



ISPN 2024: 50th Annual Meeting of the International Society for Pediatric Neurosurgery

Toronto, 13 - 17 October 2024

© The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2024

ISPN 2024 Meeting Co-Chairs: James M. Drake & Abhaya V. Kulkarni
ISPN 2024 President: Shlomi Constantini
ISPN 2024 Scientific Chair: Benedetta Pettorini
ISPN 2024 Scientific Co-Chair: Michael Dewan

Platform Presentation Abstracts

PF-001

LiTT Laser Interstitial Thermal Therapy

MRI guided laser interstitial thermal therapy for epilepsy in the paediatric population: efficacy and safety from Great Ormond Street Hospital for Children experience

Martin M Tisdall¹, Cameron Elliott⁴, Felice D'arco³, Sophia Varadkar²
¹Department of Neurosurgery, Great Ormond Street Hospital For Children, London, United Kingdom

²Department of Epilepsy, Great Ormond Street Hospital For Children, London, United Kingdom

³Department of Neuroradiology, Great Ormond Street Hospital For Children, London, United Kingdom

⁴Department of Neurosurgery, University of Alberta Hospital, Neurosurgery, Edmonton, Canada,

OBJECTIVE: MR-guided Laser Interstitial Thermal Therapy (MRg-LiTT) is a minimally invasive epilepsy surgery technique. It potentially reduces approach related morbidity and allows pseudo real time thermal monitoring both within, and surrounding, the lesioned area. We describe the experience of paediatric LiTT for epilepsy at Great Ormond Street Hospital for Children (GOSH). We report clinical indication, outcomes, adverse events, and assess anatomic correspondence between MRI lesion identified on intra- and post-operative images.

MATERIAL AND METHODS: Retrospective review of consecutive paediatric epilepsy MRg-LiTT cases at GOSH between 2019 - 2022. Relevant perioperative clinical data were obtained from the electronic clinical record. Intraoperative imaging including thermography, DWI and post-gadolinium T1 and routine pre/postoperative MRI were reviewed. The anatomic overlap between intraoperative and post-operative lesions was categorized as >80%, 50-80% or <50%. Seizure outcome was categorised by Engel Score.

RESULTS: 26 patients (10F) underwent LiTT for hypothalamic hamartoma (HH; n=21) or insula focal cortical dysplasia (FCD; n=5) at mean age 8.4 yrs (range 5 months to 17 years) with mean follow-up of 1.1 ± 1.0 years. Previous surgery occurred in 6 patients 23% (2 HH-LiTT, 2 HH partial

resection, 2 insula FCD thermocoagulation). Worthwhile improvement or better was achieved in all 22 patients with available data with Engel I outcome in 15 (68%). Permanent postoperative complications occurred in 4/26 (15%) including hyperphagia/weight gain (n=2), GH deficiency (n=1) & memory disturbance (n=1). 14 patients had both intraoperative DWI/post-gadT1 and delayed MRI collected at 5.8 ± 5.4 months. Intraoperative DWI lesions were predictive (>80% correspondent) of intraoperative post-gad T1 lesions in 10/14 (71%). Intraoperative post-gad T1 were predictive (>80% correspondent) with resultant encephalomalacia in 11/14 patients (79%).
CONCLUSION: Paediatric MRg-LiTT for lesioning of deep-seated epileptogenic foci is safe and effective. Intraoperative DWI or post-contrast T1 are predictive of resultant lesions on delayed MRI.

Keywords: litt, paediatric epilepsy surgery, hypothalamic hamartoma, focal cortical dysplasia, magnetic resonance imaging

PF-002

LiTT Laser Interstitial Thermal Therapy

Real-time Changes in Large-scale Thalamic Circuitry Following Laser Ablation of Hypothalamic Hamartomas

Karim Mithani¹, Oliver L Richards¹, Mark Ebden², Noor Malik¹, Ladina Greuter¹, Hrishikesh Suresh¹, Flavia V Gouveia², Elysa Widjaja³, Shelly Weiss⁴, Elizabeth Donner⁴, Hiroshi Otsubo⁴, Ayako Ochi⁴, Puneet Jain⁴, Ivanna Yau⁴, James T Rutka¹, James M Drake¹, Alexander G Weil⁵, George M Ibrahim¹

¹Division of Neurosurgery, Hospital for Sick Children, Toronto, Canada

²Neurosciences & Mental Health, SickKids Research Institute, Toronto, Canada

³Department of Diagnostic Imaging, Hospital for Sick Children, Toronto, Canada

⁴Division of Neurology, Hospital for Sick Children, Toronto, Canada

⁵Division of Neurosurgery, Centre Hospitalier Universitaire Sainte-Justine, Montreal, Canada

OBJECTIVE: Gelastic seizures due to hypothalamic hamartomas (HH) are challenging to treat, in part due to an incomplete understanding of seizure propagation pathways. Although magnetic resonance imaging-guided laser interstitial thermal therapy (MRgLITT) is a promising intervention to disconnect HH from ictal propagation networks, the optimal site of ablation to achieve seizure freedom is not

known. In this study, we investigated real-time post-ablation changes in resting-state functional connectivity to identify large-scale networks associated with successful disconnection of HH.

MATERIAL AND METHODS: Children who underwent MRgLITT for HH at two institutions were consecutively recruited and followed for a minimum of one year. Seizure freedom was defined as Engel score of 1A at the last available follow-up. Immediate pre- and post-ablation resting-state functional MRI scans were acquired while maintaining a constant depth of general anesthetic. Multivariable generalized linear models were used to identify real-time changes in large-scale connectivity associated with seizure outcomes.

RESULTS: Twelve patients underwent MRgLITT for HH, of whom five were seizure-free at their last available follow-up. Real-time changes in thalamocortical circuitry involving the anterior cingulate cortex were associated with seizure-freedom. Children who were seizure-free demonstrated an increase and decrease in connectivity to the pregenual and dorsal anterior cingulate cortices, respectively. In addition, children who became seizure-free demonstrated increased thalamic connectivity to the periaqueductal gray immediately following MRgLITT.

CONCLUSION: Successful disconnection of HH is associated with real-time, large-scale changes in thalamocortical connectivity. These changes provide novel insights into the large-scale basis of gelastic seizures and may represent intraoperative biomarkers of treatment success.

Keywords: laser interstitial thermal therapy, hypothalamic hamartomas, gelastic seizures, epilepsy, connectomics

PF-003

Functional

Corpus callosotomy in children with drug-resistant epilepsy: a 10-year experience from a single centre

Silvia Beatriz Sanchez Marco¹, Michael R Carter², Jayesh Patel¹, William Singleton², Danielle Cole³, Sarah Rushton³, Elliot Warren³, Nick Kane³, Spas Getov³, Rebecca Wilson⁴, Mathew Gilbert⁵, Marcus Likeman⁶, Victoria Edwards¹, Michelle Seymour¹, Kate Watts¹, Andrew A Mallick¹

¹Department of Paediatric Neurology, Bristol Royal Hospital for Children, Bristol, United Kingdom.

²Department of Paediatric Neurosurgery, Bristol Royal Hospital for Children, Bristol, United Kingdom.

³Department of Neurophysiology, Bristol Royal Hospital for Children, Bristol, United Kingdom.

⁴Department of Neuropsychology, Bristol Royal Hospital for Children, Bristol, United Kingdom.

⁵Department of Neuropsychiatry, Bristol Royal Hospital for Children, Bristol, United Kingdom.

⁶Department of Neuroradiology, Bristol Royal Hospital for Children, Bristol, United Kingdom.

OBJECTIVE: Corpus callosotomy is a palliative surgical procedure for patients with generalised or multifocal drug-resistant epilepsy, particularly with drop attacks. We describe the experience of corpus callosotomy at our centre over ten years.

MATERIAL AND METHODS: The records of patients who underwent corpus callosotomy between January 2012 and December 2021 were analysed. Clinical data, comorbidities, genetic and imaging data, seizure outcome (Engel Epilepsy Surgery Outcome Scale), use of anti-seizure medications (ASM), type of corpus callosotomy, and complications were recorded.

RESULTS: Inclusion criteria were met for 41 patients, 25 males (61%) and 16 females (39%). 13 patients (32%) had a diagnosis of

Lennox-Gastaut syndrome. Brain MRI revealed abnormalities in 27 cases (66%). Genetic testing identified a pathogenic genetic variant in 21 cases (51%). The median number of previously used anti-seizure medications at the time of surgery was 5 ± 2.2 SD (range 3 to 12). 34 patients (83%) underwent a total corpus callosotomy. Median age at surgery was 10 ± 4.8 SD years old (range 9 months to 19 years old). Transient neurological complications were experienced by 21 out of 41 patients (51%) including hemiparesis, wound and respiratory infection. Almost every patient experienced mild symptoms of disconnection syndrome, but two patients experienced a more marked phenotype which improved within 3 months. 35 out of 41 (85.4%) had seizures within 12 months of surgery, 5 cases were Engel II, 14 cases were Engel III, and 16 cases returned to baseline (Engel IV). Six cases remained seizure free at 12 months (Engel I). The median number of anti-seizure medications significantly reduced ($p=0.046$) from three to two after corpus callosotomy.

CONCLUSION: Corpus callosotomy is well tolerated in children and the majority have a worthwhile reduction in seizure frequency after 12 months of surgery. The number of anti-seizure medications can be reduced after corpus callosotomy.

Keywords: Epilepsy, Corpus callosotomy, Paediatrics, Seizure outcome.

PF-004

Functional

Thalamic Neuromodulation in Pediatric Patients with Refractory Epilepsy

Saadi Ghatan¹, Fedor Panov Evgeny Panov¹, Lara Vanessa Marcuse², Madeline Cara Fields², Natasha Acosta Diaz², Sonam Verma², Jiyeoun Yoo², Maite Lavega Talbott², Sloane Sheldon², Adam Saad²

¹Department of Neurosurgery, Mount Sinai Health System, New York, USA

²Department of Neurology, Mount Sinai Health System, New York, USA

OBJECTIVE: Pediatric epilepsies are characterized by extratemporal, multifocal, mutable, and widespread network involvements, and epilepsy surgery remains deeply underutilized for this population. To reach more children with refractory pediatric epilepsy, we have targeted thalamic nuclei with depth electrodes in the management of refractory multifocal and network epilepsies in children since 2014, with the use of the Responsive Neurostimulation System (RNS) and Deep Brain Stimulation (DBS).

MATERIAL AND METHODS: Amongst a population of 160 patients who have undergone cranial neurostimulation procedures at our institution, 54 patients are less than 18 years of age. Twenty-four children have received thalamic electrodes in the centromedian (CM), anterior thalamic nucleus (ANT), and pulvinar (PULV) nuclei in association with closed and open looped neurostimulation devices. Institutional Review Board approval was granted to perform retrospective reviews of patient outcomes.

RESULTS: All 24 patients in this analysis had follow up greater than 6 months. One patient experienced a device related infection that necessitated removal. There were no other adverse events associated with implantation or tolerance of the devices. Outcomes varied according to co-morbid diagnoses, but improvements in seizure control appear to be associated with a longer duration of neuro-modulation, detection-stimulation strategies with corticothalamic electrodes, and connectomic analyses to guide implantations. 18/24 patients experienced greater than 75% seizure control above their pre-implantation baseline, and one quarter of these patients were

super responders, with greater than 90% seizure control. 7% of the patients did not experience an appreciable benefit at last follow up. **CONCLUSION:** Thalamic implants are well-tolerated with a small risk of infection in pediatric patients with refractory epilepsy. Efforts to arrive at targeting strategies that predict greater efficacy and programming strategies that facilitate faster time to efficacy are ongoing and necessary, where developmental windows in children are limited.

Keywords: seizures, children, tuberous sclerosis, Lennox-Gastaut

PF-005

Functional

Are fast ripples (250 – 500 Hz) biomarkers of pathological tissue in pediatric focal epilepsy?

Nicolas Von Ellenrieder¹, Mariam Al Rashid², Bradley Osterman³, Elisabeth Simard Tremblay³, Jason Karamchandani⁴, Marie Christine Guiot⁴, Jean Gotman¹, Roy William Roland Dudley²

¹Department of Neurology and Neurosurgery, Montreal Neurological Institute, McGill University, Montreal, Quebec, Canada

²Department of Pediatric Surgery, Division of Neurosurgery, Montreal Children's Hospital, Montreal, Quebec, Canada; Department of Neurology and Neurosurgery, Montreal Neurological Institute, McGill University, Montreal, Quebec, Canada

³Department of Pediatrics, Division of Pediatric Neurology, Montreal Children's Hospital, Montreal, Quebec, Canada

⁴Department of Pathology, Montreal Neurological Institute, Montreal, QC, Canada

OBJECTIVE: In focal epilepsy, fast ripples (FRs; 250–500Hz) recorded with stereo-electroencephalography (SEEG) have been proposed as a biomarker of epileptogenicity. It is believed that most healthy brain tissue cannot generate FRs. We investigated whether FRs are a biomarker of the pathological tissue underlying epileptogenicity.

MATERIAL AND METHODS: Following presurgical evaluation, patients were implanted with SEEG electrodes and FR analysis performed during NREM sleep; FR rate $\geq 1.0/\text{min}$ was considered positive. Patients underwent focal resection with multiple tissue specimens collected from the hypothesized epileptogenic zone (EZ). The location of each specimen could be determined precisely and co-registered with electrodes, such that the FR rate associated with each specimen could be determined. Some specimens were too far from electrode contacts and were excluded. The value of FRs as biomarkers of pathological tissue was then assessed.

RESULTS: In total, 282 brain specimens were collected from the hypothesized EZ of 18 patients (6-30 samples/patient); 236 (83.6%) of these were close enough to electrode contacts to allow correlating FR rates and pathology. 176 of them (74.5%) had histopathology (58.9% focal cortical dysplasia); 150 (63.6%) were positive for FRs. FRs indicated pathological tissue with 67.0% sensitivity, 47.7% specificity, 78.7% positive predictive value, and 32.6% negative predictive value, reflecting a poor ability of FRs to predict pathology. At the patient level, all had samples with pathological tissue. Six cases with FRs recorded in regions distant to the resection had seizure recurrence. The other 12 patients remain seizure-free after including in the resection all regions containing FRs ($\geq 1\text{yr}$ follow-up).

CONCLUSION: The excellent seizure outcome following resection of all regions containing FRs, despite a high rate of histopathology without FRs, suggests that FRs are not a biomarker of histopathology, but of epileptogenicity (i.e., not all pathological tissue is epileptogenic). Detection of FRs may be more important than detection of histopathology.

Keywords: paediatric focal epilepsy, stereo-electroencephalogram, fast ripples, histopathology, outcome, biomarkers

PF-006

Functional

Intraoperative electrocorticography in epilepsy surgery: initial results in a resource-limited hospital

Thang Nam Le¹, Anh Tuan Le¹, Luan Trung Ho¹, Tuan Anh Dang²

¹Neurosurgery department, Neurology Center of Vietnam National Children's Hospital

²Neurology department, Neurology Center of Vietnam National Children's Hospital

OBJECTIVE: Pre-surgical epilepsy evaluation remains challenging in resource-limited countries. At Vietnam National Children's Hospital, with the support of a major epilepsy surgery center, we have implemented epilepsy surgery using intraoperative electrocorticography (EcoG) since 2017. We report here our initial experience with Intraoperative EcoG and its utility in epilepsy surgery.

MATERIAL AND METHODS: 37 epilepsy patients underwent pre-surgical evaluation and Intraoperative ECoG guided epilepsy surgery. The surgical procedures employed included intraoperative EcoG guided lesionectomy or lobectomy. Postoperative MRI and EEG were evaluated. Seizure outcome was categorized as per Engel's classification

RESULTS: The average age of the study group was 6,0 year-olds, 21/37 patients (56.8%) had main lesions located in the left hemisphere. Patients with lesions located in the frontal lobe accounted for the highest proportion with 25/37 patients (67.6%); 9/37 patients with epileptic zone related to the motor strip and 1/37 patients related to the Broca area. Pathological characteristics: Focal cortical dysplasia 18/37 (48.7%), tumors 16/37 (43.2%), tuberous sclerosis complex 3/37 (3.2%). Follow-up results at least 6 months after surgery achieved Engel I in 17/37 (45.9%) patients, 15/37 (40.5%) patients achieved Engel II. We found that improved epilepsy outcome is related to the absence of epileptic waves on EcoG recording after resection.

CONCLUSION: Intraoperative ECoG is a useful technique that can be deployed in resource-limited hospitals, helping to improve treatment of medically intractable epilepsy.

Keywords: intraoperative electrocorticography, intractable epilepsy, seizure, resource-limited hospital.

PF-007

Cranio-cervical Junction and Chiari

Foramen magnum stenosis in achondroplasia: a dynamic but not necessarily insidious process. A twenty-year cohort study

Richard Moon¹, Timoteo Almeida², Will Singleton³, Simon Langton Hewer⁴, Sarah Smithson⁵, Christine Burren⁶, Richard Edwards²

¹Department of Paediatric Neurosurgery, Bristol Royal Hospital for Children, University Hospitals Bristol and Weston NHS Foundation Trust, Bristol, UK; Department of Neurosurgery, University Hospital of Wales, Cardiff and Vale University Health Board, Cardiff, UK; Division of Psychological Medicine and Clinical Neurosciences, School of Medicine, Cardiff University, Cardiff, UK

²Department of Paediatric Neurosurgery, Bristol Royal Hospital for Children, University Hospitals Bristol and Weston NHS Foundation Trust, Bristol, UK

³Department of Paediatric Neurosurgery, Bristol Royal Hospital for Children, University Hospitals Bristol and Weston NHS Foundation Trust, Bristol, UK; Translational Health Sciences, Bristol Medical School, University of Bristol, Bristol, UK

⁴Department of Paediatric Respiratory Medicine, Bristol Royal Hospital for Children, University Hospitals Bristol and Weston NHS Foundation Trust, Bristol, UK

⁵Department of Clinical Genetics, St Michael's Hospital, University Hospitals Bristol and Weston NHS Foundation Trust, Bristol, UK

⁶Department of Paediatric Endocrinology, Bristol Royal Hospital for Children, University Hospitals Bristol and Weston NHS Foundation Trust, Bristol, UK

OBJECTIVE: Uncertainty persists over the optimal management of foramen magnum (FM) stenosis in achondroplasia. We describe the natural history of FM stenosis, evaluate the safety of surveillance management, and assess indications for surgical decompression in a consecutive 20-year patient cohort.

MATERIAL AND METHODS: Clinical and radiological data were retrospectively collected from all patients within a regional skeletal dysplasia service, January 2012 – January 2024. Severity of radiological stenosis was classified using the Achondroplasia Foramen Magnum Score.

RESULTS: Thirty-two of thirty-eight children (84%) underwent MR imaging. Indications for initial MRI were baseline screening (n=8), respiratory concern (n=8) or neurological concern (n=15). Twenty-eight patients demonstrated FM stenosis (87.5%): 13 with preserved CSF signal (AFMS1), 9 with CSF signal loss (AFMS2), 2 with spinal cord distortion without signal change (AFMS3) and 4 with spinal cord signal change (AFMS4). There was no significant correlation between AFMS and oxygen desaturation index. Following initial MRI, 3 patients, all AFMS4 with neurological symptoms, underwent FM decompression (age 7, 58 & 76 months). Nineteen patients conservatively managed (1 AFMS0, 9 AFMS1, 6 AFMS2, 2 AFMS3, 1 AFMS4) had repeat imaging. Seven demonstrated improved radiological appearances (including from AFMS4) and 10 remained stable. Two patients, both clinically asymptomatic, developed more severe stenosis, 1 with spinal cord signal change who subsequently underwent FM decompression (age 89 months). Median age at last follow-up was 9.5 years (range 2.1–24.5). Median duration of follow-up was 7.1 years (range 0.8–17.8). Thirty-seven patients were ambulant at last follow-up (1 was tetraplegic from an unrelated cause). No patient initially conservatively managed developed progressive neurological symptoms secondary to FM stenosis.

CONCLUSION: The natural history of FM stenosis is dynamic, not always insidiously progressive and with a low risk of clinical/radiological deterioration (5% in our cohort). Clinical surveillance remains a safe management strategy. We advocate FM decompression for symptomatic/progressive spinal cord signal change only.

Keywords: Achondroplasia, skeletal dysplasia, foramen magnum,

PF-008

Craniocervical Junction and Chiari

Range of Motion After Occipitocervical and C1-2 Posterior Spinal Instrumentation and Fusion in Children

Richard Anderson¹, Hammad Khan¹, Yosef Dastagirzada¹, Douglas Brockmeyer², Joshua Pahys³, Matthew Oetgen⁴, Jennifer Bauer⁵, Sean Lew⁶, Jonathan Martin⁷, David Harter¹, Juan Carlos Rodriguez Olaverri⁸, Pediatric Spine Study Group¹

¹Department of Neurosurgery, New York University, New York, USA

²Department of Neurosurgery, University of Utah, Salt Lake City, USA

³Shriner's Hospital, Philadelphia, USA

⁴Department of Orthopedic Surgery, Children's National Hospital, Washington DC, USA

⁵Department of Orthopedic Surgery, University of Washington, Seattle, USA

⁶Department of Neurological Surgery, Medical College of Wisconsin, Milwaukee, USA

⁷Connecticut Children's Hospital, Hartford, USA

⁸Department of Orthopedic Surgery, New York University, New York, USA

OBJECTIVE: Adult biomechanical studies suggest up to 40% reduction in flexion-extension range of motion (ROM) after occipitocervical and atlantoaxial fusion. Anecdotal experience in children suggests less reduction in ROM following these procedures, but without quantitative assessments. We aimed to determine the extent of reduction in cervical spine flexion-extension following O-C2 and C1-2 fusion in pediatric patients.

MATERIAL AND METHODS: The Pediatric Spine Study Group (PSSG) international registry was queried for patients < 21 years of age who underwent O-C2 or C1-2 stabilization. Patients without cervical spine flexion-extension radiographs preoperatively and > 6 months postoperatively were excluded. Flexion, extension, and overall ROM of the cervical spine were measured using McGregor's line and the inferior endplate of C7. Occipitocervical angles between flexion-extension at baseline and latest follow-up were compared using student's t-test.

RESULTS: 34 patients (18 male, 16 female) were included, with 19 undergoing O-C2 and 15 undergoing C1-2 stabilization. The mean age was 9.3 +/- 4.5 years with an average follow-up of 3.5 +/- 2.6 years. Patients who underwent O-C2 fusion had a statistically significant reduction in neck extension (78.3° vs. 69.1° [11.7%], p=0.011) and overall ROM (91.9° vs. 81.3° [11.5%], p=0.009) between preoperative and final follow-up radiographs, but no significant reduction in flexion (-13.7° vs. -12.3°, p=0.599). After C1-2 fusion, there was a trend towards reduction in overall ROM (85.1° vs. 77.5° [8.9%], p=0.070), with no difference in extension (70.1° vs. 63.1°, p=0.116) or flexion (-14.9° vs. -14.4°, p=0.840).

CONCLUSION: In this cohort, children undergoing O-C2 stabilization had an 11.5% reduction in cervical spine ROM, primarily due to reduction in extension. There may be a smaller reduction in flexion-extension motion after stabilization in children when compared to adult biomechanical studies. Further studies with video analysis including axial rotation and lateral bending will be necessary to fully quantify cervical spine motion after fusion at the craniocervical junction.

Keywords: Cervical spine, motion, instrumentation, fusion, stabilization, arthrodesis

PF-009

Craniocervical Junction and Chiari

Temporal changes in tonsillar herniation and associated syringomyelia in so-called benign pediatric Chiari type I malformation

Hiroaki Sakamoto¹, Noritsugu Kunihiro², Ryoko Umaba², Kazuhiro Yamanaka², Kentaro Naito¹, Takeo Goto¹

¹Department of Neurosurgery, Osaka Metropolitan University Graduate School of Medicine, Osaka, Japan

²Department of Pediatric Neurosurgery, Osaka City General Hospital, Osaka, Japan

OBJECTIVE: We observed tonsillar herniation and syringomyelia over time in asymptomatic or minimally symptomatic pediatric Chiari type I malformation.

MATERIAL AND METHODS: From 2008 to 2023, there were 74 asymptomatic or minimally symptomatic children who had tonsillar herniation exceeding 3 mm below the foramen magnum at the initial diagnosis but had no diseases causing tonsillar herniation. The mean age at initial diagnosis was 6 years (1–15 years), and the children were followed conservatively for a mean of 7 years (2–13 years).

RESULTS: In 37 cases with herniation exceeding 10 mm at the time of initial MRI, 63% improved (22% normalized), 16% remained unchanged, and 22% worsened. Of 5 patients with the herniation worsening >15mm, two patients over 20 years of age showed slight deterioration of posterior neck pain and another one diagnosed at age 7 years had decompression surgery 12 years later due to worsening the syringomyelia. In 29 cases with 5-10 mm herniation, 69% improved (62% normalized), 7% remained unchanged, and 24% worsened, but no patients worsened their symptoms. In 8 cases with herniation from 3 to 5 mm, 50% normalized (herniation less than 3mm), 12% unchanged, and 38% worsened. In this group one case diagnosed at 2.5 years of age underwent decompression surgery 2 years later because of an enlarged syringomyelia. Twelve cases (16%) showed mild syringomyelia, but it spontaneously shrank with improvement of herniation in all but the two operated on above.

CONCLUSION: In long conservative follow-up of benign pediatric Chiari type I malformation the herniation tends to improve with growth. However, there are a small number of patients who need decompression due to progressing syringomyelia even when the herniation is < 5mm at initial diagnosis. Considering tonsillar herniation shows dynamic change with growth, patients with even mild herniation at initial diagnosis are recommended to be followed until the tonsils normalize their position.

Keywords: benign Chiari type I malformation, conservative observation, syringomyelia, tonsils

PF-010

Craniocervical Junction and Chiari

Pediatric Cervical Stenosis and Instability: Exploring Pathogenesis, Treatment Efficacy, and Prospects Ahead in 100 Cases

Olga M Sergeenko, Alexander V Burtsev

Neurosurgical Department, Ilizarov Center, Russia

OBJECTIVE: This study aims to investigate the prevalence, clinical characteristics, treatment modalities, and long-term outcomes of pediatric cervical stenosis, providing insights into effective management strategies and future directions for improving patient care

MATERIAL AND METHODS: Pediatric cases diagnosed with cervical stenosis between 2012 and 2022 were retrospectively identified from the hospital records. Relevant demographic, clinical, and radiological data were collected for each patient, including age at diagnosis, presenting symptoms, imaging findings, and associated comorbidities. Details of the treatment approaches employed, including surgical interventions, conservative management, and follow-up protocols, were documented.

RESULTS: A cohort of 100 pediatric patients aged 6 months to 18 years was recruited, with 65 diagnosed with atlanto-axial dislocation and instability, primarily associated with Klippel-Feil syndrome. Additionally, 3 patients (5%) had Down syndrome, 3 patients (5%) had cerebral palsy, and 16 patients (25%) had various systemic diseases. Among 25 patients with os odontoideum, 13 presented with permanent dislocation, and 12 demonstrated instability upon functional radiographic assessment. In the subaxial kyphosis/stenosis group, systemic pathology was predominant among 25 out of 31 patients, including mucopolysaccharidosis, neurofibromatosis, achondroplasia, and other conditions, with 28 out of 31 presenting with cervical-level myelopathy. Chronic myelopathy, headache or neck pain was predominant in all groups, with varying severity. All patients underwent spinal surgery - screw-based spinal stabilization with decompression. Patients were reevaluated after a median

follow-up of 7.1 years (range: 2 to 11 years). No significant dynamic score changes were observed, and age group differences persisted. There was an improvement in neurological and functional status over time

CONCLUSION: Spinal stenosis and instability are infrequent issues in childhood, usually arising from developmental anomalies and systemic diseases, leading to progressive neurological decline. Early surgical intervention becomes imperative to avert severe complications like paralysis, despite inherent risks, ultimately yielding favorable neurological and functional outcomes.

Keywords: pediatric spinal stenosis; spinal instability; CVJ instability

PF-011

Craniocervical Junction and Chiari

Which Type Of Duraplasty For CM Surgery?

Laura Grazia Valentini¹, Ignazio Gaspare Vetrano¹, Emma Ferrari¹, Veronica Saletti², Marco Moscatelli³, Tommaso Galbiati¹

¹Department of Neurosurgery, Fondazione IRCCS Istituto Neurologico Carlo Besta, Milan

²Department of Pediatric Neurology, Fondazione IRCCS Istituto Neurologico Carlo Besta, Milan

³Neuroradiology Unit, Fondazione IRCCS Istituto Neurologico Carlo Besta, Milan

OBJECTIVE: Treatment for Chiari Malformation type 1 (CM1) with symptoms and/or Syringomyelia is posterior fossa decompression with duraplasty (PFDD). Its main complication is cerebrospinal fluid (CSF) leak (8-67%), that may lead to surgical failure due to meningitis/arachnoiditis. Different dural substitutes are employed, their efficacy has to be checked by case-control studies. The present investigated differential efficacy of allografts preventing CSF leaks.

MATERIAL AND METHODS: We performed a retrospective analysis on CM1 patients submitted to PFDD for the first time at FINCB between 2006 and 2023. Clinical, radiological, and surgical data were extracted from a prospectively maintained database. Surgical procedures were scrutinized focusing on dural grafts and sutures, perioperative complication, need for subsequent surgeries and surgical results. Finally, the occurrence of CSF leak was matched with the type of dural graft and sutures utilized, the two variables that changed in the surgical technique. Data were analyzed using a Survival Analysis.

RESULTS: We analyzed 409 CM1 patients undergoing to PFDD: 368 cases had complete surgical data, 30 had autologous duraplasty. The remaining 338 cases with heterologous duraplasty from equine and bovine pericardium were submitted to compared statistical analysis. The mean follow-up was 39 (adults) and 45 (children) months. Global CSF complications with revision was 6.6%, with a higher incidence in children than in adults (10% vs 3.9%). There was no difference in the occurrence of adverse events (CSF leak, Revision Surgery, VP Shunt) between the different dural patches by univariate analysis if applied on global series, although the trend reached near significance (P=0.06). If just the higher risk pediatric cases are considered, the value reached significance (P=0.01) in favor of equine pericardium, when combined with a collagen matrix inlay graft.

CONCLUSION: The study on this large homogenous CM1 series demonstrated that PFDD with heterologous duraplasty may have low CSF complications if a correct surgical selection and technique is applied.

Keywords: Chiari Malformation, Syringomyelia, Posterior Fossa Decompression, Duraplasty, Complication, CSF

PF-012

Craniovertebral Junction and Chiari Variations of the Atlas Vertebra Amongst Children Undergoing Craniovertebral Fixation

Anita Ahmadi Birjandi¹, Felice D' Arco², Stewart Tucker³, Dominic Nolan Paul Thompson¹

¹Department of Neurosurgery, Great Ormond Street Hospital for Children, London, United Kingdom.

²Department of Radiology, Great Ormond Street Hospital for Children, London, United Kingdom.

³Department of Orthopaedic and Spine Surgery, Great Ormond Street Hospital for Children, London, United Kingdom.

OBJECTIVE: To describe the anatomical variations in the C1 vertebra and their biomechanical consequences in children undergoing craniovertebral fixation.

MATERIAL AND METHODS: The study design was a retrospective single-centre review of children <18 years, undergoing craniovertebral fixation procedures. Demographic data and underlying diagnosis were collected from electronic case note review. Analysis of CT and/or MRI images was performed to assess changes in the atlas; (i) incomplete ring (ii) diastasis of C1- lateral subluxation at C1/C2 of more than 30% and (iii) assimilation of C1 to occiput. Biomechanical effects at craniovertebral junction (CVJ) were classified as deformity (basilar invagination), instability or compression.

RESULTS: 85 children had undergone OC fixation at a median age of 7 years (IQR= 9). Adequate radiology and demographic data were available for 79/85. C1 abnormalities were present in 51/79 (64.5%) cases. The most common underlying diagnoses were Morquio syndrome 7/51 (13.7%), Segmentation anomaly 5/51 (9.8%), Down's syndrome 4/51 (7.8%) and Spondyloepiphyseal Dysplasia 4/51 (7.8%). C1 anomalies comprised incomplete ring 49/51 (96%), diastasis 24/51 (47%) and assimilation 10/51 (19.6%). Amongst the abnormal C1 group, 40/51 (78.4%) had instability, 35/51 (68.6%) had compression of the spinal cord and 12/51 (23.5%) had CVJ deformity.

CONCLUSION: Abnormalities of the C1 ring are common in children undergoing OC fixation and this, frequently, precludes screw placement at C1. Children with skeletal dysplasia are particularly at risk for these abnormalities. It is currently unclear whether these anomalies are a cause or a consequence of instability and deformity at the CVJ.

Keywords: craniovertebral junction, atlas, c1

PF-013

Technology

Automated artificial intelligence evaluation of upper extremity function using single view smartphone video

Gloria Su¹, Kevin Sun¹, Natalie Baddour², Edward Lemaire³, Ishaasamyuktha Somasundaram², Rajkumar Jeeva², Kevin Cheung⁴, Albert Tu⁴

¹Children's Hospital of Eastern Ontario, Research Institute

²University of Ottawa, Department of Engineering

³Ottawa Hospital Research Institute, Centre for Rehabilitation Research and Development

⁴Children's Hospital of Eastern Ontario, Department of Surgery

OBJECTIVE: Standardized assessments of upper extremity function are essential for pediatric patients with cerebral palsy and upper extremity dysfunction. The Modified Mallet score (MMS) is a validated

visual assessment tool for upper extremity function. Traditional evaluation however, is laborious and time-consuming with potential variability in interpretation. This study tests an AI augmented automated upper extremity evaluation system using markerless detection of 2D body points from conventional smartphone video.

MATERIAL AND METHODS: Approval was obtained from the institutional REB prior to study initiation. The Modified Mallet score consists of five movements including: Global Abduction, Global External Rotation, Hand to Neck, Hand on Spine and Hand to Mouth. Smartphone videos of patient upper extremity movement evaluated using the MMS were prospectively obtained (424 videos). OpenPose BODY-25 was applied and MMS then calculated using an automated pipeline. Trained human observers manually scored videos for reference and the interpretations were compared.

RESULTS: Overall, the automatic scoring of most movements were very good (Macro precision, Macro recall and Macro f1-scores of 0.85-0.99, and RMSE of less than 0.3) with the exception of global external rotation where Macro values only approach 0.5, and the RMSE is 0.39. We postulate that the AI is less accurate when parts of the upper extremities are out of direct view as may occur while assessing global external rotation from a single viewpoint.

CONCLUSION: We have developed an AI augmented protocol that can automate extraction of MMS from smartphone video of extremity movement. This process allows for rapid and accurate assessment without the need for specialized equipment or immediate presence of a trained clinician. This technology has significant potential to be used in numerous settings including remote patient assessment, post-operative evaluation and ongoing follow up. Refinement of the algorithm and evaluation with larger datasets will further improve performance of this pipeline.

Keywords: artificial intelligence, smartphone, brachial plexus, cerebral palsy, remote evaluation, innovation

PF-014

Technology

Development of Visual Analytics Tool to Track Adverse Events, Develop Quality Metrics and Improve Outcomes in Pediatric Neurosurgery

George Jallo, Luis Rodriguez, Kentlee Battick, Luis Ahumada
Johns Hopkins All Children's Hospital, St Petersburg Florida, USA

OBJECTIVE: The true rate for adverse effects in pediatric neurosurgery is not well known. In 2019 at Johns Hopkins All Children's Hospital we had an internal audit that demonstrated an overall adverse effect of 20% in the time 2014-2019. This included a morbidity rate of 9-12%, readmissions of 15% and return to the operating room rate of 10%. There was no continuous tracking and monitoring of all neurosurgical cases in real time. We developed an Excel dashboard to allow for prospective tracking, however this was manual and labor intensive.

MATERIAL AND METHODS: In 2022, a redcap database was developed that allowed the neurosurgery to track all cases and complications in a granular fashion. The dashboard incorporated demographic data (race, language, ethnicity, gender and zip code) in addition to the complication, readmission data and return to operating room.

RESULTS: This visual database allows the team to visualize each specific adverse event based on any of the demographic data, type of procedure, by surgeon or date. It allows for patient specific tracking of social determinants of health care. This has allowed the team to

recognize that there is increased rate of complications after craniotomy for tumor resection in Hispanic/Latin and primary Spanish language speakers in our region. This allows the team to modify the management of these children to prevent future complications

CONCLUSION: The development of this visual analytics dashboard with cases entered since 2017 (4500+) allows for predictive analytics modeling to identify patients at risk for complications. The neurosurgery team has developed a process to address such patients before surgery.

Keywords: complications, surgery, infection, adverse effect

PF-015

New Technology

Burr Hole Approach for Tumor Resection - Endoscopic Ultrasonic Aspirator Use in a Bi-center Experience

Ulrich Wilhelm Thomale¹, Francesco Tengattini², Valentina Pennacchietti¹, Pietro Spennato², Giuseppe Cinalli²

¹Pediatric Neurosurgery, Charité - Universitätsmedizin Berlin, Germany

²Pediatric Neurosurgery, AORN Santobono Pausilipon, Naples, Italy

OBJECTIVE: Endoscopic tumor surgery is most often restricted to biopsies or secondary CSF circulation disturbances. Reports on surgical experience using pure endoscopic tumor surgery are sparse. The aim of this study is to retrospectively investigate results from a bi-center cohort using a pure endoscopic ultrasonic aspirator for tumor resection.

MATERIAL AND METHODS: The technique of intra-endoscopic ultrasonic aspirator (Endoscopic Neurosurgical Pen (ENP), Söring, Germany) was available since 2012 and 2020 in the centers, respectively. All interventions were retrospectively identified. The clinical patient characteristics, the intention to treat, intraoperative data, possible complications, follow-up time as well as patient outcome were recorded. Radiological data was used to measure the tumor volume and volume change following tumor surgery.

RESULTS: A total of 55 patients (female: n=23, mean age: 8.4±5.4 yrs.) were treated by ENP tumor resection in a total of 65 interventions. Tumor entities treated among others were optic pathway glioma (n=11), craniopharyngiomas (n=15), and SEGAs (n=7), mostly localized in the third (n=31) or lateral ventricle (n=17). Median hospital stay was 7 days (range: 2-122) and time of surgery was 91.5 minutes (range: 19-364). Two patients needed blood transfusion. Mean tumor volume reduction was 61.4±37.5%. Intention for extent of resection was reached in 31 patients (56.4%), while in 5 patients (9.1%) more resection and in 19 patients (34.5%) less resection was achieved. Infection and rebleeding rate were 4.6%, respectively. Mortality was 5.4% after follow up time of 2.3±2 years and referred exclusively to the course of malignant tumor disease.

CONCLUSION: Endoscopic tumor resection via a burr hole using and dedicated ultrasonic aspirator was feasible, effective and safe in the majority of patients. Experience with the surgical technique and patient selection seem to be the most important factors for surgical success. The pure endoscopic tumor resection technique adds another option to the surgical armamentarium for intra or paraventricular tumors and warrants further investigation on a broader scale.

Keywords: brain tumor, neurooncology, neuroendoscopy, extent of resection, endoscopic neurosurgery pen

PF-016

Endoscopy Neurotrauma/Critical Care

Artificial Intelligence in Traumatic Brain Injury: A Comparison of XGBoost Machine Learning Algorithm versus Logistic Regression in Moderate and Severe Pediatric TBI

Matheus Fernando Manzolli Ballesterio¹, Leandro Cândido De Souza¹, Benedicto Oscar Colli², Alexandre Levada³, Gabriel De Moraes Ribeiro², Ricardo Santos De Oliveira²

¹Department of Medicine, Federal University of São Carlos - UFS-Car, São Carlos, Brazil

²Division of Neurosurgery, Department of Surgery and Anatomy, School of Medicine of Ribeirão Preto, São Paulo University - USP, Ribeirão Preto, Brazil

³Department of Computing, Federal University of São Carlos - UFS-Car, São Carlos, Brazil

OBJECTIVE: Compare the accuracy of the logistic regression model with the Extreme Gradient Boosting (XGBoost) machine learning model and the factors associated with unfavorable outcomes (Glasgow outcome scale (GOS) 1-3).

MATERIAL AND METHODS: This is a retrospective cohort study, which included patients aged 0-18 with moderate or severe TBI and using the Glasgow outcome scale to assess functional capacity. In XGBoost, 80% of the sample was used for training and 20% for testing. The accuracy and AUROC of the models analyzed were compared. SHAP was used for interpretability of the model.

RESULTS: From a databank with 3606 TBI children, 267 individuals were included in the study. The mean age was 9.8 years-old (SD=5.9), 177 (66.2%) were white, 189 (70.6%) were male, 179 (66.9%) of the cases were blunt and penetrating trauma, 64 (24%) had an unfavorable outcome (GOS 1-3).

The classic logistic regression model was statistically significant for classifying an unfavorable outcome, [X²(35) = 121,742; p < 0.001; Nagelkerke R²=0.548], with an accuracy of 86.1%. Each point in Glasgow Coma Scale was 0.58 times less likely to an unfavorable outcome. Increasing severity of Head Injury was associated with an increased likelihood of a unfavorable outcome. In the ROC curve analysis, the results showed a statistically significant result (AUC=0.901, p<0.01).

The XGBoost algorithm achieved an accuracy of 0.89, AUROC of 0.81, RMSE of 0.3. The most important variables in the model using SHAP value were: GCS (1.4), Head injury severity (1.05), Length of Stay (1).

CONCLUSION: The logistic regression model was slightly superior for classifying cases with an unfavorable outcome. Despite this, the XGBoost algorithm showed excellent accuracy and light data processing capacity. Further studies should be carried out to improve the algorithm's hyperparameters in order to improve the findings.

Keywords: Machine Learning, Traumatic Brain Injury, XBoost, Epidemiology

PF-017

New Technology

Tubular single-port endoscopic assisted surgery for fetal myelomeningocele repair

Sergio Cavalheiro¹, Marcos Devanir Silva Da Costa¹, Mauricio Mendes Barbosa², Patricia Alessandra Dastoli¹, Stéphanno Gomes Pereira Sarmiento², Ítalo Capraro Suriano¹, David Pares³, Cid Ura², Antônio Fernandes Moron²

¹Department of Neurology and Neurosurgery, Escola Paulista de Medicina- Universidade Federal de São Paulo, São Paulo-SP, Brazil; Fetal Medicine Division, Hospital e Maternidade Santa Joana, São Paulo- SP, Brazil

²Fetal Medicine Division, Hospital e Maternidade Santa Joana, São Paulo- SP, Brazil

³Department of Obstetrics, Escola Paulista de Medicina – Universidade Federal de São Paulo, São Paulo-SP, Brazil

OBJECTIVE: To describe a low-cost and easily reproducible alteration of the Bruner and Tulipan procedure to preserve uterine muscular fibers.

MATERIAL AND METHODS: We present a retrospective cohort of 10 pregnant women whose fetuses developed lumbosacral myelomeningoceles (MM). The MM was repaired through a fetal neurosurgical procedure using a tubular single-port endoscopy-assisted technique. This study was conducted at Santa Joana and São Paulo Hospitals between January 2020 and June 2023. The procedure comprised the tubular retraction of circular fibers from the uterine body without excision of the uterine wall. Tubular devices with progressively larger diameters were used for retraction without cutting the uterine muscular fibers, and a 25 mm diameter tubular retractor was used to allow endoscopic-assisted closure of the MM using microsurgical techniques.

RESULTS: Their average birth age was 36 and 3/7 weeks. Defect repair was possible in all cases. The mean surgical time was 130 min. Two of the patients developed hydrocephalus. One patient was treated with a ventriculoperitoneal shunt and the other underwent an endoscopic third ventriculostomy with choroid plexus coagulation.

CONCLUSION: This is an easy and reproducible procedure that avoid excision of the uterine wall and promote workspace for microsurgical techniques assisted by endoscopy, and is the first step for future single-port correction using robotic techniques.

Keywords: myelomeningocele, fetal neurosurgery, fetal surgery, tubular surgery, single-port surgery, fetal endoscopic surgery

PF-018

Dysraphism

Long-term outcomes after fetal Spina Bifida closure

Charlotte C. Kik¹, Yada Kunpalin¹, Abhaya V. Kulkarni³, Abby Varghese⁵, Nimrah Abbasi¹, Greg Ryan⁴, Philip L.J. Dekoninck², Paige T. Church⁶, Armaan Malhotra³, Kamini Raghuram⁷, Edmond Kelly⁷, Tim Van Mieghem⁴

¹Fetal Medicine Unit, Department of Obstetrics and Gynaecology, Mount Sinai Hospital and University of Toronto, Toronto, Canada.

²Department of Obstetrics and Gynaecology, Division of Obstetrics and Fetal Medicine, Erasmus MC Sophia Children's Hospital, Rotterdam, The Netherlands.

³Division of Neurosurgery, Department of Surgery, Hospital for Sick Children and University of Toronto, Toronto, Canada.

⁴Ontario Fetal Centre, Toronto, Canada.

⁵Department of Urology, Hospital for Sick Children and University of Toronto, Toronto, Canada.

⁶Spina Bifida Clinic, Holland Bloorview Kids Rehabilitation Hospital, Toronto, Canada.

⁷Department of Pediatrics, Mount Sinai Hospital and University of Toronto, Toronto, Canada.

OBJECTIVE: To evaluate the long-term developmental outcomes in initial cases treated with prenatal spina bifida surgery at Mount Sinai Hospital, Toronto, Canada.

MATERIAL AND METHODS: This cross-sectional study included consecutive cases undergoing prenatal spina bifida surgery since the program's start in 2017. Each case had at least one year of postnatal follow-up. An Ages and Stages Questionnaire assessed developmental progress in communication, motor, problem-solving, and social skills, categorized as 'Typical Development', 'Possible Delay', or 'Significantly Delayed'. Additional outcomes included neurological, functional, bladder, and bowel functioning.

RESULTS: Of the 41 patients, 24 (58.5%) responded to the follow-up, 3 (7.3%) were deceased.

Among the respondents, the median age at evaluation was 46.5 months (range 13-74 months). Lesion types included myelomeningocele (62.5%) and myeloschisis (37.5%), with L5 as the most common level (33.3%). A majority of children demonstrated typical development in communication and problem-solving skills (79.2%), while gross motor development exhibited significant delays in most cases (91.7%). Fine motor skills varied, with over half showing typical development (56.5%) and a notable proportion possibly experiencing delays (34.8%). In the home environment, all children were able to ambulate independently; 41.7% walked and 58.3% used crawling as their primary mode of movement. A majority (58.3%) needed walking aids. Orthopedic interventions were necessary for 16.7% of participants. Ankle orthosis was most common (62.5%), and most children (83.3%) engaged in physical therapy weekly. One-third (33.3%) received CSF derivation surgery. For bladder function, 41.7% used intermittent catheterization, and oral laxatives were utilized for bowel management in 45.8% of cases.

CONCLUSION: This study showed a mixed developmental profile among patients who underwent open fetal spina bifida repair. Future research should explore quality of life assessment for better understanding of prenatal intervention effects. Additionally, developing a core outcome set is crucial for standardizing treatment evaluation and enabling comparisons across studies.

Keywords: fetal surgery, myelomeningocele, long-term outcome, development

PF-019

Dysraphism

Folic acid consumption among Hispanic women of reproductive age in the US: A systematic review

Nicole Villalba¹, Kayla Byrne¹, Sunny Abdelmageed³, Megan Votoupal², Diamond Dominguez¹, Sandi Lam³, Roxanna Garcia¹

¹Department of Neurosurgery, Northwestern University Feinberg School of Medicine, Chicago, Illinois, USA

²Division of Pediatric Neurosurgery, Ann and Robert H. Lurie Children's Hospital, Chicago, Illinois, USA

³Division of Pediatric Neurosurgery, Ann and Robert H. Lurie Children's Hospital, Chicago, Illinois, USA; Department of Neurosurgery, Northwestern University Feinberg School of Medicine, Chicago, Illinois, USA

OBJECTIVE: In 1998, the United States implemented mandatory folic acid fortification of enriched cereal grain products to prevent neural tube defects (NTD) in newborns. Despite this initiative, rates of spina bifida remained highest in Hispanic births. Voluntary folic acid fortification of corn masa flour was approved in 2016, without resulting improvement in NTD rates. This study seeks to shed light on the state of folic acid consumption among Hispanic women and identify avenues for increasing folic acid intake.

MATERIAL AND METHODS: A systematic search was conducted in accordance with the Preferred Reporting Items for Systematic

Reviews and Meta-Analyses (PRISMA) guidelines using three databases. Seven studies were included.

RESULTS: Hispanic women relied more on dietary folic acid than supplement use. Commonly cited folic acid-fortified products consumed by Hispanic women included cereals, bread, flour, pasta, and corn masa flour. Compared to non-Hispanic White (NHW) women, Mexican American women who primarily spoke Spanish had lower folic acid intake. Hispanic women were more likely to have suboptimal red blood cell folate concentrations, associated with a higher risk of NTD prevalence, compared to NHW women. No significant differences were found between folic acid intake and NTD prevalence among Hispanic women following voluntary folic acid fortification of corn masa products.

CONCLUSION: There is a notable disparity in folic acid intake between Hispanic women and NHW women. Differences in diet, supplement use, and acculturation factors may contribute to the variations in folic acid intake between Hispanic women and NHW women. The limited data in the literature underscores the need for further research into the contribution of specific folic acid-fortified products to the overall folic acid intake in Hispanic women, and for future targeted interventions.

Keywords: folic acid, Hispanic women, neural tube defects

PF-020

Dysraphism

Urodynamic based early tethered cord release can preserve lower urinary tract function and avoid augmentation cystoplasty in patients with myelomeningocele

Tomomi Kimiwada¹, Dan Ozaki⁴, Toshiaki Hayashi², Takeyoshi Honta⁴, Tomohiro Eriguchi³, Shinako Takeda³, Kiyohide Sakai³, Reizo Shirane², Hidenori Endo⁴

¹Center for Pediatric Neurology and Neurosurgery, Shimane University Hospital, Izumo, Japan

²Department of Neurosurgery, Miyagi Children's Hospital, Sendai, Japan

³Department of Urology, Miyagi Children's Hospital, Sendai, Japan

⁴Department of Neurosurgery, Tohoku University Graduate School of Medicine, Sendai, Japan

OBJECTIVE: Diagnosing tethered cord syndrome (TCS) in myelomeningocele (MMC) patients is challenging due to the lack of objective indicators. This retrospective analysis focuses on urological manifestations and evaluates whether tethered cord release (TCR) for TCS at an early stage could prevent lower urinary tract dysfunction and avoid augmentation cystoplasty (AC).

MATERIAL AND METHODS: This study analyzed 55 patients with MMC. The follow-up duration exceeded 6 years. The study investigated patient characteristics and the surgical indications and outcomes of TCR.

RESULTS: The duration of follow-up averaged 12.6±3.5 years (range, 6.0–19.0 years). TCR were performed on 27 (49.1%) out of 55 patients, totaling 33 procedures. Five received two TCRs, and one received three TCRs. The mean age at each TCR was 7.5±2.9 years (range, 2.2–12.7 years) for the first TCR (n=27), 10.9 years (range, 10.1–11.7 years) for the second TCR (n=5), and 15.9 years for the third TCR (n=1). The first TCR was conducted in response to deteriorating motor symptoms in one patient, and deteriorating sensory symptoms in three patients, as well as worsening findings in video-urodynamic studies (VUDS) in 26 patients. After the procedure, motor symptoms improved in one patient (100%), sensory symptoms improved in two patients (66.7%), and VUDS findings improved in 18 patients (66.7%). The preoperative VUDS revealed urological deterioration characterized by a high-pressure bladder,

reduced bladder capacity, increased detrusor overactivity (DO), and vesicoureteral reflux (VUR). The postoperative VUDS showed improvements in bladder function, including decreased bladder pressure and DO, increased bladder capacity, and compliance. None of the patients had AC or renal dysfunction.

CONCLUSION: Routine VUDS can be a significant indicator for early diagnosis of TCS. Performing TCR at an early stage is beneficial not only to protect renal function but also to avoid AC in MMC patients. It is important to develop a standardized approach for the diagnosis and treatment of TCS.

Keywords: myelomeningocele, tethered cord syndrome, urodynamic study, augmentation cystoplasty

PF-021

Dysraphism

Global Variability in Fetal Spina Bifida Surgery: A Survey of Neurosurgical Strategies

Charlotte C Kik¹, Yada Kunpalin¹, Abhaya V Kulkani³, Philip L.J. Dekoninck², Jochem K.H. Spoor⁴, Tim van Mieghem⁵

¹Department of Obstetrics and Gynaecology, Mount Sinai Hospital and University of Toronto, Toronto, Ontario, Canada.

²Department of Obstetrics and Gynaecology, Division of Obstetrics and Fetal Medicine, Erasmus MC Sophia Children's Hospital, Rotterdam, The Netherlands

³Division of Neurosurgery, Department of Surgery, Hospital for Sick Children and University of Toronto, Toronto, Ontario, Canada.

⁴Department of Neurosurgery, Erasmus MC, Rotterdam, The Netherlands.

⁵Ontario Fetal Centre, Toronto, Ontario, Canada

OBJECTIVE: To investigate the global variability in intra-operative neurosurgical management strategies in fetal spina bifida surgery.

MATERIAL AND METHODS: All international fetal spina bifida surgery centers were invited to participate in an online survey addressing various aspects of the surgery, including fetal selection criteria, surgical technique, and common intraoperative challenges.

RESULTS: Thirty-four centers responded to the survey (72%), half of whom perform less than 10 surgeries annually (55.9%). The most common minimum gestational age for surgery was 23 weeks (36%, n = 12), ranging from <21 weeks (9%, n = 3) to >24 weeks (9%, n = 3). The maximum gestational age for surgery varied from <26 weeks (24%, n = 8) to 30 weeks (3%, n = 1), with the majority occurring at 26 weeks (50%, n = 17). Open fetal surgery is the predominant method in 76% of centers (n = 26), followed by hybrid percutaneous fetoscopic surgery (29%, n = 10), and fully percutaneous fetoscopic surgery (15%, n = 5). Filum terminal dissection is done in 58% (n = 19) of centers and placode tubularization in 46% (n = 15). Myofascial flaps are routinely used in 55% of the centers (n = 18). When primary skin closure is not possible, 39% (n = 13) will use releasing side cuts and a third of all centers will use acellular dermal matrix grafts (33.3%, n = 11). Extensive skin defects and suboptimal fetal access were commonly cited as the most significant intraoperative challenges.

CONCLUSION: There is variability in the fetal inclusion criteria and intra-operative management of fetal spina bifida across centers. This emphasizes the need for more research on best practices as well as standardized outcome reporting (ideally through 'core outcomes') to allow for comparison between centers. Identified challenges, such as difficulties in skin closure, highlights specific areas for future innovations in the field.

Keywords: fetal surgery, fetoscopy, myelomeningocele, quality improvement, neurosurgery

PF-022

Dysraphism

Fetoscopic Prenatal spina bifida repair: How we developed this approach and how currently we do

Jose Luis Peiro¹, Foong Yen Lim¹, Braxton Forde², Mounira Habli³, David McKinney², Soner Duru⁴, Charles B Stevenson⁵

¹Cincinnati Children's Fetal Care Center, Division of Pediatric General and Thoracic Surgery, Children's Hospital Medical Center (CCHMC), Cincinnati, Ohio, USA; University of Cincinnati College of Medicine, Cincinnati, Ohio, USA.

²Cincinnati Children's Fetal Care Center, Cincinnati Children's Hospital Medical Center (CCHMC), Division of Obstetrics and Gynecology, University of Cincinnati Medical Center, Cincinnati, Ohio, USA; University of Cincinnati College of Medicine, Cincinnati, Ohio, USA.

³Cincinnati Children's Fetal Care Center, Cincinnati Children's Hospital Medical Center (CCHMC), Cincinnati, Ohio, USA; Division of Obstetrics and Gynecology, Good Samaritan Hospital, Cincinnati, Ohio, USA

⁴Cincinnati Children's Fetal Care Center, Division of Pediatric General and Thoracic Surgery, Children's Hospital Medical Center (CCHMC), Cincinnati, Ohio, USA.

⁵Cincinnati Children's Fetal Care Center, Cincinnati Children's Hospital Medical Center (CCHMC), Division of Pediatric Neurosurgery, Cincinnati, Ohio, USA; University of Cincinnati College of Medicine, Cincinnati, Ohio, USA

OBJECTIVE: To describe the experimental development and the clinical implementation of the laparotomy-assisted fetoscopic prenatal spina bifida (SB) repair discussing the technical aspects

MATERIAL AND METHODS: This study analyzes the technical aspects from 88 consecutive patients who underwent multilayered fetoscopic surgical spina bifida repair at our institution since December 2016.

RESULTS: All 88 fetal spina SB cases were successfully repaired by fetoscopic approach without needs of conversion to open fetal surgery. The later day offered is 25 weeks and 6 days of gestation following the inclusion criteria of MOMS trial. We use maternal midline laparotomy to expose the uterus and allow us better positioning the fetus and to close the amniotic membranes at the end of the procedure. We remove half of the amniotic fluid content and replaced it with warmed and humidified carbon dioxide to create a gas chamber for better visualization. The neural placode and nerve roots are released and un-tethered from the surrounding tissue. Out of 88 patients that underwent fetoscopic SB repair, the first 4 had duraplasty with a biocellulose dural patch, and the subsequent 84 cases had duraplasty using cryopreserved HUC matrix allograft. Currently we are using a double layer of this dural patch. We create skin flaps to achieve primary skin closure in the midline in 75% of cases using a running 3-0 monofilament barbed suture. In the other 25% of cases, mostly myeloschisis, we use a thin acellular human dermal skin substitute patch. The average operative time from skin incision to closure was 262 + 44.3 minutes. Moreover, fetuses remain very stable during whole intervention. Only one patient required intraoperative resuscitation and delivery at 25 weeks gestation for persistent bradycardia who did well in NICU.

CONCLUSION: Laparotomy-assisted, three-miniport fetoscopic approach for prenatal myelomeningocele multi-layered repair offers excellent access and visualization for an effective watertight closure.

Keywords: Fetoscopic Prenatal spina bifida repair, experimental prenatal spina bifida repair,

PF-023

Dysraphism

The incidence of third-trimester motor function decline in postnatal repair myelomeningocele patients

William Ernest Whitehead

Department of Neurosurgery, Baylor College of Medicine, Houston, USA

OBJECTIVE: One of the known benefits of fetal surgery for myelomeningocele (MMC) is preventing a decline in lower extremity motor function that can occur in the third trimester of pregnancy due to the neurotoxic effects of amniotic fluid and trauma to the exposed placode. This study reports the incidence of decline in motor function during the third trimester in postnatal repaired MMC patients.

MATERIAL AND METHODS: All postnatal MMC closures between December 2011 and July 2021 were screened. Singleton pregnancies with hindbrain herniation and MMC between T1 and S1 were included. Fetuses were excluded for genetic abnormalities, severe kyphosis, other congenital anomalies, and an inadequate prenatal ultrasound. Prenatal ultrasound scans before 26 weeks gestational age were evaluated to determine the presence or absence of movement at the hips, knees, and ankles. This was compared to the physical exam findings after delivery and before surgery. The following variables were evaluated as risk factors for motor decline: anatomic level of lesion, race, ethnicity, gender, type of lesion (cystic v. flat), presence of clubbed feet, and gestational age at delivery.

RESULTS: Fifty-eight MMC patients met study criteria. There was no decline in movements in 24/58 (41%) patients. Two patients lost 1 myotome level of movement (2%); twenty patients lost 2 myotome levels of movement (34%); and twelve lost 3 or more myotome levels of movement (21%). The absence of clubbed feet prior to 26 weeks gestational age was the only significant risk factor for a decline in motor function (chi-square test; p=0.003).

CONCLUSION: A significant number of MMC patients repaired postnatally will not lose motor function in the third trimester (41%). The risk of decline is lower in fetuses who are already impaired with clubbing of the feet in the second trimester. These findings can aid in prenatal counseling regarding fetal intervention.

Keywords: myelomeningocele, spina bifida, fetal surgery, neural tube defects

PF-024

Hydrocephalus and Neuro

De novo variants truncating the LIM domain of LDB1 cause a novel human neurodevelopmental disorder featuring cerebral ventriculomegaly

Neel H Mehta¹, Garrett Allington², Kedous Y. Mekbib³, Evan Dennis¹, Benjamin Reeves⁴, Phan Q. Duy⁵, Emre Kiziltug³, Shujuan Zhao⁶, Carol Nelson Williams⁷, Stephen Mcgee⁸, Seth L. Alper⁹, Andres Moreno De Luca¹⁰, Shozeb Haider¹¹, Sheng Chih Jin¹², Kristopher T. Kahle¹³

¹Department of Neurosurgery, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA

²Department of Pathology, Yale University School of Medicine, New Haven, CT, USA; Department of Neurosurgery, Yale University School of Medicine, New Haven, CT, USA; Department of Neurology, Columbia University Vagelos College of Physicians and Surgeons, New York, NY USA

³Department of Pathology, Yale University School of Medicine; Department of Neurosurgery, Yale University School of Medicine, New Haven, CT, USA.

⁴Department of Neurosurgery, Yale University School of Medicine, New Haven, CT, USA.

⁵Department of Neurosurgery, Yale University School of Medicine, New Haven, CT, USA; Department of Neurosurgery, University of Virginia School of Medicine, Charlottesville, VA, USA

⁶Department of Genetics, School of Medicine, Washington University, St. Louis, MO, USA.

⁷Department of Genetics, Yale University School of Medicine, New Haven, CT, USA.

⁸GeneDx, Gaithersburg, MD, USA

⁹Division of Nephrology and Center for Vascular Biology Research, Beth Israel Deaconess Medical Center, and Department of Medicine, Harvard Medical School, Boston, MA, USA

¹⁰Department of Radiology, Neuroradiology Section, Kingston Health Sciences Centre, Queen's University Faculty of Health Sciences, Kingston, ON, Canada.

¹¹School of Pharmacy, University College London, London, UK

¹²Department of Genetics, School of Medicine, Washington University, St. Louis, MO, USA; Broad Institute of Harvard and MIT, Cambridge, Massachusetts, USA.

¹³Department of Neurosurgery, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA; Department of Neurosurgery, Yale University School of Medicine, New Haven, CT, USA; Broad Institute of Harvard and MIT, Cambridge, Massachusetts, USA; Division of Genetics and Genomics, Manton Center for Orphan Disease research, Department of pediatrics, and Howard Hughes Medical institute, Boston Children's Hospital, Boston, MA, USA; Harvard Center for Hydrocephalus and Neurodevelopmental Disorders, Massachusetts General Hospital, Boston, MA, USA..

OBJECTIVE: Congenital hydrocephalus (CH), characterized by cerebral ventriculomegaly (CV), is a common yet poorly understood pediatric neurosurgical condition. Through integrative genomic analysis, we aimed to unveil new candidate genes and pathways involved in CV and CH pathogenesis, shedding light on neurogenesis and cellular signaling. **MATERIAL AND METHODS:** We assembled the largest CV cohort to date, including >2,697 parent-proband trios consisting of neurosurgically-treated congenital hydrocephalus. We conducted whole-exome sequencing on this cohort to identify novel damaging de novo variants (DNVs) and conducted a comprehensive single-cell analysis on an existing dataset of the developing CNS to examine the expression patterns of relevant genes across fetal neurogenesis.

RESULTS: Across our cohort, we identified an exome-wide significant enrichment of protein-altering de novo variants (DNVs) in LIM Domain Binding 1 (LDB1) ($p = 1.11 \times 10^{-15}$). Seven unrelated patients with ventriculomegaly, developmental delay, and dysmorphic features harbored loss-of-function DNVs that truncate LDB1's carboxy-terminal LIM interaction domain (LID), which binds and regulates the assembly of LIM homeodomain-containing transcriptional regulators. Another patient had a damaging de novo missense variant in the LDB1 homodimerization domain predicted to disrupt LDB1 activation. Integrative genomic analyses suggest LDB1 is a key regulatory hub of gene transcription in ventricular zone neuroprogenitor cells by binding LIM-homeodomain proteins like SMARCC1 and ARID1B, interacting subunits of the SWI/SNF (mammalian BAF) chromatin modifying complex. Indeed, LIM homeodomain containing genes carry a disproportionate burden of protein-damaging DNVs in our cohort, with SMARCC1 ($p = 5.83 \times 10^{-9}$) and ARID1B ($p = 1.80 \times 10^{-17}$) surpassing exome-wide significance thresholds.

CONCLUSION: These data identify LDB1 as a novel neurodevelopmental disorder gene and suggest a LDB1-regulated transcriptional

program is essential for human brain morphogenesis, highlighting the utility of trio-based WES to identify pathogenic variants in structural brain disorders. Our results support a "neural stem cell" paradigm of CH subtypes.

Keywords: Hydrocephalus; Ventriculomegaly; LDB1; neurodevelopment; stem cells

PF-025

Hydrocephalus and Neuro

Hydrocephalus treatment ETV/CPC vs VPS outcome in Al-Basheer Hospital, NeuroKids project- Jordan

Anas Said¹, Samer Elbabaa², Derek Johnson³, Benjamin Warf⁴

¹Anas Said MD, Department of Neurosurgery, Al Basheer Hospital Ministry of Health, Jordan

²Samer K. Elbabaa, MD, FAANS, FAAP, FACS Chief, Pediatric Neurosurgery Director, Orlando, Florida, USA

³Derek Johnson, Chief Executive Officer, Neurokids org. Washington, USA

⁴Benjamin C. Warf MD Professor of Neurosurgery, Harvard Medical School Hydrocephalus/Spina Bifida Chair, Boston Children's Hospital

OBJECTIVE: A new ETV/CPC program to treat hydrocephalus in infants was established at Al-Basheer hospital in Jordan in partnership with Neurokids. The program included on-site training using donated flexible endoscopes. The objective of this study is to assess the surgical outcomes of all patients who underwent ETV/CPC during the onsite training as well as patients who underwent hydrocephalus treatment after the onsite training via the mentorship program.

