Session I: Plenary Papers 1-8
Paper 1: 8:45 AM - 9:05 AM

EARLY, EMPIRIC 4-FACTOR PROTHROMBIN COMPLEX CONCENTRATE IN TRAUMA PATIENTS PREDICTED TO REQUIRE A LARGE-VOLUME BLOOD TRANSFUSION: RESULTS OF THE PHASE III TAP TRIAL

Introduction: The administration of concentrated coagulation factors may reduce mortality in bleeding trauma patients, who are often coagulopathic. The aim of the "Trauma And Prothrombin Complex Concentrate" (TAP) trial was to evaluate the impact of early, empiric 4-Factor Prothrombin Complex Concentrate (PCC), compared to placebo, on 6 hour mortality, in trauma patients predicted to require a large volume transfusion.
Methods: International, multicenter, randomized, double-blind, placebo-controlled, parallel-group, exception-from-informed-consent, phase 3 large simple clinical trial, conducted across 90 trauma centers in the USA, UK, and Australia. Trauma patients were randomly assigned to receive either PCC or placebo. (NCT05568888)
Results: 1366 patients were enrolled, of whom 868 were included in the prespecified modified intention to treat analysis. Patient demographics and injury characteristics were balanced between the two groups. In the PCC group, 31 of 432 patients (7.2%) died within 6 hours of randomization (the primary outcome), compared to 18 of 436 patients (4.1%) in the placebo group. The estimated difference between placebo and PCC, under the prespecified Bayesian logistic regression model, was −2.8% (95% credible interval, −5.8% to 0.1%). The posterior probability of a mortality difference >0 was 3.1% at 6 hours; and 3.0% at 24 hours, and 1.4% at 30 days. Acute kidney injury requiring renal replacement therapy was more common in the PCC group (relative risk, 1.82; 95% confidence interval, 1.17 to 2.83).
Conclusions: In trauma patients predicted to require a large-volume transfusion, early empiric use of PCC increased mortality and acute kidney injury compared with placebo.

Session I: Plenary Papers 1-8
Paper 2: 9:05 AM - 9:25 AM

THROMBOELASTOGRAPHY PLATELET MAPPING-GUIDED RESUSCITATION AFTER TRAUMATIC INTRACRANIAL HEMORRHAGE: ARE PLATELETS THE PROBLEM?

Introduction: Coagulopathy is a known sequela of traumatic brain injury, and platelet dysfunction has been implicated as a key contributor to traumatic intracranial hemorrhage (tICH) progression. Despite this association, the role of platelet transfusion (PT) remains controversial, particularly with patients with reported pre-injury antiplatelet use. We hypothesized that thromboelastography with platelet mapping (TEG-PM) could objectively identify clinically significant platelet dysfunction following tICH, and that TEG-PM-guided transfusion may reduce hemorrhage progression and improve outcomes.
Methods: We retrospectively reviewed adults (≥18 years old) admitted to a Level I trauma center (2019–2023) with computed tomography (CT)-confirmed isolated tICH, who underwent TEG-PM testing. Severe tICH was defined by diffuse axonal injury, radiographic "severe" designation, subdural hematoma >10 mm, midline shift, or neurosurgical intervention. Repeat head CT was obtained 6-12 hours after presentation to assess progression. Platelet activity was categorized as suppressed (MA-AA or MA-ADP ≤ 35) or partially suppressed (MA-AA or MA-ADP 35-45) regardless of pre-injury antiplatelet use. PT was administered at clinician discretion, variably guided by antiplatelet history or TEG-PM results. Univariate and multivariate analyses were performed to evaluate associations between platelet activity, tICH severity, PT, and hemorrhage progression.
Results: Among 315 patients with traumatic ICH (mean age 64.9±1.5), 147 (46.7%) met severe ICH criteria, of whom 97 (66%) were male. Pre-injury aspirin use did not differ by injury severity, but severe tICH were less likely to take clopidogrel (11 (7%) vs 27 (17.1%), p=0.0060). Initial TEG-PM-defined platelet suppression occurred at similar rates in patients with severe and non-severe ICH (38 (25.9%) vs 43 (28.5%), p=0.6104). Overall, 88 (27.9%) patients received platelet transfusion, including 51 (57.9%) with severe tICH and 37 (42.1%) with non-severe tICH (p=0.0730). Among transfused patients, 45 (90%) demonstrated initial MA-AA suppression and 35 (70%) MA-ADP suppression (5 (1.6%) exhibited dual suppression). Repeat TEG-PM in 83 (26.3%) patients frequently showed persistent platelet dysfunction despite transfusion. Ongoing MA-AA suppression was observed in 48 (57.8%) patients, (37 full, 11 partial); MA-ADP suppression persisted in 37 (44.6%) patients (16 (19.3%) full and 21 (25.3%) partial suppressed). Hemorrhage progression on follow-up CT occurred more frequently in patients with severe vs. to non-severe tICH (70 (44.6%) vs 33 (20.9%), p<0.0001). Among those with hemorrhage progression (n=103, 32.7%), 35 (39.8%) were transfused versus 68 (30.0%) who did not (p=0.0956). Unexpectedly, MA-AA suppression (not MA-ADP) was associated with significantly less hemorrhage progression on follow-up CT (22 (45.8%) vs 24 (68.6%), p=0.0396). On multivariable analysis, initial severity was the strongest independent predictor of hemorrhage progression (OR 3.9, 95% CI 1.2-13.8). After adjusting for age, gender, PT, and severity, continued MA-AA suppression despite platelet transfusion remained independently associated with decreased odds of hemorrhage progression (OR 0.30, 95% CI 0.098-0.938; AUROC 0.77).
Conclusion: Early tICH progression appears primarily driven by initial injury severity. Platelet transfusion was frequently followed by persistent TEG-PM-defined platelet suppression. Counterintuitively, MA-AA suppression was associated with less hemorrhage progression, raising the possibility that certain "physiologic" suppression patterns may be protective or that circulating platelet-inhibiting factors correlate with improved outcomes. While TEG-PM identifies platelet dysfunction independent of reported antiplatelet use, transfusion thresholds based on TEG-PM abnormalities remain undefined. Prospective studies are needed to determine which TEG-PM phenotypes warrant platelet transfusion in traumatic ICH.

Session I: Plenary Papers 1-8
Paper 3: 9:25 AM - 9:45 AM

A FIRST-IN-CLASS INTRAMUSCULAR ADMINISTERED ANTIFIBRINOLYTIC FOR TRAUMA HEMORRHAGE CONTROL FRACTURE PAIN

Introduction: Antifibrinolytics targeting activation of plasminogen to plasmin, thus inhibiting degradation of formed blood clot, have been utilized for decades in hemorrhage control and prevention. Among these, tranexamic acid (TXA) is the most widely used agent and has been incorporated into multiple clinical guidelines for emergency use. However, its relatively low potency and concentration necessitate the administration of large injection volumes and often repeated doses to achieve therapeutic levels, a requirement that significantly limits its utility in pre-hospital emergency settings. To address the unmet need for rapid hemorrhage control in life-threatening trauma, we have developed a novel small-molecule plasminogen activation inhibitor designed for effective bleeding control via a single intramuscular injection.

Methods: The pharmacological activity of the compound was evaluated through ex vivo assays using normal human blood supplemented with tissue plasminogen activator (t-PA) and the test agent, assessing both inhibition of plasminogen activation and stabilization of formed clots. Additionally, drug efficacy was demonstrated in rat and rabbit hemorrhage models. Clinical development has progressed with the completion of a first-in-human single-ascending-dose study in healthy volunteers, as well as a multiple-ascending-dose proof-of-concept study in patients with abnormal uterine bleeding.

Results: Preclinical studies demonstrated a 6–10× higher antifibrinolytic potency than that of TXA. In human subjects, a clear pharmacokinetic-pharmacodynamic (PK-PD) relationship was established, with clinical meaningful reduction in menstrual bleeding volume. Furthermore, a favorable safety profile has also been confirmed through comprehensive preclinical toxicology assessments and supported by data from the two completed clinical studies.

Conclusion: We have successfully developed a novel antifibrinolytic drug with proven efficacy and safety in human. This compound holds potential for broader application compared to existing antifibrinolytic therapies, due to its suitability for both intramuscular and intravenous administration. Future clinical development will include studies involving pre-hospital trauma patients.

Session I: Plenary Papers 1-8
Paper 4: 9:45 AM - 10:05 AM

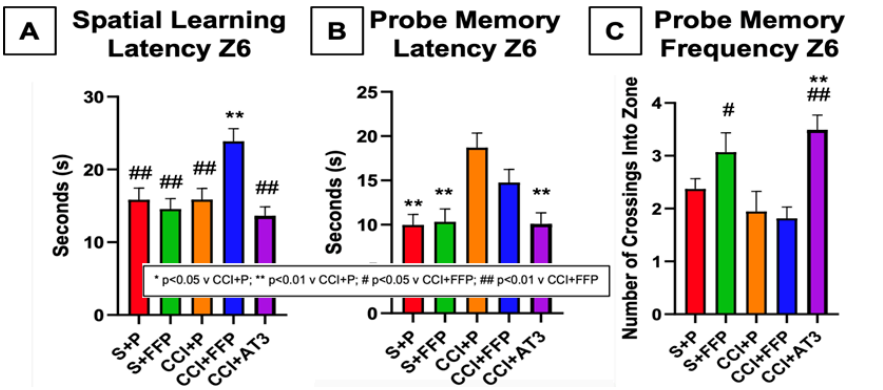
ANTITHROMBIN III (AT3) OUTPERFORMS FFP, IMPROVING COGNITIVE RECOVERY AFTER SEVERE ISOLATED TBI IN A MURINE MODEL FRACTURE PAIN

Introduction: Fresh frozen plasma (FFP) administered after isolated severe traumatic brain injury (TBI) may negatively impact learning while improving global neurological recovery. One component of FFP, antithrombin III (AT3), demonstrates anti-inflammatory effects on injured brain and may be a key FFP element that supports post-TBI recovery. We hypothesized that compared to FFP, AT3 better improves learning and memory after severe TBI.

Methods: Male CD1 mice (n=29) underwent sham craniectomy (S) or craniectomy followed by severe TBI via controlled cortical impact (CCI) and received saline (placebo, P), FFP (10cc/kg), or AT3 (250IU/kg) 30 minutes later. Morris water maze exercises conducted on days 6-14 characterized cued/spatial learning and memory. Decreased latency/distance and increased frequency/duration across four zones (Z5 [escape platform], Z6/Z7 [concentric circular areas surrounding Z5], and Z1 [quadrant containing Z5]) indicated superior learning and memory.

Results: Cued learning was unaffected by FFP or AT3. Spatial learning was worsened by FFP but not by AT3 which, instead reduced latency to Z5 ($p<0.01$), Z6 (Fig. A), and Z7 ($p<0.01$). Furthermore, AT3 consistently improved memory, decreasing latency to Z1 ($p<0.01$), Z5 ($p<0.01$), Z6 (Fig. B), and Z7 ($p<0.01$) as well as increasing frequency into Z1 ($p<0.01$), Z6 (Fig. C), and Z7 ($p<0.01$).

Conclusions: AT3, an FFP component, confers better neurological recuperation, particularly through improved memory recovery after severe TBI. Further investigation is needed to determine the mechanism(s) of action of both therapeutics.



Session I: Plenary Papers 1-8
Paper 5: 10:05 AM - 10:25 AM

DOES SURGICAL STABILIZATION OF RIB FRACTURES INFLUENCE READMISSION OUTCOMES IN OLDER ADULTS?

Introduction: Surgical stabilization of rib fractures (SSRF) is increasingly used in the elderly but its effect on readmission outcomes remains unclear. This study assesses readmission rates and mortality following SSRF compared to non-operative management (NOPM) in older adults.
Methods: A retrospective analysis of the Nationwide Readmissions Database (NRD 2016–2017) identified patients aged ≥ 65 years having isolated thoracic trauma with multiple rib fractures. Frailty was calculated using modified Frailty Index-11. Exclusions included fourth quarter discharges and index admission mortality. Patients undergoing SSRF during index admission were compared with those managed non-operatively. Propensity-score matching (1:3) was performed adjusting for age, sex, frailty, thoracic AIS, flail chest, pneumothorax, hemothorax, pulmonary contusion and mechanical ventilation requirement. Outcomes included all-cause readmission, rib-fracture–related readmission (pneumonia, sepsis, respiratory failure, pleural effusion or hemothorax), time to readmission, and readmission mortality.
Results: Out of 36,646 included patients; 408 (1.1%) underwent SSRF. Before matching, SSRF patients were younger, less frail, had more flail chest, hemothorax, and mechanical ventilation requirement ($p<0.001$). After matching (401 SSRF: 1,141 NOPM), covariate balance was adequate (ASMDs<0.1). 30-day (6.9% vs 10.6%) and 90-day (14.0% vs 18.8%) all-cause readmission rates were lower in SSRF ($p<0.05$).
Rib-fracture–related readmissions were significantly reduced following SSRF (4.9% vs 8.5%, $p = 0.027$), driven by lower pneumonia rates. SSRF had lower overall readmission mortality (3.1% vs 9.6%, $p = 0.043$) and index readmission mortality (2.0% vs 6.8%, $p = 0.038$). Emergent readmission rate was significantly higher with NOPM (88.1% vs 79.6%) but no difference was seen in time to readmission.
Conclusion: In older adults with multiple rib fractures, SSRF was associated with significantly lower all-cause and rib-fracture–related readmissions in addition to lower readmission mortality when compared with NOPM. The findings suggest that the benefits of operative rib fixation in the elderly extend beyond acute hospitalization, reflected by a lower readmission burden.

Session I: Plenary Papers 1-8
Paper 6: 10:25 AM - 10:45 AM

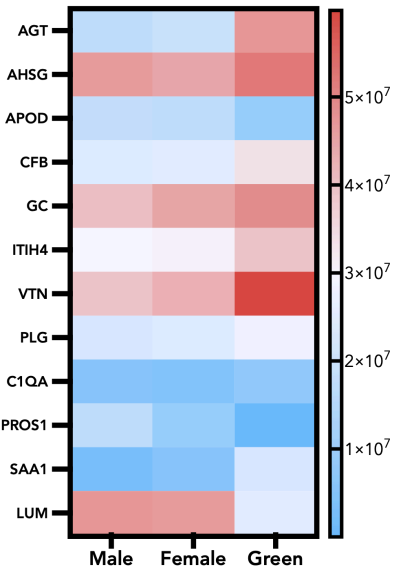
GREEN PLASMA EXHIBITS A PROCOAGULANT, PRO-COMPLEMENT, AND IMMUNO-MODULATORY PROTEOMIC PROFILE

Introduction: Green-colored plasma, observed in female donors taking oral contraceptives and its characteristic hue due to elevated ceruloplasmin levels, exhibits enhanced hemostatic performance compared with standard female and male plasma.We sought to define the proteomic signatures underlying these functional differences.

Methods: Pooled plasma specimens from MALE (n=21), FEMALE (n=21), and GREEN (n=21) donors underwent protein isolation and mass spectrometry analysis targeting 359 proteomic signatures. Differential expression was analyzed using Kruskal–Wallis testing. Pathway enrichment was performed using Reactome hierarchical analysis.

Results: Compared with MALE and FEMALE plasma, GREEN plasma demonstrated increased expression of complement activation proteins (CFB, C1QA), platelet degranulation (VWF, F13A1), endothelial activation (SAA1), tissue remodeling and repair (VTN, GC), and oxidative stress scavenging (CP) (all $p<0.05$). Conversely, GREEN plasma showed reduced expression of anticoagulant (PROS1) and fibrinolytic (PLG) proteins.

Conclusion: GREEN plasma exhibits a distinct proteomic profile enriched in procoagulant, complement, and immunomodulatory pathways, with relative suppression of anticoagulant and fibrinolytic proteins, providing mechanistic support for previous work. Collectively, green plasma's higher clotting factor levels and superior hemostatic function provide a foundation for future studies aimed at enhancing the hemostatic efficacy of resuscitation in trauma.



Session I: Plenary Papers 1-8
Paper 7: 10:45 AM - 11:05 AM

PROPRANOLOL ADMINISTRATION FOLLOWING TRAUMATIC BRAIN INJURY INDUCES DISTINCT GENE EXPRESSION PROFILES

Introduction: Traumatic brain injury (TBI) remains a major cause of morbidity and is frequently followed by prolonged intensive care stays that model sustained physiologic stress. Beta-blockade has been investigated as an adjunct therapy for TBI based on its potential to reduce sympathetic hyperactivation. The molecular mechanisms underlying neuroinflammatory signaling remain incompletely defined. We hypothesized that propranolol (BB) use following TBI would alter expression of genes related to neuroinflammation.

Methods: Male Sprague-Dawley rats (n=4-6/group) were divided into five groups: 1) naïve (daily handling only), 2) TBI 7d (controlled cortical impact (CCI) followed by 7 days of daily handling, 3) TBI 7d with daily propranolol administration (TBI+BB 7d), 4) TBI with chronic restraint stress for 7 days (TBI/CRS 7d), 5) TBI/CRS 7d with daily propranolol administration (TBI/CRS+BB 7d). RNA was extracted from the injured frontal lobe and analyzed using the NanoString Neuroinflammation panel. Differential gene expression was analyzed using ROSALIND. Significant differentially expressed genes (sDEG) were defined as fold change ≥ 1.5 or ≤ -1.5 with $p<0.05$. Functional pathway analysis was performed using Qiagen Ingenuity Pathway Analysis.

