

presented with left-sided HD. His cervical MRI revealed enlarged epidural with anterior, left-ward displacement of the posterior dura and spinal cord. He underwent surgical treatment by laminotomies, along with tenting of an autologous duroplasty to the overlying laminae. **Results:** We decided to combine epidural venous plexus coagulation with posterior duraplasty and dural fixation using tenting suture which led to a favorable clinical outcome has not been previously proposed in the literature.

We hypothesize that in this context, an abnormal vasculature could also predispose to posterior epidural venous plexus engorgement, anterior dural displacement in cervical flexion, and microvascular changes in the anterior spinal arterial circulation, leading to the progressive anterior horn cell ischemia that lead to the clinical phenotype of HD. **Conclusions:** The association between HD and VGAM in this patient may provide clues with regard to the pathophysiology of HD.

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Tissue Plasminogen Activator in Addition to Twist Drill Drainage as a Treatment for Chronic Subdural Hematomas – A Descriptive Analysis

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Background: Current literature provides little consensus on universal guidelines for first-line treatment of chronic subdural hematomas (cSDH). However, administration of local tissue plasminogen activator (tPA) may enhance the traditional method of twist drill drainage (TDD). The study aims to explore the efficacy of TDD with and without tPA, at achieving clinically relevant drainage (200mL) and reducing recurrence of cSDH. **Methods:** A retrospective review of patients (N=34) with cSDH is presented. Patients who received TDD with tPA (n=17) were identified and matched, based primarily on age and hematoma volume, to a control group (n=17), TDD without tPA. Variables of interest include initial hematoma volume, volume drained, length of stay, and recurrence rates. Descriptive analysis was run. **Results:** Average age for patients was 74.6 with 76% male. Mean drainage volumes for the tPA cohort was 381.6mL and TDD without tPA cohort was 151.3mL. The addition of tPA resulted in drainage volumes nearly double (1.9x) the clinically relevant amount and had low recurrence rates (12.5%). TDD without tPA failed to result in clinically relevant drainage and had a recurrence rate of 52.9%. Average length of stay differed by two days (9.71 tPA; 7.71 control). **Conclusions:** TDD with tPA was effective at treating cSDH in our population.

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Reducing the risks of proximal and distal shunt failure in adult hydrocephalus: A Shunt Outcomes Quality Improvement (ShOut-QI) Study

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Background: Ventriculoperitoneal (VP) shunt failures in adult patients are common and subject patients to multiple surgeries and a decreased quality of life. A prospective cohort Shunt Outcomes Quality Improvement (ShOut-QI) initiative was implemented to reduce shunt failure incidence through neuronavigation-assisted proximal catheter insertion and laparoscopy-guided distal catheter anchoring over the liver dome to drain CSF away from the omentum. **Methods:** “Pre-ShOut” and “Post-ShOut” groups of patients included those with and without neuronavigation/laparoscopy, respectively for insertion of a new VP shunt. The primary outcome was shunt failure which was defined as any return to surgery for shunt revision as determined with a standardized clinical and radiology follow-up protocol. **Results:** 244 patients (97 Pre-ShOut, 147 Post-ShOut), mean age 73 years, were enrolled over a 7-year interval and observed for a mean duration of 4 years after shunt insertion. Neuronavigation improved proximal catheter placement accuracy by 20% ($p < .001$), and shunt failure occurred in 57% vs 23% in the Pre-ShOut and Post-ShOut groups, respectively ($p = .008$), representing a 53% relative risk reduction in the incidence of shunt failure. **Conclusions:** Adult shunt failure incidence may be significantly reduced by improving the accuracy of proximal catheter placement with neuronavigation and reducing the risk of distal catheter failure with laparoscopic-guided placement.

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Pilot Study of a Multi-center, Randomized, Blinded, Placebo-Controlled Trial of Shunt Surgery in Idiopathic Normal Pressure Hydrocephalus

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Background: To describe preliminary results of a multi-center, randomized, blinded, placebo-controlled, pilot trial of shunt surgery in idiopathic normal pressure hydrocephalus