MATERIAL AND METHODS: We reviewed the charts and radiographic studies of all pediatric patients under the age 2 years who received treatment for hydrocephalus at Al-Basheer Hospital after introducing the ETV/CPC program in July 2023

RESULTS: More than 50 pediatric patients underwent either ETV/CPC or VPS insertion, Twenty two patients underwent ETV/CPC and 28 patients underwent VPS insertion for initial hydrocephalus treatment by other neurosurgeons in the same department during the same duration, Ten patients (20%) were son of refugees which constituted 20% of the total population, The cause of HCP was aqueduct stenosis (35%), MMC (30%), IVH of prematurity (30%). Mean age of treatment was 4 months (range 1 – 24 months). Mean follow-up period was 6 months. At follow up ETV/CPC patients was successful in 60 %, while 50 % of VPS insertion had failed due to obstruction or infection patient's the most common complication of ETV/CPC was CSF leak from incision site in 5 patients, just two of them required VPS insertion.

CONCLUSION: ETV/CPC continues to show promising results for the treatment of infants with hydrocephalus regardless of geographical location or etiology of hydrocephalus. The partnership with Neurokids was essential to launch the program via providing endoscopic equipment, onsite training, and remote mentorship. Multi-center study analyzing outcomes from programs launched by Neurokids can help providing a better assessment of ETV/CPC outcomes from different geographical locations around the globe.

Keywords: Hydrocephalus, ETV/CPC, Neurokids, Jordan

PF-026

Hydrocephalus and Neuro

Does Machine Learning Improve Prediction Accuracy of the Endoscopic Third Ventriculostomy Success Score? A Contemporary Hydrocephalus Clinical Research Network Cohort Study

Armaan K. Malhotra¹, Abhaya V. Kulkarni², Leonard H. Verhey³, Ron W. Reeder⁴, Jay Riva Cambrin⁵, Hailey Jensen⁴, Hcrn Collaborators⁶, John R. W. Kestle⁷

¹Division of Neurosurgery, University of Toronto, Toronto, Canada

²Division of Neurosurgery, Hospital for Sick Children, Toronto, Ontario, Canada

³Division of Neurosurgery, Department of Clinical Neurosciences, Spectrum Health, Michigan State University, Grand Rapids, Michigan, United States

⁴Department of Pediatrics, University of Utah, Salt Lake City, Utah, United States

⁵Division of Neurosurgery, Alberta Children's Hospital, University of Calgary, Calgary, Alberta, Canada

⁶Hydrocephalus Clinical Research Network, Salt Lake City, Utah, United States

⁷Department of Neurosurgery, University of Utah, Salt Lake City, Utah, United States

OBJECTIVE: This Hydrocephalus Clinical Research Network (HCRN) study had two AIMS: 1) to compare the predictive performance of the original ETV Success Score (ETVSS) using logistic regression modeling with other newer machine learning (ML) models and 2) to assess whether inclusion of imaging variables improves prediction performance using ML models.

MATERIAL AND METHODS: We identified children undergoing first-time ETV for hydrocephalus that were enrolled prospectively at HCRN sites. The primary outcome was 6-month ETV success. The cohort was randomly divided into training (70%) and testing (30%) datasets. We constructed a multivariable logistic regression model using the classic ETVSS covariates; additional ML models were utilized including eXtreme Gradient Boosting, support vector machine, artificial neural network, and naïve Bayes architectures. Hyperparameter tuning was performed using the training dataset with cross-validation and predictive performance was evaluated for each model on the testing dataset using area under the receiver operating characteristic curve (AUROC). Repeat model training and testing was performed with addition of imaging covariates.

RESULTS: There were 752 patients that underwent first time ETV, of which 185 patients (24.6%) experienced ETV failure within 6-months. There were no baseline differences in cohort characteristics or outcome frequency between training and testing subgroups. For aim 1 using the classic ETVSS variables, ML models did not outperform logistic regression with AUROC 0.60 (95% CI: 0.52-0.69) for Naïve Bayes (highest ML model performance) and 0.68 (95% CI: 0.60-0.76) for logistic regression. After inclusion of imaging features (aim 2) ML model prediction improved but remained no better than logistic regression with the highest AUROC of 0.67 (95% CI: 0.59-0.75) attained using Naïve Bayes architecture compared to 0.68 (95% CI: 0.59-0.76) for logistic regression.

CONCLUSION: This contemporary study demonstrated that ML modeling strategies did not improve performance of the ETVSS model over classic logistic regression. Inclusion of imaging variables did not meaningfully improve prediction performance.

Keywords: machine learning, hydrocephalus, endoscopic third ventriculostomy, success score, prediction, clinical epidemiology

PF-027

Hydrocephalus and Neuro

A Multi-Center Study of Non-Invasive Wireless Assessment of CSF Shunt Function in Hydrocephalus Patients

Sandi K. Lam¹, David D. Limbrick, Jr.², Jesse Skoch³, Jarod L. Roland⁴, Gerald A. Grant⁵, Matthew C. Tate⁶, Kurtis Auguste⁷, David

J. Langer⁸, Fady T. Charbel⁹, Jenna E. Koschnitzky¹⁰, R. Chad Webb¹⁰, Adam M. Zysk¹⁰

¹Department of Neurological Surgery, Northwestern University Feinberg School of Medicine, Division of Pediatric Neurosurgery, Ann and Robert H. Lurie Children's Hospital, Chicago, Illinois, USA

²Department of Neurosurgery, Washington University in St. Louis School of Medicine, St. Louis, Missouri, USA; Department of Neurosurgery, Virginia Commonwealth University, Richmond, Virginia, USA;

³Division of Pediatric Neurosurgery, Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio, USA

⁴Department of Neurosurgery, Washington University School of Medicine, St. Louis, Missouri, USA

⁵Department of Neurosurgery, Duke University, Durham, North Carolina, USA

⁶Department of Neurological Surgery, Feinberg School of Medicine, Northwestern University, Chicago, Illinois, USA

⁷Department of Pediatric Neurosurgery, Benioff Children's Hospital, UCSF Weill Institute for Neurosciences, San Francisco, California, USA

⁸Department of Neurosurgery, Lenox Hill Hospital, Donald and Barbara Zucker School of Medicine at Hofstra/Northwell Health, New York, NY, USA

⁹Department of Neurosurgery, University of Illinois at Chicago, Chicago, Illinois, USA

¹⁰Rhaeos, Inc., Evanston, Illinois, USA

OBJECTIVE: Diagnosing cerebrospinal fluid (CSF) shunt malfunction can be difficult and relies on a combination of indirect and/or invasive methods. This study evaluated the performance of the non-invasive FlowSense wireless device to rapidly assess shunt flow. The objective of this study was to establish diagnostic performance of the device in subjects presenting with a possible shunt malfunction.

MATERIAL AND METHODS: This was a prospective, blinded, observational multi-center study of patients with an existing ventriculoperitoneal CSF shunt and symptoms of a shunt malfunction. Patients underwent evaluation with the FlowSense device and standard-of-care imaging (typically CT or MRI) and were followed for 7 days to determine if a revision was performed to repair or replace the existing shunt. In patients undergoing a revision, intraoperative assessment of shunt functionality established the presence or absence of a complete obstruction. FlowSense device data were used to categorize shunt function as flow confirmed or flow not confirmed.

RESULTS: In the N=70 full analysis dataset, the sensitivity of the study device (correct identification of a non-flowing shunt) was 88.9% (68.4-100.0%, 95CI), and the specificity (correct identification of a flowing shunt) was 49.2% (36.6-61.7%) with a negative predictive value (NPV; percentage of correct "flow confirmed" measurements) of 96.8% (90.6-100.0%). Given the high NPV, FlowSense results were also analyzed in conjunction with CT or MRI results when the device reported "flow not confirmed." In this use case, the sensitivity of the study device with imaging was 71.4% (38.0-100.0% 95% CI) and the specificity with imaging was 93.3% (87.0-99.6).

CONCLUSION: The study generated FlowSense data to identify CSF shunt flow in symptomatic patients. High NPV suggests potential application to rule out shunt malfunction in clinic visits and the emergency department. Ongoing diagnostic performance and clinical outcome studies are gathering additional data in a broad and representative patient population.

Keywords: hydrocephalus, shunts, shunt flow monitor

PF-028

Hydrocephalus and Neuro

Exploring Mechanisms Driving Ventricular Catheter Obstruction In Patients With Pediatric Hydrocephalus: Insights from a Multi-center Shunt Biobank Study

Prashant Hariharan¹, Christopher Roberts², Carolyn Harris³

¹Department of Biomedical Engineering, Wayne State University, Detroit, Michigan, United States of America

²Department of Chemical Engineering and Materials Science, Wayne State University, Detroit, Michigan, United States of America

³Department of Chemical Engineering and Materials Science, Wayne State University, Detroit, Michigan, United States of America; Department of Biomedical Engineering, Wayne State University, Detroit, Michigan, United States of America

OBJECTIVE: Ventricular catheters (VC) used to divert cerebrospinal fluid in patients with hydrocephalus often fail due to tissue blockage within its drainage holes. The mechanisms driving obstruction remain poorly understood. To address this and identify potential predictors for patient-specific shunt performance, we leveraged our multicenter biobank and its comprehensive dataset.

MATERIAL AND METHODS: 1132 failed VCs and pertinent clinical data were collected from six centers across the United States. Each drainage hole on the VCs was classified based on the degree of tissue obstruction following macroscopic analysis. Additionally, a subgroup of these catheters underwent detailed examination using confocal microscopy, immunofluorescent labeling, histology, and immunohistochemistry. Univariate, multivariate, and binned analyses were conducted to explore potential associations between clinical data and degree of VC obstruction.

RESULTS: Among VCs identified as obstructed by surgeons through intraoperative assessment, 36% were categorized as unobstructed upon macroscopic analysis. 61.5% of VCs that we categorized as obstructed, exhibited tissue aggregates blocking at least one hole, while most holes (70%) showed no tissue aggregates. Choroid plexus (present in 24% of VCs) and microglia (constituting 2–6% of cells in obstructing tissue) were not significant contributors to the obstruction. Large tissue aggregates with consistent cell density were observed in VCs after varying durations of implantation, suggesting mechanisms that do not necessarily worsen over time. VCs from patients with 0 to 2 lifetime revisions had a higher proportion of obstructed VC holes compared to those from patients with 10+ revisions ($p = 0.0484$). VCs contacting the ventricular wall were more likely to have holes with protruding tissue aggregates ($p = 0.005$).

CONCLUSION: VC obstruction seems to result from a combination of factors, with no single factor reliably predicting the extent of obstruction or the potential duration of patency. However, grouping patients based on multiple factors could enhance our ability to predict and prevent such obstructions.

Keywords: Hydrocephalus, Biobank, Ventriculoperitoneal shunt, Shunt failure, Retrospective cohort, Multicenter

PF-029

Hydrocephalus and Neuro

Impact of the BASICS trial (The British Antibiotic or Silver Impregnated Catheters for ventriculoperitoneal Shunts) on ventriculoperitoneal shunt surgery in the UK: a clinical and health economic analysis

Conor Mallucci¹, Ali Bakhsh², Rocio Fernández Méndez^{3,5}, Giovanna Culeddu⁷, Conor Gillespie³, Marco Palma⁸, John Pickard⁶, Dyfrig Hughes⁷, Carrol Gamble⁹, Alexis Joannides⁴, Michael Jenkinson³

¹Department of Neurosurgery, Alder Hey Children's Hospital, Liverpool, UK

²Institute of Systems, Molecular and Integrative Biology, University of Liverpool, UK

³Department of Neurosurgery, The Walton Centre NHS Foundation Trust, Liverpool, UK

⁴Department of Clinical Neurosciences, University of Cambridge, Cambridge, UK

⁵The UK Shunt Registry, Cambridge, UK

⁶NIHR Brain Injury MedTech Cooperative, Cambridge, UK

⁷Centre for Health Economics and Medicines Evaluation, Bangor University, UK

⁸MRC Biostatistics Unit, University of Cambridge

⁹Liverpool Clinical Trials Centre, University of Liverpool, UK

OBJECTIVE: Shunt infection remains a major cause of morbidity and burden on health resources. The BASICS trial reported a significantly lower incidence of infection with antibiotic shunts (2.2%) compared to standard (6.0%) and silver (5.9%). We undertook a clinical and health economic impact analysis of the BASICS trial on routine shunt surgery practice and shunt infection in the UK

MATERIAL AND METHODS: Using UK Shunt Registry data (UKSR). Comparison of antibiotic and standard shunt use in patients of any age undergoing insertion of their first ventriculoperitoneal shunt for hydrocephalus during the period pre-BASICS (January 2004 to June 2013) and post-BASICS (January 2018 to December 2021). Primary outcome was the percentage of antibiotic shunts inserted. Secondary outcome was revision rate for infection. A budget impact analysis was conducted to estimate the cost savings resulting from reduced revision rates due to infection following the transition from standard shunts to antibiotic shunts. Cost inputs and infection rates were extracted from the BASICS economic evaluation and from the UKSR.

RESULTS: There were 12476 new shunt insertions and 2482 revisions. Antibiotic shunt use increased from 36.9% in paediatrics and 20.5% in adults in 2004, to 99.2% in paediatrics and 96.8% in adults in 2021. The largest annual change in antibiotic shunt use was between 2018 and 2019 (year of BASICS publication), with a 14.9% increase in paediatrics and a 27.2% increase in adults. Compared to standard shunts, the infection rate for antibiotic shunts were significantly lower in children (5.1% versus 1.9%, $p < 0.001$) and adults (1.5% versus 0.9%, $p = 0.031$). Transitioning to antibiotic shunts is estimated to save the NHS £955,811 (95% CI £698,332, £1,229,359) per annum

CONCLUSION: We demonstrated that the BASICS study changed clinical practice in the UK. Antibiotic shunts are the first choice for patients and they reduce infection in clinical practice, saving the NHS around £1 million per year.

Keywords: Hydrocephalus, infection, VP shunt, health economics

PF-030

Endoscopy/Neurotrauma/Critical Care

Prognostic Modeling for Clinical Outcomes in Diffuse Axonal Injuries via Magnetic Resonance Imaging: Insights from a Single-Center Investigation

Maria Sole Venanzi¹, Lelio Guida¹, Marie Bourgeois¹, Mathilde Chevnard², Marjolaine Guillaume², Thomas Baluwblomme¹

¹Neurosurgery Unit, Necker-Enfants malades hospital, Paris (France)

²Rehabilitation Department for Children with Acquired Neurological Injury, Saint Maurice Hospitals, Saint Maurice, Paris (France)

OBJECTIVE: Diffuse axonal injury (DAI) manifests following traumatic brain injury (TBI), often caused by rapid acceleration and deceleration forces. This injury disrupts neuronal network integrity,

potentially leading to varied functional deficits. The predominant classification for DAI, established by Hume Adams and colleagues, relies solely on histopathological features. Our novel approach aims to correlate Magnetic Resonance Imaging (MRI) findings with patients' clinical details and neuropsychological follow-up.

MATERIAL AND METHODS: Following Ethical Committee approval, we enrolled pediatric patients diagnosed with DAI based on early MRI scans conducted between January 2009 and December 2022, excluding those with cerebral contusions. Our analysis focused on demographic and clinical parameters, including Glasgow Coma Scale scores, intubation duration, neurological examination results, and epilepsy presence. Neuropsychological evaluations during follow-up, emphasizing cognitive assessments via the Wechsler Intelligence Scale for Children Fifth Edition, Rey–Osterrieth Complex Figure test, and short-term memory assessment, were collected. Utilizing artificial intelligence techniques, specifically the K-nearest neighbor algorithm and BIANCA, we segmented DAI lesions observed on MRI sequences: Fluid Attenuated Inversion Recovery (FLAIR) and Susceptibility Weighted Imaging (SWI). Statistical analyses with Niistat software investigated correlations between clinical data and neuroimaging findings.

RESULTS: Fifty-three patients who underwent MRI within 30 days of trauma at our institution were included. All received follow-up evaluations at the same institution. Significant distribution clusters were anatomically and radiologically identified using BIANCA. Our analysis revealed correlations between these areas' localization and density with various clinical parameters, epilepsy presence, and cognitive assessments during follow-up.

CONCLUSION: Our study lays the groundwork, utilizing artificial intelligence models, for a novel DAI classification, potentially facilitating prospective studies, eventually with Diffuse Tensor Imaging (DTI). Additionally, it represents the first investigation into DAI and long-term neuropsychological outcomes in pediatric patients.

Keywords: Diffuse Axonal Injury (DAI), Artificial Intelligence, Neuropsychological Evaluations, K-Nearest Neighbor Algorithm, Classification

PF-032

Functional

Quantitative Analysis and Clustering of Sensory Nerves by Triggered EMG Data during Single-Level SDR in Spastic Cerebral Palsy with Different Levels of Motor Function

Wenbin Jiang¹, Qijia Zhan¹, Junlu Wang¹, Bo Xiao²

¹Department of neurosurgery, Shanghai Children's Hospital, Shanghai Jiaotong University, Shanghai, China

²Department of neurosurgery, Shanghai Children's Medical Center, Shanghai Jiaotong University, Shanghai, China

OBJECTIVE: To quantitatively analyze the sensory nerves in children with spastic cerebral palsy with varying motor function, and to cluster them using unsupervised machine learning for further analysis.

MATERIAL AND METHODS: We retrospectively reviewed intra-operative electrophysiological monitoring data from single-level selective dorsal rhizotomy (SDR) procedures at Shanghai Children's Hospital between January 2020 and January 2024. Triggered-EMG data from sensory nerves were selected for analysis, excluding nerve rootlets that only triggered responses in the anal sphincter. Threshold-200 was defined as the current intensity evoking a 200 μ V EMG amplitude in one of the monitored muscles, while Threshold-100 and Threshold-25 were defined similarly for 100 μ V and 25 μ V EMG amplitudes, respectively. Trigger-EMG patterns under these thresholds were normalized and divided into three groups. Unsupervised machine learning (k-means) was used to cluster all sensory nerve fibers into different subgroups.

RESULTS: A total of 50 children were included in the study, with 3 classified as Gross Motor Function Classification System (GMFCS) Level I, 13 as Level II, 21 as Level III, and 13 as Level IV, respectively. Children with different motor function levels exhibited different thresholds of sensory nerve roots, with higher thresholds (Threshold-25, Threshold-100 and Threshold-200) observed in those with better motor function (Figure A). The spread of muscle activity after stimulation differed among children with different motor function levels, with greater spread observed in those with poorer motor function (Figure B). Unsupervised machine learning can effectively cluster the nerve roots into five subgroups (Figure C), with Cluster 5 containing more nerve roots in children with poorer motor function and Cluster 4 containing fewer nerve roots (Table).

CONCLUSION: The characteristics of sensory nerves vary among patients with different motor function levels. Unsupervised machine learning can effectively classify sensory nerve roots based on these variations.

Keywords: selective dorsal rhizotomy, triggered EMG, machine learning

PF-033

Functional

Selective Dorsal Rhizotomy – Quality of life and spasticity outcomes at 5-year follow-up – the Leeds experience

Kate Mccune, Katie Davis, Catherine Wilshire, Sarah Ford, Kit Tsu Tang, Shona Michael, John Goodden

Leeds Children's Hospital, Leeds Teaching Hospitals NHS Trust

OBJECTIVE: Selective Dorsal Rhizotomy is a well-recognised technique to reduce / remove lower limb spasticity in children with cerebral palsy. In the UK, since 2019 SDR is provided as an NHS-funded treatment for children aged 3-10-years, with confirmed cerebral palsy and spasticity mainly affecting the legs, functioning at GMFCS II-III. An MRI is required to show periventricular leucomalacia.

We present the 5-year Quality of Life (QoL) and spasticity outcomes from 90 patients treated in our centre.

MATERIAL AND METHODS: The first SDR procedure was in October 2012. Post-operative outcomes are recorded in electronic records and in a prospective spreadsheet database; >170 patients treated to date.

SDR is performed by a single surgeon with the single-level technique and standardized 3-week post-operative physiotherapy regime. Intra-operative neurophysiology is always used. Patient selection criteria are in accordance with the current 2019 NHS / NICE criteria. The only variation has been the age at surgery.

All patients have standardised pre- & post-op assessments including 3D Gait Analysis, GMFM-66, Ashworth grading, muscle power & joint range of movement. Quality of Life (QoL) is assessed using the CPQoL questionnaire.

RESULTS: Currently >170 patients have been treated with SDR in Leeds, with 5-year follow-up assessments completed for >90. Our early (2-year) post-operative results have been previously reported. We present the multi-modal outcomes for QoL, tone (Ashworth), and GMFM function for patients with completed 5-year follow-up – mapping progress since surgery. All patients have a sustained reduction in tone after SDR. GMFM increases by 11.4% at 2-years and 13.0% at 5-years. There were no significant complications.

CONCLUSION: Progressing from 2-year to 5-year follow-up, SDR continues to provide effective tone management with associated improvements in function. Subjectively all patients report ongoing benefit. Quality of life continues to show improvement compared to baseline but is slightly lower at 5-years compared with 2-years.

Keywords: Selective Dorsal Rhizotomy (SDR), Spasticity, Cerebral Palsy, Outcome, Quality of Life

PF-034

Functional

Effect of Selective Dorsal Rhizotomy on Bladder Dysfunction in Children with Spastic Cerebral Palsy: Correlation with Intraoperative Neurophysiology MonitoringWenbin Jiang¹, Bo Xiao²¹Department of neurosurgery, Shanghai Children's Hospital, Shanghai Jiaotong University, Shanghai, China²Department of neurosurgery, Shanghai Children's Medical Center, Shanghai Jiaotong University, Shanghai, China

OBJECTIVE: This study aimed to investigate the efficacy of Selective Dorsal Rhizotomy (SDR) in ameliorating lower urinary tract symptoms (LUTS) in children with spastic cerebral palsy (SCP) and explore the correlation between postoperative LUTS improvement and intraoperative electrophysiological data.

MATERIAL AND METHODS: A total of 247 pediatric patients with SCP who underwent SDR were retrospectively analyzed. Preoperative and postoperative assessments included the Gross Motor Function Classification System (GMFCS), Gross Motor Function Measure-66 (GMFM-66), Modified Ashworth Scale (mAS), and Dysfunctional Voiding Scoring System (DVSS). Intraoperative electrophysiological data, including the threshold of sphincter-related sensory and motor nerve roots before and after SDR, were recorded.

RESULTS: Among the enrolled patients, 94 cases (38.1%) experienced at least one type of LUTS before surgery. There was a negative correlation between preoperative DVSS and Pre-operational GMFM-66 scores ($R=-0.32$, $P<0.0001$). The proportion of patients with LUTS and constipation differed significantly according to GMFCS levels ($P<0.05$). Postoperative evaluations revealed a noteworthy decrease in lower limb muscle tone, accompanied by improved motor function during the mean follow-up period of 4.1 years. The Gross Motor Function Measure-66 scores showed a significant enhancement from 58.8 ± 13.2 before surgery to 65.4 ± 14.0 postoperatively ($P < 0.0001$). The threshold for sphincter-related sensory nerves significantly increased after SDR ($P<0.0001$), while the threshold for sphincter-related motor roots remained unchanged. Intraoperative neurophysiological analysis revealed an elevation in the threshold of sensory nerve roots associated with the anal sphincter following surgery. Patients who experienced improvements in LUTS symptoms exhibited a higher proportion of sensory nerve roots capable of eliciting anal sphincter EMG activity exceeding $20 \mu V$.

CONCLUSION: SDR surgery effectively reduces lower limb muscle spasticity, improves motor function, and alleviates LUTS symptoms in children with SCP. Neurophysiological monitoring during surgery provides insights into the mechanisms underlying these improvements, emphasizing the importance of further research in this area.

Keywords: Selective Dorsal Rhizotomy (SDR) Spastic Cerebral Palsy (SCP) Lower Urinary Tract Symptoms (LUTS) Intraoperative Neurophysiology Monitoring Bladder Dysfunction

PF-035

Functional

The Application of Neurosurgical Treatments for Pediatric Chronic PainSunny Abdelmageed¹, Gloria Bae², Kannan Aravagiri⁴, James M Mossner¹, Nicole Villalba¹, Siegfried J Adelhoefer³, Ravi D Shah⁴, Jeffrey S Raskin¹¹Division of Pediatric Neurosurgery, Ann and Robert H. Lurie Children's Hospital, Chicago, Illinois, USA; Department of Neurosurgery, Northwestern University Feinberg School of Medicine, Chicago, Illinois, USA²Chicago Medical Schools, Rosalind Franklin University, Chicago, Illinois, USA³Department of Neurosurgery, Charité University Hospital, Berlin, Germany⁴Division of Pediatric Anesthesiology, Ann and Robert H. Lurie Children's Hospital, Chicago, Illinois, USA

OBJECTIVE: Chronic pain is often underreported and undermanaged in pediatric patients. Current guidelines for pediatric chronic pain encompass various therapeutic modalities but rarely, if ever, include neurosurgical treatments. This review discusses the role of neurosurgical procedures in treating chronic pain in children and adolescents.

MATERIAL AND METHODS: A systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Review and Meta-analyses (PRISMA) guidelines using three databases: PubMed, Embase, and Scopus. 40 studies were included.

RESULTS: 31 (77.5%) manuscripts reported neuropathic pain, 5 (12.5%) reported nociceptive pain and 4 (10%) reported mixed pain. The most common neurosurgical procedure employed was intrathecal pain pump placement (32.6%) followed by spinal cord stimulation (27.9%). Spinal cord stimulation was the most common treatment of neuropathic pain (32.3%), 7 studies reported quantitative treatment efficacy, 1 reported non-efficacy and 2 reported improvement but did not quantify efficacy. Nociceptive pain was treated with 5 different procedures; stereotactic mesencephalotomy, deep brain stimulation and radiofrequency dorsal root ganglia ablation reported quantitative efficacy, while intrathecal pain pump and occipital nerve stimulation did not quantify pain relief. Mixed pain treated with cordotomy and intrathecal pain pump reported improved pain but did not quantify efficacy while one study reported non-effective treatment using intrathecal pump and midline myelotomy.

CONCLUSION: Neurosurgical treatments for chronic pediatric pain are safe, although broad efficacy cannot be determined due to sparse literature and inadequately quantified pain responses. Guidelines for escalating chronic and end of life pain management in pediatric patients should be updated to include neurosurgical treatments and appropriate outcome scales. Focused research on appropriate patients, available neurosurgical therapies, and pediatric outcomes is warranted.

Keywords: palliative treatment, pain relief

PF-036

Functional

Robot-assisted implantation of bilateral GPi DBS electrodes in children with dystonia: experience of planning software integration with bespoke surgical toolingMoumin Awadelkarim K Mohamed¹, Vicki Harris¹, Alison Burchell⁵, Rachel Smith⁵, Todd Smallbone³, Sam Amin³, Max Woolley², Reiko Ashida⁴, William Gb Singleton, I⁶¹Department of Paediatric Neurosurgery, Bristol Royal Hospital for Children²Renishaw Neuro Solutions Ltd, Wotton-under-Edge, United Kingdom,³Department of Paediatric Neurology, Bristol Royal Hospital for Children⁴Department of Functional Neurosurgery, Southmead Hospital, Bristol⁵Department of Physiotherapy, Bristol Royal Hospital for Children-⁶Translational Health Sciences, Bristol Medical School, University of Bristol, UK

OBJECTIVE: In our institution, we pioneer an approach to paediatric deep brain stimulation (DBS) for dystonia, employing cutting-edge techniques and technology. Utilizing a single-stage, fully image-guided procedure under general anesthesia, we leverage the Renishaw stereotactic robot (Neuromate®) alongside our in-house NeuroInspire® planning software and bespoke surgical tooling. This method, adapted from our successful experiences in adult patients, marks a paradigm shift in paediatric DBS. Our effort aims to elucidate the efficacy and precision of DBS in paediatric dystonia, bridging innovation and established methodology.

MATERIAL AND METHODS: This is a single-centre retrospective case note review of 16 lead placement. We use a single case study to illustrate a stepwise surgical technique. Following which, all patients who underwent robotic-assisted GPi DBS were included in the study. Postoperative CT scans were used to establish actual trajectory which was compared to the preoperative plan on NeuroInspire™. We reported Euclidean error, radial error, depth difference and angle error. **RESULTS:** We report 16 primary lead implantations to the GPI in patients with genetic or acquired dystonia (6 vs 2). All the procedures were done under general anaesthesia. The average radial error was 0.85 mm (SD 0.42), Euclidean error was 1.21mm (SD 0.5) and depth absolute error of 0.43 mm (SD 0.75). There was no difference between right-sided and left-sided errors.

CONCLUSION: The use of this NeurolMate™ Robot based surgical technique in paediatric DBS implantation aid the delivery of accurate and reliable GPi stimulation. Its accuracy is comparable, if not superior, to the results in adult population and to other surgical techniques reported in paediatric DBS.

Keywords: Robotic, DBS, dystonia, surgical tooling

PF-037

Functional

Are intrathecal baclofen test doses needed prior to intrathecal pump implantation? Experience of a tertiary multidisciplinary paediatric complex movement disorder clinic

Jack Wildman¹, Elizabeth Tan¹, Frances Belcher¹, Miranda King¹, Rachel Smith¹, Victoria Harris¹, Todd Smallbone², Sam Amin², Elias Dumour¹, Greg Fellows¹, Michael Carter¹, Richard Edwards¹, William Singleton¹

¹Department of Paediatric Neurosciences, Bristol Royal Hospital for Children, University Hospitals Bristol and Weston NHS Foundation Trust, Bristol, United Kingdom

²Department of Paediatric Neurology, Bristol Royal Hospital for Children, University Hospitals Bristol and Weston NHS Foundation Trust, Bristol, United Kingdom

OBJECTIVE: At Bristol Royal Hospital for Children a lumbar intrathecal baclofen (ITB) bolus test dose is given as standard practice prior to ITB pump implantation. A positive result is deemed as a reduction in hypertonia. Undertaking test dosing requires an additional hospital admission and may increase the time between referral for ITB treatment and subsequent pump insertion. This study aimed to determine the clinical value of ITB test dosing prior to pump implantation.

MATERIAL AND METHODS: Single-centre retrospective analysis of patients referred for ITB therapy between 2014 and 2024. Data collection included: referral demographics; time between referral, test dosing and pump implantations; and test dose responses. Modified Ashworth Scale (MAS) data was analysed at baseline, following test dosing and 1 year after pump implantation.

RESULTS: 63 patients aged 4-17 years were referred for ITB therapy. 57 patients underwent test dosing with 55 positive responses (96%) and 2 negative responses (4%).

50 patients underwent pump implantation, of whom 6 did not have test dosing. Reasons for omitting test dosing included procedural difficulty, complex spinal comorbidities and clinical urgency. 100% of the non-tested patients had improved MAS at 1 year versus pre-insertion, compared with 91% of those with positive testing. In those who underwent testing there was no significant correlation between post-test MAS and 1 year post-implantation MAS.

Average wait time from referral to implantation in patients who underwent test dosing was 392 days, compared with 369 days in non-tested patients.

CONCLUSION: Most patients referred for ITB therapy have positive test doses, but post-test MAS does not correlate well with MAS at 1-year post-implantation. The majority of patients undergoing pump insertion experience improvement in MAS after 1 year regardless of whether they underwent test dosing. In appropriately selected patients, ITB pump implantation without test dosing should be considered and could significantly reduce waiting time from referral to implantation.

Keywords: Intrathecal, Baclofen, Spasticity

PF-038

Neuro-Oncology

Post-operative ocular motility disorders in children with posterior fossa tumours: 24 years' GOSH experience

Nishchit Hegde¹, Sebastian Toescu¹, Justyna Ekert¹, Ahmed Ghoneim², Dominic Thompson¹, Owase Jeelani¹, Richard Bowman², Kristian Aquilina¹

¹Department of Paediatric Neurosurgery, Great Ormond Street Hospital for Children, London, United Kingdom

²Department of Ophthalmology, Great Ormond Street Hospital for Children, London, United Kingdom

OBJECTIVE: To evaluate the incidence of new ocular motility disorders (OMDs) following surgery for posterior fossa tumours (PFTs) in children and identify risk factors.

MATERIAL AND METHODS: A retrospective, observational cohort design was employed to collect demography, tumour location, laterality and histology of all paediatric PFTs who underwent surgery at Great Ormond Street Hospital, London, between 1998 and 2021. Clinical details on post-operative OMDs including cranial nerve palsies, nystagmus and gaze paresis, and associated risk factors, were evaluated.

RESULTS: Of 601 children who underwent surgery for PFTs during this period, 447 had no OMDs pre-operatively. Post-operatively, 94 children (32%) of comparable gender (48 males) and age (44 cases < 5 years, 50 cases > 5 years), developed OMDs. The most prevalent was esotropia (40 patients (42.5%)). Multiple OMDs occurred in 33 children (35.1%), followed by nystagmus, 4th and 3rd cranial nerve palsies at 9 (9.5%), 7 (7.4%) and 5 (5.3%) cases respectively. Left esotropia was more frequent than right or bilateral (18:11:11 cases). Esotropia was associated with facial weakness in 18 cases (19%).

In affected children, tumours were midline in 77 (81.9%) and predominantly right or left in 10.6% and 6.3% respectively. OMDs were more common in tumours involving the vermis (54.2%, $p = 0.07$) compared to 4th ventricular (21.27%), cerebellar hemispheric (11.7%), brainstem and other/multi-site lesions. Medulloblastomas (39.3%) were the commonest tumours associated with post-operative OMDs, followed by pilocytic astrocytomas (27.6%), ependymomas (15.9%) and others (17%). The risk of development of new post-operative OMDs in aggressive tumours like medulloblastomas (36.63%) was higher than other PFTs ($p = 0.002$). Fifteen children eventually needed surgery for correction of persistent squint.

CONCLUSION: Esotropia was the commonest OMD following surgery for PFT in this cohort. The risk of developing post-operative OMDs in paediatric PFTs is highest for malignant tumours involving the vermis. The role of vermian infiltration or injury in post-operative OMDs needs further investigation.

Keywords: Paediatric posterior fossa tumour, ocular motor outcomes, vermian lesion, esotropia

PF-039

Basic Research and Trials

Bridging Pediatric Epilepsy Surgery with Basic Science: From sEEG to Intracellular Recordings

Adriano Cattani¹, Siyan Wang², Maxime Levesque², Jean Pierre Farmer¹, Massimo Avoli², Roy Dudley¹

¹Montreal Children Hospital, McGill University, 1001 Decarie Blvd, Montreal, QC, Canada, H4A 3J1

²Montreal Neurological Hospital-Institute, Department of Neurology and Neurosurgery, and of Physiology, 3801 University, Montreal, QC, Canada, H3A 2B4

OBJECTIVE: Pre-surgical evaluation from refractory pediatric epileptic patients is crucial in order to identify epileptogenic zone (EZ) and increases the chances of post operative seizures free. However the complexity of an epileptic circuitry remains unclear. High frequency oscillations (HFOs) expressed during sEEG recordings are commonly used as biomarkers to identify EZ. In this study, we performed electrophysiological recordings on acute slices from pediatric patients to better understand the physiopathology of EZ.

MATERIAL AND METHODS: Electrophysiological recordings were performed in acute slices from surgical resections containing maximal HFOs recorded in sEEG evaluation from pediatric patients with refractory epilepsy. Spontaneous excitatory postsynaptic currents (sEPSCs) and spontaneous seizures like events (sSLEs) were analyzed. Immersion chamber bath application of in vitro pro-convulsivants (e.g. 4-aminopyridine (4AP) and bicuculline methobromide (BMO)) was performed to investigate pharmacological properties from induced interictal epileptiform discharges (IEDs).

RESULTS: Abnormal trends of sEPSCs were recorded in 10 neurons and 10 sSLEs were identified in 9 other cells. Both sEPSCs and sSLEs were completely abolished by application of NBQX (5 μ M). Application of 4AP (150 μ M) and BMO (100 μ M) induced transient recurrence of GABAB outward currents (GABOCs; n = 55) before neuronal network synchronization and the generation of IEDs. GABOCs were completely blocked by the GABAB receptors antagonist CGP-55845 (10-20 μ M; n = 11). Levetiracetam (300-1200 μ M) reduced amplitude and frequency (n = 14) but failed to block IEDs and Lacosamide (200-800 μ M) strongly reduced (n = 4) and completely abolished (n = 16) IEDs.

CONCLUSION: Using sEEG for exact localization of EZ and target resection increases identification of sEPSCs and sSLEs electrophysiological ex vivo recordings, thus providing unique scenario for better epileptogenesis comprehension in pediatric epilepsy. GABOCs play a major role in neuronal network synchronization and cadence of IEDs. Lacosamide shows better effect in blocking IEDs compared to Levetiracetam.

Keywords: stereoelectroencephalography, high frequency oscillations, pediatric epilepsy, whole cell patch clamp and field potential recordings.

PF-040

Vascular

Embolization Vs Stereotactic Radiosurgery For Arteriovenous Malformations In Children. A Comparative Trial Between Two Large Referral Centers

Noa Schwartz¹, Gregory James², Yuval Rimoni¹, Fergus Robertson³, Adam Rennie³, Eliahu Perlow⁴, Dulanka Silva², Amir Kershenovich¹, Ido Ben Zvi¹

¹Neurosurgery department, Schneider Children's Medical Center of Israel, Petah Tikva, Israel

²Neurosurgery department, Great Ormond St Hospital, London, UK

³Interventional neuroradiology department, Great Ormond St Hospital, London, UK

⁴Interventional neuroradiology department, Schneider Children's Medical Center of Israel, Petah Tikva, Israel

OBJECTIVE: Brain arteriovenous malformations (AVM) in children constitute the primary cause of spontaneous hemorrhages. Given the accumulated lifetime risk for haemorrhage in this age-group, most centers recommend treatment at diagnosis. Traditionally AVMs were treated with embolization and/or microsurgery, with stereotactic radiosurgery (SRS) reserved for inoperable or failed embolization/surgery cases. In recent years there has been a paradigm shift towards earlier use of SRS. We aimed to examine two centers which hold these two approaches, comparing cure and bleeding rates among others, to assess the efficacy of these approaches.

MATERIAL AND METHODS: A retrospective analysis of prospectively maintained databases of two pediatric neurosurgery referral centers. Center A's approach supports embolization either with a curative intent or as preparation for surgery, with SRS seldomly performed. Center B embolizes only high-risk features (aneurysms) and as preparation for surgery. If surgery is not considered, then SRS will be considered. For both centers, a multimodal approach is executed when appropriate. Pediatric patients with brain AVM diagnoses were included. Untreated patients and those with insufficient data were excluded.

RESULTS: Across the two centers 107 patients were evaluated with a mean of 26.6 months follow-up. In center A there were significantly less hemorrhages at presentation compared to center B, although center A had significantly more aneurysms on angiography. Center A performed 10.8% SRS compared to 67.8% in center B. In terms of cure, 47% of the patients in center A achieved cure compared to 62.5% of center B. Rebleed rates were lower in center B-7% compared to 16%.

CONCLUSION: When comparing these two approaches, SRS as a primary choice for non-surgical patients or as an adjunct to surgery seems to be safe and efficacious, with the downside of a slower curative process (4-5 years follow-up). Embolization correlated with double the rebleed rates compared to SRS, possibly due to changes in flow velocity.

Keywords: AVM, Stereotactic radiosurgery, embolization

PF-041

Other

Functional benefit following Selective Dorsal Rhizotomy in ambulant diplegic cerebral palsy shows continued growth in functional improvement at 2 years

George Richard Hudson¹, Mary Cramp⁴, Jennifer Smith¹, Sam Amin³, Anna Clarke², William Guy Atherton², Richard J Edwards¹

¹Department of Paediatric Neurosurgery, Bristol Royal Hospital for Children, Bristol, United Kingdom

²Department of Paediatric Orthopaedics, Bristol Royal Hospital for Children, Bristol, United Kingdom

³Department of Paediatric Neurology, Bristol Royal Hospital for Children, Bristol, United Kingdom

⁴University of the West of England, Bristol, United Kingdom

OBJECTIVE: Selective Dorsal Rhizotomy (SDR) is indicated for management of spasticity in cerebral palsy (CP). In the UK, SDR is offered to those who meet criteria, but recovery time-course is understudied. Here, we evaluate recovery pattern in a single centre.

MATERIAL AND METHODS: We used single-level laminectomy with 50-66% (L1) and 66/75% (L2-L4/L5-S1) roots sectioned. GMFM-66 scores for 173 consecutive children, 2011-2018, were collected pre- and post-SDR. Children with spastic diplegia, GMFCS 2/3 and complete scores were included. A linear mixed effects regression was fitted with time-after-surgery, age, sex and contemporaneous orthopaedic intervention as fixed effects, and the patient as a random effect. Likelihood-ratio and t-tests were used accordingly. GMFM-66 scores over time were compared to the minimum clinically important difference (MCID) reported by Oeffinger, 2008 and natural development curves.

RESULTS: 150 (87%) children were included, with average age 7 (SD=2.3, range=3-17), 66 female (44%) and 48 GMFCS grade 2 (32%). Mean pre-op GMFM-66 was 59.6 (SD=9.9), increasing to 62.1 (SD=10.3), 64.5 (SD=11.2), and 66.9 (SD=11.8) 6-, 12- and 24-months post-surgery (overall increase=7.4, 95% CI=6.5-8.2, $p<0.001$). Regression modelling showed time-after-surgery (beta=3.64/year) and age (beta=1.47/year) were associated with GMFM-66 ($p<0.001$), with no covariate interaction. Of 140 patients with comparable natural development curves, mean increase at 24 months was 7.2 (SD=5.2), compared to 2.4 (SD=2.4) predicted using these curves (difference=4.9, 95% CI=4.1-5.7, $p<0.001$), with the gap continuing to widen. GMFM-66 increase was greater for GMFCS 2 (70.7-79.6, difference=9.0) than GMFCS 3 (54.0-60.5, difference=6.5, $p=0.01$). Annual additional GMFM-66 improvement above the natural curves for each grade (1.9/2.7) exceeded the MCID (1.5/1.2 respectively).

CONCLUSION: GMFM-66 improved significantly 2 years post-SDR compared to natural curves, surpassing the MCID for GMFCS 2/3. At 2-years, increase in functional improvement above natural development curves had not plateaued, identifying a need for longer follow-up and possible benefit from extended intense neurorehabilitation.

Keywords: Paediatric, Selective Dorsal Rhizotomy, Cerebral palsy, GMFM-66, Single-level laminectomy

PF-042

Neuro-Oncology

From vein to brain: enhancing trafficking of CAR T-cells to diffuse midline glioma

Louise F Steele Saukila¹, Alastair Hotblack¹, Carmen Rodriguez¹, Matteo Righi⁴, Tammy Kalber³, Kristian Aquilina², Antonia De Cola⁵, Michael McNicholas⁵, Manav Pathania⁵, Martin Pule¹, Karin Straathof¹

¹University College London Cancer Institute, London, UK

²Great Ormond Street Hospital for Children, London, UK

³University College London Centre for Advanced Brain Imaging, London, UK

⁴Autolus Limited, London, UK

⁵University of Cambridge, Cambridge, UK

OBJECTIVE: H3K27M-altered diffuse midline glioma (DMG) is the deadliest childhood brain tumour, with treatment limited by anatomical location and chemoresistance; palliative radiotherapy remains the mainstay of treatment. Chimeric antigen receptor (CAR) T-cell therapy

produces promising pre-clinical results in treating these tumours whilst leaving interspersed normal brain cells intact. Early clinical outcomes of GD2-CAR T-cell therapy for H3K27M-altered DMG demonstrate short-lived neurological and radiological improvement. Enhancing trafficking to and infiltration into the tumour core may enhance CAR T-cell efficacy. Here, advanced T-cell engineering modules are tested for their ability to improve CAR T-cell trafficking.

MATERIAL AND METHODS: A library of T-cell engineering modules was created each with a unique DNA barcode to allow identification of CAR T-cells expressing a given module. The library includes chemokine receptors (CCR) to improve tumour homing by chemotaxis towards tumour-secreted chemokines, adhesion molecules to increase extravasation across the blood-brain-barrier, and molecules to degrade upregulated tumour extracellular matrix (ECM) components to improve CAR T-cell motility through the tumour. Murine T-cells were co-transduced with a CAR and barcoded advanced T-cell engineering modules and administered intravenously in syngeneic models of high-grade glioma (HGG)/DMG. Tumour, normal brain, bone marrow, spleen and liver tissue were collected at several time points post CAR T-cell administration to assess presence of CAR T-cells using genetic barcodes.

RESULTS: Co-expression of advanced T-cell engineering modules did not impair CAR T-cell function in vitro. CARs co-expressing selected CCRs were preferentially detected in tumour tissue in mice with GL261-EGFRvIII or H3.3(K27M)p53(LOF)PDGFRA(WT)-engrafted tumours. Findings were further validated by flow cytometry detection of selected CCR-expressing CAR T-cells as compared to CAR T-cells without additional engineering components. Similar experiments for adhesion molecules and ECM modifiers are planned.

CONCLUSION: Results to date indicate that CAR T-cells co-expressing selected CCRs enhance their homing to HGG/DMG tumours, encouraging further in vivo research to assess impact on CAR T-cell efficacy.

Keywords: CAR T-cell therapy, diffuse midline glioma, high-grade glioma, adaptive T-cell therapy

PF-043

Neuro-Oncology

Intraoperative ultra-fast deep-learned CNS tumor classification and its impact on pediatric neurosurgical decision making

Mariska Sie¹, Eelco W. Hoving¹, Oscar H. J. Eelkman Rooda¹, Carlo Vermeulen², Marc Pages Gallego², Lennart Kester¹, Mariëtte E. G. Kranendonk¹, Pieter Wesseling³, Jasper Van Der Lugt¹, Bastiaan B. J. Tops¹, Jeroen De Ridder²

¹Princess Máxima Center for Pediatric Oncology, Utrecht, The Netherlands

²Oncode Institute, Utrecht, The Netherlands & Center for Molecular Medicine, University Medical Center Utrecht, Utrecht, The Netherlands

³Princess Máxima Center for Pediatric Oncology, Utrecht, The Netherlands & Department of Pathology, Amsterdam University Medical Centers/VU Medical Center, Amsterdam, The Netherlands

OBJECTIVE: Central nervous system (CNS) tumors are the most common solid tumors in children, representing the leading cause of pediatric cancer-related deaths. First line treatment mostly includes neurosurgical tumor resection in which a delicate balance must be struck between maximizing the extent of resection and minimizing the risk of neurological morbidity. An important factor for determining whether the risk of a more aggressive resection is acceptable is the tumor type. We aim to analyze the impact of intraoperative ultra-fast classification of CNS tumor tissue using nanopore sequencing on pediatric neurosurgical decision making.

MATERIAL AND METHODS: Recently, we described Sturgeon, a deep learning approach trained on simulated nanopore sequencing data generated from readily available methylation array data which can accurately classify tumor types based on intraoperatively generated sequence data. [Vermeulen et al. Nature 2023] This ultra-fast diagnostic tool is now further validated during CNS tumor resection in our national pediatric oncology center in the Netherlands. Neurosurgical decision making is defined by aimed surgical extent of resection (SR0-3) before surgery and during surgery (before/after frozen section and nanopore results). After surgery, the achieved extent of resection is evaluated by integrating surgical grading with radiological assessment on MRI (MR0-3).

RESULTS: As previously described, Sturgeon delivered reliable and accurate diagnoses within 40 minutes after starting sequencing in 45 out of 50 retrospectively sequenced samples (while abstaining from diagnosis of the other 5 samples). Implementation in real time surgery results in a turnaround time between taking out sample material to diagnosis in less than 90 minutes. The impact on neurosurgical decision making is analyzed in a national pediatric oncology center with an average of 115 CNS tumor resections a year.

CONCLUSION: Ultra-fast deep-learned (pediatric) CNS tumor classification using nanopore sequencing during surgery is not only feasible and reliable, but also can provide guidance to neurosurgeons towards the most optimal surgical strategy.

Keywords: CNS tumor classification, nanopore sequencing, intraoperative diagnostic tool, neurosurgical strategy

PF-044

Neuro-Oncology

External validation of predictive models for postoperative hydrocephalus in pediatric patients with posterior fossa tumors

Hendrik-Jan Mijderwijk¹, Daan Nieboer², Ulrich-Wilhelm Thomale³, Sara Iglesias⁴, Radek Fric⁵, Oscar HJ Eelkman Rooda⁶, Mariska Sie⁶, Charlotte Brunsmann¹, Jan F Cornelius¹, Bienvenido Ros⁴, Andreas Schaumann³, Bernt J Due-Tønnessen⁵, Hans C Bock⁷, Friederike Knerlich-Lukoschus⁷, Eelco W Hoving⁶, Thomas Beez¹

¹Department of Neurosurgery, Heinrich Heine University Medical Center, Düsseldorf, Germany

²Department of Public Health, Erasmus MC, University Medical Center, Rotterdam, the Netherlands

³Department of Pediatric Neurosurgery, Charité - Universitätsmedizin Berlin, Berlin, Germany

⁴Department of Neurosurgery, Hospital Regional Universitario de Málaga, Málaga, Spain

⁵Department of Neurosurgery, Oslo University Hospital-Rikshospitalet, Oslo, Norway

⁶Princess Máxima Center for Pediatric Oncology, Utrecht, The Netherlands

⁷Division Pediatric Neurosurgery, Department of Neurosurgery, University Medical Center Göttingen, Göttingen, Germany

OBJECTIVE: Postresection hydrocephalus (PH) after posterior fossa tumor (PFT) resection in children is common with incidences reported up to 40%. Adequate management of PH is highly consequential to patient-burden including commencement of adjuvant therapy. The (modified) Canadian Preoperative Prediction Rule for Hydrocephalus ((m)CPPRH) aims to preoperatively identify children at risk for PH. External validation is necessary before its clinical implementation in Europe. However, a comprehensive analysis is currently lacking. This study seeks to validate the (m)CPPRH in European children.

MATERIAL AND METHODS: We obtained data from retrospective registries at six university hospitals across four European countries. Children (<18 years) with newly diagnosed posterior fossa tumors who subsequently underwent resection were eligible for analyses. The predictor variables of the (m)CPPRH (age younger than 2 years, papilledema/presence of transependymal edema, severity of hydrocephalus, presence of intracranial metastases and the preoperative estimated tumor diagnosis) were collected in addition to need for either ventricular shunting or endoscopic third ventriculostomy within 6 months after tumor resection—i.e. PH. Performance of the (m)CPPRH was assessed with discrimination (c-statistic) and calibration (calibration-in-the-large, calibration slope and calibration plots) measures.

RESULTS: The combined cohorts consisted of 461 children of whom 53 (11.5%) developed PH. Mean age was 92.5 ± 56.2 months. The c-statistic equaled 0.75 (0.58-0.86) and 0.74 (0.62-0.84) for the CPPRH and mCPPRH respectively. Both the CPPRH and mCPPRH showed some signs of overestimation of risk of PH and the calibration slope indicated too extreme predictor effects on average.

CONCLUSION: The (m)CPPRH shows potential for preoperative identification of children at risk for PH following PFT surgery. Although additional model updating is needed, it may serve as an adjunct tool in Europe for data-driven personalized decision-making, patient counseling, and risk stratification in future research endeavors subjected to the first line treatment of PH in children with PFT.

Keywords: hydrocephalus, posterior fossa tumors, prediction model, validation, pediatric neurosurgery

PF-045

Neuro-Oncology

Subsequent primary neoplasms in survivors after initial radiotherapy in SMARCB1/INI1-deficient atypical teratoid/rhabdoid tumors (AT/RT) and SMARCB1/INI1-retained AT/RT-like tumors in brain and spine

Tai Tong Wong¹, Hsiu Ju Yen², Hsin Hung Chen², Muh Lii Liang², Yi Shan Yang¹, Shi Chien Lin², Donald Ming Tak Ho², Man Hsu Huang¹, Chi Long Chen¹, Cha Lang Fong¹, Yi Yen Lee², Yen Ling Lau¹, Yi Wei Chen¹, Hsin Lun Lee¹, Cha Chun Kuo¹, Feng Chi Chen², Kevin Li Chun Hsieh¹, Kuo Sheng Wu¹

¹Pediatric Neurooncology Group, Taipei Medical University Hospital, Taipei Medical University

²Pediatric Neurooncology Group, Department of Neurosurgery, Neurological Institute, Taipei Veterans General Hospital

OBJECTIVE: We retrospectively review the frequency of subsequent primary neoplasms after initial radiation therapy in a cohort series of 58 cases in infants and children.

MATERIAL AND METHODS: Pediatric patients ages 0-19 years old with the diagnosis of INI1-deficient expression (INI1-) AT/RT or INI1-retained expression (INI1+) AT/RT-like tumors in brain and spine from 1982-2022 were retrieved and reviewed. Fifteen cases were revised from other diagnosis.

RESULTS: The median age in the whole series was 2.0 years with sex ratio of 1.1. There were 39 INI1- AT/RTs (median age 17 months) and 19 INI1+ AT/RT-like tumors (median age 7.4 years). Five of the 19 INI1+ tumor were embryonal tumors with rhabdoid features. BRG1 expression was not assessed in the remaining 14 INI1+ tumors. After diagnosis, initial adjuvant therapy included conventional dose chemotherapy (CDCT) 24 (41.4%), high dose chemotherapy (HDCT) 4 (6.9%), RT 23 (39.7%), and no therapy before progression 7 (12.1%). The distribution of initial RT was 11 in INI1- AT/RT and 12 in INI1+

AT/RT-like tumors. Among 14 survivors receiving initial RT in a latent period of 6.5 years (ranged 2.5–12.1 years), 5 (35.7%) developed subsequent primary neoplasms (SPN) including 2 glioblastomas, 1 osteosarcoma, 1 spinal cell sarcoma, and 1 atypical meningioma. Three patients died in a median period of 11.2 months (range 5.1 months – 2.8 year) after SPN diagnosis. These SPNs were two glioblastoma and 1 osteosarcoma. There was no SPN in survivors receiving CDCT or HDCT therapy.

CONCLUSION: There are improving tumor control in tumors received initial RT after diagnosis. High frequency of SPNs and related mortalities is a big concern. Modification of radiotherapy and adaptation of future novel therapy are necessary.

Keywords: atypical teratoid/rhabdoid tumor, embryonal tumor with rhabdoid features, radiotherapy, subsequent primary neoplasm

PF-046

Neuro-Oncology

Revisiting the application of intraoperative MRI in maximizing complete resection in pediatric LGG

Sofie Dietvorst¹, Dawn Hennigan¹, Shivaram Avula², Conor Mallucci¹
¹Department of Neurosurgery, Alder Hey Children's Hospital Trust, Liverpool, UK

²Department of Radiology, Alder Hey Children's Hospital Trust, Liverpool, UK

OBJECTIVE: The extent of resection in low-grade glioma (LGG) is known to be correlated with prognosis. We aimed to investigate the contribution of intraoperative MRI to the extent of resection in pediatric patients with LGG, where complete resection (CR) was the predefined goal of surgery based on imaging, probable diagnosis and clinical status.

MATERIAL AND METHODS: The tumor registry at Alder Hey Children's hospital was searched to identify all patients with I) a confirmed histological diagnosis of LGG after surgery, II) operated with intent of CR, III) intraoperative MRI was used. Intraoperative MRI was first introduced in our hospital in 2009, the patients were included from 2010 till 2023.

RESULTS: 164 operations were included based on the criteria. CR was confirmed on the first intraoperative MRI in 77 operations (47%). In 73 operations (44.5%), we proceeded with second look surgery for further resection, with CR achieved in 59 operations (80.8%) after second look surgery. The overall rate of CR for LGG in this group was 86% on final operative imaging, as verified by independent radiology assessment.

Long-term follow-up was available for 144 operations (87.8%) with median follow-up of 46 months. In the CR group, there was disease recurrence in 18 cases (14.2%). In the incomplete resection group, there was disease progression in 10 cases (58.8%), which is significantly more than in the CR group (Chi square test, $p < 0.01$).

CONCLUSION: In nearly half of the operations (44.5%) for LGG where CR was the predefined surgical aim, we proceeded with second look surgery for further resection of tumor after intraoperative MRI. In 80.8% of this group, we were able to achieve CR. As shown in our long-term follow-up, there is a clear difference in recurrence/progression when CR is obtained for LGG, which emphasizes the positive impact of using intraoperative MRI.

Keywords: low grade glioma, intraoperative MRI, extent of resection

PF-047

Neuro-Oncology

Neurosurgical Outcomes for Pediatric Medulloblastoma in 8 Low- and Middle-Income Countries

Ronnie E Baticulon¹, Luis Arredondo², Danny A Campos³, Dharmendra Ganesan⁴, Cristian José Pineda Martínez⁵, Miguel Angel Vaca Ruiz⁶, Kathleen Joy O Khu¹, Nuha Omran⁷, Syed Ahmer Hamid⁸, Paloma Amarillo⁹, Cesar Villegas¹⁰, Ibrahim Qaddoumi¹⁰, Daniel C Moreira¹⁰, GAPNO RetroMB Study Group¹⁰

¹Division of Neurosurgery, Philippine General Hospital, University of the Philippines Manila, Manila, Philippines

²Pediatric Neurosurgery, Hospital Civil de Guadalajara, Guadalajara, Mexico

³Pediatric Neurosurgery, Instituto Nacional de Salud del Niño San Borja, Lima, Peru

⁴Department of Surgery, Neurosurgery Division, University of Malaya Medical Centre, Kuala Lumpur, Malaysia

⁵Pediatric Neurosurgery, Hospital Nacional de Niños Benjamín Bloom, El Salvador

⁶Hospital Infantil Teletón de Oncología, Santiago de Querétaro, Mexico

⁷Radiotherapy Department, Borg El Arab University Hospital- Pediatric Oncology Center, University of Alexandria, Alexandria, Egypt

⁸Department of Pediatric Hematology and Oncology, Indus Hospital & Health Network, Karachi, Pakistan

⁹Department of Pediatric Hematology and Oncology, Pereira Rossell Hospital, Montevideo, Uruguay

¹⁰Department of Global Pediatric Medicine, St. Jude Children's Research Hospital, Memphis, Tennessee, USA

OBJECTIVE: Limited data exist on the diagnosis and treatment of children with medulloblastoma in low- and middle-income countries (LMICs). Here we describe the largest series of pediatric patients with medulloblastoma in LMICs, focusing on neurosurgical outcomes and barriers to surgical care in 8 countries.

MATERIAL AND METHODS: Records of all pediatric patients with newly-diagnosed medulloblastoma from 2014 to 2018 in 9 participating centers in Egypt, El Salvador, Malaysia, Mexico, Pakistan, Peru, Philippines, and Uruguay were retrospectively reviewed. Data on demographics, clinical presentation, neurosurgical treatment, post-operative complications, time to surgical care, and perioperative and long-term outcomes were analyzed.

RESULTS: Neurosurgical data were available for 330 patients, with a median age of 7.7 years (range: 1 month to 20 years) and M:F ratio of 1.65:1. Median times to tumor resection were as follows: 29 days from first visit with a physician and 10.5 days from first neuroimaging. Either gross total or near-total resection was achieved in 47% and 17% patients, respectively. 22 underwent second-look surgery for tumor residual (7%) while 16 (5%) had reoperation for hematoma evacuation. Ventriculoperitoneal shunt insertion was required in 169 patients (51%): 106 pre-resection, 17 during resection, and 46 post-resection. Brain abscess, meningitis, and/or ventriculitis developed in 39 patients (12%). Only 180 patients (55%) were able to complete frontline treatment, consisting of adjuvant chemotherapy and craniospinal irradiation. 213 patients (65%) were alive on last follow-up, with a median follow-up period of 2.4 years after tumor surgery.

CONCLUSION: In this cohort of patients with medulloblastoma in LMICs, shunt complications and infections were significant contributors to perioperative morbidity and mortality. By improving components of surgical systems, reducing delays in diagnosis and surgical treatment, and increasing the quality of surgical care, centers that treat

children with medulloblastoma can improve the proportion of patients completing frontline therapy, thereby increasing their overall survival.

Keywords: Medulloblastoma, LMIC, global neurosurgery, second-look surgery, shunt complications, health systems

PF-048

Neuro-Oncology

Long-term outcomes of paediatric craniopharyngiomas: multi-centre comparative study

Vitor Nagai Yamaki¹, Jai Sipra², Bruno Peres³, Flavia Massey⁴, Catuto Quianga⁶, Guilherme Borsatto⁵, Joao Paulo Telles⁵, Inês Silva¹, Juan Pedro Martinez Barbera³, Asthik Biswas⁷, Kshitij Mankad⁷, Hoong Wei Gan⁸, Hani Marcus⁴, Owase Jeelani¹, Darren Hargrave⁹, Hamilton Matushita⁶, Suely Marie⁵, Kristian Aquilina¹

¹Department of Neurosurgery, Great Ormond Street Hospital for Children NHS Foundation Trust, London, UK

²Developmental Biology and Cancer section, University College London Great Ormond Street Institute of Child Health, London, UK

³Department of Radiology, Hospital das Clinicas da Faculdade de Medicina da Universidade de Sao Paulo, Brazil

⁴Department of Neurosurgery, National Hospital for Neurology and Neurosurgery, London, UK

⁵Department of Neurology, LIM 15, Hospital das Clinicas da Faculdade de Medicina da Universidade de Sao Paulo, Brazil

⁶Department of Neurosurgery, Hospital das Clinicas da Faculdade de Medicina da Universidade de Sao Paulo, Brazil

⁷Department of Neuroradiology, Great Ormond Street Hospital for Children NHS Foundation Trust, London, UK

⁸Department of Endocrinology, Great Ormond Street Hospital for Children NHS Foundation Trust, London, UK

⁹Department of Oncology, Great Ormond Street Hospital for Children NHS Foundation Trust, London, UK

OBJECTIVE: The correlation of long-term outcomes for paediatric craniopharyngioma (CP) with management strategies remains unclear. In this study we aimed to compare long-term outcomes of CP and identify management paradigms associated with better prognosis.

MATERIAL AND METHODS: This study was conducted at two paediatric neurosurgery units (GOSH, UK, and USP, Brazil). Children with CP treated over a 20-year period were identified and standardized clinical outcomes recorded for comparative analysis. Baseline MRIs were reviewed and volumetric T1-weighted images segmented by an experienced paediatric neuroradiologist.

RESULTS: 123 patients were identified (USP=52; GOSH=71). There were no demographic differences between series (mean age: USP=9.2±4.6; GOSH=8.2±4.1 years). Headaches and visual deficits were the commonest presenting symptoms. Growth hormone deficiency (USP=62.5%; GOSH=35%; p=0.009) and visual deficits (USP=60%; GOSH=40.8%; p=0.04) at presentation were more common in the USP cohort. There was more hypothalamic invasion in the GOSH cohort (Paris grade 2: GOSH=67.0%; USP=37.5%; p=0.026), but larger cystic volumes in the USP cohort (USP= 373.5±635.55 cm³; GOSH=220.1±322.4 cm³; p=0.02). There were more subtotal resections at USP (78%) and more cyst aspirations at GOSH (62%). 80% of patients at GOSH received radiotherapy compared to 32% at USP (p<0.05). Mean follow-up at GOSH was 7.5±4.8 years compared to 10.1±5.6 years at USP. GOSH exhibited better hypothalamic (p=0.08) and better visual outcomes (p=0.01). Post-operative

visual outcomes were correlated to the pre-operative visual condition (adjusted for tumour size, radiological characteristics, and treatment modalities). In multivariate analysis (n=123), subtotal/gross-total resection (OR0.17; 95%CI:0.05-0.55, p<0.01) and older age at diagnosis (OR0.91, 95%CI:0.82-0.99, p=0.04) were associated with longer progression-free survival.

CONCLUSION: Comparative analysis of two large CP series identified different paradigms of surgical management with similar long-term outcomes. GOSH series presented better hypothalamic outcomes. Long-term visual outcomes were predicted by initial visual deficit. Subtotal/gross-total resection was not related to worse clinical outcome, but longer progression-free survival.

Keywords: Craniopharyngioma; Hypothalamic neoplasms; Hypothalamic diseases; Oncology

PF-049

Neuro-Oncology

International Rare Brain Tumor Program: Paving the pathway to cure rare brain tumors

Dipak Poria, Lane Williamson, Alexis Dowiak, Brian Rood, Javad Nazarian, Roger Packer, [Adriana Fonseca](#)
Children's National Hospital

OBJECTIVE: Pediatric CNS (Central Nervous System) tumors are the leading cause of cancer related death in children. Recent incorporation of DNA methylation and molecular alterations for the classification and diagnosis of CNS tumors has changed neuro-oncology. However, molecularly defined entities are extremely rare and poorly characterized posing significant challenges due to the lack of entity-specific clinical, molecular, and therapeutic data.

MATERIAL AND METHODS: To address the critical knowledge gaps, The International Rare Brain Tumor Registry (IRBTR) was created to systematically collect clinical, radiological data, tumor samples, and biospecimens of children diagnosed with rare brain tumors including, CNS sarcomas, BCOR-altered tumors, astroblastoma/MN1-altered tumors, germ cell tumors, unclassifiable brain tumors, and other novel rare brain tumor entities. The Rare Brain Tumor Program aims to deepen our understanding of biological mechanisms of rare brain tumors using a multi-omics approach (epigenomics, genomics, transcriptomics, proteomics, and tumor immune microenvironment) to investigate the association of molecular signatures with clinical features and outcomes. Furthermore, we aim to establish cell lines and animal models from primary tumor samples and de novo cell line generation using brain organoid through genetic engineering approaches.

RESULTS: To date, five North American sites, four South American two Australian and three sites in Europe and Asia have joined the efforts and are enrolling patients in the study.

CONCLUSION: IRBTR intends to establish a well annotated international repository biobank and therapeutic discovery platforms for current and future rare brain tumor research aiming to improve our understanding of the biological mechanisms of rare brain tumor entities and to develop standardized treatment strategies through a multidisciplinary international collaboration.

