

Scientific Session I - Raymond H. Alexander, MD Resident Paper Competition

Paper #1
January 10, 2018
8:00 am

OVER RESUSCITATION WITH PLASMA IS ASSOCIATED WITH SUSTAINED FIBRINOLYSIS SHUTDOWN AND DEATH IN PEDIATRIC TBI

Christine M. Leeper, MD, Matthew Neal, Timothy Billiar, MD,
Jason L. Sperry, MD, MPH*, Barbara A. Gaines, MD*
University of Pittsburgh Medical Center

Presenter: Christine M. Leeper, MD

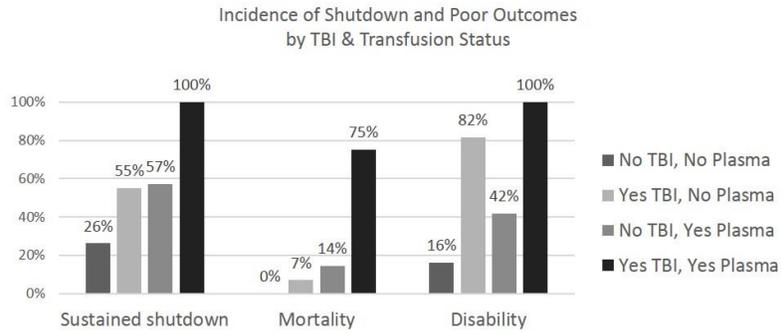
Discussant: Rachael Callcut, MD, University of California San Francisco

Objectives: Elevated INR is a marker of poor outcome, but not necessarily bleeding or clinical coagulopathy, in injured children. Conversely, children with traumatic brain injury (TBI) tend to be hypercoagulable based on thromboelastography(rTEG) parameters. Many clinicians continue to utilize INR as a treatment target.

Methods: Prospective observational study of children age<18 with rTEG on arrival and daily thereafter for 7 days. Standard TEG definitions of hyperfibrinolysis(HF; LY30=3) and fibrinolysis shutdown (SD; LY30=0.8) were applied. AIS score=3 defined severe traumatic brain injury. 24-hour blood product transfusion volumes were documented. Outcomes were death and disability.

Results: 101 patients were included: median (IQR) age=8(4-13), injury severity score=25(16-30), 47% severe TBI, 16% mortality, 45% discharge disability. Neither total volume nor any single product volume transfused (mL/kg; all $p>0.1$) differed between TBI and non-TBI groups. On univariate analysis, transfusion of PRBC ($p=0.016$), plasma ($p<0.001$) and platelets ($p=0.006$) were associated with sustained shutdown; however, in a regression model that included all products and controlled for TBI, only plasma remained an independent predictor of sustained SD (OR=1.15, $p=0.033$). Every mL/kg plasma was associated with a 15% increased odds of sustained SD. Patients with both severe TBI and plasma transfusion had 100% sustained SD, 75% mortality, and 100% disability in survivors. Admission INR was elevated in TBI patients, but did not correlate with TEG-ACT($p=NS$) and was associated with sustained SD($p=0.006$).

Conclusions: Plasma transfusion is associated with sustained fibrinolysis SD and poor outcome, particularly in patients with severe TBI. This may be an indicator of over resuscitation; plasma transfusion should be directed by evidence of clinical bleeding or abnormalities in TEG-ACT, rather than an arbitrary INR threshold.



Patients with severe traumatic brain injury who received plasma have the highest incidence of sustained fibrinolysis shutdown and poor outcomes.

Logistic Regression Model to predict sustained shutdown			
Product (mL/kg)	Odds Ratio	95% Confidence Interval	p value
Plasma	1.15*	1.04-1.31	0.036
Platelets	1.16	0.74-1.82	0.518
Red Blood Cells	0.98	0.91-1.04	0.481
Traumatic Brain Injury	4.26	1.8-10.8	0.002

*Every mL/kg plasma is associated with 15% increased odds of sustained SD

Plasma is the only blood product that independently predicts sustained shutdown after controlling for traumatic brain injury.

Scientific Session I - Raymond H. Alexander, MD Resident Paper Competition

Paper #2
January 10, 2018
8:20 am

PLASMA CO-ADMINISTRATION IMPROVES RESUSCITATION WITH TRANEXAMIC ACID OR PROTHROMBIN COMPLEX IN A PORCINE HEMORRHAGIC SHOCK MODEL

John P. Kuckelman, DO, Morgan R. Barron, MD, Donald Moe, Michael S. Lallemand, MD, John McClellan, Shannon Marko, Matthew J. Eckert, MD*, Matthew J. Martin, MD*
Madigan Army Medical Center

Presenter: John P. Kuckelman, DO

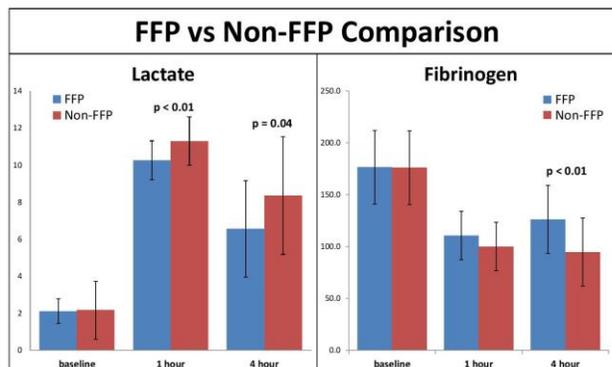
Discussant: Martin A. Schreiber, MD, Oregon Health and Science University

Objectives: Traumatic coagulopathy has been well characterized, but still carries high rates of mortality due to bleeding. A "factor-based" resuscitation strategy using pro-coagulant drugs and factor concentrates in lieu of plasma is being used, but with little evidentiary support. We sought to evaluate and compare resuscitation strategies using combinations of tranexamic acid (TXA), prothrombin complex concentrate (PCC), and fresh frozen plasma (FFP).

Methods: A 35% blood volume hemorrhage combined with a truncal ischemia-reperfusion injury was utilized in 60 adult swine to produce uniform shock and coagulopathy. Animals were randomized to control (N=12), a single agent group (TXA, N=10, PCC, N=8, or FFP, N=6) or combination groups (TXA-FFP, N=10, PCC-FFP, N=8, TXA-PCC, N=6). Resuscitation was continued to 6 hours. Outcomes included hemodynamics, lab values, and thromboelastometry (ROTEM). Results were compared between all groups, with additional comparisons between FFP and non-FFP groups.

Results: All 60 animals survived to 6 hours. Shock was seen in all animals, with hypotension (MAP 44mmHg), tachycardia (HR 145), acidosis (pH 7.18, lactate 11), anemia (HCT 17), and coagulopathy (Fibrinogen 107). There were clear differences between groups for mean pH ($p=0.02$), INR ($p<0.01$), clotting time (CT, $p<0.01$), lactate ($p=0.01$), creatinine ($p<0.01$), and fibrinogen ($p=0.02$). FFP groups had improved resuscitation and clotting parameters (Figures), with lower lactate 6.5 vs 8.4 ($p=0.04$), and increased fibrinogen at 126 vs 95 ($p<0.01$). ROTEM showed shortened CT at 60s in the FFP group vs 65s in the non-FFP group ($p=0.04$).

Conclusions: When correcting traumatic coagulopathy, combinations of FFP with TXA or PCC were superior in improving acidosis, coagulopathy, and clotting time over these agents alone or in combo without plasma. Further validation of pure "factor-based" strategies is needed.



Scientific Session I - Raymond H. Alexander, MD Resident Paper Competition

Paper #3
January 10, 2018
8:40 am

BLOOD PRODUCT AGE VERSUS MORTALITY: RESULTS FROM THE PRAGMATIC RANDOMIZED OPTIMAL PLATELET AND PLASMA RATIO (PROPPR) TRIAL

A. Cozette Kale, MD, MPH, Ronald Chang, MD, Erin Fox, Mohammad Rahbar, Rachel Mitchell, Stacia DeSantis, Eileen M. Bulger, MD, Mitchell J. Cohen, MD, FACS, Bryan A. Cotton, MD, MPH*, Timothy C. Fabian, MD*, Kenji Inaba, MD, Jeffrey D. Kerby, MD, PhD*, Peter Muskat, Terence O'Keeffe, MD, MSPH*, Sandro Rizoli, MD, PhD, FRCSC, FACS*, Thomas M. Scalea, MD, FACS, FCCM*, Martin A. Schreiber, MD, FACS*, Karen Brasel, MD, MPH, Jeanette M. Podbielski, RN BSN, Michael Swartz, Charles E. Wade, PhD, John B. Holcomb, MD*
PROPPR Study Group
University of Texas Health Science Center at Houston

Presenter: A. Cozette Kale, MD, MPH

Discussant: Ali Salim, MD, Brigham & Women's Hospital

Objectives: The storage lesion of red blood cells (RBC), plasma (PLAS), and platelets (PLT) has been described. However, few studies have evaluated the independent effects of blood product age in seriously injured patients. We hypothesized that transfusion of older blood products was associated with increased mortality at 6hr, 24hr, and 30d in massively bleeding trauma patients.

Methods: Blood product and outcomes data prospectively collected during the PROPPR trial were analyzed. PLAS (FFP and thawed plasma) age was defined as days since thawing. "Old" was defined based on the median blood product age: RBC at least 20 days, PLAS at least 2 days, and PLT at least 4 days of storage. The total products and proportion of old RBC, PLAS, and PLT prior to the end of active resuscitation were calculated. We constructed a mixed-effects parametric survival model (Weibull distribution) controlling for age, ISS, mechanism, treatment arm, and total products transfused as fixed effects and study site as a random effect.

Results: There were 680 patients who received 7,776 RBC units (median 12 days, IQR [12, 27]), 4,489 PLAS units (median 2 days, IQR [1, 3]), and 940 PLT units (median 4 days, IQR [3, 5]). PLAS age significantly decreased with increasing units transfused while mortality increased (Figure). Conversely, there was no such change in the RBC or PLT age. Higher proportion of old RBC and young PLAS, but not old or young PLT, were associated with mortality (Table). Receiving any old RBC was associated with increased 6hr (HR 3.4, 95% CI 1.3-8.8) and 24hr (HR 2.2, 95% CI 1.1-4.5), but not 30d, mortality.

Conclusions: Transfusion of a higher proportion of old RBC, or receiving any RBC ≥ 20 days old, was associated with increased mortality. Young PLAS, but not old or young PLT, was associated with mortality. This finding is potentially confounded by decreasing PLAS age with increasing units transfused.

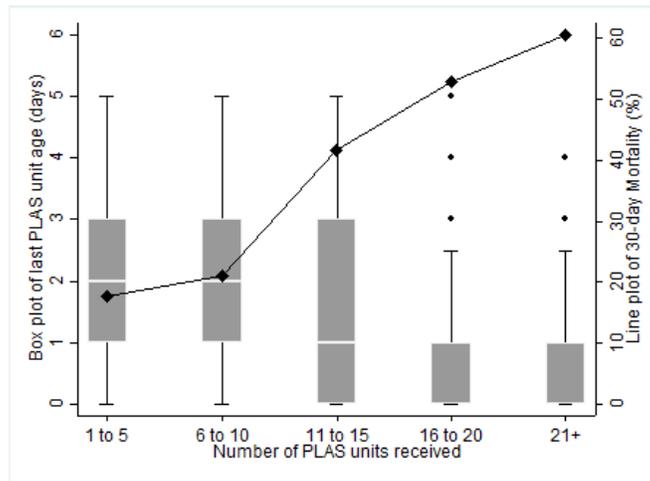


Figure. PLAS age decreased with increasing transfusions while mortality increased.

6h mortality	HR*	95% CI	30d mortality	HR*	95% CI
↑Old RBC	1.09	1.02 – 1.18	↑Old RBC	1.06	1.01 – 1.12
↑Old PLAS	0.91	0.85 – 0.98	↑Old PLAS	0.93	0.88 – 0.97
↑Old PLT	0.96	0.91 – 1.02	↑Old PLT	0.99	0.95 – 1.03
24h mortality	HR*	95% CI	* Hazard ratios for every 10% increase in proportion of old product		
↑Old RBC	1.08	1.01 – 1.16			
↑Old PLAS	0.91	0.86 – 0.98			
↑Old PLT	0.96	0.92 – 1.01			

Table. Increasing proportion of old RBC and young PLAS, but not old/young PLT, were associated with mortality at 6h, 24h, and 30 days.

Scientific Session I - Raymond H. Alexander, MD Resident Paper Competition

Paper #4
January 10, 2018
9:00 am

DO ALL HEAD INJURED PATIENTS ON ANTIPLATELET DRUGS REALLY NEED PLATELETS?

Christopher Bell, MD, Carlos Pelaez, MD*, Sarah K Spilman, MA, Darla Eastman,
Richard A. Sidwell, MD, FACS*, Joseph Sherrill
Iowa Methodist Medical Center

Presenter: Christopher Bell, MD

Discussant: Jose L. Pascual, MD, PhD, University of Pennsylvania

Objectives: It is common for patients with traumatic intracranial hemorrhage (ICH) taking antiplatelet medications to receive platelet transfusion after the ICH is identified. There is no high-quality evidence to guide platelet transfusion for these types of patients. In an effort to standardize the approach to platelet transfusion, a Level I trauma center adopted a targeted platelet transfusion guideline. Platelet reactivity test (PRT) results (Accriva Diagnostics, San Diego, CA) were used to determine need for transfusion, and patients who were non-therapeutic on antiplatelet medication (Aspirin or P2Y12 inhibitors) were not transfused, regardless of severity of head injury.

Methods: The protocol was analyzed retrospectively to evaluate outcomes during the study period (June 2014–December 2016). All patients had moderate to severe ICH (head abbreviated injury score > 1), received a PRT for known or suspected antiplatelet medication use, and had at least two head CT scans. Differences were assessed with Kruskal-Wallis and chi-square tests.

Results: 167 patients met study inclusion criteria and 49 patients (29%) had non-therapeutic PRT results. The groups did not differ by injury severity score and approximately 40% of patients in each group had a severe to critical ICH (head AIS>3). Regardless of ICH type or severity, 92% of patients with a non-therapeutic PRT were not transfused, and only 2 patients (4%) had clinically significant progression of the bleed. Implementation of this protocol reduced platelet transfusions by 56% and associated healthcare costs by 50%.

Conclusions: Using a targeted platelet transfusion protocol for ICH patients with non-therapeutic platelet reactivity significantly reduced platelet usage, particularly for patients with known or suspected antiplatelet medication use and unreconciled home medications. Results demonstrate that not all head injured patients taking antiplatelet drugs need to be transfused.

Table 1. Patients with intracranial hemorrhage (ICH), broken down by platelet reactivity test (PRT) result, June 2014 to December 2016 (N=167)

	Non-Therapeutic PRT N=49	Therapeutic PRT N=118	p-value
Age, median (IQR)	69 (57, 86)	79 (67, 84)	.06
Unstable physiology in emergency department (ED), n (%)	13 (27%)	13 (11%)	.02
Severe or critical head bleed, n (%)	19 (39%)	48 (41%)	.87
Injury severity score (ISS), median (IQR)	14 (10, 22)	14 (9, 21)	.46
Antiplatelet therapy home medication, n (%)	24 (49%)	108 (92%)	<.001
Received platelet transfusion, n (%)	4 (8%)	94 (80%)	<.001
ICU days, median (IQR)	3 (2, 5)	3 (2, 4)	.32
Hospital length of stay, median (IQR)	5 (3, 7)	4 (2, 7)	.28
Mortality, n (%)	6 (12%)	10 (9%)	.56
Clinically significant worsening of ICH, n (%)	4 (8%)	7 (6%)	.73

Table 1. Patients with intracranial hemorrhage (ICH), broken down by platelet reactivity test (PRT) result, June 2014 to December 2016 (N=167)

Figure 1. Clinically significant worsening of intracranial hemorrhage (ICH), compared by head abbreviated injury severity score (AIS) and initial platelet reactivity test (PRT) result.

Key: Black bars denote patients with non-therapeutic PRT. Gray bars denote patients with therapeutic PRT. In the stacked bars, red indicates clinically significant worsening.

