Childs Nerv Syst (2017) 33:1785–1853
DOI 10.1007/s00381-017-3557-0

ABSTRACTS

45th Annual Meeting of International Society for Pediatric Neurosurgery, Denver, USA, 8-12 October, 2017

Michael Handler, ISPN 2017 Annual Meetings' Chair
Anthony Figaji, ISPN 2017 Scientific Committee Chair
Francesco Sala, ISPN 2017 Scientific Committee Co-Chair

PLATFORM PRESENTATIONS

Monday, 9 October 2017
08:50 – 10:15

Platform Presentations: Epilepsy

PF-001

Special topic: Epilepsy

Multilobar and hemispheric disconnective epilepsy surgery: A single center experience in 67 pediatric patients

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OBJECTIVE:To present our experience with hemispheric and multilobar disconnective surgery in a series of 67 children and adolescents with drug-resistant epilepsy.
MATERIAL-METHODS:From 10/1998 - 04/2017 a vertical parasagittal hemispherotomy (HT) according to the technique of O Delalande was performed in 52 pediatric patients (28 male, 24 female; median age 5 yrs, range from 3 months to 19 yrs). Underlying pathologies were perinatal MCA infarction (23), cortical dysplasia 11), other pathologies (18).
From 01/ 2005 - 04/2017 a multilobar subhemispheric disconnection was performed in 15 patients (6 male, 9 female; median age 8.9 yrs, range from 1.1 to 19 yrs): temporo-parieto-occipital (TPO) disconnection (12), centro-frontal disconnection (1), temporo-occipital disconnection (1), frontal lobe disconnection combined with a centro-parietal resection (1). Underlying pathologies were a posterior hemispheric dysplasia (7), other pathologies (8).
A comprehensive preoperative evaluation was performed in all patients. Outcome was assessed by the Wieser-classification.
RESULTS:In the HT group the follow-up period was 1 months to 19 yrs (median 9.3 yrs). Seizure outcome was Wieser class 1a in 48 children (92.3%) and class 5 in 4 children (7.7%).There was one death on day 4 after surgery due to generalized hyponatriamia induced brain edema.
In the subhemispheric disconnection group follow-up was 1 months to 12.5 years (median 6.4 years). Seizure outcome was Wieser class 1a in 12 children (80%), class 1 in 2 (13.4%) and class 4 in 1 (6.6%).
In three patients a shunt implantation was necessary after HT, two patients had a temporary EVD and one patient had an Ommaya reservoir. Two previously shunted patients needed shunt revision after frontocentral disconnection (1) and TPO (1).
CONCLUSIONS:The hemispheric and subhemispheric multilobar disconnective techniques used in our series proved to be applicable independent on the underlying pathology and the shunting rate is low.

PF-003

Special topic: Epilepsy

Intrinsic Thalamocortical Connectivity is Associated with Seizure Response to Chronic Vagus Nerve Stimulation in Children with Intractable Epilepsy

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OBJECTIVE:Although chronic vagus nerve stimulation (VNS) is an established treatment for medically-intractable childhood epilepsy, there is considerable heterogeneity in seizure response and little data are available to pre-operatively identify patients who may benefit from treatment. Since the therapeutic effect of VNS may be mediated by afferent projections to the thalamus, we tested the hypothesis that intrinsic thalamocortical connectivity is associated with seizure response following chronic VNS in children with epilepsy.
MATERIAL-METHODS:Twenty-one children (ages 5-21 years) with medically-intractable epilepsy underwent resting-state fMRI prior to implantation of VNS. Independent component analysis (ICA) and whole brain connectivity to thalamic regions of interest were performed. Dual regression and multivariate generalized linear models

were used, respectively, to correlate resting-state data with seizure outcomes. A supervised support vector machine (SVM) algorithm was used to classify response to chronic VNS on the basis of intrinsic connectivity.
RESULTS:Of the 21 subjects, 12 (57%) had greater than 50% improvement in seizure control after VNS. Enhanced connectivity of the thalamus to the anterior cingulate cortex (ACC) and left insula was associated with greater VNS efficacy. Using ICA, significantly greater integration of intrinsic networks associated with the anterior thalamus was also identified in children with better seizure response to VNS. Within our cohort, SVM correctly classified response to chronic VNS with 90.5% accuracy.
CONCLUSIONS:Enhanced intrinsic connectivity within thalamocortical circuitry is associated with seizure response following VNS. These results encourage the study of intrinsic connectivity to inform neural network-based, personalized treatment decisions for children with intractable epilepsy.

PF-004

Special topic: Epilepsy

Accuracy of robot assisted StereoEEG electrode placement in children

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OBJECTIVE:The aim of this study was to compare the accuracy of robot assisted (RA), and frameless optical (FO) navigated, stereoelec troencephalography (SEEG) electrode placement in children, and to identify factors that affect accuracy.
MATERIAL-METHODS:We undertook a retrospective review of all children who underwent SEEG implantation at Great Ormond Street Hospital. We calculated placement error at cortical entry and target by calculating the Euclidean distance between the planned and actual positions. For each electrode, we measured skin thickness, bone thickness, and intracranial length. Entry angle of electrode to bone was calculated using stereotactic coordinates. Mann-Whitney test was used to compare the implantation methods. We used a stepwise linear regression model to test for factors that affected accuracy.
RESULTS:We identified twenty children (age 4 to 19 years old) who underwent stereotactic placement of a total of 218 electrodes. Between 5 and 17 electrodes were placed in a single procedure. Six procedures were performed using FO (Medtronic Stealth) and fourteen with RA (Renishaw Neuromate) navigation. There were no implantation complications. Median target point localization error was 4.5 mm (interquartile range (IQR) 2.8-6.1) for FO and 1.1 mm (IQR 0.7-1.6) for RA placement. Median entry point localization error was 5.5 mm (IQR 4.0-6.4) for FO and 0.7 mm (IQR 0.5-1.0) for RA placement. The difference in accuracy between FO and RA placement was highly significant at both cortical entry point and target (both $p < 0.0001$). Skin thickness and intracranial length correlated positively with error at the target. Skin, bone thickness, and younger age correlated positively with error at entry.
CONCLUSIONS:Robotic-assisted electrode placement is highly accurate and is more accurate than frameless optical navigated placement. Larger error margins should be used when placing deep electrodes, in young children and in areas of increased skin thickness such as the temporal region.

PF-005

Special topic: Epilepsy

Thirty Years of Hemispherectomies: The Miami Experience

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OBJECTIVE:Hemispherectomy as a treatment option for medically-refractory, unihemispheric epilepsy in its various forms has enjoyed high seizure-free outcomes despite challenging morbidity. Here we describe our experience with hemispherectomy in a single large consecutive case series.
MATERIAL-METHODS:We analyzed 127 consecutive cases (in 122 unique patients) utilizing hemispherectomy (7.6% anatomical, 92.4% functional) for intractable epilepsy between June 1988 and April 2016.
RESULTS:At the time of surgery, patients ranged in age from 28 days to 27 years (mean=7.3 years; median=5.7 years). 22 patients were less than a year old, 76 were between 1-12 years, 18 were ages 13-18, and 6 were 19 or older. Prior to surgery, 82.8% of patients experienced daily seizures with the most common diagnosis being perinatal stroke (42.6%), followed by various infantile unihemispheric disorders. One-quarter (25.4%) underwent surgery within a year of seizure onset. Just over half (52.5%) were operated on the left. 96.1% of surgeries achieved complete disconnection. Five patients (4.1%) underwent reoperation. There was no immediate operative mortality. Early surgical complications (including unanticipated stroke, clinically significant bleeding, and immediate post-operative infections) were reported in 18.0% of cases. Late post-operative sequelae, including the development of hydrocephalus requiring shunt, occurred in 14.8% of cases. Superficial hemosiderosis was not observed. The effect of pre-operative patient characteristics (e.g., age, etiology), surgical experience, and technique (cf., anatomic versus functional) on the development of post-operative complications and seizure control will be examined in a multivariable analysis. Among patients with at least two years of post-surgical follow up, 78.3% were seizure free. Of the five that were reoperated, 2 (40%) achieved seizure freedom.
CONCLUSIONS:Despite significant surgical morbidity, hemispherectomy for catastrophic pediatric epilepsy remains a highly effective operation with few surgical failures and extremely high rates of seizure control.

PF-006

Special topic: Epilepsy

How durable are drop attack outcomes after corpus callosotomy in children?

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OBJECTIVE:Corpus callosotomy is a disconnective surgical treatment used for the palliative treatment of medically refractory epilepsy characterised by injurious drop attacks. Sustained seizure freedom at last follow up diminishes with longer case series and little is known about how seizure freedom changes over time. This paper describes the durability of drop attack outcomes at the Children's Hospital at Westmead in Sydney and Great Ormond Street Hospital for Children in London.
MATERIAL-METHODS:Between January 1995 and December 2015, 76 patients under 18 years underwent corpus callosotomy. Patient records were analysed for drop attack frequency, antiepileptic drug (AED) usage, and neurological and surgical complications. Post-surgery drop attack frequency was analysed using Kaplan–Meier event-free survival curves. Multivariate regression analysis was used to assess the effect of clinical characteristics on outcome at last follow up.
RESULTS:55 patients met inclusion criteria. Median follow up was 36 months (interquartile range=34 months). Overall 26/55 patients (47.3%) were either free of drop attacks or continued to have rare drop attacks at last follow up. Of the remaining 29 children, 26/29 patients (89.7%) had a return of drop attacks within 12 months of surgery. There were significantly fewer AED used at last follow up compared with pre-surgery (2 vs 3, $p<0.05$) and significantly fewer injuries among patients who continued to have drop attacks (42.3% vs 73.1%, $p<0.05$). There were no predictors of developing drop attacks post-surgery. 11/55 patients (20.0%) had transient neurological complications, 5/55 patients (9.1%) had minor surgical complications and 1/55 patient (1.8%) had a major surgical complication (hydrocephalus). There were no deaths.
CONCLUSIONS:Corpus callosotomy is a well-tolerated palliative procedure that is effective at reducing the severity of drop attacks in children. When drop attacks do return, they are more likely to do so within the first 12 months of surgery.

PF-007

Special topic: Epilepsy

Failures in epilepsy surgery: analysis of 45 patients in a monoinstitutional series

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OBJECTIVE:To investigate the causes leading to bad outcomes in epilepsy surgery.
MATERIAL-METHODS:Since 2007 162 patients received epilepsy surgery; at last follow-up, 45 out of them (27.8%) showed Engel Class Outcome lower than I (II – III – IV): 23 females and 22 males; mean age 14.2 years (range 2.4 – 43.1 years). Surgical procedures included: lesionectomy (13), temporal lobectomy (11), hemispherotomy (7), anterior corpus callosotomy (6), frontal lobectomy (2), occipital lobectomy (2), multi-lobar lobectomy (3), endoscopic disconnection of hypothalamic hamartoma (HH) (1). Nine patients (20%) underwent invasive recordings: SEEG (7), subdural grids (2).
All patients submitted to resective surgery showed persisting seizures due to incomplete resection of LAEts and/or FCDs. 4/13 patients submitted to lesionectomy underwent second surgery to complete the resection. 4/11 patients received a second procedure after incomplete temporal lobectomy. Two hemispherotomies were completed while two were converted into hemispherectomy all regarding diffuse hemispheric dysplasia. One patient did bad despite anatomic hemispherectomy because of a genetic mutation not investigated. Patients submitted to anterior corpus callosotomy showed the worst outcome due to bilateral and diffuse epileptogenic foci. The patient submitted to endoscopic disconnection of HH Type III (endo/exophytic) slightly improved because of partial removal.
RESULTS:In our series 27.8% (45/162) of patients submitted to epilepsy surgery did not achieve a good outcome. The main prognostic factor was the incompleteness of lesionectomy and temporal lobectomy. Disconnective surgery (hemispherotomy, endoscopic disconnection of HH) fails if incomplete especially in case of diffuse hemispheric dysplasia. Palliative surgery (anterior corpus callosotomy) may fail due to bilateral and multiple epileptogenic foci. Hidden genetic mutations may further drop the outcome
CONCLUSIONS:The incompleteness of resection and disconnection frequently lead to surgical failure of epilepsy surgery. Invasive recordings may help to achieve complete resection while a complete genetic work-up before surgery is mandatory.

PF-008

Special topic: Epilepsy

Outcomes of Hemispherotomy in Paediatric Epilepsy Surgery

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OBJECTIVE:Describe our experience of hemispherotomy for paediatric epilepsy and identify prognostic factors for seizure and cognitive outcome.
MATERIAL-METHODS:All notes of patients undergoing hemispherotomy at Great Ormond Street Hospital (GOSH) between 1991 and 2016 were retrospectively collected from the hospital database, focusing on the latest assessment preoperatively and the medical records at 12 months follow up. Statistical analysis was conducted using univariate and multivariate ordinal logistic regression analysis using STATA (14.0) (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP).

RESULTS:Data were available for 164 patients. Mean age of seizure onset was 1.89 years and mean age at the time of surgery was 6.81 years. Of the 209 children operated, 164 had follow up duration of more than one year. Our study comprised 44.7% females and 55.3% males. Five children had complications intraoperatively (2.8%) and 10 children suffered from hydrocephalus postoperatively (5.5%). One-year post surgery, 73.2% were seizure-free, 2.4% experienced rare seizures, 14.6% had an improvement of > 75% in seizures and 9.8% showed no improvement. Twenty-seven children underwent a redo hemispherotomy (15.1%). Moreover, 60.1% of patients decreased their antiepileptic drugs intake by a mean of 1.96 drugs. On a cognitive level, no significant difference was found between preoperative and postoperative assessments. The most significant predictor of cognitive outcome is preoperative cognitive level ($p<0.001$)
CONCLUSIONS:Hemispherotomy is a safe and effective treatment for children with presumed unilateral epileptogenic zone. Preoperative cognitive level is preserved but dramatic gains in cognition are not expected.

PF-009

Special topic: Epilepsy

Hemispherectomy for catastrophic epilepsy in the young

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OBJECTIVE:Hemispherectomy for medically refractory catastrophic epilepsy is often deferred in very young children due to the extensive nature of the procedure and the risk of significant blood loss. We evaluated the safety and efficacy of hemispherectomy in a cohort of young patients to identify patient factors associated with blood loss and seizure outcomes.
MATERIAL-METHODS:We performed a retrospective chart review of hemispherectomies performed at our institution from 1989–2011, and included all children undergoing surgery before age 3. For outcomes analysis, we excluded children with fewer than 2 years of follow-up.
RESULTS:We identified forty-one children less than 3 years of age at surgery (< 1 year, n=21; < 6 months, n=9). Seizure onset occurred at 3 months, with average age at surgery of 1.25 years. Average weight at surgery was 9 kg (range 3-15 kg). The most common etiologies were hemimegancephaly (38%) and perinatal stroke (28%). Most hemispherectomies were functional (85%). Average estimated blood loss (EBL) was 58 cc/kg. Twenty percent of patients became coagulopathic, which was significantly associated with EBL greater than 50 cc/kg ($p = 0.0002$). EBL was significantly higher in patients with hemimegancephaly ($p = 0.0005$). All patients received transfusions intraoperatively; 64% requiring transfusions post-operatively. Nine patients had hydrocephalus; 3 had shunts preoperatively. Eight required permanent CSF diversion postoperatively (21%). There was one delayed mortality from sepsis early in the series. At 5 years, overall seizure freedom was 69%, and was not associated with age at surgery. Seizure freedom was higher in patients with hemimegancephaly ($p = 0.0299$) and stroke ($p = 0.226$) compared to patients with other etiologies (Otohara, schizencehaly, Rasmussen's, Sturge Weber).
CONCLUSIONS:Hemispherectomy for catastrophic epilepsy can be performed safely even in the youngest of patients by an experienced team. The underlying etiology of seizures influences the intraoperative blood loss and postoperative seizure outcome.

Monday, 9 October 2017
11:40 – 12:50

Platform Presentations: Epilepsy / SDR

PF-010

Special topic: Epilepsy

Disconnection vs excision? A ten year review of hypothalamic hamartomas

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OBJECTIVE:Hypothalamic hamartomas (HH) are rare tumors of childhood. They are usually associated with gelastic seizures. The optimal management of these tumors lacks a consensus. We present our experience with hypothalamic hamartomas over a ten year period.
MATERIAL-METHODS:This study presents a retrospective review of 16 patients with HH's treated between 2002 and 2012 at the All India Institute of Medical Sciences (AIIMS), New Delhi, India, a tertiary care neurosurgical centre.
RESULTS:There were 16 patients with an age ranging from 1.5 years to 20 years and included 9 males and 7 females. The most common symptom was seizures (81%; gelastic seizures-62.5%) followed by precocious puberty (56.2%). The median tumor volume was 5.9 cc (range 1.3 to 108 cc). Fourteen patients underwent surgery while two were managed conservatively. Three patients received secondary Gamma Knife therapy. A good seizure outcome (Engel class I and II) post surgery was seen in 8 (50%) patients. The median follow up period was 39 months (range 1 to 114 months). The odds ratio for a better seizure outcome was 2.5 times more in disconnection than for excision. The symptoms of precocious puberty had resolved in 7 of the 9 affected patients (78%). Transient diabetes insipidus was seen in one (6.2%) patient postoperatively while hyperphagia was noted in four (25%) patients. Hyperphagia persisted in all four patients until last follow up.
CONCLUSIONS:HHs present with gelastic seizures or precocious puberty. Disconnection of the HH is more effective and a safer procedure vis-a-vis excision for controlling seizures.

PF-011

Special topic: Epilepsy

Strengths and pitfalls of disconnective procedures in epilepsy surgery

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OBJECTIVE:To show the efficacy of disconnection approach and its correlation to the size and the anatomy of the epileptic foci.
MATERIAL-METHODS:We report a series of 46 consecutive pediatric cases eligible for disconnective surgery treated at our Institution from 2011 to 2016. All patients (pts) underwent presurgical workup, including clinical evaluation, scalp video-EEG monitoring, 3T-MR and neuropsychological testing. Pts with hypothalmic hamartoma (HH) had endocrinological evaluation and 8 pts underwent invasive stereo-EEG monitoring. The series was divided by three main groups: 1) HH (18pts); 2) multilobar epilepsy (10pts); 3) hemispheric epilepsy (18pts). Mean age at surgery was 9.5 years (0.2-39.0±8.3). Disconnective techniques included: group 1) robotic-assisted endoscopy; group 2) frontal or temporo-parieto-occipital (TPO); 3) vertical parasagittal. In 10 cases intraoperative neuromonitoring was performed. All pts had an early (24h) postoperative MRI and at least one year of follow-up (27.4 months,12-57±33.6). Seizure outcome was defined according to Engel scale. HH were evaluated according to Delalande classification.
RESULTS:Twelve pts experienced temporary postoperative deficits. Two pts had permanent deficits, including worsening of hemiparesis and mild III nerve palsy. One patient developed an asymptomatic ischemia of the disconnected area. No postoperative hemorrhages, infections or endocrine dysfunctions were observed. In HH group the mean postoperative hospitalization was 2 days. In group 3) a ventricolo-peritoneal shunt was required in 30% of cases. Engel I pts were: in group 1)14/18 pts; in group 2)6/10; in group 3)11/14.
CONCLUSIONS:Disconnective procedures are safe and effective approaches in pediatric cases and are associated with minor surgical morbidity and fast patient recovery. The epilepsy outcome for HH is better for type II and III. In multilobar epilepsy cases, the outcome of TPO disconnections is better than frontal approaches. Results of vertical parasagittal hemispherotomy are comparable to other hemispherotomy techniques. Accurate knowledge of specific surgical key points is mandatory for a successful disconnection.

PF-012

Special topic: Epilepsy

The Use of Magnetic Resonance Guided Laser Thermal Ablation in Children with Intractable Epilepsy due to Tuberousclerosis Complex: single or multi-staged minimally invasive option

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OBJECTIVE:Intractable Tuberousclerosis-epilepsy has classically been treated with invasive monitoring followed by resective surgery.
We have developed a protocol for treatment using MRI guided LITT in single or multiple stages
MATERIAL-METHODS:Our study was approved by the SUNY Upstate Medical University Institutional Review Board. Retrospective chart review was done for patients up to 18 years of age who received MR-guided laser interstitial thermal therapy for ablation of epileptogenic cortical tubers from 2012-2016 at our hospital. All patients had persistent seizures despite being on complex medication regimens involving multiple anti-epileptic drugs (AEDs). Prior to treatment, these patients had all received a thorough medical workup including, at a minimum, electroencephalography (EEG) and magnetic resonance imaging (MRI). Additional video electroencephalography (vEEG), MRI imaging, positron emission tomography (PET), and/or single photon emission computer tomography (SPECT) were obtained if indicated.
RESULTS:We treated seven patients (3 boys and 4 girls) with ages 2 to 17 y old. Two patients required a single MRIgLITT session while five received multi-staged treatment. One to up to four lasers were applied per session. Follow up runs from 50 to 17 months. All of the patients had an improved Engel's outcome post treatment.
CONCLUSIONS:Intractable epilepsy in children with tuberousclerosis can be treated in a minimally invasive fashion with LITT under MRI guidance. Our experience is promising in the management of seizures. Longer follow up is necessary to evaluate long term seizure control and neuropsychological improvement.

PF-014

Functional

Selective Dorsal Rhizotomy Surgery in Leeds- our first 80 cases

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OBJECTIVE:Selective Dorsal Rhizotomy (SDR) is an operation that reduces abnormal lower limb tone for children with cerebral palsy and spasticity mainly affecting the legs. A multidisciplinary SDR programme was started in Leeds in October 2012. We present the outcomes from the first 80 patients treated.
MATERIAL-METHODS:The first SDR procedure for this series was performed in October 2012. Post-operative outcomes have been prospectively recorded using a spreadsheet database.
SDR was performed according to a standardised protocol. Through a single-level laminectomy, using intra-operative neurophysiology, approximately 66% dorsal rootlets are cut from L1-S1. Standardised selection criteria were used - spastic diplegia with dynamic spasticity limiting function, no dystonia, typical MRI changes, and GMFCS Level 2 or 3.
All patients had standardised pre- & post-op assessments with 3D Gait Analysis, GMFM-66, Ashworth grading, muscle power & joint range of movement. Quality of Life is also assessed by the use of the CPQoL questionnaire.
RESULTS:By the end of March 2017, 80 patients were treated with SDR in Leeds. The cohort comprises 53 males and 27 females, with a mean age at surgery of 6.53 years (range 2.6-14.39y). Patients were GMFCS 2 (34) or GMFCS 3 (46). Mean follow-up to October 2017 will be 2.73 years (range 0.55-4.96y).

All patients have reduction in tone after SDR. The average GMFM-66 improvement (compared with pre-operative baseline) at the first year after surgery was 8.1%, and 11.6% at the second year. Additional outcomes with range-of-movement, Quality of Life and Gait have been monitored and will be reported in this paper.
There were no significant complications - specifically no paralysis, incontinence or spinal deformity.
CONCLUSIONS:SDR is an effective treatment for carefully selected patients diagnosed with cerebral palsy with spasticity mainly affecting their legs. Multi-modal outcome assessments have shown sustained improvements across many domains.

PF-014a

Functional

Quality of Life Outcome after Selective Dorsal Rhizotomy Surgery - experience over the first 60 cases in Leeds

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OBJECTIVE:Selective Dorsal Rhizotomy (SDR) aims to improve function and mobility through reduction in abnormal lower limb tone. We present Quality of Life (QoL) outcomes from the first 60 patients operated & followed up for at least one year from surgery.
MATERIAL-METHODS:The first SDR procedure was in October 2012. Post-operative outcomes are prospectively recorded using a spreadsheet database.
SDR was performed according to a standardised protocol. Through a single-level laminectomy, using intra-operative neurophysiology, 66% L1-S1 dorsal rootlets are cut. Patient selection criteria were: spastic diplegia with dynamic spasticity limiting function, no dystonia, typical MRI changes, GMFCS Level 2 or 3.
All patients had standardised pre- & post-op assessments with 3D Gait Analysis, GMFM-66, Ashworth grading, muscle power & joint range of movement. QoL was assessed using the CPQoL questionnaire.
RESULTS:Overall, 80 patients have been treated with SDR in Leeds. We report the Quality-of-Life outcome for the first sixty patients for whom complete pre- and post-operative CPQoL data was available. For more than 40 of these patients, the data is also available for the 2-year follow-up interval.
The 60 patients comprised 41 males and 19 females, with a mean age at surgery of 6.47years (range 2.6-13.8). Patients were GMFCS 2 (28) or GMFCS 3 (32). Mean follow-up to October 2017 will be 3 years (range 1.6-4.96y).
All patients have reduction in tone after SDR. Multi-modal outcomes have been monitored r.
At one-year post-operatively, CPQoL demonstrated improvements against baseline, in all domains. The largest difference was a 40.3% improvement in the "Participation & Physical Health", followed by a 27.9% reduction in "Pain and Impact of Disability".
There were no significant complications.
CONCLUSIONS:SDR is an effective treatment for carefully-selected patients with cerebral palsy and spasticity affecting their legs. Quality of Life assessment demonstrated improvements, particularly in the participation domain and pain domain.

PF-015

Functional

Intrathecal Baclofen Test Dose: Predictive Role in Selective Dorsal Rhizotomy

Benedetta Pettorini, Joseph Attwood, Dawn Hennigan, Morag Sangster, Ram Kumar, Anthony Jesurasa, Chris Sneade
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OBJECTIVE:Selective Dorsal Rhizotomy (SDR) is a surgical procedure used to alleviate lower limb spasticity in children suffering from cerebral palsy. In some cases, in particularly GMFCS grade III, the response to SDR is difficult to predict, and due to the irreversible nature of the procedure, this can make the decision to offer SDR challenging for the clinician. No studies have looked to see if a trial dose of intrathecal Baclofen is an effective option for patient selection for surgery.
MATERIAL-METHODS:At Alder Hey Children's Hospital, 12 paediatric patients eligible for SDR surgery were given a 24 hour continuous intrathecal baclofen infusion prior to the decision to undergo definitive operative management. Patients were assessed clinically (Modified Ashworth Scale, modified MRC scale, Global Rating Scale, informal gait assessment and VGA) at regular intervals following initiation of intrathecal baclofen, and a decision was made in conjunction with parents whether to proceed with SDR. Parents were followed up post-operatively to obtain their opinion on the trial dose and how it influenced their decision.
RESULTS:A total of 12 patients were included in the study, with GMFCS levels between III (n= 9) and IV (n= 3). The decision for SDR occurred in 8 patients (67%) with remaining 4 patients (33%) not undergoing the procedure. Feedback was received from 5 parents; this was positive in 4 out of the 5 cases, who found the trial dose useful when giving consent for surgery.
CONCLUSIONS:In this study, we recognise the potential role for intrathecal baclofen in patient selection for SDR. Intrathecal Baclofen was useful for reinforcing clinical decision making in candidates potentially suitable for definitive surgery. It also gives parents insight into the realistic outcome of SDR and assists them in decision making.

Monday, 9 October 2017
14:00 – 15:30

Parallel Session: Craniofacial

PF-016

Craniofacial

Long-term results of minimal invasive biparietal cranioplasty for the management of sagittal craniosynostosis

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[2]Pediatric Neurosurgery Department,Catholic University Medical School, Rome, Italy
[3]Pediatric Neurosurgery Department, International Neuroscience Institute, Hannover, Germany

OBJECTIVE:We report on the experience and the late results of a personal series of children operated on for sagittal craniosynostosis with a biparietal cranioplasty through linear skin incision.
MATERIAL-METHODS:The technique consists of a biparietal expansive cranioplasty obtained by a wide sagittal synostectomy and large craniectomies along the coronal and the lambdoid sutures. The procedure is carried out through two to six short skin incisions (2-3 cm long) strategically scattered over the scalp. No postoperative orthesic helmets were used. The patients were followed up postoperatively with cephalometric measurements, ophthalmic examinations and neuropsychological tests according to their age. The minimum follow-up required for the inclusion in the present study was 3 years.
RESULTS:Children with sagittal synostosis operated on between January 2002 and December 2014 have been included. There were 192 patients, with a mean age of 5.6 months. The mean duration of the operation was 62 minutes, the mean blood loss was 100 cc and the mean hospital stay was 3.8 days. Two were the major complications in this series: one dural tear with focal cortical injury (0.5%), and one pseudomeningocele, which needed a surgical repair (0.5%), all resolved without consequences. At a mean follow up 5.3 years a stable satisfactory cosmetic correction was achieved in 186 children (Sloan's Class I: 88%, Class II: 8%, Class III: 4%). The late cephalic index mean improvement was 8.7%. Three patients were reoperated for a bone crest detected in the follow-up (1.5%) and three patients were reoperated with open technique due to the evidence of bilateral papilledema and increased ICP at an invasive ICP measurement.
CONCLUSIONS:The use of simplified surgery is indicated in young children with sagittal craniosynostosis. The technique here presented allows to achieve a stable long-term cranial reshaping with limited complication rates and minor impact of the surgical scar.

PF-017

Craniofacial

Chiari malformation management in bilambdoid and sagittal synostosis

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OBJECTIVE:To evaluate the role of the tonsillar herniation or Chiari malformation (CM) managemant in combined bilambdoid and sagittal synostosis (BLSS) surgical treatement and to define if CM is responsible of an increased re-operation rate.
MATERIAL-METHODS:This is a monocentric restrospective study including 31 non-syndromic patients with BLSS treated between 1972 and 2014. Four out of 31 patients were not operated because of absence of raised intracranial pressure (ICP), absence or asymptomatic CM. Twenty-seven cases required surgery: vault decompression (10) or posterior expansion (17) among them 7 with distraction, or a combination including foramen magnum release (FM) in 4/27. The influence of CM and type of surgery were analyzed on outcome.
RESULTS:Eight (8/27) patients operated on did not present with CM, but 3 required a secondary vault remodelling for raised ICP. No further problem occurred in that subgroup.
Nineteen (19/27) operated patients presented CM at initial diagnosis, among them associated with syringomyelia (SYR) in 1 and with central apneas (CA) in 3. After treatment CM improved in 1, remained stable in 13/19 patients, and worsened in 5 with development of SYR that appeared 4 years later. In the subgroup that underwent FM decompression (4/19), none required secondary surgery and all had an uneventful follow-up. In the subgroup of 15/19 patients submitted to a posterior expansion or vault decompression without FM release, 8 secondary or tertiary procedures were necessary. Globally, 8/27 patients (30%) were operated twice and 4 of them (15%) needed more than two procedures, some of them for aesthetic reasons.
CONCLUSIONS:The management of CM in BLSS is essential to reduce the number of surgical procedures. Posterior distraction alone was not sufficient in our experience to prevent deterioration of CM secondarily. FM decompression should initially be discussed in combination of posterior distraction.

PF-018

Craniofacial

Reducing Post-Operative Craniofacial Infection Rates; The Alder Hey Surgical Site Infection Bundle

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[2]Department of Neurosurgery, Alder Hey Children's Hospital, Liverpool, United Kingdom

OBJECTIVE:Surgical site infection causes significant morbidity for patients with extended lengths of inpatient stay and/or recurrent admissions/attendances, exposure to antibiotic side effects and the risks of further surgery, together with the additional health economics costs of these factors to the hospital. Surgical site infection occurs within 30 days of surgery and can be categorised into superficial incisional infection, deep incisional infection and organ/space infection. The aim of this paper is to introduce the concept of the Alder Hey Surgical Site Infection Bundle (SSIB), and the impact that this has had on our surgical site infection rates.
MATERIAL-METHODS:We introduced the SSIB for all patients undergoing procedures within the Alder Hey Craniofacial Department in 2015, with the aim of reducing our surgical site infection. This protocol involved pre-, peri- and post-operative care bundles. Each surgical time frame has its own bundle which must be completed. We prospectively collected data on surgical site infection prior to the introduction of the SSIB, and after the SSIB was introduced.
RESULTS:In the year prior to the introduction of the SSIB the surgical site infection rate for all craniofacial procedures was 4.9%. After the introduction of the SSIB, the surgical site infection rate for all craniofacial procedures was 1%. This is a significant improvement in the craniofacial surgical site infection rate.
CONCLUSIONS:The SSIB has reduced the surgical site infection rate by 3.9%. The SSIB is well tolerated and adhered to by patients. It has therefore had a positive impact on reducing patient

morbidity, and improved craniofacial surgical health economics. We would recommend the introduction of similar protocols in other craniofacial surgical units.

PF-019

Craniofacial

Surgical treatment for craniosynostosis: 20 years of experience in 310 cases

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[2]Santo Antonio Children's Hospital, Porto Alegre, Brazil
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OBJECTIVE:The surgical treatment of craniosynostosis can be associated with serious complications, including death. The aim of this paper is to review the epidemiology and surgical results in 310 cases using cranial vault remodeling techniques for surgical treatment of craniosynostosis.
MATERIAL-METHODS:Were studied 310 consecutive patients operated between 1996 and 2016. The surgical technique consisted of an aggressive approach with extensive decompression, cranial vault remodeling and forehead advancement when necessary. All patients receive a invasive arterial pressure monitoring, oximetry and capnography. Intraoperatively, careful attention to bleeding, use of Colorado needle to skin incisions and early blood transfusion was used to avoid hemodynamic instability. Patients have the tracheal tube removed at the end of surgery and received a post-operative care in the pediatric intensive care unit.
RESULTS:Boys were 211 (68%) and girls were 99 (32%) with an average age of 10 months of age (range from 18 days to 100 months) and average weight of 9 kg (range from 3 to 36 kg). Most cases, 291 (94%), were non-syndromic with only one suture affected in 260 (89%): sagittal 175 (68%), metopic 45 (17%), unilateral coronal 35 (13%) and unilateral lambdoid 4(2%). Multiple sutures involvement in non-syndromic were seen in 31 (11%): bilateral coronal 16, sagittal + lambdoid bilateral 7, sagittal + unilateral coronal 6, sagittal and bilateral coronal 1 and sagittal + bilateral coronal +metopic 1.
19 (6%) cases were syndromic. The surgical technique used was: craniotomy with cranial vault remodeling 104 (34%), craniectomy 103 (33%), bilateral fronto-orbital advancement 63 (20%) and unilateral fronto-orbital advancement 40 (13%). There were no surgical mortality.
CONCLUSIONS:The best surgical results for craniosynostosis, with no mortality and low morbidity can be achieved with an early aggressive treatment associated with intensive intraoperative monitoring, strategies to minimize blood loss, early blood transfusion, recovery in the pediatric ICU and treatment offered by an experienced team.

PF-020

Craniofacial

The metopic-sagittal craniosynostosis -Report of 35 operative cases-

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OBJECTIVE:The metopic-sagittal synostosis thought to be rare condition. 35 cases of this condition were diagnosed. Here we introduce their clinical symptoms, neuro-radiological findings and surgical treatment methods, as well as discuss the relevant literature.
MATERIAL-METHODS:Subjects included 35 patients (33 boys and 2 girls; mean age 4.2 years; range 1-8 years). Magnetic resonance imaging (MRI) confirmed that there were no abnormal findings in the brain. Thirty patients presented with symptoms including speech delay, hyperactivity, autistic tendency, motor impairment, self-mutilation, and panic/temper tantrum behaviors. No other congenital malformation was observed, and all cases were considered to be the non-syndromic type. The final diagnosis was made using three dimensional-computed tomography (3D-CT) scans. The surgery was done the fronto-orbital advancement in addition to remove the large parts of sphenoid bones including sphenoid ridges at the skull base and trimmed the calvarium as necessary to reduce pressure.
RESULTS:Surgical intervention improved clinical symptoms in nearly all 35 patients; cosmetic problems in patients with scaphocephaly were also corrected.
CONCLUSIONS:In the cases of child patients with metopic-sagittal synostosis who had clinical symptoms, surgical intervention improved such symptoms, suggesting its potential utility for metopic-sagittal synostosis with clinical symptoms. A surgical procedure focusing on the skull base was important for our successes. Based on the fact that metopic-sagittal synostosis was diagnosed in 35 patients at one institution over a relatively short period of time, this pathological condition may not be as rare as is currently believed.

Monday, 9 October 2017
14:00 – 15:30

Parallel Session: Vascular

PF-021

Vascular

Polymorphisms in CD40 are associated with Moyamoya disease in children

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OBJECTIVE:The etiology of Moyamoya (MMD) disease remains unknown. Immune and inflammation dysfunction may play an important role in understanding the pathogenesis of this rare disease. We investigate single nucleotide polymorphisms (SNPs) found previously in Kawasaki disease (KD) and perform a genetic analysis among Chinese pediatric patients with MMD.
MATERIAL-METHODS:We analyzed patients' DNA for SNPs in B lymphoid tyrosine kinase, CD40, and coatomer protein complex beta-2 subunit, which have been previously associated with KD. Genotyping was performed by sequencing the genetic regions containing the SNPs with custom-made primers. A total of 5 genotype polymorphisms were included among 48 cases and 50 controls.
RESULTS:The mean age of MMD children was 6.72±3.63 years old. We found two SNPs polymorphisms were associated with MMD. Polymorphisms rs4813003 major allele CC and rs1535045 minor allele TT of CD40 were statistically associated.

CONCLUSIONS:Our findings provide evidence that there maybe a relationship between MMD and auto-immune dysfunction. Further analysis in the pathogenesis within the vascular wall may provide genotype specific personalized therapy target.

PF-022

Vascular

The Neurosurgeon's Role in Managing Vein of Galen Malformation: Experience from 118 Cases

Alex Smedley[1], Fergus Robertson[2], Adam Rennie[2], Sanjay Bhate[2], Martin Tisdall[2], Vijeya Ganesan[2], Greg James[2]
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OBJECTIVE:Vein of Galen malformation (VOGM) is a complex intracranial vascular malformation in which the vein of Markowski is kept patent by intracerebral AV shunts. Cases can present at various stages of childhood. VOGM itself is managed primarily with endovascular embolization for a variety of presentations. We review our surgical experience in a large cohort of these patients to determine the extent of the modern role of the neurosurgeon in VOGM management.
MATERIAL-METHODS:Retrospective cohort study of 118 consecutive patients diagnosed with VOGMs managed at Great Ormond Street Hospital (GOSH). Information taken from database and electronic medical records review.
RESULTS:118 patients were assessed, 75 male (64%) and 43 female (36%); with 261 embolisations, an average of 2.21 per patient, with outliers at the extremes including 8 in a single patient. 33 (28%) patients required at least 1 neurosurgical intervention (75 procedures in total), an average of 2.3 per patient in this group. EVD, VPS, ETV and their revisions were the most common neurosurgical interventions. Of those who had neurosurgical intervention 33% are alive with no deficit, 42% alive with deficit, and 24% have died; compared with 45%, 28%, 28% in the group who had no neurosurgery. Follow of up was a mean of 73.5 months per patient.
CONCLUSIONS:The rate of neurosurgical intervention in patients with VOGM is significant, and our results suggest a relationship with deficit burden. We propose the existence of a cohort of more complex cases, needing multiple embolisations and neurosurgerical procedures. This is an important consideration when counselling patients and planning a VOGM service.

PF-023

Vascular

Postoperative increase patterns of cerebral blood flow in the patients with bilateral cerebrovascular moyamoya disease

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OBJECTIVE:We analyzed the postoperative increase patterns of cerebral blood flow (CBF) in patients with bilateral moyamoya disease treated with two-stage operations.
MATERIAL-METHODS:Nine patients with bilaterally operated moyamoya diseases, aged 6–16 years, 4 boys and 5 girls, were included. Direct and indirect anastomoses were performed unilaterally, and the surgeries on the contralateral side were performed 0.5–2 years later. The cerebrovascular reserve capacity (CRC), the increased ratio of the CBF by the administration of acetazolamide, was measured with N-isopropyl-[123I] p-iodoamphetamine single photon emission computed tomography (IMP-SPECT) thrice; before and after the first surgery, and after the second surgery.
RESULTS:The increase in CRC was classified into two patterns - synchronized and independent. The synchronized increase seen in six patients indicated that the CRC in the first-operated hemisphere increased from -5.4% to 10.4% after the first surgery, and increased further to 17.6% after the second surgery. The CRC in the second-operated hemisphere increased from -1.2% to 8.2% even after the contralateral side surgery, and finally reached to 16.9% after the bilateral surgeries. The independent increase pattern seen in three patients indicated that the CRC in the first hemisphere increased from -3.1% to 18.1%, with no further increase after the bilateral surgeries (11.0%). The CRC in the second-operated hemisphere deteriorated from 17.4% to 6.6% after the contralateral surgery, and increased to 12.4% after the ipsilateral surgery. Normal and stenosis of the posterior cerebral arteries (PCA) were seen in patients with the synchronized and the independent patterns, respectively.
CONCLUSIONS:Bilateral hemispheric CRC increases after unilateral surgery because the compensation of CBF supplied by the PCA shifts to the non-operated hemisphere after no assistance is needed to the operated hemisphere. However, the CRC in patients with the involvement of PCA stenosis depends on the surgical anastomosis only.

PF-024

Vascular

Dose reduction with digital subtraction angiography for neuroangiography in pediatric population

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Cincinnati Children's Hospital Medical Center, Cincinnati, USA

OBJECTIVE:The purpose of this study was to quantify dose reduction of radiation by digital subtraction angiography (DSA) using image processing techniques for the purposes of neuroangiography in children. Although previous studies (Soderman et. al, 2013) have demonstrated the efficacy of this technology in adults, studying dose reduction in children is imperative in reducing lifetime radiation exposure and allowing for completion of full length imaging studies without overexposing pediatric patients.
MATERIAL-METHODS:Patient data was collected from December 2013 to December 2015, with a total of 112 patients enrolled. Data from 98 patients was analyzed using the reference system (AlluraXPER), while data from 46 patients was analyzed using the current system (AlluraClarity). Diagnostic images were enhanced using noise reduction, pixel shift, and motion compensation. Patient radiation exposure was measured using total radiation dose and dose area product. Analysis of variance was calculated between the two systems to assess the primary outcome. Fluoroscopy time and number of fluoroscopy images acquired were analyzed as surrogate markers of physician behavior during the "training phase" with the current system.
RESULTS:The use of imaging processing techniques with the Clarity system provided significant reduction in radiation dose over the XPER system ($p < 0.001$) from 2.72 to 1.67 mGy/frame. Additional dose indicators, including dose area product (DAP), also showed significant reduction ($p < .005$), from

490 to 336 mGy*cm2/frame. There was no significance in the imaging time or number of images captured between the two systems.
CONCLUSIONS:Utilization of digital subtraction neuroangiography with image processing techniques provided approximately 62% radiation dose reduction in the pediatric population, correlating with previous studies in the adult population. There was no discernable impact on physician behavior in the "training phase". Given the vulnerability of children to radiation exposure, this marks a clinically significant improvement in imaging techniques for pediatric neuroangiographic procedures.

PF-025

Vascular

Transcallosal-transseptal interforniceal approach for total resection of superior midbrain and medial thalamus cavernous malformations in children: surgical management and literature review

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OBJECTIVE:Symptomatic brain stem cavernous malformations (CMs) often present the dilemma of choosing an approach for their resection. Through a right frontal craniotomy, the experience of transcallosal-tansseptal interforniceal (TCSIF) approach was reported firstly in children superior midbrain and medial thalamus CMs.
MATERIAL-METHODS:Twelve children with superior midbrain and medial thalamus CMs underwent lesion resection via TCSIF approach at Capital Medicine University Tiantan hospital from January 2008 to December 2016. The clinical chart, radiographs, and operation reports were reviewed retrospectively, and follow-up evaluations were obtained prospectively.
RESULTS:Twelve hemorrhagic lesions resection were performed in 12 patients (7 female, 5 male) aged 1.5-16 years (mean 7.8 years). There are no deaths, venous infarction, significant intraoperative bleeding and subsequent instances of disconnection syndrome, while only 1 late rebleeding (less than total resection). Morbidity was minimal, including postoperative hydrocephalus in 4 patients (requiring a new shunt during follow-up), early short-term memory deficits in 5 cases (persistent in 2), Parinaud syndrome in 3 cases (1 of these had appeared preoperatively, 2 of these almost completely resolved), postoperative oculomotor nerve paresis in 1 child (but recovered during follow-up).
CONCLUSIONS:TCSIF approach is an effective and relatively safe technique for midbrain and medial thalamus CMs in children. It should be recommend as an additional approach for lesions which is located in the midline midbrain and thalamus intruding into third ventricle, because of effective access to the floor of the third ventricle with minimal forniceal retraction and intact deep venous structure.

