Poster #50

IMPROVING KNOWLEDGE, ATTITUDES AND BELIEFS ABOUT TRAUMA-INFORMED CARE BY IMPLEMENTATING A NOVEL NATIONAL CURRICULUM: A STUDY OF 23 US TRAUMA CENTERS

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Introduction: Trauma-informed care (TIC) is a framework acknowledging "trauma" as a complex psychological state based upon past and present experiences. Understanding this state improves patient-provider interactions, reduces bias, and improves outcomes. Few TIC educational opportunities exist for those caring for injured patients. We aim to test the effectiveness of a novel educational curriculum on TIC knowledge, attitudes and beliefs.
Methods: We conducted a multi-site pilot at 23 US trauma centers using a standardized curriculum given in-person or via a virtual platform. We measured knowledge, attitudes and beliefs using online pre and post questionnaires developed by our multidisciplinary team. Descriptive statistics were used to analyze the data.
Results: 1,255 surveys were completed with diverse participants (see table). Despite 40% having >5 years trauma work experience, TIC was a new concept for 64% of participants and 72% never had training, although concepts of social determinants of health were well understood (86.3%). There was a notable effect of the intervention on knowledge and beliefs. Participants rated the training as high-quality, informative and relevant.
Conclusion: TIC requires education and cultural shifts that have historically been difficult to reliably implement without a sanctioned national curriculum. Our study demonstrates that this relatively short, accessible, and effective educational intervention could be delivered widely to various providers and using various platforms with fidelity, with the ultimate goal of improving equitable quality care for all patients.

Percentage (N=1,255)																
27	25	24	6	5	4	2	2	1	.7	.3	3	21	42	28	2	6
Trainee	Nurse	Surgeon	Allied Health*	APP	Social Work	Administrator	Comm	Chaplain	Paramedic	Mental Health	Other	New Concept	Little familiarity	Some familiarity	Expert	Did not Answer
Occupation												TIC Exposure				

*Includes Physical, Occupational, Speech and Respiratory Therapists, Dieticians and Pharmacists

Poster #51

REVISITING TRAUMATIC BRAIN INJURY IN THE GOLDEN YEARS

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Introduction: Traumatic brain injury (TBI) is a significant health concern, particularly among geriatric patients. Readmission after TBI could be associated with increased worse outcomes. In this study, we aimed to investigate the rates and causes of readmission in geriatric patients that sustain TBI.
Methods: We used National Readmission Database 2015-2016 and included all geriatric patients (age≥65 years) that were admitted due to TBI in the index hospital. Primary outcomes of this study were rates of readmission and mortality when readmitted. Secondary outcomes were relations between index discharge disposition and hospital length of stay (LOS) and readmission and rates of recurrent TBI.
Results: Totally, 284,817 patients were identified with TBI on their first visit. Of them, 73,152 patients (25.7%) were readmitted. Rates of readmission was highest in patients that were discharged to a short-term hospital (34.5%) followed by Skilled Nursing Facility (SNF)\ Intermediate Care Facility (ICF) (30.8%) and was lowest in patients that were discharged home in the first admission (22%) ($p<0.001$). The mean age of readmitted TBI patients was 80.08±7.83 years and 34,324 patients (46.9%) were male. Totally, 4,066 patients (5.6%) died on the readmission. The mean time to readmissions was 69.86±74.24 days. The mean index hospital LOS was significantly longer in patients who were later readmitted (7.02±9.28 vs. 6.06±8.76 days, $p<0.001$). 16.7% of readmissions were due to recurrent TBI and 12.2% were due to falls. On a sub-analysis on patients with readmission less than 30 days, recurrent TBI was the reason of readmission in 24.2% of patients and 14.4% were readmitted due to falls. The odds of readmission in TBI patients increased significantly with advanced age (OR=1.008), longer index hospital LOS (OR=1.012) and primary discharge to short-term hospital (OR=1.789) and SNF\ICF (OR=1.497) ($p<0.001$ for all).
Conclusion: Readmissions, especially within less than a month, due to recurrent TBI and falls are high among geriatric population who are admitted for TBI. The readmission rate is higher in patients who are discharged to short-term hospital or SNF\ICF. Targeted interventions and comprehensive care planning are imperative to reduce readmission rates and improve outcomes for geriatric TBI patients.