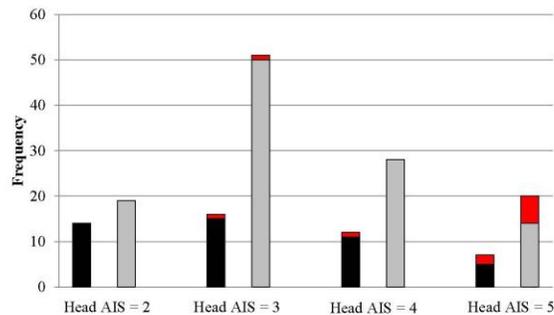


Figure 1. Clinically significant worsening of intracranial hemorrhage (ICH), compared by head abbreviated injury severity score (AIS) and initial platelet reactivity test (PRT) result.

Key: Black bars denote patients with non-therapeutic PRT. Gray bars denote patients with therapeutic PRT. In the stacked bars, red indicates clinically significant worsening.

Scientific Session I - Raymond H. Alexander, MD Resident Paper Competition

Paper #5
January 10, 2018
9:20 am

EARLY PREDICTION OF HEMODYNAMIC INSTABILITY IN CRITICALLY ILL PATIENTS: A PROSPECTIVE STUDY

Jarot Guerra, MD, Asif Rahman, Larry Eshelman, Szymon Bieganski, Brian Gross,
Kelly Bochicchio, Minnan Xu-Wilson, Grant V. Bochicchio, MD, MPH*
Washington University in St. Louis

Presenter: Jarot Guerra, MD

Discussant: Robert D. Winfield, MD, University of Kansas Medical Center

Objectives: Earlier identification of patients at risk of hemodynamic instability has the potential to improve outcome. We previously developed a real time risk score, the hemodynamic instability indicator (HII), which predicts the need for cardiovascular support in ICU patients. We set out to validate this score in a trauma/surgical ICU.

Methods: We prospectively enrolled patients who were expected to stay in the ICU for at least 24 hours, hemodynamically stable, and expected to survive at least 48 hours and not DNI/DNR. HII was continuously calculated in real time by integrating risk factors such as vitals and laboratory values using a previously developed machine learning algorithm. All hemodynamic interventions were collected. The 24 hours before intervention is labeled as the pre-intervention true positive region. The region following resuscitation and until ICU discharge is considered the stable or false positive region. For each intervention segment, we evaluated how well our score predicted that episode of hemodynamic instability in the pre-intervention segment

Results: 126 patients were enrolled. The majority (64%) were male and acute care surgery patients (55%) with a median age of 60. 49% were eventually started on inotropes/pressors. ICU mortality was 9.4% and median ICU length of stay was 5.8 days. Of the enrollees, 60 patients (with sufficient data to calculate the pre-intervention score) were included for further analysis of HII performance. HII significantly predicted the need for pressors/inotropes within 24 hours of the event with sensitivity of 0.56, specificity of 0.76, ($p < 0.01$) with increasing probability as time approached intervention initiation.

Conclusions: HII strongly predicted the need for pressor/inotrope use with increasing predictability as time approached pressor/inotrope initiation. Earlier identification of instability could potentially initiate earlier intervention and improve outcome.

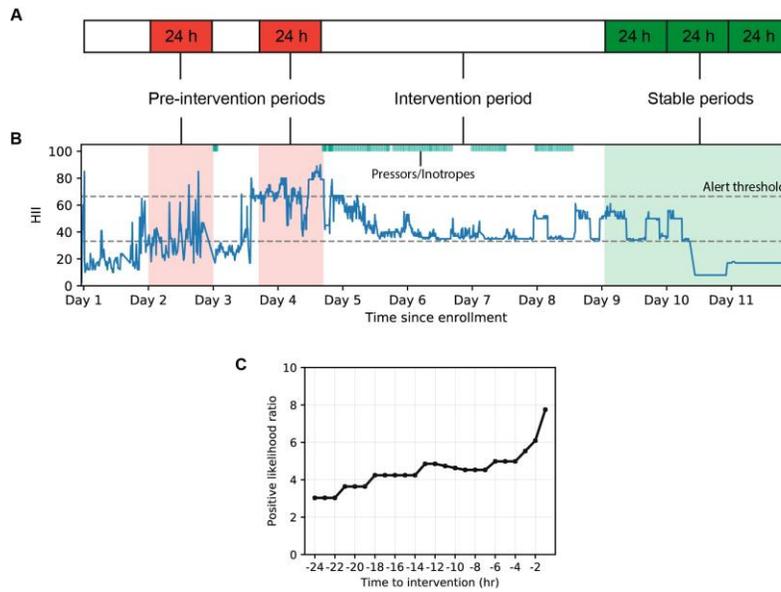


Figure 1. A) Pre-intervention, Intervention and stable periods. B) HII tracks therapy response. C) The positive likelihood ratio shows that the index predicts episodes of hemodynamic instability with increasing likelihood approaching the time of intervention.

Scientific Session II - Raymond H. Alexander, MD Paper Competition

Paper #6
January 10, 2018
10:00 am

MOBILE FORWARD LOOKING INFRARED TECHNOLOGY ALLOWS RAPID ASSESSMENT OF RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA IN HEMORRHAGE AND BLACKOUT CONDITIONS

Morgan R. Barron, MD, John P. Kuckelman, DO, John McClellan, Michael Derickson, Cody Phillips, Shannon Marko, Joshua Smith, Matthew J. Eckert, MD*, Matthew J. Martin, MD*
Madigan Army Medical Center

Presenter: Morgan R. Barron, MD

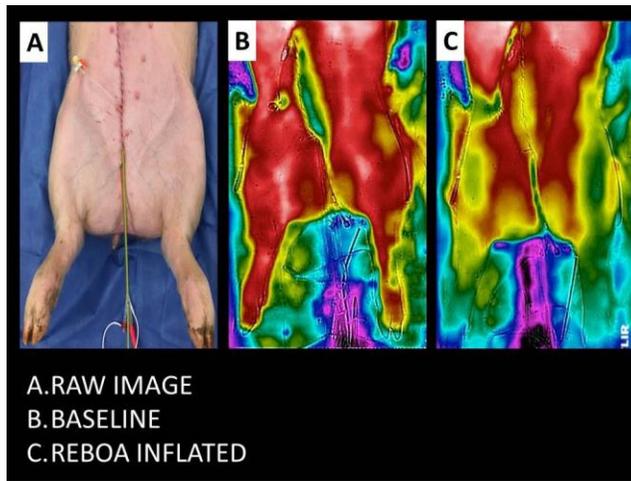
Discussant: Joseph J. DuBose, MD, R Adams Cowley Shock Trauma Center

Objectives: Objective assessment of final REBOA position and adequate distal occlusion is clinically limited. We propose that mobile forward looking infrared (FLIR) thermal imaging is a fast, reliable, and non-invasive method to assess REBOA position and efficacy in scenarios applicable to battlefield care.

Methods: Ten swine were randomized to a 40% hemorrhage group (H, n=5) or non-hemorrhage group (NH, n=5). Three experiments were completed after zone one placement of a REBOA catheter. REBOA was deployed for 30 minutes in all animals followed by randomized continued deployment vs sham in both light and blackout conditions. FLIR images and hemodynamic data were obtained. Images were presented to 62 blinded observers for assessment of REBOA inflation status.

Results: There was no difference in hemodynamic or laboratory values at baseline. The H group was significantly more hypotensive (MAP 44 vs 60, $p<0.01$), vasodilated (SVR 634 vs 938, $p=0.02$), and anemic (HCT 12 vs 23.2, $p<0.01$). H animals remained more hypotensive, anemic, and acidotic throughout all 3 experiments. There was a significant difference in the temperature change (Δ_{Temp}) measured by FLIR between animals with REBOA inflated vs not inflated (5.7°C vs 0.7°C , $p<0.01$). There was no significant difference in FLIR Δ_{Temp} between NH and H when balloon was inflated or deflated. Blinded observer analysis of FLIR images correctly identified adequate REBOA inflation and aortic occlusion 95.4% at 5 minutes and 98.8% at 10 minutes (PPV_{5min} = 99% and PPV_{10min} = 100%).

Conclusions: Mobile thermal imaging is an easy, rapid, and reliable method for assessing distal perfusion after occlusion by REBOA. Smart phone based FLIR technology allows for confirmation of adequate REBOA placement at the point of care, and performance was not degraded in the setting of major hemorrhage or blackout conditions.



Group	Subgroup	Percent Correct
Overall	5 Minutes	95.4%
	10 Minutes	98.2%
5 Minutes	Light	94.4%
	Blackout	96.8%
	Healthy	92.6%
	Hemorrhage	97.6%
10 Minutes	Light	98.4%
	Blackout	97.9%
	Healthy	97.9%
	Hemorrhage	98.4%

Blinded Evaluator Analysis

Scientific Session II - Raymond H. Alexander, MD Paper Competition

Paper #7
January 10, 2018
10:20 am

EXTERNAL VALIDATION OF A 5-VARIABLE CLINICAL PREDICTION RULE FOR IDENTIFYING CHILDREN AT VERY LOW RISK FOR INTRA-ABDOMINAL INJURY FOLLOWING BLUNT ABDOMINAL TRAUMA

Chase A. Arbra, MD, Adam M. Vogel, MD*, Leah Plumblee, Jingwen Zhang, Melvin S. Dassinger, Robert T. Russell, MD, MPH, Martin L. Blakely, Christian J. Streck, Jr., MD*
Medical University of South Carolina

Presenter: Chase A. Arbra, MD

Discussant: Richard A. Falcone, Jr., MD, MPH, Cincinnati Children's Hospital

Objectives: A clinical prediction rule was developed by the Pediatric Surgery Research Collaborative (PedSRC) to identify patients at very low risk for intra-abdominal injury (IAI) and IAI receiving acute intervention (IAI-I) who could avoid abdominal computed tomography (CT). Our objective was to test the validity of this rule in an external dataset.

Methods: A public use pediatric blunt trauma dataset was obtained from the Pediatric Emergency Care Applied Research Network (PECARN). Patients 16 years of age and younger with all five elements of the clinical prediction model: chest x-ray (CXR), abdominal history and physical exam, aspartate aminotransferase (AST), and amylase or lipase collected within 6 hours of arrival were included in the study. We excluded patients presenting greater than 6 hours after injury. The primary outcome was IAI and secondary outcome was IAI-I.

Results: We included 2,435 patients from the PECARN dataset, with a median age of 10 [5,14] years. There were 235 patients with IAI (9.7%) and 60 patients with IAI-I (2.5%). Test characteristics for the clinical prediction rule can be found in Table 1. In patients with no abnormality in any of the five prediction rule variables (complaint of abdominal pain; tenderness, distension, or contusion on abdominal exam; abnormal CXR; AST>200; elevated pancreatic enzymes), the rule had a negative predictive value (NPV) of 99.3% for IAI and 100.0% for IAI-I. In patients identified as very low risk by the clinical prediction rule, 46.8% underwent CT scanning.

Conclusions: A highly-sensitive clinical prediction rule using history, physical exam, labs and x-ray was successfully validated using a large public access dataset of pediatric patients. Following blunt trauma, abdominal CT scans are commonly performed in the very low risk population identified by the prediction rule with little benefit.

Validation of PedSRC 5-Variable Clinical Prediction Model for IAI and IAI-I		
	IAI [Percent (95% CI)]	IAI-I [Percent (95% CI)]
Prediction rule sensitivity	97.5% (94.3, 99.0)	100% (92.5, 100.0)
Prediction rule specificity	37.0% (34.9, 39.0)	34.5% (32.6, 36.4)
Negative predictive value	99.3% (98.3, 99.7)	100% (99.4, 100.0)
Positive predictive value	14.2% (12.5, 16.0)	3.7% (2.9, 4.8)
Negative likelihood ratio	0.07 (0.03, 0.15)	0.0 (0.0, -)

Figure Legend: IAI = intra-abdominal injury, IAI-I = intra-abdominal injury requiring intervention

Scientific Session II - Raymond H. Alexander, MD Paper Competition

Paper #8
January 10, 2018
10:40 am

CONTINUOUS REMOTE ISCHEMIC CONDITIONING ATTENUATES COGNITIVE AND MOTOR DEFICITS AFTER MODERATE TRAUMATIC BRAIN INJURY

Viraj Pandit, MD, Muhammad Khan, MD, ElRasheid Zakaria, Tally Largent-Milnes,
Terence O'Keeffe, MD, MSPH*, Todd Vanderah, Bellal Joseph, MD*
The University of Arizona

Presenter: Viraj Pandit, MD

Discussant: Carlos J. Rodriguez, DO, MBA, Walter Reed National Military Medical Center

Objectives: Remote Ischemic Conditioning (RIC) has shown to improve outcomes in different clinical settings. However, the role of continuous (daily) RIC has not been studied. Aim of our study is to assess impact of continuous RIC on cognitive and motor function following traumatic brain injury (TBI).

Methods: We subjected 24 male C57BL mice to a cortical-controlled TBI. 2-hrs after TBI, animals were randomly allocated to either continuous RIC group (n=12) or Sham group (n=12). RIC was induced by non-invasive external compression of the femoral artery using tourniquet (six 4-min cycles) every 24 hour for 5 days. A baseline rotarod test (measured by latency to fall) and novel object recognition (NOR) was done before induction of TBI. Post-TBI rotarod and NOR tests were performed on day 1 through 5, 7, 14 & 21. Animals were sacrificed on day 21 and brain sections were analyzed using Hematoxylin & Eosin (H&E) staining to evaluate hippocampal CA1 area for neuronal injury.

Results: Post TBI, both groups had lower latency to fall compared to baseline at all-time points. RIC group had higher latency to fall compared to Sham at all-time points and statistically significant after day 4, till day 21 (**Figure 1**). Similarly, Both groups had lower recognition index compared to baseline post TBI at all-time points. RIC animals had significantly higher recognition index than the Sham after day 2 till day 21 post TBI (**Figure 2**). H&E sectioning of brain samples of sham group revealed that more neurons in the hippocampal CA1 area appeared shrunken with eosinophilic cytoplasm and pyknotic nuclei compared to RIC group.

Conclusions: This is the first study to report the impact of continuous RIC on outcomes post TBI. Continuous RIC post-injury results in improved cognitive functions and motor coordination in a mouse model of moderate TBI. In addition, RIC also preserves the neuronal viability post TBI. Further studies are required to determine optimum dosage and frequency to maximize its beneficial effects following TBI.

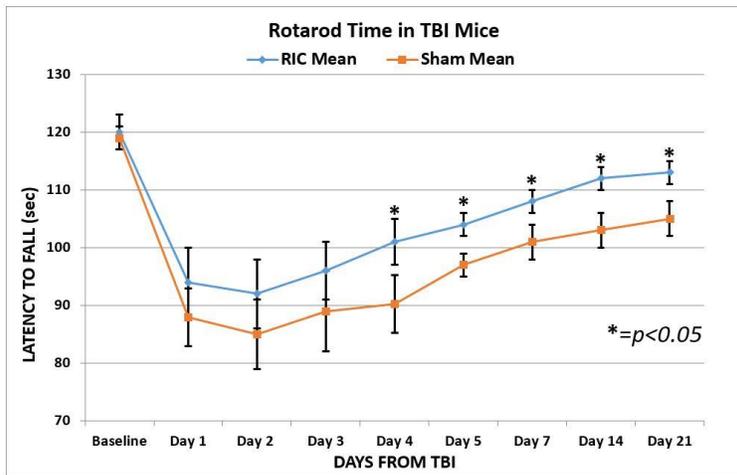


Figure 1. Rotarod test time in the RIC and the Sham group

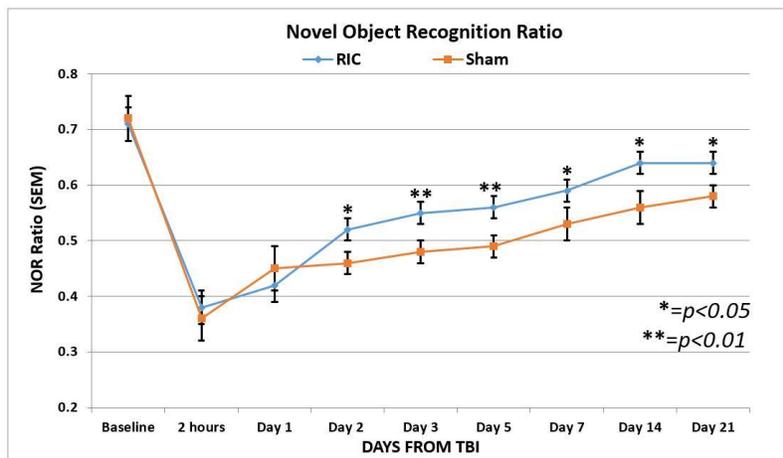


Figure 2. Novel object recognition test time in the RIC and the Sham group

Scientific Session II - Raymond H. Alexander, MD Paper Competition

Paper #9
January 10, 2018
11:00 am

FVC <1: A MARK FOR HIGH RISK PATIENTS

Rachel L. Warner, DO, Nicole Cornell, Porter Knollinger, Stanley B Wolfe, BS,
Gerald Hobbs, Alison M. Wilson, MD*
West Virginia University

Presenter: Rachel L. Warner, DO

Discussant: Bryce R. H. Robinson, MD, MS, Harborview Medical Center

Objectives: Rib fractures (RFx) continue to be a source of morbidity and mortality. A RFx care pathway has been used based on Forced Vital Capacity (FVC). Previous studies have validated FVC in triaging pts to admission level of care (FVC: <1, 1-1.5, > 1.5). The objective of this study was to test the hypothesis that deterioration of FVC to < 1 after admission is a marker for high risk patients and impacts outcomes.

