Session I: Plenary
Paper 1 7:50 AM

DECOMPRESSIVE CRANIECTOMY OR MEDICAL MANAGEMENT FOR REFRACTORY INTRACRANIAL HYPERTENSION: AN AAST-MITC PROPENSITY SCORE ANALYSIS

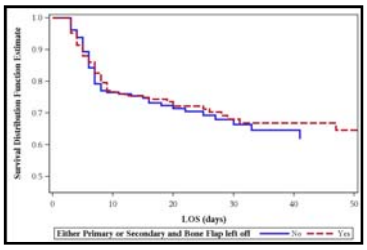
Raminder Nirula*, M.D., M.P.H., D Millar, T Greene, PhD, M. McFadden, MS, Thomas M. Scalea*, M.D., Deborah M. Stein*, M.D., M.P.H., Louis J. Magnotti*, M.D., Gregory J. Jurkovich*, M.D., Gary Vercruysse*, Amy D. Wyrzykowski*, M.D., Demetrios Demetriades*, M.D., Ph.D., Lynette A. Scherer*, MD, Andrew Peitzman **, Jason Sperry*, MD, Kathryn Beauchamp, Scott Bell, Iman Feiz-Erfan, Patrick O'Neill, Raul Coimbra*, M.D., Ph.D., AAST Multi-Institutional Trials Committee

Invited Discussant: Samir M. Fakhry

Introduction: Severe traumatic brain injury (TBI) management involves minimizing cerebral edema to maintain brain oxygen delivery. While medical therapy (MT) consisting of sedation, hyperosmolar therapy and ventriculostomy is the standard of care, decompressive craniectomy (DC) for refractory intracranial hypertension (ICH) has gained renewed interest. Since TBI treatment guidelines consider DC a late intervention after MT failure, we sought to determine if early DC was associated with improved survival.

Methods: Eleven Level 1 trauma centers provided clinical data and head CT scans of patients with a GCS<=13 and radiographic evidence of TBI. CTs were blindly graded according to the Marshall classification. A propensity score (PS) to receive DC (regardless of whether DC was performed) in those surviving 2 days was calculated for each patient based upon patient demographics, comorbidities, physiology, overall and head injury severity and treatment center. Patients who actually received a DC were matched to patients with similar PS who received MT for mortality assessment.

Results: There were 2602 patients who met inclusion criteria of whom 264 (10.1%) received DC. Variables associated with performing a DC included gender, race, ICP monitor placement, ICP, in-house trauma attending, traumatic SAH, midline shift and basal cistern compression. The relative risk ratio of death when DC was performed compared to MT was 0.95 (95%CI: 0.71 to 1.27, Figure). Length of stay was significantly longer for DC patients (25.8 ± 25.1 vs. 20.2 ± 18.6, p<0.01).



Conclusion: DC does not appear to significantly improve mortality in patients with refractory ICH compared to MT. Neurosurgeons should take pause before entertaining this resource demanding form of therapy.

Session I: Plenary
Paper 2 8:10 AM

NTI PROSPECTIVE EVALUATION OF THE VENTILATOR BUNDLE IN TRAUMA PATIENTS: DOES IT REALLY WORK?

Martin Croce*, M.D., Karen J. Brasel*, M.D., M.P.H., Raul Coimbra*, M.D., Ph.D., Charles A. Adams, Jr.*, MD, Preston R. Miller*, M.D., Michael D. Pasquale*, M.D., National Trauma Institute

Invited Discussant: David A. Spain

Introduction: Since its introduction by the IHI, the Ventilator Bundle (VB) has been credited with a reduction in ventilator associated pneumonia (VAP). The VB consists of stress ulcer prophylaxis (SUP), DVT prophylaxis (DVTP), head of bed elevation (HOB), and daily sedation vacation (SV) with weaning assessment. While there is little compelling evidence that the VB is effective, it has been widely accepted. In order to provide evidence regarding VB efficacy, the National Trauma Institute organized a prospective multi-institutional trial to evaluate the utility of the VB.

Methods: This prospective observational multi-institutional study included 5 level 1 trauma centers. Entry criteria required at least 2 days of mechanical ventilation of trauma patients in an ICU. Patients were followed daily in the ICU until the development of VAP, ICU discharge, or death. Compliance with each VB component was recorded daily, along with patient risk factors and injury specifics. Primary outcome was development of VAP.

Results: 559 patients were enrolled. 71% were male, predominately blunt injury; mean age, ISS, and 24 hour GCS were 47, 23, and 8.6, respectively. Overall VB compliance was 85%. VAP occurred in 35% and was not associated with age, gender, or ISS. DVTP (OR .90, $p<.01$), SV (OR .48, $p<.03$), and SUP (OR .01, $p<.001$) were independently associated with no VAP; HOB was not. Cox proportional hazards analysis was then performed to account for time dependent VB compliance. There was lower VB compliance early in ICU stay in patients with VAP vs those without VAP (HR .85, $p<.001$).

Conclusion: In this multi-center study of severely injured patients, use of the VB appears beneficial. Some components are more protective than others. The VB is most effective when implemented early in ICU stay, and is less effective when incompletely utilized.

Session I: Plenary
Paper 3 8:30 AM

OPEN ABDOMINAL MANAGEMENT AFTER DAMAGE CONTROL LAPAROTOMY FOR TRAUMA: A PROSPECTIVE, OBSERVATIONAL AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA MULTICENTER TRIAL

Joseph DuBose*, Thomas M. Scalea*, M.D., John B. Holcomb*, M.D., Binod Shrestha, Obi Okoye, MD, Kenji Inaba*, MD, Tiffany K. Bee*, M.D., Timothy C. Fabian*, M.D., James Whelan, Rao R. Ivatury*, M.D., AAST Multi-Institutional Trials Committee

Invited Discussant: Preston Miller

Introduction: We conducted a prospective observational multi-institutional study to examine the natural history of the open abdomen (OA) after trauma and identify risk factors for failure to achieve primary fascial closure (PFC) after OA use in trauma.

Methods: Adults requiring OA for trauma were enrolled over 2 years. Demographics, presentation, and management variables were utilized to compare PFC and non-PFC patients, with logistic regression used to identify independent risk factors for failure to achieve PFC.

Results: A total of 509 patients from 14 ACS level I trauma centers were enrolled. The majority were male (79%), mean age 39 ± 18 years. ISS was ≥ 15 in 86% of patients, 85% had an abdominal AIS ≥ 3. Overall mortality was 16.3%.Initial PFC with unaltered native fascia was achieved in 312 (61.3%).

Predictors of failure to achieve PFC after OA during initial trauma hospitalization

Step	AOR (95% CI)	Cumulative R2	
Enteric Fistula development	1	16.93 (1.94, 147.07)	0.080
Lactate: ≥ 7.5	2	3.56 (1.67, 7.56)	0.073
Intra-abdominal abscess/sepsis	3	2.56 (1.37, 4.79)	0.030
ISS ≥ 15	4	3.19 (1.49, 6.80)	0.035
Post-operative antibiotics	5	0.56 (0.35, 0.91)	0.014
Number of re-explorations	6	1.07 (1.00, 1.15)	0.015

Other variables in model; Age, Abdomen AIS ≥ 3, Admission Hb, pH, INR, Estimated intra-operative blood loss, Intra-operative crystalloid use, Intra-operative blood use, Post operative fluid balance, Acidosis, Clinical coagulopathy, Emergency department thoractomy, Anterolateral thoracotomy, Negative pressure device, volume of crystalloids used in first 24 hrs, volume of colloids used in first 24 hrs, Total fluid infused at 24 hours; and maximum peak airway pressure, Discontinuous resected bowel, Acute lung injury/ARDS.

Conclusion: Our study identifies independent risk factors associated with failure to achieve PFC during initial hospitalization after OA use for trauma. Additional study is required in order to validate appropriate algorithms that optimize the opportunities to achieve PFC and outcomes in this population.

Session I: Plenary
Paper 4 8:50 AM

CHASING 100%: THE USE OF HYPERTONIC SALINE TO IMPROVE EARLY FASCIAL CLOSURE RATES FOLLOWING DAMAGE CONTROL LAPAROTOMY

John Harvin, Mark Mims, Juan Duchesne, MD, Charles E. Wade*, Ph.D., John B. Holcomb*, M.D., Charles Cox, Jr.*, MD, Bryan A. Cotton*, M.D., University of Texas Health Science Center-Houston

Invited Discussant: Eileen M. Bulger

Introduction: Failure to achieve fascial closure after damage control laparotomy (DCL) is associated with increased morbidity and long-term disability. We hypothesized that hypertonic saline (HTS), which reverses resuscitation-induced intestinal edema in animals, would improve early primary fascial closure (EPFC) rates.

Methods: Prospective study of trauma patients undergoing DCL, 01/10-07/11. HTS group: 30 mL/hr of 3% NaCl as maintenance fluids while fascia was open. Cohort group: isotonic fluids (at 125 mL/hr). Primary outcome: EPFC, defined as primary fascial closure by post-injury day 7. Secondary outcomes: time to closure, closure at first take-back.

Results: Seventy-seven patients underwent DCL (23 received HTS, 54 received isotonic fluids). There were no differences in demographics, injury severity, and pre-ICU vitals, labs, fluids or transfusions. Rates of closure at first take-back and EPFC were higher in the HTS group (TABLE). At discharge, HTS patients had a 96% primary fascial closure rate compared to 80% with standard fluids.

	Isotonic (n=54)	HTS (n=23)	p-value
Median 24-hour fluids, L (IQR)	7.8 (5.7, 10.2)	3.9 (2.9, 6.4)	<0.001
Median time to closure, hr (IQR)	49 (36, 126)	34 (22, 45)	<0.001
Closure at first take-back, %	53%	78%	0.036
Fascial closure by day 7, %	76%	100%	0.010

Conclusion: The use of 3% HTS as maintenance fluids following DCL was associated with 100% EPFC. Previous data has shown that earlier closure reduces infectious, wound and pulmonary complications. HTS may be used an adjunct to facilitate fascial closure in patients undergoing DCL.

Session I: Plenary
Paper 5 9:10 AM

CRYOPRESERVED DEGLYCEROLIZED BLOOD IS SAFE AND ACHIEVES SUPERIOR TISSUE OXYGENATION COMPARED TO REFRIGERATED RED BLOOD CELLS

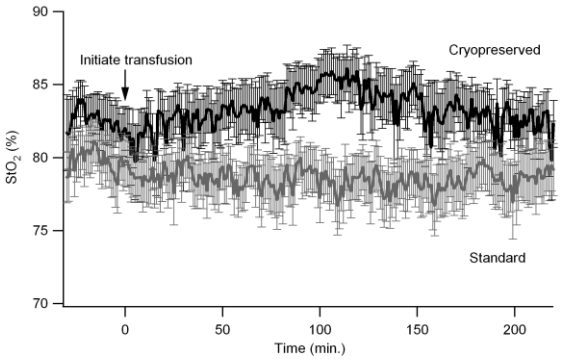
Loic Fabricant, Jerome Differding, Laszlo Kiraly, Martin Schreiber*, M.D., Samantha Underwood, Oregon Health & Science University

Invited Discussant: Frederick Moore

Introduction: During preservation under standard conditions, donated liquid red blood cells (RBC's) experience multiple functional and structural changes known as the storage lesion. Increased RBC age is associated with increased infection rates, organ failure and mortality.

Methods: This prospective, randomized, double-blinded study enrolled stable trauma patients, who required RBC transfusion. Patients were randomly assigned to receive standard or cryopreserved RBC's. Continuous tissue oxygenation (StO2) monitoring was performed during the peri-transfusion period. Hematocrit and thromboelastography (TEG) pre and post transfusion were evaluated. Patients were monitored for transfusion reactions and outcomes. Blood smears were assessed after transfusions.

Results: Fifty seven patients were were randomized and groups were well matched for demographics and ISS. No statistically significant differences were noted in hematocrit change, TEG parameters, blood Smear findings, transfusion reactions, or clinical outcomes. StO2 was found to be greater within the cryopreserved group.



Conclusion: Cryopreserved RBC's are equally safe and efficacious to refrigerated RBC's. This storage technique extends the lifespan of RBCs to 10 years, potentially preserving this precious resource and preventing the storage lesion. StO2 was found to be superior in patients receiving cryopreserved RBC's. This finding has the potential to drive a paradigm shift in transfusion practices.

Session I: Plenary
Paper 6 9:30 AM

NORMAL SALINE VS. PLASMA-LYTE A IN INITIAL RESUSCITATION OF TRAUMA PATIENTS: A RANDOMIZED TRIAL

Jason B. Young, MD PharmD, Garth H. Utter, MD MSc, Joseph M. Galante, MD, Ho H. Phan, MD, Yifan Yang, MD, Brock A. Anderson, MD, Carol R. Schermer*, M.D., M.P.H., Lynette A. Scherer*, MD, University of California, Davis Sponsor: Lynette A. Scherer*, MD

Invited Discussant: Kenneth L. Mattox

Introduction: 0.9% saline, which is often used for initial resuscitation of trauma patients, can exacerbate the metabolic acidosis that occurs with injury. We sought to compare resuscitation with 0.9% saline versus a calcium-free balanced crystalloid solution (Plasma-Lyte A). We hypothesized that Plasma-Lyte A would better correct the base excess at 24 hours after injury.

Methods: We conducted a randomized, double-blind trial of adult trauma patients who required blood transfusion, intubation, or operation within 60 minutes of arrival. Subjects received solely either 0.9% saline or Plasma-Lyte A for resuscitation during the first 24 hours after injury. The primary outcome was mean change in base excess from 0 to 24 hours. Secondary outcomes included 24-hour base excess, arterial pH, serum chloride, total fluid intake, open abdomen and closure rate; and in-hospital mortality.

Results: Of 626 screened patients, 65 were randomized and 46 consented. Mean age was 38 ± 16 years; 76% were men. 57% had blunt injuries. Mean ISS was 23 ± 16. 17% had admission SBP ≤90mmHg. Baseline pH for entire cohort was 7.27 ± 0.11, base excess -5.9 ± 5.0, and serum chloride 106 ± 4.

	0.9% Saline (n=24)	Plasma-Lyte A (n=22)	P-Value
Change in Base Excess at 24 Hrs	4.4 ± 3.9	7.5 ± 4.7	0.02
Base Excess at 24 Hrs	-2.0 ± 4.6	2.1 ± 3.9	0.002
Arterial pH at 24 Hrs	7.37 ± 0.07	7.41 ± 0.06	0.02
Serum Cl (mEq/L) at 24 Hrs	111± 8	104 ± 4	0.001
Total Fluid Intake at 24 Hrs (L)	14.0 ± 12.2	15.6 ± 13.4	0.68
Open Abdomen	5 (21%)	4 (18%)	0.82
Open Abdomen Closed	4 (80%)	3 (75%)	0.78
In-Hospital Mortality	4 (17%)	3 (14%)	0.78

Conclusion: Compared to 0.9% saline, resuscitation of trauma patients with Plasma-Lyte A resulted in improved acid-base parameters and less hyperchloremia at 24 hours post-injury. Further study is warranted to evaluate whether resuscitation with Plasma-Lyte A improves clinical outcomes.

Session I: Plenary
Paper 7 9:50 AM

LIMB SALVAGE AFTER COMPLEX REPAIRS OF EXTREMITY ARTERIAL INJURIES IS INDEPENDENT OF SURGICAL SPECIALTY TRAINING

Steven R. Shackford*, M.D., Richard Y. Calvo, M.P.H., VTTO Study Group, Scripps Mercy Hospital Trauma Service

Invited Discussant: Norman Rich

Introduction: Major extremity arterial injuries (EAI) are managed by various surgical specialties. The impact of surgical specialty training on limb salvage following EAI has not been evaluated. We performed a multicenter retrospective comparative study to assess limb salvage rates following EAI to determine the effect of surgical specialty training on outcome.

Methods: We retrospectively analyzed patients requiring interposition grafting for EAI at 12 trauma centers between the years 1995-2010. EAI from subclavian and common femoral through distal extremity arteries-excluding foot and palmar-were studied. Outcomes were recorded at the time of discharge from the index hospitalization. Factors affecting limb salvage were determined using multivariate logistic regression.

Results: 546 patients were included with a mean age of 31, ISS of 14, and probability of survival (Ps) of 93%; 31% had blunt injury. There were 33 (6%) amputations. Outcomes did not differ by admitting hospital. Patients were stratified according to the specialty training of surgeons who managed their EAI: general surgery, vascular/cardiovascular and orthopedic/plastic. Limb AIS, admission SBP, admission GCS, and Ps were not significantly different between specialty strata. Limb salvage was not significantly different between specialty groups (Table). After adjustment, variables associated with amputation were female gender, increased length of stay, and blunt mechanism of injury.

Specialty Training	N	Limb Salvage
General surgery	327 (60%)	93%
Vascular/cardiovascular	207 (38%)	95%
Orthopedics/Plastic	12 (2%)	100%
		P=0.470 (NS)

Conclusion: Limb salvage following EAI is independent of specialty training. The majority of EAI complex repairs are performed by trauma surgeons with general surgery training.

Session I: Plenary
Paper 8 10:10 AM

OCCULT PNEUMOTHORACES IN CRITICAL CARE (OPTICC): A PROSPECTIVE MULTI-CENTRE RANDOMIZED TRIAL OF PLEURAL DRAINAGE FOR VENTILATED TRAUMA PATIENTS WITH OCCULT PNEUMOTHORACES

Andrew Kirkpatrick, Sandro Rizoli*, MD, JF Ouellet, Marco Sirois, Corina Tiruta, Kevin Laupland, Maureen Meade, Vincent Trottier, Chad Ball*, Assistant Professor, University of Calgary Sponsor: Chad Ball*

Invited Discussant: J. Wayne Meredith

Introduction: The treatment of occult pneumothoraces (OPTXs), identified on CT but not supine CXR, remains controversial; limited to small or uncontrolled series; and unfocused on patients (PTS) undergoing positive pressure ventilation (PPV). PTS may be at risk from tension pneumothoraces (TPTXs) without drainage, or pleural drainage complications if treated.