Poster #52

CURRENT STATE OF TRAUMA CLINICAL GUIDANCE GLOBALLY: A SYSTEMATIC REVIEW

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Introduction: Investments in cost-effective healthcare system strengthening have led to the development of clinical practice guidelines (CPGs), defined as clinical decision-making aids built on scientific evidence, experiential knowledge, and patient values. This review evaluates accessibility, relevance, and quality of existing trauma CPGs globally.
Methods: A systematic review evaluated trauma-related clinical aid sources published from 2016 to 2023, searching in English across eight databases and 28 professional society websites. Using a combination of Medical Subject Headings (MeSH) terms or similar we included protocols, guidelines, position papers, reviews and consensus documents, assessing their quality using the National Guideline Clearinghouse Extent Adherence to Trust-worthy Standards (NEATS).
Results: Out of 986 records, 108 met review criteria, excluding unretrievable (13), outdated (25), non-trauma (110), and not fitting CPG definition (730). Ninety percent of trauma CPGs, featured a first author from a high-income country (HIC). When categorizing CPGs by the first author's region, 43% came from North America, 8% from South America, 35% from Europe, 13% from Asia & Pacific and 1% from Africa. Eighty-two percent of CPGs were public access with no registration required, the remaining 18% had an average cost of 45.7 USD (13.38 SD). Regarding guideline standard adherence, the mean quality score of all guidelines was 3.81 (scale 1-5), 77% disclosed the source of funding, 91% involved a multidisciplinary group and 54% explicitly mentioned inclusion of a methodologic expert. On logistic regression, the tested variables included English language, public access, first/senior author from HIC, multidisciplinary group, methodological expert, and professional society endorsement. The only factor predictive of a high (≥4) NEATS score was the reported presence of a methodological expert.
Conclusion: Current CPGs largely feature authors from HIC with minimal representation from low and middle-income countries (LMIC), despite LMIC bearing a higher injury burden. Promoting LMIC authorship recognizes the value of cultural perspectives and local expertise in resource allocation. Improving CPGs impact may involve expert methodological input and addressing accessibility barriers like cost, registration, and language.

Poster #53

PENETRATING TRAUMA RE-INJURY: WHAT IS THE PROGNOSIS OF PATIENTS WITH MULTIPLE TRAUMAS?

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Introduction: Recurrent presentations for separate traumatic injuries account for a large proportion of urban trauma activations, with rates as high as 10-44%. However, injury patterns and in-hospital surgical and critical care needs for patients experiencing penetrating trauma reinjury outside the United States have not been thoroughly evaluated. Trauma is a global public health issue with a disproportionately high burden of morbidity and mortality in immature trauma systems. This study analyzed the injury burden, need for surgical and critical care resources, and short-term outcomes in patients presenting with penetrating trauma reinjury in a single urban trauma center in Chile.

Methods: In a retrospective review of a prospectively collected hospital trauma registry, we included patients over age 15 treated from 1/2019-12/2020 for penetrating trauma, defined as stab wounds (SW), gunshot wounds (GSW), and other high-velocity projectile injuries. Reinjury was defined as any subsequent hospitalization for new penetrating injury; previous injuries' sequelae were excluded. The primary outcome was all-cause mortality, and secondary outcomes included hospital length of stay (LOS), intensive care unit (ICU) LOS, length of vasoactive drug requirement, operating room (OR) time, and need for blood transfusion within 3 hours of arrival. Chi-squared test and Student's t-test were used for group comparisons, logistic regressions for independent association of mortality with reinjury.

Results: Of 1,028 included patients, 100 (9.72%) experienced penetrating trauma reinjury, and 22 (2.1%) experienced two or more reinjuries. Most patients were male (92.96%), and 65.8% of cases were GSWs. Greater number of reinjuries was associated with greater mortality, higher proportion of GSW to SW, longer ICU and hospital LOS, longer vasoactive drug requirement, and higher 3-hour transfusion need.

Conclusion: Patients suffering penetrating trauma reinjury had poorer outcomes and required more hospital resources than those with one incident of penetrating trauma. To reduce armed violence and prevent penetrating reinjuries, successful community- and hospital-based violence prevention and intervention programs should be adapted to the Chilean context.

Poster #54

MODIFIED BRAIN INJURY GUIDELINES IMPROVE RESOURCE UTILIZATION IN A PUBLIC HEALTHCARE SYSTEM

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Introduction: The management of traumatic brain injury (TBI) and intracranial hemorrhage (ICH) can be resource-intensive and present considerable challenges in a public healthcare system. The modified Brain Injury Guidelines (mBIG) provide an algorithmic approach to determine which patients need additional computed tomography (CT) scans of the head, neurosurgical consultation, and hospitalization. Although mBIG has demonstrated improved resource utilization in several studies, it has not been evaluated within a publicly-funded healthcare model. We sought to determine whether implementation of mBIG at two tertiary-care trauma centres in Canada would reduce repeat imaging and unnecessary neurosurgical consultations, without adverse outcomes.