Methods: A retrospective study of pts enrolled in a RFx Care pathway at a level 1 trauma center from 2009-2014. All pts had an admission FVC (aFVC) > 1. Two groups were analyzed: pts with a lowest inpt FVC < 1 (grpA) compared to pts with lowest inpt FVC > 1 (grpB). Complications [pneumonia (PNA), upgrade to the ICU, re-admission (ReAdm) and intubation (Int)] and demographics were examined. Pts without documented FVCs and those with aFVC < 1 were excluded. P-value < 0.05 was considered significant.

Results: 1106 pts were analyzed (GrpA 187, GrpB 919). Pts whose FVC dropped < 1 during admission (GrpA) had a higher complication rate [15% (GrpA) vs 3.2% (GrpB); P<0.001]. Rates of PNA, ReAdm, unplanned upgrade and Int were all significantly higher in GrpA [PNA: 9% (GrpA) vs 1.4% (GrpB), p<0.001; ReAdm: 4% (GrpA) vs 1.7% (GrpB), p=0.04; Upgrade 3.7% (GrpA) vs 0.2% (GrpB), p<0.001; Int: 1.6% (GrpA) vs 0.1% (GrpB), p=0.02]. Hospital length of stay was longer in pts whose FVC dropped <1 during admission [10 days (GrpA) vs 4 days (GrpB) p<0.001].

Conclusions: FVC predicts complications in pts with Rfx. Pts whose FVC falls <1 during admission are at high risk for pulmonary complications. Daily FVC testing for pts admitted with Rfx can predict outcomes. FVC <1 should be implemented as a marker for complications. Once FVC drops <1 pts should be considered for increased interventions. Even if the pt has not yet clinically deteriorated, consideration for higher level of care is warranted. Limitations include retrospective analysis and not excluding concomitant injuries.

Table 1. Complication Rates		
Complications	GrpA lowest FVC <1 n=187	GrpB (lowest FVC >1) n=919
Pneumonia	17 (9%)	13 (1.4%)
Re-Admission	8 (4.2%)	16 (1.7%)
Intubation	3 (1.6%)	1 (0.1%)
Unplanned Upgrade to ICU	7 (3.7%)	2 (0.2%)
Any Complication	29(15.5%)	30 (3.2%)
Hospital LOS	10 days	4 days

Table 1. Complication Rates of Pts with any FVC <1 during admission vs Pts with FVC >1

Table 2. Patient Characteristics		
Characteristics	GrpA lowest FVC <1 n=187	GrpB lowest FVC >1 n=919
Age	58	48
Gender (F,M)	72 (39%), 115 (61%)	191(21%), 731 (79%)
AIS Chest	3	2
ISS	17	13
Chest tube present	11 (5%)	95 (10%)
COPD	33 (17.6%)	78 (8.4%)
Avg admission FVC	1.3	1.6
Avg highest FVC	1.6	2.1
Avg lowest FVC	0.7	1.4

Table 2. Characteristics of Pts with FVC <1 during admission vs Pts with FVCs >1 during admission

Scientific Session II - Raymond H. Alexander, MD Paper Competition

Paper #10
January 10, 2018
11:20 am

BEDSIDE DYSPHAGIA SCREENS IN PATIENTS WITH TRAUMATIC CERVICAL INJURIES: AN IDEAL TOOL FOR AN UNDER-RECOGNIZED PROBLEM

Sarah E. Posillico, MD, Joseph F. Golob, MD*, Andrea Rinker, Laura Kreiner, MD*, Rebecca S. West, Kristen Conrad-Schnet, DO*, Michael L. Kelly, MD, Jeffrey A. Claridge, MD, MS*
MetroHealth Medical Center

Presenter: Sarah E. Posillico, MD

Discussant: Suresh K. Agarwal, Jr., MD, University of Wisconsin Hospitals and Clinics

Objectives: We initiated a prospective interventional study utilizing a nurse-driven bedside dysphagia screen (BDS) in patients with cervical spine injury (CI) to address three objectives: 1) determine the incidence of dysphagia; 2) determine the utility of the new BDS as a screening tool; and 3) compare patient outcomes, specifically dysphagia-related complications, in the study period to a retrospective cohort.

Methods: All patients with CI admitted to a Level I Trauma Center were enrolled in a prospective 12-month study (June 2016-June 2017) and then compared to a prior 14-month cohort of like patients. Our new protocol directed that every patient underwent a BDS prior to oral intake. If the patient failed the BDS, a modified barium swallow (MBS) was obtained. Exclusion criteria were Emergency Department discharge, inability to participate in a BDS, leaving against medical advice, or death prior to BDS. A failed MBS was defined as a change in diet and a need for a repeat MBS. Dysphagia was defined as a failed MBS or the presence of a dysphagia-related complication.

Results: Of 221 consecutive prospective patients identified, 114 met inclusion criteria without BDS protocol violations (Table 1). The incidence of dysphagia was 16.7% in all prospective study patients, 14.9% in patients with isolated CI, and 30.8% in patients with spinal cord injury. The BDS demonstrated 84.2% sensitivity, 95.8% specificity, 80.0% positive predictive value, and 96.8% negative predictive value. There were no dysphagia-related complications. The prospective study patients demonstrated less dysphagia-related complications ($p=0.037$) when compared to the retrospective cohort of 214 patients (Table 2).

Conclusions: The introduction of the BDS resulted in increased dysphagia diagnoses, with a significant reduction in dysphagia-related complications. We recommend incorporating BDS into care pathways for patients with CI.

Demographic Data	Total N= 114
Female Gender	55 (48.2%)
Median Age (IQR)	66 (53.8-81.3)
Blunt Mechanism of Injury	113 (99.1%)
Same Level Falls	45 (39.5%)
Patients with Neurologic Comorbidity	31 (27.2%)
Cervical Spine Fracture	107 (93.9%)
Central Cord Syndrome	7 (6.1%)
Spinal Cord Injury	13 (11.4%)
Operative Intervention Needed	43 (37.7%)

Table 1. Demographic data of 114 prospective patients with cervical injuries that underwent complete screens without violations.

	Retrospective (n=214)	Prospective (n=168)	p-value
Female Gender	102 (47.7%)	75 (44.6%)	0.557
Median Age (IQR)	60 (39.8-81.3)	66 (48.8-80)	0.122
Operative Repair	51 (23.8%)	49 (29.2%)	0.239
MBS Performed	21 (9.8%)	34 (20.2%)	0.004
Dysphagia Diagnosed	19 (8.9%)	24 (14.3%)	0.097
Pts with Dysphagia-related Complications	6 (2.8%)	0 (0.0%)	0.037
Deaths	7 (3.3%)	3 (1.8%)	0.523
Deaths due to Dysphagia	4 (1.9%)	0 (0.0%)	0.134

*To match retrospective cohort, these are patients who met inclusion criteria minus central cord syndrome patients.

Table 2. Comparison of demographic and outcomes data for retrospective and prospective* patient cohorts.

Scientific Session II - Raymond H. Alexander, MD Paper Competition

Paper # 11
January 10, 2018
11:40 am

PROSPECTIVE VALIDATION OF A GRADING SCALE FOR CHOLECYSTITIS

Tarik Madni, MD, Evan Barrios, Jonathan Imran, Audra Clark, Alana Christie, Alexander L. Eastman, MD, MPH, FACS*, Christian T. Minshall, MD, PhD*, Stephen S.Y. Luk, MD, FACS, FCCP*, Joseph P. Minei, MD, MBA, FACS*, Herb A. Phelan III, MD, FACS*, Michael W. Cripps, MD*
University of Texas Southwestern Medical Center

Presenter: Tarik Madni, MD

Discussant: Martin D. Zielinski, MD, Mayo Clinic

Objectives: Surgical reimbursement and resident case entry for Laparoscopic Cholecystectomy (LC) is largely uniform regardless of case complexity. A grading scale for cholecystitis was previously developed to stratify the severity of gallbladder (GB) disease in response to these pitfalls. This five-tiered grading system based on anatomy and inflammatory changes has been demonstrated to be highly reproducible with an Intraclass Correlation Coefficient of 0.804. We aimed to prospectively validate this scale as a measure of LC difficulty.

Methods: Eleven Acute Care Surgeons were asked to grade the initial view of GBs during LC between 9/2016 and 3/2017. These raters then filled out a post-operative questionnaire regarding the difficulty of the surgery. Primary outcome was difficulty of surgery, rated between 1 (least difficult) and 5 (most difficult). The Jonckheere-Terpstra test, Mantel-Haenzel Chi-Square test, or ANOVA was used to test for association between peri-operative data and gallbladder grade. Multinomial logistic regression was used to analyze the odds of increasing difficulty and length of surgery for each grade. All tests were performed at the two-sided 0.05 significance level with Bonferonni-adjusted *p*-values.

Results: A total of 667 LC were performed, with a survey response rate of 48% (317). There were 60 grade 1 GBs (19%), 90 Grade 2 (28%), 102 Grade 3 (32%), 28 Grade 4 (9%), and 37 Grade 5 (12%). Diagnosis of acute cholecystitis, surgical difficulty, partial cholecystectomy and open conversion rates, pre-op WBC, and length of operation all significantly increased with increasing grade (Table 1). Increased odds of greater difficulty and length of surgery were found between each grade on multinomial logistic regression (Table 2).

Conclusions: This study successfully validates this grading scale for cholecystitis as an accurate measure of LC difficulty. Further studies are required to integrate this scale into reimbursement and case entry practices.

Table 1. Association of perioperative gallbladder grade with other surgical parameters

	Perioperative Gallbladder Grade					q
	1 (n = 60)	2 (n = 90)	3 (n = 102)	4 (n = 28)	5 (n = 37)	
N (%)						
Diagnosis						
Acute cholecystitis	22 (36.7)	35 (38.9)	58 (56.9)	20 (71.4)	31 (83.8)	<0.0001
Other diagnosis	38 (63.3)	55 (61.1)	44 (43.1)	8 (28.6)	6 (16.2)	
Difficulty of surgery*						
1	39 (65.0)	23 (25.6)	7 (6.9)	0 (0.0)	0 (0.0)	<0.0001
2	17 (28.3)	53 (58.9)	36 (35.3)	5 (17.9)	2 (5.4)	
3	3 (5.0)	10 (11.1)	42 (41.2)	5 (17.9)	1 (2.7)	
4	1 (1.7)	4 (4.4)	13 (12.7)	14 (50.0)	12 (32.4)	
5	0 (0.0)	0 (0.0)	4 (3.9)	4 (14.3)	22 (59.5)	
Abnormal anatomy						
No	56 (93.3)	81 (90.0)	82 (80.4)	24 (85.7)	31 (83.8)	0.5953
Yes	4 (6.7)	9 (10.0)	20 (19.6)	4 (14.3)	6 (16.2)	
Partial cholecystectomy						
No	60 (100.0)	90 (100.0)	98 (96.1)	28 (100.0)	25 (67.6)	<0.0001
Yes	0 (0.0)	0 (0.0)	4 (3.9)	0 (0.0)	12 (32.4)	
Converted to open						
No	60 (100.0)	90 (100.0)	102 (100.0)	27 (96.4)	29 (78.4)	<0.0001
Yes	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	8 (21.6)	
Bile duct leak post-op						
No	60 (100.0)	89 (98.9)	102 (100.0)	28 (100.0)	32 (88.9)	0.0105
Yes	0 (0.0)	1 (1.1)	0 (0.0)	0 (0.0)	4 (11.1)	
Mean ± Std. Dev.						
Pre-op total bilirubin	0.6 ± 0.6	0.7 ± 0.7	0.6 ± 0.6	0.6 ± 0.3	1.1 ± 1.2	0.0257
Pre-op WBC count	8.8 ± 3.0	9.0 ± 3.2	9.6 ± 3.5	10.7 ± 3.8	12.3 ± 4.4	<0.0001
Length of op., min	63.3 ± 22.5	69.8 ± 22.5	79.8 ± 28.0	89.1 ± 28.8	108.1 ± 41.7	<0.0001

Except where indicated, the Mantel-Haenzel Chi-Square test for ordinally-scaled response was used to analyze the association of grade with categorical variables, and ANOVA was used to analyze the association of grade with continuous measures. Provided q-values are Bonferonni-adjusted p-values. *Jonckheere-Terpstra test for doubly-ordered categorical data was used.

Table 2. Multinomial logistic regression analysis of perioperative gallbladder grade with other surgical parameters

	Odds Ratio (95% CI)				p
	Grade 1 VS Grade 5	Grade 2 VS Grade 5	Grade 3 VS Grade 5	Grade 4 VS Grade 5	
Difficulty of surgery (per increase of 1)	0.01 (0.01, 0.03)	0.04 (0.02, 0.09)	0.12 (0.06, 0.24)	0.31 (0.16, 0.59)	<0.0001
Length of surgery (per increase of 10 minutes)	0.57 (0.48, 0.69)	0.67 (0.58, 0.77)	0.79 (0.71, 0.89)	0.87 (0.76, 1.004)	<0.0001

Table 2 contains the results from the multinomial logistic regression analysis of perioperative gallbladder grade with difficulty of surgery and length of surgery. The odds of being grade 1 were 0.01 times the odds of being grade 5 when difficulty increases by 1. Similarly, the odds of being grade 2 are 0.04 times lower, odds of being grade 3 are 0.12 times lower, and the odds of grade 4 are 0.31 times lower than those of being grade 5. The odds of being grade 1 when length of surgery increases by 10 minutes are 0.57 times the odds of being grade 5. As with difficulty, the odds ratios increase the closer the grade is to 5; as surgery increases by 10 minutes, the odds are 0.67, 0.79, and 0.87 times the odds of being grade 5 for grades 2, 3, and 4, respectively.

Scientific Session III-A

Paper #12
January 11, 2018
10:30 am

THE ROLE OF 4-FACTOR PROTHROMBIN COMPLEX CONCENTRATE (4-PCC) IN COAGULOPATHY OF TRAUMA: A PROPENSITY MATCHED ANALYSIS

Hassan Aziz, MD, Faisal S Jehan, MD, Lynn Gries, Muhammad Khan, MD, Terence O'Keeffe, MD, MSPH*, El Rasheid Zakaria, Andrew L. Tang, MD*, Narong Kulvatunyou, MD*, Bellal Joseph, MD*
The University of Arizona

Presenter: Hassan Aziz, MD

Discussant: Ryan A. Lawless, MD, Denver Health Medical Center

Objectives: Coagulopathy is a common complication after severe trauma. 3-factor PCC has shown to be effective in reversing coagulopathy of trauma (COT), however, the role of 4-factor PCC is still unclear. The aim of our study is to compare 4-PCC+FFP vs. FFP alone for the treatment of COT.

Methods: We reviewed all trauma patients >18y of age who received PCC+FFP or FFP alone at our Level I trauma center from 2014-16. We excluded patients on preinjury oral anticoagulants. Patients were divided into two groups (4-PCC+FFP: FFP alone) and were matched in a 1:2 ratio using propensity score matching (PSM) for demographics, vital and injury parameters, and initial INR. COT was defined as admission INR>1.5. Corrected INR was defined as INR<1.5. Outcome measures were time to correction of INR, pRBC units transfused, thromboembolic complications, and mortality.

