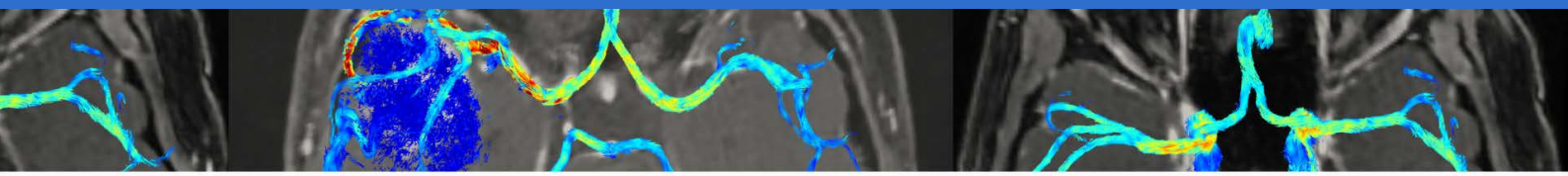

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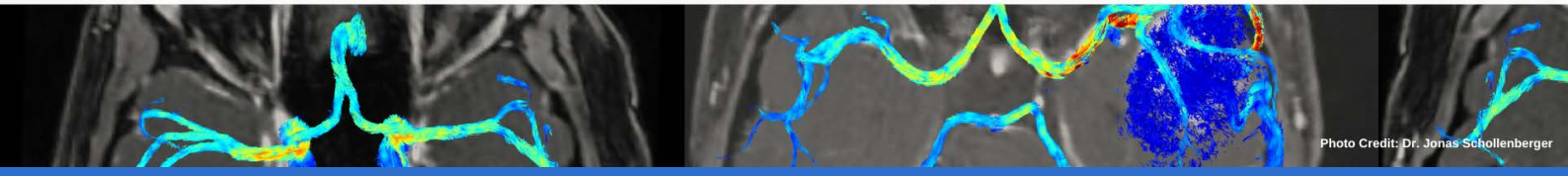

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Poster Abstract Proceedings

Contents

Acute Treatement

P-A-1: **Early surgical treatment of post-stroke epilepsy**

Alexandra Kuznetsova[1], Inna Shchederkina[1], Alexander Levov[1], Vladimir Solovyev[1], Vadim Russkin[1], Matvey Livshitz[1]

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Introduction Nearly 50% of children with stroke had acute symptomatic seizures, cumulative risk for post-stroke epilepsy with acute symptomatic seizures is 52,5% at 1 year. In children population main predictors for post-stroke epilepsy are 1) acute symptomatic seizures; 2) early age; 3) cortical involvement. Before surgical treatment a lot of children with post-stroke epilepsy had drug-resistant course. Hypothesis Early surgical treatment (functional periinsular hemispherectomy) of post-stroke epilepsy is effective and safe for children with hemiparesis and massive glial hemispheric damage. Materials & methods 7 patients underwent functional periinsular hemispherectomy for post-stroke epilepsy, age under 24 months, in neurosurgical department of Morozov Children City Hospitlal in 2020-2021. Methods: brain MRI + MR angiography, EEG video monitoring, blood tests. Results All patients were under 24 months, mean age 17,1 months. 4 patients with arterial ischemic stroke, 2 patients - hemorrhagic stroke, one patient first had hemorrhagic stroke due to aneurism rupture of middle cerebral artery (M1) and arterial ischemic stroke due to vasospasm. All patients had acute symptomatic seizures and received antiseizure drugs. All patients had first unprovoked seizure 4-5 months after stroke, had asymmetric infantile spasms and epileptic encephalopathy. Six were pharmacoresistant, one was operated immediately after the onset of epilepsy. After functional periinsular hemispherectomy seizures in all patients stopped, follow-up for 12-48 months is Engel 1a. 6-12 months after surgery antiseizure drugs are cancelled. In all patients, a year after the operation, an improvement in motor and cognitive skills was noted against the background of rehabilitation treatment. Conclusion Patients with cystic-glial transformation of the brain localized in one hemisphere after the acute cerebrovascular accident with structural epilepsy at the age of up to 2 years have a good prognosis afte

P-A-2: **Hyperacute pediatric stroke pathway of care: what are the determinants for an earlier access to recanalization treatments and better outcomes? Data from the KidClot study.**

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Introduction. Reducing management delays until revascularization in acute arterial ischemic stroke (AIS) is critical to improve outcomes, yet the determinants of such delays have not been reported in children. Hypothesis. We explored the determinants of delay between last-known-well (LKW) and initiation of recanalization treatment in children. Methods. This is an ancillary study of the national French KidClot study, which included consecutive pediatric patients with AIS and recanalization treatment (IV thrombolysis IVT and/or mechanical thrombectomy MT)

from January 1, 2015 to May 31, 2018. We assessed the effect of i) pre-hospital triage (i.e. dispatching considering a potential stroke), ii) direct admission to a tertiary care center versus need for transfer, and iii) management in a pediatric vs adult unit on the delay from LKW to recanalization treatment, as well as on clinical outcomes (mRS at 1 year). Results 68 children were included, treated with IVT alone (n=31), MT alone (n=23), or combined IVT+MT (n=14). Median age was 11 years old [IQR 4-16] and initial PedNIHSS 13 [IQR 7-19]. Prehospital triage demonstrated a significant role in reducing LKW to first recanalization treatment delay (229 vs. 270 min, p=0.01), especially for delays to MT (p<0.001). No significant effect on treatment delay was associated with direct vs secondary admission to a tertiary care center, or management in an adult vs pediatric unit (although a tendency towards shorter delay to MT was observed in adult units: 370 vs 437 min, p=0.06). Prehospital triage was significantly associated with favorable outcome, with a shift towards lower mRS categories (p=0.021) despite similar presentation severity. Conclusions In children with AIS, prehospital triage seems to be the most significant factor associated with shorter recanalization treatment delays, and better outcomes in treated patients. These results present a major incentive to improve the prehospital part of pediatric stroke codes.