(iNPH). **Methods:** Five sites of the Adult Hydrocephalus Clinical Research Network (AHCNRN) randomized 18 patients scheduled for ventriculoperitoneal shunting based on CSF-drainage response. Patients were randomized to a Codman® Certas® Plus valve with SiphonGuard at either setting 4 (Active, N=9) or setting 8/"virtual off" (Placebo, N=9). Patients and assessors were blinded to the shunt setting. Outcomes included 10-meter gait velocity, cognitive function, and bladder activity scores. The prespecified primary analysis compared changes in 4-month gait velocity in the Active versus Placebo groups. Placebo-set shunts were then blindly adjusted to the active setting and all patients underwent 8 and 12-month post-surgical assessment. **Results:** At 4-months, gait velocity increased by 0.28 ± 0.28 m/s in the Active Group and 0.04 ± 0.17 m/s in the Placebo Group ($p=0.071$). Overactive Bladder (OAB-q) scores significantly improved in the Active versus Placebo groups ($p=0.007$). At 8 months, Placebo gait velocity increased by 0.36 ± 0.27 m/s and was comparable to the Active Group (0.40 ± 0.20 m/s; $p=0.56$). **Conclusions:** This AHCNRN study shows a trend suggesting gait velocity improves more at an Active shunt setting than a Placebo shunt setting and demonstrates the feasibility of a placebo-controlled trial in iNPH.

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Novel 3D printing for complex cranial reconstruction in neurosurgery - A case series

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Background: Cranial reconstruction is a common consequence of neurosurgical disease and intervention following craniectomy, trauma, infection, congenital defects, or neoplasm. Most commonly, Computer Aided Design-Computer Aided Manufacturing (CAD-CAM) technology is utilized in cases where autologous bone cannot be used. These patient-specific implants provide excellent cosmesis, however individual costs range from \$800-15,000, making routine use challenging in the current Canadian health care environment. Here we present a novel method using desktop 3D printers to manufacture patient-specific molds for intraoperative reconstruction of various cranial defects. **Methods:** Our first patient presented following two separate traumas requiring decompressive craniectomy and subsequent posterior fossa decompression without interval cranioplasty. The second patient required reconstruction during resection of intraosseous meningioma. Both cases were performed using a titanium-mesh/poly-methyl-methacrylate (Ti-PMMA) construct draped over the mold. The third case, cranioplasty following decompressive craniectomy outside the country, was performed using a "two piece" mold and PMMA was casted into the mold and allowed to harden. **Results:** Patients reported satisfaction with cosmesis, without adverse outcomes. Cost per case was \$50-100, representing an estimated cost savings of \$685,000 per year in Canada. **Conclusions:** Given excellent outcomes in addition to cost effectiveness, this case series provides evidence for use of this alternate technique with similar patient outcomes.

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Transitioning from Pediatric to Adult care: a Qualitative Study of Patients with Hydrocephalus and their Caregivers

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Background: Hydrocephalus is a common pediatric neurosurgical condition that requires lifelong care into adulthood. Significant gaps in care are thought to exist for youth transitioning to adult care, but little is known about how patients and their caregivers feel about the process. This study examines the perceptions of adolescents, young adults and caregivers when transitioning from pediatric to adult care at a single Canadian center. **Methods:** 40 patient/caregivers (7 adolescents, 13 young adults and 20 parents) treated at BC Children's Hospital participated in semi-structured interviews using the qualitative research methodologies of grounded theory. Interviews were transcribed verbatim and coded, with common themes identified. **Results:** Four overarching themes relating to the process of transitioning from pediatric to adult care were identified: (1) Inadequacy of communication between pediatric and adult care teams and patients/caregivers; (2) Uncertainty relating to the prospect of life as an adult with hydrocephalus; (3) Anxiety and fear regarding navigating a new health care environment; and (4) sadness at the loss relationships with the pediatric health care team. **Conclusions:** We identified a general dissatisfaction with the transitioning process for hydrocephalus. Common themes and concerns identified may form the basis of an improved transitioning model for youth with hydrocephalus as they become adults.

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Characterizing and comparing brain injury associated with traditional self-retracting brain retractors with novel tubular retractors

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Background: Tubular retractors are FDA approved and in the Neurosurgical marketplace, but adaptation has been hampered by lack of evidence showing superiority over traditional retractors when performing subcortical surgery. This study examines brain injury associated with traditional brain retractors versus tubular retractors. **Methods:** Nine porcine models underwent a simulated neurosurgical operation. Retractors were inserted for four hours after which the porcine model was euthanized. The en-bloc extracted porcine brain was fixed in 10% formalin, paraffin embedded, sectioned at 4 um and stained with hematoxylin and eosin (H&E) using standard laboratory protocols. Computer algorithms were generated to calculate areas of cerebral edema and hemorrhage adjacent to retractor surfaces. **Results:** Using a two-tailed t-test with a significance level of 0.05, traditional brain retractors were associated with statistically significant greater areas of cerebral edema when compared to tubular retractors