Results: 516 patients analyzed, of which 120 patients (4-PCC+FFP: 40, FFP: 80) were matched. Mean age was 58+/-20 y; 60% were male, median ISS was 29 [14?38]. Mechanism of injury was blunt in 87% patients. 4-PCC+FFP was associated with an accelerated correction of INR (373 vs. 955 min; $p=0.001$), decrease in pRBC units (7 vs. 9 units; $p=0.04$), and FFP units (5 vs. 7 units; $p=0.03$) transfused as compared to FFP alone. 4-PCC+FFP was associated with lower mortality rate (25% vs. 33% $p=0.04$) as compared to FFP alone, however, there was no difference in the thromboembolic complications (2.5% vs. 1.2%, $p=0.5$) between the two groups. Administration of PCC+FFP led to an earlier correction of the INR compared to FFP alone (**Figure 1**).

Conclusions: Results of our study demonstrated that the use of 4-factor PCC in conjunction with FFP is associated with rapid reversal of INR and reduction in transfusion requirements as compared to FFP alone. 4-PCC is an effective therapy for the reversal of COT without increasing the risk of thromboembolic complications.

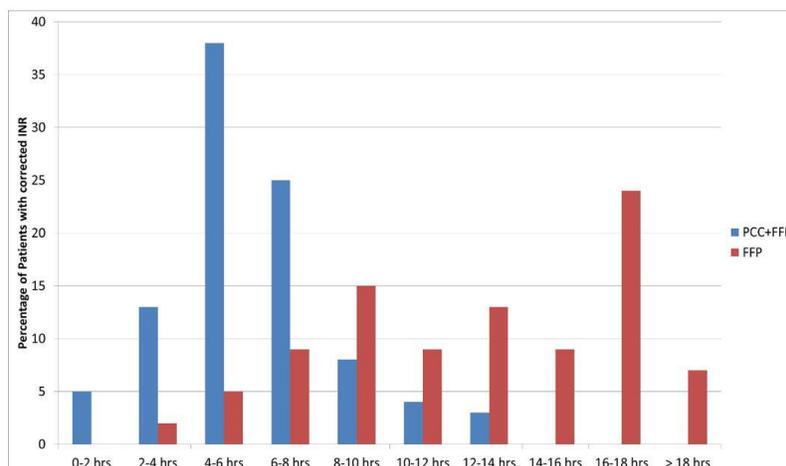


Figure 1. Proportion of patients with corrected INR and time to correction of INR

Scientific Session III-A

Paper #13
January 11, 2018
10:50 am

IN VITRO EFFECTS OF A KAOLIN BASED HEMOSTATIC DRESSING ON ANTICOAGULATED BLOOD

Michael W. Cripps, MD*, Canon Cornelius, Natalia Vasquez, Jocelyn Wey, Peter Gales
University of Texas Southwestern Medical Center

Presenter: Michael W. Cripps, MD

Discussant: Andrew J. Dennis, DO, Cook County Hospital

Objectives: The use of kaolin coated dressings has become common in hemostatic treatment algorithms and have efficacy in normal patients, but their increased use will inevitably include patients on anticoagulants. We hypothesize that kaolin coating material (KCM) will improve clotting regardless of anticoagulation medication.

Methods: A prospective study was performed on blood from 45 patients on anticoagulation agents and 5 healthy controls. 10 patients were on a vitamin K antagonist (VKA), 10 on unfractionated heparin (UH), 10 on an anti-platelet (AP) agent, 10 on a Xa inhibitor (Xa), and 5 on a direct thrombin inhibitor (DTI). None were on more than one type of anticoagulation medication. Viscoelastic (VE) testing was performed with and without KCM. All p-values were adjusted for multiple comparisons.

Results: The addition of KCM significantly decreased the time for initial clot formation (CT) in all groups (Figure 1). The mean CT for controls was decreased from 692 to 190.8 sec ($p < 0.001$). KCM decreased the initial clot formation time by about 1.5 times in those on DTI ($p = 0.043$) and 2.5 times in those taking AP medication ($p < 0.001$). The most profound effect was seen in those on UH (No KCM 1602 secs vs KCM 440 secs; $p < 0.001$), VKA (No KCM 1152 secs vs 232 secs; $p < 0.01$), and Xa (No KCM 1342 secs vs 287 secs; $p < 0.001$). Analysis of other clot formation parameters revealed that KCM significantly improved the clot formation kinetics (CFT) only in patients taking Xa ($p = 0.03$). KCM improved maximum clot strength in patients on UH and Xa ($p = 0.05$). Patients on UH had a larger effect size with an increase in clot strength from 24.35mm to 43.35mm while those on Xa had an increase of 38.7mm to 49.85mm.

Conclusions: In this in vitro analysis, the addition of KCM to the blood of patients taking any of these anticoagulation medications significantly improved the time to initial clot formation, indicating that kaolin based hemostatic dressings will be effective in initiating clot formation in patients on anticoagulants.

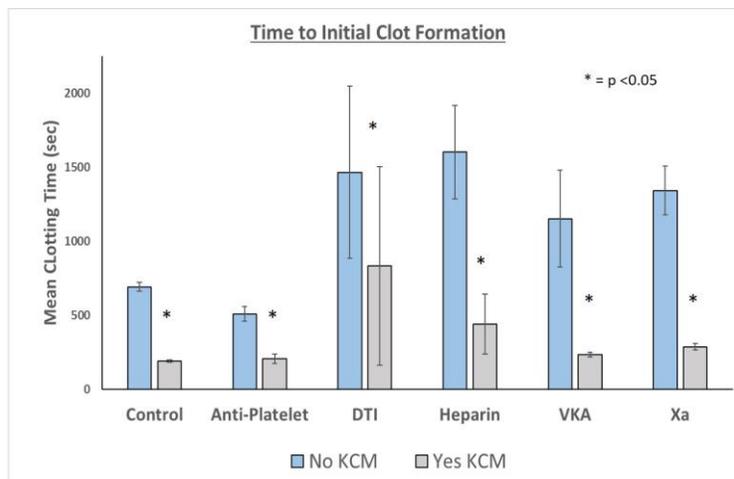


Figure 1. The addition of kaolin coating material (KCM) improved the time it takes to start forming a clot in all test groups.

Scientific Session III-A
Paper #14
January 11, 2018
11:10 am

MAR RATIO PREDICTS SHOCK VOLUME: TWO METRICS TO UNDERSTAND BURDEN OF INJURY

Brian L. Brewer, MD, Stephanie Savage, MD, MS*, Ben L. Zarzaur, MD, MPH*,
Tyler McCarroll, Greg Gaski, Todd McKinley
Indiana University

Presenter: Brian L. Brewer, MD

Discussant: Franklin Lee Wright, MD, University of Colorado Denver

Objectives: Shock volume (SV) is a novel metric designed to quantify global oxygen debt over time. SV temporally integrates serial shock indices to reflect critical illness and hypoperfusion, as in increased base deficit and multisystem organ dysfunction following injury. Recent research has demonstrated that the ratio of MA to R on admission thromboelastography (TEG) not only reflects underlying coagulation dysfunction, it is an excellent predictor of mortality attributable to hemorrhage. We hypothesized that a relationship exists between admission MAR ratio and subsequent shock volume.

Methods: Injured patients admitted to a Level 1 trauma center were included. Demographic data, injury characteristics and laboratory values were collected. The SV at 3, 6, 12 and 24 hours from admission was calculated from serial shock indices. The MAR ratio was calculated from admission TEG as follows:

MA/R = MAR ratio

Correlation analysis was used to determine the relationship between serial shock volumes and the admission MAR ratio.

Results: 80% of patients were male, mean age was 37 years(SD 12) and mean ISS was 29.4(SD 12.5). 32% had a positive critical administration threshold (CAT) within the first 24 hours and overall mortality was 7%. Correlation between the admission MAR ratio and the shock volume are displayed in Figure 1. There was a significant negative association with decreasing MAR ratio correlating with increased shock volumes (3 hours -0.3284, $p=0.0046$; 6 hours -0.4170, $p=0.0002$; 24 hours -0.3154, $p=0.0066$).

Conclusions: The true burden of injury is often difficult to anticipate immediately after injury. Shock volume quantifies cumulative volume of shock but utility is limited as it may take up to 24 hours to accurately calculate. The MAR ratio, which is calculated from the admission TEG, has a significant inverse relationship with shock volume at 3, 6 and 24 hours. The MAR ratio may serve as an immediate indicator of severity of shock and the potential downstream physiologic effects prior to other indicators.

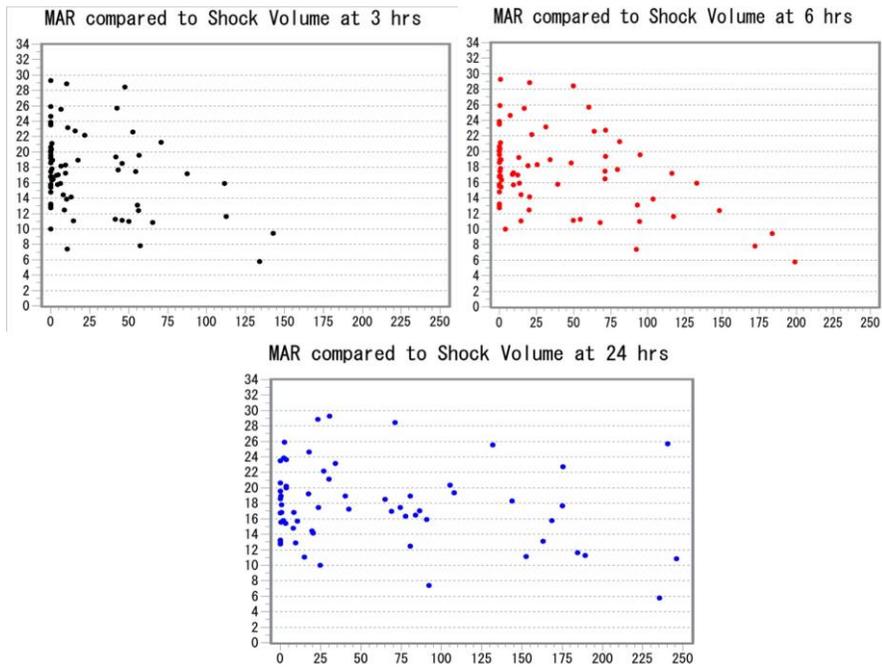


Figure 1 - Correlation between MAR ratio and Shock Volume at 3, 6 and 24 hours following admission.

Scientific Session III-A

Paper #15
January 11, 2018
11:30 am

ASSOCIATION OF FRESH WHOLE BLOOD AND SURVIVAL AT ROLE 2 MEDICAL TREATMENT FACILITIES IN AFGHANISTAN

Jennifer M. Gurney, MD*, Amanda M Staudt, PhD, MPH, Shawn C. Nessen, DO, FACS*, Tuan Le, MD, DrPH, Philip C. Spinella, MD, FCCM*, Andrew Cap, Zsolt T. Stockinger, MD, FACS*, Stacy A. Shackelford, MD*, Heather Pidcoke, Elizabeth A Mann-Salinas, PhD, RN
US Army Institute of Surgical Research

Presenter: Shawn C. Nessen, DO

Discussant: Matthew J. Eckert, MD, Madigan Army Medical Center

Objectives: The objective of this study was to compare mortality in combat casualties who received fresh whole blood (FWB) as compared to those who received no FWB and partial or complete component therapy at forward deployed (Role 2) medical treatment facilities (MTFs) with surgical capability.

Methods: Patients were separated into two groups: 1) received FWB (n=215) and 2) did not receive FWB (n=896); moreover, both groups potentially received plasma, Red Blood Cells (RBCs), and occasionally platelets. Kaplan-Meier plot, log rank test, and multivariate cox regression were performed to compare survival of patients 8 hours after Role 2 admission. A subgroup analysis was conducted among patients requiring a massive transfusion (FWB n=132, no FWB n=98).

Results: In FWB patients, 30.5% of total median blood volume transfused was FWB. In the Kaplan-Meier plot, survival was similar between FWB (93.5%) and no FWB (94.6%) groups ($p=0.6434$); however, after controlling for combat mortality index (i.e. physiological injury severity), base deficit, casualty classification, patient affiliation, and volume of blood product and crystalloid, the risk of mortality was elevated in patients who did not receive FWB (HR=2.0, 95% CI 1.1-3.8) versus patients who received FWB. For massive transfusion patients, the Kaplan-Meier plot showed increased survival in patients who received FWB (89.4%) as compared to patients who did not (79.6%) ($p=0.0385$); although, after adjusting for covariates, the difference in mortality between the study groups was only marginally significant (HR=1.9, 95% CI 0.9-4.0).

Conclusions: These results corroborate previous studies demonstrating, in environments where platelets are largely unavailable, patients who received FWB had lower mortality. Further analysis is needed to elucidate other factors (e.g. traumatic brain injury, temperature) that may result in improved survival in patients who receive FWB.

Scientific Session III-A

Paper #16
January 11, 2018
11:50 am

A COMPARISON OF RESUSCITATION INTENSITY (RI) AND CRITICAL ADMINISTRATION THRESHOLD (CAT) IN PREDICTING EARLY MORTALITY AMONG BLEEDING PATIENTS: A MULTICENTER VALIDATION IN 680 MAJOR TRANSFUSION PATIENTS

David Meyer, MD, Bryan A. Cotton, MD, MPH, Erin Fox, Deborah M. Stein, MD, MPH, FACS, FCCM*,
John B. Holcomb, MD*, Mitchell J. Cohen, MD, FACS,
Kenji Inaba, MD, Elaheh Rahbar
University of Texas Health Science Center at Houston

Presenter: David Meyer, MD

Discussant: Ronald B. Tesoriero, MD

Objectives: We sought to evaluate the performance of the Critical Administration Threshold (CAT) and Resuscitation Intensity (RI) as more appropriate replacements for massive transfusion (MT) in defining mortality risk in patients undergoing major transfusions.

Methods: Patients predicted to receive MT at 12 Level-1 trauma centers were randomized in the PROPPR trial. MT: ≥ 10 U RBC in 24 hours; CAT+: ≥ 3 U RBC in first hour; RI: total products in the first 30 minutes (1 U RBC, 1 U plasma, 1.0 L crystalloid, 0.5 L colloids each assigned 1 unit). RI was evaluated as a continuous variable as well as dichotomized at ≥ 4 units. Each of these models was evaluated for their ability to predict mortality at 3, 6, and 24 hours.

Results: Of 680 patients randomized, 301 patients met MT, 521 met CAT+, and 445 had RI ≥ 4 . Of those that died, 23% never reached MT threshold, but were all captured by CAT+ and RI ≥ 4 . Half of patients who were CAT+ or RI ≥ 4 met MT criteria. The 30-day mortality was similar between CAT+ (28%) and RI ≥ 4 patients (29%). Predictive values for 24-hour mortality are represented in the TABLE below. In addition, when RI was evaluated as a continuous variable, each unit increase was associated with a 20% increase in hemorrhage-related mortality (OR 1.20, 95% CI 1.15-1.29).

Conclusions: Both RI and CAT may serve as valid surrogates for early mortality in severely injured patients undergoing major transfusion, capturing patients who be lost using MT definition. While CAT+ showed the best sensitivity overall, RI ≥ 4 consistently demonstrated better specificity and similar PPV and NPV. While CAT+ may better capture those patients receiving a RBC-dominant resuscitation, RI ≥ 4 captures other resuscitation fluids and blood products, and can be used as a continuous variable to provide quantitative as well qualitative risk of death.

3-hour mortality				
	PPV	NPV	Sensitivity	Specificity
MT	9%	92%	51%	56%
CAT+	9%	97%	92%	25%
RI ≥ 4	9%	95%	77%	36%
6-hour mortality				
MT	16%	92%	64%	58%
CAT+	13%	96%	91%	25%
RI ≥ 4	14%	93%	78%	36%
24-hour mortality				
MT	21%	90%	63%	59%
CAT+	17%	94%	90%	26%
RI ≥ 4	18%	92%	80%	37%

A comparison of early mortality prediction by MT, RI and CAT

Scientific Session III-A

Paper #17
January 11, 2018
12:16 pm

BLEEDING AND THROMBOEMBOLISM AFTER TBI IN THE ELDERLY: A REAL CONUNDRUM

Nina Glass, MD*, Aparna Vadlamani, Franchesca Hwang, MD, Ziad C. Sifri, MD*, Anastasia Kunac, MD*,
Stephanie Bonne, MD*, Sri Ram Pentakota, Peter Yonclas,
Anne C. Mosenthal, MD*, David H. Livingston, MD*, Jennifer Albrecht
Rutgers-New Jersey Medical School

Presenter: Nina Glass, MD

Discussant: Ali Cheaito, MD, University of California Los Angeles

Objectives: Studies suggest that up to 50% of elderly traumatic brain injury (TBI) patients are on anticoagulant therapy at the time of injury. Both trauma surgeons and neurosurgeons question whether anticoagulation should be stopped to prevent bleeding or recurrent TBI or continued to prevent thromboembolic (TE) events. Our objectives were 1) to evaluate the risks of bleeding and recurrent TBI vs. TE events following an initial TBI in older adults, and 2) to identify risk factors for TBI, bleeding, and TE events in this setting.