Ischemic Stroke

P-B-3: **Pediatric Spinal Cord Infarction - a Case Series**

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[1]University of Texas health science center Houston

Introduction: We present a case series of 5 children with spinal cord infarction (SCI). Our objectives are to study the clinical presentation, MRI findings, etiology, risk factors and treatment options for pediatric SCI. Methods: Descriptive analyses of 5 pediatric patients with SCI. Results: Median age was 8 years (range 0.2-15). There were 2 males and 3 females. 3 patients presented with lower extremity weakness (bilateral in 2, unilateral in 1) and 2 with hemiplegia. Pain was reported in 2 patients (back pain in 1, neck/shoulder pain in 1). MRI showed infarction involving thoracic spine in 3, cervical spine in 1, and cervical and thoracic spine in 1 patient. Notably, imaging was initially negative in 2 patients, with infarct visible on follow-up imaging 3-5 days later (Figure 1). Suspected etiologies included vascular malformation versus hemorrhagic infarct in 1, rotational arteriopathy in 1, and fibrocartilaginous embolism in 3 patients. Thrombosis was not found in any patient. Treatment was mainly supportive, though 2 patients received pulse steroids during the initial diagnostic period. 3 patients were started on prophylactic aspirin. At 3 months follow up, 4 patients had improved, with 1 asymptomatic, 3 ambulatory with mild to moderate deficits; 1 patient had spastic diplegia. Discussion/Conclusion: Pediatric SCI is mostly idiopathic. In our series, fibrocartilaginous embolism ,rotational arteriopathy, and vascular malformation were suspected etiologies. Thrombotic disorders have been associated with SCI, though none was found here. Sudden pain and neurological deficits can be presenting features. MRI was essential for diagnosis and follow-up. Thrombotic, infectious, and vessel-imaging work-up were required to evaluate the etiology. Treatment is mainly supportive. The utility of antiplatelet agents in idiopathic SCI is unclear. The outcome appears encouraging with all except one patient improved or recovered on follow-up.

P-B-4: Examining the Impact of Pediatric Arterial Ischemic Stroke on Cerebral Blood Flow within the Hippocampus and its Relationship with Observed Neurological Deficits

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In this study, the impact of Cerebral Blood Flow (CBF) in non-ischemic brain regions is analyzed measure stroke severity. The hippocampus is a complex brain structure in the temporal lobe and plays a role in learning, memory and spatial navigation. Monitoring hippocampal CBF after AIS may help in understanding its role in childhood development, and allowing for stroke outcome predictions. CBF within the ipsilesional (stroke hemisphere) and contralesional (non-stroke hemisphere) hippocampi was assessed and associated with neurological and sensorimotor deficits observed at acute, subacute (3-7 days post-stroke) and chronic (3 months post-stroke) phases of stroke recovery. Nine pediatric stroke patients (mean age 14.89 ± 2.85, 4 Male) with unilateral, non-hippocampal stroke lesions were scanned using arterial spin labelling MRI in a 3T Siemens MRI scanner with a 2D pulsed labeling scheme. Neurological outcome was evaluated with the Pediatric Stoke Outcome Measure (PSOM) at 3-7 days and at 3 months post-stroke. Mean CBF at the hippocampi were compared to seven healthy controls (mean age 14.53 ± 1.43, 2 Male). Mean CBF (mL/100g/min) in the ipsilesional and contralesional hippocampi were 52.77 ± 10.98 and 54.69 ± 14.24 respectively. Mean CBF in the control group was found to be greater at 61.14 ± 12.30. ANOVA between groups revealed an F-statistic of $F=1.24$ ($p=0.30$) and a post hoc one tailed t-test between the ipsilesional and control group yielded a t-statistic of $t=1.55$ ($p=.067$). A negative correlation of $\rho=-0.77$ ($p=.025$) was observed between CBF ratios in intrasubject hippocampi and the PSOM score observed at the acute timepoint. CBF ratios against PSOM score at three months post-stroke showed a Spearman coefficient of $\rho=-0.96$ ($p<<.001$). Intrasubject CBF between hippocampi at the acute timepoint was found to be a strong indicator of neurological and sensorimotor deficits at three months ponths post-stroke. A larger sample size is required to determine validity.

P-B-5: Investigating the Use of Statins in a Juvenile Photothrombotic Rat Stroke Model

Daniel Sare[1], Daniel Li[1], Trish Domi[1], Adam Waspe[1], Nomazulu Dlamini[2], Andrea Kassner[1]

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INTRODUCTION Acute ischemic stroke (AIS) remains as a significant cause of neurological impairment and ranks as one of the top ten causes of death in childhood. While current research has revealed new treatment practices, risk factors, and neurological outcomes, there remains a gap in our understanding of the mechanisms of stroke in the developing brain, as well as limited therapies, especially beyond the perinatal or neonatal period. The photothrombotic 'ring' model causes ischemic damage within a given cortical area by

photochemically induced platelet occlusion of cortical vasculature. Using this technique facilitates reproducible infarction sizes with delineated boundaries for precise lesion characterization. When considering treatment for AIS, use of HMG-CoA reductase inhibitors (statins) are a potential candidate. This study aims to longitudinally assess stroke and BBB damage following use of a statin in a juvenile photothrombotic rat stroke model using quantitative MRI. METHODS A photothrombotic stroke was induced in 10 male Sprague Dawley rats. 5 rats received 20 ml/kg of Atorvastatin and 5 rats received no treatment. Quantitative MRI (T2W, DWI, DCE) was performed at Day 0, 2, 7 on all rats using a 3T MRI system. 3D slicer was used to analyze the T2W images. The lesion was segmented for each slice to calculate lesion volume. Apparent diffusion coefficient (ADC) maps were created from DWI images and values were calculated for the lesion, penumbra, and control area. Permeability maps were generated from DCE images using the Patlak model and values were calculated within the lesion and control area. Student's t-tests, Benjamini-Hochberg corrected for multiple comparisons with an α level of 0.05, were conducted to compare both groups. RESULTS The measured T2W lesion volume was significantly reduced in the statin group on day 2 ($p = 0.048$) and 7 ($p = 0.028$) following AIS. ADC and BBB values showed no significant changes between groups over time.

