

Scientific Session IV-B

Paper #30
January 12, 2018
10:15 am

CONTEMPORARY UTILIZATION OF ZONE III REBOA FOR TEMPORARY CONTROL OF PELVIC AND LOWER JUNCTIONAL HEMORRHAGE RELIABLY ACHIEVES HEMODYNAMIC STABILITY IN SEVERELY INJURED PATIENTS

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Presenter: Joseph J. DuBose, MD

Discussant: Alistair Kent, MD, MPH, Johns Hopkins Hospital

Objectives: We utilized the AAST AORTA database to examine the contemporary utilization of distal (Zone 3) REBOA for management of traumatic pelvic and lower extremity junctional hemorrhage.

Methods: AORTA registry patients requiring Zone 3 REBOA from eight ACS Level 1 centers were examined. After excluding patients in arrest at time of AO, demographics, elements of treatment and outcomes were identified.

Results: From Nov 2013 – Dec 2016, 30 patients had Zone 3 REBOA (83.3% male; 96.7% injured by blunt mechanisms). Median age was 41.0 (IQR 38); median ISS 41.0 (IQR 12). Hypotension on admission (SBP < 90 mm Hg) was present in 30.0% and 53.3% had admission heart rate > 120 bpm. Median initial pH was 7.14 (IQR 0.22), and median admission lactate 9.9 mg/dL (IQR 5). Pelvic binders were utilized in 40%. Occlusion balloon devices included Coda™ (70%), ER-REBOA™ (13.3%), Reliant™ (10%); placed using plain film (50%); external landmarks (30%), fluoroscopy (16.7%), and ultrasound (3.3%). After REBOA, hemodynamics improved in 96.7% and stability (BP consistently > 90 mm Hg) was achieved in 86.7%. Median duration of REBOA was 53.0 mins (IQR 112). Median PRBC and FFP requirements were 19.0 units (IQR (17) and 17.0 units (IQR 14), respectively. One amputation unrelated to REBOA utilization was required. Systemic complications included AKI (23.3%) and MODS (10%). REBOA specific complications included groin hematoma (3.3%) and distal thromboembolization (16.7%). Survival to discharge was 56.7%, with in-hospital deaths occurring in the ED 7.7%, OR 23.1%, ICU 69.2%.

Conclusions: Zone III REBOA for early control of pelvic or junctional hemorrhage in patients in extremis provides hemodynamic stability sufficient to achieve definitive control in environments beyond the ED. Additional study is required determine optimal patient selection.

Scientific Session IV-B

Paper #31
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10:35 am

OCCUPATIONAL EXPOSURE DURING EMERGENCY DEPARTMENT THORACOTOMY: A PROSPECTIVE, MULTI-INSTITUTION STUDY

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Presenter: Andrew Nunn, MD

Discussant: Jacques Mather, MD, MPH, University of Maryland Medical Center

Objectives: Occupational exposure (OE) is an important consideration during emergency department thoracotomy (EDT). While HIV/hepatitis prevalence in trauma patients (0-16.8%) and OE rates during operative trauma procedures (1.9-18.0%) have been reported, OE risk during EDT is unknown. We hypothesized that EDT OE risk would be greater than other operative trauma procedures.

Methods: A prospective, observational study at 16 US trauma centers was performed (2015-2016). All bedside EDT resuscitation providers were surveyed with a standardized data collection tool and risk factors analyzed with respect to the primary endpoint, EDT OE (percutaneous injury, mucous membrane, open wound, or eye splash). Provider, patient variables and outcomes were evaluated with single and multivariable logistic regression analyses.