Methods: A retrospective analysis of 52,228 Medicare beneficiaries hospitalized with TBI from 2006 to 2010 was performed. We calculated unadjusted risk of post-injury TBI, GI bleeding, or hemorrhagic stroke (bleeding events) and TE events (stroke or MI) over twelve months of follow-up and identified risk factors for these events.

Results: Among beneficiaries with TBI, risk of TE events (4.9 events/100 person-years; 95% confidence interval (CI) 4.7, 5.1) was significantly higher than bleeding events (4.0 events/100 person-years; CI 3.8, 4.2). Several common risk factors (liver disease, COPD) predisposed to all of these complications (Table). Atrial fibrillation and coagulopathy were risk factors for thromboembolic events. Alcohol use and previous history of bleeding were associated with higher risk of bleeding events after TBI. In addition, depression and previous stroke were associated specifically with recurrent TBI.

Conclusions: For elderly patients admitted with TBI, the incidence of thromboembolism is significantly higher than that of bleeding and caution regarding restarting anticoagulation in high-risk patients may be detrimental. Specific risk factors for bleeding and TE events were identified and can help guide care of older adults following TBI. Further studies are needed to establish the optimal management of elderly TBI patients, in particular with respect to anticoagulation.

Risk Factor	Any Bleed	Thromboembolic Events
Race (Black/Other)	X	
Male	X	
Cataracts	X	
Alcohol dependence	X	
Pre-TBI history of bleeding	X	
Disability/End Stage Renal Disease	X	
Discharge to a nursing facility	X	
COPD	X	X
Hyperlipidemia	X	
Liver disease	X	X
Coagulation defect		X
Ischemic heart disease		X
Neurologic disease		X
Rheumatoid arthritis		X
Atrial fibrillation		X

Risk Factors for Adverse Events among Medicare beneficiaries following Traumatic Brain Injury

Scientific Session IV-B - Cox-Templeton Injury Prevention Paper Competition

Paper #18
January 11, 2018
10:30 am

CAN PLANNED TRAFFIC PATTERNS IMPROVE SURVIVAL AMONG THE INJURED DURING MASS CASUALTY MOTORCYCLE RALLIES?

Cecily E. DuPree, DO, Aaron Pinnola, DO, Stefanie Gibson, Keely Muertos, Andrea Romano, John Davis, MD, FACS, Antonio Pepe, MD*, Jason D Sciarretta, MD, FACS
University of South Carolina

Presenter: Cecily E. DuPree, DO

Discussant: Allan B. Peetz, MD, Vanderbilt

Objectives: The objective of this study was to determine whether the implementation of a scheduled controlled "traffic loop" could improve overall mortality and impact patient outcomes during the city's high volume motorcycle rally.

Methods: All motorcycle-related injuries during the city's May "Bike Week" were retrospectively reviewed over a 4-year period. Comparative analysis was completed between "non-traffic loop" Memorial Day weekends of 2013 through 2016 and the city's scheduled 23-mile 3-day "traffic loop" (10pm to 2am) during years 2015 and 2016. The two groups were compared for age, gender, injuries, ISS, GCS, length of stay (LOS), ventilator free days, and mortality. The primary outcome was mortality.

Results: 139 injured patients were reviewed. Non-traffic loop group included 120 patients and 19 patients in the traffic loop group. Mean age was 36.1±11.2 years, 72.1% male. Helmet use observed in 11.5% and 27% were legally intoxicated. Comparison groups were equivalent in age, gender, ISS, and GCS; however, traffic loop patients required longer ICU LOS (17.0 vs 5.2 days, p=0.047) and ventilator days (29.5 vs 6.0 days, p=0.024). Traffic loop injury patterns were significantly more likely to involve abdominal trauma (p=0.002). A 7% decrease in helmet use and a 15% increase in head injuries was seen during traffic loop hours but not statistically significant. All patients were equally as likely to experience chest, extremity, and craniofacial injuries. Although no statistical difference was observed in mortality rates of comparison groups, no deaths occurred during traffic loop hours (0% vs 5%).

Conclusions: The implementation of a controlled traffic loop improved motorcyclist survival with no reported mortalities and suggest planned control traffic patterns during high city volume events can be successful however follow up study over a prolonged period is warranted to confirm our early findings.

Demographic & Outcomes	Non-Traffic Loop	Traffic Loop	p-value
Age, years [Mean (SD)]	36.5 (11.1)	34.0 (11.9)	0.376
Male [n (%)]	83 (69.2)	15 (78.9)	0.589
ICU admission [n (%)]	14 (11.7)	3 (15.8)	0.705
Loss Control [n (%)]	54 (45.0)	7 (36.8)	0.506
Collision with vehicle [n (%)]	61 (50.8)	10 (52.6)	0.114
ETOH \geq legal limit [n (%)]	30 (25.0)	7 (36.8)	0.278
LOS, days [Mean (SD)]	3.1 (7.7)	5.6 (16.6)	0.291
ICU LOS, days [Mean (SD)]	5.2 (5.2)	17.0 (22.0)	0.047
Vent days [Mean (SD)]	6.0 (4.8)	29.5 (27.6)	0.024
Abdominal injury [n (%)]	4 (3.3)	4 (21.1)	0.002
Mortality [n (%)]	6 (5.0)	0 (0%)	0.319

Demographics and Outcomes



23-mile Traffic loop

Scientific Session IV-B - Cox-Templeton Injury Prevention Paper Competition

Paper #19
January 11, 2018
10:50 am

MAPPING AREAS WITH CONCENTRATED RISK OF TRAUMA MORTALITY: A FIRST STEP TOWARD MITIGATING DISPARITIES IN TRAUMA

Molly P. Jarman, PhD, MPH, Elliott R. Haut, MD, PhD, FACS*, Frank Curriero, Renan Castillo
Johns Hopkins School of Public Health

Presenter: Molly P. Jarman, PhD, MPH

Discussant: Mayur Narayan, MD, MPH, MBA, MPHE, Weil Cornell Medicine/NY Presbyterian Hospital

Objectives: Many rural, minority, and low-income communities face geographic barriers to trauma care, which may contribute to health disparities in injury. The built and social environment at the injury scene may also contribute to these disparities, and may compound risk from individual patient demographic and injury characteristics. The objectives of this study were to classify injury events based on features of the injury scene, and to examine patient demographic, injury characteristic, and mortality patterns by location class.

Methods: Data from the 2015 Maryland Adult Trauma Registry and eMEDS pre-hospital Patient Care Reporting System (n = 16,082) were used in a latent class analysis of injury scene characteristics (trauma center distance, trauma center type, land use, community level income, and median age). Distributions of individual patient characteristics and outcomes were examined by location class. Odds of death by location class were estimated with logistic regression, with and without adjustment for demographic and injury characteristics.

Results: Eight classes were identified: rural, exurban, young middle suburb, aging middle suburb, inner suburb, urban fringe, high income urban core, and low income urban core. Patient demographic and injury characteristics varied across classes. Odds of death varied by class, with and without adjustment for individual patient characteristics, and were highest for rural, middle suburban, and low income urban locations. Individual characteristics appear to mask the relationship between location class and mortality.

Conclusions: Characteristics of injury scenes can be categorized into distinguishable classes, and odds of death vary significantly by location class. Identifying areas with highest risk of mortality and patterns of individual risk factors may guide targeted primary injury prevention and clinical treatment interventions.

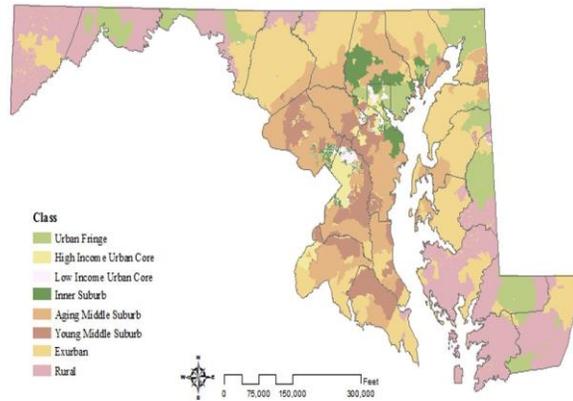


Figure 1: Geographic Distribution of Latent Classes

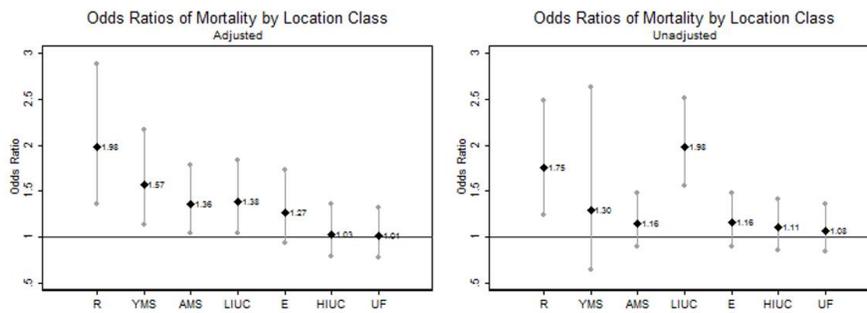


Figure 2: Mortality Odds Ratios by Location Class. Inner Suburb is the reference class. Adjusted model included age, sex, race/ethnicity, insurance status, CCI, severity, mechanism, prehospital time, and mechanism/time interaction. R = Rural, YMS = Young Middle Suburb, AMS = Aging Middle Suburb, LIUC = Low Income Urban Core, E = Exurban, HIUC = High Income Urban Core, UF = Urban Fringe.

Scientific Session IV-B - Cox-Templeton Injury Prevention Paper Competition

Paper #20
January 11, 2018
11:10 am

IMPLEMENTATION IS NOT ENOUGH: GRADUATED DRIVERS LICENSING BENEFITS FROM PUBLIC AWARENESS CAMPAIGNS

Stephanie Bonne, MD*, Iesha Suber, Arnold Anderson, David H. Livingston, MD*
Rutgers-New Jersey Medical School

Presenter: Stephanie Bonne, MD

Discussant: Linda Ding, MD, University of South Alabama

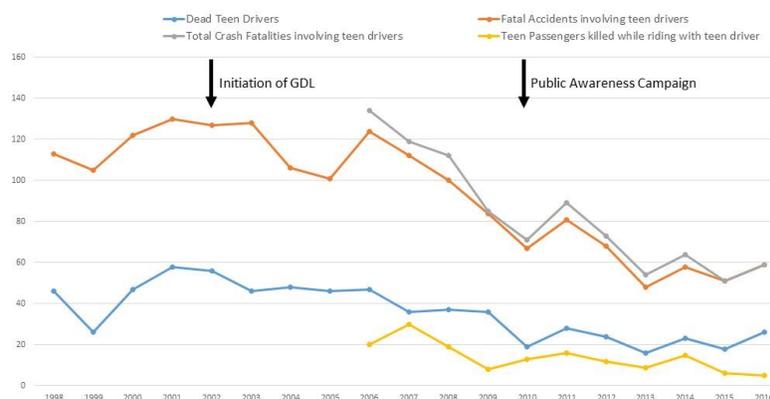
Objectives: Graduated Drivers License (GDLs) are required in most states. GDLs involve a staged approach to licensing teen drivers with a supervisory period followed by a restricted, then full license. Surveys suggest that parents have poor acceptance of restrictions imposed by GDLs and poor compliance. NJ initiated GDLs in 2002, however, fatal crash data showed minimal effect on teen-driver deaths until a subsequent public awareness and enforcement campaign was launched.

Methods: Data from 1998-2016 was obtained from New Jersey's Fatal Accident Investigation Unit. State Police data on total crash fatalities and teen passenger deaths were available after 2005. Data before and after GDL and implementation in 2006 and the state-wide awareness campaign in 2010 were evaluated. Paired t-tests were performed; $p < 0.001$ considered significant.

Results: Initiation of GDL had minimal effect with no change in numbers of dead teen drivers or fatal crashes in the 4 years before and after the law (44 vs. 49 dead teen drivers, 117 vs. 115 for fatal crashes, $p > 0.05$). After a comprehensive public and law enforcement campaign in 2010, fatal crashes declined. Comparing the 7 years prior and after the campaign, decreases are seen in dead teenaged drivers (42 vs. 22, $p < 0.001$) and total fatal teen crashes (107 vs. 61, $p < 0.001$). Comparing 4 years before and 6 years after there were decreases in crash fatalities in teen drivers (112 vs 66, $p < 0.001$) and in number of dead teen passengers in a vehicle operated by a teen (19 vs 11 $p < 0.001$).

Conclusions: GDL laws are common, but implementation alone may be insufficient in decreasing teen MVC fatalities. A comprehensive, public-health based awareness campaign involving the public and law enforcement is needed to ensure compliance and educate about benefits of GDLs in decreasing deaths. Additional studies in other states are needed to assess the validity of these findings.

New Jersey Traffic Fatality Data in Teenaged Drivers
1998-2016



Scientific Session IV-B - Cox-Templeton Injury Prevention Paper Competition

Paper #21
January 11, 2018
11:30 am

EVALUATING THE EFFECTIVENESS OF TRANSLATED A MATTER OF BALANCE FALL PREVENTION PROGRAM MATERIALS FOR NON-ENGLISH SPEAKING PARTICIPANTS

Elizabeth S. Wolfe, CAGS, ATC, Sandra Strack Arabian, CSTR, CAISS, Janis Breeze, Nikolay Bugaev, MD*
Tufts Medical Center

Presenter: Elizabeth S. Wolfe, CAGS, ATC

Discussant: Cindy Blank-Reid, RN, MSN, CEN, Temple University Hospital

Objectives: A Matter of Balance (MOB) is an evidence-based fall prevention program shown to reduce fear of falling (FOF) in English speaking participants. The effectiveness of translated Chinese and Spanish MOB materials in reducing FOF is unknown. The purpose of this study was to evaluate if MOB reduced FOF in Chinese- and Spanish-speaking participants.

Methods: This Institutional Review Board approved, prospective interventional study recruited participants from MOB classes in 2 northern states from November 2014 to October 2015. The Falls Efficacy Scale-International (FES-I) (16-64 point scale; 16= not concerned [about falling] to 64= very concerned) and a demographic questionnaire were used to survey participants at the first class (baseline), last class, and 6 months after the MOB course. FES-I means were compared across and within the language groups using ANOVAs or paired t-tests. Statistical significance was defined by $p < 0.05$.

Results: Ninety participants enrolled, 77 (85.6%) completed the course (Chinese [n=37, 48%]; Spanish [n=19; 25%], English [n=21, 27%]), and 54 (60%) completed the 6-month survey (Chinese [n=33, 61%], English [n=21, 39%]). Most participants were female (n=77, 86%) and had a high school education or less (n=76, 84%, $p < 0.0001$) (Tables 1 & 2). Baseline FES-I scores were higher in the Chinese (40.9 ± 12.6) compared to Spanish (32.0 ± 10.8) and English (28.9 ± 10.0) ($p = 0.0001$). Chinese FES-I scores significantly increased at the last class (+7.1, $p = 0.009$) and 6 month survey (+6.7, $p = 0.0088$). FES-I scores decreased in the Spanish (-6.6, $p = 0.016$) and English groups (-2.7, $p = 0.14$) at last class, and English 6 month FES-I scores were slightly lower than baseline (-0.4, $p = 0.8$) (Table 2).

Conclusions: Chinese had higher FOF at the end the course and 6 months after MOB compared to baseline. The MOB did show promise in reducing FOF in both the Spanish and English groups.