P-B-6: **Focal Cerebral Arteriopathy in a Nigerian Child**

Joy Alejo[1], Ikeoluwa Lagunju[1], Michael Adeyekun[1]

[1]University College Hospital

Introduction In Nigeria and sub-Saharan Africa, the commonest cause of strokes in childhood is sickle cell disease. Focal cerebral arteriopathy (FCA) accounts for up to 12% of paediatric strokes but is relatively under-diagnosed and under-reported in this part of the world. We report a case in a 4 year old girl. Case history A previously healthy 4 year old girl presented with a day's history of vomiting, left sided focal seizures and subsequent weakness of the left upper and lower limbs. Her haemogblobin phenotype is A. There was no antecedent history of a rash, fever, cough or coryza. Clinical examination revealed a moderately dehydrated young girl, with a left upper motor neurone facial nerve palsy, left sided hypotonia, hyper-reflexia and reduced power. A diagnosis of a right hemispheric cardiovascular accident of unknown cause was made. Clotting profile and full blood count iwere normal. Electrolytes, urea and creatinine were also normal. Fasting lipid profile was also within normal limits. Echocardiography was normal. Cranial CT revealed extensive acute right cerebral infarct in the right MCA & PCA territories (Figure 1). Brain MRI revealed extensive acute right cerebral infarct in the right MCA & PCA territories likely due to right ICA occlusion (Figure 2). MRA TOF as well as volume rendered images showed non-visualization of the ICA on the right with some signal intensity noted in the right MCA presumably from collateral flow from both ACA (Figure 3). Patient had aspirin and prednisolone, and commenced physiotherapy. Power gradually increased to 3+ in the left upper limb and 4 in the left lower limb. She has continued to improve. Conclusion Sickle cell disease is not the only cause of childhood ischaemic stroke in our region. FCA should be considered. Prognosis is favourable even in our setting.

P-B-7: **Patterns of Infarction in Acute Hydrocephalus**

Stuart Fraser[1], Wilmot Bonnet[2], Michael Dowling[2], Sam Russo[1], Beth Anne Cavanaugh[1]

[1]Division of Child and Adolescent Neurology, [2]Division of Child Neurology

Objective: To describe patterns of ischemic infarction in cases of acute hydrocephalus. Methods: Authors identified recent cases from their institutions and shared clinical descriptors. Brief case reports and imaging findings are described below. Case 1: A 12 month old with dandy walker malformation and ventriculoperitoneal shunt presented for new onset seizures and altered mental status. Magnetic resonance imaging demonstrated worsening hydrocephalus and the patient went to the operating room for emergent shunt revision. Post-operative MRI the following day demonstrated watershed, posterior cerebral artery, and cerebellar infarctions (Figure 1) Case 2: A 16 year old male with a history of ventriculoperitoneal shunt and epilepsy presented in status epilepticus. MRI confirmed shunt failure and the patient was emergently taken to OR for hydrocephalus. He had delayed recovery after shunt revision, and MRI demonstrated posterior cerebral artery and cerebellar infarctions (Figure 2) Case 3: A 2 year old male with achondroplasia developed sudden onset confusion and lethargy. Emergent magnetic resonance imaging demonstrated acute hydrocephalus, as well as infarction in the occipital lobe and cerebellar hemispheres. After ventriculoperitoneal shunt placement, he had no further infarction (Figure 3). Conclusion: Acute hydrocephalus, associated with increased intracranial pressure, is associated with posterior cerebral artery and cerebellar infarction. The exact mechanism of infarction is unclear. We propose posterior cerebral artery infarctions may be mediated from tentorium cerebelli impinging on the posterior cerebral arteries. Cerebellar infarcts may also be mediated by a similar mechanism.

P-B-8: **Traumatic Pediatric Spinal Cord Stroke Presenting with Acute Spinal Shock**

Abhijit Das[1], Alex Ankar[1], Alyssa Runco[1], Kristen Fisher[1], Sarah Risen[1], Daniel Davila Williams[1]

[1]Baylor College of Medicine

Spinal cord infarction is difficult to diagnose in pediatrics, especially given symptomatic overlap with demyelinating/neuroinflammatory disease and its low incidence. Typical presentations involve acute, progressive loss of function at corresponding spinal levels, though autonomic symptoms are not well described in children. Here, we describe a pediatric patient presenting with neurogenic shock due to acute traumatic spinal cord infarction attributed to fibrocartilaginous emboli (FCE). A 10-year-old female presented after being found on the floor. She recalled a neck hyperextension-hyperflexion event while cheerleading the night prior. Hours later, she developed bilateral hand weakness and paresthesias in all extremities. In the morning, she fell when walking and could not get up. Initial vitals revealed hypothermia, normocardia, and hypotension requiring vasoactives. Head CT was normal. She was admitted to ICU for presumed urosepsis given pyuria. Neurologic exam was notable for intact mentation and sensation, 0/5 distal upper extremity (UE) strength in all modalities, UE areflexia, 3/5 proximal UE strength, and 4/5 lower extremity strength with intact reflexes. Spinal MRI revealed traumatic disc protrusion at C3-C4 and C4-C5 with associated edema; DWI showed diffusion restriction from C3-C7 suggestive of acute infarct from FCE. CSF evaluation was unrevealing for neuro-inflammation. She was later discharged to inpatient rehab. The incidence of neurogenic shock in cervical spinal cord injury has been reported at 29%, though it is unclear if incidence is higher among patients with cord ischemia. In the acute setting, other differentials, such as acute flaccid myelitis or transverse myelitis, can also present with vital

signs that may be interpreted as dysautonomia rather than neurogenic shock. In patients presenting with acute, progressive myelopathy coupled with severe autonomic instability, it is imperative to consider ischemic injury in the differential diagnosis.

P-B-9: **Pediatric stroke associated with inflammatory focal cerebral arteriopathy secondary to tuberculous meningitis in the United States**

Mahesh Chikkannaiah[1], Sarah Yu[2], Laura Fonseca[1], Ajay Goenka[3], Gogi Kumar[1]

[1]Dayton Children's Hospital, [2]Wright State University, [3]Eternal Hospital

Abstract Objective We report a 11-month-old under immunized girl from the United States with ischemic stroke associated with inflammatory focal cerebral arteriopathy secondary to tuberculous meningitis. Methods Diagnosis was based upon the head CT, brain MRI, and magnetic resonance angiography (MRA) of the head and neck, CSF evaluation, TB blood and skin test, and gastric aspirate culture. Results Patient presented to the local emergency department (ED) for left arm and leg weakness. Laboratory work was significant for hyponatremia. Head CT demonstrated an area of attenuation in the right basal ganglia and caudate nucleus, and a focus of gray and white matter differentiation loss in the right frontal cortex. MRI brain showed a right middle cerebral artery stroke. CSF evaluation showed pleocytosis with hypoglycorrhachia and elevated protein. Further testing showed mediastinal and hilar lymphadenopathy and additional history included exposure to a grandparent with active tuberculosis. Discussion This case emphasizes the importance of childhood vaccinations and considering CSF evaluation, which is usually not considered as part of routine pediatric stroke work up. With increasing international travel and global immigration, clinicians even in the non-endemic countries should consider tuberculosis in their differential diagnosis.