Results: 1360 participants (23% attending, 59% trainee, 11% nurse, 7% other) were surveyed after 305 EDT (GSW 68%, prehospital CPR 57%, ED signs of life 37%) of which 15 patients survived (13 neurologically intact) their hospitalization. Overall, 22 OE were documented, resulting in an OE rate of 7.2% (95%CI; 4.7-10.5) per EDT and 1.6% (95%CI; 1.0-2.4) per participant. No differences in trauma center level, number of participants or hours worked were identified. Providers with OE were primarily trainees (68%) with percutaneous injuries (86%) during the thoracotomy (73%). Full precautions were utilized in only 46% of exposed providers (Figure). Multivariable logistic regression determined that each PPE item utilized correlated with 32% decreased OE risk (OR 0.68; 95%CI 0.52-0.88; $p=0.004$).

Conclusions: With 13 neurologically intact survivors and EDT OE rates that are *not* more common than previously reported operative trauma procedure OE rates, our results suggest that 1) OE should not deter providers from performing EDT and 2) improved universal precaution compliance would further minimize OE risk.

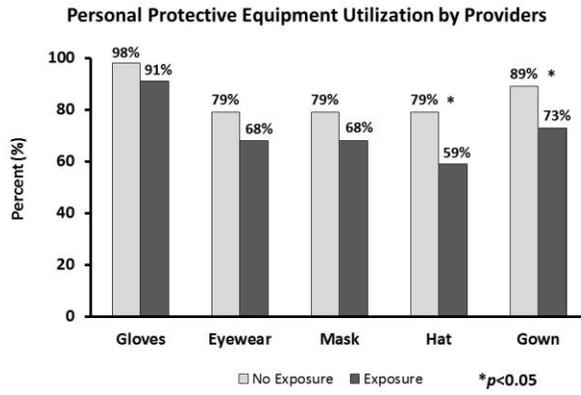


Figure: An itemized comparison of personal protective equipment utilized with respect to provider occupational exposure during EDT.

Scientific Session IV-B

Paper #32
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10:55 am

FIT-TO-FLY? PREDICTING ADVERSE EVENTS IN SEVERE TRAUMATIC BRAIN INJURY

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Presenter: Christine L. Ramirez, MD

Discussant: Stephanie Streit, MD, United States Air Force

Objectives: In the battlefield, automated prediction of impending intracranial insults could assist with decision making regarding air evacuation to neurosurgical-capable facilities. This study aimed to test models of various data sources such as continuous vital sign (VS) monitoring and biomarkers to predict adverse intracranial pressure (ICP) changes in severe traumatic brain injury (TBI) prior to occurrence.

Methods: Patients with severe TBI were prospectively enrolled. Continuously measured VS and cytokine levels (CYT) were obtained on admission and every 6 hours for 72 hours. Systemic vital signs (SVS), such as blood pressure and heart rate, and intracerebral monitoring (ICM), such as ICP and cerebral perfusion pressure (CPP), were recorded. Boosting decision trees were used to rank the importance of SVS, ICM and CYT to predict four outcomes in the following 6 hours: (1) ICP > 20 mmHg for > 30 minutes, (2) ICP > 30 mmHg for > 15 minutes, (3) mean ICP > 15 mmHg and (4) mean ICP > 20 mmHg.

Results: 61 patients were prospectively enrolled. The mean age was 40 ± 18.9 years and 78.7% were male. Median admission motor Glasgow Coma Score was 3, median Marshall Classification score was 3, and in-hospital mortality rate was 22.9%. The use of SVS alone had the lowest predictive ability (AUROC 72-84%, $p < 0.01$). The use of CYT alone had a slightly higher AUROC of 83-84% ($p < 0.01$). The use of SVS+ICM and SVS+ICM+CYT showed the prediction ability with an AUROC range of 86-92% and 87-90%, respectively (Fig.1). 10-fold cross-validation demonstrated that SVS+ICM models also had AUROCs of 79%-83% in unseen future data (Fig.2).

Conclusions: Prediction of impending adverse ICP events is possible and has the potential to inform expeditionary decision-making before emergency aircraft evacuation. SVS and/or cytokines carry some predictive value, but ICM appears to be the most direct predictor of the development of intracranial events.