Methods: Adults with traumatic OPTXs and requiring PPV were randomized to pleural drainage or observation (one side only enrolled if bilateral). All subsequent care and method of pleural drainage was per attending discretion. Primary outcome was a composite of respiratory distress (RD; need for urgent pleural drainage, acute/sustained increases in O2 requirements, ventilator dysynchrony, and charted respiratory events).

Results: Ninety-five severely injured (mean ISS 33 + 11) PTS were enrolled at 4 Centres; Calgary (57), Toronto (28), Quebec (7), and Sherbrooke (3), with 3 exclusions. Forty were randomized to drainage (TT selected in all); 52 to observation. Rates of RD were 42 versus 30% in treated versus observed ($p = 0.2254$). In those observed, 21% required subsequent pleural drainage (45% PTX progression, 44% pleural fluid, 18% worsening pneumonia). One (2%) observed PTS had TPTX, treated with urgent TT and otherwise without sequelae. Serious drainage complications occurred on the study side in 15% of those randomized to drainage, with sub-optimal TT position noted in a further 15%. There were no differences in death; ICU, ventilator, or hospital; days between groups.

Conclusion: OPTXS can be safely observed in hemodynamically stable patients undergoing PPV, although 1/5 may eventually require drainage, and TPTXs still occur. Complications of pleural drainage remain unacceptably high and future work should attempt to identify who among those observed warrant prophylactic drainage.

Session I: Plenary
Paper 9 10:30 AM

SUB-OPTIMAL COMPLIANCE WITH EVIDENCE-BASED GUIDELINES IS ASSOCIATED WITH INCREASED MORTALITY IN PATIENTS WITH SEVERE TRAUMATIC BRAIN INJURIES

Shahid Shafi*, M.D., Sunni Barnes, D Millar, Justin Sobrino, Rustam Kudyakov, Louis J. Magnotti*, M.D., Gary Vercruysse*, Lynette A. Scherer*, MD, Raul Coimbra*, M.D., Ph.D., Gregory J. Jurkovich*, M.D., Nadine Rayan, Candice Berryman, Raminder Nirula*, M.D., M.P.H., AAST Multi-Institutional Trials Committee

Invited Discussant: Frederick Luchette

Introduction: Evidence-based management guidelines (EBM) for severe Traumatic Brain Injuries (TBI) were promulgated decades ago. However, their adoption into bedside clinical practices is not known. The purpose of this study was to measure compliance with EBM guidelines for management of severe TBI and its impact on patient outcome.

Methods: This was a retrospective study of blunt TBI (11 Level I trauma centers, 2008-09, n=2056 patients). Inclusion criteria were admission GCS ≤ 8 and a CT scan showing TBI, excluding non-survivable injuries, i.e., Head AIS 6. Compliance with six non-operative EBM processes was measured (endotracheal intubation, treatment of hypotension, correction of coagulopathy, intra cranial pressure monitoring, maintaining cerebral perfusion pressure ≥ 50 cm, and discharge to rehabilitation). Compliance rates were calculated for each center using multivariate regression to adjust for patient demographics, physiology, injury severity, and TBI severity.

Results: The study group was typical of Level I trauma centers (age 43±20 years, 74% males). Patients were severely injured (ISS 30±12, GCS of 4±2, mortality 34%). Overall compliance rate was 74%, with wide variation between centers (range 60% to 88%). Only three centers achieved > 80% compliance rates. Risk-adjusted compliance was worse than average at two centers, better than average at one, while the remainder were average. Multivariate analysis showed that increased compliance with EBM was associated with reduced mortality (Odds ratio 0.88, 95% CI 0.81 to 0.96, $p < .005$). Sensitivity analysis showed that complete compliance with these processes could save an additional 272 lives (mortality rate reduction 39%).

Conclusion: Despite wide spread dissemination of EBM guidelines, patients with severe TBI continue to receive inconsistent care. Barriers to adoption of EBM need to be identified and mitigated to improve patient outcomes.

SYNERGISTIC EFFECTS OF HYPERTONIC SALINE AND VALPROIC ACID IN A LETHAL TWO-HIT MODEL

Zhengcai Liu, MD, PhD, Yongqing Li, MD, PhD, Baoling Liu, MD, Ting Zhao, MD, Wei Chong, MD, PhD, Marc A. de Moya*, M.D., George Velmahos*, M.D., Ph.D., Hasan Alam*, M.D., Massachusetts General Hospital

Invited Discussant: Peter Rhee

Introduction: Hemorrhagic shock (HS) followed by an infection (second hit) can result in severe systemic inflammatory response and multiple organ failure. Multiple studies have shown that resuscitation with hypertonic saline (HTS) can blunt the inflammatory response. We have also demonstrated that treatment with large doses of valproic acid (VPA; 300 mg/kg), a histone deacetylase inhibitor, improves survival in a rodent two-hit model [HS followed by cecal ligation and puncture (CLP)]. In the present study, we examined whether combination of HTS with VPA would allow us to achieve survival advantage at a lower dose of the drug (200 mg/kg).

Methods: Male Sprague Dawley rats were subjected to HS (50% blood loss) and randomized into 5 groups (n=7-8/group): 1) normal saline (NS; 32ml/kg), 2) 7.5% saline (HTS; 4 ml/kg), 3) VPA (200 mg/kg), 4) NS+VPA, and 5) HTS+VPA. After 24 h, they underwent CLP followed by the same doses of NS, HTS, and/or VPA, and were monitored for 10 days. In a parallel experiment, blood and peritoneal irrigation fluid were subjected to ELISA 3h and 24h after CLP to measure myeloperoxidase (MPO) activity (marker of oxidative damage) and TNF-α levels.

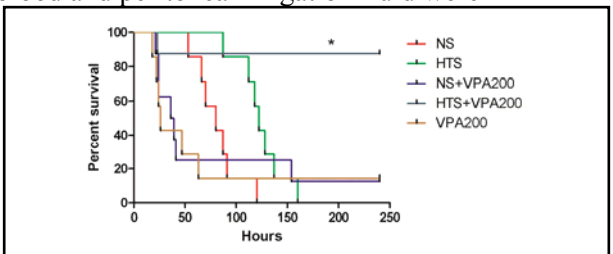


FIGURE. EFFECT OF DIFFERENT RESUSCITATION ON SURVIVAL IN A RAT TWO-HIT MODEL. *: P<0.05.

Results: Treatment with HTS+VPA significantly improved survival (87.5%), compared to the other groups (14.3%; $p < 0.05$), while attenuating peritoneal MPO activity and circulating TNF-α levels.

Conclusion: This is the first study to show that VPA and HTS can work synergistically to attenuate inflammation and improve survival in a lethal two-hit model.

Session IVA: Shock/Resuscitation
Paper 11 1:35 PM

SUPERIOR HEMOSTATIC PROFILES OF NEVER FROZEN LIQUID PLASMA (LQP) COMPARED TO THAWED FRESH FROZEN PLASMA (TP)

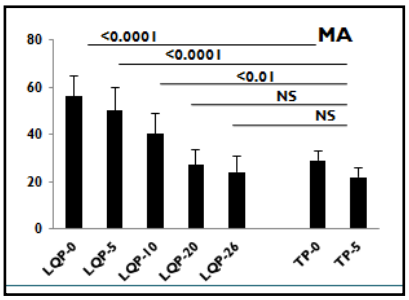
Nena Matijevic, Yao-Wei Wang, Bryan Cotton*, Elizabeth Hartwell, James Barbeau, John B. Holcomb*, M.D., University of Texas Health Science Center-Houston Sponsor: John B. Holcomb*, M.D.

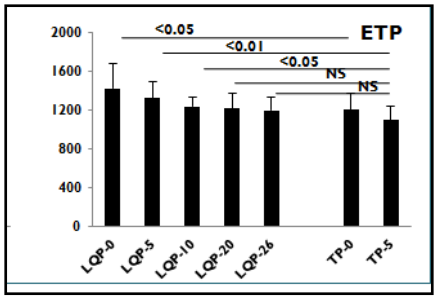
Invited Discussant: Martin Schreiber

Introduction: Immediate use of TP when resuscitating hemorrhagic shock patients has become more common. According to the AABB, FFP is the preferred product that can be used up to 5 days after thawing. However, limited data exist on the clinical use and hemostatic profiles (HP) of FDA approved Liquid Plasma (LQP), which can be cold stored for up to 26 days. We characterized changes in LQP HP during 26 days of cold storage.

Methods: 10 FFP and 10 LQP single donor units, matched by gender and blood group, were analyzed. FFP was thawed and kept refrigerated for 5, and LQP for 26 days. HP were evaluated at days 0 and 5 in TP, and 0, 5, 10, 20 and 26 in LQP, by TEG, thrombogram, and platelet microparticles (PMP).

Results: LQP had a superior capacity to form a clot and generate thrombin compared to TP. During 26 days of storage LQP HP initially exceeded that of TP, and eventually decreased to levels similar to that of TP. At 26 days of storage, significantly higher PMP ($p<0.001$) were found in LQP compared to TP. Changes in the endogenous thrombin potential (ETP, nM thrombin*min) and TEG maximum amplitude (MA, mm) over time are shown in Figures.





Conclusion: Compared to the widely used TP, the hemostatic profiles of LQP were superior and sustained 5 times longer, indicating that never frozen plasma should be used when immediate plasma resuscitation is required.

Session IVA: Shock/Resuscitation
Paper 12 1:55 PM

REDEFINING MASSIVE TRANSFUSION (MT): EVERY SECOND COUNTS

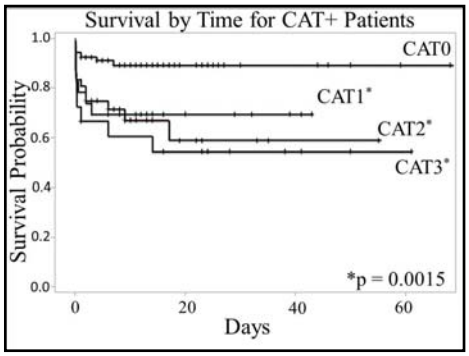
Stephanie Savage*, MD, Ben L. Zarzaur*, M.D., MPH, Martin Croce*, M.D., Timothy C. Fabian*, M.D., University of Tennessee Health Science Center - Memphis

Invited Discussant: Thomas M. Scalea

Introduction: The concept of MT(≥10 units PRBCs/24 hrs) is retrospective, arbitrary and prone to survivor bias. Accounting for rate and timing is a more accurate conceptual framework. We redefined MT as a critical administration threshold (CAT) of 3 units/hr, which is clinically pertinent and reflects hemorrhagic shock. The purpose of this study was to compare the traditional form of MT to a CAT-based definition in predicting mortality.

Methods: Patients receiving transfusion in the first 24 hours were included. Precise transfusion times for each unit, in minutes, were calculated from time of injury. MT and CAT were compared to determine risk of death. Uni- and multivariate analyses were used to examine inpatient mortality.

Results: 169 patients(75% >21 ISS) were studied. 46% were CAT+; 24% met MT criteria. With logistic regression, a CAT of 3 units/hr (CAT+) was more predictive of death compared to 2, 4, 5 or 6 units/hr. CAT was met once (CAT1), twice (CAT2) or ≥ 3 times (CAT3) in 21%, 14% and 11% respectively. Increasing CAT was associated with increased mortality(Fig). CAT identified 73% of all deaths; MT only identified 32% and failed to identify 39% of CAT+ deaths. CAT[HR 3.58 (1.80,7.15)] had a stronger association with mortality than MT[HR 1.82(1.02,3.26)]. Accounting for survival bias, CAT[HR 3.15 (1.40,7.11)] continued to be associated with mortality.



Conclusion: Traditional MT does not reflect illness severity. CATs allow prospective identification of critical patients and eliminates survival bias. CAT may serve as an activation trigger for transfusion protocols, allowing earlier identification of patients with critical transfusion requirements. Transfusion strategy research must consider CAT in evaluating outcomes.

ADMINISTRATION OF FIBRINOGEN IN EXSANGUINATING TRAUMA PATIENTS IS ASSOCIATED WITH IMPROVED SURVIVAL AT 6 HOURS BUT NOT AT DISCHARGE

Arasch Wafaisade, Rolf Lefering, Thomas Brockamp, Marc Maegele, Manuel Mutschler, Lendemans Sven, Bertil Bouillon*, Christian Probst, University of Witten/Herdecke Sponsor: Raul Coimbra*, M.D., Ph.D.

Invited Discussant: John Holcomb

Introduction: Despite poor evidence and high costs, fibrinogen concentrate (FC) represents one of the most frequently used hemostatic agents in exsanguinating trauma. The aim was to assess whether the administration of FC in severely injured patients was associated with improved outcomes.

Methods: Patients documented in the Trauma Registry of the German Society for Trauma Surgery (primary admissions; Injury Severity Score, ISS≥16) that had received FC during initial care between ER arrival and ICU admission (FC+) were matched with patients that had not received FC (FC─).

Results: The matched-pairs analysis yielded two comparable groups with n=294 patients each with a mean ISS of 38±14 (FC+) and 37±13 (FC─) (p=0.73), the mean age was 40±17 vs. 40±16 (p=0.72), respectively. Patients were predominantly male (71.1% in both groups, p=1.0). Upon ER arrival, hypotension (systolic blood pressure ≤90mmHg) occurred in 51.4%(FC+) and 48.0%(FC─) (p=0.41). Patients were administered 12.8±14.3 (FC+) vs. 11.3±10.0 (FC─) red blood cell units (p=0.20). Thromboembolism occurred in 6.8% (FC+) vs. 3.4% (FC─) (p=0.06) and multiple organ failure (MOF) in 61.2% vs. 49.0% (p=0.003), respectively. While 6-hour mortality was 10.5% (FC+) vs. 16.7% (FC─) (p=0.03) and mean time to death was 7.5±14.6 days vs. 4.7±8.6 days (p=0.006), overall hospital-mortality was 28.6% vs. 25.5% (p=0.40), respectively.

Conclusion: This is the first trial to study the effect of FC administration alone in bleeding trauma. In our large population of severely injured patients, the early use of FC was associated with a significantly lower 6-hour mortality and increased time to death, but also increased MOF. A reduction of overall hospital mortality was not observed in FC+ patients. These outcome data may implicate that FC converted early deaths from hemorrhage to late deaths from MOF.

THROMBOELASTOGRAM (TEG) GUIDED RESUSCITATION IS SUPERIOR TO STANDARDIZED MTP RESUSCITATION IN MASSIVELY TRANSFUSED PENETRATING TRAUMA PATIENTS

Nicole Tapia, Alex Chang, Michael Norman*, Francis Welsh, Bradford Scott*, Matthew J. Wall, Jr.*, M.D., Kenneth L. Mattox*, M.D., James Suliburk, Baylor College of Medicine
Sponsor: Matthew J. Wall, Jr.*, M.D.

Invited Discussant: Ernest E. Moore

Introduction: For nearly a decade our center performed TEGs to analyze coagulation profiles, allowing rapid, data-driven blood component therapy. After consensus recommendations for massive transfusion protocols ⟨MTP⟩, we implemented a MTP in October 2009 with 1:1:1 ratio of blood ⟨RBC⟩, plasma ⟨FFP⟩, and platelets (plt). We hypothesized that TEG directed resuscitation is equivalent to MTP resuscitation.

Methods: All patients receiving ≥ 6 units ⟨U⟩ of RBC in the first 24 hours for 21 months before and after MTP initiation in an urban Level I trauma center were examined. Demographics, mechanism of injury ⟨MOI⟩, injury severity score ⟨ISS⟩, 24 hour volume of RBC, FFP, plt, crystalloid, and 30 day mortality were compared, excluding patients with traumatic brain injuries. Variables were analyzed using Student's t-test and Chi-square or Fisher's Exact.

Results: For the preMTP group, there were 165 patients. In the MTP group, there were 124 patients. There were no significant differences in ISS, MOI ⟨65% penetrating⟩, age, or sex. All patients received less crystalloid after MTP adoption ⟨$p<0.001$⟩. There was no difference in volume blood products or mortality in patients receiving ≥ 6U RBC. Blunt trauma MTP patients who received ≥ 10U RBC received more FFP ⟨$p=0.02$⟩ with no change in mortality. Penetrating trauma patients who received ≥ 10U RBC received similar volume FFP, however mortality increased from 54.1% for MTP vs. 33.3% preMTP ⟨$p=0.04$⟩.

Conclusion: TEG directed resuscitation is equivalent to standardized MTP for patients receiving ≥ 6U RBC, and for blunt MOI patients receiving ≥ 10U RBC. MTP therapy worsened mortality in penetrating MOI patients receiving ≥ 10U RBC indicating a continued need for TEG directed therapy. A 1:1:1 strategy may not be adequate in all patients.

DOSE ADJUSTING ENOXAPARIN IS NECESSARY TO ACHIEVE ADEQUATE DEEP VENOUS THROMBOSIS PROPHYLAXIS IN TRAUMA PATIENTS

Todd Costantini, M.D., Emily Min, PharmD, Robert Winfield, M.D., Vy Tran, PharmD, Kevin Box, PharmD, Dale Fortlage, Jay J. Doucet*, M.D., Vishal Bansal*, M.D., Raul Coimbra*, M.D., Ph.D., UC-San Diego Health Sciences

Invited Discussant: M. Margaret Knudson

Introduction: Standard DVT prophylaxis with enoxaparin is known to result in inadequate protection in certain trauma patients, with sub-therapeutic plasma anti-Xa levels associated with elevated DVT rates. We hypothesized that measuring the efficacy of 30mg twice-daily (bid) dosing of enoxaparin using anti-Xa levels and performing dose adjustments to achieve target levels would minimize DVT rates in trauma patients.