PF-026

Vascular

Management of Pediatric Posterior Circulation Aneurysms - 12 years single instituition experience

Mayank Garg[1], Pankaj Kumar Singh[1], Leve Joseph[2], Dattaraj Sawarkar[1], Amandeep Kumar[1], Shashank Sharad Kale[1], Bhawani Shanker Sharma[1], Ashok Kumar Mahaptra[1]
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OBJECTIVE:Pediatric posterior circulation aneurysms differ from adults aneurysms in various aspects like morphology, etiology, management and outcome and are rare entity. The aim of this study is to describe our experience of treating 16 children with posterior circulation aneurysms and getting wiser regarding etiology, clinical characteristics, management and outcome of posterior circulation aneurysms.
MATERIAL-METHODS:Pediatric patients (age less than 18 year) with posterior circulation aneurysm managed at our institute from January 2004 to August 2015 were included in this retrospective study. Demographic, clinical, radiological and management details were retrieved from hospital records.
RESULTS:Total 16 patients with posterior circulation aneurysms were included in the study (mean age 13.1 years, range-7-18 years). 75% of the patients had Subarachnoid hemorrhage (SAH) with headache as most common symptom in 62.5 % patients followed by cranial nerve palsies (25%), seizure (18.8%), hemiparesis (18.8%) and ataxia (12.5%). Most common location of aneurysm was Posterior Cerebral Artery in 43.75% of patients followed by basilar artery in 25% patients. Most of these patients had dissecting aneurysm present in 62.5% of patients. Eleven (68.75%) patients underwent endovascular surgery and in one (6.25%) patients microsurgical clipping was performed. At mean follow up of 34.7 months (15 patients) complete occlusion was observed in all the treated aneurysms. Overall good outcome was present in 87.5% of patients.
CONCLUSIONS:Posterior cerebral artery is most common location for posterior circulation aneurysm in pediatric population and most of them are of dissecting variety. Good outcome was observed with both endovascular and microsurgical treatment at long term follow up.

PF-027

Vascular

Internal Maxillary Bypass for Complex Pediatric Aneurysms

Long Wang, Xiang'en Shi, Hai Qian
SanBo Brain Hospital, Capital Medical University

OBJECTIVE:Complex pediatric aneurysms (PAs) are an unusual clinicopathologic entity, and data remain limited regarding the use of a bypass procedure to treat this formidable disorder
MATERIAL-METHODS:Internal maxillary artery (IMA) to middle cerebral artery (MCA) bypass with radial artery graft (RAG) was utilized to isolate PAs. Bypass patency and aneurysm stability were evaluated using intraoperative Doppler ultrasound, indocyanine green videoangiography and postoperative angiography. The modified Rankin Scale (mRS) was used to assess neurological function.
RESULTS:Over a 5-year period, 7 pediatric patients (aged 18 years or younger) were included in our analysis. The age of the patients ranged from 12 to 18 years (mean, 14.4 years), and the mean size of the PAs was 23.6 mm (range: 9 to 37 mm) with all of the cases presenting complex characteristics. Three PAs were treated using proximal artery occlusion (PAO), 2 were completely excised following an aneurysmal distal IMA bypass, and a combined PAO and aneurysm excision procedure was performed in the 2 remaining cases. The measured intraoperative blood flow ranged from 40.0 to 90.8 ml/min (mean, 61.6 ml/min). The graft patency rate was 100% during the postoperative recovery and at the last follow-up (mean, 20 months; range: 7-45 months). Excellent outcomes were observed in all patients except for one who died of multiple organ failure.
CONCLUSIONS:IMA bypass is an essential technique for the treatment of selected cases of complex PAs

Monday, 9 October 2017
17:00 – 17:48

Platform Presentations: Hydrocephalus

PF-028

Hydrocephalus

Choroid plexus clears macromolecules from the ventricles in experimental hydrocephalus

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OBJECTIVE:Choroid plexus is known to be a major source of cerebrospinal fluid and therefore, has been the target of surgical destruction or coagulation in the treatment of hydrocephalus. The role of choroid plexus in the homeostasis of the cerebrospinal fluid is unclear in the presence of hydrocephalus. Our objective was to study the role of choroid plexus in experimental hydrocephalus in relation to clearance of dextrans.
MATERIAL-METHODS:We performed experiments to study the distribution and kinetics of iron labeled dextran in rats using a 7T MRI scan for a period of two hours during and immediately following injection. Rats were randomly divided into three groups: normal (9), communicating hydrocephalus induced by kaolin (11) and obstructive hydrocephalus induced by kaolin (4). Presence of iron tagged dextran in the choroid plexus was determined as a change in the MRI signal (decreased T2 value) and histology after sacrifice of the animals.
RESULTS:MR data was measured at three different time points: preinjection, 35 minutes post and 79 minutes post injection. In ALL groups, there was a choroid plexus uptake of iron-tagged dextran into the choroid plexus. Most notably in the 79 minute post injection grouping, a return to baseline T2 values in the normal group was significantly far below baseline T2 values in both the kaolin-induced hydrocephalus groups ($p<0.05$).
Normal rat, CP T2 values 101±5(n=18) (pre), 64±1(35m post), 92±1 (79m post). Hy-BC rat, CP T2 values 148±26(n=76) (pre), 60±4(35m post), 71±8(79m post). Hy-CM rat, CP T2 values156±32(n=53) (pre), 39±6(35m post), 35±4(79m post). Histopathology confirmed the presence of dextrans in the choroid plexus.
Both serum and urine spectrophotometric assays detected the dextrans: serum (assay) peaked at 30 mins and urine (assay) peaked at 45 mins.
CONCLUSIONS:Choroid plexus plays a beneficial role in the clearance of macromolecules from the CSF in both normal and hydrocephalic states.

PF-029

Hydrocephalus

Evolution of the Choroid Plexus as a Portal to Homeostasis

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OBJECTIVE:The desired functional parameter of evolutionary selective pressure is homeostasis; the choroid plexus (CP) is a central player by producing/refining energetically-favored molecules.
MATERIAL-METHODS:This paper investigates evolutionary paths of three proteins: transthyretin (TTR), insulin-like growth factor (IGF)-II, lactate dehydrogenase (LDH), pivotal to CP homeostasis.
RESULTS:As predominant secreted protein, TTR is synthesized de novo/constitutively expressed. Its evolutionary oldest most fundamental function is transport of thyroid hormones (THs) T3 and T4 into CSF, creating extracellular pools for growth/differentiation/full proliferation of neural stem cells in adjacent subventricular-zone (SVZ). Beginning with stem reptiles, 350Mya, is evidence of CP-TTR gene-transcripts accompanying nascent emerging neocortex. This ancient CP-TTR partnership perfectly matched THs, free of complex signal transduction mechanisms. TTR homeostasis guarantees phenotypic survival, $p<0.001$; no human null-TTR-embryo could survive.
Homeostatic IGF-II is transcribed/secreted into CSF. Paternally imprinted in mammalian embryogenesis, CP-GF-II is ideosyncratically bi-allelic; mitogenic autocrine/paracrine effects begin just after neural tube closure, continuing first-half gestation, guiding/patterning general/specific brain growth in CSF's SVZ niches: asymmetric neurons E0-E40/E0-E43; symmetric neurons E40-E100/E43-E120, macaques/humans, respectively. This enhanced the Eutherian lineage evolutionary switch, 130Mya, from extracellular T3 to T4 prominence giving greater flexibility; precisely controlled intracellular T3 benefited specific brain regions: cortex-65%, cerebellum-51%, pons-35%.
LDH focuses on choroidal transport mechanisms essential to ion homeostasis; an adaptive advantage in vertebrate transitioning, from gill to air breathing >400Mya, reestablished acid-base parameters: newly elevated PCO2 stimulus necessitated regulation extracellular pH through transport of HCO3- and lactate. Septupled blood flow/quintupuled capillary diameters in highly-vascularized CP helped maintain CP's respiratory/metabolic energy requirements. Lactate from RBCs poured into abundant CP mitochondria whose portal to aerobic metabolism is LDH, and RBC's polypeptide LDH-B:LDH-A's aerobic status, evolutionary sensitive: rats 0.0, macaques 1.8, humans 3.8.
CONCLUSIONS:Earliest CP function proposed, "animal spirits that gave energy", embodies this far-reaching role.

PF-030

Hydrocephalus

A randomized trial of endoscopic third ventriculostomy with choroid plexus cauterization (ETV/CPC) compared to ventriculoperitoneal shunt for the treatment of post-infectious hydrocephalus in Ugandan infants

Benjamin C Warf[1], Abhaya V Kulkarni[2], Schiff J Schiff[3], Edith Mbabazi Kabachelor[4], John Mugamba[4], Peter Ssenyonga[4], Ruth Donnelly[2], Jody Levenbach[2], Vishal Monga[3], Mallory Peterson[3], Michael Macdonald[3], Venkateswararao Cherukuri[3]
[1]Harvard Medical School
[2]University of Toronto
[3]Pennsylvania State University
[4]CURE Children's Hospital of Uganda

OBJECTIVE:Post-infectious hydrocephalus (PIH) in infants is a major health burden in sub-Saharan Africa. Recently, treatment by endoscopic third ventriculostomy with choroid plexus cauterization (ETV/CPC) has shown some advantages over traditional ventriculoperitoneal shunt (VPS). It is unknown, however, if either treatment results in superior cognitive outcome and brain growth. Therefore, controversy over the preferred treatment remains.
MATERIAL-METHODS:We conducted a randomized trial to determine if ETV/CPC or VPS results in superior cognitive outcome in the treatment

of Ugandan infants (<180 days old) with PIH. The primary outcome was Bayley Scales of Infant Development (BSID-3) Cognitive scaled score at 12 months after surgery, measured by blinded evaluators. Brain volume from CT scan was assessed by evaluators blinded to patient outcome. All analyses were by intention-to-treat.
RESULTS:Fifty-one eligible infants were randomized to ETV/CPC and 49 to VPS. There was no significant difference in 12 month BSID-3 Cognitive score (p=0.35, estimated difference 0 [0, 2]) or in any other BSID-3 score. There were no significant differences in treatment failure (p=0.24, log–rank, hazard ratio 1.4 [0.7, 3.0]) or achieving normal brain volume (21.3% ETV/CPC, 27.7% VPS, p=0.63). Brain volume, but not ventricular volume, at 12 months correlated with all BSID-3 scores.
CONCLUSIONS:Cognitive and other outcomes were similar between ETV/CPC and VPS, without evidence of superiority for either treatment. These findings indicate that ETV/CPC is an acceptable option for the treatment of infant PIH in sub-Saharan Africa. Where appropriate expertise exists, ETV/CPC could be considered a preferred option, given its advantages in resource-poor settings.

PF-031

Hydrocephalus

CSF-shunting and ETV in 400 pediatric patients. Shifts in understanding, diagnostics, case-mix, surgical management during half a century

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OBJECTIVE:To characterize shifts from the 1960s to the first decade in the 21st century as to diagnostics, case-mix, and surgical management of pediatric patients undergoing permanent CSF diversion procedures.
MATERIAL-METHODS:134 patients below 15 years of age were first time treated with CSF shunt or ETV for hydrocephalus or idiopathic intracranial hypertension (IIH) in 2009-2013. this represents our current practice. Our previously reported cohorts of shunted children 1967-1970 (n=128) and 1985-1988 (n=138) served as background for comparison.
RESULTS:In the 1960s; ventriculoatrial shunt was the preferred procedure (94 %), neural tube defect was the leading etiology (33 %), and overall 2-year survival rate was 76 % (non-tumor survival 84 %).
In the 1980s; ventriculoperitoneal shunt (VPS) had become standard (91 %), the proportion of NTD children declined to 17 %, and the 2-year survival rate was 91 % (non-tumor survival 95 %).
In the years 2009–2013; 73 % underwent VPS, and 23 % ETV as their initial surgical procedure. The most prevalent etiology was CNS tumor (31 %). The proportion of NTD patients was yet again halved to 8 %. The 2 years of survival was 92 % (non-tumor survival 99 %).
CONCLUSIONS:The case-mix in pediatric patients treated with permanent CSF diversion has changed over the last half-century. With the higher proportion of children with CNS tumor and inclusion of the IIH children, the median age at initial surgery has shifted substantially from 3.2 to 14 months. Between the 1960s and the current cohort, 2 years of all-cause mortality fell from 24 to 8 %. 18 patients experienced shunt failure more than 15 years after last revision, and first-time shunt failure has been observed 29 years after initial treatment. This underscores the importance of lifelong follow-up.

PF-032

Hydrocephalus

Endoscopic management of paediatric complex hydrocephalus

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[2]Pediatric Neurosurgery, Institute of Neurosurgery, Catholic University Medical School, Rome, Italy

OBJECTIVE:To define the role of neuroendoscopy as an adjuvant technique for the management of peadiatric complex hydrocephalus
MATERIAL-METHODS:The authors performed a retrospective analysis of a series of peadiatric patients operated on for complex hydrocephalus between January 2003 and October 2016 at the Catholic University Medical School, Rome, Italy. Surgical procedures included:cysts marsupialization, septostomy, aqueductoplasty, and Monro foraminoplasty. Clinical and radiological follow up included AF ultrasounds in the immediate postoperative period in amenable cases and MR performed in the first week after surgery as well as at 6 months and one year in all the patients. After the first year MR controls were planned yearly if clinical conditions remained stable.
RESULTS:59 procedures were performed in 37 patients (23 M, 14F, mean age:9,72 years). Twenty-eight children had a multiloculated hydrocephalus, 4 were operated on for an entrapped 4th ventricle, 4 for an isolated temporal horn and one for an entrapped occipital horn. Neuronavigation was used as an adjuvant tool in 10 selected cases. At a mean follow-up of 3.5 years, 15 children required additional endoscopic procedures, all of them affected by multiloculated hydrocephalus. The shunt infection rate was 13.5% (4/37 cases), whereas shunt revision was needed for mechanical shunt malfunction only in one case. At the latest clinical control seventy-three percent of the children have only one shunt, 8/37 patients (21.6%) have a double ventricular catheter and 2 children (5.4%) are shunt free.
CONCLUSIONS:We confirm that neuroendoscopy has a main role in the long term management of complex hydrocephalus significantly contributing to the reduction of the number of shunts and of the shunt revision rate. Neuronavigation should be performed in all cases in which the ideal trajectory needs to be established resulting particularly helpful in infants with multiloculated ventricular spaces.

Tuesday, 10 October 2017
08:40 – 10:00

Platform Presentations: Dysraphism

PF-034

Dysraphism

Practice Preferences for Neurosurgical Management in Spina Bifida: a survey of the American Society for Pediatric Neurosurgery

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OBJECTIVE:To better understand and quantify differences in Neurosurgical practice preferences related to management of patients with open myelomeningocele (MMC)
MATERIAL-METHODS:A broad based survey was developed by a neurosurgical working group that widely surveyed practice preferences for a variety of Neurosurgical problems encountered across the lifespan in patients with SB. We utilized Survey Monkey to distribute the survey to 232 members of the American Society of Pediatric Neurosurgery (ASPN) via Survey Monkey. There were 32 ASPN members who were not available by e mail or had retired from clinical practice. Of the remaining 200 members there were responses from 80 members (40% response rate). All results are self reported and non-validated.
RESULTS:Eighty percent of ASPN surveyed Neurosurgeons obtain routine brain imaging on patients with SB. Symptoms of shunt failure without radiographic change prompt revision in about 1-25% of cases. This cohort was more willing to perform shunt revision for symptoms alone compared with images alone. For an intact shunt with increased ventricles and no symptoms 60% of respondents would observe while 25% would revise. An asymptomatic broken shunt without ventricular enlargement produced evenly divided responses between observation, intervention and further investigation. Operative shunt exploration is always performed before Chiari II decompression (C2MD) in 56% and performed sometimes in 40%.
CONCLUSIONS:This cohort of academic pediatric neurosurgeons emphasized symptoms above imaging changes in making shunt revision decisions. The role for shunt exploration before C2MD is widely but not universally embraced. Criteria that cross thresholds to trigger C2MD and tethered spinal cord release (TSCR) will be reviewed

PF-034a

Dysraphism

Spina Bifida Association of America (SBA) mediated guideline development for Neurosurgical management of pediatric patients with myelomeningocele-

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OBJECTIVE:The development of clinical guidelines can advance and establish benchmarks of care. The Spina Bifida Association of America (SBA) serves to help patients in providing information, advocacy and to promote and optimize care for individuals and families who are affected with Spina Bifida. A recent objective has been to develop a series of evidence based guidelines for the care of patients with Spina Bifida.
MATERIAL-METHODS:A Neurosurgery working group was convened and reviewed papers related to clinical management of MMC in children. After multiple versions of a draft of clinical practice parameters were circulated the group met as part of a multi-disciplinary group at the World Congress of Spina Bifida Research and Care in Coronado, California to discuss, revise and finalize the Guidelines. The completed Guidelines reflect a range of evidence that ranges from Class I to expert consensus opinion.
RESULTS:Women of childbearing years should be encouraged to take 400 micrograms of dietary folate. Neurosurgeons have a potential contributory role in pre-natal consultations. Intrauterine closure should be discussed and referrals made for prospective candidate families. Protection of the newborn placode is accomplished by positioning, local cares and timely closure. Early intervention for hydrocephalus is triggered by brain stem signs such as stridor, leakage from the back/closure site and accelerated head growth with ventriculomegaly. Hydrocephalus management may be accomplished by multiple methods but remains central to good outcomes. Surgical decompression of the Chiari II malformation remains controversial and should be considered after shunt function is assured. Operative untethering of the tethered spinal cord (TSC) may result in protection from neurologic decline in the symptomatic patient.
CONCLUSIONS:Disparities in practice preferences exist and there is a paucity of well designed prospective trials to properly inform practice guidelines with high quality evidence. Current consensus guidelines will be shared with the ISPN audience for discussion and review.

PF-035

Dysraphism

Long term cognitive outcome of infants with myelomeningocele and hydrocephalus primarily treated with an ETV

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OBJECTIVE:To compare the long term cognitive outcome of infants with myelomeningocele and hydrocephalus, who underwent endoscopic third ventriculostomy (ETV), with a comparable group of infants who underwent ventriculo-peritoneal shunt placement (VPS) for the management of their hydrocephalus
MATERIAL-METHODS:Infants treated for hydrocephalus related to an open spina bifida operated on between January 2002 and December 2007 at the Pediatric Neurosurgery Unit of the Catholic University Medical School, Rome, were selected. Global QI and selective verbal and performance QI were evaluated. Specific domains that were investigated included language, attentio, visuo-spatial abilities, praxia and problem solving. Two evaluation times were reviewed for comparison purposes, the first at 1 year of age (T0) and the second at the latest follow-up (T1) (mean follo-up 9.2 years)
RESULTS:109 infants were included, 49 of them treated with an ETV (Group I) and 60 treated with a VP shunt (Group II) (M/F=1.3/1; mean age at the time of treatment 1.5 months). Group I infants showed a better global cognitive profile both at T0 and T1. This difference remained stable at the latest follow-up, without a significant worsening in both groups. When selective functions were considered, attention, visuo-spatial and visuo-constructive abilities were the ones which were more compromised without significant

differences at T0 among the two groups. At T1, infants with a VPS showed a tendency to a worsening of visuo-spatial functions, whereas infants who underwent ETV showed an improvement for the same.
CONCLUSIONS:Infants treated with an ETV have a tendency to a better global cognitive profile at both T0 and T1. They do not show differences in selective functions compared with those treated with a VPS at T0, whereas, differently from infants with a VPS, they seem to have a tendency to improve in visuo-spatial functions at the long term follow-up.

PF-036

Dysraphism

Untethering of Spinal Cord Prior to Spinal Deformity Correction Procedures in Pediatric Patients with Myelomeningocele

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OBJECTIVE:Patients with myelomeningocele (MMC) are born with low lying spinal cord but only up to 32% develop tethered cord syndrome after the initial neurosurgical repair. Post MMC repair tethered cord release (TCR) is performed in these patients to improve neurological and urological symptoms when they occur. Additionally, TCR is common in this patient population prior to spinal deformity surgery. However, no standard recommendations were established for performing TCR prior to deformity correction. The neurological outcomes has not been reported in a large patient sample. We aim to assess the need for TCR in MMC patients who undergo spinal deformity correction surgery.
MATERIAL-METHODS:We retrospectively reviewed MMC patients treated at Arkansas Children's Hospital between 2006 and 2017 who underwent surgery for spinal deformity and have documented follow-up for at least one year postoperatively. Demographics, preoperative diagnosis, surgical indications, neurological findings, operative course, and outcomes were collected. Correlations between TCR and outcomes were analyzed.
RESULTS:Forty patients (16 male and 23 female) were identified. Thoracic and lumbar level MMC accounted for 89.74% (35/39) of patients. Average age at spinal deformity surgery was 10.66 years, and 7.81 years at TCR. Two patients underwent two spinal deformity surgeries where TCR was performed prior to the second surgery and not the first. In twenty surgeries, TCR was performed before spinal deformity surgery, and in three surgeries TCR was performed after spinal deformity surgery. Overall, 69.23% (27/39) patients had complications, 14.81% (4/27) being shunt related. TCR before spinal corrective surgery was not significantly correlated to outcomes in our analyzed data, or to occurrence of postoperative complications.
CONCLUSIONS:TCR prior to spinal deformity surgery was not significantly correlated to improved outcomes in MMC patients in our study. Therefore, it may not be indicated in all patients prior to their spinal deformity corrective surgery in the absence of related symptoms.

PF-037

Dysraphism

How much do plastic surgeons add to the closure of myelomeningoceles?

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OBJECTIVE:Myelomeningocele closure is a standard pediatric neurosurgical procedure and is performed in most neurosurgical departments. It is generally performed by pediatric neurosurgeons with occasional support from plastic surgeons for larger lesions (historically up to 25%).
Over the last 8 years in our department all these procedures have been performed jointly with our pediatric plastic surgical colleagues. We reviewed all our cases over this period to see if there was any benefit in the plastic surgeon being present at all cases.
MATERIAL-METHODS:Analysis of a prospectively kept database of all our myelomeningocele closures since the inception of joint operating in our institution, January 2009-March 2017.
RESULTS:Thirty children, 12 males and 18 females. 1 thoracic, 4 thoraco-lumbar, 5 lumbar, 18 lumbo-sacral and 2 sacral myelomeningoceles. One patient had bilateral V-Y incisions with latissimus dorsi flaps, 1 patient had bilateral rhomboid rotation skin flaps and 5 patients had a unilateral rhomboid flap. Four patients had a complication, 2 CSF leaks (responding to ventriculo-peritoneal shunting), 1 wound infection and 1 flap tip necrosis (healed with dressings alone). Two patients died from unrelated conditions.
CONCLUSIONS:In our series 7/30 (23%) cases involved a more complex closure in keeping with the literature. The authors feel that having the plastic surgeon at all closures has led to a very low wound complication rate in our cohort.

PF-038

Dysraphism

Stridor presenting at birth in neonates with myelomeningocele: Results of an international multicenter study

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OBJECTIVE:Stridor, associated with vocal cord paralysis (VCP), in neonates with Myelomeningocele (MMC) typically appears after birth. Control of hydrocephalus and Chiari Malformation (CM) decompression usually improves symptoms. Rarely, stridor presents at birth and prior cases suggest that the prognosis for these patients is poor. The purpose of this study was to review patients with MMC and stridor at birth from multiple centers and to analyze their outcomes. We hypothesized that stridor at birth predicts a dismal outcome and does not respond to CM decompression.
MATERIAL-METHODS:We conducted an international survey in February 2011 under the auspices of the Education Committee of the ISPN. Via a web survey tool, ISPN members were asked to identify their MMC patients with stridor at birth and those who developed stridor later in infancy. The members who further agreed to participate provided de-identified data detailing demographics, clinical findings, management and outcomes.
RESULTS:Eleven centers provided retrospective data for ten years ending in February 2014. The incidence of stridor at birth was 2% in the study group. 82% (14/17) of patients with stridor at birth underwent CM decompression. VCP was present in 82% of these patients versus 53% in patients presenting with stridor later in life. 47% (8/17) of patients with stridor at birth died compared to 13.6% of patients who developed stridor later. 70% of the former were younger than 3 months at the time of death. The cause of death was respiratory failure mainly. 6 of the remaining patients with stridor at birth had tracheostomy and were on ventilator.
CONCLUSIONS:Our multicenter study revealed that stridor at birth in neonates with MMC is rare and has a poor prognosis despite maximum treatment. A non-operative palliative management may be a reasonable option to offer in this population. This study provides guidance for the treating physicians.

PF-039

Dysraphism

Intradural spine surgery does not carry an increased risk of shunt revision compared to extradural spine surgery in pediatric myelomeningocele patients

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[4]Division of Orthopedic Surgery, Department of Surgery, Children's Hospital of Alabama, Birmingham, AL

OBJECTIVE:Pediatric patients with myelomeningocele frequently have comorbid scoliosis and tethered cord syndrome, often requiring surgical intervention. Intra-dural surgeries may carry a higher risk of shunt malfunction due to entry into the subarachnoid space. It has been anecdotally observed that need for shunt revision followed spinal intra-dural surgery at a high rate. In this study, we sought to compare rates of shunt malfunction after intra-dural and extra-dural spine surgeries.
MATERIAL-METHODS:We reviewed records of the National Spina Bifida Program Registry for Children's of Alabama to identify patients that had undergone a shunt revision, tethered cord release (TCR), and/or spinal fusion for deformity. The registry records were reviewed for all identified patients to determine if a shunt revision was performed within the first year after TCR or spinal fusion.
RESULTS:Analyses included 39 patients who underwent spinal fusion and 93 patients who underwent TCR. In the spinal fusion group, rates of shunt revision at 30, 60, 90 days and 1 year were 5.1%, 5.1%, 10.3%, and 12.8%, respectively. In the TCR groups, rates of shunt revision at 30, 60, 90 days and 1 year were 7.5%, 10.8%, 11.8%, and 18.3%, respectively. There was no statistically significant difference between groups at any time point ($p>0.2$). Kaplan-Meier curves were constructed showing freedom from shunt revision (Figure), and using the log-rank test, there was no significant difference between Kaplan-Meier curves ($p=0.28$).
We performed additional post-hoc analyses to compare these spinal surgery groups with two additional groups: abdominal surgery, and tonsillectomy/adenoidectomy. At 30 days, 60 days, 90 days and 1 year, there was no significant difference between groups using a Chi-square test ($p>0.2$).
CONCLUSIONS:In a review of single-institution registry data, we found no difference in the risk of shunt malfunction after intra-dural and extra-dural spinal surgeries.

PF-040

Dysraphism

Are all lipomas equal? A study of 'dorsal type' lipomas.

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OBJECTIVE:*Treatment of lipomas of the conus region remains controversial. Natural history studies indicate at least a proportion has a more indolent clinical course than previously considered. Currently, no clear clinical or radiological factors allow risk stratification for deterioration. According to a recent Ph.D. thesis, complex lipomas with only dorsal attachment to the terminal spinal cord or conus have improved long-term motor and continence outcomes, independent of surgery.*
We therefore reviewed our dorsal lipomas to see if these have a low risk for late deterioration and should be managed non-operatively.
MATERIAL-METHODS:*All dorsal lipomas were identified from a departmental database. Initial MRI's were reviewed; criteria for dorsal type were; a) lipoma attachment on dorsal aspect of spinal cord or conus, b)*

tip of conus readily identifiable c) preserved subarachnoid space inferior and ventral to conus. Children older than 3 years at last follow-up were included. Medical and urological reports were reviewed for motor and continence status. Details of operative interventions were recorded. Patients with associated malformations that might influence outcome were excluded.
RESULTS:*26 children met the criteria with median age at last follow-up of 9,10 years (4,68;12,70). 9/26 had undergone untethering (2 prophylactic vs 7 symptomatic). All were independently mobile at last follow-up. In those without surgical intervention (n=17) none had motor deficits. 17/17 had achieved urinary continence confirmed clinically and by bladder function assessment. Of those who had untethering surgery (n=9) one had motor deficits, 8/9 were continent.*
CONCLUSIONS:*Lipomas of the conus region are heterogeneous. Those with dorsal type morphology, where the conus can be radiologically identified, have good neurological and urological prognosis. Close surveillance is required during childhood. Unthetering should be reserved for those showing new or progressive deficits, delayed intervention does not compromise long-term outcome. Dorsal lipomas may have less intrinsic neural dysplasia than transitional and chaotic type lipomas.*

PF-041

Dysraphism

Surgical treatment of tethered cord secondary to filum and conus lipomas in children and adults: Is there an argument to support prophylactic surgery?

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OBJECTIVE:Conus (CLs) and filum lipomas (FLs) account for tethered cord syndrome (TCS) in both children and adults. Yet the management of asymptomatic patients and the role of prophylactic surgery is different in these two populations. We reviewed our experience in the surgical treatment of CLs and FLs in adults and children to better elucidate the role of surgery in asymptomatic patients. Only patients operated on with the support of intraoperative neurophysiological monitoring (IONM) were included in this study.
MATERIAL-METHODS:We reviewed clinical charts, neuroimaging data, surgical reports and follow-up of 51 patients (28 in the pediatric group (PG), 23 in the adult group (AG)) operated on for either FLs or CLs, since 2000. The neurological status was assessed through the Necker Functional Score (NFS), ranging from 4(worse) to 18(best), and a score >15 being indicative of a normal life.
RESULTS:Pre-operatively mean NFS was 16.6 in the PG, where 50% of patients arrived asymptomatic at surgery, and 13.3 in the AG where all patients arrived symptomatic at surgery. Mean follow-up was 84 months. In none of the patients with FLs (4 in each group) the NFS worsened post-operatively. Among patients with CLs, in the PG the NFS improved in 38.1%, remained stable in 38.1% and in 23.8% worsened some years after surgery; in the AG, the NFS improved in 43.8%, remained stable in 50% and worsened in 6.2%. At the follow-up, the overall NFS was 17 in the PG and 14.1 in the AG (p=0,0001). There was no permanent surgical morbidity.
CONCLUSIONS:While more children than adults presented a later neurological deterioration, they maintained a higher NFS. This suggests that early, IONM assisted, "prophylactic" surgery cannot prevent later deterioration in some children, but still warrants a better functional outcome when compared to the adult population where all patients were symptomatic before surgery.

PF-042

Dysraphism

Management alternatives for massive occipital encephalocele, A study of 5 patients

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OBJECTIVE:The objective of this study is to show different Management alternatives for massive occipital encephaloceles, as observed in 5 cases treated at the Institute of Neurosurgery "Asenjo" in Santiago, Chile.
MATERIAL-METHODS:Five patients with massive occipital encephaloceles were treated between 2012 and 2017. All of them were operated at diferent ages and with diferent techniques. We reviewed the clinical data and images of these 5 cases, recording the different therapeutic strategies in each one, and the results obtained until April 2017.
RESULTS:Just one patient was operated in the newborn period, he was born with an open defect, dying within a few days after the intervention. In three cases, spring - assisted cranial vault expansion and occipital osteotomy was performed before the reparation of the defect. In these three cases, on a second stage, the herniated neural tissue was partially resected. The vault defect was repaired on the same surgery just in one of these cases. These three patients were operated for the first time after the age of three months. In a single case, the aproach was the primary repair, removing all the content of the encephalocele, at the age of 4 months. In this case the defect contained no brain tissue. Three patients underwent the installation of VP shunts.
CONCLUSIONS:Massive Occipital Encephalocele is a rare condition, its surgical management is a challenge for neurosurgeons, especially when there is apparently normal herniated tissue or vascular structures inside the encephalocele. There are different alternatives for surgical management, we propose diferent strategies depending on the characteristics of the herniation, the age of the patient and the presence of associated conditions such as microcephaly or hydrocephalus. We succesfully performed spring asisted cranial vault expansion prior to the defect repair and partial resection of herniated tissue in children who survive the first trimester of life.

Tuesday, 10 October 2017
11:45 – 12:25

Platform Presentations: Special Session On Global Surgery

PF-043

Global Children's Surgery

Global Neurosurgery for Children; results of an internationally circulated questionnaire to assess resources and the will to collaborate

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OBJECTIVE:The magnitude of neurosurgical disease globally is unknown. We sought to estimate the surgical and consultative proportion of diseases commonly encountered by neurosurgeons, as well as surgeon case volume and perceived workload.
MATERIAL-METHODS:An electronic survey was sent to 193 neurosurgeons previously identified via a global surgeon mapping initiative. Surgeons were asked to estimate the proportion of 11 neurological disorders that, in an ideal world, would require either neurosurgical operation or neurosurgical consultation. Respondent surgeons indicated their confidence level in each estimate. Demographic and surgical practice characteristics – including case volume and perceived workload – were also captured.
RESULTS:Eighty-five (85) neurosurgeons from 57 countries representing all WHO regions and World Bank income levels completed responses. Neurological conditions estimated to warrant neurosurgical consultation with the highest frequency were brain tumors (96%), spinal tumors (95%), hydrocephalus (94%), and neural tube defects (92%), while stroke (54%), central nervous system infections (58%), and epilepsy (40%) carried the lowest frequency. Similarly, surgery was deemed necessary for an average of 88% of cases of hydrocephalus, 82% of spinal tumors and neural tube defects, and 78% of brain tumors. Degenerative spine disease (44%), stroke (31%), and epilepsy (24%) were found to require surgical intervention less frequently. Confidence levels were consistently high (lower quartile > 70/100 for 90% of questions) among respondents, and estimates did not vary significantly across WHO regions or among income levels. Surgeons reported performing a mean of 245 (median 190) cases annually. On a 100-point scale indicating a surgeon's perceived workload (0-not busy, 100-overworked), respondents selected a mean workload of 75 (median 79).
CONCLUSIONS:With a high level of confidence and strong concordance, neurosurgeons estimated the surgical burden of common neurological disorders, facilitating measurement of the expected annual volume of neurosurgical disease globally.

PF-044

Global Children's Surgery

Challenges in the management of paediatric brain tumors in resource-limited settings: the case of craniopharyngioma in Malawi

Patrick Dongosolo Kamalo
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OBJECTIVE:Craniopharyngiomas are histologically benign tumors but depict a malignant behavior due to their tendency to invade vital surrounding structures. Radical resection is associated with considerable recurrence rates and significant endocrine morbidity. Surgical goals are to decompress the base of skull and the ventricles, whilst minimizing risk of recurrence and endocrine disturbances. In Malawi we have limited capacity in the spectrum of management for craniopharyngiomas. The objective of this study was to find out the challenges we meet in managing these patients at Queen Elizabeth Central Hospital, a major referral hospital in Malawi.
MATERIAL-METHODS:Retrospective analysis of consecutive patients presenting to the neurosurgical unit at Queen Elizabeth Central Hospital, in Malawi, over a period of 5 years was done. Data sources were theatre book records, ward admission records, imaging registry, and case notes.
RESULTS:We identified 20 patients and the median age was 9 years old (range 3-38 years). Most patients had tumor of mixed solid and cystic components; and the cysts were complex in 65%. Hydrocephalus was very common (90%). Our main mode of treatment was ventricular decompression through endoscopic fenestration of cysts causing ventricular obstruction (12/20 patients). Follow up results showed that despite control of cyst size and hydrocephalus after initial endoscopic fenestration, accompanied by symptomatic relief in the majority of cases, solid component of tumors continued to grow, with re-accumulation of cyst fluid over time. Thus improvement was transient and patients eventually required insertion of ventriculo-peritoneal shunt and repeat cyst fenestrations for definitive control of hydrocephalus.
CONCLUSIONS:Craniopharyngioma is relatively common in Malawi. Current management remains conservative with endoscopic control of cyst mass effect and ventriculoperitoneal shunting of resultant hydrocephalus. Capacity for comprehensive surgical and medical management of the disease is necessary in order to improve the quality of care of these patients.

PF-045

Global Children's Surgery

Overview of pediatric neurosurgery in Nepal

Maya Bhattachan[1,2,3], Gopal Raman Sharma[1,2], Pawan Kumar Sultaniya[1], Krishna Sharma[1,2], Gopal Sedhain[3], Sumit Joshi[1,2], Rajkumar K.c[1,2]
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[3]Department of Neurosurgery, Green City Hospital, Kathmandu, Nepal

OBJECTIVE:To analyze the various pediatric neurosurgical cases admitted in three hospitals in Kathmandu and the difficulties encountered in their management and follow up.
MATERIAL-METHODS:A retrospective study of pediatric patients who underwent neurosurgical intervention in three different hospitals in Kathmandu, Nepal from January 2014 to December 2016 were studied.

Age, sex and frequency of various neurosurgical diseases, their surgical management and outcomes were analyzed.
RESULTS:There were a total of 435 pediatric neurosurgical cases admitted of whom 107 underwent surgical intervention. 70% were male. Age varied from 45 days to 16 years, most of them were in the age group of 3 and 8 years. 68% of the patients were from Kathmandu and the rest of the patients were from different cities and remote areas. Among the surgical cases 57% was traumatic brain injury, 14% tumor, 10% hydrocephalus, 6.5% spinal dysraphism and 3% vascular malformations. Follow up of the patients were done from 1 week to 3 months. 47% of the patients were lost to follow up at 3 months. The outcome of surgical procedures were favorable in 53% and the surgical mortality rate was 23%.
CONCLUSIONS:The majority of the pediatric neurosurgical cases was of traumatic brain injury due to fall because of inadequate child safety in urban dwellings. The cases of pediatric brain tumors and spinal dysraphism present late resulting in poor outcome. Poor compliance for follow up was due to geographical and financial issues in most of the cases.

PF-046

Global Children's Surgery

After training as a Paediatric Neurosurgeon what next: My challenge after an oversea training

Gyang Markus Bot
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OBJECTIVE:To highlight the challenges of Paediatric Neurosurgeons in developing countries after returning from an oversea training using my experience.
MATERIAL-METHODS:A one year review of challenges affecting a neurosurgical practice after an oversea training
RESULTS:Developing countries have weak systems that need to be strengthened. Incessant industrial action and disharmony is a major factor militating against the progress of neurosurgery. There are poor infrastructures and equipment to advance this specialty in developing countries. There is also a paucity of trained support staff especially critical care physicians and protocols to assist them. Paediatric neurosurgeons in developing countries need continuous collaboration with advance centers and they need to be involved in high-level research and mentoring which is likely to strengthen the quality of care, facility and research. There is a need to encourage the provision of paediatric neurosurgery units that have a "one-stop shop" concept.
CONCLUSIONS:The International society of Paediatric neurosurgeons can serve as an interface to help put some pressure on the government and the hospital administration of centres that have trained Paediatric neurosurgeons. ISPN can also help encourage the development of Paediatric sub-speciality units, as well as enhance the transfer of equipment, skills, mentoring, collaborative research and training in grant applications.
ISPN should also recognize and incentivize the progress of hospitals in developing countries that has made an attempt to improve its Paediatric neurosurgical service, case volume and standards.

Wednesday, 11 October 2017
09:20 – 10:30

Platform Presentations: Neurotrauma PF-047

Special topic: Neurotrauma/Critical Care

Trauma Infant Neurological Score (TINS) is superior to Children's GCS in evaluating head injured infants younger than 24 months

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[2]Department of Pediatrics, Korall Children's medical center, Netanya, Israel

OBJECTIVE:Traumatic Head Injury continues to be a major risk factor for mortality and morbidity in the pediatric population. The early diagnosis and treatment is the key to best prognosis. Most diagnostic scores used for infants are problematic for CT guidance and prognostication. The objective of this paper is to propose Trauma Infant Neurological Score (TINS) as a sensitive and valid score both for prognostication and as guide when to perform CT in head injured infants.
MATERIAL-METHODS:Part a: retrospective study performed in 312 head-injured infants who had CT on admission, using children's coma score (CCS) and TINS for evaluation. Part b: a prospective study using TINS>2 as a guideline for CT, and as a prognostic tool, compared to (CCS). TINS (previously introduced by the senior Beni, 1999) includes "Trauma Mechanism", Intubation, Neurological exam (including alertness, pupils, motor) and Scalp (subgaleal hematoma). Minimal score is 1, and 10 the worst score.
RESULTS:In the retrospective study of 312 infants (mean age 12+7m), Loss of consciousness appeared in 19.6%, Vomiting 33.3%, 33 infants were Intubated on arrival (10.6%), 76.3% had abnormal CT scan. TINS > 2 was associated with a higher incidence of pathological CT. In the prospective study of 200 infants, TINS was applied, indicating CT scan for TINS>2. All infants with TINS 1-2 had good outcome, 15% of infants had abnormal CT. In 2 cases child abuse/neglect was diagnosed, in infants with skull fracture on CT, TINS score 2, and no focal neurological deficit. Previous emergency room visits have been verified.
CONCLUSIONS:Even though a larger cohort of infants should be studied prospectively, we propose that TINS is a sensitive and valid tool in head injured infants. We propose a multicenter prospective study using TINS for head injury in infants.

PF-048

Special topic: Neurotrauma/Critical Care

Examining cerebral metabolism using microdialysis in children with severe traumatic brain injury

Ursula Karin Rohlwink, Johannes Marthinus Enslin, Jacob Hoffman, Sinead Ross, Graham Fieggen, Anthony Figaji
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OBJECTIVE:Outcomes after severe traumatic brain injury (TBI) in children can be improved by reducing secondary injury but these mechanisms are poorly understood. Brain microdialysis is an advanced technique with clinical and research potential that is largely unexplored in children. In a pediatric TBI cohort we used microdialysis to examine brain metabolism in association with outcome and other indicators of brain physiology.
MATERIAL-METHODS:Cerebral metabolite data were analysed in children with severe TBI (GCS≤8) who had multimodality monitoring including microdialysis, brain tissue oxygen tension (PbtO2) and intracranial pressure (ICP). Brain extracellular fluid (ECF) samples were collected hourly from the microdialysis catheter for a maximum of 5 days

and were analysed at the bedside (Iscus Flex, MDialysis) for metabolites (lactate, pyruvate, lactate/pyruvate ratio [LPR], glucose, glycerol, glutamate). ICP, PbtO2 and cerebral perfusion pressure (CPP) data were collected continuously and averaged for comparison. Systemic glucose was recorded from arterial blood gases.
RESULTS:We analysed metabolite data in 22 patients (median age 7 [0.4-13] years). High brain LPR was associated with low PbtO2 (correlation r=-0.6, p<0.01, AUC 0.9 for PbtO2 <10mmHg) and high ICP (r=0.35, p<0.01). An elevated LPR (≥40) was associated with increased mortality (p<0.01) and poor clinical outcome (p=0.02). ECF glucose decreased at lower CPPs in keeping with a lower limit of autoregulation, but was only moderately correlated with systemic glucose (r=0.4, p<0.01). Glycerol increased with contusions and demonstrated dynamic trends consistent with cellular injury.
CONCLUSIONS:This is the first comprehensive set of microdialysis data for children. It is a promising real-time clinical tool to examine dynamic brain chemistry changes associated with secondary injury, and may help to better understand the complex pathophysiology of TBI, generate new questions, and direct treatment strategies.

