the nutritional status is a major challenge, especially in severely injured patients (SIP). This observational prospective study aimed to identify metabolites, lipoproteins and vitamins that can be used to assess nutritional status of SIP during ICU admission.

Material & methods: In 27 SIP, plasma metabolite and lipoprotein concentrations were analyzed in relation to the diagnosis of malnutrition (Subjective Global Assessment (SGA) ≤ 5) through partial least squares discriminant analysis. Metabolites and lipoproteins with a Variable Importance in Projection (VIP) score ≥ 1.5 were

considered potentially useful for discrimination between well-nourished and malnourished SIP at day 5 of ICU admission. In the 10 SIP that developed malnutrition during ICU admission, the mean metabolite and lipoprotein levels on day 1–3 were compared to mean concentrations in the first days malnutrition was diagnosed (paired samples T-test). Mean Vitamin D levels and the amount of samples with insufficient vitamin D levels (< 50 nmol/L) were also compared between the well-nourished and malnourished SIP (resp. Independent samples T-test and Fisher’s exact test).

Results: An increase of VLDL, LDL and IDL, and a decrease of HDL particle levels were related to malnutrition (VIP ≥ 1.5). Increased total cholesterol and creatine concentrations were associated with malnutrition in the 10 patients < 55 years, and decreased concentrations of both metabolites were associated with malnutrition in the 8 patients ≥ 55 years. In both age groups, several amino acids (alanine, glycine, leucine, lysine, and valine), 2-hydroxybutyric acid, and succinic acid were increased, and tyrosine and glucose were decreased in case of malnutrition. Vitamin D was not found to be related to malnutrition.

Conclusions: Several lipoproteins and metabolites seem to be associated with malnutrition in SIP and show potential for serving as an objective parameter for malnutrition in trauma patients.

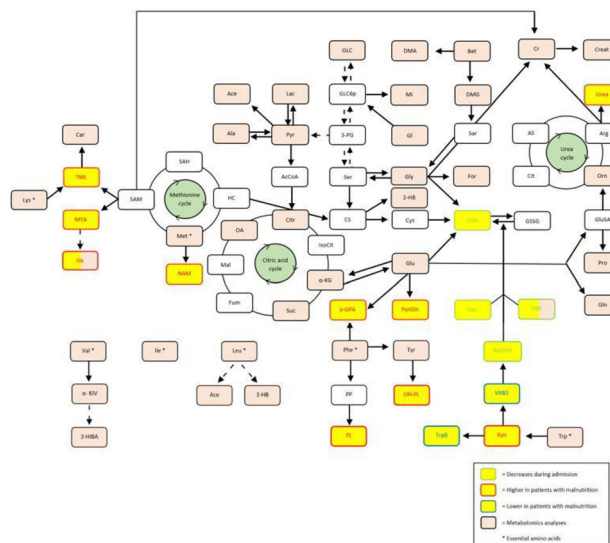
Figure 1: Metabolites potentially associated with malnutrition in critically ill patients based on currently available literature [1, 2]

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1-palmitoyl-GPE, 1-palmitoyl-glycerophosphoethanolamine; 2-HB, 2-Hydroxybutyrate; 3-HB, 3-Hydroxybutyrate; 3-HIBA, 3-Hydroxyisobutyrate; 3-PG, 3-phosphoglycerate; AcCoA, Acetyl-CoA; Ace, Acetate; Ala, Alanine; Arg, Arginine; AS, Argininosuccinate; α-KG, α-ketoglutarate; α-KIV, α-ketoisovalerate; Bet, Betaine; Car, Carnitine; Cit, Citrulline; Citr, Citrate; Cr, Creatine; Creat, Creatinine; CS, Cystathionine; Cys, Cysteine; DMA, Dimethylamine; DMG, Dimethylglycine; For, Formate; Fum, Fumarate; Gl, Glycerol; GLC, glucose; GLC6p, Glucose-6-phosphate; Gln, Glutamine; Glu, Glutamate; GluSA, Glutamate-1-semialdehyde; Gly, Glycine; GSH, Reduced glutathione; GSSG, Glutathione disulfide; γ-GPA, γ-Glutamylphenylalanine; HC, Homocysteine; Hx, Hypoxanthine; Ile, Isoleucine; IsoCit, Isocitrate; Kyn, Kynurenine; Lac, Lactate; Leu, Leucine; Lys, Lysine; Mal, Malate; Met, Methionine; MI, Myoinositol; MTA, 5-Methylthioadenosine; NADPH, Nicotinamide-adenine-dinucleotidephosphate; NAM, N-acetylmethionine; OA, Oxaloacetate; OH-PL, 3- (4-hydroxyphenyl)lactate; Orn, Ornithine; Phe, Phenylalanine; PL, Phenyllactate; PP, Phenylpyruvate; Pro, Proline; Pyr, Pyruvate; PyrGlu, Pyroglutamine; SAH, S-adenosylhomocysteine; SAM, S-adenosylmethionine; Sar, Sarcosine; Ser, Serine; Suc, Succinate; TML, N-6-trimethyllysine; Trp, Tryptophan; TrpB, Tryptophan Betaine; Tyr, Tyrosine; Val, Valine; VitB3, Vitamin B3 (nicotinamide); VitB4, Vitamin B4 (choline); VitC, Vitamin C; VitE, Vitamin E.

Fig. 1



SYSTEMS

OP 60

Accuracy of trauma triage criteria in a multicenter setting

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Introduction: The Swedish National Trauma Triage Criteria (SNTTC) [1], implemented in 2017, is divided into three levels; Trauma Alert, Trauma Response or Cautions. The SNTTC have previously been examined for under- and overtriage [2] but not for accuracy of the criteria. The aim of the study was to evaluate the SNTTC with regard to its accuracy in predicting a severely injured patient or a patient in need for an emergency intervention.

Material & methods: Data was collected from six hospitals in Sweden via the Swedish Trauma Registry. The analyzed population consisted of 626 patients examined with regard to the New Injury Severity Score (NISS), performed emergency interventions and the criterion used to initiate the trauma call. Sensitivity, specificity, positive predictive value (PPV) and positive likelihood ratio (LR +) were calculated, as well as undertriage and overtriage.

Results: The SNTTC as a whole had a sensitivity > 80% for a severely injured patient. The Trauma Alert Criteria had the highest accuracy (AUC 0.724), higher LR + (3.5 vs all criteria 1.4), specificity (82.3 vs 39.1%) and PPV (55.4 vs 37.6%) but a lower sensitivity of 62.6%. With the physiological criteria alone, LR + (6.7), specificity (93.3%) and PPV (70.2%) improved compared to Trauma Alert Criteria, however, sensitivity (44.8%) and accuracy (AUC 0.690) decreased.

Conclusions: Severely injured patients and patients in need for an emergency intervention are efficiently identified by the SNTTC, which also exhibits the best sensitivity compared to other examined combinations. No additional criterion was found to improve the protocol enough to promote a change.