Methods: We conducted a retrospective review of all adults (≥18 years) presenting to two university-affiliated tertiary-care trauma centres in Edmonton with ICH or TBI, between July 1, 2022 and March 31, 2023. Patients were excluded if their initial Glasgow Coma Score (GCS) was less than 13, did not receive a CT head scan, or had focal neurological findings. mBIG score (mBIG 1,2, or 3) was assigned based on imaging and clinical findings on arrival to hospital. Clinical characteristics, including the number of repeat CT scans, neurosurgical consultation, and neurological deterioration in hospital, were evaluated.

Results: We reviewed 911 charts, of whom 322 patients had ICH on imaging. Among this group, 29 (9%) were mBIG1; 62 (19%) were mBIG2; 231 (72%) were classified as mBIG3. Among the 91 patients with mBIG1 or mBIG2 ICH, 66 (73%) received unnecessary neurosurgical consultation, and 50 unnecessary repeat CT scans were performed. There was no neurological deterioration among mBIG1 or mBIG2 patients and repeat imaging did not change management.

Conclusions: A sizeable proportion of patients with ICH may be managed without repeat imaging or neurosurgical consultation, without suffering adverse outcomes. Modified Brain Injury Guidelines (mBIG) are a safe and resource-efficient tool for managing patients with TBI and ICH within a public healthcare system.

Poster #55

ANALYSIS OF NERVE REGENERATION INHIBITOR RGMA AND MICROGLIA IN THE MURINE CONTROLLED CORTICAL IMPACT MODEL

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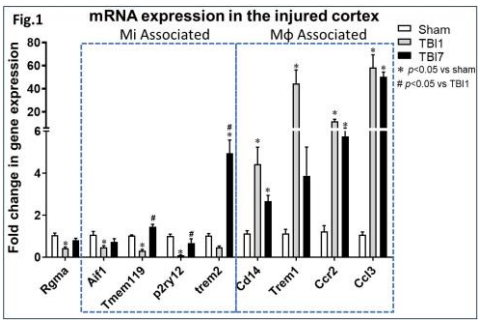
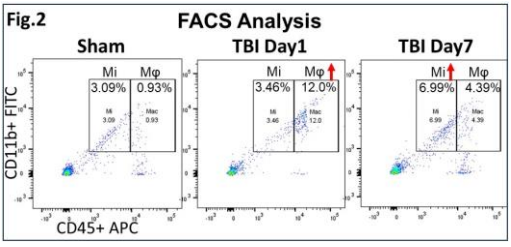
Introduction: We have previously reported that microglia (Mi) are suspected to be involved in the expression of repulsive guidance molecule a (RGMa), a neuroregeneration inhibitor, in a murine traumatic brain injury (TBI) model. We aimed to clarify the changes over time in Mi and macrophage (Mφ) activation, and RGMa expression in the injured brain after TBI.
Methods: We employed controlled cortical impact (CCI) model for TBI. Brains were extracted 1 and 7 days after the injury (n=6 per group), and RNA was extracted from brain contusion sites. RT-PCR was performed on RGMa and activation markers for Mi and Mφ (Aif1, Tmem119, P2ry12, Trem2, Cd14, Trem1, Ccr2, Ccl3). Flow cytometry (FACS) was performed to evaluate changes in Mi and Mφ at the site of TBI.
Results: In RT-PCR, RGMa showed a significant decrease at day 1 ($p<0.05$), but recovered at day 7, comparable to Sham. The Mi markers Aif1, Tmem119, Trem2 and P2ry12 also showed a significant decrease at day 1 ($p<0.05$), similar to RGMa, but recovered at day 7. (Fig.1) FACS analysis showed that both Mi (CD11b+, CD45 intermediate) and Mφ (CD11b+, CD45 high) increased at day1 and day 7 compared to Sham. However, by day7, the percentage of Mi increased and that of Mφ decreased (Fig.2).
Conclusion: In TBI, Mφ was activated and the activation of RGMa and Mi was decreased on day 1, while RGMa and Mi increased on day 7, suggesting that RGMa-expressing Mi may be involved in the inhibition of nerve regeneration after TBI.