Table 1: Demographic Characteristics by Language among Matter of Balance (MOB) Participants

Language of MOB Class (n)	Chinese (37)	Spanish (25)	English (28)	p-value
Female Gender (n, %)	28 (78)	22 (88)	27 (96)	0.057
Age Category (n, %)*				
<75	9 (25.0)	12 (42.9)	15 (65.2)	0.042
75-79	14 (38.9)	10 (35.7)	4 (17.4)	
>79	13 (36.1)	6 (21.4)	4 (17.4)	
Countries of Origin (n)	China (34) Hong Kong (1) Philippines (1) Taiwan (1)	Bolivia (1) Cuba (4) Dominican Republic (11) Peru (1) Puerto Rico (3) No Answer (5)	United States (27) Cuba (1)	N/A
Mean Years in the US (SD)	27.5 (12.3)	22.3 (17.8)	N/A	N/A

*missing n=3

Table 1: Demographic Characteristics by Language among Matter of Balance (MOB) Participants

Table 2: Survey Answers by Language for Participants Who Completed the MOB Course

	Chinese (37)	Spanish (25)*	English (28)	p-value
Education (n, %)				
Less than high school	23 (64)	14 (67)	3 (12)	<0.0001
High school	4 (11)	7 (33)	18 (69)	
College and higher	9 (25)	0	5 (19)	
Mean number of health problems (SD)**	1.5 (0.9)	1.3 (0.9)	1.5 (1.2)	0.8352
Use of an assistive device (n, %)***	13/33 (39)	13/20 (65)	11/23 (48)	0.1942
Baseline: Had ≥ 1 fall in past 6 months (n, %)	6/36 (17)	3/22 (14)	5/26 (19)	0.8744
Completed final class FES-I (n, %)	37 (100)	19 (76)	21 (75)	0.0009
Baseline FES-I Mean (SD)	40.9 (12.6)	32.0 (10.8)	28.9 (10.0)	0.0001
Final Class FES-I Mean (SD)	48.0 (12.3)	27.5 (8.3)	25.0 (7.2)	<0.0001
Mean change from baseline (paired t-tests)	7.1 (15.6) p=0.009	-6.6 (10.9) p=0.016	-2.7 (7.9) p=0.14	-
Completed 6-month follow-up FES-I (n, %)	33 (89)	-	21 (75)	0.18
6 month FES-I Mean (SD)	47.2 (14.3)	-	27.0 (9.6)	<0.0001
Mean change from baseline to 6 month (paired t-tests)	6.7 (13.8) p=0.0088	-	-0.4 (5.8) p=0.8	-
6 month f/u: Had ≥ 1 fall in past 6 months (n, %)	10/33 (30.3)	-	3/21 (14.3)	0.18

*Six-month follow-up surveys were not available from Spanish-speaking MOB group

**Diabetes, hyper- and hypotension, heart condition, neuropathy, lung condition, stroke, other

***Walker, cane, hearing device, vision device, other

Table 2: Survey Answers by Language for Participants Who Completed the MOB Course

Scientific Session IV-B - Cox-Templeton Injury Prevention Paper Competition

Paper #22
January 11, 2018
11:50 am

MIAMI-DADE COUNTY YOUTH WEAPONS OFFENDER PROGRAM: A POTENTIAL MODEL TO REDUCE FIREARM CRIME RECIDIVISM NATION-WIDE

Rene Gamboa, MS, LMHC, Anjali Sarver, Marilyn Sutherland, Enrique Ginzburg, MD*
University of Miami Miller School of Medicine

Presenter: Rene Gamboa, MS, LMHC

Discussant: Anthony Bottiggi, MD, University of Kentucky College of Medicine

Objectives: Objectives: Homicide is the third leading cause of death among youth aged 15 to 24 years in the United States. 86% of the deaths are due to firearms (CDC). The Juvenile Gun Court in Birmingham, Alabama reported a recidivism rate of 41% for its first 100 participants in 1995 and the Juvenile Gun Program in Minneapolis, MN reported 49% of its graduates had new criminal charges. The goal of this study is to evaluate and compare Miami Dade County's juvenile weapon offender program (JWOP) efficacy in preventing recidivism of high-risk youth.

Methods: Methods: This study is a retrospective analysis of 79 graduates surveyed by the MDC Juvenile Services Department (JSD) of GATE Program graduates over a ten-year period of 1999-2009. The GATE Program is an intervention based program conducted at Jackson Memorial Hospital/ Ryder Trauma Center for males ages 13 to 17 convicted of weapons possession charges or other non-violent weapon offenses. Experiential education and cognitive behavioral interventions are used to achieve the goal of deterring violence and future weapon use.

Results: Results: Re-arrest data from the MDC JSD demonstrated the lowest nation-wide recidivism re-arrest rate of 29% of GATE clients who graduated between 1999-2009.

Conclusions: Conclusion: The GATE Program exhibits the most promising recidivism rate of youth weapons offenders nation-wide. A more robust analysis of recent GATE graduates is underway to assure continued success of the program. If continued efficacy is identified, there is a need for expansion and adaptation of this program to inner city communities around the United States to reduce recidivism of youth weapons offenders and prevent potential death and disability.

Scientific Session IV-B - Cox-Templeton Injury Prevention Paper Competition

Paper #23
January 11, 2018
12:10 pm

INTIMATE PARTNER AND SEXUAL VIOLENCE: A FOCUS ON MALE PATIENTS

Tanya L. Zakrison, MD, MPH, FRCSC, FACS*, Rondi Gelbard, MD*, Xian Luo-Owen,
David Turay, MD, PhD*, Brian H. Williams, MD, FACS*
Ryder Trauma Center, University of Miami Miller School of Medicine

Presenter: Tanya L. Zakrison, MD, MPH, FRCSC, FACS

Discussant: Carnell Cooper, MD, Prince George's Hospital Center

Objectives: A recent EAST-supported, multicenter trial demonstrated a similar rate of intimate partner and sexual violence (IPSV) between male and female trauma patients, regardless of mechanism. Our objective was to perform a subgroup analysis of our affected male cohort as this remains an understudied group in the trauma literature.

Methods: We conducted a recent EAST-supported, cross-sectional, multicenter trial over one year (03/15-04/16) involving four Level I trauma centers throughout the United States. We performed universal screening of adult trauma patients using the validated HITS (Hurt, Insult, Threaten, Scream) and SAVE (sexual violence) screening surveys. Risk factors for male patients were identified. Chi-squared test compared categorical variables with significance at $p < 0.05$. Parametric data is presented as mean +/- standard deviation.

Results: A total of 2034 trauma patients were screened, of which 1281 (63%) were men. Of this cohort, 119 men (9.3%) screened positive for IPSV, 10.4% for intimate partner violence and 6.5% for sexual violence. On categorical analysis of the HITS screen, the proportion of men that were physically hurt was 4.8% compared to 4.3% for women ($p = 0.896$). A total of 4.9% of men screened positive for both intimate partner and sexual violence.

Conclusions: One out of every twenty men that present to trauma centers are survivors of both intimate partner and sexual violence. They are at similar risk for physical abuse as women when this intimate partner violence occurs.

Scientific Session IV-A

Paper #24
January 12, 2018
10:15 am

DECONSTRUCTING DOGMA: NON-OPERATIVE MANAGEMENT OF SMALL BOWEL OBSTRUCTION IN THE VIRGIN ABDOMEN

Morgan L. Collom, DO, Mackenzie Campbell-Furdick, Billy Moore, Nadeem N. Haddad, MD, Martin D. Zielinski, MD, FACS*, Therese M. Duane, MD, FACS*, Mohamed D Ray-Zack, MBBS
JPS Health Network

Presenter: Morgan L. Collom, DO

Discussant: April E. Mendoza, MD, University of California San Francisco

Objectives: Management of SBO has become more conservative, especially in those patients with previous abdominal surgery (PAS). However, surgical dogma continues to promote operative exploration for patients with SBO with no previous abdominal surgery (NAS). With the increase in use of CT resulting in more SBO diagnoses, it is important to reevaluate the role of mandatory exploration. Gastrografin (GG) decreases the need for operative exploration and may be an option for patients without previous surgery. We hypothesize that the use of GG in the SBO population without previous surgery will be equally effective in reducing operative exploration rate compared to the SBO population with previous surgery.

Methods: This prospective, multi-institutional, observational study was performed by comparing adjusted operative exploration rates between NAS and PAS. Rate adjustment was accomplished through multivariate logistic regression.

Results: Overall, 601 patients were included in the study; 500 with and 101 patients without prior abdominal surgery. The groups were similar except for age, gender, prior abdominal surgery including colon surgery, prior SBO admission and history of cancer as shown in Table 1. Multivariate analysis showed that PAS (OR = 0.47, $p=0.03$) and the use of GG (OR = 0.11, $p<0.01$) were independent predictors of not needing surgery, while ICU admission (OR = 16.0, $p<0.01$) was associated with a higher likelihood of need for operation. Figure 1 demonstrates that the use of GG significantly decreased the need for operation not only in the PAS group but also, and even more substantially, in the group of patients with NAS.

Conclusions: Patients receiving GG in both the NAS and the PAS group had lower rates of operative exploration for SBO compared to those that did not receive GG. Based on these results, patients with a diagnosis of SBO with NAS should be considered for GG and not automatic operative exploration.

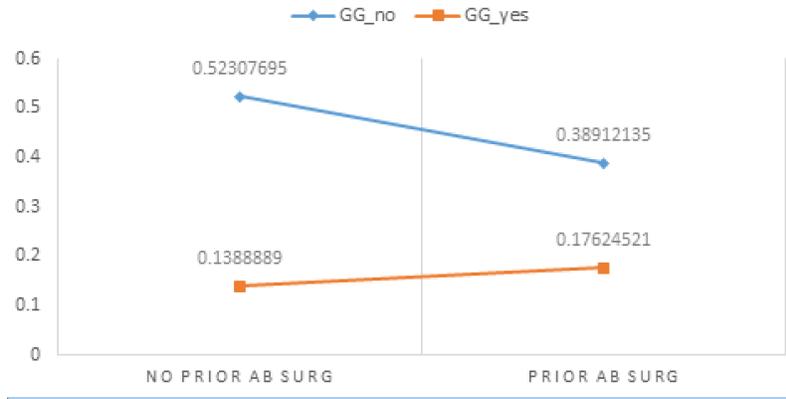


Figure 1.0. Comparing surgery rates for patients with and without history of abdominal surgery, N = 601.

Characteristic	Non-Gastrografin group N=304 (%)	Gastrografin group N=297 (%)	P-value
Operative exploration	127 (41.8)	51 (17.2)	< 0.01
Age >= 65 years	126 (41.5)	150 (50.5)	0.03
Female	140 (46.1)	135 (45.5)	0.88
Prior SBO admission, yes	95 (31.3)	120 (40.4)	0.02
Prior SBO surgery, yes	42 (13.8)	67 (22.6)	0.01
Prior abdominal surgery, yes	239 (78.6)	261 (87.9)	< 0.01
Readmission within 30 days	51 (16.8)	32 (10.8)	0.03
Surgical admission, yes	212 (69.7)	241 (81.1)	< 0.01
SBP, mean (SD)	136.1 (23.0)	136.3 (22.2)	0.92
BMI, mean (SD)	26.7 (7.3)	28.1 (6.9)	0.02
Heart rate, mean (SD)	87.4 (18.1)	83.5 (16.5)	0.01
WBC, mean (SD)	10.4 (5.0)	10.3 (4.0)	0.82
Hx Crohn's disease	12 (4.0)	5 (1.7)	0.09
Prior total abdominal colectomy	16 (5.3)	20 (6.7)	0.45
Duration of obstipation, days, mean(SD)	1.7 (2.5)	1.3 (1.7)	0.04

Table 1. Selected characteristics of SBO patients by Gastrografin challenge status, N = 601.

Scientific Session IV-A

Paper #25
January 12, 2018
10:35 am

CAN ACUTE CARE SURGEONS PERFORM WHILE FATIGUED? AN EAST MULTICENTER PROSPECTIVE STUDY

Kevin M. Schuster, MD, MPH*, Joshua P. Hazelton, DO, FACS*, Deviney Rattigan, Linh Nguyen, J. Martin Perez, MD*, Melissa Blatt, Lara Spence, MD
Yale School of Medicine

Presenter: Kevin M. Schuster, MD, MPH

Discussant: Lawrence Lottenberg, MD, Charles E. Schmidt College of Medicine, Florida Atlantic University

Objectives: Fatigued surgeon performance has only been assessed in simulated sessions or retrospectively after a night on call. Our goal was to determine if self-reported fatigue of acute care surgeons affects patient outcome.

Methods: Four acute care surgery services prospectively collected emergency case outcomes over 18 months. Surgeons defined emergency cases by identifying the patient as needing an immediate operation upon consultation or admission. Surgeons reported, the following day, sleep time accumulated prior to operation, if non-clinical delays to operation occurred and patient volume during the shift. To maximize differences, fatigued surgeons were defined as performing a case after midnight without having slept in the prior eighteen hours. Rested surgeons performed cases before 9 PM or after at least 3 hours of sleep prior to operation. A four-level ordinal scale was used to assign case complexity. Hierarchical logistic regression models were constructed to assess the impact of fatigue on morbidity and mortality while controlling for center and patient level factors.

Results: Of 720 cases collected 567 met criteria for fatigue or rested. Of these cases 158 (27.9%) were performed at night and 154 by a fatigued surgeon. Rested surgeons were more likely to be operating on an older or female patient, other characteristics were similar. Outcomes including mortality, major morbidity, blood loss, incidence of abdominal closure and ostomy creation were similar (Table 1). After controlling for center and patient factors, surgeon fatigue did not impact mortality or major morbidity (Table 2). Mortality variance was 8.3% and morbidity variance was 7.8% at the center level.

Conclusions: Surgeons have similar outcomes in a fatigued or rested state and have equal rates of ostomy creation and fascial closure. Work schedules for acute care surgeons should not be adjusted for the sole purpose of improving patient outcomes.

	Rested surgeon n(%)	Fatigued surgeon n (%)	p
Total patients	413 (72.8)	154 (27.2)	
Age: mean (SD)	52.6 (19.7)	48.5 (20.1)	0.034
Gender female	185 (44.8)	52 (33.8)	0.018
Race			
White	243 (60.8)	81 (54.0)	0.344
Black or African American	102 (25.5)	45 (30.0)	
Asian	10 (2.5)	7 (4.7)	
Other	45 (11.3)	17 (11.3)	
Admitted from			
Home	328 (81.8)	119 (79.9)	0.851
Other acute care hospital	69 (17.2)	28 (18.8)	
ECF	4 (1.0)	2 (1.3)	
Presented with severe sepsis/septic shock	86 (20.8)	33 (21.6)	0.861
Presented with hemorrhagic shock	77 (18.6)	29 (18.8)	0.960
Fascia left open	103 (25.4)	45 (29.6)	0.321
Ostomy created	47 (57.3)	12 (38.7)	0.077
Death	39 (9.82)	12 (8.28)	0.585
Major Morbidity	188 (47.36)	71 (48.97)	0.740

Table 1: SD - Standard deviation, ECF - extended care facility

	Odds ratio for mortality (95% CI)	p	Odds ratio for major morbidity (95% CI)	p
Age	1.06 (1.03 – 1.09)	<0.001		
Admit From				
Home	Reference		Reference	
Other acute care hospital	1.49 (0.55 – 4.11)	0.042	0.87 (0.47 – 1.63)	0.763
ECF	31.73 (1.76 – 571.39)	0.019	1.49 (0.11 – 19.9)	0.686
Functional Status				
Independent			Reference	
Partially dependent			451.96 (<0.01 - >999)	0.756
Totally dependent			0.98 (0.13 – 15.97)	0.386
Hypertension	1.40 (0.55 – 3.55)	0.476		
CHF	5.01 (1.36 – 18.40)	0.011		
Dyspnea	2.77 (0.60 – 12.83)	0.329		
Ventilator dependent	5.86 (1.99 – 17.28)	0.001	2.34 (0.88 – 6.25)	0.088
Ascites	1.15 (0.28 – 4.70)	0.845		
Weight loss	2.44 (0.52 – 11.41)	0.257		
Bleeding disorder	0.93 (0.33 – 2.63)	0.896	1.87 (0.86 – 4.07)	0.116
Sepsis				
None	Reference		Reference	
SIRS	3.86 (1.20 – 12.46)	0.277	1.68 (0.94 – 3.00)	0.082
Sepsis	5.38 (1.43 – 20.28)	0.148	1.97 (0.95 – 4.09)	0.069
Septic shock	10.88 (3.04 – 38.90)	<0.001	16.76 (4.63 – 60.66)	<0.001
Hemorrhagic shock	4.84 (1.31 – 17.85)	0.018		
Hemoglobin	0.84 (0.69 – 1.01)	0.067	0.91 (0.99 – 1.01)	0.057
Case complexity				
Level I	Reference		Reference	
Level II	213.08 (0.09 - > 999)	0.193	3.79 (1.08 – 13.35)	0.038
Level III	242.04 (0.11 - >999)	0.153	6.16 (1.76 – 21.61)	0.005
Level IV	835.71 (0.31 - >999)	0.095	21.71 (3.83 – 123.08)	<0.001
Surgeon Fatigue	1.47 (0.54 – 3.96)	0.448	1.38 (0.82- 2.30)	0.224
Model area under ROC curve	0.921		0.862	