Keywords: rare brain tumors, cell lines, animal models, novel therapeutics

PF-050

Craniofacial

Type 1-Calci-fied Cephalohematoma in a Rural Area: A Case Report and Review of Confirmed CasesRaisul Maarif¹, Bagus Sulistyono², Wimba Prastarana², Wihasto Suryaningtyas¹, Muhammad Arifin Parenrengi¹¹Department of Neurosurgery, Airlangga University, Surabaya, Indonesia²Department of Neurosurgery, Sidoarjo Hospital, Sidoarjo, Indonesia**OBJECTIVE:** Cases of calci-fied cephalohematoma (both Type 1 and Type 2) have been infrequently documented. A case report from rural area and narrative review of such cases were done.**MATERIAL AND METHODS:** A scoping search of the PubMed database was conducted using the following Medical Subject Headings (MeSH) to explore the literature: "calci-fied cephalohematoma," "ossi-fied cephalohematoma," and "cephalohematoma" itself.**RESULTS:** We presented a case of a newborn boy of 3 months presenting with cephalohematoma since birth, which was originally soft but later turned hard and calci-fied, with no history of aspiration or surgery. Surgical intervention was done by a simple reconstructive cranial surgery. The patient made a full recovery with no issues. We also comprehensively address the anatomy, grouping, pathophysiology, and a number of documented cases including the treatment considerations of calci-fied cephalohematoma.**CONCLUSION:** Ossification is a common undesirable consequences of cephalohematomas. An ideal result depends on awareness and a well-defined treatment plan. The type of calci-fied cephalohematoma determines the surgical possibilities, and underneath the proper treatment, favorable results are achievable.**Keywords:** calci-fied, ossified, cephalohematoma, infant, craniofacial surgery

PF-051

Craniofacial

Comparative Outcomes of Posterior Vault Expansion Techniques in Craniosynostosis: A Retrospective Analysis of Static, Springs Classic Vector, and Springs Vertical Vector MethodsAmparo Saenz, Asma Bin Mahmoud, Simon Eccles, Dulanka Silva, David Dunaway, Greg James, Juling Ong, Owase Jeelani
Craniofacial Department, Great Ormond Street Hospital, London, United Kingdom**OBJECTIVE:** The premature fusion of skull sutures, known as craniosynostosis, leads to an asymmetrical calvarium with restricted growth potential, unable to adequately accommodate brain growth in some cases. This results in a risk of raised ICP as well as aesthetic concerns. Posterior vault expansion (PVE) offers a safe intervention that increases intracranial volume and alleviating symptoms of venous hypertension. A number of surgical techniques exist for PVEs. Our study is the first comparative analysis of three different PVE techniques—static, with springs Classic Vector (CV), and with springs Vertical Vector (VV)—performed by the same surgical team.**MATERIAL AND METHODS:** A retrospective review included all patients with initial PVE between 2018 and 2023. We analysed functional outcomes, re-operation and complication rate, spring extrusion and infection, blood transfusion, admission length, and intracranial volumes (ICV).**RESULTS:** We included 154 patients, 48 PVE static, 60 PVE CV and 46 PVE VV. Of those, 116 patients had surgery for raised ICP. Functional improvement was similar in the three techniques. The Regression analysis showed that syndromic patients and age at surgery influenced the reoperation rate. PVE CV was more commonly used in younger and syndromic patients and showed a higher re-operation rate (31.67%) compared to PVE Static (6.25%) and PVE VV (10.87%) (Figure 1, 2 and 3). The PVE Static procedure takes longer than spring assisted PVEs. There was a statistically significant difference between the ICV of PVE Classic and PVE Static (a difference of 11%) (Figure 4). All the other variables didn't differ significantly. **CONCLUSION:** All three techniques are safe and effective in treating the raised ICP and aesthetic issues. Compared to the other two techniques, PVE Classic has the highest ICV increase but also a higher reoperation rate, which may be due to the increased proportion of syndromic and younger patients.**Keywords:** Craniosynostosis - Surgical technique - Outcomes

PF-052

Craniofacial

Secondary Premature Fusion of Additional Sutures after Surgery for Sagittal CraniosynostosisMegan V Ryan¹, Sophia Blasco¹, Lindsey Freeman², Zachary Halloran³, Kaitlin Olson⁴, Scott Lebeau², Corbett Wilkinson¹¹Division of Neurosurgery, Children's Hospital Colorado, Aurora, United States²Department of Neurosurgery, University of Colorado, Anschutz Medical Campus, Aurora, United States³Metropolitan State University of Denver, Denver, United States⁴Department of Pediatrics, University of Colorado School of Medicine, Aurora, United States**OBJECTIVE:** Premature fusion of additional sutures after surgery for sagittal craniosynostosis has been described. However, what suture(s) and whether single or multiple sutures are more commonly involved is incompletely known. Largely unknown are whether premature fusion occurs more frequently after 1) open or endoscopic surgery and 2) surgery that disturbs sutures in addition to the sagittal (eg bilateral frontoparietal morcellation, bicoronal barrel-stave cranioplasty). This study investigates these questions.**MATERIAL AND METHODS:** We reviewed the records of all patients who underwent initial surgery for single-suture sagittal craniosynostosis at a single children's hospital 2009-2022 and were followed at least one year postoperatively. We recorded the type of surgery, whether surgery disturbed the coronal or lambdoid sutures, whether there was postoperative fusion of additional sutures, and which sutures were fused. Univariate logistic regression was used to assess relationships between variables and secondary suture fusion.**RESULTS:** Three hundred thirty-one patients were included, 83 females (25.2%) and 246 males (74.8%). Sixty patients (18.1%) underwent endoscopic craniectomy, whereas 271 patients (81.8%) underwent open surgery. One hundred sixty-eight surgeries (63.4%) involved disturbance of a suture in addition to the sagittal. Nine patients (2.7%) had post-operative premature fusion of additional sutures, all 9 coronal (2.7%) and 1 lambdoid (0.3%).

There were no significant differences in the odds of premature additional suture fusion between patients who underwent open-versus-endoscopic surgery (p=0.57). If additional sutures were disturbed, the odds of premature additional suture fusion were decreased by a factor of 0.18 (95% CI (0.03,0.81), p=0.04).

CONCLUSION: There was no significant association between open-versus-endoscopic surgery and premature fusion of additional sutures after sagittal craniosynostosis surgery at our center, whereas making cuts that disturbed additional sutures was associated with a lower rate of additional suture fusion.

Keywords: craniosynostosis, scaphocephaly, coronal sutures, lambdoid sutures, suture fusion

PF-053

Craniofacial

Intraoperative Intracranial Pressure Changes in Children with Craniosynostosis Undergoing Endoscopic-Assisted Strip Craniectomy

Vincent Aquino, Ziyad Makoshi, David Yates
El Paso Children's Hospital

OBJECTIVE: Craniosynostosis can lead to progressive cranial and skull base deformities and can be associated with increased intracranial pressure (ICP), ophthalmological manifestations, behavioral changes, and developmental delay. The majority of published data on the incidence of elevated ICP include older children undergoing open surgical correction. Endoscopic-assisted release of fused sutures with postoperative helmet therapy is an established method for managing craniosynostosis presenting at an early age, however the immediate effect of this approach on ICP in a young cohort has not been previously reported.

MATERIAL AND METHODS: Prospective data on 52 children undergoing endoscopic-assisted release of stenosed cranial sutures was included. Individuals were excluded if they underwent open correction or had prior cranial surgery. Individuals underwent a standardized endoscopic approach for each suture type. ICP was measured using an intraparenchymal sensor both prior to creation of the neosuture and after complete release of the stenosed suture. An ICP reading of greater than 10 mm Hg was considered elevated.

RESULTS: Mean age was 5.3 months, range 1 – 32 months, and 94% were under 12 months of age. The mean opening pressure was 12.7 mm Hg and the mean closing pressure 2.9 mm Hg. Opening ICP \geq 10 mm Hg was present in 58%, \geq 15 mm Hg in 31%, and \geq 20 mm Hg in 23%. No patient had an ICP above 10 mm Hg at closing. The mean percentage change in ICP among all craniosynostosis cases was a 64% decrease. Optic disc swelling was identified in 28 children preoperatively and improved in 22 children at follow up.

CONCLUSION: Increased intracranial pressure can occur in infants with craniosynostosis at higher rates than previously reported. Endoscopic-assisted craniectomy has an immediate effect on lowering intracranial pressure and improving postoperative ophthalmological findings.

Keywords: Craniosynostosis, Endoscopic, Intracranial pressure, Strip-craniectomy

PF-054

Craniofacial

Outcomes of surgery for non-syndromic craniosynostosis in older children with delayed presentation– our experience

Vishakha Karpe, Subodh Raju

Department of neurosurgery, Rainbow Childrens hospital, Hyderabad, India

OBJECTIVE: Craniosynostosis is associated with many neurocognitive impairments, along with raised intracranial pressure (ICP) with its sequelae if not treated early. Children presenting late (>1 year) pose specific problems both clinically and surgically. This study evaluates children with delayed presentation with non-syndromic craniosynostosis and their surgical and neurodevelopmental outcomes.

MATERIAL AND METHODS: Consecutive 28 patients with non syndromic craniosynostosis presenting late (age >1 year) between September 2017 and March 2024 were included. All children were evaluated by a multidisciplinary team clinically, radiologically and with invasive intracranial pressure monitoring if necessary. Surgery type and cranial vault remodelling was determined by the type suture fused and deformity. Surgical and neurocognitive outcomes were evaluated.

RESULTS: In our series, mean surgical age was 41 months.

22 patients had developmental delay (motor & /or speech) and 6 patients had proptosis. 11 patients has papilloedema and 5 patients had partial optic atrophy on fundoscopy. 5 patients had autistic spectrum disorder. Frontoorbital advancement was technically difficult and not able to perform in 3 patients due to severe adherence of superior sagittal sinus to hyperostotic fused suture and large emissary veins. Dural tears occurred in 8 patients.

Blood loss was greater (average- 225ml).

Headaches, vomiting or visual disturbances were improved in all patients who presented with that. There was significant improvement in neurocognitive abnormalities in all patients. One patient had recurrence of raised ICP after 1 year and needed redo surgery. No significant residual bony defects found after 2 years of surgery in any patient.

CONCLUSION: This series suggests a high rate of morbidity in patients with delayed presentation in terms of more neurocognitive and behavioural abnormalities, sequelae of raised ICP, visual impairment, technical difficulty of surgery and increased blood loss, hospital stay etc. Surgery definitely improves neurodevelopmental, cognitive and behavioural abnormalities and reduces ICP. Recurrence of deformity can occur in severe cases needing redo surgery.

Keywords: Craniosynostosis, nonsyndromic, late presentation, neurocognitive, fraontoorbital advancement

PF-055

Craniofacial

Brain volume analysis in patients with FGFR-related craniosynostoses

Ombeline Delassus¹, Lucas Chollet¹, Barbara Youngui¹, Jeremy Sadoine⁴, Giovanna Paternoster², Jean Francois Mangin⁴, Roman Hossain Khonsari³, David Germanaud⁴

¹Craniofacial Growth and Form, Hôpital Necker – Enfants Malades, Assistance Publique – Hôpitaux de Paris, Paris, France

²Department of Neurosurgery, Hôpital Necker – Enfants Malades, Assistance Publique – Hôpitaux de Paris, Paris, France

³Department of Maxillofacial surgery and Plastic surgery, Hôpital Necker – Enfants Malades, Assistance Publique – Hôpitaux de Paris, Paris, France

⁴CEA, NeuroSpin, 91191 Gif-sur-Yvette, France

OBJECTIVE: Syndromic craniosynostoses are conditions with well-described skull and facial involvement, and multifactorial neurological and cognitive impacts. Few studies have analysed brain anatomy in these conditions. We aimed to describe cerebral volumes in a group of syndromic patients (Crouzon, Apert, Muenke).

MATERIAL AND METHODS: 1.5T and 3T 3DT1-weighted MRI (3 scanners, 4 sequences IR-prep ultrafast GE) have been analysed and resampled at millimeter isotropic resolution. We compared 4 groups: 75 controls (2-18 years, average 10 years), 14 Crouzon syndrome (1.5-16 years, average 4.14 years), 7 Apert syndrome (3-21 years, average 13 years, 3

boys), 17 Muenke syndrome (0.8-15.9 years, average 3.6 years). Brain segmentation was performed by coupling AssemblyNet and Morphologist (BrainVISA), and multiple linear regression OLS (age, sex, sequence and group effect) and normative analysis were used. Results were validated using rank (Mann Whitney) and proportionality tests (Fisher).

RESULTS: The volume analyses showed no significant difference in the intracranial, cerebral and cerebellar volume between CS and controls, except moderate increased volume of the lateral ventricles. In the MS group, normative analysis showed a higher volume of temporal, parietal and central areas ($p < 0.0014$). The AS group has larger intracranial, cerebrospinal, cerebellar, lateral ventricle and grey matter volume vs controls.

CONCLUSION: We provide the first controlled comparison of the large compartments of the brain and its global gyrification in CS, MS and AS. Our results open perspectives on the influence of severity of craniosynostosis, the number of sutures involved, the association with closed sutures, and comparisons with non-syndromic craniosynostosis. Although based on a small and heterogenous cohort, this study paves the way for further investigations on the functional significance of brain anomalies in FGFR-related craniosynostoses.

Keywords: syndromic craniosynostosis, brain volumetry, MR volumetry

PF-057

Craniofacial

Endoscopic Surgery for the Treatment of Craniosynostosis - Challenges in Implementing a New Minimally Invasive Technique

Dalila Forte¹, Amets Sagarrabay², Rafael Fernandes³, Rui Sobrinho³, Inês Ramadas³, Teresa Pinheiro³, Francisco Rebelo³, Pedro Barros³, João Pedro Oliveira⁴, Joana Tavares⁴, Miguel Azevedo⁵, Miguel Correia¹, Teresa Cenicante⁶, João Estrada⁷, Cristina Pestana⁸, Hugo Faria⁹, Mário Matos¹

¹Pediatric Neurosurgery Unit, Hospital Dona Estefânia, Unidade Local de Saúde São José, Lisbon, Portugal

²Neurosurgery Department, Hospital CUF Descobertas, Lisbon, Portugal

³Neurosurgery Department, Hospital de São José, Unidade Local de Saúde São José, Lisbon, Portugal

⁴Neurosurgery Department, Unidade Local de Saúde de Lisboa Ocidental, Lisbon, Portugal

⁵Neurosurgery Department, Unidade Local de Saúde Almada-Seixal, Almada, Portugal

⁶Anesthesiology Department, Hospital Dona Estefânia, Unidade Local de Saúde São José, Lisbon, Portugal

⁷Pediatric Intensive Care Unit, Hospital Dona Estefânia, Unidade Local de Saúde São José, Lisbon, Portugal

⁸Anesthesiology Department, Hospital CUF Descobertas, Lisbon, Portugal

⁹Pediatrics Department, Hospital CUF Descobertas, Lisbon, Portugal

OBJECTIVE: The increasingly early diagnosis and referral of patients with craniosynostosis enabled using less invasive endoscopic techniques with the aim of minimizing surgical aggressiveness, hemorrhagic complications, and hospitalization time. The objective of this work is to share our experience, the challenges encountered, and the results obtained with this new technique.

MATERIAL AND METHODS: Retrospective study of the first 17 patients with craniosynostosis undergoing endoscopic surgical treatment at Hospital Dona Estefânia and Hospital CUF Descobertas, starting in June 2020.

RESULTS: Seventeen patients with non-syndromic craniosynostosis were operated on, including 11 sagittal, 2 unicoronal, 2 metopic, 1 bicoronal, and 1 involving multiple sutures (right coronal, sagittal, and bilateral lambdoid). The mean age and weight at the time of surgery were 4 months and 6.500 kg, respectively. The surgical technique consists of endoscopic suturectomy, associated with bilateral parietal osteotomies in sagittal craniosynostosis. The average duration of the procedure was 191 minutes, with an average estimated blood loss of 80 mL and administration of 12 mL/kg of packed red blood cells. The recorded complications were transient ischemia of the upper limb and sepsis associated with central catheter. The average length of hospital stay was 5 days, with 3 days in the intensive care unit (ICU). Ten patients underwent treatment with cranial orthosis, which was well-tolerated. The average follow-up time was 12 months. Aesthetic results were sequentially documented photographically, and craniometric measurements were obtained using an analog caliper (in all patients) and digital scanner in patients treated with orthosis.

CONCLUSION: We achieved a low rate of perioperative complications with the implementation of endoscopic technique for craniosynostosis correction. The main challenge associated with this technique is the associated blood loss. The aesthetic and craniometric results obtained to date are favorable.

Keywords: endoscopy, minimally-invasive, craniosynostosis

PF-058

Craniofacial

Combined Non-Syndromic Craniosynostosis: A challenging diagnosis

Tatiana Protzenko¹, Fernanda Rolemberg², Juan Llerena², Sayonara Gonzalez², Dafne Horovitz², Antônio Bellas¹

¹Department of Pediatric Neurosurgery, National Institute of Health for Women, Children and Adolescent Fernandes Figueira/Oswaldo Cruz Foundation, Rio de Janeiro Brazil

²Department of Genetics, National Institute of Health for Women, Children and Adolescent Fernandes Figueira/Oswaldo Cruz Foundation, Rio de Janeiro Brazil

OBJECTIVE: The classification of craniosynostosis depends on the combination of some characteristics: when the sutural disease is part of a syndrome; morphological appearance of the patient; the sutures involved and the progression of the disease. Based on these criteria, it is possible to classify most craniosynostosis. However, some patients with non-syndromic craniosynostosis have an unusual phenotype that is difficult to classify. The aim of this study is to describe rare forms of unclassified craniosynostosis and determine its clinical, radiological characteristics and challenges of diagnosis and treatment.

MATERIAL AND METHODS: 19 cases of non-syndromic combined craniosynostosis were analyzed among 220 studied cases of craniosynostosis referred for treatment from January 2018-January 2023. The clinical phenotype, 3D reconstruction CT scans and the resultant vector when 2 or more sutures were synostotic were analyzed. All patients were molecularly studied.

RESULTS: Among 220 patients, combined non-syndromic cases were: oxycephaly (2), anterior brachycephaly (8), coronal-metopic synostosis (1), metopic-sagittal synostosis (4) and ipsilateral coronal-lambdoid association (4). Of these patients, the ipsilateral coronal and lambdoid combination represented the most difficult diagnosis, and all patients were previously investigated and treated in other units as positional plagiocephaly. This type of combined craniosynostosis leads to the annulment of the compensation vectors and the patient may

present a discrete contralateral parietal bulging, but the major facial changes related to anterior plagiocephaly do not occur, as also the posterior fossa changes related to the lambdoid suture are minimized. Likewise, the coronal-metopic association prevents contralateral frontal compensation, as sagittal-metopic combination also prevents the classic phenotype related to trigonocephaly.

CONCLUSION: Combined unilateral coronal-lambdoid, sagittal-metopic and coronal-metopic synostoses are rare, and the unique phenotype does not comply with Virchow's predictions. Recognizing these types of craniosynostosis is essential for adequate treatment and neurosurgeons and pediatricians must be aware of this possible differential diagnosis that is sometimes misdiagnosed as positional plagiocephaly.

Keywords: combined non-syndromic craniosynostosis, lambdoid synostosis, coronal synostosis, complex craniosynostosis

PF-059

Craniofacial

Analysis of Delay in Treatment in a Cohort of Craniosynostosis at a tertiary care centre: A Surrogate Marker for Delay of Treatment in Paediatric Neurosurgery

Anuraag Gattu, Nanda Madhusoodanan, Suhas Udayakumaran
Division of Paediatric Neurosurgery, Department of Neurosurgery, Amrita Institute of Medical Sciences and Research Centre, Amrita Vishwa Vidyapeetham, Amrita University, Kerala, India

OBJECTIVE: To identify the key factors influencing the referral of a patient with craniosynostosis to a tertiary centre for definitive treatment.

MATERIAL AND METHODS: A retrospective and prospective cohort study was conducted on all patients presenting to the outpatient department of a tertiary care centre with a diagnosis of craniosynostosis. A structured questionnaire was used to collect details of events prior to referral. The details were analysed based on the definition of delay in treatment as defined in the detailed methodology using descriptive statistics such as frequencies and percentages for categorical variables.

RESULTS: The study included 112 patients, with 61 classified as syndromic and 51 as non-syndromic. Antenatal identification occurred in 27.9% of syndromic cases and 3.9% of non-syndromic cases. Neonatologists identified syndromic cases in 82.0% of instances, but only 41.0% were referred, mainly due to uncertain diagnoses from specialists (52.5%). Additionally, 14.8% of syndromic patients were referred by a paediatrician. Non-syndromic cases were mostly identified postnatally (96.1%), with referrals coming from neonatologists (25.5%), geneticists (2.0%), paediatricians (62.7%), paediatric neurologists (7.8%), and ophthalmologists (2.0%). Parents initiated primary medical attention in 7.8% of cases, while specialists initiated it in 92.2% of cases. Cranial treatment for non-syndromic patients typically began before the age of 2 years (70.6%), while for syndromic patients, it began before the age of 1 year (42.6%) and patients aged 1-2 years accounted for 11.5% of the cases.

CONCLUSION: There is a clear need for awareness of identification in non-syndromic cases. Paediatricians need to be educated regarding the timing of referral and definitive treatment in both syndromic and non syndromic types of Craniosynostosis. This analysis indicates that the study can serve as a surrogate marker for delay in treatment in paediatric neurosurgery.

Keywords: Craniosynostosis, Delay, Paediatrician, Neonatologist, Diagnosis

PF-060

Basic Research and Trials

TROPHY Registry Study – Surgical Results From 6 Months Follow-up Data

Ulrich Wilhelm Thomale¹, Guiseppa Cinalli², Sergey Gorelyshev⁹, Abhaya Kulkarni⁴, Andreas Schaumann¹, Valentina Pennacchietti¹, Friederike Knerlich Lukoschus⁶, Jonathan Roth⁵, Sergio Cavalheiro⁷, Spyros Sgouros⁸, Shlomi Constantini⁵, Elena Bogoslovskaja³, Christoph Buehrer¹⁰, Hans Christoph Bock⁶, Trophy Study Group¹¹

¹Pediatric Neurosurgery, Campus Virchow Klinikum, Charité Universitätsmedizin, Berlin, Germany

²Pediatric Neurosurgery, AORN Santobono Pausilipon, Naples, Italy

³Pediatric Neurosurgery, Surgut Clinical Perinatal Center

⁴Pediatric Neurosurgery, Sick Children Hospital, University of Toronto, Toronto, Canada

⁵Pediatric Neurosurgery, Tel Aviv Medical Center, Tel Aviv, Israel

⁶Pediatric Neurosurgery, University Medical Center Göttingen, Göttingen, Germany

⁷Pediatric Neurosurgery, Federal University of Sao Paulo, Sao Paulo, Brazil

⁸Pediatric Neurosurgery, Iaso Childrens Hospital, Athens, Greece

⁹Pediatric Neurosurgery, Moscow Bashlyeva Pediatric Hospital, Moscow, Russia

¹⁰Department of Neonatology, Campus Virchow Klinikum, Charité Universitätsmedizin, Berlin, Germany

¹¹International Research Community

OBJECTIVE: Hydrocephalus as a consequence of intraventricular hemorrhage (IVH) of prematurity represents a challenging form of cerebrospinal fluid circulation disturbance. It remains unresolved which temporary measures are best for intracranial pressure relief before sufficient body weight is reached for possible shunt implantation. The TROPHY (Treatment of Posthemorrhagic Hydrocephalus in neonates) registry study is designed to compare different methods of temporary treatment for safety and efficacy.

MATERIAL AND METHODS: An online accessible registry was designed for prospective, international data collection. Eligible patients were neonates with IVH and dynamic signs of ventricular enlargement necessitating surgical pressure relief. Based on local institutional practice, infants received either ventricular access device (VAD), external ventricular drainage (EVD), ventriculo-subgaleal shunt (VSGS) or neuroendoscopic lavage (NEL). Preoperative data, technical aspects of surgery, and follow up data were collected in standardized manner.

RESULTS: A total of 238 patients with sufficient 6 months follow up data were included (VAD 47 patients, EVD 34 patients, VSGS 75 patients, and NEL 82 patients). Preoperative patient data were comparable among the groups. After 6 months follow up, differences were seen in frontal lobe parenchymal defect ($p < 0.001$, being highest in NEL group), multiloculated hydrocephalus ($p < 0.05$, being highest in EVD group), parenchymal defect ($p < 0.05$, being highest in VAD group) and proportion needing a permanent shunt ($p < 0.001$, being highest in VSGS group). No statistical differences were found in complication or surgical revision rate.

CONCLUSION: Initial data analysis of the TROPHY registry provides an international perspective on temporizing treatment options for post-hemorrhagic hydrocephalus after IVH of prematurity. Among the most common techniques (VAD, EVD, VSGS and NEL) some differences in complications and outcomes were identified in this early, preliminary analysis. Further research with longer follow-up will be performed to draw clearer conclusions.

Keywords: intraventricular hemorrhage, posthemorrhagic hydrocephalus, external ventricular drainage, ventricular access device, ventricular subgaleal shunt, neuroendoscopic lavage

PF-061

Basic Research and Trials

Site-targeted Complement Inhibition Modifies Recruitment and Activation of Microglia in a neonatal murine model of Germinal Matrix Hemorrhage

Devin Hatchell¹, Mohammed Alshareef², Tyler Vasas³, Davis Borucki⁴, Stephen Tomlinson¹, Ramin Eskandari⁵

¹Department of Microbiology and Immunology, Medical University of South Carolina, Charleston, SC, USA

²Department of Neurological Surgery, Children's Hospital of Colorado, Aurora, CO, USA

³College of Medicine, Medical University of South Carolina, Charleston, SC, USA

⁴Department of Neuroscience, Medical University of South Carolina, Charleston, SC, USA

⁵Department of Neurological Surgery, Medical University of South Carolina, Charleston, SC, 29425, USA

OBJECTIVE: We have shown that targeted inhibition of the complement system using a specialized complement inhibitor that targets sites of P-selectin (2.3Psel-Crry) reduces hydrocephalus rates, mortality, and neurological deficits at an adolescent timepoint. Here we investigate further the molecular and cellular pathology of post-GMH sequelae and the effects that site-targeted complement inhibition has on complement deposition, microglial morphology, and phagocytic activity as it relates to our previous evidence of cognitive improvements in adolescence.

MATERIAL AND METHODS: P4 mice were subjected to collagenase induced-GMH and treated with 2.3Psel-Crry or vehicle every 3 days until P14. High-resolution imaging of microglia and complement immunofluorescent staining were deconvoluted and reconstructed in 3D-plane using Imaris Microscopy Image Analysis Software. MFI of images were quantified as total voxel number. Individual microglia from 63x confocal imaging were then processed/analyzed using Imaris Labkit and FilamentTracer software to determine morphologic characteristics and volume/percent of internalized complement per microglia. **RESULTS:** After GMH injury, C3 deposits in periventricular tissue and is significantly reduced when treated with 2.3Psel-Crry. The reduction in C3 presence following treatment correlates with a reduction in microglial presence within the periventricular space. Further characterization of complement-dependent recruitment and activation of periventricular microglia shows increased internalization of C3-opsonized material and amoeboid-like morphology. Treatment with a site-targeted complement inhibitor post-GMH resulted in decreased internalized C3 and morphologic characteristics comparable to that of a naïve murine brain.

CONCLUSION: Within the study provided, we show that complement deposition is highly prevalent in periventricular tissue post-GMH and is correlated with microglia activity. Furthermore, we show that treatment with 2.3Psel-Crry mitigates this inflammatory response. We have previously provided evidence of the potential of a novel site-targeted complement inhibitor (2.3Psel-Crry) in improving outcomes and neurocognition in adolescence following GMH. This study correlates cellular findings of complement deposition and microglia activation contributing to detrimental neuroinflammation, providing mechanistic insight into 2.3Psel-Crry's therapeutic effects.

Keywords: Germinal Matrix Hemorrhage, Complement, P-selectin, Neuroinflammation, Microglia

PF-062

Basic Research and Trials

Brain-derived immune cells are important role players in neuroinflammation

Ursula Rohlwink, Gabriela Singh, Kate Morris, Nqobile Thango, Nico Enslin, Anthony Figaji

Division of Neurosurgery, Department of Surgery, Neuroscience Institute, University of Cape Town, South Africa

OBJECTIVE: Neurosurgeons have opportunities to contribute to innovations and insights that can improve outcomes in central nervous system (CNS) infections in children, a major contributor to the global burden of disease. Understanding the role of neuroinflammation is key, but our studies often rely on the peripheral immune cell counts in cerebrospinal fluid (CSF) to determine disease severity and treatment response. The role of CNS resident immune cells has been overlooked because they are difficult to study - cells die rapidly after CSF collection and few neurosurgical units are appropriately equipped for immediate analysis. We developed a method to provide the first description of CSF brain-derived immune cell phenotypes in children with common neurosurgical infections.

MATERIAL AND METHODS: We developed a method to freeze ventricular CSF for delayed cellular analysis using flow cytometry – a key tool to study immune cells- and used this to immunophenotype 14 sub-groups of peripheral (polymorphonuclear cells, lymphocytes, and granulocytes) and CNS immune cells (microglia and astrocytes) in ventricular CSF from children with CNS infections.

RESULTS: Our method enabled effective freezing and analysis of CSF without compromising cell viability or integrity. In a cohort of 30 children (median age 2.3 [1.1 – 3.7] years) with meningitis, shunt infection, and ventriculitis we analysed 61 CSF samples (30 admission, 31 serial) and found that microglia were the most abundant cell type present on admission (median 129.85 cells/ μ L) and over time ($p < 0.001$), followed by lymphocytes (median 34.04 cells/ μ L). Astrocytes were more abundant (median 9.43 cells/ μ L) than neutrophils or monocytes (median 1.45 and 5.71 cells/ μ L respectively).

CONCLUSION: We have shown for the first time the dominant contribution of brain-resident immune cells to the neuroinflammatory response to CNS infections. The techniques developed by this study could be used to characterise the unique neuroinflammatory response in different neurosurgical conditions and lead to the development of novel immunomodulatory therapies.

Keywords: neuroinflammation, infection, immune cells

PF-063

Basic Research and Trials

Genome-wide and transcriptome-wide association study of neural tube defects implicates primary defects in neurogenesis

Andrew T Hale¹, Jing He², Sarah U Morton³, Jeffrey P. Blount¹, Steven J Schiff⁴, Lisa Bastarache²

¹Department of Neurosurgery, University of Alabama at Birmingham, Birmingham, AL, USA

²Division of Genetic Medicine, Vanderbilt University Medical Center, Nashville, TN,

³Division of Newborn Medicine, Boston Children's Hospital, Harvard Medical School, Boston, MA

⁴Department of Neurosurgery, Yale University School of Medicine, New Haven, CT

OBJECTIVE: The genetic mechanisms underlying neural tube defect (NTD) risk and pathogenesis are complex and largely based on animal model studies. To our knowledge, no large-scale human genetic study of NTDs has been performed. Here we perform genome-wide and transcriptome-wide association studies (GWAS, TWAS) of NTDs to inform our genetic and molecular understanding of the disease.

MATERIAL AND METHODS: We conducted a GWAS (minor allele frequency > 0.1%) and TWAS of NTDs in patients of European ancestry from 3 biobanks (BioVU, UK Biobank, and All of US) totaling 649 cases and 689,136 controls. TWAS was performed using MAGMA. Gene set enrichment analysis (GSEA) was performed to identify genetically determined pathways conferring NTD risk. Polygenic risk score (PRS) was calculated using 6 p-value thresholds to empirically determine case-control discrimination.

RESULTS: GWAS identified 85 SNPs associated with NTDs that reached genome wide significance ($p < 5 \times 10^{-8}$) across 57 unique loci. TWAS identified 435 genes that reach transcriptome-wide significance $p < 5 \times 10^{-8}$. We identified pathways involved in regulation of neurogenesis and neural stem cell function, rather than folate metabolism, as primary genetic drivers of NTDs. We then performed Mendelian Randomization to delineate the shared and independent risk factors of folate levels to risk of NTD. Finally, to construct a potentially clinically scalable genetic tool to quantify NTD risk, we create a PRS which performed exceptionally well ($p < 1.09 \times 10^{-185}$), and included 263 SNPs with p-value threshold $< 5 \times 10^{-6}$.

CONCLUSION: We perform the first large-scale GWAS and TWAS of NTDs. These data provide important genetic insight into the primary role of neurogenesis underlying NTD risk and may help clarify the molecular mechanisms underlying folate-insensitive cases of NTDs. However, expansion of genetic studies across diverse populations where co-evolution of humans and environmental-imposed selection pressures (i.e., dietary folate levels) may differentially shape the genetic architecture of NTDs is needed.

Keywords: neural tube defects, human genetics, genomics

PF-064

Global Neurosurgery

A Single Centre Retrospective Ten Years of Experience: The Trends of Pediatric Neurosurgery Cases from 2013 to 2022

Sheila Sumargo, Ahmad Faried, Mirna Sobana

Department of Neurosurgery, Faculty of Medicine, Universitas Padjadjaran, Dr Hasan Sadikin General Hospital, Bandung, Indonesia

OBJECTIVE: In developing countries, pediatric neurosurgical conditions are often neglected due to prioritization of communicable diseases in child health programs, leading to a high rate of childhood mortality and disability due to untreated surgical infections and congenital anomalies. To improve the allocation of healthcare resources and develop targeted interventions, it is crucial to understand the epidemiology of pediatric neurosurgical cases in these settings. Here, we describe the pediatric neurosurgery epidemiology profile in the last 10 years in one of the largest public hospitals in Indonesia.

MATERIAL AND METHODS: This retrospective descriptive study was conducted in Dr. Hasan Sadikin General Hospital, Bandung, Indonesia. Patients aged ≤ 18 years old who came to the emergency room and hospitalized between 2013 and 2022 were included. Patients who died on arrival or had insufficient clinical data were excluded.

RESULTS: The study included 6,067 patients (65.6% male), with the highest frequency in the 12-18 years old age group. Patient loads peaked in 2014 and were lowest during the COVID-19 pandemic. Trauma was the most common reason for presentation, followed by congenital anomalies, and infectious diseases. Neuroimaging

modalities revealed intracranial hemorrhage and skull fracture in approximately 60% of trauma cases, regardless of their head injury classification. Hydrocephalus was the predominant diagnosis in congenital cases. Tumor and vascular cases were less common, accounting for only 10% and 7% of patients, respectively. Nearly half of the cases (42%) were managed operatively.

CONCLUSION: Traumatic injury and congenital disorders were the primary reasons for pediatric neurosurgical cases in our center. Improving healthcare services, facilities, as well as supportive health policies is crucial for comprehensive management of pediatric neurosurgical cases in developing countries.

Keywords: Pediatric neurosurgery, epidemiology, global neurosurgery

PF-065

Global Neurosurgery

Geospatial Analysis of Access to Emergency Pediatric Neurosurgery Care in an Underdeveloped Country: The Case of Peru

Milagros Niquen Jimenez¹, Edson J Ascencio³, Antony Barja³, Henry Ruiz Garcia⁴, Luis Felipe Gutierrez Perez², Eylem Öcal⁵, J. Jaime Miranda⁶, Gabriel Carrasco Escobar³

¹Facultad de Medicina Humana Alberto Hurtado, Universidad Peruana Cayetano Heredia, Lima, Peru; Department of Pediatric Neurosurgery, Instituto Nacional de Salud del Niño, Lima, Peru

²Department of Pediatric Neurosurgery, Instituto Nacional de Salud del Niño, Lima, Peru

³Health Innovation Laboratory, Innovalab. Universidad Peruana Cayetano Heredia, Lima, Peru

⁴Department of Neurological Surgery, University of Iowa, Iowa City IA, USA

⁵Department of Neurological Surgery, University of Arkansas for Medical Sciences, Arkansas Children's Hospital, Little Rock, Arkansas, USA

⁶CRONICAS Center of Excellence in Chronic Diseases, Universidad Peruana Cayetano Heredia, Lima, Peru; Sydney School of Public Health, Faculty of Medicine and Health, University of Sydney, Sydney, Australia

OBJECTIVE: We aimed to evaluate access and travel time to emergency pediatric neurosurgical care facilities in Peru.

MATERIAL AND METHODS: In March 2024, we identified emergency neurosurgical care institutions listed on the National Registry of Institutions Providers of Health Services (RENIPRESS) website, classified by geographic location. Using QGIS and RStudio, we mapped these facilities and estimated travel times. Google Earth Engine processed geospatial data of 94,925 villages, incorporating land coverage types, roads, river networks, and elevation data to produce high-resolution travel time estimates. One institution was excluded due to incomplete coordinates.

RESULTS: A total of 135 hospitals provide neurosurgical care in the country, but only 58 offered emergency care including only three with dedicated pediatric neurosurgery (ages ranging from birth to less than 18 years old) on neurosurgeon on call. Geographically, institutions were concentrated in the Coastal region ($n=49$, 85%), followed by the Andean region ($n=7$), and the Amazon region ($n=2$). Out of 94,925 villages, 92,010 were rural and 2,915 were urban. The overall mean travel time in minutes required to access emergency care was 438 (Standard deviation [SD] = 446). Travel time was strongly different (p -value < 0.001) between rural (Mean [SD] = 444 [448]) and urban villages (Mean [SD] = 249 [299]). The longest travel times in minutes were observed in two states of the Peruvian Amazon: Ucayali (Mean [SD] = 1,780 [1,380]; Maximum = 11,600) and Loreto (Mean [SD] = 1,640 [1,560]; Maximum = 8,960).

CONCLUSION: This study underscores substantial disparities in accessing emergency pediatric neurosurgical care across Peru. Notably, within the Peruvian Amazon, only 20% provide emergency neurosurgical services. Rural communities face significantly longer travel times compared to urban areas, a discrepancy that is pronounced in remote regions such as the Peruvian Amazon where it may take days to weeks to access pediatric emergency neurosurgical care.

Keywords: pediatric neurosurgical care, travel time, geographic distribution, global neurosurgery, peru

PF-066

Global Neurosurgery

Virtual Telementorship to Instruct Selective Dorsal Rhizotomy Technique in a Resident Cadaver Lab at Philippine General Hospital

Stephen Dann del Rosario¹, Belinda Shao², Joseph Oldam², Ariana Barkley³, Patricia Clerkin⁴, Kenny Seng⁵, Gerardo Legaspi¹, Ronnie Baticulon⁵, Philipp Aldana⁶

¹Division of Neurosurgery, Department of Neurosciences, Philippine General Hospital, Manila, Philippines

²The Warren Alpert Medical School of Brown University, Providence, Rhode Island, USA

³Neurosurgery Outreach Foundation, Jacksonville, Florida, USA; Department of Neurosurgery, University of New Mexico, Albuquerque, New Mexico

⁴Neurosurgery Outreach Foundation, Jacksonville, Florida, USA; Department of Pediatric Neurosurgery, Valley Children's Healthcare, 9300 Valley Children's Place, Madera, CA, 93636, USA

⁵Division of Neurosurgery, Department of Neurosciences, Philippine General Hospital, Manila, Philippines; Department of Anatomy, College of Medicine, University of the Philippines Manila, Manila, Philippines

⁶Neurosurgery Outreach Foundation, Jacksonville, Florida, USA; Division of Pediatric Neurosurgery, Department of Neurosurgery, University of Florida College of Medicine, Jacksonville, Florida, USA

OBJECTIVE: Workforce strengthening to address the unmet pediatric neurosurgical need in the Philippines requires increased trainee learning opportunities and modalities for mentorship of existing surgeons in remote areas of the archipelago. Telementorship adjuncts to surgical education may facilitate these in an accessible, active, and continuing manner. Prior to scale-up in a patient care setting, it is important to test feasibility in a local non-clinical context.

This study aims to assess the feasibility of using virtual telementorship in a cadaver lab to teach selective dorsal rhizotomy (SDR) dissection techniques to neurosurgery residents at the Philippine General Hospital (PGH).

MATERIAL AND METHODS: Junior neurosurgical residents participated in an online lecture followed by telementored cadaver dissections at the operative microscope, guided by an overseas faculty neurosurgeon via live audio/video exchange. Usability metrics and survey responses were recorded. Post-lab, un-proctored dissections were completed by each participant, and surgical skills of the film were evaluated by a blinded adjudicator via the Objective Structured Assessment of Technical Skills (OSATS).

RESULTS: Total of four rhizotomy-naïve junior residents participated. During each one-on-one telementored dissection session, an average of 30 question-answer or mentor-mentee redirection exchanges transpired, allowing remote guidance of the procedure. Internet connection problems were frequent, with a mean of 5 connectivity issues requiring reconnections. All residents reported improved confidence in performing SDR following the didactic. In post-lab assessments, all

successfully completed main components of the procedure, and OSATS demonstrated basic proficiency in nearly all surgical domains.

CONCLUSION: A telementored cadaver lab was completed via live, virtual surgical instructor to junior neurosurgery residents in an LMIC setting. The didactic was effective at teaching a novel procedure as demonstrated by improved residents' reported confidence, and the assessment of surgical skills in video recordings. It is recommended that technical requirements such as a reliable internet connection be ensured, before telementorship is evaluated in actual clinical setting.

Keywords: Southeast Asia, LMIC, Objective Structured Assessment of Technical Skills, trainee education, workforce strengthening

PF-067

Global Neurosurgery

Gemini Untwined – a Global Health Service for Craniopagus Twins

Noor ULOwase Jeelani¹, Gemini Untwined Team²

¹UCL Great Ormond Street Institute of Child Health (GOSH ICH)

²Gemini Untwined

OBJECTIVE: Barring hydrocephalus and trauma, paediatric neurosurgery remains a discipline of rare diseases with its associated challenges. With a reported incidence of 1 in 2.5 million live births, craniopagus twins are perhaps the rarest of such conditions that paediatric neurosurgeons and allied specialists deal with. How do we improve outcomes for these rare children born craniopagus, where no one country has the case volumes to allow us to do so? The answer is by created a Global health service and research platform for these children.

MATERIAL AND METHODS: Since the 1950s, approximately 1 set of twins has been reported annually in the medical literature. The majority go unreported due to sub optimal outcomes or lack of access. We set up a foundation, Gemini Untwined in 2018 and have undertaken 7 sets of separation globally, with 13 surviving children and further sets currently undergoing separation across Asia, Europe, Africa and Latin America. **RESULTS:** We use a multidisciplinary, staged approach for assessing these cases and only select cases are put forward for attempted separation. We next use basic surgical data sets, CT and MRI scans, Tractography and DSAs coupled with advanced 3D rapid prototyping and augmented reality platforms to study, discuss, rehearse and undertake these separations. Seven children separated under age 1 year are functioning with minimal or no disabilities. One child died during separation due to cardiac and renal anomalies that were incompatible with individual survival. 6 children separated between 2-4 years of age have moderate levels of long-term disability.

CONCLUSION: Rare cases such as Craniopagus twins require a global health care system that transcends national boundaries and asymmetric resources, to allow us to collate, further and share our knowledge to provide optimal advice and outcomes.

Our foundation acts as a global repository of information and support for clinicians and families faced with these challenging cases.

Keywords: Global Neurosurgery, Craniopagus, Augmented Reality

PF-068

Global Neurosurgery

Sub-Saharan African experience of neurosurgical-oncologic care: challenges and barriers encountered at 7 cancer treatment centers

Joseline Haizel Cobbina¹, Yordanos Ashagere², Hamisi K Shabani³, Jason Labuschagne⁴, William Copeland⁵, Frank Nketiah Boakye⁶,

Kachinga Sichizya⁷, Misbahu Haruna Ahmad⁸, Addisalem Belete², Silky Chotai¹, Michael C. Dewan¹

¹Department of Neurosurgery, Vanderbilt University Medical Center, Nashville, TN, USA

²Department of Neurosurgery, Zewditu Memorial Hospital, Addis Ababa, Ethiopia

³Department of Neurosurgery, Muhimbili Orthopaedic Institute, Dar es Salaam, Tanzania

⁴Department of Paediatric Neurosurgery, Nelson Mandela Children's Hospital, South Africa

⁵Department of Neurosurgery, Tenwek Mission Hospital, Bomet, Kenya

⁶Department of Neurosurgery, Komfo Anokye Teaching Hospital, Ghana

⁷Department of Neurosurgery, University Teaching Hospital, Zambia

⁸Department of Neurosurgery, Aminu Kano Teaching Hospital, Nigeria

OBJECTIVE: Wide disparities in neurosurgical-oncologic care and treatment outcomes exists globally despite recent improvements in diagnostics and cancer therapy. To better understand the challenges to neurosurgical-oncologic care in low resource settings, we collected data on national neurosurgery capacity and hospital diagnostic and treatment capacity across 7 national referral hospitals in 7 countries Sub-Saharan Africa (SSA).

MATERIAL AND METHODS: A 42-item self-administered questionnaire was distributed to partner neurosurgeons at the 7 sites via REDCap in April 2023 to provide country and hospital level capacity data on neurosurgical-oncologic care.

RESULTS: Neurosurgical and neurosurgical-oncologic care was reported to be available in a limited number of provinces/states/regions in 6 out of the 7 countries. The neurosurgery and pediatric neurosurgery workforce density across the 7 countries ranged between 0.03 – 0.67 per 100,000 and 0 – 0.05 per 100,000 respectively.

Three hospitals had no pediatric ICU with the remaining four having between 2-8 bed-capacity pediatric ICU. One hospital did not have both CT and MRI scanner available and relied solely on private diagnostic facilities for neuroimaging. Histopathology services were largely limited to basic hematoxylin and eosin (H&E) and/or advanced histopathology staining. Molecular subtyping was available at only one hospital.

None of the 7 hospitals had neurocritical care expertise, neuroradiologist, or neuropathologist. Four hospitals had a pediatric anesthesiologist. Only one hospital had a neuro-oncologist, but none had a pediatric neuro-oncologist. Both adjuvant chemotherapy and radiotherapy was unavailable at 3 hospitals. Rehabilitation was largely limited to basic physical and occupational therapy at all 7 hospitals.

Although all 7 countries had a multiple health payer system, the payment structure differed across the 7 hospitals for different neurosurgical-oncologic services with patients making out-of-pocket payments for all services in some cases. Financial constraint was reported as a major barrier to care.

CONCLUSION: System-level interventions are needed to strengthen neurosurgical-oncologic care capacity in SSA especially for children.

Keywords: neurosurgical-oncology, sub-Saharan African, workforce density, health payer system, health infrastructure

PF-069

Global Neurosurgery

The Awareness of Prenatal Folic Acid Intake Among Mothers with Hydrocephalic Children at a Tertiary Institution in Lake Zone Region, Mwanza, Tanzania

James Lubulwa¹, Sibabaong'ombe John Masaka², Christopher Bonfield³

¹Department of Neurosurgery, Bugando Medical Center, Mwanza, Tanzania

²Catholic University of Health and Allied Sciences Mwanza, Tanzania]

³Department of Neurosurgery, Vanderbilt University Medical Center, Nashville, TN, USA

OBJECTIVE: Prenatal folic acid supplementation has been associated with the prevention of neural tube defects and hydrocephalus, a known burden on maternal and child health, especially in low and middle income countries, such as Tanzania. However, little is known about the awareness and perceptions of mothers regarding prenatal folic acid intake among mothers with hydrocephalic children in this region. Therefore, this study assessed the awareness of mothers regarding the importance of prenatal folic acid supplementation, identified their perceptions, and explored potential factors influencing their willingness to adhere to supplementation recommendations.

MATERIAL AND METHODS: Data was collected prospectively over 9 months among consecutive mothers with hydrocephalic children at a tertiary institution in Mwanza, Tanzania. Structured interviews were conducted using questionnaires to gather information on participants, and data were analyzed.

RESULTS: Among 176 mothers, 90% were aware of folic acid supplementation with antenatal clinics being the primary source of information (84%) and most (78%) recognized the importance of prenatal folic acid. However, only 47% used folic acid supplementation at some point during pregnancy. Among those unwilling to take folic acid pills (10%), 44% expressed fear of side effects on the mother, 39% worried about impacts on the child, and 17% believed supplementation had no medical benefits. Approximately half believed that not taking folic acid pills could be a contributing factor to the development of hydrocephalus in children, while 20% did not. Furthermore, 27% admitted not knowing the potential relationship, and various other factors, such as family history, child injury, maternal illness during pregnancy, child's illness, and even beliefs in witchcraft, were mentioned to as potential causes of hydrocephalus.

CONCLUSION: This study highlights both low folic acid use, but also high awareness levels and persistent misconceptions among mothers regarding prenatal folic acid supplementation. Addressing these misconceptions through comprehensive health education is paramount for tailored interventions.

Keywords: folic acid intake; hydrocephalus; prenatal; awareness; LMIC; Tanzania

PF-070

Vascular

Multidisciplinary treatment of cerebral arteriovenous malformations in pediatric patients at National Taiwan University Hospital Sheng Che Chou¹, Shih Hung Yang², Chung Wei Lee³, Kuo Chuan Wang², Furen Xiao², Chang Mu Chen², Dar Ming Lai², Sheng Hong Tseng², Jui Chang Tsai², Han Min Tseng², Yong Kwang Tu², Swei Ming Lin², Meng Fai Kuo²

¹Department of Traumatology, National Taiwan University Hospital, Taipei, Taiwan; Division of Neurosurgery, Department of surgery, National Taiwan University Hospital, Taipei, Taiwan

²Division of Neurosurgery, Department of surgery, National Taiwan University Hospital, Taipei, Taiwan

³Department of Medical Imaging, National Taiwan University Hospital, Taipei, Taiwan

OBJECTIVE: Limited literature exists on the multidisciplinary approach to treating pediatric arteriovenous malformations (AVMs).

Successful management typically entails a combination of microsurgery, stereotactic radiosurgery (SRS), and embolization.

MATERIAL AND METHODS: We conducted a retrospective review of pediatric patients with cerebral AVMs treated at National Taiwan University Hospital from 1995 to 2023.

RESULTS: Among 70 children with cerebral AVMs, 59 (84.3%) experienced intracranial hemorrhage, with common symptoms including headache, seizures, altered consciousness, and focal neurological deficits. Microsurgical resection was performed on 50 patients (71.5%), while 19 (27.1%) underwent SRS. Additionally, one patient (1.4%) solely received embolization. Within the microsurgical resection group, 18 patients (36%) underwent preoperative embolization. Six patients (12%) received adjuvant SRS, and another six (12%) required repeat operations for residual AVM. One patient experienced AVM recurrence and underwent subsequent microsurgical resection. The overall AVM obliteration rate was 90%, while in the SRS group, it was 78.9%. Three patients (15.8%) in the SRS group underwent embolization prior to treatment. Notably, one patient with a large AVM saw no change in size post-treatment, while another experienced intracranial hemorrhage after SRS and subsequently underwent embolization and microsurgery. Two patients developed radiation necrosis but responded well to steroid treatment. Preoperative embolization significantly facilitated microsurgical resection of larger AVMs ($p < 0.05$), whereas AVMs situated in deep-seated or eloquent areas were more likely to be treated with SRS. During follow-up, 62 patients (88.6%) demonstrated good functional outcomes, with 65 patients (92.9%) experiencing improved or stable statuses.

CONCLUSION: In conclusion, our series underscore the efficacy of multidisciplinary approaches in enhancing AVM obliteration rates. Preoperative embolization notably aids in the resection of larger AVMs, while intracranial hemorrhage is a common presentation in pediatric AVM cases, with excellent functional outcomes achievable through aggressive treatment.

Keywords: cerebral arteriovenous malformation, microsurgery, embolization, stereotactic radiosurgery

PF-071

Vascular

Characteristics and treatment of intracranial aneurysms in children

Peng Sun, Mading Zhou, Yutong Liu, Xinglong Zhi, Jianxin Du, Gao Zeng

Department of Neurosurgery, Xuanwu Hospital, Capital Medical University, Beijing, China

OBJECTIVE: Pediatric intracranial aneurysm is a kind of rare disease, which is significantly different from that in adults. By reviewing the cases in our center, we summarized the characteristics of pediatric intracranial aneurysms, and made a preliminary discussion on the treatment and prognosis.

MATERIAL AND METHODS: We reviewed patients with intracranial aneurysms under 18 years old in our center from 2002 to 2022. The general condition, clinical manifestations, aneurysm location, size and shape Treatment modalities and complications were reviewed. Imaging and clinical outcomes were followed up.

RESULTS: A total of 82 patients with 99 aneurysms were included. There were 32 cases of ruptured and 50 cases of unruptured. 11 cases had multiple aneurysms. There were 67 aneurysms in the anterior circulation and 32 in the posterior circulation. There were 27 fusiform/dissecting aneurysms and 32 giant (>25mm) aneurysms. Twenty-six aneurysms were treated by

microsurgery and 46 by interventional therapy. Thirty-five patients (46 aneurysms) were followed up for 6.6-127 months, with an average of 52.3 months. 32 cases (91%) had good prognosis (mRS0-1).

CONCLUSION: Pediatric intracranial aneurysm is a kind of rare disease, which is significantly different from that in adults. Complex aneurysms are more common. The treatment strategy needs to be customized individually, but no matter what kind of treatment, it has no significant effect on the overall prognosis. Higher clinical grade, rebleeding and incomplete aneurysm occlusion are the factors affecting the prognosis. The prognosis of children is relatively good, but considering the long-expected survival of children, long-term close follow-up is necessary.

Keywords: aneurysm, children, endovascular procedures, microsurgery

PF-072

Vascular

Management of paediatric arteriovenous malformations: Is SRS worth the wait?

George Richard Hudson, Kumar Abhinav, Mario Teo, Michael Carter, William Singleton, Elias Dumour, Richard J Edwards

Department of Neurosurgery, Bristol Royal Hospital for Children and North Bristol Trust, Bristol, United Kingdom

OBJECTIVE: Management of arterio-venous malformations (AVMs) varies by centre and increasingly involves stereotactic radiosurgery (SRS). Here, we evaluate performance of elective surgery vs SRS in a single centre.

MATERIAL AND METHODS: Paediatric AVM cases either treated or managed conservatively presenting between 2008-2023 were retrospectively analysed.

RESULTS: We identified 79 children with AVMs and analysed 60 complete cases. Average age at presentation was 11.5 and 77% were ruptured. Regarding SM-grade and treatment, 10 were grade I (9 elective surgery, 1 SRS), 20 grade II (2 treated emergently, 11 elective surgery, 7 SRS), 15 grade III (2 treated emergently, 6 elective surgery, 5 SRS, 1 surgery/SRS combined, 1 died), 9 grade IV (1 treated emergently, 4 elective surgery, 2 SRS, 1 observed, 1 awaiting treatment) and 3 grade V (all observed). 3 cases had unknown grade.

Elective surgery obliterated 29/31 cases (94%), plus 1 after subsequent SRS/surgery. In contrast, SRS obliterated 7/15 cases (47%), plus 2 after further SRS. This difference was marked for grade III/IV AVMs with 10/10 [Surgery] vs 2/6 [SRS] obliterations after 1 round of treatment. Median time to angiography-confirmed cure was 152 [Surgery] vs 1113 days [SRS].

There was no elective mortality. At one-year, elective surgery was associated with 1 case of hemianopia, 1 tinnitus, 1 altered sensation/headache, and 1 worsened hemiparesis. Elective SRS was associated with 1 case of radionecrosis, and headache was common (5/15). Median mRS was 1. On follow-up of all 79 children, there were 4 recurrences (3 surgical, 1 SRS) and 5 rebleeds (3 observed, 2 whilst awaiting definitive management).

CONCLUSION: SRS is becoming the dominant treatment for paediatric AVMs. Here however, elective surgery had higher obliteration and shorter time-to-obliteration than SRS, especially for grade III/IV AVMs. For high grade (III/IV) AVMs with ongoing re-bleeding risk, surgery remains an effective, safe way to eliminate this risk.

Keywords: Arteriovenous Malformation, Paediatric, Stereotactic Radiosurgery, Microsurgery

PF-073

Vascular

Pediatric infectious aneurysms: individual patient pooled analysis on presentation, management and outcomes

Andrew Rejsner¹, Youssef M Zohdy², Ali Alawieh¹, Rim El Annan², Jad H Assi², Jacob R Lepard¹, Joshua J Chern¹

¹Children's Healthcare of Atlanta, Atlanta, GA USA

²Emory University, Atlanta, GA USA

OBJECTIVE: Infectious intracranial aneurysms (IIAs) are a rare sequel of systemic infection and occur most commonly in patients with infective endocarditis (IE). Despite the increasing use of non-invasive screening angiography in patients with IE, the incidence remains low, yielding limited data on the management of IIAs in pediatric populations. We performed a pooled analysis of all published series of pediatric patients with IIAs to study the disease landscape including presentation, management, and outcomes.

MATERIAL AND METHODS: Data included in this study were pooled from published literature on IIAs between 1960 and 2023. Abstracts were selected for full review to include only manuscripts reporting at least one case of pediatric IIA (age 0–18 years).

RESULTS: A total of 145 pediatric (birth to 18 years of age) patients with 178 IIAs were included. Patients presented with rupture in 68% of cases, of which 36% had intraparenchymal hemorrhage and 39% had subarachnoid hemorrhage. Using multivariate logistic regression, independent predictors of rupture were posterior location (aOR 10, P=0.041) and history of IE (aOR 7.2, P=0.001). Primary medical management was successful in 82% of cases with unruptured aneurysms while, in those with ruptured IIAs, medical management was successful in 26% of cases. The 90-day mortality rate was 28%. Using multivariate logistic regression, ruptured IIAs (aOR 5.4, P<0.01) and failure of medical management (aOR 11.1, P<0.05) were independent predictors of 90-day mortality.

CONCLUSION: Pediatric IIAs remain a rare complication of systemic or localized CNS infection in the pediatric population. Medical management of unruptured aneurysms is highly successful, while ruptured aneurysms have a remarkably high rate of failure of medical management and should be treated by early surgical or endovascular intervention when feasible.

Keywords: Infectious intracranial aneurysms, mycotic aneurysms, pediatric, pooled analysis

PF-074

Vascular

Pediatric Cerebral Aneurysm: Over 15 Years' Experience at the National Neuroscience Institution

Majed Alghamdi¹, Meshari Almutairi¹, Abdulrahman Alturki¹, Mohammed Bafaquh¹, Mahmoud Alyamani¹, Yasser Orz¹, Nora Alse-drani², Khalid Alghamdi³

¹National Neuroscience Institute, King Fahad Medical City, Riyadh, Saudi Arabia.

²Department of Neurosurgery, Prince Sultan Military Medical City, Riyadh, Saudi Arabia

³Department of Neurosurgery, King Faisal Specialist Hospital and Research Center, Riyadh, Saudi Arabia

OBJECTIVE: This manuscript aims to shed light on pediatric cerebral aneurysms by examining a 15-year series of cases at the National Neuroscience Institution. It strives to advance our understanding and

guide the crafting of more precise, effective treatment strategies, with an emphasis on the critical role of sustained monitoring.

MATERIAL AND METHODS: Employing a retrospective review approach, this paper analyzed pediatric intracranial aneurysms treated between 2005 and 2020. Data collection centered on demographic details of the patients, the specific attributes of the aneurysms, their clinical manifestations, and the outcomes following treatment, all within the context of the neurovascular board's management decisions. Although this study does not include a meta-analysis, it provides foundational insights for future, more exhaustive research efforts.

RESULTS: Among the 25 patients (64% male, mean age 13 years), the majority of aneurysms were saccular (77%), with a significant proportion presenting symptomatically with subarachnoid hemorrhage (SAH). Treatment was evenly divided between surgical clipping and endovascular techniques, reflecting a tailored approach to individual cases. The follow-up period (mean 3.9 years) revealed a recurrence rate of 4% in treated aneurysms, with 32% of patients experiencing neurological deficits post-treatment. Mortality stood at 12%, underscoring the severity of pediatric cerebral aneurysms.

CONCLUSION: As shown in this study, the resolution of challenges accompanying pediatric cerebral aneurysms is far more complicated owing to the peculiarities of the course of the condition, methods of diagnosis, and therapeutic procedures in comparison to those in adults. Even though both neurosurgical and endovascular technologies have made considerable progress, decision-making peculiarities and the possibility of persistent complications require continued awareness and additional academic research. The results underscore the vital necessity for a high level of specialized patient-centered assistance in which a multidisciplinary team approach could alter the outlook for this high-risk population.

Keywords: pediatric, cerebral, aneurysm, outcome, prognosis.

Flash Presentation Abstracts

FL-001

Functional

The utility of Multicentre Epilepsy Lesion Detection algorithm in identifying epileptic activity and predicting seizure freedom in MRI lesion-negative children

Aimee Goel, Stefano Seri, William Lo, Joshua Pepper
Department of Neurosurgery, Birmingham Children's Hospital, Birmingham, UK

OBJECTIVE: Children with drug-resistant focal epilepsy (DRFE) with no focal lesion identified on structural MRI are challenging to treat. A recently developed deep-learning-based MRI lesion detection algorithm, the Multicentre Epilepsy Lesion Detection (MELD) algorithm, has shown good ability to identify focal cortical dysplasia (FCD). We applied this algorithm to our cohort of MRI-negative children with refractory focal epilepsy who underwent stereoelectroencephalography (SEEG) to determine its accuracy in predicting FCD location, seizure onset zones and clinical outcomes.

MATERIAL AND METHODS: We retrospectively applied the MELD algorithm to a consecutive series of MRI-negative patients who underwent SEEG at our tertiary paediatric epilepsy surgery centre. We assessed to what extent the MELD cluster corresponded with the epileptogenic zone, and the positron emission tomography (PET)-identified epileptic region. In those who underwent resective surgery, we analysed whether the region of MELD abnormality corresponded with the surgical target and to what extent this was associated with seizure freedom.

RESULTS: We identified 37 SEEG studies in 28 MRI-negative children in whom we could run the MELD algorithm. Of these, 14 (50%) children had clusters identified. Nine (32%) children had clusters concordant with seizure hypothesis, 6 (21%) had clusters concordant with PET imaging, and 5 (18%) children had at least one cluster concordant with SEEG electrode placement. Of these, 5 MELD clusters correctly predicted either seizure onset or irritative zone based on SEEG stimulation data. Sixteen children (57%) went on to have resective or lesional surgery. Of these, only one patient (4%) had a MELD cluster which co-localised with the resection cavity and this child had an Engel 1A outcome.

CONCLUSION: In our cohort of MRI-negative DRFE cases, MELD algorithm identified abnormal clusters in half of cases, with a fifth of cases having SEEG-electrode concordant clusters. Machine-learning-based lesion detection using MELD is a promising field, but further work is required before it aids diagnosis.

Keywords: Focal cortical dysplasia, drug resistant focal epilepsy, multicentre lesion detection, MRI-negative epileptic lesion, automated lesion detection, epilepsy

FL-002

Functional

Pre-surgery and post-surgery characterization of pediatric patients undergoing temporal lobe surgical treatment for refractory epilepsy at an epilepsy center in Bogotá-Colombia

Juliana Paola Mendoza Mantilla¹, Marco Aurelio Venegas Mariño², Cesar Augusto Buitrago Guzman²

¹El Bosque University, Bogotá- Colombia

²Uniepilepsias, Center for Epilepsy Treatment, Bogotá-Colombia

OBJECTIVE: Describe the results of surgical treatment of temporal lobe surgery (TLS) during childhood, between 3 and 18 years of age.

MATERIAL AND METHODS: We reviewed 50 to 300 cases of patients with TLS for refractory epilepsy, considering the clinical-pathological profile and seizure control outcomes.

RESULTS: In an equal gender group of males and females, with an average age of seizure onset of 141.2 months. Most patients had radiological lesions (74%), predominantly associated with the temporal epileptogenic zone (44%) and extratemporal (26%), followed by multilobar (16%) and multifocal (2%) cases. The most common surgical procedures were cortico-amigdal-hippocampectomy (68%) and temporal cortical resection without mesial structures (30%), with a minimal complication rate (82% without complications). Various pathologies were identified in patients, with hippocampal sclerosis type I being the most common (10%), followed by cortical dysplasia type I (12%) and dual pathology (20%). Other findings included tumors (6%), ischemic vascular events (6%), and nonspecific mesial sclerosis (18%). Out of the 50 patients, 36 were followed up for one year, revealing controlled seizures with an average reduction in the number of medications from 2.5 to 2.1 associated with classifications in the Engel scale: 1A (50%), 2A (6%), and 2B (4%).

CONCLUSION: Our study found that only 16% of temporal lobe epilepsy (TLE) cases occurred in patients under 18 years old. Literature indicates a correlation between dual pathology, malformations, and hippocampal sclerosis, with a favorable prognosis post-surgery. Similarly, 60% of our patients had favorable Engel classifications (1A, 2A, or 2B). Additionally, complication rates were low, aligning with literature. Clinical, epidemiological, EEG, and imaging findings, are essential for early surgical intervention in refractory cases. TLS plays a significant role in pediatric TLE management. Individualized patient care is vital for accurate diagnosis and management, preventing long-term implications and improving care for children with TLE.

Keywords: Temporal lobe epilepsy, temporal lobe epilepsy surgery, pediatric epilepsy, refractory epilepsy, surgical outcome, pre/post-surgical evaluation

FL-003

Functional

An observational study on outcome of hemispherotomy in children with refractory epilepsy

Suchanda Bhattacharjee, Sheik Afsan Zabeen, Madhur Srivastava
Nizam's Institute of Medical Sciences, HYDERABAD, INDIA

OBJECTIVE: This study aims to evaluate the clinical characteristics and outcome of hemispherotomy in children with refractory hemispherical epilepsy.

MATERIAL AND METHODS: Retrospective analysis of data in twenty five children aged ≤ 18 years who underwent hemispherotomy and had at least two years post-surgery Follow-up and operated between 2014 to 2021 was performed. All but one underwent Delalande's vertical para-sagittal or interhemispheric hemispherotomy (VPH), while lateral peri-insular functional hemispherotomy was performed in that one case

RESULTS: The age of onset for epilepsy in the study population was congenital to 4 years of age and the average duration of epilepsy at least 5years. The mean age at surgery of the study population was 10-13 years. Gliosis due to presumed childhood infarct was most common etiology, followed by multilobar focal cortical dysplasia followed by Rasmussen's encephalitis and hemimegalencephaly in this series. There was no significant difference between the surgery groups for the reported acute post operative seizures (APOS). There were two mortality in this cohort and one required a subdural peritoneal shunt. At last follow up 90% patients were seizure free; there was no difference between the groups for seizure freedom. When analyzed for outcome between the etiologies, seizure freedom was similar for gliosis due to infarct, Rasmussen's encephalitis and malformations of cortical development (MCD). There was a significant improvement in the cognitive and scholastic performance when last followed up. The caregivers satisfaction was high in the outcome of this procedure.