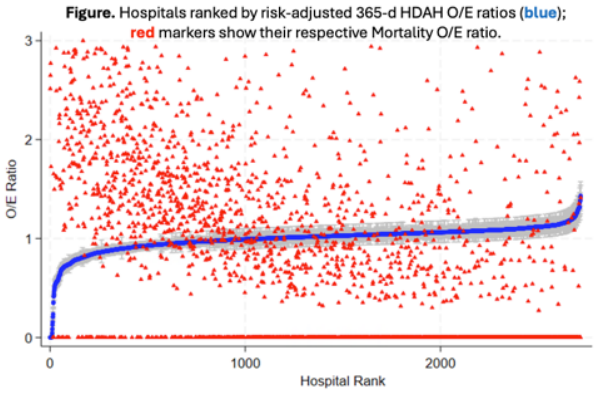
Results: Compared to TBI alone, TBI BB 7d demonstrated 138 sDEG (28 upregulated, 102 downregulated), including genes associated with neuronal signaling, neurotransmitter regulation, and epigenetic modulation. Pathway analysis identified significant involvement of the NOTCH signaling axis. In the TBI/CRS model, propranolol treatment yielded 87 sDEG (18 upregulated, 69 downregulated). These genes were enriched in pathways related to cellular stress responses and inflammatory regulation. Notably, propranolol downregulated components of the NOTCH–WNT signaling network, a pathway implicated in angiogenesis, learning and memory, and stress-response modulation.

Conclusions: Propranolol administration following TBI, with and without chronic stress exposure, resulted in distinct neuroinflammatory transcriptional profiles. Propranolol modulates the NOTCH pathway which is involved in both stress response and neurorecovery. These findings provide mechanistic insight into how beta-blockade may influence neurorecovery and stress-related neuroinflammation following TBI.

Session I: Plenary Papers 1-8
Paper 8: 11:05 AM - 11:25 AM

FROM DEATH RATES TO DAYS AT HOME: REFRAMING QUALITY BENCHMARKING AFTER EMERGENCY GENERAL SURGERY IN OLDER ADULTS

Introduction: Healthy Days at Home (HDAH) is a patient-centered outcome capturing days alive and spent at home (minus time spent in the hospital/ED department, rehabilitation/nursing/hospice facility, home health care) over 365 days after an index hospitalization. Traditional quality metrics like mortality fail to capture recovery and post-acute experience after Emergency General Surgery (EGS), outcomes that matter most for elderly patients. We compared hospital performance using risk-adjusted O/E ratios for HDAH and examined which patient/hospital factors were associated with receiving care at top performing hospitals.
Methods: Using 2017-2018 Medicare fee-for-service claims, we identified older adults, ≥65 years, who underwent an EGS procedure. Hospitals were ranked by risk-adjusted observed-to-expected (O/E) mean HDAH ratios into top and bottom quartiles. We also estimated mortality O/E ratios for comparison. Multilevel logistic model was used to assess factors associated with treatment at a high-performing (HP) hospital.
Results: 29,828 older adults underwent EGS. Figure shows hospital O/E Comparison (HDAH vs mortality). Academic status was associated with being a HP hospital (OR 1.64, 95% CI 1.01-2.71). Age (OR 1.02, 95% CI 1.01-1.02), Black race (OR 1.34, 95% CI 1.08-1.66), and frail status (OR 1.18, 95% CI 1.02-1.42) were associated with care at a HP hospital.
Conclusion: O/E benchmarking using HDAH identifies hospitals that differ from mortality-based rankings and highlights dimensions of recovery and post-discharge performance that might better reflect what is truly important for the elderly population.



Session IIIA: Papers 9-18
Paper 9: 2:10 PM - 2:30 PM

OUTCOMES OF EARLY VS DELAYED TEVAR IN HIGH-GRADE BLUNT THORACIC AORTIC INJURY WITH SEVERE SOLID ORGAN INJURY

Introduction: Thoracic endovascular aortic repair (TEVAR) is the preferred treatment for blunt thoracic aortic injuries (BTAIs) requiring repair but optimal timing remains unclear especially in the setting of high-grade BTAI (Grade III/IV). While delayed repair is recommended for concomitant traumatic brain injury (TBI), it is unclear whether this guidance should extend to patients with concomitant solid organ injury (SOI).
Methods: We performed a retrospective analysis of the Aortic Trauma Foundation registry (2014-2025). Patients with high-grade BTAI (grades III and IV) and severe SOI (AAST grade ≥ 4 or requiring surgical hemorrhage control/emergent embolization) were included. Outcomes were compared between early (< 24 hours) versus delayed (≥ 24 hours) TEVAR.
Results: Of 1375 patients, 658 (47.9%) underwent TEVAR and had documented BTAI grade. 574 (87.2%) had high-grade BTAI and 112 (19.5%) had concomitant severe SOI. Early TEVAR was performed in 81.3%. Baseline demographics, injury severity, blood product utilization, and distribution of Grade III versus IV injuries were similar between groups. Patients undergoing early repair had higher systolic blood pressure ($p=0.04$), lower heart rate ($p=0.01$), and lower lactate ($p=0.04$) on admission. Length of stay, in-hospital outcomes and mortality did not differ between groups.
Conclusion: These findings show that the majority of patients with high-grade BTAI and concomitant severe SOI undergo early TEVAR, despite potential hemorrhagic risk associated with intraoperative heparinization. Delayed repair is thought to allow for stabilization and resuscitation before aortic repair; however, these findings suggest that early TEVAR in patients with severe BTAI may be pursued in hemodynamically stable patients with severe SOI without an increase in adverse outcomes.

Session IIIA: Papers 9-18
Paper 10: 2:30 PM - 2:50 PM

SCAN OR SCRUB: A MULTICENTER REVIEW FOR CTA UTILITY IN PEDIATRIC LOWER EXTREMITY VASCULAR INJURY WITH HARD SIGNS

Introduction: In the era of widespread use of computed tomographic angiography (CTA), recent adult literature has questioned the utility of hard signs to accurately identify vascular injuries. The role of CTA in pediatric lower extremity vascular injury (LEVI) patients remains unknown. We aim to evaluate the utility of CTA in pediatric trauma patients presenting with hard signs of LEVI.

Methods: A multicenter retrospective review over 13 years was conducted at four Level I Trauma Centers (two adult [ATC] and two pediatric [PTC]). We included trauma patients <18 years old presenting with LEVI and hard signs (diminished or absent pulses, pulsatile hemorrhage, distal ischemia, expanding hematoma). CTA utilization was assessed with respect to patient characteristics, operative intervention, and hospital outcomes.

Results: 102 pediatric patients with hard signs were included; 60.8% treated at an ATC and 24.5% transferred from an outside hospital. Median age was 16 years (IQR 13-17). Most injuries were due to penetrating mechanism (72.5%). CTA was performed in 29.4% of the cohort with ATC and PTC scanning with similar frequency (43.3% vs 56.7%). Blunt mechanisms (50.0% vs 18.1%), transfers (36.7% vs 19.4%), and ischemic hard signs (96.7% vs 61.1%) were more likely to undergo CTA. A LEVI was identified in 100% of patients who underwent CTA. Most patients underwent operative intervention regardless of preoperative imaging (93.3% CTA vs 98.6% no CTA), and the rate of surgical exploration without arterial repair was similar in both groups (7.1% CTA vs 9.9% no CTA). There was no difference in hospital length of stay (median 10 vs 10 days), or survival to discharge (100% vs 90.3%) between the CTA and no CTA groups.

Conclusions: In pediatric patients with hard signs of LEVI, CTA did not identify additional injuries over physical exam, reduce operative exploration rates, or improve hospital outcomes. Unlike in the adult population, these findings suggest limited clinical utility of CTA in the pediatric cohort and support prompt operative management based on physical examination alone.

Session IIIA: Papers 9-18
Paper 11: 2:50 PM - 3:10 PM

CIVILIAN TRAUMA VOLUME AND MILITARY SURGEON READINESS: EVALUATING JKSA THRESHOLD FEASIBILITY AT A LEVEL I TRAUMA CENTER

Introduction: The Joint Knowledge, Skills, and Abilities (JKSA) metric assesses U.S. military surgeon readiness for deployment using CPT-codes relevant to combat casualty care. Civilian-military partnerships are a strategy to help military surgeons meet JKSA thresholds. We evaluated JKSA scores for trauma activations at an urban Level I trauma center to assess feasibility of achieving JKSA thresholds in a civilian-military partnership model.

Methods: JKSA scores for all trauma encounters were obtained from 3/1/2024 – 3/1/2025. JKSA procedural scores were derived from CPT codes, and diagnostic scores from patient ICD-10 codes. Annual JKSA scores were calculated overall. Mean JKSA points accrued per 24-hour trauma call estimated the number of calls required to meet the JKSA trauma readiness thresholds of 16,500 procedural points and 200,000 diagnostic points. To determine trauma volume ranking, our institution's annual trauma volume was compared with other ACS TQIP centers.

Results: Although institutional trauma volume was above the 75th percentile among ACS TQIP participating centers, the procedural JKSA per call was 191 points while the diagnostic JKSA per call was 5,541 points. Based on these averages, 86 calls annually (7 per month), and 36 calls annually (3 per month) would be required to meet procedural and diagnostic JKSA metrics, respectively.

Conclusion: At a high-volume Level I trauma center, civilian trauma case mix does not universally provide adequate JKSA procedural density for military trauma surgeons to meet JKSA thresholds in isolation. Although military-civilian partnerships remain essential, evaluating center trauma JKSA density may improve civilian-military partnership site selection and help optimize the duration and call frequency of embedded models.

Session IIIA: Papers 9-18
Paper 12: 3:10 PM - 3:30 PM

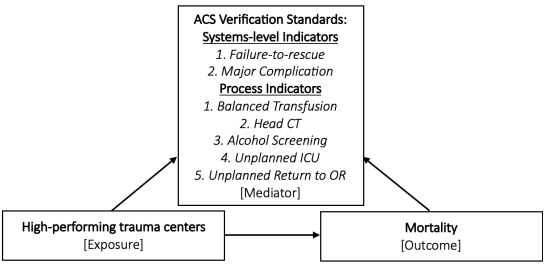
IPSILATERAL ISN'T INFERIOR: VEIN GRAFT LATERALITY LIKELY DOES NOT IMPACT OUTCOMES AFTER LOWER EXTREMITY REVASCULARIZATION IN TRAUMA

Introduction: An autologous vein interposition graft is a well-established treatment for traumatic arterial injuries of the lower extremity when direct repair is not feasible. Surgical dogma holds that a contralateral (CONTRA) vein graft is preferred over an ipsilateral (IPSI) vein graft to avoid outflow issues after revascularization. We evaluated patients with major arterial injuries and hypothesized there would be no difference in patency, perfusion, and limb salvage between CONTRA and IPSI.
Methods: The registry of a level 1 trauma center was queried for patients with external iliac, femoral, or popliteal arterial injuries who underwent interposition bypass with autologous femoral or saphenous vein conduit from 2019-2024. Patients were stratified by graft harvest site (IPSI vs. CONTRA) and compared. Multivariable logistic regression determined factors associated with ambulatory status on discharge.
Results: 191 patients met the inclusion criteria. Most were male (84%) and sustained a penetrating injury (79%). The median age was 29 years (IQR: 21-40), and the Injury Severity Score was 11 (IQR: 9-17). Injured arteries included: external iliac (6), femoral (116), and popliteal (87). Only 8% required a damage-control shunt as the index operation. Of 191 patients, 80 had IPSI (9%[n=7] femoral; 91%[n=73] saphenous), and 111 had CONTRA (3% [n=3] femoral; 97% [n=108] saphenous). IPSI had more popliteal injuries (55% vs. 39%, p=0.026). CONTRA had more major amputations (4% vs. 14%, p=0.003). Reasons for amputation included: concomitant limb injury (n=7), graft occlusion (n=9), and infection (n=2). There was no difference in mortality (p=0.402) or patency at discharge (p=0.880). There was no difference in patency, perfusion, or limb salvage at 1, 3, and 5 years in those who followed up. Blunt mechanism (AOR: 3.289, 95% CI 1.412-7.66, p=0.006) and concomitant orthopedic injury (AOR: 3.240, 95% CI 1.451-7.235, p=0.004) were associated with non-ambulatory status on discharge, after controlling for covariates, including amputation.
Conclusion: The ipsilateral vein can be a suitable conduit for lower extremity arterial injuries in trauma, contrary to dogma. Harvest site laterality may be determined by limb injury severity, which is not well captured by commonly collected variables. Appropriate conduit is the most important factor for sustained graft patency.

Session IIIA: Papers 9-18
Paper 13: 3:30 PM - 3:50 PM

DOES ADHERENCE TO ACS VERIFICATION STANDARDS MEDIATE MORTALITY BENEFITS AT HIGHER-PERFORMING TRAUMA CENTERS? A CAUSAL MEDIATION ANALYSIS

Introduction: The American College of Surgeons (ACS) Verification Review and Consultation (VRC) program quality measures have standardized trauma care nationally. However, outcomes of trauma patients still vary substantially. We sought to understand which specific ACS-VRC quality measures mediate mortality benefits among trauma centers.
Methods: We conducted a retrospective cohort study of ACS TQIP data (2019-22). We identified high-performing centers (HPTCs) by fitting a hierarchical mixed-effects logistic model of in-hospital mortality in a training cohort of 2019/20 data. Centers in the lowest decile of risk-standardized mortality were designated HPTCs. In the held-out 2021/22 cohort, we estimated propensity for HPTC care using inverse probability treatment weighting adjusted for nine confounders. We pre-specified ACS-VRC mediators into two systems-level indicators and five process indicators (Figure). We estimated direct and mediated effects on in-hospital mortality using an interventional causal mediation framework with bootstrap intervals.
Results: Among 851,440 adults at 409 centers, 38 HPTCs (9.8%) showed a 20% overall mortality reduction compared to non-HPTCs (OR: 0.80, $p<0.001$). Of the seven VRC standards examined, systems-level indicators were dominant causal mediators: failure-to-rescue explained 22.6% of the HPTC mortality advantage, and major complication prevention explained 8.7%. These effects concentrated in high-acuity populations with failure-to-rescue explaining 47.9% of the mortality gap in penetrating trauma and 17.1% in isolated traumatic brain injury. In contrast, process standards contributed minimally: balanced transfusion showed no association with HPTC status association, while alcohol screening, head CT imaging, unplanned return to OR and unplanned ICU admission each mediated <1% of the total effect.
Conclusion: Nearly a third of the mortality advantage at high-performing trauma centers is mediated through systems-level complication management, particularly failure-to-rescue. In contrast, process-of-care indicators had minimal mediating roles, suggesting that current verification benchmarks may not fully capture the mechanisms driving survival differences. As verification standards evolve, prioritizing complication recognition and rescue systems may offer the highest-yield targets for improving trauma outcomes nationally.



Session IIIA: Papers 9-18
Paper 14: 3:50 PM - 4:10 PM

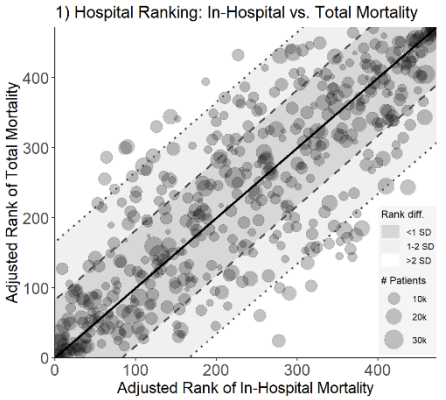
BENCHMARKING CONSEQUENCES OF DEFINING MORTALITY AS IN-HOSPITAL DEATH PLUS HOSPICE DISCHARGE

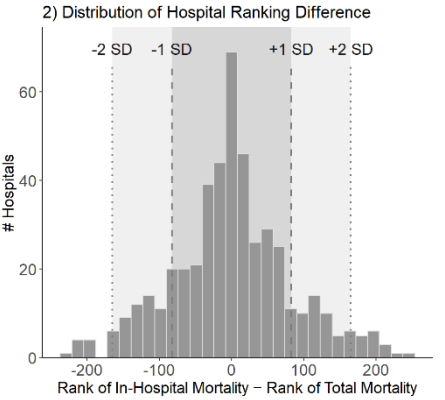
Introduction: ACS TQIP uses risk adjusted total mortality (TM=in-hospital mortality+hospice discharge) to benchmark trauma centers (TCs), but the impact of adding hospice to TM definition is poorly studied. We examined whether using TM versus in-hospital mortality modified TC rankings.

Methods: Using TQIP Participant Use Files, this retrospective study included adults (18-89y) admitted to Level I/II TCs (2017-2023). The primary outcome was the difference in TC rankings based on in-hospital mortality and TM, using mixed models adjusted for age, sex, race, comorbidities, mechanism of injury, injury type, GCS, ISS, and vital signs.

Results: 4,586,638 patients from 472 TCs were included. In-hospital mortality was 2.8% and 1.0% were discharged to hospice, with a TM of 3.8%. Compared to TC ranks using in-hospital mortality, ranks changed when hospice was added. The distribution of rank-change was normal (1 SD = 83 ranks). Using adjusted rankings, 29% of TCs moved >1 SD in rank (14% improved, 15% worsened), with 30 (6%) of these moving >2 SD.

Conclusion: Adding hospice for benchmarking reshapes TC performance comparisons. With hospice use growing and varying by region, TM will increasingly reflect care patterns, not only injury outcomes. Objective benchmarking requires additional research and validation of the TM metric.





Session IIIA: Papers 9-18
Paper 15: 4:10 PM - 4:30 PM

WHEN TIME STANDS STILL: MEASURING AIRWAY, BREATHING, AND CIRCULATION INTERVENTION TIMES DURING TRAUMA RESUSCITATIONS

Introduction: Timely airway, breathing, and circulation (ABC) interventions may be lifesaving during trauma resuscitations. We hypothesize that trauma video review (TVR) can measure the time required to perform ABC interventions in the trauma bay. The specific aim of this study was to use TVR to measure the time required to perform ABC interventions.

Methods: This was a prospective study (August-December 2025) of TVR of resuscitations of adult trauma patients arriving to our academic, Level I trauma center at the highest-level of activation. ABC interventions in the trauma bay included rapid sequence intubation (RSI), placement of chest tube placement, peripheral IV (PIV), or central venous line, as well as blood transfusion. Total time (TT) was defined as time from decision to end of intervention. This was subdivided into decision-to-intervention (DTI) start time and intervention time (IT), defined as start to end of actual intervention. Decision time was recorded as the first verbal instruction to perform an intervention apart from PIV, for which decision time was recorded as patient arrival time. Visual cues were used to record intervention-specific start time and end time using standardized definitions for each intervention.