P-B-10: **Acute hemichorea following thrombectomy for left MCA stroke in an adolescent male**

Melissa Fleming[1]

[1]Children's National Hospital

Intro: Movement disorders following stroke are a rare but known phenomenon. Presentations includes chorea, dystonia, tremor, ballism, and parkinsonism. They can occur acutely or delayed; they can be transient or persistent. The basal ganglia are frequently involved. Presented here is a case of hemichorea following thrombectomy. Case: The patient is a 16-year-old male who presented to our ED with classic signs of left MCA stroke: acute right hemiparesis, facial droop, and aphasia. Imaging demonstrated thrombus at the left ICA terminus. He received TPA and was briefly transferred to an outside hospital for thrombectomy. He returned to our hospital the next day for ongoing management with a very different exam. His facial droop and aphasia were resolved, with only slight weakness in the right arm and leg. However, he had new involuntary movements on the right side, described as chorea. Seizure was ruled out with negative EEG. Repeat imaging showed left MCA territory infarct with some residual clot within the left MCA but improved flow. His hemichorea was thought to be the result of basal ganglia involvement of stroke. He was started on tetrabenazine for management. Discussion: Hemichorea following stroke is a rare finding, estimated at 1% based on literature

review. Notably, these studies were in adults; prevalence among pediatric and adolescent stroke survivors could not be found. Imaging typically demonstrates basal ganglia involvement though other involved structures include the thalamus, subthalamic nuclei, and cortex. Chorea after ischemic stroke tends to present quickly, within hours. It is noteworthy that our patient initially presented with hemiparesis, but, following thrombectomy, had quick return of strength but acute hemichorea. Pharmacologic therapy options include antipsychotics, benzodiazepines, antiepileptics, and tetrabenazine. Improvement or resolution of chorea within 6 weeks is reported in most patients, though some will have persistent symptoms.

Moyamoya

P-C-11: **Depression and Anxiety in Children and their Parents Following Diagnosis of Moyamoya**

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[1]Boston Children's Hospital, [2]Attending

Introduction: Children with moyamoya and their parents experience significant stress around the time of diagnosis. There are not many studies that examine the extent of the symptoms including clinical concerns for anxiety and depression around time of diagnosis. Hypothesis: Children with moyamoya and their parents will have higher rates of anxiety and depression on standardized questionnaires than the general population. Methods: We enrolled parents of children with moyamoya as well as the child if child was 6 years of age or older prior to revascularization surgery. At time of enrollment parents and child filled out standardized questionnaires on symptom of anxiety and depression. Parents filled out Beck's Depression Inventory (BDI) and Beck's Anxiety Inventory (BAI). Children filled out the Behavioral Assessment System for Children 3rd edition (BASC-3). Results: A total of 22 children with moyamoya enrolled in our study, some children were less than 6 years old so we did not collect emotional outcomes on them. Children's age ranged from 13 months to 18 years old with 14 females (63%). In our cohort of children with moyamoya 12 children, 17 mothers, and 12 fathers filled out questionnaires. Four fathers (33%) and 4 mothers (24%) had clinical concern for depression. We did not have any mothers or fathers with clinical concern for anxiety. However, 4 children (33%) had clinical concern for anxiety and 3 children (25%) had clinical concern for depression. Conclusion: Compared to the general population children with moyamoya have higher rates of depression and anxiety while their parents have higher rates of depression. Further research is needed to determine if symptoms improve post-revascularization surgery.

Outcomes and Rehabilitation

P-D-12: **Outcome Measures in Pediatric Stroke: A Systematic Review**

Kathryn (Casey) Nesbit[1], Bryce Yale[2], Laura Hess[3], Micah Mar[2], Alejandra Roque[4], Dana Jacobs[2], Janice Brown[3], Jordan Ng[3], Reilly Todd[3], Alyssa Vo[3]

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Pediatric stroke has a significant impact on children and families. Outcome measures are essential to guide clinical management and inform research priorities, yet these instruments are highly varied in scope and application. Because pediatric stroke care and research is evolving, there is a need for a current review of pediatric stroke outcome measures. The purpose of this study was to systematically review the current literature for pediatric outcome measures, describe the studies using pediatric outcome measures, and describe the outcome measure characteristics. From an initial search of 1625 articles with duplicates removed, 116 articles met inclusion criteria. In those 116 articles, 95 distinct outcome measures were identified. Our review noted the most used outcome measures focused on deficits of the child whereas there was a paucity of outcomes used that included patient and family perspectives, recovery in natural contexts (e.g., home, school, community), and inadequate representation executive function and quality of life. We also found a lack of reliable and valid outcomes for the pediatric hemorrhagic stroke population, and a limited number of outcomes that measure recovery over time. The findings in this systematic review support recommendations for future development and use of pediatric stroke outcome measures, particularly for pediatric hemorrhagic stroke, that better capture the impacts to child and family life and contextually meaningful aspects of recovery over time.

P-D-13: **Lesion size and household income predict neurocognitive outcome following pediatric stroke**

Claire Champigny[1], Samantha Feldman[1], Nataly Beribisky[2], Mary Desrocher[2], Tamiko Isaacs[2], Pradeep Krishnan[1], Georges Monette[2], Nomazulu Dlamini[1], Peter Dirks[1], Robyn Westmacott[1]

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Objective: This prospective clinical study examined the impact of eight predictors on neurocognitive outcomes following pediatric stroke across a range of domains (e.g., processing speed, working memory, executive functions). Predictors included: age at stroke, stroke type (arterial ischemic vs. hemorrhagic), lesion size relative to total brain volume, lesion location and structures involved, time since stroke, neurologic severity, presence of seizure disorder post-stroke, and socioeconomic status (i.e., household income). Method: Youth with a history of stroke (n=92) underwent neuropsychological testing. Their caregivers completed a standardized parent report. Hospital records provided medical history. Spline regressions, likelihood ratio tests, one-way analysis of variance, Welch's t-tests, and simple linear regressions examined associations between predictors and outcome measures. Results: Larger lesions and lower household income were significantly associated with worse neurocognitive outcomes across most domains. Ischemic stroke was associated with worse outcome in attention and executive functions compared to hemorrhagic stroke. Participants with a seizure disorder had more severe executive functioning impairments than participants without seizures. Youth with cortical-subcortical lesions scored lower on a few measures than youth with cortical or subcortical lesions. Neurologic severity predicted scores on few measures. No significant differences were found based on age at stroke, time since stroke, lesion laterality, or supra- versus infratentorial lesion. Conclusions: Lesion size and household income predict neurocognitive outcome following pediatric stroke. Findings should inform clinical practice through enhanced appraisals of prognosis, tailored psychoeducation for

families, and the development of services and interventions aimed at fostering optimal development for youth with stroke.