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OP 61**Outcomes after prehospital traumatic cardiac arrest in the Netherlands: a retrospective cohort study**

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Introduction: Traumatic cardiac arrest (TCA) is a severe and life-threatening situation that mandates urgent action. Outcomes after on-scene treatment of TCA in the Netherlands are currently unknown. The aim of the current study was to investigate the rate of survival to discharge in patients who suffered from traumatic cardiac arrest and who were subsequently treated on-scene by the Dutch Helicopter Emergency Medical Services (HEMS).

Material & methods: A retrospective cohort study was performed including patients ≥ 18 years with TCA for which the Dutch HEMS were dispatched between January 1st 2014 and December 31st 2018. Patients with TCA after hanging, submersion, conflagration or electrocution were excluded. The primary outcome measure was survival to discharge after prehospital TCA. Secondary outcome measures were return of spontaneous circulation (ROSC) on-scene and neurological status at hospital discharge.

Results: Nine-hundred-fifteen patients with confirmed TCA were included (table 1). ROSC was achieved on-scene in 261 patients (28.5%). Thirty-six (3.9%) patients survived to hospital discharge of which 17 (47.2%) had a good neurological outcome. Age < 70 years (0.7% vs. 5.2%; $p = 0.041$) and a shockable rhythm on first ECG (OR 0.65 95%CI 0.02–0.28; $p < 0.001$) were associated with increased odds of survival (table 2).

Conclusions: Neurologic intact survival is possible after prehospital traumatic cardiac arrest. Younger patients and patients with a shockable ECG rhythm have higher survival rates after TCA.

Fig. 1

	Entire cohort (n=915)
Age (year)	47 (30-63)
Gender	
Male	684 (76.4%)
Female	211 (23.6%)
Undocumented	20
Trauma Mechanism	
Road traffic accident	479 (52.3%)
Fall from height	224 (24.5%)
Blunt otherwise	61 (6.7%)
Stab wound	75 (8.2%)
Gunshot wound	69 (7.5%)
Penetrating otherwise	7 (0.8%)
Time between HEMS dispatch and arrival (minutes)	
Time (minutes)	15 (11-20)
0-10 minutes	158 (19.1%)
11-15 minutes	288 (34.8%)
> 15 minutes	382 (46.1%)
Undocumented	87
First ECG rhythm	
Asystole	402 (50.3%)
PEA	367 (45.9%)
Shockable (VF/VT)	30 (3.8%)
Undocumented	116

Data are shown as median (P₂₅-P₇₅) or as n (%). HEMS: helicopter emergency service. PEA, pulseless electrical activity; VF, ventricular fibrillation; VT, ventricular tachycardia.

Fig. 2

	Survivors (n=36; 3.9%)	Non-survivors (n=879; 96.1%)	p-value
Age (years)	36 (24-50)	48 (30-64)	0.006*
Gender			
Male	27 (75.0%)	657 (76.5%)	0.842**
Female	9 (25.0%)	202 (23.5%)	
Undocumented	0	20	
Trauma Mechanism			
Blunt	26 (72.2%)	738 (84.0%)	0.103***
Road traffic accident	17 (65.4%)	462 (62.6%)	
Fall from height	5 (19.2%)	219 (29.7%)	
Blunt otherwise	4 (15.4%)	57 (7.7%)	
Penetrating	10 (27.8%)	141 (16.0%)	
Stab wound	7 (70%)	68 (48.2%)	
Gunshot wound	2 (20%)	67 (47.5%)	
Penetrating otherwise	1 (10%)	6 (4.3%)	
Time between HEMS dispatch and arrival (minutes)			
Time (minutes)	14 (9-19)	15 (11-20)	0.297*
0-10 minutes	9 (29.0%)	149 (18.7%)	
11-15 minutes	9 (29.0%)	279 (35.0%)	
> 15 minutes	13 (41.9%)	369 (46.3%)	
Undocumented	5	82	
First ECG rhythm			
Asystole or PEA	19 (82.6%)	750 (96.6%)	0.018**
Shockable (VF/VT)	4 (17.4%)	26 (3.4%)	
Undocumented	13	103	

Data are shown as n (%) or median (P₂₅-P₇₅).
 HEMS, helicopter emergency service; EMD, electromechanical dissociation.
 * Mann-Whitney U test
 ** Fisher's Exact test
 *** Chi-square test with Yates correction

OP 62

Mortality risk stratification in isolated severe traumatic brain injury using the revised cardiac risk index

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Introduction: Traumatic brain injury (TBI) continues to be a significant cause of mortality and morbidity worldwide.¹⁻³ As cardiovascular events are among the most common extracranial causes of death after a severe TBI, the Revised Cardiac Risk Index (RCRI) could potentially aid in the risk stratification of this patient population.⁴⁻⁸ This investigation aimed to determine the association between the RCRI and in-hospital deaths among isolated severe TBI patients.

Material & methods: All adult patients registered in the TQIP database between 2013 and 2017 who suffered an isolated severe TBI, defined as a head AIS ≥ 3 with an AIS ≤ 1 in all other body regions, were included. Patients were excluded if they had a head AIS of 6. The association between different RCRI scores (0,1,2,3, ≥ 4) and in-hospital mortality was analyzed using a Poisson regression model with robust standard errors while adjusting for potential confounders, with RCRI 0 as the reference.

Results: 259,399 patients met the study's inclusion criteria. RCRI 2 was associated with a 6% increase in mortality risk [adjusted IRR (95% CI): 1.06 (1.01-1.12), p = 0.027], RCRI 3 was associated with a 17% increased risk of mortality [adjusted IRR (95% CI): 1.17 (1.05-1.31), p = 0.004], and RCRI ≥ 4 was associated with a 46% increased risk of in-hospital mortality [adjusted IRR (95% CI): 1.46 (1.11-1.90), p = 0.006], compared to RCRI 0.

Conclusions: An elevated RCRI ≥ 2 is significantly associated with an increased risk of in-hospital mortality among patients with an isolated severe traumatic brain injury. The simplicity and bedside applicability of the index makes it an attractive choice for risk stratification in this patient population.

Fig. 1

RCRI	IRR (95% CI)	P-value
0	ref.	
1	0.98 (0.95-1.01)	0.199
2	1.06 (1.01-1.12)	0.027
3	1.17 (1.05-1.31)	0.004
≥4	1.46 (1.11-1.90)	0.006

Poisson regression model with robust standard errors adjusted for age, sex, race, initial GCS in the ER, AIS, comorbidities, and neurosurgical intervention. Multiple imputation by chained equations was used to manage missing values.