Methods: Patients admitted to the trauma service were included if they received at least 3 doses of prophylactic enoxaparin and underwent at least 2 screening venous duplex. Peak plasma anti-Xa levels ≤ 0.2 IU/ml were considered low and the dose was increased by 10mg bid until adequate anti-Xa levels were obtained. A strict screening venous duplex protocol was followed. Patients were excluded if they were diagnosed with a DVT prior to beginning enoxaparin or did not have correctly timed anti-Xa levels.

Results: Sixty-two trauma patients met inclusion criteria and were included in this study. There were 3 patients diagnosed with DVT (4.8%). Patients had a mean age of 44.6 years, were predominantly male (69%), and had an average hospital stay of 21.5 days. Of the 62 patients, 18 (29%) had therapeutic anti-Xa levels on standard enoxaparin 30mg bid. Compared to patients who received enoxaparin 30mg bid, the 44 patients (71%) who required enoxaparin dose adjustment were more likely to be younger (40.4 vs. 51.0 yrs, $p<0.05$), male (92.6% vs. 54.3%, $p<0.01$), and have higher body weight (91.6 vs. 76.0 kg, $p<0.001$). There were no DVTs identified in the group that underwent an enoxaparin dose adjustment.

Conclusion: Due to the high number of patients on sub-therapeutic doses of enoxaparin, dose adjustments based on anti-Xa levels should be standard practice in trauma care. Further randomized studies are needed to confirm that dose adjusting enoxaparin leads to lower DVT rates in trauma patients.

IMPACT OF INVERSE RATIOS ON PATIENTS WITH EXSANGUINATING VASCULAR INJURIES: IS MORE THE NEW PARADIGM?

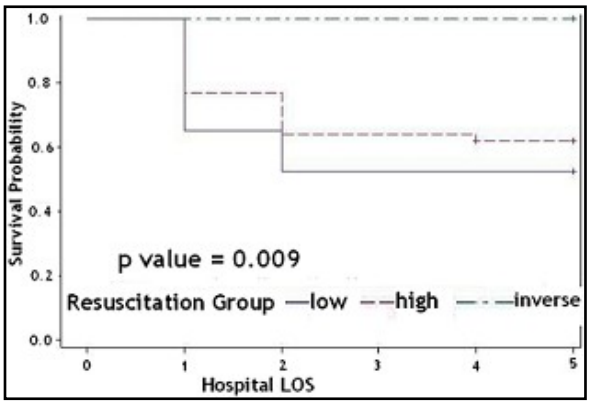
Chrissy Guidry, DO, Norman McSwain, Jr.*, MD., Jiselle Heaney, MD MPH, Peter Meade, MD MPH, Juan Duchesne, MD, Tulane School of Medicine

Invited Discussant: David H. Wisner

Introduction: Optimal resuscitation ratios for civilian exsanguinating vascular injuries has not been determined. We hypothesize improved outcomes in patients with vascular injuries when an aggressive ratio of FFP to PRBC is implemented.

Methods: 5 year retrospective analysis of all vascular injuries requiring hemostatic resuscitation. Resuscitation groups by ratios of FFP:PRBC were: Inverse (>1:1), High (1-1:2), and Low (<1:2). Patients with ≥10 units PRBC were evaluated in each resuscitation group. Survivability KM curves were generated.

Results: 258 patients had vascular injuries requiring component therapy [Low (n=78), High (n=156), Inverse (n=24)]. Massively transfused extremity injuries showed a trend between resuscitation ratio and amputations [Low (36.8%), High (7.7%), Inverse (0%)] p=0.02. KM curve for all vascular injuries:



Conclusion: This is the first study that highlights the benefits of an inverse ratio of FFP:PRBC in exsanguinating vascular injuries. Achieving low ratios only adds bias to worse outcomes.

DEFINING WHEN TO INITIATE MASSIVE TRANSFUSION [MT]: A VALIDATION STUDY OF INDIVIDUAL MASSIVE TRANSFUSION TRIGGERS IN PROMMTT PATIENTS

Rachael Callcut, MD, MSPH, Bryan A. Cotton*, M.D., Peter Muskat*, M.D., Erin Fox, Charles E. Wade*, Ph.D., John Holcomb*, MD, Martin Schreiber*, M.D., Mohammad Rahbar, Mitchell Jay Cohen*, M.D., Karen J. Brasel*, M.D., M.P.H., Eileen M. Bulger*, M.D., Bryce Robinson, D.Min, MFT, on behalf of the PROMMTT Study Group, Stanford University/University of Cincinnati/University of Texas Health Science Center at Houston

Invited Discussant: Timothy C. Fabian

Introduction: Early predictors of MT would prevent under-triage of patients likely to require MT. This study validates triggers using the Prospective Observational Multicenter Major Trauma Transfusion sTudy [PROMMTT].

Methods: All enrolled in PROMMTT were analyzed. The initial ED value for each trigger was compared for patients receiving MT (>=10 units pRBCs in 24 hours) vs. no MT. Adjusted ORs for MT are reported using multiple logistic regression. If all triggers were known, a Massive Transfusion Score [MTS] was created with 1 point assigned for each met trigger.

Results: 1245 patients were prospectively enrolled with 305 receiving a MT. Data was available for all triggers in 68% of the patients including 65% (199/305) of the MTs. INR was known on 87% (1081/1245). All triggers except penetrating mechanism were valid individual predictors of MT with INR the most predictive. For those with all triggers known, a positive INR trigger was seen in 41% receiving MT. Patients with a MTS<2 were unlikely to recieve MT (NPV 90%). If any 2 triggers were met (MTS >=2), sensitivity for predicting MT was 85%. MT was present in 30% with a MTS>=2 compared with 10% of those with MTS<2 (OR 3.5, 2.3-5.4, p<0.0005).

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	Unadjusted			Adjusted		
Triggers	OR	95% CI	p-value	OR	95% CI	p-value
INR >1.5	**3.2**	**2.3-4.4**	**<0.0001**	**2.5**	**1.8-3.5**	**<0.0001**
SBP <90	**2.2**	**1.7-3.0**	**<0.0001**	**1.9**	**1.4-2.6**	**<0.001**
Hgb <11	**2.3**	**1.8-3.1**	**<0.0001**	**1.7**	**1.3-2.3**	**<0.001**
BD>=6	**2.2**	**1.7-2.9**	**<0.0001**	**1.6**	**1.2-2.1**	**0.001**
FAST (+)	**2.0**	**1.5-2.6**	**<0.001**	**2.0**	**1.5-2.6**	**<0.001**
HR>=120	**1.5**	**1.2-2.0**	**0.002**	**1.4**	**1.0-1.8**	**<0.001**
Penetrating	1.0	0.8-1.3	0.86	1.1	0.8-1.4	0.73

Conclusion: Parameters that can be obtained early in the initial ED evaluation are valid predictors for determining likelihood of MT.

EMERGENCY USE OF TYPES A+ AND A- PLASMA IN TRAUMA PATIENTS

Martin Zielinski, James Stubbs, Pamela Johnson, Naeem Goussous, Scott P. Zietlow*, M.D., Donald H. Jenkins*, M.D., Mayo Clinic

Invited Discussant: Marc A. de Moya

Introduction: Massive transfusion protocols lead to increased usage of the rare universal plasma donor, type AB, potentially limiting supply. Due to safety data, with a goal of avoiding shortages, our blood bank exploited types A+ and A- rather than AB for all emergency release plasma transfusions. We hypothesize that ABO incompatible plasma transfusions will have similar outcomes to ABO compatible transfusions.

Methods: Review of all trauma patients receiving emergency release plasma (types A+/A-) from 2008 to 2011. ABO compatibility was determined post hoc. Deaths prior to blood typing were eliminated. $P < 0.05$ was considered statistically significant.

Results: Of 189 patients, 21 received ABO incompatible (11%) and 168 received ABO compatible (89%) transfusions. There was no difference in age (50 vs 59 years), sex (52% vs 64% male), ISS (25 vs 25) or time spent in the trauma bay (26 vs 25 minutes). Median blood product units transfused were similar: emergency release plasma (3 vs 2), ABO compatible FFP (2 vs 2), total plasma at 24 hours (6 vs 4), total RBC at 24 hours (4 vs 5), plasma:RBC at 24 hours (1.2:1 vs 1.1:1) and plasma deficits at 24 hours (-1 vs 0). Overall complications were similar (38% vs 38%) as were rates of ARDS (5% vs 2%), TRALI (5% vs 1%), TACO (4% vs 2%), pneumonia (15% vs 12%), DVT (0% vs 4%), pulmonary embolus (5% vs 1%) and death (10% vs 25%). Ventilator (6 vs 4), ICU (4 vs 3) and hospital days (9 vs 7) were similar. There were no hemolytic reactions.

Conclusion: Utilization of types A+/A- for emergency release plasma results in ABO incompatible transfusions; however, this has little effect on clinical outcomes. Blood banks reticent to adopt massive transfusion protocols due to supply concerns may safely utilize plasma types A+/A-, expanding the pool of emergency release plasma donors.

Session IVA: Shock/Resuscitation
Paper 19 4:15 PM

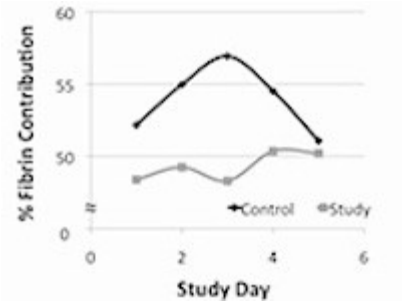
PLATELETS ARE DOMINANT CONTRIBUTORS TO POST-INJURY HYPERCOAGULABILITY

Jeffrey Harr, Ernest E. Moore*, M.D., Theresa Chin, Arsen Ghasabyan, Eduardo Gonzalez, Anirban Banerjee, Christopher Silliman, University of Colorado Denver

Invited Discussant: Mitchell Jay Cohen

Introduction: Venous thromboembolic disease (VTE) has a high incidence following trauma, but significant debate remains regarding prophylaxis. Both fibrin and platelets contribute to clot strength, and thrombelastography (TEG) can distinguish contributions of each. Therefore, we hypothesized that TEG could be employed to identify a decrease in clot strength contribution following low molecular weight heparin (LMWH) prophylaxis.

Methods: SICU trauma patients (n=44) were randomized to receive 5000U of LMWH once daily (control) or to TEG guided prophylaxis, up to 5000U twice daily (study), and were followed for 5 days.



Results: Control (n=21) and Study (n=23) groups were similar in age (43 vs 39), BMI (28.0 vs 26.5), ISS (30 vs 27), and female sex (24% vs 30%). Fibrinogen and platelet count did not differ, and increased LMWH did not affect clot strength between the control and study groups by day 5. Study patients had significantly lower fibrin contribution to clot strength on days 2 (49% vs. 55%) and 3 (48% vs. 57%) compared to control ($p<0.05$). Fibrin had stronger correlation to clot strength on day 1 ($R^2=0.41$ vs 0.19) compared to platelet count, but was superseded by platelet count on day 3 ($R^2=0.14$ vs 0.38) which persisted up to day 5.

Conclusion: Increased LMWH decreases fibrin contribution to clot strength, but has no effect on overall clot strength implicating increased platelet contribution. Platelet count also had increased correlation with clot strength from day 3 supporting the dominant role of platelets. Therefore, these data suggest a role for anti-platelet therapy in VTE prophylaxis following trauma.

THE PRINCIPAL COMPONENTS OF ACUTE TRAUMATIC COAGULOPATHY

Matthew Kutcher, Adam Ferguson, Mitchell Jay Cohen*, M.D., University of California, San Francisco Sponsor: Mitchell Jay Cohen*, M.D.

Invited Discussant**:** Sandro Rizoli

Introduction: Clotting factor abnormalities in acute traumatic coagulopathy are poorly understood, with application of traditional regression techniques confounded by collinearity. We hypothesized that principal components analysis (PCA), a pattern-finding technique, would identify clinically predictive patterns in the complex clotting factor milieu after trauma.

Methods: Plasma was prospectively collected from 163 critically-injured trauma patients. Prothrombin, Factors V, VII, VIII, IX, X, D-dimer, activated and native Protein C, and antithrombin III levels were assayed, and subjected to PCA to identify principal components (PCs).

Results: Of 163 patients, 19.0% had coagulopathy (INR≥1.3). PCA identified 3 PCs, accounting for 67.5% of variance (see Figure). PC1 identified global clotting factor depletion; PC2 the activation of Protein C and fibrinolysis; and PC3 Factor VII elevation and VIII depletion. PC1 score correlated with penetrating injury and injury severity, predicting coagulopathy (OR 4.67, p<0.001) and mortality (OR 1.47, p=0.032). PC2 score correlated with injury severity, acidosis, and shock, and significantly predicted ventilator-associated pneumonia (OR 1.59, p=0.008), acute lung injury (OR 2.24, p<0.001), multiorgan failure (OR 1.83, p=0.002), and mortality (OR 1.62, p=0.006). PC3 did not significantly predict outcomes.

	PC1	PC2	PC3
Prothrombin	-0.86	-0.04	0.11
Factor V	-0.78	0.01	-0.11
Factor VII	-0.62	0.01	0.47
Factor VIII	-0.35	0.34	-0.73
Factori IX	-0.69	0.07	0.03
Factor X	-0.88	-0.01	0.20
D-dimer	0.25	0.80	0.00
aPC	0.20	0.74	0.39
Protein C	-0.80	0.11	-0.05
AT III	-0.74	0.16	-0.17

Conclusion: PCA identifies distinct patterns of coagulopathy: depletion coagulopathy predicts mortality and INR elevation, while fibrinolytic coagulopathy predicts infection, end-organ failure, and mortality, without detectable differences in INR or PTT. These disparate patterns identify specific perturbations to target directed resuscitation and treatment.

PLATELET MITOCHONDRIAL MEMBRANE POTENTIAL CORRELATED WITH SEVERITY IN SIRS PATIENTS.

Kazuma Yamakawa, M.D., Hiroshi Ogura*, M.D., Taichin Koh, B.S., Yoshihito Ogawa, M.D., Naoya Matsumoto, M.D., Yasuyuki Kuwagata, M.D., Takeshi Shimazu*, M.D., Osaka University Graduate School of Medicine

Invited Discussant: Ronald Maier

Introduction: The role of mitochondrial dysfunction has not been thoroughly clarified in the pathogenesis of critically ill patients. The objective of this study was to investigate mitochondrial membrane potential (MMP) and apoptosis in circulating platelets in patients with systemic inflammatory response syndrome (SIRS).

Methods: A total of 36 patients who fulfilled the criteria for SIRS and 12 healthy controls were included. The cause of SIRS was sepsis in 13 patients, trauma in 13 and others in 10. We used the mitochondrial indicator JC-1 in conjunction with flow cytometry to measure MMP, and annexin V to evaluate apoptosis in peripheral blood platelets. The severity of illness was assessed by SIRS score, APACHE II score and SOFA score.

Results: JC-1 positive platelets with MMP deterioration significantly increased in SIRS patients than those in controls (11.2±0.8% vs. 7.4±0.4%, $p<0.001$). Apoptosis in platelets was also enhanced in patients than those in controls (9.9±1.0% vs. 5.2±0.7%, $p<0.001$). Interestingly, JC-1 positive platelets increased significantly with the increase in SIRS scores ($p<0.001$, Figure 1). There was a significant correlation between JC-1 positive platelets and severity of illness, such as APACHE II score (Figure 2), SOFA score and serum lactate levels (all $p<0.05$).

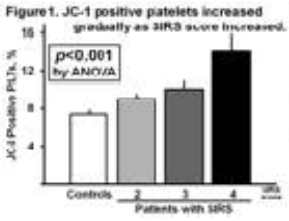


Figure 1. JC-1 positive platelets increased gradually as SIRS score increased.

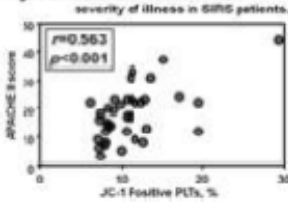


Figure 2. Platelet MMP correlated with severity of illness in SIRS patients.

Conclusion: We demonstrated that MMP was decreased and apoptosis was enhanced in circulating platelets in SIRS patients. Platelet MMP significantly correlated with the severity of SIRS, and may have a diagnostic value in critically ill patients.

EARLY CRYSTALLOID RESUSCITATION ADVERSELY AFFECTS OUTCOMES IN ADULT BLUNT TRAUMA PATIENTS: AN ANALYSIS OF THE GLUE GRANT DATABASE

George Kasotakis, MD, Antonios Sideris, MD, Yuchiao Yang, Marc A. de Moya*, M.D., Hasan Alam*, M.D., David King*, Ronald G. Tompkins*, M.D., George Velmahos*, M.D., Ph.D., Massachusetts General Hospital Sponsor: George Velmahos*, M.D., Ph.D.

Invited Discussant: Jason Sperry

Introduction: Aggressive crystalloid resuscitation in patients with penetrating torso injuries and burns is associated with significant morbidity. Our hypothesis was that early crystalloid resuscitation adversely affects outcomes in adult blunt trauma patients.

Methods: : Data were derived from the Glue Grant. Our primary outcome measure was all-cause mortality. Secondary outcomes included days on mechanical ventilation; ICU and hospital length of stay (LOS); inflammatory- (ARDS, multiple organ failure [MOF]) and resuscitation-related morbidity (abdominal compartment syndrome, acute renal failure) and nosocomial infections (ventilator associated pneumonia [VAP], bloodstream, urinary tract and surgical site infections [SSI]).