P-D-14: **Associations Between Motor Functioning and Intellectual Abilities in Pediatric Arterial Ischemic Stroke**

Justine Ledochowski[1], Mahmoud Slim[1], Mary Desrocher[2], Robyn Westmacott[1], Nomazulu Dlamini[1]

[1]The Hospital for Sick Children, [2]York University

Motor impairments are one of the most common adverse outcomes after pediatric arterial ischemic stroke (AIS) yet knowledge of the relationship with intellectual abilities is limited. We hypothesized that motor functioning in early post-AIS recovery would be associated with intellectual functioning. Participants were 64 children, 34 childhood AIS (Mage= 11.90[2.38]); 30 perinatal AIS (Mage= 8.75[2.22]), from the Children's Stroke Program at SickKids Hospital. Motor functioning was assessed with the Pediatric Stroke Outcome Measure sensorimotor subscale at two timepoints, Time 1: early recovery (childhood: 30 days post-stroke to 1 year; perinatal: 2-5 years of age) and Time 2: closest to neuropsychological testing. Intellectual abilities were measured using the Wechsler Intelligence Scale for Children 4th or 5th edition. Motor functioning at Time 1 was associated with processing speed (r= -.391, p= .036) in the perinatal group and with intellectual functioning (r= -.414, p= .018) verbal abilities (r= -.444, p= .011), working memory (r= .393, p= .026), and processing speed (r= -.351, p= .042) in the childhood group. There were no associations between Time 2 motor functioning and intellectual abilities in the perinatal group, and only with processing speed (r= -.525, p= .002) in the childhood group. When motor functioning was dichotomized (no/mild vs. moderate/severe), at Time 1 children with perinatal AIS and moderate/severe deficit had significantly lower perceptual reasoning (t[28]= 2.15, p= .040) and children in the childhood group with moderate/severe deficit had significantly lower perceptual reasoning (t[32]= 2.35, p= .025) and processing speed (t[32]= 2.14, p= 0.41). No differences were found at Time 2. Associations between motor functioning during early stroke recovery and intellectual abilities may be related to neuroplastic changes post-injury, affecting subsequent development of intellectual abilities through hierarchical maturational processes.

Perinatal Stroke

P-E-15: **Fatal malignant neonatal arterial ischemic stroke with internal carotid occlusion: a pathological and clinic-radiological case study**

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[1]HUG

Introduction: Malignant neonatal arterial ischemic stroke concomitant with large vessel occlusion are rare and potentially life-threatening. Their origin is still controversial and very few cases reported in the literature. Case: The neonate was born full-term following an uneventful pregnancy without obstetrical maneuvers. Mild transient distress was noted at birth. Due to

increasing lethargy, hypotonia and possible subtle seizures on day 2 of life, MRI was promptly conducted and showed an extensive left malignant hemispheric infarct with mass effect, left uncal herniation, right MCA infarct as well significant brainstem wallerian degeneration well visible on DWI and T2 sequences. Besides the ischemic lesions, the MRI angiography showed a complete occlusion of the left ICA, due a thrombus extending into the left MCA. Echocardiography demonstrated a PFO, normal anatomical structures, no intracardiac thrombus. The child rapidly deteriorated and was transferred to the NICU for reanimation. Given the very poor prognosis, and after multidisciplinary consensus as well as family approval, withdrawal of care was decided, and comfort measures initiated. The child died in parents' arms on day 3. Prothrombotic work-up was negative. On autopsy, thrombi were identified in the portal vein, the left iliac artery, the left MCA, and the left SCA. Large bilateral cerebral infarcts related mainly to the MCA territories were confirmed. A high grade fetal malperfusion syndrome with multiple thrombi within chorionic vessels was seen on placenta examination. Based on the various findings, it appears very likely that the severely abnormal placenta was the source of multiple thromboembolic stroke. Discussion: This case adds not only evidence of the presumed pathogenesis of perinatal arterial ischemic stroke, but also highlights the potential dramatic outcome of such situation, in particular when persistent occlusion of major neonatal cerebral vessel is still present on early imaging.

P-E-16: **Risk factors for Hemiplegic Cerebral Palsy due to Arterial Ischemic Stroke or Periventricular Venous Infarction**

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Objective: We sought to determine risk factors for hemiplegic cerebral palsy (HCP) associated with perinatal arterial ischemic stroke (AIS) or periventricular venous infarction (PVI). Methods: We studied children with hemiplegic cerebral palsy (HCP) enrolled at nine rehabilitation centres across Ontario. We compared children with underlying AIS or PVI on clinically acquired brain imaging. In addition, we analyzed prenatal (maternal, prenatal/gestational) and perinatal (obstetrical, neonatal) characteristics collected from birth records and standardized parent interviews. Results: The 144 children with HCP (62% male) included 95 with AIS and 49 with PVI. On multivariate analysis, children with PVI had increased rates of maternal fertility treatment (OR=4.7;95%CI=1.0-28.7;p=0.0379) and decreased rates of neonatal seizures (OR=0.03;95%CI=0.0002-0.255;p=0.0001), systemic blood clots (OR=0.082;95%CI=0.0006-0.795;p=0.0278) and emergency cesarian section (OR=0.3;95%CI=0.093-0.896). Preterm delivery rates were similar for AIS and PVI. Conclusion: We determined novel risk factors differentiating the two most typical forms of focal ischemic brain injury in children with hemiplegic CP. These include fertility treatments, mode of delivery, neonatal seizures and systemic blood clots. These findings provide direction for further research exploring causal pathways of focal brain injury and cerebral palsy.