IRR, Incident rate ratio; TBI, traumatic brain injury; RCRI, Revised Cardiac Risk Index; GCS, Glasgow Coma Scale; ER, emergency room; AIS, abbreviated injury score; COPD, chronic obstructive pulmonary disease

OP 63

The Injury Prevention and Outcomes following Trauma (IPOT) project: a nationwide registry-based study in Norway

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Introduction: Traumatic injuries constitute a major cause of mortality and morbidity. Still, the public health burden of trauma in Norway has not previously been characterized by the use of nationwide registry data. The aim of the project is to establish a comprehensive research database, where the Norwegian National Trauma Registry (NTR) will be merged with several data sources to pursue three main research topics: 1) the *public health burden of trauma* (e.g. excess mortality, disability-adjusted life-years), 2) *trauma aetiology* (e.g. socioeconomic factors, comorbidity, drug use), and 3) *trauma survivorship* (e.g. survival, drug use, use of welfare benefits, work ability, education, income).

Material & methods: Trauma patients included in the NTR from 01.01.2015 to 31.12.2018 will be coupled with data from Statistics Norway, the Norwegian Patient Registry, the Cause of Death Registry, the Registry of Primary Health Care, and the Norwegian Prescription Database. To quantify the public health burden, DALYs will be calculated from the NTR. To address trauma aetiology, we will conduct nested case–control studies with trauma-free controls (drawn from the National Population Register) matched to each trauma case on birth year, sex and index date. Conditional logistic regression models will be used to estimate trauma risk according to relevant exposures. To address trauma survivorship, we will use cohort and matched cohort designs and time-to-event analyses to examine various post-trauma outcomes.

Results: A total of 26,652 trauma patients were included in the analysis and coupled with 265,620 trauma-free controls drawn from the National Population register. All variables in the data set included one year before trauma (2014) until two years after (2020). The data set consists of more than 500 million datapoints. The protocol has been published [1].

Conclusions: Coupled registry data is a potential solution as more knowledge is warranted on trauma risk factors and long-term outcomes. Establishment of a Norwegian prospective nationwide registry coupled with central health registries is feasible, and analyses addressing the main research topics will follow.

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1. Stenehjem JS, Røise O, Nordseth T, Clausen T, Natvig B, Skurtveit SO, Eken T, Kristiansen T, Gran JM, Rosseland LA. Injury Prevention and long-term Outcomes following Trauma—the IPOT project: a protocol for prospective nationwide registry-based studies in Norway. *BMJ open* 2021; 11: e046954.

OP 64

Accuracy and uncertainty of prehospital clinical assessment to diagnose major injuries

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Introduction: Prehospital identification of major injuries is essential for decision-making, but even expert clinicians may be inaccurate. The degree to which clinician uncertainty affects accuracy is unknown. We aim to determine the diagnostic accuracy of prehospital clinical assessment to identify major injuries, determine the effect of clinician uncertainty on accuracy, and analyse factors associated with inaccuracy.

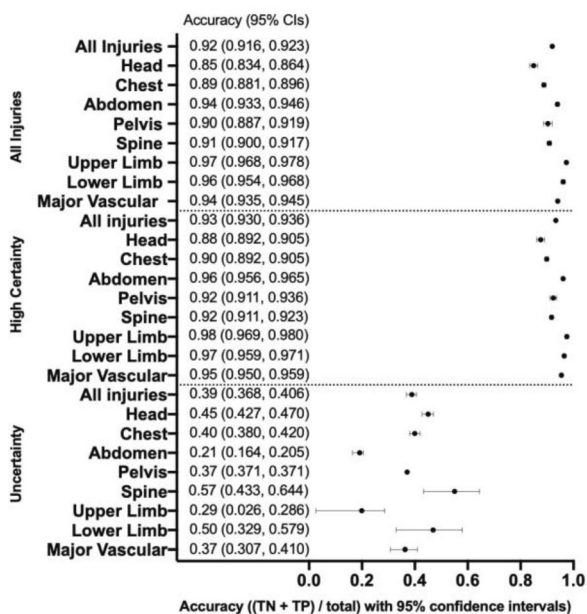
Material & methods: Retrospective evaluation of diagnostic performance of prehospital trauma clinicians compared to in-hospital diagnosis. Patients included all adults (≥ 16 years) injured in 2019–2020, assessed by London's Air Ambulance and conveyed to the Royal London Hospital. Diagnostic accuracy was calculated for 22 major injuries, and 9 abbreviated injury scale (AIS) regions. Subgroup analyses were conducted based on clinician certainty of injuries. Multivariate logistical regression analyses were conducted for each AIS region, with inaccuracy as the dependent variable, and patient, clinician, and environmental factors as independent variables.

Results: 921 patients met inclusion criteria for the study. Overall accuracy of prehospital clinical assessment was 92%, sensitivity 43%, specificity 96%, positive predictive value 51%, and negative predictive value 95%. Clinicians were more uncertain of head and torso injuries (range 25%–40%) than extremity injuries (6–10%). Overall accuracy when clinicians were certain was 93%, reducing to 39% when clinicians were uncertain (Fig. 1). The risk of inaccuracy increased when the patient was multiply injured (odds ratios (OR) and 95% confidence intervals (CI) ranged from 1.84 (1.02–3.32) to 7.29 (1.94–47.8)), and the clinician was uncertain (OR 3.8 (95% CI 0.96–12.8) to 311 (89.1–1567)).

Conclusions: The impact of clinician uncertainty on prehospital diagnostic accuracy of injuries is profound. These data will help inform solutions for improving prehospital diagnostic accuracy and reducing uncertainty, such as diagnostic adjuncts and clinical decision support.

Fig. 1

Figure 1. Accuracy of prehospital clinical assessment to identify major injuries. AIS regions of all injuries, and when clinicians had high certainty, and uncertainty.



OP 65

Do undertriaged trauma patients fulfil trauma team activation criteria?

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Introduction: Failure to identify serious injury may lead to delayed diagnostics and lifesaving interventions. Trauma team activation (TTA) is based on specific criteria (i.e. physiologic, anatomic, mechanism of injury and other) to ensure rapid therapeutic interventions upon hospital admission. Severely injured patients not by trauma team is often referred to as undertriage [1]. The aim of this study was to assess if undertriaged trauma patients were eligible for TTA based on pre-hospital documentation.

Material & methods: All surgical and orthopaedic patients admitted to the Emergency Department (ED) at St. Olav’s University hospital in Trondheim, Norway from 01.01.15–31.12.2020 were screened to identify potentially undertriaged trauma patients. St. Olav’s University Hospital is the trauma centre of Central Norway and covers a population of approximately 700,000. Undertriage was defined as patients with an Injury Severity Score (ISS) > 15 without TTA (numerator) of the total number of patients with an ISS > 15 (denominator). In the undertriaged patients, the clinical documentation from the Emergency Medical Communication Center (i.e. responsible for TTA) were reviewed to assess if these patients

fulfilled TTA criteria based solely on accessible pre-hospital documentation.