Results: In our sample of 1,754 patients, in-hospital mortality was not affected, but ventilator days ($p<0.001$) and LOS in the ICU ($p=0.009$) and the hospital ($p=0.002$) correlated strongly with the amount of crystalloids infused in the first 24 hours post-injury. Volume of crystalloid resuscitation was also associated with ARDS ($p<0.001$), MOF ($p<0.001$), bloodstream ($p=0.001$) and SSI ($p<0.001$), and abdominal compartment syndrome ($p<0.001$) in a dose-dependent fashion, when age, severity of injury, comorbidities, and colloid & blood product transfusions were controlled for.

24h crystalloid resuscitation	Adjusted O.R. (95% C.I.)	*p*-value
<5 L	Reference	
5-10 L	1.7 (0.71-3.9)	0.24
10-15 L	2.3 (1-5.4)	**0.05**
>15 L	3.4 (1.5-7.9)	**<0.005**

Table 1: Adjusted Odds Ratio for ALI/ARDS

24h crystalloid resuscitation	Adjusted O.R. (95% C.I.)	*p*-value
<5 L	Reference	
5-10 L	1.5 (0.7-3.3)	0.29
10-15 L	1.9 (0.9-4.1)	0.1
>15 L	2.9 (1.3-6.1)	**<0.007**

Table 2: Adjusted Odds Ratio for MOF

24h crystalloid resuscitation	Adjusted O.R. (95% C.I.)	*p*-value
<5 L	Reference	
5-10 L	1.7 (0.6-5)	0.32
10-15 L	2.3 (0.8-6.6)	0.12
>15 L	2.8 (1-8.2)	**0.05**

Table 3: Adjusted Odds Ratio for SSI

24h crystalloid resuscitation	Adjusted O.R. (95% C.I.)	*p*-value
<5 L	n/a	
5-10 L	Reference	0.29
10-15 L	4.8 (1.4-16.4)	**0.01**
>15 L	8.7 (2.6-28.9)	**<0.001**

Table 4: Adjusted Odds Ratio for abdominal compartment syndrome

Conclusion: Crystalloid resuscitation is associated with significant morbidity in blunt adult trauma patients.

LIPOPOLYSACCHARIDE AND HEMORRHAGIC SHOCK CAUSE SYSTEMIC INFLAMMATION BY DIFFERENT MECHANISMS

Karlijn van Wessem, Marjolein Heeres, Pieter Leliefeld, Leo Koenderman, Luke Leenen*, M.D., University Medical Center Utrecht

Invited Discussant: Joseph Cuschieri

Introduction: Hemorrhagic shock (HS) and sepsis are common after trauma and patients often need ventilatory support. Subsequently, neutrophil mediated complications such as ARDS can occur. An important underlying mechanism is neutrophil (PMN) priming by DAMPS(caused by e.g. HS and ventilation) and PAMPS (e.g. LPS in sepsis). The aim of this study was to compare the inflammatory response induced by DAMPS (liberated during HS) and PAMPS (LPS) under conditions of high volume ventilation.
Methods: 27 male Sprague-Dawley rats were randomized for mechanical ventilation (MV) alone (9 rats, PEEP 5 cm H2O, Pressure Controlled +20 cm H2O, FiO2 0.33), MV+HS (9 rats, hemorrhage 30% volume loss) or MV+LPS (9 rats, LPS 5mg/kg i.v.). Five rats were used as controls. Total PMN count in blood was measured and the expression of activation markers(CD62L and CD11b) on PMNs was determined by flow cytometry. PMNs in the lung were measured by total myeloperoxidase (MPO). Results are expressed as means±SEM, $p \leq 0.05$ is considered statistically significant.
Results: All treated rats had more PMNs than controls (control 0.4±0.1x106/ml, MV 2.3±0.3x106/ml, MV+LPS 2.8±0.7x106/ml, MV+HS 1.9±0.4x106/ml, p=0.01). MPO was significantly higher in all groups compared to controls (control 21±1units/µg, MV 72±4 units/µg, MV+LPS 94±16 units/µg, MV+HS 50±8 units/µg lung tissue, p=0.0002). MV and MV+HS rats had CD62Lbright/CD11bdim PMN phenotypes whereas MV+LPS rats showed CD62Ldim/CD11bbright PMN phenotype.
Conclusion: All ventilated rats showed a systemic inflammatory response. The response to HS and MV were very similar suggesting a common pathway of DAMP associated inflammation. In marked contrast, LPS caused a different inflammatory response. It is concluded that shock induced by DAMPS and PAMPS have different underlying mechanisms.

PREHOSPITAL HYPERTONIC RESUSCITATION IS ASSOCIATED WITH HYPO-COAGULATION, HYPER-FIBRINOLYSIS AND ANTI-INFLAMMATORY RESPONSES

Sandro Rizoli*, MD, Eileen M. Bulger*, M.D., Joseph Cuschieri*, M.D., Wolfgang Junger, Shawn Rhind, University of Toronto

Invited Discussant: Rosemary A. Kozar

Introduction: Hyper-inflammation, hypo-coagulation and hyper-fibrinolysis are common after trauma. The impact of different resuscitation fluids on inflammation and coagulation remains mostly unknown. We proposed to study the effects of hypertonic fluids in hypovolemic trauma patients.

Methods: Prospective randomized controlled trial on pre-hospital use of 7.5% hypertonic saline (HS; n=9); 7.5% HS/6% dextran 70 (HSD; n=8) or 0.9% NaCl (NS; n=17) in hypovolemic patients (SBP ≤70mmHg). Tissue factor [TF], TF pathway inhibitor [TFPI], thrombomodulin [TM], D-dimers [DD]), thrombin-activatable fibrinolysis inhibitor [TAFI], tumor necrosis factor [TNF]-α, interleukin [IL]-6, IL-10, IL-1 receptor antagonist [RA] were measured on admission, 12h & 24h, and in 20 healthy individuals by ELISA. Analysis of variance was used to compare differences between groups.

Results: Compared to healthy individuals: 1) trauma patients had higher DD (>100x higher) and TM at all times and lower TAFI at 12 and 24h. 2) NS-treated patients had higher TF at all times, which was lower in HSD patients that had higher TFPI. Peak DD occurred in HSD patients. Compared to healthy individuals, trauma patients had higher serum IL-6, TNF- and IL-10 at all times. TNF- was higher in NS-treated patients at 12h vs. HSD; peak TNF- occurred in patients treated with NS. IL-1ra levels were 6x higher in HSD vs. either HS or NS while IL-10 was similar in all groups. All comparisons were significant at $p<0.05$.

Conclusion: Resuscitation fluids have intrinsic molecular effects on coagulation and inflammation. In hypovolemic trauma patients, HSD exerts anti-coagulant (higher TM & TFPI; lower TF), pro-fibrinolytic (peak DD; lower TAFI) and anti-inflammatory effects. (Supported by NIH R01-2007-000-20819-0; Defence R&D Canada)

COAGULATION SYSTEM CHANGES ASSOCIATED WITH SUSCEPTIBILITY TO INFECTION IN TRAUMA PATIENTS

Elaine Cole, Ross Davenport, Henry De-Ath, Jo Manson, Karim Brohi*, Queen Mary, University of London Sponsor: Karim Brohi*,

Invited Discussant: Laura Moore

Introduction: Infection following trauma is associated with increased morbidity and mortality and is common following severe hemorrhage. There is a strong interaction between the coagulation and immunity. The objective of this study was to establish if there was an association between changes in coagulation status after hemorrhage and the subsequent incidence of infection.

Methods: A prospective cohort study of adult injured patients presenting to a major trauma center over a two year period. Blood was drawn at 24 hours following admission and analyzed using functional thromboelastography testing and laboratory defined tests of coagulation and blood count. Patients were followed up for infectious episodes whilst in hospital using Center for Disease Control infection definitions.

Results: 158 patients were recruited. 71 (45%) developed infection and were older (44 years vs. 32 years $p=0.01$) and more severely injured (ISS 25 vs.10 $p<0.01$). White cell counts at 24 hours were normal for patients who developed infection and those who did not (both groups 9.6 x10 9/L). Protein C was lower in those with infection (70.2 iu/dL vs. 83.3 iu/dL $p=0.02$), with a dose dependent increase in infection as levels of PC decreased. Plasmin activation at 24 hours was also strongly associated with infection plasmin-antiplasmin (Infection vs no infection: 6156 µg/L vs. 3324 µg/L $p=0.03$). The infection cohort had overall 12% lower procoagulant levels (varied between factor VIII 6.4% and factor II 16.2%).

Conclusion: There is a strong association between the status of the coagulation system after 24 hours and the development of infection following trauma. Improved early coagulation management may decrease infection rates in this patient group.

A NATURAL IMMUNOMODULATOR ATTENUATES THE SYSTEMIC INFLAMMATORY RESPONSE IN POLYMICROBIAL PERITONITIS

Katie Love, M.D., Rebecca Barnett, MBBS MRCS, Ian Holbrook, MSII, James Peyton, Gerald Sonnenfeld, PhD, William G. Cheadle*, M.D., University of Louisville Sponsor: William G. Cheadle*, M.D.

Invited Discussant: Saman Arbari

Introduction: Activated hexose correlated compound (AHCC), derived from shiitake mushrooms, increases resistance to infection in immunocompromised hosts with positive effects on dendritic cells, NK cell function and IL-2 production. It may also be attenuating the systemic inflammatory response by regulating the secretion of cortisol and norepinephrine (NE).

Methods: Female Swiss-Weber mice were pretreated with AHCC (Amino Up Chemical Co., Sapporo, Japan) or water by gavage prior to undergoing cecal ligation and puncture (CLP). Peritoneal exudate cells and blood samples were harvested at 4 and 24 hours following CLP. Plasma and peritoneal levels of cortisol and NE were obtained using ELISA. Peritoneal bacteria were quantified by colony counts after 24 hours. Significance was denoted by a p-value <0.05.

Results: Plasma and peritoneal cortisol levels were increased 4 hours after CLP compared to normal controls, with no difference between the pretreated groups. At 24 hours post CLP, higher levels of cortisol were maintained in both plasma and peritoneal fluid, but the concentrations were significantly lower in those gavaged with AHCC (plasma $p<0.001$, peritoneal $p=0.027$). There was no change in plasma or peritoneal NE levels at 4 hours. At 24 hours, higher levels of NE were detected in both plasma and peritoneal fluid, with significantly lower concentrations in those gavaged with AHCC (plasma $p<0.001$, peritoneal $p<0.001$). Peritoneal bacterial counts were lower at 4 and 24 hours in the AHCC group, though this was not significant.

Conclusion: The systemic stress hormone response was diminished in mice pretreated with AHCC. Enhanced immune function observed with AHCC could be due to attenuated levels of circulating stress hormones, which have been shown to inhibit NK cells, cytokines, and T cell activation.

Session IVB: Shock/Resuscitation/Infection
Paper 27 3:35 PM

CIRCULATING SERUM PROCALCITONIN CONCENTRATION (PCT) AND INJURY SEVERITY IN CRITICALLY ILL TRAUMA PATIENTS (TP)

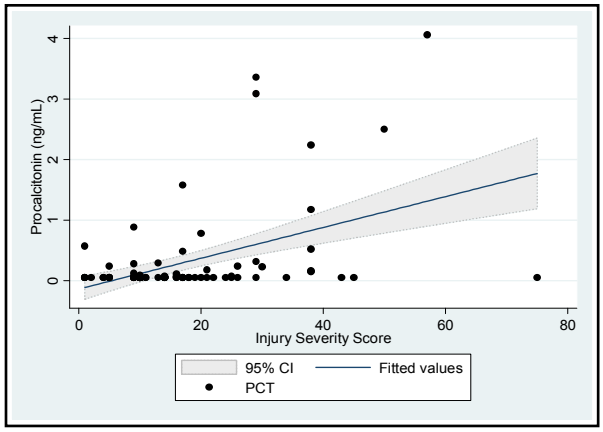
Peter McWhorter, Vanessa Ho, Jian Shou, M.D., Soumitra Eachempati*, M.D., Philip Barie*, M.D., M.B.A., New York Presbyterian Hospital - WCMC

Invited Discussant: Peter McWhorter

Introduction: PCT, a marker of innate immunity, is used most commonly as a sepsis biomarker. Traumatic injury may also upregulate PCT, but a relationship between PCT and injury severity is not established. Hypothesis: TP with higher Injury Severity Scores (ISS) have higher admission PCT than patients with lower ISS.

Methods: Prospective study of 100 consecutive TP admitted to a tertiary-care, university surgical ICU. Admission PCT, ISS and Abbreviated Injury Scale components, low-impact mechanism (LIM) (e.g., fall from standing), hospital length of stay (LOS), and mortality (M) were recorded. Pearson correlation and linear regression quantified the relationship of PCT and ISS. Logistic regression determined if PCT was associated with body region. X+/- SEM, $p<0.05$.

Results: ISS was 16.3+/-12.7; LIM n=46. Age was 63.4+/-23.3 y; 61% male. M, 5%. LOS was 12.5+/-19.4 d. Mean PCT was 0.28+/-0.70 ng/mL. PCT and ISS were associated; Pearson R=0.46, $p<0.001$; (Figure), which was stronger with LIM TP excluded (R=0.55, $p<0.001$). By logistic regression, thorax and extremity (including pelvis) injuries were associated with higher PCT (both, $p<0.001$).



Conclusion: PCT correlates with ISS, particularly for higher injury severity and high-energy mechanisms. Relative to the PCT values observed in sepsis, the response to trauma is modest. In that sepsis is common after major injury, PCT kinetics and its utility as a sepsis biomarker after injury deserve study.

Session IVB: Shock/Resuscitation/Infection
Paper 28 3:55 PM

EARLY TRANSCRIPTIONAL REGULATION OF THE HEPATIC ACUTE PHASE RESPONSE IS RELATED TO MORTALITY IN THE MURINE CECAL LIGATION AND PUNCTURE MODEL

Alan Sherburne, Kendra Iskander, Zhongyan Wang, Suresh K. Agarwal, Jr.*, M.D., Daniel Remick, Peter Burke*, M.D., Boston Medical Center Sponsor: Peter Burke*, M.D.

Invited Discussant: Christopher Baker

Introduction: The hepatic acute phase response involves significant changes in gene expression with regulation at the transcriptional level. Liver-specific transcription factors, including hepatic nuclear factor (HNF)4α & HNF1α, play important roles in murine injury models. In murine cecal ligation & puncture (CLP), interleukin (IL)-6 levels have been shown to predict 5-day mortality. We hypothesize a shift in hepatic phenotype, demonstrated by changes within HNFs-DNA binding activities, hepatic gene production and plasma acute phase protein (APP) levels, will be associated with predicted mortality.

Methods: 55 mice underwent CLP with 6h plasma IL-6 levels to allow stratification into groups predicted to die (P-DIE) or live (P-LIVE). Mice were sacrificed at 6h, 24h and 48h (n=28, 17, 10, respectively) to obtain liver for gel shifts, mRNA extraction and RT-PCR for fibrinogen-γ(FGG) & serum amyloid A(SAA) mRNA levels. Plasma FGG and SAA levels were determined by ELISA from blood obtained at 6h, 24h and 48h.

Results: At 6h, HNF4α-DNA binding was significantly decreased in P-DIE when compared to P-LIVE (69.8±11% vs. 127±17%, p=0.01). Both 6h FGG mRNA and plasma SAA were significantly lower within P-DIE (RQ 7.1±0.9 vs. 11.1±2.1, p=0.04; 817±70 vs. 1076±74 μg/mL, p=0.03, respectively). Similar trends were present within HNF1α–DNA binding at 6h & 24h and SAA mRNA at 6h, but did not reach statistical significance.

Conclusion: In this murine model, predicted mortality is associated with modifications of hepatic transcriptional regulatory events, mRNA production and plasma APP expression. These alterations in hepatic phenotype occur very early, well before other clinical manifestations of increased mortality. Greater understanding of early transcriptional regulation will lead to potential targets to alter liver phenotype and improve outcome.

Session IVB: Shock/Resuscitation/Infection
Paper 29 4:15 PM

INITIAL IVC DIAMETER ON CT INDEPENDENTLY PREDICTS MORTALITY AND SHOCK IN SEVERELY INJURED TRAUMA PATIENTS

Jeremy Johnson, Tabitha Garwe, Ademola Adeseye, David Bishop, Robert Fails, Roxie Albrecht*, M.D., Jason Lees, University of Oklahoma Health Sciences Center

Invited Discussant: George Garcia

Introduction: In the trauma population, patients with physiologic compromise may present with "normal" vital signs. We hypothesized that the IVC diameter could be used as a surrogate marker for hypovolemic shock and predict mortality in severely injured trauma patients.

Methods: A retrospective cohort study was performed at a Level I trauma center on 161 severely injured adult (age ≥ 16) trauma patients who were transported from the scene and underwent abdominal CT within one hour. Exposure of interest was dichotomously defined as having an infrarenal transverse to anteroposterior IVC ratio of ≥ 1.9 (flat IVC), or ratio < 1.9 (not exposed), based on area under the curve (AUC) analysis. The primary outcome was in-hospital mortality. Covariates included initial heart rate (HR), systolic blood pressure (SBP), bicarbonate (CO2), base excess (BE), creatinine (Cr) and hemoglobin (Hb) values, as well as the injury severity score (ISS). Correlation analysis between the IVC ratio and other known markers of hypoperfusion was performed. Logistic regression was used to determine the independent effect of the IVC ratio on mortality.

Results: Of the 161 patients, 30 had a flat IVC. The IVC ratio had a significant ($p < 0.05$) inverse correlation with initial CO2, Hb, and BE and direct correlation with Cr and ISS. After controlling for age, ISS, and presence of severe head injury, patients who had a flat IVC were 5.4 times more likely to die compared to the non-exposed cohort, (C.I. 1.23 – 23.85). Importantly, HR and SBP had no predictive value in this patient population.