P-E-17: **Spontaneous perinatal intracranial hemorrhage-clinical, neuro-imaging and etiological correlates**

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OBJECTIVE: to characterize clinical, neuroimaging data and etiology of spontaneous perinatal intracranial hemorrhage (spICH) in non-preterm. METHODS: a prospective, single-center study of 102 consecutive cases with spICH identified in the fetal/neonatal period between 2014-2022. RESULTS: Fifty-nine cases (58%) were diagnosed antenatally (termination of pregnancy-n=22). Intraventricular hemorrhage (IVH) was the most common hemorrhage type (73%), followed by periventricular hemorrhagic venous infarction (PVHI) (54%), parenchymal (13%), subdural (12%) and subpial (10%) hemorrhage. IVH was more commonly diagnosed prenatally (p=0.003), whereas subpial hemorrhage was exclusively diagnosed postnataly (p<0.001). Of the 73 born neonates, those with prenatal diagnosis were less likely to show symptoms in the perinatal period (p=0.005). There was no difference between prenatal versus postnatal cases or between types of hemorrhage in terms of maternal age, parity status, and mode of delivery. Intrauterine growth retardation was associated with parenchymal hemorrhage (p=0.039). Germinal matrix was the most common origin of hemorrhage (48%) and was more common in the prenatal group (65% vs. 28%, p<0.001), followed by choroid plexus (46%), hemorrhagic transformation of venous infarction (8%), bleeding diathesis (3%), vascular malformation (2%) and congenital tumor (1%). A family history of thrombophilia or coagulopathy was associated with subpial hemorrhage (p=0.033), and post-natal IVH (p=0.009). Genetic workup was performed in 42%, yielded a diagnosis in 35% of them, mostly with antenatal bleeding (p=0.003), and was associated with prenatal PVHI (p=0.029). Conclusion: Patterns of hemorrhage, as well as mechanisms, were different between the prenatal and postnatal cases, suggesting different disease mechanisms. Coagulopathy may contribute to spICH presenting in the postnatal period, whereas genetic factors play a major role in prenatal ICH.

P-E-18: **White matter tractography of visual pathways in children with perinatal stroke**

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Introduction: Perinatal stroke (PS) occurs in 1:1100 births and impairment can affect independence throughout the lifespan. The most common types of PS are arterial ischemic stroke (AIS) and periventricular venous infarction (PVI). Cerebral visual impairment is common after PS but mechanisms remain under-investigated. Understanding the structural development and plasticity of visual pathways will support the advancement of prognostic tools and contribute to validated therapies reducing impairment. Hypothesis: White matter microstructure of the afferent visual pathway will be altered in PS compared with typically developing controls (TDCs), with the greatest differences in children with AIS. Methods: White matter diffusion imaging and tractography were used to isolate optic radiations. Diffusion and T1-weighted anatomical sequences were obtained using a 3T GE MR750w scanner. Probabilistic white matter tractography was completed using anatomically placed regions of interest combined with a constrained spherical deconvolution model.. Mean fractional anisotropy (FA) was extracted for each optic radiation and compared between PVI, AIS and

TDCs using ANCOVA, controlled for age. FA was compared between hemispheres using paired t-tests. Results: Ninety-three children aged 6-18 years (N=22 AIS, N=28 PVI) as well as similarly aged TDCs (N=43) were recruited. Both AIS and PVI groups showed lower FA in both the lesioned and non-lesioned hemispheres compared to controls ($p<0.001$). Between-hemisphere differences in FA were present in the AIS group ($p<0.001$), but not in PVI ($p=0.21$). Conclusion: Analysis of white matter in visual pathways shows bihemispheric differences in microstructure between children with different PS types and healthy controls, with the greatest differences observed in the AIS group. Future research will investigate perceptual and ophthalmological outcomes to determine prevalence and severity of visual impairment in children with PS, specifically AIS.

Risk Factors and Prevention

P-F-19: **Cerebrovascular complications in oncology diseases in children: experience of the Primary Pediatric Stroke Center and pediatric oncological Center of Moscow .**

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Risk factors of stroke in oncological diseases are: direct effects of the tumor, infection, coagulopathy, diagnostic and treatment procedures, chemotherapy and radiation therapy, bone marrow transplantation, and hematopoietic factors. Material and methods: The study included children treated at the Morozov Children's Clinical Hospital who had a diagnosis of cancer with cerebrovascular complications from 2018 to 2020. Methods: clinical, anamnestic, laboratory, neuroimaging. Results: For the period 2018-2020, 369 children were included in the Moscow register of cerebrovascular diseases, of which 41 patients (11.1%) had cancer. The average age was 7.5 years, of which 51.2% were boys. Group 1 - patients with brain tumor - 21 patients (51.2%); group 2 - patients with leukemia - 22%, group 3 - patients with extracranial tumor - 26.8%. Arterial ischemic stroke (AIS) was observed in 14 children - 10.4% of all AIS in stroke register, hemorrhagic stroke (HI) in 21 children, which accounted for 11.7%, sinus thrombosis (ST) in 6 patients - 10.7%. In group 1, the distribution was as follows: AIS 38%, HI 47.6%, ST 9.5%. Death was in 8 patients (19,5%), among all deaths due to cerebrovascular disease - 22.8%. In group 1, death was 14.2%, in group 2 - 44%, in group 3 - 9%. Conclusion.Cerebrovascular complications in oncology diseases are not rare. In patients with neurooncology HI predominated. Cerebrovascular complications increased mortality among cancer patients.

Stroke Readiness and Guidelines

P-G-20: **Stroke diagnosis and characteristics after implementing a multidisciplinary stroke alert system**

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Background and Aims Paediatric stroke is a rare event, ~2/100.000 children, but it has an important morbidity, being the main cause of acute acquired cerebral injury. Stroke alerts and care pathways have become an integral part of acute paediatric stroke care and their implementation is recommended by several Stroke and Neurology Associations. Methods A prospective, observational study was performed, in our tertiary paediatric institution, from February 2019 to December 2022, since implementation of a multidisciplinary stroke alert system and care pathway in our county and hospital. Demographic, clinical and neuroimaging data was collected and analysed. Results There were 92 stroke alert activations during the study period, but only 27 (29.3%) were true strokes. 19 of them were ischemic (70.4%), 7 haemorrhagic strokes (25.9%) and 1 sinus venous thrombosis (3.7%). Age range for patients who suffered a stroke was 6 months to 15 years old, with a peak incidence in patients older than 10 years, 14 patients (51.9%). 70.4% were males. 17 patients required more than one neuroimaging technique for the diagnosis of stroke, generally cranial computed tomography (CT) followed by magnetic resonance image (MRI). Invasive intracranial pressure monitoring was used in 3 patients. Only 2 patients with ischemic stroke received acute treatment with thrombolysis, and 1 of them received also thrombectomy. 3 patients with haemorrhagic strokes underwent surgery. 4 patients underwent endovascular treatment, 3 of them had a diagnosis of cerebral AVM and 1 had a basilar aneurysm. 2 patients died (7.4%). 19 patients of 25 survivors (76%) suffered sequelae after stroke, most of them hemiparesis 15 (78.9%). Conclusions A stroke was detected in almost a third of stroke alert activations and acute treatment was uncommon in our cohort. The implementation of a multidisciplinary alert system improves diagnosis and treatment of stroke patients.