Poster #56

ASSOCIATION BETWEEN CT VOLUMETRY AND INTRACRANIAL PRESSURE ELEVATION IN TRAUMATIC BRAIN INJURY: A RETROSPECTIVE COHORT STUDY

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Introduction: Intracranial pressure (ICP) elevation is associated with poor outcomes in patients with traumatic brain injury (TBI), and ICP is one of the key indicators in the management of TBI patients. Although ICP elevation is sometimes estimated from CT images as a substitute for ICP sensor placement, the association between CT images and ICP elevation remains unclear. This study aimed to objectively elucidate this association through the utilization of a freely available programming code for CT assessment.
Methods: We conducted a retrospective cohort study at Rinku General Medical Center in Japan from April 2014 to August 2023, including patients of all ages with TBI and inserted ICP sensors. ICP values were compared with CT series taken at the same timing. 'CT volumetry' was employed to analyze CT series, visualizing and calculating intracranial volume (ICV) and three density volumes: low-density volume (LDV), middle-density volume (MDV), and high-density volume (HDV). The thresholds for the density areas were determined as averages by three blinded trauma physicians. The code was developed using Python and the OpenCV module, enabling cost-free and versatile utilization. The primary outcome was ICP value, and an ICP elevation was defined as ICP > 22mmHg for a dichotomous outcome to assess diagnostic accuracy.
Results: A total of 123 TBI patients and 267 CT series were analyzed. The percentage of LDV to ICV (LDV%) was related to ICP elevation (Odds ratio 0.55 [95% confidence interval (CI), 0.42-0.73]). The area under the receiver operating characteristic curve for LDV% predicting ICP elevation was 0.852 [95%CI,0.777-0.927]. LDV% > 5% had a negative likelihood ratio of 0.13 [95%CI, 0.00-0.49], and LDV% > 10% could completely exclude ICP elevation.
Conclusion: CT volumetry was associated with ICP elevation in TBI. LDV% was a useful indicator to exclude ICP elevation in TBI.

Poster #57

IMPACT OF TRAUMATIC BRAIN INJURY ON FIBRINOLYTIC DYNAMICS IN SEVERELY INJURED PATIENTS

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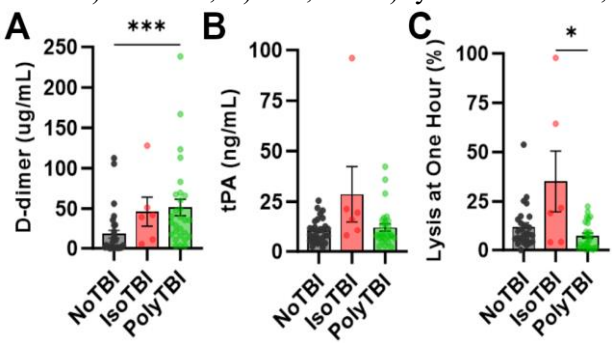
Introduction: In severely injured patients, dysregulated coagulation impairs stable clot formation and increases mortality. Traumatic brain injury (TBI) notably precipitates a spectrum of derangements to normal clot formation and breakdown. This study examined profiles of clot mechanics and stability, specifically in patients suffering TBI.
Methods: Plasma was isolated from 63 trauma patients upon emergency department arrival. Clotting kinetics, mechanics, and fibrinolysis rates were measured with rheological and turbidity assays. ELISAs were performed to assess tissue plasminogen activator (tPA) and D-dimer levels.
Results: Patients with TBI had higher mortality, and significantly higher D-dimer levels, indicating pre-hospital lysis, when compared to patients without TBI. This early lysis was seen across injury severity. To isolate the specific contribution of TBI, patients were divided into those with isolated TBI (IsoTBI), TBI with extracranial injuries (PolyTBI), and no head injury (NoTBI). IsoTBI and PolyTBI exhibited increases in pre-hospital lysis (A). IsoTBI exhibited increased tPA levels (B) and a significant increase in clot lysis rate one hour after clot activation compared to the other groups (C).
Conclusion: Our study demonstrates that early hyperfibrinolysis and predisposition to excess lysis were not due to injury severity or quantity of injury but were attributable to TBI. Turbidity measurement was uniquely sensitive in detecting persistent fibrinolysis in isoTBI patients. Therefore, the utilization of turbidity assays and D-dimer as complementary tools to classify clotting status can inform early treatment approaches.

Figure: Fibrinolytic markers A) D-dimer, B) tPA, and C) lysis at one hour, in NoTBI (n=29), isoTBI (n=6) and polyTBI (n=26) patients. Significance between groups indicated by * $p < 0.05$, *** $p < 0.001$.