Results: TVR was performed for 260 consecutive trauma resuscitation patients (45 years old, 77% male, 47% White non-Hispanic, 76% blunt trauma). Median minutes:seconds (IQR) for ABC interventions in table.

Conclusion: TVR can be used to measure ABC intervention times during resuscitations in the trauma bay. Actual intervention times are short, with decision-to-intervention times consuming the majority of total time to complete these interventions. TVR may uncover opportunities to address inefficiencies associated with decision-to-intervention times.

Intervention	n (%)	TT	DTI	IT
RSI	56 (21%)	6:14 (4:25-7:22)	4:38 (3:24-6:05)	0:54 (0:37-1:13)
Chest Tube	25 (10%)	6:35 (4:23-11:34)	4:48 (2:28-8:45)	2:55 (1:29-3:43)
PIV	179 (69%)	4:05 (2:22-6:33)	1:59 (1:21-3:46)	1:02 (0:37-2:12)
Central Line	24 (9%)	7:52 (5:11-10:06)	3:27 (2:05-4:42)	3:55 (1:55-5:31)
Transfusion	52 (20%)	6:49 (4:49-8:40)	2:56 (1:05-3:53)	3:44 (2:07-5:00)

Session IIIA: Papers 9-18
Paper 16: 4:30 PM - 4:50 PM

BEDSIDE THORACIC IRRIGATION IS COST-EFFECTIVE FOR TRAUMATIC HEMOTHORAX

Introduction: Bedside thoracic irrigation at presentation after traumatic hemothorax has been shown to reduce overall hospital resource utilization and costs while avoiding secondary interventions. However, no formal cost-effectiveness analysis comparing thoracic irrigation (TI) with standard tube thoracostomy (TT) alone has been conducted. Using peer-reviewed literature, we assessed whether TI was a cost-effective alternative to TT for traumatic hemothorax.

Methods: We created a decision-analytic model to compare TI with TT for traumatic hemothorax. Our primary outcome was the incremental cost-effectiveness ratio (ICER) for TI relative to TT. We defined a willingness-to-pay threshold of $100,000/QALY, with ICERs falling below this threshold considered cost-effective. We used a 30-day time horizon to simulate the index inpatient stay, and any secondary interventions during the index stay. All costs were modeled from the perspective of a trauma center. To create our model, we sourced transition probabilities, costs, and health utilities (measured in QALY) from peer-reviewed literature. We modeled probabilities and utilities on β-distributions and costs on γ-distributions to simulate real-world variability. We then performed 1,000 iterations of our model, each comprising 10,000 Monte Carlo simulations.

Results: After 1,000 iterations, TI was cost-effective in 88.7% of iterations. On average, TI saved $101,511.12 and generated a 0.02 QALY benefit per simulated case relative to standard TT. Thus, at our willingness-to-pay threshold, bedside TI was the dominant intervention. After testing a wide range of parameter values, we found that our model was sensitive to the total admission costs for TI and for standard TT alone.

Conclusion: For otherwise healthy patients with traumatic hemothorax, adding TI to standard TT resulted in average cost savings for hospitals and improved patients' quality of life. Our findings support the continued adoption of TI and increased accessibility to TI kits for the treatment of traumatic hemothorax.

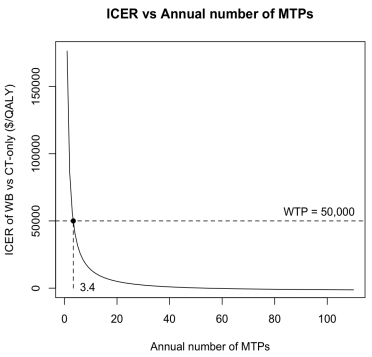
Session IIIA: Papers 9-18
Paper 17: 4:50 PM - 5:10 PM

WHEN IS IT COST-EFFECTIVE TO IMPLEMENT A WHOLE BLOOD PROGRAM? A COST-EFFECTIVENESS ANALYSIS FOR CIVILIAN TRAUMA CENTERS

Introduction: Emerging evidence suggests that integrating whole blood (WB) into massive transfusion protocol (MTP) may reduce mortality compared with component therapy (CT), although whether this practice is cost-effective is less clear. We conducted a cost-effectiveness analysis to identify the threshold trauma volume at which implementing a WB program becomes economically justified for an institution.

Methods: Data for 24-hour mortality and blood utilization were obtained from a previously published retrospective study using data from the American College of Surgeons Trauma Quality Improvement Program databank. Post-trauma quality of life and healthcare costs were obtained from U.S. Life Tables, 2023 and Medical Expenditure Panel Survey data. Anticipated costs of blood products, program initiation and maintenance were obtained from our local blood bank. WB wastage was defined as nonuse within 14 days and modeled based on trauma patient volume requiring MTP. We developed a Markov cohort model to evaluate health and economic consequences of adding WB to MTP compared with using CT only. A probabilistic threshold analysis was performed to determine the minimum annual MTP volume at which adding a WB program is cost-effective, assuming a willingness-to-pay of $50,000 per quality-adjusted life-year (QALY).

Results: Based on our institution (98 MTPs, three expected WB wastage events per year, $100,000 initiation cost amortized over 5 years, $20,000 annual program cost), adding WB is cost-effective compared to CT alone, with an incremental cost-effectiveness ratio (ICER) of $2345/QALY. The threshold analysis found that a minimum of 4 MTPs per year was required to prefer WB program implementation.



Conclusions: A WB program is cost-effective based on our institutional parameters and would be so for many large trauma centers. This study provides a generalizable modeling tool for trauma centers to evaluate the cost-effectiveness of a WB program based on their patient and resource profiles.

Session IIIA: Papers 9-18
Paper 18: 5:10 PM - 5:30 PM

ESTIMATING THE COST OF A PREHOSPITAL BLOOD PROGRAM

Introduction: Research supporting improved outcomes with prehospital transfusion has led to expanding interest in prehospital blood programs in recent years. However, uncertainty surrounding implementation and sustainment costs remains a central barrier to broader adoption, particularly at a statewide or national scale. South Texas serves as a useful case study for practical cost estimation, with prehospital blood product utilization data available across diverse population densities for a multi-year period. By extrapolating this estimate, we can predict the annual cost of a statewide or national prehospital transfusion program.

Methods: We compiled 2021-2023 actual blood utilization in 22 South Texas counties with a combined population of 3,000,525 and classified them into 6 standard population categories. The blood utilization for each category was averaged to estimate an annual utilization for a given population size. All 254 Texas counties were classified into the six categories to predict total annual blood utilization. Per capita cost was based on Texas' 2023 population estimate and current unit cost of blood of $500. Per capita cost was then applied to the 2024 US population estimate.

Results: The per capita annual sustainment cost was $0.24. At the national level, this equates to $81.6 million for 340 million Americans.

Conclusions: We used the data from South Texas to estimate the sustainment costs of prehospital blood programs across the state. Since blood usage and cost per capita is largely dependent on a state's population distribution, the per capita calculation may overestimate for densely populated states and underestimate for states with large rural populations. However, the $0.24 per capita estimate presents a simple and efficient way of calculating the annual budget cost of an established prehospital blood program at both the state and national level.

Population (2023)	Category	Estimated Annual Unit Utilization	# Counties	Total Population	Estimated Total Annual Cost
< 10,000	Frontier	15.8	92	417,714	$ 728,459.02
10,001 - 50,000	Rural	60.7	89	2,055,540	$ 2,701,368.85
50,001 - 99,999	Suburban	84.5	30	1,968,070	$ 1,266,885.25
100,000 - 999,999	Urban	77.0	36	10,811,845	$ 1,386,000.00
1M-2.99M	Super Urban	338.0	6	10,415,007	$ 1,014,000.00
≥3M	Metropolis	354.0	1	4,835,125	$ 177,000.00
		TOTALS	**254**	**30,503,301**	$ 7,273,713.11

Session IIIB: Papers 19-28
Paper 19: 2:10 PM - 2:30 PM

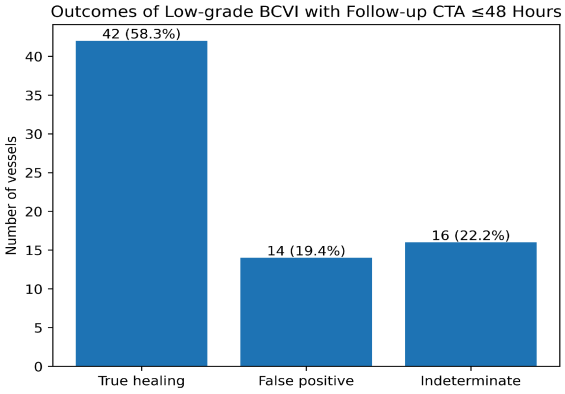
THE GHOST IN THE CT MACHINE: EARLY REPEAT CT ANGIOGRAPHY FOR LOW-GRADE BLUNT CEREBROVASCULAR INJURIES IDENTIFIES HIGH RATES OF MISDIAGNOSIS OR MISCLASSIFICATION

Introduction: Low-grade blunt cerebrovascular injury (BCVI) identified on CT angiography (CTA) frequently appears to resolve on early follow-up imaging. Whether this apparent resolution represents true vascular healing or recognition of an initially misclassified lesion remains uncertain. We aimed to analyze our experience with early repeat CTA and identify factors associated with diagnostic misclassification.

Methods: Adult trauma patients with low-grade BCVI diagnosed on CTA at a Level I trauma center (2015–2025). Lesions demonstrating resolution on follow-up imaging were classified as true healing or non-true injury (false-positive or indeterminate). Associations were evaluated using regression models accounting for clustering of vessels within patients.

Results: Among 150 patients with 225 BCVI vessels, 127 lesions (56%) demonstrated apparent resolution. Early follow-up CTA (≤48 hours) was available in 72 vessels, of which 30 (42%) were categorized as non-true injury, including 14 false-positive and 16 indeterminate lesions (see Figure). Smoking history and vascular comorbidities were more common in the non-true injury group ($p < 0.05$). On multivariable analysis, smoking (OR 3.36) advanced age (OR 1.04 per year), and technical limitations of the initial CTA (OR 3.19) were independently associated with misclassification, while injury-related factors were not.

Conclusion: Apparent resolution of low-grade BCVI frequently reflects diagnostic misclassification rather than true vascular healing. Our findings suggest diagnostic challenges of CTA in low-grade BCVI, including a high incidence of false-positive or indeterminate findings. This supports cautious interpretation of initial CTA results and a possible role for routine early (within 48 hours) repeat CTA to improve diagnostic accuracy and guide therapy.



Session IIIB: Papers 19-28
Paper 20: 2:30 PM - 2:50 PM

EXPLORING THE NATURAL HISTORY OF BLUNT CEREBROVASCULAR INJURIES USING SHORT INTERVAL REIMAGING

Introduction: Blunt cerebrovascular injury (BCVI) occurs in up to 8% of trauma patients and carries significant morbidity and mortality. Current management emphasizes early antithrombotic therapy (AT); however, this can pose a challenging clinical scenario in the setting of polytrauma. The short-term natural history of BCVI is unknown. We aim to characterize changes of BCVI on early repeat imaging and hypothesize that low-grade injuries (I–II) will improve or resolve, whereas higher-grade injuries (III–V) will persist or progress.

Methods: We studied adult trauma patients (2022 - 2025) at our urban, academic, Level 1 trauma center who had a BCVI identified on initial computed tomography angiography (CTA). BCVIs were graded using the Biffl classification system (grades I-V). Patients were included if they had repeat CTA in the first seven days of admission. The primary outcome was change in grade of BCVI.

Results: There were 113 patients (64% male, 42 years old) with 184 BCVIs identified, including 100 vertebral and 84 carotid artery injuries. Patients were severely injured, with an average ISS of 25 and head/neck AIS of 3.3, and overall mortality of 3%. Mean interval between scans was 3±2 days. Table shows change in BCVI grade on repeat imaging; there were no grade V injuries identified.

Conclusion: Short interval reimaging of BCVI identifies early changes in grade that affect management. Low-grade injuries were more likely to improve and resolve compared to high-grade injuries which were more likely to persist. These findings support using early repeat imaging to both discontinue AT when appropriate and identify patients who may require escalation of care.

Initial Grade	Improved	Worsened	No change
I	51%	6%	43%
II	57%	7%	35%
III	29%	0%	71%
IV	36%	0%	64%

Session IIIB: Papers 19-28
Paper 21: 2:50 PM - 3:10 PM

NO TIME TO WAIT: PREDICTING DELAYED PROGRESSION OF INTRACRANIAL HEMORRHAGE FOLLOWING BLUNT TRAUMA

Introduction: Progression of traumatic intracranial hemorrhage (ICH) is common and informs decisions about monitoring and repeat head CT imaging. Most prior work focuses on early progression. However, predictors of delayed hemorrhage beyond 48 hours remain less clear. The aim of this study was to identify predictors of delayed ICH progression in blunt-injured trauma patients.

Methods: Consecutive adult (≥18) patients over a 24-month period, ending in December 2024 with ICH on initial head CT who survived ≥48 hours post-injury at a single Level I trauma center were identified. Data regarding patient characteristics, severity of injury and shock, type of ICH (SDH, SAH, IPH, IVH, multi-compartmental), and pre-injury anticoagulant and/or alcohol use were recorded. The primary outcome was delayed ICH progression. Patients were stratified by progression of ICH (defined as radiographic worsening on follow-up CT imaging) into early (<48 hours) or late (≥48 hours) and compared. Multivariable logistic regression analysis was used to identify independent predictors of delayed ICH progression.

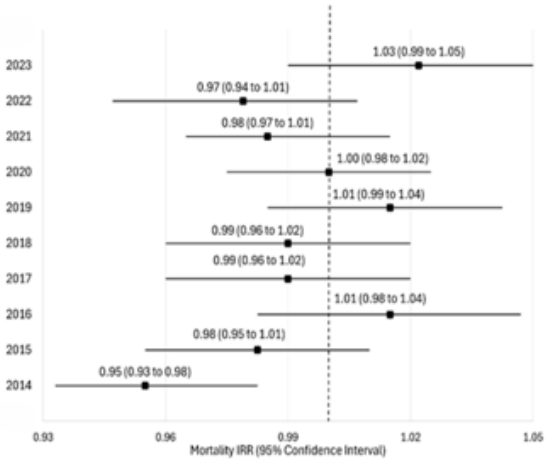
Results: 544 patients were identified: 223 (41%) experienced delayed ICH progression and 321 (59%) did not. Both groups were clinically similar with respect to age (46 vs 48, p=0.52), sex (73% male vs 74%, p=0.09), shock severity (SI: 0.7 vs 0.7, p=0.58) and pre-injury anticoagulant use (56.1 vs 55.6%, p=0.99). However, patients with delayed progression had greater neurologic injury at presentation, with lower median GCS (7 vs 9, p=0.0005) and higher Rotterdam CT score (3 vs 3, p=0.016). Multivariable logistic regression identified lower admission GCS (OR 1.14, 95%CI 1.06-1.23, p<0.001), type of ICH (SAH: OR 3.77, 95%CI 1.23-11.6, p=0.021 and multi-compartmental: OR 2.57, 95%CI 1.11-5.91, p=0.027) and higher Rotterdam CT score (OR 1.36, (%%CI 1.05-1.76, p=0.02) as independent predictors of delayed ICH progression following blunt injury.

Conclusions: Delayed ICH progression is not infrequent following blunt injury. Initial CT hemorrhage pattern and neurologic status were the strongest predictors of delayed progression. Thus, for patients presenting with select ICH types and greater neurologic injury, closer monitoring with more liberal use of repeat CT may be warranted.

Session IIIB: Papers 19-28
Paper 22: 3:10 PM - 3:30 PM

IS THE ACS TQIP BENCHMARK FOR ICP MONITORING VALID? AN ANALYSIS OF ICP MONITORING AND MORTALITY ACROSS TRAUMA CENTERS

Introduction: In severe traumatic brain injury (sTBI), intracranial pressure (ICP) monitoring detects and directs management for intracranial hypertension. The American College of Surgeons Trauma Quality Improvement Programs (ACS TQIP) reports annual ICP monitor usage across all participating trauma centers, however the mortality benefit is unknown. We assessed the correlation between ICP monitor use and mortality to validate its incorporation as a TQIP quality measure.
Methods: Adult patients (≥18 years) meeting sTBI ACS TQIP criteria admitted to Level I or II trauma centers from 2013-2023 were identified. Center- and year-specific ICP rates and in-hospital mortality were calculated. Multivariable generalized linear mixed models evaluated the association between ICP utilization and mortality, adjusting for aggregated demographic and clinical covariates, with year as random effects.
Results: Among 191,686 sTBI patients, 29,224 (15.2%) underwent ICP monitoring. ICP utilization increased modestly over the study period (7.9% in 2014 to 9.3% in 2023). Patients receiving ICP monitoring had higher injury severity and longer hospital and ICU stays. Stratified Poisson regression showed a statistically significant association between higher rates of ICP use and reduced mortality in 2014 only. After adjustment for patient and center characteristics, ICP utilization was not independently associated with in-hospital mortality after 2014 (OR 0.99, 95% CI 0.98-1.01; p=0.5).
Conclusion: Across a decade of national TQIP data, center-level ICP monitoring rates were not associated with reduced mortality after risk adjustment. These findings question the validity of ICP monitoring as a mortality-based quality benchmark within ACS TQIP.



Session IIIB: Papers 19-28
Paper 23: 3:30 PM - 3:50 PM

HEALTH INSURANCE LOSS AFTER TRAUMA: RISK FACTORS AND IMPLICATIONS

Introduction: Prior studies have examined mechanisms of post-trauma financial toxicity in isolation, despite these factors being closely interconnected. Loss of health insurance coverage may serve as a more comprehensive indicator of overall financial well-being, better identifying high-risk groups while capturing the broader economic impact and informing direct policy interventions to optimize recovery from trauma.

