the first 13 interviews (8 males, 5 females; median age 54), 10 had English as a first language, all completed post-secondary education, and 8 had a brain tumor. In addition to expecting excellent surgical skills and comprehensive medical knowledge, participants expected "good" neurosurgeons to be human (compassionate, empathetic, no ego), transparent communicators, accountable, passionate, collaborative, emotionally composed and highly intuitive. However, there were marked differences in minimum set of competencies required and the expectations of the thresholds to determine competence for neurosurgeons. **Conclusions:** Patient perspectives show commonalities and marked differences of the expected competencies compared to CBD and significant variability of the thresholds of competence. Further investigations should explore these themes in other specialties. The existing CBD curriculum will need to expand its framework to include humanistic values to improve public perceptions of competence.

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High-Fidelity Simulation-Based Microsurgical Training for Neurosurgical Residents

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doi: 10.1017/cjn.2021.457

Background: Microsurgical techniques remain a cornerstone of neurosurgical training. Despite this, neurosurgical microvascular case volumes are decreasing as endovascular and minimally invasive options expand. As such, educators are looking towards simulation to supplement operative exposure. We review a single institution's experience with a comprehensive, longitudinal microsurgical simulation training program, and evaluate its effectiveness. **Methods:** Consecutive postgraduate year 2 (PGY-2) neurosurgery residents completed a one-year curriculum spanning 17 training sessions divided into 5 modules of increasing fidelity. Both perfused duck wing and live rat femoral vessel training modules were used. Trainee performance was video recorded and blindly graded using the Objective Structured Assessment of Technical Skills Global Rating Scale. **Results:** Eighteen participants completed 107 microvascular anastomoses during the study. There was significant improvement in six measurable skills during the curriculum. Mean overall score was significantly higher on the fifth attempt compared to the first attempt for all 3 live anastomotic modules ($p<0.001$). Each module had a different improvement profile across the skills assessed. The greatest improvement was observed during artery-to-artery anastomosis. **Conclusions:** This high-fidelity microsurgical simulation curriculum demonstrated a significant improvement in the six microneurosurgical skills assessed, supporting its use as an effective teaching model. Transferability to the operative environment is actively being investigated.

NEUROTRAUMA

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Self-Assembling Peptide Biomaterial to Optimize Human Stem Cell-Based Regeneration of the Injured Spinal Cord

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doi: 10.1017/cjn.2021.458

Background: Human induced pluripotent stem cell-derived neural stem cells (hiPS-NSCs) are a promising therapeutic approach to regenerate after spinal cord injury (SCI) as they can differentiate to myelinating oligodendrocytes, synaptically-active neurons, and supportive astrocytes. Unfortunately, most chronically injured patients develop *ex vacuo* microcystic cavitations which prevent regenerative cell migration and neurite outgrowth. QL6 is a novel, pH-neutral, biomaterial which can self-assembles into a supportive extracellular matrix (ECM)-like matrix *in vivo*. This work assesses QL6's ability to support hiPS-NSC-based regeneration. **Methods:** *In Vitro:* hiPS-NSCs were extensively characterized by EDTA assay, qPCR, and immunocytochemistry(ICC), electron microscopy(EM) and neurosphere formation assays. *In Vivo:*Immunodeficient rats received clinically-relevant chronic C6-7 injuries. Animals were randomized: (1)vehicle, (2)hiPS-NSCs, (3)QL6, (4)QL6+hiPS-NSCs. All rats underwent treadmill rehabilitation and behavioural testing. A subset underwent single-cell RNA sequencing(scRNAseq). **Results:** hiPS-NSCs proliferated robustly on QL6($Ki67^+/DAPI^+$; 29%vs6%; $p<0.01$). EDTA assay showed hiPS-NSC binding to QL6 to be driven by calcium-independent mechanisms. Importantly, QL6 enhanced adherent neurosphere formation. EM-imaging provided the first images of the hiPS-NSC/QL6 interaction. Behavioural assessments demonstrate synergistic improvements with combinatorial treatment. High-throughput scRNA-seq differential gene expression analyses suggest QL6 is altering lineage signalling in the human graft post-transplantation. **Conclusions:** This work provides key proof-of-concept data that QL6 can support translationally-relevant human iPS-NSCs in traumatic SCI.

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Accuracy of External Ventricular Drain Freehand Placement in patients with Traumatic Brain injury. A 5-year single-institution experience

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doi: 10.1017/cjn.2021.459

Background: Placement of an external ventricular drain is considered a simple yet fundamental procedure. Despite its wide practice, an inaccuracy rate of around 50% has been reported.