Results: 2726 patients were treated by the trauma team, of which 582 (21%) patients had an ISS > 15. In addition, 144 patients admitted to the ED had an ISS > 15 and were not met by the trauma team. This represents an undertriage rate of 20%. Of the undertriaged patients 113 of 144 patients (78%) fulfilled TTA criteria: physiologic (n = 45), anatomic criteria (n = 39), mechanism of injury (n = 3), and other (n = 26).

Conclusions: The rate of undertriage was high and the majority of the undertriaged patients fulfilled pre-defined trauma team activation criteria.

The References:

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OP 66

The impact of regionalized trauma care on the distribution of severely injured patients in the Netherlands

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Introduction: Twenty years ago an inclusive trauma system was implemented in the Netherlands. The goal of this study was to evaluate the impact of structured trauma care on the concentration of severely injured patients over time.

Material & methods: All severely injured patients (Injury Severity Score [ISS] ≥ 16) documented in the Dutch Trauma Registry (DTR) in the calendar period 2008–2018 were included for analysis. We compared severely injured patients, with and without severe neuro-trauma, directly brought to trauma centers (TC) and non-trauma centers (NTC). The proportion of patients being directly transported to a trauma center was determined, as was the total Abbreviated Injury Score (AIS), and ISS.

Results: The documented number of severely injured patients increased from 2350 in 2008 to 4694 in 2018 (Fig. 1). During this period on average 70% of these patients were directly admitted to a TC (range 63–74%). Patients without severe neurotrauma had a lower chance of being brought to a TC compared to those with severe neurotrauma. Patients directly presented to a TC were more severely injured, reflected by a higher total AIS and ISS (Fig. 2), than those directly transported to a NTC.

Conclusions: Since the introduction of a well-organized trauma system in the Netherlands, trauma care has become progressively centralized, with more severely injured patients being directly presented to a TC. However, still 30% of these patients is initially brought to a NTC. Future research should focus on improving pre-hospital triage, to facilitate swift transfer of the right patient to the right hospital.

Fig. 1

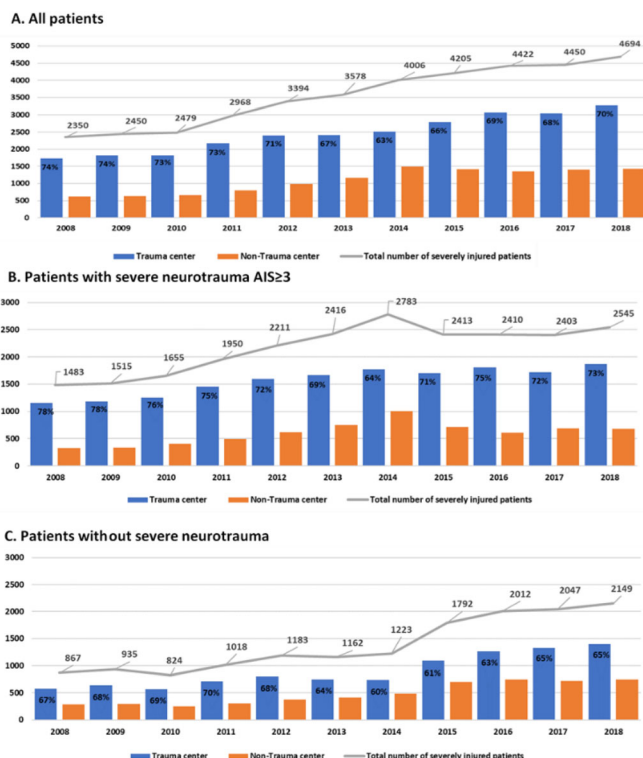
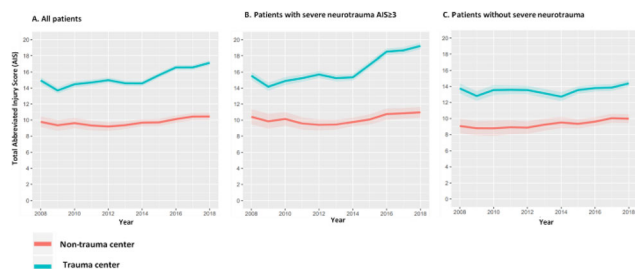


Fig. 2



OP 67

Patterns and mechanisms of Major Trauma injuries during and after the UK Covid-19 Nationwide lockdown: Analysis from a UK Major Trauma Centre.

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Introduction: The seasonal variability in major trauma injuries and presentation is a well-known phenomenon. However, the COVID-19 pandemic and the associated UK nationwide lockdown led to an unprecedented change in societal behaviours and opportunities for harm that ultimately led to the well reported decreases in admissions in patterns and demographics of injuries seen during the lockdown would be temporary or an enduring phenomenon post-covid.

Material & methods: This prospective cohort study included all patients admitted following major trauma injuries during the 10-weeks of 9th March–18th May 2020 (lockdown cohort), compared with those patients admitted during the 10-weeks from the 4th July 2020– 12th September 2020 (post-lockdown cohort) at our Major Trauma Centres in the United Kingdom. The outcomes of interest were volume, spectrum and mechanism of injuries presenting to the major trauma centre during lockdown and post-lockdown and the associated risk of 30-day mortality.

Results: A total of 692 major trauma admissions were included in this analysis. Of these, 237 patients were admitted during the lockdown and 455 patients admitted post-lockdown. This represented a twofold increase in trauma admission between the two periods. Characteristically, both cohorts had a higher proportion of male patients (73.84% male in lockdown, 72.5% male post-lockdown). There was a noted shift in age groups between both cohorts with an overall more elderly population during lockdown (p = 0.0292). There was a significant difference in mechanisms of injury between the two cohorts. The 3-commonest mechanisms during the lockdown period were: Road traffic accidents—31.22%, Falls of less than 2 m—26.58% and falls greater than 2 m causing 22.78% of major trauma admissions. However, in the post-lockdown period Road traffic accidents represented 46.15% of all trauma admissions with falls greater than 2 m causing 17.80% and falls less than 2 m causing 15.16% of major trauma injuries. With falls in the elderly associated with an increased risk of 30-day mortality.

Conclusions: The lifting of lockdown restrictions resulted in a two-fold increase in major trauma admissions that was also associated with significant changes in both the demographic and patterns of injuries with Road traffic accidents contributing almost half of all injury presentations.

Trial registration: This study was classed as service evaluation and registered with the local audit department, registration number: 20-177C.

OP 68

The association of radiologic body composition parameters with clinical outcomes in level-1 trauma patients—A retrospective cohort study

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Introduction: The present study aims to assess whether CT-measured muscle mass, muscle density and visceral adipose tissue are associated with complications and other clinical outcomes in trauma patients.