Methods: We used the Merative MarketScan® Commercial Database to evaluate insurance loss 6 months after hospitalization among privately insured, working-age patients (2018-2022). Trauma cases (primary ICD-10 diagnosis) were propensity score-matched to non-trauma controls using nearest-neighbor matching on demographics, comorbidities, in-hospital characteristics, and insurance types. Multivariable logistic regressions were used to assess differences between trauma and non-trauma cohorts and to identify independent risk factors for coverage loss.

Results: A total of 25,793 trauma cases and 103,172 non-trauma cases were identified. 3,366 (13.1%) trauma patients and 12,044 (11.7%) non-trauma patients lost insurance six months after hospitalization. A diagnosis of trauma was independently associated with a 12% increase in the odds of insurance loss (OR 1.12, 95% CI 1.07-1.17; P<.001). Among trauma patients, younger age, higher comorbidities, longer hospital stays, and employment in trade, services, or construction were identified as independent risk factors for insurance loss, while middle age, having a health maintenance organization (HMO) insurance plan, and employment in finance were protective.

Conclusion: Trauma is independently associated with increased risk for post-hospitalization health insurance loss. This study identified risk factors that enable targeted interventions to help trauma patients maintain coverage and improve their recovery trajectory.

Insurance Loss at 6 Months after Trauma Admission

Signif. Covar.		OR (95% CI)	P	
Age Group				
	35-44	Reference		
	18-34	1.5 (1.33-1.68)	<.001	***
	45-54	0.83 (0.74-0.92)	<.001	***
Ins. Type				
	Comp.	Reference		
	HMO	0.6 (0.47-0.78)	<.001	***
CCI				
	0 or 1	Reference		
	2 or 3	1.35 (1.23-1.48)	<.001	***
	4+	2.07 (1.79-2.39)	<.001	***
Region				
	N Central	Reference		
	Northeast	0.86 (0.76-0.97)	.02	*
LOS				
	<3 days	Reference		
	>=8 days	1.44 (1.3-1.6)	<.001	***
Industry				
	Manufact.	Reference		
	Trade	1.96 (1.69-2.26)	<.001	***
	Finance	0.83 (0.71-0.96)	.01	*
	Services	1.48 (1.32-1.65)	<.001	***
	Construct.	4.24 (2.79-6.45)	<.001	***

Session IIIB: Papers 19-28
Paper 24: 3:50 PM - 4:10 PM

IMPACT OF CAREGIVER PRESENCE ON RECOVERY TRAJECTORIES IN A TRAUMA MEDICAL HOME MODEL

Introduction: Older injury survivors often experience prolonged psychological and functional morbidity. The Trauma Medical Home (TMH) model provides multidisciplinary coordinated care for 6 months to improve long-term recovery. Prior analyses suggest that there may be heterogenous treatment effects. A possible modifier is the role of informal caregivers in improving long-term outcomes. We hypothesized informal caregivers would enhance recovery among patients receiving TMH.
Methods: The parent trial was a randomized clinical trial at four Level I trauma centers, enrolling patients aged ≥ 50 with ISS ≥ 9 without a brain or spinal cord injury. In this secondary analysis, patients were categorized by presence or absence of an identified caregiver. Outcomes, measured at baseline, 6, and 12 months, included quality of life (SF-12 PCS and MCS), depression (PHQ-9), anxiety (GAD-7), and physical function (SPPB).
Results: We analyzed 419 patients: 265 with an identified caregiver and 154 without. In the usual-care arm, patients with caregivers had significantly higher 12-month physical QoL improvement (SF-12 PCS) than those without ($p=0.011$), whereas in the TMH arm caregiver status had minimal effect ($\beta=0.09$). Among patients with baseline depression, caregiver presence was associated with greater 12-month mood improvement, with lower depression ($\beta = -4.02$, $p = 0.019$) and anxiety scores ($\beta = -2.82$, $p = 0.005$), and similar improvements in depression scores were seen in patients with baseline anxiety ($\beta = -4.30$, interaction $p = 0.039$).
Conclusion: Caregiver involvement enhanced recovery in specific contexts. Integrating caregivers into post-discharge care may be beneficial for older trauma patients especially those with high baseline psychological symptoms and in the absence of structured post-injury care.

Session IIIB: Papers 19-28
Paper 25: 4:10 PM - 4:30 PM

ANTIPLATELET THERAPY DRIVES DELAYED INTRACRANIAL HEMMORRHAGE RISK IN ANTICOAGULATED GERIATRIC FALL PATIENTS

Introduction: Repeat head CT (CT2) in anticoagulated geriatric patients after ground-level falls with negative initial CT (CT1) has limited evidence for its clinical utility. The rate of delayed intracranial hemorrhage (dICH) and the proportion requiring intervention remain poorly defined, and no validated bedside tool exists to risk-stratify patients for selective repeat imaging. We sought to determine the incidence and clinical significance of dICH, identify bedside-available predictors, and develop a risk stratification score.

Methods: A single-center retrospective cohort study of consecutive patients ≥65 years on ≥1 antithrombotic agent presenting after ground-level fall to a Level II trauma center (2016–2022). Patients with negative CT1 who underwent CT2 comprised the analytic cohort. Primary outcome was dICH on CT2. Multivariable logistic regression adjusted for age, sex, and INR assessed drug-class effects. Firth penalized maximum likelihood addressed rare-event bias. Six modeling approaches were compared for predictor identification.

Results: Of 1,724 patients enrolled, 1,709 with negative CT1 underwent CT2. Twenty-two (1.29%; 95% CI 0.81–1.95%) developed dICH, of whom only 1 (4.5%) required neurosurgical intervention, representing 0.06% of the total cohort (NNT for repeat CT: 1,709). After adjustment for age, sex, and INR, aspirin carried 5.3-fold higher odds of dICH than warfarin (aOR 5.32, 95% CI 1.08–26.31, p=0.04). Aspirin+warfarin combination had the highest rate at 5.66% (3/53). On Firth regression, INR >3.0 (aOR 4.68, 95% CI 1.59–13.73, p=0.005), male sex (aOR 2.34, 0.96–5.71, p=0.06), and antiplatelet use (aOR 2.95, 0.96–9.06, p=0.06) were identified as predictors; all six modeling methods converged on these same three variables.

Conclusion: Delayed ICH after negative initial CT in anticoagulated geriatric fall patients is rare (1.29%) and almost never requires intervention (0.06%). Contrary to conventional teaching, aspirin carried over 5-fold higher adjusted odds of dICH than warfarin. A simple 3-variable bedside score identifies 30% of patients as low-risk (dICH 0.39%, NPV 99.6%), potentially reducing repeat CT utilization by one-third. The absence of GCS as a significant predictor supports medication-based rather than symptom-based risk stratification in this population.

Session IIIB: Papers 19-28
Paper 26: 4:30 PM - 4:50 PM

TIME TO ENDOTRACHEAL INTUBATION AND MORTALITY IN MODERATE TRAUMATIC BRAIN INJURY: A PROPENSITY-MATCHED ANALYSIS

Introduction: Traumatic brain injury (TBI) is a major public health concern, and airway management is critical to early care. While physiologic rationale and guidelines support early airway control in severe TBI, the optimal in-hospital timing for endotracheal intubation (ETI) for patients with moderate TBI remains undefined, resulting in practice variation. This study aimed to evaluate the association between time to ETI and in-hospital mortality among adults with moderate TBI.

Methods: We conducted a retrospective cohort study using the ACS Trauma Quality Improvement Program (TQIP) data for 2019–2023. Adult patients with blunt moderate TBI (admission GCS 9–12) who underwent acute in-hospital ETI (defined as ≤2 hours after arrival) were included. Patients with prehospital ETI and prehospital cardiac arrest were excluded. Early ETI was defined as intubation within 30 minutes of hospital arrival, and late ETI as intubation between 30 minutes and 2 hours after hospital arrival. Propensity score matching (1:1 nearest neighbor, caliper 0.2) was used to balance demographics, injury severity, neurologic and physiologic variables, comorbidities, and hospital characteristics. The primary outcome was in-hospital mortality. Secondary outcomes included hospital LOS, ICU LOS, ventilator days, ARDS, and VAP.

Results: Among 19,203 patients included (median age 46 years; 73% male), mortality was 13.0% in the early ETI group vs. 21.4% in the late ETI group (overall mortality 15.2%). Propensity matching yielded 3,669 matched pairs with well-balanced covariates. After matching, early ETI was associated with lower in-hospital mortality compared with late ETI (17.2% vs. 21.0%, $p<0.001$; NNT=27) and 22% lower odds of death (OR 0.78, 95%CI:0.70–0.88). There were no differences in ARDS, VAP, hospital LOS, ICU LOS, or ventilator days.

Conclusion: In this large national cohort of patients with moderate blunt TBI requiring acute airway management, earlier in-hospital intubation was associated with significantly and meaningfully lower mortality without increased pulmonary complications or resource utilization. Additional analyses suggested by these preliminary results include more granular modeling of admission GCS (continuous or subclassified) and subgroup analyses by hypotension, hypoxia, and hospital trauma level. These findings support further prospective evaluation of timing-based airway strategies in moderate TBI.

Session IIIB: Papers 19-28
Paper 27: 4:50 PM - 5:10 PM

LEGAL DRIVERS OF HEALTH: BEDSIDE LEGAL ADVOCACY REDUCES RE-INJURY BUT INCREASES HEALTHCARE UTILIZATION AMONG VIOLENTLY INJURED PATIENTS

Introduction: Medical-legal partnerships (MLPs) embed legal advocates within healthcare teams to address health-harming legal needs that impede recovery from traumatic injury. However, the impact of MLPs on clinical outcomes in trauma remains unknown. We examined associations between a bedside MLP intervention and hospital readmission and re-injury rates among hospitalized patients who sustained violent injury.

Methods: This retrospective cohort study compared intervention (MLP) and standard care groups at an urban Level 1 trauma center (November 2022–November 2024). The intervention group received bedside legal advocacy addressing income support, housing, employment, and public benefits up to 1-year post-discharge as well as our Hospital-Based Violence Intervention Program (HVIP). The standard care group received HVIP alone. Primary outcomes were hospital readmission and re-injury (any occurrence and within 1 year). Adjusted odds ratios were calculated controlling for age, gender, ethnicity, race, and length of stay.

Results: Among 632 patients (362 intervention, 270 comparison), the intervention group was older (mean 38 [SD 12] vs 32 [SD 14] years), more likely to be male (90% vs 82%), with longer hospital stays (median 7 [IQR 3–14] vs 3 [IQR 1–6] days; all $p<0.05$); 85% identified as Black and 71% had firearm injuries. The intervention group had higher readmission odds (aOR 1.56; 95% CI 1.10–2.22; $p=0.014$) but 66% lower re-injury odds (aOR 0.34; 95% CI 0.20–0.56; $p<0.001$), with consistent results at 1 year.

Conclusion: Bedside legal advocacy was associated with 66% lower re-injury odds but increased readmissions, possibly reflecting enhanced healthcare engagement. These findings support integrating legal advocacy into injury care and justify a randomized trial to establish causality.

Session IIIB: Papers 19-28
Paper 28: 5:10 PM - 5:30 PM

AUGMENTING TRAUMA REGISTRY ABSTRACTION WITH ARTIFICIAL INTELLIGENCE: A VALUE-ADDED PROPOSAL

Introduction: Abstracting data for trauma registries is a time and labor-intensive process. Artificial intelligence (AI) may enhance manual chart review by automatically extracting variables, screening out negative cases, and providing more granular detail on positive cases. Brim is an AI platform that assists with chart abstraction from unstructured chart documentation (e.g. clinical notes, imaging reports). We hypothesized that Brim could abstract a complex trauma registry variable with a high degree of sensitivity and cost-effectiveness.

Methods: We evaluated Brim's performance in adult trauma patients admitted to a level 1 trauma center. The variable unplanned return to operating room (RTOR) was selected for evaluation as it is a complex variable that can take significant time to review, and there is usually significant related chart documentation. Positive cases often prompt further review to identify cause and opportunities for improvement. Thus, for positive RTOR cases, we prompted Brim to classify reason for RTOR into hemorrhage, infection, or another cause. Brim results were compared to the gold standard of manual abstraction by trained registrars.

Results: Of 6019 patients, 50 had an unplanned RTOR identified in the trauma registry. Brim identified 45 true positive cases and 140 false positive cases. The sensitivity was 90%, specificity was 97.6%, positive predictive value 24.3%, and negative predictive value was 99.9%. In classification of the reason for RTOR among the 45 true positive cases identified, Brim correctly categorized 2327 hemorrhage cases, 12/13 infection cases, and 5/8 other cause cases. Using Brim, abstraction required 128 minutes and cost $452. In comparison, a registrar abstracting this variable can take 5 minutes per patient requiring 30,095 minutes to complete the same task, costing $15,674.

Conclusion: AI can quickly and economically abstract trauma registry variables from unstructured documents. It can focus process improvement efforts by providing granular detail on complex binary variables in the trauma registry on-demand with little additional cost.

Session IV: Papers 29-34
Paper 29: 7:30 AM - 7:50 AM

A NOVEL OPTIMIZED BLOOD COMPONENT FOR POST HEMORRHAGIC SHOCK RESUSCITATION TRANSFUSION

Introduction: Trauma patients with massive hemorrhage require transfusion during damage control resuscitation (DCR) and post-surgical recovery when volume replacement with oncotic protein may be required to support blood pressure with limited movement of free water into extravascular tissues and hemostasis with reduced thrombotic risk. Trauma patients are susceptible to transfusion-transmitted bacterial infections during repeated exposure to blood products that may retain low burdens of viable bacteria. Pathogen reduction (PR) treatment with Amotosalen-UVA photochemistry of platelet components, plasma (P), cryoprecipitate fibrinogen complex (PRCFC), and plasma cryoprecipitate reduced (PRPCR) are FDA approved to reduce transfusion-transmitted infection risk. PRCFC and PRPCR, manufactured from PR-P, have 5-day post-thaw expiration for ready availability, and retain endothelial-platelet interactions critical to microvascular bleeding in trauma associated hemorrhage and during post-operative recovery.
Methods: The hemostatic function and properties of PR-PC, PR-P, PRCFC, and PRPCR were characterized by coagulation and microfluidic assays to simulate vascular interactions in trauma between platelets, subendothelial collagen, fibrinogen (F), and von Willebrand Factor (VWF).
Results: PRCFC with 5-day post thaw expiration is enriched for F (9.22±2.26 mg/mL), FVIII (2.83±0.80 IU/mL), VWF (6.22±2.33 IU/mL), and FXIII (0.12± 0.02 mg/mL). In contrast, PRPCR is depleted of fibrinogen (1.47±0.15 mg/mL), FVIII (0.15±0.05 IU/mL), and VWF (0.10±0.00 IU/mL); but retains FXIII, and thrombin generation (1156±208 nM·min) due to retention of factors II,V, VII, IX, X, and XI, as well as Proteins C, S, α-2 plasmin inhibitor, ADAMTS13 (1.32±1.8 IU/mL), albumin, and immunoglobulins. In microfluidic assays, PRCFC supports platelet adhesion and aggregation at low shear ($300s^{-1}$) and high shear ($1500s^{-1}$) indicating conserved F and VWF mediated platelet adhesion and thrombus formation. In contrast, PRPCR supports platelet adhesion at low shear due to retention of F; but demonstrates no platelet adhesion or thrombus formation on collagen at high shear (1,500 and $3000s^{-1}$) due to absence of VWF.
Conclusions: PRCFC is optimized for hemostasis during DCR while PRPCR is optimized for volume replacement and hemostasis with reduced thrombotic risk post DCR during the recovery phase.

Session IV: Papers 29-34
Paper 30: 7:50 AM - 8:10 AM

EARLY BUT NOT LATE TRANEXAMIC ACID PROTECTS THE MICROCIRCULATION IN SHOCK: A MICROFLUIDIC STUDY

Introduction: Tranexamic acid (TXA) administration has been shown to reduce trauma-hemorrhage mortality when given early post injury. The optimum window for administration appears to be ≤ 1-hour post injury. Later administration (> 3-hours) has been associated with worse outcomes. TXA administration has beneficial effects outside of its antifibrinolytic activity. Trauma-hemorrhagic shock (T/HS) is associated with an early hypocoagulable state followed by a hypercoagulable profile. T/HS is associated with derangement of the endothelial glycocalyx (EG) layer and endothelial dysfunction. The temporal effects of TXA on the microcirculation are uncertain. We postulated that "late" administration of TXA would be ineffective on protection of the microvasculature. We have shown that "early" TXA administration was protective of the microvasculature in a microfluidic perfusion model. The possibility that "late" TXA administration (> 3-hours) may have adverse effects was evaluated in the current study using a microfluidic vascular perfusion model *in vitro*.

Methods: Human umbilical vein endothelial cell (HUVEC) monolayers were established in microfluidic flow channels under physiologic or pathophysiologic conditions (1% O_2 and epinephrine). TXA at a clinically relevant concentration (150μM) was added at 1hr.and 6hr. time periods. Whole blood labelled with AF546-fibrinogen (diluted 2:1) was then added to the perfusion device. Tissue plasminogen activator (tPA) and plasminogen activator inhibitor (PAI-1) assays were performed. Glycocalyx shedding of the EG layer was indexed by measuring syndecan-1 (Syn-1) in the perfusate. EG thickness was achieved by XYZ stacks of the endothelial layer and fibrin deposition on the endothelial cell layer was indexed by fluorescent assay. Endothelial permeability was assessed by measuring the fluorescence intensity of the interaction of biotinylated fibronectin (used as a matrix for HUVEC monolayers) and FITC-avidin.

Conclusions: "Early" TXA protected the microcirculation from HR/epi insult, glycocalyx degradation/shedding, changes in the ratio of tPA/PAI-1 activities and fibrin deposition on the endothelial cells. TXA administration at 6 hours reduced tPA activity to control values but was associated with increased PAI-1 activity indicating a prothrombotic state. This was associated with increased fibrin deposition in both 6-hour groups; highest in the experimental group containing TXA. Urokinase concentrations were increased in all experimental groups and highest at 6-hours ± TXA. A similar effect with fibrin deposition was noted and was significantly increased with TXA treatment at 6-hours.