PF-049

Special topic: Neurotrauma/Critical Care

Predicting Outcomes in Children with Traumatic Brain Injury: Utilizing An Artificial Neural Network

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OBJECTIVE:Modern surgical planning and prognostication requires the most accurate outcomes data to practice evidence-based medicine. For clinicians treating children following traumatic brain injury (TBI), these data are lacking. Artificial Neural Networks (ANNs) are machine-learning algorithms that have been shown to outperform conventional statistics in predictive ability, and have proven useful as clinical outcome prediction tools among various subspecialties, including neurosurgery. Our aim was to assess imaging features on CT in combination with clinical assessment in order to comprehensively predict post-TBI outcomes in children using an artificial neural network. Adoption of ANN models into a modern electronic medical record system represents an attractive way to incorporate evidence-based medicine into routine care.
MATERIAL-METHODS:We retrospectively reviewed clinical records of children under the age of 18 who suffered a TBI and presented to tertiary-care children's hospital between 2006-2013. Clinical and radiographic variables seen on head CT were collected. Using these data, we trained an ANN to delineate between "favorable" and "unfavorable" 6-month post-TBI outcome, where a "favorable outcome" is defined as a Glasgow Outcome Score ≥ 4. The artificial neural network was constructed using MATLAB.
RESULTS:565 patients were included in our final cohort. In our cohort, GCS, pupillary light reaction, glucose & hemoglobin at presentation, SDH, ICH, IVH, cistern integrity and midline shift were univariate predictors of unfavorable outcomes. Thus, we used these variables to construct an ANN that is able to predict unfavorable outcomes at 6-months post-TBI in children with superb accuracy (ROC AUC = 0.9462 ± 0.0422). To our knowledge, this is the first ANN that has been used to measure post-TBI outcomes in children.
CONCLUSIONS:Artificial Neural Networks are machine-learning algorithms that can be leveraged to more accurately and comprehensively predict clinical outcomes, including TBI outcomes in children.

PF-050

Special topic: Neurotrauma/Critical Care

Can artificial intelligence predict the necessity of CT scan for infants with minor head injury ?

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OBJECTIVE:For the management of minor head injury (mHI) in children, we previously published data regarding applicability of the PECARN rule for infants with mHI in Japan and proposed quantification methods type II as a new simple clinical decision rule. These methods could be satisfactory in clinical settings, however a more high-quality method has been expected. The purpose of this study was to assess the feasibility of artificial intelligence (AI) to predict the necessity of CT scan for infants with mHI.
MATERIAL-METHODS:From 2005 to 2014, 1091 infants (younger than 2 years) with mHI were enrolled in this retrospective study. Clinical data were analyzed using decision tree analysis (DTA) in AI to predict the necessity of CT scan for infants with mHI.
RESULTS:Machine learning with DTA was able to create a learning algorithm for AI to predict the necessity of CT scan for infants with mHI. Variables which were included in this DTA were scalp hematoma, alternation of consciousness, number of vomiting, Glasgow Coma Scale, age, gender, LOC duration, and not acting normally per parent. The machine learning with DTA had an accuracy of 96.1%, a negative precision value of 97.0%, a positive recall of 98.8%, and a negative F-measure of 98.1%. Those values showed this learning algorithm for AI could be used to predict the necessity of CT scan for infants with mHI.
CONCLUSIONS:The learning algorithm for AI created in this study would be better to identify infants who need CT scan after mHI. This study indicated AI would be able to predict the necessity of CT scan for infants with mHI.

PF-051

Special topic: Neurotrauma/Critical Care

Proteomics and inflammatory mediators in cerebral extracellular fluid from brain microdialysis in severe paediatric traumatic brain injury

Ursula Rohlwink, Sarah Ive, Omesan Nair, Sinead Ross, Nico Enslin, Graham Fieggen, Anthony Figaji
Division of Neurosurgery, Department of Surgery, University of Cape Town, South Africa

OBJECTIVE:Several mechanisms of secondary brain injury worsen outcome after traumatic brain injury (TBI) but these are poorly understood, particularly in children, for whom there are fewer studies. Protein analysis of the cerebral extracellular fluid (ECF) from microdialysis monitoring can provide insight into the pathophysiology underlying secondary injury, including the inflammatory response. We examined targeted inflammatory proteins and unbiased whole proteome analysis in brain ECF. This is the first known study to conduct unbiased proteomics in microdialysis ECF in paediatric TBI.
MATERIAL-METHODS:ECF was collected hourly for up to 5 days post-injury in children with severe TBI (GCS≤8) who had a cerebral microdialysis catheter inserted. ECF was pooled for protein testing. Inflammatory proteins (interleukin [IL]-6, 8, 10, 1α, 1β, 1-receptor agonist (Ra), monocyte chemoattractant protein [MCP-1] and vascular endothelial growth factor [VEGF]) were analysed using a multi-analyte array (Luminex). Unbiased proteomics was performed using mass spectrometry and liquid chromatography. Proteins were identified using MaxQuant and the Uniprot human protein database.
RESULTS:Inflammatory markers were analysed in 16 patients (median age 5.9 [2.8-13] years). Overall ECF pro-inflammatory cytokines like IL-6 and -8 peaked early and then declined, whereas anti-inflammatory cytokines like IL-1Ra peaked later. High concentrations of MCP-1 suggest a monocyte-driven immune response. Proteomic analysis in a subgroup of 14 patients identified 1187 protein groups; serum, cytoarchitectural, apolipoprotein, inflammatory and amyloid-associated proteins were most abundant. Neuronal tissue injury proteins like S100 and glial fibrillary acidic protein (GFAP) were also identified.
CONCLUSIONS:Microdialysis is a feasible tool in paediatric TBI to explore brain pathophysiology and generate new hypotheses. It allows direct interrogation of brain samples and time-resolved tracking over several days. Our results demonstrate the ability to explore brain inflammation after injury, activated protein pathways, and potential biomarkers of injury severity and outcome; it forms the foundation for future studies.

PF-052

Special topic: Neurotrauma/Critical Care

The true value of ICP monitoring in pediatric brain insults is not measuring ICP …but optimizing CPP

Konstantin Hockel[1], Felix Neunhoeffer[2], Jennifer Diedler[1], Ines Gerbig[2], Ellen Heimberg[2], Martin Ulrich Schuhmann[1]
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OBJECTIVE:Acute brain insults might produce a raise of ICP. As important as keeping ICP levels below thresholds (which?) is maintaining a CPP level, that maximizes chances for sufficient brain perfusion (CPPopt). CPPopt is completely unknown unless determined. An important recent advancement in neuro-intensive care was the recognition, that cerebrovascular autoregulation (AR), being a major mechanism regulating cerebral blood flow, can be determined from correlating ICP and blood-pressure (PRx: pressure-reactivity-index). PRx can be used to identify the individual CPPopt at a specific time. We report our experience with PRx and CPPopt in pediatric neurocritical care.
MATERIAL-METHODS:27 children with severe TBI (mean GCS 5) and 22 with other acute brain insults underwent computerized ICP and ABP monitoring with ICM+ software to determine CPP, PRx and CPPopt continuously. PRx and CPPopt were used to guide ICP and APB, aiming to keep patients at CPPopt. If ICP couldn't be controlled conservatively decompressive craniectomy but never barbiturates were used.
RESULTS:In all patients PRx could be determined and, provided AR was intact or recovering, CPPopt calculated. In early fatal cases AR was absent. In surviving TBI cases, when dichotomized to favorable/unfavorable outcome (50% each), no significant difference existed for overall ICP, CPP and PRx. However, time with impaired AR was significantly longer in unfavorable outcome patients (>60h vs. <10h, p=0.001). Continuously impaired AR of ≥ 24h was associated to unfavorable outcome. These principles were also true following ischemia, drowning or hemorrhage.
CONCLUSIONS:More important than just controlling ICP is using the ICP-signal to guide ABP management, thus AR and to bring and maintain patients at CPPopt. To follow these principles is likely to result in a pronounced positive impact on outcome in pediatric neurointensive care.

PF-054

Other

The comparison of transorbitally measured optic nerve sheath diameter (ONSD) and invasively measured intracranial pressure (ICP) in pediatric patients in neurosurgery

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OBJECTIVE:It is assumed, that the width of the optic nerve sheath diameter (ONSD) is dependent on intracranial pressure (ICP) and pulsatility and thus constitutes a non-invasive accessible „window“ for qualitative assessment of ICP. Data on the correlation to invasively measured ICP in children are scarce and then earliest series have been obtained from ventilated patients on the intensive care unit (ICU). We report on a mixed cohort of pediatric neurosurgical patients were ICP measurements were available both intubated and awake, only a minority from ICU patients
MATERIAL-METHODS:34 patients (median age 5 years) were investigated and 42 single ONSD/ICP measurements were analyzed. Diagnoses were hydrocephalus (n=11), tumor (n=3), craniosynostosis (n=7) and other intracranial pathologies (n=13). Ultrasound ONSD determination was performed immediately prior to invasive ICP measurement and the mean binocular ONSD was compared to ICP. ICP measurement was performed via intraparenchymal/ epidural ICP probe, extraventricular drainage or puncture of the shunt reservoir / lumbar CSF space in children awake or analgo-sedated.
RESULTS:6 patients were <1 year, 5/6 had an open anterior fontanelle. In the entire patient cohort the correlation between ONSD and ICP was good (r= 0.6, p< 0.01). In children < 1 year the ONSD value with the best accuracy for detecting ICP ≥10 and ≥ 20 mmHg was 4.6 and 4.8 mm compared to 5.2 and 5.6 mm in children ≥ 1 year (sensitivity 88.9 and 90%, specificity 83.3 and 61%, OR 16 and 11.7, AUC 0.901 and 0.817).
CONCLUSIONS:Transorbital ultrasound measurement of ONSD is a reliable technique to assess increased ICP in every clinical situation,

including the impact of age and fontanelle status. ONSD thresholds enable qualitative orientation regarding ICP categories with a very satisfying diagnostic accuracy. ONSD is an ideal non-invasive and quickly available screening tool to rule out or indicate elevated ICP in pediatric neurosurgery.

PF-054a

Other

First-line ultrasound assessment of optic nerve sheath diameter (ONSD) in clinical routine if raised intracranial pressure (ICP) is suspected: First experiences and threshold values

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OBJECTIVE:In pediatric neurosurgery many pathologies are associated with increased intracranial pressure (ICP). Thus a reliable technique to assess children non-invasively is needed. Transorbital ultrasound determination of the optic nerve sheath diameter (ONSD) is a promising method, since the width of the optic nerve sheath mirrors the intracranial compartment. We investigate how ONSD values correlate to relevant ICP increase and patient management in the daily routine in pediatric neurosurgery.
MATERIAL-METHODS:104 patients (median age 6 years) underwent transorbital ultrasound of the ONSD. Diagnoses included hydrocephalus (n=50), tumor (n=18), craniosynostosis (n=15) and other intracranial pathologies (n=21). Dependent on the diagnosis, the investigation was performed in awake or sedated children, pre- and post-operatively, or longitudinally over a period, respectively.
RESULTS:46 patients with convincing symptomatology of increased ICP underwent surgery to decrease ICP. All patients had increased ONSD values before surgery (mean 5.89 ± 0.82mm), which decreased after surgery (mean 5.14 ± 0.8 mm) ($p<0.001$). 25 patients with moderate clinical signs of raised ICP had normal ONSD values (mean 4.78 ± 0.38 mm). In those, also on the basis of ONSD values, a wait-and-see strategy was applied. None underwent a surgical intervention during follow-up. In 16 patients with mild symptoms of raised ICP, higher ONSD values were found (mean 5.4 ± 0.29 mm). In those further diagnostics were recommended.
The ONSD cut-off value with the highest diagnostic accuracy for a relevant increase of ICP was 5.3 mm, with a sensitivity of 83%, specificity of 94%, an odds ratio (OR) of 47.5 and an AUC of 0.901.
CONCLUSIONS:Transorbital ultrasound determination of ONSD is a reliable, non-invasive technique to quickly evaluate the presence of relevant ICP increase. ONSD thresholds enable a qualitative orientation regarding ICP categories with good diagnostic accuracy. ONSD is an ideal first-line screening tool in pediatric neurosurgery and should become routine in every unit.

Wednesday, 11 October 2017
11:50 – 12:14

Platform Presentations: Neuro-Oncology

PF-055

Special topic: Neuro-oncology

Cerebellar Mutism after Posterior Fossa Tumor Resection in Children: A Multi-center International Retrospective Study to Determine Possible Modifiable Factors

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OBJECTIVE:A preliminary survey of prior pediatric neurosurgery fellows trained in a single center but now working in different centers around the world suggested variable rates of cerebellar mutism syndrome (CMS) after posterior fossa (PF) tumor resection in children and indicated differences among centers in surgical management of these tumors. The objectives of this study were: (1) to determine the incidence of postoperative pediatric CMS in centers where prior fellows worked, and (2) to identify potentially modifiable factors related to surgical management rather than tumor biology that correlated with the incidence of CMS.
MATERIAL-METHODS:Retrospective review of children <18 years who underwent initial resection for a midline PF tumor within a recent two-year period at multiple centers in different countries. Charts and imaging were reviewed. Modifiable surgical factors assessed included hydrocephalus treatment pre-resection, ultrasonic aspirator use, external ventricular drain (EVD) use during resection, surgical approach, and complete or near total resection.
RESULTS:There were 191 patients from 8 centers in 4 countries (Canada, Germany, India, and the United States). Median age at surgery was 6 years (range <1–17 years). The overall incidence of CMS was 20.9% (range 17.9–26.9%). The range of rates between centers of pre-surgical hydrocephalus treatment were 15.4–64.9%, of ultrasonic aspirator use were 30.0–97.4%, of EVD use were 0.0–60.0%, of telovelar approach were 12.9–93.3%, and of complete or near total resection were 50.0–82.1%. A bivariate logistic regression showed no correlation between CMS and pre-resection hydrocephalus treatment, ultrasonic aspirator use, extent of resection, EVD use, telovelar surgical approach, or complete or near total resection (R-squared<5%).
CONCLUSIONS:There was extensive variation among centers in the management of midline posterior fossa tumors, but none of the potentially modifiable factors in surgical management that were examined correlated with the incidence of postoperative CMS.

PF-056

Special topic: Neuro-oncology

Awake craniotomy in children

Ibrahim Jalloh[1], Gaston Echaniz[2], Deya Abu Reesh[1], Samuel Strantzas[1], Abhaya V Kulkarni[1], Michael Taylor[1], Peter Dirks[1], James Drake[1], Tara Der[2], James T Rutka[1]
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OBJECTIVE:Awake craniotomy is the gold standard for safely resecting lesions where function, particularly language, is at risk. However questions remain regarding the feasibility and utility of awake craniotomy with cortical stimulation in children. We report our experience of awake craniotomy in a series of children undergoing tumor and epilepsy surgery.MATERIAL-METHODS:A retrospective review of children undergoing awake craniotomy between 2009 and 2016. We use the asleep-awake-asleep paradigm employing a combination of propofol, fentanyl/remifentanyl, pin-site local anesthesia and regional scalp blocks.
RESULTS:23 craniotomies were performed in 20 children (6F, 14M) aged 8 - 17 (median 14y) with an awake period ranging from 15 - 155 mins (median 60 mins). Pre-operative functional imaging (fMRI and/or MEG) was used to aid functional localization in 17/23 surgeries. 18 awake craniotomies were performed for tumors (including 5 low grade gliomas, 3 high grade gliomas, 3 gangliogliomas, 3 ependymomas) and 5 craniotomies were to resect seizure foci. In those patients undergoing tumor surgery 11/18 achieved GTR. 1 child became uncooperative leading to abandonment of speech mapping; all other children tolerated awake craniotomy. 5 children experienced transient post-operative deficits; there were no permanent deficits.
CONCLUSIONS:Awake craniotomy in select children as young as 8 can be carried out safely. It is a reliable method for functional localization and influences surgical decision-making facilitating GTR in tumor surgery. Pre-operative preparation that includes detailed discussion between the patient, family, surgeon, anesthetist and neuropsychologist is paramount.

PF-057

Special topic: Neuro-oncology

Overexpression of Cyclin D1 enhances DNA Repair in Pediatric Ependymomas

Muh Lii Liang[1], Tsung Han Hsieh[3], Yi Wei Chen[4], Yi Yen Lee[1], Feng Chi Chang[5], Shih Chieh Lin[6], Donald Ming Tak Ho[6], Tai Tong Wong[7], Yun Yen[3], Muh Hwa Yang[2]
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[6]Department of Pathology and Laboratory Medicine, Taipei Veterans General Hospital
[7]Department of Neurosurgery, Taipei Medical University Hospital, Taipei Medical University, Taipei, Taiwan

OBJECTIVE:The young age, resistance of residual tumor and repetitive recurrence are still major obstacles of treatment in pediatric ependymomas. The applications of post-operative adjuvant irradiation have many long-term intellectual sequelae for the young children, especially less than 3 years. The efficacy of high dose chemotherapy also has not yet proven. Recently, overexpression of cyclin D1 (CCND1) had been reported in ependymomas, especially located on supratentorium; however, the role of CCND1 and related mechanism had not yet been explored.
MATERIAL-METHODS:We retrospectively analyzed clinic-pathological factors in 82 cases of ependymoma, less than 20 years old. The predominance of CCND1 were fished out through computational analysis of gene expression microarray and validated by qRT-PCR and immunohistochemistry stains. The biological and radiation effect through knock-down CCND1 were confirmed in ependymomas cell model.
RESULTS:Thirty-one (37.8%) out of 82 ependymoma cases were under 3 years old age. The 10 years PFS and OS were 38% and 60 %. Gross total resection was the single significant prognostic factor for longer 10 years PFS and OS in multivariant analysis ($P<0.05$). For supratentorial locations, 13 (92%) out of 14 primary and all 7 (100%) recurrent ependymomas were up-regulated and 3 out of 5 paired samples have higher CCND1 expression in recurrent tumors. Furthermore, overexpression of cyclin D1 could be enhanced after radiation 6 and 8 Gy in ependymomas cells. Homologous combination activities of DNA repair were significantly suppressed after knock-down cyclin D1 (shCCND1) and expression levels of γH2AX were enhanced in shCCND1 after irradiation of ependymomas cells.
CONCLUSIONS:The possible radiation-resistance mechanism of DNA damage and enhanced repair through overexpression of CCND1 were demonstrated in pediatric ependymomas cell model. The results provide new therapeutic approach for the patients with tumor recurrence.

Wednesday, 11 October 2017
14:00 – 15:00

Platform Parallel Presentations: Hydrocephalus

PF-058

Hydrocephalus

Shunt dependent hydrocephalus after fenestration of arachnoid cysts in children

Anton Korshunov, Youry Kushel, Armen Melikian
Department of pediatric neurosurgery, N.N. Burdenko National Scientific and Practical Center for Neurosurgery (Moscow, Russia)

OBJECTIVE:Fenestration of suprasellar (SS) and sylvian fissure (SF) arachnoid cyst (AC) is straightforward and provide benefit of shunt independent life to the majority but not all affected children. We aimed to analyze whether shunt dependent hydrocephalus after fenestration of AC is associated with surgical technique (microsurgery vs endoscopy), cyst location (SSAC vs. SFAC) or patient age.
MATERIAL-METHODS:We retrospectively reviewed electronic records of our department to identify children (<18 y/o) who had their first

surgery for SSAC or SFAC from 1999 to 2016 by means of endoscopic or microsurgical fenestration. Postoperative course, follow up records and departmental medical image database were reviewed to identify patients who required CSF shunt insertion after initial cyst fenestration.
RESULTS:141 patients were identified including 72 with SSAC's (all had endoscopic fenestrations) and 69 with SFAC's (46 microsurgical and 23 endoscopic fenestrations). Follow up ranged from 1 to 184 months (mean 22,5). 20 patients (14,1%) required CSF shunt insertion including 18 VP shunts, 1 LP shunt and 1 subduro-peritoneal shunt. 1 patient (0,7%) had repeat fenestration of SSAC.
Shunt dependent hydrocephalus was strongly associated with age at surgery: mean age of patients who required shunts was 1,9 y/o vs. 5,9 y/o of those who remained shunt independent (p=0,002 – Student's t test). 30% of patients younger than 1 y/o become shunt dependent, compared with 26% of patients aged 1-2 y/o and 4% of patients >2 y/o at surgery. Surgical technique and cyst location did not correlate with shunt dependency.
CONCLUSIONS:Shunt dependent hydrocephalus after fenestration of AC's in children is strongly associated with age at surgery of less than 2y/o and is not related to surgical technique or cyst location. This need to be considered while discussing indications and timing of surgery for AC in children.

PF-059

Hydrocephalus

Computerized Shunt-Infusion-Study (SIS): A quick, radiation free, minimal invasive way for quantitated assessment of hydrocephalus shunt function

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OBJECTIVE:Hydrocephalus shunt malfunction can occur insidiously without obvious signs/symptoms of raised ICP and is then a diagnostic challenge. Indices can be mild/unspecific symptoms like headaches, a failure of ventricular size or head circumference to regress/stop growth after shunt implantation, or child development below expectations. Imaging-based shunt-tests like „shuntogramms" or radio-tracer studies are, if at all, qualitative and carry risks of radiation exposure. Computerized shunt-infusion-studies, however, enable a quantitated shunt function assessment without radiation exposure. We report on feasibility and results of this technique which is our routine procedure for shunt assessment.
MATERIAL-METHODS:Children with suspected shunt malfunction were investigated with SIS. For the purpose two butterfly needles are inserted into the pre-chamber, one for ICP recording, one for mock CSF infusion. After baseline ICP recording, infusion is started at 1.5 ml/min until a new ICP plateau is reached. Dedicated software (ICM+), knowing the shunt's resistance characteristics, calculates baseline and plateau ICP, ICP-amplitudes, outflow resistance and critical shunt pressure, thus generates objective/quantitated data on shunt function.
RESULTS:35 SIS on Codman programmable or Miethke proGAV shunts were performed in strictly sterile handling, either in awake or mildly sedated children (depending on age/behavior). In all patients quantitated results were obtained. No shunt infection occurred. 50% of investigated shunts had an elevated shunt resistance, 10% borderline function and 40% were fully functional. All obstructed shunts were revised. In all cases either ventricular size decreased, external CSF spaces enlarged, head circumference stopped growing or parents reported subtile clinical improvements.
CONCLUSIONS:SIS is an simple and elegant radiation free technique for quantitated shunt function-tests and answers reliably all questions regarding suspected shunt malfunction. Dedicated software knowing shunt hydrodynamic characteristics is necessary and small children will need short term sedation. SIS should become routine in pediatric neurosurgery units.

PF-060

Hydrocephalus

Endoscopic management of multiloculated hydrocephalus: Use of a novel ultrasound-based intra-operative guidance technique

Llewellyn Padayachy, Emmanuel Wegoye, Anthony Figaji, Graham Fieggen
University of Cape Town

OBJECTIVE:Multiloculated hydrocephalus remains a challenging problem for pediatric neurosurgeons. Endoscopic membrane fenestration has reduced the shunt revision rate, but adequate communication of the loculated compartments remains difficult to confirm intra-operatively. Ventriculography techniques are quite invasive and restricted to pre-and post-operative imaging. We present our experience treating this condition using a novel ultrasound-based intraventricular microbubble injection technique for assessing the ventricular anatomy and adequacy of membrane fenestration.
MATERIAL-METHODS:Endoscopic procedures performed in 21 patients with multiloculated hydrocephalus were prospectively studied. In all patients neuronavigation was used to plan the trajectory preoperatively and intra-operative ultrasound guidance was then used to assess its adequacy. The appropriate ventricular compartment was cannulated, CSF released, 5 mL of aerated saline 'microbubble' was then injected into the ventricle, prior to endoscopic membrane fenestration to delineate the distorted, compartmentalized ventricular anatomy. During the procedure, the microbubble injection was repeated and imaged with IOUS to confirm adequate communication of the compartments.
RESULTS:21 patients including 14 males and 7 females with a mean age 10.4 months underwent 24 endoscopic fenestrations. The etiology of the hydrocephalus was post infectious in 17 cases (82%). In 14 patients the post-fenestration IOUS imaging demonstrated adequate communication of the ventricular system and a single ventricular catheter, with additional holes, was inserted. In 7 patients, isolated or inadequately communicated compartments were demonstrated, the fenestrations were revisited during the same procedure and either enlarged or new fenestrations were made. The mean number of loculated compartments preoperatively was 4.6 (SD 1.8). 19 out the 21 patients received a single ventricular catheter for treatment of their hydrocephalus, with a mean of 1.09 (SD 0.3) ventricular catheters per patient.
CONCLUSIONS:Microbubble assisted endoscopic fenestration in multiloculated hydrocephalus is a useful and cost-effective technique. It currently provides the only real-time intra-operative imaging detail required for assessing the adequacy of these endoscopic procedure.

PF-061

Hydrocephalus

Neuroendoscopic Lavage for the Treatment of Postinfectious Hydrocephalus

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OBJECTIVE:The treatment of postinfectious hydrocephalus in children remains to be a challenge. Conventional treatment such as external ventricular drain (EVD) and antibiotic therapy are effective treatment options. A problematic issue often is the cerebrospinal fluid (CSF) protein load and intraventricular debris which might persist after infection and may cause shunt malfunction. In this study we restrospectively investigated neuroendoscopic lavage for clearance of CSF in children with postinfectious hydrocephalus.
MATERIAL-METHODS:We retrospectively analyzed 52 consecutive patients treated for postinfectious hydrocephalus at our institution. 29 patients (control group, CG) were treated conventionally between November 2004 and March 2010. 23 patients (neuroendoscopic group, NEG) underwent neuroendoscopic lavage for removal of intraventricular debris between April 2010 and October 2015. In these cohorts complications, shunt dependancy and shuntrevision rate were evaluated retrospectively.
RESULTS:The patient groups did not differ regarding sex distribution or age at surgery. In NEG patients lavage was performed at mean of 1.6+/-1times (1-4). No relevant complications were observed in NEG patients after lavage. Shunt rate in NEG patients was 91% as compared 100% in CG patients ($p = 0.109$). In NEG patients VP shunt implantation was performed later (CG: 22.1±21days vs. NEG: 46±46days, $p = 0.034$). Within 24 months after shunt implantation shunt revision rate was 1.87 ±1.8 in CG and 0.48±0.9 in NEG ($p<0.001$). Reinfection was seen in 32 cases in 18 patients on in CG compared to 1 in 1 patient in NEG ($p<0.001$).
CONCLUSIONS:According to our single center experience we demonstrated that neuroendoscopic lavage is a safe and effective treatment for postinfectious hydrocephalus in children. After introducing neuroendoscopic lavage in postinfectious hydrocephalus we could observe a decreased number of overall shunt revisions in shunt depended patients as well as a lower number of reinfections.

PF-062

Hydrocephalus

Evaluation of secondary ETV

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OBJECTIVE:Secondary endoscopic third ventriculostomy (ETV) may be considered when done in the form of repeat endoscopic ventriculostomy for treatment of failed ETV in obstructive hydrocephalus due to stoma closure or in cases presenting with shunt malfunction. Varying reports in literature cite an ETV success rate of approximately 65-70 % in cases of shunt malfunction. Secondary ETV has also been used in shunt infections. Although the procedure does not obviate the need for later shunt implantation, it is shown to delay the subsequent procedures.
MATERIAL-METHODS:Thirty six cases of shunt malfunction underwent ETV at a mean age of nine years. Four cases of primary ETV failure underwent a secondary ETV. In all cases of secondary ETV or in cases where there has been some bleeding during the procedure, an Ommaya reservoir and ventricular catheter were inserted for quick access. This is helpful in acute hydrocephalus due to blockage of the stoma.
RESULTS:Seventy percent success rate was seen with secondary ETV for shunt malfunction and seventy five percent success rate was seen in secondary ETV for primary ETV failure. We found that the follow up period required was much longer than for a primary procedure, as failures were seen even two years following secondary ETV.
CONCLUSIONS:An increase in ETV efficacy has been reported in post-hemorrhagic hydrocephalus from 60.9% for primary ETV to 100% for secondary ETV. Secondary ETV done in cases of shunt malfunction in obstructive hydrocephalus gave a 70 % chance of long term shunt free status. Hence, it would be reasonable to offer all patients with malfunctioning shunts and a favorable anatomy, the opportunity for shunt independence irrespective of the original cause of hydrocephalus.

PF-063

Hydrocephalus

Overdrainage-Related Ventricular Tissue is a Significant Cause of Proximal Shunt Obstruction

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OBJECTIVE:Prospective studies of ventricular shunts demonstrate a staggering failure rate of 50% after two years. The majority of shunt malfunctions are due to proximal ventricular catheter obstruction. According to the literature and surveys of North-American pediatric neurosurgeons, obstructions are most often attributed to in-growth of choroid plexus and/or reactive cellular aggregation. Here, we report overdrainage-related evagination of ventricular wall tissue as a significant, if not primary cause of proximal shunt obstruction.
MATERIAL-METHODS:A retrospective review was completed on patients undergoing shunt revision surgery between 2008 to 2015, identifying all cases in which endoscopic documentation of ventricular tissue ingrowth was reported in the senior author's surgical notes. Detailed clinical, radiographic, histological and surgical findings were examined.
RESULTS:Fifty patients underwent 83 endoscopic shunt revision procedures that revealed in-growth of ventricular wall tissue into the catheter tip orifices, producing partial, complete, or intermittent shunt obstructions. Real-time endoscopic evidence demonstrates outgrowths of ventricular wall tissue at various stages of development, which appear to form secondary to siphoning. Ventricular bands are associated with small ventricles when the shunt is functional, but may dilate at the time of obstruction.
CONCLUSIONS:Ventricular wall tissue is a significant cause of proximal shunt obstruction, which appears to be related to siphoning of surrounding tissue into the ventricular catheter, and CSF overdrainage as a primary mechanism. We will discuss the impact of these observations on our understanding of the pathophysiology of shunt malfunction and treatment options.

PF-064

Hydrocephalus

Comparison of MRI CSF Flow Imaging Methods

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OBJECTIVE:MR brain imaging allows detection of abnormalities such as hydrocephalus, which arises from abnormal cerebrospinal fluid (CSF) physiology. There are three main MR methods for imaging CSF flow (Figure 1): T2-weighted flow-void, phase-contrast, and tag-based MR. Flow-void and phase-contrast imaging are adversely affected by turbulent CSF flow. Tag-based flow imaging methods such as Time-Spatial Labeling Inversion Pulse (TimeSLIP) are sensitive to detect turbulent and slow CSF flow, but changing background signals may render the interpretation more difficult than a method with static background. Here we introduce a variant of tag-based flow imaging, Time Static Tagging and Mono-contrast Preservation—TimeSTAMP—that minimizes the changing background signal. We acquired images and compared these methods.
MATERIAL-METHODS:Ten healthy volunteers (5 female, 36 ± 18 years) were examined using: (i) Standard T2-weighted flow-void, (ii) phase-contrast MR, (iii and iv) tag-based flows TimeSLIP, TimeSTAMP. The images were reviewed by five trained observers who recorded their ability to confirm CSF flow on a Likert scale (5=best...1=worst).
RESULTS:CSF flow was detectable with high confidence for the tag-based methods, Likert score mean and standard deviation: 4.8 ± 0.2 for both TimeSLIP and TimeSTAMP. Confidence levels were significantly lower ($p<0.0001$) for the flow-void (2.5 ± 0.7) and phase-contrast MRI (2.6 ± 0.5). There was no significant difference between the two tag-based methods. The TimeSTAMP sequence provided visualization of flowing CSF (Figure 2) and eliminated the variation of the background signal intensity (Figure 2).
CONCLUSIONS:In this study, tag-based images were preferred over T2-weighted flow void and phase-contrast images. No preference for TimeSLIP or TimeSTAMP was demonstrated in our assessment of healthy volunteers; nevertheless the tag-based imaging was preferred, and TimeSTAMP's reduced background signal changes may provide more robust diagnoses of CSF abnormalities in patients with altered CSF flow dynamics where interpretation is more difficult.

Wednesday, 11 October 2017
14:00 – 15:00

Platform Parallel Presentations: Chiari/ Other

PF-065

Chiari malformation

Syndromic craniosynostosis and late appearing syringomyelia

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OBJECTIVE:It has been reported that due to premature synostosis of the lambdoid suture more than 70% of patients with Crouzon syndrome concurrently suffer from chronic tonsillar herniation (Chiari Type I malformation) and subsequently (20%) associated syringomyelia. This occurence has not been studied for other syndromic craniosynostosis.
MATERIAL-METHODS:A 15-year, from 2000 to 2015, single-center, retrospective outcome assessment of 151 children treated for syndromic craniosynostosis was conducted. Crouzon (88 patients, 52M/36F), Aperts (33 patients,18M/15F) and Pfeiffer (30 patients 16M/14F) were included. Assessment of tonsillar herniation and synringomyelia was obtained through Magnetic Resonance imaging (MRI) and polysomnographic studies which looked for central an obstructive apneas.
RESULTS:Among the 151 children, 42 patients presented Chiari type I malformation (19 patients with Crouzon, 23 with Pfeiffer, none in Aperts). Among them, syringomyelia was present in 25 children with Crouzon or Pfeiffer but none in Aperts, The mean age of syringomyelia diagnosis was 5.5 years (range, 10 months to 16 years). Posterior fossa decompression procedure was undertaken in 21 patients. Posterior fossa decompression (associated with posterior distraction in 5) decreased the number of central and obstructive sleep apnea. Neurological symptoms (paraparesis) were relieved but syringomyelia images stayed unchanged.
CONCLUSIONS:The etiology of Chiari seems multifactorial. The authors recommend that posterior fossa decompression should be considered the primary treatment for Chiari malformation to prevent late syringomyelia and central sleep apneas, in Crouzon and Pfeiffer. It can be associated with posterior vault expansion in the same time if intracranial pressure is present, but this study suggests that insufficent treatment of Chiari will lead to syringomyelia.

PF-066

Chiari malformation

Why does Chiari surgery fail?

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OBJECTIVE:*Whilst foramen magnum decompression (FMD) is the mainstay of treatment for Chiari I malformation (CIM) persisting symptoms requiring further surgery is reported in up to 20% of cases. In this study we sought to evaluate risk factors for failure in Chiari surgery.*
MATERIAL-METHODS:*From a departmental database of operative surgery all cases of FMD for CIM were identified. For the purposes of this study failure was defined as the need for a second operation. Demographic details, indications for surgery and surgical technique were assessed for all FMD's. Pre-operative radiology was reviewed from all failures and twice as many controls to assess for features of complex Chiari including Chiari 1.5 (obex below FM), clival basal angle <125 degrees, ventral brainstem compression (pB-C2 >9mm or craniovertebral junction malformation.*
RESULTS:*Of 142 FMD procedures for CIM 17 (12%) required at least one subsequent surgery. Second surgery comprised revision FMD (13, 1with fixation), cranial vault expansion (2) or CSF diverting procedure(2). Younger age at the time of surgery was associated with failure (8.3 years vs 11 years) as was a bone only decompression ($p<0.05$) (performed in 59% of failed cases vs 21% of successful). Amongst failed cases an underlying syndrome was present in 9/17 (53%) compared with 19/125 (15%) successful cases ($p<0.05$). Multi-suture craniosynostosis was the commonest syndrome. None of the radiological signs were correlated with failure.*
CONCLUSIONS:*The aetiology of CIM is both heterogeneous and complex. In young patients and those with an underlying syndrome, alternative pathophysiological mechanisms for CIM need to be considered and addressed primarily. Our results fail to support the routine use of bone only decompression.*

PF-067

Chiari malformation

International Survey on the Management of Chiari I Malformation and Syringomyelia: Evolving Worldwide Opinions

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OBJECTIVE:A previously published survey, of international pediatric neurosurgeons, suggested most would not operate on asymptomatic patients with Chiari I Malformation (CM), unless syringomyelia was present. Most respondents favoured routine dural opening and grafting when completing a craniocervical junction decompression. In the ensuing years, there has been further information from multiple CM studies, with regards to indications, success rates of different surgical interventions, and complications. The purpose of this study is to re-evaluate current opinions and practises in pediatric CM.
MATERIAL-METHODS:Pediatric Neurosurgeons worldwide were surveyed, using ISPN communication. Respondents were given scenarios similar to the 2003 CM survey of the ISPN - cases with and without syringomyelia, in order to determine opinions regarding whether to surgically intervene, and if so, with which operations.
RESULTS:Of 300 surveys electronically distributed, 122 responses were received (40.6% response rate) - an improvement over the 30.8% response rate in 2003. Pediatric Neurosurgeons from 33 different countries responded. There was broad consensus that non-operative management is appropriate in asymptomatic CM (>90%) as well as asymptomatic CM with small syrinx (>65%). With large syrinx, a majority (>80%) would recommend surgical intervention. Scoliotic patients are generally offered surgery only with large syrinx. There has been a clear shift in the surgical management over the past decade, with a bone-only decompression now offered more commonly, whereas previously dural opening was favored. There remains, however, great variability in the operation offered.
CONCLUSIONS:This survey, with a relatively strong response rate, and with broad geographic representation, summarizes current world-wide expert opinion regarding CM. Asymptomatic CM and CM with small syrinx are generally managed non-operatively. When operation is indicated, there has been a shift towards less invasive surgical approaches, with fewer respondents now opting to open the dura at the primary operation.

PF-068

Chiari malformation

Syringo-Subarachnoid Shunt for the Treatment of Persistent Syringomyelia following Chiari Decompression: Surgical results

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OBJECTIVE:Approximately 30% of patients treated by foramen magnum decompression (FMD) for Chiari I-associated-syringomyelia, will show persistence, recurrence or progression of the syrinx. The surgical treatment for these patients is still debated, while some advocate re-decompression of the foramen magnum, others suggest a shunting procedure (e.g. syringopleural or syringo-subarachnoid shunt). This study evaluates the clinical and radiological outcome of syringo-subarachnoid shunt (SSS) as the treatment for persistent syringomyelia after FMD.
MATERIAL-METHODS:Data was retrospectively collected. Primary outcome measurement was neurological function (assessed with the Modified Japanese Orthopedic Association (mJOA) Scale). Secondary outcome measurements were surgical complications, re-operation rate, and syrinx status on magnetic resonance imaging (MRI).
RESULTS:At our department 21 patients (14 females (66.7%)) underwent SSS either concurrent to the FMD, or at a later stage between the years 2003 and 2016. Two minor surgical complications, a wound dehiscence and postoperative kyphosis, requiring revision surgery, was seen, while no major complication or mortality occurred. The median change in the mJOA score was an improvement of 3 points of the total of 17 points of the scale (from 13 preoperatively to 16 postoperatively at a mean follow up of 24.9 months). Expressed as percentage, overall improvement was 11.8% (95% confidence interval 5.9 – 17.6), showing statistical significance ($p<0.001$). On postoperative MRI, shrinkage of the syrinx was seen in all patients but one, where the syrinx remained unchanged. Expressed as percentage, the improvement of the syrinx surface was 76.3% (95% confidence interval 65.0 – 87.7), showing statistical significance ($p<0.001$), while the improvement of syrinx span was 36.4% (95% confidence interval 21.8 – 50.9), showing no significant difference ($p=0.05$).
CONCLUSIONS:SSS for persistent, recurrent, or increasing syrinx following FMD for Chiari I malformation is a safe and effective surgical treatment when performed selectively by an experienced neurosurgeon.

PF-069

Chiari malformation

Intradural pathology and pathophysiology associated with Chiari I malformation with and without syringomyelia

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OBJECTIVE:The pathophysiology of cerebrospinal fluid (CSF) obstruction and tonsillar herniation in Chiari I malformation (CM-I) is unclear and the cause of CM-I associated syringomyelia is not well understood. Therefore, we sought to examine the intradural pathology and CSF flow pathophysiology in the posterior fossa that occurs in the setting of CM-I +/- syringomyelia.
MATERIAL-METHODS:A prospective database was initiated in March 2003 to record all intraoperative findings during surgical treatment of CM-I +/- syringomyelia. A total of 388 surgeries were performed on 382 patients from March 2003 to June 2016. A total of 109 primary posterior fossa intradural procedures were performed on 109 patients. Univariate followed by multivariate analyses were performed.
RESULTS:The following intradural pathology was observed not to be obstructive to CSF flow: opacified arachnoid (33.0%), thickened arachnoid (0.9%), gliotic tonsils (40.4%), tonsillar cysts (0.9%), and caudal descent of the 4th ventricle and cervicomedullary junction (78.0%). The following intradural pathology was observed to be obstructive to CSF flow: medialized tonsils (100%), tonsil occupying/obstructing 4th ventricle (21.1%), intertonsillar and tonsillar/cervicomedullary arachnoid adhesions (85.3%), vermian PICA branches obstructing the foramen of Magendie (43.1%), and arachnoid veils obstructing/occluding foramen of Magendie (52.3%). Arachnoid veils occurred as multiple types and were observed in 59.5% of CM-I patients

with syringomyelia, which was significantly greater than the 33.3% of CM-I patients without syringomyelia who had an arachnoid veil ($p = 0.018$). The caudal descent of the 4th ventricle and cervicomedullary junction occurred with a greater degree of tonsillar herniation ($p < 0.001$) and correlated with a cervicomedullary kink/buckle on preoperative MRI.
CONCLUSIONS:Intradural pathology associated with CM-I +/- syringomyelia is much more prevalent than previously recognized. A subset of this pathology appeared to obstruct CSF flow and therefore, may play a role in the pathophysiology of both CM-I tonsillar herniation as well as CM-I associated syringomyelia.

PF-070

Chiari malformation

Degree of Pulsatile Tonsils May Predict Patient Outcome After Foramen Magnum Decompression

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OBJECTIVE:The mechanism of symptoms of foramen magnum obstruction with Chiari malformation have been derived from static MRI imaging. We studied movement of foramen magnum structures with the cardiac and respiratory cycles by recording intra-operative cine ultrasound.
MATERIAL-METHODS:We made cine ultrasound recordings of ten patients undergoing foramen magnum decompression and five-controls having surgery above the tentorium where we scanned the foramen magnum from above. Ultrasound cine was recorded for each patient for 15 seconds on average. Tonsilar movement was measured per cardiac cycle in relation to a bony anatomical structure - the lamina of C1 or C2 or the edges of the foramen magnum.
RESULTS:44 patients were studied, 20 controls and 24 study groups. In the control group movement ranged from 0 to 1.5mm. In the study group, movement ranged from 2.5 to 6mm. Pulsatility of tonsils post decompression is not restoration to normal physiology. In 6 cases we reduced pulsatility by allowing CSF flow, both had reduced post operative symptoms compared to the others.
CONCLUSIONS:Pulsatile movement of cerebellar tonsils is not normal. Abolishing it surgically where possible by allowing space for CSF to flow through the foramen magnum may improve outcomes.