Material & methods: A retrospective cohort study was conducted on adult patients admitted to the University Medical Center Utrecht following a trauma between January 1st and December 31st, 2017. Trauma patients aged 16 years or older without severe neurological injuries, who underwent a CT that included the abdomen within 7 days of admission, were included. An artificial intelligence (AI) algorithm was used to retrieve muscle areas to calculate the psoas muscle index (PMI) and to retrieve psoas muscle density (PMD) and visceral adipose tissue (VAT) area from axial CT images. Multi-variable logistic and linear regression analyses were performed to assess associations between body composition parameters and outcomes.

Results: A total of 404 patients were included for analysis. The median age was 49 (interquartile range [IQR] 30–64), and 66.6% were male. Severe comorbidities (ASA 3–4) were seen in 10.9%, and the median ISS was 9 (IQR 5–14). PMI was not independently associated with complications. There were independent associations between PMI and an unfavorable Glasgow Outcome Scale (GOS) (odds ratio [OR] 0.63, 95% confidence interval [CI] 0.45–0.89) and mortality (OR 0.44, 95% CI 0.21–0.93). PMD was independently associated with development of a complication (OR 0.63, 95% CI 0.47–0.84), pneumonia (OR 0.62, 95% CI 0.43–0.90), and delirium (OR 0.53, 95% CI 0.33–0.83). VAT was associated with delirium development after adjustment for other factors (OR 1.96, 95% CI 1.13–3.40).

Conclusions: In level-1 trauma patients without severe neurological injuries, psoas muscle density was associated with complications, whereas psoas muscle area was not. Visceral adipose tissue was associated with delirium. Automatically retrieved body composition parameters are able to identify patients at risk for complications and other adverse outcomes.

Fig. 1

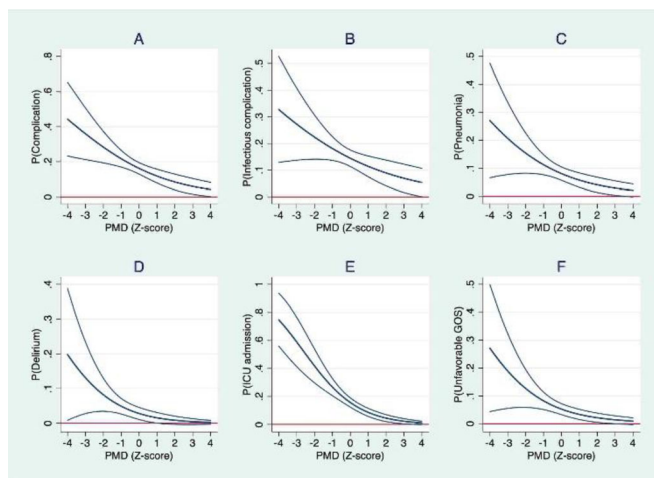
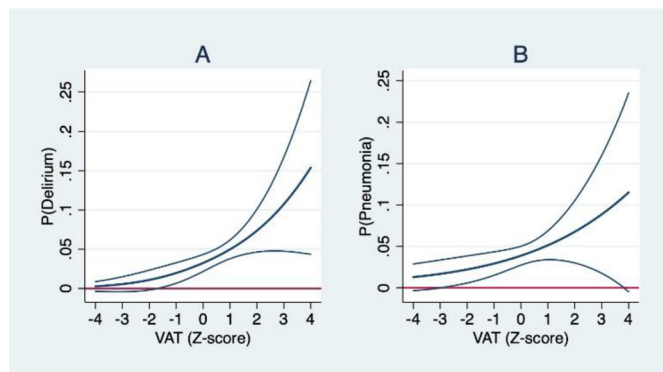


Fig. 2



RESUS

OP 69

Calcium administration in Major Haemorrhage Protocol

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Introduction: Calcium is an essential part of the major haemorrhage protocol (MHP) in major trauma. It minimize the exacerbation of transfusion related coagulopathies due to the citrate preservative in transfused blood binding to ionised calcium in plasma leading to a further reduction in plasma calcium and thus is unable to participate in the coagulation cascade as an essential co-factor. Up to 50% of trauma patients may present with hypocalcaemia prior to transfusion and especially in patients with a shock index > 1, this leads to the risk of exacerbated coagulopathies (1). Given the importance of the issue we were surprised at the sparse guideline and exact protocol for calcium administration in the MHP. An audit was completed at Nottingham University Hospital in 2019, analysing the percentage of patients who received calcium as part of a massive transfusion and the incidence of hypocalcaemia. Our initial quality improvement project in 2019 showed 75% of patients received calcium supplementation, with only 10% of patients achieving a corrected serum calcium. The implementation of this audit lead to a change to the MHP transfusion guidelines, making it mandatory to consider calcium administration. A second closed loop was performed in 2021 to review the effects of this change in guideline.

Material & methods: Retrospective review of patients with activated MHP between May and July 2021. Documentation was reviewed whether calcium was administrated as part of the major transfusion guideline. In absence of a current exact standard we recommend that 100% of all massive transfusion should have received calcium. A massive transfusion was defined as 10 red blood cells units or more in 24 h, 3 within an hour or any 4 blood products within 30 min. Data was collected using the Trauma Audit and Research Network (TARN) database and our digital health records (DHR).

Results: Of the 52 patients in which the MHP was activated, 46 patients were included in the audit due to lack of documentation in 6 patients. Comparing the initial loop in 2019 to the new loop in 2021 there was 3.8 fold increase in patients who received the MHP. Out of these 10/12 (75%) received calcium and on average after 6.4 units of blood products in the first loop. In the second loop 23/46 (50%) received calcium supplementation and on average sooner, after 4 units

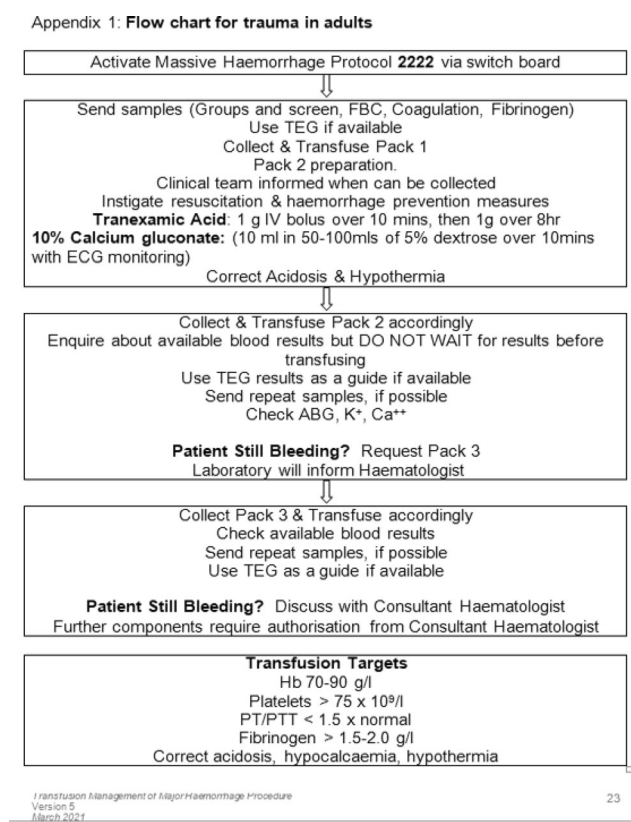
of blood products. 1/10 (10%) of patients had their calcium corrected to normal range in the first loop compared to 18/23 (78.3%) in the second loop.