CONCLUSION: Gliosis due to presumed childhood infarct was the leading cause of medically refractory epilepsy caused by hemispheric lesions in the current study. The cognitive and scholastic performance also improved in this cohort on a minimum two years follow up.

Keywords: refractory, epilepsy, hemispherotomy

FL-004

Functional

Spectrum of FCD in surgically treated epilepsy patients

Suchanda Bhattacharjee, Afshan Zabeen, Vasundhara Rangan, Megha Uppin
Nizam's Institute of Medical Sciences, Hyderabad, India

OBJECTIVE: To study the histopathological findings and outcomes in relation to intraoperative EcoG in patients diagnosed with Focal Cortical Dysplasias (FCD) following epilepsy surgery.

MATERIAL AND METHODS: Case records of patients who have undergone resective or disconnection surgeries for medically refractory epilepsy at our centre over the past six years were studied. Those who have been diagnosed with FCD on histopathological examination of the biopsied tissue were included. Outcome was assessed in those patients with follow up of over one year

RESULTS: 30 cases were included. The patients were between 3 to 20 years of age with equal members of both sexes. Type 2 FCD, found in over half the cases, was the most common pathological diagnosis. Type 3 dysplasias were associated with a variety of pathological entities.

CONCLUSION: With the evolution of understanding and thereby diagnosis of FCD over the years, that it is a cause of refractory epilepsy that may be surgically treatable becomes increasingly clear. The spectrum of FCD cases and their outcomes in correlation to intraoperative ECoG in a tertiary care centre in south India have been studied and presented.

Keywords: focal cortical dysplasia, refractory epilepsy, electrocorticography

FL-005

Functional

Mobility outcome following functional hemispherotomy for intractable epilepsy

Lauren Baldwin¹, Nichola Birchall², Claire Rylance², Joshua Pepper³, A Richard Walsh³, William B Lo³

¹School of Medical and Dental Sciences, University of Birmingham Medical School, Birmingham, England

²Department of Physiotherapy, Birmingham Children's Hospital, Birmingham, England

³Department of Neurosurgery, Birmingham Children's Hospital, Birmingham, England

OBJECTIVE: Functional hemispherotomy is an effective treatment for intractable unihemispheric epilepsy in children. The disconnection of the corticospinal tract can potentially worsen contralateral motor function, with or without pre-existing hemiparesis caused by the underlying aetiology. Whilst seizure freedom outcomes are well reported, functional mobility and the pattern of recovery have not been systematically studied, placing uncertainty on clinicians, patients, and families. Due to its great importance for development, education, and socialisation, we examined motor outcomes 12 months post-hemispherotomy and identified factors associated with this.

MATERIAL AND METHODS: This is a single institute retrospective cohort study from 2012 to 2022. Patient demographics, aetiology and seizure outcome by Engel classification were collected from a prospectively kept database and hospital records. 12-month post-operation functional mobility was graded from I (normal) to V (wheelchair dependent) (Table 1).

The mobility outcome was analysed, and prognosticating factors were identified.

RESULTS: Fifty out of seventy-six consecutive patients undergoing surgery from 2012 to 2022 had adequate pre- and post-operative motor outcome data. Age at operation ranged from 55 days to 18 years. The aetiology was vascular in 26(52%). Pre-operatively, 33/50 children had normal or mildly impaired mobility (I, II). Post-operation, 38 were grade I-II. Overall, 42(84%) remained at the same mobility level/improved following surgery. Of note, 2 patients who were wheelchair-bound progressed to walking with a limp at 12 months post-hemispherotomy, both being seizure free; and one went from standing only to wheelchair-bound with worsened seizures.

Proportions of children with the same/improved 12-month mobility with vascular versus non-vascular aetiology were 92% versus 75% ($p=0.10$). Mobility did not correlate with 12-month Engel class.

CONCLUSION: Despite the disconnection of the corticospinal tract, most children undergoing hemispherotomy can achieve the same, or improved motor function at 12 months after their operation.

The result of this study will be helpful in pre-operative counselling and help facilitate surgical decision-making.

Keywords: hemispherotomy, mobility

FL-006

Functional

Clinical Results of Anatomical Hemispherectomy as Surgical Treatment for Rasmussen's Encephalitis

Zita Elizabeth Salazar Ramirez¹, Mayra Alejandra Arce Lozoya¹, Sandra Orozco Suarez², Aldo Antonio Cruz³, Israel Grijalva Otero², Alma Griselda Ramirez Reyes⁴

¹Pediatric Neurosurgery Resident at Pediatric Hospital "Dr. Silvestre Frenk Freund" of Centro Médico Nacional Siglo XXI in Mexico City, Mexico

²Research Unit of Neurological Disorders at Hospital de Especialidades "Dr. Bernardo Sepúlveda" of Centro Médico Nacional Siglo XXI in Mexico City, Mexico

³Conductual Neurosciences Department at Facultad de Estudios Superiores Iztacala, UNAM in Mexico City, Mexico

⁴Chair of Pediatric Neurosurgery Department at Pediatric Hospital "Dr. Silvestre Frenk Freund" of Centro Médico Nacional Siglo XXI in Mexico City, Mexico

OBJECTIVE: Rasmussen's encephalitis causes drug-resistant epilepsy, progressive neurological deficit and cognitive impairments. The authors present the clinical results of a single institution of anatomical hemispherectomy in pediatric patients with Rasmussen's encephalitis to demonstrate its relevance, effectiveness in seizure control, as well as long-term improvement in neuropsychological functioning.

MATERIAL AND METHODS: Consecutive patients from the Pediatric Hospital "Dr. Silvestre Frenk Freund" of Centro Médico Nacional Siglo XXI in Mexico City with a confirmed diagnosis of Rasmussen's encephalitis who underwent anatomic hemispherectomy and had complete neuropsychological (cognitive, behavioral, emotional and adaptive functions) evaluations, before and one year after surgery, were retrospectively analyzed. Demographic information, pre and postoperative seizure and functional outcome were reviewed.

RESULTS: The complete cohort included 18 patients, of which six were lost in follow-up. Out of the remainder 12 patients, 10 males and 2 females with an average age of 8.66 years (range 2 – 14 years, median 9 years), six patients completed the neuropsychological evaluation, most with severe presurgical impairments in expressive language and adaptive functioning. One surgery had to be stopped before full hemispherectomy could be completed due to blood loss. There was no incidence of hydrocephalus or mortality due to surgical complications. At follow-up nine patients were able to ambulate, 11 patients could communicate through speech, and only three patients had seizure recurrence, but with decreased episodes.

CONCLUSION: Even though there has been a gradual shift towards functional hemispherectomy or hemispherotomies worldwide, the surgical technique for anatomical hemispherectomy used in our institution has proven to be effective in seizure control for pediatric patients with refractory drug-resistant epilepsy due to Rasmussen's encephalitis with long-term improvement in neuropsychological function and quality of life. This technique has proven to still be relevant and useful when patients are diagnosed in the early stages of the disease.

Keywords: Rasmussen's encephalitis, Rasmussen, Epilepsy, Anatomical hemispherectomy, Epilepsy surgery

FL-007

Functional**Vertical or Horizontal Hemispherotomy for Pediatric Hemispheric Drug-Resistant Hemispheric Epilepsy: Does one outwit the other? - A technical comparison**

George Chandy Vilanilam, Lokesh Vellore Dasarathan, Krishna Kumar Kesavapisharady

Neurosurgery Department, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum, Kerala, India

OBJECTIVE: Hemispheric epilepsy syndromes causing drug-resistant epilepsy in children have excellent seizure outcomes after functional hemispherotomy (75-90% Engel Class 1). A plethora of hemispheric pathologies and multiple surgical variations of hemispherotomy techniques in the pediatric population, create scope for further surgical innovation and outcome enhancements.

MATERIAL AND METHODS: Vertical (Delalande) hemispherotomy (VH) and Horizontal (Villemure) hemispherotomy (HH) techniques were compared from a technical surgical perspective. We evaluated 150 pediatric hemispheric disconnections done at our quaternary comprehensive epilepsy care centre from 2000-2023 to compare hemispheric surgical landmarks and morphometric variations. Morphometrics of surgical landmarks and ease/difficulty of surgical access with reference to the callosum (anterior commissure, genu, body, splenium), fronto-basal disconnection limits, insular cortex, temporal stem, amygdala, hippocampus, choroidal fissure, parieto-occipital disconnection limits, were compared in these 2 techniques across various hemispheric pathologies.

RESULTS: The essential 5 disconnections (fronto-basal, complete callosotomy, insular, mesial temporal, parieto-occipital) could be achieved effectively in both technical variations of hemispherotomy. However ease/difficulty of access to key surgical landmarks and morphometric variations based on the centrality of the pathology and lobar volumes could confer an advantage to prefer either vertical or horizontal hemispherotomy, as per the situational demand. Access to the temporal stem is relatively easier in HH and splenial access easier in VH.

CONCLUSION: The choice of functional hemispherotomy approach (VH or HH) is guided by the centrality of pathology, lobar volume, ventricular size and surgeon preference. Better access to key surgical landmarks and consideration of morphometric variations helps choice of approach and optimises essential disconnections and seizure outcome benefits. Completeness of the essential disconnections is the key to good hemispherotomy outcomes, irrespective of the technical variations.

Keywords: vertical hemispherotomy, horizontal hemispherotomy, hemispheric epilepsy, drug resistant epilepsy

FL-008

Functional**An anterior quadrant disconnection, as a subtotal modification of a peri-insular hemispherotomy was effective in seizure control for pediatric intractable frontoparietal epilepsy associated with early ischemic stroke or hypoxic ischemic encephalopathy**Goichiro Tamura¹, Juan Pablo Appendino², Alice Ho², Morris Scantlebury², Julia Jacobs Levan², Walter Hader²

¹Calgary Comprehensive Epilepsy Program, Department of Clinical Neurosciences, University of Calgary Cumming School of Medicine, Calgary, Canada; Department of Neurosurgery, University of Tsukuba Hospital, Tsukuba, Japan

²Calgary Comprehensive Epilepsy Program, Department of Clinical Neurosciences, University of Calgary Cumming School of Medicine, Calgary, Canada

OBJECTIVE: Perinatal ischemic or hemorrhagic brain injuries result in significant long-term consequences, including drug-resistant epilepsy and severe developmental delay. Hemispheric disconnection procedures, commonly considered in pediatric patients with such intractable epilepsy, are associated with inevitable severe contralateral motor and visual deficits. Here, we report a novel visual sparing anterior quadrant disconnection procedure for selected patients with seizures associated with perinatal vascular insults.

MATERIAL AND METHODS: Retrospective chart review of pediatric patients (< 18 yrs) who underwent anterior quadrant disconnection between January 2017 and December 2022 was performed using our patient database. Seizure semiology and results of detailed pre-surgical investigations were collected. Postoperative seizure outcomes and complications were assessed. Disconnection steps include modified peri-insular hemispherotomy, frontobasal disconnection, splenium-sparing transventricular callosotomy, and parietal disconnection.

RESULTS: Four female patients (mean age 11.3 years) were identified. The etiology of epilepsy included hypoxic-ischemic encephalopathy (HIE) in 2 cases, perinatal middle cerebral artery (MCA) stroke in 1 case, and premature intraventricular hemorrhage in 1 case. All patients presented with contralateral spastic hemiparesis or quadriplegia and MRI revealed diffuse or frontoparietal cystic encephalomalacia with prominent ventriculomegaly in all cases. Contralateral clonic or tonic motor seizures were present in all patients. Two patients were completely seizure free where surgery had been considered curative. Seizures continued in 2 palliative cases, but their severity and frequency were significantly reduced. No permanent neurological complications, including visual field deficits or hydrocephalus, were observed after surgery.

CONCLUSION: Anterior quadrant disconnection is an effective visual pathway sparing procedure in selected patients with frontal parietal onset seizures and associated cystic encephalomalacia secondary to perinatal vascular insults including MCA stroke, premature intraventricular hemorrhage and HIE.

Keywords: perinatal brain injury, hypoxic ischemic encephalopathy, drug resistant epilepsy, disconnection, anterior quadrant disconnection, hemispherectomy

FL-009

Functional**Stereo-EEG for Epileptogenic Focus Localization in Schizencephaly: A Single-center Experience in Four Patients**

Hsin Hung Chen

Division of Pediatric Neurosurgery, The Neurological Institute, Taipei Veterans General Hospital, Taipei, Taiwan

OBJECTIVE: Schizencephaly is a congenital cerebral malformation characterized by clefts in the hemispheres of the brain, where variations in semiology often make it difficult to localize epileptogenic focus. Here, we report on a series of patients who underwent stereo-encephalography (SEEG) for epileptogenic focus localization and subsequent SEEG-guided surgical intervention.

MATERIAL AND METHODS: Four patients (ages 27, 33, 27, 25 years) with a mean seizure history of 16 years (range 8-22 years) were analyzed. Data pertaining to semiology, video-encephalography (EEG), magnetic resonance imaging, positron emission tomography, and invasive EEG studies, surgical intervention and post-surgery outcome were collected and analyzed.

RESULTS: All seizure onset zones were within the extent of schizencephaly; however, the limbic system (including the hippocampus, amygdala, cingulate gyrus, or insula) was involved in early spreading. Two patients underwent SEEG-guided radiofrequency thermo-ablation (RFTA) in the seizure onset zone, 1 patient underwent lesionectomy via craniotomy, and 1 underwent neither RFTA nor lesionectomy. At 2 years post-surgery, the outcomes were as follows: Engel grade Ia (n=2), Ib (n=1), and III (n=1).

CONCLUSION: This article reports on a precise approach to treating patients with schizencephaly dependent of seizure onset zone and functional cortex mapping.

Keywords: Epilepsy surgery, Radiofrequency thermoablation, Schizencephaly, Stereo-encephalography

FL-010

Functional

Low-intensity focused ultrasound to disrupt epileptogenesis: A proof-of-concept preclinical study

Whitney Erin Parker, Sandesh Kamdi, Thach Vu Nguyen, David Kolb, Marianna Baybis, Pavlos Anastasiadis
Department of Neurosurgery, University of Maryland School of Medicine, Baltimore, Maryland, USA

OBJECTIVE: Posttraumatic epilepsy occurs in about 3% of patients suffering traumatic brain injury (TBI) and is often poorly responsive to medical treatment. To date, no trials of therapies to prevent epilepsy after TBI have been successful. Low-intensity focused ultrasound (LOFU) has been shown to activate calcium flux through mechanoreceptors *in vitro*, a process which underlies critical aspects of epileptogenesis. We use stereotactic dorsal hippocampal injection of kainic acid (KA) in rats to generate a well-characterized epilepsy model, which induces transient status epilepticus, followed by a critical latent period of 2-4 weeks, after which spontaneous recurrent seizures develop. Our objective is to determine whether LOFU delivered during the early latent period after KA insult can interrupt pathologic changes that promote epileptogenesis.

MATERIAL AND METHODS: A subset of animals were treated with LOFU 2 days following KA injection, during the latent period, and their frequency of seizures and behavioral changes were monitored over 8 weeks. At 4 and 8 weeks after KA injection, histopathological changes were assessed using cresyl violet staining, and mechanistic changes using immunohistochemistry to quantify neuronal activity (cFos), excitatory glutamatergic neurons (vGlut), inhibitory GABAergic neurons (GAD1/67), cell death (Caspase 3), astrogliosis (GFAP), and mTOR activity (pS6).

RESULTS: Hippocampal LOFU treatment delivered during the latent period following KA injection prevents the disruption of cytoarchitecture seen in CA3, CA1, and dentate gyrus hippocampal subregions of KA-injected animals. LOFU attenuates several mechanistic features of epileptogenesis, including increasing inhibitory and decreasing excitatory tone, decreasing cell death and astrogliosis, and decreasing pathological mTOR activity. Importantly, LOFU treatment decreases the number of spontaneous recurrent seizures and aggressive behavioral responses in treated animals compared with the untreated cohort.

CONCLUSION: Our results reveal the potential of LOFU in abrogating the development of epileptic networks and introduce a novel non-invasive, non-pharmacological strategy to prevent epilepsy following a traumatic insult, rather than treat its consequences.

Keywords: Low-intensity focused ultrasound (LOFU), epileptogenesis, kainic acid, epilepsy models, posttraumatic epilepsy (PTE), mesial temporal lobe epilepsy (MTLE)

FL-011

Functional

Stereotactic radiofrequency anterior capsulotomy for paediatric Tourette syndrome

Kostiantyn Kostiuk, Yurii Medvedev, Andrii Popov, Andrii Lisiany, Valerii Cheburakhin, Vladislav Buniakin, Davud Tevzadze
Department of functional neurosurgery and neuromodulation, Romodanov Neurosurgery Institute

OBJECTIVE: Tourette syndrome is indeed a complex neurological disorder characterized by motor and phonic tics, typically beginning in childhood, and often accompanied by various behavioural comorbidities. The aim of the study is to evaluate the effectiveness and safety of stereotactic radiofrequency (RF) anterior capsulotomy in the treatment of TS.

MATERIAL AND METHODS: 5 children with TS underwent RF anterior capsulotomy at the Romodanov neurosurgery institute, comprising 4 (80%) boys and 1 (20%) girl. The patients' ages ranged from 11 to 17 years (median 14 years). The assessment included the following tests: Yale Global Tic Severity Scale (YGTSS), Global Assessment of Functioning (GAF) Scale, Yale-Brown Obsessive Compulsive Scale (Y-BOCS), HDRS, and Beck's Depression Inventory scales. All patients were evaluated at six months, one year after the treatment, and 3 (60%) of them - two years after the operation.

RESULTS: All patients suffered from bilateral motor and phonic tics, which were resistant to medication. In 4 (80%) cases, Obsessive compulsive syndrome was the primary clinical symptom of TD, significantly impacting the patients' quality of life. The improvement in tics was observed within a few weeks after the surgery and continued to progress with time. The vast majority of children reported maximum improvement two months after surgery. After one year of follow-up, the YGTSS score improved by 54% and the GAF score had improved by 21%. There was no regression of motor symptoms one year after treatment. There were no any operative complications, postoperative neurological and mood complications after operation.

CONCLUSION: Despite the study's limited sample size, our findings indicate that stereotactic RF bilateral anterior capsulotomy is a reliable and safe approach for managing motor and vocal tics in children with TS. Additionally, anterior capsulotomy can significantly alleviate signs of OCD.

Keywords: Tourette syndrome, motor and phonic tics, stereotactic anterior capsulotomy

FL-012

Functional

Seizure and educational attainment in children undergoing hippocampus-sparing temporal lobectomy (HSTL)

Yan Ting Woo, John Ying Wei Ong, Joshua Pepper, A Richard Walsh, William B Lo
Department of Neurosurgery, Birmingham Children's Hospital, Birmingham, UK

OBJECTIVE: Standard anterior temporal lobectomy with amygdalo-hippocampectomy offers good seizure freedom and neuropsychological outcome. In children with temporal seizure associated with neocortical and/or amygdalar abnormality, a subset do not have radiological changes in the hippocampus nor neuropsychological impairment suggestive of

hippocampal dysfunction. Hippocampus-sparing temporal lobectomy (HSTL), as a surgical option, preserves cognitive function whilst maximising seizure freedom. This study thus aims to evaluate the seizure and functional outcomes in children who have undergone HSTL.

MATERIAL AND METHODS: This is a 20-year (2002-21) single institute retrospective cohort study. Data were collected from a prospectively kept database, electronic health records, and follow-up telephone interviews. Primary outcomes included seizure freedom and education/employment status. Secondary outcomes included neuropsychological and psychiatric status. Data were then analysed using descriptive statistics on SPSS Statistics v29.0.0.0.

RESULTS: Sixteen patients were included (12 male). The median age at operation was 11 years (range: 6.5-16), and last follow-up age was 21 (16-27). The commonest aetiology was ganglioglioma (5/16); other pathologies included focal cortical dysplasia (3/16), dysembryoplastic neuroepithelial tumour (2/16), and astrocytoma (2/16). 12/16 (75%) had an Engel class I outcome at 12 months post-operation. At last follow-up (median: 5 years), 12/16 (75%) were in Engel class I.

Education/employment status was available in 11 out of 16 patients. Four under-18 year old were at mainstream school. For those ≥ 18 years old, 4 were still in education, 2 were working and 1 was receiving social benefit. All lived with their parent(s). Half (4/8) of the patients with an Engel I outcome and 3/3 with Engel \geq II had a mental health diagnosis.

CONCLUSION: HSTL offers good post-operative seizure control, and is associated with good education/employment profile. Non-seizure free patients tend to have higher prevalence of mental health condition.

Keywords: Hippocampus-sparing, temporal lobectomy, education, employment, mental health

FL-013

Craniocervical Junction and Chiari

Pattern & Outcome of Cranio-Cervical and Cervical Spine Injuries associated with Head Injuries in Children: 30-Year Institutional Review

Gurish A Solanki

Birmingham Women's & Children's Hospital

OBJECTIVE: Head injuries are the primary reason for pediatric admissions post-trauma.

Road traffic accidents often result in severe head and neck trauma. Cervical spine injuries in children are rare (reported incidence 1.5%) and challenging to diagnose radiographically. Common cranio-cervical injuries include atlanto-occipital dislocations/fractures which can be fatal. Atlas, odontoid fractures and "hangman's fractures" and spinal cord injury without radiographic abnormality (SCIWORA) (common in under 2 years old). Optimal management (conservative vs. surgical) remains uncertain.

We analyze the pattern, management, and outcome of CCJ and cervical spine injuries (CSI) in children with head injuries over 30 years

MATERIAL AND METHODS: A retrospective analysis from 1995 to 2024 was performed. The key parameters included age, sex, mechanism of injury, level and type of cranio-cervical/cervical spinal injury, management, and outcome measures like Frankel grade and Glasgow outcome score were used

RESULTS: • Between 1995 to 2005, 445 (67% boys and 33% girls) and from 2006 to 2024, 1133 (two-thirds boys) children with head injuries were identified.

• Cranio-cervical injuries association with head injuries remained at 2.5% (9/445) to 2.64% (74/1133) over 30 years. Upper cervical injuries are more common across all age groups and mechanisms of injury. Higher mortality rate in younger children.

• Occipito-cervical, atlanto-axial dislocations, atlas and axis fractures' management was invariably surgical stabilization as often do not respond to conservative treatment.

• Initial immobilization and non-operative management followed by fixation resulted in favorable outcomes for most patients.

CONCLUSION: • The incidence of CCJ and cervical injuries remains static at 2.5 to 2.64% in head injuries over 30 years.

• Upper cranio-cervical spine dislocations predominate and are associated with severe head injury and high mortality.

• Neurological recovery prognosis is primarily related to the severity of the initial neurological injury rather than the management method.

• Predictable patterns of cervical spine injuries in children suggest strategies for prevention based on observed patterns

Keywords: traumatic brain injury; cranio-cervical junction; cervical spine injury; atlanto-occipital dislocation; SCIWORA; Hangman fracture

FL-014

Craniocervical Junction and Chiari

Surgical management of Chiari malformation Type I in pediatric population: a single center experience

Maria Sole Venanzi¹, Marco Pavanello¹, Mattia Pacetti¹, Francesca Secci¹, Andrea Rossi², Alessandro Consales¹, Gianluca Piatelli¹

¹Neurosurgery Unit, IRCCS Istituto Giannina Gaslini, Genoa, Italy-
²Neuroradiology Unit, IRCCS Istituto Giannina Gaslini, Genoa, Italy

OBJECTIVE: Chiari malformation type 1 (CM-1) involves cerebellar tonsils descent below the foramen magnum. In Chiari malformation type 1.5 (CM-1.5) both cerebellar tonsils and brainstem result herniated. Surgical treatment is not performed in asymptomatic patients, while the presence of syringomyelia represents an indication for surgery.

Reflecting on our own experiences, we examined the intraoperative use of ultrasonography and systematically analyzed various aspects encompassing patients' clinical profiles, surgical methodologies, and subsequent outcomes.

MATERIAL AND METHODS: The study retrospectively examined pediatric patients with CM-1 and CM-1.5 at Giannina Gaslini Hospital from 2006 to 2020, analyzing demographics, radiological findings, surgical interventions, and outcomes.

RESULTS: - Out of the total 211 patients who underwent surgery, 83.9% were diagnosed with CM-1 and 16.1% with CM-1.5. Headaches were prevalent (69%) and cerebellar signs were noted in 29% of patients. Syringomyelia and hydrocephalus were present in 28.4% and 8% of cases, respectively. Intra-operative ultrasonography guided interventions, with 59.8% requiring bony and ligamentous decompression, 27.1% undergoing duraplasty.

CONCLUSION: The surgical treatment of CM-1/CM-1.5 involves posterior cranial fossa decompression. Choosing between bony decompression alone or combining it with duraplasty has always been controversial in pediatric population. If we consider as surgical endpoint the restoration of cerebrospinal fluid (CSF) flux, intra-operative ultrasound may be a real-time helpful tool in orienting the surgical strategy, yet refinement with quantitative measures is needed.

Keywords: Chiari Malformation, Syringomyelia, Posterior Fossa Decompression, Duraplasty

FL-015

Craniovertebral Junction and Chiari

Atlantoaxial rotatory fixation in children – a systematic review of contemporary management

Thomas Beez¹, Hendrik Jan Mijderwijk¹, Max Scheyerer², Jan F. Cornelius³, Sebastian Ahmadi³

¹Pediatric Neurosurgery, Universitätsklinikum Düsseldorf, Germany

²Department of Orthopedic Surgery, Universitätsklinikum Düsseldorf, Germany

³Department of Neurosurgery, Universitätsklinikum Düsseldorf, Germany

OBJECTIVE: Atlantoaxial rotatory fixation (AARF) is an acquired, fixed, abnormal rotation of C1 on C2 with uni-/bilateral facet subluxation, caused by an acute trigger in a setting of increased ligamentous laxity. Evidence is weak and guidelines are lacking. This systematic review (SR) of the modern literature aims to provide a large pooled dataset for guiding management and avoiding under-/overtreatment.

MATERIAL AND METHODS: Pubmed/Medline, Google Scholar and bibliographies were searched according to a prespecified algorithm based on MESH terms and filtered for age (birth - 18 years) and contemporary publication date (2014/1 - 2024/4), after registration at PROSPERO. Articles were manually selected following PRISMA methodology. Risk of bias assessment was performed with Robvis app.

RESULTS: Pooled data of 550 patients (265 / 48.2% male, 284 / 51.6% female, mean age 7.8 years) from 60 articles was analyzed (N=35 case reports, N=10 case series, N=15 cohort studies). Severity grades were evenly distributed (Fielding & Hawkins grade I = 35.8%, II = 28.1%, III = 36.1%). Etiology was trauma (56.8%) or ear-nose-throat infection/surgery (33.4%). Main presenting symptom was torticollis (85.6%). Median interval from onset to diagnosis was 1 month (range 0-60). Initial conservative treatment (mainly traction & orthosis or closed reduction & orthosis) was applied in 80%, with a crossover rate to surgery (mainly C1-C2 fusion) of 11% due to recurrence/failure (Figure 1). By tendency, initial surgery was applied in older children with longer symptom duration and higher deformity severity. Within 129 weeks mean follow-up, outcomes were excellent. However, studies showed large heterogeneity and high risk of bias.

CONCLUSION: In this large contemporary pooled cohort of children with AARF, conservative treatment with traction/reduction and orthosis was initiated in 80% and successful in 69%. Surgery is indicated upon conservative treatment failure and upfront in older children with severe long lasting AARF. This SR provides reliable data for counseling and decision-making.

Keywords: atlantoaxial joint, rotatory fixation, subluxation, displacement, children, torticollis

FL-016

Craniovertebral Junction and Chiari

Calvarial bone graft for craniovertebral junction fixation in children

Vitor Yamaki, Anita Ahmadi, Dominic Thompson

Department of Neurosurgery, Great Ormond Street Hospital, London, United Kingdom

OBJECTIVE: To evaluate the efficacy of calvarial graft (CG) in craniovertebral fusion procedures in children at a single center.

MATERIAL AND METHODS: Paediatric patients in whom CG had been used as the sole construct, or to augment a semi-rigid construct were

identified from a prospective operative database. Age, underlying diagnosis and clinical presentation were obtained from review of the electronic patient record. The primary outcome was bony fusion confirmed on CT. Additional outcome measures were donor site morbidity and need for further surgery.

RESULTS: From 82 paediatric CVJ procedures, CG was used in 15 patients with a mean age of 4.1 (\pm 3.52) years. Aetiology comprised skeletal dysplasia (n=12), congenital anomaly of segmentation (n=1) and cervical trauma (n=2). Myelopathy was the most common clinical finding (9/15), followed by cervical pain (3/15). The indications for surgery comprised atlanto-axial subluxation (8/15), basilar invagination with compression (2/15), and cervicomedullary compression without instability but deemed at risk of instability following decompression (4/15). CG was used in three scenarios: (i)CG +wire only (n=10); (ii)CG +semirigid instrumentation (n=3); (iii)CG to augment rigid instrumented fixation (n=2). In 13 patients a Halo-body Jacket was used peri-operatively. At a mean time of 4.4 months following surgery, 80% of cases had radiological evidence of fusion.

CONCLUSION: Full thickness calvarial bone graft is readily available, has good structural integrity and is associated with minimal donor site morbidity. CG should be considered for use as a sole construct, or to augment semi-rigid constructs when instrumented fixation is precluded.

Keywords: Spine; Paediatrics; Craniovertebral; Calvarial graft

FL-017

Craniovertebral Junction and Chiari

Endoscopic foramen magnum decompression for Chiari malformation type I

Tomoru Miwa, Kento Takahara, Masahiro Toda

Department of Neurosurgery, Keio University School of Medicine, Tokyo, Japan

OBJECTIVE: The suboccipital midline incision line tends to remain as a conspicuous wound depending on its length and degree of scarring. In this study, we investigated whether effectiveness of decompression and shortening of the incision line length can be achieved by using neuroendoscopy for foramen magnum decompression (FMD) in pediatric Chiari malformation type I cases.

MATERIAL AND METHODS: Seventeen pediatric FMD cases (6-17 years old). The skin incision line was set at 20 to 35 mm and about 2 cm caudal from theinion, so that it would within the hairline of the suboccipital region. The range of FMD was 25 to 30 mm square and C1 laminectomy was also performed. Duraplasty was performed in all cases. During the operation, 4mm diameter rigid scope was freely grasped and the operative field was expanded as if lifting the skin to secure a sufficient field of view.

RESULTS: In all cases, the symptoms improved after surgery, and no perioperative complications such a cerebrospinal fluid leakage except for one case of hydrocephalus 40 days after surgery were observed. Six patients with extensive syringomyelia showed postoperative shrinkage. The length of skin incision was 27.8 mm (20-40) on average. Before this series, 5 pediatric cases aiming for cosmetic shortening without using endoscopes had an average length of 54.6 mm (45-60), and an average shortening of 27 mm was obtained with using of the endoscope.

CONCLUSION: Under the endoscope, the skin incision line could be shortened, and safe and sufficient decompression without perioperative complication was possible. In addition, the skin incision could be kept well within the hairline and the patient's cosmetic satisfaction could be improved. The reason why cerebrospinal fluid leakage was not observed in all cases may be because the skin incision line was short and there was little subcutaneous space.

Keywords: Chiari malformation type I, foramen magnum decompression, endoscopy, skin incision line length, syringomyelia, cerebrospinal fluid leakage

FL-018

Craniocervical Junction and Chiari

Surgical, Clinical and Radiological outcome analysis of Pediatric bony craniovertebral junction abnormalities - An institutional experience in a resource poor Low middle income country peripheral institute

Aayush Gupta, Mayank Garg, Deepak Kumar Jha, Suryanarayanan Bhaskar, Jaskaran Singh Gosal, Mohit Agrawal, Raghavendra Kumar Sharma, Vikas Janu
Department of Neurosurgery, All India Institute of Medical Sciences, Jodhpur, India

OBJECTIVE: 1. To study the clinical, surgical, and radiological outcome analysis of craniovertebral junction abnormality cases
2. To study the difficulties faced in a new institute in a resource poor country during the development years in operating pediatric CVJ cases.
3. To study the cost effectiveness of surgical implants and economic burden on the patients

MATERIAL AND METHODS: Retrospective analysis of all the pediatric craniovertebral junction developmental abnormality cases (i.e., age < 18 years) which were managed surgically in Department of Neurosurgery at All India Institute of Medical Sciences, Jodhpur, Rajasthan, India from November 2018 to February 2024.

The cases were analyzed with their demographics, pre op clinical examination, radiological studies, surgical procedure, complications intra op and post op, post-surgical clinical and radiological improvements.

RESULTS: In a span of 6 years and 2 months total of 31 pediatric craniovertebral junction abnormalities cases were operated. Surgeries included Occipitocervical fusion, C1-C2 fusion, posterior decompression. Methods for Occipitocervical fusion included contoured stainless-steel rods, lateral mass screws, laminar screws. Methods for C1-C2 fixation included wiring, lateral mass/ pars screws, transarticular screws. Good neurological outcomes were noted in majority of the cases with 1 mortality in post op period and few having complications including – broken wires, surgical site infection, implant failure. The cost of surgery for the patient is minimal as most of the patients come from poor economical strata and the other benefit includes the various schemes provided by the Government of India to reduce the cost of surgery and also of the implants.

CONCLUSION: Pediatric craniovertebral junction abnormalities can be managed with good neurological outcomes even in resource constraint settings if dealt with properly. Also, that with the use of indigenously made cheaper implants, the outcomes and fusion rates are good and comparable with other studies.

Keywords: pediatric craniovertebral junction abnormalities, resource poor, peripheral institute,

FL-019

Craniocervical Junction and Chiari

Posterior angulation of dens in operated and non-operated Chiari cohort and implications

Fardad T. Afshari, Bobby Sachdev, Vesta S. Najmi, Guirish A. Solanki, Desiderio Rodrigues
Department of Neurosurgery, Birmingham Children's Hospital, Birmingham, United Kingdom

OBJECTIVE: Chiari-1 malformation has been shown to be associated with skull base and craniocervical anomalies. One of the more recently associated anomalies is posteriorly angled dens. Objective of this study was to evaluate dens angulation in operated symptomatic and conservatively treated asymptomatic Chiari cases and assess impact of dens retroflexion on rate of revision or cerebrospinal fluid diversion following primary foramen magnum decompression (FMD).

MATERIAL AND METHODS: We undertook a retrospective study of all operated Chiari cases over a 15 year period. Non-operated reference cohort were consecutive Chiari patients referred to our tertiary unit over a period of 4 years. Information including demographics, age, sex, length of cerebellar tonsils below McRae's line, Pb-C2 distance, angle of retroversion and retroflexion and grade of retroflexion as well as rate of revision and CSF diversion were collated.

RESULTS: Overall, 126 Chiari 1 patients were included in this study (65 non-operated asymptomatic and 61 operated symptomatic). Mean age of non-operated cohort was 10.2 years (M:F 30:35). Mean cerebellar tonsillar length below McRae's line was 10.3 mm. 7.7% of this cohort had associated syrinx. Mean angles of retroversion and retroflexion were 76 and 78 degrees respectively. Retroflexion grades included (9.2% grade-1, 35% grade-2, and 52.3% grade-3). Pb-C2 distance was 6.8 mm.

Mean age of operated cohort was 11.3 years (M:F 21:40). Mean cerebellar tonsillar length below McRae's line was 15 mm. 45.9% of this cohort had associated syrinx. Mean angles of retroversion and retroflexion were 73 and 74.5 degrees respectively. Retroflexion grades included (4.9% grade-1, 16.5% grade-2, and 78.6% grade-3). Pb-C2 distance was 6.9 mm.

No difference was observed in measured parameters between groups with and without FMD revision or CSF diversion.

CONCLUSION: Operated Chiari-1 cohort had more retroverted and retroflexed dens with longer tonsillar length compared to non-operated cohort.

Keywords: Chiari Malformation, Dens, Foramen Magnum Decompression, Retroflexion, Retroversion

FL-020

New Technology

A service evaluation on the use of chest-sited intraventricular access devices for the infusion of cerliponase alfa in Batten disease at a single tertiary UK paediatric centre

Jack Read¹, Aimee Donald², Stephanie Rhead², Lervia Moo², Gabrielle Chan², Fiona Heap², Simon Allan Jones², Dipak Ram², Ian Kamaly Asl²

¹University of Exeter Medical School, College of Medicine and Health, University of Exeter

²North of England Batten's Service, Royal Manchester Children's Hospital & University of Manchester, Manchester, United Kingdom

OBJECTIVE: Cerliponase alfa is an enzyme replacement therapy to treat neuronal ceroid lipofuscinosis type 2. This is achieved through direct intraventricular infusions on a two-weekly basis via intraventricular access devices. Typically, these are head-sited devices, in this report we describe the use of subcutaneous tunnelled chest-sited access devices.

MATERIAL AND METHODS: We prospectively documented incidents, incidents, complications and access frequency in chest-sited and head-sited devices over one year. Families and nurses were surveyed regarding sedation, distraction, access, securing, satisfaction, and device preference. Comparison was made between chest-sited and head-sited devices regarding these factors.

RESULTS: Among 17 patients, 16 completed the questionnaire (10 chest-sited, 6 head-sited). Sedation was used by 10% of chest-sited patients vs 50% of head-sited patients, all finding it very effective. Distraction techniques were utilised by 66.67% of chest-sited and 80% of head-sited patients, with 72.73% finding them very effective, especially singing, technology, and play. Families reported equal ease of access and device securing in both groups, expressing equal satisfaction. Among patients with experience with both types, 50% preferred chest-sited devices while 50% had no preference. In the nursing questionnaire, significant differences were observed between chest-sited and head-sited groups. Chest-sited devices were deemed easier to access ($p=0.0308$), secure ($p<0.0001$), and elicited higher satisfaction levels ($p<0.0001$). There was no significant difference in overall satisfaction among specific devices ($p=0.2631$). Access success rates were better with chest-sited compared to head-sited devices ($p=0.0128$). Incident and complication rates were similar between head-sited and chest-sited devices ($p=0.4389$). There was no difference in device survival between chest and head sited ports ($p=0.4492$).

CONCLUSION: The study suggests chest-sited access devices offer benefits like reduced sedation, easier access, better device securing, higher access success rates, and greater nursing satisfaction. Both devices have similar survival, incident and complication rates and we conclude that chest-sited devices are a safe and effective alternative in this setting.

Keywords: Batten disease, CLN2, Intraventricular access, subcutaneous chest sited devices

FL-021

New Technology

Development and validation techniques for machine learning outcome prediction in post-operative paediatric brain tumours; a step towards personalised medicine?

Catherine Pringle¹, Stavros Stivaros¹, Ian Kamaly Asl¹, John Paul Kilday¹, Andrew Brass², Martin Fergie²

¹Department of Paediatric Neurosurgery, Royal Manchester Children's Hospital, Manchester, UK

²Division of Informatics, Imaging and Data Science, University of Manchester, Manchester, UK

OBJECTIVE: Paediatric brain tumours represent one of the most common causes of childhood malignancy and remain the leading cause of cancer related death in children. The provision of personalised outcome prediction within this cohort of children has great importance with regards to our future ability to determine individualised medical approaches to their care, follow-up and treatment regimens.

Our objective was to assess the performance of differing machine learning methodological approaches for the development of relapse predictive models and identification of novel potential predictive factors in post-operative paediatric brain tumour patients.

MATERIAL AND METHODS: Integration of clinical, histological, biological, surgical and imaging data into a single data repository from which multiple machine learning paradigms could be trialled and evaluated. The study end point was radiological evidence of disease recurrence or progression. Model performance was evaluated using the Concordance Index.

RESULTS: Outcome prediction modelling in 113 paediatric posterior fossa tumours demonstrated that CoxNet L1 and L2 approaches yielded the best success in integrating data and providing one-year outcome prediction for relapse. Refining variable selection to known predictive outcome factors of age, GTR, metastatic status then created a concordance index of 0.63 (95% CI 0.54-0.72) which was improved to 0.72 (95% CI 0.62-0.81) with the addition of advanced metric MRI and tumour molecular data.

CONCLUSION: The application of machine learning modelling to such amalgams of data generated from a small data cohort such as paediatric brain tumour has potential promise in providing outcome prediction beyond that of current clinical predictors alone. This work suggests that such approaches, when refined and expanded with increasing patient numbers, may be the building blocks for future personalised medicine system that can be translated into clinical practice.

Keywords: artificial intelligence, machine learning, paediatric brain tumours, paediatric neuro-oncology, outcome prediction

FL-022

New Technology

Exoscope Efficacy and Feasibility in Pediatric Spinal Neurosurgery: A Single-Institution Cohort Case Series

Conor Cunningham, Noah Lee Ahmad Nawabi, Brian Fabian Saway, Mohammad Mahdi Sowlat, Matheus Pereira, Zachary Hubbard, Orgeest Lajthia, Guilherme Porto, Sunil Patel, Libby Kosnik Infinger, Ramin Eskandari

Department of Neurosurgery, Medical University of South Carolina, Charleston, SC, USA

OBJECTIVE: The exoscope has emerged as an efficacious microscope in adult spinal neurosurgery providing improved operative field visibility and surgeon ergonomics. However, outcome data and feasibility are underrepresented in the pediatric literature. We present the largest case series aimed at assessing operative and clinical outcomes in pediatric patients undergoing various exoscope-assisted spinal surgeries.

MATERIAL AND METHODS: A retrospective review was conducted on all consecutive pediatric (age <18 years) spinal surgeries performed with the use of an exoscope by 3 senior surgeons at a single institution from 2020-2023. Demographics and clinical and operative outcomes were reviewed and analyzed.

RESULTS: Ninety-six exoscope-assisted pediatric spine surgeries were performed on 89 unique patients, 41 (42.7%) of which were male. The mean age at surgery was 12 (± 5.3) years. Spinal cord detethering (55.8%) was the most common procedure performed. The overall mean operative time for all procedures was 155 (± 86) minutes, and the mean estimated blood loss was 18 (± 41) mL. The mean length of stay was 5.4 (± 6.5) days. There were 14 (14.6%) patients with complications in this cohort. At final follow-up, 64 (83.1%) of symptomatic patients reported neurologic symptom improvement.

CONCLUSION: Using the exoscope in a variety of pediatric spinal surgeries resulted in an acceptable average operative time, estimated blood loss, length of stay, and rate of neurologic symptom improvement. The exoscope appears to be an efficacious option for pediatric neurosurgical spinal procedures.

Keywords: Ergonomics; Exoscope; Neurosurgery; Pediatric; Spine; Tethered cord; Visualization.

FL-023

New Technology

Revolutionizing Pediatric Neurosurgical Planning with High-Resolution Mixed Reality: Beyond the Conventional in Craniopagus Twins Separation

Ali Rezaei Haddad, Noor Ul Owase Jeelani

Developmental Biology & Cancer Dept, University College London, London, United Kingdom

OBJECTIVE: This study aims to transcend traditional augmented reality (AR) limitations by showcasing a high-resolution, on-device rendering mixed reality technique for complex pediatric neurosurgical cases, focusing on craniopagus twins separation. This method is distinguished by its unparalleled interactivity, rendering smoothness, and the ability to handle intricate anatomical details in real time, using natural human hand gestures that are intuitive to surgeons. This approach seeks not only to enhance visual clarity but also to streamline the surgeon's interaction with digital information as seamlessly as if interacting with the physical world.

MATERIAL AND METHODS: Leveraging the capabilities of mixed reality technology, Unity engine, and FDA-approved segmentation algorithms, we introduced a bespoke mixed reality application specifically designed for neurosurgical planning. This application transformed DICOM scans of patients with craniofacial deformities and craniopagus twins into interactive, high-fidelity holographic models. Our breakthrough technique, featuring on-device rendering, eliminates the dependence on external computing resources, ensuring seamless, high-resolution visualizations that respond in real time to surgeon interaction, particularly through natural hand gestures.

RESULTS: Our methodology culminated in the creation of holographic 3D models within 30 hours, showcasing unprecedented detail and no observable latency, thus facilitating a natural and immersive interaction with complex anatomical structures. Surgeons were empowered to explore and simulate surgical strategies with a level of precision and clarity not previously achievable, significantly enhancing preoperative planning and strategy formulation.

CONCLUSION: The introduction of a bespoke, on-device, high-resolution mixed reality application for surgical planning represents a paradigm shift in pediatric neurosurgery. By delivering a level of detail and interactivity that surpasses existing AR methods, this approach not only streamlines the surgical planning process but also elevates the standard of care for the most challenging neurosurgical cases. Our findings underscore the transformative potential of this technology in improving surgical outcomes and patient care, heralding a new era of precision and efficiency in pediatric neurosurgery.

Keywords: pediatric neurosurgery, mixed reality, high-resolution visualization, craniopagus twins, surgical planning

FL-024

New Technology

Medical Education and Technology: Brain Surgery Training with Avatars

Giselle Coelho¹, Willian David Freeman², Leslie V. Simon³, Rabih Tawk², Matheus Vasconcelos¹, Victor Hugo Benalia⁴, Michael C. Dewan⁵, Benjamin Warf⁶

¹Department of Neurosurgery Santa Casa de Misericórdia de São Paulo Hospital, São Paulo; Brazil

²Department of Neurological Surgery, Neurology and Critical Care, Mayo Clinic, Jacksonville, FL,

³Department of Emergency Medicine; Mayo Clinic, Jacksonville, FL, USA

⁴Department of Neurosurgery Baptist Hospital, Jacksonville; USA

⁵EDUCSIM, Inc. Sao Paulo, SP; Brazil

⁶Department of Neurosurgery Boston Children's Hospital, Boston; MA, USA

OBJECTIVE: INTRODUCTION: Hydrocephalus has a high incidence in children, caused by the accumulation of fluid in the cerebral ventricles. In general, 6,000 children develop hydrocephalus annually during the first 2 years of life, (50% of hydrocephalus cases is

congenital). Neurosurgical treatments can be: shunt placement or neuroendoscopy. Almost all shunts (or ventriculoperitoneal shunts) will fail at least once (usually several times) over the years. The neuroendoscopic treatment is a procedure that reestablishes the normal drainage of the cerebrospinal fluid within the brain, creating a new fluid pathway. However, this technique requires specialized training. Mixed simulation is a methodology for training healthcare professionals through the use of advanced educational technology. **OBJECTIVE:** Apply the mixed simulation to train neurosurgery residents to perform Neuroendoscopy in Amazon region in Brazil.

MATERIAL AND METHODS: The training consisted to combine the physical baby simulator and the professor avatar. The realistic simulator presents hydrocephalus, veins, arteries and bleed effect. The avatar was created after capturing the movements of the professor Benjamin Warf (renowned professor, flexible neuroendoscopy creator), it was also equipped with an artificial intelligence database (being able to answer questions in Portuguese and English). Trainees trained using mixed simulation, were evaluated by senior neurosurgeons.

RESULTS: Nine trainees were evaluated exhibited development and enhancement in surgical skills, which were deemed significant for additional training. Moreover, it was noted that the likelihood of any individual error significantly diminished following each training session, with an average decrease of 41.65% (ranging from 38.7% to 45.6%).

CONCLUSION: The training based on practical experiences with physical and avatar models can reduce the learning curve in a safe way.

Keywords: Mixed Reality; Avatar; Neurosurgery Education; Learning Curve

FL-025

New Technology

Evaluation of the use of a non-invasive MR technique (Time-STAMP) for clinical management of abnormal cerebral spinal fluid circulation in a pediatric population

Madison Gutierrez¹, Isabel Torres², Joseph Ha³, Jacob Al Husseini³, Stefan Blüml², Peter Chiarelli³, J. Gordon McComb³

¹Department of Neurosurgery, Children's Hospital Los Angeles, Keck School of Medicine, University of Southern California, Los Angeles, USA; Rudi Schulte Research Institute, Santa Barbara, USA

²Department of Radiology, Children's Hospital Los Angeles, Keck School of Medicine, University of Southern California, Los Angeles, USA; Rudi Schulte Research Institute, Santa Barbara, USA

³Department of Neurosurgery, Children's Hospital Los Angeles, Keck School of Medicine, University of Southern California, Los Angeles, USA

OBJECTIVE: Abnormal cerebral spinal fluid (CSF) circulation at the cranio-cervical junction (CCJ) and aqueduct of Sylvius (AS) are encountered with some frequency in a pediatric population. Being able to determine CSF flow non-invasively at these two locations and the need for or result of surgical intervention requires monitoring. This report evaluates the clinical usefulness of Time-STAMP.

MATERIAL AND METHODS: A record review was undertaken to identify all patients who had Time-STAMP studies to identify CSF flow at the CCJ or AS.

RESULTS: Record review identified 102 pediatric patients with Chiari malformations and 73 with evaluation pre- and/or post- endoscopic third ventriculostomy (ETV) in which Time-STAMP imaging was performed. Out of a total of 175 patients, 147 (84%) obtained interpretable Time-STAMP studies of which 130 (88%) had evidence in the

medical records that Time-STAMP aided in making the decision for surgical intervention or to observe, and in determining the outcome of CCJ decompression or ETV. No patients were identified in which Time-STAMP interpretation was contradicted by later follow-up studies resulting in a management change.

CONCLUSION: Using the noninvasive MR Time-STAMP technique to visualize CSF movement at the CCJ or AS is valuable for managing patients with abnormal CSF flow at these locations.

Keywords: Hydrocephalus, MR imaging, Chiari malformation, Aqueduct of Sylvius, endoscopic third ventriculostomy, cerebrospinal fluid flow

FL-026

Dysraphism

Factors affecting retethering following surgery for spinal cord lipomas

Shibu Vasudevan Pillai, Madhusudhan Bharatwaj
Department of Neurosurgery, Narayana Health, Bangalore, India

OBJECTIVE: This study aims to analyze the factors that can influence retethering following spinal cord lipoma surgery.

MATERIAL AND METHODS: We did a retrospective analysis of spinal cord lipomas in children operated at a single institution between 2012 and 2023. During the follow-up period, the entire cohort was split into those who developed symptoms of retethering and those who did not. The symptom free survival for each lipoma type and extent of resection (complete, near total-small layer left on cord or roots, and partial) were analyzed using Kaplan Meier Analysis. Factors like sex, age, redo cases, preoperative symptoms, intraoperative motor evoked potential findings, type of dural closure and placode reconstruction (neurulation) were analyzed for their role in retethering using univariate and multivariate cox regression analysis.

RESULTS: Seventy-two children (33 transitional, 25 dorsal, 5 terminal and 9 chaotic lipomas) were analyzed. Seven were redo surgeries. The follow-up period ranged from 2 to 144 months. Fifty-six (77.7%) underwent total excision, 10(13.8%) underwent near total and 6(8.3%) were partially resected. During follow-up, 7 children (9.72%) developed new onset bladder/ bowel or motor deficits suggestive of cord retethering. The overall progression free survival for a 10-year follow-up from motor decline is $93.4\% \pm 5.2$ and bladder/bowel decline is $81.9\% \pm 5.2$. Retethering was more likely in Chaotic lipomas compared to other lipoma types ($p=0.001$) and following partial rather than complete or near total resection ($p=0.05$). Retethering developed in 7.40% of neurulated versus 16.60% non-neurulated cases; and in 8.16% with graft assisted dural closure versus 13.04% with primary dural closure.

CONCLUSION: The main factors associated with cord retethering following surgery for spinal cord lipomas are chaotic type of lipomas, and partial resection of the lipoma during initial surgery. Although, graft assisted dural closure and neural placode reconstruction were associated with lower risk of retethering, these factors were not statistically significant.

Keywords: spinal cord lipoma, retethering, causative factors

FL-027

Dysraphism

Assessment of Ventricular Size and Neurocognitive Outcomes in Children with Post-Natal Closure of Myelomeningocele

Grace Y Lai¹, Gina B Pfeiffle², Heidi Castillo³, Joyce Harvey⁵, Caroline Farless⁵, Taron Davis², Jonathan Castillo³, Nalin Gupta⁴

¹Department of Neurosurgery, Division of Pediatric Neurosurgery, University of Nebraska Medical Center, Children's Nebraska, Omaha NE USA

²Department of Pediatrics, Division of Developmental Medicine, University of California San Francisco, Benioff Children's Hospital, San Francisco, CA USA

³Department of Developmental Pediatrics, University of Nebraska Medical Center, Children's Nebraska, Omaha, NE USA

⁴Department of Neurosurgery, Division of Pediatric Neurosurgery, University of California San Francisco, Benioff Children's Hospital, San Francisco, CA USA

⁵UCSF Benioff Children's Hospital, San Francisco, CA USA

OBJECTIVE: To assess if ventricular size prior to shunting is correlated with neurodevelopmental outcomes in children with post-natal myelomeningocele closure.

MATERIAL AND METHODS: A retrospective review of medical records at a single institution was performed on children who had post-natal myelomeningocele closure and neuropsychological testing between 2018-2023. The frontal-occipital horn ratio (FOHR) was measured immediately prior to shunt placement, or on the first imaging study that reported ventricular stability for non-shunted patients. The primary outcome was Full Scale IQ (FSIQ) on the Weschler Intelligence Scale appropriate for the patients' age. Secondary outcomes included indices of the Weschler scale, the Global Executive Composite from the Behavior Rating Inventory of Executive Function – Second Edition, and the General Adaptive Composite from the Adaptive Behavior Assessment Scale – Third Edition. Uni- and multi-variable regression was used to determine if FOHR was correlated with neuropsychological scores.

RESULTS: Forty patients met inclusion criteria, of which 26 (65%) had shunted hydrocephalus. Average age at neuropsychological testing was 10.9 ± 0.6 years (range 4.8-16.9). The FOHR was greater in the shunted group (0.64 vs 0.51, $p < 0.001$). There were no differences in neuropsychological test results between the shunted and non-shunted groups. On multi-variate analysis, however, greater FOHR was associated with lower FSIQ ($p=0.025$) and lower Visual Spatial Index (VSI) scores ($p=0.013$), which remained significant after controlling for gestational age at birth, lesion level, shunt status, and shunt revision status.

CONCLUSION: A greater FOHR was correlated with lower scores on the FSIQ and the VSI of the Weschler Intelligence Scales. Larger studies will be needed to further explore the relationship between ventricle size, hydrocephalus, and neurodevelopmental outcomes.

Keywords: myelomeningocele, hydrocephalus, neurodevelopment, functional outcome, ventriculomegaly, spina bifida, ventriculoperitoneal shunt

FL-028

Dysraphism

Retethering risk in pediatric spinal lipoma of the conus medullaris

Toshiaki Hayashi

Department of Neurosurgery, Miyagi Children's Hospital, Sendai, Japan

OBJECTIVE: Lipoma of the conus medullaris (LCM) causes neurological symptoms known as tethered cord syndrome (TCS). The symptoms can be seen at diagnosis and during long-term follow-up. In this report, pediatric LCM cases that underwent untethering surgery under the policy of performing surgery if diagnosed regardless of symptoms were retrospectively reviewed to evaluate long-term surgical outcomes.

Possible risk factors for retethered cord syndrome (ReTCS) were evaluated in the long-term follow-up period.

MATERIAL AND METHODS: A total of 51 consecutive pediatric patients with LCM who underwent first untethering surgery and were followed for more than 10 years were retrospectively analyzed. The surgery was performed with a partial removal technique. Pre- and postoperative clinical and radiological data were reviewed to analyze the outcomes of surgery and identify potential risk factors for ReTCS. **RESULTS:** During follow-up, 12 patients experienced neurological deterioration due to ReTCS. The overall 10-year and 15-year progression-free survival rates were 82.3% and 75.1%, respectively. On Univariate analysis, lipoma type of Lipomyelomeningocele (OR: 11, 95%CI: 2.50-48.4, P=0.0014), age at surgery (OR: 0.41, 95%CI: 0.14-1.18, P=0.0070), and mean growth rate after surgery (OR: 2.00, 95%CI: 1.12-3.41, P=0.0040) were significant factors associated with ReTCS. Cox proportional hazard models showed that lipoma type of lipomyelomeningocele (HR: 5.16, 95%CI: 1.54-20.1, P=0.010) and mean growth rate after surgery (HR: 1.88, 95%CI: 1.00-3.50, P=0.040) were significantly associated with the occurrence of ReTCS.

CONCLUSION: The more complex lesions and high growth rate after surgery seem to increase the risk of ReTCS. Considering that the highest growth rate is seen in infancy, to avoid prophylactic surgery in infancy for a complex LCM with a high risk of adhesion may be a good option. However, the dilemma is that TCS symptoms in infancy are not always easy to diagnose, including via urodynamic evaluations.

Keywords: Conus medullaris, Retethering, Spinal lipoma, surgical treatment

FL-029

Hydrocephalus and Neuro

Correlation of Ventricular Anatomical Variants in Hydrocephalus Patients After Myelomeningocele Repair During ETV and CPC Procedures Using FIESTA-C/CISS MRI

Mohamed Badran

Neurosurgery Department, Mansoura University Hospitals, Mansoura University Faculty of Medicine, Mansoura, Dakahlia, Egypt.

OBJECTIVE: Hydrocephalus following myelomeningocele repair is commonly associated with variable intracranial anomalies, which can lead to an increase in the morbidity associated with the management of hydrocephalus by endoscopic third ventriculostomy (ETV) and/or choroid plexus cauterization (CPC). The purpose of this study was to determine the sensitivity of FIESTA-C/CISS MRI in detecting anatomical variants that could have surgical implications during ETV and CPC, aiming for appropriate case selection to improve the outcome of ETV and CPC in this group of patients.

MATERIAL AND METHODS: A prospective study was conducted over a three-year period on 23 patients with hydrocephalus following myelomeningocele repair. All patients underwent FIESTA-C/CISS MRI before ETV and/or CPC. Anomalies in the intraventricular pathway of ETV or CPC were assessed and compared to previous MRI findings to evaluate its sensitivity.

RESULTS: All patients included in the study had a mean age of 3.23 ± 1.1 months. There were 11 males (47.8%) and 12 females (52.2%). One patient had agenesis of the foramen of Monro and underwent CPC, while the remaining 22 patients had ETV and CPC. Anatomical variants of the lateral and third ventricles were recorded during endoscopy and compared with MRI readings. The sensitivity of FIESTA-C/CISS MRI for detecting anatomical variants was as follows: body of the fornix (52.2%), septum pellucidum (82.6%), foramen of Monro (91.3%), third ventricle size (90.9%),

massa intermedia (86.8%), thickness of the floor of the third ventricle (86.4%), inclination (90.9%), prepontine space size (100%), and presence of arachnoid membranes (81.8%).

CONCLUSION: Intraventricular and CSF-related anatomical variants can be detected by FIESTA-C/CISS MRI studies when applied before endoscopy. Due to the high sensitivity of FIESTA-C/CISS MRI, the application of this data provides prospects for surgical planning and increases the success rate of ETV and/or CPC.

Keywords: Hydrocephalus, Myelomeningocele, FIESTA MRI, ETV.

FL-030

Hydrocephalus and Neuro

ETV v/s Ventriculoperitoneal shunt for management of tubercular meningitis with hydrocephalus in pediatric population: A Randomised control study

Monica Narayanaswamy, Ajay Choudhary

Department of Neurosurgery, ABVIMS and Dr. Ram Manohar Lohia Hospital, New Delhi, India

OBJECTIVE: 1. To compare safety and efficacy of ETV versus VP shunt in the treatment of hydrocephalus in TBM.

2. To assess clinical and radiological profiles of patients with TB Meningitis that would be better suited to either VP shunt or ETV.

MATERIAL AND METHODS: This study was a single center randomized prospective study on 60 patients of TBM hydrocephalus in the pediatric age group (less than 18 years of age). Patients included in the study were randomized to undergo either VP shunt or ETV. Both groups were followed up for a minimum of 5 months and assessed for success and failure rates as well as procedural complications and neurologic sequelae.

RESULTS: 30 patients underwent ETV with a success rate of 63.3% with 6 out of 11 failures occurring within the first 16 days after surgery (median Time to Failure – 3 days). In the VP shunt group, there was a success rate of 60.05% and a median time to failure of 50 days. Modified Vellore Grading was found to be a significant factor in determining outcome in both ETV and VP shunt groups with High grade TBM consistently associated with poor outcome (OR=4.2).

CONCLUSION: ETV can be performed effectively in young children including infants, as well as those with communicating hydrocephalus, high CSF cell counts and protein levels with a lower rate of failure than that of VP shunt. Hence ETV should be attempted as the first choice CSF diversion procedure in hydrocephalus secondary to TBM where technical expertise and experience with this procedure is available as it avoids the myriad of life-long complications associated with shunts like multiple shunt revisions in patients with TBM which is inevitable due to the nature of the disease

Keywords: 1. ETV 2. VP SHUNT 3. Tuberculous Meningitis

FL-031

Hydrocephalus and Neuro

Treatment of hydrocephalus following fetal repair of myelomeningocele: comparing endoscopic third ventriculostomy with choroid plexus cauterization (ETV/CPC) to ventricular shunting (VPS)

Joseline Haizel Cobbina¹, Justine Izah², Shilin Zhao³, E. Haley Vance¹, Michelle Dunlap⁴, Stephen Gannon⁴, Campbell Liles¹, Aaron M Yengo Kahn⁵, Matthew E. Pontell⁶, Robert P Naftel¹, John C. Wellons¹, Michael C Dewan¹

¹Department of Neurosurgery, Vanderbilt University Medical Center, Nashville, Tennessee, USA

²Meharry Medical College, Nashville, Tennessee, USA

³Department of Biostatistics, Vanderbilt University Medical Center, Nashville, Tennessee, USA

⁴Surgical Outcomes Center for Kids, Monroe Carell Jr Children's Hospital at Vanderbilt University Medical Center, Nashville, Tennessee, USA

⁵Department of Neurosurgery, University of Utah, Salt Lake City, Utah, USA

⁶Division of Pediatric Plastic Surgery, Monroe Carell Jr. Children's Hospital at Vanderbilt, Nashville, Tennessee, USA

OBJECTIVE: To compare clinical and craniometric outcomes of patients treated for hydrocephalus following fetal myelomeningocele repair (fMMR) via ventricular shunt (VPS) or endoscopic third ventriculostomy with choroid plexus cauterization (ETV/CPC).

MATERIAL AND METHODS: This was a retrospective cohort study of children treated for hydrocephalus via ETV±CPC or VPS following fMMR at Vanderbilt between 2012-2021. The primary outcomes were treatment failure and time-to-failure (TTF). Secondary outcomes included changes in hydrocephalus metrics and healthcare resource utilization.

RESULTS: Among 88 patients who underwent fMMR, 37 (42%) required permanent CSF diversion out of which 19 received treatment at Vanderbilt. Twelve patients underwent ETV±CPC, and 7 underwent VPS at a median corrected gestational age of 23 weeks vs 1 week, respectively ($p=0.002$). The preoperative median head circumference (HC) percentiles (99.5 vs 94.0, $p=0.006$) and z-scores (2.33 vs 1.56, $p=0.006$) for the ETV±CPC cohort was larger than that of the VPS cohort. At 6 months postoperatively, the median HC percentile (98.0 vs 50.0, $p=0.023$) and z-score (2.05 vs 0.00, $p=0.021$) for the ETV±CPC cohort was significantly larger than the VPS cohort. There was no difference in Δ FOHR between the cohorts 6 months after the index procedure ($p=0.37$). 86% of VPS patients required shunt revision with a median TTF of 9.8 months. 17% of ETV±CPC patients required a redo ETV at 17.5 months. The median number of hydrocephalus-related hospital readmissions was significantly lower in the ETV±CPC cohort than VPS cohort ($p=0.006$). The ETV±CPC cohort had fewer CT scans ($p=0.004$) and X-rays ($p<0.001$) than the VPS cohort.

CONCLUSION: In a single-center cohort, hydrocephalic fMMR patients treated via ETV±CPC remained shunt-free, while majority of patients receiving an up-front shunt required revision. This is the first study comparing ETV±CPC to VPS in the fMMR hydrocephalus population. While larger, multicenter studies are needed, these results suggest ETV/CPC may be a preferred means of CSF diversion following fMMR.

Keywords: hydrocephalus, myelomeningocele, ETV/CPC, fMMR, VPS, time-to-failure

FL-032

Hydrocephalus and Neuro

Evaluating a standardised algorithm for the management of post-haemorrhagic hydrocephalus in preterm infants

Saniya Mediratta¹, Malak Mohammed¹, Sebastian Toescu¹, William Dawes¹, Greg James¹, Owase Jeelani¹, Dulanka Silva¹, Zubair Tahir¹, Dominic Thompson¹, Martin Tisdall¹, Aswin Chari¹, Cristine Sortica Da Costa², Kristian Aquilina¹

¹Department of Neurosurgery, Great Ormond Street Hospital, London, UK

²Department of Neonatology, Great Ormond Street Hospital, London, UK

OBJECTIVE: Posthemorrhagic hydrocephalus (PHH) related to prematurity is now the commonest cause of hydrocephalus in neonates. PHH has been shown to have poorer neurodevelopmental outcomes than other aetiologies of hydrocephalus. There is large variation in current practice for treatment of PHH, with no consensus on type, timing or indication for temporising device and permanent CSF diversion. This study aims to evaluate a standardised protocol utilised at a tertiary paediatric neurosciences unit.

MATERIAL AND METHODS: A retrospective case series of all patients transferred to Great Ormond Street Hospital for PHH between August 2012 and January 2024 was conducted. Neonates were managed according to a standardised protocol. The indication for VSG was persistent ventricular index above the 97th centile plus 4mm despite 2 lumbar punctures with recommended drainage of 10mls/kg of CSF. **RESULTS:** 113 preterm infants received a VSG shunt in this period. 11 of these had neuroendoscopic lavage at the time of VSG insertion and were therefore excluded from the analysis. 61.6% of patients were male. 97% of VSGs were inserted for grade III or IV IVH. The median gestational age and weight at VSG shunt insertion were 31+0 weeks (IQR 29+1 – 32+3) and 1175g (IQR 965-1455) respectively. 76.5% of patients required permanent CSF diversion with a ventriculoperitoneal (VP) shunt, and of these, 42% required at least 1 VP shunt revision during follow-up (median follow-up of 5.4 years). The mean time from VSG to VP shunt insertion was 82.3 days. The median number of VP shunt revisions was 1.