PF-071

Chiari malformation

Differences between symptom presentation for the pediatric and adult Chiari patient: Is it a different disease or a reflection of time

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[3]Department of Neurosurgery, Drexel University School of Medicine, Philadelphia, PA,
[4]Department of Neurosurgery, National Institute of Health, Bethesda, MD
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OBJECTIVE:While pediatric medicine has long been misconstrued as the treatment of "little adults," disparities between the two cohorts have never been more apparent than in the evaluation of Chiari malformations. These differences likely manifest divergent etiologies or perhaps different timelines along a disease continuum. Herein, we compare the clinical presentation of a disparate group of adult Chiari patients versus pediatric cohorts to help elucidate possible mechanisms of development
MATERIAL-METHODS:Retrospective data of sequential operative Chiari patients were reviewed for 93 adults patients from three centers (NJ, MD, DC-2010 to present), and compared to 137 pediatric patients from CNMC (1995-2014). A total of 21 presenting symptoms were assessed for age cohorts of 0-5, 6-12, 13-19, 20-39, 40-59, 60-79 years. Student t-tests were performed for significance.
RESULTS:In this large multi-center cohort of adults, an overwhelming 88% of patients were female versus 53% for children. The average age of female patients was 37.4 versus 36 years-old for males. When comparing the two populations, adults were found to have a higher incidence of specific presenting symptoms, including headaches ($32 \pm 2.08\%, p<0.0001$), neck pain ($7.29 \pm 1.76\%, p<0.0001$), gait difficulties ($13.18 \pm 1.327\%, p<0.0001$), extremity symptoms ($17.67 \pm 1.062\%, p<0.0001$), weakness ($4.83 \pm 0.82\%, p<0.0001$), and paresthesia ($15.67 \pm 0.87\%, p<0.0001$). The frequency of these symptoms increased with age. Incidence of syrinx was higher in children ($6.47 \pm 1.3\%, p<0.0001$), and a number of presenting symptoms were only observed in pediatric patients (e.g bulbar impairments, drooling, oculomotor abnormalities, decreased motor coordination, hyperreflexia/tonia). (See Figure 1)
CONCLUSIONS:The significant difference in presenting Chiari symptoms for adults versus children underscores the diverse underpinnings of this condition, also manifested by the significant majority of the adult patients being female. The differences observed here imply unique clinical entities, which in turn require specific therapeutic approaches for adequate treatment. Subsequent studies may offer additional insight into what separates the adult patient from the pediatric cohort for Chiari malformation.

Wednesday, 11 October 2017
15:00 – 15:16

Platform Parallel Presentations: Chiari/ Other

PF-072

Antenatal diagnosis and treatment

Impact of Microneurosurgical Neural Placode Tubularization on Reducing Spinal Cord Tethering and Incidence of Inclusion Cyst Following 60 Fetal In-Utero Myelomeningocele Repairs

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[3]Saint Louis Fetal Care Institute, SSM Health Cardinal Glennon Children's Hospital

OBJECTIVE:The Management of Myelomeningocele Study (MOMS) trial showed improved hydrocephalus and motor/cognitive outcomes in the prenatal repair group compared to the postnatal group. Reports of spinal cord tethering and increased rates of inclusion cysts (IC) were reported in the literature. Closure technique used during MOMS trial did not include placode tubularization. We evaluated the impact of tubularization on tethering and IC rates as well as wound dehiscence rates.
MATERIAL-METHODS:We retrospectively reviewed charts for technique of fetal MMC repair, gestational age (GA) at time of repair and birth, dehiscence at repair site and spinal MRI findings.
RESULTS:60 females underwent prenatal MMC repair (2011-2017) between 20 and 26 weeks GA. All MMC defects underwent successful in-utero repair, with progression of pregnancy (average GA at birth:34+4/7 weeks). 58 babies have been born, 56 are alive (2 neonatal mortalities due to prematurity, one excluded for lack of research consent). From the remaining 55 patients, 9 patients (16.3%) developed clinical signs of tethered cord syndrome (TCS) requiring microsurgical detethering. When comparing the patients with and without TCS, we trended towards statistical significance when looking at rates of placode tubularization at time of fetal MMC repair. This occurred in only 2/9 (22.2%) of the TCS group and occurred in 21/36 (58.3%) of the non-tethered group, (p=0.071). Of 45 patients with MRI data, 6 patients (6/45=13.3%) had an IC. 2 (33%) of them required detethering while 4(66%) remain asymptomatic. At birth, 16/55 (29%) had superficial skin dehiscences managed conservatively with local wound care and positioning restrictions. Five patients (5/55=9%) required secondary repair after birth due to dehiscence/CSF leak.
CONCLUSIONS:This is the first cohort in the post-MOMS trial era to suggest microneurosurgical placode tubularization during fetal MMC repair can lower rates of early spinal cord tethering and IC formation. Superficial skin dehiscences at birth following fetal MMC repair could be managed conservatively.

PF-073

Chiari malformation

Syringobulbia in the pediatric population with Chiari I abnormality

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OBJECTIVE:Syringobuliba (SB) is a rare entity. Few cases are reported in the pediatric population (<18 years) with Chiari malformation 1 (CM1). Our database was analyzed in the MRI era (1984-2012) to recognize pathology, management strategies and document longterm outcomes.
MATERIAL-METHODS:530 adults and 290 children with CM1 were surgically treated. SB occurred in 12/290 children. Tumors, infections, Chiari II malformations were excluded. All patients underwent MRI (coronal, axial, sagittal with thin cuts), brain stem auditory evoked responses, trigeminofacial electrophysiology studies and sleep studies. Syringohydromyelia (SHM) was present in 12/12; SB in medulla 9, into upper brain stem 3, syringocephaly 1. 6/12 SB communicated with fourth ventricle from lateral cleft, 6 had no V4 communication. Ventral bony CVJ abnormalities 3 and 3 had previous posterior fossa surgeries.
Headache, neck pain seen in all. Cranial nerve abnormality IX, X – 12/12, multiple cranial nerve palsies 8/12, myelopathy 12/12.
At operation foramen Magendie was occluded by scar/veil/tonsil. Intradural exploration of V4 secured egress. No stents were used since 2004. Floor of V4 carefully inspected and documented. A communication into the syringobulbia was seen in 6/12. Dural graft completed the decompression.
Followup clinical evaluation 6 weeks, 3 months, 1 year and 3 years including MRI.
RESULTS:Syringobulbia was the first to deflate; before SHM; usually in 3 months. Cranial nerve palsies regressed in 11/12. SB resolved in 12/12.
CONCLUSIONS:SB in CM1 always with SHM; communicated with 4th ventricle in 50%. Securing V4 egress gives longterm success.

Thursday, 12 October 2017
08:15 – 10:00

Platform Presentations: Neuro-oncology

PF-074

Special topic: Neuro-oncology

Surgical outcomes and prognostic factors of pediatric medulla gliomas

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OBJECTIVE:Medulla gliomas are rare and surgically challenging tumors with limited reports. Here, we present our experience with surgical resection of pediatric medulla gliomas.
MATERIAL-METHODS:Thirty-five children with medulla gliomas underwent surgical resection at our hospital between Jan 2008 and Nov 2016. The clinical, radiological, operative and pathological findings of these patients were retrospectively reviewed.
RESULTS:The majority (85.7%) of tumors in our series were of low-grade (12 WHO gradeI, 18 WHO gradeII, 4 WHO grade III and 1 WHO gradeIV). Gross total (100%), near-total(≥90%), subtotal(75%-90%)and partial resection (<75%) were achieved in 15 (42.9%), 2(5.7%), 12 (34.3%) and 6(17.1%) patients respectively. The 1-year, 5- year and 9-year overall survival (OS) rates were 90.1%, 67.7%, and 67.7%, respectively. The median follow-up period was 26 months (ranged from 6-113 months). There was no surgical morbidity. However, 4 patients (4/35, 11.4%) died between 3 to 9 months after surgery despite radiologically confirmed stable disease, among which 2 patients died of sleep apnea unexpectedly, 1 patient died of pneumonia and the other died of radiation injury. Nine patients died of disease progression. A Cox hazard proportion ratio model was used to identify factors influencing OS, including sex, history, preoperative KPS, growth pattern, focality, enhancement, cystic degeneration, pathological grade, extent of resection (EOR) and treatment modality. On univariate analysis, focality (P = 0.004; HR, 7.19; 95% CI, 1.87-27.72), enhancement (P = 0.002; HR, 9.09; 95% CI, 2.25-36.82), lower grade (P = 0.003; HR, 5.90; 95% CI, 1.85-18.83) and radical resection (EOR≥90%, P = 0.035; HR, 5.50; 95% CI, 1.13-26.90) were associated with favorable prognosis. On multivariate analysis, focality (P = 0.032; HR, 4.93; 95% CI, 1.15-21.07) and enhancement (P = 0.027; HR, 5.01; 95% CI, 1.20-20.90) were associated with favorable prognosis.

CONCLUSIONS:Surgical resection, although challenging, can provide favorable long-term prognosis for medulla gliomas, especially those of low grade.

PF-075

Special topic: Neuro-oncology

Quality of life in massive opticohypothalamic glioma. An analysis of an experience in 73 cases treated over 18 years

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OBJECTIVE:Gliomas of the visual pathways represent 1% to 5% of childhood brain tumors. About 43% occur in children <10 years old. The treatment approach is controversial. Although benign, opticohypothalamic chiasmatic gliomas can have aggressive course in young children.
MATERIAL-METHODS:Seventy-three cases of opticohypothalamic chiasmatic were surgically treated in our department over the past 18 years (1998-2016). A retrospective analysis is presented. A semi-structured interview for disease domain specific quality of life (QOL) was performed in a focused group of 30 patients to elicit themes to provide a thematic analysis
RESULTS:The average age of presentation was 14.8 years and duration of complaints was 3 months. Headaches, vomiting and dimunition of vision were commonest complaints. The average size of the tumor was 7.4 cm. All patients underwent only biopsy of the tumor through subfrontal approach. Ventriculoperitoneal shunt was required in 19 patients postoperatively. Postoperatively, all patients above 4 years of age were administered radiotherapy. The average follow-up period was 7 years. Nonsymptomatic recurrence was noted in 8 patients. Median time to tumor progression was 55 months. The 5- and 10-year survival probabilities were 93% and 74%, respectively. The functional activity assessed by Barthel's Index is maintained in children with low grade optochiasmal gliomas treated with conformal RT. The decline in functional activity is seen in patients with tumor recurrence and complications. However, improvement in functional activity after RT was observed at 3 years follow-up, maximum improvement seen in visually impaired patients.
CONCLUSIONS:Barthel's Index is a simple, reproducible, quick, easy, especially applicable for older children and adolescents. It may be used as an outcome measure tool in clinics with resource limitations. Adjuvant radiotherapy offers reasonable control in longterm. The approach towards Quality of life issues should be more aggressive including psychosocial intergration. There is a need for more objective, better quality of life studies.

PF-076

Special topic: Neuro-oncology

Diagnostic Value of Stereotactic Biopsy for Intrinsic Brainstem Tumors in Children

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OBJECTIVE:Radiologic diagnosis alone has been believed sufficiently reliable to decide the treatment for the intrinsic brainstem gliomas in children. Surgical biopsy has been considered to be risky and thus reserved for controversial cases. We evaluated the diagnostic relevance of MRI findings compared to histologic results confirmed by stereotactic biopsy.
MATERIAL-METHODS:We retrospectively reviewed 38 pediatric patients (age, 0-18 years) who underwent the stereotactic biopsy for their intrinsic brainstem tumors in authors' hospital from 2000 to 2015. MRI findings were analyzed to verify specific factors to predict the histological results. Forty-two stereotactic biopsies were performed in 39 patients via trans-cerebellar approach. The median age at diagnosis was 7 years (range, 2-17 years) and male patients were predominant (male patients, 28).
RESULTS:Diagnostic accuracy of MRI was 84.6% for brainstem tumors and 71.8% for brainstem gliomas. Contrast enhancement was a significant factor to differentiate the tumor from non-neoplastic lesion of the brainstem and diffuse lesion was significantly related to histological result of brainstem gliomas (OR 29.119 (95% CI, 1.3-637.702), p=0.032, OR 13.889 (95% CI, 2.105-90.909), p=0.006).
No procedure-related mortality was documented and overall morbidity rate was 7.1%. Overall diagnostic yield of stereotactic biopsy was 92.8%.
CONCLUSIONS:MRI alone may not be adequate to guide the treatment for the intrinsic brainstem tumors in children. Stereotactic biopsy via trans-cerebellar approach can be a safe procedure with high diagnostic yield and should be considered as a standard diagnostic tool in pediatric brainstem tumors.

PF-077

Special topic: Neuro-oncology

A scoring system of brainstem glioma based on Diffusion Tensor Imaging

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OBJECTIVE:To establish a scoring system for brainstem gliomas based on diffusion tensor imaging (DTI) and to investigate its relationship with pathological grade and prognosis.
MATERIAL-METHODS:A total of 50 patients underwent surgical resection of brainstem gliomas were retrospectively analyzed. All patients had preoperative DTI. Corticospinal tract (CST) and medial lemniscus (ML) were reconstructed and used to develop a scoring system. Five types of CST and ML were identified as follows: normal (1 score), deviated (2 scores), encased (3 scores), deviated with damage (4 scores) and encased with damage (5 scores). Tumors were classified into low-score group (scores range from 4 to 12) and high-score group (scores range from 13 to 20) according to the sum of scores of bilateral CSTs and MLs. The relationship between this score system and pathological grade and overall survival (OS) were evaluated using the Cox proportional hazard model.
RESULTS:Fifteen (30%) low-grade gliomas (LGG, WHO grade I and II) and 35 (70%) high-grade gliomas (HGG, WHO grade III and IV) were included. The median OS was 11 months (ranged from 1 to 46.1 months) for the whole cohort, with a median follow-up period of 9 months (ranged from 3 to 48 months). The DTI score group was statistically associated

with pathological grade (p=0.019, Fisher's Exact test) with the majority of tumors in high-score group (15/16, 93.75%) were HGG. Patient with high DTI score had significantly shorter OS than those with low score (p = 0.004, HR 3.489, 95% CI 1.486–8.190). On multivariate analysis, both lower DTI score (P = 0.034; HR, 2.683; 95% CI, 1.075-6.692) and lower pathological grade (P = 0.004; HR, 18.883; 95% CI, 2.366-150.672) were associated with favorable prognosis.
CONCLUSIONS:We developed an scoring system for brainstem gliomas based on DTI score which can predict pathological grade and overall survival.

PF-078

Special topic: Neuro-oncology

Ultra Low-Dose Radiation Enhances Immune-Modulated in vitro Pediatric Medulloblastoma Cell Death

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OBJECTIVE:Group 3 and 4 Medulloblastoma (MB) are strongly associated with poor outcomes and require neurotoxic treatments for survival. Little is known about the interactions of the CNS immune system microglia with these aggressive pediatric MB cells. Emerging evidence suggests that malignant tumors specifically modify tumor associated microglia (TAM) into an inactive M2-phenotype, in contrast to classically activated proinflammatory cytotoxic M1-type. These M2-type microglia exert medulloblastoma-supportive effects through reduced anti-tumor functions, increased expression of immunosuppressive mediators, and non-immune tumor promotion through expression of trophic and invasion-facilitating substances. Molecular signaling for activation of TAM into M1-like phenotype occurs through 4-1BB (CD-137), a regulatory protein involved in immune cell proliferation and survival.
MATERIAL-METHODS:In the current study, we used ultra low-dose single fraction radiation as an immune primer in combination with monoclonal antibody (mAb) to stimulate TAM into a cytotoxic M1-like phenotype and enhance anti-tumor immune responses in co-culture models. Co-cultures included Medulloblastoma cell lines from group 3 and 4 MB, TAM and peripheral blood mononuclear cells (PBMC); Primary cortical neurons, TAM and PBMC. Co-cultures were subjected to 1Gy single fraction radiation followed by administration of 4-1BB mAb.
RESULTS:ELISA spot demonstrated treatment of 50 ng of 4-1BB (CD137) + 1Gy X-ray radiation reconverted M2 phenotype (arginase +, CD163+, CD204+, IL-10+ and TGF-β+) to M1 phenotype (iNOS+++, IL-1+, IL-12+, IL-23+ iNOS+, NO+, TNF- +, IFN- + and upregulated MHC –II and CD86). Conditional media from M2-phenotype microglia failed to demonstrate effects on MB cells (MP1), where as conditional media from M1-phenotype microglia induced MB cell death. Co-culture experiments demonstrated additive effects of radiation + 4-1BB mAb on MB cell death with sparing of normal cortical neurons.
CONCLUSIONS:4-1BB mAb plus low-dose single fraction radiation may prove to be beneficial for the treatment of medulloblastoma through improved immune-mediated cell death while sparing neurotoxicity.

PF-079

Special topic: Neuro-oncology

Single Fraction Low-Dose Radiation Modulates Oncogenes and HLA Class I/II Molecules in Pediatric Human Medulloblastoma Cells

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OBJECTIVE:Group 3 and 4 Medulloblastoma were strongly associated with elevated levels of oncogenes (c-MYC, CDK6 and MYCN). Critical immune functions of antigen presentation, specifically through the HLA class I/II pathway have yet to be studied. Thus, the aim of the present investigation was to study the effect of low-dose X-ray radiation (LDXR: 1 Gy) on the functional immunological responses of Group 3 and 4 MB cells (D283, and D341) with respect to c-MYC, CDK6 and MYCN function
MATERIAL-METHODS:The aim of the present investigation was to study the effect of low-dose X-ray radiation (LDXR: 1 Gy) on the functional immunological responses of Group 3 and 4 MB cells (D283, and D341) with respect to c-MYC, CDK6 and MYCN functions and evaluate alteration in HLA Class I/II immune pathways which may be affected by immune priming ultra LDXR.
RESULTS:Western blot analysis showed LDXR reduced 20% of the expression of c-Myc in group 3 and CDK6 and MYCN expression in group 4 medullobalstoma cells respectivly. Interestingly, LDXR reduced the expression of histone methylases EZH2 and KDM6A protein levels, which exclusively expressed in groups 3 and 4 medulloblastomas. At the same time LDXR upregulated more than 20 % of the expression of human leukocyte antigen (HLA) class I, and HLA II molecules such as HLA-DP, HLA-DQ, HLA-DR complex, HLA-DM (an important catalyst of the class II-peptide loading), in MB cells as compared to the non-irradiated in vitro. Ii (invariant chain) expression was reduced (more than 25 %) in the LDXR group.
CONCLUSIONS:These results suggest that LDXR may alter several immune modulating molecules including directly influencing both HLA Class I and II pathways. This could lead to enhanced T-cell/tumor-cell interaction and T-cell mediated tumor cell death.

PF-080

Other

Surgical Challenges Of Auditory Brainstem Implantation In Infants And Children With Cochlear Nerve Deficiency: Experience With 116 Patients

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[2]International Center For Performing And Teaching Auditory Brainstem Surgery In Children, Milano, Italy
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[4]University Of Milano, ENT Department, Milano, Italy

OBJECTIVE:Determine the degrees of surgical challenges of auditory brainstem implantation (ABI) in infants and children.
MATERIAL-METHODS:Study design: Retrospective study
Setting: Tertiary academic medical center
Patients: 116 children with cochlear nerve deficiency ranging in age from 8 months to 16 years at implantation with Cochlear and Med-El.
Intervention(s): ABI via a modified retrosigmoid craniotomy. In all children a full sequence of snapshots of the foramen of Luschka (FL) and of neurovascular structures around it, obtained during surgery were reviewed by four independent individuals to identify and describe by consensus the different degrees of surgical challenge to implant the ABI.
Main outcome measure(s): Levels of surgical challenges from 1 to 5 and number of electrode providing stimulation of the cochlear nuclei.
RESULTS:ABI was implanted in all children. Intraoperatively electric auditory brainstem responses characteristic of auditory processing in the brainstem were obtained from 5 to 20 electrodes. No intra and postoperative permanent complications were observed and all children were discharged home on post-operative day 4 to 10.
CONCLUSIONS:In children with CND and coexisting congenital abnormalities of the foramen of Luschka and surrounding neurovascular structures the implantation of the ABI may be troublesome and risky and should be limited to experienced centers.
Advanced anatomical knowledge of the microanatomy of the foramen of Luschka and adjacent area is a mandatory prerequisite for safe exposure and improved access to the lateral recess and cochlear nuclei.
ABI implantation should be early considered for infants and children with severe cochlear or cochlear nerve pathology not suitable to cochlear implantation.

PF-081

Special topic: Neuro-oncology

Generating in vivo somatic mouse mosaics with locus-specific, stably-integrated transgenic elements

Gi Bum Kim[1], Marina Dutra Clarke[1], Rachelle Levy[1], Hannah Park[2], Sara Sabet[2], Aslam Akhtar[1], David Saxon[1], Ashley Watkins[1], Amy Yang[1], Serguei Bannykh[3], Moise Danielpour[3], Joshua J Breunig[1]
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[3]Samuel Oshin Comprehensive Cancer Center, Cedars-Sinai Medical Center, Los Angeles, CA

OBJECTIVE:Viral vectors and electroporation (EP)-mediated gene transfers are efficient means of inducing somatic mosaicism in mice, but they lack the exquisite control over transgene copy number, gene zygosity, and genomic-locus specificity that genetically engineered mouse models (GEMMs) provide. Here, we develop and demon-strate a simple and generalizable in vivo method, mosaic analysis by dual recombinase-mediated cassette exchange (MADR).
MATERIAL-METHODS:MADR allows for stable labeling of mutant cells express transgenic elements from a precisely-defined chromosomal locus by using dual recombinase-mediated cassette exchange. To test our method, we generated reporter-labeled lineages using electroporation of cells in vitro or in vivo from stem and progenitor cells in a well-defined Rosa26mTmG mouse. Further, we demonstrate the ability to utilize inducible or multi-cistron elements for the generation of mutant cell populations in vivo.
RESULTS:We demonstrate the power and versatility of MADR by creating novel glioma models with mixed, reporter-defined zygosity or with "personalized" driver mutations from pediatric glioma—each manipulation altering the profile of resulting tumors. For example, we have observed that transductions of forebrain progenitors in vivo with plasmids encoding the H3.3. K27M or G34R mutations faithfully recapitulates the clinical phenotype of pediatric GBM patients with these mutations.
CONCLUSIONS:MADR provides a higher-throughput genetic platform for the dissection of development and disease, and this rapid method can be applied to the thousands of existing gene-trap mice.

PF-082

Special topic: Neuro-oncology

Assessment of the risk factors impacting functional outcomes and spinal deformity for pediatric spinal cord tumors

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OBJECTIVE:With surgical resection and adjuvant therapy, the majority of patients with pediatric spinal cord tumors survive. Recovery and long term outcomes are often complicated by functional impairment and spinal deformity secondary to the tumor, the extent of surgery and degree of neuromuscular sequelae. We sought to further characterize the functional outcomes and incidence of spinal deformity based on patient and tumor related variables.
MATERIAL-METHODS:IRB approved retrospective study of children < 18 years diagnosed with a primary intradural spinal cord tumor between 2002 and 2017. Patient, tumor, surgery and treatment related variables were recorded. The Modified McCormick Scale was recorded for each patient.
RESULTS:We identified 24 patients, median age = 13.4 years (range 13 months to 17 years) diagnosed with a low grade tumor including astrocytoma WHO I (n=5), Astrocytoma WHO II (n=2), myxopapillary ependymoma (n=10), Lipoma (n=3), meningioma (n=2), and glioneuronal tumor (n=2). A diagnosis of astrocytoma was associated with development of progressive spinal deformity in 6 of 7 patients, present preoperatively in 4 of 7 patients, with a median of 8 levels involved and crossing a junctional level in 5 patients. MMS pre and postoperatively associated with development of spinal deformity: grade I=23%, grade II= 66%, grade III=67%.
CONCLUSIONS:Impaired functional outcomes and the development of progressive spinal deformity are not uncommon following treatment for pediatric spinal cord tumors. Close surveillance is warranted for patients with neurologic and functional impairment, along with those with tumor spanning over 8 levels and crossing the cervicothoracic or thoracolumbar junction. Laminoplasty was not found to be protective against progressive deformity.

PF-083

Special topic: Neuro-oncology

Biopsy of Diffuse Intrinsic Pontine Gliomas: An Assessment of Safety Profile and Considerations of Tumor Heterogeneity

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OBJECTIVE:Diffuse intrinsic pontine glioma (DIPG) is a devastating, currently incurable pediatric brain tumor. Although previous practice diagnosed pontine tumors based on characteristic imaging appearance, there has been resurgence in DIPG biopsy, supporting discovery of the molecular basis of this distinct pediatric disease and potential targets for novel therapies. We present our institutional pontine tumor biopsy experience, including evaluation of biopsy safety, use of tissue diagnostics and outcomes.
MATERIAL-METHODS:We retrospectively reviewed all cases of pontine masses at Seattle Children's Hospital (SCH) from 2009 to 2016. Cases were reviewed for preoperative clinical presentation, treatment, biopsy technique, molecular characterization and outcome. For cases undergoing biopsy, needle biopsies were obtained using neuronavigation via a transcerebellar approach through the middle-cerebellar-peduncle. Further molecular characterization was completed on eight samples, five in the context of a clinical trial and two on a CLIA-certified targeted next-generation-sequencing (NGS) panel incorporated into standard brain tumor diagnosis in 2016.
RESULTS:Seventeen patients underwent a stereotactic biopsy of a pontine tumor during the study period. Diagnosis from biopsy included anaplastic astrocytoma (n=5), diffuse astrocytoma (n=5), glioblastoma (n=3), and PNET (n=4). One patient with PNET had a hemorrhage and 2 patients had transient neurological deficits. Molecular characterization (n=9) revealed a heterogeneous population of pontine tumors with regards to MGMT-methylation. Potential targets for novel kinase inhibitor therapy were identified in 5/8 with molecular characterization, including EGFR, PDGFRA, MET, PI3KCA, and MTOR. Median patient survival post-biopsy was 12.7-months.
CONCLUSIONS:Biopsy of pontine lesions is relatively safe using modern neurosurgical technique, and should be considered for diagnosis at experienced centers in standard clinical practice and supporting research. Pontine tumor biopsy benefits patients by facilitating integrated molecular and histologic diagnosis and identifying actionable targets for therapy. However, given the currently poor prognosis regardless of biopsy result, the decision of whether to biopsy should be approached on an individual basis.

PF-084

Special topic: Neuro-oncology

Outcomes following Endoscopic Endonasal Resection of Sellar and Suprasellar lesions in Pediatric Patients

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OBJECTIVE:The endoscopic endonasal approach (EEA) is emerging as a credible surgical alternative for resection of sellar and suprasellar lesions such as pituitary adenomas, craniopharyngiomas, and Rathke cleft cysts. However, the application of this surgical approach to pediatric patients poses several unique challenges that have not yet been well evaluated. The authors evaluate the safety, efficacy, and outcomes associated with the use of the endoscopic endonasal approach for treatment of these pathologic entities in pediatric patients.
MATERIAL-METHODS:We perform a retrospective review of 30 pediatric patients who underwent endoscopic endonasal resection and record surgical, endocrine and ophthalmological outcomes, as well as complications.
RESULTS:Of the 30 pediatric patients, 9 had pituitary adenomas, 12 had craniopharyngiomas, and 9 had Rathke cleft cysts. Twenty-three (77%) patients had gross-total resection determined by 3-month postoperative MRI and 22 (73%) remain disease free to date. Eleven (37%) patients experienced improvements in their vision and 11 (37%) experienced improvement in anterior pituitary function. Complications included new endocrinopathy in 6 (20%) patients, new permanent diabetes insipidus in 5 (17%) patients, headaches in 5 (20%) patients, vasospasm/stroke in 3 (10%) patients, and CSF leak in one patient (3%). The peri-operative mortality rate was 0% and the mean follow up period was 37 months.
CONCLUSIONS:This study highlights the endoscopic endonasal approach as a safe, effective, and less-morbid surgical alternative for the management of sellar and suprasellar pathologies in pediatric populations with excellent outcomes and minimal complications.

Thursday, 12 October 2017
10:50 – 12:50

Platform Parallel Presentations: Neuro-oncology

PF-085

Special topic: Neuro-oncology

Pituitary Adenomas in the Pediatric Population: A Single-Center Series

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OBJECTIVE:Pituitary adenomas are rare in the pediatric population. We present a unique cohort of children operated transsphenoidally on pituitary adenoma from a single center.
MATERIAL-METHODS:Inclusion criteria were: age <21 years and histopathological diagnosis of adenoma after transsphenoidal surgery. The electronic file was used for prospective and retrospective data collection on symptoms, surgical complications, pituitary function before/after surgical intervention. Intraoperatively surgical assessment was obtained per surgical report with respect to GTR. Follow-up data were collected from outpatient clinical visit and/or correspondence concerning pituitary function and MRI.
RESULTS:Among 962 consecutive patients who underwent transsphenoidal surgery at the University Medical Center Hamburg-Eppendorf (Germany) between April 2013-December 2016, 50 patients (5.2%) were 21 years old or younger (range: 6-21 years, mean: 16.5). 25 (50%) patients had with pituitary adenomas; M:F = 13:12. 8 were macroadenomas(>1cm3). Time from onset of symptoms to first operation had a range of 0-48 months (mean: 18.5 months). 9(36%) patients overall

complained of headaches preoperatively. 1 patient had objective (hemianopsia) and 4 subjective visual disturbances preoperatively. Histopathological diagnosis revealed 13 (52%) ACTH, 5(20%) prolactinoma, 3(12%) mixed STH-prolactinoma, 1(4%) STH adenoma, 2(8%) TSH adenoma and 1(4%) hormonally inactive adenoma. There were no surgical complications. On clinical follow-up (range: 1-34.5 months, mean: 10.4 months), 19 patients (76%) were in "remission" with normal hormone panels and 2(8%) had persistent hormone disturbances; 4 were pending. Neuroradiological follow-up (range: 2.5-35.3 months, mean: 10 months): 10 patients (40%) with GTR, 3 (12%) RD, in 5 (20%) unclear. 7 patients have pending follow-up MRI results. Surgical estimation of complete resection correlated significantly with MRI findings of GTR on follow-up (Fisher's exact, p=0.013).
CONCLUSIONS:Our data show the feasibility of transsphenoidal surgery with high success rates and low complication rates.

PF-086

Special topic: Neuro-oncology

Pre-Radiation Chemotherapy Improves Survival in Pediatric Diffuse Intrinsic Pontine Gliomas

Pierre Aurélien Beuriat[1], Zeynep Gokce Samar[2], Cecile Faure Conter[2], Christian Carrie[3], Line Claude[3], Sylvie Chabaud[4], Camille Chabert[5], Federico Di Rocco[1], Alexandru Szathmari[1], Didier Frappaz[2], Carmine Mottolese[1]
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OBJECTIVE:The median survival rarely exceeds 9 months after standard treatment of DIPG by radiotherapy. The BSG 98 protocol was a prospective trial of frontline chemotherapy aimed at delaying radiation until time of clinical progression. As overall survival (OS) results were encouraging, it was proposed as a routine in our cancer center for further DIPG patients who did not participate to another study
MATERIAL-METHODS:Protocol consisted of frontline chemotherapy: the first course was BCNU-cisplatin, and the second and third were high-dose methotrexate. Standard radiotherapy was delivered either at time of progression or electively after 12 months. From september, 15, 2004 through september, 15, 2014: 16 patients were treated according to BSG 98 protocol. A contemporary comparison cohort of 9 patients who received any experimental treatment that contained at least local radiation therapy served as controls. The initial and 3 monthly MRI were retrospectively centrally reviewed by a specialized neuro-radiologist according to published criteria.
RESULTS:One patient received only one course of BCNU-cisplatin. Two patients underwent one cycle; 2 patients two cycles; one patient three cycles; nine patients received four cycles, and one patient even received 5 complete cycles. Three patients experienced iatrogenic infections, and ten patients required platelet transfusions. Median OS increased significantly in patients treated according to protocol compared to contemporary control (16.1 (IC95% = 10.4; 19.0) months vs 8.8 (IC95% = 1.4; 12.3) months p=0.0003; median PFS was longer but not statistically significant (respectively 8.6 vs 3.0 months p=0.113).
CONCLUSIONS:BSG 98 strategy is confirmed as one of the most effective current treatment of DIPG. It may serve as a control arm in randomized trial exploring innovative treatment, and may be proposed to families who are reluctant for biopsy. The quality of life during the increased survival time was one of the important advantage in our group of patient.

PF-087

Special topic: Neuro-oncology

Surgical management of vestibular schwannomas in NF 2 should aim at growth control and hearing preservation not tumor removal

Isabel Gugel, Quiang Li, Laura Maria Laffitte, Artiom Garbi, Martin Ulrich Schuhmann
Division of Pediatric Neurosurgery, Department of Neurosurgery, Eberhard Karls University Hospital, Tübingen, Germany

OBJECTIVE:Management of vestibular schwannomas (VS) in children/adolescents with NF2 is profoundly different from VS treatment in sporadic cases. Bilateral functional hearing preservation is the primary treatment goal. We evaluate tumor growth rate and hearing outcome after decompression of the internal auditory canal (IAC) followed by various extents of tumor removal.
MATERIAL-METHODS:We collected data of 24 children (adolescent (9-18 years) with NF2. Minimum follow-up was 1 year. Hearing was assessed using pure-tone audiograms, speech discrimination test and brainstem auditory evoked potentials (BAEPs). Tumor volumetry was performed on all suitable MRI scans to determine tumor growth rate. 10 patients received bevacizumab later-on when BAEPs worsened again. Surgery was indicated if BAEPs started to / had already deteriorated. The more affected side was addressed first. Extend of debulking was tailored according to intra-operative BAEPs stability.
RESULTS:35 ears (11 patients bilaterally, 13 unilaterally) were addressed. In all BAEPs deteriorated prior to change in hearing tests. All cases underwent decompression of IAC. Complete tumor removal was achieved in 3/30 tumors (all without pre-operative functional hearing). Growth rate was not influenced by surgery, however, controlled by bevacizumab in 8/10 patients. BAEPs deteriorated after surgery in 4 ears (one > 20 dB), in 21 ears BAEPs were stable and in 10 improved. All patients experienced functional hearing preservation over years with marked variations regarding tumor growth and hearing loss.
CONCLUSIONS:Decompression of IAC and tumor debulking according to BAEPs is a successful strategy for long-term hearing preservation in NF2 children/adolescents. Ideal timing and combination with bevacizumab at time of further BAEPs deterioration can stabilize hearing and control tumor growth over a long time into young adulthood.

PF-088

Special topic: Neuro-oncology

The role of surgery in pediatric optic pathway gliomas: 156 cases results from one institute

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OBJECTIVE:Optic pathway gliomas (OPGs) account for 3–5% of all pediatric CNS tumors and the management is quiet challenging including observation, surgery, chemotherapy and radiotherapy(RT).

Since there is not broad consensus regarding the optimal treatment, the role of surgery and radiotherapy in OPG is controversial. The role of different treatment options were analyzed based the patients outcome with long term follow-up.
MATERIAL-METHODS:All the cases diagnosed with OPG and treated at Beijing TianTan Hospital between April 2003 and November 2015 were retrospectively reviewed. The data of clinical manifestation, treatment options, vision outcome, post-operative life quality was evaluated and the patients' prognosis associated factors was analyzed.
RESULTS:One hundred and fifty-six patients were included in this study, with mean age of 6.7 years (ranges from 10 months to 28 years). OPGs were divided according to Dodge classification (TypeIn=11; Type IIn=89; Type III n=56). Four cases had neurofibromatosis type 1. One hundred and fourty-nine cases underwent surgical debulking, and 2 were stereotactic biopsied. Among 149 patients received surgical intervention, 79 patients were given radiotherapy, 4 patients received chemotherapy. Histopathology confirmed pilocytic n=52, pilomyxoid n=68, fibrillary astrocytoma n=1,and grade I papillary-glioneuronal tumor n=3 The overall survival rate was 84.8% with mean follow-up period of 43 months. The EFS was 61.7% and 84.8 %, the quality of life was 40.4 % and 74.7 %, in surgery only and surgery followed RT group, respectively. The preservation rate of both visual and endocrinal functions was 63.8 % and 67.1 % in two groups.
CONCLUSIONS:The role of surgery in symptomatic OPG is get histological diagnosis and relief of hydrocephalus if there was. Surgical debulking with radiotherapy decreases tumor size with less complications. The significant prognostic factors confirmed in this study was the age and radiotherapy. The OPG patients with NF1 was much lower in Chinese patients than in literatures.

PF-089

Special topic: Neuro-oncology

Medulloblastoma – A single institution's longitudinal perspective on survival and functional morbidity

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[2]Department of Medical Statistics, University College London, London, UK

OBJECTIVE:The purpose of this study was to examine the effects of recent changes in the management of medulloblastoma on survival and morbidity compared with our two previously published series – 1965-1974 and 1980-1990.
MATERIAL-METHODS:A retrospective review of clinical records and imaging of all patients with medulloblastoma, admitted May 1995-May 2010.
RESULTS:104 patients; 73 males (70%), 31 females (30%); age range 19 days to 14.95 years (mean 6.7 years). Duration of symptoms: 1 day-365 days (mean 61 days). 30-day mortality (3/104) 4.7%.
Overall survival (OS): 5-year: 61.5% (CI 52.9 – 71.6%);10-year: 50.7% (CI 41.5 – 61.9%); this was statistically better than the 2nd cohort of our 1965-1974 series but not that of our 1980-1990 series.
Event-free survival (EVS): 5-year: 51% (CI 42.2 – 61.5%); 10-year 40.4% (CI: 31.5 – 51.9%).
Risk stratification: 8 patients unable to be risk-stratified leaving 96 (5-year OS 66.7% (95% CI 56.8 – 72.1%); 5-year EVS 55.2% (95% CI: 46.1 – 66.1%)).
High risk (< 3 years) (n=21): 52.4% (95% CI 34.8, 78.8%)
High risk (> 3 years)(n=22): 50% (95% CI 32.9 – 75.9%
Standard risk (n=53): 79.2% (95% CI 69.0 – 91.0%)
After various factors analysed for independent effect on their 5-year EVS only duration of symptoms and pathological categorisation found significant before and after risk adjustment.
Functional assessment of 63 5-year survivors: 42 had learning difficulties with 10 attending Special Needs schools. 11 had significant mobility issues and 26 of 37 had hearing impairment requiring hearing aids.
CONCLUSIONS:Despite changes in chemotherapy regimes, imaging and pathology the outlook for "all-comers" with a diagnosis of medulloblastoma remains dismal. It takes many years before, from a single oncology unit's perspective, an incremental improvement in overall survival becomes statistically apparent – and it comes with a heavy burden of treatment-related morbidity.

PF-090

Global Children's Surgery

The treatment of pediatric focal brainstem gliomas:with 42 cases follow-ups

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OBJECTIVE:Safe maximal surgical resection is the initial treatment of choice for focal brainstem gliomas. We reviewed the clinical characteristics, therapy, and outcomes of nontectal focal brainstem gliomas treated at the Neurosurgical Center of Beijing Tiantan Hospital, China and discuss its clinical features and treatment in a pediatric population.
MATERIAL-METHODS:We retrospectively studied focal brainstem gliomas cases in our center from 2013 to 2016, the 42 patients of this cohort with complete follow-up was conducted in an attempt to better understand clinical outcomes following multidisciplinary treatment modalities for pediatric brainstem gliomas. Investigational variables including clinical presentations, anatomical distribution, radiological findings, histological findings and clinical outcomes were analyzed.
RESULTS:Median age at diagnosis was 8 years and sex ratio were 21:21; histology was confirmed in 41/42 tumors, 46 % were astrocytoma and 37% were pilocytic astrocytoma, 7% were WHO III-IV grade tumors; All patients underwent initial tumor resection, 90% achieved gross total removal, the median pre-op Kps was 60,the median discharge Kps was 70; 18/42 received adjuvant therapy. By the time of follow-up 4 cases have progression and 3 patient died, overall survival was 92.8%, the median follow-up Kps was 90.
CONCLUSIONS:This single-institution retrospective study demonstrates excellent survival rates for children with focal brainstem gliomas. The use of rational surgical approaches, advanced microneurosurgical techniques, intraoperative neuromonitoring, and the Diffusion Tensor Imaging fusion neuronavigation can provide the required safety to ensure that patients will not suffer undue consequences neurologically from surgery.

PF-091

Special topic: Neuro-oncology

Molecular Analyses Demonstrate an Immunosuppressive Phenotype in the Cyst and Solid Tumor Compartments of Pediatric Adamantinomatous Craniopharyngioma

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OBJECTIVE:Adamantinomatous Craniopharyngioma (ACP) is associated with considerable short and long term morbidity. There are currently no well-established directed therapies. Recent studies demonstrated pro-inflammatory characteristics in both the solid and cyst compartments, but no data have examined whether immunosuppressive mechanisms are active in these tumors. ↑
MATERIAL-METHODS:Milliplex cytokine and gene expression analyses were used to compare ACP with other common pediatric brain tumors and normal tissue. Immunohistochemistry and fluorescence-activated cell sorting (FACS) were used to characterize the intratumoral ACP immune cell phenotype.
RESULTS:ACP demonstrated highly elevated levels of IDO-1 (FC 9.43 versus all other tumor/tissue types, p=1.4x10-28), confirmed by IHC staining for IDO-1 in the epithelial tumor compartment. Elevated levels of IL-10 were demonstrated in the cyst fluid and solid tumor compartments of ACP. Myeloid cells from the ACP cyst compartment demonstrated low levels of CD64 and HLA-DR expression, combined with high levels of CD163 expression. This pattern is most consistent with immunosuppressive milieu. Both CD4 and CD8(+) T-cells demonstrated positive staining for PD-1, most consistent with an exhausted phenotype.
CONCLUSIONS:Pediatric ACP is characterized by immunosuppressive factors in both the solid and cyst fluid compartments. This finding must be further considered within the context of the pro-inflammatory characteristics that have been previously described. It further raises the prospect of clinical translation through the application of available immune-directed therapies.

PF-093

Special topic: Neuro-oncology

11C-MET PET/CT for preoperative grading and prognostic value in brainstem glioma patients

Hai Yu[1], Xiaobin Zhao[2], Peng Zhang[1], Changcun Pan[1], Yu Sun[1], Cheng Xu[1], Yibo Geng[1], Yuliang Wu[1], Pengcheng Zuo[1], Zhen Wu[1], Junting Zhang[1], Liwei Zhang[1]
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OBJECTIVE:To analyse the preoperative grading and prognostic value in brainstem glioma patients by using the ^{11}C-MET PET/CT
MATERIAL-METHODS:Forty-five cases of brainstem gliomas were enrolled in the Department of Neurosurgery, Beijing Tiantan Hospital, Capital Medical University from October 15, 2015 to June 15, 2016,including 26 males and 19 females. All patients were preoperatively diagnosed with brainstem occupying lesion. Patients were examined with head MRI and head ^{11}C-Met PET at the same time. And they were all underwent the craniotomy resection or stereotactic guided brainstem biopsy. Semi-quantitative analysis using maximum standardized uptake value (SUVmax),maximum tumor-to-normal brain ratios (TBRmax) and tumor / normal ratio (TBR) were analyzed in LGGs and HGGs. Clinical datas were ralated to the medical records of those patients. The patients were followed up and the HGGs patients' PFS survival data were analyzed by Cox regression method.
RESULTS:There were significant differences in ^{11}C-Met PET SUVmax tumor, SUVmean tumor, TBRmax and TBRmean between the low-grade group (15 cases) and the high-grade group (30 cases) tumor group ($p < 0.01$ ($P < 0.05$). There was no significant difference between SUVmean and SUVmean ($p > 0.05$). There were significant differences in ^{11}C-Met PET SUVmax tumor, SUVmean tumor, TBRmax and TBRmean between grade III brainstem gliomas (22 cases) and grade IV brainstem glioma group (7 cases) 0.01), SUVmean control, SUVmean control and SUVmax tumor / SUV mean tumor value were not statistically significant ($p > 0.05$); The range threshold between LGG and HGG is 1.535 and 1.635 in ^{11}C-Met PET TBRmax and TBRmean threshold of 1.635.
CONCLUSIONS:^{11}C-Methionine PET/CT imaging is a noninvasive modality that is useful in improving preoperative grading for gliomas. However, whether it could be a prognostic marker in higher grade glioma patients should be thoroughly analyzed after long enough analysis in prospective cohort.