Conclusions: We have achieved to create an effective amendment to the MHP guideline within our trust recommending that all patients with activated MHP transfusion protocol should receive supplementary calcium as to avoid exacerbated coagulopathy. The implemented change has led to a significant improvement in corrected serum calcium levels in patients who received major transfusions. There still are avenues to improve the calcium administration in our trauma centre. We recommend placing the new adapted MHP guideline into the major haemorrhage packs. This leaves us with the bigger question, should we give prophylactic calcium to all our trauma patients who are bleeding?

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Fig. 1



OP 70

Impact of preinjury antithrombotic therapy on 30-day mortality in older patients hospitalized with traumatic brain injury (TBI) in the era of antithrombotic reversal protocols.

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Introduction: Antithrombotic therapy, comprising antiplatelet and anticoagulant drugs, is frequently used in the elderly population. Although antithrombotic therapy reduces the risk of ischemic events in patients with cardiovascular disease, atrial fibrillation, and venous thromboembolism, they are associated with an increased risk of spontaneous and traumatic intracranial bleeding. Nevertheless, the effect of these drugs on survival and functional outcome after traumatic brain injury (TBI) is unclear. Contemporary TBI series after the introduction of direct oral anticoagulants (DOACs) are needed to evaluate the current risk of preinjury antithrombotic use in TBI patients from centers that have implemented protocols for reversal of antithrombotic drugs.

Material & methods: This retrospective study included patients ≥ 65 years admitted to a Norwegian Level 1 trauma center with TBI identified on cerebral computed tomography (cerebral-CT) during 2014–2019. The primary outcome was 30-day mortality. Uni- and multivariate logistic regression analyses estimated the association between the use of antithrombotic drugs and mortality. A reversal protocol for antithrombotics was used throughout the study period.

Results: The study includes 832 consecutive TBI patients ≥ 65 years. The median age was 76 years, 58% were males, and 50% had moderate/severe TBI. Preinjury use of antithrombotics was registered in 471/832 (55.6%) patients; antiplatelet therapy alone in 268, anticoagulant therapy alone in 172, and combined antiplatelet and anticoagulant therapy was significantly associated with 30-day mortality, while preinjury antiplatelet or anticoagulation treatment alone was not. No difference in 30-day mortality between patients using vitamin K antagonists (VKAs), DOACs, and low molecular weight heparins (LMWH) was encountered.

Conclusions: In this cohort, neither antiplatelet nor anticoagulant therapy alone was associated with increased 30-days mortality. Combined antiplatelet and anticoagulant therapy posed increased risk of 30-days mortality.

Uncategorized References:

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OP 71

The use of ROTEM for early identification of persistent bleeding in severe trauma

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Introduction: Multiple injured patients may continue to exhibit hemodynamic instability after bleeding control has been attempted by operative or endovascular interventions, this instability may be due to unrecognized persistent bleeding or severe inflammatory response syndrome (SIRS). Our objective was to determine which is the best marker for early identification of persistent bleeding in unstable trauma patients.

Material & methods: Severe trauma patients were prospectively enrolled from 3/2016 to 5/2019. Definitive interventions for hemorrhage were recorded and defined as ongoing need for transfusion; use of vasoactive drugs and need for surgical/angio-embolization for definitive bleeding control. At the 8th hour of arrival hemodynamic status was re-evaluated and patients with hypotension (< 90 mmHg), tachycardia (> 100 bpm) or in vasopressor support were considered hemodynamically unstable. Two groups were defined: “Persistent bleeding” (PB) (patients who needed at least one definitive intervention) and “Systemic Inflammatory response” (SIR) (who didn’t need any). Resuscitation markers were evaluated and ROTEM results were classified in 5 phenotypes, according to the degree of abnormality observed (0 = normal; 1 = fibrinogen deficiency; 2 = hypocoagulability; 3 = platelet deficiency; 4 = global deficiency; 5 = global deficiency hyperfibrinolysis).

Results: A total of 66 consecutive patients were included: Mean age 42 years (SD 15), male 80%, median ISS 25.5 (IQR 8–68) and mortality 18.2%. Nine patients were excluded (3 patients died < 8th hour and 6 died of severe head trauma). IR. *p* < 0,05. Persistent hemodynamic instability was found in 40 patients; 25 were found to have persistent bleeding (18 needed blood cell transfusion, 6 needed surgery and 3 needed embolization for bleeding control) and 15 had SIRS. ROTEM in patients with persistent bleeding group 3–4–5 (> 3) were statistically significant different when compared with ROTEM in SIRS patients ROTEM groups 0–1–2 versus (*p* = 0,026).

Conclusions: An abnormal ROTEM phenotype higher or equal to 3 found 8 h after trauma was associated with clinically relevant persistent bleeding.

Figure 1: Table comparing mean values of statistically significant variables between persistent bleeding and inflammatory response

Fig. 1

	Mean values (standard deviation)			
	HR (bpm)	Hemoglobin (g/L)	Lactate (mg/dL)	ROTEM®
Inflammatory response	100 (14)	118 (18)	25 (9)	<3
Persistent bleeding	113 (19)	94 (15)	40 (21)	>3
Statistical significance	p=0.018	p < 0.001	p = 0.006	p = 0.021

OP 72

Effect of anti-thrombin III administration on the prognosis of severe trauma patients with disseminated intravascular coagulation

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Introduction: In this study, we investigated the effects of anti-thrombin III administration on the prognosis of severe trauma patients with disseminated intravascular coagulation.

Material & methods: From January 2012 to December 2019, 140 patients with DIC were enrolled among severe trauma patients with an ISS score of 16 or higher who were admitted to the trauma-ICU during the period. These patients were classified into antithrombin III-administered and non-antithrombin III-administered groups. And their clinical data including laboratory finding, trauma and ICU related severity score, prognosis include length of stay of hospital, and needs of organ supports were collected retrospectively. Through statistical analysis of the collected clinical information, the effect of antithrombin III administration for severe trauma patient with DIC was analyzed.