CONCLUSION: A streamlined, standardised algorithm for management of PHH optimises care and encourages early referral, helping to facilitate early intervention and potential recruitment to clinical trials.

Keywords: Post-haemorrhagic hydrocephalus, subgaleal shunt, ventricular index

FL-033

Hydrocephalus and Neuro

Comparative Efficacy of Ventriculosubgaleal Shunt Versus Ventricular Reservoir in Achieving Shunt Independence for Infants with Post-Hemorrhagic Hydrocephalus by Six Months

Lucinda Chiu MD¹, Syed Khalid MD², Jonathan Scoville MD, MPH³, Sandi Lam MD, MBA³

¹Department of Neurological Surgery, Rush University Medical Center, Chicago IL USA

²Department of Neurological Surgery, University of Illinois at Chicago, Chicago IL USA

³Department of Neurological Surgery, Northwestern University Feinberg School of Medicine, Division of Pediatric Neurosurgery, Ann and Robert H. Lurie Children's Hospital, Chicago, IL, USA

OBJECTIVE: Low-birth weight, premature infants often have severe intraventricular hemorrhage (IVH), which can progress to post-hemorrhagic hydrocephalus (PHH), requiring temporary, or even permanent, cerebrospinal fluid diversion. Initial temporizing management of PHH includes placement of a ventriculosubgaleal shunt (VSGS) or ventricular access device (VAD). Studies have found similar permanent shunt conversion rates between VSGS and VAD, but were limited by sample scope and size. The rate of conversion to permanent shunt within six months post-IVH in premature infants, comparing the efficacy of VSGS and VAD, remains underexplored.

MATERIAL AND METHODS: This retrospective study used ICD-10 codes in the PearlDiver Mariner database to analyze the medical records of premature infants diagnosed with grade 3 or 4 IVH who underwent VAD or VSGS treatment. A 2:1 matching process was used to control demographics, IVH severity, degree of prematurity, and associated respiratory or gastrointestinal conditions. We assessed the

rates and odds of conversion to permanent shunts within six months, employing Kaplan-Meier plots for shunt-free probability and log-rank tests for distribution comparisons.

RESULTS: Our matched analysis included 222 infants (VAD, n=145, VSGS, n=77) and demonstrated no difference in the proportion of gender, respiratory conditions, necrotizing enterocolitis, extreme prematurity, and Grade III or IV IVH ($p>0.8$). The odds of requiring a permanent shunt were significantly lower in the VSGS group compared to the VAD group within six months (OR: 0.47, 95% CI: 0.33-0.66, $p<.001$). From day sixty onwards, Kaplan-Meier plots indicated a notable divergence in shunt-free probability within six months (Log-Rank $p<.001$). **CONCLUSION:** This study highlights a significant reduction in the need for permanent shunt placement within six months for post-IVH in premature infants who underwent VSGS versus VAD, suggesting that VSGS may be a more favorable temporizing procedure for managing PHH in this vulnerable population.

Keywords: Hydrocephalus, Premature birth, Intraventricular hemorrhage, Shunt, Reservoir

FL-034

Hydrocephalus and Neuro

Short-Term Outcomes of Endoscopic Third Ventriculostomy and Choroid Plexus Cauterization in Children with Hydrocephalus at Arusha Lutheran Medical Center in Northern Tanzania: A Retrospective Study

Kerry Alexandra Vaughan¹, Erik Mulla³, Habib Emil Rafka⁴, Cyrus Elahi¹, Saning'o John Sindila³, Jonah E Attebery⁵, Dilantha B Ellegala¹, Happiness Rabel²

¹Barrow Global, Department of Neurosurgery, Barrow Neurological Institute, Phoenix, AZ, USA

²Unit of Neurosurgery, Kilimanjaro Christian Medical Centre, Moshi, Tanzania

³Department of Surgery, Arusha Lutheran Medical Centre, Arusha, Tanzania

⁴College of Medicine Medical University of South Carolina, Charleston, SC, USA

⁵Department of Pediatrics University of Colorado Aurora, CO, USA

OBJECTIVE: Despite the progress being made in building up surgical infrastructure in East Africa, access to neurosurgical care still remains a challenge. There are over 6,000 new cases of pediatric hydrocephalus annually in Sub-Saharan Africa and only ~50 neurosurgeons to treat those cases. Traditionally, the treatment for pediatric hydrocephalus has been a ventriculoperitoneal shunt, however surgeons have revisited endoscopic third ventriculostomy with choroid plexus cauterization (ETV/CPC). There has been uncertainty surrounding the safety and efficacy of ETV/CPC for infants <1 year in LMIC settings. This study investigates the safety and efficacy of ETV/CPC at a regional hospital in Northern Tanzania.

MATERIAL AND METHODS: This is a single-center, retrospective study of short-term outcomes of ETV/CPC at Arusha Lutheran Medical Center, Tanzania. Study participants were all children ages 0-18 years old diagnosed with hydrocephalus who underwent ETV (with or without CPC) between February 2020-February 2022. We captured basic demographic data, etiology of hydrocephalus, and the endoscopic third ventriculostomy success score (ETVSS). Successful treatment was defined by avoidance of shunt from time of ETV through 3-month follow-up.

RESULTS: During the study period, we performed 54 ETVs, including 45 ETV/CPC and 9 ETVs alone. Mean age at ETV was 21.1 months (range 119.5 months). Forty-nine patients (90.7%) underwent

successful ETV, defined as not needing subsequent VP shunt. Five cases (9.3%) were complicated by major morbidity/mortality; three requiring VPS placement and two deaths due to neonatal sepsis. The majority of patients (51.9%) were <1yr old at the time of surgery. The failure rate of ETV/CPC in our patients <1yr was 8.6% (n=3) compared to 14.3% (n=2) for patients >1yr. Outcomes were significantly better for ETV+CPC patients and for those with a higher ETVSS (P value < 0.001).

CONCLUSION: In our Northern Tanzanian pediatric population, ETV +/- CPC can be safely done in children <1 year and can bypass the need for VPS in many young patients. Further research is needed evaluating long-term outcomes in these patients.

Keywords: hydrocephalus, endoscopic third ventriculostomy, global neurosurgery, choroid plexus cauterization, safety, morbidity

FL-035

Hydrocephalus and Neuro

Comparison Of Third Ventriculostomy Alone Versus With Cauterization Of The Choroid Plexus In Infants: Preliminary Results

Artur Henrique Galvao Bruno Da Cunha, Pedro Lucas Negromonte Guerra

Hospital da Restauração, Recife, Brazil

OBJECTIVE: Controversies surrounding third ventriculostomy (ETV) associated with choroid plexus cauterization (CPC) have persisted from the early 2000s to the present day. Infants in their first year are at the highest risk of both shunt dysfunction and ETV failure. In this study, the authors present the preliminary findings of a comparative study between ETV and ETV plus CPC in infants under one year of age.

MATERIAL AND METHODS: The study analyzed data from 171 patients, all of whom were under 1 year old and underwent ETV or ETV plus CPC to treat hydrocephalus caused by aqueductal stenosis between 2015 and 2023. The observation period was limited to 6 months per patient, and implanting a shunt was considered a procedure failure. The researchers used the chi-square method to compare the outcomes between the groups and identify any differences.

RESULTS: In the study, 66 patients underwent ETV only. The ages of these patients ranged from 3 to 10 months. The other 105 patients underwent ETV + CPC, with ages ranging from 2 to 11 months. The study results revealed that 66% of the patients who underwent ETV plus CPC had positive outcomes, which was significantly higher than the 36% positive outcomes in the group that only underwent ETV ($p<0.001$).

CONCLUSION: The results indicate that ETV combined with CPC is superior to ETV alone, despite the short observation period and some biases.

Keywords: Hydrocephalus, infants, third ventriculostomy, choroid plexus, ETV, CPC.

FL-036

Hydrocephalus and Neuro

Surgical management of hydrocephalus in open myelomeningocele

Benjamin Hall, Natasha Aziz, Dawn Hennigan, Benedetta Pettorini
Department of Neurosurgery, Alder Hey Children's Hospital NHS Foundation Trust

OBJECTIVE: Hydrocephalus may occur in up to a quarter of children born with open myelomeningocele (MMC) and has previously been associated with poorer quality of life compared to hydrocephalus of

other aetiology. This case-control study reviewed shunt valve variety and survival in hydrocephalus patients with MMC.

MATERIAL AND METHODS: Electronic notes were retrospectively reviewed to identify all paediatric patients undergoing shunt insertion for hydrocephalus secondary to MMC between Jan 2010 and Sep 2023. Hydrocephalus patients of alternative aetiology from the same interval were collected as controls. Data included: i) patient demographic ii) aetiology iii) valve iv) shunt survival v) shunt failure rate and vi) cause of failure.

RESULTS: 95 patients born with open MMC were included; a further 229 patients were identified as controls. Aetiology of hydrocephalus in the control group included intraventricular haemorrhage (IVH) (40.6%), tumours (11.8%) and meningitis (8.3%). MMC patients were significantly younger at time of first shunt insertion (2.6 (SD 228) vs 37.8 (SD 1809) months, $p < 0.01$).

Choice of first shunt valve did not differ significantly: 23.7% of MMC patients received programmable valves compared to 19.1% controls ($p = 0.36$). Indication for shunt revision varied: proximal catheter blockage was significantly more common in MMC patients (45.5% vs 25.6%, $p < 0.01$) though valve blockage (25.4% MMC patients vs 24.4% controls) and infection rates (23.6% vs 24.4%) were similar between groups. De novo shunt survival was significantly shorter in MMC patients compared to controls, at 46.2 months (95%CI: 36.7-55.7) vs 64.4 (95%CI: 58.1-70.8) ($p = 0.01$). 24-month shunt survival in MMC patients was 48.4% vs 62.3% in controls.

CONCLUSION: MMC patients with hydrocephalus require shunting significantly earlier than other aetiologies. An associated significantly shorter de novo shunt survival also portends an higher shunt revision rate in this complex cohort. Further subgroup analysis will be presented.

Keywords: Myelomeningocele, hydrocephalus, ventriculoperitoneal, shunt

FL-037

Hydrocephalus and Neuro

Jugular foramen stenosis in infants with external hydrocephalus
Giuseppe Cinalli¹, Giuliana Di Martino¹, Carmela Russo², Adriana Cristofano², Stefania Picariello³, Maria Allegra Cinalli⁴, Giuseppe Mirone¹, Federica Mazio², Mario Quarantelli⁵, Pietro Spennato¹, Eugenio Maria Covelli²

¹Department of Neurosciences, Unit of Neurosurgery, Santobono-Pausilipon Children's Hospital, AORN, Naples, Italy

²Department of Neurosciences, Unit of Neuroradiology, Santobono-Pausilipon Children's Hospital, AORN, Naples, Italy

³Department of Oncology, Unit of Neuro-Oncology, Santobono-Pausilipon Children's Hospital, AORN, Naples, Italy

⁴Department of Neurosurgery, Fondazione IRCCS San Gerardo dei Tintori, Monza, Italy

⁵Biostructure and Bioimaging Institute, National Research Council, Naples, Italy

OBJECTIVE: To measure the size of jugular foramina in infants affected by external hydrocephalus (EH) and in a control group to support the hypothesis that jugular foramen (JF) stenosis may determine dural venous sinus alterations and increased venous outflow resistance as the main pathophysiological factor.

MATERIAL AND METHODS: The minimum, maximum, and mean values of JF areas were measured on phase-contrast magnetic resonance venous angiographies (angio MRV PCA3D) performed on 81 infants affected by EH and compared with 54 controls.

RESULTS: A significantly smaller JF area was found in patients than in controls (43.1 ± 14.6 vs. 52.7 ± 17.8 ; $p < 0.001$), resulting in significantly smaller mean JF areas in patients than in controls (51.6 ± 15.8 vs. 57.0 ± 18.3 ; $p = 0.043$). In patients, smaller JF areas were significantly associated with higher venous obstruction grading (VOGS) both on the right ($p = 0.018$) and left side ($p = 0.005$). Positional plagiocephaly (cranial vault asymmetry index $> 3.5\%$) was more common among EH patients than among controls (38/17) without achieving significance ($p = 0.07$). Among the 38 plagiocephalic patients, the JF area was smaller on the flattened side than on the contralateral side for a significant number of patients with both right (21/7) and left (9/1) plagiocephaly ($p < 0.0005$), as was the mean area (48.2 ± 16.4 mm² vs. 57.5 ± 20.7 mm², $p = 0.002$), and the VOGS was significantly greater on the plagiocephalic side than on the contralateral side (1.6 ± 1.1 vs 1.1 ± 0.9 , $p = 0.019$).

CONCLUSION: In this series of infants affected by EH, the mean size of the ostium was significantly smaller in both JF than in the control group. JF stenosis was significantly associated with higher degrees of venous obstruction on both sides, suggesting a direct extrinsic effect of JF size on the dural sinus lumen and a possible consequent effect on venous outflow resistance. Positional plagiocephaly, when present, was associated with a decreased JF area and increased VOGS on the flattened side.

Keywords: external hydrocephalus, jugular foramen, benign pericerebral collection, venous hypertension, postural plagiocephaly, infants

FL-038

Hydrocephalus and Neuro

Why do ventricles dilate? A thermodynamic perspective

Michael Egnor¹, Liu Yang², Racheed Mani¹, Robert Kleyner¹, Susan Fiore¹, Petar Djuric²

¹Department of Neurosurgery, Renaissance School of Medicine, Stony Brook University, Stony Brook New York 11795 USA

²Department of Electrical and Computer Engineering, Stony Brook University, Stony Brook New York 11795 USA

OBJECTIVE: Our conventional understanding of the pathophysiology of hydrocephalus is that it is caused by an imbalance between formation and absorption of CSF. Ventricular dilation is due to a 'back-up' of CSF into the ventricles. Yet investigators have found that the normal pressure gradient for CSF absorption diminishes or reverses in hydrocephalus, which is inconsistent with increased resistance between the site of CSF formation and absorption. Furthermore, investigators have found that an increase in CSF pulse pressure, not distal obstruction to CSF absorption, causes ventricular dilation. Flow MRI imaging shows marked abnormalities of CSF pulsatility in hydrocephalus. There is strong evidence that abnormal CSF pulsatility, not CSF malabsorption, is the cause of hydrocephalus and of ventriculomegaly that accompanies it.

We propose a theory of intracranial thermodynamics in which the intracranial windkessel mechanism occurs by diversion of smooth power of blood flow into the capillaries and diversion of pulsatile power of blood flow through the CSF to the veins. We tested this theory on a computer model of hydrocephalus.

MATERIAL AND METHODS: We model intracranial thermodynamics using an electrical tank circuit, which accurately simulates ICP waveforms. We simulate hydrocephalus by increasing impedance to pulsatile power in the CSF pathway. We simulate ventricular enlargement by reducing impedance (i.e., increasing volume) of the CSF pathway.

RESULTS: The thermodynamic model reproduces the salient features of hydrocephalus, such as increased ventricular CSF pulse pressure and ventriculomegaly.

CONCLUSION: We propose that ventricular dilation in hydrocephalus is an active adaptive response to windkessel impairment caused by increased impedance to pulsatile power in the CSF pathways. Ventriculomegaly is not a consequence of CSF malabsorption. This thermodynamic theory is consistent with what is known about the pathophysiology of hydrocephalus, and points to new approaches to shunt design and to the management of disorders of intracranial thermodynamics.

Keywords: hydrocephalus CSF pulsatility ventriculomegaly windkessel thermodynamics

FL-039

Hydrocephalus and Neuro

Using optic nerve sheath diameter over ventricular size to assess hydrocephalus in pediatric patients with pineal region tumors

Julian Zipfel, Kevin Ferraris, Ash Singhal

Division of Paediatric Neurosurgery, BC Children's Hospital, Vancouver, Canada

OBJECTIVE: Pineal region tumors are a heterogeneous group of pathologies often symptomatic due to occlusive hydrocephalus and elevated intracranial pressure (ICP). A non-invasive technique for assessment of ICP is measuring the optic nerve sheath diameter (ONSD). Identifying patients who need immediate intervention is of importance in neurosurgical care. As elevated ICP may not always be associated with clinical signs, the adjunct of ONSD could help managing patients undergoing treatment. The goal of this study is to assess the available magnetic resonance imaging (MRI) of patients with pineal region lesions undergoing surgical treatment with respect to pre- and postoperative ONSD and frontal occipital horn ratio (FOHR) as an indicator for hydrocephalus.

MATERIAL AND METHODS: Retrospective data analysis was performed in all patients operated for pineal region lesions at a tertiary care center between 2010 and 2023. Only patients with pre- and postoperative MRI were selected for inclusion. Clinical data and ONSD at multiple time points, as well as FOHR were analyzed. Imaging parameter dynamics were correlated with clinical signs of hydrocephalus before and after surgical treatment.

RESULTS: Thirty-three patients with forty operative cases met the inclusion criteria. Hydrocephalus was seen in 80% of cases preoperatively (n=32/40). Presence of hydrocephalus was associated with significantly elevated ONSD pre- (p=0.006) and postoperatively (p=0.017). There was a significant decrease in ONSD immediately (p<0.001), at 3 months (p<0.001) and at 12 months (p<0.001). In patients without hydrocephalus, no significant changes in ONSD were observed (p=0.369).

CONCLUSION: ONSD is a useful adjunct in identification of high ICP in patients presenting with pineal region tumors and evaluation of treatment response postoperatively as well as for the evaluation of treatment failure.

Keywords: ONSD, pineal region tumors

FL-040

Hydrocephalus and Neuro

Change in Optic nerve sheath diameter (ONSD) and Optic disc elevation (ODE) in predicting Shunt failure in the Emergency department (ED) (CHOOSE study)

Adrienne L Davis¹, Mark Tessaro¹, Suzanne Schuh¹, Magali Gauthey², Sara Breitbart³, Maya Sumaida⁴, Onaiza Zahid⁵, Helen Branson⁶, Suzanne Laughlin⁶, Brian W Hanak⁷, Abhaya V Kulkarni³

¹Division of Emergency Medicine, Hospital for Sick Children, University of Toronto, Toronto, ON, Canada

²Department of Pediatrics, Hopital de la Tour, Geneva, Switzerland

³Division of Neurosurgery, Hospital for Sick Children, University of Toronto, Toronto, ON, Canada

⁴Department of Pediatrics, Alberta Children's Hospital, Calgary, AB, Canada

⁵Department of General Practice, University Hospitals Sussex, NHS Foundation Trust, East Sussex, England

⁶Division of Paediatric Neuroradiology, Hospital for Sick Children, University of Toronto, Toronto, ON, Canada

⁷Department of Neurosurgery, Loma Linda University Health, Loma Linda, CA, USA

OBJECTIVE: In shunted children 0-18 years of age, presenting to the ED with query shunt failure, to determine if change in optic nerve sheath diameter from prior asymptomatic baseline (Δ ONSD) predicts shunt failure* as determined in the operating room by the treating Neurosurgeon. Shunt failure defined as: obstructed ventricular catheter, fractured shunt tubing, or shunt migration out of the ventricle.

MATERIAL AND METHODS: Prospective cohort study in a tertiary care children's hospital. Baseline ocular point-of-care ultrasound (POCUS), by trained ED and neurosurgery staff were performed on asymptomatic shunted children attending clinic. Patients with comorbid eye pathology were excluded. A 2nd POCUS was performed if presenting to the ED with symptoms of failure. Shunt failure (primary outcome) was defined as complete/partial obstruction of 1+ components of the shunt, fracture or migration, determined intraoperatively, blinded to POCUS findings. A sample size of 73 paired scans achieved 80% power to detect a mean of paired differences of 0.5mm (σ of 1.5, 2-sided α of 5%). Logistic regression was used to determine the odds of failure associated with an increase in ONSD by 1mm.

RESULTS: 76 pairs of scans were completed on 58 patients and 18% (14/76) had shunt failure. Δ ONSD was significantly associated with shunt malfunction: OR 35.4 (95%CI 6.49–327.77), p<0.001, while Δ ODE was not: OR 6.21 (95%CI 0.32–149.20), p=0.234. Δ ONSD AUROC was 0.86 with an ideal cutoff of \geq 0.4mm (Sensitivity 93%, Specificity 73%). Δ ONSD was also associated with +CT/MRI (increased ventricle size, periventricular interstitial edema, or effacement of cortical sulci): OR 8.3 (95%CI 2.32–29.77), p=0.001.

CONCLUSION: Δ ONSD is associated with shunt failure and +CT/MRI in our sample of children with ventricular shunts, while Δ ODE is not. Further research is warranted to confirm findings in a larger, multisite sample and determine whether Δ ONSD positively contributes to clinical prediction rules for pediatric shunt failure.

Keywords: Ventricular shunt failure, point-of-care ultrasound, optic nerve sheath diameter, hydrocephalus, emergency department

FL-041

Hydrocephalus and Neuro

Endoscopic Management of Pediatric Complex Hydrocephalus – A procedure survival analysis and clinico-radiological outcome study using Ventricular volumetry

Kevin Jude Sudevan, Dhaval Shukla, Subhas Konar, Nishanth Sadashiva

National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore, India

OBJECTIVE: To evaluate the survival of endoscopic procedures performed for complex hydrocephalus, to quantify clinical outcomes in terms of standardized scales and assess correlation with radiological outcomes using ventricular volumetry.

MATERIAL AND METHODS: A retrospective analysis of patients with complex hydrocephalus, managed with neuroendoscopic procedures at a tertiary neurosurgical centre, was performed. In addition to demographic and clinical details, pre-operative and follow-up clinical status (using the Pediatric Functional Status Score (FSS) and Pediatric Cerebral Performance Category (PCPC) Scales) was assessed. Procedure failure was defined as any subsequent surgical procedure for management of hydrocephalus, and survival as time from the first endoscopic procedure to failure or last available follow-up. Ventricular volume and ventricle: brain volume ratio were calculated on serial imaging.

RESULTS: We analyzed 40 pediatric patients with a median age of 11 months (2-96 months), the most common sub-type being post-meningitic multiloculated hydrocephalus (70%). Median survival of an endoscopic procedure was 24 months (5.7–33.6 months). Over a median follow-up duration of 15 months, 26 days (2.2–111 months), median FSS improved by 5 points and median PCPC score improved from 4 (Severe disability) to 3 (Moderate disability). Over a mean radiological follow-up of 8.5 months, the median percentage decrease in ventricle size was 27.14%, and ventricle: brain volume ratio was 30.57%. Strong positive correlation ($R = 0.58-0.75$) was noted between decrease in Ventricular volume and Ventricle: Brain ratio with improvement in FSS and PCPC scores.

CONCLUSION: Endoscopic procedures, although effective in managing complex hydrocephalus, may not be a one-stop long-term solution, which we have described in terms of procedure survival. The use of objective scales and ventricular volumetry to quantify clinical and radiological improvement enabled demonstration of a significant correlation, even in complex hydrocephalus. The potential of ventricular volumetry as a prognostic factor in complex hydrocephalus is hence postulated.

Keywords: complex, hydrocephalus, multiloculated, volumetry, endoscopy, post-meningitic

FL-042

Hydrocephalus and Neuro

Elevated systemic venous pressures as a common pathology in prepubertal pediatric idiopathic intracranial hypertension

Marianne Juhler¹, Torben Skovbo Hansen¹, Casper Schwartz Riedel², Nicolas Hernandez Norager²

¹Department of Neurosurgery, Aarhus University Hospital, Aarhus, Denmark

²Department of Neurosurgery, Copenhagen University Hospital, Rigshospitalet, Copenhagen, Denmark

OBJECTIVE: Pediatric idiopathic intracranial hypertension is a challenging and rare disease. As the nomenclature suggests, the etiology remains unknown, with multiple etiologies being investigated. This study explores the potential role of increased systemic or cerebral venous pressures as a common universal mechanism.

MATERIAL AND METHODS: A prospective observational study in accordance with the STROBE guidelines was conducted, including prepubertal children with IIH referred to the neurosurgical department. Patients underwent a comprehensive diagnostic protocol, including MRI or CT scan, continuous intracranial pressure monitoring, and endovascular venography, including venous pressure measurements.

RESULTS: 11 consecutive patients were included (six boys and five girls, age 0.7-6.1, mean BMI 18.3). Venous stenosis was found in 3 patients. The remaining eight patients had normal intracranial anatomy.

All patients had elevated venous pressures with a mean superior sagittal sinus pressure of 22 mmHg, mean internal jugular vein pressure of 18 mmHg, and mean central venous pressure of 15 mmHg. Daytime intracranial pressure averages 13.3, while nighttime ICP averages 16.8 with either A- or B-waves in 10/11 patients.

CONCLUSION: Increased systemic venous pressures were found in all patients, pointing to a possible shared cause in prepubertal IIH, offering potential new treatment avenues. Further large-scale studies are needed to confirm these findings and explore the underlying reasons for this increased venous pressure.

Keywords: IIH, prepubertal IIH, ICP, venous hypertension, pathophysiology

FL-043

Hydrocephalus and Neuro

Radiologic Signs in Endoscopic Third Ventriculocisternostomy in Non-communicating Pediatric Hydrocephalus

Davit Tatoshvili¹, Anna Tietze², Andreas Schaumann¹, Valentina Pennacchiotti¹, Ulrich Wilhelm Thomale¹

¹Pediatric Neurosurgery, Charité - Universitätsmedizin Berlin, Germany.

²Institute of Neuroradiology, Charité - Universitätsmedizin Berlin, Germany.

OBJECTIVE: Endoscopic third ventriculocisternostomy (ETV) became standard of treatment for non-communicating hydrocephalus in children. Predicting success was described to relate to age, diagnosis and a pre-existent shunt system. Radiological signs may also be relevant as predictive markers. The current study investigates radiological signs in a single center retrospective analysis for treatment success.

MATERIAL AND METHODS: During a ten-year period (2010-19) ETV interventions were collected from a single center cohort. The clinical patient characteristics and follow-up in terms of reoperations and specifically the need for shunt implantation were investigated. Radiological data was retrieved from the in-house PACS system to analyze preoperative signs of non-communicating hydrocephalus such as ventricular size, pressure gradients at the third ventricle (3rd ventricular floor, lamina terminalis and pineal recess) and any signs of obstruction (aqueductal or 4th ventricular outlet obstruction or a prepontine membrane).

RESULTS: From 136 ETV interventions 95 met the inclusion criteria (age: <18years; >6months follow-up; MR image data availability, treatment goal for shunt independence). In chi-square statistical evaluation of single parameters age >6months (OR: 32.5; range: 4.8-364), FOHR <0.56 (OR: 6.1; range: 2.2-16.3) and non-PHH as underlying diagnosis (OR: 13.1; range: 1.9-163) showed significant increased odds ratio for shunt independence. The logistic regression model for multiple parameters showed age > 6months (OR: 54.5; range: 4.9-603) together with FOHR <0.56 (OR: 9.1; range: 2.2-38), outward bulged lamina terminalis (OR: 3.8; range: 1.01-14.4) and non-4th-ventricular-outlet obstruction (4thVOO) (OR: 0.27; range: 0.08-0.94) as significant factors for ETV success.

CONCLUSION: The indication to perform an ETV does often rely on radiological signs. We found that smaller ventricular enlargement and bulged lamina terminalis were relevant radiological parameters together with age >6 months and missing 4thVOO in patients with non-communicating hydrocephalus. Similar analysis should be applied in a larger cohort of patients with multi-center approach.

Keywords: Neuroendoscopy, third ventriculocisternostomy, ETV, non-communicating hydrocephalus, shunt independence

FL-044

Hydrocephalus and Neuro

Neuroendoscopic Lavage for the Management of Neonatal Intraventricular Haemorrhage: an analysis of procedural safety and long-term outcomes

Susan Isabel Honeyman, Seán Christopher Martin, Timothy Lawrence, Amedeo Calisto, Jayaratnam Jayamohan, [Shailendra Magdum](#)
Department of Paediatric Neurosurgery, John Radcliffe Hospital, Oxford.

OBJECTIVE: Intraventricular haemorrhage (IVH) is a common complication of prematurity and optimal treatment remains uncertain. Neuroendoscopic lavage (NEL) has garnered interest as a method for removal of intraventricular haematoma, with outcomes suggesting it to be safe and potentially efficacious. To the best of our knowledge, we present the largest series to assess the outcomes from NEL, without the combined use of access devices, for the management of neonatal IVH. **MATERIAL AND METHODS:** A retrospective review was carried out, between January 2011 and November 2023, identifying infants who underwent NEL for hydrocephalus following neonatal IVH at our institution. Data was extracted on patient demographics, co-morbidities, complications, re-operation requirement and neurodevelopmental outcomes.

RESULTS: 45 patients (29M:16F) underwent NEL, with a median gestational age of 27+1 weeks (range, 23+1 to 41+0) and median birth weight of 910g (range, 480g to 3460g). A single patient had grade II IVH, 15 patients had grade III and 29 patients had grade IV disease, according to Papile grading. The median corrected age at NEL was 36+0 weeks (range, 39+5 to 61+4). The median weight at NEL was 1205g (range, 870g to 5600g). At the time of NEL, 28 patients underwent simultaneous endoscopic third ventriculostomy. The overall complications rate was 9/45 patients (20.0%). 18 patients (40.0%) required no further operations following NEL and survived independent of a shunt. We found patients who were younger and had a lower body weight at time of NEL had a statistically greater chance of shunt independence. 27 patients (60.0%) went on to require shunt insertion and for these patients the 12-month shunt survival rate was 19/27 (70.4%). **CONCLUSION:** NEL is safe and potentially efficacious treatment for neonatal IVH. The procedure may reduce shunt dependence and, for those who require CSF diversion, improve shunt survival. Neurodevelopmentally, good motor and cognitive outcome can be achieved.

Keywords: neuroendoscopic lavage, intraventricular haemorrhage, posthemorrhagic hydrocephalus

FL-045

EndoscopyNeurotrauma/Critical Care

Improving Hospital Resource Utilization through an Advanced Practice Provider-Led Pediatric Head Injury Outpatient Clinic

[Stefanie Hartman](#), Emma Hartman, Alfred Pokmeng See
Department of Neurosurgery, Boston Children's Hospital, Harvard Medical School, Boston, MA, USA.

OBJECTIVE: After initial evaluation and intervention by a neurosurgeon, head injury patients require follow up outpatient care. Advanced Practice Providers (APPs) can care for these patients at a high level, maintaining positive patient outcomes while decreasing the nonsurgical case burden on neurosurgeons. An APP-led clinic for outpatient head injury follow up was established to meet these goals. In this study, the authors evaluated hospital resource utilization before and after the

establishment of an APP-led outpatient clinic for pediatric head injury follow up.

MATERIAL AND METHODS: Charts for 691 encounters of pediatric patients with head injuries who received treatment at Boston Children's Hospital in the Department of Neurosurgery between 2017 – 2023 were reviewed for diagnosis, follow up, and billing characteristics. Patients were grouped relative to our protocol change on January 1, 2019. Hospital resource utilization was compared and analyzed. **RESULTS:** Prior to the protocol change, there were 217 unique patients with 1.16 visits each on average and after the protocol change, there were 420 patients with 1.15 visits per patient. This makeup was not significantly different ($p = 0.43$). A total of 405 patients had skull fracture listed as the primary billing code, 176 had intracranial injury, and 36 had concussion. Prior to protocol change, 20% of visits were with an APP, which increased to 73% of visits in the period after protocol change. Patients were 10 times more likely to see an APP after the intervention period (OR = 10.60, 95% CI 7.31-15.37). Length of time between discharge and outpatient follow up did not significantly change post-intervention ($p = 0.23$).

CONCLUSION: An APP-led outpatient clinic can be beneficial in managing the volume of non-emergent outpatient head injury cases and maximizing hospital resource utilization. Future efforts are warranted to improve outcomes and care efficiency for our head injury patients.

Keywords: TBI, outpatient, APP, efficiency, resource utilization

FL-046

EndoscopyNeurotrauma/Critical Care

Neurotrauma and Post-Traumatic Seizures in Pediatric Patients at an Urban Level 2 Trauma Center: A Retrospective Study

[Eric Alexander Grin](#), Aarti Kishore Jain, Asmita Mittal, Gaddah Abouzein, Hannah Weiss, Eveline Teresa Hidalgo
Division of Pediatric Neurosurgery, Department of Neurosurgery, NYU Langone Health, New York, United States of America

OBJECTIVE: Post-traumatic seizures may occur acutely or months after initial traumatic brain injury (TBI). Current guidelines recommend prophylactic anti-epileptic drugs (AEDs) in cases of moderate to severe TBI. Follow-up care is essential to monitor for neurological sequelae. We sought to describe the pediatric TBI population at an urban Level 2 trauma center and analyze clinical outcomes and neurologic follow-up.

MATERIAL AND METHODS: All patients 18 years and younger presenting with TBI and positive imaging from 2018-2024 were included. Electronic medical records were retrospectively reviewed for patient demographics, injury type, hospital course, and clinical outcomes.

RESULTS: A total of 45 TBI patients were identified (34 male) with an average age of 11.7 years. Three patients died in the emergency department. Of the surviving 42 patients, four (9.5%) had a post-traumatic seizure within 24 hours of injury. Patients who experienced seizures had a median Glasgow Coma Scale (GCS) score of 9 (range 7-15) versus a median of 15 (range 3-15) for patients who did not experience seizures. All patients who experienced seizures received loading doses of levetiracetam and underwent video electroencephalography monitoring, as did two additional patients with waxing and waning mental status. No seizure activity was recorded in the six patients monitored; the patients were discharged with seven days of prophylactic levetiracetam. Of the patients who did not experience a seizure, 25/38 (65.7%) also received prophylactic levetiracetam. All patients who had a seizure presented for follow-up with neurology within three months of discharge versus only 14/38 (36.8%) of non-seizure patients ($p < 0.05$). Of all the patients who followed-up, no patients experienced further seizures.

CONCLUSION: The use of prophylactic AEDs in patients both with and without immediate post-traumatic seizures may help prevent seizure development after TBI. Further work is needed to improve rates of neurological follow-up in pediatric TBI patients who do not experience immediate post-traumatic seizures.

Keywords: Neurotrauma, traumatic brain injury, post-traumatic seizures

FL-047

Endoscopy/Neurotrauma/Critical Care

Complexity of Skull Fractures in Children: Characteristic Features, Clinical Assessment and Imaging

Alkim Demirci¹, Toni Dimitrov Kondev², Elena Yankova Moynova², Yavor Petkov Enchev²

¹Department of Neurosurgery, University Hospital "St. Marina" Varna, Bulgaria

²Medical University of Varna, Varna, Bulgaria

OBJECTIVE: Head trauma in children is the most common cause for visiting the emergency departments, with over one million reported annually. Skull fractures in the pediatric population have a relatively high incidence. This study examines the assessment in children with head trauma and emphasizes the importance of Computed tomography (CT). While physical examination remains vital for assessing brain function, a head CT scan is crucial nowadays, revealing eventual skull fractures in patients with normal neurological status.

MATERIAL AND METHODS: This study includes a period of 3 years- from 2020 to 2023. In our neurosurgical department were hospitalized 10 trauma pediatric patients with skull fractures. The average age in the series ranges from 0 to 18 years and the male/female distribution was 2/8. All patients underwent neurological examination and CT scan.

RESULTS: Two of the patients had impression fractures, 1 had a multifragmentary depression fracture, and the remaining 6 had linear fractures. A cerebrospinal fluid (CSF) leak was observed in only one of the patients. Out of 9 patients, 6 scored perfectly (15) on the pGCS, 2 scored 14, 1 scored 7 and 1 wasn't assessed. 50% of the patients (5 out of 10) presented with hematoma. Surgery was needed in 30% of the cases (3 out of 10).

CONCLUSION: Head injuries can lead to serious health problems and are the biggest cause of death from trauma in children. A comprehensive history and physical exam, focusing on neurological function and potential skull fractures, is crucial for evaluating the risk of significant intracranial injury (ICI). This study demonstrates that pGCS score alone is an insufficient criterion to definitively exclude skull fractures in the pediatric population. CT scans identified skull fractures in some patients despite the absence of neurological deficits. These findings highlight the importance of CT scans as the gold standard diagnostic modality for skull fractures in children.

Keywords: skull fracture, traumatic brain injury (TBI), intracranial injury (ICI), pediatric, computed tomography (CT) scans, glasgow coma scale (pGCS) score

FL-048

Functional

Multimodal Neurosurgical Therapy for Cases of Severe Refractory Hypertonia: a case series

Gloria H. Bae¹, Sunny Abdelmageed², James M. Mossner², Robin Trierweiler³, Benjamin Katholi⁴, Jeffrey S. Raskin²

¹Chicago Medical School, Rosalind Franklin University of Medicine and Science, North Chicago, USA

²Department of Neurosurgery, Northwestern University Feinberg School of Medicine, Chicago, USA; Division of Pediatric Neurosurgery, Ann & Robert H. Lurie Children's Hospital, Chicago, USA

³Nuvasive Clinical Services, Columbia, USA

⁴Department of Psychiatry, Shirley Ryan Ability Lab, Chicago, USA

OBJECTIVE: Medically refractory hypertonia within the pediatric population leads to severe disability and can be difficult to treat. Surgical interventions for mixed hypertonia or dystonia include neurosurgical approaches such as lumbosacral ventral-dorsal rhizotomy (VDR) and intrathecal baclofen (ITB). These therapies are not always effective individually, sometimes warranting a multimodal surgical paradigm. In this study, we examined the outcomes of a combined lumbosacral VDR and ITB cervical catheter revision in pediatric patients with medically refractory hypertonia.

MATERIAL AND METHODS: We performed a retrospective chart review of pediatric patients at our institution who underwent concurrent lumbosacral VDR and ITB cervical catheter revision between 2021-2023.

RESULTS: Two patients were included: 1) a 16-year-old male with quadriplegic mixed hypertonia and 2) a 17-year-old female with secondary dystonia. Both patients had severe medically refractory hypertonia resistant to ITB delivered through a thoracic catheter tip. Patient one experienced improvement in his Barry Albright dystonia scale (BADs) from 29 to 17 and lower extremity modified Ashworth scale from 4 to 0, while patient two's BADs decreased from 32 to 13 at three months postoperatively. The patients' caregivers also reported significant improvement in caregiving provision, including patient positioning and transfers.

CONCLUSION: We highlight favorable outcomes using multimodal surgery including ITB catheter revision from lumbar to cervical tip placement and lumbosacral VDR in pediatric patients. Multimodal therapy is feasible and better addresses severe refractory hypertonia, particularly in patients who have failed prior ITB therapy. Future study is necessary to optimize patient selection and outcomes.

Keywords: Hypertonia, Dystonia, Intrathecal Baclofen, Ventral-Dorsal Rhizotomy

FL-049

Functional

The (missing) impact of Selective Dorsal Rhizotomy (SDR) on Cerebral Palsy (CP) Treatment -Concepts

Maria Abel¹, Peter Bernius³, Michael Poschmann³, Mathias Hoesl⁴, Steffen Berweck², Hannes Haberl¹

¹Department of Neurosurgery and Epilepsy Surgery, Spine- and Scoliosis Surgery, Schön Klinik Vogtareuth, Vogtareuth, Germany

²Department of Pediatric Neurology, Neurorehabilitation and Epileptology, Schön Klinik Vogtareuth, Vogtareuth, Germany

³Center for Children & Neuro-Orthopedics, Schön Klinik München Harlaching, Munich, Germany

⁴Gait and Motion Analysis Laboratory, Schön Klinik Vogtareuth, Vogtareuth, Germany

OBJECTIVE: Spasticity is a key-symptom of cerebral palsy. The dysregulation of muscular tonus causes an immediate handicap and is regarded as a trigger of subsequent osseous and muscular deformations. Today's state-of-the-art single level SDR is able to eliminate spasticity of the lower limbs permanently with very few exceptions. The introduction of such a powerful tool, capable to erase a key problem of cerebral palsy, challenges the surrounding spasticity-focused therapy concepts which are at risk to become redundant or to undergo fundamental changes. However, the expected reaction remains barely

perceptible or absent. It seems as if the opportunity to fundamentally overhaul CP therapy remains unrecognized or even avoided. This communication aims at initiating a long overdue discussion on reshaping the CP-therapy-concept in a multidisciplinary approach.

MATERIAL AND METHODS: Only very few centers, dealing with a substantial amount of post-SDR patients, are currently revising their multidisciplinary treatment concept, targeting CP patients after surgically eliminated spasticity. This communication reports a new multidisciplinary approach of mobility-preserving treatment.

RESULTS: The Munich Concept of early neuronal (SDR), muscular (percutaneous myofasciotomy), oseus (percutaneous hip-screws), and kinematic (mobility preserving orthoses) intervention is aiming at an immediate gain of function as well as the prevention of extensive follow-up deformation surgery. The concept is appreciated by patients and parents. Short term results are encouraging.

CONCLUSION: Early and mobility preserving multidisciplinary approaches in the treatment of spastic CP aim at immediate gain of function and prevention of invasive and restrictive traditional therapy components.

Keywords: SDR, Cerebral Palsy, Spasticity

FL-050

Functional

Palliative single-level selective dorsal rhizotomy for children with spastic cerebral palsy GMFCS grade IV and V – A case series and systematic review of the literature

Maria Licci, Nicole Alexandra Frank, Ladina Greuter, Abeelan Rasadurai, Isabel Fernandes Arroiteia, Stephanie Juenemann, Raphael Guzman, Jehuda Soleman

University Hospital Basel, Switzerland

OBJECTIVE: The objective is to outline the indication and outcome of palliative SDR for non-ambulatory patients with CP GMFCS grade IV and V, focusing on improvement of spasticity and of patient and caregiver's reported quality of life assessment.

MATERIAL AND METHODS: Retrospective case series of CP patients with GMFCS IV or V, undergoing single-level SDR. Further, a systematic review on outcome was conducted. The primary outcome was the reduction of spasticity based on the modified Ashworth scale (MAS). Secondary outcomes were the change of Gross Motor Function Measure-66 (GMFM-66), evaluation of patient-related outcome measures (PROM), surgical morbidity, and mortality.

RESULTS: We included 11 consecutive children under the age of 20 years undergoing palliative single-level SDR. All patients showed a reduction of MAS (mean 1.09, ± 0.66) while no surgical morbidity and mortality occurred. For the systematic review results from our case series, in addition to 4 reports, with a total of 274 patients were included. Reduction of spasticity based on MAS was seen in all studies (mean range 1.09 to 3.2 points). Further, in two studies spasticity of the upper extremities showed a MAS reduction as well (mean range 1.7-2.8 points). GMFM-66 improved in 72% of the patients, while bladder function improved in 78% of the patient. Based on the PROMs 92% of the patients/caregivers were satisfied with the outcome and their QoL after the procedure. Two wound infections (2.6%) and one CSF-leak (1.3%) occurred, while no surgery-related mortality was described.

CONCLUSION: Our analysis shows an improvement in spasticity, daily care, and comfort for CP patients GMFCS grade IV and V. Larger cohorts analyzing the outcome of palliative single-level SDR, based on MAS, GMFM-66 and PROMS are still needed and should be the focus of future studies.

Keywords: Single-level selective dorsal rhizotomy, cerebral palsy, spasticity, non-ambulant, GMFCS IV, GMFCS V

FL-051

Functional

Woof Woof! What lessons can paediatric epilepsy surgeons learn from helping set up a canine VNS programme?

Michael Rust Carter¹, Tom Harcourt Brown²

¹Dept of Paediatric Neurosurgery, Bristol Royal Hospital for Children, Bristol, UK

²Dept of Veterinary Medicine, Bristol Veterinary School, Bristol University, Bristol, UK

OBJECTIVE: Human and Canine epilepsy share many similar features and many of our patients with epilepsy also have dogs with epilepsy. Both species may benefit from VNS implantation as a neuro modulatory therapy.

The main objective of this study was to determine if useful areas of crossover exist between VNS therapy deployed for canine epilepsy and VNS therapy used in young humans.

MATERIAL AND METHODS: Comparison was made between VNS therapy deployed in over 500 cases of paediatric epilepsy at our institution with 24 cases of VNS implanted for canine epilepsy at the school of veterinary medicine at the University of Bristol. Specific attention was paid to case selection, surgical technique, complications and outcomes after treatment.

RESULTS: Many areas of canine VNS therapy are very similar to those encountered in humans. Others, such as surgical anatomy, technique and complications, are quite different. Outcome assessments, also, were quite nuanced. Review of the comparative surgical anatomy and the deployment of intra operative neurophysiological monitoring in dogs allowed identification of several areas where complications in human practise might be reduced. Similarly, analysis of treatment outcomes in dogs prompted useful discussion of the optimal measurement of outcome in humans. Dogs definitely benefitted from expertise acquired in humans and deployment of VNS for treatment resistant canine epilepsy appears both feasible and effective. Useful discussions regarding cost and the overall philosophical value of treatment were enabled by the comparison between the two groups.

CONCLUSION: Several areas of crossover benefit were identified during this study and will form the basis of further evaluation. Transitional studies appear to have much to commend them in this regard, with both practises potentially benefiting from innovations undertaken in the other.

Keywords: Neuromodulation, VNS, Outcome measures,

FL-052

Functional

Evaluation of the effect of vagal nerve stimulation with the SenTiva M1000 device on seizure frequency in paediatric patients

Milan Makwana¹, Rebecca J Lipscombe³, Frances Gibbon², Johann Te Water Naude², Anthony R Jesurasa¹, Paul Leach¹, Chirag K Patel¹

¹Department of Paediatric Neurosurgery, University Hospital of Wales, Cardiff, UK

²Department of Paediatric Neurology, University Hospital of Wales, Cardiff UK

³Cardiff University, Cardiff UK

OBJECTIVE: To investigate the effect of the SenTiva M1000 vagal nerve stimulator (VNS) on seizure frequency in paediatric patients. First generation VNS devices have been shown to reduce seizure frequency. Newer models such as the SenTiva M1000 use cardiac seizure detection and influence vagus nerve stimulator output and so may confer advantage with seizure management.

MATERIAL AND METHODS: Retrospective review on patients aged under 17 years who had an implantation of the SenTiva M1000 device at University Hospital of Wales, Cardiff, UK. The primary outcome measure was to establish a reduction in seizure frequency using the McHugh Classification for each patient by using the case notes and comparing baseline seizure frequency pre-device insertion. Secondary outcomes were to assess for a reduction in anti-epileptic drug (AED) use.

RESULTS: Thirteen patients (7M:6F) were identified. Mean age at insertion was 13.5 years. Mean follow-up time was 35.5 months. Five patients had previously undergone VNS implantation using the Demipulse 103 model. All (13) patients saw a reduction in the frequency of seizures ten of the patients (76.9%) had >50% reduction in their seizure frequency of which 8 (61%) had a >80% reduction (Engel Class I). Three (23%) of patients had a <50% reduction in seizure frequency. Four (30.1%) of patients reduced the number of AED's on their regular prescription at the end of follow-up compared to baseline pre-device insertion. Two patients had their devices removed due to infection.

CONCLUSION: In our small series of patients, the SenTiva M1000 device demonstrated a greater reduction in seizure frequency than previously described in the literature and a small reduction in AED use. Further studies on a larger retrospective series are required.

Keywords: Epilepsy, VNS

FL-053

Functional

Characteristics of Pediatric Drug Resistant Epilepsy Responders and Nonresponders to Vagus Nerve Stimulation: a Retrospective Cohort Study

James Mossner¹, Sunny Abdelmageed¹, Ryan Wang², Kristina F Terrani³, Megan Votoupal⁴, Klaudia Dziugan⁴, Heba Akbari⁵, Rachel Pauley⁵, David Bieber⁵, Sandi Lam¹, Jeffrey S Raskin¹

¹Division of Pediatric Neurosurgery, Ann & Robert H. Lurie Children's Hospital Chicago, IL, USA; Department of Neurosurgery, Northwestern University Feinberg School of Medicine, Chicago, IL, USA

²Chicago Medical School, Rosalind Franklin University of Medicine and Science, North Chicago, IL, USA

³Department of Neurosurgery, University of Arizona College of Medicine, Tucson, Arizona, USA

⁴Division of Pediatric Neurosurgery, Ann & Robert H. Lurie Children's Hospital Chicago, IL, USA

⁵Division of Pediatric Neurology, Ann & Robert H. Lurie Children's Hospital of Chicago; Department of Neurology, Northwestern University Feinberg School of Medicine, Chicago, IL, USA

OBJECTIVE: Drug resistant epilepsy (DRE) affects ~13.7% of the pediatric population. Vagus nerve stimulation (VNS) is a neuromodulatory therapy leading to a 57% reduction in seizures at 2.5 years of follow-up; 43% of patients remain refractory and may not be offered other surgical or medical therapies. We sought to identify characteristics of DRE patients who respond or are refractory to VNS therapy.

MATERIAL AND METHODS: We performed a retrospective chart review of pediatric DRE patients who underwent VNS implantation at our institution from 2013-2021. Patients were classified as "responders" to VNS if they experienced a 50% or greater reduction in seizure

frequency at 2-year and most recent follow-up compared to baseline. Variables included demographic factors, surgeon, original generator model, revision history, primary seizure type and frequency, and number of anti-epileptics. Chi-Squared and Student's T-test were used to assess significance.

RESULTS: 48 patients (26 responders and 22 nonresponders) were included in the study. No significant differences were found between responders and non-responders for age, sex, race, operating surgeon, original generator model, revision history, or number of AEDs were identified. Responders showed significant reductions in seizure frequency compared to baseline which was not observed in nonresponders (p=0.02). Patients of non-Hispanic origin were significantly more likely than Hispanic patients to have a reduction in seizure frequency compared to baseline (57.1% vs 16.7%, p=0.02). Although not significant, responders had a higher frequency of baseline seizures than did nonresponders (59.8 vs 28.9, p=0.21).

CONCLUSION: We identified that non-Hispanic patients were more likely to respond to VNS therapy compared with Hispanic patients and that nonresponders had less frequent seizures at baseline than responders. Nonresponders should complete a new Phase I work-up and be reevaluated for surgery; additionally, Hispanic patients and those with lower seizure frequency could potentially be considered for intracranial neuromodulatory therapies.

Keywords: neuromodulation

FL-054

Neuro-Oncology

Navigated Intraoperative Ultrasound in Pediatric Brain Tumors

Kevin Klein Gunnewiek¹, Kirsten M Van Baarsen¹, Mariska Sie¹, Oscar H J Eelkman Rooda¹, Evie H M Graus¹, Wyger M Brink², Maarten H Lequin¹, Eelco W Hoving¹

¹Department of Neuro-oncology, Princess Máxima Center for Pediatric Oncology, Utrecht, The Netherlands

²Magnetic Detection and Imaging group, TechMed Centre, University of Twente, Enschede, The Netherlands

OBJECTIVE: The aim of this study was to evaluate the diagnostic value and accuracy of navigated intraoperative ultrasound (iUS) in pediatric oncological neurosurgery as compared to intraoperative magnetic resonance imaging (iMRI).

MATERIAL AND METHODS: A total of 19 pediatric patients undergoing tumor debulking surgery with iUS, iMRI and neuronavigation were included in this study. Prospective acquisition of iUS images was done at two time points during the surgical procedure: 1) before resection for tumor visualization and 2) after resection for residual tumor assessment. Dice similarity coefficients (DSC), Hausdorff distances 95th percentiles (HD95) and volume differences, sensitivity and specificity were calculated for iUS segmentations as compared to iMRI.

RESULTS: A high correlation (R=0.99) was found for volume estimation as measured on iUS and iMRI before resection. A good spatial accuracy was demonstrated with a median DSC of 0.71 (IQR: 0.11) and a median HD95 percentile of 4.61 mm (IQR: 2.06 mm). The assessment after resection demonstrated a sensitivity of 100% and a specificity of 80% for residual tumor detection with navigated iUS. A moderate accuracy was observed with a median DSC of 0.61 (IQR: 0.17) and a median HD95 of 5.84 mm (IQR 2.56 mm) for residual tumor volumes.

CONCLUSION: We found that iUS measurements of tumor volume before resection correlate well with those obtained from preoperative MRI. The accuracy of residual tumor detection was reliable as compared to iMRI, indicating the suitability of navigated iUS for directing the surgeon's attention to areas suspect for residual tumor. Based

on our clinical experiences, iUS could lead to more efficient timing of iMRI acquisitions or be a substitute when iMRI is not available. Therefore, iUS is considered as a valuable addition to the neurosurgical armamentarium.

Keywords: Intraoperative Ultrasound, Intraoperative MRI, Neuronavigation, Pediatric neurosurgery, Neuro-oncology

FL-055

Neuro-Oncology

Radioresistant cell surface molecules in paediatric diffuse midline glioma brainstem tumours: a preclinical in vitro study

Nurfarhanah Bte Syed Sulaiman¹, Kheng Wei Yeoh³, Ben Sim⁵, Enrica Tan⁴, Kenneth Chang⁶, Wan Tew Seow², Sharon Yin Yee Low¹

¹Neurosurgical Service, KK Women's and Children's Hospital, Singapore

²Department of Neurosurgery, National Neuroscience Institute, Singapore

³National Cancer Centre Singapore, Singapore

⁴Haematology/Oncology Service, KK Women's and Children's Hospital

⁵Yong Loo Lin School of Medicine, National University of Singapore

⁶Department of Pathology and Laboratory Medicine, KK Women's and Children's Hospital

OBJECTIVE: Paediatric brainstem diffuse midline gliomas (bDMG) are rare, aggressive tumours with marked intratumoral heterogeneity. Standard radiotherapy improves overall survival by a few months. However, radioresistant bDMG cells lead to inevitable disease progression. Recently, B7-H3 (CD276) chimeric antigen receptor T-cell (CAR-T) immunotherapy has been demonstrated as a potential therapeutic target for bDMG patients. Nonetheless, treatment efficacy relies on the identification of the appropriate cell surface (CD) molecule to target. Building on current knowledge, we hypothesize that other CD molecules will be concurrently expressed in surviving bDMG cells after radiotherapy.

MATERIAL AND METHODS: Patient-derived H3K27M-positive bDMG cell lines are cultured in a chemically-defined media. Next, cells are seeded in 6-well plates to 70% confluence. Subsequently, the plates are irradiated with 0, 5, 10 and 20 Gy respectively, at a dose rate of 2.6 Gy /min. After each one-dose treatment, surviving cells are collected. The 770-plex nCounter® PanCancer Immune Profiling Panel is used to interrogate and quantify gene expression profiles of these cells. Results are compared and analysed for statistical significance.

RESULTS: Six bDMG cell lines are successfully cultured and radiated. Post-treatment cell viability is quantified via IC50 calculations. We observe that gene expressions of CD276, CD44, CD47, CD63 and CD81 remain steadfast despite high-dose radiation treatment. Of interest, statistically significant higher fold change expressions of CD46, CD164 and CD59 are noted in a subgroup of bDMG cell lines post-radiation treatment. A focused literature review corroborates that these CD molecules are associated in poor prognosis in various malignant cancers.

CONCLUSION: Based on gene expression profiling, our in vitro study reports that in addition to CD276, there is a group of CD molecules that are likely radioresistant. Future mechanistic studies are required to better understand their oncogenic roles in bDMG.

Keywords: paediatric brainstem gliomas, H3K27-altered brainstem gliomas, cell surface molecules, radioresistance

FL-056

Neuro-Oncology

Use of intraoperative MRI (iMRI) in pediatric low grade glioma (pLGG) surgery in the era of high quality intraoperative ultrasound (iUS)

Martin Ulrich Schuhmann¹, Armen Narayan¹, David Gorodezki², Julian Zipfel¹, Katalin Lörincz¹, Jonas Tellermann¹, Martin Ebinger²

¹Section of Pediatric Neurosurgery, Department of Neurosurgery, University Hospital Tuebingen, Germany

²Department of Pediatric Oncology, University Children's Hospital, Tuebingen, Germany

OBJECTIVE: iMRT demands additional personnel, time, and technical set-up, making it a costly enterprise in economically difficult times. In contrary, quality of iUS machines has greatly improved and functional limitations of eloquent areas dominate decision making over removing visualized remnants. We compares indications for and results of iMRI and iUS guided pLGG surgery

MATERIAL AND METHODS: We analyzed data of 82 children undergoing pLGG resection between 2015 to 2020, 52 guided by iUS only, 30 with additional iMRI.

RESULTS: In cerebral hemispheric tumors GTR was achieved in 20/21 cases regardless of use of iMRI or iUS only. In 15/18 cerebellar hemispheric tumors operated without iMRI, GTR was achieved with no recurrence.

In anterior supratentorial midline glioma (SMG) we found higher pre-op tumor volumes and higher relative resection extend following iMRT, but also higher residual tumor volumes and more progression thereafter.

In posterior SMG, iMRT was used more than iUS, resulting in a higher GTR rate, higher resection extend and smaller residual volumes.

6/8 tumors within the 4th ventricle and 8/10 medullary tumors were operated without MRI, in no case GTR was intended. 10/18 showed later progression.

In pontine pLGG, however, iMRI was used in all 5 cases, one GTR achieved and those with residual tumor volume below 2 ml residuals remained stable.

CONCLUSION: In cerebral and cerebellar hemispheric pLGG, the additional use of iMRI was not beneficial and high quality iUS guided surgery had excellent resection and tumor control rates. In anterior SMGs, the use of iMRI does not appear to be advantageous, whereas it seems to support GTR /STR and stability of the residual in posterior SMGs. In pLGG involving the brain stem, additional iMRI does not seem to carry an advantage for tumor control, since functional monitoring mostly does not permit to bring the residual tumor volume low enough to promote long-term stability.

Keywords: pediatric low grade glioma, eloquent areas, intraoperative MRI, intraoperative ultrasound, outcome

FL-057

Neuro-Oncology

Evaluation of neurosurgical robot-assisted precision navigation biopsy surgery for pediatric brainstem tumors based on multi-modal image fusion and analysis of pathological findings

Wu Qiang Che, Shu Deng, Lei Yang

Department of Neurosurgery, Kunming Children's Hospital, Kunming Medical University, Kunming city, China

OBJECTIVE: Review of 12 children with brainstem tumors in multimodal image fusion technology with robotic surgical guidance for brainstem pathology tissue acquisition and treatment outcome analysis.

MATERIAL AND METHODS: Combined use of multimodal image fusion technology and robotic guidance for preoperative evaluation, surgical access design and pathology tissue sampling, and summary of treatment outcomes and pathology characterization with 12 children with brainstem tumors.

RESULTS: Avg age of 12 children: 7 years (min: 4, max: 12), all underwent successful robot-guided brainstem tissue acquisition (1 case showed gliosis). Post-op review: Few bubbles in sampling area, no bleeding, secondary hematomas, or significant scalp hematomas. All children ambulatory by post-op day 2.

Tumor histopathology summary: Varied features including astrocytoma, diffuse glioblastoma, embryonal tumors. Changes in morphology, tissue structure, immunohistochemistry, and gene mutations observed. Positive GFAP, Olig2, some H3K27M mutations, and Ki-67 expression. Highlights the complexity of brainstem tumors, necessitating further research and clinical observation.

CONCLUSION: Evaluation of multimodal imaging allows for characterization of the lesion from multiple perspectives and aids in the assessment of the site of sampling, thereby increasing the success rate and certainty of the procedure. The use of the middle cerebellar peduncle as a route is practical, safe, and maneuverable, and is consistent with local brain anatomy.

Keywords: Brain stem tumors; pediatric brain tumors; multimodal imaging; robotic surgery; biopsy; pathology

FL-058

Neuro-Oncology

The comparative outcomes in effectiveness of transcallosal interhemispheric over transcortical approach for pediatric intraventricular tumors

Hanna Salauyeva, Mikle Talabaev, Kevin Fernando Venegas «Republican Research and Clinical Center of Neurology and Neurosurgery» of the Ministry of Health of the Republic of Belarus

OBJECTIVE: We investigate and compared the postoperative results of the application of interhemispheric and transcortical approaches in the surgery of intraventricular tumors in children. We also studied postoperative complications and their impact on quality of life based on long-term follow-up.

MATERIAL AND METHODS: Retrospective review of 121 pediatric patients with primary or secondary ventricle tumors who underwent neurosurgical treatment from 2012 to 2022. The patients were divided into two groups. In the studied groups, removal was performed using two different approaches: transcortical (group 1) and interhemispheric (group 2). The first group included 51 patients, 23 (45.1%) of them female and 28 (54.9%) male, median age 7.8 years, the second group 70 patients, of whom 35 girls (50%), and the remaining 35 (50%) were boys the median age was 7 years. Data on completeness of removal and postoperative neurological deficit, as well as the development of de novo epilepsy were collected and analyzed.

RESULTS: Tumors were located in the third ventricle in 50 (41.3%) patients, in the lateral ventricles in 42 (34.7%), in the subcortical nuclei and thalamus in 26 (21.5%) and in the pineal region in 3 (2.5%). Gross total removal was achieved in 22 (43.1%) patients in the transcortical group (1) and 29 (41.4%) in the interhemispheric (2). Neurological

disorders associated with the use of transcortical approach developed in 14 (27.5%) cases, interhemispheric in 6 (8.6%) cases ($p=0.005$).

Approach-related complications after using interhemispheric approach, such as SMA syndrome were in 3 (4.2%) cases which regressed within two months. Transient memory and mental disorder was diagnosed in one (1.4%) case.

De novo seizures occurred in 7 (13.7%) patients in group 1 and 2 (2.9%) in group 2 ($p=0.02$).

CONCLUSION: Interhemispheric approach was relatively safe in pediatric neurosurgery and avoided damage to cerebral cortex with similar gross total resection. Transcortical surgery was associated with higher risk epilepsy.

Keywords: intraventricular tumor, interhemispheric approach, tumor resection, pediatric neurosurgery

FL-059

Neuro-Oncology

The changes in attitude to paediatric tumour sampling for diagnostic and research purposes from 2014 to 2024

Yazan El Adwan¹, Lee Shipman², Rafael Furtado E Carvalho³, Kristian Aquilina³, Darren Hargrave³, Ian Kamaly Asl¹

¹Department of Paediatric Neurosurgery, Royal Manchester Children's Hospital/University of Manchester, Manchester, United Kingdom

²Department of Paediatric Oncology, Alder Hey Children's Hospital, Liverpool, United Kingdom

³Department of Paediatric Neurosurgery, Great Ormond Street Hospital, London, United Kingdom

OBJECTIVE: There is an ongoing, increasing need for paediatric tumour tissue samples for both diagnostic and research purposes. We aimed to evaluate how attitudes towards sampling of paediatric tumours have changed over the last 10 years.

MATERIAL AND METHODS: A survey of the British Paediatric Neurosurgery Group was undertaken in 2014 looking at both general attitudes towards tumour sampling and specific questions regarding practice in a series of 4 cases. The same survey was administered to the group in 2024.

RESULTS: There were 32 respondents in 2014 and 37 in 2024. Overall there was an increase in the 10 years from 76% to 81% of consent being obtained for samples being stored for research purposes and this was most evident for stereotactic procedures (67% to 80% - $p=0.08$).

The number of surgeons who specifically adjust their technique to maximise tumour sample increased from 53% to 62%.

For resective procedures there was a trend of increasing the volume of tumour obtained for sample (30% to 35% - $p=0.23$).

For stereotactic procedures; mean number of cores taken for diagnostic purposes increased from 3.3 to 5.3 ($p<0.001$) and for research purposes increased from 0.6 to 2.0 ($p<0.001$).

In 2024 a biopsy was offered for a brainstem lesion always 32%, often 19%, sometimes 30%, rarely 11% and other 8%. The indication being for diagnostic purposes 11%, research 22% and both 68%.

CONCLUSION: This study shows that although there is variation in practice amongst surgeons within a national group, the trends are to an increasing recognition that safely maximising paediatric tumour tissue samples for both diagnostic and research purposes is important.

Keywords: paediatric, tumour, sampling, diagnostic, research

FL-060

Neuro-Oncology

Sonodynamic therapy using MR-guided focused ultrasound (MRgFUS) for pediatric patients with DIPG: a single-center experience with 43 treatments

Gregory Keating¹, Kelsi Chesney², Nirali Patel², Daniel Donoho¹, John Myseros¹, Chima Oluigbo¹, Robert F. Keating¹, Hasan R. Syed¹
¹Department of Neurosurgery, Children's National Hospital, Washington, DC, USA

²Department of Neurosurgery, Medstar Georgetown University Hospital, Washington, DC, USA

OBJECTIVE: Sonodynamic therapy (SDT) is a drug-device treatment modality that targets the heme synthesis pathway in brain tumors. MR-guided focused ultrasound (MRgFUS) is used to activate protoporphyrin XI (PpXI), a metabolite of 5-ALA, to facilitate downstream pathways resulting in tumor cell apoptosis. We report the largest series of SDT in patients with diffuse intrinsic pontine glioma (DIPG) with an emphasis on technical challenges and lessons learned.

MATERIAL AND METHODS: A retrospective review of a prospectively collected database was reviewed of all patients who underwent SDT between 2022 and 2024 at Children's National Hospital. Patient demographics, treatment characteristics, procedure durations, and complications were analyzed. A clinical algorithm is outlined to facilitate an efficient workflow between multiple team members.

RESULTS: 11 patients (3M:8F) with an average age of 8.2 years (range: 5-12 years) underwent 43 treatments between August and April 2024 for a diagnosis of DIPG. An average of 3.6 treatments were performed per patient (range: 2-8). Target areas for sonication included tumor within the pons in all patients. 2 patients with metastatic lesions in the occipital lobe and corpus callosum were additionally treated. With increasing experience, there were significant reductions observed in total anesthesia time, sonication time, and changes in average core body temperature. Complications occurred in 2.3% of patients and included a non-operative epidural hematoma. Device-related malfunctions occurred in 4 treatments (9.3%), resulting in one aborted procedure. Technical challenges related to membrane water leak and sonication errors occurred in 33.3% and 11.6% of cases, respectively, and were all overcome by subsequent user modifications.

CONCLUSION: We present the largest series of SDT using MRgFUS for patients with DIPG within a clinical trial. This study underscores the potential technical challenges inherent in such procedures and offers invaluable insights into the nuances of this treatment modality. A multi-disciplinary treatment team is critical for its applications in the pediatric population.