	Glycocalyx thickness (nm)	Syn-1 (ng/ml)	tPA activity (pg/ml)	PAI-1 activity (pg/ml)	Fibrin deposition (% area coverage)
HUVEC control	431.3 ± 8.8	25.5 ± 3.6	16 ± 1.1	2650 ± 150	10 ± 1.6
HR + epi (1hr.)	188.1 ± 7.2*	90.8 ± 6.8*	451 ± 20*	208 ± 18*	43 ± 2.8*
HR + epi + TXA (1hr.)	182.4 ± 6.5*	23.8 ± 4.2*#	22 ± 1.4*#	2570 ± 125#	13 ± 1.1*#
HR + epi (6hr.)	167.6 ± 6.1*#	94.5 ± 5.4$	235 ± 18*$	536 ± 20*#$	53 ± 3.3*#$
HR + epi + TXA (6hr.)	171.5 ± 5.5*#$	87.4 ± 7.4*$	10 ± 1.1*#&$	2600 ± 130#&	71 ± 3.9*#&$

Results: Mean ± SD, N = 4 for each group*$p<0.05$ vs. control, #$p<0.05$ vs. HR + epi (1hr.), &$p<0.05$ vs. HR + epi (6hr.), $$p<0.05$ vs. HR + epi + TXA (1hr.)
Endothelial permeability was increased in all experimental groups except with 1hr. post HR + epi + TXA treatment ($p<0.05$).

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Paper 31: 8:10 AM - 8:30 AM

DEFYING EXPIRATION: EVALUATING THE COAGULATION POTENTIAL OF HUMAN PLASMA RESCUED FROM EXPIRED WHOLE BLOOD

Introduction: Whole blood programs for trauma resuscitation may be limited by concerns about the relatively short (21 day) storage period for human whole blood stored in citrate phosphate dextrose (CPD). We hypothesized that plasma rescued from expired whole blood would maintain coagulation potential during subsequent storage.

Methods: After IRB approval, aliquots of donated human whole blood units stored in CPD were centrifuged on Day 1 to produce standard fresh frozen plasma (FFP) or liquid plasma (LP). At day 21, previously stored whole blood units were used to create rescued FFP or rescued LP, which was then stored for an additional 21 days. Thrombin generation was measured by calibrated automatic thrombinoscope (CAT), thromboelastometry (ROTEM) assessed coagulation potential, microvesicles quantified by flow cytometry, and coagulation factors measured by ELISA.

Results: At 21 days of storage, rescued plasma demonstrated thrombin generation similar to standard FFP and LP. ROTEM demonstrated no difference in coagulation potential. However, after an additional 21 days of storage, rescued FFP and LP demonstrated greater thrombin generation as evidenced by higher peak thrombin production compared to standard 21-day storage [(FFP 250.1±13.7 nm vs 76.6±16.1 nm; $p<0.05$) and (LP 186.4±35.6 nm vs 64.9±83.6 nm; $p<0.05$)]. Both rescued FFP and LP contained higher concentrations of platelet-derived microvesicles compared to standard storage plasma. Rescued LP contained higher levels of tissue factor bearing microvesicles and lower Factor IX and Protein S levels compared to standard LP.

Conclusion: Our data demonstrate enhanced coagulability aspects of plasma rescued from expired whole blood. Plasma rescued from expiring whole blood may represent a strategy to extend blood product usage and correct coagulopathy.

Session IV: Papers 29-34
Paper 32: 8:30 AM - 8:50 AM

RESUSCITATION USING FRESH FROZEN PLASMA IMPROVES NEUROCOGNITIVE OUTCOMES IN A NON-TBI MOUSE MODEL OF POLYTRAUMA AND HEMORRHAGIC SHOCK

Introduction: Cognitive dysfunction is a common consequence of traumatic injury that can have lasting impact on quality of life. Even without direct traumatic brain injury (TBI), trauma-related hemorrhagic shock can impair cerebral autoregulation, causing malperfusion, inflammation, and neuronal injury — particularly within hippocampal regions that are vital to memory and behavior. Emerging evidence suggests that disruption of the endothelial glycocalyx (eGC)—a key regulator of vascular permeability and inflammation—contributes to trauma-induced endotheliopathy and may be linked to secondary neurologic injury. Although modern resuscitation strategies favor early administration of fresh frozen plasma (FFP) and blood products over crystalloid solutions, the impact of resuscitation fluids on post-injury cognition and underlying eGC-dependent mechanisms in polytrauma-hemorrhagic shock (PT/HS) remains poorly defined. Our prior work demonstrated that FFP resuscitation preserves eGC expression and reduces multi-organ vascular leak early after injury in a non-TBI murine model of PT/HS. The current study extends these findings by evaluating cognitive outcomes in this model and determining whether resuscitation with FFP protects against cognitive decline compared to lactated Ringer's (LR).

Methods: Male C57BL/6 mice were randomly assigned to sham procedure or PT/HS followed by resuscitation with either LR or FFP. PT/HS mice were anesthetized and received a laparotomy followed by bilateral femoral artery cannulation for mean arterial pressure (MAP) monitoring. Blood was removed to maintain a MAP of 25-30 mmHg for 60 min followed by resuscitation with LR or FFP for 20 min. After decannulation, mice received bilateral pseudofractures induced by injections of bone homogenate from a littermate, followed by muscle crush injuries to the lower extremities. Sham mice received anesthetization, laparotomy, and bilateral femoral artery cutdown without cannulation, hemorrhage or other injuries. Four days post-surgery, mice underwent open field testing (OFT) to assess anxiety behavior and locomotive function. Fear conditioning (FC) was conducted on days 7 and 8 to assess learning and memory. On day 7, mice were exposed to three pairings of a sound cue followed by foot shock. On day 8, freezing behavior was recorded during re-exposure to the context and in response to the sound cue, without foot shock. Mice were then sacrificed and brains were harvested for immunohistology to assess accumulation of the eGC fragments, hyaluronan and heparan sulfate.

Results: OFT revealed no significant differences between treatment groups, indicating that anxiety behaviors were unaffected and that locomotion was fully restored to sham levels in both resuscitation groups by post-injury day 4. In contrast, FC showed that mice resuscitated with FFP had significantly increased percentage of total time in the context spent frozen on day 8 compared to mice resuscitated with LR (49.9% vs, 29.3%, $p<0.05$), suggesting improved hippocampal-dependent memory in the FFP group. Freezing times in response to the sound cue did not differ between sham or PT/HS groups. Preliminary data show that mice resuscitated with LR have increased hyaluronan and heparan sulfate deposition within the hippocampus, which was not seen in sham or PT/HS-FFP mice.

Conclusions: Resuscitation with FFP significantly improved contextual fear memory after PT/HS compared to LR. Based on prior work, this neuroprotection may be associated with the ability of FFP to preserve the vascular endothelium and attenuate eGC breakdown that, in turn, mitigates accumulation of bioactive eGC fragments within the hippocampus. Future research will elucidate the neuroprotective mechanisms of FFP, focusing on its potential to preserve blood-brain barrier integrity and stabilize the eGC — both of which are inherently linked to cognitive outcomes.

Session IV: Papers 29-34
Paper 33: 8:50 AM - 9:10 AM

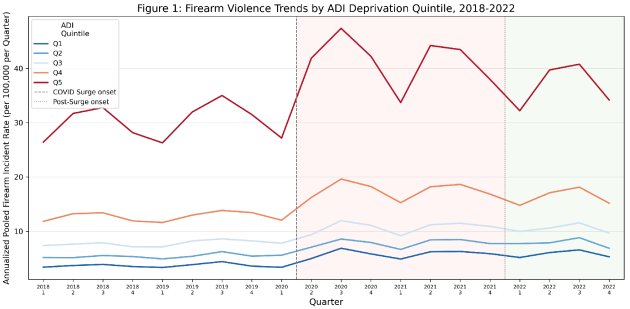
PREPARING FOR THE NEXT CRISIS: LESSONS FROM COVID-19 ON THE DYNAMICS OF US FIREARM VIOLENCE

Introduction: US firearm violence increased during COVID-19, yet its distribution across neighborhoods remains poorly understood. We used the pandemic as a natural experiment to characterize firearm injury risk under acute stress.

Methods: Shooting incident data from the Gun Violence Archive (2018-2022) across 233,423 US census block groups were analyzed using an ecological interrupted time series design. Firearm violence was compared pre-, during, and post-COVID surge by neighborhood deprivation (2020 Area Deprivation Index quintiles; Q1 least to Q5 most deprived). Negative binomial regression with deprivation-by-phase interactions and population offsets estimated shooting incidents per 100,000 population within census block groups. Pooled rates were calculated by quintile, with a subanalysis using 2020 Census urban-rural designations.

Results: At baseline, shooting rates were higher in more deprived block groups (IRR 12.34, 95% CI 11.71–13.02, p<.001; Figure 1). During the COVID surge, US firearm violence increased in every deprivation quintile and 49% overall (IRR 1.49, 95% CI 1.43-1.56, p<.001). In absolute terms, shooting incidents increased most in Q5 (30.1 to 41.6 per 100,000 population), however, Q1 had the largest proportional increase (60% vs 38% in Q5). 23,381 block groups experienced firearm violence for the first time during COVID-19; Q1-Q3 accounted for 52% of these new locations. In 2022, firearm violence remained elevated from baseline: Q1 had the least proportional recovery (58% vs 22% in Q5) though Q5 still had the most shootings. Urban block group shootings rose 54% (p<.001) while rural/suburban block groups had no significant increase.

Conclusion: COVID-19 both intensified and geographically broadened firearm violence, extending into previously unaffected, lower-deprivation urban neighborhoods. Recovery was also inequitable. These findings highlight the need for place-based prevention strategies to mitigate violence during future societal stressors.



Session IV: Papers 29-34
Paper 34: 9:10 AM - 9:30 AM

INFANT AND TODDLER TRAUMA PATIENTS HAVE SIMILAR RISK OF COMPLICATIONS AND MORTALITY AT PEDIATRIC-ONLY VERSUS COMBINED PEDIATRIC-ADULT TRAUMA CENTERS

Introduction: Previous research has demonstrated that pediatric-only hospitals (POHs) and combined pediatric-adult trauma centers (CPACs) have comparable outcomes in generalized pediatric trauma populations. However, infants and toddlers have distinct physiology and injury patterns that may be infrequently seen at CPACs, and outcomes in this age group remain poorly characterized. This study aimed to compare pediatric trauma patients (PTPs) ≤2 years old treated at POHs versus CPACs, hypothesizing similar mortality and in-hospital complications between hospital types.
Methods: The 2017-2023 TQIP database was queried for all PTPs ≤2 years old. Patients were grouped by treatment at POHs or CPACs. Hypotension was defined as systolic blood pressure <70 mmHg, tachycardia as heart rate >190 beats per minute (bpm) for PTPs <1 year-old and >140 bpm for PTPs 1–2 years-old, and tachypnea as respiratory rate >40 breaths per minute. Bivariate analyses and multivariable logistic regression controlling for age, Injury Severity Score (ISS), and vitals on arrival were performed.
Results: Of 39,373 PTPs ≤2 years-old, 26,412 (67.1%) were treated at POHs and 12,961 (32.9%) at CPACs. Demographics, median ISS (4), and rates of emergent operation were similar between cohorts (all $p>0.05$). Patients treated at CPACs more often presented with hypotension (0.9% vs 0.6%, $p=0.002$), tachycardia (32.9% vs 27.9%, $p<0.001$), and received blood transfusions within 4 hours of arrival (1.7% vs 1.1%, $p=0.002$). The CPAC cohort had an increased complication rate (1.3% vs 1.0%, $p=0.03$); however, this difference was not significant after multivariable analysis (OR 0.87, CI 0.71-1.08, $p=0.21$). The rate (1.3% vs 1.6%, $p=0.07$) and independent associated risk of mortality were also similar between groups (OR 1.08, CI 0.86-1.37, $p=0.51$).
Conclusion: This 7-year national analysis demonstrated that in PTPs ≤2 years old, the associated risk of in-hospital mortality and complications were similar between POHs and CPACs. These findings reinforce that trauma verification and designation processes are maintaining high standards of care across both institution types, even among infant and toddler trauma patients.

Session X: Papers 35-41
Paper 35: 7:30 AM - 7:50 AM

INTRAOPERATIVE THERMOGRAPHY PREDICTS SURGICAL SITE INFECTION AND ENABLES EARLY DETECTION IN EMERGENCY GENERAL SURGERY

Introduction: Surgical site infections (SSI) complicate 10-25% of emergency general surgery (EGS) cases. Although peri-incisional temperature gradients reflect local perfusion, thermal-based studies have not been assessed for intraop SSI risk stratification. We hypothesized that infrared thermography at incision-closure would predict 30-day SSI, and that serial postop thermal imaging would identify SSI earlier than standard care.

Methods: 151 adults undergoing open EGS procedures (≥5cm incision length) were enrolled prospectively. Thermal incisional images were acquired at a standardized distance (30-40cm) and angle (90°) at pre-incision closure, post-closure, and daily until hospital discharge. Calibrated temperatures were extracted from peri-incisional zones (near: 0–0.5cm and far: 1–2cm from incision edge). The primary metric was the peri-incisional temperature gradient (PITG, Dnear-far), normalized for ambient and core temperature; a priori hypothermia was defined as negative PITG (<0°C; physiologic null). A 1:2 matched case-control analysis compared all SSI cases (adjudicated within 30 days using CDC/NHSN criteria) to controls using paired nonparametric tests. Matching was based on antibiotic prophylaxis received, procedure, diabetes, smoking, immunosuppression, and ASA score. Discrimination was assessed by area under the curve [AUC]), and sensitivity and specificity were calculated.

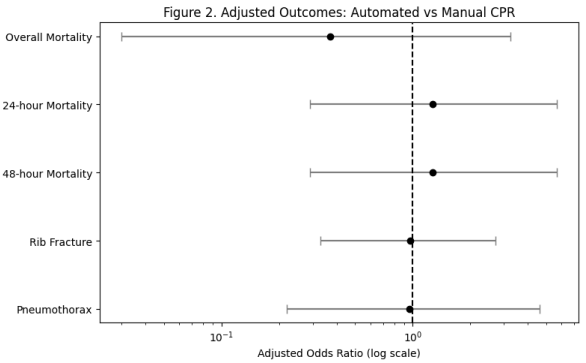
Results: 18/151 patients (12% incidence) who developed SSI (15 superficial, 3 organ-space) were matched to 36 controls (standardized mean differences <0.10). Pre-closure PITG was significantly lower in SSI vs. controls (median −0.70°C [IQR −1.01 to −0.17] vs. +0.41°C [IQR −0.38 to +1.01]; p<0.001; AUC 0.81 [95% CI 0.69–0.91]); at PITG <0°C, sensitivity 83% and specificity 64%. A thermal spike (postop rise in PITG >0.5°C) was 100% specific for SSI with spikes occurring 3.1±0.5 days before clinical SSI diagnosis. Most controls maintained PITG ≥0°C through discharge (31/36; p<0.001). Focal cold spots (any incision segment ≥1°C below the incision mean) was more frequent in SSI patients (72% vs. 17%; p<0.001).

Conclusion: Closure peri-incisional hypothermia was associated with subsequent SSI in EGS patients. Serial thermography signaled SSI days earlier than clinical diagnosis. Portable thermography may provide a practical, real-time, low-cost tool for intraoperative risk stratification and early postoperative SSI detection.

Session X: Papers 35-41
Paper 36: 7:50 AM - 8:10 AM

MANUAL VERSUS AUTOMATED CHEST COMPRESSIONS IN TRAUMATIC CARDIAC ARREST: A NATIONAL PREHOSPITAL ANALYSIS

Introduction: Traumatic cardiac arrest remains a high-mortality condition, and the role of automated chest compression (AC) devices in this setting remains controversial. We sought to compare outcomes between automated and manual compressions (MC) using a national prehospital dataset, accounting for injury severity, mechanism, and prehospital confounders.
Methods: We performed a retrospective analysis of the Linking Investigations in Trauma and Emergency Services (LITES) database, including patients ≥15 years who received prehospital CPR with documented use of AC or MC. Primary outcome was overall mortality. Secondary outcomes included 24 and 48 hour mortality, rib fractures, pneumothorax, and discharge disposition. Multivariable regression and inverse probability-weighted propensity analyses adjusted for age, sex, injury mechanism, Injury Severity Score (ISS), and prehospital time intervals. Prespecified subgroup analyses examined blunt vs penetrating trauma, short vs prolonged prehospital times, and urban vs rural EMS systems. Sensitivity analyses excluded extreme transport times and evaluated alternative exposure definitions and early survival outcomes.
Results: Among 77,575 patients, 171 were included (MC = 76; AC = 95). AC use was more common among White and non-Hispanic patients and was associated with higher ISS and longer prehospital times. After adjustment and propensity weighting, there were no significant differences between AC and MC in overall mortality, 24- or 48-hour survival, rib fractures, pneumothorax, or discharge disposition. Findings were consistent across subgroup and sensitivity analyses.
Conclusion: In this national cohort, AC were not associated with increased mortality or injury compared with MC, despite longer prehospital times and higher injury severity. These findings support the safety and feasibility of AC as an adjunct in traumatic cardiac arrest and highlight the need for prospective studies to define optimal patient selection.