Conclusion: A flat IVC on initial abdominal CT has a significant correlation with other known markers of shock and is an independent predictor of mortality in severely injured trauma patients. This finding should heighten awareness of the need for aggressive intervention and potential for physiologic decompensation in patients with otherwise "normal" vital signs.

Session IX: Acute Care Surgery
Paper 30 8:00 AM

THE PRICE OF ACUTE CARE SURGERY

Raeshell Sweeting, Jeffrey Carter, Anthony A. Meyer*, M.D., Ph.D., Preston B. Rich*, M.D.,
University of North Carolina

Invited Discussant: Reuven Rabinovici

Introduction: Numerous organizations have identified access to emergency surgical care as a crisis. One barrier is the financial disincentive associated with caring for this patient population. We sought to identify contributing factors by analyzing endemic data during the development of an Acute Care Surgery (ACS) service at an academic health care system.

Methods: Financial data (receipts, payer mix, dollars/RVU) and productivity measures (OR procedures, RVUs) were obtained for a surgical division over six-month periods before and after transition to an ACS model. Using national data, a sensitivity analysis was performed to identify salary targets required for an ACS surgeon to have equitable career reimbursement using standard financial modeling (net present value) with comparable surgical specialists.

Results: Post-ACS, operative volume increased 25%, work RVUs increased 21%, but net receipts increased only 11%. $/RVU decreased primarily due to a higher proportion of uninsured patients (188% increase). As a result, the $/RVU for ACS patients was 28% lower in comparison to non-ACS specialties. Increasing ACS salaries in proportion to the observed $/RVU discount realigned ACS economic value with other specialties in aggregate.

Conclusion: A national shortage of ACS surgeons exists, due in part to financial misalignment. We demonstrated that despite an increase in clinical activity, transition to an ACS model resulted in a relative reduction in payment. A rational systems-based approach to ACS development that objectively targets the RVU reimbursement disparity would reduce economic disincentives related to a career in ACS and potentially address the emergency surgical care crisis.

Session IX: Acute Care Surgery
Paper 31 8:20 AM

ACUTE CARE SURGERY: WILL THEY COME?

Jamie Coleman, M.D., Thomas J. Esposito*, M.D., M.P.H., David V. Feliciano*, M.D., Indiana University School of Medicine

Invited Discussant: Jose Diaz

Introduction: Concern over lack of resident interest due to the nonoperative nature and compromised lifestyle associated with a career as a "trauma surgeon" has led to the emergence of a new Acute Care Surgery (ACS) specialty. This study examines the opinions of current general surgical residents about training and careers in this new field.

Methods: A 36 item online anonymous survey regarding ACS was sent to the program directors of 55 randomly selected general surgery training programs for distribution to their categorical residents. The national sample consisted of 1515 PGY 1-5 trainees.

Results: Response rate was 46%. Over 90% of residents had an appropriate understanding of the components of ACS as generally described (trauma, surgical critical care [SCC], emergency general surgery). Nearly half (46%) of all respondents have considered ACS as a career. Overall, ACS ranked as the 2nd most appealing career ahead of SCC and Trauma, but behind General Surgery (GS). A large majority of residents believed ACS offers better or equivalent case complexity (88.2%), scope of practice (83.7%), case volume (75.4%), and level of reimbursement (69%) than GS alone. Respondents who answered ACS had a better scope of practice (61% vs 36%), lifestyle as an attending (77% vs 34%), or level of reimbursement (83% vs 38%) compared to GS were twice as likely ($p<0.0001$) to have considered ACS as a career. Overall, 40% of residents believed ACS offers a worse lifestyle in comparison to GS.

Conclusion: These results suggest that there is notable interest in the "new" specialty of ACS. The level of resident interest in ACS as a fellowship and career may be increased by marketing positively viewed aspects of practice and addressing negative perceptions related to lifestyle. It may be appealing to add an elective GS component to certain ACS practice options.

Session IX: Acute Care Surgery
Paper 32 8:40 AM

HOW MANY SUNSETS? TIMING OF SURGERY IN ADHESIVE SMALL BOWEL OBSTRUCTION

Dean Schraufnagel, Sean Rajaee, Frederick H. Millham*, M.D., Tufts Medical Center

Invited Discussant: Rao R. Ivatury

Introduction: Best practices promulgated by this society suggest that delay in surgery for Adhesive Small Bowel Obstruction (SBO) should not exceed 5 days. This study aims to probe the relationship between operative delay and adverse outcome (AO) in SBO using the National Inpatient Sample (NIS)

Methods: We used the NIS for 2009. The relationship between days to surgery (Preop Days) and AO, defined as occurance of a defined set of complications (Comp), death during hospitalization (Death), resection (Rsx), and postoperative length of stay greater than 7 days (Postop Days>7) was assessed taking into account potential confounding factors using regression analysis.

Results: 22460 patients were identified with SBO. 4826 (21.5%) of these required surgery, the remainder did not, staying a median of 3 days (90th percentile 7 Days). Of the surgical group, 1208 (25.0%) patients had Rsx, 138 (2.86%) died, 3216 (66.7%) were female. Mean age was 62.2 years, mean total length of stay 8.51 days, mean Preop Days was 1.94 days. Odds Ratio (OR) of Death for operated patients was 1.59 (95% CI: 1.08 – 2.32) for patients with Preop Days>1 and 1.64 (95% CI: 1.02 – 2.19) when Preop Days>3. Rxs was more likely on patients with Preop Days<1 OR 1.24 (95%CI: 1.07 – 1.45) and Preop Days >3, OR 1.31 (95%CIs: 1.07 – 1.59). Postop Days>7 was more likely if surgery Preop Days were >1, OR 1.26(95%CI: 1.07 – 1.45) and OR 1.31 (95%CI: 1.07 – 1.59) if Preop Days were >3. No relationship between Comp and Preop Days was observed.

Conclusion: Most patients who resolve SBO do so within 5 days. Delay in management of SBO is associated with Death and Post Op Days>7. Rsx increases when Preop Days>4. Optimal timing for operation in non-resolving SBO appears to be less than 5 days.

Session IX: Acute Care Surgery
Paper 33 9:00 AM

SURGEON PERFORMED ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY (ERCP) DURING LAPAROSCOPIC CHOLECYSTECTOMY (LC) IS SAFE AND EFFECTIVE.

Matthew Johnson, M.D., Timothy D. Browder*, M.D., John J. Fildes*, M.D., Parker Fillmore, M.D., Darlene Haff, Ph.D., MPH, Maris Jones, M.D., Nathan Ozobia, M.D., University of Nevada School of Medicine Sponsor: John J. Fildes*, M.D.

Invited Discussant: L.D. Britt

Introduction: ERCP performed by a gastroenterologist as a separate procedure from LC will be referred to as the two-step procedure. We hypothesize that acute care surgeons can safely perform both ERCP and LC as a one-step procedure and demonstrate a reduction in pre-op days, hospital charges and decreased length of stay (LOS).

Methods: This study was approved by the IRB. Patients with cholelithiasis/cholecystitis and elevated liver function tests, gallstone pancreatitis, cholangitis, or choledocholithiasis were studied. All 40 patients were admitted to the Emergency General Surgery (EGS) service. 20 patients underwent the one-step procedure and 20 underwent the two-step procedure. Pre-op days, total hospital LOS, total operative time, complications, and total hospital charges were collected retrospectively. Total operative time was defined as the sum of minutes to perform the ERCP and the laparoscopic cholecystectomy.

Results: There was a significant difference in pre-op days, hospital charges, and total hospital LOS between the groups. The difference in total operative time was not statistically significant. There were no complications.

	One-Step	Two-Step	p<0.05
Number of Pts	20	20	N/A
Pre-Op Days	1.40	2.65	Yes
Total Hospital LOS	3.35	5.10	Yes
Total Operative Time	110.0	111.45	No
Complications	0	0	No
Total Hospital Charges	$51,938	$72,515	Yes

Conclusion: These data show that acute care surgeons can safely perform both ERCP and laparoscopic cholecystectomy as a one-step procedure. Further, this approach resulted in a reduction in hospital charges, decreased pre-op days, and decreased LOS.

Session X: Acute Care Surgery
Paper 34 9:50 AM

A POPULATION-BASED ANALYSIS OF THE CLINICAL COURSE OF 8,974 PATIENTS WITH ACUTE CHOLECYSTITIS DISCHARGED WITHOUT CHOLECYSTECTOMY

Charles de Mestral, MD, Ori Rotstein, MD MSc, Andreas Laupacis, MD MSc, Jeffrey Hoch, PhD, Brandon Zagorski, MS, Avery Nathens*, MD PhD MPH, Li Ka Shing Knowledge Institute of St. Michael's Hospital

Invited Discussant: Gregory J. Jurkovich

Introduction: Trials support cholecystectomy on first admission for most patients with acute cholecystitis (AC); however, practice patterns remain variable worldwide. We present a contemporary analysis of the clinical course of patients with AC discharged without cholecystectomy.

Methods: Using administrative databases capturing all ED visits and hospital admissions within a geographic region encompassing 13 million persons, we identified adults with a first emergency admission for AC without common bile duct stones over 2004-2010. In those discharged without cholecystectomy, the probability of a gallstone related event (ED visit or hospital readmission) was derived using Kaplan-Meier methods. The association of patient characteristics with time from discharge to first gallstone related event was explored through multivariable survival analysis.

Results: 8,974 of 22,003 patients with AC (41%) did not undergo cholecystectomy on first admission. Within up to 6 years of follow-up, 54% of patients underwent elective cholecystectomy and 8% required urgent cholecystectomy. The probability of a gallstone-related complication by 6 weeks, 12 weeks and 1 year was 14%, 21% and 32% respectively. After adjusting for sex, income quintile and comorbidity index, the risk of a gallstone related event was highest in patients 18 to 34 years old.

Conclusion: Intent to perform cholecystectomy by 12 weeks after an emergency admission for AC is associated with a 21% probability of a gallstone related ED visit or hospital admission. The increased risk in younger patients reinforces the value of early cholecystectomy in the non-elderly.

Risk of Gallstone Related Event	
Age Group	Hazard Ratio (95% CI)
18-34	1.90 (1.63 - 2.22)
35-49	1.43 (1.24 - 1.64)
50-64	1.26 (1.10 - 1.44)
65-79	1.31 (1.15 - 1.48)
≥80	Reference

Session X: Acute Care Surgery
Paper 35 10:10 AM

INCREASING LENGTH OF PREOPERATIVE HOSPITALIZATION INCREASES MORBIDITY AND POSTOPERATIVE LENGTH OF STAY AFTER CHOLECYSTECTOMY FOR ACUTE CHOLECYSTITIS

Kelli Brooks, John Scarborough, Steven Vaslef*, M.D., Mark Shapiro*, M.D., Duke University University Medical Center

Invited Discussant: Nathan Mowery

Introduction: The objective of our study was to determine the impact of preoperative length of hospitalization on postoperative outcomes after emergency cholecystectomy (EC) for acute cholecystitis.

Methods: Patients from the 2005-2010 ACS-NSQIP database undergoing EC within 7 days of admission for acute cholecystitis were included. Multivariate logistic and linear regression were used to determine the association between preoperative length of hospital stay and postoperative outcomes, adjusting for a number of preoperative variables. Subgroup analysis was also performed for those patients at highest risk for postoperative morbidity due to the presence of preoperative sepsis or other acute comorbid conditions.

Results: 5,268 patients were included for analysis. Delay in operation resulted in higher postoperative morbidity and costs of care, both in the overall cohort (Table) and in a subgroup of high-risk patients.

Outcome Variable	Preoperative Length of Stay Prior To Cholecystectomy					AOR/Beta Coefficient (95% CI) of Outcome For Each Additional Preoperative Hospital Day *
	0 Days (n=2,620)	1 Day (n=1,757)	2 Days (n=498)	3 Days (n=204)	4+ Days (n=189)	
30-Day Morbidity	178 (6.8%)	154 (8.8%)	67 (13.5%)	34 (16.7%)	38 (20.1%)	1.10 (1.00,1.21), p = 0.045
Open Cholecystectomy	427 (16.3%)	375 (21.3%)	144 (28.9%)	63 (30.9%)	70 (37.0%)	1.12 (1.05,1.21), p = 0.001
Postoperative LOS [Median (IQR) days]	1 (1-3)	2 (1-3)	2 (1-4)	3 (1-5)	4 (2-7)	0.03 (0.02,0.04)#, p< 0.0001
Total LOS [Median (IQR) days]	1 (1-3)	3 (2-4)	4 (3-6)	6 (4-8)	9 (7-12)	0.26 (0.25, 0.27)#, p< 0.0001
* Adjusted for patient demographics, ASA classification, preoperative sepsi classification, presence of acute and/or chronic comorbid illnesses, and preoperative LFTs						
# Beta coefficient represents increase in log of postoperative/total LOS for each additional day patient was admitted to hospital prior to operation						

Conclusion: The results of our analysis, the largest to date on this topic, suggest that EC should be performed within 24 hours of admission for acute cholecystitis, rather than later during hospitalization.

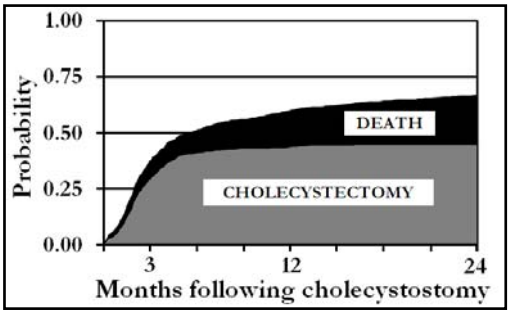
Session X: Acute Care Surgery
Paper 36 10:30 AM

CHOLECYSTOSTOMY: A BRIDGE TO HOSPITAL DISCHARGE BUT NOT DELAYED CHOLECYSTECTOMY

Charles de Mestral, MD, David Gomez, MD, Barbara Haas, MD, Sunjay Sharma, MD, Brandon Zagorski, MS, Avery Nathens, MD, PhD, MPH, Li Ka Shing Knowledge Institute of St. Michael's Hospital

Invited Discussant: Babak Sarani

Introduction: Current data on the clinical course of patients managed with percutaneous cholecystostomy (PC) is limited to single institution studies of small sample size. We present the characteristics and course of a population-based cohort with acute cholecystitis managed with PC. **Methods:** We designed a retrospective cohort study using administrative databases capturing all ED visits and hospital admissions within a geographic region with a population of 13 million. From adults with a first emergency admission for acute cholecystitis from 2004 to 2010, those managed with PC were included in the cohort. The cumulative incidences of subsequent cholecystectomy and death were calculated, considering death a competing risk to cholecystectomy.



Results: Of 22,614 patients with acute cholecystitis, 746 (3.3%) underwent PC within a median of 2 days (IQR 1-3) from ED presentation. The cohort was elderly with a median age of 78 years (IQR 67-85), 33% had at least one major comorbidity and 14% were in the ICU. In-hospital mortality was 5%. By 1 year after PC, 41% had undergone cholecystectomy while an additional 19% had died prior to any operation. Postoperative mortality in patients undergoing cholecystectomy was 2% and 6% by 30 days and 1 year, respectively.

Conclusion: While PC is often performed with the intent of delayed cholecystectomy, less than half of patients actually go on to surgery. High mortality, and likely ongoing contraindications to surgery, preclude intervention in a majority of patients.

Session X: Acute Care Surgery
Paper 37 10:50 AM

STAPLED VERSUS HANDSEWN ANASTOMOSES IN EMERGENCY GENERAL SURGERY: A RETROSPECTIVE REVIEW OF OUTCOMES IN AN EMERGING PATIENT POPULATION

Jason Farrah, MD, Cynthia Lauer, MD, Mallory Bray, Jason Mccartt, Preston Miller*, Michael Chang*, M.D., J. Wayne Meredith*, M.D., Nathan Mowery*, MD, Wake Forest University School of Medicine Sponsor: Nathan Mowery*, MD

Invited Discussant: Susan Brundage

Introduction: Studies have recently identified unique clinical and physiologic characteristics of emergency general surgery (EGS) patients and called for outcomes data in this population. There are no data analyzing the impact of technique on anastomotic failure rates in EGS patients. The purpose of the current study was to compare outcomes of handsewn (HS) versus stapled (ST) bowel anastomoses in EGS patients.

Methods: A retrospective chart review of all patients admitted by our EGS service undergoing bowel resection for emergent indications from January 2007 to July 2011. Time from surgery to diagnosis of anastomotic failure was recorded as was the diagnostic modality and treatment of each anastomotic failure. Specific data on damage control techniques, if utilized, were also collected.

Results: There were 101 (43.3%) HS, and 132 (56.7%) ST anastomoses in 231 patients. Operative times were similar regardless of technique used (228 min HS vs 205 min ST, p =.23). Anastomotic failures were identified in 28 patients (12.01%) and were significantly higher in the ST group than the HS group (14.4% vs 6.1%, p=.003). A multivariate logistic regression analysis, controlling for age and preoperative nutritional status, revealed stapled technique to be an independent risk factor for anastomotic failure (OR=2.65, 95% CI 1.08-6.50, p=0.034).

Conclusion: Anastomotic failures are more than twice as likely with stapled than handsewn anastomoses in the EGS population. This is true even when controlling for markers of preoperative nutrition and demographics. These data demonstrate that the handsewn anastomosis should be the preferred method of reconstruction after bowel resection in EGS patients.

COMPARING CLINICAL PREDICTORS OF DEEP VENOUS THROMBOSIS VERSUS PULMONARY EMBOLUS AFTER SEVERE BLUNT TRAUMATIC INJURY: A NEW PARADIGM FOR POST-TRAUMATIC VENOUS THROMBOEMBOLISM?