P-G-21: **Fostering Collaboration in Acute Pediatric Stroke Care: Lessons from Creating an Interdisciplinary Alert System**

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Introduction Rapid stroke diagnosis via emergent neuroimaging can prevent secondary injury. Pediatric stroke alerts, however, are infrequent, leading to limited opportunities to practice protocols. Pediatric stroke alerts also require urgent collaboration between multiple discrete teams to coordinate imaging, sedation, hyperacute treatments, and other aspects of care. This can result in communication breaks, logistical challenges, and unclear divisions of responsibility. Objective By identifying stakeholder needs across disciplines, we sought to streamline our ED stroke alert process and improve time-to-imaging for children presenting acutely with suspected stroke. Methods We performed a retrospective assessment of stroke alerts in the Stanford pediatric ED from 2016-2021. Root cause analysis was performed using the 5 Whys methodology and fishbone diagram. Surveys were conducted with neurology, emergency medicine, pediatric anesthesia, neuro-IR, and neuroradiology stakeholders regarding potential sources of imaging delays. Staged interventions were implemented between January-June 2022 using Plan-Do-Study-Act cycles. Time-to-imaging was measured for each stroke alert pre- and post-intervention. Results Surveys indicated that key drivers of imaging delays could be categorized as provider protocol familiarity, information and equipment availability, and process and outcome transparency. Interventions were designed to address each key driver (Figure 1). Post-implementation, short-term analysis demonstrated a consistent but as yet-statistically insignificant decrease in mean time-to-imaging for CT

(47±31 to 22±13 minutes, p=0.26), MRI without sedation (67±52 to 49±22 minutes, p=0.15), and MRI with sedation (151±42 to 92±7 minutes, p=0.07, Figure 2). Conclusions Communication across teams is essential for effective pediatric stroke care. We offer our process improvement experience with adaptable interventions at a large, tertiary-care hospital system.

Vascular malformations and hemorrhagic stroke

P-H-22: **Treatment of cerebral aneurysms in children and adolescents on the basis of the primary pediatric stroke center in Moscow.**

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Relevance: According to StatPearls, the approximate estimate is from 1 to 3 cases of childhood aneurysm per 1 million population. At the moment, there is no specific algorithm of the treatment of brain aneurysms in children and adolescents in the acute period of stroke. Object: To analyze the experience of treating cerebral vascular aneurysms in children in the primary pediatric stroke center in Moscow. Materials and methods: The study is a single -center retrospective analysis. We examined and operated on 13 children with cerebral vascular aneurysms. Average age = 7 years 8 months. The ratio of male to female is 9 to 4. Methods: CT angiography, direct cerebral angiography. Results: 4 patients underwent endovascular aneurysm embolization microspirals, 5- open microsurgical aneurysm clipping, 2- microsurgical removal of intracerebral hematoma with simultaneous aneurysm trapping. 2 patients attempted endovascular embolization, due to the impossibility of performing this manipulation, it was performed microsurgical aneurysm clipping. In 8 patients there was no neurological deficit in the preoperative period, in the postoperative period there were no increase in neurological deficit, no hemorrhages. 3 patients retained the initial neurological deficit: 2- hemiparesis, 1- tetraparesis. In 1 patient in the postoperative period after endovascular stenting, a hemorrhage occurred that did not require surgical intervention. 1 patient died on 3 days after embolization of a gigantic aneurysm of the intracranial segment of the right vertebral artery. Conclusions: After the treatment, 76% of children had a level of consciousness of 15 b according to GCS, 15% had a level of consciousness of 13 b according to GCS, 1 patient died. On the basis of the primary pediatric stroke center a registry is being maintained, as well as algorithms for managing patients with cerebral aneurysms are being worked out.

P-H-23: **Social Determinants of Health and Pediatric Hemorrhagic Stroke: A New Facet of the IPSS**

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Introduction Although pediatric hemorrhagic stroke (HS) accounts for 50% of childhood strokes, large pediatric stroke registries like the International Pediatric Stroke Study (IPSS) have focused on ischemic stroke. Previously, the IPSS has not collected data on social determinants of health (SDOH). Objective We sought to expand the IPSS registry to include HS and begin novel data collection on SDOH. Methods We developed new IPSS data collection forms related to HS and SDOH. After IRB approval, IPSS sites enrolled children (aged >28 days - 18 years) who had HS between 2004 and 2023. Local sites conducted a retrospective chart review. SDOH were collected by guardian report. We centrally analyzed data including frequencies and proportions of age, sex, race, ethnicity, language, educational attainment, and household income. Preliminary Results To date, ten IPSS sites enrolled 120 children (58% male) with HS. The median age at onset of stroke was 9.9 years (IQR 4.3-14.0). Vascular malformations were identified in 53 patients (44%). Arteriovenous malformation (n = 33) was the most commonly reported etiology, followed by aneurysm (n = 6) and cavernous malformation (n = 2). Race and ethnicity data were available in 115 (95%) patients (Table 1). SDOH were reported for 50 (42%) families. Among these, 15 (30%) reported speaking a different language than their healthcare provider and 8 (53%) required an interpreter. Of 36 families for whom primary caregiver educational attainment data and household income data was available, 19 (53%) obtained a Bachelors degree or higher, whereas 28 (78%) reported their household income. Significance This is a preliminary analysis of a novel international HS registry. Our interim analysis suggests that a significant proportion of families of children with HS may have language barriers. In this ongoing registry study, we plan to further examine SDOH in children with hemorrhagic stroke.

P-H-24: **Angiographic Cure of a Highly Angiogenic Vein of Galen Malformation by Staged Transarterial and Transvenous Embolization: Case Report**

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Introduction Patients with Vein of Galen malformations (VOGM) can develop significant angiogenesis leading to hemodynamic and structural remodeling. This results in an extensive fine angiogenic network fistulizing to the vein of Galen. In patients with angiogenic networks, transarterial embolization (TAE) is challenging due to poor penetration and access while transvenous approaches (TVE) carry a risk of hemorrhage from pathologic vasculature. These patients present early and symptomatically and can have devastating outcomes if not treated. Objective We illustrate the case of a pediatric patient who presented with an angiogenic VOGM ultimately treated by staged TAE with a miniature dual-lumen balloon microcatheter (DLBC) and curative TVE. Case Presentation A 12-month-old boy presented after VOGM was identified during workup for progressive hydrocephalus. Endovascular embolization was offered. The infant underwent five staged TAE, followed by curative TVE via pressure cooker technique. Initial pre-embolization angiogram demonstrated a diffuse vascular network within the third ventricle and choroidal fissure superiorly feeding the malformation. Because the network complicated fistulous point access, a miniature DLBC was utilized to achieve distal pedicle flow arrest and partial network devascularization. Postoperatively, the embolization was complicated by IVH and hydrocephalus requiring an ETV with no lasting neurological deficit.