Thursday, 12 October 2017
10:50 – 12:50

Platform Parallel Presentations: Spine, Vascular

PF-094

Spine

Instrumenting long and fusing short in young children undergoing occipital-cervical-thoracic stabilization: Technical note and case series

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[2]Department of Orthopedic Surgery, Columbia University, New York, USA

OBJECTIVE:The long-term effects of instrumentation and fusion of the occipito-cervico-thoracic spine on spinal growth in young children are poorly understood. In order to minimize the effects of this surgery on the growing pediatric spine, we report a novel technique in four children with cervico-thoracic instability who underwent instrumentation from the occiput to the upper thoracic region for stabilization but without bone graft at the craniovertebral junction (CVJ). Subsequent surgery was then performed to remove the occipital instrumentation, thereby allowing further growth and increased motion across the CVJ.
MATERIAL-METHODS:Three very young children (15, 30, and 30 months old) underwent occipital to thoracic posterior segmental instrumentation due to cervical or upper thoracic dislocation, progressive kyphosis, and myelopathy. One child (10 years) underwent similar instrumentation for progressive cervico-thoracic scoliosis. Bone graft was placed at and below C2 only.
RESULTS:After follow-up CT scan demonstrated posterior arthrodesis without unintended fusion from O-C2, three patients underwent removal of the occipital instrumentation. Follow-up cervical spine flexion/

extension radiographs demonstrated partial restoration of motion at the CVJ. One patient has not had removal of the occipital instrumentation yet because she is only four months postoperative.
CONCLUSIONS:Instrumenting long while fusing short provides an opportunity for spinal stabilization in young children while reducing the effects on spinal growth and motion. This technique can be considered in children who require longer instrumentation constructs for temporary stabilization but only need fusion in more limited areas where spinal instability exists.

PF-095

Spine

Management of pediatric cervical kyphosis-experience of 24 cases

Sandip Chatterjee, Lalgudi Srinivasan Harishchandra
Park Neurosciences, Park Clinic, Kolkata, West Bengal, India

OBJECTIVE:Cervical spine in children is quite different from that in adults. Kyphotic deformities in children involving the cervical spine are not common and the etiology also differs from that seen in adults. The aim of the analysis is to present causes of this unusual deformity in children and highlight the difficulties faced during surgery.
MATERIAL-METHODS:This is a retrospective evaluation of 24 cases of cervical kyphosis in the pediatric spine operated by the author in the period from 2006 to 2015.
RESULTS:Of the 24 children, 9 were females and 15 were males with an average age of 8.4 years. The etiology was post-infective in 13 cases, and due to congenital dysplasia in 9 cases; in 2 cases the deformity was iatrogenic caused by previous laminectomies.
All cases were done under neurophysiological monitoring. There was transient worsening of neurological deficit in 4 cases, and in 1 of these the deterioration was permanent. Correction was done till the SSEP (somatosensory evoked potentials) dropped significantly. Correction of kyphosis to over 60% was possible in 20 out of the 24 cases. Neurological deficit improved in 16 of 19 cases that presented with significant neurological deficit.
Problems of soft bone and fixation issues will be discussed.
CONCLUSIONS:Correcting kyphotic deformity in the paediatric spine is a surgical challenge, more in congenital conditions rather than in post-infective situations. However reversal of neurological deficit is possible if the procedure is carried out carefully with intraoperative neurophysiological monitoring.

PF-097

Vascular

Comparison of clinical and angiographic outcomes after encephaloduroarteriosynangiosis in patients with the genetic variant RNF213

Won Hyung Kim, Sang Dae Kim, Dong Jun Lim
Department of Neurosurgery, Korea University Ansan Hospital, Ansan, South Korea

OBJECTIVE:Moyamoya disease (MMD) is a chronic cerebraovascular disease. In children, MMD have a strong relationship with ischemic events. Recent studies identified that RNF213 is a major susceptibility gene for MMD and p.Arg4810Lys (rs112735431) is the most common variant in East Asian MMD patients. Previous animal studies using RNF213 knockout mice suggested the potential role of the RNF213 abnormality in the development of pathological angiogenesis in chronic ischemia. They showed that angiogenesis was enhanced in mice lacking RNF213 after chronic hind-limb ischemia. We hypothesized that outcomes of indirect bypass surgery including encephaloduroarteriosynangiosis (EDAS) might be better in the pediatric MMD patients with RNF213 varient. Therefore, we investigated the clinical and angiographic outcomes in our cohort of pediatric MMD patients.
MATERIAL-METHODS:Between 2008 Jan and 2014 Jan, we included patients with MMD, probable MMD. The presence of genetic variant RNF213 was examined among them. We divided the patients into either ischemic or hemorrhagic groups according to the patients' clinical presentation and imaging findings. We compared the angiographic and clinical outomes following EDAS in those groups.
RESULTS:Our study analyzed a total number of 32 patients who underwent EDAS surgery. Among them, 9 patients were children and 23 patients were adults. Unfortunately, all of the pediatric patients treated with EDAS had the genetic variant RNF213 except one child and their initial clinical presentation was ischemic symptom. Diagnosis of the child without RNF213 was probable MMD. Among adult patients, better clinical and angiographic outcomes were found in ischemic group than hemorrhagic group.
CONCLUSIONS:All of the pediatric patients who underwent EDAS with definite MMD in our study had a variant in RNF213. Among adult patients, better clinical and angiographic outcomes were found in ischemic group than hemorrhagic group whether they had a genetic variant in RNF213 or not.

PF-100

Infection

Development of a rapid complement-based diagnostic test for shunt infection and meningitis

James M Johnston[1], Theresa N Ramos[2], Anastasia A Arynchyna[1], Tessa E Blackburn[2], Jeffrey P Blount[1], Brandon G Rocque[1], Curtis J Rozzelle[1], Scott R Barnum[2]
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[2]Department of Microbiology, University of Alabama at Birmingham, USA

OBJECTIVE:Children with cerebrospinal fluid (CSF) shunts frequently develop shunt failure and/or infection. Shunt infection requires rapid diagnosis; however, traditional laboratory methods and microbiological culture are time consuming and expensive, with imperfect sensitivity and specificity. In this study, we hypothesized that soluble membrane attack complex (sMAC), a multimeric component of the terminal complement pathway, would be a sensitive and specific biomarker of shunt infection.
MATERIAL-METHODS:CSF samples were assayed for sMAC by ELISA in 246 consecutive patients with suspected shunt failure or infection. CSF was obtained at the time of initial evaluation with shunt tap or surgical intervention. Statistical analysis was performed to assess the diagnostic potential of sMAC in pyogenic bacterial infected versus non-infected patients.
RESULTS:Children with pyogenic shunt infection had significantly increased sMAC levels in CSF compared with noninfected patients (3,211 ± 1,111 ng/ml vs. 26 ± 3.8 ng/ml, P = 0.0001). Using an sMAC cutoff level of 43ng/ml, the test had 93% sensitivity and 86% specificity for diagnosis of pyogenic shunt infection, with receiver

operator characteristic (ROC) area under the curve (AUC) of 0.966, (95% CI 0.934-0.99). In infected patients undergoing serial CSF draws, sMAC levels were also prognostic for both positive and negative clinical outcomes. Of note, children with delayed, broth-only growth of commensal organisms (P. acnes, S. epidermidis, etc.) had the lowest sMAC levels (7.96 ± 1.7 ng/ml).
CONCLUSIONS:Elevated CSF sMAC levels are both sensitive and specific for pyogenic shunt infection and may serve as a useful prognostic biomarker during recovery from infection. sMAC is not elevated in cases of infection with commensal organisms, suggesting either contamination or suppressed immunologic response. Current work includes development, manufacture and validation of an inexpensive, thermostable, commercially available sMAC-based lateral flow assay for bedside diagnosis of pyogenic shunt infection and non-shunt-associated meningitis in both developed and developing health care systems.

PF-101

Spine

Management of paediatric cervical spine pathology using posted screws – A useful alternative to conventional cervical fusion instrumentation

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OBJECTIVE:Paediatric cervical spinal pathologies requiring instrumented fusion are often challenging cases. The variation in pathology, anatomy and the frequent requirement for multiple surgeries over a number of years can prove surgically complex. Often, conventional fusion technologies are smaller versions of instrumentation used in adult practice, bringing with them their own issues, which can further complicate the management.
Here we present some examples of recent cases, the challenges they presented and our experience with newer posted screw technologies.
MATERIAL-METHODS:We reviewed cases of occipito-cervical / cervical / cervico-thoracic fusion undertaken at Alder Hey Children's Hospital since 2013, using the Medtronic Vertex Select posted screw module.
RESULTS:Since 2013, seven patients have been operated on utilising the Medtronic Vertex Select posted screw module for fusion surgery. Of these, six patients underwent occipito-cervical fusion and one patient required fusion from C5 – T2. Three of these cases were revisional surgeries, which had previously undergone fusion surgery with conventional 'tulip' head screw technologies.
The pathologies treated included: Down's Syndrome (with associated cranio-cervical junction instability); Grisel's Syndrome; trauma and intradural pathology. The patients ranged in age from 8 to 15 years old, with a female-to-male ratio of 5:2. All of the patients had at least one year's follow-up and to date, none have undergone further related surgery.
CONCLUSIONS:The management of paediatric cervical spine pathology requiring stabilisation/fixation is complex. Surgery in this group of patients is challenging and can be associated with significant morbidity. Conventional 'tulip' screw systems, whilst representing the industry standard, can be associated with technical challenges, particularly related to the size of the 'tulip' itself. Posted screw systems represent an evolving newer technology, which can help overcome some of the challenges presented by conventional systems, especially with respect to the size of the screw head.

PF-103

Other

The individuality of intracranial arachnoid cysts in children – a single institute analysis

Martina Messing Jünger[1], Andreas Röhrig[1], Sandra Kunze[1], Elke Januschek[2]
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[2]Sana Klinikum Offenbach GmbH, Neurosurgical Department, Germany

OBJECTIVE:Intracranial arachnoid cysts are benign space-occupying lesions, which may be symptomatic with increased size. The prevalence in children is 2.6% with a predominance in males and localization in the left temporal fossa (Al-Holou et al, 2010). The aim of this study was to analyse children with intracranial arachnoid cyst regarding size, location, symptoms, revision rates and underlying causes.
MATERIAL-METHODS:The authors retrospectively evaluated all consecutive patients with intracranial arachnoid cyst treated by surgery between 1/2009 and 12/2015 in a children`s hospital. Children, who were previously operated in another institution were excluded.
RESULTS:45 children (34 males, 11 females) were included. In 35.6% (n=16) the arachnoid cyst was located in the temporal fossa. Other locations were posterior fossa (10), suprasellar (8), interhemispheric fissure (5), intraventricular (2), quadrigeminal cistern (2), convexity (1) and bihemispherical (2). 27 cases were increasing in size. Most children presented with macrocephaly (58%) and hydrocephalus. 2 children had 8th nerve deficits. Initially we performed microsurgical (21) or endoscopic (17) fenestration, primary shunt insertion or endoscopic fenestration with shunt insertion werde performed in 3 patients each. Endoscopic fenestration and stent implantation was carried out in one. Secondary shunt implantation became necessary due to persistent hydrocephalus in 5 endoscopic and 2 microsurgical fenestrations. In each group one re-fenestration was performed. Only one CSF fistula without infection occured. The follow up period ranges from 3 to 83 month.
CONCLUSIONS:Only symptomatic arachnoid cysts should been treated. Management should be individualized depending on cyst location. Temporal as well as posterior fossa cysts are probably best treated with microsurgical fenestration. Revision rate is higher in the endoscopic group, however, a re-do is possible without additional risks. In case of insufficient CSF resorption ventriculo- or cystoperitoneal shunting becomes necessary, but should be avoided as primary method.

PF-104

Spine

Spinal Stenotic Compression In Young Achondroplasia Children - First Report Of Treatment With Augmentation Laminoplasty

Naomi Slator, Oluwafikayo Fayeye, Guirish A Solanki
Department of Neurosurgery, Birmingham Childrens Hospital, Birmingham, UK

OBJECTIVE:Achondroplasia typically results in compressive spinal canal stenosis in 1/3 of children, but rare under 15 years. Laminectomy is the mainstay of treatment, but destabilisation requiring complex fixation is common.

Laminoplasty is widely used in paediatric practice for treatment of compressive myelopathy. There are no reports of its use in the management of paediatric achondroplasia.
We report our experience of eight augmentation laminoplasties in five children with canal stenosis secondary to achondroplasia with up to 7 years post-operative follow up.
MATERIAL-METHODS:Retrospective analysis of electronic records and radiology database between 2010 and 2017 was performed. Eight augmentation laminoplasty procedures were performed in five children. Ages ranged from 5-14 (10) years. F:M ratio 3:2. All children underwent regular follow-up, with clinical and radiological monitoring (specifically looking for kyphotic deformity, construct integrity, re-stenosis). We evaluated interpedicular distance, central and lateral stenosis and canal dimensions.
RESULTS:Presentation was either acute cauda equina compression with sphincteric dysfunction, neurogenic claudication or radiculopathy.
Following the initial 5 augmentation laminoplasties 4 remained stable. One showed screw loosening with laminoplasty sump; concomitant disease progression necessitated revision laminoplasty with extension to L4. Additional imaging did not show progression at 32 months. Laminoplasties were performed at two other sites for disease progression in another child.
All patients improved symptomatically with reversal of neurology at the time of most recent follow up. All postoperative imaging showed good decompression. Spinal canal augmentation was maintained. No patient developed new or progressive angulation.
CONCLUSIONS:Regular construct and deformity monitoring is essential. Construct failure may require revision laminoplasty. Cervical and thoraco-lumbar augmentation laminoplasties were effective in decompression of acute cauda equina and cervical compression without skeletal instability or deformity development over 5 years. Augmentation laminoplasty eliminates instability/deformity (as with post-laminectomy), avoiding subsequent multi-level fixation. We emphasise the small nature of this initial series and longer term follow-up is ongoing.

FLASH PRESENTATIONS

Monday, 9 October 2017
12:04 – 12:16

Flash Presentations: Epilepsy / SDR

FL-001

Special topic: Epilepsy

Surgical resection of Hypothalamic Hamartoma using intraoperative MRI

Libby Van Tonder[1], Sasha Burn[1], Jo Blair[1], Mohammed Didi[1], Andrea Mcclaren[1], Timothy Martland[3], Mike Carter[2], Conor Mallucci[1]
[1]Alder HeyChildren's NHS Foundation Trust
[2]Bristol Royal Hospital for Children
[3]Royal Manchester Children's Hospital

OBJECTIVE:Hypothalamic hamartomas are rare non-neoplastic lesions which cause severe refractory epilepsy with associated behavioural, psychiatric and endocrine issues. The development of new minimally invasive techniques for the treatment of HH presents the need to reappraise the effectiveness and safety of each approach.
We review the outcomes of HH patients treated surgically, utilising intraoperative MRI, by a team of Alder Hey NHS Foundation Trust tumour and epilepsy neurosurgeons since 2011.
MATERIAL-METHODS:Patient records of all HH cases operated on since 2011 were reviewed to confirm history of presentation and clinical outcomes.
RESULTS:10 patients have undergone surgery for HH under the dual care of Alder Hey tumour and epilepsy neurosurgeons during this period. 8 cases had a midline transcallosal, interforniceal approach with the remaining 2 having a transcallosal, transforaminal approach. All patients had an IOMRI scan, with 40% needing further tumour resection post IOMRI. 40% had a total resection, 3 patients had near total resection and 3 patients had subtotal resection (~30% tumour residual on postoperative MRI).
No new neurological complications developed post operatively. Hypothalamic axis derangements were seen in 3 cases, including 1 diabetes insipidus with hypocortisolaemia, 1 hypodipsia and 1 transient hyperphagia.
80% are seizure free, the remaining 2 patients have had significant improvements in seizure frequency.
CONCLUSIONS:IOMR was used to tailor the ideal tumour resection volume safely based on anatomy of the lesion, which combined with the open transcallosal, interforniceal route performed by surgeons experienced in the approach resulted in excellent, safe and effective seizure control.

FL-002

Special topic: Epilepsy

Update of Surgical outcome in Infantile intractable Epilepsy

Ju Seong Kim[1], Seung Woo Park[2], Eun Kyung Park[1], Kyu Won Shim[1], Heung Dong Kim[3], Dong Seok Kim[1]
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[3]Department of Pediatric Neurology, Severance Children's Hospital, College of Medicine, Yonsei University, Seoul, Korea

OBJECTIVE:We already reported preliminary outcome of infantile epilepsy surgery in ISPN 2016. Major problem of early age intractable epilepsy is retardation of neurodevelopment. However, early removed or isolated the epileptogenic focus through early surgical intervention could be achieve good epilepsy control and correct the neurocognitive development.
MATERIAL-METHODS:This study was designed retrospective analysis for Infantile epilepsy patients (under age of 3) who underwent epilepsy surgery from 2006 to 2016 in Severance Children's Hospital. We have analyzed the neurocognitive development before and after surgery, as well as epilepsy surgical outcomes and complications.
RESULTS:Totally, 109 patients underwent epilepsy surgery. (Corpus callosotomy; 33, Resective surgery; 48, Hemispherotomy; 22, Posterior quadrantectomy; 3, Endoscopic hamartoma disconnection; 1, Resective surgery due to lateralization after callosotomy; 2) 78% of patient achieved seizure free. And among the patient except callosotomy, it showed a successful seizure control rate (>90% reduction) at 98%. In addition, neurocognitive outcomes were could not reach the standard development

of the same age groups but it could be confirmed the inner personal development.
CONCLUSIONS:Epilepsy surgery in infant is difficult and dangerous procedure, but it could help to achieve the excellent outcome of epilepsy and proper development of neurocognitive functions.

FL-003

Special topic: Epilepsy

Pediatric Tumoral Epilepsy Surgery in a single medical center

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Division of Pediatric Neurosurgery, Taipei Veterans General Hospital, Taipei, Taiwan

OBJECTIVE:To review the clinical and neurophysiologic features and surgical outcome in pediatric patients with intractable tumoral epilepsy.
MATERIAL-METHODS:Patients with drug-resistant epilepsy who underwent resection of brain tumors, confirmed by surgical pathology, seen between 2011 and 2017 at Taipei Veterans General Hospital Pediatric Epilepsy Center, were selected. Medical records were reviewed for age at diagnosis, age at onset of seizures, delay between seizure onset and tumor diagnosis, types and frequencies of seizures, EEG results, use of anticonvulsants, extent of surgery, and pathologic diagnosis.
RESULTS:Twenty patients were identified, 90% of them with low-grade tumors. Complex partial seizure was the most common seizure type. All patients underwent at least one surgical procedure with average follow-up of 2 years after surgical intervention. 90 percent of patients had significant postoperative seizure improvement (Engel's classes I and II). Gross total tumor resection predicted postoperative seizure freedom ($p < 0.05$).
CONCLUSIONS:Long-term follow-up of patients with intractable tumoral epilepsy in children suggests good response of seizures to surgery, which is unrelated to age at diagnosis, EEG, or pathology. Extent of tumor resection was significantly predictive of outcome, whereas early intervention showed good quality of life with discontinued anticonvulsants.

Monday, 9 October 2017
14:00 – 15:30

Parallel Session: Craniofacial

FL-004

Craniofacial

Variant of front-orbital advancement before hypertelorism correction

Eric Arnaud, Djamila Benderbous, Giovanna Paternoster, Syril James, Estelle Vergnaud, Michel Zerah
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OBJECTIVE:Boxshift osteotomy is commonly used around 4 years of age to correct an hypertelorism when the occlusion is normal. In case of an associated craniosynostosis, the Marchac two stage strategy with the initial correction of craniosynostosis before one year of age and secondarily box shift is recommended.
MATERIAL-METHODS:Five children with frontocranionasal dysplasia (a rare condition linked to chromosome X which combines a bicoronal dysostosis and an increase distance between the bony orbits) were treated in a two stage strategy. All children underwent a fronto orbital advancement before one year of age.
In order to prepare the boxshift, a modified cut of the osteotomy is designed at the time of the FOA. In both lateral upper part of the bandeau, a slight triangular shape was integrated, corresponding to the mirror design in the inferior lateral part of the forehead. This modification was carried out with resorbable fixation.
RESULTS:In all patients there was no defect in reossification in the triangular part, allowing for a simpler procedure at the time of boxshift medialization. When the boxshift has been carried out, the Marchac technique of conservation of lateral spurs allow the avoidance of the supraorbital bar, making the procedure simpler.
CONCLUSIONS:This variation emphasizes the two stage strategy of treatment in cranio-fronto-nasal dysplasia:
1) modified FOA before age 1
2) Boxshift osteotomy around 4 years of age (when occlusion is normal)

FL-005

Craniofacial

Examining the Need for Routine Intensive Care Admission after Surgical Repair of Single Suture or Nonsyndromic Craniosynostosis

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OBJECTIVE:At BC Children's Hospital (BCCH), pediatric patients with single suture or nonsyndromic craniosynostosis are routinely admitted post operatively directly to a standard surgical ward after craniosynostosis surgery. The purpose of this study was to investigate the safety of admitting these patients directly to the ward and to examine the rate at which patients were subsequently transferred to higher level of care (ICU), the events that led to the transfer, and any characteristics of the patient that might place the patient at higher risk for needing ICU care.
MATERIAL-METHODS:This study retrospective reviews medical records of pediatric patients who underwent single suture or nonsyndromic craniosynostosis repair, including extended strip craniectomy, fronto-orbital advancement, and cranial vault remodeling, from 2011-2016 at BCCH. Location of admission from the operating room (ward/ICU) and transfer to the ICU from the ward were evaluated. Patient and operative factors were recorded and analyzed.
RESULTS:One hundred fourteen patients had surgery for single suture or nonsyndromic craniosynostosis. Eighty were open procedures (cranial vault reconstruction, fronto-orbital advancement, extended strip craniectomy) and 34 were minimally invasive endoscopic assisted craniectomy (EAC). Sutures affected were: sagittal 66 (32 open, 34 EAC), coronal 20 (15 unilateral, 5 bilateral), metopic 23, and multisuture 5. Only 7 patients (6%; 5 open, 2 EAC) were initially admitted to the ICU from the operating room, most commonly for: elevated pre-operative intracranial pressure, lack of ward bed, older patients with large reconstructions, or significant medical comorbidity. Of the 107 patients (75 open, 32 EAC) admitted directly to the ward postoperatively, none required transfer to the ICU.

CONCLUSIONS:Unless there are significant co-morbidities, patients with single suture or nonsyndromic craniosynostosis can be managed safely on the ward, and do not require routine admission to the ICU after surgery. This could potentially result in significant cost savings and more efficient ICU resource utilization.

FL-006

Craniofacial

Evolution of the transfusion rates in the surgical correction of trigonocephaly

Federico Di Rocco[1], Marie Manfiotto[1], François Pierrick Desgranges[2], Sylvie Combet[2], Pierre Aurélien Beuriat[1], Alexandru Szathmari[1], Carmine Mottolese[1]
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[2]Departement of Pediatric Anesthesia, Hopital Femme Mère Enfant

OBJECTIVE:Transfusion rates in craniofacial surgery vary greatly according to the different type of synostosis, surgical techniques and transfusion protocols. To try and assess these latter variations we studied the transfusion rates in our institution in trigonocephalic children operated on with the same technique in 3 different period of time.
MATERIAL-METHODS:Charts of children operated on for a trigonocephaly between November 2006 and March 2008 (Group 2006), November 2010 and March 2012 (Group 2010), November 2015 and March 2017 (Group 2015) were reviewed for peri or post-operative transfusions.
RESULTS:During these 3 periods, 52 children were operated on (Group 2006: 17 children, 13 boys mean age 14 months; Group 2010: 17 children, 10 boys mean age 10.7 months; Group 2015: 18 children, 15 boys mean age 10.5 months). Since 2012,Epo and Exacyl are used routinely as preoperative adjuvant techniques to prepare the child for the craniofacial surgery. In all cases the supraorbital bandeau and the forehead were removed,remodeled and fixed with resorbable plates. Particular care was given to the specific anterior parasagittal emissary veins from the sagittal sinus for hemostasis control.
Forty-four children were transfused either during surgery or in the first days after surgery. Ttransfusion's rates were: 2006: 70%, 2010: 100%; 2015: 83%. No complications directly related to the transfusions were recorded.
CONCLUSIONS:The changes in transfusion rates found in the present study that focuses on only one type of synostosis and one surgical technique reflect not only the modification in the age of patients (younger children at surgery in the recent years due to an earlier referral), but also to the modifications of transfusion protocols following a general trend in craniofacial surgery. The introduction of adjunctive treatments such as EPo and Exacyl has helped to reduce the need of transfusion of blood derived products during craniofacial procedures.

FL-007

Craniofacial

Cranioplasty With Autologous Bone Graft in Children

Hamilton Matushita, Daniel Dante Cardeal, Fernanda Gonçalves Andrade, Manoel Jacobsen Teixeira
Department of Neurosurgery - São Paulo University

OBJECTIVE:The autologous bone flap is the most physiologic approach to perform a cranioplasty, mainly in children. Autologous bone is the cheapest and most suitable material for use in children, because it grows with the skull. Unfortunately, it requires a further surgical incision and it may be associated with high incidence of bone resorption. The purpose of this study is to evaluate complications related to donor sites and resorption of the fresh bone autograft taken from rib and calvaria, in children.
MATERIAL-METHODS:In the past 16 years, twenty-eight children between the ages of 7 months and14 years underwent the repair of large skull defects using autologous bone, harvested from rib and calvaria at the time of surgery. After cranioplasty, we monitored resorption of the bone flaps with computed tomography, evaluated the clinical and aesthetic results, and complications related to donor site. Follow-up period ranged from 7 to 82 months (mean, 50 months).
RESULTS:The bone flap was taken from the skull in all children, and additionally from the rib in 10 children. Etiology of skull defects was: trauma 15, tumor10, and congenital 3. The site of skull defects was: parietal (uni or bilateral) 9, fronto-parietal 5, fronto-temporo-parietal 5, frontal (uni or bilateral) 3, parieto-occipital 2, parieto-temporal 2, and fronto-orbital 2. The defect surface area ranged from 3,4 cm2 to 189,2 cm2 (mean area = 50,1cm2). Bone resorption was identified in the follow ct scan in 2 (15%) patients, but clinical and aesthetic results were considered highly satisfactory. Related to donor site, all patients complained of posterior thoracic pain, however, transiently.
CONCLUSIONS:The process of autogenic skull repair using fresh bone autografts, taken from the cranium and ribs offer excellent outcome with low rate of absorption, and complications. We recommend performing this technique as the first option in children.

FL-008

Craniofacial

A novel minimally-invasive procedure for the correction of sagittal craniosynostosis that does not require endoscopy or post-operative helmet use: technique and results

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OBJECTIVE:We present the results of a series of 28 patients who underwent a novel minimally-invasive calvarial vault remodeling procedure for sagittal craniosynostosis which does not require endoscopy or postoperative helmet use.
MATERIAL-METHODS:This novel procedure will be illustrated. It involves three small incisions and extensive osteotomies using only bone scissors. Results of an early (n=18) and later (n=10) series of patients will be presented qualitatively and quantitatively.
RESULTS:At a mean of 20 months follow-up, results are reported for the early series cohort versus the later series cohort:
1. There were no major perioperative morbidities or mortalities.
2. The sole complication was a superficial scalp infection in the early cohort.
3. The cephalic index improved to normal in all patients (0.79 early, 0.89 later) with marked immediate and sustained improvement in occipital and parietal deformities. Frontal deformities passively improved over time.
4. Mean operative time decreased from 111 minutes to 91 minutes.
5. Mean hospital stay was equal at two days, including the day of surgery.
6. Estimated blood loss decreased from 101 to 48 cc.

7. Transfusion rate was stable at 80% with mean volume decreasing from 20 to 6 ml/kg. We believe the rate of transfusion was excessive, due to anesthesiologists' anxiety and difficulty estimating blood loss.
8. Mean age at time of operation increased slightly from 2.3 to 2.9 months. Maximal patient age was 4.5 months; the bone cut easily with scissors and EBL was minimal.
CONCLUSIONS:This novel minimally-invasive calvarial vault remodeling procedure is safe and highly effective for the surgical management of sagittal craniosynostosis in the young infant. This technique obviates the need for an endoscope and expensive surgical equipment. Deformity correction is immediate and sustained, without the need for post-operative helmet use. This technique should enjoy wide application across the globe.

FL-009

Craniofacial

Sagittal Craniectomy with Biparietal Morcellation for Scaphocephaly: 3D Photography Analysis of Results

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OBJECTIVE:There is no clear consensus on surgical treatment for scaphocephaly. In this study, we evaluate the cephalometric outcomes of children who have undergone sagittal craniectomy with biparietal morcellation, the standard surgery for scaphocephaly at Children's Hospital Colorado.
MATERIAL-METHODS:Inclusion criteria were 1) isolated non-syndromic sagittal craniosynostosis, 2) sagittal craniectomy with biparietal morcellation performed February 2013 through February 2016, and 3) complete records, including pre- and postoperative 3D photography. Cephalic index (CI) was calculated using 3D photography. Demographic and clinical characteristics were compared between two age groups, < 6 months old at the time of surgery and >= 6 months. Statistical analysis was used to test the interaction between age at surgery and change in CI.
RESULTS:There were a total of 70 subjects, 46 < 6 months old at the time of surgery and 24 >= 6 months old. The two age groups were similar in terms of preoperative CI.
In subjects who were < 6 months old at the time of surgery the CI increased an average of 8 percentile points between the pre-op and last post-op value, whereas in subjects who were >= 6 months the CI increased by an average of 4 ($p < 0.001$). 87% of subjects who were < 6 months old at the time of surgery and 75% of those who were >= 6 months achieved a normal CI (>= 75).
Subjects who were younger than 6 months of age tended to undergo the standard operation, whereas subjects older than 6 months were more likely to also undergo frontal bone remodeling.
CONCLUSIONS:Sagittal craniectomy with biparietal morcellation is an effective surgical treatment for infants with scaphocephaly. It leads to a significant increase in cephalic index, although this effect is less in subjects who undergo surgery at >= 6 months of age, even with frontal bone remodeling.

FL-010

Craniofacial

Computer-assisted quantification of the skull deformity for craniosynostosis from 3D head CT images using morphological descriptor and hierarchical classification

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OBJECTIVE:To propose the automatic diagnosis and reliable quantitative analysis of the degree of the skull deformity.
MATERIAL-METHODS:33 normal subjects, 23 deformity subjects with sagittal synostosis(SS), 16 deformity subjects with bicoronal synostosis(UCS), 9 deformity subjects with UCS and 9 deformity subjects with unilambdoid synostosis(ULS) were enrolled. 3D mean normal skull models are generated and the mean normal skull model is deformed to deformity skull by using multi-level three-stage registration. In first stage, point registration is performed. In second stage, alternate surface and point registrations are repeatedly performed. In third stage, to estimate the degree of local deformation of mean normal surface model against the deformity surface model, multi-level deformable registration based on B-spline is performed. To extract the features using calculated deformation in each cranial bone, the two local distance indices and two local ratio indices are calculated as the degree and distribution of expansion and reduction between corresponding cranial bones patches of deformity surface model and mean normal surface model. In classification, hierarchical SVM classifier is proposed.
RESULTS:Total accuracy was estimated to be 93.3%, shown a greatly increase of 45.8% compared with traditional cranial index. The sensitivity and specificity of normal subject were estimated to be 75.6% and 78.9% due to the lack of consideration of difference between mild deformity subject and normal subject, but the sensitivity and specificity of normal subject were estimated to be 93.9% and 91.2%. Using 3D morphological features, specificity of UCS and sensitivities of UCS and ULS were estimated to be 97.3%, 100% and 96.7%.
CONCLUSIONS:We proposed an automatic diagnosis and reliable quantitative analysis of the degree of the skull deformity using morphological descriptor and hierarchical classification. Our method can be used for the early diagnosis, surgical planning and post-surgical assessment as well as quantitative analysis of skull deformity.

FL-011

Craniofacial

Biparietal Meander Expansion Technique: A Surgical Option for the Treatment of Sagittal Synostosis at an Age >1 year

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OBJECTIVE:Sagittal suture synostosis (SSS) is the most common form of craniosynostosis. For older patients no surgical strategy has become a standard. In this cohort we have operated SSS patients with biparietal meander expansion technique. The aim of this study is to introduce the new surgical technique and report about satisfaction of parents of patients after surgery.
MATERIAL-METHODS:The biparietal meander expansion (BME) technique incorporates bilateral serpentine craniotomies and fixation of the consecutive bone tongues by biparietal expansion. In this retrospective study, 16 patients (12m/4f; 14months – 31years) older than 12 months of age with isolated sagittal craniosynostosis were evaluated after BME. We reviewed data including operative time, blood loss and average length of hospital and ICU stay. Phone interviews with caretakers or patients (12 patients, 9m/3w) were performed to evaluate satisfaction after surgical treatment.
RESULTS:The average length of operation was 181 min (Median 171.5 min, range 128-294 min). The overall level of postoperative satisfaction was very high. The aesthetic appearance is experienced much less obvious compared to the appearance before the operation. All parents evaluated that the head shape of children are either 'better' (58%) or 'much better' (42%) than preoperative head shape. 67% of parents answered that their children have no functional limitation in their daily activities at all. Above all 92% of them answered that they would choose this operation again if they could.
CONCLUSIONS:BME is feasible for older SSS patients enabling immediate stability of the reconstructed calvarium. The survey of caregivers or patients showed a favourable outcome in the surgical treatment of SSS in a more complex condition of an older patient cohort.

Monday, 9 October 2017
14:00 – 15:30

Parallel Session: Vascular

FL-013

Vascular

Integrative management of pediatric cerebral AVMs

Ali S Haider[1], Ibrahim Jalloh[1], William Lo[1], Nessa Timoney[1], Eisha Christian[1], Prakash Muthusami[2], Manohar Shroff[2], Timo Krings[3], Vitor Pereira[3], Michael Schwartz[4], Douglas Cochrane[1], James T Rutka[1], James Drake[1], Abhaya V Kulkarni[1], Peter Dirks[1]
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[4]Division of Neurosurgery, Sunnybrook Health Sciences Centre, Toronto, Canada

OBJECTIVE:Intervention with the aim of obliteration is recommended for most cerebral AVMs in children. Embolization and radiosurgery (SRS) are less likely to achieve cure with a single treatment compared to microsurgery. Whether the use of multiple interventions to cure AVMs negatively impacts outcome is debated.
MATERIAL-METHODS:An analysis of data collected retrospectively from consecutive pediatric patients presenting with an AVM between 2002 and 2012.
RESULTS:83 children (37F; 46M) aged 2 – 17 years. 66/83 (80%) presented with hemorrhage, 41 of whom required urgent craniotomy and/or EVD. Overall, 36 (43%) required more than one treatment to achieve AVM obliteration including several children with AVM recurrence on delayed angiography. 47 children (57%) underwent microsurgical resection 14 of whom underwent adjuvant embolization. 5 children underwent multiple embolizations and 11 children required both embolization and SRS.
Overall, 53/77 (69%) had a good outcome (mRS 0 or 1). 4 children died (5%) as a result of their presenting hemorrhage. 27/45 (60%) of those who required a single treatment for AVM obliteration had a good outcome (mRS 0 or 1) versus 26/32 (81%) of those who required multiple treatments (p=NS).
CONCLUSIONS:Microsurgical resection is most likely to achieve AVM cure. Embolization and SRS are more likely than surgery to require multiple treatments but still produce good outcomes in select patients. A multidisciplinary approach is essential for the management of AVMs in children. Angiographic follow-up of AVMs is recommended due to risk of recurrence in children.

FL-014

Vascular

Arteriovenous malformation treatment outcomes in the UK North West Paediatric Neurosurgery Network

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[1]Alder HeyChildren's NHS Foundation Trust
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OBJECTIVE:Arteriovenous malformations (AVM) are rare congenital vascular lesions caused by the abnormal development of blood vessels within the brain. The commonest presentation is haemorrhage, regardless of age, but up to 85% of children present with a bleed with an associated mortality of 25% The use of the three treatment modalities (microsurgical resection, endovascular embolization and stereotactic radiosurgery) currently varies between treatment centres in the UK. We examined the outcomes of paediatric AVMs in the North West paediatric neurosurgical network with respect to the treatment modality employed.
MATERIAL-METHODS:A review of all neurovascular activity was undertaken in December 2015 which identified the cohort of AVM patients under the care of neurosurgeons in the North West of England. A retrospective patient case note review was then undertaken.
RESULTS:31 patients in Alder Hey and 26 patients in Manchester Children's Hospital presented for care within the North West Paediatric Neurosurgery Network between 2007 and 2015. Patients were twice as likely to have surgical management of their AVM in Manchester. No patient re-bled whilst awaiting SRS.
CONCLUSIONS:Treatment modality preference for the management of AVM varies even within the North West Paediatric Neurosurgery Network, we examine the outcomes of those treatments.

Monday, 9 October 2017
17:48 – 18:15

Flash Presentations: Hydrocephalus

FL-015

Hydrocephalus

Ventriculomegaly associated to congenital zika syndrome: does shunting improve clinical features?

Eduardo Jucá[1], Rafaela Menezes[2], Thayse Figueiredo[2], Erlane Ribeiro[2], Luciano Pamplona[2], André Pessoa[3], Saile Kerbage[3]
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OBJECTIVE:Congenital Zika Syndrome (CZS) is a new entity, with few information about its course and natural history. It is known that prenatal infection by zyka virus is associated to disrupted nervous system development, leading to typical neurological disabilities and deformities. Some children from the initial CZS 2015 cohort in Brazil are presenting progressive ventriculomegaly associated to aggravation of seizures and neurological impairment. Aim of this study is to evaluate the development of hydrocephalus and the impact of ventriculoperitoneal shunt insertion in the clinical condition of these children.
MATERIAL-METHODS:Data was obtained from charts review, direct interviews with patient's parents, direct neurological examination and analysis of pre and post-op neuroimages.
RESULTS:A group of 110 patients had a CZS diagnosis since july 2015. Among them, 21 patients had remarkable ventricles enlargement noted on follow up CT scans. Three boys and two girls were operated for a VP shunt insertion between november 2016 and february 2017. Age of these operated patients ranged from 8 to 14 months. All five patients had clinical improvement after ventriculoperitoneal shunt implantation. Parents reported amelioration concerning waking time during the day and better eye contact. Overall improvement was noted regarding seizures, with remarkable diminution of daily episodes. Regarding neurological examination, patients presented less spasticity and more cervical control post-operatively. There were no clinical or image based shunt complications. In two out of five cases, a slight increase in parenchymal lenght could be noted in the CT scans.
CONCLUSIONS:This series point out the possibility of hypertensive hidrocephalus development in CZS patients after the first year of life. Affected children may benefit from ventriculoperitoneal shunt implantation. These findings suggest a dual pathology association: brain parenchyma damage by the virus itself and hypertensive hydrocephalus, as already seen in some cases of congenital rubella, toxoplasmosis or cytomelovirus associated hydrocephalus.

FL-016

Hydrocephalus

Neural Tube Defect (NTD) & Hydrocephalus Surveillance: Scenario In Dhaka, Bangladesh, Tip Of The Iceberg

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OBJECTIVE:Neural tube defect (NTD) and hydrocephalus both are severe congenital malformations and rank amongst the most common birth defect throughout the world. Although it is an alarming problem in developing country like Bangladesh, unfortunately the number of studies is too scanty. Therefore the present study is to observe the different presentation of NTD and hydrocephalus and their treatment outcome.
MATERIAL-METHODS:This retrospective study includes total 3221pts of NTD and hydrocephalus treated by Paediatric surgeons in BSMMU and different Private Hospitals of Dhaka city during January'1997 to December'2016. Although the real number of cases is sky high this only shows the tip of the iceberg.
RESULTS:Among 3221 patients, 2863 (88.9%) were NTDs and 358 (11.1%) were hydrocephalus. Age ranges from 1 day to 2 years, male predominance. Among 2863NTDs, 2767 (85.9%) had spina bifida cystica and 454 (14.1%) were occulta. Repair of the defect with insertion of V-P shunt was preferred operation. Only 148 (4.6%) treated conservatively without V-P shunt and currently stable. Out of 358 hydrocephalus patients, 340 (95%) were obstructive and 18 (5%) were communicating variety. V-P shunt insertion was done in 338 (93.6%) patients and 20 patients having mild ventricular dilatation are under close follow-up. Out of 3221patients, 112 (3.5%) died after operation. Among rest 3109 patients, only 2045 (66%) were in follow-up. 552 (26.9%) are well, 1026 (50%) having some complication and 474 (23.1%)pts suffering from severe morbidity like lower limb paralysis, urinary & faecal incontinence and tropic ulcer at back. Many of incontenant patients are further treated with Mitrofanoff and augmentation cystoplasty.
CONCLUSIONS:Being Champion in MDG with significant achievement in all health indicators, still the incidence of NTDs is much higher in Bangladesh. Progress in the clinical treatment of NTDs, research on pathogenesis, and integrated approaches by the government, NGOs and social workers is required for better service and rehabilitation of these children and to open new avenues to fight these challenges.

FL-017

Hydrocephalus

Comparison of the position of ventricular catheter in freehand technique vs. ultrasound guided technique in infantile hydrocephalus

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OBJECTIVE:Hydrocephalus among infants is a common problem to neurosurgeons. They are managed with ventriculo-peritoneal shunts by most neurosurgeons. The use of adjuvants in shunting like ultrasound may help improve the accuracy of catheter placement when compared to blind placement by free-hand technique. The usefulness of this adjuvant technology in shunting and its role on shunt survival is not well established because of alteration of position of catheter post shunting. This study analyses the role of ultrasound in accuracy of catheter placement in comparison with free-hand shunting.
MATERIAL-METHODS:This study is a Prospective randomized control study (2014-2016). Surgery will be performed either based on free hand technique or ultrasound guided technique. Post operative a CT scan will be taken to assess the position of the catheter. Various factors which could be responsible for change in catheter position were assessed (ventricle size; age of infant; role of anchoring; head position). Patient will be

followed for duration of minimum one year noting for any complication during this period.
RESULTS:Total of 39 infants were included. 23 of them were shunted by free-hand technique; 16 of them were Ultrasound guided. Accuracy rate with free hand technique was 26.1% and with ultrasound guidance was 62.5% (p – 0.0456). In 62.5% of the ultrasound guided shunting change in catheter position could be noted post operative period. None of the evaluated factors were significantly associated with alteration in catheter position.
CONCLUSIONS:Ultrasound guided shunting of infantile hydrocephalus is helpful in improving the accuracy of catheter placement though its conversion into shunt survival remains unproven. There are unknown factors which alter the final position of catheter after placement. We believe the stiffness of the catheter could have a major influence.