Scott C. Brakenridge, MD MSCS, Steven Henley MS, T. Michael Kashner JD MPH PhD, Richard Golden PhD, Herbert A. Phelan* MD MSCS, Mitchell Jay Cohen* M.D., Jason L. Sperry* MD, Ernest E. Moore* M.D., Joseph P. Minei* M.D., Ronald V. Maier* M.D., Joseph Cuschieri* MD
University of Washington

Invited Discussant: Steven R. Shackford

Introduction: The traditional paradigm is that DVT and PE after injury are different phases of a single disease process, often labeled as venous thromboembolism (VTE). However, we theorize that DVT and PE may represent independent thrombotic entities rather than different stages of a single pathophysiologic process.

Methods: We examined a large, multi-center prospective observational cohort of severely injured blunt trauma patients to compare clinical risk factors for DVT and PE, including indicators of shock, injury severity, resuscitation parameters, comorbidities and VTE prophylaxis. Risk factors for each outcome were analyzed using best approximating, cross-validated logistic regressions selected using advanced stochastic/exhaustive search procedures.

Results: The study cohort consisted of 1,822 severely injured blunt trauma patients (median ISS = 33, median base deficit = -9.5). Incidence of DVT and PE were 5.1% and 3.8% respectively. Only 9 of 159 (5.7%) patients with a VTE complication were diagnosed with both DVT and PE. Independent risk factors for DVT included ISS >24 (OR 1.91, 95% CI 1.09-3.36) and BMI >29 (OR 1.60, 95% CI 1.05-2.42), while independent risk factors for PE were serum lactate >5 (OR 2.61, 95% CI 1.61-4.23), male gender (OR 2.0, 95% CI 1.11-3.59) and crystalloid resuscitation > 15 L (OR 1.68, 95% CI 1.05-2.67).

Conclusion: Risk factors for clinical diagnosis of DVT after severe blunt trauma appear to represent overall injury burden and obesity, while risk factors for PE are gender specific and more representative of shock state and overall physiologic derangement. Post-traumatic DVT and PE may represent distinct pathologic thrombotic processes as opposed to the traditional thrombus and subsequent embolus dogma of venous thromboembolism.

ACS PEDIATRIC TRAUMA CENTER CERTIFICATION: DEFINING THE RELATIONSHIP BETWEEN VOLUME AND MORTALITY

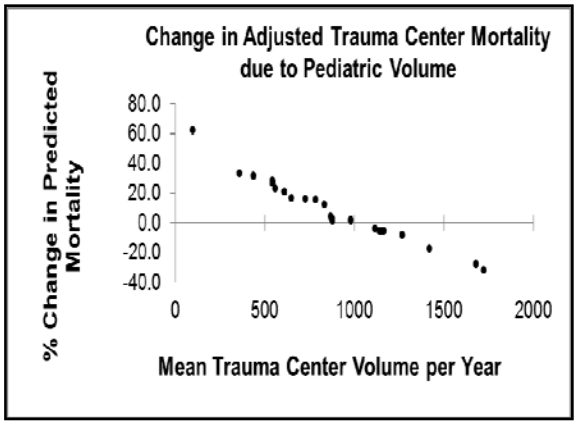
Cassandra Villegas, MD, Bellal Joseph, MD, Erynne Faucett, MD, Randall S. Friese*, M.D., Terence O'Keeffe, MB ChB, Moutamn Sadoun, Julie Wynne, Andrew Tang, M.D., Narong Kulvatunyou, Peter Rhee*, MD, MPH, FACS, FCCM, University of Arizona - Tucson

Invited Discussant: Michael L. Nance

Introduction: While there is a trauma center volume requirement for adult ACS Level 1 certification, no such requirement exists for pediatric trauma centers. The objective of this study was to determine if there is a volume to mortality relationship in pediatric trauma and whether recommendations could be made for establishing volume requirements for ACS pediatric trauma center level certification.

Methods: Retrospective analysis of pediatric trauma patients in the 2007-2008 NTDB treated at designated pediatric trauma centers (PTC). Transfer, burn, and dead on arrival patients were excluded, and the primary outcome was mortality. Demographic and injury characteristics were used to calculate adjusted mortality, and hierarchical regression determined the added effect of pediatric trauma volume on predicted PTC mortality.

Results: Twenty-seven PTC met study criteria and treated 37,679 pediatric patients over two years. Median PTC volume was 1,045 patients per year (IQR 491) with a median unadjusted mortality rate of 1.16% (IQR 0.92%). Hierarchical regression analysis found pediatric trauma volume to be significantly associated with PTC mortality (OR 0.9993, $p<0.01$) and to change adjusted PTC mortality rates by as much as 60% (see Graph).



Conclusion: There is a clear pediatric volume and mortality relationship such that PTC that treated ≥980 patients per year had reduced adjusted mortality rates.

AT FIRST BLUSH: ABSENCE OF CT CONTRAST EXTRAVASATION IN GRADE IV-V ADULT BLUNT SPLENIC TRAUMA SHOULD NOT PRECLUDE ANGIOEMBOLIZATION

Indermeet Bhullar, Eric Frykberg*, M.D., Joseph J. Tepas, III*, M.D., Daniel Siragusa, Andrew J. Kerwin*, M.D., University of Florida, Jacksonville

Invited Discussant: Andrew Peitzman

Introduction: In order to clarify the role, indications and outcomes for angioembolization (AE) of nonoperatively managed (NOM) splenic trauma, the implications of absent contrast blush (CB) on computed tomography (CT) of high grade (IV-V) blunt splenic trauma (BST) in adults was analyzed.

Methods: All BST patients presenting at a single institution from July 2000 to December 2011 were retrospectively reviewed. Grade of injury (AAST scale), CB on initial CT, numbers nonoperatively managed and undergoing AE, and failures of NOM were analyzed. Statistical analysis was performed using Chi Square.

Results: Of 1,056 total BST patients, 864 (82%) underwent CT evaluation and 556 (64%) were hemodynamically stable and eligible for NOM. 95 NOM patients (17%) had CB. AE was done in 88 of these, with angiographic extravasation found in 86 (97.7%), and 3 of these 88 (3.4%) failed NOM. The remaining 7 CB were observed without AE, of which 5 (71.4%) failed NOM ($p=0.0004$). 53 of all 556 NOM patients (9.5%) had high grade injuries without CB; 19 of these (36%) underwent AE, 17 (89.4%) had angiographic extravasation, and there were no NOM failures in this group. The other 34 high grade injuries without CB or AE had 32% failure of NOM ($p=0.03$).

Conclusion: The strong correlation of CB with active bleeding on angiogram mandates AE for CB in all BST undergoing NOM. However, the absence of CB in high grade BST does not reliably exclude active bleeding. This may be the reason for the high reported failure rates of NOM in high grade BST, as AE is not typically performed in the absence of CB. These data suggest that all hemodynamically stable high grade BST in adults should undergo AE regardless of CB in order to optimize the success and safety of NOM.

Session XIV: Critical Care/Abdominal/Outcomes
Paper 41 10:50 AM

THE EFFECTS OF ARGININE VASOPRESSIN ON ORGAN DONOR PROCUREMENT RATES AND SUBSEQUENT EARLY OUTCOMES IN HEART AND LUNG RECIPIENTS

David S. Plurad*, M.D., Scott Bricker, MD, Angela Neville, M.D., Frederic S. Bongard*, M.D., Brant Putnam*, MD, Harbor-UCLA Medical Center

Invited Discussant: Carrie Sims

Introduction: Hormone Replacement Therapy (HRT) in the management of brain dead organ donors is common. Arginine Vasopressin (AVP) is also associated with beneficial effects but is used variably. We hypothesize that AVP is associated with increased organ yield and improved early outcomes for heart and lung recipients.

Methods: Organ Procurement and Transplantation Network (OPTN) databases were utilized. Donors treated with HRT and successfully procured from Jan, 1, 2009 to Jun, 30, 2011 were studied. HRT is defined as infusions of insulin, steroids and thyroid hormone. AVP (+) vs. (-) donors were compared. Recipients subsequently transplanted with either a heart or lung were identified and those with an AVP (+) donor graft were compared to those without. The rates of overall, heart and lung procurement in donors, and early (<1 month) graft failure and death in recipients were studied.

Results: There were 12,471 donors included where 7,783 (62.4%) received AVP. CVA [4,778 (38.3%)] was the most common cause of death. There was a significant increase in high-yield (≥4 organs)(50.8% vs. 39.2%,<.01) heart (38.8% vs. 31.9%,<.01) and lung (26.1% vs. 20.4%, <.01) recovery with AVP. Adjusting for significant factors, AVP was independently associated with high-yield procurement [1.37 (1.26-1.49), <.01]. There were 7,605 transplanted patients who received a heart [4,334 (57%)] or lung [3,271 (43%)]. There were no adjusted differences in the overall rates of early graft failure or death in recipients whose donors had received AVP.

Conclusion: AVP with HRT is associated with a significant increase in successful organ recovery vs. HRT alone or with other agents. There does not appear to be unfavorable effects on early heart or lung graft function or recipient outcome. AVP should be universally adopted as a component of HRT in the management of donors with neurologic death.

THE IMPACT OF BRAIN DEAD ORGAN DONOR DEMOGRAPHICS AND CRITICAL CARE ENDPOINTS ON LIVER TRANSPLANTATION AND GRAFT SURVIVAL RATES.

Matthew Bloom, Shariq Raza, Akash Bhakta, Tyler Ewing, Marko Bukur, Rex Chung, Eric Ley, Daniel Margulies*, Ali Salim*, Darren Malinoski*, Cedars-Sinai Medical Center Sponsor: Ali Salim*, M.D.

Invited Discussant: Peep Talving

Introduction: Intensivists have become increasingly involved in donor management in order to increase the number of organs available for organ transplantation, but criteria for organ acceptance remain inconsistent. We sought to determine predictors of liver graft utilization and function in order to better guide the management of potential organ donors.

Methods: The following data were prospectively collected on all brain dead organ donors in UNOS Region 5 from 2008 to 2011: age, BMI, critical care end points of resuscitation, liver graft outcomes, and cold ischemia time. Critical care data included mean arterial pressure (MAP), central venous pressure (CVP), PaO2:FiO2 ratio (P:F), serum glucose, urine output, and vasopressor dosages. Endpoints were recorded at the time of consent to reflect donor hospital management, 12-18 hours later to reflect when organ offers were being made, and prior to organ recovery. Separate analyses to determine risk factors for liver transplantation and graft survival rates were performed using the t-test and variables with a $p < 0.05$ are presented below.

Results: Data were complete for 961 donors. 873(91%) livers were recovered, of which 730(84%) were transplanted, with 694(95%) functioning after 74±73 days of follow-up. Lower age (38.2 vs. 46.7 years), BMI (26.0 vs. 28.8 kg/m2), CVP (8.6 vs. 9.4 mmHg), and glucose (165 vs. 182 mg/dL) as well as higher MAP (84.5 vs. 81.4 mmHg) and P:F (275 vs. 230) were associated with liver selected for transplantation. Graft survival was associated with lower age (37.9 vs. 44 years) and BMI (25.8 vs. 29.8 kg/m2), as well as higher neosynephrine dosages (8.7 vs. 1.2 mgc/min).

Conclusion: Improved hemodynamic, respiratory, endocrine, and renal critical care endpoints in brain dead organ donors are associated with liver graft utilization. Donor age and BMI impact graft survival.

Session XVIA: Shock/Transfusion/Outcomes/Critical Care
Paper 43 1:00 PM

HYPERACUTE ADRENAL INSUFFICIENCY (HAI) AFTER HEMORRHAGIC SHOCK EXISTS AND IS ASSOCIATED WITH POOR OUTCOMES

Deborah M. Stein*, M.D., M.P.H., Elliot Jessie, Sean Crane, Joseph Kufera, Carlos Rodriguez, Jay Menaker*, Tracy Timmons, Thomas M. Scalea*, M.D., R Adams Cowley Shock Trauma Center

Invited Discussant: Mihae Yu

Introduction: Adrenal insufficiency has been extensively described in sepsis but not in acute hemorrhage. We sought to determine the incidence of Hyperacute Adrenal Insufficiency (HAI) immediately after hemorrhage and its association with mortality.

Methods: Patients with acute traumatic hemorrhagic shock prospectively had serum cortisol levels collected on admission. Inclusion criteria were hypotension (SBP <90 or SBP <100 x2 or unable to obtain BP within first 10 minutes of admission) and active hemorrhage. Clinicians were blinded to results and no patient received steroids in the acute phase.

Results: 50 patients were enrolled over a 6-month period. Mean age was 35 ±15.9 years and 48% had penetrating injury. Mean admission cortisol was 17.9 ±7.5 mcg/dl. Sources of hemorrhage (some had multiple) included: solid organ (12), thorax (10), major vascular (8), pelvis (8), extremity (8), mesentery (4), cardiac (2), unknown/other (13). Acute mortality from hemorrhage was 32%. Overall mortality was 42%. Severe HAI (serum cortisol <10 mmol/dl) was present in 8 (16%). Relative HAI (<25 mmol/dl) was present in 44 (88%). Patients who died of acute hemorrhage had significantly lower mean cortisol levels (11.4 ±6.2 vs. 21.0 ±6.0; $p<0.001$). In multivariate analysis, cortisol levels were highly associated with mortality from hemorrhage with an odds ratio of 1.34 (CI=1.12-1.61). Receiver Operating Characteristic analysis indicated serum cortisol has an 87% accuracy in differentiating survivors of acute hemorrhage from non-survivors.

Conclusion: This study is the first to report that HAI is common after hemorrhagic shock and is strongly associated with mortality. HAI may be a marker of depth of shock, but is potentially rapidly modifiable as opposed to other markers, such as lactate or base deficit. Further work is needed to determine whether steroids can change outcome in selected patients.

MESENTERIC LYMPH DIVERSION ABROGATES 5-LIPOXYGENASE ACTIVATION IN THE KIDNEY FOLLOWING TRAUMA AND HEMORRHAGIC SHOCK

John Stringham, Ernest E. Moore*, M.D., Jeffrey Harr, Fabia Gamboni, Miguel Fragoso, Anirban Banerjee, University of Colorado Denver Sponsor: Ernest E. Moore*, M.D.

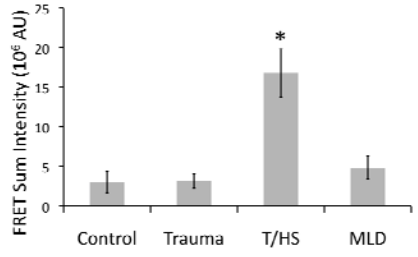
Invited Discussant: Russell Gruen

Introduction: Early acute kidney injury (AKI) following trauma increases subsequent multi-organ failure and mortality. Leukotrienes have been implicated in AKI and in acute lung injury (ALI). Leukotriene production from arachidonic acid (AA) requires 5-lipoxygenase (5-LO) and 5-lipoxygenase activating protein (FLAP). Prior work shows that diversion of AA-rich post-shock mesenteric lymph attenuates ALI. The effect of mesenteric lymph diversion (MLD) on kidney injury is unknown. We propose that MLD will decrease FLAP and 5-LO associations in kidney following trauma and hemorrhagic shock (T/HS).

Methods: Rats underwent procedures for Control, Trauma (laparotomy only), T/HS (laparotomy, hemorrhagic shock to MAP of 30 mmHg for 45 min, and resuscitation) and MLD (T/HS with diversion of the mesenteric duct). Kidney sections were immunostained for 5-LO and FLAP. Confocal images were taken. FRET intensity was calculated, normalized to the donor signal, and analyzed by one-way ANOVA with Tukey post-hoc analysis.

Results: Glomerular images show no difference between groups. In T/HS the renal medulla exhibits increased FRET signaling in the interstitium, with none seen in the tubules. There is a 3.5-fold increase in FRET sum intensity in T/HS (Figure 1, $p<0.005$). MLD decreased FRET sum intensity to control levels.

FIGURE 1:



* P < 0.005 vs. all groups. Standard Error shown.

Conclusion: 5-LO and FLAP co-localize in the interstitium of the renal medulla following T/HS. This coincides with pathologic changes seen in tubules during AKI. These data suggest that early leukotriene production predisposes the kidney to injury.

Session XVIA: Shock/Transfusion/Outcomes/Critical Care
Paper 45 1:40 PM

COMPARISONS OF LR AND HEXTEND RESUSCITATION ON COAGULATION FOLLOWING TISSUE INJURY AND SEVERE HEMORRHAGE IN PIGS

Wenjun Martini, Lorne Blackbourne*, Michael Dubick, US Army Institute of Surgical Research Sponsor: Lorne Blackbourne*,

Invited Discussant: David B. Hoyt

Introduction: Coagulopathy after hemorrhagic shock contributes to mortality in trauma patients. This study compared changes in coagulation function over 6h after resuscitation with lactated Ringer's (LR) and Hextend (Hex) in pigs with femur injury and hemorrhagic shock.

Methods: Pigs were randomized into control (C), LR , and Hex (n=7 each) groups. Femur fracture was induced using the captive bolt stunner at midshaft of the left legs of the pigs, followed by hemorrhage of 60% total blood volume and resuscitation with either LR (3x bled volume), or Hex (equal to bled volume). Pigs in C were not bled or resuscitated. Hemodynamics were measured hourly for 6h and blood samples were taken at baseline (BL), 15 min and 6h after resuscitation.