Keywords: sonodynamic therapy; SDT; focused ultrasound; diffuse intrinsic pontine glioma; DIPG

FL-061

Neuro-Oncology

From Clinical to Imaging: The Application of Machine Learning in the Differential Diagnosis of Pineal Region Germinoma

Ningrong Ye¹, Xuejun Li², Yuanxiang Lin¹, Dezhi Kang¹
¹Department of Neurosurgery, First Affiliate Hospital Of Fujian Medical University, Fuzhou, China

²Department of Neurosurgery, Xiangya Hospital Central South University, Hunan, China

OBJECTIVE: This study focuses on leveraging multimodal data, employing machine learning and deep learning techniques, to develop a predictive model for the precise diagnosis of pineal region germinoma

MATERIAL AND METHODS: This study collected clinical and pathological information from 323 patients with pineal region masses diagnosed at Xiangya Hospital from January 2010 to January 2023, supplemented with data on 2899 pineal region tumor patients from the SEER database. The differences in age, gender, and other clinical features between pineal region germinoma and other lesions in this area were analyzed. A predictive model for diagnosing pineal region germinoma was developed based on these clinical features. Subsequently, for 149 patients with pre-treatment MRI reports, General Language Model (GLM130B, GPT4) and Natural Language Processing (NLP) to extract effective information from the imaging reports to further construct a diagnosis prediction model based on these reports. Furthermore, the MRI data of 122 patients with pineal region lesions with clear pathological diagnosis and complete magnetic resonance imaging data were selected. Utilizing radiomics combined with deep learning, we crafted an image-based diagnostic model for pineal region germinoma.

RESULTS: In our study, we developed various models to diagnose germinoma. The first model, based on age and sex, achieved 76% accuracy (AUC: 0.80). The second model, utilizing the MedBERT algorithm and radiology reports, reached a 70% accuracy (AUC: 0.70). We also applied a radiomics-based machine learning approach, which showed that adding T2 imaging sequences significantly enhanced diagnostic accuracy. A deep learning model using these T2 sequences achieved a 78% accuracy (AUC: 0.84), further improved to 81% accuracy (AUC: 0.87) when including age and gender data.

CONCLUSION: Age and gender are crucial for diagnosing pineal region germinoma. Large language models, such as GLM, effectively structure medical imaging reports, identifying relevant features precisely. Deep learning modeling of pineal tumor images can accurately predict germinoma.

Keywords: pineal region germinoma, radiomics, deep learning, MRI, differential diagnosis, LLM

FL-062

Neuro-Oncology

Role of Bevacizumab in Giant progressive Vestibular Schwannomas in NF2 patients following gamma Knife Radiosurgery

Deepak Agrawal, Pavana Vi, Ramesh Doddamani
 Department of Neurosurgery & Gamma Knife, AIIMS, New Delhi

OBJECTIVE: To study the effect of Bevacizumab on tumor volume in cases of Giant progressive Vestibular Schwannomas in NF2 patients following gamma Knife Radiosurgery.

MATERIAL AND METHODS: This prospective study included Patients of NF2 with bilateral vestibular schwannoma who underwent Gamma-knife therapy from 1st January 2009 to 31st December 2021 at AIIMS, New Delhi. All patients in whom tumour progression (>20% increase) was seen on radiological follow up were given Bevacizumab (10mg/kg infusion) over 6 cycles and followed up clinico-radiologically. Patients needed to have at least 24 months of clinical and radiological follow-up after gamma-knife surgery and at least 2 follow up MRI scans 6 months apart following bevacizumab therapy to be included in the study.

RESULTS: A total of 122 patients (156 schwannomas) with NF2 underwent GKRS for vestibular schwannoma during study period. 31 patients (42 schwannomas) had increase in tumor size, of which 18

patients (26 schwannomas) received Bevacizumab therapy. The median volume of tumor(s) treated was 11.809 (range 0.894 to 19.960 cc). Average duration of follow up after bevacizumab therapy was 12.55 (+/-9.127) months. At 3 months follow up, 40.09% of the tumors had responded to the therapy (> 20% decrease in tumor volume), with 59.09% tumors remaining stable. At 12 months follow up, 50% of the tumors had responded to therapy, 7 (43.75%) were stable and one tumor (6.25%) had increased in size.

CONCLUSION: Our study is the largest study in the world to evaluate the role of bevacizumab in giant progressive vestibular schwannomas (average tumor volume 11.8 cc) associated with NF2 patients, as well as those with 'biologically aggressive' subset of NF2 patients.

Keywords: NF2, Vestibular Schwannoma, Gamma-knife, Bevacizumab, Giant

FL-063

Neuro-Oncology

Aggressive surgical resection for children craniopharyngioma based on prerequisite for hypothalamic preservation: a series of 782 pediatric patients

Shi Xiang Xiangen

Capital Medical University Sanbo Brain Hospital

OBJECTIVE: A retrospective analysis was conducted on surgical outcomes for pediatric craniopharyngioma patients, focusing on hypothalamic preservation during microsurgical resection.

MATERIAL AND METHODS: 782 pediatric cases of craniopharyngioma were treated surgically from January 2004 to May 2023. 62.9% were boys and 37.1% were girls, with ages ranging from 8 months to 15 years old. The tumor size in pediatric patients ranged with an average diameter of 3.95 ± 1.357 cm. 83.4% had cystic tumors, 89.1% had shell-like or nodular calcified tumors, and 11.9% had solid tumors. A unifrontal basal interhemispheric approach was preferred in 91.4% of pediatric patients, while 8.6% of pediatric patients underwent a pterional craniotomy or combination of anterior with middle cranial fossa approaches.

RESULTS: Total, subtotal, and partial removal of tumors were achieved in 90.2%, 7.5%, and 2.3% patients, respectively. The pituitary stalk was intentionally preserved in 87.1% cases despite partial injury or remains intact with peeling off the residual tumor. Within the perioperative period, there were 2.7% deaths. Of the remaining patients, 77.6% were followed up for an average of 3.9 years. Out of 607 patients, 92.3% had total tumor removal and 47 had a subtotal or partial resection. 11.6% of the patients with total tumor removal experienced recurrence in an average of 3.3 years while 91.5% patients with subtotal or partial resection had tumors progressive within an average of 0.5 years. There were 3.1% deaths related to postoperative complications during follow-up. A total of 71.3% patients with an endocrine disturbance required postoperative substitution of the deficient hormone.

CONCLUSION: Microsurgical resection is an effective treatment for pediatric craniopharyngiomas, with a long-term tumor-free outcome and significant improvement in quality of life. The hypothalamus preserved is crucial for the success of the microsurgical resection, irrespective of the tumor's features.

Keywords: surgical resection, craniopharyngioma, hypothalamic preservation

FL-064

Neuro-Oncology

Radical Resection of Large and Giant Craniopharyngiomas in Children May Decrease Need for Adjuvant Radiotherapy

Jillian H Plonsker¹, Michael G Brandel¹, John H Crawford³, Vijay Patel², Javan Nation², Michael L Levy²

¹University of California San Diego

²Rady Children's Hospital

³University of California Irvine

OBJECTIVE: The pituitary gland and hypothalamus are exquisitely radiosensitive in children. We performed a retrospective review of all large (>2cm) and giant (>5cm) pediatric craniopharyngiomas who underwent surgical intervention at a large, free-standing quaternary care children's hospital to evaluate the clinical need and timing of proton beam radiation postoperatively.

MATERIAL AND METHODS: This case series included 38 patients who underwent either open or endoscopic endonasal resection over a 20-year period (2002-2022). Only patients with their index surgery at our institution were included.

RESULTS: Mean age was 8.7 years and 42% were female. 14 tumors were categorized as giant, and 24 were large. Patients presented with headache (62%), vision changes (59%), nausea/vomiting (43%), and hypopituitarism (55.9%). Half of included patients presented with hydrocephalus, and 34% of tumors involved the third. For large tumors, surgical approach was 46% transsphenoidal and 54% transcranial (e.g. orbitozygomatic craniotomy). For giant tumors, approach was 21% transsphenoidal and 79% transcranial. Gross total resection was achieved in 97.4%. Five-year progression free survival was 61%, and 42% experienced progression (recurrence or residual growth). Complications occurred in 18%, including a 5% cerebrospinal fluid leak rate. Using obesity as a proxy for hypothalamic dysfunction, forty-six percent were overweight preoperatively and fifty-four were overweight postoperatively, indicating no significant hypothalamic injury. Pituitary dysfunction was common, at >84%. Median follow up was 62 months. Only 12% of patients underwent adjuvant radiation, with the remaining patients initiating proton beam at a mean of 25.7 months post operatively.

CONCLUSION: We conclude that radical resection of large and giant pediatric craniopharyngioma can reduce the need for postoperative proton beam therapy or significantly delay initiation in young children, minimizing the risk of associated compromise to the visual apparatus and hypothalamus. These outcomes can be safely accomplished with gross-total resection rates and complication profiles that mimic similarly reported patient outcomes in the existing peer-reviewed medical literature.

Keywords: craniopharyngioma, proton, radiotherapy, giant

FL-065

Neuro-Oncology

Identification and validation of the ferroptosis related hub genes by unsupervised machine learning in medulloblastoma

Xin Chen¹, Sen Li², Kunfang Yang³, Yu Liu², Jianguang Liu², Ruoping Chen², Qijia Zhan²

¹Ward 6A, Children's Hospital of Shanghai, Shanghai, China

²Department of Neurosurgery, Children's Hospital of Shanghai, Shanghai, China

³Department of Pediatrics, Shanghai United Family Hospital, Shanghai, China

OBJECTIVE: In this study, we delved into the molecular basis of medulloblastoma, a formidable childhood brain tumor, aiming to enhance diagnostic accuracy and tailor therapies.

MATERIAL AND METHODS: Leveraging transcriptomic data from GEO datasets, we pinpointed 1484 DEGs, including 11 upregulated and 25 downregulated DEFeGs linked to medulloblastoma. Functional analyses highlighted their involvement in hypoxia, metal ion binding, and pathways such as mitophagy and drug resistance. Immune infiltration analysis, prognostic evaluation, and drug sensitivity prediction were conducted. Feature gene expression across different datasets was explored and confirmed through qRT-PCR analysis in human tissue samples.

RESULTS: We identified 1484 DEGs, including 11 upregulated and 25 downregulated DEFeGs associated with medulloblastoma. These DEFeGs exhibited enrichment in processes linked to hypoxia, metal ion binding, and pathways involving mitophagy, carcinogenesis, and drug resistance. Using WGCNA, we identified a black module that was highly correlated with the FeRG Score. This module contained 114 hub genes, of which 58 were DEGs. Machine learning algorithms identified CEND1, LRP1B, and FEZ1 as the final feature genes. A nomogram based on these feature genes showed high diagnostic value, achieving a predictive accuracy of 98.6% in one patient. This accuracy was further supported by ROC analysis, with all three feature genes exhibiting AUC values exceeding 0.85 across various datasets. Immune infiltration analysis revealed that 19 immune cell types exhibited significant differences between the medulloblastoma and control groups. Additionally, drug sensitivity analysis revealed significant positive correlations between the expression levels of FEZ1 with SGX-523, CEND1 with Sabutoclax, and LRP1B with AZD-1208. Conversely, these genes showed notable negative correlations with Allopurinol.

CONCLUSION: In conclusion, the study identifies and characterizes feature genes (FEZ1, CEND1, and LRP1B) associated with medulloblastoma, demonstrating their potential roles in diagnosing medulloblastoma and modulating drug responses and immune infiltration in medulloblastoma.

Keywords: Ferroptosis, Medulloblastoma, Diagnostic Biomarkers, Nomograms, Neurosurgery

FL-066

Neuro-Oncology

Hypnosis and pediatric awake neurosurgery

Pierre Aurélien Beuriat¹, Magali Marchal², Lionel Bapteste², Alexandru Szathmari¹, Matthieu Vinchon¹, Federico Di Rocco¹, Anne Sarah Szostek²

¹Department of Pediatric Neurosurgery, Hôpital Femme Mère Enfant, Hospices Civils de Lyon, Lyon, France

²Department of Pediatric Anesthesiology, Hôpital Femme Mère Enfant, Hospices Civils de Lyon, Lyon, France

OBJECTIVE: Awake neurosurgery is routinely performed. However, there are no recommendations regarding intraoperative anesthetic management, as well as the contribution of hypnosis to this practice. We report our experience with the benefit of hypnosis for awake surgery in children.

MATERIAL AND METHODS: We retrospectively analyzed the contribution of hypnosis and the overall dose of anesthetic drug used in children operated on under awake surgery between 2021 and 2023

RESULTS: Five patients benefit from an awake procedure during the inclusion time for a total of 6 surgeries. The same drugs were used in all patients: dexmedetomidine, propofol and remifentanyl. The standard protocol includes drug anesthesia with spontaneous ventilation and local scalp anesthesia. The first patient, 12 years old, was operated on for refractory epilepsy. The first procedure was performed with standard awake anesthesia technique (no hypnosis). Unfortunately, a major agitation with displacement of the headrest required to end to the surgery. This patient was able to successfully benefit from his surgery 3 months later by adding hypnosis to the standard drug with a decrease in the dose of Propofol (0.029 versus 0.235 mg/kg/min). Since this successful experience, hypnosis became systematic for awake procedure with an increase in its overall use during the procedures. This led to an important decrease in the total dose of Propofol (0.077 mg/kg/min then 0.040 mg/kg/min then 0.036 mg/kg/min then 0.027 mg/kg/min). The dosages of remifentanyl and dexmedetomidine were approximately the same during the 6 interventions.

CONCLUSION: This shows the major positive impact of the use of hypnosis on the performance of awake neurosurgeries, particularly in the pediatric population. It guarantees good tolerance of the surgery, as well as maximum comfort for our patients.

Keywords: awake, pediatric neurosurgery, anesthesia, hypnosis

FL-067

Neuro-Oncology

A comparative analysis of prognostic factors in thalamic and brainstem H3 K27M–altered diffuse midline gliomas from a tertiary health care center

Aprajita Chaturvedi¹, Nishanth Sadashiva¹, Dhaval Shukla¹, Arivazhagan Arimappagan¹, Nupur Pruthi¹, Vikas Vazhayil¹, Prabhuraj Ar¹, Subhas Konar¹, Manish Beniwal¹, Vani Santosh², Jitender Saini³, Shilpa Rao²

¹Department of Neurosurgery, NIMHANS, Bengaluru, India

²Department of Neuropathology, NIMHANS, Bengaluru, India³Department of Neuroimaging & Interventional Radiology, NIMHANS, Bengaluru, India

OBJECTIVE: H3K27M altered diffuse midline glioma is an aggressive glioma that arises from midline structures and carries a poor prognosis with a median overall survival of 9-12 months. Despite the recent advances, the condition remains an enigma with few known prognostic factors. The significance of anatomical localization of this entity is also controversial and, in this study, we have compared the clinical, radiological, and survival variables of thalamic and brainstem pediatric DMGs.

MATERIAL AND METHODS: This is a retrospective study from a tertiary health care centre. We have performed a review of medical records of patients of age 18 years and below with histopathologically proven diagnosis of diffuse midline glioma, H3K27M altered arising in either thalamus or brainstem for the period 2018 to 2022. Clinical, neuroimaging, and pathology were re-reviewed and prognostic factors for 3 months, 6 months and overall survival was analysed for all patients.

RESULTS: A total of 117 pediatric patients with diffuse midline glioma were included. There were 25 (21.4%) thalamic, and 72 (78.6%) brainstem DMGs. Median age was 14 and 8.5 years in thalamic and brainstem DMGs respectively. Median survival was 7 months in both the groups. Location of the tumor did not affect the survival (p-value:

0.881). Patients who received radiotherapy with or without chemotherapy had significantly better survival (10 months versus 3 months, p -value < 0.001).

CONCLUSION: There was no significant relation between the location of the tumor and the survival. Overall median survival in our study was low due to the lack of adherence to adjuvant therapy in our patient cohort. The recent advances in patient-targeted therapy has rejuvenated worldwide interest in DMGs and requires further studies for better treatment delivery and patient prognostication

Keywords: diffuse midline glioma, H3K27M altered, pediatric glioma, high grade glioma, DMG

FL-068

Neuro-Oncology

Clinical features and surgical results of pediatric CNS sarcomas. A referral center experience in Peru

Danny Alex Campos Sanchez¹, Esther K Velarde Llerena¹, Rosdali Y Diaz Coronado², Daniel C Moreira³, Sandro Casavilca Zambrano⁴

¹Pediatric Neurosurgery Service, Instituto Nacional de Salud del Niño – San Borja, Lima, Peru

²Pediatric Oncology Department, Instituto Nacional de Enfermedades Neoplásicas, Lima, Peru

³Department of Global Pediatric Medicine, St Jude Children's Research Hospital, Tennessee, USA

⁴Pathology Department, Instituto Nacional de Enfermedades Neoplásicas, Lima, Peru

OBJECTIVE: The aim is to describe the clinical features and surgical results of pediatric CNS sarcomas (PCS) in a tertiary referral center, in order to have our own data and establish institutional practice benchmarks.

MATERIAL AND METHODS: All children with diagnosis of PCS conducted in our Pediatric Neurosurgery Service between January 2018 and December 2023 were included. We reviewed for demographic, clinical presentation, radiologic and surgical results.

RESULTS: 52 children were included, with median age of 7.3 (SD ± 3.4 years), 30 males (57.7%) and 22 females (42.3%). Median duration of symptoms was 15.9 days. Presenting symptoms were vomiting (90.4%), headache (88.5%), drowsiness or behavioral changes (36.5%), weakness or loss of balance (34.6%), seizures (25%), and others (23.1%).

In 47 (90.4%) cases the location was supratentorial: frontal (65.4%), parietal (13.5%), multilobar (5.8%) and other locations (5.8%). CT finding included edema (94.2%), hemorrhage (65.4%), contrast enhancement (63.5%), tumor volume > 30cc (63.5%), and local invasion (51.9%).

In 27 (51.9%) GTR was achieved, subtotal in 21 (40.8%), and partial in 4 (7.7%). Patients with tumor volume < 30cc and hemorrhage absence had higher GTR rates. Tumor volume > 30cc, edema, hemorrhage and local infiltration had higher subtotal resection. Intraoperative RBC transfusion was performed in 73.1%. Median ICU stay was 8.3 days. Second surgery was performed in 48.1% and 11.5% underwent third surgery.

Surgical morbidity was 78.8% after first surgery. Cerebral hematoma (26.9%), CSF fistula (25%), hemorrhage in other locations (25%), stroke (21.1%), weakness (19.2%) and CNS infection (7.7%) were most common. The 30-days postoperative mortality was 3.8%

CONCLUSION: Sudden intracranial hypertension, frequently huge tumors, vascular and invasive lesions, and young children affected makes PCS challenging and surgically demanding lesions. Significant morbidity is related to surgery. A task should be included development

of protocols to improve tumor resection and reduces hospital stay, in order to received timely adjuvant therapy.

Keywords: CNS sarcoma, pediatric, clinical features, surgical outcome

FL-069

Neuro-Oncology

Radiation-induced meningiomas have an aggressive clinical course: the genetic signature is limited to NF2 alterations, and the epigenetic signature is H3K27me3 loss

Seung Ki Kim¹, Tae Kyun Kim², Jong Seok Lee¹, Ji Hoon Phi¹, Seung Ah Choi¹, Joo Whan Kim¹, Chul Kee Park³, Hongseok Yun⁴, Young Soo Park², Sung Hye Park⁵

¹Division of Pediatric Neurosurgery, Seoul National University Children's Hospital, Seoul National University College of Medicine, Seoul, Republic of Korea

²Department of Neurosurgery, Nara Medical University, Nara, Japan

³Department of Neurosurgery, Seoul National University Hospital, Seoul, Republic of Korea

⁴Department of Genomic Medicine, Seoul National University Hospital, Seoul, Republic of Korea

⁵Department of Pathology, Seoul National University Hospital, Seoul, Republic of Korea

OBJECTIVE: Radiation-induced meningioma (RIM) is the most common secondary brain tumor after cranial irradiation. While the clinical course of RIM is considered to be more aggressive than that of sporadic meningioma (SM), the genetic predisposition for RIM is not established well.

MATERIAL AND METHODS: We investigated a database of 24 patients who met the RIM criteria between January 2000 and April 2023. Genetic analysis through next-generation sequencing with a targeted gene panel for brain tumors was performed on 10 RIM samples. Clinical, radiological, and pathological parameters were evaluated with genetic analyses.

RESULTS: The median ages for receiving radiotherapy (RT) and RIM diagnosis were 8.0 and 27.5 years, respectively, with an interval of 17.5 years between RT and RIM diagnosis. RIMs tended to develop in non-skull bases and multifocal locations. Most primary pathologies included germ cell tumors and medulloblastoma. The tumor growth rate was 3.83 cm³ per year, and the median tumor doubling time was 0.81 years. All patients underwent surgical resection of the RIMs. The histological grade of the RIMs was World Health Organization grade 1 (64%) or 2 (36%). The recurrence rate was 20.8%, with a higher in young-age (62.5%), high-dose (75%), and extended-field (79.2%) RT groups. Genetic analysis revealed NF2 one copy loss in 90% of the patients, specific NF2 mutations and additional copy number aberrations in grade 2 RIMs. TERT promoter mutation and homozygous deletion of CDKN2A/B, indicative of malignant meningiomas, were not identified. H3K27me3 loss was associated with a higher prevalence of grade 2 RIMs (66.7%) and high recurrence rates (33.3%).

CONCLUSION: Our study supports that the genetic profiles of RIMs are unique, primarily involving NF2 alterations. Chromosomal abnormalities and a high prevalence of H3K27me3 loss are identified in grade 2 RIMs.

Keywords: brain neoplasm, meningioma, radiation, pediatric, pathology, genetic testing.

FL-070

Neuro-Oncology

Characterization of the pattern of leptomeningeal metastasis in childhood medulloblastomaDaniel P. Sexton¹, Eric M. Thompson²¹Department of Neurosurgery, Duke University, Durham, United States²Department of Neurosurgery, University of Chicago, Chicago, United States

OBJECTIVE: Medulloblastoma is the most common pediatric central nervous system malignancy in children. Despite improvements in therapy, the mortality rate is still high, with roughly 30% of patients with high-risk disease not surviving past five years. Leptomeningeal metastasis is present at initial diagnosis in roughly 40% of patients and is the leading cause of mortality. It is unknown if medulloblastoma cells bind to the arachnoid, pia, or both. Determining this has putative therapeutic implications. The objective of the present study is to characterize the location and attachment sites of leptomeningeal medulloblastoma metastases based on magnetic resonance imaging in a retrospective cohort.

MATERIAL AND METHODS: A total of 22 patients with metastatic medulloblastoma were reviewed that were treated at our institution between 2003 and 2022. Demographic information, histology, and extent of surgical resection were collected. Molecular subgroups of patients were not available for most patients, so this variable was excluded. Magnetic resonance imaging (MRI) studies at the time of initial metastasis presentation were reviewed and used to characterize the location, attachment site, and appearance of leptomeningeal metastases.

RESULTS: Thirteen (59%) patients had metastases at diagnosis while the rest were metastatic at recurrence. Fifteen (68%) had diffuse metastasis rather than discrete lesions. Metastases were located on the spinal cord in 15 patients, brain stem in 12 patients, cauda equina in 10 patients, and supratentorially in 5 patients. Fourteen (64%) had metastatic deposits strictly adherent to the pia while the remaining 8 patients had deposits that appeared to adhere to both pia and arachnoid.

CONCLUSION: Leptomeningeal metastases in medulloblastoma most frequently occurs on the pia mater in the brain stem, spinal cord, and cauda equina. This suggests that the pia mater is composed of a pro-adherent extracellular matrix niche that may be targetable by future therapeutics.

Keywords: Childhood medulloblastoma, metastasis, neuroimaging

FL-071

Neuro-Oncology

Incidence of Postoperative Paediatric cerebellar mutism syndrome over a 17-year period with an emphasis on the surgical technique – The Alder Hey Experience

Natasha Aziz, Conor Mallucci, Barry Pizer, James Hayden, Dawn Hennigan, Chelsea Harvell, Avula Shivaram

Alder Hey Children's Hospital, Liverpool, United Kingdom

OBJECTIVE: Post-operative paediatric cerebellar mutism syndrome (CMS) is a devastating complication following posterior fossa (PF) tumour resections. In our tertiary-level paediatric neurosurgical centre, surgical techniques related to posterior fossa brain tumour resection have been modified since 2016 to reduce the incidence of pCMS i.e. avoiding a transvermian approach, excessive retraction, and reducing Cavitron Ultrasonic Aspirator (CUSA) use, avoiding ultrasonic aspiration near

the cerebral aqueduct, superior cerebellar peduncles, and the brainstem and preoperative planning. This study aims to determine the incidence of pCMS before and after the change in surgical approach.

MATERIAL AND METHODS: In this retrospective case series, we evaluate patients records of all who underwent a PF tumour resection between 2007-2023. The diagnosis of pCMS was made based on the consensus definition published by the Posterior Fossa Society in 2016.

RESULTS: Our study included 167 patients who underwent 176 PF tumour resections between 2007 – 2023, with an average age of 8-years-old and 1.1:1 M:F ratio, of which 31 were diagnosed with pCMS. The rate of pCMS reduced from 24% between 2007-15 to 13% between 2016-23 ($p=0.04$). This difference was significant for both high-volume and low-volume tumour surgeons (24-8%; 0.02, 33-23%; 0.007% respectively) and in the high-risk patient-group using the Rotterdam Score (64%-29%; $p=0.02$). Medulloblastoma (34%) was more likely to be associated with post-operative CMS compared to pilocytic astrocytoma (13%) ($p=0.02$). Midline tumours were more likely to be associated with pCMS compared to hemisphere tumours ($p=0.0089$).

CONCLUSION: We noted a reduction in the rate of pCMS in our neurosurgical centre following the modification of surgical strategy, particularly among our high-volume tumour surgeons and in patients identified as high-risk preoperatively. This highlights the importance of surgical factors in the aetiology of pCMS and suggests that the incidence may be reduced with improved surgical technique.

Keywords: posterior fossa syndrome, cerebellar mutism, surgical technique, posterior fossa tumour, cerebellar mutism syndrome

FL-072

Neuro-Oncology

Copy number variation in Sonic Hedgehog (SHH)-Medulloblastoma: inhibitors of HDAC and PI3K as potential therapeutic optionsMonica Mureb¹, Sabrina L. Zeller¹, Eris Spirollari¹, Raphael Salles Scorteganga De Medeiros², Mohan Das¹, Jared Pisapia¹, Sidnei Epelman², Chirag D. Gandhi¹, Nelci Zanon³, Meena Jhanwar-Uniyal¹¹Department of Neurosurgery, New York Medical College/Westchester Medical Center, Valhalla, New York, USA.²Department of Pediatric Oncology, Hospital Santa Marcelina, São Paulo, Brazil³Department of Neurology and Neurosurgery, UNIFESP-Universidade Federal de São Paulo, São Paulo, Brazil

OBJECTIVE: Sonic Hedgehog (SHH)-medulloblastoma (MB) originates from granule cell precursors of the developing cerebellum that display SHH-signaling pathway activation. Aberrant p53 in SHH-MB is linked to disease progression and poor prognosis. Copy number variation (CNV) is a form of genomic structural variation that causes abnormal gene copy numbers, such as gene amplifications, gains, and losses. It is an important factor that regulates the expression of both protein-coding and non-coding genes, thus affecting various signaling pathways. In this study, we analyze genomic patterns of SHH-MB tumors and evaluate the use of HDAC and PI3K inhibitors as therapeutic options.

MATERIAL AND METHODS: SHH-MB tumors (IRB-approved; $n=15$) were evaluated for genomic abnormalities using OncoScan CNV Plus-Assay and ChAS 4.2 software. The presence of isochromosome 17q [i(17q)] was determined by fluorescence in situ hybridization (FISH). Effects of small molecule inhibitors targeting HDAC (LBH-589) and PI3K (Buparlisib; BKM) were assessed via functional assays (cell proliferation, migration, cell cycle, and drug resistance).

RESULTS: Approximately 30% of patients exhibited i(17q) with multiple p53 mutations, with no apparent correlation with metastasis observed. Besides p53, frequent genetic aberrations in IDH2: p.R140Q: c.419G>A (40%); PTEN:p.P248fs*5:c.741_742insA (60%); KRAS:p.Q61H:c.183A>C (60%); and isochromosome 9p were seen. LBH-589 and BKM-120 suppressed SHH-MB cell proliferation and migration. Drug resistance studies demonstrated that SHH-MB cells were resistant to BKM-120 treatment. These inhibitors function by targeting the mTOR pathway.

CONCLUSION: While the significance of genetic alterations in SHH-MB requires further investigation, the presence of i(17q) may define a poor prognosis, and aberrant p53 may be an essential criterion for disease progression and therapy resistance. Furthermore, small molecule PI3K and HDAC inhibitors may provide novel therapeutic options for SHH-MB treatment.

Keywords: Medulloblastoma, sonic hedgehog (SHH), Genetic variations, p53, HDAC and PI3K inhibitors

FL-073

Neuro-Oncology

Should Post-operative Stereotactic Radiosurgery be the Standard of Care in Craniopharyngioma Patients?

Deepak Agrawal, Saurabh Gupta, Shashank S Kale
Department of Neurosurgery & Gamma Knife, All India Institute of Medical Sciences, New Delhi-110029

OBJECTIVE: To analyse the clinical and radiological outcomes in patients receiving adjuvant gamma knife radiosurgery (GKRS) / radiotherapy (RT) for residual and recurrent craniopharyngiomas, and compare outcomes with patients who did not receive any postoperative radiotherapy.

MATERIAL AND METHODS: In this retro-prospective case-control study, we enrolled all consecutive patients who received adjuvant RT or GKRS for recurrent/ residual craniopharyngiomas over 9 years (January 2011- December 2019), with a minimum radiological follow up of 12 months. Consecutive surgically treated craniopharyngioma patients over two years (January 2018- December 2019). who did not receive any postoperative radiotherapy constituted the control group. The clinical, and radiological outcomes were compared between the two groups.

RESULTS: A total of 79 patients were enrolled for this study. 35 patients received GKT or RT, with a median age of 21 years (range 6-55 years). At a median follow up of 60.1 months (range 24 to 118 months), the tumor control rate was 91.4% (n=32). In the control group there were a total of 44 patients, with a median age of 16 years (range 3-48 years), and a median follow-up of 38.8 months; The mortality rate was 5.71% (n=2) in the group that received GKT/RT, compared to 25% (n=11) in the operative group, including a perioperative mortality of 11.4% (n=5). Kaplan-Meier analysis, and log-rank tests showed longer progression free survival (PFS) and overall-survival (OS) rates for patients receiving post-operative GKT/RT (5-year PFS of 92.3% vs 77.4%, p=0.03, and 5-year OS of 92.0% vs 74.6%, p=0.01). Cox proportional-hazards results showed adjuvant GKRS/RT (HR = 0.158, 95% CI = 0.033-0.757) to be an independent prognostic factor for overall survival in craniopharyngioma patients.

CONCLUSION: This study shows that Gamma Knife radiosurgery offers improved clinical and radiological outcomes as compared to only surgery, and should be considered in all patients with residual/recurrent disease.

Keywords: craniopharyngioma; Gamma knife; radiosurgery; India; stereotactic

FL-075

Neuro-Oncology

Cushing's disease in children – Challenges and outcomes over 15 years in a single centre

Ahmed El Naggar¹, Helen Storr², Mehul Dattani³, Joan Grieve⁴, Neil Dorward⁴, Kristian Aquilina¹

¹Department of Neurosurgery, Great Ormond Street Hospital, London, UK.

²Department of Paediatric Endocrinology, Royal Free Hospital, London, UK.

³Department of Paediatric Endocrinology, Great Ormond Street Hospital, London, UK

⁴Department of Neurosurgery, The National Hospital for Neurology and Neurosurgery, London, UK.

OBJECTIVE: Cushing's disease (CD) in children is rare. Due to difficulties in clinical, biochemical and radiological diagnosis, surgical access and post-operative endocrine care, the management of paediatric CD is challenging. We reviewed our institutional experience of paediatric CD over the last 15 years to determine outcomes and complications.

MATERIAL AND METHODS: Clinical details, neuroradiology and outcomes of all children who underwent surgery for CD in our institution between 2006 and 2023 were reviewed.

RESULTS: 25 children (14F) age 5-16 years (mean 11.7) underwent surgery for CD. 18 were pre-pubertal at diagnosis. Symptoms were present for a mean of 2.1 years before diagnosis. 70% percent had growth failure. Mean morning, sleeping midnight and 24-hour urinary cortisol concentrations were 593, 476 and 652 nmol/L respectively. Inferior petrosal sinus sampling lateralized in 76%. MRI revealed an adenoma in 15 children (2.6 – 7 mm diameter). Microscopic and endoscopic transsphenoidal surgery (TSS) was performed in 14 and 11 respectively. Biochemical cure was achieved in 19 patients (76%) after TSS. There was no difference between the two operative approaches. Six failures were treated with further surgery (2), radiotherapy (2) or metyrapone / ketoconazole (2). 6 children had transient diabetes insipidus post-operatively; 2 required growth hormone supplementation. There were no other endocrine deficiencies. Post-operative CSF leak occurred in 3 children and was managed by a lumbar drain.

CONCLUSION: CD in children is almost always diagnosed late despite established signs and symptoms, including weight gain and growth failure. TSS is as effective as in adults. A multidisciplinary team is crucial to the safe and effective management of these children.

Keywords: Cushing's disease; transphenoidal surgery; corticotroph adenoma

FL-076

Neuro-Oncology

The Learning Curve for Intra-Operative MRI in a Single Centre

Chloé Louise Gelder, Rebecca Sarah Chave Cox, Gnanamurthy Sivakumar, Atul Kumar Tyagi, Paul Dominic Chumas, John Robert Goodden
The Leeds Children's Hospital, Leeds, UK

OBJECTIVE: Extent of resection (EoR) remains of central importance for brain & CNS tumour outcome. As centres seek to improve EoR and optimise neurological outcome, there has been an increase in establishment of intra-operative magnetic resonance imaging (iMRI) facilities. An iMRI was opened in Leeds in 2019. We use a 2-room

solution incorporating a high-field GE Signa Architect AIR™ 3-Tesla MRI scanner.

MATERIAL AND METHODS: Cases identified from a prospective operation database. The first iMRI case was in July 2019. All subsequent neuro-oncology patients were identified. Electronic records analysed, with data extracted about iMRI use, operation notes, operation timings and outcomes. For cases where iMRI was not used, data was analysed to review (1) why iMRI was not used and (2) whether the outcome could have been improved. We present our learning as we adapted systems to adopt this technology in our centre.

RESULTS: iMRI used for 50 cases; including 5% with a second iMRI after resection of a target identified in the first iMRI. In total ~40% iMRI cases further small volume tumour residuum was resected after the first scan identified areas of concern. An additional 25 had immediate post-operative imaging in the iMRI scanner under the same GA.

Reasons for no iMRI include the COVID-19 pandemic and limited out-of-hours suitably-trained staff. For non-iMRI cases, findings such as brainstem invasion and vessel attachment meant outcome would not have altered for many.

Innovations include immediate post-operative iMRI for a spinal tumour patient for feasibility analysis, and novel AIR™ coil use.

CONCLUSION: iMRI has been useful to improve extent of resection. As with any new equipment, there is a learning curve as people and systems develop. The 2-room solution is important for overall productivity. A manufacturer research agreement has allowed clinically useful innovation.

Keywords: intra-operative MRI, iMRI, extent of resection, paediatric neuro-oncology, paediatric neurosurgery

FL-077

Craniofacial

Endoscopic treatment of isolated lambdoid craniosynostosis and the ongoing improvement in craniofacial deformity over time

Ziyad Makoshi, Vincent Aquino, David Yates
El Paso Children's Hospital

OBJECTIVE: This paper aims to present a 26-year experience treating unilateral lambdoid craniosynostosis with endoscopic-assisted strip craniectomy and postoperative cranial orthotic therapy and the changes that can continue to occur over a decade.

MATERIAL AND METHODS: A total of 34 patients with unilateral lambdoid craniosynostosis were treated between 1996 and 2024. There were 18 males and 16 females. Two 2-cm incisions were made immediately lateral to lambda on the affected side and immediately medial to asterion. Using endoscopic-assisted visualization, a strip craniectomy was performed between the afore-mentioned anatomical landmarks. Following surgery, all patients were placed in cranial orthoses to assist in the correction of craniofacial deformities. Pre and postoperative photographs were analyzed for correction of three different deformities: cranial scoliosis, facial twist, and mastoid tilt.

RESULTS: Age ranged from 25 days to 19 months. Average surgical time was 59.72 minutes (range 29 – 133 minutes). No blood transfusion was required for the cohort and all patients were discharged on postoperative day one. Mean preoperative facial twist was $7.12 \pm 1.87^\circ$. There was a significant difference between preoperative facial twist and last available post-operative measurements (mean improvement of 3.97° , $p < 0.001$, BCa 95% CI 2.87 – 5.02). Mean preoperative posterior cranial scoliosis was $6.09 \pm 2.71^\circ$. There was a significant difference between preoperative cranial scoliosis and last available postoperative measurements (mean improvement

of 3.25° , $p = 0.004$, BCa 95% CI 2.21 – 4.31). Mean preoperative mastoid tilt was $17.53 \pm 3.2^\circ$. There was a significant difference between preoperative mastoid tilt and last available postoperative measurements (mean improvement of 4.91° , $p < 0.001$, BCa 95% CI 3.67 – 6.33).

CONCLUSION: Endoscopic-assisted strip craniectomy for treatment of unilateral lambdoid craniosynostosis in children followed by cranial orthosis is associated with excellent long-term results that continue to improve over time. Surgery is safe with minimal blood loss and short hospital stay.

Keywords: Craniosynostosis, Lambdoid, Endoscopic, Craniofacial, craniometrics

FL-078

Hydrocephalus and Neuro

Socioeconomic Disparities in the Presentation and Management of Shunting Procedures for Cerebrospinal Fluid Diversion

Emery Buckner Wolfson¹, Geena Jung¹, Hailey Reiser¹, Margaret Keymakh¹, Timothy Kim¹, Ryan Fatemi¹, Seyed Ahmad Naseri Alavi², Andres Pasuizaca¹, Pushti Shah¹, Genesis Liriano², Andrew J Kobets²

¹Albert Einstein College of Medicine, Bronx, NY, USA

²Department of Neurological Surgery, Montefiore Medical Center, Bronx, NY, USA

OBJECTIVE: Prior literature has reported that low median household income (MHI) is associated with worse surgical outcomes, increased emergency department visits, and mortality. However, the effect of MHI on ventriculoperitoneal shunt care has not been well elucidated. Here, we sought to examine differences in shunt management and outcomes across MHI groups of patients who presented to our center for hydrocephalus-related shunt procedures from 2018-2022.

MATERIAL AND METHODS: We performed a retrospective analysis of patients who underwent hydrocephalus-related shunt procedures from 2018-2022 at an academic hospital in a socially disadvantaged, urban setting. Zip codes were cross-referenced to census data to determine MHI for each patient. Patients were stratified based on MHI: <\$40,000 (Group 1), \$40,000-\$70,000 (Group 2), \$70,000-\$100,000 (Group 3), >\$100,000 (Group 4).

RESULTS: 334 encounters among 256 patients (ages 4 days to 89 years) were included for data analysis. Age, sex, surgery duration, etiology/reason for shunt encounter, presence of altered mental status on admission, and number of encounters per patient over the study period did not significantly differ between income groups. There was a significant difference in valve type across income groups ($p < .05$), with a greater percentage of fixed-pressure valves utilized in the lowest income group (53.49% for Group 1 versus 41.9%, 37.5%, 44.68% for Groups 2-4, respectively), and a greater percentage of programmable valves utilized in the highest income group (40.5% for Group 4 versus 25.6%, 37.5%, 33.8% for Groups 1-3, respectively). There were no significant differences in the presence of post-surgery complications, post-surgical issues on shunt series X-ray, or re-operation between the different income groups.

CONCLUSION: Despite what other studies have reported about the association between MHI and surgical outcomes, we found no significant differences in the presence of shunt complications and re-operations between different MHI groups.

Keywords: hydrocephalus, shunt, median household income, socioeconomic disparities, clinical management, surgical complications

FL-079

Craniofacial

Long-term results of minimally invasive strip craniectomy without helmet therapy for scaphocephaly – a single-centre experience

Katharina Lutz¹, Andreas Röhrig², Jasmin Al Hourani², Sandra Kunze², Jana Forkosh², Jonathan Wermelinger¹, Martina Messing Jünger²

¹Neurosurgery Department, Inselspital, Bern University Hospital and University of Bern, Bern 3010, Switzerland

²Pediatric Neurosurgery, Asplepios Childrens` s Hospital, 53757, Sankt Augustin, Germany

OBJECTIVE: Scaphocephaly is the most common type of craniosynostosis and various surgical techniques are used for treatment. Due to late postoperative changes of the head shape, long-term outcome data is important for evaluating any new surgical technique. At our institution, minimally invasive strip craniectomy without regular helmet therapy is the standard treatment in scaphocephalic patients.

MATERIAL AND METHODS: Between October 2021 and February 2023, we retrospectively examined the skull shape of patients who underwent minimally invasive strip craniectomy for scaphocephaly using a 3D surface scan technique. The cephalic index (CI), the need for helmet therapy and additional cosmetic outcome parameters were investigated.

RESULTS: We included 70 patients (72.5 % male). The mean follow-up time was 46 (10–125) months and the mean CI was 75.7 (66.7–85.2). In 58 patients, the final cosmetic result was rated as “excellent/good” (mean CI: 76.3; 70.4–85.0), in 11 as “intermediate” (mean CI: 73.3; 66.7–77.6), and in one case as “unsatisfactory” (CI 69.3). The presence of a suboccipital protrusion was associated with a “less than good” outcome.

CONCLUSION: Minimally invasive strip craniectomy is an elegant and safe method to correct scaphocephaly. Our data show good cosmetic results in the long term even without regular postoperative helmet therapy.

Keywords: Scaphocephaly, sagittal craniosynostosis, craniosynostosis, minimally invasive strip craniectomy, helmet therapy, long-term outcome

FL-080

Craniofacial

Application of Virtual Planning and 3D Printing Guide in Surgical Management of Craniosynostosis

Kuan Lin Wu¹, Ting Chen Lu², Tzu Chin Lin¹, Chun Shang Chan³, Chieh Tsai Wu¹

¹Department of Neurosurgery, Chang Gung Memorial Hospital, Chang Gung University, Taoyuan, Taiwan

²Craniofacial Center, Department of Plastic and Reconstructive Surgery and Craniofacial Research Center, Chang Gung Memorial Hospital, Chang Gung University, Taoyuan, Taiwan

³Medical Augmented Reality Research Center, Chang Gung Memorial Hospital, Taoyuan, Taiwan

OBJECTIVE: This study aims to elaborate on the application of virtual surgical planning (VSP) and 3D printing guides in the surgical management of craniosynostosis and present the digital workflow through steps involved in planning, execution, and assessment.

MATERIAL AND METHODS: A retrospective review of patients, undergoing cranial vault and cranio-orbital remodeling procedures for syndromic and non-syndromic craniosynostosis, was performed. VSP

and simulation were performed and adjusted the patients' skull shape according to the age-matched standard skull. Patient-specific custom-made surgical cutting and reconstruction guide was printed in a medical grade 3D printer using biocompatible material. We measured patients' anthropometric cranial indices on 3D reconstructed models from CT scans before and after the operation.

RESULTS: In total, 78 patients with various presentations of craniosynostosis were operated on from 2017 to 2024. There were 59 male and 19 female patients, with a mean age of 19.62 months old, while receiving the surgery. 38 patients presented with sagittal suture craniosynostosis, 11 patients with bi-coronal craniosynostosis, 9 with metopic craniosynostosis, 7 with unicoronal craniosynostosis, and 13 with unilateral lambdoid craniosynostosis. Patients are divided into subgroups according to their cranial symmetry. The symmetric group consisted of sagittal/metopic/bi-coronal craniosynostosis and the asymmetric group of unicoronal/lambdoid craniosynostosis. In both symmetric and asymmetric groups, anthropometric cranial indices differences with standard skull (in percentage) demonstrated significant differences before and after the operation. In comparison with the population receiving operations without virtual surgical planning, less blood loss during operation (VSP: 194.69mL, traditional: 465.31mL; P value <0.001) and reduced length of hospital stay (VSP: 9.81 days, traditional: 13.38 days; P value = 0.005).

CONCLUSION: The digital and surgical workflow presented for the surgical management of syndromic and non-syndromic craniosynostosis using 3D printing surgical jigs proved reliable and predictable. In addition, less intraoperative blood loss and less hospital stay is achieved.

Keywords: computer-assisted surgical simulation, craniosynostosis, 3D printing, surgical guide, virtual surgical planning, anthropometric cranial index

FL-081

Craniofacial

Management of Craniosynostosis Patients: Insights from Patient-Reported Outcome Measures (PROMs)

Sofia Guernouche, Marc Lecouat, Szathmari Alexandru, Matthieu Vinchon, Pierre Aurélien Beuriat, Isabelle Verlut, Huguet Ludivine, Federico Di Rocco

Department of pediatric neurosurgery, National Reference Center - HCL - Lyon, France

OBJECTIVE: Surgery for craniosynostosis in children aims to correct skull deformities and improve functional outcomes. Parental Patient-Reported Outcome Measures (PPROMs) are tools for evaluating the experiences.

We aimed to evaluate PPRoms in assessing the surgical outcomes and quality of life in children undergoing surgery for craniosynostosis.

MATERIAL AND METHODS: Our cohort included all children under the age of 7 years coming to the medical out-patient consultation for the follow-up of a craniosynostosis at our center during two years.

RESULTS: Eighty PPRoms questionnaires concerning 54 children (34 boys and 20 girls) were completed: 27 sagittal, 16 metopic and 11 coronal suture craniosynostosis. The average age of the children was 3.7 years. Both parents filled separately a PPRom in 23 of the cases whereas in the remaining 31 only one parent was present.

The lowest scores and most recurrent anxieties concerned the items on behavior and emotions, the shape of the child's skull and the scar (average score of 7 compared to other items above 10). Conversely, parents showed little distress for the child's cognitive development, acquisition, autonomy and relationships with others.

Interestingly, 22% of the parents were not able to answer correctly what type their synostosis their child had despite several pre and post operative consultations.

When comparing maternal and paternal PPROMs when available (43%), in 75% of those, we found a difference of at least 2 points in at least one item of the PPROM.

CONCLUSION: PPROM offers valuable insights into the subjective experiences and quality of life outcomes in children undergoing surgery for craniosynostosis. While most children experience improved physical and psychosocial outcomes postoperatively, ongoing attention to pain management, psychosocial support, and long-term functional outcomes is essential to optimize patient-centered care and surgical outcomes.

Thus, the PPROM facilitates the multidisciplinary management in the follow-up of patients with craniosynostosis.

Keywords: Craniosynostosis, Development, Quality of life, Outcomes Measurement

FL-082

Craniofacial

Open versus endoscopic surgery for the management of patients with non-syndromic craniosynostosis: an analysis of treatment and costs of related outcomes

Javier Cuellar Hernandez¹, Omar Ortega Ruiz², Mauricio Torres Martínez², Mariana Villafranca Cantú², Emilio Piñeyro Cantú², Eduardo Menchaca Welsh², Javier Terrazo Lluch³

¹Department of Neurosurgery, Hospital Zambrano Hellion, TecSalud, San Pedro Garza García, Nuevo León

²Tecnologico de Monterrey, School of Medicine, Monterrey, Nuevo León, México

³Department of Neurosurgery, National Institute of Pediatrics, Mexico City,

OBJECTIVE: Endoscopic surgery for children with craniosynostosis have experienced an increasing tendency. However, open procedures are still considered an option in the treatment of this pathology. There is an ongoing debate regarding the optimal treatment for craniosynostosis as diverse factors influence the election of the surgical approach. Previous evidence favors endoscopy, still, evidence remains unfulfilled by a limited number of patients and the lack of an analysis of cranial index (CI) outcomes and costs. We seek to contribute to the elucidation of an established treatment decision algorithm for patients with craniosynostosis.

MATERIAL AND METHODS: Three previous meta-analyses published in 2018 yielded 11 eligible papers. We performed a systematic review and meta-analysis of the literature in MEDLINE and EMBASE databases through Pubmed, Scopus and Ovid to fill the gap of information between 2018 and 2024. 23 total articles were included in the final analysis.

RESULTS: Variables analyzed were baseline characteristics, length of stay, blood loss, transfusion rates and volume, operative time, differences between pre and postoperative CI and costs. Analysis of data concluded a younger age at surgery in patients undergoing endoscopic surgery ($p = <0.00001$). Blood loss, transfusion rates and volumes depicted favored outcomes for endoscopy with less blood loss during surgery ($p = <0.00001$), operative time ($p = <0.00001$) and transfusion rates ($p = <0.00001$) as well as lower transfused volumes ($p = <0.00001$). Differences in CI between groups showed a higher, but not significant change in CI in endoscopy ($p = 0.20$). In-stay costs in the endoscopic cohort were lower ($p = <0.00001$).

CONCLUSION: Endoscopic surgery carries less complications as well as differences in cranial index. Treatment related costs are

slightly decreased in endoscopic procedures after including costs related to outpatient care. Open surgery can be considered in older children and if no endoscope or experienced surgeons in endoscopic procedures are available.

Keywords: craniosynostosis, endoscopic surgery, outcomes, non-syndromic craniosynostosis.

FL-083

Craniofacial

Early Endoscopic Strip Craniectomy for Treatment of Bilateral Coronal Synostosis in Children with Apert Syndrome

Emma Hartman¹, John Meara², Mark Proctor¹

¹Department of Neurosurgery, Boston Children's Hospital, Harvard Medical School, Boston, MA, USA.

²Department of Plastic Surgery, Boston Children's Hospital, Harvard Medical School, Boston, MA, USA.

OBJECTIVE: In Apert Syndrome, the premature closure of the coronal sutures results in turribrachycephaly. Many recent studies indicate that an early first stage surgery can minimize the progression of turribrachycephaly, improving morphology, and protecting function. Options for early surgical management include posterior occipital expansion, or endoscopic strip craniectomy (ESC) of the fused coronal sutures.¹⁻³ In this study, the authors evaluated their clinical experience with early ESC for patients with Apert syndrome.

MATERIAL AND METHODS: Charts for 27 pediatric patients with Apert syndrome who underwent ESC between 2010 – 2023 were reviewed for demographic and diagnosis characteristics, surgical details, follow up, and subsequent character.

RESULTS: Average age at surgery was 3.7 months with 13 male: 14 female. Of the 27 patients, 24 had bilateral coronal synostosis, 2 had additional fused sutures, and 1 had unicoronal synostosis. Two patients had CSF leak treated with lumbar drain. Cranial remodeling helmets were fitted within a week of surgery and continued for 6 - 9 months (mean 7.1 months). Overall correction of turribrachycephaly was excellent, but progressive suture fusion could occur. Twelve patients (44%) required a follow up FOA, due to elevated ICP concerns ($n = 9$) or frontal retrusion ($n = 3$). Average age at follow up surgery was 4 years. Two patients required a third operation due to a CSF leak ($n = 1$) and ICP concerns due to a plate failure requiring return to OR on post-operative day 4 ($n = 1$). Average follow up was 6.7 years.

CONCLUSION: Endoscopic suturectomy with post-operative helmet therapy is a good treatment alternative to avoid secondary turribrachycephaly in children with bicoronal synostosis. Unlike posterior distraction, which is a 3-surgery treatment plan, currently <50% of children treated by endoscopic surgery have required additional operations. Additional long term follow up is needed.

Keywords: Craniosynostosis, Apert Syndrome, pediatrics, minimally invasive surgery

FL-084

Craniofacial

Changes in cerebral blood flow following cranial vault remodeling in craniosynostosis

Giuseppe Cinalli¹, Marco Aiello², Ursula Pia Ferrara³, Carmela Russo⁴, Eugenio Maria Covelli⁴, Pietro Spennato¹, Lucia De Martino³, Stefania Picariello³, Giuseppe Mirabelli⁷, Francesco Grassi², Giovanni Smaldone², Domenico Vincenzo De Gennaro¹,

Camilla Russo⁴, Rosaria Manna⁵, Lucia Quaglietta³, Ferdinando Aliberti⁶

¹Department of Neurosciences, Unit of Neurosurgery, Santobono-Pausilipon Children's Hospital, AORN, Naples, Italy

²SYNLAB SDN, IRCCS, Naples, Italy

³Department of Oncology, Unit of Neuro-Oncology, Santobono-Pausilipon Children's Hospital, AORN, Naples, Italy

⁴Department of Neurosciences, Unit of Neuroradiology, Santobono-Pausilipon Children's Hospital, AORN, Naples, Italy

⁵Department of Neurosciences, Unit of Rehabilitation, Santobono-Pausilipon Children's Hospital, AORN, Naples, Italy

⁶Department of Neurosciences, Unit of Cranio-Maxillo-facial surgery, Santobono-Pausilipon Children's Hospital, AORN, Naples, Italy

⁷Department of Strategic Staff, Unit of Research Laboratories and Biobank, Santobono-Pausilipon Children's Hospital, AORN, Naples, Italy

OBJECTIVE: To offer the preliminary results on the differences between pre- and immediate post-operative cerebral blood flow (CBF) with arterial spin labeling (ASL) in patients with craniosynostosis (CRS).

MATERIAL AND METHODS: All craniosynostosis operated on at the Santobono-Pausilipon Children's Hospital from May 2023 were prospectively enrolled in a 24-month single-center study (funded by grant PNRR-MR1-2022-12376512). MRI is performed before, immediately after and >6 months after cranial vault remodeling to evaluate modification of CBF, quantified (mL/100 g/min) from the pulsed continuous ASL acquisition and averaged across brain regions segmented on structural MRI with the Infant FreeSurfer tool. Thirteen ROIs were chosen for each hemisphere and 6 ROIs were selected on the midline. Thirty-one patients have been enrolled so far and underwent pre-op and immediate post-op MRI.

RESULTS: To date, full analysis of pre-op and immediate post-op CBF is available for 11 subjects (4-87 months) affected by scaphocephaly (7 cases), trigonocephaly (2 cases), plagiocephaly (1 case) and complex craniosynostosis (1 case). Pre-op MRI was performed on average 9 days before surgery (range 1-29 days). Post-operative MRI was performed in average 6 days after surgery (range 2-7 days). An increase in CBF after cranial vault remodeling was evident in 7 patients (5 scapho, 1 trigono, 1 Pfeiffer). Increase range was 9,29%-85,45%, average increase was +38,71%. A decrease in CBF was instead observed in 4 patients (2 scapho, 1 trigono, 1 right plagio). Decrease range were -5,82%--26,89%, average decrease was -19,80%.

CONCLUSION: Cranial vault remodeling can induce significant variations in CBF in the immediate post-operative period. The possibility of both figures (increased and decreased CBF) is of interest and needs to be validated by analysis of larger numbers and of the long term (>6 months) MRI. Increased CBF was more significant and more frequently observed in the 11 patients studied so far.

Keywords: craniosynostosis, biobank, cerebral blood flow, scaphocephaly, magnetic resonance, arterial spin labeling

FL-085

Craniofacial

H craniectomy 12-years review in isolated sagittal craniosynostosis: evidence of improvement in reintervention rate and Esthetic results

Giovanna Paternoster¹, Cyril James¹, Roman Hossein Khonsari², Federico Di Rocco¹, Dominic Renier¹, Eric Arnaud¹

¹Department of Neurosurgery, Hôpital Necker – Enfants Malades, Assistance Publique – Hôpitaux de Paris, Paris, France

²Department of Maxillofacial surgery and Plastic surgery, Hôpital Necker – Enfants Malades, Assistance Publique – Hôpitaux de Paris, Paris, France

OBJECTIVE: H craniectomy is one of the most common technique for the treatment of isolated sagittal craniosynostosis. A longterm analysis of 12 years of experience in the same Centre in 456 patients is presented.

MATERIAL AND METHODS: Between 2010 and 2021, 456 patients have been operated for isolated scaphocephaly in Necker Hospital Enfants Malades in Paris. Clinical, radiological, neuropsychological data of 233 patients in the period 2010-2015-15 (group 1) and 233 patients in the period 2015-2021 (group 2) have been analysed. Some differences in age at surgery and mild changes in surgical technique has been introduced in 2015

RESULTS: In the group 1, we record 108 patients – 48.4% - operated older than 160 days, while in the group 2 we note only 30 patients - 12.8%. The re-intervention rate is the 3.6% in group 1 (8 patients) and 0.8% in group 2 (2 patients).

Considering the age at surgery, 7/8 of re-operated patients in the group 1 and 2/2 in the group 2 can be observed in the older subgroup of patients. In both groups, we observe environ 80% of secondary coronal synostosis, 20% of mild cognitive difficulties and 6% of autism spectrum problems.

CONCLUSION: H craniectomy is the gold standard surgical procedure for isolated scaphocephaly in our department. Trying to reduce the re intervention rate and the esthetic outcome, some changes has been introduced from 2015: the evidence of increased risk in patients firstly operated older than 160 days has been demonstrated. No significative differences in neuropsychological problems have been found in the 2 groups of patients: a possible genetic substrate need to be assessed.

H craniectomy is a very well know technique. The strict respect of age at surgery inferior of 160 days and an enlarged length of craniectomy seems to reduce the re intervention rate.

Keywords: scaphocephaly, H-technique, esthetic outcome, neurocognitive outcome

FL-086

Craniofacial

Long-term Morphological Outcomes of Surgical Treatment for Sagittal Synostosis in Infants Younger than Six Months

Hamilton Matushita, Daniel Dante Cardeal

Department of Neurosurgery - São Paulo University, São Paulo, Brazil

OBJECTIVE: The primary objective of this study is to quantitatively evaluate the morphological changes resulting from interventions in children under the age of six months who have undergone open surgical craniectomy.

MATERIAL AND METHODS: We present a retrospective analysis of 85 consecutive cases involving infants diagnosed with sagittal synostosis and those aged below six months who underwent surgical intervention. Since 2004, comprehensive anthropometric measurements have been systematically recorded for all craniosynostosis patients during the pre- and post-operative phases

RESULTS: The surgical procedures in this cohort comprised extended suturectomy with wedge osteotomies in parietal bone for 51 cases, supplemented by partial reconstruction of frontal (15 cases) or occipital (19 cases) bulging in 34 cases. The mean age at surgery was 4,69 months (range 2-6 months), with male predominance observed (58/27). The mean cephalic index (CI) preoperatively was 0,64 (range 0,56-0,71) (+_0,03). Subsequent follow-up assessments included annual CI measurements using a spreading caliper for up to five years postoperatively. During the initial year, a mean CI improvement of 17% (range 5%-24%) (p<0.05) was noted, while over the long term, a 3% (range

1%-8%) decline in CI was observed at the end of the five-year period. Two cases (2,3%) necessitated reoperation, and significant skull defects were detected in two cases (2,3%) on the late postoperative CT scans. Late-onset intracranial hypertension was observed in 3 cases (3,5%).
CONCLUSION: Our findings indicate that extensive suturectomy can significantly improve scaphocephalic cranial morphology, particularly when combined with targeted frontal or occipital bulging remodeling. Suturectomy represents a viable surgical approach for passive cranial remodeling, contingent upon the brain growth dynamic most pronounced during infancy. Therefore, its application is confined to this specific age cohort. Given the heightened osteogenic potential of young children, a degree of morphological regression was evidenced by the observed 3% decline in CI after five years of follow-up.

Keywords: sagittal synostosis, scaphocephaly, craniosynostosis, cephalic index, anthropometric measurement

FL-087

Craniofacial

Long-term follow-up in 415 operated cases with single suture scaphocephaly

Sofie Dietvorst¹, Lawrence Choi², Anusha Hennedige³, David Richardson³, Christian Duncan⁴, Vejay Vakharia¹, Chris Parks¹, Ajay Sinha¹

¹Department of Neurosurgery, Alder Hey Children's Hospital Trust, Liverpool, UK

²Department of Neurosurgery, Auckland City Hospital, Auckland, New Zealand

³Department of Maxillofacial Surgery, Alder Hey Children's Hospital Trust, Liverpool, UK

⁴Department of Plastic Surgery, Alder Hey Children's Hospital Trust, Liverpool, UK

OBJECTIVE: There are multiple operative options to treat single suture scaphocephaly. The goal of the operation is to avoid raised intracranial pressure (ICP) and to improve cosmetic appearance. In Alder Hey Children's hospital we use passive vault remodeling (PVR), subtotal (SVR) or total vault remodeling (TVR) and endoscopic strip craniectomy (ESC) with helmet as main treatment options. We wanted to compare our results as a supraregional craniofacial referral center, which is one of the largest single center databases available.

MATERIAL AND METHODS: We did a retrospective analysis of all the operated cases to treat single suture scaphocephaly at Alder Hey, syndromic or multisuture synostosis was excluded. The patients were included from 2012 till 2023. Age, type of surgery, issue of ICP at diagnosis, cephalic index (CI) pre- and postoperative, type and indication for reoperation and length of follow-up were included in the database.

RESULTS: 415 patients were included based on the operative records; 200 underwent PVR, 206 underwent SVR/TVR, 8 underwent ESC+helmet, 1 was treated with springs. Median follow-up was 46 months. Median age at surgery was 4 months for PVR and ESC+helmet, 21 months for SVR/TVR. 18 patients were treated for high ICP due to synostosis, with median age at surgery being 54 months. Reoperations for intracranial hypertension or persistent abnormal head shape were done for 17 patients treated with PVR (8.5%), 4 patients treated with SVR/TVR (1.9%) and 1 patient treated with ESC+helmet (12.5%). In all operated patients, there was a significant increase in postoperative versus preoperative CI (paired t-testing, $p < 0.01$).

CONCLUSION: PVR and SVR/TVR are the most common procedures to treat scaphocephaly, with PVR being done at an earlier age. In less than 10% of PVR there is a need for reoperation due to increased ICP or abnormal head shape, with the advantage of PVR being less invasive than SVR/TVR.

Keywords: scaphocephaly, intracranial pressure, cephalic index

FL-088

Craniofacial

Papilloedema: a highly specific predictor of raised intracranial pressure in a complex neurosurgical paediatric cohort

Azam Ali Baig, Alexander Mitchell, Usama Kanj, Desiderio Rodrigues, Sally Painter, Joseph Abbott

Department of Neurosurgery, Birmingham Women's and Children's Hospital, Birmingham, United Kingdom

OBJECTIVE: Papilloedema is recognised as an indicator of raised intracranial pressure, although there is a paucity of literature describing the utility of fundoscopy in screening for raised ICP in children with craniofacial synostosis, particularly young children. We sought to investigate the association of optic disc morphology with ICP in children, and to define the sensitivity and specificity of papilloedema as a clinical indicator of raised ICP and determine if age, or underlying conditions impact the findings.

MATERIAL AND METHODS: Retrospective analysis of all patients undergoing ICP monitoring at a designated paediatric neurosurgical and craniofacial unit in the United Kingdom between October 2009 and October 2018. The fundoscopy findings and ICP monitoring data were analysed for 31 children with craniosynostosis and 29 children without craniosynostosis.

RESULTS: All children who had papilloedema had raised ICP confirmed with monitoring. Across the 60-patient cohort, confirmed papilloedema on fundoscopy had Positive Predictive Value (PPV) of 1.00, Negative Predictive Value (NPV) of 0.64 with sensitivity 48% and specificity 100% for the presence of raised ICP ($p = < 0.0001$). In the craniosynostosis group, PPV was 1.00, NPV was 0.39, sensitivity 48% and specificity 100% ($p = < 0.03$). There is no correlation between severity of optic disc swelling using Frisen grading and elevation of ICP. Age did not affect the presence of papilloedema in those with raised ICP.

CONCLUSION: The presence of papilloedema is a strong indicator of raised ICP in a child, regardless of underlying aetiology. Detailed fundoscopy can prevent the need for further investigations including imaging-related radiation and invasive CSF pressure monitoring.

Keywords: Papilloedema, Craniosynostosis, Intracranial pressure, Fundoscopy, Optic disc

FL-089

Craniofacial

Utilization of intraoperative ultrasound in endoscopic sagittal suture synostosis repair to optimize incision planning

Julian Zipfel, Kevin Ferraris, Ash Singhal

Division of Paediatric Neurosurgery, BC Children's Hospital, Vancouver, Canada

OBJECTIVE: Endoscopy-assisted craniectomy with lateral osteotomies and postoperative helmet molding therapy is a widely used approach in managing sagittal suture craniosynostosis. Several individual modifications of this approach have been published and are utilized. Generally, the incisions are placed just posterior to the anterior fontanelle and just anterior to the posterior fontanelle and lambdoid sutures, and accurate incision placement optimizes safe separation of the superior sagittal sinus. We present our 10 year experience with an ultrasound-assisted approach to identify the lambdoid sutures and precisely place the skin incisions.

MATERIAL AND METHODS: We included all patients in care at our institution between 2013 and 2023 operated for sagittal suture craniosynostosis with endoscopy-assisted craniectomy with lateral osteotomies and postoperative helmet molding therapy. A retrospective review of clinical parameters, surgical data as well as outcomes and imaging studies was performed.

RESULTS: We identified 102 patients operated during the observation period. Mean age was 3.9 ± 3.5 (range 2.7-6.4) months. Patients were predominantly male (73.5%, n=75) preoperative ultrasound was documented in 59.8% of cases (n=61). In 100% of cases, the incisions were placed posterior and anterior to the anterior and posterior fontanelle, respectively.

CONCLUSION: Using this technique of ultrasound guided identification of the lambdoid suture/posterior fontanelle as well as coronal suture/anterior fontanelle, may aid in adequate placement of skin incisions as well as confirming diagnosis. This indication, coupled with the many other published indications for point of care ultrasound, reaffirms the overall utility of ultrasound in pediatric operative neurosurgery.