Results: Of the 140 enrolled patients, 61 were treated with anthrombin III and 79 were not administered with anthrombin III. When comparing the two groups, there was no statistically significant difference in the baseline characteristics of the two groups in initial laboratory result, initial vital sign, and trauma related severity score (AIS, ISS, RTS) (Table 1). As a prognostic marker, changes of SOFA score of two groups were compared. The improvement of SOFA score (Delta SOFA) was statistically significantly greater in the administered group. (*P* = 0.009) (Fig. 1). In addition, it was confirmed that the larger the improvement of the SOFA score, the greater the proportion of the antithrombin-administered group than the non-administered group. (*P* = 0.002) (Fig. 2). However, there was no statistical difference between two groups in the frequency or duration of organ support treatments such as renal replacement therapy and mechanical ventilation. (Table 2) And mortality (28 days, Overall) length of stay (ICU, total hospital) did not show a significant difference (Table 3).

Conclusions: Administration of antithrombin III to severe trauma patients with DIC features showed improvement in SOFA score, and it helps in recovery from multi organ dysfunction. And if appropriate indications are studied in the future, it will be possible to maximize the improvement effect of this drug in patients with severe trauma.

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Table 1. Baseline characteristics of patients

	AT III non-Adm. (n = 79)	AT III Adm. (n =61)	P value
Age, years, mean ± SD	56.41±16.29	58.21±16.48	0.518
Gender, n (%)			0.168
Male	51 (64.6)	46 (75.4)	
Female	28 (35.4)	15 (24.6)	
BMI, mean ± SD	24.15±4.86	23.36±3.07	0.267
AIS, mean ± SD			
Head and neck	1.72±1.87	2.08±2.01	0.275
Face	0.44±0.78	0.51±0.91	0.649
Chest	1.87±1.62	2.18±1.71	0.28
Abdomen	2.04±1.58	1.56±1.56	0.075
Extremities	2.08±1.74	1.98±1.69	0.753
External	0.06±0.56	0.03±0.18	0.684
ISS, mean ± SD	27.38±12.04	28.15±9.33	0.681
RTS, mean ± SD	5.715±1.796	6.203±1.806	0.115
V/S mean ± SD			
SBP_worst	70.95±17.43	75.11±23.9	0.235
PR_worst	154.01±148.98	150.26±133.05	0.877
RR_worst	29.25±11.56	38.28±28.84	0.012
GCS_worst, mean ± SD	5.72±4.2	5.97±4.1	0.729
Lab_initial, mean ± SD			
Hb	10.4±2.19	10.82±2.53	0.301
Plt	171.67±66.90	175.25±87.49	0.785
Cr	1.14±0.79	0.98±0.39	0.158
T.bil	0.72±0.76	0.72±0.6	0.981
PT(INR)	1.42±0.29	1.42±0.52	0.999
PO2	151.6±58.9	154.7±65.3	0.773
Lactate	5.64±3.48	5.63±3.61	0.99
FDP	229.25±184.97	170.20±137.82	0.039
Fibrinogen	151.63±103.66	168.89±98.33	0.32
D-Dimer	19667.1±14491.7	19708.9±17012.9	0.987
AT III	63.57±17.75	58.48±20.54	0.119

Fig. 1 Change of SOFA score



Fig. 2 Comparison of Delta SOFA

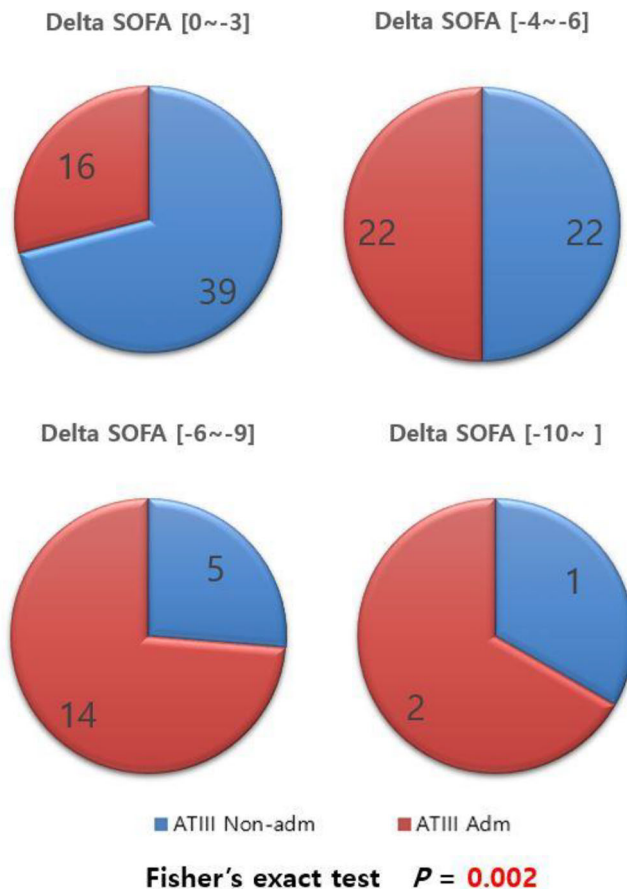


Table 2. Needs of organ support treatment for two groups

	AT III non-Adm. (n = 79)	AT III Adm. (n =61)	P value
Incidence of Mechanical ventilation (%)	66 (88)	56 (93.3)	0.297
Duration of Mechanical ventilation, mean ± SD	17.47±18.93	16.32±12.25	0.694
Incidence of Renal replacement therapy (%)	14 (18.7)	15 (24.6)	0.402
Duration of Renal replacement therapy, mean ± SD	20.5±24.74	23.8±16.37	0.673
Duration of using iv Vasopressor, mean ± SD	5±12.8	5.24±5.85	0.912

Table 3. Comparison of length of stay (LOS) and mortality

	AT III non-Adm. (n = 79)	AT III Adm. (n = 61)	P value
ICU LOS	23.0±33.6	21.4±17.9	0.749
H-LOS	61.8±52.1	73.1±71.4	0.29
28day mortality	11 (14.7)	8 (13.1)	0.795
Overall mortality	14 (18.7)	15 (24.6)	0.402

OP 73

Swine models of isolated hemorrhagic shock and tissue injury shed light on trauma-induced coagulopathy

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Introduction: Tissue injury (TI) and hemorrhagic shock (HS) are major drivers of trauma induced coagulopathy (TIC). Injured patients with TIC typically have combined TI and HS. We developed a large animal model to isolate TI and HS and characterize the mechanisms of these individual insults on TIC. We hypothesized that both HS and TS decreased clot strength, but only HS increased hyperfibrinolysis.

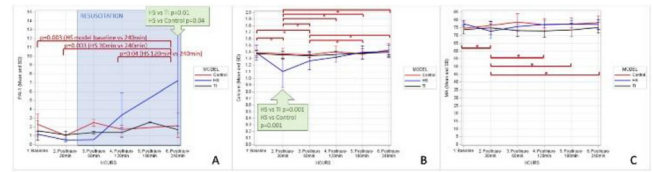
Material & methods: 50 kg Yorkshire swine were randomized into 3 groups: isolated TI (bilateral chest wall and femur fractures), isolated HS (bleeding to a base deficit of 10 mEq/l followed by resuscitation with shed blood) or Controls (no injury). Viscoelastic coagulation assays, PAI-1, TAFI, protein-C, and histones were analyzed at pre-selected timepoints. Linear mixed models for repeated measures were used to compare HS vs TI vs Controls over time; p-values were FDR adjusted for pairwise comparisons.