FL-018

Hydrocephalus

Endoscopic surgery for intraventricular arachnoid cysts in children: clinical presentation, radiological features, management and outcomes over a twelve-year period

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OBJECTIVE:Less than 0.5% of arachnoid cysts are intraventricular in origin. We review our experience with intraventricular arachnoid cysts in children with endoscopic surgery over 12 years.
MATERIAL-METHODS:Retrospective review of intraventricular arachnoid cysts who underwent surgery between 2005 and 2016. Clinical notes and imaging were reviewed; data on demographics, presentation, cyst location, procedure(s) undertaken, and outcomes were collected.
RESULTS:Twenty-eight patients with endoscopically-treated intraventricular arachnoid cysts were identified (M:F = 16:12; median age: 1.52 years, range: 7 days-13 years). All had hydrocephalus at presentation, many had symptoms/signs of raised intracranial pressure, and five (18%) were asymptomatic. Concomitant structural neuroanatomical abnormalities were present in 10 (36%). Endoscopic cyst fenestration was combined with endoscopic third ventriculostomy (ETV) in 9 and septostomy in 2. Eight (29%) patients experienced transient and/or conservatively-managed complications. Further surgery was required in 11 (39%); this was non-significantly less likely when cyst fenestration was performed with ETV compared to cyst fenestration alone (18% vs. 53%, p=0.065). One (4%) patient died during follow-up, from unrelated pathology. After median follow-up of 65.3 months in survivors (range: 5.5-133.5 months), 23 (82%) cases were clinically and radiologically stable without a shunt in situ.
CONCLUSIONS:Intraventricular arachnoid cysts are associated with a high risk of hydrocephalus and raised intracranial pressure. Endoscopic fenestration is safe and effective in most cases, with an acceptable complication rate. Most remain shunt-independent. The addition of ETV at the time of cyst fenestration may reduce the likelihood of revisional surgery. Endoscopic surgery should be first-line therapy when considering intervention for symptomatic intraventricular arachnoid cysts and for those that are asymptomatic but increasing in size on serial imaging. Asymptomatic arachnoid cysts, particularly in children under four, should be monitored closely for enlargement.

FL-019

Hydrocephalus

The management of asymptomatic "hydrocephalus" in infancy

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University of Missouri Kansas City School of Medicine

OBJECTIVE:A survey of current practices in the management of asymptomatic hydrocephalus.
A review of the literature on the outcomes of shunting versus endoscopic third ventriculostomy.
Acknowledging parental preferences in elective surgery.
MATERIAL-METHODS:A survey of members of the American Society of Pediatric Neurosurgeons was carried out using the illustrative case of an infant with progressive ventriculomegaly secondary to aqueduct stenosis but normal developmental milestones and no symptoms. An electronic survey was circulated and the case presented and the audience response was captured electronically. The majority of the participants were board certified, experienced pediatric neurosurgeons. The results were analyzed for this study followed by a review of the literature on the advantages and disadvantages of the treatment options, including a note on parental participation in decision making.
RESULTS:There were a total of seventy-three respondents. The majority of the respondents 36 (49%) recommended performing endoscopic third ventriculostomy. Twenty seven physicians (37%) recommended simple observation with no surgical intervention at this time. Eight physicians (11%) recommended placing a ventriculoperitoneal shunt and two physicians (3%) recommended randomization in a clinical trial. The parents elected to have a ventriculoperitoneal shunt placed and the child is doing well 18 months after surgery with rapid growth in brain volume.
CONCLUSIONS:Although there is a clear preference for ETV over ventriculoperitoneal shunt placement amongst respondents, the literature supports a clinical equivalence with specific advantages for each procedure. Given the clinical equiopoise, should parents participate in the design of the next randomized trial?

FL-020

Hydrocephalus

Shunt-series x-rays in Paediatric Shunt Revision. How useful are they?

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Department of Paediatric Neurosurgery, Leeds General Infirmary, Leeds, UK.

OBJECTIVE:To investigate the role of shunt-series x-rays for the diagnosis of shunt dysfunction and post-operative assessment after paediatric shunt revision.
MATERIAL-METHODS:Retrospective cohort study of single institute experience of 50 consecutive paediatric patients who had shunt revision between 13th January 2014 and 17th September 2016.
Data collected included: patient demographics, hydrocephalus aetiology, shunt type, shunt-series x-ray frequency and indication (pre-& post-operative), and whether this changed patient

management. A shunt-series x-ray was defined as x-rays of the skull, chest and abdomen.
RESULTS:Fifty patients were included (23 male, 22 female), median age 9.5 years (range: 1 month – 17 years). Most were ventriculoperitoneal shunts (43 parietal, 6 frontal); with 1 parietal ventriculoatrial shunt.
The underlying aetiology of the hydrocephalus is included within the paper.
Reasons for shunt revision were: 22 proximal catheter block, 4 proximal catheter + valve block, 8 valve block, 4 distal catheter block / migration, 6 distal catheter fracture, 2 distal catheter disconnection, 2 distal catheter + valve block and 2 valve change for underdrainage / overdrainage.
A pre-operative shunt-series was performed in 25 patients (50%). Eight of these (32%) diagnosed shunt dysfunction (6 fracture, 2 disconnection).
A post-operative shunt-series was requested for 7 patients (14%). These were all requested to confirm the shunt position / continuity without a specific intra-operative concern being documented in the operation note. None of these patients required further surgery or change in their management.
CONCLUSIONS:In selected cases, a pre-operative shunt-series can be useful in diagnosis of shunt dysfunction. Our data suggests, however, that this could be a targeted x-ray of the head and cervical spine, to reduce radiation exposure.
After shunt revision, this study showed that routine shunt series x-rays are not useful.
We therefore recommend against performing routine post-operative shunt-series unless there is a specific clinical indication. In these circumstances, single body-region x-rays could be considered, to reduce radiation exposure.

FL-021

Hydrocephalus

The Alder Hey experience of Meithke valves for de novo ventriculoperitoneal shunts in the pediatric population

Libby Van Tonder, Dawn Williams, Benedetta Pettorini, Chris Parks, Sasha Burn, Ajay Sinha, Conor Mallucci
Alder HeyChildren's NHS Foundation Trust, Liverpool, United Kingdom

OBJECTIVE:Deciding which shunt valve to implant in Pediatric hydrocephalus presents a challenge due to physical growth, changing activities and individual CSF dynamics.
In Alder Hey Children's NHS Foundation Trust, Meithke valves are used for all de novo shunt surgery.
MATERIAL-METHODS:Between January 1st 2010 and December 31st 2015 data was collected prospectively by a nurse specialist in Alder Hey Children's NHS Foundation Trust paediatric neurosurgery department.
RESULTS:201 de novo Meithke valves were implanted. Average age was 2.6years (range 0-18.6, median age 0.37), 47% were female. 140 de novo Meithke valves inserted have not required revision.
The Kaplan-Meier rate of valve survival was 73.4% at 1 year and 70.8% at 5 years. Mean survival time was 4.3 years (range 3.9-4.6, 95% confidence interval).
56 patients required ≥1 shunt revision for any cause. 23 revisions were due to valve blockage/malfunction whilst only 1 had over drainage. 21 were revised due to confirmed/suspected infection. 9 cases had no reason for revision recorded.
CONCLUSIONS:While 1 year survival of shunts in this cohort is comparable to other series, long-term (5 year) survival of Meithke valve shunts appears to be superior to rates quoted of non-Meithke valve shunts (Kulkarni et al 2013, Kestle et al 2000).
Our series appears to support the case that gravitational valves overcome positional over drainage, with only 0.5% of patients requiring shunt revision due to over drainage.
Meithke valves appear to overcome the problem of over drainage, have excellent longevity and are well tolerated in the Pediatric population.

Tuesday, 10 October 2017
10:05 – 10:40

Flash Presentations: Dysraphism

FL-023

Dysraphism

The value of Intraoperative Neurophysiological Monitoring in spinal dysraphisms surgery: Toward zero morbidity

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OBJECTIVE:The aim of this prospective study is to describe the Intraoperative Neurophysiological Monitorning (IOM) multimodal approach technique used during the surgical untethering of children with closed spinal dysraphisms (CSD) and present our clinical experience.
MATERIAL-METHODS:Forty-three children (October 2013-October 2016) with a tethered cord secondary to a variety of CSD underwent untethering of the spinal cord under IOM. All procedures were performed by the same surgeon and the same neurophysiologists team. Eighteen patients had a spinal lipoma. The mean age was 5.5 years old (6 months -14 years). Twenty-three patients were male. IOM mapping of the conus-cauda region has been performed through direct stimulation of these structures and bilateral recording from segmental target muscles. Monitoring tecniques such as somatosensory evoked potentials (SEPs), transcranial motor-evoked potentials (MEPs) from the limb muscles and anal sphincters, and the bulbocavernosus reflex (BCR) were used to assess the functional integrity of the neural structures during the surgery.
RESULTS:The IOM was feasible in all cases. The monitorability rate was 91% for SEPs, 95% for limb muscles MEPs, 90% for anal sphincter MEPs and 55% for BCR. The untethering was achieved in all cases. At the last follow-up, in pre-operatively symptomatic patients surgery improved limbs pain in 90 % of the cases, motor and sensory deficits in 37 % of the cases and sphincter functions in 20 % of the cases. Post-operatively, one patient developed a transient motor weakness (six days) and two patients had a transient bladder retention (three weeks). No patient developed a permanent post-operative defcit.
CONCLUSIONS:In our experience IOM is a "sine qua non" in spinal dysraphims surgery, particularly in spinal lipomas and re-untethering cases where the anatomical judgement doesn't suffice. IOM allows to precisely identify the neural elements improving dramatically the cord untethering, the surgeon's skills and minimizing neurological morbidity.

FL-024

Dysraphism

Role of electrophysiological monitoring in surgery for tethered cord

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Division of Paediatric Neurosurgery, Department of Neurosurgery, Amrita Institute of Medical Sciences and Research Centre, Kochi, India

OBJECTIVE:To evaluate the significance of intraoperative monitoring in surgery for tethered cord in relation to outcome.
MATERIAL-METHODS:The study was prospectively done in the Division of Paediatric Neurosurgery, AIMS, Kochi, India. 47 patients who are diagnosed with spinal dysraphism and operated and intraoperatively electrophysiologically monitored were included. Their preoperative neurological, urological and orthopedic status compared with post-operative status clinically. Informed consent was taken from all the patient. The duration of study was from from march 2013 to march 2015. Intraoperative monitoring (SSEP, MEP, and Direct stimulation) was done with XELTEK PROTEKTOR 32 IOM System, NATUS NEUROLOGY/MEDICAL INC. Middleton, USA. All statistical analysis was done with IBM SPSS version 19. For finding association with categorical variables Pearson Chi-square test was used.
RESULTS:The following significant observations were made:
o Out of 47, recurrent cases were 19 (41%), new cases were 28 (59%)
o Male:Female = 1:1.6
o Preoperatively, 17 (36%) had motor deficit, 30 (64%) had normal bladder function, 14 (30%) had abnormal bowel function and 18 (38%) had orthopedic deform
o 45 (96%) had regular follow up
o Follow up ranged from 1 month to 21 months. Mean of 8.8months
o During immediate post-operative period 42 (89%) had preserved motor function, while 38 (81%) had preserved bladder function, 44 (94%) had bowel function preserved
o On follow up no patient had any motor function deterioration, 1 patient had bladder function deterioration and 1 patient had bowel function deterioration
o Sensitivity of IOM in predicting new neurological deficit was 95.4%
o Specificity of IOM in predicting new neurological deficit was 66.7%
o Positive predictive value was 97.7%
o Negative predictive value was 50%
o Diagnostic accuracy was 93.6%
CONCLUSIONS:• Intraoperative monitoring is sensitive in diagnosing any neural injury during spinal dysraphism surgery, but are not very specific.
• IOM has a good diagnostic accuracy
• Postoperative motor and urological outcome was significant (p value<0.05) with use of monitoring during resection of different abnormal tissues

FL-025

Dysraphism

Congenital Spinal Deformity and Occult Spinal Dysraphism – Our Experience

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[2]Department of Pediatric Spine, International Centre for Pediatric Musculoskeletal Care, Mumbai, India.

OBJECTIVE:Surgery for correction of congenital scoliosis is high risk. When associated with Occult Spinal Dysraphism and other systemic involvement it is worse. We have attempted to find a relationship of Dysraphism with the type of vertebral developmental anomalies like failure of fusion and failure of segmentation, so that the surgeon is well informed and can plan better with regards the timing for untethering, deformity correction or fusion in-situ.
MATERIAL-METHODS:Case records of 836 children between Jan. 1995 to Dec. 2015 from the International Spine clinic and Bombay Hospital were analysed.
490 were found to have Congenital Spinal Deformity.
RESULTS:MRI scans were available in 239 cases, 149 females and 90 males, 217 with scoliosis or kyphoscoliosis and 22 with kyphosis.
Of the 217 MRIs, with Scoliosis, 122 had Intraspinal anomalies
Of the 22 MRIs with Kyphosis 5 had Intraspinal anomalies
Mean age at presentation 5.2 yr. Ranging from 3 months to 17 years
Neuro Orthopedic Syndrome was seen in about 20% with asymmetry of lower limb length and thin muscles with discrepancy in the foot size and orientation.
CONCLUSIONS:Spinal deformity at birth should make the physician suspect presence of an occult dysraphism more so when there is a scoliosis (56.68%) than Kyphosis (22.72%)
Spinal deformity due to failure of bony vertebral formation has the lowest risk of an intraspinal dysraphism (44.23%) and the highest risk is with children who have mixed type of vertebral anomaly (62.19%)
Skin markers like hairy patch, dermal sinus and associated neuro-orthopedic syndrome, increase the chances of an intraspinal anomaly.
Every child with a spinal deformity should be investigated with an MRI and CT prior to any surgical correction of the deformity.
All dysraphisms need to be dealt with surgically prior to curve corrections. However, fusion of deformity in-situ may obviate the need for surgical correction of Dysraphism.

FL-026

Dysraphism

3D visualization of secondary neurulation and caudal cell mass in chick embryos

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OBJECTIVE:Secondary neurulation plays an important role in neural tube defect, one of common congenital anomalies. However, there has been no common and definite anatomical definition of caudal cell mass(CCM) and secondary neurulation especially when and where-compared to limbs and somites- this process takes place. This study is to visualize CCM of chick embryos in different stages, stage 14 to 24, by comparing 3D-processed images and histologic slices of chick embryos and to introduce established anatomical description of secondary neurulation.
MATERIAL-METHODS:Chicken eggs were purchased from a commercial source (Pulmuone, Korea) and incubated at 38 to 39 °C with humidity greater than 70 %. Developmental stage was determined according to the staging system of Hamburger and Hamilton(H–H). Chick embryos of H–H stages 14, 16, 18, 20, 22, 24 were harvested. For MicroCT, specimens were prepared

by phosphotungstic acid staining and embedded into 0.5% agarose. High-resolution volumetric CT of embryos was performed at 0.95 μm^3 isometric voxel resolution using Skyscan 1172 MicroCT scanner (Bruker). Bruker software and ITK-SNAP were used for segmentation and volume rendering. For histology, the embryos were prefixed with 10 % neutral-buffered formalin, sectioned to 4 μm in thickness and stained with hematoxylin–eosin.
RESULTS:Caudal cell mass(CCM) was clearly delineated and reconstructed into 3D images for H-H stages 14 – 24 samples. We found common shape and volume features of CCM for each stage while some anatomical variations between samples were observed. Also, secondary neural tube formation from CCM and junction between primary and secondary neural tube were visualized. We three dimensionally showed and analyzed topological relationships between CCM and other structures.
CONCLUSIONS:We could successfully visualize secondary neurulation and caudal cell mass in chick embryos development. When and where this process happens were efficiently clarified using MicroCT and 3D image processing, which was not feasible by conventional H&E staining of histology samples.

FL-027

Dysraphism

Myelomeningocele: long-term neurosurgical treatment and follow-up in 231 patients

Tatiana Protzenko, José Francisco Manganelli Salomão, Saint Clair Gomes Junior, Antônio Rosa Bellas
Fernandes Figueira Institute/FIOCRUZ

OBJECTIVE:The aim of this study is to describe the long-term management of myelomeningocele and the associated conditions.
MATERIAL-METHODS:During a 20-year period, 231 patients were treated. We analyse the associated conditions that increase morbidity:myelomeningocele level, time of repair of the defect, hydrocephalus rate, shunt disfunction rate, motor level, Chiari II malformation, sphincter disorders, urinary tract infections, tethered cord syndrome, orthopedic deformities, epilepsy, arterial hypertension, obesity, latex allergies. Patients with congenital infections, ventricular hemorrhage and follow-up less than 1 year were excluded.
RESULTS:67,1% of the patients underwent myelomeningocele repair within 48 hours. During the follow-up period, 83,5% needed a shunt placement and the disfunction rate was 47,2%. 17,6% of these patients had more than one shunt disfunction. The main cause of shunt disfunction was proximal obstruction (21%), followed by infection (20%). We registered a total of 167 shunt revisions. We found that head circumference higher than 38 cm was related with high incidence of shunt disfunction ($p<0,001$). 8 (4,2%) of the 193 shunted patients had images that confirmed shunt independence, but half of them presented shunt disfunction during follow up. 94,8% of the cases presented anatomical Chiari II malformation, but only 12,1% had symptoms. The presence of symptomatic Chiari II malformation increases in 11 times the risk of death. 12 patients (4,85%) presented tethered cord syndrome and required reoperation. We identified 314 hospitalizations and related main causes were shunt disfunction, followed by urinary tract infection and suspected signs of shunt disfunction. Latex allergies were found in 7 patients (3%)
CONCLUSIONS:We found that higher head circumference is significantly related to higher rates of shunt disfunction. Also, patients that are thought to be shunt free should be followed carefully, once in our series we registered shunt disfunction in half of them. Patients with myelomeningocele and shunt device have an elevated number of hospitalizations due to shunt disfunction, urinary tract infection and suspected but non confirmed shunt disfunction.

FL-028

Dysraphism

Could distal spinal cord transection be a definite solution for tethered cord syndrome patients? A preliminary report of 5 patients

Kuo Sen Han, Peter Albert Woerdeman
Department of Neurosurgery, University Medical Center Utrecht, Utrecht, The Netherlands

OBJECTIVE:Tethered Cord Syndrome (TCS) is a lifelong problem for patients with quite often progressive neurological deterioration and relapses of pain and discomfort which sometimes need several redo surgeries of the tethered cord with often moderate long-term clinical success. Though the spinal cord transection technique (SCT) is controversial, clinical benefit has been observed in a select group of cases with a myelomeningocele repair history. This study evaluated the effects of the SCT regarding patients' discomforts and pain, progressive neurological deterioration including bladder function and the postoperative complications.
MATERIAL-METHODS:Five TCS-patients with residual complains of neurological pain and deficits with history of early surgeries for closure of (Lipo-) Myelomeningocele at lower lumbar/ sacral levels were studied. Transection was performed just under the functioning root levels corresponding on the MRI. Post-operative functioning of the patient was compared to pre-operative functioning.
RESULTS:The clinical outcome and patients' satisfaction status were evaluated after the SCT-surgery; most of the patients were very satisfied and had no neurological deterioration. Follow up ranged from 1 month to 2.5 years. Pain was diminished and the available urodynamic test showed improvement. No CFS leaks were encountered.
CONCLUSIONS:Based on the earlier findings and this study, the preliminary results of this "controversial" SCT in TCS-patients are promising. The controversial SCT-surgery technique is safe and uncomplicated. However, we need more TCS-patients to be included and longer follow up for evaluation of the results.

FL-029

Dysraphism

Closed dysraphisms of the cervical and thoracic spine

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National Institute for Women, Children and Adolescents Fernandes Figueira (IFF_Fiocruz), Rio de Janeiro, RJ, Brazil
OBJECTIVE:Closed cervical and thoracic dysraphisms (CCTD) are rare, accounting from 1.6 to 8% of all cases of spina bifida occulta. Our aim is report a series of CCTD and its clinical and pathological characteristics
MATERIAL-METHODS:Retrospective study of 34 cases found among 179 closed spinal dysraphism. Cervico-occipital lesions, spina bifida bellow L1 and lesions associated to myelomeningocele were excluded. The age at operation ranged from 2 days to 9 years (mean age 1.05 y, and median 4m.)
RESULTS:All patients had midline cutaneous stigmata: 21 were of the saccular type, but another cutaneous signatures were also registered. The cervical region was affected in 19 patients (55%). Laminar defects ranged from less than 1 to 8 vertebrae were milder in cervical region but without statistical difference between the two regions. Vertebral segmentation defects were found in 5 patients and

Klippel-Feil syndrome in one. Neuro-orthopedic manifestations were seen in 8 patients. Another 8 had hydrocephalus and all these had saccular lesions. All patients were operated on. In 20, typical findings of Pang's saccular (16) or flat LDM were identified. In 2 SCM-2 was associated. Three cystic lesions related to myelocistoceles and in 2 no tethering elements were found inside the sac. SCM-1 was the primary lesion in 3 patients and all had a thick filum terminale concomitantly cut. In 2 out of 3 patients with dermal sinus, intramedullary dermoid cysts were also found. Postoperatively, one patient died due to associated malformations. Complications were CSF leak (n=2) and infection at the operative site (n=1). During follow-up, 4 patients were reoperated: 3 due to cord retethering and 1 due multiple associated malformations.
CONCLUSIONS:LDM accounts for most of the CTD. Vertebral defects vary from discrete to very extensive and severe. Other forms of spinal dysraphisms are uncommon but may be found remote from the lumbosacral region.

FL-030

Dysraphism

What determines good neurological outcome of patients of Tethered cord syndrome? Analysis of factors affecting outcome

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Division of Paediatric Neurosurgery Department Of Neurosurgery, Amrita Institute of Medical sciences, Kochi, Kerala, India

OBJECTIVE:To study the clinical profile and surgical outcome of patients who underwent surgery for tethered cord syndrome and to analyse the factors affecting long term outcome
MATERIAL-METHODS:Patients presenting to Amrita Institute of Medical Sciences between January 2009 to August 2016 (n = 182 patients) were included. Patients were evaluated in terms motor, bowel/bladder deficits and associated anomalies. All patients underwent detethering of cord, electrophysiological monitoring was used in all the patients except neonates with spina bifida. Following surgery all patients were followed up with imaging and clinical improvement of pre operative motor, bowel and bladder functions.
RESULTS:We had about 182 patients 108 (59%) were females and 74 (40%) males. The distribution of pathologies were as follows:
50 (27%) patients had Myelomeningocele, 50 (27%) patients had Lipomyelomeningocele, 19 (11%) patients had dermal sinus, 18 (10%) had diastematomyelia.
Average follow up was up to 24 months
57 (31%) patients had motor weakness, out of which 25 patients (43%) improved in motor power post operatively and on follow up,
60 (32%) patients had bladder dysfunction, 23 (38%) improved,
36 (20%) patients had bowel dysfunction, 4 (11%) improved.
In our study total 16 (8%) patients required repeat detethering of cord. Myelomeningocele was the commonest pathology requiring repeat detethering of cord.
Intraoperative monitoring was done in 134 patients.
• Sensitivity of monitoring in predicting new neurological deficit was 99.23 %
• Specificity of 75%.
• Positive predictive value of 99.23%
• Negative predictive value of 75%
CONCLUSIONS:• Timing of surgery and pathology is key to neurological preservation and outcome.
• Long term neurological and urological follow up is necessary to pick up early signs of retethering of cord.
• Electrophysiological monitoring is a key essential adjunct.

FL-031

Dysraphism

Lipid profile of lumbosacral lipomas: developing a biomarker

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[2]Cardiff University School of Medicine, Institute of Infection and Immunity, Cardiff, UK

OBJECTIVE:Lumbosacral lipomas (LSL) are a common form of closed spinal dysraphism. Timing of surgery remains controversial with many children remaining ostensibly asymptomatic for the first decade of life. To optimise timing of surgery we hope ultimately to develop a biomarker to indicate disease progression before neurological deterioration begins. We have analysed the lipid profile of CSF, plasma and urine of children with symptomatic LSL and compared to that of children undergoing spinal surgery for other unrelated spinal pathologies.
MATERIAL-METHODS:Ethics approval was obtained. Intraoperative samples of blood, urine and CSF were collected (n=6). Lipids were extracted via the Dyer method and run through a mobile phase gradient by high performance liquid chromatography and separated with an Accucore C18 column. Lipids were detected in negative and positive electrospray mode and mass/charge ratio determined with Orbitrap mass spectrometry (ThermoFisher). Data processing was performed using MSconvert and XCMS software. Lipid identification was achieved with MSlipidomics and LipidMaps.
RESULTS:9,799 lipids were detected in CSF samples, 499 were significantly different in abundance between LSL and control samples ($P<0.05$). 8,366 lipids were detected in plasma samples, 349 were significantly different in abundance between LSL and control samples ($P<0.05$). Of these only 12 lipids demonstrated the same properties on liquid chromatography separation and mass spectrometry detection. One lipid was found to be significantly more abundant in CSF, plasma and urine. Analyses of the mass/charge ratio and separation time on liquid chromatography suggest this lipid is lysophosphatidylethanolamine.
CONCLUSIONS:Lysophosphatidylethanolamine has been described in the literature as being involved in an obesity mediated inflammatory response. We propose that this lipid is a likely candidate biomarker and intend to further quantify levels in symptomatic and asymptomatic LSL children. Development of a biomarker will allow more robust guidance when deciding timing of surgical intervention for LSL children.

Wednesday, 11 October 2017
10:30 – 10:45

Flash Presentations: Neurotrauma

FL-032

Special topic: Neurotrauma/Critical Care

Prediction of cerebral morphine concentration in paediatric traumatic brain injury (TBI) with the rat physiologically based pharmacokinetic (PBPK) model

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[3]Division of Neurosurgery, Department of Neurosurgery, University of Cape Town, South Africa
[4]Department of Pharmacology, Academic Medical Centre, Amsterdam, The Netherlands

OBJECTIVE:Several acute neurosurgical conditions use various therapeutic drugs but our understanding of how these enter the brain is limited. In paediatric traumatic brain injury (pTBI) analgesia and sedation are essential but evidence-based regimens are lacking and a better understanding of drug distribution in the brain is needed. A pharmacokinetic (PBPK) model using rat physiological data for describing pharmacokinetics (PK) at cerebral locations (brain extracellular fluid [ECF] and cerebrospinal fluid [CSF]) was developed. We aimed to determine the feasibility of using a humanised version of this model to predict cerebral morphine drug concentrations.
MATERIAL-METHODS:Participants included children with severe TBI (GCS≤8) who underwent cerebral microdialysis monitoring. ECF from the microdialysis catheter was collected hourly for chemistry analysis and remnant fluid was stored. Morphine concentrations in the ECF and blood were measured using liquid chromatography mass spectrometry, and compared to the rat PBPK model that was translated by replacing system- and drug-specific parameters.
RESULTS:Eight patients (median age 8 [2.8-13] years, median weight 24 [14.5-55] kg) received morphine infusions [10 - 40 mcg/kg/hour] and underwent microdialysis monitoring. The rat PBPK model was translated by scaling up the drug transport clearance at the blood brain barrier (brain weight) and the brain drug diffusion rate (brain and CSF volume). The humanised model predicted morphine concentrations within the 90% prediction interval in 97% of plasma samples, and in ECF samples from normal-appearing brain tissue.
CONCLUSIONS:Cerebral morphine drug recovery with microdialysis is feasible in pTBI. The rat PBPK model can be translated to adequately predict paediatric brain morphine PK in normal appearing tissue. These pilot data suggest that combining pharmacokinetic modelling with data from microdialysis may contribute to developing evidence-based pharmacotherapy in pTBI. Further validation is ongoing but this may be an important foundation for future studies of cerebral drug penetration generalisable to other conditions.

FL-034

Special topic: Neurotrauma/Critical Care

Traumatic brain injury in the pediatric population following sports accidents with or without helmet use in Hamburg, Germany

Angela Bandte[1], Klaus Püschel[1], Fritzsche Sophie Friederike[2], Emami Pedram[2], Kammler Gertrud[2], Hessler Christian[3], Krajewski Kara[2]
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[2]Department of Neurosurgery, University Medical Center Hamburg-Eppendorf, Hamburg, Germany
[3]Department of Spinal Surgery, St. Marien Hospital, Mülheim an der Ruhr, Germany

OBJECTIVE:Soccer, bicycling and horsebackriding are sports most commonly associated with TBI in Germany. Aim of this study was to explore differences between sports disciplines and helmet use with regards to diagnostics, concussion symptoms, hemorrhage and fractures, operations, length of hospital/ICU stay and outcome.
MATERIAL-METHODS:After ethics approval, retrospective analysis was performed for patients ages 5-17 from January 1, 2009- August 14, 2014 based on the diagnosis "traumatic brain injury" using the electronic patient file for both university hospital locations. Descriptive data analysis, multi- and univariate logistic regression were employed.
RESULTS:A total of 380 children and adolescents were identified. 162 (42.6%) were female and 218 (57.4%) were male. Mean age was 11.9 ±3.8 years. TBI occurred during bicycling (n=64), horsebackriding (n=19), and soccer (n=16). A helmet was used n=26 (14 cyclists and 12 riders), helmet not used n=20 (all cyclists). Wearing a helmet reduced risk for loss of consciousness by factor 0.7 (CI 0.18-2.52) compared to not wearing a helmet. N=251 patients with non-sports-related TBI (NSTBI) served as a control group for further analyses: the risk of amnesia after a riding accident was 2.9x (CI 1.1-21.6) higher and for bicycling 4.8 (CI 0.3-239) higher than NSTBI. Risk of epidural hematoma 2.2x (CI 0.4-12.3) higher for cycling and 4.9x (CI 0.5-50.4) higher for soccer compared to NSTBI. The risk of requiring invasive ICP monitoring is 1.8x (Cl 0.15-21.5) higher for riding vs. soccer accidents.
CONCLUSIONS:Despite the low number of cases, a reduction of risk for loss of consciousness was shown. There were no adverse effects of wearing a helmet apparent from the data, therefore it supports existing recommendations for use of helmets. Despite helmet use, ICP monitoring data suggests more severe brain injury for riding accidents. Introduction of protective head gear in soccer should be evaluated.

FL-035

Special topic: Neurotrauma/Critical Care

Epidemiology and outcome of Postoperative Neurosurgical Pediatric Patients

Barbara Albuquerque Morais[1], Ana Paula Carvalho Canela Balzi[2], João Manoel Silva Jr[2], Wellingson Silva Paiva[1], Daniel Dante Cardeal[1], Hamilton Matushita[1], Manoel Jacobsen Teixeira[1], Fabiane Aliotti Regalio[2], Juliana Akemi Saka[2], Maria Jose Carvalho Carmona[2], Fernanda Goncalves Andrade[1], Luiz Marcelo Sa Malbouisson[2]
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OBJECTIVE:Little is known about pediatric neurosurgical patients in the postoperative period. The care of this patients remains a challenge in the intensive care unit (ICU), with a 40% complications rate reported at literature. Therefore, identifying the characteristics and risk factors in this population may help in the management of these patients. The present study aims to evaluate the clinical characteristics of this population and the factors associated with mortality in this group.
MATERIAL-METHODS:A Cohort study, over 3 years, was conducted with pediatric neurosurgical patients consecutively admitted to an ICU of a tertiary hospital. Patients over 16, who remained less than 24 hours in the ICU and readmissions were excluded. Patients were followed until hospital discharge.
RESULTS:112 patients with a mean age of 9 (5 to 12) years were enrolled. The most frequent surgery was brain tumor resection, followed by trauma patients. The average length of hospital stay was 6 (4-11) days. The incidence of septic shock was 3.7%, being

3.6% due to infection of the central nervous system, followed by ventilator-associated pneumonia at 2.8%. The incidence of hyponatremia and hypernatremia was 16.1% and 7.1%, and the incidence of intracranial hemorrhage was 4.5% and 11.7% had seizures. The mortality rate during hospitalization was 4.5%. The factors associated with death were hypernatremia (80% versus 3.7%, p <0.001) and patients who had intracranial hemorrhage (40% versus 2.8%, p <0.001).
CONCLUSIONS:Postoperative pediatric neurosurgical patients have a mortality around 5% and a high complication rate of 34%, being the main factors associated with mortality hypernatremia and intracerebral hemorrhage. Recognizing the implications, complications and mortality of neurosurgical procedures facilitates medical action to improve survival and quality of life of these children.

FL-036

Special topic: Neurotrauma/Critical Care

Eleven years of surgical management of pediatric spine trauma in Lyon

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Pediatric Neurosurgery, Hopital Femme Mere Enfant, Bron, Hospices Civils de Lyon, Lyon University Hospital, France

OBJECTIVE:Introduction
Spine trauma is less common in the pediatric age compared to adult population. The consequences can be more severe on a growing spine and, if not adequately treated, they can lead to irreversible deformations with bad sagittal balance.
MATERIAL-METHODS:We performed a retrospective review of 73 children treated for a spinal trauma between 2005 and 2016. The mean age was 14.1 years. The M:F ratio was 1:1.3. Spinal injuries were more common in the teenagers' group (14 – 18 years) and the predominant etiology was motor vehicle collision (MVC) (36%). Level of injury was cervical in young patients and lumbar in teenagers. Thirty-seven patients (51%) had a neurological deficit at preoperative examination. Early surgery (median timing 1 day vs. 3.2 days in all group) was done in case of neurological deficit or in case of posterior fragment displacement (PFD) superior to 5mm. Forty-five patients with thoraco-lumbar fracture underwent fusion via posterior approach and 28 patients with cervical injury underwent anterior cervical fusion. All patients have been followed clinically and radiologically to evaluate the quality of neurological recovery and fusion/realignment.
RESULTS:Out of 37 patients with neurological deficits thirteen improved after surgery (33%). There was a trend of improvement of neurological deficit when the PFD was under 5 mm but no significant correlation could be found regarding age, level of injury, Magerl classification or timing of surgery. Mortality was of 2.7%.
CONCLUSIONS:Our experience show that teenagers are at greatest risk for spine trauma. Small children are at risk for cervical lesion even in moderate energy trauma. Early surgery permitted neurological improvement in only 33% of cases. At the cervico–thoracic and at the dorso-lumbar junction we recommend two levels up and down fixation. The material should not be removed before 1 ½ year in order to prevent the risks of secondary deformation.

Wednesday, 11 October 2017
12:14 – 12:45

Flash Presentations: Neuro-Oncology

FL-037

Special topic: Neuro-oncology

The Association of Hospital Case Volume on the Outcomes of Pediatric Patients Undergoing Posterior Fossa Tumor Resection

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OBJECTIVE:Higher volume hospitals have been associated with better quality of care, consequently enhancing patient outcomes. The goal of this study was to examine the relationship between patient-hospital volume and outcomes of children undergoing posterior fossa tumor resection.
MATERIAL-METHODS:Using Pediatric Health Information System (PHIS) data for years 2011 through 2015, we included children ages 0-17 years undergoing posterior fossa tumor resection. Quality of care markers such as length of hospital stay (LOS), routine discharge home and adjusted total admission cost were analyzed for relationships with hospital volume of brain tumor cases (low, medium and high categories, or continuous variable) and adjusted for patient demographic and clinical characteristics. LOS was defined as time to routine discharge, with patients not routinely discharged censored at time of disposition.
RESULTS:A mean of 2,893 children *per* year underwent surgery in 49 U.S. hospitals. High volume centers had shorter LOS reflected as higher hazard of routine discharge when compared to medium (HR 1.27, p=0.0010) and low volume (HR 1.28, p=0.0003) hospitals. As a binary endpoint, the odds of routine discharge in high volume hospitals were 1.50 and 2.07 times the odds in medium (p=0.2417) and low volume (p=0.0303) hospitals, respectively. The geometric mean costs in high volume hospitals were 59% and 37% less than in medium (p=0.0158) and low volume (p=0.1858) hospitals, respectively. When analyzed as a continuous covariate, an increase in average annual volume of 50 patients increased the hazard of routine discharge by 13% (p=0.0002), increased the odds of routine discharge by 32% (p=0.0892), and reduced the geometric mean cost by 27% (p=0.0767).
CONCLUSIONS:Children undergoing posterior fossa tumor resection in higher volume hospitals received improved quality of care (shorter hospital LOS, increased discharge home, and reduced costs). Referral to higher volume children's hospitals may improve outcomes for children with newly diagnosed posterior fossa tumors.

FL-038

Special topic: Neuro-oncology

Ultrasound-induced opening of the blood-brain barrier improves drug delivery to the brain in animal models – The Sonocloud project

Kévin Beccaria[1], Catherine Horodyckid[2], Guillaume Bouchoux[3], Michael Canney[3], Lauriane Goldwirt[4], Stéphanie Puget[1], Alexandre Carpentier[5]

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OBJECTIVE:To evaluate the feasibility and safety of ultrasound-induced opening of the blood-brain barrier (BBB) with an innovative ultrasound (US) device (Sonocloud) and to evaluate drug delivery to the brain after BBB opening in preclinical experiments.
MATERIAL-METHODS:The Sonocloud is a custom-built transducer constructed by using a 10-mm flat piezoceramic disc. After epidural application, the transducer was operated at a center frequency of 1.05 MHz, a pulse repetition frequency of 1 Hz, and a pulse length of 25,000 cycles. Different sonication protocols were applied to mice, white New-Zealand rabbits and non human primates, in association with intravenous injection of microbubble US contrast agent (Sonovue®). Opening of the BBB was determined by Evans blue dye extravasation and contrast enhancement after gadolinium injection in MRI. Drug delivery (Temozolomide, Irinotecan, Carboplatin) to the brain after intravenous injection and BBB opening was assessed in rabbits and primates. Clinical, radiological, electrophysiological and histological assessments were performed.
RESULTS:A non focused but targeted opening of the BBB was obtained for acoustic pressures varying from 0.3 to 0.8Mpa, in both brain hemispheres and brainstem. Histological effects were limited to rare perivascular red blood cell extravasations. Moderate and transient edema was visible on FLAIR sequences, but no ischemic nor hemorrhagic lesions were observed on T2* and DWI sequences. No modification of the behavioral or neurological exam was observed after repeated sonications in primates. A significant increase in brain parenchyma concentrations of Temozolomide, Irinotecan and Carboplatin were observed after opening of the BBB in rabbits and primates.
CONCLUSIONS:The BBB can be safely and transiently opened by the Sonocloud ultrasound device. Drug delivery to the brain can be improved after US-induced opening of the BBB in animal models. The first phase I trial currently performed in adults (La Pitié Salpétrière Hospital, Paris, France) may be applied in children treated for a brain tumor.

FL-039

Special topic: Neuro-oncology

Chemotherapy Administration Directly into the Fourth Ventricle in Children with Recurrent Malignant Fourth Ventricular Brain Tumors: Results of Two Pilot Clinical Trials

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OBJECTIVE:Novel treatments are needed for children with recurrent, malignant brain tumors. We hypothesize that chemotherapy administered directly into the fourth ventricle is safe and can yield high drug levels and treatment responses.
MATERIAL-METHODS:In 2 IRB (Institutional Review Board)-approved clinical trials, patients with recurrent medulloblastoma, atypical teratoid/rhabdoid tumor (ATRT), or ependymoma underwent surgical implantation of a fourth ventricle catheter attached to a ventricular access device. Cerebrospinal fluid (CSF) flow throughout the neuraxis was confirmed by CINE MRI post-operatively. The first 5 patients received 3 treatment cycles, with additional cycles offered for partial response or stable disease. Each cycle included 4 consecutive daily 2 milligram (mg) methotrexate infusions. The next 5 patients received 18 total 4 mg (n=3) or 6 mg (n=2) methotrexate infusions administered twice weekly. Disease response was assessed via MRI scans and CSF cytology. Serum (4 hour) and CSF (24 hour) methotrexate levels were measured in the first 5 patients.
RESULTS:10 patients (medulloblastoma=7, ependymoma=2, ATRT=1) cumulatively received 330 infusions. There were no serious adverse events or new neurological deficits attributed to infusions. Two additional enrolled patients were withdrawn prior to planned infusions due to rapid disease progression. Three patients with medulloblastoma had partial response, 2 had stable disease, and 2 had progressive disease. Both patients with ependymoma and the patient with ATRT had progressive disease. Median serum methotrexate level four hours after infusion was 0.04 micromoles per liter (μmol/L). Range was 0.02 – 0.13 μmol/L. Median trough CSF methotrexate level 24 hours after infusion was 3.18 μmol/L (range 0.53 - 212.36 μmol/L).
CONCLUSIONS:These trials mark the first reported infusions of chemotherapy directly into the fourth ventricle. High drug levels were achieved without causing neurological toxicity. Some patients with recurrent medulloblastoma experienced a beneficial anti-tumor effect both within the fourth ventricle and at distant sites.

FL-040

Special topic: Neuro-oncology

Long Term Outcome of Tectal Plate Glioma Versus Idiopathic Aquaductal Stenosis Patients

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OBJECTIVE:Tectal plate gliomas (TPG) constitute a distinct entity of benign brainstem tumors which show an indolent clinical course. The clinical outcome is generally believed to be good. However there is virtually no knowledge about the cognitive outcome of patients with TPG.
MATERIAL-METHODS:We analyzed the clinical and radiological data of 16 pediatric TPG patients and compared these with data of 12 pediatric idiopathic aquaductal stenosis (IAS) patients treated in our center from

1991 to 2010. For both groups we retrospectively assessed the clinical and radiological data. In each group 8 patients volunteered for a prospective cross sectional study assessing cognitive outcome using a standardized neuropsychological test battery (table 1).
RESULTS:In the TPG group 13 patients were treated for hydrcephalus. The mean time to treatment was 3.2 months. The mean clinical and radiological follow up was 84 and 70 months. The average maximum diameter of the tumor increased with 11% and the estimated tumor volume with 35%. Considering the management of the obstructive hydrocephalus the fronto-occipital horn ratio (FOR) decreased with 22%. All patients in the IAS group were treated for hydrocephalus with a mean time to treatment of 1.7 months. The mean clinical and radiological follow up was 117 and 85 months. The FOR showed a decrease of 19%. Six participants in the TPG group scored between average and high average on the Total IQ scale. In the IAS group, patients achieved scores ranging between intellectual deficit and average. Scores on executive functions were similar in both clinical groups.
CONCLUSIONS:Hydrocephalus management is the key element in TPG patient care. Despite tumor progression the long term clinical outcome was excellent. Since the cognitive outcome is favorable and substantially better than in the IAS group, patients seem to compensate well for the presence of a tumoral mass in the brain stem.

FL-041

Special topic: Neuro-oncology

Involvement of Tumor Suppressor p53 Protein in Medulloblastoma Subtypes: Finding Therapeutic Targets

Anubhav G Amin[1], Raphael Salles Scortegagna De Medeiros[2], Seung Won Paul Jeong[1], Samuel Gelnick[1], Sidnei Epelman[2], Michael Tobias[1], Avinash Mohan[1], Meic H Schmidt[1], Raj Murali[1], Nelci Zanon[3], Meena Jhanwar[1]
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OBJECTIVE:Medulloblastoma (MB) is the most common primary pediatric malignant brain tumor, which is genetically classified into 4 groups: classic (WNT), sonic hedgehog (Shh), group 3 and group 4. Recent genetic studies have demonstrated that MB with mutated tumor suppressor p53 protein may be associated with aggressive progression of disease and commonly harbor genetic anomalies including MYCN and GLI2 amplifications, which confers drug resistance. This study investigates the frequency of p53 mutation found in human MB samples and whether p53 status correlates to disease progression and metastasis.
MATERIAL-METHODS:MB tumors (n=41) were evaluated for the expression of glioma transcription factor 1 (GLI-1), Grb2-associated binding protein 1 (GAB-1), natriuretic peptide receptor (NPR), voltage-gated potassium channel (KV1) and mutant p53 by immunohistochemistry. A p53-mutant MB cell line was used to investigate the signaling pathway leading to proliferation, migration, cell cycle, and drug resistance using HDAC (LBH-589) and PI3K (BKM-120) inhibitors.
RESULTS:GAB-1 was highly expressed in the Shh group (82%) while KV1 expression was evenly distributed in all subtypes. There was no obvious correlation with expression of GLI-1, GAB-1, NPR, or KV1 with metastasis. Analysis of loss of p53 and overexpression of MYC varied in each subtype. Combined treatment with LBH-589 and BKM-120 reduced cell proliferation, migration and S-phase entry, however, MB cells were resistant to sole PI3K inhibitors treatment.
CONCLUSIONS:The findings of this investigation provide evidence for role of mutant P53 in MB progression. Furthermore, this study has investigated possible targeted therapy to MB.