Results: MAP decreased to 50% of BL by the 60% hemorrhage but returned to BL within 1h after LR or Hex resuscitation. Heart rate was increased (from 91±4 bpm to 214±20 bpm, $p<0.05$) by hemorrhage, but returned to BL within 1h in LR group, while it remained elevated for 6h in the Hex group. Resuscitation with LR (4346 ±237 ml) or Hex (1642±42 ml) reduced Hct, total protein, fibrinogen, and platelet counts differently (Table 1, all $p<0.05$ vs. BL in LR and Hex). PT was prolonged in LR (INR 1.2±0.0) and Hex (INR 1.5±0.1), but aPTT was prolonged only in Hex for 6h. Clot strength (TEG-MA) was decreased from BL 72±1mm to 63±2 mm at 15 min ($p<0.05$) and returned to BL at 6h in the LR group, but remained lower for 6h in the Hex group. The overall clotting capacity (TEG-CI) in LR was decreased at 15min but returned to BL at 6h, whereas TEG-CI in Hex was decreased for 6h.

	Hct		Total Protein(%BL)		Fibrinogen(%BL)		Platelets(%BL)	
	15 min	6h	15 min	6h	15 min	6h	15 min	6h
Control	28%±1%	28%±1%	99%±2%	95%±2%	102%±3%	108%±5%	97%±4%	92%±4%
LR	13%±1%	15%±1%	47%±2%	61%±2%	55%±3%	78%±4%	49%±5%	50%±4%
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Conclusion: Coagulation impairment by traumatic hemorrhage and resuscitation was persistent for 6h with Hex but not with LR. The lack of recovery with Hex is likely due to larger and prolonged depletions of coagulation substrates and further documents the need to restrict the use of high molecular weight starch in resuscitation fluids for bleeding casualties.

GOAL DIRECTED RESUSCITATION IN THE PREHOSPITAL SETTING: A PROPENSITY ADJUSTED ANALYSIS

Joshua Brown, Mitchell Jay Cohen*, M.D., Andrew Peitzman*, Ronald V. Maier*, M.D., Michael A. West*, M.D., Ph.D., Joseph Cuschieri*, M.D., Joseph P. Minei*, M.D., Ernest E. Moore*, M.D., Timothy Billiar, Jason Sperry*, University of Pittsburgh Sponsor: Jason Sperry*,

Invited Discussant: Hasan Alam

Introduction: A "scoop and run" approach with limited prehospital (PH) crystalloids is beneficial in penetrating torso trauma; however little is known about optimal PH resuscitation in severely injured blunt trauma patients.

Methods: Data were obtained from a multicenter prospective study of blunt injured adults (ISS>15, TBI excluded). Subjects were divided into HIGH (>500cc) and LOW (≤500cc) PH crystalloid groups. Propensity adjusted regression was used to determine the independent association of PH crystalloid groups with 30d mortality and coagulopathy (admit INR>1.5) in subjects with and without PH hypotension (SBP<90mmHg) after controlling for PH time, injury and shock severity, and propensity of PH crystalloid.

Results: Of 1,216 subjects, 822 (68%) received HIGH PH crystalloid and 616 (51%) had PH hypotension. ISS and base deficit were similar between HIGH and LOW PH crystalloid groups in subjects with and without PH hypotension. In subjects without PH hypotension, HIGH crystalloid was associated with over a 2-fold higher risk of mortality and acute coagulopathy (Table) but not in subjects with PH hypotension. HIGH crystalloid was associated with correction of PH hypotension on ED arrival (OR 2.02; 1.06-3.88, p=0.03). Each 1mmHg increase in ED arrival systolic blood pressure was associated with a 2% increase in survival in subjects with PH hypotension (OR 1.02; 1.01-1.03, p<0.01).

Subjects without PH hypotension			
Mortality	*HR*	*95% CI*	*p value*
HIGH vs. LOW	2.52	1.30-4.91	<0.01
Coagulopathy	*OR*	*95% CI*	*p value*
HIGH vs. LOW	2.52	1.20-5.32	0.01

Conclusion: In severely injured blunt trauma patients, PH crystalloid >500cc was associated with worse outcome in patients without PH hypotension but not those with PH hypotension. HIGH crystalloid was associated with correction of PH hypotension. This suggests PH resuscitation should be goal directed based on presence or absence of PH hypotension.

DUODENAL INJURIES IN THE VERY YOUNG- CHILD ABUSE?

Lauren Sowrey, MD, Karla Lawson, Pamela Garcia-Filion, David Notrica*, MD, David W. Tuggle*, M.D., James Eubanks, MD, R. Todd Maxson*, M.D., John Recicar, Stephen M. Megison*, M.D., Nilda Garcia*, MD, UT Southwestern -Austin

Invited Discussant: Barbara A. Gaines

Introduction: Duodenal injuries in children are uncommon. In children, they have specifically been linked with child abuse in case reports. Due to the rarity of the diagnosis, few studies to date have looked at the association between duodenal injuries and mechanism of injury in the younger child. We hypothesize that all children under 2 years old with duodenal injuries were the result of child abuse.

Methods: A retrospective cohort study of patients admitted with duodenal injuries to six, ACS verified, Level 1 pediatric trauma centers. All institutions had IRB approval. The trauma registries were used to identify children aged 0-5 from 1991-2011. Multiple variables were collected and included age, mechanism of injury, type of duodenal injury, additional injuries, and mortality. Relationships were analyzed using Fischer's exact test.

Results: We identified 32 patients with duodenal injuries with an average age of 3 years old. Duodenal injuries included a duodenal hematoma (40%), perforation (28%), transection (25%), contusion (3%), or laceration (3%). Out of 32 children presenting with duodenal injuries, 20 were child abuse (62.5%). All duodenal injuries in children less than 2 years of age were due to child abuse (n=6/6, p=0.06) and over half of the children over 2 were due to child abuse (n=14/26). Children with transections were more likely to be less than 2 years old compared to those with other duodenal injuries (p=0.02). Of note, 53% of all duodenal injuries resulted in operation, 53% had additional injuries, and 12.5% resulted in death.

Conclusion: Duodenal Injuries are extremely rare in the pediatric population. This multi- institutional investigation found child abuse consistently associated with duodenal injuries in children less than 2 years of age. The evidence supports a child abuse investigation on every child under the age of 2 with a duodenal injury.

VALIDATION OF THE BIG SCORE IN PREDICTING MORTALITY IN THE ADULT TRAUMA POPULATION

Thomas Brockamp, Marc Maegele, Christine Gaarder*, M.D., J. Carel Goslings*, M.D., Ph.D., Mitchell Jay Cohen*, M.D., Rolf Lefering, Pieter Joosse, Pal Naess*, MD, PhD, Nils Skaga, Tahnee Groat, Simon Eaglestone, Matthew Borgman, Philip Spinella, Martin Schreiber*, M.D., Karim Brohi*, Barts and the London School of Medicine & Dentistry

Invited Discussant: Howard Champion

Introduction: The BIG score (Admission base deficit (B), international normalized ratio (I), and Glasgow Coma Scale (G)) has been shown to predict mortality on admission in pediatric trauma patients. The objective of this study was to assess the performance of the BIG score in predicting mortality in an adult trauma population, and to compare it with the existing TRISS and PS09 scores.

Methods: A retrospective analysis using data collected between 2005-2010 from seven trauma registries in Europe and the United States was performed. We assessed the ability to predict mortality via Receiver Operating Characteristic (ROC) curves. We assessed the BIG score with original and newly derived coefficients using logistic regression. We then compared area under the ROC curves (AUROCs) with those TRISS and PS09.

Results: 5796 datasets were retrieved to validate the BIG score. The mean ISS was 17.8 ± 13.9 and the mean 30-day mortality rate was 8.1%. Our results show that with an AUROC of 0.859 the original BIG score performs as good in an adult population as it does in children. After logistic regression and adaptation of BIG coefficients the BIG score AUROC remained unchanged. The BIG score compared favorably to the TRISS (AUC 0.908) and the PS09 scores (AUC 0.912) as a mortality predicting tool.

Conclusion: The pediatric BIG score is a good predictor of mortality in the adult population. No change in coefficients is required. The BIG score performs almost as well as TRISS and PS09 scores but has the advantage of being available shortly after admission and may therefore be used for clinical prognostication or as a research tool for the design and implementation of clinical trials.

SKIN CLOSURE AFTER LAPAROTOMY IN HIGH-RISK PATIENTS: OPENING OPPORTUNITIES FOR IMPROVEMENT

Mark Seamon*, MD, Brian Smith, Lisa Capano-Wehrle, Abdulla Fakhro, Nicole Fox, MD, Michael Goldberg, Niels Martin*, MD, FACS, Abhijit S. Pathak*, M.D., Steven Ross*, M.D., Cooper University Hospital

Invited Discussant: Michael F. Rotondo

Introduction: While many surgeons leave laparotomy incisions open after colon injury to prevent SSI, other injured patient subsets are also at risk. We hypothesized that leaving trauma laparotomy skin incisions open in high-risk patients with any enteric injury or requiring damage control laparotomy (DCL) would decrease superficial SSI (sSSI) and fascial dehiscence rates.

Methods: Patients who underwent trauma laparotomy (2004-2008) at two Level-I centers were reviewed. To ensure a high-risk sample, only patients with transmural enteric injuries or need for DCL surviving >4d were included. SSI were categorized by CDC criteria and risk factors analyzed by skin closure (open vs. any closure). Significant ($p<0.05$) univariate variables were applied to two multivariate analyses examining sSSI and dehiscence.

	Open (n=143)	**Closed (n=360)**	***p***
Age	34±15	31±14	0.049
ISS	19±13	17±10	0.016
SBP Nadir	90±32	106±28	<0.001
SCIP Compliance	20%	32%	0.009
RBC Transfusion	6±9	3±5	<0.001
Colon Injury	41%	44%	0.618
DCL	57%	27%	<0.001
sSSI	10%	31%	<0.001
Dehiscence	2%	8%	0.014

Results: Of 1501 patients who underwent laparotomy, 503 met inclusion criteria. Patients were young (32±14yrs) with penetrating (74%) or enteric (80%) injuries, and DCL (36%) and SSI (44%, superficial 25%, deep 3%, organ/space 25%) were common. While no difference in sSSI after loose (n=136) or complete skin closure (n=224) was detected ($p=0.7$), sSSI were less common with open skin, despite multiple risk factors, than with any skin closure (Table). In multivariate analyses controlling for age, ISS, hypotension, SCIP antibiotic compliance, enteric injury, DCL, and RBC transfusion, open incisions independently decreased the risk of sSSI ≈7x (OR 0.14, $p<0.001$) and fascial dehiscence 4x (OR 0.25, $p=0.038$).

Conclusion: Management of skin incisions takes careful consideration like any other step of a laparotomy. Our results suggest that the decision to leave skin open is one simple method to improve outcomes in high-risk patients.

Session XVIA: Shock/Transfusion/Outcomes/Critical Care
Paper 50 3:20 PM

IMPACT OF INTESTINAL HOST DEFENSES ON CLOSTRIDIUM DIFFICILE DISEASE SEVERITY

Alicia Olson, M.D., Lawrence N. Diebel*, M.D., David Liberati, MS, Wayne State University

Invited Discussant: Philip Barie

Introduction: The severity of Clostridium difficile (C. diff.) associated infection depends on virulence factors of the organism and host factors including intestinal barrier function. The intestinal mucus layer has recently been recognized as the first line of defense against enteric pathogens. Its interaction with mucosal humoral immunity provided by secretory IgA (SIgA) is unknown as it relates to C. diff. disease severity. This was studied in vitro.

Methods: Confluent HT29 (non mucus producing) and HT29-MTX (mucus producing) intestinal epithelial cells (IEC) were exposed to C. diff. toxin A (6hrs.) and IEC toxin internalization, permeability (FITC-dextran), and necrosis (propidium iodide staining) determined. In some experiments SIgA was added and cleavage was determined by measurement of intact SIgA and secretory component (sc) fractions by ELISA. TNFα and IL-6 were measured from basal chamber culture supernatants by ELISA.

Results: mean ± S.D., 6hr. toxin A exposure.

	HT29	HT29-MTX	HT29+IgA	HT29-MTX+IgA
Perm. (nmol.cm-2.hr-1)	0.76±0.02	0.50±0.02*	0.66±0.02	0.36±0.14#
% necrosis	12.4±0.5	7.1±0.3*	7.9±0.2	3.2±0.2#
Tox A uptake (ng/ml)	77.2±6.2	25.3±3.1*	53.9±5.0	11.9±2.8#
SIgA intact (ng/ml)	----	----	185.6±1.9	359.8±2.6$
sc fraction (ng/ml)	----	----	242.7±2.6	21.9±2.0$
TNF (pg/ml)	39.8±2.0	23.3±1.5*	21.5±1.8	10.7±1.6#
IL-6 (pg/ml)	28.3±1.7	11.7±1.1*	12.1±1.6	5.8±1.2#

*p<0.001 vs. HT29, #p<0.001 vs. all other groups, $p<0.001 vs. HT29+IgA

Conclusion: Both intestinal mucus and SIgA were important in limiting C. diff. associated disease severity in this model. A synergistic effect of mucus and IgA was also noted and may be due to protection of SIgA from proteolytic cleavage.

DOES HELICOPTER TRANSPORT IMPROVE OUTCOMES INDEPENDENTLY OF EMS TIME?

Gabriel E. Ryb*, M.D., M.P.H., Carnell Cooper*, M.D., Patricia Dischinger, PhD, University of Maryland, Program in Trauma

Invited Discussant: John A. Morris, Jr.

Introduction: While some studies suggest a positive effect of helicopter transport (HT) on civilian injury outcomes, there is no clear evidence that EMS time (EMSt) mediates HT beneficial effect. We hypothesized that HT improved trauma outcomes independently of EMSt.

Methods: Cases of adult injured patients transported directly by ambulance (AMB) or HEL to level I and II trauma centers were selected from the 2007 National Trauma Data Bank Research Data Set. AMB and HEL cases were compared in relation to their mortality and possible confounders. Chi^2, student t and Wilcoxon tests were used for univariate comparisons (α=0.05). Logistic regression was used to calculate odds ratios (OR) and 95% confidence intervals for the association between HEL transport and death independent of age, gender, hypotension, ISS, RTS, injury type and EMSt (i.e. time from dispatch of EMS unit to hospital arrival).

Results: Of the 198,184 cases available for analysis, 84% were transported by AMB and 16% by HT. Compared to those transported by AMB, HT cases were younger (40.1 y vs. 44.7 y) and more likely to be male (71% vs. 67%). They were transported more commonly to level I trauma centers (74% vs. 64%) and were subjected to longer EMSt [median (q1-q3)] [56 (45-70) min vs. 40 (31-52) min.]. They experienced more frquently severe injuries (ISS 13.5 vs. 9.3 and RTS 7.0 vs. 7.5), hypotension (5.3% vs. 3.8%), and a higher mortality (6.2% vs 4.1%, $P<0.0001$). MLR adjusting for confounders revealed a lower mortality for HT transport [adjusted OR of death = 0.60 (0.56-0.65)]. Survival advantage of HT remained present after stratifying by EMSt, mechanism of injury and ISS.

Conclusion: HT is associated with an improved survival independently of EMSt. Further studies should elucidate which factors (i.e. interventions, training, geography, system maturity) mediate this effect.

ABSTRACT WITHDRAWN

HOSPITAL-BASED VIOLENCE INTERVENTION: RISK REDUCTION RESOURCES THAT ARE ESSENTIAL FOR SUCCESS

Randi Smith, M.D., Sarah Dobbins, Abigail Evans, Rochelle A. Dicker*, M.D., University of California, San Francisco Sponsor: Rochelle A. Dicker*, M.D.

Invited Discussant: Edward E. Cornwell, III

Introduction: Hospital-based violence intervention programs (VIPs) aim to reduce violent injury and recidivism. The aim of this study was to determine which risk reduction variables are associated with success in our VIP. We hypothesized that our recidivism rate declined since VIP's inception and that we could identify risk reduction variables that were independent determinants of program success.

Methods: We analyzed our prospectively collected data for 2005-2011 from our VIP database. Success was defined as >50% needs met without recidivism or attrition. Impact Analysis was performed per a model promoted by the CDC. Measures include rates of risk reduction and injury recidivism. Case management (CM) time spent per client (dose) was defined as low (1-3 hrs/wk), or high (> 3 hrs/wk). Logistic regression was performed.

Results: 260 clients received services; need for risk reduction resources was identified in 176 (75%). Meeting needs in education, mental health and employment (all $p<0.05$) proved significantly associated with success. Housing, court advocacy and professional training did not correlate with success. The 6-year program recidivism rate was 4% vs. historical control of 16% ($p<.05$). High CM exposure in the first 3 months was also significant ($p<.05$). Housing, court advocacy, and job training did not correlate with success. Also not associated with success was age, gender, education level, prior incarceration/probation, probation or length of time in program.

Conclusion: Over 6 years, our recidivism rate has decreased 4-fold compared to the rate prior to VIP inception. For startup and maintenance of a VIP, it is essential to know where to focus collaborative efforts in communities to target the most critical risk reduction resources. This study provides guidance; securing education, mental health care and employment and early "high dose" CM appear to be predictive of client success.

Session XVIB: Neurological/Critical Care
Paper 54 1:00 PM

NOT ALL BETA-BLOCKERS ARE BETTER FOR TRAUMATIC BRAIN INJURY

Terence O'Keeffe, MB ChB, Angelika Gruessner, PhD, Randall S. Friese*, M.D., Bellal Joseph, MD, Narong Kulvatunyou, Julie Wynne, Andrew Tang, M.D., Peter Rhee*, MD, MPH, FACS, FCCM, University of Arizona - Tucson Sponsor: Peter Rhee*, MD, MPH, FACS, FCCM

Invited Discussant: Bryan Cotton

Introduction: Prior studies have shown that beta-blocker (BB) use is associated with improved survival in patients with traumatic brain injuries (TBI). It is not known if all BBs are responsible for this effect. Our hypothesis was that the specific BB used makes a difference in outcome.