Session X: Papers 35-41
Paper 37: 8:10 AM - 8:30 AM

A SECONDARY ANALYSIS OF THE IMPACT OF TIME TO SURGERY ON MORTALITY IN NON-COMPRESSIBLE TORSO HEMORRHAGE: AN AAST TIME TO SURGERY MULTICENTER STUDY

Introduction: Non-compressible torso hemorrhage (NCTH) remains a leading cause of traumatic death. Although rapid time to hemorrhage control intervention is emphasized, the effects of in-hospital timeline remain uncertain. We hypothesize that shorter time from hospital arrival to operating room (OR) start would increase survival.
Methods: Hypotensive patients age ≥15 years with NCTH were collected prospectively from 27 trauma centers from 5/2018-12/2024. Hypotension was defined as initial systolic blood pressure of ≤ 90 mmHg in the field. Survivors were compared to non-survivors with primary outcomes of time to surgery and mortality. Multivariable logistic regression analyses were performed to identify risk factors associated with mortality.
Results: Over the 6.5-year study period, 803 patients were hypotensive with NCTH, of which 132 (16.4%) died. The non-survivor group had a higher mean age (46.7 vs. 37.3 years, $p<0.001$), higher new injury severity score (NISS) (40.7 vs. 28.0, $p<0.001$), and higher rate of blunt injury (65.2% vs. 48.7%, $p=0.002$) compared to the survivor group. There was no difference in median prehospital time (33 vs. 31 minutes, $p=0.69$) or median emergency department (ED) to OR time (50 vs. 59 minutes, $p=0.07$). Blunt injury non-survivors moved faster through every time point from the ED to OR end (136 vs. 180 min, $p<0.001$). Penetrating non-survivors had shorter ED time to OR (33.5 vs. 41 min, $p<0.001$), but similar total time to OR end (144 vs. 153, $p=0.09$). In a multivariable logistic regression model for all patients, increased age (Odds Ratio (OdR) 0.96, $p<0.001$), shock index (OdR 0.34, $p<0.001$), and NISS (OdR 0.95, $p<0.001$) were associated with decreased odds of survival, while shorter time from ED time to OR (1.00, $p=0.51$) was not associated with increased survival.
Conclusion: For NCTH patients the median time from ED presentation to OR was 57 minutes. Altered physiology and greater injury severity were associated with decreased odds of survival, while shorter time to surgical hemorrhage control was not associated with increased survival. Precision prehospital interventions should target early physiologic correction as expedited in-hospital time to intervention is not sufficient to improve survival from NCTH in both blunt and penetrating patients.

Session X: Papers 35-41
Paper 38: 8:30 AM - 8:50 AM

THE NIGHT AND WEEKEND EFFECT IN TRAUMA: PATIENTS WHO LOOK WELL ARE MOST AT RISK

Introduction: The "night and weekend effect" describes increased mortality during off-hours admission. We evaluated this effect in trauma patients and identified vulnerable subgroups using multiple physiological stability indicators in a middle-high-income country.
Methods: Retrospective cohort study at two high complexity hospitals(2012-2022. Patients were classified by admission timing: Weekday/Daytime (reference), Weekday/Nighttime, Weekend-Holiday/Daytime, and Weekend-Holiday/Nighttime. Primary outcome was in-hospital mortality. Multivariable logistic regression adjusted for age, hospital, ISS, mechanism, and systolic blood pressure. Effect modification was assessed by stratifying across four stability indicators: GCS (≥13 vs <13), SBP (≥90 vs <90 mmHg), HR (<120 vs ≥120 bpm), and ISS (<16 vs ≥16).
Results: Among 20,369 patients, overall mortality was 9.0%. After adjustment, nighttime admission increased mortality: mortality by 40%: Weekday/Nighttime aOR 1.40 (95%CI 1.19-1.65) and Weekend-Holiday/Nighttime aOR 1.41 (95%CI 1.18-1.67), both p<0.001. Stratified analysis revealed the effect was statistically robust among physiologically stable patients: GCS≥13 nighttime aOR 1.64 (95%CI 1.22-2.20, p=0.001); SBP≥90 nighttime aOR 1.45 (95%CI 1.20-1.74, p<0.001); HR<120 nighttime aOR 1.42 (95%CI 1.18-1.70, p<0.001); ISS<16 nighttime aOR 1.95 (95%CI 1.43-2.68, p<0.001). Conversely, patients with physiological derangement (low GCS, hypotension, tachycardia, high ISS) showed NO significant off-hours effect across all indicators, point estimates were closer to null with wider confidence intervals, though smaller sample sizes in these subgroups limited statistical power to detect effects
Conclusion: The night and weekend effect was statistically detectable and most pronounced among patients with normal physiological parameters. Patients who "look well" may be particularly vulnerable to off-hours care variations, likely receiving lower priority during off-hours despite harboring occult injuries requiring timely intervention.

Session X: Papers 35-41

Paper 39: 8:50 AM - 9:10 AM

EVALUATING CLINICAL OUTCOMES OF REGIONAL VERSUS GENERAL ANESTHESIA FOR ISOLATED HIP FRACTURES IN GERIATRIC TRAUMA PATIENTS

Introduction: The optimal anesthetic choice for operative management of geriatric hip fractures between regional and general anesthesia remains heavily debated. This study aims to evaluate perioperative outcomes associated with anesthesia type in geriatric patients undergoing surgery for isolated hip fractures.

Methods: This retrospective cohort study was conducted to evaluate geriatric trauma patients (≥65 years) with isolated, blunt, moderate to severe (ISS≥9) hip fractures utilizing the ACS-TQIP database from 2017 to 2023. Patients were grouped by anesthetic technique: regional or general anesthesia. The primary outcome was in-hospital mortality. Secondary outcomes included regional anesthesia failure rate, complication rates, hospital length of stay (LOS), and ventilator-free days (VFDs).

Results: Among geriatric trauma patients with moderate-severe hip fractures, regional anesthesia was associated with a 60% reduction of in-hospital mortality (aOR: 0.391, 95% CI: 0.094-1.621, p = 0.196, SE: 0.725) and an increase of 4 additional VFDs (β = 4.307, 95% CI: -2.665-11.278, p = 0.223, SE: 3.505), though these values did not reach statistical significance. Importantly, regional anesthesia was not associated with increases in complication rates, including DVT, PE, and stroke. Lastly, regional anesthesia demonstrated a regional failure rate of 0.96%, a delirium rate of 0%, and no differences in hospital LOS or VFDs.

Conclusion: Regional anesthesia was associated with perioperative outcomes comparable to those of general anesthesia, and a trend toward lower in-hospital mortality was observed. These findings highlight that regional anesthesia is a safe option, highlighting the importance of anesthesia selection in optimizing outcomes in geriatric trauma patients with isolated hip fractures.

Session X: Papers 35-41
Paper 40: 9:10 AM - 9:30 AM

THE PROOF IS IN THE PUDDING: THE VALUE OF THE AAST ACUTE CARE SURGERY FELLOWSHIP AS DESCRIBED BY FELLOWSHIP GRADUATES

Introduction: The AAST Acute Care Surgery (ACS) fellowship prepares surgeons for practice in all aspects of trauma and emergency general surgery; however, applicant characteristics, motivations, and perceived post-training outcomes have not been well described. We sought to characterize individuals who pursue ACS training, factors influencing this decision, and reported early career outcomes.
Methods: We performed a retrospective cross-sectional analysis of the AAST graduate survey administered to ACS fellows completing training from 2015-2023. Surveys were distributed within 1-2 years of fellowship completion and assessed demographics, residency experience, motivations for fellowship, current practice, and perceived training outcomes. Results were summarized using descriptive statistics.
Results: Of 469 eligible graduates, 293 (62%) responded. Most respondents were aged 30–35 years (58%), and 45% were female. The decision to pursue an ACS fellowship was most commonly made during PGY-4/5 of residency (42%). Respondents were asked to rank 12 factors influencing their decision to pursue fellowship (1 = most important). The highest-ranked factors were case diversity (mean rank 4.06), case complexity (5.06), ACS exposure (5.03), and mentorship (5.16). After fellowship, 93% reported practicing ACS, primarily in urban (79%), university-affiliated (45%), and level I trauma centers (69%). Most reported that fellowship prepared them for independent practice (93%) and academic roles (79%), increased marketability (90%) and self-confidence (91%), and was worth the time investment (89%). Confidence improved in clinical decision-making (91%), teaching (78%), leadership (82%), administrative skills (66%), research (56%), and time management (67%). Most respondents (82.9%) reported that they would recommend ACS fellowship training to others.
Conclusion: These findings demonstrate that ACS fellowship training provides preparation not only for clinical practice but also for academic, leadership, and administrative roles. Graduates report meaningful improvements in confidence in clinical decision-making, teaching, research, and leadership, among other professional domains. This national characterization highlights the fellowship's role in developing a versatile ACS workforce.

Session X: Papers 35-41
Paper 41: 9:30 AM - 9:50 AM

THE AAST EARLY-CAREER ACADEMIC PIPELINE: SCHOLARLY OUTPUT AMONG ASSOCIATE MEMBER FACULTY AND ALIGNMENT WITH AAST RESEARCH PRIORITIES

Introduction: The AAST recently established research priorities to advance acute care surgery. However, the concentration of scholarly output within its early-career workforce and its alignment with these priorities remain unknown. We sought to quantify productivity concentration among AAST associate member faculty and assess alignment with society-defined priorities.

Methods: We conducted a cross-sectional analysis of AAST associate member faculty within seven years of fellowship completion. Outcomes included PubMed-indexed publication count, H-index, and alignment with AAST research priorities (determined by structured review of publications using predefined priority domains). Productivity concentration was quantified using the Gini coefficient. Associations between fellowship duration (1- vs 2-year) and post-fellowship publication counts were evaluated using negative binomial regression with log(years since fellowship completion) as an offset, adjusting for pre-fellowship publication count and advanced degrees.

Results: Among 471 faculty, median[IQR] publication count and H-index were 8[3-21] and 4[2-8], respectively; 23% had fewer than two publications. Scholarly output was highly concentrated (Gini=0.60), with the top decile of faculty producing 43% of all publications. Faculty productivity trajectories demonstrated substantial heterogeneity (Figure). Fewer than one-third (31%) of publications aligned with an AAST research priority. Completion of a 2-year fellowship was not associated with the number of post-fellowship publications (IRR [95%CI]: 1.0 [0.8-1.3]).

Conclusion: Early-career scholarly output within the AAST is highly concentrated and only partially aligned with organizational research priorities. Strategic refinement and expansion of existing mentorship and research support programs may help broaden participation in scholarly productivity while supporting engagement with AAST research priorities.

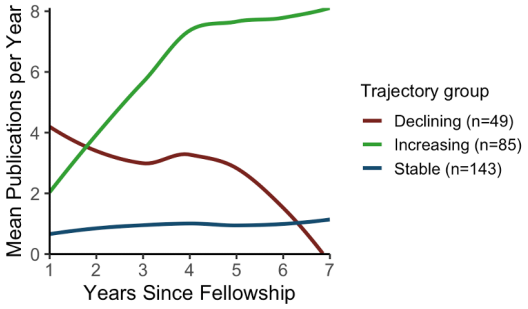


Figure. LOESS-smoothed mean annual publication trajectories among AAST associate member faculty with≥3 years of post-fellowship publication track record. Groups were defined by the slope of individual linear regression of annual publication counts on post-fellowship year (publications/year): increasing (>0.30), declining (<-0.30), and stable (-0.30 to 0.30)

Session XIIIA: Papers 42-50
Paper 42: 1:45 PM - 2:05 PM

IS MORE TOO MUCH? SINGLE VERSUS COMBINATION ANTIBIOTIC PROPHYLAXIS IN LOW-GRADE COLON INJURIES

Introduction: There are no guidelines focused on the use of single versus combination perioperative antibiotic therapy for non-destructive colon injuries. We sought to compare the rates of post-operative infectious complications in patients presenting with AAST grade I and II colon injuries who were managed with single versus combination therapy. We hypothesized that patients receiving a single agent will have similar surgical site infection rates to those receiving combination therapy.
Methods: This was a sub-analysis of a retrospective, multicenter trial of patients presenting with AAST grades I and II colon injuries. Patients were dichotomized into two groups: those who were given a single antibiotic agent pre-operatively and those who were managed with combination therapy. Antibiotic selection was at the discretion of the treatment team. The primary outcome was the rate of organ space infection (OSI). Secondary outcomes included length of stay (LOS) data and 30-day mortality. Multivariate logistic regression was performed to assess if perioperative antibiotic therapy was an independent predictor of OSI.
Results: A total of 1,902 patients met inclusion criteria. Most were young (32 [22-42]), male (79%), and presented after penetrating trauma (58%). 977 patients presented with a AAST grade I injury and 877 presented with a grade II injury. 1,382 (73%) of patients received a single antibiotic agent for prophylaxis and 520 (27%) were treated with combination therapy. On multivariate analysis, combination therapy was associated with a significantly lower odds of OSI compared to single-agent therapy (OR 0.38, 95% CI 0.21-0.66, $p<0.001$). Penetrating mechanism, increased AIS, degree of fecal contamination, and resection with anastomosis were all associated with higher odds of OSI.
Conclusion: Combination antibiotic therapy was associated with a 60% reduction in the rate of organ space infection following low-grade colon injury. This finding supports the use of combination antibiotic prophylaxis in this population.

Session XIIIA: Papers 42-50
Paper 43: 2:05 PM - 2:25 PM

COMPARING MIS VS OPEN REPAIR OF PERFORATED PEPTIC ULCER DISEASE: A 69-CENTER PROPENSITY-MATCHED EVALUATION OF 664 PATIENTS

Introduction: Perforated Peptic Ulcer Disease (PUD) is a high-morbidity Emergency General Surgery (EGS) diagnosis. The benefits of minimally invasive (MIS) vs. open repair have been demonstrated in RCT's but real-world use is less well understood.

Methods: All PUD cases from the ACS NSQIP EGS Targeted Module (July 2022-December 2024) were included. A 2:1 propensity-matched cohort was derived, comparing MIS to open surgery, adjusting for age, sex, ASA class, BMI, AAST disease severity grade, presence of preoperative sepsis, hypoalbuminemia, smoking status, ascites, and diabetes. Univariate regression within the matched cohort compared MIS to open surgery for 12 clinical outcomes.

Results: After propensity matching 671 patients from 69 hospitals remained, 405 open, and 266 MIS. All covariates achieved standardized mean differences below 0.1, the commonly accepted threshold for excellent balance. Complications among the open group were common, with nearly 50% admitted to intensive care, 30% experiencing postop sepsis, and a 9% mortality rate. MIS approach was associated with significantly lower morbidity, mortality, renal complications, prolonged ventilation, and ICU admission. There were no differences in operative time or reoperation **(Table 1)**.

Conclusion: In this multicenter analysis, MIS surgery for perforated PUD demonstrated superior post-operative outcomes, and no meaningful change in operative time, return to OR, or readmissions. This analysis demonstrates the clinical benefits of MIS techniques in the management of perforated PUD and highlights the need for additional uptake in EGS care.

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Outcome	Open (n=405)	Lap (n=259)	Odds/Risk/Rate Ratio	p-value
Renal complication	35 (8.6%)	9 (3.5%)	0.38 (0.18, 0.81)	0.01
Mortality	38 (9.4%)	10 (3.9%)	0.39 (0.19, 0.80)	0.01
Prolonged Ventilation	42 (10.4%)	12 (4.6%)	0.41 (0.20. 0.87)	0.02
ICU admission	181 (44.7%)	67 (25.9%)	0.43 (0.30, 0.61)	<0.01
Major complication	97 (24.0%)	44 (17.0%)	0.64 (0.43, 0.96)	0.03
Cardiac complication	16 (4.0%)	7 (2.7%)	0.67 (0.27, 1.68)	0.40
Return to OR	32 (7.9%)	15 (5.8%)	0.71 (0.38, 1.34)	0.29
Pneumonia	33 (8.1%)	18 (6.9%)	0.85 (0.45, 1.59)	0.60
Sepsis	136 (33.6%)	84 (32.4%)	0.94 (0.67, 1.31)	0.70
Operative time (min)	100.9	98.8	0.98 (0.90, 1.07)	0.65
Length of stay (days)	7.5	8.0	1.05 (0.98, 1.13)	0.20
Readmission	36 (8.9%)	24 (9.3%)	1.06 (0.63, 1.76)	0.83

Table 1 - Complication rates in open and MIS groups, with associated regression outputs

Session XIIIA: Papers 42-50
Paper 44: 2:25 PM - 2:45 PM

RESUSCITATING INNOVATION: THE ACUTE CARE SURGERY (ACS) INFLECTION POINT

Introduction: A 2023 Nature study showed scientific innovation quantified by the CD5 disruption index (CD5-DI; positive=paradigm-shifting; negative=consolidating) has decreased since 1945, but surgery subspecialty trends are unknown.
Methods: Using SciSciNet (1985-2020), we analyzed 2.35M papers from 337 surgery journals and 11 subspecialties: CT, Colorectal, ENT, GenSurg, Neuro, Ortho, Plastics, SurgOnc, Transplant, Trauma/ACS, and Vascular. 5 year CD5-DI trends were assessed. To test whether the 2005 ACS definition in J Trauma was an inflection, we performed structural break and interrupted time series analyses. SurgOnc served as control (parallel pre-trend, $p=0.29$). 2003 (conceptualization) and 2008 (fellowships) were tested as other time points.
Results: All 11 subspecialties showed disruption decline; 10 crossed into consolidation by 2009. Trauma was unique, crossing last (2019) and returning to positive disruption by 2020. CD5-DI rankings in 2020 were: Trauma (disruptive), GenSurg, SurgOnc, Transplant, Colorectal, Vascular, CT, Plastics, Neuro, Ortho, and ENT (consolidating). Trauma CD5-DI was 8-fold higher and its decline 3-fold slower than ENT (both $p<0.01$). 2005 (ACS formalization) was significant for Trauma ($F=24.8$, $p<0.0001$) but not SurgOnc ($p=0.17$). Trauma's pre-2005 decline (-0.73×10^{-4}/year) became flat post-2005. Sensitivity analysis confirmed 2005 as the break timepoint.
Conclusion: Most surgical subspecialties build on existing knowledge; Trauma continues with disruptive innovation. 2005 was an inflection point. Our findings suggest that creating a distinct ACS identity with core competencies and dedicated training pathways sustains innovation and carries lessons for emerging subspecialties seeking to maintain scientific vitality.