FL-042

Special topic: Neuro-oncology

Different Strategies in management of Childhood Craniopharyngiomas - Experience of 114 case

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OBJECTIVE:Craniopharyngioma surgery remains a challenging zone in neurosurgery. We hereby report our experience at Children's Cancer Hospital Egypt – 57357 (CCHE-57357) in management of childhood craniopharyngiomas.
MATERIAL-METHODS:The medical records of 114 craniopharyngioma case treated at Children's Cancer Hospital Egypt (CCHE-57357) in the period from 2007 to 2017 were reviewed. We confirmed the radiological, surgical, histopathological findings as well as molecular identification of Beta-catenin mutations in adamantinomatous craniopharyngioma. As it has been reported that β-catenin mutations are associated with faster tumor recurrence after tumor total excision or radiotherapy.
RESULTS:The study included 114 cases in which male to female ratio was 1.2:1. Age varied from 1 to 17 years with mean age 7.9 years. Clinical follow up ranged from 0.5 to 9 years.
Tumor surgery was performed through pterional approach using conventional microsurgical techniques in 74 cases (65%), endoscope-assisted microsurgical techniques in 30 cases (26.3%) and omaya insertion in 10 cases (8.7%). Gross total resection (GTR), subtotal resection (STR) and biopsy were achieved in 49 cases (43%), 49 cases (43%), and 16 cases (14%), respectively.
50 patients received upfront radiotherapy while, 63 patients were kept under follow up after surgery either because GTR (40 cases) was achieved or to preserve the good hormonal profile the patient had. Patients kept under follow up showed 39 recurrences; 24 after GTR, 13 after STR and 2 after biopsy and they received subsequent radiotherapy. Postoperative complications included visual affection, oculomotor palsy, hematoma and vasospasm. Post-radiation complications included delayed visual deterioration, cognitive deficits, and abnormal movements. One post-operative mortality occurred in this series.
CONCLUSIONS:Whenever tumor is dissectible from hypothalamus, GTR and adequate hormonal replacement provides good outcome and mildest acceptable morbidities. However, when hypothalamus is involved, leaving the smallest residue is recommended. Radiotherapy should be reserved for recurrent tumors and large or enlarging residual tumors.

FL-043

Special topic: Neuro-oncology

Pharmacological inhibition of methyltransferase EZH2 in *in vitro* and *in vivo* models of medulloblastoma

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OBJECTIVE:Medulloblastoma demonstrate epigenetic changes that silence target genes. For example, Enhancer of Zeste Homologue 2 (EZH2) acts as a transcriptional repressor by methylating H3K27, causing chromatin compaction that inhibits differentiation and maintains a stem cell-like state. EZH2 is overexpressed in medulloblastoma, and its inhibition by shRNA leads to decreased H3K27 methylation and selective killing of human medulloblastoma cells. Several clinically relevant chemical inhibitors of EZH2 activity have been identified, including EPZ-6438. An important clinical goal for medulloblastoma is the development of effective and non-toxic directed therapeutics. Our objective with this research was to examine the impact of pharmacological EZH2 inhibition on tumorigenesis *in vitro* and *in vivo*.
MATERIAL-METHODS:Patient tumor derived medulloblastoma cell lines were treated with the EZH2 inhibitor drug EPZ-6438. Colony formation assays established IC50 curves for medulloblastoma cell lines. Western blot analysis was used to determine protein and methylated histone levels. D458 cell line injections were performed into cerebellums of athymic, nude mice. Mice were treated with oral gavage of EPZ-6438 or control.
RESULTS:Addition of EPZ-6438 to medulloblastoma cell lines caused dose dependent inhibition. Western Blotting confirmed decreased tri-methylated H3K27 in cells treated with EPZ-6438. *In vivo*, no significant difference was found in average survival of treated and control cohorts. However, Western blot analysis indicated decreased tri-methylated H3K27 in intracranial tumor samples from mice, indicating that the drug crosses the blood brain barrier.
CONCLUSIONS:Pharmacological inhibition of EZH2 via EPZ-6438 decreases medulloblastoma cell growth *in vitro*. EZH2 activity can be inhibited in intracranial tumors by oral administration of EPZ-6438 in an *in vivo* medulloblastoma model. Although EPZ-6438 monotherapy does not significantly increase clinical survival, further investigation into synergistic drugs is warranted to develop a targeted clinical treatment paradigm.

FL-044

Special topic: Neuro-oncology

Proteomic characterization of the solid component of craniopharyngioma

Luca Massimi[1], Claudia Martelli[2], Riccardo Serra[1], Paolo Frassanito[1], Gianpiero Tamburrini[1], Ilaria Inserra[2], Federica Iavarone[2], Massimo Castagnola[2], Massimo Caldarelli[1], Claudia Desiderio[3]
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OBJECTIVE:The interest on the molecular characterization of craniopharyngioma in children is still high because of the unfavorable clinical characteristics of the adamantinomatous variant. In previous studies, we demonstrated the presence of several inflammation-related peptides and proteins in the cystic fluid of pediatric craniopharyngioma, which suggest an inflammatory origin of the cyst formation. The goal of this study was to investigate the solid component of this tumor.
MATERIAL-METHODS:The bioptic samples of craniopharyngioma taken during the surgical removal of the tumor were analyzed through a bottom-up/top-down nano-liquid chromatography-mass spectroscopy proteomic platform. The tissues of 7 consecutive pediatric patients (5 males, 2 females; mean age at surgery: 11 years) were considered for this study.
RESULTS:Overall, 165 proteins were detected. Most of them are involved in the network of cell functional interactions, with the prevalence of catalytic and enzymatic activities. More in details, actin alpha cardiac muscle 1 and cytoplasmic 1, vimentin, annexins, tubulins, glyceraldehyde-3-phosphate dehydrogenase, vitronectin and apolipoprotein A1 were the most abundant proteins identified. Moreover, beta-catenin and related proteins were clearly detected. As for the cyst fluid, the present analysis confirmed the presence of thymosin beta 4, prothymosin alpha isoform2, ubiquitin and its C-terminal truncated form, calmodulin, alpha-defensins 1-3 by the top-down approach.
CONCLUSIONS:The present study provides some important observations: 1) The two proteomic approaches complement each other in providing protein characterization of adamantinomatous craniopharyngioma; 2) The detection of beta-catenin and its products points out a possible involvement of the adherence system in the tumor pathogenesis, with a minor contribute of the intermediate filaments and actin cytoskeleton; 3) The identification of thymosins and, in particular, α-defensins also in the solid component of the tumor further supports the hypothesis of the role of inflammation in its pathogenesis.

Wednesday, 11 October 2017
15:00 – 15:30

Flash Parallel Presentations: Hydrocephalus

FL-045

Hydrocephalus

Natural history of paediatric cranial arachnoid cysts

Alex Smedley, Samuel Hall, Aabir Chakraborty, Nijaguna Mathad, Ryan Waters, Owen Sparrow, Vassilios Tsitouras
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OBJECTIVE:A significant number of cranial arachnoid cysts are discovered incidentally, and the detection rate continues to rise due to the increasing usage of MRI investigations. This study aims to determine the clinical course of such cysts detected in paediatric patients.
MATERIAL-METHODS:A retrospective cohort study of all paediatric cranial arachnoid cysts managed at a single UK centre between 2007-2016.
RESULTS:One hundred and fifteen patients (mean age 7.0 years, 76% male) were reviewed during the 10 year period. The most common cyst

location was the middle fossa (n=45), followed by posterior fossa (n=37), and other supratentorial convexity locations (n=14). Eighty four (72%) patients had cysts that were regarded as incidentals, since they were found upon investigations for clearly un-associated symptoms. Among the incidental cyst group the average clinical follow-up was 3.1 clinic appointments over an average 15.9 months total follow-up during which time no patients developed symptoms. Only 23 patients had radiological follow-up (17 with MRI) with an average duration of 18.6 months, of which one cyst increased in size without clinical significance. Seventeen patients had ophthalmology follow-up, of which 10 were for unrelated issues and the 7 referred as part of their cyst management, were all normal. Two patients had neuro-cognitive assessments as part of the management for their unrelated developmental delay. One (1.1%) incidental posterior fossa cyst in a 3 month old was treated surgically due to risk of impending hydrocephalus.
CONCLUSIONS:This cohort shows that the majority of paediatric cranial arachnoid cysts were asymptomatic and that these patients have a low risk of requiring surgery. The risk of a cyst increasing in size on radiological follow-up is also low and surveillance scans did not alter the clinical management in this cohort.

FL-046

Hydrocephalus

Elevated Intracranial Pressure: Modeling Pressure-Induced Cellular Injury ex vivo

Ramin Eskandari, Micheal E Smith
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OBJECTIVE:Improved understanding of the pathophysiology of elevated intracranial pressure (ICP) lies in the identification of biomarkers of early cellular injury. The lack of a model to study cellular pathways associated with elevated ICP-induced cellular injury has impeded progress. Identifying and characterizing cellular biomarkers associated with elevated ICP will advance our understanding of the pathological cascade leading to brain injury, while providing potential therapeutic targets for the treatment of hydrocephalus and other pressure-related brain pathologies. We utilized a novel 3D ex-vivo pressure-controlled CNS cell culture system to assess the earliest indicators of pressure-induced cell injury.
MATERIAL-METHODS:To simulate pressure induced brain injury, we developed an ex vivo model of hydrocephalus, which combines 3D neural cell cultures and a newly developed Pressure Controlled Cell Culture Incubator (PC3I). Human cells were maintained in a 3D peptide-conjugated alginate hydrogels were subjected to different pressures to mimic both physiologic and pathologic conditions. Culture media bathing the cell-laden hydrogels was analyzed for injury/inflammatory biomarkers, while cellular viability was determined using intracellular esterase activity and plasma membrane integrity. ATP release was used as a marker of cellular stress/injury.
RESULTS:Inflammatory biomarkers were measurable in the media bathing the 3D cellular constructs following both sustained and pulsatile pressure exposures. We demonstrated the ability to maintain greater than 50% cellular viability in 3D alginate hydrogels for up to 4 weeks. ATP-release assays revealed that a time-dependent statistically significant increase in neurons, but not astrocytes, while multiplex assay suggest cytokines IL-6 & IL-8 elevation following sustained pressure exposures compared with controls.
CONCLUSIONS:These data indicate extracellular release of ATP is an important signal associated with elevated pressure, and may be a key in the early secondary injury response to elevated ICP in the developing neonatal brain. The trend towards elevated inflammatory cytokines are also possible key injury mechanisms with roles in cell injury.

FL-047

Hydrocephalus

The significance of secondary craniosynostosis in morbidity of shunted children

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OBJECTIVE:One of the late complications of shunting operations is shunt-induced craniosynostosis. The aim of this study was to evaluate the incidence of this pathology, impact on the patient's condition, clinical picture and to determine indications for surgery and optimal surgical method
MATERIAL-METHODS:59 children were included in the study with shunt dysfunction who were treated in our hospital from 2014 to 2016. Inclusion criteria were: 1) age at the time of the survey over 1 year; 2) implantation of the shunt system within the first 12 months of life. Condition of bone sutures was evaluated by three-dimensional reconstruction of the patient CT-scans. Cases of primary craniosynostosis were excluded based on the CT-data which were performed before the primary implantation of a shunt system or in a few months after
RESULTS:Age of the patients ranged from 1 to 14 years. Premature cranial sutures closure found in 27 patients (46%). 3 of them (11%) were presented with clinical symptoms of increased intracranial pressure, radiological signs of craniocerebral disproportion and had a history of multiple shunt revisions. Remodeling cranial vault operations were performed in this patients: two biparietal craniotomies and one fronto-occipito-parietal reconstruction. All patients demonstrated significant improvement. No complications were observed after reconstructive surgery
CONCLUSIONS:Shunt-induced craniosynostosis is one of delayed complications of shunting operations. However, its presence itself is not an indication for surgery and should not be cause for surgical aggression. Only if secondary craniosynostosis is combined with manifestations of craniocerebral disproportion an intervention is indicated to increase the intracranial volume. In such cases, reconstructive operation is an effective method of treatment that improves the patient's condition

FL-049

Hydrocephalus

Reduction of shunt infections after application of a shunt protocol

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OBJECTIVE:Reduction of shunt infection is a major clinical challenge in pediatric neurosurgery. We aimed to investigate the effect on shunt infections of a shunt protocol in children with hydrocephalus in Western Sweden.
MATERIAL-METHODS:Patients with a first shunt insertion were identified and frequency of shunt infection was reviewed for children treated for hydrocephalus 2001-2006 in Western Sweden (Group A). Background data include age, prematurity, length of surgery and etiology of hydrocephalus. Primary outcome was a new surgery due to shunt infection. In Oct 2012 we implemented a shunt protocol (including written instructions for preoperative disinfection, stricter routines for preoperative administration of antibiotics, double gloving, reduced number of door openings and limits for the number of persons in the operating room). The same parameters for children treated in the same region Oct 2012-Dec 2015 was reviewed (Group B) and we compared the shunt infection rate between the two groups.
RESULTS:Group A included 76 children, and Group B 47 patients with a mean follow-up time of 4.7 years in group A and 2.3 years in Group B. There were no significant differences in median age (Group A/B 0.2/0.5 years), gender (Group A/B 45/41% girls) or frequency of prematurity (Group A/B 34/32%). The three most common etiologies were the same in both groups: intraventricular hemorrhage (Group A/B 29%/25%), tumor (Group A/B 22%/32%) and myelomeningocele (Group A/B 26%/12%). Shunt infection rate was 17% in Group A and 8.5 % in Group B. Time from shunt insertion to removal of shunt for infection was 76.8, 3-572 (mean, range) days in Group A and 30.8, 11-55 (mean, range) days in Group B.
CONCLUSIONS:Implementation of a protocol for shunt surgery reduced shunt infection rate by 50%

FL-050

Hydrocephalus

Long term outcome of hydrocephalus with myelomeningocele

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OBJECTIVE:Most of hydrocephalus with myelomeningocele is treated with ventricular peritoneal shunt soon after birth. However, the long-term outcome is unknown. Among 42 myelomenigocele patients who are visiting our department, we investigated the long-term outcome of 39 patients who underwent VP shunt during infancy.
MATERIAL-METHODS:Patients were divided into three groups, 0 to 9 years old (group A n=13), 10-19 years old (group B, n=14), and over 20 years old (group C, n=12 people). Number of ventricular peritoneal shunt operations, whether shunt was functioning at the final examination, whether shunt was removed or not, and whether endoscopic third ventriculostomy (ETV) was performed or not, was evaluated.
RESULTS:The average age was 18.3 years, the average number of shunt operations was 2.8 times, and especially in group C, the number was 5.6 times. In total, 17 cases were considered to be free from shunt dependence, 5 in group A (38%), 7 in group B (50%) and 6 in group C (50%). There were 14 cases (35.9%) in which the shunt was removed, and in 8 cases ETV was performed at the time of shunt removal. There were 3 cases in which the shunt remains but obviously not functioning. The number of the cases naturally became shunt-independent state (patients who did not undergo ETV), were totally 9, 1 in Group A (7%), 4 in group B (29%), and 4 in group C (36%).
CONCLUSIONS:A certain number of cases where hydrocephalus due to myelomeningocele escapes naturally from shunt dependent state over time. Moreover, the possibility of reducing the proportion of shunt dependence can be achieved by performing ETV to shunt dependent cases.

FL-051

Hydrocephalus

It's not always the shunt to blame: sterile peritoneal malabsorption of cerebrospinal fluid in children

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OBJECTIVE:Ventriculoperitoneal shunt (VPS) malfunction due to peritoneal malabsorption of cerebrospinal fluid (CSF) is an incompletely understood phenomenon in the absence of infection. We sought to analyze this complication in a contemporary cohort of children with VPS.
MATERIAL-METHODS:Cases were defined as reoperations due to peritoneal CSF malabsorption in the absence of proven infection or malfunction of the shunt itself. Patients were retrospectively identified from an institutional database comprising 181 pediatric VPS implantations between 2000 and 2016 and medical charts were reviewed.
RESULTS:Sterile CSF malabsorption occurred in 4 patients (2 male, 2 female) at a mean age of 12.5 months (range 1 to 24 months). An increase in abdominal girth and ventricular size were the presenting signs. Excessive intraabdominal fluid could be detected on ultrasound. Regarding the etiology of hydrocephalus, three patients had brain tumor resections (two medulloblastomas, one choroid plexus carcinoma) and one patient had aqueductal stenosis. Analysis of risk factors revealed previous chemotherapy in the three oncological patients (actinomycin D in one and methotrexate in two patients) and premature birth at 30 weeks of gestation in the child with congenital hydrocephalus. One oncological patient was subsequently diagnosed with veno-occlusive disease of the portal vein after developing hepatomegaly and raised liver enzymes, presumably secondary to chemotherapy with actinomycin D. All patients underwent temporary shunt externalization and then conversion to a ventriculoatrial shunt (VAS). Ventricular size improved in all patients and ascites regressed.
CONCLUSIONS:VPS failure due to peritoneal malabsorption of CSF is a rare event and should be taken into account in shunted children presenting with concomitant CSF underdrainage and significant ascites. Risk factors suggested by our data include previous chemotherapy as well as prematurity. Conversion to a VAS appears to be an effective treatment. To further analyze this rare complication a multicentric registry would be desirable.

FL-052

Hydrocephalus

Reliability of cerebrospinal fluid turbulence and choroid plexus visualization on fast-sequence MRI in pediatric hydrocephalus

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OBJECTIVE:Endoscopic third ventriculostomy with choroid plexus cauterization (ETV/CPC) has gained popularity in the treatment of neonatal and infant hydrocephalus. Identification of treatment failure is critically important. A pilot study of two novel imaging markers seen on fast-sequence T2 axial MRI demonstrated potential clinical utility. Reliability of detecting these markers among multiple raters must be established prior to multicenter investigation.
MATERIAL-METHODS:Two sets of de-identified single-shot T2-weighted turbo spin-echo axial images were prepared from scans of ETV/CPC patients at our center from March 2013 to January 2016. The first demonstrated the lateral and third ventricles for visualization of turbulent cerebrospinal fluid dynamics; the second, the lateral ventricular atria for choroid plexus glomus detection. Three raters (Group 1) received written instructions before evaluating each image set twice, separated by one week. Another eight raters (Group 2) evaluated both image sets following oral instruction and group training on a "pre-test" image set. Fleiss' Kappa coefficients with 95% confidence intervals were calculated for intra- and inter-rater reliability in Group 1 and inter-rater reliability in Group 2.
RESULTS:Intra-rater reliability kappa coefficients for Group 1 were > 0.74 for turbulence and > 0.80 for choroid plexus; their inter-rater kappa coefficients at initial assessment were 0.50 (0.37, 0.62) and 0.56 (0.43, 0.69), respectively. Group 2 inter-rater kappa scores were 0.82 (0.78-0.86) for turbulence and 0.62 (0.58-0.66) for choroid plexus.
CONCLUSIONS:With minimal training, intra-rater reliability on visualization of turbulence and choroid plexus was substantial but inter-rater reliability was only moderate. After modestly increasing training, inter-rater reliability improved to near-perfect and substantial reliability for visualization of turbulence and choroid plexus, respectively. Given adequately trained observers, multi-center investigation of the potential clinical utility of these markers appears feasible.

Wednesday, 11 October 2017
15:16 – 15:25

Flash Parallel Presentations: Chiari/ Other

FL-053

Antenatal diagnosis and treatment

Ventriculomegaly diagnosed in fetal period: outcome and incidence of post natal hydrocephalus. A series of 278 cases

Nathalie Chivoret[1], Anne Claude Madkaud[2], Pascale Bach Segura[3], Anthony Joud[2], Olivier Klein[2]
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[3]Department of woman and children imaging, CHRU Nancy, France

OBJECTIVE:To describe a population of fetal ventriculomegaly and to evaluate the outcome (including post natal hydrocephalus
MATERIAL-METHODS:Reports of women who underwent ultrasound scanning between 18 and 36 weeks of gestation in two level 3 french centres during the period January 1, 2000 to December 31, 2010, were reviewed. According to the severity of ventriculomegaly of fetuses, women were divided into three groups: mild ventriculomegaly (Group A); moderate ventriculomegaly (Group B); and severe ventriculomegaly (Group C). The women were classified into the "gray zone" group if the fetal lateral ventricle measured between 7 mm and <10 mm. All cases were followed up with additional ultrasound scans. Postnatal information was obtained from the computer database or the medical charts.
RESULTS:A total of 278 cases were reviewed. Among this cases, 44 % were considered severe, 31 % moderate and 26 % mild. 48% of cases had associated anomalies and severe ventriculomegaly was significantly more often related with this anomalies compared to the other groups. Eight cases had an abnormal karyotype. 43 % of women opted for termination of pregnancy (18 patients lost to follow up). In mild ventriculomegaly, only 9 % opted for termination of pregnancy, 30 % in moderate and 71 % in severe. For the 73 patients who delivered and with follow up was available, 8 deaths were observed, 73 % of chlidren in group of mild ventriculomegaly had normal neurological development, 70 % in moderate ventriculomegaly and 54 % in severe ventriculomegaly. Only 13 children (21% of lived births) had post natal hydrocephalus with the need for CSF diversion.
CONCLUSIONS:Cases of isolated and mild ventriculomegaly without additional structural brain anomalies or chromosomal aberrations had good prognoses. It is important to make the parents of these fetuses aware of these risks, from a medico-legal point of view.

FL-055

Antenatal diagnosis and treatment

Improvement Of Quality Of Care Of Spina Bifida Patients Through Prenatal Neurosurgical Consulting

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OBJECTIVE:Myelomeningocele (MMC) is the most common neural tube defect occurring in 3-4/10,000 births. Prenatal diagnosis and consultation, can potentially alter outcomes. The effect prenatal neurosurgical consultation has on parental decision making as well as patients' outcome has not yet been adequately investigated. We expect quality of care, therefore outcomes of pediatric MMC patients whose parents received neurosurgical prenatal consults at our institution might be better than in those whose parents did not.
MATERIAL-METHODS:The study was staged to initially evaluate functional outcomes and secondly quality of care and life as perceived by the families. We identified all MMC patients treated at our institution from October 2011 to March 2017. Demographics, time of diagnosis, receipt of prenatal neurosurgical consultation, and follow-up duration and outcomes were reviewed and analyzed. A questionnaire was created for the second stage to asses parental perspectives on neurosurgical prenatal consults.
RESULTS:Forty-four patients were followed up for a mean duration of 23.19 months after surgery which was done at mean age 2.06 days. 88.63% (39/44) had lumbar/lumbosacral defect. 36.36% (16/44) had a complicated course postoperatively and 38.63% (17/44) improved at their last follow up visit, neither were significantly correlated to prenatal consults. 77.27% (34/44) were diagnosed on prenatal imaging of which 5.88% (2/34) did not receive prenatal neurosurgical consult. 75% (33/44) had received prenatal consults, all by the same attending neurosurgeon. Type of medical insurance was not significantly correlated to receiving prenatal consults. Fetal surgery is not provided at our institution and none of the cases received fetal surgery nor elected to terminate.
CONCLUSIONS:Prenatal neurosurgical consults to MMC cases does not appear to affect patient's functional outcomes. Further evaluation for

any positive changes in quality of care due to improved parental perceptions as a result of prenatal neurosurgical consultations is planned.

Thursday, 12 October 2017
10:00 – 10:20

Flash Presentations: Neuro-oncology

FL-056

Special topic: Neuro-oncology

Use of the intraoperative fluorescent diagnostics (5-ALA) in surgical treatment of pediatric patients with cerebral tumors

Aleksandr Kim[1], William Khachatryan[2]
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[2]Department of Pediatric Neurosurgery, Polenov Russian Scienific Research Institute of Neurosurgery

OBJECTIVE:To evaluate the safety and efficiency of intraoperative fluorescent diagnostics (FD) in children under resection of cerebral tumors
MATERIAL-METHODS:Analyzed results of surgical treatment of 55 patients aged from 3 to 17 years in the period from 2013 to 2016 (60 surgical procedures with the usage of FD were done). Patients received 5-ALA at 20mg/kg of body weight 3-4 hours before the tumor resection. The usage of 5-ALA was done only in case of absence of any contraindications. The medication was in use only with the informed consent from parents and the approval of our Neurosurgery Institute Committee of Ethics.
RESULTS:In the group of children with glioma the intensity of fluorescence was statistically dependent on the grade of tumor ($p<0,05$). Generally the fluorescence was absent in 27 out of 60 cases (45%). All F-negative cases in the group of children with Gr.IV tumor applied to medulloblastoma (4) or to primitive neuroectodermal tumor (PNET) (1). Generally, the volume of tumor resection was higher under positive fluorescence. However statistical differences were gained in the analyze of tumor resection volume dependence on localization and fluorescence intensity. Clinically significant side effects were not registered. In 6 patients was registered transient increase of alanine transaminase level.
CONCLUSIONS:FD is a safe method for pediatric patients and allows increasing the extent of malignant glioma resection. At the stage of planning the surgical treatment, FD should be considered together with neuromonitoring results, the extent of involvement of eloquent brain zones into tumor and other specific factors. Fluorescence intencity during the primary tumor removal does not guarantee the similar effect in the following recurrent tumor resections. It is necessary to continue further study on efficiency and clinical relevance of FD for pediatric patients with tumor of different types and grade during the primary and recurrent growth of tumor.

FL-057

Special topic: Neuro-oncology

Input of Molecular Analysis in the Management of Pediatric Medulloblastoma: The Current Status in Taiwan

Tai Tong Wong
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OBJECTIVE:The 2016 revised WHO classification of CNS tumors applies molecular parameters to defined medulloblastoma (MB) in 2016. Since then, we aim at establishing molecular subtyping, related molecular analysis, and imaging features evaluation in pediatric MBs. The purpose is to provide standardized diagnosis and optimal treatment in different risk subgroups of patients.
MATERIAL-METHODS:With IRB approval, the clinical data, tumor imaging features, and RNA-S from frozen specimens of 47 patients in our cohort series were analyzed.
RESULTS:Excluding 9 intermediate cases, referring to the 22 reported subgroup specific signature genes proposed by Taylor et al. for molecular subgrouping, we classified WNT (5 cases), SHH (7 cases), Ggroup 3 (10 cases), and Group 4 (16 cases) in 38 MB cases. Seven patients were $\lesssim$3 years old. Metastatic MB at diagnosis occurred in 11 (29%) cases that includes 0 cases in WNT, 2 (28.6%) of SHH, 4 (40%) of group 3, and 5 (31.3%) of group 4 tumors. Anterior third ventricle lesion is seen in 1/2 SHHs, 0/4 Group 3, and 3/5 Group 4 patients with metastasis at diagnosis. Correlating with imaging features and molecular subgroups, all 7/7 SHH tumors were cortical-centered, and 12 of 16 group tumors were no to poor enhancing. One case with SHH tumor, MYCN amplification, TP53 mutation, 14q loss, with M3 status died 13 months after diagnosis. One patient with MYCN amplification had a second anaplastic astrocytoma. Overall survival was best in WNT tumors and worst in Group 3 tumors with significant difference to WNT and Group 4 tumors.
CONCLUSIONS:Metastasis at diagnosis, extent of tumor, craniospinal irradiation are the most significant prognostic factors in BM treatment. With input of molecular parameters integrating imaging features and clinical risk factors, in Taiwan, we are now reaching a consensus to standardize MB diagnosis and optimize treatment according to the updated new risk stratification.

FL-059

Special topic: Neuro-oncology

The rationale and design of a registry for pediatric patients with CNS lesions treated with robotic radiosurgery

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OBJECTIVE:Although robotic radiosurgery is a well-established and reliable method in adults with CNS lesions scientific evidence in pediatric patients remains scarce for both benign and malign entities. In addition the incidence of pediatric CNS lesions amenable to radiosurgery is low, thus clinical trials for evaluating this method and its indications in children are mandatory. The purpose of this register study is to collect detailed information about the efficacy, safety and outcome of pediatric CNS lesions treated with robotic radiosurgery, using the CyberKnife radiosurgery system.
MATERIAL-METHODS:The radiosurgery registry for pediatric patients ($\leq$ 18 years) with CNS lesions is designed as an interdisciplinary multicenter observational study, intending to include patients on a retrospective and prospective basis. Epidemiologic, clinical and imaging data will be collected and the follow-up will be monitored electronically throughout a five-year period. Imaging data shall be evaluated beyond the five years period. Primary endpoint will be clinical outcome for benign lesions at five years of follow-up, for malign lesions local tumor control at 1- and 2-year follow-up, respectively. Secondary endpoints will be radiation toxicity, side effects and neurocognitive development.

RESULTS:Patient enrollment will be initiated at 11 treatment centers throughout Germany, intending to expand recruitment internationally with additional centers in the EU applying for local ethics approval to take part in the study. The first twelve months are designed as a pilot phase followed by the initiation of separate sub-studies deriving from preliminary results.
CONCLUSIONS:The CyberKnife registry for pediatric CNS lesions aims to collect treatment and outcome data and to evaluate the results in pediatric patients on a multicenter level. The analysis should support the hypothesis that robotic radiosurgery offers a safe and effective treatment option for children with specific indications in highly selected cases. It may also serve as a basis for the development of future clinical studies.

FL-060

Special topic: Neuro-oncology

Supratentorial Parenchymal Ependymomas in Children: Experience with 66 Patients at a Single Institute

Chunde Li, Wei Liu, Jian Gong, Yongji Tian, Tao Sun, Miaomiao Liu
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OBJECTIVE:To study the clinical features, imaging findings, treatment methods and results, and prognosis of supratentorial parenchymal ependymomas in children
MATERIAL-METHODS:66 children with supratentorial parenchymal ependymomas were treated by the senior author at Tiantan Hospital between June 2010 and December 2014. The clinical manifestations, neuroimaging findings, treatment methods, and therapeutic results were retrospectively reviewed.
RESULTS:The study included 66 boys and three girls. The patients were aged from 2 to 16 years with an average age of 6.94 years. Gross total surgical removal (GTR) was achieved in 59 cases (89.4%), subtotal removal (STR) was achieved in 5 cases (7.6%) and partial removal (PR) was achieved in 2 patients. There were 24 ependymomas, 41 anaplastic ependymomas, and 1 subependymoma. The mean follow-up duration was 47.2 months (range, 6–83 months). During the follow-up period, 13 patients (19.7%) developed recurrent tumors: 6 patients with GTR (10.2%), 5 patients with STR (100%) and 2 patients with PR (100%). 9 patients reoperated and 5 patients died during the follow-up
CONCLUSIONS:The preoperative diagnosis of supratentorial parenchymal ependymomas is difficult. GTR can be achieved with a favorable long-term outcome using an improved microsurgical technique.

Thursday, 12 October 2017
12:18 – 12:45

Flash Parallel Presentations: Neuro-oncology

FL-062

Special topic: Neuro-oncology

Clinical features, management and outcomes of pediatric central nervous system tumors disseminated and nondisseminated at presentation: a fourteen-year experience

Matthew Anthony Kirkman, Kim Phipps, Kristian Aquilina
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OBJECTIVE:It is unusual for pediatric central nervous system (CNS) tumors to be disseminated at presentation, and literature on the clinical features, management and outcomes of this specific group is scarce. Surgical management decisions can be challenging, particularly in the presence of hydrocephalus. We present our experience in managing pediatric CNS tumors disseminated and nondisseminated at presentation over fourteen years.
MATERIAL-METHODS:Retrospective review of prospectively-collected data on children presenting to our tertiary center between 2003 and 2016 inclusive.
RESULTS:We identified 53 patients with CNS tumor dissemination at presentation (M:F=34:19, median age=3.8 years, range=7 days-15.6 years) and 308 without dissemination (M:F=161:147, median age=5.8 years, range=1 day-16.9 years). Five tumor groups were studied: medulloblastoma (disseminated n=29/nondisseminated n=74), other primitive neuroectodermal tumor (n=8/n=17), atypical teratoid rhabdoid tumor (n=8/n=22), pilocytic astrocytoma (n=6/n=138), and ependymoma (n=2/n=57). Median follow-up in survivors was not significantly different between those with (64.0 months, range=5.2-152.0 months) and those without disease dissemination at presentation (74.5 months, range=4.7-170.1 months; $P>0.05$). Dissemination status at presentation significantly impacted survival, risk of recurrence, rates of complete resection of the operated lesion, chance of proceeding to palliative care as an early management strategy, surgical complication rate, and risk of requiring CSF diversion (all $Ps<0.05$). Differences between the five tumor groups were evident. No factors to predict the need for permanent CSF diversion following temporary external ventricular drainage were identified on multivariate analysis, and there was no clear superiority of either ventriculoperitoneal shunt or endoscopic third ventriculostomy as a permanent CSF diversion procedure.
CONCLUSIONS:Tumor type and dissemination status at initial presentation significantly affect outcomes across a range of measures. The management of hydrocephalus in patients with CNS tumors is challenging, and further prospective studies are required to identify the optimal CSF diversion strategy or strategies in this population.

FL-063

Special topic: Neuro-oncology

Clinical Outcomes of Pineal Region Masses in Paediatric Patients: Single Institution Ten Years Retrospective Review

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OBJECTIVE:Pineal region masses' surgery has always been challenging requiring specialized surgical and stereotactic techniques. The paediatric age group is even more intriguing because of the varied histopathological presentations. The purpose of this review was to analyse a decade's experience of managing pineal region masses in children.
MATERIAL-METHODS:Retrospective analysis of forty five patients aged 18 years and below, treated between 2007-2016 was conducted.

Clinico-radiological assessment and their management reviewed using the hospital data base.
RESULTS:The age ranged from zero to 18 years with a mean of 10.8 years. Two thirds of the patients were male. Surgery was performed in all of the patients in the form of definite tumor excision, endoscopic third ventriculostomy with biopsy and shunt surgery. Two patients were subjected to secondary gamma knife therapy as well. Tissue diagnosis was varied, most common being the germ cell tumors (Germinomas and yolk sac tumors) followed by pineoblastomas. CSF tumor markers were helpful in forming a probable diagnosis and further planning the management strategy. Results in detail will be discussed.
CONCLUSIONS:Improvised tissue handling micro surgically along with protocolised preoperative workup and postoperative intensive care have made room for aggressive surgical resection as a definite form of therapy followed by adjuvant therapy when needed.

FL-064

Special topic: Neuro-oncology

Posterior fossa ependymomas in children. Our experience from 2000 to 2015

Alexandru Szathmari[1], Federico Di Rocco[1], Pierre Aurelien Beuriat[1], Alexandre Vasiljevic[2], Didier Frappaz[3], Cristophe Rousselle[1], Carmine Mottolese[1]
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[3]Pediatric Hematological and Oncological Institute, Centre Leon Berard, Lyon, France

OBJECTIVE:We reviewed our series of posterior fossa ependymomas (PfEp) between 2000 and 2015 in order to evaluate results with standardized management.
MATERIAL-METHODS:Out of 42 children operated, 30 were PfEp (71.5%). The age ranged between 7 months and 17 years (median 5.1 years). Clinically, intracranial hypertension was present in 17 patients, a gait disturbance in 6, a stiff neck in 5 and a nystagmus in 3 patients. In 12 cases, ventriculocisternostomy was performed 48h before direct approach A postoperative MRI was done in all patients to confirm the quality of resection. Complete removal was achieved in all patients: 26 initial and in 4 patients after a second look (under 3 weeks). Histopathology showed a predominance of OMS grade II ependymomas (17 grade II vs. 12 grade III). Eight patients had post-operative chemotherapy and 19 had radiotherapy, according to the SFOP protocol.
RESULTS:The overall survival is of 67% (n=20 patients) with a median follow-up of 6.4 years (average 7.2; range 9 months to 17 years). Mortality is of 23% with a median of 3 years after surgery (average 4; range 1 to 9 years). Three patients were lost of view. The rate of recurrence was of 33% (n=10). At long term follow up, a partial post-operative facial palsy was found in 4 children, a diplopia by VI nerve partial palsy in 2 and a slight residual cerebellar syndrome in 4 patients. Thirteen patients have a normal schooling and 2 with sustain. Two patients work normally.
CONCLUSIONS:This series confirms that posterior cerebral fossa ependymoma is an aggressive tumor. Despite advances in molecular studies no evident therapeutic target emerged yet. Therefore, surgery with complete removal remains the most important prognostic factor even if there is a greater risk for post-operative deficits.

FL-065

Special topic: Neuro-oncology

Evaluation of Viruses and Toksoplasma Gondii in Etiology of Glioblastoma Multiforme

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[5]Department of Neurosurgery, Erciyes University School of Medicine,Kayseri,Turkey

OBJECTIVE:Glioblastoma (GBM) is a commonly seen brain-tumor in adults, which comprises 12-15% of intracranial tumors&60-75% of astrocytic tumors. It has been reported that there are mutations underlying tumorigenesis which are caused by combined and/or consecutive effects of multiple factors. Relationships among multiple oncogenes, microorganisms and tumors have been investigated.
MATERIAL-METHODS:Tumor group (TG) consisted of 50 patients diagnosed as GBM,while control group (KG) consisted of brain-tissues obtained from 21 autopsy-cases with cause of death other than tumor&/or infection.TG was further subdivided into 2-groups: TG-1 in which microorganism was detected and TG-0 in which no-microorganism was detected. In the tissue-samples in TG&KG,genetic materials of HSV-1&HSV-2, CMV,EBV,Measles,PV,JCV,BKV,SV-40 and Toxoplasma gondii were evaluated via PCR. In TG,presence of microorganism, age, gender, survival,Karnofsky performance scores (KPS),resection-extent, histopathological&radiological data& KG data were statistically analyzed by SPSSforWindows15.0.
RESULTS:Genetic-materials of 4 different microorganisms were detected in 12-patients (Toxoplasma gondii[5],EBV[3],BKV[4] and JCV[1]) in TG, while no genetic-material was detected in KG. In TG, genetic-materials of both JCV&Toxoplasma were detected in one tumor-tissue.In TG,relationship between presence of EBV&survival or tumor localization was statistically-significant.In TG&TG-1,tumors were predominantly located at left-hemisphere and temporal-lobe, in particular. Significant-inverse relationship was found between age-at-diagnosis &survival. Significant-positive relationship was found between mass-volume&edema-volume. Significant-inverse relationship was found between mass volume and post-operative KPS.Significant-positive relationship was found between mass-volume and shift-effect of mass and between edema-volume and shift-effect of mass. Significant-positive relationship was found between preoperative-KPS and postoperative-KPS.Diagnosis-at-younger age, longer survival, male-predominancy, decrease in mass-volume, edema-volume and mass-effect were detected in TG1 group. The higher preoperative-KPS in TG-1 was found statistically-significant.
CONCLUSIONS:The GBM is more commonly localized at temporal-lobe and functional-areas. EBV-DNA(+)tumor cases have profound localization and longer survival. The detection of microorganism in tumor tissue affects age-at-diagnosis, survival, KPS,mass and extent of edema-volume. The detection of microorganism in tumor-tissue suggests that these microorganisms may play role in tumor-development and prognosis. The establishing the effect of viruses on tumor-development and prognosis will allow developing novel and alternative methods in the treatment-protocols. Thus,larger-case-series and prospective-studies are needed.

FL-067

Special topic: Neuro-oncology

Treatment outcome of intracranial non-germinomatous germ cell tumors in children

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OBJECTIVE:Aim of this study is to evaluate the treatment outcome of intracranial non-germinomatous germ cell tumor (NGGCT) and to identify the pitfall of the treatment.
MATERIAL-METHODS:15 patients with NGGCTs were treated between January 2000 and December 2016 with average age of 10.3 years, including 10 boys and 5 girls. Location of tumor was 10 pineal region, 4 supraseller and 1 posterior fossa. The study included NGGCTs with a tissue or marker diagnosis, excluding pure germinoma and mature teratoma. 14 patients received chemoradiotherapy and 6 patients underwent salvage surgery.
RESULTS:5-year overall survival and event-free survival was 90% with average follow-up period of 53 months. 1 patient of immature teratoma initially disseminated died of disease progression. 4 patients of supraseller NGGCT required hormonel replacement and 2 out of 6 patients who underwent craniospinal irradiation revealed moderate degree of intellectual disturbance.
CONCLUSIONS:Patients achieved comparable outcomes by combined modality treatment. Long-term follow-up is needed to define the benefit and complication of the treatment.

Thursday, 12 October 2017
12:18 – 12:40

Flash Parallel Presentations: Miscellaneous

FL-069

Infection

Investigating the immune response in paediatric brain infections: transcriptomic analysis in tuberculous meningitis

Ursula K Rohlwink[1], Rachel Lai[6], Armin Deffur[5], Anna Coussens[5], Nico Enslin[1], Katalin A Wilkinson[2], Brian Eley[3], Michael Levin[4], Ronald Van Toorn[8], Regan Solomons[8], Anthony Figaji[1], Robert Wilkinson[7]
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OBJECTIVE:Cerebral infections are a major burden of disease in children, typically presenting to neurosurgeons when complicated by hydrocephalus and intracranial collections. Surgery is often needed, but is only part of management. A better understanding of the inflammatory response is essential as it strongly impacts outcome. Examining the RNA transcriptome offers insight into pathogenesis and the molecular basis of the immune response and could elucidate novel biomarkers and avenues for treatment. We examined the transcriptomic signature of tuberculous meningitis (TBM) in peripheral and site of disease samples using total RNA sequencing (RNA-seq).
MATERIAL-METHODS:Blood and cerebrospinal fluid (CSF) samples were collected from children treated for TBM from 2014-2016. Controls included patients with non-tuberculosis cerebral infections ('non-TB', n=7, blood and CSF) and patients undergoing elective neurosurgery for non-infective conditions ('healthy' controls, n=47, blood only). Blood was collected in Paxgene tubes, various methods for CSF collection and RNA extraction were piloted to find an optimal approach. Samples underwent RNA-seq and pathway analysis.
RESULTS:Samples were collected from 20 TBM patients (median age 3 [0.3-12] years). Blood analyses demonstrated a strong inflammatory and cell death signature, with a higher abundance of RNA transcripts associated with the inflammasome pathway detected in TBM patients relative to 'healthy' controls. The gene expression differential relative to 'non-TB' controls was not remarkable, but sample numbers were small. CSF RNA-seq analysis is currently underway.
CONCLUSIONS:This is the first known study to conduct RNA-seq in blood and CSF in TBM. Blood results demonstrate a strong innate immune response associated with tissue damage. We anticipate that CSF results will offer novel insight into inflammation at the site of disease. Our sample preparation and RNA analysis methods could be generalised to other forms of cerebral infections, and will generate hypotheses for further research, including novel immune-based therapies.

FL-071

Other

Scalp lumps: experiences in a single institution and effective differential diagnosis

Eun Jung Koh[1], Kyu Chang Wang[2], Seung Ki Kim[2], Ji Yeoun Lee[2], Ji Hoon Phi[2]
[1]Department of Neurosurgery, Dongguk University Ilsan Hospital, Goyang-si, Gyeonggi-do, Republic of Korea

[2]Division of Pediatric Neurosurgery, Seoul National University Children's Hospital, Seoul, Republic of Korea

OBJECTIVE:Scalp and skull masses in infants and children are not uncommon. Most lesions are benign and curable by simple surgical resection. However, scalp and skull masses have various causes and clinical manifestations. There are the possibilities of malignancy, metastasis and intracranial extension that change the treatment policy. The purpose of this study is to find out the frequent disease and the essential evaluation for differential diagnosis in scalp and skull lesions.