In the trauma setting, targeting the ventricles with a blind freehand technique is challenging due to distorted anatomy. Failure to cannulate lead to multiple passes with a higher risk of complications. **Methods:** A retrospective study from a single institution was conducted using a trauma registry between March-2014 and March-2019 were included. Accuracy of EVD placement was determined using the Kakarla grading system **Results:** 224 TBI patients with total of 241 EVDs were performed, 211 met our criteria. Among them, Grade-1 (optimal placement) was achieved in 39.3%, Grade-2 (suboptimal in non-eloquent tissue) in 21.8% and Grade-3 (suboptimal in eloquent tissue) in 38.9%. A total of 74 EVDs were inserted in the intensive care unit, while 137 EVDs were inserted in the operating room. Our accuracy for ICU insertions was 50%, 25.7%, 24.3% for Grades1,2 and3 respectively, while our OR insertion accuracy was 33.6%,19.7%,and46.7% **Conclusions:** EVD is commonly performed, yet a substantial rate of inaccuracy is reported. This highly suggests the need to improve accuracy, possibly with the adjunct of image-guided techniques, to further optimize catheter placement

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Off-road vehicle fatalities and alcohol in patients with major traumatic brain injury: the risk of impaired driving

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doi: 10.1017/cjn.2021.460

Background: Intoxicated patients injured in off road vehicle (ORV) crashes have higher rates of traumatic brain injury (TBI) and intensive care unit (ICU) admission, as well as prolonged ICU length of stay. This study evaluated the impact of alcohol intoxication on mortality among major TBI patients injured in off-road vehicle crashes. **Methods:** A retrospective analysis (2002-2014) of off-road vehicle injuries in Nova Scotia resulting in major TBI was performed. ORVs included ATVs, snowmobiles, and dirt bikes. A logistic regression model was constructed to test for in-hospital mortality and adjusted for age, Abbreviated Injury Scale (AIS) Head, Injury Severity Score, and blood alcohol concentration (BAC). **Results:** There were 176 drivers and passengers of off-road vehicles. Overall mortality was 28%. BAC testing was performed in 61% patients; 85% of pre-hospital deaths were BAC positive (mean BAC=31 ± 17.39 mmol/L) and 70% in-hospital deaths were BAC positive (mean BAC=26 ± 23.12 mmol/L). After adjusting for confounders, high injury severity and intoxication increased the likelihood of in-hospital mortality. **Conclusions:** These findings demonstrate that alcohol intoxication is a significant risk factor for mortality among off-road vehicle collisions; for every mmol/L change in BAC, there was a 10% increase in the chance of in-hospital mortality.

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Impact-detecting helmets as indicators of concussion and blood brain barrier integrity in university football players

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doi: 10.1017/cjn.2021.461

Background: Repetitive sub-concussive head impacts have been associated with changes in brain architecture and neurological symptoms. In this study, we examined the association between repetitive sub-concussive impacts, impact burden, and blood brain barrier (BBB) integrity in university football players. **Methods:** 59 university football players were followed over the 2019 season. Athletes with diagnosed concussion and those sustaining impacts that alerted a sideline impact monitor (relayed by ferroelectric helmet sensors) underwent dynamic contrast-enhanced MRI (DCE-MRI) within one week of injury/alert, and 4 weeks following initial incident. **Results:** Helmets recorded 2648 impacts over 48 cumulative hours. 8 concussions occurred during the 2019 season (2.82 per 1000 activity hours). On average, athletes with a diagnosed concussion had 55.3 impacts to the front sensor, compared to 14.1 in non-concussed athletes. Athletes who consented to DCE-MRI (n=5) had 10.78% BBB-D within a week of concussion/alert, and 6.77% BBB-D at 4-weeks. **Conclusions:** We show quantification of BBB integrity relative to head impact burden for the first time. This preliminary study highlights the potential of impact-detecting helmets to provide relevant impact characteristics and offers a foundation for future work on neurological consequences of repetitive sub-concussive impacts.

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Transcranial Doppler Based Continuous Assessment of Cerebrovascular Reactivity in Adult Traumatic Brain Injury: A Scoping Review of Associations with Outcomes

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doi: 10.1017/cjn.2021.462

Background: Disruption in cerebrovascular reactivity following traumatic brain injury (TBI) is a known phenomenon that may hold prognostic value. Transcranial Doppler (TCD) has been employed to evaluate cerebrovascular reactivity following injury utilizing a continuous time-series approach. **Methods:** A systematically conducted scoping review of the literature on the association of continuous time-domain TCD based indices of cerebrovascular reactivity, with outcomes following moderate and severe TBI was performed. Multiple databases were searched