Table 2: ECF - extended care facility, CHF - congestive heart failure, SIRS - systemic inflammatory response syndrome, ROC - receiver operating characteristic

Scientific Session IV-A

Paper #26
January 12, 2018
10:55 am

RAPID RECOVERY OF PROTEIN DEBT IS ASSOCIATED WITH FEWER COMPLICATIONS IN CRITICALLY INJURED ADULTS

Jennifer L. Hartwell, MD, FACS*, Jenalee Cooksey, Ann Cotton, Chelsea Wenos,
Ben L. Zarzaur, MD, MPH*, Grace S. Rozycki, MD, MBA, FACS*
Indiana University

Presenter: Jennifer L. Hartwell, MD, FACS

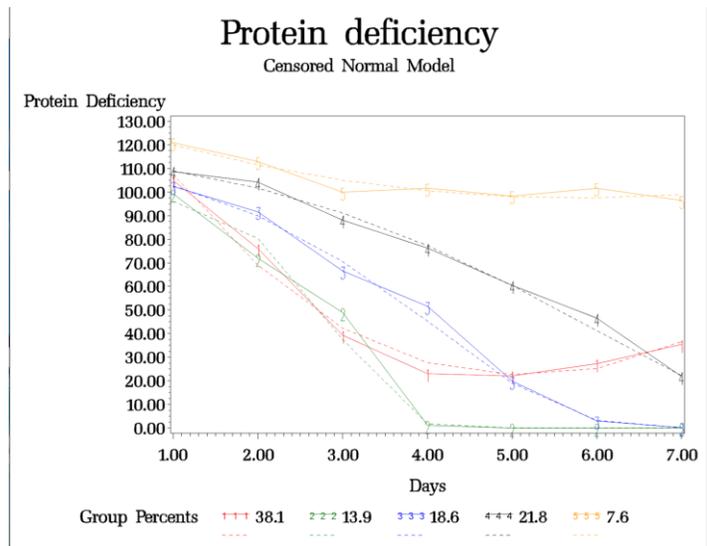
Discussant: Mack D. Drake, DO, Grady Memorial Hospital

Objectives: Injured patients are at risk of accumulating protein and caloric debt due to interrupted feeding. We hypothesized that differing injury patterns would result in variability in correcting the protein debt and that failure to meet protein goals during the first week of ICU admission would be associated with increased complications.

Methods: Injured adults who were unable to be volitionally fed were included. Data collected included demographics, injury characteristics, major surgical procedures, total prescribed and delivered protein and calories during the first seven days of admission, and complications. Group-based trajectory modeling (GBTM) was used to identify subgroup feeding trajectories.

Results: The included 274 patients (71.2% male) had a mean age 50.56 years \pm 19.76, mean ISS 26 \pm 14, time to first nutrition 39.6 hours \pm 24.3, mean caloric debt/7 days 5717.9 calories \pm 2290.65, mean protein debt/7 days 383 grams \pm SD 160.8. C norm modeling reveals five quintiles of patients with varying trajectories of protein deficits over the first week of admission (graph). Group 5 never closes the protein gap, includes more patients with digestive tract injuries (33%, $p=0.0002$), higher mean number of surgeries (1.71, $p=0.001$), longer time to first nutrition (61.9 hours, $p=0.001$) and the highest mean number of complications (1.52, $p=0.0086$). Group 2, who close their protein debt within 4 days, have the lowest mean number of complications (0.62, $p=0.0086$). (table)

Conclusions: There is heterogeneity in the trajectory of protein debt recovery among injury pattern groups. Patients with digestive tract injuries are at increased risk for failure to close their protein debt with a significantly increased risk of complications. There is a decline in complication rates if the protein debt is closed within four days, calling into question the application of current guidelines that NPO status may be acceptable for up to seven days.



Protein Deficiency Trajectory Over First Week of Critical Care Admission

Group	% Blunt	% Penetrating	% Ortho Injury	% Digestive Tract Injury	Mean Complications	Mean # Surgeries	Mean Time 1 st nutrition
1	94.29	3.81	20.95	6.67	1.34	0.93	32.18
2	90.48	9.52	16.67	0	0.62	0.74	23.57
3	90	8	22	12	1.02	0.9	42.6
4	89.29	7.14	44.64	19.64	1.23	1.7	54.43
5	85.71	14.29	42.86	33.33	1.52	1.71	61.9
p-value	0.5542	0.3165	0.0026	0.0002	0.0086	0.001	0.001

Protein Debt Trajectory Group Characteristics

Scientific Session IV-A

Paper #27
January 12, 2018
11:15 am

COMPARISON OF TWO WATER-SOLUBLE CONTRAST PROTOCOLS FOR SMALL BOWEL OBSTRUCTION

Priscilla Ding, BS, Christopher Dodgion, MD, MSPH, MBA*, Tracy VandeWater,
Mohamed D. Ray-Zack, MBBS, MD, Nadeem N. Haddad, MD, Jacob Peschman, Travis Webb,
Martin D. Zielinski, MD, FACS*, Colleen Trevino
Medical College of Wisconsin

Presenter: Priscilla Ding, BS

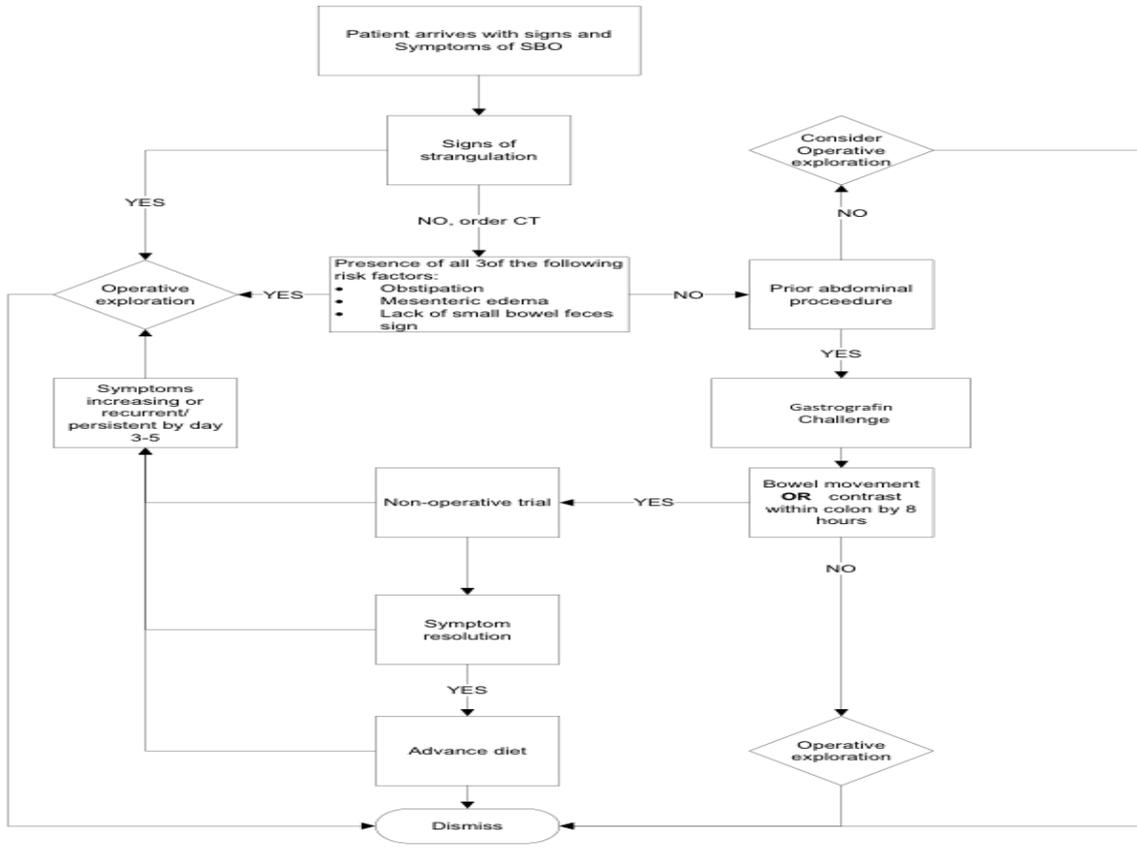
Discussant: Melissa M. Boltz, DO, MBA, Penn State Milton S. Hershey Medical Center

Objectives: Small bowel obstruction (SBO) accounts for 15% of acute surgical admissions, 300,000 operations and up to \$2.3 billion in expenditures annually. Recent guidelines advocate a water-soluble contrast challenge (WSCC) protocol as a cornerstone to treatment but whether high osmolar (Gastrografin, GG) or isosmolar (Omnipaque, OP) contrast agents should be used is unknown. We aim to evaluate the adoption and compare the efficacy of two SBO WSCC protocols which utilize differing osmolar WSCC agents.

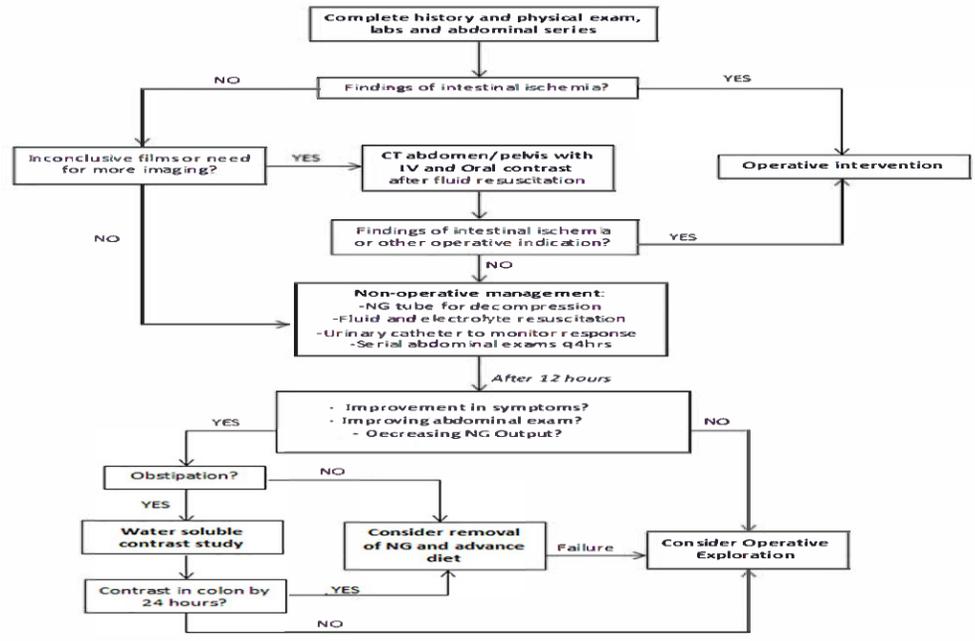
Methods: A multicenter, prospective observational study was conducted from July 2015-January 2017. Logistic and linear regression were used to investigate the influence of WSCC administration on length of stay (LOS), operative rate (OR), and time to operation both within and between each institution's protocol.

Results: 287 patients were treated for SBO at two institutions (150 at Int1, 137 at Int2; median age 65 ± 16 ; 57% female). 61% (Int1 75 pts, Int2 95 pts) received a WSCC and 39% (Int1 70 pts, Int2 35 pts) underwent an operation. Both contrast agents decreased LOS (GG 6d vs 16d, $p=.001$; OP 4.5d vs 6d $p=.69$) and OR (GG 26% vs 74%, Odds Ratio 0.13 $p<.0001$; OP 16% vs 47%, Odds Ratio 0.21 $p=.0002$) as compared to those patients who did not get contrast. The time to operation was increased with use of either agent (GG 92hrs vs 22hrs $p<.0001$; OP 72hrs vs 40hrs $p=.0004$) but without an increase in small bowel resection rate. When comparing the WSCC agents there was not a significant difference between LOS, OR, or time to operation. There were significant differences between protocols in OR (Int1 50% vs Int2 26% $p<.0001$) and time to operation (Int1 46hrs vs Int2 41hrs $p=.033$).

Conclusions: Utilization of either contrast agent reduced length of stay and operative rates. We found significant differences in outcomes between protocols, but additional investigations are needed to determine the exact etiology of these results and optimize these protocols.



Institution 1: SBO Protocol Using Gastrografin (High Osmolar)



Institution 2: SBO protocol Using Omnipaque (Isosmolar)

Scientific Session IV-A

Paper #28
January 12, 2018
11:35 am

THE OPIOID EPIDEMIC IN ACUTE CARE SURGERY—CHARACTERISTICS OF OVERPRESCRIBING FOLLOWING LAPAROSCOPIC CHOLECYSTECTOMY

Kristine T. Hanson, MPH, Stephanie F. Polites, MD, Cornelius Thiels,
Martin D. Zielinski, MD, FACS*, Elizabeth B. Habermann, PhD
Mayo Clinic

Presenter: Kristine T. Hanson, MPH

Discussant: Jeffrey D. Kerby, MD, PhD, University of Alabama at Birmingham

Objectives: Postoperative prescribing must be optimized in emergency surgery patients to address the opioid epidemic as misuse is commonly preceded by a prescription for acute pain. The purpose of this study was to identify characteristics associated with higher opioid prescribing following laparoscopic cholecystectomy (LC).

Methods: Patients age ≥ 18 who underwent LC at a single institution 2014-2016 were identified. Opioids prescribed at discharge were converted to oral morphine equivalents (OME) and compared to CDC guidelines (200 OME). Preoperative opioid use was defined as any opioid prescription ≤ 90 days before LC. Univariate and multivariable methods determined characteristics associated with a top tertile opioid prescription.

Results: Of 1309 patients, 34% had an emergent LC and 66% were elective. Nearly all (96%) received opioids at discharge. Median OME was 225 (IQR 150-300), and 59% were prescribed above CDC guidelines. Top tertile prescriptions (≥ 300 OME) were more likely in patients age < 50 (37% vs 31%, $p=.04$) but did not vary by sex ($p=.41$). Prescribing did not differ for patients with acute cholecystitis, biliary colic, and gallstone pancreatitis ($p=.12$). While median OME did not differ between emergent and elective LC (225, IQR 150-300 for both, $p=.13$) (Figure), emergent had more top tertile prescriptions (37% vs 31%, $p=.04$). However, preoperative opioid use was more likely in elective patients (15% vs 9%, $p=.002$). On multivariable analysis adjusting for diagnosis, age, and preoperative use, emergent status was not associated with top tertile prescription (Table). Refill rate was 7%.

Conclusions: Over half of patients undergoing LC were prescribed opioids in excess of CDC guidelines. Variation in prescribing patterns was not fully explained by patient factors. Acute care surgeons have an opportunity to optimize prescribing practices with the ultimate goal of reducing opioid misuse.

Figure. Opioid oral morphine equivalents (OME) prescribed at discharge following emergent vs elective laparoscopic cholecystectomy.

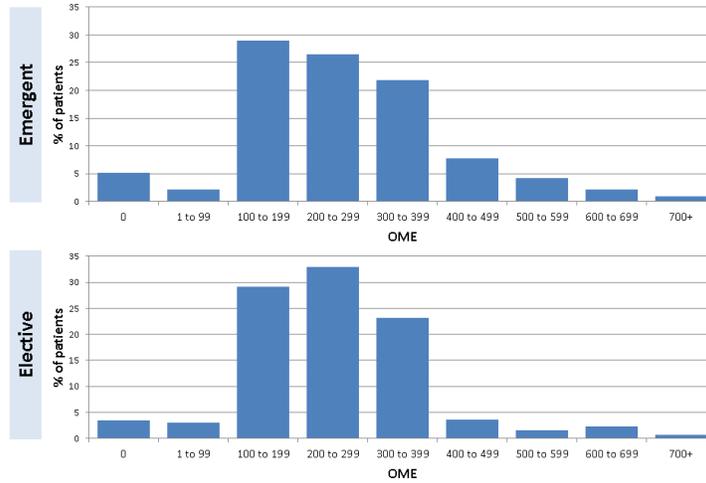


Figure. Opioid oral morphine equivalents (OME) prescribed at discharge following emergent vs elective laparoscopic cholecystectomy.