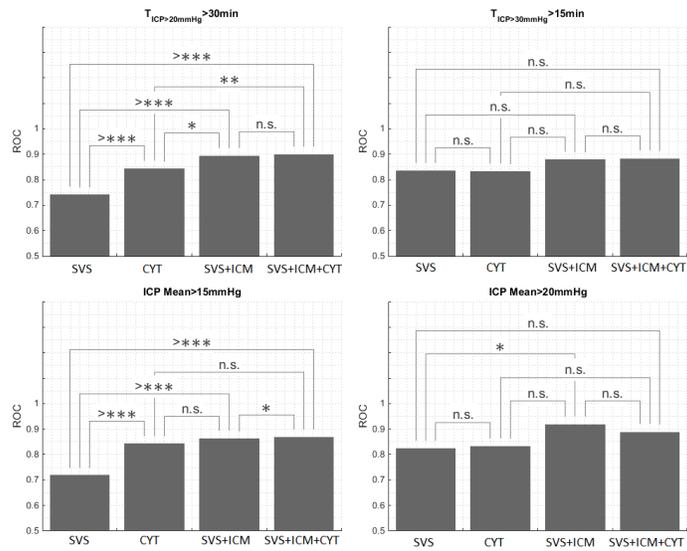


Fig. 1 AUROC values and comparison among different experiments. Models with ICM outperform other models in predicting adverse ICP changes.

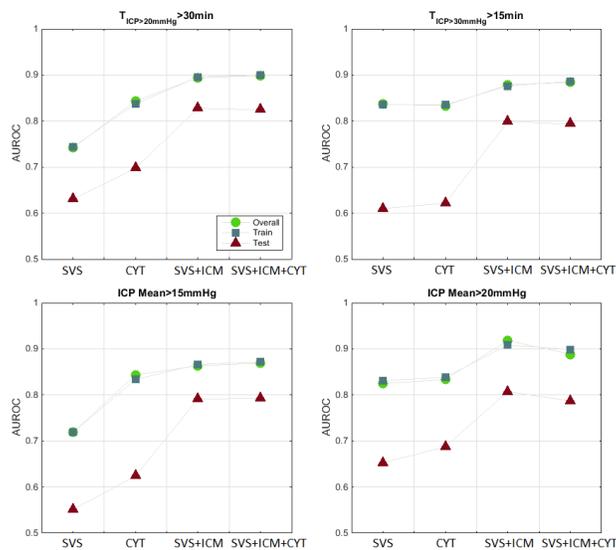


Fig. 2 Model performance evaluation with 10-fold cross-validation. overall (green), training (blue), and testing (red) show that models with ICM have higher AUROC and are more stable in predicting unseen new data.

Scientific Session IV-B

Paper #33
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SUBSEQUENT LEARNING AND MEMORY RECOVERY IS DELAYED IF TBI IS ACCOMPANIED BY A CONCOMITANT BONE FRACTURE

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Presenter: Yujin Suto, MD, PhD

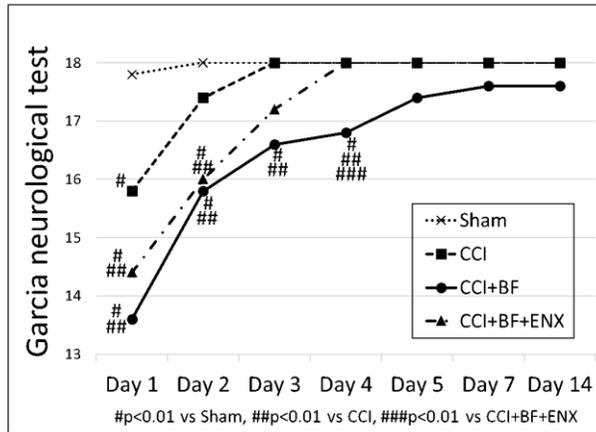
Discussant: Deborah M. Stein, MD, MPH, R Adams Cowley Shock Trauma Center

Objectives: Cognitive recovery from severe TBI is primarily affected by the severity of the initial cerebral injury but it is unknown if a concomitant bone fracture (BF) affects this recovery. Enoxaparin (ENX) after TBI decreases cerebral penumbral neutrophil mobilization and may slow progression of secondary brain injury. We hypothesized that: 1) a concomitant BF worsens learning/memory recovery after TBI and, 2) ENX improves recovery.