Poster #58

OPTIMIZING THE MODIFIED BERNIE NORWOOD CRITERIA FOR EARLY PROPHYLAXIS ADMINISTRATION

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Introduction: The clinical decision to administer venous thromboembolism prophylaxis (VTE PPX) is determined by an assumption of low re-bleeding risk. There is very little research on the timing of the higher risk groups and very early administration of VTE PPX, which prohibits the facilitation of an evidence-based strategy. Findings from this study will inform clinical decisions designed to help TBI patients avoid VTE complications.
Methods: This retrospective cohort study utilized the ACS-TQIP-PUF from 2017 to 2021. The study involved a review of VTE PPX type and timing, demographics, injury categories, in-hospital complications, morbidity factors, comorbidity, neurosurgical procedures with timing, and in-hospital mortality. The study population consisted of adult (≥15 years) patients who received LMWH, UFH, or mechanical filter VTE PPX with no missing times and had a blunt isolated TBI based upon the mBNC. The population was split into two groups, patients with and without a comorbid history of anticoagulation or bleeding disorder (BLEED). The mBNC was applied to distinguish each group into a low-risk, moderate-risk, and high-risk of re-bleeding. The risk groups were stratified into early (≤ 24-hour), mid (> 24 to < 72-hour), and late (≥ 72-hour) VTE PPX administration.
Results: A total of 99,078 patients were included in the analysis; 75,952 (76.6%) did not have a comorbid BLEED. Multivariable regression models found a protective effect against mortality (BLEED OR .36, CI = .25 to .51; vs no BLEED OR .30, CI = .23 to .39), DVT (BLEED OR .28, CI = .14 to .57; vs no BLEED OR .22, CI = .15 to .33) and PE (BLEED OR .31, CI = .09 to 1.03; vs no BLEED OR .29, CI = .16 to .55) if VTE PPX was given early in both the low and moderate-risk groups (all values $p < .01$). The high-risk group found a higher odds of mortality in the early (OR 2.11, CI = 1.06 to 4.18, $p = .03$) and mid (OR 1.39, CI = 1.10 to 1.75, $p < .01$) VTE PPX BLEED group.
Conclusion: Early VTE PPX in the low and moderate risk mBNC reports to be effective in preventing VTE and mortality, with the absence of neurosurgical procedures only in the low-risk group regardless of BLEED. Early VTE PPX in the high-risk group prevents VTE; however, associates with a higher odds of mortality.

Poster #59

SERUM BIOMARKERS TO PREDICT THERAPEUTIC INTESNITY AND LOSS OF CEREBRAL AUTOREGULATION IN SEVERE TBI

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Introduction: Current treatment of severe traumatic brain injury involves reducing cerebral edema and resultant intracranial hypertension. Intracranial pressure (ICP) elevations can compress brain parenchyma and decrease cerebral perfusion, altering cerebral autoregulation. Disruption of the endothelial glycocalyx increases vascular permeability and disrupts coagulation and inflammation. The goal of this study is to determine if serum biomarkers can predict loss of cerebral autoregulation and if serum biomarkers are predictive of a malignant ICP phenotype requiring higher therapeutic intensity.

Methods: 25 trauma patients with severe TBI (GCS <9) underwent continuous ICP monitoring. Serum biomarkers of acute phase reactants were obtained on admission and serially after ICP monitor placement. Modified PILOT scale quantified therapeutic intensity. Pressure Reactivity index (PRx), correlation between ICP and mean arterial pressure (MAP) was used as a metric for cerebral autoregulation

Results: Multiple regression modeling demonstrated higher initial acute phase reactants correlated with greater area under the curve (AUC) PILOT scores. Syndecan-1 release greater than 40 predicted higher PILOT AUC. Pearson's correlation analysis demonstrated a correlation between soluble thrombomodulin (sTM) levels at 48hrs and the PRx between 48-72hrs (Pcc=0.4376, p=0.06). Additionally, sTM levels within 24 hrs were correlated with PRx between 36-48hrs (0.35, p=0.10) and PRx 48-72hrs (0.3955, p=0.0938). Syndecan-1 levels 2hrs post-admission showed a correlation with PRx between 36-48hrs (r=0.55, p=0.02).

Conclusion: This suggests an association between endothelial dysfunction and both therapeutic intensity and the brain's autoregulatory capacity after acute TBI. Increased release of acute phase reactant proteins and Syndecan-1 is associated with increased PILOT scores, demonstrating a relationship between elevated serum biomarkers and higher therapeutic intensity. Elevations in sTM and Synd-1 precede a loss of cerebral autoregulation. Identification of these biomarkers can alter TBI management.