Table. Odds of a top tertile opioid prescription at discharge.

	OR	95% CI	p-value
Emergency Department Admission (Ref: no)			
Yes	1.24	0.93-1.64	0.15
Diagnosis (Ref: Acute Cholecystitis)			
Pancreatitis	1.35	0.91-2.03	0.14
Biliary colic/Other Biliary	0.94	0.70-1.26	0.67
Age (Ref: 50+ years)			
<50 years	1.26	0.98-1.60	0.05
Pre-operative Opioid Use (Ref: Naive)			
Pre-operative Use	1.38	0.99-1.93	0.06

Abbreviations: CI, Confidence Interval; OR, Odds Ratio.

Table. Odds of a top tertile opioid prescription at discharge.

Scientific Session IV-A

Paper #29
January 12, 2018
11:55 am

EAST MULTICENTER TRIAL ON TARGETED TEMPERATURE MANAGEMENT FOR HANGING-INDUCED CARDIAC ARREST

Cindy H. Hsu, MD, PhD*, Bryce E. Haac, MD, Roumen Vesselinov, PhD, Joseph A Kufera, MA, Mack D Drake, DO*, Andrew C. Bernard, MD*, Alberto Aiolfi, MD, Kenji Inaba, MD, Holly E Hinson, MD, MCR, Chinar Agarwal, MD, Joseph Galante, MD, Emily M Tibbits, M.D., Nicholas J. Johnson, MD, David Calbom, MD, Mina F. Mirhoseini, MD, Mayur B. Patel, MD, MPH, FACS*, Karen R. O'Bosky, MD, Christian Chan, MD, Pascal O. Udekwu, MD, MBA, MHA*, Megan Farrell, PhD, Jeffrey Wild, MD*, Katelyn Young, BS, Daniel C. Cullinane, MD*, Deborah J. Gojmerac, RN, Alexandra Weissman, MD, Clifton Callaway, MD, PhD, Imoigele P. Aisiku, MD, Raghu R. Seethala, MD, Ivan N. Co, MD, Debbie Y. Madhok, MD, Bryan Darger, MD, Dennis Y. Kim, MD, FRCSC, FACS, FCCP*, Lara Spence, MD, Thomas M. Scalea, MD, FACS, FCCM*, Deborah M. Stein, MD, MPH, FACS, FCCM*
R Adams Cowley Shock Trauma Center, University of Maryland School of Medicine

Presenter: Cindy H. Hsu, MD, PhD

Discussant: David T. Efron, MD, Johns Hopkins Hospital

Objectives: We sought to determine the outcome of suicidal hanging and the impact of targeted temperature management (TTM) on hanging-induced cardiac arrest (CA) through a multicenter retrospective study sponsored by Eastern Association for the Surgery of Trauma (EAST).

Methods: We collected patient demographics, CA variables, diagnostics studies, TTM metrics, and discharge outcome from January 1989 to December 2015. Cerebral performance category (CPC) score of 1 or 2 was considered good neurologic outcome, while CPC of 3 or 4 was considered poor outcome. Chi-square and ANOVA tests were performed for categorical and continuous variables, respectively.

Results: Total of 670 hanging patients from 16 centers were analyzed for this study. Their mean age was 34.6; 80.9% were male, and 70% were Caucasian. 192 patients (28.7%) including 20 dead on arrival suffered from CA. The CA patients had significantly higher Injury Severity Score (ISS), lower admission systolic blood pressure, more cerebral anoxia, and worse admission Glasgow Coma Score (GCS), survival, and neurologic outcome (Table 1). Of the 172 CA patients who survived to hospital admission, 80 (46.5%) received post-arrest TTM. Their unadjusted survival (23.8% vs 38%, $p=0.04$) and neurologic outcome (18.8% vs 35.9%, $p=0.01$) were worse than non-TTM CA patients (Table 2). However, after adjusting for admission GCS score of 3 to 8, differences between TTM vs non-TTM survival (23.8% vs 30.0%, $p=0.37$) and neurologic outcome (18.8% vs 28.8%, $p=0.14$) were not significant.

Conclusions: Hanging patients who suffered from CA had worse outcome than non-CA patients. CA patients who received post-arrest TTM had worse unadjusted survival and neurologic outcome than non-TTM patients, but these differences were not significant after adjusting for admission GCS score. Further analysis is necessary to determine TTM's role for the care of more severely injured hanging CA patients.

	CA (n=192)	Non-CA (n=478)	p-value
Age (Mean ± SD)	34.7 ± 13.4	34.6 ± 12.6	.90
Male, n (%)	156 (81.3)	386 (80.8)	.88
Caucasian, n (%)	140 (76.1)	329 (72.0)	.29
ISS (Mean ± SD)	16.6 ± 13.8	5.7 ± 6.5	<.001
Adm SBP (Mean ± SD)	125.3 ± 36.1	135.4 ± 23.7	<.001
Adm GCS, n (%)			<.001
3-8	180 (94.2)	209 (45.9)	
9-12	3 (1.6)	33 (7.3)	
13-15	8 (4.2)	213 (46.8)	
Cerebral anoxia, n (%)	108 (63.2)	56 (12.2)	<.001
Overall Survival, n (%)	54 (28.1)	461 (96.4)	<.001
Good neuro outcome, n (%)	48 (25.0)	450 (94.1)	<.001

Table 1: Characteristics of Cardiac Arrest and Non-Cardiac Arrest Hanging Patients

	TTM CA (n=80)	Non-TTM CA (n=92)	p-value
Age (Mean ± SD)	35.4 ± 12.7	34.9 ± 13.7	.81
Male, n (%)	65 (81.3)	75 (81.5)	.96
Caucasian, n (%)	63 (82.9)	66 (74.2)	.18
ISS (Mean ± SD)	17.6 ± 9.2	15.4 ± 13.4	.33
Adm SBP (Mean ± SD)	132.2 ± 35.9	118.8 ± 35.3	.02
Lowest SBP (Mean ± SD)	100.3 ± 24.7	96.2 ± 24.1	.30
Prehospital GCS, n (%)			.02
3-8	80 (100)	79 (92.9)	
13-15	0 (0)	6 (7.1)	
Adm GCS, n (%)			.006
3-8	80 (100)	80 (87.9)	
9-12	0 (0)	3 (3.3)	
13-15	0 (0)	8 (8.8)	
Admission laboratories (Mean ± SD)			
pH	7.2 ± 0.2	7.2 ± 0.2	.44
Base excess	-9.4 ± 5.7	-8.2 ± 6.3	.21
Lactate	7.6 ± 7.2	6.2 ± 4.2	.17
Cerebral anoxia, n (%)	52 (65.8)	55 (62.5)	.66
Overall Survival, n (%)	19 (23.8)	35 (38.0)	.04
Good neuro outcome, n (%)	15 (18.8)	33 (35.9)	.01

Table 2: TTM Versus Non-TTM Patient Characteristics and Outcome

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

Joseph J. DuBose, MD*, Megan Brenner, MD*, Amelia Pasley, DO*, Laura J. Moore, MD*,
John B. Holcomb, MD*, Jeremy W. Cannon, MD, SM, FACS*, Mark J. Seamon, MD*,
David J. Skarupa, MD, FACS*, Kenji Inaba, MD, Joseph Ibrahim, MD*, Nathaniel Poulin, MD*,
Todd Rasmussen, MD, Thomas M. Scalea, MD, FACS, FCCM*
R Adams Cowley Shock Trauma Center

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
January 12, 2018
10:35 am

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

Andrew Nunn, MD*, Priya Prakash, MD*, Kenji Inaba, MD, Alvarez Escalante, Zoë Maher, MD*, Seiji Yamaguchi, Dennis Y. Kim, MD, FRCSC, FACS, FCCP*, James Maciel, William C. Chiu, MD, FACS, FCCM*, Byron Drumheller, Joshua P. Hazelton, DO, FACS*, Kaushik Mukherjee, MD MSCI*, Xian Luo-Owen, Rachel M. Nygaard, PhD, Bryan C. Morse, MS, MD*, Caitlin A Fitzgerald, MD, Patrick L. Bosarge, MD*, Randeep S. Jawa, MD*, Susan E. Rowell, MD*, Louis J. Magnotti, MD*, Adrian W. Ong, MD*, Tejal S. Brahmhatt, MD*, Michael D. Grossman, MD*, Mark J. Seamon, MD*
University of Pennsylvania

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.

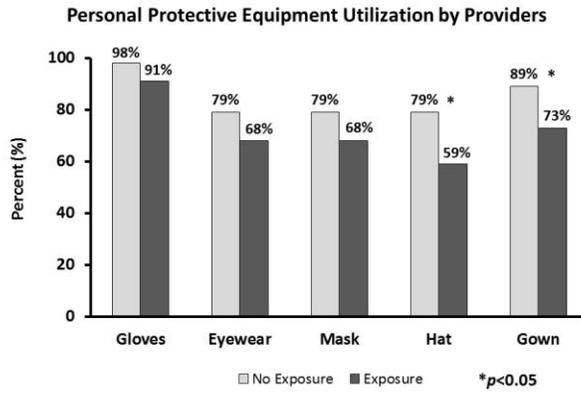


Figure: An itemized comparison of personal protective equipment utilized with respect to provider occupational exposure during EDT.

Scientific Session IV-B

Paper #32
January 12, 2018
10:55 am

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

Christine L. Ramirez, MD*, Shiming Yang, PhD, Joseph Nehu Parimi, Peter Hu, PhD, Yao Li, Thomas M. Scalea, MD, FACS, FCCM*, Deborah M. Stein, MD, MPH, FACS, FCCM*
R Adams Cowley Shock Trauma Center, University of Maryland School of Medicine

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.

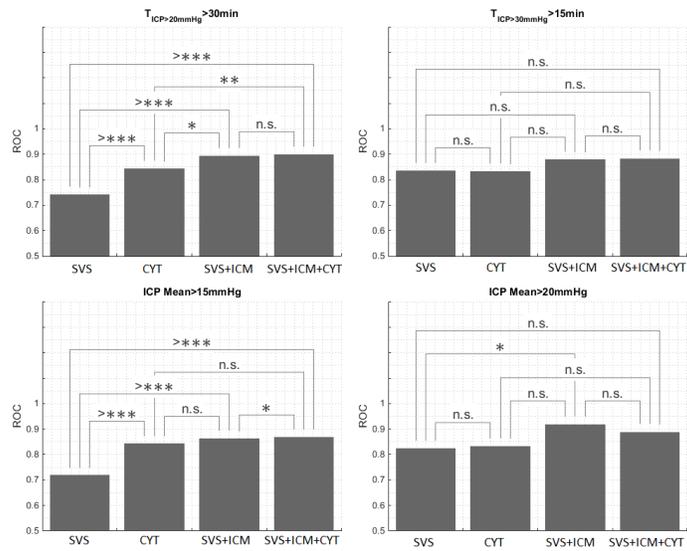


Fig. 1 AUROC values and comparison among different experiments. Models with ICM outperform other models in predicting adverse ICP changes.

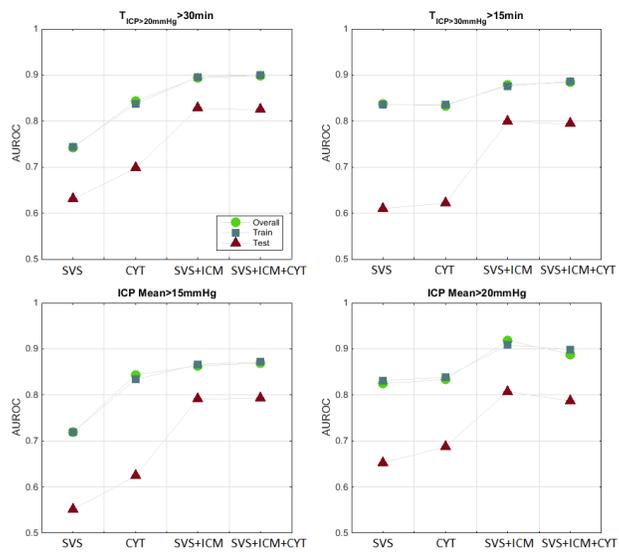


Fig. 2 Model performance evaluation with 10-fold cross-validation. overall (green), training (blue), and testing (red) show that models with ICM have higher AUROC and are more stable in predicting unseen new data.

Scientific Session IV-B

Paper #33
January 12, 2018
11:15 am

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

Yujin Suto, MD, PhD, Katsuhiko Nagata, MD, Syed Ahmed, Kevin Browne, John Cognetti, Victoria Johnson, Ryan Leone, Lewis J. Kaplan, MD, FACS, FCCM, FCCP*, Douglas Smith, Jose L. Pascual, MD, PhD, FRCS(C), FACS, FCCM*
University of Pennsylvania

Presenter: Yujin Suto, MD, PhD

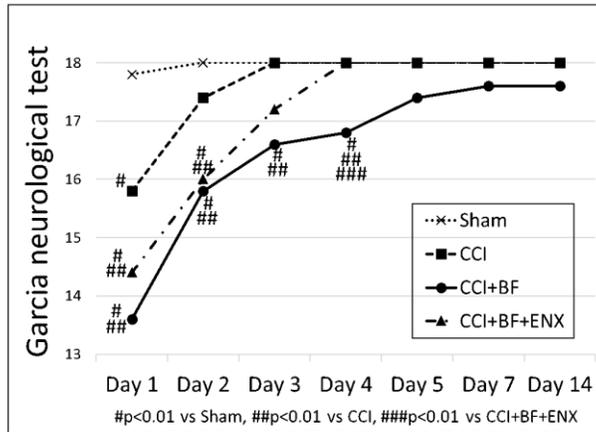
Discussant: Deborah M. Stein, MD, MPH, R Adams Cowley Shock Trauma Center

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.

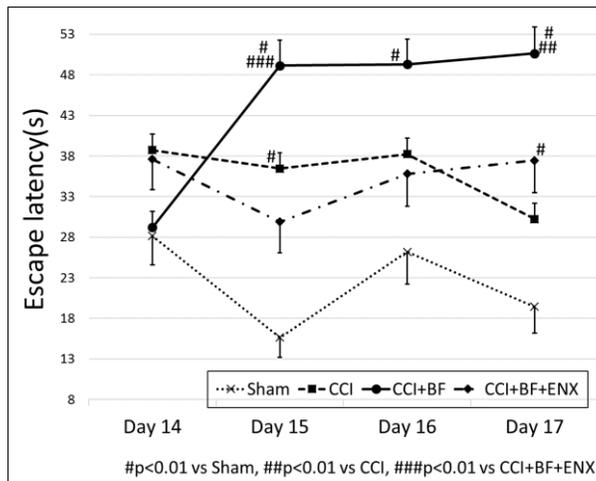
Methods: CD1 male mice underwent TBI (controlled cortical impact - CCI: velocity=6m/sec, depth=1.0mm) or sham craniotomy +/- tibial fracture, receiving either ENX (0.8mg/kg, 1time/day) or saline for 14 days after injury. Randomization defined 4 groups (Sham, CCI, CCI+BF, CCI+BF+ENX, n=5/each). Body weight 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
January 12, 2018
11:35 am

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

Robert Laskowski, MD, PhD*, Randeep S. Jawa, MD*, Jane E. McCormack, RN, BSN*, Emily Huang, MS,
James A. Vosswinkel, MD*, Neeta D Chaudhary, MD, PhD*
Stony Brook University Medical Center

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.

Scientific Session IV-B

Paper #35
January 12, 2018
11:55 am

IMPLEMENTING A CALL BACK PROGRAM IN THE TRAUMA POPULATION

Jennifer Bath, MSN, RN, AGCNS-BC, CEN, TCRN*, Daniel Freeman, Mariana Salamoun, Andrea Wright, Mark E. Hamill, MD FACS FCCM*, Katie M. Love, MD*, Daniel I Lollar, MD*, Bryan R. Collier, DO FACS*
Carilion Roanoke Memorial Hospital

Presenter: Jennifer Bath, MSN, RN, AGCNS-BC, CEN, TCRN

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.