Keywords: sagittal suture synostosis, endoscopic, sonography

FL-090

Craniofacial

A comparison of the percent of cerebrospinal fluid volume in patients with craniosynostosis before and after surgery using Voxel Based Morphometry

Hirokazu Nakatogawa¹, Tadashi Miyagawa², Takamichi Yamamoto³, Tomohiro Nakamura⁴, Chikanori Inenaga⁴

¹Department of Pediatric Neurosurgery, Seirei Hamamatsu General Hospital, Hamamatsu City, Shizuoka, Japan

²Department of Pediatric Neurosurgery, Matsudo City General Center, Matsudo City, Chiba, Japan

³Department of Neurosurgery, Seirei Mikatahara General Hospital, Hamamatsu City, Shizuoka, Japan

⁴Department of Neurosurgery, Seirei Hamamatsu General Hospital, Hamamatsu City, Shizuoka, Japan

OBJECTIVE: Raised intracranial pressure (ICP) is a well-known aspect of craniosynostosis (CS). However, those changes in cerebrospinal fluid (CSF) volume before and after surgery are not clear. As far as we ranged extensively over the literature, there were no reports that had evaluated changes in CSF volume after distraction osteogenesis. The aim of our pilot study was to examine the ratio of the CSF volume and the brain tissue (the grey matter (GM) and the white matter (WM)) volume in patients with CS before and after surgery using the voxel based morphometry (VBM) in statistical parametric mapping (SPM) 12 software.

MATERIAL AND METHODS: We performed a retrospective cohort study of patients with CS by the distraction osteogenesis. We compared the ratio of the GM and the WM volume to CSF volume between preoperative and postoperative cases. Data were analyzed using VBM in SPM 12 software.

RESULTS: From April 2017 through June 2023, we treated 14 consecutive cases who underwent distraction osteogenesis. The ratio of GM and WM volume and CSF volume became significantly lower postoperatively (19.8% preoperatively vs 15.1% postoperatively, $p=0.022$, respectively).

CONCLUSION: In our pilot study, patients with CS had the percent of CSF volume that was alleviated by cranial distraction osteogenesis.

Keywords: 1) Craniosynostosis, 2) intracranial pressure, 3) cerebrospinal fluid, 4) voxel based morphometry 5) distraction osteogenesis

FL-091

Craniofacial

Functional Posterior Calvarial Vault Distraction Protocol – Maximising functional benefits with PCVD in syndromic craniosynostoses

Suhas Udayakumaran¹, Vinanthi Vinay², Pramod Subhash²

¹Division of paediatric Neurosurgery, Department of Neurosurgery, Amrita Institute of Medical Sciences and Research Centre, Kochi, India

²Division of Craniomaxillofacial Surgery, Amrita Institute of Medical Sciences and Research Centre, Kochi, India

OBJECTIVE: To evaluate a cohort of patients who underwent posterior cranial vault distraction (PCVD) according to our protocol for syndromic craniosynostoses.

MATERIAL AND METHODS: We retrospectively collected details of all the patients who had undergone PCVD for various indications between March 2015 and November 2023, with a follow-up of at least one year and six months. The evaluation was based on a detailed clinical assessment, multidimensional computed tomography, MRI brain rapid protocol, Ophthalmological evaluation, sleep study and nasal endoscopy if indicated.

The surgical technique involved posterior calvarial craniotomy (Supra-, sub torcular) and, in selected patients, strategic barrel stave along the synostotic bones and venous decompression along the transverse and sigmoid veins. According to our total calvarial treatment protocol, frontorbital advancement and remodelling (FOAR) with or without LeFort III osteotomy and Midface distractor placement during PCVD distractor removal.

RESULTS: 34 patients between the ages of 4 and 204 months (mean 34 months) were included in the study. PCVD craniotomy was supra-torcular (9/34) and sub-torcular (25/34). Certain other nuances in selected patients, viz., craniectomy and venous decompression along the transverse and sigmoid veins in (22/34) and strategic barrel staving along the stenosed bones (beyond postcalvarium), were done in (7/34). According to our treatment protocol, frontorbital advancement and remodelling (FOAR) with a LeFort III osteotomy and midface distractor placement during PCVD distractor removal.

Based on the presentation, a satisfactory outcome was noted in all patients functionally and aesthetically. The average increase in intracranial volume was 186 ± 61 cm³.

Frontorbital advancement and remodelling (FOAR) was done in (15/34) patients, LeFort III osteotomy and Midface distractor placement in (3/34) during PCVD distractor removal and FOAR (4/34) during MD removal.

CONCLUSION: Our technical modifications have added to the functional and aesthetic benefits with no additional morbidity.

Keywords: Posterior calvarial distraction, Functional, total calvarial approach

FL-092

Craniofacial

Chaos to flow: Categorisation, nomenclature to problem mapping- Proposing a Unified Interdisciplinary language in craniosynostoses

Suhas Udayakumaran¹, Vinanthi Vinay², Shibani Nerurkar², Pramod Subhash², Dilip Panikar³

¹Division of paediatric Neurosurgery, Department of Neurosurgery, Amrita Institute of Medical Sciences and Research Centre, Kochi, India

²Division of Craniomaxillofacial Surgery, Amrita Institute of Medical Sciences and Research Centre, Kochi, India

³Department of neurosurgery, Aster Medicity, Kochi, India

OBJECTIVE: (1) To create a nomenclature for universal and interdisciplinary application among various specialists in managing craniosynostoses patients.

(2) To apply the taxonomy to an institutional cohort and create a representative “problem map.”

MATERIAL AND METHODS: The taxonomy described by (Udayakumaran et al., 2022) was adopted on the institutional cohort between 2015 and 2023. It was based on the following tenets:

I. CATEGORISATION

The main characteristic of the taxonomy is that categorisation is issue-based and according to functional issues:

C1: Aesthetic issues

C2/CI: Intracranial pressure (ICP)

C3/CA: Predominantly Airway issue

C4/CIA: ICP and airway issues both

C5: Delayed Diagnosis

II. DEPICTING THE NOMENCLATURE

Based on the investigation, the craniofacial surgeon evaluates any patient at presentation clinically and represents the categories.

i. The letter “C” would represent the category. The subsequent letter would describe the presentation issue of raised ICP represented “I” and “A” for airway.

ii. To this aetiology/genetic information

iii. Treatment status [Treated (1)/untreated (0)] is added

a. Illustrative Case

C4ITAT (Crouzons) refers to C4 with ICP and airway treatment and a genetic diagnosis of Crouzons

b. C1 (Brachycephaly) (NOI) refers to brachycephaly in C1 with the genetic diagnosis “Not otherwise identified” (NOI)

III. Problem mapping

The institutional cohort adopted the authors’ proposed taxonomy between 2015 and 2023 to develop a representation system. The cohort representation map or the “problem map” aimed to have a pictorial representation that satisfied the following tenets:

1) Informative, pictorial with clarity

2) Simplistic and attractive representation (Categories with their respective aetiology, treatment, outcome, etc.)

3) Universally applicable to transfer information between institutional systems with updates

RESULTS: We have demonstrated the nomenclature and the application for “problem mapping” a cohort.

CONCLUSION: We have proposed a goal-based universal language and representation for interdisciplinary communication.

Keywords: Categorization, nomenclature, taxonomy, Problem mapping, language, interdisciplinary

FL-093

Craniofacial

Ultra early Endoscopic Synostectomy in Craniosynostosis

Brian T Oliver, Sharief Mohammed, Gautam G Malkani, [Aaron Mohanty](#)

University of Texas Medical Branch at Galveston, Galveston, TX, USA

OBJECTIVE: Endoscopic synostectomy (ES) is conventionally carried out between 3 to 6 months of age though often the diagnosis is made at birth or early in neonatal period. The consideration to delay the surgery at an early age possibly relates to the anesthesia risk and blood loss in young infants. We earlier reported our preliminary results of ultra-early synostectomy performed before 8 weeks of age. In the present communication, we share our experiences gained with patients over the past 13 years.

MATERIAL AND METHODS: A retrospective analysis of the prospectively maintained database of infants operated with ES.

RESULTS: 76 synostectomies were performed by one pediatric neurosurgeon between 2011 and 2023. Of these, 39 were at or below 8 weeks of age. 16 were 2 weeks or younger, 12 between 3 to 4 weeks and 11 where between 5 to 8 weeks of age. The infants weighed between 2.25 kg and 4.9kgs. 29 had single suture craniosynostosis while 10 had multi suture synostosis. In single suture synostosis, the operative duration varied between 14 - 40 minutes with the estimated blood loss varied from 10 to 40 ml. For the multisuture group, the operative duration (30- 120 mins) and the blood loss (20-180 ml) were significantly higher, with requirement of blood transfusion during surgery. In 3 children with multisuture craniosynostosis, the procedure was staged due to blood loss. 3 infants experienced postoperative complications (duraotomies 2, kernicterus 1). Postoperatively, all underwent cranial orthoses placement. One child with a single suture craniosynostosis and 4 with syndromic craniosynostosis required repeat surgery. The follow-up varied between 6 months to 12 years. None of the single suture craniosynostosis required a repeat surgery during the follow-up.

CONCLUSION: We believe ES is safe in early neonatal period and the philosophy of postponing surgery till 3 months of age needs to be reconsidered.

Keywords: endoscopic synostectomy, craniosynostosis, ultra-early synostectomy

FL-094

Craniofacial

Craniosynostosis in Africa: A Systematic Review and Meta-Analysis

[Kwadwo Darko](#)¹, [Sonia Pulido](#)², [Muhammad Ammar Haider](#)³, [Milan Sivakumar](#)⁴, [Bernice Limann](#)⁵, [Pearl Tenkorang](#)⁵, [Okikioluwa Odesanya](#)⁶, [Peace Odiase](#)⁷, [Mark Farid](#)⁸, [Umaru Barrie](#)⁴, [Bruno P. Braga](#)⁹, [Mabel Banson](#)¹, [Teddy Totimeh](#)¹⁰

¹Department of Neurosurgery, Korle Bu Teaching Hospital, Accra, Ghana

²University of Illinois College of Medicine, Peoria, IL, USA

³C.M.H. Lahore Medical College, Lahore, Pakistan

⁴Department of Neurological Surgery, University of Texas Southwestern Medical Center, Dallas, TX 75390, USA

⁵University of Ghana Medical School, Accra, Ghana

⁶All Saints University, School of Medicine, Dominica

⁷Meharry Medical College, Department of Biochemistry and Cancer Biology, Nashville, TN, USA

⁸Department of Computer Engineering, University of Texas at Dallas

⁹Department of Neurological Surgery, University of Texas Southwestern Medical Center, Dallas, TX 75390, USA; Children’s Medical Center, Dallas, TX 75235, USA

¹⁰Accra Medical Centre, Accra, Ghana

OBJECTIVE: Craniosynostosis, a congenital skull deformity that negatively impacts development and quality of life of children if left untreated. We aimed to synthesize literature on craniosynostosis in Africa.

MATERIAL AND METHODS: A systematic review of the literature using PubMed/MEDLINE, SCOPUS, Web of Science and Google Scholar databases were searched according to PRISMA guidelines. A proportional meta-analysis was performed.

RESULTS: Twenty-eight studies with 647 patients (8 African countries) were included. In our analysis of 12 retrospective articles, 56.6% of patients (317/560) were males, with a mean age 2.4 (95%

CI: 1.1-3.7) years. Head deformity was the most reported presentation in 77.8% of cases (332/427). Syndromic craniosynostosis was seen in 25.2% (95% CI: 13.7%-36.6%) with Crouzon 13.8% (95% CI: 9.9%-17.6%) as the most reported syndrome. Reported phenotypes were trigonocephaly 31.5% (95% CI: 3.6%-59.4%), anterior plagiocephaly (23.2%, 95% CI: 5.1%-41.3%) and scaphocephaly 22.1% (95% CI: 13.5%-30.8%). Multiple suture synostosis was seen in 37.4% (95% CI: 8.8%-65.9%). Fronto-orbital advancement was performed in 26.5% (95% CI: 0.0-54.6) of cases and vault remodeling in 43.1% (95% CI: 4.3%-81.9%), 0.5% (CI: 0.0%-1.1%) had endoscopic surgery. Postoperative complications included CSF leaks (5.4%, 95% CI: 0.0%-11.6%) and surgical site infections (4.5%, 95% CI: 0.0%-10.8%). Follow-up ranged between 0.2-40.9 months, 95.6% of cases (95% CI: 90.1%-100.0%, 4 articles) had improved deformity and neurological deficits at last follow-up. The mortality rate was 3.1% (95% CI: 0.0%-6.9%). 8 articles described primary challenges in Africa including restricted access to medical resources and limited infrastructure for surgical management of craniosynostosis. Proposed solutions centered around collaborative initiatives between high income and low-income countries for comprehensive training aimed at enhancing diagnostics and treatment capabilities.

CONCLUSION: Our review provides insight on patterns on craniosynostosis in Africa. It highlights the need for early diagnosis and collaboration aimed at standardizing data to enhance our understanding of the burden and geographical variations of craniosynostosis across Africa.

Keywords: Craniosynostosis, Africa, Pediatric Neurosurgery, Resource-limited settings.

FL-095

Craniofacial

Positional plagiocephaly: Orthotic treatment results based on anthropometric analysis

Maria Belen Vega¹, Marcelo Peluso², Ramiro Del Rio³, Graciela Zuccaro⁴

¹Department of Neurosurgery, Hospital Fernandez, Buenos Aires, Argentina

²Department of Neurosurgery, Hospital Pirovano, Buenos Aires, Argentina

³Department of Neurosurgery, Hospital Garrahan, Buenos Aires, Argentina

⁴Department of Neurosurgery, Trinidad medical center, Buenos Aires, Argentina

OBJECTIVE: Positional plagiocephaly is nowadays one of the most frequent consultation at pediatric neurosurgical departments. The aim of this study is to describe the results of orthotic therapy in positional plagiocephaly based on an anthropometric analysis.

MATERIAL AND METHODS: A retrospective study was conducted. All patients with positional plagiocephaly who were seen in medical consultation between October 2022 and May 2024 in Trinidad Medical Center, Buenos Aires, Argentina were included. Anthropometric analysis with CAD-CAM system pre and post helmet therapy was performed. An improvement higher than 80% of deformity was considered as a successful outcome. The phenotypic presentation according to Argenta classification and the length of treatment were reviewed.

RESULTS: Thirty-four patients were included. Mean age was 5.35 months old, 74% was male, 16 (47%) had a successful outcome. None of the cases had an outcome inferior to 40%. As regards phenotypic presentation, 27 (70%) patients were grade 3 of Argenta classification.

The mean duration of the treatment was 113 days and the median was 100 days.

CONCLUSION: Almost half of the cases had an improvement better than 80% in a median length of 100 days.

No relationship between phenotypic Argenta classification and a successful outcome were found. However, good results were found in every Argenta grade.

Further studies are needed to relate if the anthropometric successful outcome has a correlation with a good cosmetic result in positional plagiocephaly.

Keywords: Deformational plagiocephaly. Cranial deformity. Orthotic treatment. Anthropometric analysis.

FL-096

Basic Research and Trials

Unveiling Therapeutic Potentials: Targeting Heat Shock Protein 90 Suppresses Medulloblastoma Cell Proliferation and Overcomes Chemoresistance in Medulloblastoma Cancer Stem Cells

Chien Kai Wang¹, Hsieng Yun Huang¹, Ying Ying Li², Shu Mei Chen¹

¹Department of Neurosurgery, Taipei Medical University Hospital, Taipei Medical University, Taipei, Taiwan

²Department of Veterans Affairs, Miami VA Healthcare System, Florida, United States

OBJECTIVE: Medulloblastoma (MB) stands as the most prevalent malignant brain tumor in children. While conventional chemotherapies are often employed in its treatment, the frequent development of chemoresistance significantly diminishes their effectiveness. Our initial research findings have revealed elevated levels of certain heat shock proteins in MB cells, potentially elucidating the mechanism behind chemoresistance. Notably, expressions of HSP70 and HSP90 are particularly pronounced in MB CD133+ cancer stem cells (CSCs). Recognizing the pivotal roles of these proteins in maintaining stemness and regulating the cell cycle, our study aims to validate HSP90 inhibition as a promising therapeutic strategy for overcoming chemoresistance in MB.

MATERIAL AND METHODS: We conducted immunoblotting and immunoprecipitation assays to assess the levels of HSP90, its client proteins, and stemness markers following treatment with the HSP90 inhibitor (17-AAG) or knockdown of HSP90 using siRNA in both MB and MB CSCs. The therapeutic effects of HSP inhibitors or HSP knockdown on these cells were evaluated through MTT assay, and Annexin V/PI analysis.

RESULTS: Our research uncovered heightened expression of HSP90 and its associated client proteins in MB cells compared to normal astrocytes. Furthermore, inhibiting HSP90 expression prompted cell cycle arrest in MB cells. Particularly noteworthy was the finding that CD133+ MB CSCs exhibited more resistant to traditional chemotherapy and elevated levels of HSP90 compared to their parental MB cells. Inhibition of HSP90 resulted in decreased sphere formation and reduced expression of stemness markers in CD133+ MB CSCs. Treatment with 17-AAG demonstrated significant antitumor activity specifically in CD133+ MB CSCs. Moreover, combining conventional chemotherapeutic agents with 17-AAG exhibited a synergistic effect in MB cells, highlighting the potential treatment of MB.

CONCLUSION: These results underscore the potential of HSP90 inhibition in targeting CSCs, thereby overcoming resistance to chemotherapeutic agents in MB. Combining chemotherapies with HSP90 blockade could emerge as a promising therapy for MB in the future.

Keywords: Heat shock protein 90, Chemoresistance, Medulloblastoma, Cancer stem cell

FL-097

Basic Research and Trials

Feedback Loops in Medulloblastoma: The Role of Ezh2 and Cyclin D1 in Tumor DynamicsAhmad Chahin¹, James Purzner², Teresa Purzner²¹Centre for Neuroscience Studies, Queen's University, Kingston, Canada²Department of Surgery, Queen's University, Kingston, Canada

OBJECTIVE: This study aims to evaluate the hypothesis that Cyclin D1 and Ezh2 are trapped within a negative feedback loop in dividing granule neuron precursors (GNPs) and medulloblastoma (MB) cells.

MATERIAL AND METHODS: We quantified H3K27me3 near the transcriptional start site of all genes using chromatin immunoprecipitation and sequencing (ChIP-Seq) data in P7 purified cerebral GNP cells and corroborated these observations to gene expression, through RNA sequencing (RNAseq). To assess the phenotypic and transcriptional consequences of loss of Ezh2 in developing GNPs, we purified P7 GNPs from Math1-Cre, Ezh2-flox knock out mice. This mouse conditionally knocks out Ezh2 in transit amplifying GNPs. MB cells were cultured in a suspension sphere environment. Imaging was conducted using the ImageXpress Micro XLS Widefield High Content Screening System and nuclei segmentation was based on DAPI staining.

RESULTS: Paradoxically, Cyclin D1 was ranked in the top 7.35% of expressed genes while being heavily marked by the repressive histone mark H3K27me3 (top 3.73%) in GNPs. Overexpression of Ezh2, a key subunit in trimethylating H3K27, increased the amount of G0-arrested MB cells (2.7-fold). Correspondingly, RNAseq data revealed a substantial increase in Cyclin D1 expression in Ezh2 conditional knockout mice relative to wild type (2-fold). The pRb/E2F1 complex is regulated upstream by Cyclin D1. Enclosing this feedback cycle, we observed that Ezh2 expression is dependent on pRb/E2F1 complex abundance. This model accounted for an unexpected outcome: combining Vismodegib, a Hedgehog inhibitor, with Ezh2 inhibitor, Tazemetostat or UNC1999, rescued MB cells from Vismodegib, which is typically highly effective at killing them.

CONCLUSION: Treatment for Sonic Hedgehog MB, particularly for patients with TP53 mutations, remains challenging as it fails to completely annihilate the tumor cells. This suggests the need for different therapeutic approaches. In this study, we developed a model that explains how we can induce GNP differentiation to differentiate tumor cells into benign neurons.

Keywords: Medulloblastoma, Differentiation Therapy, Cerebellar Granule Neuron Precursors, Cerebellar Development, Hedgehog Signaling.

FL-98

Basic Research and Trials

Nanoparticle-laden hydrogel bioink for targeted therapy in pediatric cranial defectsFederica Tiberio¹, Martina Salvati¹, Noah Giacon², Luca Polito¹, Federico Bianchi³, Paolo Frassanito³, Luca Massimi⁴, Alessandro Arcovito⁵, Gianpiero Tamburrini⁴, Wanda Lattanzi⁶¹Department of Life Science and Public Health, Università Cattolica del Sacro Cuore, Rome, Italy²Department of Basic Biotechnological Sciences, Intensivological and Perioperative Clinics, Università Cattolica del Sacro Cuore, Rome, Italy³Pediatric Neurosurgery, Fondazione Policlinico Universitario A. Gemelli IRCCS, Rome, Italy⁴Pediatric Neurosurgery, Fondazione Policlinico Universitario A. Gemelli IRCCS, Rome, Italy; Department of Neuroscience, Università Cattolica del Sacro Cuore, Rome, Italy⁵Department of Basic Biotechnological Sciences, Intensivological and Perioperative Clinics, Università Cattolica del Sacro Cuore, Rome, Italy; Fondazione Policlinico Universitario A. Gemelli IRCCS, Rome, Italy⁶Department of Life Science and Public Health, Università Cattolica del Sacro Cuore, Rome, Italy; Fondazione Policlinico Universitario A. Gemelli IRCCS, Rome, Italy

OBJECTIVE: Pediatric craniofacial surgery faces the challenge of restoring skull bone defects within a while maintaining elasticity and flexibility. Autologous bone grafting, though the current gold standard for cranioplasty and cranial defect bone tissue regeneration, is fraught with complications. This study aims to develop a moldable nanoparticle (NP)-laden hydrogel-based bioink for in situ delivery of biological drugs as an alternative strategy to enhance pediatric cranial defect treatment.

MATERIAL AND METHODS: Calvarial mesenchymal stromal cells (CMSC) were isolated from pediatric patients' cranial bone tissue waste during cranioplasty. Synthetic and natural polymeric (Poly (lactic-co-glycolic acid) (PLGA) and ferritin) NPs served as nanocarriers for small osteogenic molecules. PLGA NPs were produced using the double emulsion technique and characterized via dynamic light scattering and scanning electron microscopy. NP biocompatibility was assessed through viability assays. Intracellular trafficking of fluorescently-labeled NPs was examined through in vivo imaging and confocal microscopy. Small interference RNA (siRNA) targeting osteogenic genes was encapsulated within PLGA NPs and conjugated onto ferritin surfaces. The efficacy of siRNA-NP complexes was studied in vitro using CMSC culture and qPCR. Fluorescently-labeled PLGA NPs were 3D-printed with a hydrogel scaffold, and the scaffold's efficacy was evaluated via live-cell imaging in CMSC.

RESULTS: NP biocompatibility was confirmed in CMSC. Intracellular trafficking showed that NPs are widely distributed within cell cytoplasm avoiding lysosomes. siRNA targeting FGFR2 were effectively encapsulated in PLGA NPs and on ferritin surfaces. qPCR revealed significant and sustained FGFR2 inhibition for up to 96 hours of CMSC treatment with both siRNA-NP constructs. Live-cell microscopy demonstrated sustained intracellular release of PLGA NPs from the hydrogel in CMSC culture.

CONCLUSION: Our findings indicate that PLGA and ferritin NPs are suitable for drug delivery in CMSC, and hydrogel-PLGA-NPs bioink allows controlled release of NPs to surrounding cells. This approach holds promise for in situ delivery of therapeutic molecules in cranial bone defects.

Keywords: cranial bone defect, nanoparticle, targeted therapy, hydrogel bioink, therapeutic siRNA, calvarial mesenchymal stromal cells

FL-99

Basic Research and Trials

Montanide ISA51 administration results in immunogenic cytokine release regardless of peptide vaccine administration

Eric Thompson, Lin Cheng

University of Chicago

OBJECTIVE: Human cytomegalovirus (CMV) antigens are expressed in high-grade glioma and medulloblastoma but not adjacent normal

brain. Our group has developed a peptide vaccine (PEP-CMV) targeting the single CMV antigen, pp65, that is currently in clinical trials and has shown promising immunogenicity and survival. It is delivered with immunoadjuvant, Montanide ISA51. The objective of this study was to determine if a cocktail of peptides targeting 7 different CMV antigens (ngPEP-CMV) was more immunogenic than PEP-CMV.

MATERIAL AND METHODS: Humanized HLA-A/H2-D mice were used. Dosages were 100 µg PEP CMV and 100 µL Montanide ISA51. Animals received treatment with either 1) PEP-CMV + Montanide ISA51 (n=5), 2) ngPEP-CMV + Montanide ISA51 (n=4), 3) Montanide ISA51 (n=4), or 4) saline (n=4) intradermally on day 27, 23, and 41. Serum was obtained Day 1, 20, 27, and 41. Flow cytometry was used to assess pre, intra-, and post treatment levels of the following cytokines: IFN-γ, IL-10, CCL4, IFN-α, CXCL9, CXCL10, CXCL10, TNF-α, IL-6, IL-4, CCL3, VEGF, and CCL2.

RESULTS: Compared to pretreatment controls, there were significant increases ($P \leq 0.05$) in the following cytokines in the 3 treatment groups (PEP-CMV + Montanide ISA51, ngPEP-CMV + Montanide ISA51, Montanide ISA51): CCL4 (chemoattractant for natural killer cells), TNF-α (immune cell regulator), IL-6 (innate immune system regulator), and CCL2 (monocyte regulator). However, there was no increase in any cytokine when comparing vaccine groups (PEP-CMV + Montanide ISA51, ngPEP-CMV + Montanide ISA51) to Montanide ISA51 alone ($P > 0.05$).

CONCLUSION: The immunoadjuvant, Montanide ISA 51, elicited significant cytokine release regardless of its combination with peptide vaccine. Current research is ongoing to determine T-cell mediated immune responses in these groups and to determine if combination immunoadjuvants further increase immunogenic cytokine release.

Keywords: peptide vaccine, immunogenicity, malignant brain tumor, immunotherapy

FL-100

Neuro-Oncology

Multimodal Proteomic Analysis of Adamantinomatous Craniopharyngioma reveals a Complex Interplay of Collagen and Inflammatory Mediators that May Contribute to Normal Tissue Damage

Siddhartha Mitra¹, Aaron Knox¹, Stephen Medlin¹, Eric W Prince², Todd C. Hankinson¹

¹Department of Neurosurgery, Children's Hospital Colorado, Aurora, CO, USA

²Department of Biostatistics and Informatics, University of Colorado School of Medicine, Aurora, CO, USA

OBJECTIVE: Adamantinomatous craniopharyngioma (ACPs) is the most common pediatric suprasellar tumor. It is well known to be associated with significant morbidity and long-term mortality. This often coincides with tumor invasion/damage to the hypothalamus. This process is likely to involve alteration of the extracellular matrix (ECM) in the tumor microenvironment.

MATERIAL AND METHODS: We detailed ECM components in the solid portion of human ACP specimens using high throughput imaging mass cytometry (IMC) alongside conventional histological staining. We further examined proteins in fluid components (ACP cyst, CSF and plasma) using SomaScan, a high-throughput, aptamer-based protein quantification platform. SomaScan utilizes Slow Off-Rate Modified Aptamers (SOMAmer Reagents) for the measurement of a broad spectrum of proteins within various biological fluids.

RESULTS: High throughput spatial proteomic analysis using imaging mass cytometry demonstrated that ACP tumors have distinctive spatial organization of epithelial tissue interspersed with deep rivulets of collagen. These collagen tracts are spatially segregated from the EPCAM

expressing epithelia and are populated by Vimentin expressing cells and deeply infiltrated with Iba+ microglia and CD68+ macrophages. Furthermore, there is extensive expression of GranzymeB in collagen associated macrophages, suggesting extracellular matrix (ECM) remodeling, which has previously been associated with cytokine activation, vascular permeability and immune cell transmigration, leading to tissue injury, inflammation and repair.

SomaScan analysis identified elevated levels of proteins that are associated with inflammation and was largely consistent with existing literature regarding ACP cyst fluid components.

CONCLUSION: By integrating the data from IMC and SomaScan, our findings reveal a complex interplay between ACPs and the immune system, and specific architectural features that may help reveal means to interrupt the associated processes.

Keywords: Craniopharyngioma, Inflammation, Collagen, Imaging Mass Cytometry, SomaScan

FL-101

Basic Research and Trials

The Human Neuron Project. Optimisation of access to living neural tissue resected as part of a paediatric epilepsy surgery programme

Michael Rust Carter¹, Michael Ashby², Jack Mellor², James Hodge², William Singleton¹

¹Department of Paediatric Neurosurgery, Bristol Royal hospital for Children, Bristol, UK

²School of Physiology, Pharmacology and Neurosciences, University of Bristol, Bristol, UK

OBJECTIVE: Research into epilepsy is limited by poor access to living human neural tissue from subjects with epilepsy. Organotypic slice cultures are well established as vehicles for neurophysiological research. Many procedures carried out in paediatric epilepsy surgery programmes could yield live tissue beyond that required for histological diagnosis alone. In suitable cases this can be sampled, transported and maintained in culture, without adding to surgical morbidity or impeding histological evaluation. We describe our experiences with setting up a systematised approach, to identify and manage such cases in our service, such that living tissue samples, where possible might be optimally delivered to and processed by a university department of neurosciences.

MATERIAL AND METHODS: Description of planning, scheduling, ethical approval and consenting required to set up such a facility. Also the processes for clinical data collection and storage. We describe the requirements for case selection, and the nuances of tissue handling and transportation that optimise tissue survivability. We also describe our experience with establishing viable neuronal organotypic slice cultures in the initial cases sampled.

RESULTS: Living tissue suitable for culture is readily available from selected epilepsy surgery procedures. Survivability of tissue cultures improved with experience. Important factors identified, included careful tissue handling and orientation, avoidance of bipolar coagulation around the specimen, rapidity of transport to the lab, adequate oxygenation of transport media and maintenance of cultures in human CSF. Patient support for tissue donation was high, and no adverse patient events were encountered.

CONCLUSION: High quality neuronal tissue slice cultures, suitable for neurophysiological can readily be established from epilepsy resection specimens in children. The technical aspects are nuanced and require careful consideration. Most of the difficulties encountered are organisational and require a high degree of coordination between laboratory and surgical services. The availability of a contemporaneous

clinical data sets is an attractive feature of this comprehensive approach.

Keywords: Epilepsy surgery, Organotypic, Slice Cultures, Optimisation.

FL-102

Global Neurosurgery

Pediatric neurosurgical outcomes: a retrospective cohort analysis of early outcomes at Bugando Medical Centre, Tanzania

Cyrus Elahi¹, Johansen Joel Bwemelo², Anant Naik³, Habib Emil Rafka⁴, Jonah E Attebery⁵, Dilantha B Ellegala¹, Kerry A Vaughan¹

¹Barrow Global, Department of Neurosurgery, Barrow Neurological Institute, Phoenix, AZ, USA

²Unit of Neurosurgery, Bugando Medical Center, Bugando, Tanzania

³Carle Illinois College of Medicine, Urbana, IL, USA

⁴College of Medicine Medical University of South Carolina, Charleston, SC, USA

⁵Department of Pediatrics University of Colorado Aurora, CO, USA

OBJECTIVE: Pediatric neurosurgical procedures have historically been associated with high morbidity and mortality in low-middle-income countries (LMICs). Safe expansion of surgical sub-specialty care is critical in LMIC settings where pediatric care is often severely limited in access. We sought to analyze temporal trends in procedures and complications for a high-volume pediatric neurosurgical practice in a regional referral hospital in rural Tanzania.

MATERIAL AND METHODS: This study was a retrospective cohort study; patient charts from 2007–2013 with demographic and clinical patient information, including age, presentation, procedure, and complications were digitized and compiled in a database. For some patients, length-of-stay and cost of hospitalization was also available. Outcomes of interest included major complications, a composite outcome of reoperation, and death. A subgroup analysis of ventriculoperitoneal shunts (VPS) and shunt-related complications was also performed given the prevalence of this procedure. Multivariate regression was used to evaluate correlation between the primary outcome and associated variables.

RESULTS: Data on 973 patients were obtained from 2007–2013, including 582 VPS. Re-operation periods across the time of interest were 20.9%, and mortality was 6.4%. After VPS placement, myelomeningocele repair was the second most common procedure done in our study (19.3%). While annual case volume continued to rise, major complications were notably reduced after 2010. On linear regression, each additional year was associated with a 3.2% reduction in major complications. Reduction in complications was also associated with an increase in cost over time ($p = 0.0087$).

CONCLUSION: We demonstrate the temporal decrease in complications over time with a concurrent increase in annual case volume in this high-volume pediatric neurosurgical LMIC practice. Specifically for VPS, each year, a covariate-adjusted reduction of 3.2% was observed. Mean cost of hospitalization increased steadily year-over-year, suggesting an expansion of the cost of care for pediatric populations due to changes in hospital costs and consumables.

Keywords: global neurosurgery, pediatric neurosurgery, healthcare capacity, morbidity & mortality, hydrocephalus, sub-specialty care

FL-103

Global Neurosurgery

The Landscape of Obstacles to Care for Pediatric Central Nervous System Tumors in Ghana – A Qualitative Analysis of Health Worker Perspectives

Lakshmi Suryateja Gangavarapu¹, Joseline Haizel Cobbina², Angela Lamina³, Justice Adjei Gyamfi³, Julie Barroso⁴, Daniel Ansong⁵, Lawrence Osei Tutu⁶, Frank Nketiah Boakye³, Michael C. Dewan²

¹School of Medicine, Vanderbilt University, Nashville, TN, USA

²Department of Neurological Surgery, Vanderbilt University Medical Center, Nashville, TN, USA; Vanderbilt Institute for Global Health, Vanderbilt University Medical Center, Nashville, TN, USA

³Department of Surgery, Neurosurgery Unit, Komfo Anokye Teaching Hospital, Kumasi, Ghana

⁴School of Nursing, Vanderbilt University, Nashville, TN, USA

⁵School of Medical Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

⁶Department of Child Health, Paediatric Haematology-Oncology Unit, Komfo Anokye Teaching Hospital, Kumasi, Ghana

OBJECTIVE: Pediatric central nervous system tumors in Sub-Saharan Africa (SSA) are underdiagnosed and undertreated, leading to high morbidity and mortality. In this study, we aimed to explore existing obstacles to pediatric neurosurgical-oncology (PNSO) care through the experiences and perspectives of healthcare workers at a major neurosurgical referral center in Ghana.

MATERIAL AND METHODS: We used a qualitative descriptive approach with thematic analysis techniques to better understand this phenomenon. From October to December 2023, 15 individual interviews were conducted with healthcare workers occupying diverse roles in PNSO care at Komfo Anokye Teaching Hospital (KATH). Interview audio was recorded and transcribed, and transcription accuracy was validated by study team. Two team members conducted initial qualitative coding, identifying meaningful statements within transcripts describing obstacles to care, defining specific elements to capture these findings, and organizing supporting data throughout interviews. These elements were then analyzed to identify conceptual groupings, interactions, and impacts, which generated several overarching themes. Analysis was conducted alongside an adjudicating qualitative methodologist and KATH PNSO workforce members.

RESULTS: Overarching themes concerning obstacles to care included high out-of-pocket direct and indirect costs of PNSO care, inadequate PNSO infrastructure and limited number of trained PNSO workforce, lack of multidisciplinary coordination, health illiteracy, and socio-cultural/spiritual beliefs among patient caregivers. These factors were associated with overreliance on alternative treatments such as spiritual healers, and impairment of physician-caregiver partnership. Additionally, they contributed to poor patient outcomes and immense economic, social, and emotional hardship on patient families, as well as a cascade of burden on healthcare workers.

CONCLUSION: Pediatric neurosurgical-oncology in Ghana presents a unique challenge due to the resource-intensive, multi-disciplinary care required and there are infrastructural, financial, and social factors undermining care delivery. These findings will help identify a course of action for capacity building to improve care for this vulnerable population.

Keywords: sub-saharan africa, pediatric neurosurgical-oncology, LMIC healthcare workforce, qualitative analysis, health literacy, socio-cultural beliefs

FL-104

Global Neurosurgery

Global pediatric epilepsy surgery: a national collaborative referral network in Uganda

Sandi Lam¹, Humphrey Okechi⁴, Elysa Widjaja³, David Bieber², Richard Idro⁵, Robert Ssebunya⁵, Erik Padilla², Khrystyna Moskalyk², Emmanuel Wegoye⁴

¹Division of Pediatric Neurosurgery, Ann and Robert H Lurie Children's Hospital of Chicago, Chicago, USA; Department of Neurosurgery, Northwestern University Feinberg School of Medicine, Chicago, USA

²Division of Pediatric Neurology, Ann and Robert H Lurie Children's Hospital of Chicago, Chicago, USA; Department of Neurology, Northwestern University Feinberg School of Medicine, Chicago, USA

³Division of Pediatric Neuroradiology, Ann and Robert H Lurie Children's Hospital of Chicago, Chicago, USA; Department of Radiology, Northwestern University Feinberg School of Medicine, Chicago, USA

⁴CURE Uganda Hospital for Children, Mbale, Uganda

⁵Department of Neurology, Makerere University, Kampala, Uganda

OBJECTIVE: Epilepsy is the most common neurologic condition in the world, with a disproportionate burden of disease in low and middle income countries (LMIC). Appropriately-selected drug-resistant epilepsy patients with lesional epilepsy have the chance of a cure with surgery. We aimed to establish a global neurosurgery pilot of a pediatric epilepsy surgery program at a pediatric hydrocephalus surgery training center in subSaharan Africa.

MATERIAL AND METHODS: An established, accredited United States electroencephalography training program was modified for web-based, real-time video-conferencing, and hands-on training in Uganda. Development, implementation, and preliminary results of this pilot program to diagnose, identify, and treat pediatric patients with drug-resistant epilepsy were tracked and descriptive narratives provided.

RESULTS: Through global initiatives by ASET The Neurodiagnostic Society and Lurie Children's Hospital, online electroencephalography training was conducted for 10 participants in Uganda with a 12 month interactive Zoom-based curriculum. Two pediatric neurologists in Kampala, Uganda joined, referring candidates for lesional epilepsy surgery from across Uganda. Multidisciplinary epilepsy surgery video conference is done with ongoing peer mentorship. Surgical candidate identification, intervention, and epilepsy outcomes are tracked. To date, 16 patients have been presented; 4 patients (3-15 years) have undergone surgery with the local pediatric neurosurgery team at CURE Uganda: 3 hemispherectomies for perinatal stroke, 1 lesionectomy for frontal focal cortical dysplasia. 6-month follow-up shows Engel Class 1 outcomes of seizure freedom in 4/4 postoperative patients.

Additional public health advocacy and education about the journey of these patients has resulted in a February 2024 launch of epilepsy surgery endorsed by the Ministry of Health by the Government of Uganda.

CONCLUSION: Global pediatric neurosurgery extends to development of a scalable, sustainable, peer-mentored pediatric epilepsy surgery program. The work is ongoing for knowledge and skill transfer: this model holds potential to address the disease burden of epilepsy and help elevate quality of life for patients, families, and communities.

Keywords: epilepsy, epilepsy surgery, global neurosurgery, global health, multidisciplinary, EEG

FL-105

Global Neurosurgery

Intracranial trauma in Brazil, what do we know? An Ecological Study and Geospatial Analysis

Iracema Araújo Estevão¹, Wilson Falco Neto², Julia Ravazzi Casari², Maria Eugênia Martins Publio Correa³, Nelci Zanon Collange⁴

¹Department of Neurosurgery, Santa Paula Hospital, São Paulo, SP, Brazil;

²Faculty of Medicine of Catanduva, Catanduva, São Paulo, SP, Brazil;

³Universidade de Santo Amaro, Departamento de Medicina, São Paulo, Brazil;

⁴Universidade Federal de São Paulo - UNIFESP, São Paulo, SP, Brazil.

OBJECTIVE: Identify the spatial distribution and describe the incidence of intracranial trauma of the 0-14 age group from 2018 to 2023.

MATERIAL AND METHODS: Public government data on "Intracranial trauma" from 2018 to 2023 was obtained from the DATASUS platform (ICD-10 S06). The population used was from the last survey available for the period (2022), obtained from the Brazilian Institute of Geography. Descriptive statistics and maps processing were carried out using the QgisTM software, temporal clusters were obtained using SatscanTM and the univariate spatial autocorrelation coefficient (Moran's I2) using GeodaTM and a pseudo-p value was calculated using Monte Carlo permutations (9999). A spatial weight matrix was created using the first order queen contiguity method. Since all the data processed is public and anonymized, there was no need for an ethics committee review.

RESULTS: In the period, a total of 80,356 hospitalizations and 1,200 deaths were observed. The total cost of the condition to the public health system was R\$73,511,394.99 (US\$14,361,621.12) in the period, with an average of US\$178.72 per patient. The average length of stay was 3.2 days. Males (61.75%), browns (43.98%) and children between 1 and 4 years (34.23%) were the main inpatients. In absolute numbers, the region with the highest number of hospitalizations was the Southeast, with 40.77% of hospitalizations in the period. There was no spatial autocorrelation considering the whole period (I2 = 0.04, pseudo p-value = 0.49).

CONCLUSION: Intracranial trauma can cause severe sequelae in children and adolescents, generating significant costs for the healthcare system. Multicenter studies are the next step towards a better understanding of the local condition and prevention strategies

Keywords: Epidemiology, Intracranial trauma in Brazil., Brazil

FL-106

Vascular

Transitions to Adulthood and Adult Care in the Management of Pediatric Arteriovenous MalformationsCarla Richetta¹, Belinda Shao³, Sudhakar Vadivelu²¹Department of Neurosurgery, Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio, USA²Department of Interventional Neuroradiology, Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio, USA³Department of Neurosurgery, Warren Alpert Medical School of Brown University, Providence, Rhode Island, USA

OBJECTIVE: The transition from pediatric to adult care of chronic conditions occurs during a critical period of physical and psychosocial change for the patient. However, studies in various diseases show that the risk of loss to follow-up is high during this transition. Pediatric cerebral arteriovenous malformations (AVMs) represent a complex and heterogeneous neurological condition. The transition from childhood to adulthood further complicates management as the dynamics and focus of their care may undergo a significant shift. Whereas there is great focus on transition to adult care in other complex neurosurgical conditions there has been less discussion of the topic for pediatric AVM patients.

MATERIAL AND METHODS: We present a narrative literature review on transition from pediatric to adult care in AVM management which a special focus on the role of neurosurgeons in this delicate step. Additionally, we discuss the result of a multidisciplinary poll performed at the International Pediatric Stroke Conference 2024.

RESULTS: We review the literature on topics important to this critical young adult period: neuropsychiatric and functional outcomes, puberty, pregnancy, and sexual function, and special considerations for young adults with congenital and genetic conditions associated with AVMs. We describe as well a multidisciplinary poll performed by one of the authors at the International Pediatric Stroke Conference 2024.

Our review suggests that management and neurosurgeons involvement varies greatly based on patient factors as well as the dynamics of specific local healthcare ecosystem. Results from the poll confirmed wide variability in the recommended age to start transition, use of neuropsychological testing and physicians' perception of the most challenging aspects of the transition with AVM re-bleed risk, occupation trajectory and independent life responsibility scoring the highest.

CONCLUSION: Transition to adulthood for patients diagnosed with cerebral AVMs during childhood is not well codified in medical literature and consensus on their management is often lacking.

Keywords: AVM, transition, puberty, pregnancy, genetic conditions, neuropsychological testing

FL-107

Vascular

Mechanical Thrombectomy in patients < 5 years of ageAndrew L Garton¹, Soliman Oushy³, Darren B Orbach², Alfred P See²¹Weill Cornell Department of Neurosurgery; New York NY, USA²Boston Children's Hospital, Cerebrovascular Surgery and Interventions Center; Boston MA, USA³Mayo Clinic Department of Neurosurgery; Rochester MN, USA

OBJECTIVE: Mechanical thrombectomy for pediatric large vessel occlusion, particularly in very young children, poses an elevated degree of difficulty due to vessel size, device limitations, and underlying comorbidities in this population. Stroke in children under the age of 5 is associated with poor outcomes, however due to the rarity and complexity of endovascular treatment, reports are limited. Novel endovascular devices can be delivered via smaller microcatheters (0.0165-0.0167") which accommodate smaller blood vessels, although this has not been reported in the pediatric population.

MATERIAL AND METHODS: A retrospective review of all mechanical thrombectomies at a single institution was performed between the years of 2015 and 2023. Data regarding demographics, clinical history, procedural details with an emphasis on novel low-profile devices, and outcomes were compiled and analyzed.

RESULTS: There were 8 children under the age of 5, in whom mechanical thrombectomy was attempted. Anterior circulation occlusions occurred at a frequency of 7/8, whereas posterior circulation was seen once. Access was achieved via 6F femoral access in 5/8 cases, whereas 5F was required 2/8 times and 4F was used 1/8 times. Aspiration alone was performed once, but all other cases used retrievable stents (7/8 cases). In those in which stents were deployed, a radial diameter < 3 mm was used in 3 of those cases. When using a lower profile stent, a final TICI2a, 2b, and 3c were each observed once. Overall, in all cases, some degree of recanalization was seen in 100%, although mTICI 2C or greater reperfusion was seen in 37.5%.

CONCLUSION: In our series of very young patients (< 5 years old), devices were deployed in 87.5% of cases, including 3 low-profile devices < 3 mm. The high proportion of partial reperfusion highlights the need for improving mechanical thrombectomy device efficacy and techniques specifically for this population.

Keywords: pediatric, stroke, thrombectomy, devices, low-profile

FL-108

Vascular

Social and Economic Impacts of Pediatric Neurovascular Surgery: A Qualitative Study of Parent ExperiencesRya Muller¹, Sunny Abdelmageed², Jonathan Scoville³, Sandi Lam²¹Department of Neurosurgery, Northwestern University Feinberg School of Medicine, Chicago, Illinois, USA²Department of Neurosurgery, Northwestern University Feinberg School of Medicine, Chicago, Illinois, USA; Division of Pediatric Neurosurgery, Ann and Robert H. Lurie Children's Hospital, Chicago, Illinois, USA³Division of Pediatric Neurosurgery, Ann and Robert H. Lurie Children's Hospital, Chicago, Illinois, USA

OBJECTIVE: Pediatric neurovascular disease can have lasting impacts on health-related quality of life. High direct healthcare costs have been noted, particularly for pediatric arteriovenous malformations, yet indirect costs have not been explored. This pilot qualitative

study explored the family experience with treatment of neurovascular conditions.

MATERIAL AND METHODS: Parents or guardians of children aged 0-18 years of age who underwent surgery for a neurovascular condition at our institution between 2022-2023 underwent semi-structured interviews. Interviews explored a range of concepts including access to treatment, financial and emotional impacts, and recovery.

RESULTS: 5 of 8 (62.5%) participating parents reported that their child had emergency surgery. The median time from symptom onset to diagnosis was 7 (range 1-1095) days and from diagnosis to treatment was 1.5 (range 0.1-365) days. Families traveled a median distance of 45 (range 15-95) miles to receive treatment. The median reported time taken off work during treatment was 24.5 (range 0-180) days for mothers and 5 (range 0-105) days for fathers. 37.5% reported changes in employment status during or after treatment. Thematic analysis revealed four themes (with subthemes) related to the social and economic impacts of neurovascular disease and treatment: (1) Decision Making (communication is crucial, cost not a deterrent, pressure stems from emergency situations, time is positive factor), (2) Cost (high financial impact, loss of income, transportation), (3) Emotional Impact (distress and fear, gratitude, trust the process), and (4) Quality of Life After Surgery (difficulty accepting new reality, family routine adjustment, healthcare coordination challenging, unexpected number of rehab appointments, vision deficiencies and school disruptions).

CONCLUSION: Neurovascular surgery is associated with social, economic, and emotional impacts on patients and families. The pre-surgical and early recovery period are potential timepoints for intervention. Future studies are warranted for identifying caregiver burden and assessing interventions to support families of children undergoing treatment for neurovascular conditions.

Keywords: Arteriovenous malformation, intracerebral hemorrhage, neurovascular, pediatric, qualitative, survey

FL-109

Vascular

Indirect revascularization for management of vascular steal phenomenon in brain arteriovenous malformations

Vitor Nagai Yamaki¹, Sanjay Bathe², Vijeya Ganesan², Fergus Robertson³, Adam Rennie³, Greg James¹, Adikarige Haritha Dulanka Silva¹

¹Department of Neurosurgery, Great Ormond Street Hospital for Children NHS Foundation Trust, London, UK

²Department of Neurology, Great Ormond Street Hospital for Children NHS Foundation Trust, London, UK

³Department of Interventional Neuroradiology, Great Ormond Street Hospital for Children NHS Foundation Trust, London, UK

OBJECTIVE: To discuss management of inoperable deep-seated brain arteriovenous malformation (bAVM) with ischemic-like symptoms in paediatric patients; and to provide clinical evidence to support vascular steal phenomenon in bAVM.

MATERIAL AND METHODS: There were reported two paediatric patients who underwent indirect revascularization (IR) with encephalo-duro-arterio-myo-synangiosis (EDAMS) and superficial temporal artery (STA) pial synangiosis. Long-term clinical and radiological follow-up were presented.

RESULTS: Two deep-seated bAVMs in paediatric patients with 11 and 14 years-old were presented. Both patients presented with ischemic-related symptoms of progressive motor deficits. There were

no ischemic lesions evidenced on the MRI. EDAMS with STA pial synangiosis were performed with marked improvement of the progressive and fluctuating symptoms. At 2-years follow-up, angiogram showed a bypass from the STA to the hypoxic perinidal territory without a convincing feeling of the AVM. Both patients presented stabilization of clinical symptoms up to 4-years follow-up after IR. There was no bleeding, ischemia or structural changes on the bAVMs on the follow-up scans.

CONCLUSION: Management of inoperable bAVMs with ischemic-related symptoms can be safely managed with indirect revascularization. The cases presented provided clinical evidence to the vascular steal phenomenon in rapid shunting bAVM causing a local perinidal hypoxemia and neural damage.

Keywords: Brain arteriovenous malformation; cerebral revascularization; transient ischemic attacks

FL-110

Vascular

The Economic and Family Impact of Pediatric Neurovascular Surgery

Sunny Abdelmageed, Rya Muller, Jonathan Scoville, Sandi Lam
Department of Neurosurgery, Northwestern University Feinberg School of Medicine, Chicago, Illinois, USA; Division of Pediatric Neurosurgery, Ann and Robert H. Lurie Children's Hospital, Chicago, Illinois, USA

OBJECTIVE: Pediatric neurovascular disease are chronic conditions affecting the neurovasculature. Prior research on chronic neurological conditions have demonstrated high direct and indirect costs, however the indirect costs for pediatric neurovascular diseases have not been quantified. This pilot parent experience study aims to quantify the economic and family impact of pediatric neurovascular disease.

MATERIAL AND METHODS: Parents of children who underwent surgery for a neurovascular condition at Lurie Children's Hospital between 2022-2023 completed the Impact on Family Survey (IOFS) and the Work Productivity and Activity Impairment – General Health (WPAI-GH). IOFS scores were evaluated across five domains (financial impact, social impact, personal impact, coping, and sibling impact). Percent presenteeism and absenteeism were calculated using the WPAI-GH survey. Lost productivity costs were calculated using the human capital method.

RESULTS: 6 participants completed the surveys and 75% (n = 4) reported that their child had emergent surgery. Mean time since surgery was 17.22 ± 5.2 months. The overall average IOFS score was 2.17, indicating that families were largely impacted by neurovascular surgery. Of the five subcategories, participants score the lowest in coping (1.83) and the highest in the sibling (3.06) categories. Among employed caregivers, mean absenteeism was 5.97% and presenteeism was 26.7%. In terms of caregiving work-related productivity costs, \$1488.80 were lost per month, \$267.20 due to absenteeism and \$1221.50 due to presenteeism. Annual total lost productivity costs were \$17,865.80.

CONCLUSION: Pediatric neurovascular disease has long-lasting impacts on caregivers and family life across multiple dimensions. While presenteeism results in high indirect costs, further research is needed to quantify and validate the impact on work productivity and family impact.

Keywords: arteriovenous malformation, intracerebral hemorrhage

Nursing Symposium Presentation Abstracts

NS-001

Nursing Symposium

Assessing sleep related breathing disorders, vocal cord dysfunction and feeding issues in infants with Myelomeningocele

Ashley Birch

Pediatric Neurosurgery Department, Boston Children's Hospital, USA

OBJECTIVE: As of 2013, approximately 1.61 infants out of 10,000 live births were born in Massachusetts with spina bifida. An increasing number of these infants are transferred to our Neonatal Intensive Care Unit (NICU) for management after birth. At Boston Children's Hospital (BCH) we utilize a clinical pathway for management of these babies. Recently we have determined that there is a need for the addition of multiple diagnostic studies to establish baseline findings and assess for common problems that occur in this population. These problems include sleep related breathing disorders (SRBD), feeding issues and vocal cord dysfunction. The Spina Bifida Association reports that the prevalence of SRBD in those with myelomeningocele is between 62-81%; and moderate to severe obstructive sleep apnea (OSA) occurs in approximately 20-31% of the population. Vocal cord dysfunction as well as feeding issues are common, though exact incidence is hard to identify. Knowing the results of these studies in our population will help to guide management and care in the future.

MATERIAL AND METHODS: • A review of the literature was performed to look at prevalence of SRBD, feeding issues, and vocal cord dysfunction in those impacted by myelomeningocele and Chiari malformation type II

• The studies were added to the existing clinical management pathway and performed on four babies admitted with myelomeningocele

RESULTS: Sleep studies, bedside feeding evaluations, and flexible fiberoptic nasal endoscopy and laryngoscopy have been performed in four newborn babies with myelomeningocele and Chiari malformation type II. The results revealed mild OSA in three babies, mild central sleep apnea in two babies, and moderate central sleep apnea in one. Two of the infants required oxygen therapy during sleep at discharge. Feeding dyscoordination was identified in three of the four babies without signs of aspiration. Vocal cord function was normal in all four.

CONCLUSION: The need for the inclusion of these studies into our clinical pathway is evidenced by the identification of SRBD and the need for oxygen therapy in two out of four infants with myelomeningocele. Vocal cord function was normal and some form of feeding dysfunction was identified in all of these newborn babies. These baseline studies will be important in the future for comparison should patients develop symptoms of issues with Chiari malformation type II. The results of these studies will be used to guide the need for management. This study is currently limited by the small number of patients, we will continue this on future patients to better determine the prevalence and management of these patients.

Keywords: myelomeningocele, apnea, vocal cord dysfunction, chiari malformation type II

NS-002

Nursing Symposium

Evaluation and Revision of the Neurosurgery Incision Care Protocol at The Hospital for Sick Children

Michelle Eckstein, Rheanna Glombitza, Laura Milne

The Hospital for Sick Children, Toronto, ON – Neurosurgery Department

OBJECTIVE: In 2021, an evidence-based protocol for post-operative incision care was implemented on the neurosurgical inpatient unit at SickKids. Our objective was to evaluate adherence to the incision care protocol with the overall goal of reducing the postoperative infection rate by 10% from 4.6 to 4.1 per 100 cases.

MATERIAL AND METHODS: Using the model for improvement, PDSA cycles were conducted to implement and evaluate the protocol. The evaluation of the protocol consisted of surveying staff & families, practice observations, consultations with other surgical services and wound care experts within SickKids. Consultations were chosen based on low divisional infection and scarring rates.

RESULTS: Staff discussions and observations indicated inconsistent practice with incision care. 100% of families surveyed indicated uncertainty with materials used for incision care while in hospital versus at home and identified a desire for additional educational resources. Divisional consultants identified improvement opportunities related to frequency of cleansing and materials used. Post-evaluation, changes to the protocol consisted of the reduction in frequency of cleaning to once daily and the use of gauze to clean the incision(s). New additions to the protocol included uploading a photo of the incision to the chart on discharge and clarification of written discharge instructions including one email address to contact for incision queries.

CONCLUSION: As of May 2024, the neurosurgical infection rate is 2.5 per 100 cases. Nursing practice audits reflected 100% adherence to performing incision care daily and 70% adherence to using gauze. Chart audits showed 100% implementation of incision care instructions. The shared nursing email inbox receives an average of 3 emails a day related to incision care questions or concerns. In the future, an incision care video will be available for families on the SickKids website and written instructions will be added in multiple languages. Family feedback will also be collected and evaluated.

Keywords: Neurosurgery Incision Care Protocol

NS-003

Nursing Symposium

Developing and maintaining a high-volume non-invasive presurgical mapping center using Magnetoencephalography (MEG) and Transcranial Magnetic Stimulation (TMS) at a pediatric NAEC IV Epilepsy CenterTheresa Williard¹, J Austin Varner¹, Shalini Narayana², Roozbeh Rezaie²¹Le Bonheur Neuroscience Institute²Le Bonheur Neuroscience Institute & University of Tennessee Health Science Center Division of Pediatrics

OBJECTIVE: Many patients with drug resistant epilepsy (DRE) may benefit from epilepsy surgery. One barrier to surgical intervention is timely phase II/presurgical evaluation which can include MEG and TMS. Developing and sustaining a high-volume national non-invasive presurgical mapping center that uses MEG and TMS is one way to help reduce the wait time between DRE diagnosis and surgery.

MATERIAL AND METHODS: Setting up a successful non-invasive mapping center is contingent upon defining the setting, patient population, and services available. Beyond this, establishing protocols for safe and efficient workflow, patient screening process, and building a referral network are key elements for developing a sustainable infrastructure and providing quality care.

RESULTS: The Le Bonheur MEG – TMS program is housed within a pediatric Level IV NAEC center. This provides a mix of inpatient and outpatient referrals for epilepsy, motor, somatosensory, and language mapping. Based on patient population, anesthesia services are available for younger and developmentally delayed patients. This allows for referrals of any age to undergo testing at our center. Each patient and family are screened prior to testing to understand developmental history, seizure semiology, and contraindications to testing. Lastly, building a referral system through networking, marketing, and building rapport with tertiary epilepsy centers contributes to maintaining a steady flow of outpatient referrals. This approach has resulted in an average of 135 MEG studies per year and 86 TMS studies per year in the last four years. Additionally, our physician outpatient referral network has grown from four to 36 outside referring physicians.

CONCLUSION: Through defining our setting, patient population, and establishing safe and effective protocols, our testing center has been able to decrease the barrier to care in our country by expediting the pre-surgical evaluation timeline.

Keywords: MEG, TSM

NS-004

Nursing Symposium

Retrospective Analysis of External Intraventricular Drain Related Infections in Pediatric Patients at Ruth Rappaport Children's Hospital

Amalia Elkin

Ruth Rappaport children hospital, Rambam, Haifa, Israel

OBJECTIVE: External ventricular drain (EVD) placement is a common procedure in managing high intracranial pressure. EVD related infections (EVDRI) are the most common complication of EVD placement, associated with significant morbidity and mortality. Data regarding incidence and risk factors for EVDRI in children are scarce. Additionally, standardized practices for EVD management are lacking. We conducted a retrospective cohort study to characterize incidence and risk factors for EVDRI in our pediatric patients and to guide preventive interventions and EVD management bundles in our children's hospital.

MATERIAL AND METHODS: Demographic and clinical data of patients aged 0-18 years who underwent EVD placement at Ruth Rappaport Children's Hospital between April 2019 and April 2024 were collected from electronic medical records. Results are reported in mean and 95% confidence intervals.

RESULTS: From 2019 to 2024, 92 external ventricular drains (EVDs) were inserted into 71 patients, 33 (46.5%) females, mean age 7.7 (1.8,12.8), mean days with EVD was 8.8 (4,13.5). The most common indication for EVD insertion was ventriculoperitoneal shunt infection

(39%). In 3 (3.26%) cases an EVDRI diagnosis was made, mean days with EVD in these patients was 15.6 (9,22.2), mean age was 11.6 (8.6,15.1). All 3 patients had a history of severe traumatic brain injury with multiple hospitalizations, having undergone numerous surgeries and spending extended periods in the intensive care unit.

CONCLUSION: In our pediatric population, EVDRI were primarily observed in more complex cases, involving multiple surgeries and extended ICU stays. Identifying risk factors for EVDRI in pediatric populations is crucial for effective prevention interventions. Given the small numbers, more studies are necessary to characterize EVDRI in pediatric populations

Keywords: External ventricular drain (EVD) EVD related infections

NS-005

Nursing Symposium

Development of a neurosurgical advanced practice provider bootcamp

Michelle Parker, Christopher Isibor, Ashley K. Birch

Pediatric Neurosurgery Department, Boston Children's Hospital, USA

OBJECTIVE: To discuss the development and importance of specialized training for neurosurgical advanced practice providers (APPs)

MATERIAL AND METHODS: As one part of an ongoing initiative to improve expertise and promote specialization within our neurosurgery APP team, we developed a formal education and competency program. This program consists of an annual boot camp which includes lectures providing education on common diagnoses, hands on skills training, and a simulation component on management of neurosurgical emergencies. Evaluations are performed after completion of the bootcamp to determine the impact on the learning of the advanced practice provider.

RESULTS: Surveys performed after completion of the bootcamp indicate increased learning and satisfaction among the APP group.

CONCLUSION: The role of the advanced practice provider continues to grow within pediatric healthcare. With this growth there is an increasing focus on the importance of specialization to practice. The APP who is an expert in their specialty can provide positive outcomes for patients and the practice in which they work. Unfortunately, regardless of the specialty there are limited opportunities for a focused fellowship or a structured education program. We believe this multifaceted education program has increased knowledge and confidence within our team and this was reflected in the survey performed after completion of the bootcamp. Future plans include offering this program to other APP programs, measuring procedural competency and management of emergencies before and after completion of the bootcamp. We have also considered evaluating the impact on length of stay and patient satisfaction.

References:

Ramirez E, Schumann L, Agan D, Hoyt KS, Wilbeck J, Tyler D, Evans DD. (2018). Beyond competencies: Practice standards for emergency nurse practitioners-A model for specialty care clinicians, educators, and employers. *Journal of the American Association of Nurse Practitioners*, 30(10), 570-578. <http://doi: 10.1097/JXX.000000000000139>. PMID: 30320710

Matlick, Garrett. Barriers encountered when exploring nurse practitioner postgraduate training programs. *Journal of the American Association of Nurse Practitioners* 33(4):p 311-317, April 2021. <http://doi: 10.1097/JXX.0000000000000363>

Keywords: education, neurosurgery, advanced practice provider

NS-006

Nursing Symposium

Implementing a Standardized Pin Site Care Protocol for Patients with Halo Devices

Ji Sung Elizabeth An

Department of Neurosciences and Trauma, The Hospital for Sick Children, Toronto, Canada

OBJECTIVE: Patients in halo devices require routine care of the area where halo pins enter the skin, also known as pin sites. A practice gap regarding a lack of standardized pin site care was identified. Our aim was to develop an evidence-based standardized pin site care protocol to minimize the risk of pin site infections and complications.

MATERIAL AND METHODS: A literature review was conducted using PubMed, Cochrane Library, and CINAHL databases. A review of pin site care protocols from other institutional policies and practice guidelines was also conducted. These findings were presented to expert opinions including our neurosurgery nurse practitioners, quality improvement lead, educator, registered nurses, orthopedic team, and Holland Bloorview.

RESULTS: The literature review indicated variable results. 7 out of 15 sources were unable to identify recommendations for pin site care due to lack of evidence and consistency among facilities' pin site care regimens. It was difficult to find a unanimous conclusion for pin site care due to the wide range of cleaning solutions, utensils, and dressings. The frequency of pin site care was variable, making it difficult to conclude whether the protective factor against infections was the cleaning regimen or frequency, and to what degree. Despite the lack of high-quality evidence, normal saline, chlorhexidine, gauze, and cotton-tipped applicators were frequently recommended. The review of other institutional policies and practice guidelines identified that daily pin site care using normal saline and cotton-tipped applicators was the most common pin site care protocol.

CONCLUSION: Pin site care is widely unstandardized in Canada. A standardized pin site care protocol is needed for patients with halo devices to minimize the risk of pin site infections and complications. A standardized pin site care protocol using normal saline, gauze, and cotton-tipped applicators was implemented. Monitoring pin site infection rates post-implementation is ongoing, and outcomes will be interpreted for future studies.

Keywords: pin site care, halo pin site care, pin site infection, pin site complication, halo nursing management

NS-007

Nursing Symposium

Neuroscience Nursing in Tanzania: Sharing Knowledge and Skill to Improve Patient Care

Haley Vance¹, Dorcas Gidion Magawa³, Sylvia Leon Massawe³, Julie Woodfield⁴, Hadija Halid Mndeme³, Moses Athanasio Moses³, Donatila Kwelukilwa³, Shafi Hamis³, Marci Klaassen⁵, Evelyn Ongechi⁵, Luis Cava⁵, Roger Hartl², Laurent Lemerhi Mchome³, Gail Rousseau⁷, Halinder Mangat⁶, Hamisi Shabani³

¹Vanderbilt University Medical Center, Tennessee, USA²Weill Cornell, New York, USA³Muhimbili Orthopaedic Institute, Dar es Salaam, Tanzania⁴University of Edinburgh Centre for Clinical Brain Sciences, Edinburgh, UK⁵University of Colorado, Colorado, USA⁶University of Kansas Medical Center, Kansas, USA⁷George Washington University, Washington DC, USA

OBJECTIVE: To evaluate the impact of neuroscience nursing education offerings across Tanzania to improve care of neurosurgical patients.

MATERIAL AND METHODS: Four neurosurgical nursing educational courses were offered from February - June 2023: Neuro-Oncology International Conference, Global Neurosurgery Course, Mbeya Hospital Neurocritical Care Course, and Shinyanga Basic Emergency Care Course. A pre- and post-course survey was administered to participants to assess knowledge, skills, and course impact on practice and patient care.