MATERIAL-METHODS:Total 202 patients with scalp lump were treated surgically from January 2001 to January 2017 at the Division of Pediatric Neurosurgery of Seoul National University Children's Hospital. We reviewed the medical records of the patients to acquire demographic data, clinical histories, gross findings of the lesions, radiological examination, treatment, diagnosis and follow-up.
RESULTS:The most common diagnosis was Langerhans cell histiocytosis (LCH). 55 (27.2%) patients had LCH. In the next, 28 (13.9%) patients were diagnosed with epidermal cyst and 27 (13.4%) patients were diagnosed with dermoid cyst. The combined number of epidermoid and dermoid occurrences is similar to the number of LCH, and the sum of the three is close to half of the total. There was no difference in the incidence between genders in whole patients and in each diagnosis. The mean age at diagnosis of epidermoid/dermoid cyst is younger than of LCH. We assessed size, growth rate, location, multiplicity and gross findings of mass including hardness, pain, skin punctum, and trans-illumination. In addition, we identified how imaging tools were used in each diagnosis: skull x-ray, head ultrasonography, computed tomography and magnetic resonance.
CONCLUSIONS:Scalp and skull masses should be evaluated with an understanding of specific demographics and clinical features of each diseases. Visual and tactile inspection of the mass is very important. Furthermore, we should make full use of imaging that can identify the factors affecting treatment plan.

FL-073

Other

Is there a weekend effect in paediatric neurosurgery?

Emer Campbell, Lorraine Todd, Roddy O'kane, Anthony Amato Watkins, Meharpal Sangra
Royal Hospital for Children, Glasgow, United Kingdom

OBJECTIVE:The 'weekend effect' is currently a much discussed issue in healthcare. The vast majority of published studies focus on adult patients and mortality rates. We sought to determine whether the day of admission or the day of surgery has any impact on the significant adverse event rate or unscheduled return to theatre rate for urgent and emergency paediatric neurosurgical operations performed in our institution.
MATERIAL-METHODS:Prospective surveillance of all adverse events and deaths from 1st January 2014 to 31st December 2016 following non-elective paediatric neurosurgical procedure. The day of admission and the day of operation were categorised as week day (Monday – Friday) or Weekend / Public Holiday.
RESULTS:592 urgent and emergency procedures were performed in 260 patients. For patients admitted on a weekday and who then underwent an urgent or emergency procedure during that admission, the significant adverse event rate was 22.8% and the unscheduled return to theatre rate was 17.0%. For patients admitted on a weekend or public holiday, the significant adverse event rate was 23.6% and the unscheduled return to theatre rate was 16.4% (p value 0.649 and 0.890 respectively)
For urgent operations performed on a weekday, the significant adverse event rate was 22.6% and the unscheduled return to theatre rate was 16.5%. For urgent operations performed on a weekend or public holiday, the significant adverse event rate was 25.7% and the unscheduled return to theatre rate was 20.0%, (p value 0.650 and 0.496 respectively)
CONCLUSIONS:We find no evidence that patients either admitted on a weekend or public holiday or who undergo urgent or emergency surgery on a weekend or public holiday experience a higher complication rate than patients who are admitted or undergo surgery during the working week.

FL-075

Other

Extracranial outflow of particles solved in cerebrospinal fluid

Takuya Akai[1], Toshihisa Hatta[2], Hiroki Shimada[2], Keiji Mizuki[3], Taizo Hatta[3], Satoshi Kuroda[1]
[1]Department of Neurosurgery, Toyama University, Toyama, Japan
[2]Department of Anatomy, Kanazawa Medical University, Uchinada, Japan
[3]Department of Nanoscienece, Sojo University, Kumamoto, Japan

OBJECTIVE:Cerebrospinal fluid (CSF) is thought to be mainly absorbed into the arachnoid granules and drained into the sagittal sinus. This hypothesis can explain most pathological conditions. However, some observations conflict with this hypothesis: 1) no arachnoid granules in lower level animals and even in human fetuses; 2) no CSF collection around the dural sinus in patients with communicating hydrocephalus; 3) the paraventricular low density areas on CT in patients with hydrocephalus; 4) MR images demonstration of bidirectional turbulent CSF movements; 5) communicating hydrocephalus treatable by third ventriculostomy. In this study, we investigated the outflow of CSF in ventricles and subarachnoid space, and described the CSF movement regulation system.
MATERIAL-METHODS:Several kinds of fluorescent probes with differing molecular weights (MW), and gold particles with different size were injected into the lateral ventricle or subarachnoid space in mice with gestation of 13 days. The movements of the fluorescent probes were monitored in live, and the deposition of gold particles were observed by silver stain.
RESULTS:1) Following intra-ventricle injection, the probes dispersed into the 3rd ventricle and aqueduct immediately, but did not move into the 4th ventricle and spinal canal. With an injection of low and high molecular weight (LMW, HMW) conjugated probes, both probes dispersed into the brain but only the LMW probe dispersed into the whole body. Following intra-subarachnoid injection, both probes diffused into the spinal canal gradually. Neither probe dispersed into the brain and body. 2) The deposition of gold particles on the frontal skull base and liver were observed. The size of gold particles in liver was 2 nm in diameter.
CONCLUSIONS:1) The movements of CSF in ventricles and subarachnoid space are different. 2) The movement of metabolites in CSF to the extracranial space will be restricted by molecular weight and size. 3) The CSF outflow tracts should be disclosed.

NURSING SYMPOSIUM

Sunday, 8 October 2017
10:00 – 15:00

NS-001

The Evolution of Advanced Practice Providers in Pediatric Neurosurgery: A Clinical Review

Heather Eckman, Megan Worley, Christine Gumma, Neena Marupudi, Sandeep Sood, Abilash Haridas, Steven Ham
Department of Neurosurgery, Wayne State University, Detroit, USA; Department of Neurosurgery Children's Hospital of Michigan, Detroit, MI, USA

OBJECTIVE:This report examines the evolution of the role of pediatric nurse practitioners (CPNP) and physician assistants (PA) at the Children's Hospital of Michigan Department of Neurosurgery in Detroit, Michigan. Collectively, the advanced practice providers (APPs) are responsible for day-to-day running of the pediatric neurosurgery department to include pre and post-operative management of patients, staff the neurosurgery walk-in clinic, participate in the weekly myelomeningocele multidisciplinary clinic, assist in the operating room, complete consultations, participate in weekly neuroradiology conference and monthly morbidity and mortality conference, provide patient, community and higher learning education, participate in research, create the on-call schedule for staff members and rotating residents and provide on-call coverage.
MATERIAL-METHODS:We examined data from the last ten years, conducted personal interviews with the three attending neurosurgeons, and various APPs to gain insight into the creation and evolution of the APP managed department. We examined the contribution of the APPs to the pediatric neurosurgery department to identify the historical atmosphere that gave rise to the robust APP contribution and recognize the potential for future role expansion.
RESULTS:Currently, we staff nine APPs (five CPNPs and four PA-Cs including one team lead), three attending neurosurgeons and three rotating residents. The responsibilities of the APPs are far reaching to provide continuity of care with limited resources in response to higher patient acuity, limited resident hours, and an increase in operating cases. Our system promotes safer patient care with the number of APPs and sign-out schedule that limits the number of handoffs.
CONCLUSIONS:The advanced practice providers are responsible for daily patient management, provide in-depth education to patients and their families and engage in professional educational opportunities through the academic medical institution and various medical association conferences. The APPs have positively contributed to the patient centered approach to pediatric neurosurgery through consistent intrapersonal communication with colleagues, patients and families.

NS-002

The management of children with Achondroplasia- the neurosurgical perspective

Lindy May
Department of Neurosurgery, Hospital for Children, Great Ormond Street, London

OBJECTIVE:To provide an increased understanding of the management of children with Achondroplasia from the neurosurgical perspective.
MATERIAL-METHODS:1. A literature review of current neurosurgical intervention for children with Achondroplasia was undertaken to examine management of the following:
Cervicomedullary Compression
Spinal Stenosis
Syringomyelia
Thoracolumbar Kyphosis
Hydrocephalus
2. A case study presentation provides the neurosurgical pathway of an infant with Achondropalsia at the Hospital for Children, Great Ormond Street.
RESULTS:The literature review highlights the clinical parameters on which to base decision making regarding neurosurgical intervention (bulbar dysfunction, central sleep apnoea, myelopathy, raised intracranial pressure) and identifies the current trend to refrain from shunting for management of ventriculomegaly in the majority of cases. The case study describes a child's symptomology which led to neurosurgical intervention, and describes the clinical pathway and outcomes for the child.
CONCLUSIONS:MRI, routine sleep studies and regular neurosurgical follow up have resulted in timely medical and surgical intervention for symptomatic children with Achondroplasia, with a reduced incidence of irreversible myelopathy. Some children however will continue to have serious health consequences related to upper-airway obstruction and cervicomedullary compression despite medical and surgical intervention; moreover the majority of children with Achondroplasia will have impaired physical milestones when compared to normative values and many will have mild impairment of verbal IQ, arithmetic, attention, and executive functioning.

NS-003

Pain Control and Positioning in Children Following Selective Dorsal Rhizotomy Surgery

Janette Christine Coble
Department of Neuroscience, Saint Louis Children's Hospital

OBJECTIVE:Multiple methods to address pain post Selective Dorsal Rhizotomy (SDR) include a continuous epidural infusion, medication administration, and re-positioning. The length of time for the patient to remain flat was increased to potentially improve pain management. However, no studies in the literature were found to support the practice change. Nurses inquired whether this change resulted in optimal pain control. The primary research aim was to determine if the change in positioning resulted in a difference in pain control.
MATERIAL-METHODS:A mixed methods study was conducted to most effectively address the study aims. A retrospective quantitative design was used to compare pain medication administered before and after the practice change. Patients between the ages of 2-15 years and admitted to the neuroscience unit after SDR surgery were included. Data was electronically retrieved to record patient demographics and number of doses of scheduled and intermittent medications for pain. Descriptive and univariate statistics were used for analysis to detect differences. Qualitative methods were used to describe the nurse's experience managing the pain of SDR patients.
RESULTS:The retrospective component of the study analyzed a total of 378 patients (142 one day; 236 three day). There were no statistical differences in demographic variables between the two groups. There was no statistical significant difference between the number of intermittent doses of pain medications ($p = 0.385$) or antispasmodic medications ($p = 0.775$). The two main themes that emerged from the nurse focus groups related to pain included increased parent and child anxiety with longer flat times and decreased opportunities for distraction as a nursing intervention.
CONCLUSIONS:Results support return to the practice of only one day of flat time. Nurses perceive that increased days for lying flat contributes to child and parent anxiety, therefore decreasing flat time to one day may lower anxiety without affecting pain control.

NS-004

A Comparison of Dressing Techniques for Pre-surgical Closure of Myelomeningocele in the Neonate

Cathy Cartwright, Usiakimi Igbaseimokumo
Children's Mercy Kansas City Kansas City, Missouri, USA

OBJECTIVE:Myelomeningocele is an open neural tube defect that occurs when there is non-fusion of a portion of the bony spine, allowing extrusion of the spinal contents such as the cerebrospinal fluid (CSF), spinal cord and meninges. Although myelomeningoceles are routinely closed surgically within 24 to 48 hours after birth, the defect and exposed placode must be protected from further damage from excoriation and contamination until surgery. This is done in many different ways and a review of the literature demonstrates no evidence-based technique. Two methods to keep the defect moist and sterile are used at our large Midwestern children's hospital, the Occlusive and the Drip. There was no agreement between the neonatal and neurosurgical teams as to which technique was superior.
MATERIAL-METHODS:Design: A prospective, randomized trial was done to compare the ease of nursing care, cost of supplies, neonatal temperature and moisture of the placode at time of closure. Nurses recorded temperatures and rated ease of care on a data collection sheet. The neurosurgeon rated the condition of the placode when the dressing was removed in the operating room at time of closure.
Sample: Thirteen neonates born with a myelomeningocele at our hospital were included in the study.
RESULTS:Nurses categorized the Occlusive group as easy care (100%) compared to 60% for the Drip group, although the difference was not statistically significant (p=0.18). The mean temperatures of the two groups prior to surgery were identical at 36.9 degrees Celsius. The cost of the Drip was 6 times higher than the Occlusive technique. The placode was assessed as moist by neurosurgeons at the time of surgery.
CONCLUSIONS:Although physician and nursing barriers significantly impacted and abbreviated this study, both techniques kept the placode moist and did not affect the neonate's temperatures. The Occlusive method is easier for nursing care and more cost-effective.

NS-005

Fetal in-utero Repair of Myelomeningocele: Postnatal Wound Management From a Nursing Perspective

Anne M Gildehaus[1], Matthew Pierson[1], Emanuel Vlastos[2], Samer K Elbabaa[1]
[1]Division of Pediatric Neurosurgery, Saint Louis University School of Medicine
[2]Saint Louis Fetal Care Institute, SSM Health Cardinal Glennon Children's Hospital

OBJECTIVE:The Management of Myelomeningocele Study (MOMS) trial results showed improved hydrocephalus and motor/cognitive outcomes in prenatal repair group compared to the postnatal group. We report our wound healing patterns, dehiscence rates, wound care and nursing management of our first 57 fetal myelomeningocele (MMC) repairs performed at our center (2011-2017) following the MOMS trial.
MATERIAL-METHODS:We retrospectively reviewed the charts and radiographic studies for mothers and neonates who underwent fetal MMC repairs. We looked closely at types of fetal MMC repair (primary repair versus graft), gestational age (GA) at time of repair and birth, status of healing versus dehiscence at repair site and rates of CSF leak requiring operative revision. Methods of local wound care and positioning restrictions were evaluated to establish nursing care recommendations.
RESULTS:All MMC lesions were successfully repaired using a multilayered microneurosurgical technique between 20 and 26 weeks GA. At time of this study, 55 children are surviving. Following placode and dural closure, 49 fetuses underwent primary skin closure, including an in-lay augmenting acellular human dermis graft in 11 cases. Due to wide defects at time of fetal MMC repairs,6 fetuses underwent skin closure using on-lay graft. At birth, five fetuses underwent secondary repair using assistance of plastic surgery team, 3 of them had wide myeloschisis defects at time of MMC repair and presented with CSF leak at birth. At birth, 16/55 had superficial skin dehiscences managed conservatively with local wound care and positioning restrictions. Local wound care techniques varied form a topical antibiotic ointment or emollient to daily hydrogel dressing changes.
CONCLUSIONS:From a nursing perspective, all superficial skin dehiscences without CSF leak at birth following fetal MMC repair could be managed conservatively. Myeloschisis wide lesions are at high risk of requiring graft during fetal repair and likelihood of operative revision after birth.

NS-006

Setting up and delivering an acute, non-general anaesthetic, nurse led, Botulinum Toxin Therapy service within paediatric neurosciences

Jenny Sacree
Paediatric Neurosciences, Bristol Royal Children's Hospital, Bristol UK

OBJECTIVE:The deliverance of botulinum toxin therapy in acute care within paediatric neurosciences is an evolving arena where perhaps previously it has been more associated with general anaesthetic (GA) sessions within the orthopaedic service for chronic spasticity, perhaps especially within the cerebral palsy patient population.
We review the applications within acute paediatric neurosciences including early delivery after hypoxic ischaemic and vascular injuries and for patients in dystonic crisis and the responses to these interventions seen at our institution.
MATERIAL-METHODS:With joint physiotherapist and medical assessment, Botulinum Toxin Therapy has been delivered for children from the age of 2 – 16 years, in the acute setting, under ultrasound (USS) guidance and without GA to a variety of pathologies. Case studies, within the presentation, are used to highlight the nature of the response to therapy and the patient/parent experience of the therapy
RESULTS:The results show a very positive response to the early delivery of Botulinum toxin therapy within acute paediatric neurosciences for multiple aetiologies, and the ability to delivery this therapy without GA to a wide age range of patients
CONCLUSIONS:Nurse led, non-GA, USS guided delivery of Botulinum Toxin Therapy has an extremely useful place within acute paediatric neurosciences

NS-007

Congenital Hypotonia: Neurosurgical Management, Case Report

Kamilah Dowling, Andrew Kobets, James T. Goodrich
Montefiore Medical Center

OBJECTIVE:To discuss the management of a patient who presented in infancy with hyptonia of unknown etiology, neurosurgical management and subsequent follow up care
MATERIAL-METHODS:Will discuss the patients prognosis from presentation to 18 month follow up
RESULTS:Will discuss specifics on this patients progress
CONCLUSIONS:Prognosis is hard to determine on initial presentation, outcome is multifactorial, depends on level of care including management in acute setting, physical therapy and family involvement

NS-008

"Non Accidental Head Injury - how the nurse feels caring for these infants and the parents who may have harmed them"

Lynne Fulton
Great Ormond Street Hospital

OBJECTIVE:The aims of this study are;
1 To investigate how nurses cope when faced with an infant with non-accidental head injury and their potential perpetrator
2. Suggest methods by which nurses can be supported when caring for these families
INTRODUCTION:The mechanism for Non-accidental head injuries (NAHI) in babies includes shaking or direct impact. The pathology includes retinal haemorrhage, subdural haemorrhages, and / or encephalopathy, and is often associated with other injuries including bruising and rib / femur fractures. Mortality rates for these children is around 20% and for those who survive, disability occurs in 34% and mild disability in 25%. The true number of how many infants NAHI effects is unknown, due to non reporting and/or failure to follow protocol. Nursing this patient group can prove challenging and it is at times difficult to remain non judgemental when facing a sick infant and their potential perpetrator/s.
MATERIAL-METHODS:A qualitative study will be carried out by interviewing 10 nurses on a neurosurgical unit who have cared for NAHI infants and their parents. Qualitative data will be collected by focus group and individual interview. The results will be grouped into themes and subthemes to enable analysis.
From this analysis, suggestions will be made as to how to address the emotive responses of nurses caring for these babies and their parents, and provide support.
RESULTS:The results from this ongoing study will be provided in the presentation. Initial results however suggest that despite anger and sadness, nurses were able to initiate coping mechanisms in order to remain professional when liaising with families. Education, counselling and using senior members of the nursing team all proved beneficial. Ensuring these are all readily available is essential in delivering the best possible care experience for this patient group and maintaining the well being of nursing staff.

NS-009

Clinical Implications of skull fracture in children with head trauma

Myoung Hee Ji, Young Shin Ra
Division of Pediatric Neurosurgery, Asan Medical Center Children's Hospital, Seoul, Korea

OBJECTIVE:Head trauma can involve skull fracture and/or intracranial hemorrhage in children because larger but thinner skull contrary to adult. This study was performed to determine the clinical parameters which suggest the chance of intracranial hemorrhage in children with head trauma.
MATERIAL-METHODS:We conducted a retrospective study on patients with head trauma under the age of 18 who visited the emergency center of a Tertiary hospital for 2 years of period. Totally 98 patients was diagnosed with skull fracture after head trauma and subsequently took Brain CT scan. Male was dominant to female (63:35) and the mean age was 51.1 months.
RESULTS:Among the 98 patients with skull fractures, head trauma is mostly caused by fall (67.2%), slip (21.3%), traffic accident (TA, 6.6%) and assault (4.9%). Brain CT scan revealed that 62 patients (63.3%) had only skull fractures and 36 (36.7%) had associated intracranial hemorrhage. Symptoms of simple skull fracture were swelling (64.5%), vomiting (21%), headache (16.1%), bruise (11.3%), nausea (9.7%), loss of consciousness (9.7%) and laceration (8.1%). When skull fracture is associated with intracranial hemorrhage there were headache (44.4%), nausea (36.7%), LOC (33.3%), bruise (30.6%), laceration (22.2%) and vomiting (16.7%). Statistically, significant difference in symptom was observed between simple skull fracture and intracranial hemorrhage with skull fracture: headache (p=.0022), LOC (p=.0036), bruise (p=.0176)
CONCLUSIONS:Skull fracture is infrequently implicated with intracranial hemorrhage (36.7%) in children. When child sustain with head trauma Brain CT scan is strongly indicated in symptoms of headache, LOC, and bruise on head.

NS-010

How decreasing maternal separation prior to surgery affects physiological stability in infants and small children. A randomised control trial

Lydia Vero Nabuduwa Ssenyonga[1], Minette Coetzee[2], Nils Bergman[3]
[1]CURE Children's Hospital of Uganda, Mbale, Uganda
[2]Child Nurse Practice Development Initiative; University of Cape Town, South Africa.
[3]Paediatrics and Child Health; University of Cape Town, South Africa.

OBJECTIVE:Intensive care of critically ill infants conventionally involves extended maternal–infant separation. The widely held belief that separation anxiety is a developmental phase which occurs in 7-9 month old infants, supports numerous practices of separation in hospital settings Extensive research in preterm and term infants has demonstrated the adverse effects of separation. A clear evidence-base now exists for maternal–infant skin-to-skin contact as an alternative place of care to the incubator in neonates. Better physiological outcomes and stability have been measured in skin to skin contact than the same care provided in closed servo-controlled incubators. The presence of the mother is linked to stress modulation and homeostatic control, and supportive of infant's immature autonomic system which orchestrates the physiological stress-response. Heart rate variability (HRV) is a means of quantifying autonomic nervous system activity. Effects of the mother's presence or absence during stressful medical interventions have not been established for infants below 6 months. This presented the opportunity to investigate the physiological effect of possible separation stress in infants before and after anaesthesia and an invasive procedure.
MATERIAL-METHODS:A prospective, single blinded, randomized controlled clinical trial was done to investigate the effects of maternal separation on a sample of 8 infants younger than 6 months of age and undergoing surgery. Subjects were recruited prior to surgery and randomized by opaque sealed envelopes. Continuous monitoring of the HRV and impedance cardiograph was added to standardised care, observation and postoperative pain data validated with the mother. Data were analysed without knowledge of the groups.
RESULTS:There was an increase in autonomic activity with sympathetic activation in infants without their mothers. This research will present the full results of this study and the implications for care of infants in critical care settings.
CONCLUSIONS:The mother's presence determines the physiological stability of the child.

NS-011

Use of Advance 3D Imaging and 3-D Printing For Craniopagus Conjoined Twin Separations: Nursing Perspective

Esther Kho Uy
Montefiore Medical Center, Bronx, New York USA

OBJECTIVE:Craniopagus twins are conjoined twin who are attached to each other on the head. Only a handful will survive and be considered for surgical separation. According to a Cable

News Network, there are only 59 cases of craniopagus conjoined twin separation since 1952 world wide. Literature search for operating room nursing practice on the topic resulted with a few articles. The advancement in radiologic imaging, computer modeling and 3D printing with life size "tactile" models helped the nursing team in pre-surgical planning, preparation and its execution in the daunting task of craniopagus twin separation.
This presentation will discuss and demonstrate the use of advance 3D imaging and 3D printing by the operating room neurosurgical nursing team of The Children's Hospital at Montefiore in the separation of 2 sets of craniopagus conjoined twin.
MATERIAL-METHODS:Case studies of 2004 and 2016 craniopagus conjoined twin separations.
RESULTS:The advanced imaging and 3D printing is a very important technological armament the operating room neurosurgical nursing team have to provide best and safe nursing care for craniopagus conjoined twin going for surgical separation.
CONCLUSIONS:Craniopagus twinning is rare, separation of craniopagus twin is rarer, very few nurse will be able to see and participate in their care. Are you ready when one comes your way?

NS-012

A questionnaire to understand the support needs of the child with a craniopharyngioma and their carers. Is there a difference between those receiving adjuvant therapy and those who are not? A Nurses input

Nicole Taylor
Great Ormond Street Hospital NHS Foundation Trust, London, England

OBJECTIVE:Craniopharyngiomas are rare, slow growing tumours arising embryologically from maldevelopment in the pituitary stalk or tuber cinereum. The benign histology of the tumour contradicts its malignant tendency of recurrence and negative implications to surrounding structures and this has the potential to result in pituitary, visual, neurocognitive and hypothalamic morbidity. Although children with craniopharyngiomas have a high survival rate, due to the position of the tumour morbidity rate remains high with quality of life being negatively impacted, and disease related mortality still occurring many years on. The onset of, and living with, a craniopharyngioma can therefore be accompanied by distress, uncertainty and great anxiety for both the patient and their family. Ensuring that psychological wellbeing of the patient and their family is addressed is essential to providing holistic patient care, and can greatly affect patient experience. A nurse's role means they are in a primary position to monitor psychological wellbeing, offer support and facilitate needs accordingly.
This presentation aims to assess the adequacy of psychological support provided and facilitated by nurses to children with craniopharyngiomas, from the perspective of the patient and their main carer.
MATERIAL-METHODS:A qualitative questionnaire was devised to explore the psychological support provided by nurses to the child and family, overall ten families were asked to complete the questionnaire. Thematic analysis was applied to identify the perspective of the child and family, comparing those who received oncology input and those who did not.
RESULTS:The audit is still ongoing but preliminary results suggest that the views of children with craniopharyngiomas and their families change over time, from initial diagnosis to longer term care. Nurses therefore need to understand and address these individual concerns to provide and facilitate psychological support accordingly.
CONCLUSIONS:The presentation concludes with suggestions of how nurses can optimise the provision of such support.

NS-014

Evaluation of the family/ carer experience following paediatric epilepsy surgery in relation to post-operative complications, length of hospital stay and discharge planning

Nicola J Barnes
Great Ormond Street Hospital for Children NHS Foundation Trust, London.

OBJECTIVE:Twenty per cent of epilepsy patients remain refractory to anti-epileptic medications, epilepsy surgery has been demonstrated to be safe and offers improved outcomes than the use of medication alone. The introduction of the Children's Epilepsy Surgery Service (CESS) in 2012 has led to an increase drive for patient evaluations and proposed surgical procedures. This implicates challenges for nursing care, the demand for efficient bed management and discharge planning requires awareness of potential determinants that lead to post-operative complications or delayed hospital stay.
The aim of this mixed methods study was to identify pre-determinants of length of hospital stay following paediatric epilepsy surgery and complications that may arise. It sought to explore parental confidence of discharge planning and how they experience their return home.
MATERIAL-METHODS:Retrospective analysis of clinical records of all children who had epilepsy surgery at Great Ormond Street Hospital, January 2014-December 2015 was completed. Patient characteristics, surgical procedure and complications were analysed by parametric statistical tests. Additionally semi-structured parental interviews were ultised post-operatively to describe their child's recovery from surgery
RESULTS:116 children were included in retrospective analysis, 9 families participated in semi- structured interviews. The interaction between post-operative complications and length of hospital stay was statistically significant in prolonging length of hospital stay. Families were prepared for complications that could arise and developed appropriate coping strategies if they occurred following discharge from hospital. Most families expressed surprise at their child's ability to make a quick recovery but had continuing fear for post-operative seizures.
CONCLUSIONS:The majority of complications following epilepsy surgery are minor, self-resolving and do not cause parental concern on discharge. The provision of honest individualised nursing support may increase parental confidence in their child's discharge home and in their realistic adaption to their new life following epilepsy surgery.

NS-015

Collaboratively managing pediatric neurosurgery who are concurrent oncology patients

Angela Forbes, Amanda Breedt
Seattle Children's Hospital, Seattle, Washington

OBJECTIVE:There is a collaborative relationship between neurosurgery and oncology. In addition to the brain tumor patients, there are many other neurosurgery patients who also fall under the oncology umbrella. The oncology patient can often be quite overwhelming to the neurosurgical provider as there are many nuances to their care.
The speakers in this talk will bring their neurosurgical and oncology background to teach the pearls of the oncology patient. This will include an understanding of the chemotherapy process, looking at the how the immune system is affected and when that can be of concern, central line processes and understand why certain medications are off limits.
Cases examples will be used in the discussion including a brain tumor patient that does the dance between neurosurgery and oncology (brain tumor patient with a shunt and a patient with posterior fossa syndrome); a leukemia patient with a brain mass; and an oncology patient with an intracranial bleed.

List of posters presented at 45th ISPN Annual Meeting

Poster Session I: Monday, 9 October 2017

Pub. no.	Title Lang A	Presenter	Country
PP-001	Long term follow-up of prenatally-diagnosed patients with neurosurgical central nervous system abnormalities	Takamasa Kamei	Japan
PP-002	In-utero repair of a myelomeningocele: report of a complicated case	Charlotte Burford	United Kingdom
PP-003	MyeLDM, a new entity in the continuity	Timothée De Saint Denis	France
PP-004	How is craniosynostosis surgery done without blood transfusion in children with weight ≤10 kg?	Wan Lung Ryo Yeung	Hong Kong
PP-005	Outcomes of Early Extended Midline Strip Craniectomy for Sagittal Synostosis	Jonathan Richard Ellenbogen	United Kingdom
PP-006	Applying Neurite Orientation Dispersion and Density Imaging (NODDI) analysis in MR imaging before and after surgery in mild metopic suture synostosis with clinical symptoms	Kazuaki Shimoji	Japan
PP-007	Distraction osteogenesis for craniosynostosis - Surgical planning with consideration for complications -	Mayu Takahashi	Japan
PP-008	Midline Occipital Suture, a rare finding	Chris Parks	United Kingdom
PP-009	Evolution of Craniosynostosis Correction Techniques in Fundación Clínica Infantil Club Noel. Cali, Colombia	Dunia Patricia Quiroga	Colombia
PP-010	Frontal widening and remodeling for scaphocephalic children older than one	Giovanna Paternoster	France
PP-011	Cognitive assessment in school age Crouzon and Pfeiffer after early front-facial monobloc	Syril James	France
PP-012	Reossification of anterior skull base with pericranial flaps after frontofacial monobloc	Giovanna Paternoster	France
PP-013	Dilemma of Treatment Options for Craniosynostosis: Surgical Methods and Long-term Esthetic Outcome	Young Shin Ra	South Korea
PP-014	Endoscopic suturectomy as initial treatment of syndromal and complex craniosynostosis	Bernt J. Due Tonnessen	Norway
PP-015	Sinus pericranii: Long term outcome in a 10-year-old boy with a review of literature	Pasquale Gallo	United Kingdom
PP-016	Experience of calvarial vault remodeling using the beetle plasty technique	Erik Edström	Sweden
PP-017	The Limits of Endoscopic Endonasal Approaches in Young Children	Andrew Joshua Kobets	United States
PP-018	Unrecognized spinal dysraphism: demograchic data, specific diagnosis and outcomes	Inthira Khampalikit	Thailand
PP-019	Intradural Meningeal Cysts Presenting as Worsening Metatarsus Adductus	Alexa Bodman	United States
PP-020	Congenital dermal sinus in form of pseudophallus- case report	Toni Dimitrov Kondev	Bulgaria
PP-021	Predictive factors for postoperative surgical wound problem in pediatric patients with spina bifida	Sang Dae Kim	South Korea
PP-022	Neural Tube Defects; Still A Major Pediatric Neurosurgical Entity in Nepal	Gopal Sedain	Nepal
PP-023	Placode rotation in transitional lumbosacral lipomas – are there implications for origin and mechanism of deterioration?	Victoria Jones	United Kingdom
PP-024	Post natal management of myelomeningocele: long term outcome with a multidisciplinary team experience	Pierre Aurélien Beuriat	France
PP-025	Congenital Spinal Chord Malformations: 18 Year Epidemiological Survey in a High Specialty Hospital in Mexico	Maria Elena Cordoba Mosqueda	Mexico
PP-026	Cranial neural tube defects – does site matter?	Salima Wahab	United Kingdom
PP-027	Wilms Tumor in Occult Spinal Dysraphism: A Rare Case	Hakan Karabagli	Türkiye
PP-028	Clinical features of intraspinal cystic lesion in children	Jun Kurihara	Japan
PP-029	Cerebral abnormalities related to myelomeningocele: MR imaging evaluation	Fernanda Goncalves Andrade	Brazil
PP-030	An analysis of behavioural outcome of endoscopic fenestration of cavum septum pellucidum cyst- More grey than black and white?	Suhas Udayakumaran	India
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PP-032	Major surgical interventions for management of disabilities in children with cerebral palsy GMFC levels IV & V: The real challenge	Walid A. Abdel Ghany	Egypt
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PP-036	Quality indicators in paediatric neurosurgery – Status quo and future perspectives	Thomas Beez	Germany
PP-037	Neuropsychological impacts of indirect revascularization in pediatric Moyamoya disease	Woo Hyun Kim	South Korea
PP-038	Interhemispheric subdural empyema as complication of sinusitis in children - report of two cases and literature review	Rakesh Ranjan	India
PP-039	Brain abscess in children: predisposing factors, management and outcomes	Vianney Gilard	France
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PP-041	Natural history and management of intracranial arachnoid cysts in childhood	Tatsuki Oyoshi	Japan
PP-042	Evaluating Google and Bing Searches for Pediatric Neurosurgery Patient-Family Educational Information	Todd Maugans	United States
PP-043	Availability of Laser Scanning Confocal Microscopy for Observation of Neurulation in Early Chick Embryo	Dong Ho Kim	South Korea
PP-044	Two cases of prenatally diagnosed huge suprasellar cysts	Jun Sakuma	Japan
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PP-047	Spontaneous regression of a pineal tumor – case report an review of literature	Angela Brentrup	Germany
PP-048	Measurement of optic nerve sheath diameter (ONSD) to assess intracranial pressure (ICP) in pediatric patients in neurosurgery: comparison of ultrasound versus magnetic resonance imaging (MRI) ONSD assessment	Susanne Regina Kerscher	Germany
PP-049	A Preliminary Quantitative Proteomic Study of DIPG Children Patients Presented with Mood Disorder	Peng Zhang	China
PP-050	Using the Time-SLIP Magnetic Resonance Imaging to Establish Patency between adjacent CSF spaces in children whit Sylvian Arachnoid Cysts treated whit endoscopic fenestration	Oscar Garcia	Mexico
PP-051	Haematological Indices in Congenital Malformation of the Central Nervous System	Gyang Markus Bot	Nigeria
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PP-053	Are children with multifocal polymicrogyria good surgical candidates?	Ibrahim Jalloh	Canada
PP-054	Responsive neurostimulation for refractory epilepsy in the pediatric population: utility, feasibility and safety	Marian M. Bercu	United States
PP-055	Surgical Treatment of Medically Refractory Neonatal Epilepsy	Erin Kiehna	United States
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PP-059	Traumatic Lumbosacral Spondyloptosis in a Pediatric Patient: Case Report	Barbara Albuquerque Morais	Brazil
PP-060	Cervical Intervertebral Disc Calcification in a Pediatric Patient with Down's Syndrome: A no touch pathology	Anthony Amato Watkins	United Kingdom
PP-061	Open thoracic anterolateral cordotomy for pain relief in children: technique and report of two cases	Matthew Anthony Kirkman	United Kingdom
PP-062	Teratoma and myelomeningocoele: just how often do the two coexist?	Conor Mcgowan	United Kingdom
PP-063	Paediatric Spinal Trauma in a Major Trauma Center in the United Kingdom	Alexander Dando	United Kingdom

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PP-064	Resection of cystic cavernous angioma in eloquent area with successful outcome in a pediatric patient: case report and literature review	Abraham Ibarra De La Torre	Mexico
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PP-066	Malignant middle cerebral artery infarction in children- report of two cases and literature review	Rakesh Ranjan	India
PP-067	Indirect revascularization in adult moyamoya disease	Meng Fai Kuo	Taiwan
PP-068	Association study in Chinese children confirms IGHV gene haplotype block as conferring risk to Moyamoya disease	Wenjun Shen	China
PP-069	Epidemiological Analysis of Vascular Malformations, 10 Years Survey	Diego Ochoa Cacique	Mexico
PP-070	Imaging of Pediatric Neurovascular Lesions	Peter Kalina	United States
PP-071	Paediatric intracranial arterial aneurysms: 10 year Institutional review	Naomi Slator	United Kingdom
PP-072	An attempt to shunt removal from the shunted hydrocephalic patients with myelomeningocele	Yuichiro Nonaka	Japan
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PP-077	Complete reversibility of the chiari type 2 malformation following post natal repair of myelomeningocele	Pierre Aurélien Beuriat	France
PP-078	Surgical decompression for Chiari type I malformation in pediatric patients. How different surgical techniques affect surgical outcomes and complication rates	Carlos R Goulart	United States
PP-079	VSGS (Ventriculosubgaleal shunting) in Infants: Applications and Complications	Lalgudi Srinivasan Harishchandra	India
PP-080	Endoscopic management of quadrigeminal cistern arachnoid cysts	Zohreh Habibi	Iran
PP-081	Congenital obstruction of Foramen Monro	Farideh Nejat	Iran
PP-082	Pattern of Congenital Craniospinal Anomalies among Neurosurgical Patients in a Nigerian Tertiary Hospital	Hammed Abiola Oshola	Nigeria
PP-083	Shunt complications you would not want to see	Chidambaram Balasubramaniam	India
PP-084	The application of multiple shunt assistants in a case of severe orthostatic overdrainage in shunt treated hydrocephalus	Wolfgang Wagner	Germany
PP-085	Predictive Factors associated with Ventriculoperitoneal Shunting after Posterior Fossa Tumor Surgery in Children	Leonie Johanna Helmbold	Germany
PP-086	Shunt series x-rays in Primary Shunt Insertion. How useful are they?	James M W Robins	United Kingdom
PP-087	Intraoperative ultrasound imaging through the anterior fontanel for real-time guided insertion of the proximal catheter of ventriculoperitoneal shunts in the lateral ventricle of infants	Toni Dimitrov Kondev	Bulgaria
PP-088	Previous Endoscopic Third Ventriculostomy Does Not Increase Ventriculoperitoneal Shunt Failure Rate	Maya Kommer	United Kingdom
PP-090	Endoscopic retrieval of flanged ventricular catheters	P. Daniel McNeely	Canada
PP-091	How, when and why: our experience with telesensor devices	Martina Messing Jünger	Germany
PP-092	Endoscopic combined third ventriculostomy and limited debulking of pineal tumour by splitting the choroid fissure and massa intermedia	Charlotte Burford	United Kingdom
PP-093	The efficiency of intraoperative CT scan for the fenestration of posterior fossa hydrocephalus in pediatrics	Hirokazu Nakatogawa	Japan
PP-094	Misdiagnosis of a case with overshunting associated cervical myelopathy	Hsin Hung Chen	Taiwan
PP-095	Hydrocephalus in myelomeningcele. Reducing shunt rates in a recent case series of myelomeningocele- A consequence of stricter management or epidemiological selection. A vista of optimism?	Suhas Udayakumaran	India
PP-096	Range of management options in patients presenting with Arachnoid Cysts. 9 year experience in Single Centre	John Robert Goodden	United Kingdom
PP-097	Surgical repair of hydrocephalus in North Kivu province of Eastern Democratic Republic of Congo: Is ETV/CPC feasible in low resource settings?	Luc Malemo Kalisya	Congo, Democratic Republic of the
PP-098	Endoscopic management of paediatric cranial arachnoid cysts: a single UK centre experience	Alex Smedley	United Kingdom
PP-099	Shunt revisions: can we prevent them?	Suparna Das	United Kingdom
PP-100	Automatic and Accurate Determination of CSF Ventricular Volume	J. Gordon Mccomb	United States
PP-101	Results of nerve reconstructions in treatment of obstetrical brachial plexus injuries	Pavel Haninec	Czech Republic

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PP-103	Long-term Survival of Partially Resected Posterior Fossa Ependymoma	Shi Hun Song	South Korea
PP-104	Phenotype Modulation of Tumor Associate Microglia Targeting CCR2/IL-6 Loop in Pediatric Medulloblastoma	Ramin Eskandari	United States
PP-105	Assessment of the risk factors impacting functional outcomes and spinal deformity for pediatric clival chordoma	Erin Kiehna	United States
PP-106	Multiple spinal cord lipoma extending to posterior fossa in a neonate; Consideration of operation timing	Eui Jin Cho	South Korea
PP-107	Implications of electrified CUSA in pediatric neurosurgery	Shlomi Constantini	Israel
PP-108	Atypical Teratoid / Rhabdoid Tumor of the Spinal Cord in a Child: Case Report and Review of the Literature	Mohammed Babgi	Saudi Arabia
PP-109	Atypical Teratoid /Rhabdoid tumours (ATRT): Should near complete resection of tumours be contemplated in the under 3 year olds?	Chirag Patel	United Kingdom
PP-110	Endoscopic third ventriculocisternostomy for the treatment of hydrocephalus in children whit posterior fossa tumors	Oscar Garcia	Mexico
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PP-112	Desmoplastic infantile ganglioglioma/astrocytoma – A retrospective series of 9 cases	Pierre Antherieu	France
PP-113	Management of Pediatric Meningiomas: CCHE-57357 experience in 36 cases	Mohamed Ahmed El Beltagy	Egypt
PP-114	Immature teratoma in the pineal region demonstrating: report of a challenging case and review of the literature	Charlotte Burford	United Kingdom
PP-115	Primary intracranial choriocarcinoma: a report of 8 cases with review of literature	Chunde Li	China
PP-116	Medulloblastoma in childhood-: Comparative surgical analysis in a case series of 365 patients	Dattatraya Prakash Muzumdar	India
PP-117	Experience on Immediate Post-Operative MRI for Tumour Biopsies in Alder Hey Children's Hospital	Benedetta Pettorini	United Kingdom
PP-118	Low-grade central osteosarcoma of the skull; a very rare pathology that needs to be highlighted	Heidi Baechli	Germany
PP-119	Pineal Region Tumour: Single entry burr hole for the application of frameless image guided tumour biopsy and ventriculoperitoneal shunt as alternative to endoscopic procedure	Liew Boon Seng	Malaysia
PP-120	Optimal Management of Optic Pathway Gliomas in Children: Role of Surgical resection and Adjuvant Therapy	Young Shin Ra	South Korea
PP-121	Vasculopathic brainstem ischemia as presenting symptom of Neurofibromatosis Type 2 in children and young adults	Martin Ulrich Schuhmann	Germany
PP-122	Fourth ventricle rosette-forming glioneuronal tumor in children and adolescent: a clinicopathological study of 12 patients	Wei Liu	China
PP-123	Choroid plexus tumors in infants and young children - Lessons learnt from an institutional review	Ribhav Pasricha	India
PP-124	Secondary glioblastoma mimicking medulloblastoma recurrence	Spyros Sgouros	Greece
PP-125	Early craniopharyngioma recurrence after complete excision in children, treated successfully with gamma knife	Spyros Sgouros	Greece
PP-126	Huge subdural granuloma operated on 26 years after childhood chronic subdural hematoma	Sung Kyoo Hwang	South Korea
PP-127	Analysis of ECG abnormalities of the head trauma patients	Takayuki Inagaki	Japan
PP-128	Traumatic Extradural Hematomas in Children: Experience from a Tertiary Care Center in South India	Nishanth Sadashiva	India
PP-129	Occipital Condyle Fractures: Missed Calls In Pediatric Head Injury	Mayur Vinaykumar Kaku	India
PP-130	Repair of cranial bone defects in children using hydroxyapatite cranioplasty	Pierre Aurélien Beuriat	France
PP-131	Cranioencephalic Trauma Epidemiology in a High Specialty Insitute in Mexico 10 Year Survey	Maria Elena Cordoba Mosqueda	Mexico
PP-132	Is there a place for invasive monitoring of the Intra-Cranial Pressure (ICP) in severe brain traumatisms in the infant under one year old? A review	Alice Rolland	France
PP-133	Gunshot Penetrating Brain Injury in a Pediatric Case with Good Sequelae and a Literature Review	Yuhan Liu	China
PP-134	Traumatic Brain Injuries in Infants and Toddlers – Risk Factors For Poor Communicaton With Families	Alexandru Tascu	Romania
PP-135	Familial Lipomyelomeningocele: a Case Report and Genetic Analysis	Ramin Eskandari	United States