Session XIIIA: Papers 42-50
Paper 45: 2:45 PM - 3:05 PM

BEYOND AGGREGATE ESTIMATES: DEMOGRAPHIC STRATIFICATION IMPROVES ACCURACY FOR PREDICTING TRAUMA SYSTEM RESOURCE UTILIZATION

Introduction: Trauma system planning often relies on aggregate per-admission estimates of healthcare utilization that do not account for demographic variation in injury patterns and resource needs. We hypothesized that utilization estimates stratified by age, sex, and payer can predict resource demand more accurately than non-stratified estimates, particularly as the US population continues to age.

Methods: Using TQIP data from 2022-2024, we classified admissions at 394 continuously participating Level I/II centers into 180 demographic strata (18 age groups × 2 sexes × 5 payers). Per-admission utilization coefficients were derived from 2022–2023 (n=1,477,893) for 6 metrics: bed days, ventilator days, blood products, hemorrhage control operations, chest/abdomen operations, and neurosurgical operations. Stratified and non-stratified coefficients were then applied to 2024 admissions (n=779,791). To assess performance across age distributions relevant to trauma system planning, we calculated the absolute percent error among two cohorts: TQIP patients <65 years old and ≥65.

Results: Stratified coefficients predicted 2024 utilization within 9.3% for all utilization metrics in both cohorts. Non-stratified coefficients overestimated utilization among patients ≥65 (blood products by 195%, chest/abdomen operations by 134%, hemorrhage control operations by 114%, and ventilator days by 53%) while underestimating multiple utilization metrics among patients <65. Stratified coefficients outperformed non-stratified estimates across all six utilization metrics (Table 1).

Conclusion: Demographic-stratified utilization coefficients derived from national data predict resource demand with far greater accuracy than aggregate per-admission estimates. Failure to account for demographic variation systematically overestimates resource needs for older adults while underestimating needs for younger patients.

Table 1. Absolute Percent Error (%): Non-Stratified vs Stratified Utilization Estimates

	Patients <65 yr		Patients ≥65 yr	
Utilization Metric	**Non-stratified**	**Stratified**	**Non-stratified**	**Stratified**
Hospital bed days	+8.6	+1.8	−7.4	+1.8
Ventilator days	−8.2	+6.7	**+52.8**	+9.3
Blood products	**−23.3**	+5.2	**+195.5**	+4.7
Hemorrhage control operations	−7.9	+4.3	**+113.8**	−0.2
Chest and abdomen operations	**−23.4**	+2.0	**+133.7**	+0.8
Neurosurgical operations	**−12.7**	−1.3	**+29.0**	+0.7

Bold indicates absolute error >10%.

Session XIIIA: Papers 42-50

Paper 46: 3:05 PM - 3:25 PM

IN OLDER ADULTS, "MILD" DOES NOT MEAN LOW RISK: MULTICENTER STUDY OF 1,157 PATIENTS WITH MILD TBI AND ACUTE SUBDURAL HEMATOMA

Introduction: Acute traumatic subdural hematoma (SDH) is the most common intracranial injury in mild TBI (mTBI), particularly in older adults. However, the relationship of outcomes between patient and brain CT characteristics remains poorly described especially in a contemporary cohort. This study aims to characterize outcomes in younger and older adults with mTBI and isolated acute SDH.

Methods: This was a 10-center, retrospective cohort study of adult trauma admissions with ED GCS 13-15 and acute traumatic SDH on initial brain CT (’22-’23). Trauma registry, EHR and PACS data were collected via automated queries and manual abstraction. The primary outcome was total mortality (TM=hospital death+hospice discharge); the sample was stratified: 18-64y vs ≥65y. Multivariable backward selection logistic regression examined 21 demographic, injury, and brain CT findings as TM risk factors.

Results: 1,157 patients were included (18–64y: 28%; ≥65y: 72%; 57% transferred in). Median [IQR] non-head ISS was 1 [1-5] in 18-64y, and 1 [1-2] in ≥65y. 10% had neurosurgical intervention (18–64y: 8%; ≥65y: 11%). TM was higher in ≥65y than 18–64y (10% vs 3%, $p<0.001$). Compared to ≥65y, 18–64y were discharged to home more frequently (78% vs 51%, $p<0.001$) and to hospice less frequently (2% vs 7%, $p<0.001$). In 18-64y, significant univariate risk factors for TM were Black race, advanced directive, functionally dependent, ISS, more midline shift and thicker SDH (too few TMs for adjusted models). In ≥65y, adjusted risk factors of TM were advanced directive (OR[95%CI]: 11.8 [2.9-49.0]), male sex (3.0 [1.3-7.0]), midline shift (1.8 [1.3-2.6]), shock index (1.5 [1.1-2.1]), and worsening SDH on follow-up CT (2.9 [1.3-6.6]).

Conclusion: Despite presenting as “mild” TBI, the presence of a SDH in these older adults was associated with significantly elevated TM compared to their younger adult counterparts. These data suggest that older adults with mTBI and SDH should continue to receive highest-level care with early repeat imaging, while also triggering timely patient-centered goals-of-care discussions.

Session XIIIA: Papers 42-50
Paper 47: 3:25 PM - 3:45 PM

ENHANCING TRAUMA CARE WITH MACHINE LEARNING: A COMPARATIVE STUDY ON MORTALITY PREDICTION MODELS

Introduction: Trauma remains a leading cause of mortality worldwide, and accurate risk stratification is essential for trauma system evaluation and quality improvement. Traditional regression-based models such as the Trauma Mortality Prediction Model using ICD-9-CM codes (TMPM-ICD9) are widely used, but their performance may be limited in complex clinical settings. This study aimed to develop and validate machine learning (ML) models for in-hospital mortality prediction in major trauma patients and to compare their performance with TMPM-ICD9.

Methods: This is a prospective, single-center longitudinal study aimed at analyzing in-hospital mortality and the effect of centralization to a Level I Trauma Center. All consecutive trauma patients meeting criteria for major trauma were enrolled, defined as suspected severe injury at prehospital triage or an Injury Severity Score (ISS) >15 after secondary assessment. Predictive models using ML algorithms for in-hospital mortality were developed using variables available in hospital discharge records. As a reference, we used TMPM-ICD9. We implemented and compared the predictive performance of three different ML algorithms:

-) Decision Tree (DT): a single tree classifier.
-) XGBoost: an ensemble method based on gradient-boosted decision trees.
-) Artificial Neural Network (ANN): a feedforward neural network composed of one or more hidden layers.

Hyperparameter tuning was performed for each model. Model performance was evaluated using five different metrics: ROC AUC, accuracy, precision, recall, and F1 score.

Results: A three-step comparative analysis was conducted using progressively structured datasets. Using the full ICD-9-CM dataset, ML models outperformed TMPM-ICD9, with XGBoost achieving the highest AUC (0.83), followed by ANN (0.78) and DT (0.78), compared with TMPM-ICD9 (0.74). When limiting the analysis to TMPM-equivalent ICD-9-CM variables, XGBoost (AUC 0.90) and DT (0.85) maintained superior performance over TMPM-ICD9 (0.77), while ANN performance decreased (0.66). The addition of demographic variables (age and sex) to the full ICD-9-CM dataset further improved discrimination, with XGBoost achieving an AUC of 0.91, DT 0.88, ANN 0.85, and TMPM-ICD9 0.79 (*Figure 1*).

Conclusion: Machine learning models, particularly XGBoost, demonstrated superior accuracy compared with TMPM-ICD9 for predicting in-hospital mortality in major trauma patients using administrative data. These findings support the potential role of ML-based models in trauma system performance evaluation. Future research should focus on integrating early clinical variables available at initial assessment to enhance real-time risk stratification and trauma care optimization.

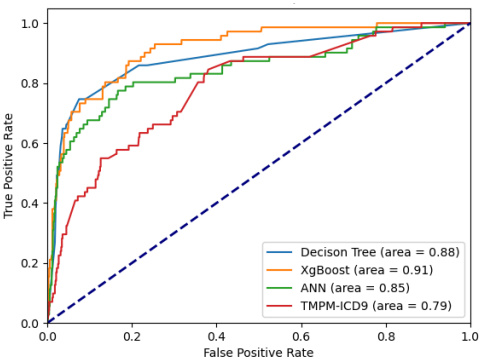


Figure 1: AUC comparison between ML models and TMPM-ICD9 after inclusion of demographic variables.

Session XIIIA: Papers 42-50

Paper 48: 3:45 PM - 4:05 PM

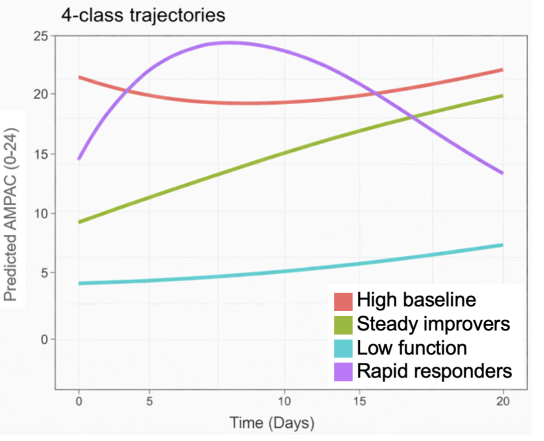
DISTINCT RECOVERY TRAJECTORIES FOLLOWING MAJOR ABDOMINAL SURGERY FOR TRAUMA

Introduction: Early mobilization after emergency abdominal surgery is recommended. However, not everyone mobilizes to the same extent or at the same rate, suggesting that physical therapy (PT) needs should be tailored based on recovery trajectory. We hypothesized that trauma patients exhibit distinct mobility recovery trajectories based on Activity Measure for Post-Acute Care (AMPAC) scores, and that these trajectories would correlate to discrete patient outcomes.

Methods: A retrospective review of adult trauma patients (≥16 years) who underwent exploratory laparotomy at a level 1 trauma center from 6/2021 to 6/2023 was performed. Demographics, AMPAC scores, clinical characteristics, and outcomes were collected. PT initiation was defined as time zero, and AMPAC scores (range 6-24) were assessed longitudinally, with higher scores indicating greater mobility. Latent class mixed modeling (linear, quadratic, cubic) was applied to longitudinal AMPAC scores to identify distinct recovery trajectories, followed by descriptive and univariate analyses across classes.

Results: Using a cubic latent class growth model (n=511), four distinct mobility trajectories were identified: **high baseline** (n=93, 18.2%), **steady improvers** (100, 19.5%), **low function** (80, 15.6%), and **rapid responders** (238, 46.5%). Trajectory classes differed significantly by injury severity score (ISS), injury type, intensive care unit (ICU) length of stay (LOS), ventilator days, hospital LOS, and discharge disposition (all $p<0.01$). Patients in the low function trajectory had the highest ISS (median 41), prolonged ICU stays (median 18 days), and were least likely to discharge home, whereas the high baseline and rapid responder classes had minimal critical care needs and a >85% home discharge rate.

Conclusion: Early mobility recovery trajectories define distinct recovery phenotypes and are strongly associated with hospital course and discharge disposition. Early trajectory identification may enable targeted allocation of finite PT resources.



Session XIIIA: Papers 42-50

Paper 49: 4:05 PM - 4:25 PM

SKIP THE PRE-OP ECHO: VALIDATION OF THE 2024 AMERICAN COLLEGE OF CARDIOLOGY/AMERICAN HEART ASSOCIATION GUIDELINES FOR PERIOPERATIVE ECHOCARDIOGRAPHY ADAPTED FOR TRAUMA

Introduction: Transthoracic echocardiogram (TTE) is widely used for pre-operative risk assessment in patients with non-emergent orthopedic and spine injuries but may contribute to costly delays in care with limited value. We evaluated the impact of the 2024 ACA/AHA guidelines for perioperative risk assessment, adapted for a trauma population.

Methods: We adapted the 2024 ACA/AHA guidelines to define indications for pre-operative TTE in stable trauma patients >50 years old who require surgery for long-bone, pelvis, or spine fracture (**Table 1**). Guidelines were applied retrospectively to stable adults admitted to a level 1 trauma center from 2020-24 who had pre-operative TTE and operative repair within one week.

Results: Of 211 patients included, 105 (50%) had guideline concordant pre-op TTEs. Guideline concordant TTEs were more likely to be abnormal (52% vs. 33%, p=0.012) and patients with guideline-concordant TTEs had significantly higher rates of unplanned ICU admission (13% vs 1%, p<0.001) and 30-day mortality (11% vs 3%, p=0.026) (**Table 2**). Of 7 patients with non-concordant TTEs and perioperative complications, 1 had an abnormal TTE showing a known condition. Of the 3 mortalities in the non-concordant group, all had a normal echo and a non-cardiac cause of death.

Conclusions: Adapted ACA/AHA guidelines accurately identify injured patients at highest risk of perioperative cardiac complications after urgent orthopedic and spine surgery. Application of the guidelines in this cohort would decrease perioperative TTE use by half with minimal clinical impact.

Table 1. Adapted ACA/AHA Preop TTE Indications
Suspected new/worsening heart failure
Known severe aortic stenosis
Suspected new/worsening pulmonary hypertension
New EKG findings
New murmur
Tropinemia*
Pericardial effusion

* Trauma-specific addition, as part of blunt cardiac injury workup

Table 2. TTE Findings and Outcomes	Guideline concordant n=105	Non-guideline concordant n=106	p
Abnormal TTE	54 (52)	35 (33)	0.012
Any major periop complication	24(23)	7(7)	<0.001
Heart failure exacerbation	4 (4)	0 (0)	0.12
Cardiac arrest	6 (6)	4 (4)	0.54
Acute MI	3 (3)	0 (0)	0.12
Unplanned ICU admission	13 (13)	1 (1)	<0.001
30 day mortality	11 (11)	3 (3)	0.026

Session XIIIA: Papers 42-50
Paper 50: 4:25 PM - 4:45 PM

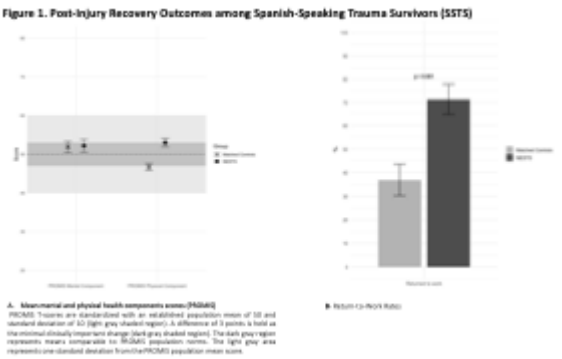
A SCALABLE CARE PATHWAY IMPROVES PHYSICAL FUNCTION AND RETURN-TO-WORK FOR SPANISH-SPEAKING TRAUMA SURVIVORS

Introduction: Spanish-speaking trauma survivors (SSTS) face unique barriers in post-injury care due to Limited English Proficiency, cultural differences, socioeconomic stressors, and ineligibility for social programs increasing risk for poor outcomes. We evaluated the impact of the NESTS (Non-English-Speaking Trauma Survivors) pathway, on 6-month outcomes among SSTS.

Methods: NESTS pathway included educational resources, structured needs assessments, a phone-based translation app, and longitudinal navigation by a Spanish-speaking community health worker who facilitated access to healthcare and community services. SSTS receiving NESTS at two Level I trauma centers were compared with matched controls (historic patients at intervention sites and contemporaneous patients at a non-intervention site). Outcomes included return-to-work and PROMIS-29 physical and mental health scores. Analyses used 1:2 nearest-neighbor propensity score matching and multivariable regression adjusted for injury mechanism, severity, and length of stay. Sensitivity analyses assessed robustness.

Results: Sixty NESTS patients were matched to 120 controls. At 6 months, NESTS participants demonstrated higher physical recovery (PROMIS Physical Component 53.0 ± 1.5 vs 46.7 ± 1.2; adjusted mean difference +6.3 [95% CI 2.4–10.2]; $p<0.001$) and greater return-to-work (71.3% vs 36.9%; OR 4.24 [95% CI 1.79–10.09]; $p<0.001$). Mental health scores did not differ. Findings were consistent across sensitivity analyses.

Conclusion: A structured, culturally concordant post-trauma care pathway improved long-term physical health and return-to-work rates among SSTS, outcomes that are traditionally difficult to improve in trauma populations. This scalable, low-cost model may reduce language-related disparities among trauma survivors.



Session XIIIB: Papers 51-58
Paper 51: 1:45 PM - 2:05 PM

PLATELET RELEASATES RESCUE TRAUMA-INDUCED ENDOTHELIOPATHY WITH A DIVERSE SECRETOME

Introduction: The endotheliopathy of trauma contributes substantially to multi-organ dysfunction and death, yet the mechanisms that underly it remain unclear and its therapeutics inadequate. While platelets are well-characterized for their role in hemostasis, they also release a variety of small molecules and proteins including cytokines, chemokines, and growth factors collectively known as platelet releasates. These secreted factors play key roles in physiologic and pathophysiologic processes. Prior work from our group has shown that platelet releasates can rescue the endothelial barrier in models of trauma-induced endotheliopathy. We have also shown that there is substantial variability in blood bank products including platelets. As such, whether the protective effect of plasma releasates varies with donor heterogeneity, the trauma milieu into which they are released and the mechanism underlying their effect remains unknown. We hypothesized that the protective effect of platelet releasates is multifactorial and affected by donor characteristics and their multiomic composition.
Methods: Blood was collected from highest activation trauma patients of differing demographic and clinical characteristics. Platelet releasates were generated by isolating platelets from trauma patient blood, activating them with calcium in Tyrode's buffer, and collecting the supernatant. Primary human umbilical vein endothelial cells (HUVECs) were cultured to confluence and transferred to 96-well ECIS plates with gold electrodes for real-time resistance-based measurement of barrier integrity via Electric Cell-substrate Impedance Sensing (ECIS). Endothelial permeability was assessed via ECIS over one hour following treatment with platelet releasates, trauma patient plasma, or their combinations, and quantified by calculating area under the resistance curve. Platelet releasates were also characterized by mass spectrometry-based proteomics.
Results: Across >50 trauma donors, plasma releasates protected against trauma plasma induced endothelial permeability with no significant differences by patient grouping (reflecting varying degrees of injury and shock) or sex. Trauma plasma induced endothelial permeability and releasates rescued this permeability equally regardless of injury severity of the patients from which they were derived. Unsupervised proteomic profiling revealed four distinct clusters of releasates defined by varying levels of coagulation, complement, and platelet activation proteins (Figure).