RESULTS: A total of 292 nurses participated in the four courses. The years of nursing experience reported was higher at the Global Neurosurgery Course (30%, more than 10 years) compared to the Mbeya Hospital NeuroCritical Care Course (28%, 3-5 years) and the Shinyanga Basic Emergency Care Course (46%, 1-2 years). The years of nursing experience reported at the Neuro-Oncology International Conference was predominantly "unknown" (58%). The number of participants completing both the pre- and post-course survey included: 20/77 (15%) for the Neuro-Oncology Course, 33/54 (61%) for the Global Neurosurgery Course, 88/118 (75%) for the Mbeya Hospital Neurocritical Care Course, and 19/24 (79%) for the Shinyanga Basic Emergency Care Course. The proportion of survey participation increased over time as the survey was adapted to an electronic format. After all four courses, self-reported knowledge of caring for the neurosurgical patient increased. The highest response for increased knowledge post-course was from the Global Neurosurgery Course, with 72% of participants reporting the course as "extremely useful". When evaluating teaching methods, bedside teaching and skills sessions scored higher at Mbeya and Shinyanga which was felt to represent greater applicability to the work environment and experience level.

CONCLUSION: The expansion of neurosurgical nurse training in Tanzania is essential for delivering high quality care. Prioritization should be given to training courses in the local settings in Tanzania in efforts to provide impactful and self-sustaining methods for improved knowledge amongst nursing.

Keywords: Nursing

NS-008

Nursing Symposium

Global neurosurgery nursing in the ISPN: What, how, when and why?

Jenny Sacree

Sidra Medicine, Doha, Qatar

OBJECTIVE: This presentation will explore the idea of a global ISPN neurosurgical nursing family.

MATERIAL AND METHODS: What is happening globally at the moment?

What we can do, as ISPN members, to enhance the movement?

How can members of high-income countries link with lower and lower middle-income countries?

What we can do to bring neurosurgical nurses from around the whole globe together and what we can achieve when we are linked together?

RESULTS: This will be an interactive discussion to promote ideas, thoughts and projects and get neurosurgical nurses talking together on the future.

CONCLUSION: Every child matters, every nurse can help: together we can make a difference to children and neurosurgical nursing around the world.

Join me to take this a little further!

Keywords: Global, neurosurgical, nursing

NS-009

Nursing Symposium

Collaborative Robotic Surgery for Pediatric Spine Arthrodesis. From planning to execution of the first case in Latin America

Allison Roberto Da Silva

Teaching Hospital of the School of Medicine of São Paulo University (HCFMRP-USP)

OBJECTIVE: INTRODUCTION: Scoliosis can be defined as the shortening of the spine caused by an S- or C-shaped lateral curvature. This deformity can be defined as idiopathic, congenital or neuromuscular. Patients with less severe deformities can be treated with anatomical braces and physiotherapy with good results, however, more severe cases require surgical intervention with instrumentation and fixation of vertebrae. In cases where the indication for correction is surgery, the use of new technologies to increase precision and minimize collateral damage has proven increasingly effective, including robotic surgeries under navigation. In 2024 June, the first robotic surgery to correct congenital scoliosis in a child in Latin America was carried out in a large University Hospital in São Paulo State. This surgery took place in collaboration between Pediatric Neurosurgery and Spine Orthopedics and was fully funded by the Brazilian Unified Health System.

OBJECTIVE: To describe the stages of planning, execution, nursing care and discharge of the pediatric patient from the first robotic arthrodesis surgery in Latin America.

MATERIAL AND METHODS: This is an experience report, where the steps of planning and executing the surgery are described, as well as training steps and the teams' learning curve with new robotic equipment.

RESULTS: The team performed the first robotic spinal arthrodesis surgery in Latin America on a 12 year's old child, all coverage was provided by the Brazilian Unified Health System and the results obtained were excellent.

CONCLUSION: Robotic surgeries to correct spinal deformities are a growing technology and represent greater precision in the surgical process, using navigation to guide the instrumentation, we obtain great quality in the alignment of the implants, significantly improving

the patient's quality of life, minimizing length of stay and improving the recovery process when compared to traditional surgeries.

Keywords: Spine Surgery, Pediatric Neurosurgery, Robotic Surgery

NS-010

Nursing Symposium

The impact of specialized neurosurgical care on advanced practice providers

Michaela Mamary Boston Children's Hospital Neurosurgical Department, USA

OBJECTIVE: In the 2023 fiscal year, Boston Children's Hospital Neurosurgical Division, had a 16.5% increase in cases completed annually, as well as a 16.1% increase in outpatient visits per year. As a result, they have expanded the number of advanced practice providers (APPs) within the department from 11 to 17. To assist providers in their education, job satisfaction, and retention, we have developed a subspecialized neurosurgical care model. This study aims to review the effect of subspecialized neurosurgical care on APP education, job satisfaction, and retention; with a secondary aim of reducing length of stay and improving patient and caregiver satisfaction.

MATERIAL AND METHODS: Two patient care teams were created; the APPs were divided evenly amongst the two teams. Teams corresponded to two distinct Neurosurgical subspecialty groupings: Group one tumor and group two epilepsy/spasticity/hydrocephalus. APPs remained on these care teams for a total of 6 weeks, caring for the corresponding patient population both inpatient and outpatient. After 6 weeks, APP teams were switched.

RESULTS: While this review is currently ongoing, a modified American Association of Critical-Care Nurses (AACN) Healthy Work Environment Assessment Tool (HWEAT) will be administered to the APPs, assessing their education, job satisfaction, and projected retention post initiation of subspecialized care. We also plan to examine length of stay and re-evaluate patient satisfaction surveys both before and after the implementation of this method.

CONCLUSION: Subspecialized care delivered by advanced practice providers within an academic medical institution shows promising results. With the adoption of subspecialized training and care teams we hope to increase APP knowledge, job satisfaction, and retention among providers. Further long-term studies are warranted to validate these findings and potentially investigate the effect on length of hospital stay, readmission rates and patient satisfaction.

References:

Langer, J. C., Gordon, J. S., & Chen, L. E. (2016). Subspecialization within pediatric surgical groups in North America. *Journal of pediatric surgery*, 51(1), 143–148. <https://doi.org/10.1016/j.jpedsurg.2015.10.038>

Beaulieu-Jones, B. R., Croitoru, D. P., & Baertschiger, R. M. (2020). Advanced providers in pediatric surgery: Evaluation of role and perceived impact. *Journal of pediatric surgery*, 55(4), 583–589. <https://doi.org/10.1016/j.jpedsurg.2019.07.002>

Keywords: pediatric neurosurgery, advanced practice providers, specialization

NS-011

Nursing Symposium

Novel administration of intraventricular baclofen for intractable dystonia

Lenny Sacree

Sidra Medicine, Doha, Qatar

OBJECTIVE: This presentation will describe an interesting case study of a teenage girl with dystonic cerebral palsy in whom we introduced continuous intraventricular baclofen (IVB) administration after a trial infusion over 2 days to improve her dystonia.

MATERIAL AND METHODS: IVB has been described in several papers and usually a test dose is given as a one off via a surgical puncture of the ventricles. For this patient after discussion with the movement disorder team we undertook surgery to implant a ventricular reservoir with the tip in the 3rd ventricle. After this had healed, we commenced a 2-day infusion via a butterfly needle in her reservoir.

RESULTS: Pre-dose assessments (PT, OT and SLP) including video recordings were made and used as a baseline for post infusion assessments.

Following a clear improvement in these assessments, the patient and family decided to go for a permanent pump insertion

CONCLUSION: The outcome for this patient in the 3 months post insertion has been very interesting.

Keywords: Dystonia, intraventricular Baclofen

NS-012

Nursing Symposium

Peri-operative, non-surgical management of babies with craniosynostosis

Leali Y Halfon

Department of Paediatric Neurosurgery, Dana-Dwek Children's hospital, Tel Aviv Sourasky Medical Center, Israel

OBJECTIVE: INTRODUCTION: Craniosynostosis is a developmental condition affecting the craniofacial region, typically necessitating surgical intervention. This surgery often involves open skull reconstruction, primarily for cosmetic reasons and occasionally to enhance functionality. It is generally performed between 3 and 8 months of age, lasting between 45 to 120 minutes, and is conducted under general anaesthesia. Postoperative care includes an overnight stay in the intensive care unit, followed by a 3–4-day hospitalization in the ward. During this period, haemoglobin levels are monitored, and pain and fever are managed as needed. For many parents, the period between referral to surgery until postoperative discharge is extremely stressful. Therefore, measures to help parents to cope are urgently needed.

AIM: We describe our efforts to assist parents in navigating this challenging time in the most positive way possible.

MATERIAL AND METHODS: Preoperatively, alongside obtaining parental consent by the treating physician, a representative of the nursing staff educates the parents and prepares them for the peri- and postoperative periods. This preparatory conversation takes place during or adjacent

to the preoperative consultation and is led by a designated, experienced nurse who will ideally provide care for the child during hospitalization. Furthermore, a Q&A leaflet that addresses key points concerning the surgery and postoperative phase is provided along with contact information (phone/email) to reach nurse/medical staff for any further questions. **RESULTS:** Based on our experience, setting parents' expectations in advance and providing them with detailed information on the perioperative care might shorten hospital stays and improve parental engagement and cooperation. Parents tend to feel more reassured and confident when well-informed before hospitalization, especially if their child is a first-born.

CONCLUSION: Future research should focus on parental satisfaction and levels of anxiety in the preoperative and postoperative periods, comparing outcomes with and without a preparatory intervention led by the nursing staff, in addition to the physician's informed consent.

Keywords: craniosynostosis

NS-013

Nursing Symposium

Adaptation of Collaborative Robotic Equipment for Epilepsy Surgeries: SEEG implant.

Allison Roberto Da Silva

Teaching Hospital of the School of Medicine of São Paulo University (HCFMRP-USP)

OBJECTIVE: INTRODUCTION: Epilepsy is a brain disease that causes recurrent seizures. The vast majority of cases are controlled with the use of medication, but some do not achieve the same success, requiring a surgical approach to ensure effective treatment. To determine a more precise location of the area to be approached, invasive monitoring: Stereoecephalography (sEEG) is used by large Epilepsy surgery centers to determine the location with assertiveness and safety. To implant the electrodes, the stereotactic surgical technique is used with good results. However, we can substantially improve OR time and precision by using collaborative robotic equipment.

OBJECTIVE: The adaptation and surgical validation of a robotic equipment designed for industry to sEEG implantation.

MATERIAL AND METHODS: This is a methodological work of adaptation and surgical validation of a new collaborative robotic equipment for sEEG implant surgeries.

RESULTS: The collaboration between Medicine School of Ribeirão Preto and the Engineering School of São Carlos of São Paulo University resulted in the adaptation of collaborative robotic equipment designed to implant sEEG in patients with difficult-to-control epilepsy. In laboratory tests, the results with programming the surgery and carrying out the procedure in a 3D mold demonstrate excellent precision, in addition to optimizing time, resources and eliminating the Sterotactic Arc.

CONCLUSION: The adaptation of robotic equipment represents a revolution in functional surgeries performed in Brazil, combining the precision of the equipment with the surgeon's experience, we will be able to considerably improve the treatment given to our patients, minimizing OR time and increasing surgical precision.

Keywords: Epilepsy, Robotic Surgery, Pediatric Neurosurgery

List of posters presented at 50th ISPN Annual Meeting

Poster Number	Topic	Title	Presenter	Country
PP-001	Neuro-Oncology	Temporal Trend of Diabetes Insipidus After Surgical Decompression of Pediatric Craniopharyngiomas Using Two Different Modalities of Vasopressin Therapy	Adithiya Kumar	India
PP-002	Neuro-Oncology	MRI markers of hypothalamic dysfunction in craniopharyngioma	Luca Massimi	Italy
PP-003	Neuro-Oncology	Case Report: Treatment of the rare B-cell lymphoblastic lymphoma with scalp lesion using rotation flap	Timothy Kim	United States
PP-004	Neuro-Oncology	Medical management for cerebellar mutism syndrome following posterior fossa surgery: A systematic review	Alaa Nabil Turkistani	Saudi Arabia
PP-005	Neuro-Oncology	Paediatric Intra-orbital Optic Pathway Glioma: A Case Series Unveiling Clinical, Surgical, Psychological and Cosmetic Insights	Anda Veronica Gherman	United Kingdom
PP-006	Neuro-Oncology	Comparative Analysis of Treatment Modalities for Pediatric Spinal Cord Glioblastoma: Insights from a Meta-Analysis	Artur Henrique Galvao Bruno Da Cunha	Brazil
PP-007	Neuro-Oncology	Exoscope-Assisted surgery in semisitting position for pediatric Posterior Fossa tumors: a single center experience	Cecilia Casali	Italy
PP-008	Neuro-Oncology	Pediatric cervical spine chordoma: salvage circumferential operations for residual tumor resection and kyphotic	Chao Ya Yang	Taiwan

		deformity correction		
PP-010	Neuro-Oncology	Impact of the SARS-CoV-2/COVID-19 pandemic on the patient journeys of children newly diagnosed with a brain tumour in the UK - a mixed method quantitative and qualitative study	Ibrahim Jalloh	United Kingdom
PP-011	Neuro-Oncology	Pineal Gland Glioblastoma Re-diagnosed as a H3K27M Diffuse Midline Glioma	Chloé Louise Gelder	United Kingdom
PP-012	Neuro-Oncology	Predictive models for postoperative hydrocephalus in pediatric patients with posterior fossa tumors: systematic review and risk of bias assessment	Hendrik Jan Mijderwijk	Germany
PP-013	Neuro-Oncology	Paediatric spine tumours: 15-year experience from a Singapore children's hospital	Jonis Michael Esguerra	Singapore
PP-014	Neuro-Oncology	Secondary glioma obscured by cochlear implant in a childhood medulloblastoma survivor	Corinne Rabbin Birnbaum	United States
PP-015	Neuro-Oncology	Teratoid/rhabdoid tumor: Atypical presentation	Daniela Rodríguez Anguiano	Mexico
PP-016	Neuro-Oncology	Comprehensive multiomics analysis reveals distinct differences between pediatric choroid plexus papilloma and carcinoma	Eun Jung Koh	South Korea
PP-017	Neuro-Oncology	Organoids in pediatric brain tumor management	Federico Di Rocco	France
PP-018	Neuro-Oncology	Incidence and Associated Factors of Spinal Sagittal Deformity Following Intramedullary Tumors Resection in Pediatric Population: A Retrospective Analysis	Giuliana Agras Menghi	Argentina
PP-019	Neuro-Oncology	Management of pediatric central nervous system tumors by a neuro-oncology multidisciplinary team in a lower-middle income country	Grace Ella Armande Djonde	Cote d'Ivoire
PP-020	Neuro-Oncology	Pediatric Embryonal Tumor Mimicking Low-grade Glial Tumor in Imaging	Hakan Karabagli	Turkey
PP-021	Neuro-Oncology	Pediatric primary intracranial melanoma: Case study	Orkhontuul Shirmen	Mongolia
PP-022	Neuro-Oncology	The ISOP Study: protocol for an international multicenter prospective cohort study investigating the Intraoperatively observed Site of Origin and growth Pattern of the molecular	Christian Dorfer	Austria

		groups of medulloblastoma		
PP-023	Neuro-Oncology	Novel use of Intra-Operative MRI for a Paediatric Spinal Tumour	Chloé Louise Gelder	United Kingdom
PP-024	Neuro-Oncology	Novel presentation of a Langerhans cell tumor affecting C2 vertebrae in a child	Isaque Hyung Tong Kim	Brazil
PP-025	Neuro-Oncology	Bilateral Multilevel Hemi-Semi Laminectomy. A technical option for extensive Spinal Tumors in Children	Javier Cuellar Hernandez	Mexico
PP-026	Neuro-Oncology	Spontaneous subependymal giant cell astrocytoma in the absence of tuberous sclerosis complex: A case report and systematic review	Christopher J Carr	United States
PP-027	Neuro-Oncology	Surgical treatment of pediatric low-grade gliomas of the brainstem: oncological and neurological outcome	Katalin Nora Lorincz	Germany
PP-028	Neuro-Oncology	Massive spinal teratoma in a 3-year-old child: an interesting case report	Katerina Apostolopoulou	Greece
PP-029	Neuro-Oncology	Predictors of Functional and Survival Outcomes following Pediatric Intramedullary Spinal Cord Tumor Resection	Katie Pricola Fehnel	United States
PP-030	Neuro-Oncology	Embryonal brain tumors in the first three years of life: experience of one institution	Liudmyla Verbova	Ukraine
PP-031	Neuro-Oncology	Brain tumors in the first three years of life: report from a single institution	Liudmyla Verbova	Ukraine
PP-032	Neuro-Oncology	A Single Centre Experience of using Intra-operative MRI In Managing Pediatric Cranial Neuro-oncology Cases	Loke Yuan Shee	Malaysia
PP-033	Neuro-Oncology	Incidentally found brain tumor in children	Ai Muroi	Japan
PP-034	Neuro-Oncology	Subcallosal- subgenual astroblastoma, unusual tumor, unusual location	Luis Angel Arredondo Navarro	Mexico
PP-035	Neuro-Oncology	The in vitro experiments of combination treatment with pyroxamide and SLC-0111 for diffuse intrinsic pontine glioma	Naohide Fujita	Japan
PP-037	Neuro-Oncology	A rare case of Paediatric Central Neurocytoma	Martin Muthinja Kiriinya	South Africa
PP-038	Neuro-Oncology	Pediatric Ganhioglioma of the posterior fossa: Case report and literature review	Matheus Merula De Almeida	Brazil

		pineal region		
PP-040	Neuro-Oncology	Cerebellar mutism / posterior fossa syndrome following resection of posterior fossa tumor in pediatric patients: Assessing pathophysiology, risk factors and neuroradiographic features	Monirah Zeya	India
PP-041	Neuro-Oncology	Internal Validation of the STAR/HOP System: Enhancing Clinical Communication and Standardizing Coding for Pediatric Craniopharyngioma	Mostafa M. E. Atteya	Saudi Arabia
PP-042	Neuro-Oncology	Optimization of MRI protocols for children with brain tumors at all stages of treatment from surgery to follow-up	Nadezhda Plakhotina	Russia
PP-043	Neuro-Oncology	Clear cell meningiomas—case presentation, review of radiographic identifiers, and treatment approaches	Margaret Keymakh	United States
PP-044	Neuro-Oncology	Hydrocephalus Management Protocol For Children With Posterior Fossa Tumors. A Pilot Single-Center Study	Noa Schwartz	Israel
PP-045	Neuro-Oncology	Analysis of Primary Paediatric Brain Tumours in a low-middle income country in Sub Saharan Africa– A 5-year retrospective review of paediatric brain tumour in KwaZulu Natal	Nomusa Busisiwe Shezi	South Africa
PP-047	Neuro-Oncology	Complete resection of the epileptogenic zone guided by intraoperative magnetic resonance imaging improves seizure outcomes	Raheel Ahmed	United States
PP-048	Neuro-Oncology	Recurrences in craniopharyngioma: are there MRI findings associated with recurrences?	Samuel Valenzuela	Chile
PP-049	Neuro-Oncology	Shifting Strategies in the Treatment of Pediatric Craniopharyngioma	Segev Gabay	Israel
PP-050	Neuro-Oncology	“A Tale of Two Pediatric Craniopharyngiomas”; Exemplifying Treatment Strategies	Segev Gabay	Israel
PP-051	Neuro-Oncology	Incidental Ependymoma in a Myelomeningocele Patient: a case report	Sergey Abeshaus	Israel
PP-052	Neuro-Oncology	Pediatric aggressive vertebral hemangioma: treatment options for the young and the frail	Shih Hung Yang	Taiwan
PP-053	Neuro-	Surgical and Targeted Therapeutic	Shu Mei Chen	Taiwan

	Oncology	Approach in a Pediatric Patient with Spinal Low-Grade Spindle Cell Sarcoma and TPM3-NTRK1 Fusion: A Case Report		
PP-054	Neuro-Oncology	Evaluating Surgical Outcomes in DNET: "The Predictive Power of Satellite Lesion Dynamics vs. Chassoux MR Classification"	Taehoon Kim	South Korea
PP-055	Neuro-Oncology	A rare case of malignant tumor presenting increased intracranial pressure sign 2 years and 9 months after treatment of subdural hematoma	Takao Tsurubuchi	Japan
PP-056	Neuro-Oncology	Comparison of Pediatric Long-Level Intramedullary Spinal Cord Tumors with those of Adults: Clinical characteristics and Surgical results	Tao Fan	China
PP-057	Neuro-Oncology	Human brain tumours in animal models: a systematic review aiming at translational paediatrics neuro oncology applications for a personalised medicine	Thais Neri Andrade De Almeida	Brazil
PP-058	Neuro-Oncology	Pediatric lower grade glioma surgery in the era of genomic medicine	Akira Gomi	Japan
PP-059	Neuro-Oncology	Treatment of pediatric craniopharyngiomas with intracystic catheter placement: Technical aspects and results	Victor Javier Fernández Cornejo	Spain
PP-060	Neuro-Oncology	Radiation-Induced Glioblastoma 24 Years after Craniospinal Irradiation for Cerebellar Medulloblastoma – Case Report and Review of Literature	William Winardi	Taiwan
PP-061	Neuro-Oncology	Dermatological, Neurological, and Bone (DNB) Grading in Disease Severity Assessment of Patients with Neurofibromatosis Type 1 in China: A Single Institutional Report	Yipeng Han	China
PP-062	Neuro-Oncology	Extra-axial pediatric cerebellopontine angle Medulloblastoma: A Rare Case Report and Review of Literature	Yu Cheng Chou	Taiwan
PP-064	Hydrocephalus and Neuro	Silent Bowel Perforation and Trans-anal migration of Distal end of ventriculoperitoneal shunts: Case Series with literature review	Achal Saxena	India
PP-065	Hydrocephalus and Neuro	Seizures as a presentation of shunt malfunction: tertiary paediatric neurosurgery experience	Aimee Goel	United Kingdom

PP-066	Hydrocephalus and Neuro	High Riding Basilar Artery / Liliquist Membrane Perforation - Challenges During Third Ventriculostomy: A Technical Note	Amol Mittal	India
PP-067	Hydrocephalus and Neuro	Clinical management challenges of hydrocephalus in patients with chromosome 9p gain and choroid plexus abnormalities: A case report and comprehensive literature review	Ann Kristin Schmitz	Germany
PP-068	Hydrocephalus and Neuro	Stented endoscopic third ventriculostomy: A multicenter study	Lee Azolai	Israel
PP-069	Hydrocephalus and Neuro	Benchtop testing reveal shunt valves used in LMIC and HIC countries overdrain with gravity and pressure pulses	Joyce Koueik	United States
PP-070	Hydrocephalus and Neuro	Effect of infantile hydrocephalus on executive function and brain network connectivity	Beryl Yt Chung	Canada
PP-072	Hydrocephalus and Neuro	A Last-Resort Alternative for Treating Complicated Hydrocephalus: A Report of Six Cases with Ventriculo-Gallbladder Shunts	Burcu Göker	Turkey
PP-073	Hydrocephalus and Neuro	Presentation of technical note in ventriculoperitoneal shunt revisions: Experience in 25 consecutive cases	Cármine Porcelli Salvarani	Brazil
PP-074	Hydrocephalus and Neuro	Analyzing Cerebrospinal Fluid Dynamics in Ventricular Catheters for Pediatric Hydrocephalus	Christopher Roberts	United States
PP-075	Hydrocephalus and Neuro	“Standard” vs Miethke Shunt Valves for Paediatric Hydrocephalus: A Retrospective Review of Outcomes	Hamza Rehman	United Kingdom
PP-076	Hydrocephalus and Neuro	Exploring the Impact of Ventricular Volume on Splenium Macro and Microstructure in Infantile Hydrocephalus	Derya Adil	Canada
PP-077	Hydrocephalus and Neuro	Differential Pressure versus Gravitational Adjustability in Pediatric Hydrocephalus Patients	Isabel Fernandes Arroiteia	Switzerland

PP-079	Hydrocephalus and Neuro	The problematic and management of overdrainage in the treatment of pediatric hydrocephalus with new generation gravitational VP-Shunt-Valves	Friederike Knerlich Lukoschus	Germany
PP-080	Hydrocephalus and Neuro	Multidisciplinary Approach to Reduce Shunt Complications over a 5 Year Period	George Issa Jallo	United States
PP-081	Hydrocephalus and Neuro	Indications and Complications of Endoscopic Third Ventriculostomy: 17 years of Experience	Hakan Karabagli	Turkey
PP-082	Hydrocephalus and Neuro	Shunt valves – do we have a quality problem? - Single center in vitro quality control study	Christopher Wendel	Germany
PP-083	Hydrocephalus and Neuro	Epidemiological aspect and type of management of hydrocephalus in children aged 0-5 years at Bernard Mevs Project Medishare Hospital (HBMPM) from January 2018 to December 2022	Edisond Florial	Canada
PP-084	Hydrocephalus and Neuro	Efficacy on Decreasing Ventricular Dilatation after Fetal Endoscopic Third Ventriculostomy Treatment for Induced Congenital Hydrocephalus in Fetal Lambs	Jose Luis Peiro	United States
PP-085	Hydrocephalus and Neuro	Staged neurosurgical approach for giant and progressive neonatal arachnoid cysts: a case series and review of the literature	Aurelia Peraud	Germany
PP-086	Hydrocephalus and Neuro	Obstructive Hydrocephalus of Uncommon Etiology: Case Report and neurosurgical management of Aqueductal Web presenting in adolescence	Aseel Masarwy	United States
PP-087	Hydrocephalus and Neuro	Ventriculo-subgaleal Shunt as a Temporising Measure in the Management of Pediatric Hydrocephalus - A Value Proposition	Llewellyn Padayachy	South Africa
PP-088	Hydrocephalus and Neuro	Implementation of an Early Intervention Management Pathway for Intraventricular Hemorrhage of Prematurity: A Quality Improvement Analysis Including Resource Utilization	Mandeep S Tamber	Canada
PP-089	Hydrocephalus and Neuro	Examining the Effect of the COVID-19 Pandemic on the Management and Outcomes of Cerebrospinal Fluid Shunt Procedures	Margaret Keymakh	United States
PP-090	Hydrocephalus and Neuro	External hydrocephalus following VOGM embolization: An illustrative case supporting dural venous sinus	Marianne Juhler	Denmark

		obstruction as causal factor		
PP-091	Hydrocephalus and Neuro	Effects of shortening distal shunt catheters in children related to patient age – a simulation study with clinical implications	Martin Ulrich Schuhmann	Germany
PP-092	Hydrocephalus and Neuro	The influence of the Covid-19 pandemic on the shunt revision rate in children	Martina Messing Jünger	Germany
PP-093	Hydrocephalus and Neuro	Management of pediatric patients with CSF shunts and cochlear implants	Florian Wild	Germany
PP-094	Hydrocephalus and Neuro	Does Endoscopic Third Ventriculostomy before posterior fossa tumour resection prevent long-term shunt dependency in children presenting with obstructive hydrocephalus?	Nada Mohammed	United Kingdom
PP-095	Hydrocephalus and Neuro	Shunt revision rates during 50 years of shunt surgeries: a prospective single center cohort study	Oula Knuutinen	Finland
PP-096	Hydrocephalus and Neuro	Distal Small Lumen Catheter in Ventriculoperitoneal shunts: Does it prevent overdrainage?	Preston D Souza	United States
PP-097	Hydrocephalus and Neuro	Association between altered white matter networks and postoperative ventricle volume in shunt-treated pediatric hydrocephalus	Renee Marie Raguett	Canada
PP-098	Hydrocephalus and Neuro	Risk Factors for Pediatric CSF Shunt Infection: Meta-analysis	Roidah Taqiyya Zahra Wathoni	Indonesia
PP-099	Hydrocephalus and Neuro	Ten Years Incidence of Pediatric Hydrocephalus and Shunt Complications: A Single Centre Retrospective Study in Indonesia	Sheila Sumargo	Indonesia
PP-100	Hydrocephalus and Neuro	Early Prediction of Tuberculous Etiology in Pediatric Acquired Hydrocephalus through Peripheral Blood Monocytes/Lymphocyte Ratio	Sheila Sumargo	Indonesia
PP-101	Hydrocephalus and Neuro	Role of flexible neuro endoscopy in management of hydrocephalus our experience in last 7 years	Shighakolli Ramesh	India
PP-102	Hydrocephalus and Neuro	Changes in hydrocephalus treatment in patients with myelomeningocele	Shohei Nagasaka	Japan
PP-103	Hydrocephalus and Neuro	Prenatal Neuro-endoscopic Intraventricular Anatomical Differences between fetal lamb and human in induced fetal hydrocephalus ovine model	Soner Duru	United States
PP-104	Hydrocephalus and Neuro	Severity of Fetal Hydrocephalus Correlates with Percentage of Denudated Areas in the Ependymal	Soner Duru	United States

		Lining of the Distended Cerebral Lateral Ventricles in ovine model		
PP-105	Hydrocephalus and Neuro	Incidence of hydrocephalus requiring shunting in Northern Finland between 1990–2016	Tiina Susanna Piironen	Finland
PP-106	Hydrocephalus and Neuro	Neuroendoscopic lavage for post-hemorrhagic hydrocephalus of prematurity: Safety and feasibility in a single institution in the United States	Tracy M Flanders	United States
PP-107	Hydrocephalus and Neuro	Neuroendoscopic lavage for post-hemorrhage hydrocephalus: Perioperative clinical pathway specific to a bedside neurosurgical treatment for premature neonates	Tracy M Flanders	United States
PP-108	Hydrocephalus and Neuro	A rare case of Ventriculoperitoneal Shunt (VPS) End Catheter Thorax Migration in an Infant Patient with Diaphragmatic Congenital Defect	Matheus Felipe De Souza Vasconcelus	Brazil
PP-109	Hydrocephalus and Neuro	Spontaneous Cutaneous Rupture secondary to Severe Congenital Hydrocephalus	Van Euldem Diaz Battad	Philippines
PP-110	Hydrocephalus and Neuro	Endoscopic Third Ventriculostomy versus Ventriculoperitoneal Shunting for Infant Hydrocephalus: A Meta-analysis and Trial Sequential Analysis	Varidh Katiyar	India
PP-111	Hydrocephalus and Neuro	Antibiotic-Impregnated Catheters in Ventriculoperitoneal Shunts for Infants: A Systematic Review and Meta-Analysis	Walter Fagundes	Brazil
PP-112	Hydrocephalus and Neuro	Effect of distal catheter length on shunt complications in infantile hydrocephalus: A single-center retrospective study	Yoko Nakanishi	Japan
PP-113	Hydrocephalus and Neuro	Implementation of an adapted perioperative ventriculoperitoneal shunting protocol in a tertiary center located in a low-to-middle-income country	Zohreh Habibi	Iran
PP-114	Endoscopy Neurotrauma / Critical Care	Spinal Injuries Resulting From Firearm Trauma in the Pediatric Population: A Cross-Sectional Analysis Using 2017-2021 TQIP Data	Matthew Merckling	United States
PP-115	Endoscopy Neurotrauma / Critical Care	Head injury in pediatric patients who underwent neurosurgical intervention	Ai Muroi	Japan
PP-116	Endoscopy Neurotrauma / Critical Care	Traumatic Brain Injury Biomarker Utility Varies by Age: A prospective analysis of 425 children	Andrew Reisner	United States

PP-117	Endoscopy Neurotrauma / Critical Care	Timing of surgical intervention for children sustaining complete traumatic spinal cord injury	Armaan K Malhotra	Canada
PP-118	Endoscopy Neurotrauma / Critical Care	Feasibility of Imaging Variable Collection from Computed Tomography Reports to Predict Outcomes for Traumatic Brain Injury Patients: A Multicenter Internal Validation Study	Armaan K Malhotra	Canada
PP-119	Endoscopy Neurotrauma / Critical Care	Paediatric Traumatic Brain Injury (pTBI): perspectives from a UK paediatric Emergency Department	Benjamin Hall	United Kingdom
PP-121	Endoscopy Neurotrauma / Critical Care	Surgical Management of Pediatric Traumatic Brain Injury Patients in a Low-Middle Income Country: Insights from a 5-Year Institutional Experience	Candice Marie Elizabeth D Tionsgon	Philippines
PP-122	Endoscopy Neurotrauma / Critical Care	Endoscopic intraventricular lavage in pediatric pyogenic ventriculitis	Carolina Belen Maldonado Alejos	Argentina
PP-123	Endoscopy Neurotrauma / Critical Care	Endoscopic Evacuation of a Cerebellar Hematoma in a Term Neonate - Advances in Surgical Technique and Case Report	Christopher Wendel	Germany
PP-124	Endoscopy Neurotrauma / Critical Care	Endoscopic third ventriculostomy combined with biopsy for tumors adjacent to the third ventricle using electromagnetic-navigation in pediatric neurosurgery	Elvis J Hermann	Germany
PP-125	Endoscopy Neurotrauma / Critical Care	Endoscopic third ventriculostomy (ETV) with choroid plexus cauterization (CPC) for hydrocephalus treatment: The Brazilian Experience	Giselle Coelho	Brazil
PP-126	Endoscopy Neurotrauma / Critical Care	General overview Pediatric spinal trauma and case report	Rodrigo López Mondragón	Mexico
PP-127	Endoscopy Neurotrauma / Critical Care	Results of surgical treatment of arachnoid cysts of the middle cranial fossa in children	Ivan Protsenko	Ukraine
PP-128	Endoscopy Neurotrauma / Critical Care	Traumatic brain injury and other multisystem injuries following unintentional falls: a 14-year retrospective cohort study of 816 children	Mandeep S Tamber	Canada
PP-129	Endoscopy Neurotrauma / Critical Care	Middle Meningeal Artery Embolization for Chronic Subdural Hematomas in Pediatric Patients – An Alternative to Surgery?	Marian Michael Bercu	United States

PP-130	Endoscopy Neurotrauma / Critical Care	Spinal Cord Infarction in Children. Difficulties In Diagnosis	Zainab Jallow	Russia
PP-131	Endoscopy Neurotrauma / Critical Care	Intracranial hypertension following an open comminuted depressed skull fracture over the posterior third of the superior sagittal sinus in a pediatric patient:	Mohammad A M A Mohammad	Ireland
PP-133	Endoscopy Neurotrauma / Critical Care	How to reduce Hydrocephalus rate in children with posterior fossa tumor	Naama Turner	Israel
PP-134	Endoscopy Neurotrauma / Critical Care	Follow up brain US as an alternative to CT scan in infants with traumatic intracranial bleed	Naama Turner	Israel
PP-135	Endoscopy Neurotrauma / Critical Care	The neuro-endoscopic cysto-cisternostomy practice principles for middle cranial fossa arachnoid cysts: a systematic review of 169 cases	Promise Tamunoipiriala Jaja	Russia
PP-136	Endoscopy Neurotrauma / Critical Care	Clinico-radiological outcomes of neuro-endoscopic cysto-cisternostomy of Sylvian arachnoid cysts: a prospective cohort study	Promise Tamunoipiriala Jaja	Russia
PP-137	Endoscopy Neurotrauma / Critical Care	Paediatric autologous cranioplasty after storage of bone flap in an abdominal pocket; single institution experience and recommendations for management	Rebecca Hodnett	United Kingdom
PP-138	Endoscopy Neurotrauma / Critical Care	Does Traumatic Brain Injury differ with socio-economic class? A large review of Falls and Index of Multiple Deprivation	Guirish A Solanki	United Kingdom
PP-139	Endoscopy Neurotrauma / Critical Care	Transnasal Endoscopic Surgery in Pediatric Pituitary Adenomas: Chilean Experience at Institute of Neurosurgery Asenjo	Samuel Alejandro Valenzuela	Chile
PP-140	Endoscopy Neurotrauma / Critical Care	Uncomplicated linear skull fractures in the paediatric population; a retrospective observational study in a UK Major Trauma Centre	Sivasri Krishna Yellamraju	United Kingdom
PP-141	Endoscopy Neurotrauma / Critical Care	Long term outcomes following severe pediatric traumatic brain injury: experience from a European supraregional trauma centre	Sofie Dietvorst	United Kingdom
PP-142	Endoscopy Neurotrauma /	Endoscopic experience in management of pediatric third ventricular tumors	Sudharsan Phagalvarthi	India

	Critical Care		Vijayaraghavan	
PP-143	Endoscopy Neurotrauma / Critical Care	Exclusion of child abuse victims from organ donation under brain death in children: Japanese facts and international comparisons	Takashi Araki	Japan
PP-144	Endoscopy Neurotrauma / Critical Care	Cushing is also Ghanaian: a case presentation	Teddy Totimeh	Ghana
PP-145	Endoscopy Neurotrauma / Critical Care	Successful endoscopic treatment of 4th ventricular arachnoid cyst in Ghana	Teddy Totimeh	Ghana
PP-146	Endoscopy Neurotrauma / Critical Care	A One-Year Retrospective Series of Pediatric Traumatic Brain Injury at a Tertiary Hospital in the Philippines	Van Euldem Battad	Philippines
PP-147	Endoscopy Neurotrauma / Critical Care	The burden of minor head injury hospital admissions and cerebral concussion in Singapore, a small developed country	Wan Tew Seow	Singapore
PP-148	Endoscopy Neurotrauma / Critical Care	Traumatic cerebrospinal fluid (CSF) Leak in infants	Yahya H Khormi	Saudi Arabia
PP-150	Dysraphism	Prenatal imaging prediction of skin lesions in dysraphism by: impact on peri-natal management	Abdulla Slayem Alblooshi	France
PP-151	Dysraphism	Latex allergy in Spina Bifida - The Indian Paradox?	Anuraag Gattu	India
PP-152	Dysraphism	Management of Ruptur Myelomeningocele in Newborn: Lesson Learned in the First Experience	Astri Avianti	Indonesia
PP-153	Dysraphism	Functional outcome after filum sectioning for tight or fatty filum in children	Aurelia Peraud	Germany
PP-154	Dysraphism	Caudal regression syndrome and the underestimated incidence of functionally relevant tethered cord. Neurological and urological outcomes after detethering in children with caudal regression syndrome	Aurelia Peraud	Germany
PP-155	Dysraphism	Descriptive analysis of myelomeningocele observed in the neurosurgery pediatric department at Bernard Mevs Hospital in Haiti from January 2018 to March 2022	Berley Alphonse	Haiti
PP-156	Dysraphism	Non-terminal myelomeningocele, a rare variant with unique imaging findings and favorable outcome	Carla Richetta	United States

PP-158	Dysraphism	Results of surgical treatment of encephalocele in children	Leonid Marushchenko	Ukraine
PP-159	Dysraphism	Supratentorial Intracranial Anomalies in Myelomeningocele Patients	Ibrahim Alataş	Turkey
PP-160	Dysraphism	Socio-Economic Profile of Families with Spina Bifida Children in Turkey	Ibrahim Alataş	Turkey
PP-161	Dysraphism	A Comprehensive Analysis of Scoliosis and Other Associated Congenital Vertebra Anomalies in Patients with Myelomeningocele- A study of 422 cases	Ibrahim Alataş	Turkey
PP-162	Dysraphism	The Investigation of the Relationship Between Meningomyelocele and MMP-9, TIMP-1, and TGF β -1 Levels	Ibrahim Alataş	Turkey
PP-163	Dysraphism	Accuracy of Using Standard Growth Curves for Newborns with Spina Bifida	Ibrahim Alataş	Turkey
PP-164	Dysraphism	Beyond "intraoperative"- Conceptualizing normative baseline to build a prognostication model based on intra-operative neuromonitoring during surgery for a tethered cord	Suhas Udayakumaran	India
PP-165	Dysraphism	PLA/PLC "Smart Patch" functionality assessment for fetal duraplasty in prenatal myelomeningocele repair using a fetoscopic surgical simulator	Jose Luis Peiro	United States
PP-166	Dysraphism	Cryopreserved decellularized human umbilical-cord matrix allograft as duraplasty for fetoscopic prenatal spina bifida repair	Jose Luis Peiro	United States
PP-167	Dysraphism	Comparative Assessment of Quality of Life in Paediatric Spinal Dysraphism in a LMIC Setting	Karthigeyan Madhivanan	India
PP-168	Dysraphism	Neurophysiological differentiation between the dorsal and anterior roots in pediatric spinal cord lipoma surgery	Katharina Lutz	Switzerland
PP-169	Dysraphism	Naked Sacrococcygeal Teratoma Associated With Dorsal Meningocele And Sacrococcygeal Inversion: An Atypical Presentation of Currarino Syndrome? - Case Based Review	Debajyoti Datta	Canada
PP-170	Dysraphism	Fetal surgery for myelomeningocele: is it reliable in developing country scenarios?	Eduardo Jucá	Brazil
PP-171	Dysraphism	Alternative treatment for Hydrocephalus in a rare case of Myelocystocele: Flexible Neuroendoscopy (FN) approach	Matheus Felipe De Souza Vasconcelos	Brazil

PP-173	Dysraphism	Cartilage within Lipomyelomeningocele and Ulnar longitudinal deficiency syndrome as VACTERL association, alliance in SHH/GLI3 and Wnt pathway, illustrative case with review of literature	Mikael Aseged Shimekit	Ethiopia
PP-174	Dysraphism	Halothane sedation with local anesthesia as a bailout procedure for neonate with subglottic stenosis and post-MMC repair defect for O-Z flap: a case report	Mikael Aseged Shimekit	Ethiopia
PP-175	Dysraphism	Recurrent tethered cord: outcome and follow-up of 20 de-tethering for symptomatic spina bifida: Choort study	Nelci Zanon Collange	Brazil
PP-176	Dysraphism	Dorsal Midline Teratoma associated with a Myelomeningocele: A Case Report and Review of Related Literature	Nina Alvarez	Philippines
PP-177	Dysraphism	Insights into Pediatric Split Cord Malformations with Dorsoventral Bony Spurs: A Tertiary Hospital's Seven-Year Journey	Priya Narwal	India
PP-179	Dysraphism	Fetoscopic techniques and postnatal care of large open spina bifida lesions	Jason Chu	United States
PP-180	Dysraphism	Rare case of Subgaleal Anterior Fontanelle Inclusion Cyst masquerading as caput succedaneum: ADELOYE-ODEKU Disease	Suyash Singh	India
PP-181	Dysraphism	Complex forms of spinal dysraphisms: clinical and surgical challenges	Tatiana Protzenko	Brazil
PP-182	Dysraphism	Allogenic umbilical cord-derived mesenchymal stromal cells improve motor function in prenatal surgical repair of myelomeningocele: an ovine model study.	Timothée De Saint Denis	France
PP-183	Dysraphism	De novo neonatal spinal dysraphism management organisation: Importance of multidisciplinary expertise in a child-mother hospital	Timothée De Saint Denis	France
PP-184	Craniofacial	Craniosynostosis, metopic suture synostosis and association with	Abraham Ibarra De La Torre	Mexico

		hemangioma and/or vascular malformation in the scalp		
PP-185	Craniofacial	Marchac Technique for Complex Craniosynostosis	Veronica Martinez Zeron	Mexico
PP-186	Craniofacial	Endoscopic treatment of metopic synostosis: case report	Emmanuel Oliveira Sampaio Vasconcelos Sá	Brazil
PP-187	Craniofacial	Optic Nerve Glioma: A Cranio-Orbital Approach for Gross Total Resection	Patrick Holton	United Kingdom
PP-188	Craniofacial	International Survey on the Contemporary Management of Positional Plagiocephaly and Single Suture Craniosynostosis	Ganesalingam Narenthiran	United Kingdom
PP-189	Craniofacial	Utility of a Novel 3D Imaging Mobile Application in the Management of Craniosynostosis	Hailey Reisert	United States
PP-190	Craniofacial	Staged Cranial Vault Reconstruction for Muenke syndrome: A Case Report & Literature Review	Hailey Reisert	United States
PP-191	Craniofacial	Autologous Bone Grafts in Pediatric Reconstructive Cranioplasty: Techniques, Outcomes and Complications	Hamilton Matushita	Brazil
PP-192	Craniofacial	Evaluating the Learning Curve and Patient Outcomes in Endoscopically Assisted Craniosynostosis Surgery: A 20-year Retrospective Analysis.	Hans Delye	Netherlands
PP-193	Craniofacial	A preliminary analysis of replicating the biomechanics of helmet therapy for sagittal craniosynostosis	Hans Delye	Netherlands
PP-194	Craniofacial	Long-term longitudinal 3D follow-up and secondary treatment aspects after endoscopic and open scaphocephaly surgery	Hans Delye	Netherlands
PP-195	Craniofacial	Treatment strategies for craniosynostosis to approach normal cranial morphology as a craniofacial center	Joji Ishida	Japan
PP-196	Craniofacial	Transfrontobasal Intradural Approach for Repair of Giant Sphenoethmoidal Encephalocele	Kevin Gunawan	Indonesia
PP-197	Craniofacial	3D Imaging in Skull Reconstruction Surgery: Utilization of A Novel Three-Dimensional Mobile Application in the Treatment of Cephalohematoma	Margaret Keymakh	United States
PP-198	Craniofacial	The MCDO (Multi-directional Craniofacial Distraction Osteogenesis) System for relapse craniosynostosis	Mihoko Kato	Japan

PP-199	Craniofacial	Non-Syndromic Complex Sagittal and Lambdoid Suture Closure: A Mercedes Benz-like Presentation of Craniostenosis	Nelci Zanon Collange	Brazil
PP-200	Craniofacial	Objective To evaluate the timing and sequencing of surgeries addressing issues in children of Faciocraniosynostoses comprehensively -"360 degree functional concept"	Suhas Udayakumaran	India
PP-202	Craniofacial	Delayed-onset Craniosynostosis Presenting with Papilledema- A Case Report and Review of Literature	Retaj Mohammad	Kuwait
PP-203	Craniofacial	3D-printed Polyether ether ketone cranioplasty for pediatric patients following depressed fracture	Samira Zabihyan	Iran
PP-204	Craniofacial	Experience of first 10 years of Endoscopic assisted craniosynostosis surgery practice in Mexico	Ricardo Gomez Espinosa	Mexico
PP-205	Craniofacial	Vascularized pericranial flap as a method to prevent persistent skull defects after craniectomy for sagittal synostosis: long term follow up	Sera Sempson	United States
PP-206	Craniofacial	The role of post-operative helmet molding after endoscopic strip craniectomy for premature sagittal suture synostosis. A comparative case series	Friederike Knerlich Lukoschus	Germany
PP-207	Craniofacial	Surgical technique and long-term results in non-syndromic sagittal suture synostosis	Elvis J Hermann	Germany
PP-208	Craniofacial	Cranioplasty In Edward Francis Small Teaching Hospital	Zainab Jallow	Russia
PP-209	Global Neurosurgery	The Impact of Neurosurgical Treatment on Cognitive and Behavioural Functions in Children with Sylvian Arachnoid Cysts	Daniela Pia Rosaria Chieffo	Italy
PP-210	Global Neurosurgery	Parental sensitivity and specificity to recognize shunt malfunction in their child: a single-center prospective study	Amparo Saenz	United Kingdom
PP-211	Global Neurosurgery	Hosting an HIC Trainee for an LMIC Neurosurgery Observership: Cookbook and Checklist from one Case Experience	Belinda Shao	United States
PP-212	Global Neurosurgery	Paediatric neurosurgery in low resource environments: opportunities for complex interventions in the developing	Desire Ngoga	United Kingdom

		world		
PP-213	Global Neurosurgery	How to improve craniostyosis treatment in a developing country context: What do we have, what we don't?	Eduardo Jucá	Brazil
PP-214	Global Neurosurgery	Epilepsy Surgery Outcomes of 81 Children Treated in a Hybrid Model in Panama in 13 Years	Emmajane G Rhodenhiser	United States
PP-215	Global Neurosurgery	Effectiveness of Epilepsy Surgery for Tuberous Sclerosis	Hiroharu Suzuki	Japan
PP-216	Global Neurosurgery	Pediatric neuro-oncology scope and management paradigms in Sub-Saharan Africa: a collaboration among 7 referral hospitals on the subcontinent	Joseline Haizel Cobbina	United States
PP-218	Global Neurosurgery	Females in Neurosurgery: a picture of the Italian scenario	Laura Grazia Valentini	Italy
PP-219	Global Neurosurgery	ESPN survey on intracranial sinogenic infection in the pre-COVID and post-COVID era	Luca Massimi	Italy
PP-220	Global Neurosurgery	Burden of pediatric neurosurgical disease and outcomes in Sierra Leone	Megan EH Still	United States
PP-221	Global Neurosurgery	Evaluating pediatric surgical and neurosurgical capacity in Freetown, Sierra Leone	Megan EH Still	United States
PP-222	Global Neurosurgery	Advanced Training Program using Virtual Presence Technology for Endoscopic Hydrocephalus Management: A Feasibility Study Across 5 LMIC Pediatric Centers	Michael Dewan	United States
PP-223	Global Neurosurgery	Application of the 6 Pillars of Sustainable Global Surgical Partnerships by the Neurosurgery Outreach Foundation (NOF) with LMICs in Asia	Philipp Aldana	United States
PP-224	Global Neurosurgery	Low-velocity pellet gun penetrating brain injury in a 6 year old girl- A Case Report and Review of Literature	Retaj Mohammad	Kuwait
PP-225	Global Neurosurgery	Establishment of Pediatric Neurosurgical Services in Ulaanbaatar, Mongolia 2019-2024	Saadi Ghatan	United States
PP-226	Global Neurosurgery	Patient and injury characteristics, case-mix and outcomes of paediatric traumatic brain injury at a high-volume tertiary care hospital in India	Sara Venturini	United Kingdom
PP-227	Global Neurosurgery	Neurosurgery Utilization Rate for Pediatric Low-Grade Glioma: A	Scott Boop	United States

		Simulation-Based Analysis		
PP-228	Global Neurosurgery	Developing pediatric neurosurgical care in Ukraine National Cancer Institute during Russian – Ukrainian War	Yurii Perekopaiko	Ukraine
PP-229	Global Neurosurgery	Starting and sustaining a neuroendoscopy service in the limited resource environment	Teddy Totimeh	Ghana
PP-233	Global Neurosurgery	A Systematic Review of Epilepsy Surgery in Low and Lower-Middle Income Countries: elements of proposed program frameworks	Sunny Abdelmageed	United States
PP-234	Global Neurosurgery	Advancing Neurosurgical Practices: Adopting High-Reliability Organization Principles in Neurosurgery	Zulma Sarah Tovar Spinoza	United States
PP-235	Craniocervical Junction and Chiari	Unsupervised Flexion Extension Cervical MRI imaging in patients with Achondroplasia, Is it Safe?	Aseel Masarwy	United States
PP-236	Craniocervical Junction and Chiari	Surgical management of Chiari malformation type 1 associated to MCAP syndrome and study of cerebellar and adjacent tissues for PIK3CA mosaicism	Carmine Mottolese	France
PP-237	Craniocervical Junction and Chiari	Occult Craniosynostosis in Normocephalic Children with Chiari I Malformation: Causative or Correlative?	Hadleigh Cuthbert	United Kingdom
PP-238	Craniocervical Junction and Chiari	Diagnostic Value of Separate Spine Imaging for Syrinx Detection in the Pre-Operative Assessment of Chiari I Malformations	Hannah Gilder	United States
PP-239	Craniocervical Junction and Chiari	A protocol for Minerva hooded plaster jacket application and 2 illustrative patients with cranio-cervical dissociation from a tertiary paediatric trauma centre	Jack Wildman	United Kingdom
PP-240	Craniocervical Junction and Chiari	Atypical Spinal Instability: Report on a Rare Case of Pediatric Tubercular Atlanto-axial Rotatory Subluxation	Jeanne Vyka Fugaban Sarangay	Philippines
PP-241	Craniocervical	Collagen matrix duraplasty in posterior	Junji Koyama	Japan

	Junction and Chiari	fossa decompression for pediatric Chiari Type 1 malformation: surgical technique and postoperative complications		
PP-242	Craniocervical Junction and Chiari	Short segment C1-C2 fixation in an Infant with Congenital Atlantoaxial Dislocation	Karthigeyan Madhivanan	India
PP-243	Craniocervical Junction and Chiari	The surgical management and outcomes of Chiari malformation type-I: A case series	María Fernanda Sánchez Silva	Mexico
PP-244	Craniocervical Junction and Chiari	Total Excision of External Dural Layer in Chiari Malformation: Insights from Long-term Follow-up of 5 Cases	Olga M Sergeenko	Russia
PP-245	Craniocervical Junction and Chiari	Fourth ventricle stent placement for treatment of refractory syringomyelia in children	Peng Sun	China
PP-246	Craniocervical Junction and Chiari	Cranio-vertebral Junction Anomaly in Larsen Syndrome: Indications and approach to posterior fixation surgery	Suyash Singh	India
PP-247	Craniocervical Junction and Chiari	Restenosis due to bone regrowth after Chiari decompression	Tilmann Schweitzer	Germany
PP-248	Functional	Corpus Callosotomy for Refractory Epilepsy: The Role of Intraoperative MRI and Outcomes of a Multinational Cohort	Aarti Kishore Jain	United States
PP-249	Functional	Using augmented reality in vertical parasagittal hemispherotomy	Azamat Zhailganov	Kazakhstan
PP-250	Functional	Understanding and Overcoming Delays in Time to Pediatric Epilepsy Surgery: a Systematic Review	Catherine Jay	United States
PP-251	Functional	Early experience of Auditory Brainstem implant in Pediatric congenital profound hearing loss	David C Y Low	Singapore
PP-252	Functional	Post-thermocoagulation seizure control guided by stereoelectroencephalography (SEEG) was evaluated in two pediatric patients undergoing treatment at an epilepsy center in Bogotá, Colombia	Juliana Paola Mendoza Mantilla	Colombia
PP-253	Functional	The impact of intraoperative MRI confirming completeness of corpus callosotomy and tissue biopsy on the outcome of pediatric patients with drug refractory epilepsy	Laurence Veilleux	Canada
PP-254	Functional	The value of intraoperative bulbocavernous reflex recording in infants undergoing spinal untethering procedures	Maria Licci	Switzerland

PP-255	Functional	Gastrointestinal and Genitourinary Manifestations from Vagal Nerve Stimulation: A Case Report and Review of the Literature	Noah Yaffe	United States
PP-256	Functional	Transition from Peri-Insular to Vertical Hemispherotomy: A Single Surgeon's Experience	Omar Salim	United Kingdom
PP-257	Functional	The physiotherapist in the operating theater: does this improve selective dorsal rhizotomy performance?	Renata Viana Brígido De Moura Jucá	Brazil
PP-258	Functional	Infant Communication Outcomes Relate to Language Network Connectivity in Utero	Rutva Master	Canada
PP-259	Functional	Pediatric Spinal Catheter Malfunction is Frequently Undiagnosed in Intrathecal Baclofen Pumps: Risk factors and Post-Operative Outcomes	Scellig Stone	United States
PP-260	Functional	An Approach to Device Salvage for Vagus Nerve Stimulator Associated Surgical Site Infection in the Paediatric Population	Stuart Holder	United Kingdom
PP-261	Functional	Outcomes of VNS therapy in Patients with Tuberous Sclerosis	Stuart Holder	United Kingdom
PP-262	Functional	The Neurosurgery-specific Drill Advantage for Stereoelectroencephalography (SEEG)	Sunny Abdelmageed	United States
PP-263	Functional	Early Hemispherectomy contributes to neural development	Yasushi Iimura	Japan
PP-264	Functional	Selectiv dorsal rhizotomy surgery cerebral palsy	Orkhontuul Shirmen	Mongolia
PP-265	Vascular	Management and Outcomes of Large Pediatric Cavernomas: a 15-year SickKids experience	Abdullah H. Ishaque	Canada
PP-266	Vascular	An Evolutionary Perspective of the Vascular Ontogeny in Febrile Seizures	Alexandra Kunz	United States
PP-267	Vascular	Symptomatic cerebral vasospasm after posterior fossa surgery in pediatric patients: single-center study and systematic literature review	Arthur Robert Kurzbuch	United Kingdom
PP-268	Vascular	"Histopathology of the distal segments of MCA and STA vessels in pediatric patients in the indian population"	Gyani J S Birua	India
PP-269	Vascular	Spontaneous, Non-Traumatic Epidural Hematoma in the setting of Vaso-occlusive Crisis among Patients with Sickle Cell Disease: A Case Series & Scoping Review	Hailey Reisert	United States
PP-270	Vascular	Fusiform Aneurysm in a Neonate presented as spontaneous intracranial hemorrhage: Case Report with	Javier Cuellar Hernandez	Mexico

		histopathological description		
PP-271	Vascular	Cerebral Proliferative Angiopathy in Pediatric Patients: Illustrative Case and Systematic Review	Jonathan T. Mo	United States
PP-272	Vascular	Efficacies and Complications of Intraventricular Lavage versus External Ventricular Drainage in Pediatric Intraventricular Hemorrhage: A Systematic Review and Meta-Analysis	Kadek Dede Frisky Wiyanjana	Indonesia
PP-273	Vascular	Cervical Spine Arteriovenous Fistula: Case Report In Pediatric Patient	Mayra Alejandra Arce	Mexico
PP-274	Vascular	Enhanced neuroprotection and angiogenic responses in chronic cerebral ischemia through endothelial progenitor cell-derived conditioned medium (EPC-CM) via transforming growth factor beta 1	Meng Fai Kuo	Taiwan
PP-275	Vascular	Venous sinus stenting in pediatric patients with normotensive pseudotumor cerebri and progressive blindness	Samira Zabihyan	Iran
PP-276	Vascular	Venous sinus stenting in pediatrics with normotensive idiopathic intracranial hypertension	Samira Zabihyan	Iran
PP-277	Vascular	Pediatric Moyamoya: experience and recommendations from the Garrahan Pediatric Hospital Moyamoya Multidisciplinary Team	Sebastian Gaston Jaimovich	Argentina
PP-278	Vascular	Endoscopic Third Ventriculostomy with possible Cauterization is Safe and Effective for Treatment of Acute Hydrocephalus in previously embolized Vein of Galen Malformations	Shivani D. Rangwala	United States
PP-279	Vascular	Mirror image cerebral arteriovenous malformations	Suchanda Bhattacharjee	India
PP-280	Vascular	Indirect bypass for revascularization in Hutchinson-Gilford Progeria Syndrome: a case-based review	Sunny Abdelmageed	United States
PP-282	Basic Research and Trials	Lesion of the cerebellar nucleus fastigii in rats affects attention and frontal cortical activity	Elvis J Hermann	Germany
PP-283	Basic Research and Trials	Investigation of Erythropoietin (EPO) and its receptor (EPOR) in relation to hypoxia inducible factors, cellular and neural progenitor markers in neuroplacodes obtained from fetal time points in a retinoic acid-induced	Friederike Knerlich Lukoschus	Germany

		myelomeningocele rat model		
PP-284	Basic Research and Trials	In vitro study of drug delivery systems to limit post-operative spinal cord tethering after intrauterine repair of myelomeningocele	Giacomo Piaser Guerrato	Italy
PP-285	Basic Research and Trials	Loss of Dynein Axonemal Heavy Chain 5 Causes Cortical Development Disorders and CSF Flow Stagnation	Madoka Nakajima	Japan
PP-286	Basic Research and Trials	Performance of the biomarkers GFAP and UCH-L1 in predicting CT scan results and neurological outcomes in children with traumatic brain injury (BRAINI-2 paediatric study): protocol of a European prospective multicentre study	Markus Lehner	Switzerland
PP-287	Basic Research and Trials	Multimodal Approach in the Management of a Complex Pediatric Arteriovenous Malformation	Mary Sara Gremille Bagaoisan Rulloda	Philippines
PP-288	Basic Research and Trials	Immunologically Targeting U1 Mutant Shh Medulloblastoma	Michelle Masayo Kameda Smith	United States
PP-290	Basic Research and Trials	Cerebrospinal fluid may flow out from brain through the frontal skull base and choroid plexus – mouse fetus study -	Takuya Akai	Japan
PP-291	Basic Research and Trials	Current status of the ESPN Pediatric Craniectomy and Cranioplasty Registry (PedCCR)	Thomas Beez	Germany
PP-292	Basic Research and Trials	Choroid plexus genome manipulation by intra-ventricular injection of AAV carrying CRISPR/Cas9	Will GB Singleton	United Kingdom
PP-293	Technology	Management of Ruptured Intracranial Arachnoid Cysts: A Bayesian Network Analysis	Debajyoti Datta	Canada
PP-294	Technology	Exploring the Influence of AI on Radiographic Interpretation of CNS Tumors	Eric W Prince	United States
PP-295	Technology	Caregiver Satisfaction with Telemedicine for Pediatric Neurosurgery	George William Koutsouras	United States
PP-296	Technology	Diffusion MRI tractography in the prevention of post-surgical neurological deficits: A systematic review and meta-analysis	Guido Guberman	Canada
PP-297	Technology	Multi-Volume Rendering for Surgical Planning of Deformity Correction in Virtual Reality	Maria Licci	Switzerland

PP-298	Technology	Risk and benefits of robotic-guided frames biopsies in pediatric posterior fossa tumors: should we change our paradigm?	Tommaso Francesco Galbiati	Italy
PP-299	New Technology	A Comparative Study of Shallow and Deep Learning Models for Predicting Post-Operative Complications in Neurosurgical and Clinical Applications with Real-world Example	Ahmed Shaheen	Egypt
PP-301	New Technology	Stimulated Raman Histology for intraoperative tumor diagnosis	Christian Dorfer	Austria
PP-302	New Technology	Developing a custom AI Agent in Neurosurgery: Initial experience with NeuroSage in Neurosurgical Training	Guirish A Solanki	United Kingdom
PP-303	New Technology	Modeling of a Virtual Children's Hospital	Jackie Zhexun Han	Canada
PP-304	New Technology	Shear Waves Elastography: experimental use for peroperative spinal cord surgery monitoring	Timothée De Saint Denis	France
PP-305	LiTT Laser Interstitial Thermal Therapy	Laser interstitial thermal therapy for a giant sessile hypothalamic hamartoma in an eight year old boy	Christopher Carr	United States
PP-306	Other	Traumatic Lumbosacral Spondylolysis and Spondylolisthesis in an 11-Year-Old Child: A Rare Case Report	Alkim Demirci	Bulgaria
PP-307	Other	Bone flap osteomyelitis following craniotomy in children: A 20-year audit	Ananth Abraham	India
PP-308	Other	Near doubling of paediatric intracranial empyema and abscess incidence since the COVID-19 pandemic	Andrew Paul Edwards Bailey	United Kingdom
PP-309	Other	Neurosurgery in Neonates and Infants	Anwar Ahmad	United Arab Emirates
PP-310	Other	3D printed titanium implants in delayed pediatric cranioplasty with excessive bony regeneration.	Audrey JL Tan	Singapore
PP-311	Other	Detection of disease-related growth curves in children with spina bifida and comparison of growth and development curves of children with spina bifida and those without spina bifida	Büşra Benton	Turkey
PP-312	Other	Contribution of ISPN to the development of pediatric neurosurgery in Mongolia	Byambatsend Dorjsuren	Mongolia
PP-313	Other	Evaluating the Prevalence of Self-reported Psychiatric Comorbidities	Christopher Bonfield	United States

		Associated with Pediatric Scoliosis Utilizing ResearchMatch		
PP-314	Other	Approaching Severe Kyphosis: a battle for two	Timothée De Saint Denis	France
PP-315	Other	Rate of Adverse Events in a Pediatric Neurosurgical Practice over 4 years	George Jallo	United States
PP-316	Other	Early predictors for maltreatment-related injuries in infancy and long-term mortality: A population-based study	Hsin Hung Chen	Taiwan
PP-317	Other	Assessment of transitional care in pediatric neurosurgery: A single center analysis and survey of patients and parents	Isabel Fernandes Arrosteia	Luxembourg
PP-319	Other	Fetal cephalocele progression: From fetal to postnatal imaging	Tracy M Flanders	United States
PP-321	Other	Creation of a Pediatric Brain Tumor Biobank: Utilization and Modernization of Data Collection	Kaethe Leonard	United States
PP-322	Other	3 cases of symptomatic CP angle arachnoid cysts	Kazuaki Shimoji	Japan
PP-323	Other	Outcomes of Anterior Scalene Myotomy for Pediatric Thoracic Outlet Syndrome	Kerrin S Sunshine	United States
PP-324	Other	The dramatic rise in paediatric intracranial empyema and abscess: What do we know about neuropsychological outcomes and family needs?	Laura Edwards-Bailey	United Kingdom
PP-325	Other	Removal of hardware after spinal fusion for thoracolumbar traumatic injury in a pediatric population: a case series	Mallory Roberts Dacus	United States
PP-326	Other	The Addition of Dexmedetomidine to General Anesthesia Reduces Intraoperative Bulbocavernosus Reflex Monitoring in Infants and Young Children	Minami Sasaki	Japan
PP-327	Other	Potential Cost Savings Using Limited-Sequence Magnetic Resonance Imaging in Adolescent Idiopathic Scoliosis Preoperative Evaluation	James Stadler	United States

PP-329	Other	Interictal Epileptiform Discharges Identified by Magnetoencephalography Aid in Guiding Stereo-Electroencephalography Placement in Drug Resistant Pediatric Epilepsy	Negar Noorizadeh	United States
PP-330	Other	Factors affecting the Length of Pediatric Phase II Invasive Epilepsy Monitoring	Nir Shimony	United States
PP-331	Other	Neurosurgical management of patients with osteopetrosis. A prospective and retrospective study in one of the main European centres for osteopetrosis, Ulm, Germany	Ohad Sharon	Germany
PP-332	Other	Fast-Sequence vs Normal-Sequence MRI for Spinal Pathology in Pediatric Patients: An Institutional Experience and Cost Analysis	Ramin Eskandari	United States
PP-333	Other	An international clinical registry for the growing pediatric spine: the Pediatric Spine Foundation	Richard Anderson	United States
PP-334	Other	Pediatric fibromyxoid brachial plexus tumor with {YWHAZ::PLAG1} gene fusion: a case report	Sean Kendrick Ngo Cua	Philippines
PP-335	Other	Radiographic Appearance of Human Botfly Larvae in the Scalp	Stacy Speck	United States
PP-336	Other	To determine age-specific normative reference values of motor evoked potentials during surgery in paediatric patients	Suhas Udayakumaran	India
PP-337	Other	Case report: Aneurysmal bone cyst in cervical spine	Daniela Rodriguez Anguiano	Mexico
PP-338	Other	The relationship between paediatric intracranial infection requiring neurosurgery and SARS-CoV-2: association or causation?	Tino Takla	United Kingdom
PP-339	Other	Autologous duraplasty using cervical fascia in posterior fossa pediatric tumors: our experience.	Jose Ascencion Arenas Ruiz	Mexico