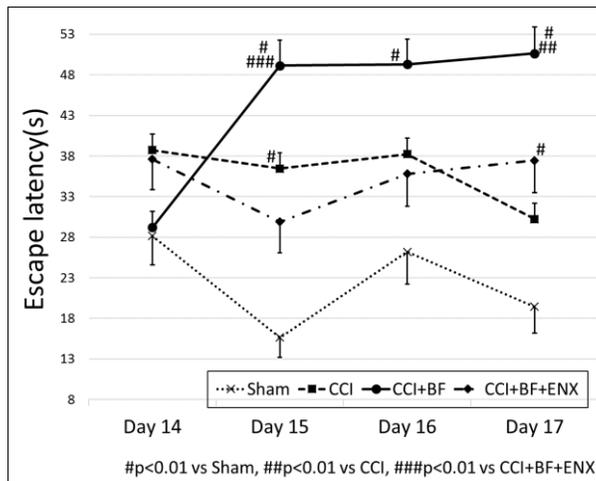
Methods: CD1 male mice underwent TBI (controlled cortical impact - CCI: velocity=6m/sec, depth=1.0mm) or sham craniotomy +/- tibial fracture, receiving either ENX (0.8mg/kg, 1time/day) or saline for 14 days after injury. Randomization defined 4 groups (Sham, CCI, CCI+BF, CCI+BF+ENX, n=5/each). Body weight loss ratio and neurological recovery (Garcia Neurological Test [GNT], max score=18) were assessed each day. Mouse learning (swimming time [s] to reach the platform day 14-17 after TBI) and memory (swimming time [s] in platform quadrant after platform removed [probe]) was assessed by the Morris Water Maze. ANOVA & Tukey's post-hoc test determined significance ($p < 0.05$).

Results: Compared to CCI alone, a BF worsened GNT scores on days 2-4 after TBI, and ENX corrected this worsening on day 4 (Fig.1). Learning the position of the submerged platform was significantly slower in CCI+BF (50.7+3.3s) than CCI alone (30.2+3.8, $p=0.001$) (Fig2). This was despite similar swimming velocities (23.7+1.3m/s vs. 24.2+1.8, $p > 0.05$) in both groups, indicating intact extremity motor function. Memory (probe trial, d 17) was greatest in Sham (22.7+4.1s), similar to CCI alone (19.4+1.6) but significantly better than CCI+BF (8.6+2.2, $p=0.047$). Body weight loss ratio was significantly greater in CCI+BF than Sham (d 2-5) ($p < 0.01$).

Conclusions: A long bone fracture accompanying TBI worsens early neurological recovery and subsequent learning/memory ability. ENX may improve neurological recovery.



As compared to CCI alone, as measured by the Garcia Neurological Test, neurological recovery on days 1 through 4 was significantly worse if CCI was accompanied by a bone fracture.



Morris Water Maze Escape Latency (swimming time taken by mice to reach the submerged platform, i.e.: learning) was greatest in CCI+BF animals and significantly worse than CCI alone animals on day 17. (Mean +/- SEM).

Scientific Session IV-B

Paper #34
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11:35 am

THE RUSH TO PRE-HOSPITAL CERVICAL SPINE CLEARANCE: ARE WE AT BREAKNECK SPEED?