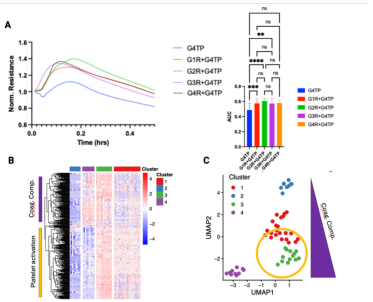


Figure: A) ECIS curve showing normalized resistance of Group 4 Trauma Plasma (G4TP), Group 1 Releasate + Group 4 Trauma Plasma (G1+G4TP), Group 2 Releasate + Group 4 Trauma Plasma (G2+G4TP), Group 3 Releasate + Group 4 Trauma Plasma (G3+G4TP), and Group 4 Releasate + Group 4 Trauma Plasma (G4+G4TP) with corresponding AUC graph to right. B) Proteomic heat map of four distinct clusters of releasates. C) Corresponding UMAP showing spread of four proteomic clusters along two axes with differential enrichment of coagulation and complement proteins and platelet activation proteins.

Conclusion: Trauma patient-derived platelet releasates preserve endothelial barrier function independent of donor injury severity, degree of shock, or sex. However, proteomic profiling revealed four distinct clusters of releasates with substantial differences in levels of expression of coagulation, complement, and platelet activation proteins. Despite this molecular and clinical diversity, the majority of releasates retained a barrier-protective phenotype, suggesting that diverse releasate endotypes result in endothelial stabilization and protection against the endotheliopathy of trauma. These findings identify platelet secretomes as both conserved effectors and heterogeneous biosignatures, supporting their investigation as therapeutic candidates and clinical biomarkers in trauma-induced endotheliopathy.

Session XIIIB: Papers 51-58

Paper 52: 2:05 PM - 2:25 PM

β-BLOCKADE REPROGRAMS TRAUMA-INDUCED CHANGES IN BONE MARROW EXOSOMAL MIRNAS

Introduction: Severe traumatic injury initiates sustained sympathetic activation that disrupts bone marrow (BM) homeostasis. Polytrauma followed by chronic restraint stress (PTRS) recapitulates severe traumatic injury followed by chronic critical illness (CCI). BM-derived exosomes mediate miRNA signaling within the marrow niche. The impact of β-adrenergic signaling on the alteration of BM exosomal miRNA regulatory networks is undefined. We hypothesized that β-adrenergic blockade (BB) modulates trauma-induced BM dysfunction by altering exosomal miRNA expression.

Methods: Sprague Dawley rats (n = 6/group) were randomized to naïve, polytrauma (PT; lung contusion, hemorrhagic shock, cecal ligation, bilateral femoral pseudofracture), or PTRS to model CCI. Additional cohorts received daily propranolol (BB) after PT or PTRS. BM exosomes were isolated on day 7 after injury. BM-derived exosomal miRNAs were profiled using ROSALIND Bioinformatics; differential expression was defined by absolute fold change thresholds (*$p < 0.05$).

Results: Following PT and PTRS, miRNAs regulating hematopoietic progenitor maintenance and erythropoiesis were suppressed, including let-7c (PT: -3.8* and PTRS: -5.5*) and miR-21 (PT: -3.1* and PTRS: -4.3*), while inflammatory and apoptotic miRNAs were upregulated. Compared with PTRS alone, PTRS+BB was associated with downregulation of stress-responsive miRNAs (miR-196a: -1.9*, miR-452: -1.8*, miR-671-3p: -1.9*). In contrast, PT+BB vs PT demonstrated upregulation of regulatory miRNAs, including miR-124 (3.2) and inflammatory signaling and immune activation (miR-101a:1.8*, miR-328: 3.3*, miR-466g: 3.2*).

Conclusion: Severe trauma followed by CCI induces sustained remodeling of the BM exosomal miRNA that favors inflammatory persistence and progenitor dysfunction. The use of BB alters these miRNA networks, shifting the marrow milieu toward restoration of hematopoietic homeostasis. These findings implicate sympathetic signaling as a mechanistic driver of trauma-induced BM dysfunction and identify exosomal miRNA modulation as a potential therapeutic pathway for mitigating chronic critical illness.

Session XIIIB: Papers 51-58

Paper 53: 2:25 PM - 2:45 PM

β BEYOND ANALGESIA: THE IMMUNOSUPPRESSIVE EFFECTS OF KETOROLAC ON REACTIVE ASCITES IN APPENDECTOMY PATIENTS

Introduction: Patient pain is frequently controlled by non-steroidal anti-inflammatories like Ketorolac. For the prevention of post-operative nausea and vomiting, general surgery patients frequently receive preoperative low dose Dexamethasone (Dex). Dex, a potent anti-inflammatory glucocorticoid, and Ketorolac may suppress immune responses vital for infection control in reactive ascites (rA) associated with appendicitis. Understanding whether preoperative anti-inflammatory exposure impacts local immune responses may inform alternate pain management strategies in appendicitis or patients with active infections.
Methods: At three level 1 trauma centers, rA was collected prior to surgical intervention for non-perforated appendicitis. 16 candidate immunomodulators were quantified using multiplex immunoassays. Patients were grouped by preoperative exposure: (1) extended (Ketorolac ≥2.5 hours with <30min Dex, n=7), (2) Dex-only (3-31 minutes, n=28), and (3) control (no anti-inflammatory exposure, n=22). Bootstrap resampling with 10,000 iterations and Hedge's g effect sizes were used; alpha<0.05 was significant.
Results: Extended exposure reduced Interleukin (IL)-8 (-5.7-fold), RANTES (-2.6-fold), and sIL-1RII (-1.8-fold) and increased sIL-6R (+1.5-fold; all $p<0.05$) versus controls, with medium-to-large effect sizes (g: 0.65-1.18). Compared to Dex-only, extended exposure suppressed IL-1β (-1.9-fold), IL-1α (-1.4-fold), RANTES (-2.1-fold), TGFα (-2.7-fold), and sIL-1RII (-2.4-fold; all $p<0.03$). Dex-only analytes showed no differences from controls.
Conclusion: In rA, preoperative Ketorolac significantly blunts local immunomodulators critical for neutrophil recruitment and bacterial clearance (IL-8 and RANTES), and raises concern that NSAIDs may compromise infection control, supporting consideration of alternative analgesic strategies.

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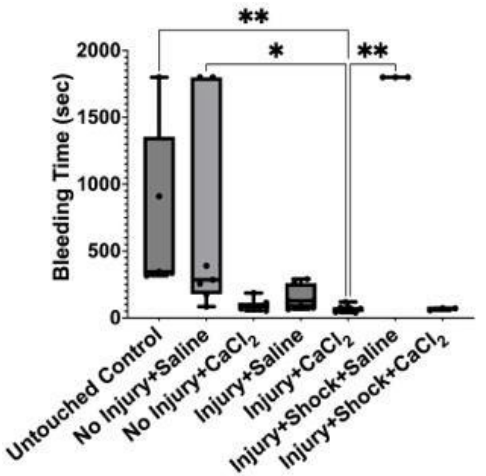
Paper 54: 2:45 PM - 3:05 PM

IMPACT OF HYPERCALCEMIA ON BLEEDING TIME AFTER TRAUMATIC INJURY IN A MURINE MODEL

Introduction: Calcium abnormalities are common in trauma - hypocalcemia contributes to coagulopathy and shock, while empiric replacement can cause iatrogenic hypercalcemia. Previous work has linked hypercalcemia to increased post-injury venous thrombosis and trauma mortality, however, its direct effects on coagulation after injury have not been defined. We hypothesized that hypercalcemia would promote a hypercoagulable state following polytrauma and hemorrhage. **Methods:** C57BL/6J mice underwent polytrauma, with a subset also subjected to controlled hemorrhagic shock and red blood cell resuscitation. Animals then received intravenous normal saline or calcium chloride ($CaCl_2$), and bleeding time was measured using a tail-transection model.
Results: In uninjured mice, $CaCl_2$ reduced median bleeding time by 69.8% (86 vs 285 sec; p=0.01). Injured mice treated with $CaCl_2$ significantly reduced bleeding time (67 sec) compared to no injury + saline (285 sec), injury + shock + saline group (1800 sec), and even untouched controls (345 sec).
Conclusion: Hypercalcemia markedly accelerates clot formation and produces a hypercoagulable state in both uninjured and injured mice. These results identify an under recognized and potentially harmful pro-thrombotic effect of aggressive calcium supplementation during trauma resuscitation and blood product transfusion.



Session XIIIB: Papers 51-58
Paper 55: 3:05 PM - 3:25 PM

TRPA1 ACTIVATION ATTENUATES GLYCOCALYX SHEDDING IN A RODENT MODEL OF HEMORRHAGIC SHOCK AND RESUSCITATION

Introduction: Disruption of the endothelial glycocalyx during ischemia/reperfusion (I/R) after hemorrhagic shock is a major driver of endothelial dysfunction and coagulopathy. The glycocalyx interacts closely with endothelial Transient Receptor Potential (TRP) channels to mediate mechanotransduction in response to shear stress. We hypothesized that TRPA1 activation (JT010) during reperfusion would reduce glycocalyx shedding in a rat model of controlled hemorrhagic shock.
Methods: Male Sprague-Dawley rats underwent cannulation of the right internal jugular vein and bilateral femoral arteries. Hemorrhagic shock was induced by blood withdrawal to a mean arterial pressure (MAP) of 40 mmHg for 30 minutes, followed by resuscitation to a MAP of 60 mmHg for 60 minutes. Animals were randomized to Sham (n=6), Untreated Hemorrhage (UH, n=6), or TRPA1 agonist (JT010) treatment (n=6). UH received Lactated Ringer's (LR), while the treatment group received 14.1 µL/kg JT010 with LR.
Results: Compared to UH, JT010-treated rats demonstrated stronger glycocalyx staining in brain ($p=0.0023$), lung ($p<0.0001$) (Figure 1), and intestine ($p=0.0187$). In lung tissue, UH animals showed increased microangiopathic fibrin deposition versus Sham, measured by fibrin specks ($p=0.0398$) and percent area ($p=0.0497$). JT010 significantly reduced fibrin specks ($p=0.0491$) and percent area ($p=0.0474$) compared to UH.
Conclusion: Ischemia-reperfusion-induced glycocalyx shedding following hemorrhagic injury is a key contributor to endothelial dysfunction and coagulopathy, with important implications to perioperative risk. These results suggest that TRPA1 represents a promising pharmacological target for the treatment of shock-induced vasculopathy.

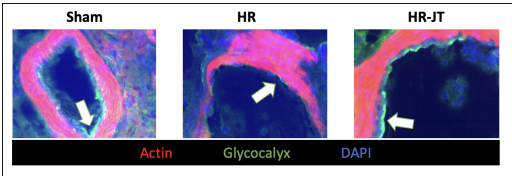


Figure 1. TRPA1 mitigates GCX shedding in lung tissue. Vessel stain: phalloidin stains smooth-muscle actin (red), DAPI is a nuclear stain (blue), fluorescein isothiocyanate-labeled wheat-germ agglutinin (FITC-WGA) stains GCX (green). Arrows point to glycocalyx. Significance assessed with one-way ANOVA.

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Paper 56: 3:25 PM - 3:45 PM

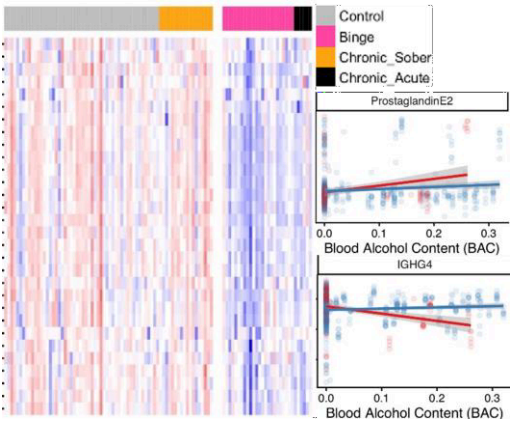
UNDER THE INFLUENCE: MULTIOMIC SIGNATURES OF ALCOHOL IN TRAUMAPATIENTS

Introduction: Alcohol misuse directly effects trauma. While significant work has been done on its epidemiologic consequences, the biologic effect of alcohol on the post-injury immune response is less well understood. Our aim was to compare multiomic plasma signatures of chronic alcohol users and acute alcohol binge preceding trauma. We hypothesized that both chronic and acute alcohol would fundamentally modify the post injury thromboinflammatory response.

Methods: Trauma patient plasma was obtained longitudinally from 148 patients from a level 1 trauma center over the first 10 days after admission. Plasma Phosphatidyl Ethanol (PEth) concentration (ng/mL) was used as a marker of chronic alcohol exposure and blood alcohol concentration (BAC) was used to measure acute alcohol exposure. Plasma samples were subjected to multiomic analysis by mass spectrometry.

Results: Patients with high admission BAC (>0.1) were found to have reduced acylcarnitine metabolites when compared to low BAC patients regardless of history of chronic alcohol exposure (**Figure 1**). Chronic alcohol users show increased inflammation, specifically increased expression of Prostaglandin E2 (PGE2) (**Figure 2a**) and decreased adaptive immunity, most significantly identified by IGHG4 expression (**Figure 2b**).

Conclusion: Acute alcohol exposure results in robust metabolomic differences in energy metabolism after injury while chronic use modifies inflammatory and adaptive immunity after trauma. These findings provide a pattern to both mechanistically describe alcohol modified post injury biology while clinically providing personalized medicine targets to understand and guide treatment in trauma patients with varying types and degrees of alcohol exposure.



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Paper 57: 3:45 PM - 4:05 PM

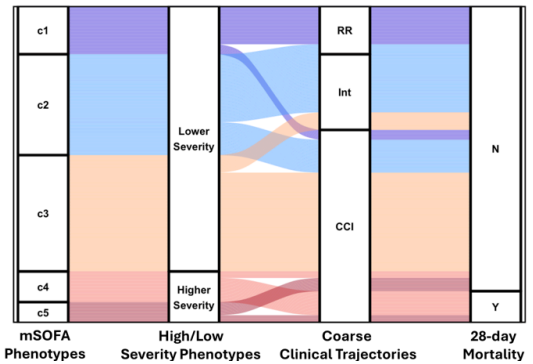
PHENOTYPES OF MULTIPLE ORGAN DYSFUNCTION IN SEVERELY INJURED TRAUMA PATIENTS: MORE HETEROGENITY THAN MEETS THE EYE

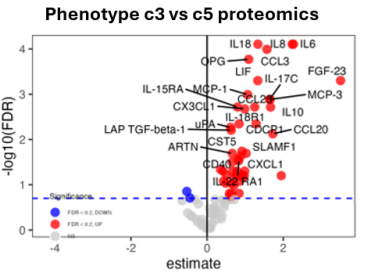
Introduction: Traditional organ failure classifications rely on cross-sectional, dichotomized categories (e.g., complicated vs. uncomplicated; chronic critical illness vs. rapid recovery), which likely oversimplify the complex evolution of multiple organ dysfunction syndrome (MODS) after severe trauma. Recognizing the heterogeneity of organ dysfunction trajectories is essential for accurate prognostication and guiding targeted therapeutic strategies. We therefore sought to identify distinct post-injury MODS phenotypes based on longitudinal patterns of organ dysfunction.

Methods: We performed a prospective, longitudinal observational cohort of critically ill trauma patients at high-risk for MODS. Serial clinical data and blood samples were measured through 28 days, death or discharge, including a 92-marker immune plasma proteomics panel. Organ dysfunction trajectories were measured by daily modified SOFA (mSOFA) scores.

Results: Sixty-nine patients were enrolled into this high-intensity clinical/biosampling cohort. Age, ISS, shock parameters and demographics are representative of a severely injured cohort. Unsupervised clustering of longitudinal mSOFA scores using latent class mixed trajectory modeling identified 5 unique MODS phenotypes (**Figure**) which differed by age, injury/shock factors, circulating immune proteomic markers (FDR<0.2), discrimination by traditional clinical trajectories, and 28-day mortality.

Conclusions: Organ dysfunction phenotypes after severe trauma are more heterogeneous than previously appreciated with distinct clinical characteristics, immune profiles and clinical outcomes.





INFECTIOUS COMPLICATIONS ARE PRECEDED BY SPECIFIC LONGITUDINAL NEUTROPHIL CELL SURFACE PATTERN AFTER POLYTRAUMA: PRELIMINARY RESULTS OF A PROSPECTIVE ANALYSIS

Introduction: Alterations in neutrophil receptors provide valuable insights into the immune response after polytrauma. Point-of-care (POC) technologies enable rapid on-site analysis of neutrophils. Previous studies demonstrated individual neutrophil surface patterns after trauma, depending on injury severity and metabolic status. We hypothesized that infectious complications after polytrauma are preceded by specific neutrophil cell surface receptor alterations.
Methods: A POC neutrophil analysis system (AQUIOS® Flow Cytometer) was implemented at a Level 1 trauma center. Polytrauma patients with an ISS>25 were prospectively included. Neutrophil cell surface expression of CD10, CD11b, CD64, CD62L and CD16 were analyzed immediately after admission, and after 8h, 24h, 48h and 5d. Patients were grouped according to the occurrence or absence of infectious complications.
Results: 24 polytrauma patients with a median ISS of 34.5 were included in this study. Trauma sequelae included spine fractures, long bone fractures and traumatic brain injury. During hospitalization, 13 out of 24 patients developed infectious complications. In patients with infectious complications, expression levels of CD64 and CD62L were significantly increased compared to those without infectious complications throughout the observation period. Additionally, CD11b expression was elevated 8h after trauma.
Conclusion: Longitudinal assessment of multiple selected neutrophil markers draws an individual neutrophil surface profile, with specific patterns associated with the development of infectious complications. This offers a promising tool for early risk stratification and identification of trauma patients vulnerable to post-traumatic infectious complications and allows for future immune-protective trauma surgery.