For the final embolization, given the arterial morphology and progressive venous reduction, TVE was the technically easiest choice to achieve angiographic cure. Follow-up angiogram demonstrated complete obliteration of the malformation and subsequent clinical follow-up demonstrated improvements in milestones. Conclusion Through a combination of new technologies and techniques, technically challenging VOGMs are now curable. The patient is able to achieve a relatively normal quality of life due to timely and effective treatment.

P-H-25: **Adjunctive Venous Sinus Stenting in Transvenous Embolization of Vein of Galen Malformation: Case Report**

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Introduction Vein of Galen Malformations (VOGM) are congenital arteriovenous malformations (AVM) primarily treated by endovascular embolization via transarterial (TAE) or transvenous (TVE) approaches. TVE can be utilized to close the malformation but carries risk of venous congestion and redirection of venous outflow with significant neurologic consequences. Objective Here, we illustrate the atypical use of an intracranial venous sinus stent to improve normal venous outflow after TVE in the case of a pediatric patient with VOGM. Case A 3-year-old girl presented for continued management of VOGM. She had received six prior TAEs at the senior author's institution: after progressive reduction of the malformation, she was a suitable candidate for TVE. Pre-embolization angiogram demonstrated a choroidal type VOGM with venous hypertension: the vein of Galen drained retrograde through the vein of Labbe, the left transverse sinus drained into cortical cerebellar veins without opacification of the left sigmoid sinus, and stenosis of the right sigmoid-jugular junction was present. Balloon angioplasty of the right sigmoid-jugular junction was performed to aid guide catheter navigation. After TVE by pressure cooker technique, balloon-assisted venous sinus stenting was performed at the right sigmoid-jugular junction to aid normal venous sinus drainage. Post-embolization angiogram demonstrated reduced shunting through the malformation and reduced aberrant cortical venous drainage. Shunted blood mainly drained to the right transverse-sigmoid sinuses with marked improvement of venous diameter and flow. The patient experienced no postoperative complications and clinical follow-up demonstrated improvement in milestones. A second TVE resulted in complete occlusion. Conclusion In patients with VOGM and venous hypertension receiving TVE, venous sinus stenting may be a safe and effective option to reduce aberrant cortical venous drainage and improve normal outflow.

P-H-26: **Treatment of children with ruptured arteriovenous malformation at the Primary Pediatric Stroke in Moscow**

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Relevance: Arteriovenous malformation (AVM) in children is a risk factor for hemorrhagic stroke. Materials: The study included 72 children who applied to "Morozov Children's City

Clinical Hospital, with a diagnosis of AVM of the cerebral vessels with the presence of intracerebral hematoma. Age ranged from 1 month. up to 18 years old, the median age at diagnosis was 9.6. Boys vs girls-36(50%) vs 35 (50%) Methods: Of 72 children, surgical treatment was performed in 61. Seven patients were not operated on, after stabilization of their condition, they were referred for stereotaxic radiosurgery. 4 patients died. Cerebral deficit was the leading symptom in 52 patients. In 17 patients, the assessment of focal symptoms was difficult due to the severity of the condition. The level of impaired consciousness: clear consciousness in 17 (23.6%), stunning in 23 (31.9%), stupor in 15 (20.9%), coma in 17 (23.6%). The most common localization of AVMs is the parietal lobe. Distribution of patients according to Spetzler-Martin gradation: AVM: type I -- 9 (12.5% %), type II -- 21 (29.2%), type III -- 26 (36.1%), IV -- 13 (18, 1%), V -- 3 (4.1%) patients. The volume of intracranial hematoma ranged from 9 ml to 130 ml. The results: based on the timing of admission to the hospital, the severity of the patient's condition, the size and location of the hematoma, its relationship to the mid-stem and basal structures, a decision was made on the need and extent of surgical intervention. Type of operation: microsurgical in 31 (51%) patients, embolization in 12 (20%) patients and combined intervention (microsurgery + embolization) - in 18 (29%) patients. Outcome: complete regression of neurological symptoms in 34 (55.7%) patients, moderate disability in 20 (32.8%) patients, severe disability in -7 (11.5%) patients. Conclusion: Surgical tactics as early as possible allows to achieve good outcomes in most patients.

P-H-27: **Dysregulated Ephrin ratio associated with CCM endothelial cell dysfunction in vitro and EphrinB2/EphB4 mutations**

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Introduction: Cerebral cavernous malformations (CCMs) are capillary malformations, which exist at the midpoint between the two ends of the continuum. The axon guidance factor Ephrin B2 and its receptor EphB4 are critical regulators of vasculogenesis and their dysregulation has been implicated in the pathogenesis of both arterial-derived and vein-based malformations. We hypothesized that in line with other malformations, expression and binding ratios of ephrins are of importance for CCM development. Methods: Patient-derived primary CCM endothelial cells (CCMECs) were compared to normal endothelial cells. Quantitative Phase Imaging system was used to study cell motility, migration and morphology and tube formation assays were performed. EphrinB2 and EphB4 expressions were assessed by PCR and immunoblots and a whole exome sequencing was done to identify potential mutations in CCMECs and a functional effect of a point mutation was investigated. Results: We established that CCMECs are functionally distinct from healthy endothelial cell controls and demonstrate altered patterns of migration and motility with impaired tube formation. CCMECs have an increased EphrinB2/EphB4 ratio and whole exome sequencing identified mutations in both EphrinB2 and EphB4. We identified a mutation at the 5-prime UTR of the EPHB4 gene (c.-124G>C) and we found that the (c.-124G>C) mutation alters the EphrinB2/EphB4 binding, affects cellular morphology, and diminishes tube formation capacity. Conclusion: These findings identify functional alterations in the EphrinB2/ EphB4 ratio as a feature linking pathophysiology across the spectrum of arterial, capillary and venous structural malformations in the central nervous system while also revealing a putative therapeutic target.