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Presenter: Robert Laskowski, MD, PhD

Discussant: Alicia R. Privette, MD, Medical University of South Carolina

Objectives: To review clinical outcomes of pre-hospital cervical collar clearance protocols 6 years after implementation at a suburban Level 1 Trauma Center.

Methods: The institutional trauma registry was queried retrospectively for pre-hospital spine immobilization and presence of cervical spine injury in adult patients admitted after sustaining blunt trauma from 2011-2016. Univariate and multivariate logistic regression analyses were performed.

Results: A total of 5,127 patients were included for analysis. The incidence of cervical spine injury remained steady (range: 8.3-9.2%) over the study period. The rate of pre-hospital cervical immobilization decreased from 53.5% in 2011 to 35.0% in 2016. The incidence of cervical spine injuries among patients presenting without cervical immobilization increased from 3.8% (2011) to 5.7% (2016); this represents a decrease in sensitivity of the pre-hospital cervical clearance protocols from 80.3% to 58.2% over this period. 14.5% of patients with cervical spine injury presenting without immobilization had a Cervical Spine AIS \geq 3; 18.5% had multi-system injuries (i.e. AIS \geq 3). Risk factors for inappropriate pre-hospital cervical clearance in the presence of cervical spine injury included fall mechanism (OR=2.80, $p<0.001$), increased age (mean age of 60.7 years vs 51.3 years, $p<0.001$), lower ISS (mean ISS 14.7 vs 19.6, $p>0.001$), functional dependence (OR= 7.00, $p<0.001$), dementia (OR 3.68, $p=0.001$), and co-morbidities \geq 2 (OR 2.46, $p<0.001$).

Conclusions: The increased rate of inappropriate pre-hospital cervical spine clearance in frail, elderly patients calls into question the applicability of current pre-hospital cervical immobilization protocols to this patient population. Even in the settings of low ISS and low energy mechanisms of injury, missed cervical spine injuries may be catastrophic.

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Paper #35
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11:55 am

IMPLEMENTING A CALL BACK PROGRAM IN THE TRAUMA POPULATION

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Discussant: Lisa Gray, BSN, MHA, RN, CPN, St. Vincent Evansville

Objectives: After hospital discharge, trauma care is fragmented potentially leading to unplanned readmissions. We hypothesize a post-discharge call back protocol would be associated with lower unplanned readmission rates.

Methods: A trauma registry retrospective analysis was performed from 10/12 to 09/16. A post discharge call back protocol was created in 10/14. Attempts to reach the patient were initially made ~72 hours post discharge. Call time and patient comments were recorded. Pre and post intervention group comparisons were analyzed for age, ISS, HLOS, and unplanned readmission. Chi-Square Test and Independent T-Test were used to assess categorical and continuous variables.

Results: 9117 admissions were analyzed; 4470 in the pre-intervention group and 4647 in the post-intervention group. The two groups did not differ by age or HLOS. The pre-intervention group had a higher ISS (11.7 v 10.3; $p<0.001$). 17.7% of the patients in the post intervention group were reached, with an average of 5.8+2.9 minutes per phone call, equating to approximately a 0.2 FTE. 97.4% of unsolicited patient feedback regarding the quality of care was deemed excellent. Comparing 2013 (pre-intervention) with 2016 (mature intervention) groups, there was a decrease in the readmission rate (1.42% vs. 0.81%; $p=0.04$). Those patients who suffered a readmission had a higher ISS (14.9 v 10.4; $p<0.01$), a longer HLOS (9.3d v 4.7d; $p<0.01$), and were more likely to have been discharged to a facility with medical oversight (37.4% v 26.7%; $p=0.03$).

Conclusions: A post trauma discharge call back program of approximately 2500 admissions/year requires a 0.2 FTE position. A decreased unplanned readmission rate is associated with a mature call back system despite a low rate of contact. Feedback regarding quality of care can be readily available. A call back program can be made more efficient if driven by ISS, HLOS, and discharge disposition.