Results: The temporal trends were significantly different across study groups for PAI-1 ($p = 0.046$), calcium ($p = 0.001$) and clot strength ($p = 0.004$). TAFI and protein-C levels were stable for all groups. PAI-1 increased significantly in HS and was higher than in TI and Controls after resuscitation (Fig. 1:A). Calcium decreased immediately postinjury in HS but improved during resuscitation (Fig. 1:B). Clot strength decreased significantly immediately after injury in HS, and improved with resuscitation (Fig. 1:C). PAI-1, calcium and MA stayed stable in TI and Controls. Fibrinolysis was higher in the HS group, but the differences did not reach significance. The TI group showed a significant increase in histones at 120 min ($p = 0.02$) then declined to baseline levels.

Conclusions: These results suggest that resuscitation of HS induces an increase in PAI-1, which has been shown to be associated with decreased fibrinolysis. The HS-induced hypocalcemia with diminished clot strength did respond to resuscitation. Isolated TI leads to early histone release, but this was not associated with TIC.

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Fig. 1



OP 75

Predicting Trauma-Induced Coagulopathy in combat casualties: updating a civilian AI risk prediction model for use in a military population

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Introduction: Early identification of casualties at risk of developing trauma-induced coagulopathy (TIC) is necessary to guide strategic decisions in trauma care, such as a damage control approach to resuscitation and surgery. An artificial intelligence (AI) risk prediction system has been developed to support decision-making following civilian trauma but was not validated in military casualties

Objectives: We aimed to update and validate the AI prediction system for military trauma casualties

Material & methods: Data was obtained from the UK Joint Theatre Trauma Registry, comprising UK military personnel injured in Afghanistan between 2009–2014 with laboratory testing of coagulation on arrival at a Medical Treatment Facility. Literature and experts were used to inform the updating of the model structure. The parameters of the variables were learned from data. The parameters of latent variables were learned from a combination of rules-based classification and data clustering, followed by expert review of discrepancies. Internal tenfold cross-validation was conducted to test the model's performance in terms of discrimination, calibration, and accuracy

Results: Our development cohort included 678 combat casualties with median age 24 (18–55) years. 675 (99.6%) were male, with a median Injury Severity Score of 9 (Interquartile range 4–20). Overall mortality was 2.9%. The incidence of TIC was 9.5%. The updated model structure included new variables such as blast mechanism, injuries characteristic of military trauma, and estimated blood loss per injury. Calibration was good (intercept -0.023, slope 1.3) and discrimination was excellent (Area under the receiver operator curve 0.95 (95% CI 0.92–0.97)). Accuracy was 0.91, with Brier score 0.06 and Brier skill score 0.50

Conclusions: An updated and recalibrated AI risk prediction system for TIC has excellent performance in military casualties. This performance is equivalent to that seen with the previous model in civilian patients. Being able to prognosticate risk of TIC from information

gathered only at initial clinical assessment will enable earlier treatment decisions tailored to individual needs

OP 76

Responder and Non-responder to resuscitation show different lipidomic courses in porcine poly trauma model

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Introduction: Posttraumatic systemic inflammatory response increases comorbidities and mortality of severe traumatized patients. Lipidomics is a new research method analyzing specific lipids, that has revealed new lipid-based inflammatory mechanisms responsible for several pathophysiological conditions [1]. We hypothesized that lipids may also contribute to the systemic physiological process during resuscitation and recovery after trauma. In the current study, we investigated the relation between responsiveness to resuscitation and lipidomic changes after trauma in poly trauma pig model

Material & methods: 25 male pigs received a combined injury of blunt chest trauma, a liver laceration, controlled hemorrhagic shock, and femoral shaft fracture. After 60 min animals received resuscitation and fracture stabilization. Venous blood was taken regularly from baseline until 6 h post trauma. Animals were divided into two groups based on serum lactate level at the end point (< 2 mmol/L; Responder (R), \geq 2 mmol/L; Non responder (NR)) and lipidomic analysis was performed retrospectively

Results: Eighteen animals were assigned to R group and 7 to NR group. Five lipid subgroups (Diacylglycerols, Triacylglycerols, Phosphatidylethanolamines, Ceramides, and Phosphatidylglycerols) showed a significant increase only in R group 2 h after trauma compared with BL. Acylcarnitines showed a significant increase after trauma in both groups

Conclusions: Five lipid groups increased only in R group. This result indicates that changes of these lipid sub groups were related to responsiveness to resuscitation. Whereas, Acylcarnitines increased in both groups, suggesting possibility to become a biomarker for trauma. Individual pathways have yet to be investigated and collation with clinical data is needed

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OP 77

Effect of occult hypoperfusion on local and systemic inflammation in a standardized porcine polytrauma model

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Introduction: Occult hypoperfusion (OH) and persistent lactic acidosis may be continuously present after resuscitation in severe trauma and hemorrhage. Systemic vital parameters might be normalized after resuscitation, however, the microcirculation is still impaired. This study was performed in order to assess the effect of occult hypoperfusion on local and systemic inflammation

Materials & methods: Male Swiss landrace pigs went under general anaesthesia and served as a standardized polytrauma model. This included a femur shaft fracture, liver laceration, blunt chest trauma, and mean arterial pressure (MAP) controlled hemorrhagic shock. One hour after trauma resuscitation included retrograde femoral nailing, inserting a chest tube if necessary, volume controlled fluid therapy and liver packing. For a total of 6 h after trauma, blood gas analysis (BGA) was taken every hour, and the local perfusion at the femoral fracture was measured utilizing oxygen to see (O2C) device. Perifracure local soft tissue (fatty tissue, and muscle) was taken 6 h after trauma and analyzed for interleukines via PCR. Results were compared 6 h after trauma

Results: This study included 24 animals, 5 (20.8%) had persistent lactic acidosis (> 2 mmol after 6 h) and fulfilled the criteria for occult hypoperfusion (OH). Group OH had significantly higher pCO₂ levels, and significantly lower pH values when compared with the control ($p < 0.05$). The local oxygenation was significantly lower in Group OH (60.4 versus 75.8, $p = 0.049$). The local hemoglobin amount was significantly lower in Group OH (39.4 vs. 63.9, $p = 0.031$). The perifracure local inflammation of fatty tissue was significantly higher in Group OH for IL8 (442.9 vs 72.3, $p = 0.05$) and for IL6 (318.3 vs. 73.9, $p = 0.03$)

Conclusions: Persistent lactic acidosis serves as an indicator for local occult hypoperfusion. The increased local inflammation might impair local healing and increase the risk for further complications and should be taken into consideration during polytrauma management

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