Methods: All adult patients with a blunt TBI admitted to the intensive care unit of an urban level 1 Trauma Center from May 2006 to July 2011 were included. Data were extracted from the Trauma Registry and the pharmacy database. Survival rates for patients receiving BB vs. controls were estimated after adjusting for possible bias using a propensity score matching algorithm.

Results: 7,048 adult patients with TBI were admitted over the study period, with 1037 (14.7%) receiving at least one dose of a BB. Using propensity scores we obtained a cohort of 942 matched patients. Survival was significantly higher in patients who received BBs compared to those who did not (91.5% vs. 83.3%). The survival benefit of BB was different when stratified by severity; patients with mild TBI (Head AIS 1,2) had 98.8% survival with BB vs. 98.2% without (p=0.61), compared to patients with severe TBI (Head AIS 3,4,5) 89.0% survival with BB vs. 78.8% without (p<0.0001). Amongst the different BBs only metoprolol and propranolol demonstrated an associated survival benefit.

BB Type	Paired N	Survival BB +ve	Survival BB-ve	P Value
Any BB	942	91.5%	83.3%	**<0.0001**
Metoprolol	577	90%	81.1%	**<0.0001**
Propranolol	48	97.9%	79.2%	**0.004**
Labetalol	78	80.8%	79.5%	0.84
Atenolol	53	100%	98.1%	0.31
Carvedilol	39	94.9%	94.9%	1.00

Conclusion: The specific beta-blocker administered affects patient survival. Metoprolol and propranolol are more effective in this population than other BBs, and should be used preferentially. Prospective clinical trials are sorely needed to confirm the survival advantage of these drugs.

Session XVIB: Neurological/Critical Care
Paper 55 1:20 PM

REPEAT HEAD CT AFTER MINIMAL BRAIN INJURY PREDICTS NEED FOR CRANIOTOMY IN ABSENCE OF NEUROLOGIC CHANGE

Chad M. Thorson, MD, Robert M. Van Haren, MD, Nicholas Namias*, MD, MBA, Christian A. Otero, MD, Emiliano Curia, MD, Alex M. Busko, BS, Jose M. Barrera, MD, Gerardo A. Guarch, MD, Malcolm R. Bullock, MD, PhD, Alan S. Livingstone, MD, FACS, Kenneth G. Proctor*, PhD, University of Miami Miller School of Medicine Sponsor: Kenneth G. Proctor*, PhD

Invited Discussant: Ali Salim

Introduction: Traumatic brain injury (TBI) is a leading cause of military and civilian death. Management strategies are focused on preventing secondary insults, which depend on early detection. However, with a renewed emphasis on cost containment, there is increased scrutiny on which tests provide crucial management information. Due to the controversy regarding the utility and exact timing of repeat CT, we tested the hypothesis that repeat head CT within 8 hours is critical for early diagnosis after minimal TBI.

Methods: The trauma registry at a level I trauma center from Jan 1996-May 2010 was retrospectively reviewed for all patients with Glasgow Coma Scale (GCS) 13-15 on arrival. Data are compared with t-tests, chi squared and multiple logistic regression; significance was assessed at $p<0.05$.

Results: There were 841 patients with GCS 13-15 and positive head CT on admission; 404 (48%) had a repeat CT within 24 hours (mean±SD time to repeat 8±6 hours). On repeat CT, 128 (32%) had worsening findings and 26/128 (20%) required craniotomy. Twenty were not intubated or sedated, and were thus clinically evaluable. Seven had decline in neurologic status prior to repeat CT and 4 had change after repeat CT leading to operative intervention. Most importantly, in 9 patients, clinical exam was unchanged, and the decision to operate was based solely on repeat CT. Logistic regression identified worsening of repeat head CT (OR 4.3, CI 2.0-9.6) and ISS (OR 1.1, CI 1.0-1.1) as independent predictors of the need for craniotomy.

Conclusion: After minimal TBI, repeat head CT within ~8 hours identifies patients who will require surgical intervention, regardless of neurologic changes. Worsening of CT and ISS were independent predictors of the need for intervention. In those with an initial positive CT, 45 repeat scans must be performed to identify the need for one craniotomy.

A PROSPECTIVE MULTICENTER COMPARISON OF LEVETIRACETAM VERSUS PHENYTOIN FOR EARLY POST-TRAUMATIC SEIZURE PROPHYLAXIS

Kenji Inaba*, MD, FACS, Jay Menaker*, Bernardino Branco, MD, Jonathan Gooch, Obi Okoye, MD, Joe Herrold, BA, Thomas M. Scalea*, M.D., Joseph DuBose*, Demetrios Demetriades*, M.D., Ph.D., LAC+USC Medical Center

Invited Discussant: Nirav Patel, M.D.

Introduction: Brain Trauma Foundation guidelines recommend seizure prophylaxis for preventing early post traumatic seizures (PTS). Phenytoin (PHE) is commonly used. Despite a paucity of data in Traumatic Brain Injury (TBI), Levetiracetam (LEV) has been introduced as a potential replacement that is more costly but does not require serum monitoring. The purpose of this study was to compare the efficacy of PHE to LEV for preventing early PTS.

Methods: Consecutive blunt TBI patients undergoing seizure prophylaxis were prospectively enrolled at two Level 1 Trauma centers over a 32 month period. Seizure prophylaxis was administered according to local protocol. Patients were monitored prospectively throughout their hospital stay for clinical evidence of seizure activity. PHE was compared to LEV with clinical early PTS as the primary outcome measure, defined as a seizure diagnosed clinically, occurring within 7 days of admission.

Results: 832 blunt TBI patients were enrolled. After excluding 15 patients who seized prior to initiation of prophylaxis, 817 were analyzed (410 PHE, 407 LEV). There were no significant differences between PHE and LEV: Age (53.6±22.6 vs. 51.8±21.4, p=0.246), Male (68.9% vs. 73.7%, p=0.142), SBP ≤ 90mmHg (1.1% vs. 2.5%, p=0.184), ISS (19.9±10.1 vs. 21.0±10.6, p=0.132), Marshall Score ≥ 3 (14.7% vs. 12.7%, p=0.417), or Craniotomy (10.8% vs. 8.8%, p=0.349). There was no difference in seizure rate (1.5% vs. 1.5%, p=1.000) adverse drug reactions (10.3% vs. 8.0%, p=0.278), or mortality (3.9 vs. 6.3%, p=0.153).

Conclusion: In this prospective evaluation of early post traumatic seizure prophylaxis, Levetiracetam did not outperform Phenytoin. Cost and need for serum monitoring should be considered in guiding the choice of prophylactic agent.

Session XVIB: Neurological/Critical Care
Paper 57 2:00 PM

HIGH VOLUME TRAUMA CENTERS HAVE BETTER OUTCOMES TREATING TRAUMATIC BRAIN INJURY

Joseph J. Tepas, III*, M.D., Lewis M. Flint*, M.D., Barbara Orban, Etienne Pracht, Associate Professor, University of Florida, Jacksonville

Invited Discussant: Raminder Nirula

Introduction: Outcome from severe traumatic brain injury (sTBI) treated in designated Level 1 trauma centers should not differ based on patient volume. We analyzed survival and discharge status from sTBI treated over the past 11 years in seven state designated Level I trauma centers.

Methods: Data for patients ages 16 to 64 were aggregated by quarter for years 2000 - 2010. TBI patients were identified using ICD-9 codes: 800 - 804, 850.1- 854. Severity was defined using the International Classification Injury Severity Score (ICISS) <0.85 (risk of death > 15%). Using a random effects model controlling for gender, race, ethnicity, and insurance status, TBI volume was analyzed against quarterly inpatient mortality, and functional recovery, defined as discharge to home or rehabilitation, versus transfer to skilled nursing facilities (SNF). Hospitals were categorized into quarterly TBI volume quintiles, using the top quintile (highest volume center) as control. To account for overall injury severity influence, ICISS was further categorized as < 20%, 20%-40%, and 40%-60%.

Results: During the study period sTBI incidence ranged from 0.19 -0.27/1000pts. Two high volume hospitals consistently treated more TBI patients (>40 pts./qtr.). Four treated <40 pts./qtr, and one transitioned from low to high volume midway through the study period. After controlling for severity, demographics, and insurance status, highest volume centers demonstrated a 9% lower mortality risk ($p<.001$). Lower volume hospitals discharged a significantly larger proportion of TBI patients to SNFs and fewer patients to home or rehabilitation facilities ($p < 0.01$).

Conclusion: High volume (>40 pts./qtr.) is associated with improved sTBI survival and, probably improved quality of life. Efforts to identify best practices and implement educational interventions to improve compliance with best practice standards will benefit patients with sTBI.

Session XVIB: Neurological/Critical Care
Paper 58 2:20 PM

RESVERATROL DECREASES OXIDANT AND NEURAL INJURY IN RATS SUFFERING FROM MILD TBI

Joshua W. Gatson, PhD, Ming-Mei Liu, James Simpkins, Kareem R. AbdelFattah, MD, Joseph P. Minei*, M.D., Steven Wolf, MD, Jane Wigginton, University of Texas Southwestern Medical Center at Dallas Sponsor: Steven E. Wolf*, M.D.

Invited Discussant: Vishal Bansal

Introduction: Following a mild traumatic brain injury (TBI) event, the secondary brain injury that persists after the initial concussion consists of excitotoxicity from increased neurotransmitter release, decreased cerebral glucose levels, oxidant injury, mitochondrial dysfunction, inflammation, and subsequent neuronal cell death. To date, there are no effective interventions used at decreasing secondary brain injury after TBI.

Methods: In this study, male rats were treated with either placebo or resveratrol (anti-oxidant; 100 mg/kg) at 30 minutes after mild TBI. Using the controlled cortical impact device, the rats were injured at 1, 3, 7, and 14 days after injury. The animals were intracardially perfused with 0.9% saline followed by 10% phosphate-buffered formalin. The whole brain was removed, sliced, and stained for caspase-3 (biomarker of cell death) levels. Lesion volume in the cortex and corpus callosum was also determined. In addition, serum levels of F2-Isoprostane were measured at the indicated time-points to determine the level of oxidant injury.

Results: In this study we found that treatment with resveratrol at 30 minutes post-injury resulted in a significant (~85%; $p< 0.0004$) reduction in the serum levels of F2-Isoprostane at the 72 hour time-point. Also, the rats treated with resveratrol had reduced cortical lesion volume ($p<0.04$). Caspase-3 staining within the cortex ($p<0.05$), corpus callosum ($p<0.01$), and hippocampus ($p<0.05$) was also reduced in the rats treated with resveratrol after injury.

Conclusion: Resveratrol given acutely after injury results in a decrease in cortical cell death, oxidant injury, and caspase-3 activation. These results suggest that resveratrol is a potent neuro-protective agent and protects various regions of the brain in this mild TBI model. These results further support the use of resveratrol as a neuro-protective agent after TBI.

SEDATION IN THE INTENSIVE CARE UNIT: MOVING BEYOND SEDATION INTERRUPTION

Brenton LaRiccia, Megan Battin, Theodophilus Ugheghe, Tara Sacco, Paul E. Bankey*, M.D., Ph.D., Jignesh Patel, Mark L. Gestring*, M.D., Julius D. Cheng*, M.D. M.P.H., Ayodele Sangosanya, Nicole Stassen*, MD, University of Rochester

Invited Discussant: Heidi L. Frankel

Introduction: Over sedation of mechanically ventilated patients contributes to worse ICU outcomes. While sedation interruption (SI) regimens have been shown to reduce sedation in medical ICUs, their utility in trauma ICUs is variable. In 2011 our trauma ICU (BTICU) implemented a regimen using aggressive up front bolus dosing of drugs, only utilizing continuous infusions if bolus dosing was ineffective over time, followed by regimented weaning of all medications. This study evaluates the efficacy of this regimen compared to our previous continuous drip/SI based practice.

	PRE N=743	POST N=749
Average Ventilator days	8.4	6.2
Total Sedation Days	1784	344
CLASBI Rate	4.5	2.7
VAP rate	12	1
Press Ganey Pain Score	93.7	94.9

Methods: Intubated patients >18 years old, admitted to the BTICU over two time periods, pre-protocol (PRE) and post-protocol (POST), were identified. Records were reviewed concurrently and retrospectively for demographics, APACHE II score, LOS, ventilator days, sedation use, complications, and outcome. Exclusion criteria included chemical paralysis, hourly neuro checks and burns.

Results: PRE(2009) and POST(2011) groups had similar demographics, APACHE II scores, and GCS. The POST group had a significant decrease in average ventilator days, total sedation days and infectious complications. (Table) In the POST group >50% of patients required <48 hours of continuous sedation and 23% never required continuous sedation. The total fall/self extubation rates and press ganey pain scores were unchanged.

Conclusion: This study shows that a protocol that preferentially utilizes intermittent pain and sedation medications, instead of continuous infusions with SI greatly decreases ICU sedation use and improves ICU infection rates, decreases ventilator days, without significant complications.

EARLY NON-BRONCHOSCOPIC BRONCHO-ALVEOLAR LAVAGE (SCREENING-BAL): PREDICTOR OF VENTILATOR ASSOCIATED PNEUMONIA (VAP)?

Christian Minshall, MD, PhD, Evert Eriksson, MD, Kenneth Hawkins, BSRRT, Steven Wolf, MD, Joseph P. Minei*, M.D., University of Texas Southwestern Medical Center at Dallas
Sponsor: Joseph P. Minei*, M.D.

Invited Discussant: Martin Croce

Introduction: Ventilator-associated pneumonia (VAP) is a problem in trauma and emergency general surgery patients. Our hospital-acquired infection prevention committee approved the use of early non-bronchoscopic broncho-alveolar lavage (screening-BAL) in the surgical intensive care unit (SICU) to identify ventilated patients with bronchiolar bacteria prior to 48 hours. We reviewed the results of this quality improvement initiative.

Methods: All ventilated patients in the SICU (3/11 - 2/12) underwent a screening-BAL 36-48 hours after intubation; quantitative culture results (>10sup4 CFU/mL) were used to identify positive specimens. Clinical pneumonia was defined as clinical pulmonary infection score (CPIS)>6 with a subsequent positive diagnostic-BAL. Sequential organ failure assessment (SOFA) scores were averaged for the first 48 hours in SICU. Continuous and dichotomous data were compared and a multivariate regression analysis was performed on the screening-BAL and pneumonia results.

Results: Screening-BALs were performed in 108 [69 trauma (median ISS 20.4; IQR 8, 51) and 39 emergency general surgery (median SOFA 7.1; IQR 4.8, 10.3)] patients; 55 of these specimens were positive. Thirty-seven clinical pneumonias were diagnosed and 33 (89%) identified the same organism as the screening-BAL. Clinical pneumonia developed in 3 patients with a negative screening-BAL (NPV = 0.94; AUC 0.81). Antibiotic therapy at the time of the screening-BAL was associated with a negative screen (0R 0.31; CI 0.135, 0.71). Pneumonia developed on median day 4.7 (2, 13) and field intubation was an independent risk factor (OR 4.4; CI 1.6, 12.2).

Conclusion: Positive screening-BAL specimens in trauma and emergency general surgery patients are associated with the development of VAP by the same organism. Further studies must be conducted to evaluate the role of screening-BAL in this patient population.

WHO GETS EARLY TRACHEOSTOMY? EVIDENCE OF UNEQUAL TREATMENT AT 185 ACADEMIC MEDICAL CENTERS

Joshua Shaw, Christopher Macomber, Gordon FitzGerald, Fred Anderson, Timothy Emhoff*, M.D., Shimul Shah, Heena Santry, M.D., M.S., University of Massachusetts

Invited Discussant: Clay Cothren Burlew

Introduction: While the benefits of early tracheostomy in ventilator dependent patients are well established, the reasons for variation in time from intubation to tracheostomy remain unclear. We identified clinical and demographic disparities in time-to-tracheostomy.

Methods: We queried the University HealthSystem Consortium (2007-2010) for adult patients receiving a tracheostomy after initial intubation. Time-to-tracheostomy was designated 'EARLY' <5 days or 'LATE' >10 days. Cohorts were stratified by time-to-tracheostomy and compared using univariate tests of association and multivariable logistic regression.

Results: 26,011 patients underwent tracheostomy after initial intubation: 34% EARLY (N= 8,835) and 66% LATE (N=17,176). On both univariate and multivariable analyses, females, Non-Whites and Medicaid patients were less likely to receive an early tracheostomy (see table). However, EARLY patients experienced lower rates of both ventilator associated pneumonia (VAP) (OR 0.64; CI95% 0.51–0.75) and mortality (OR 0.59; 95%CI 0.55–0.64).

	Early (n=8,835)	Late (n=17,176)	Univariate OR	Multivariable OR
Female Sex	3,294 (31)	7,470 (69)	0.77 (0.73–0.81)	0.83 (0.78–0.87)
Non-White Race	3,081 (29)	7,250 (71)	0.71 (0.67–0.75)	0.78 (0.74–0.82)
Medicaid	1,445 (31)	3,287 (69)	0.83 (0.77–0.88)	0.86 (0.79–0.94)

Conclusion: Early tracheostomy was associated with both reduced VAP and increased survival. Yet there were still significant disparities in time to tracheostomy according to sex, race and type of insurance. Application of evidence based algorithms for tracheostomy may reduce unequal treatment and improve overall VAP and mortality rates. Additional research into this apparent bias in referral/rendering of tracheostomy is needed.

WHICH CENTRAL VENOUS CATHETERS HAVE THE HIGHEST RATE OF CATHETER ASSOCIATED DEEP VENOUS THROMBOSIS: A PROSPECTIVE ANALYSIS OF 2128 CATHETER DAYS IN THE SURGICAL INTENSIVE CARE UNIT

Darren Malinoski*, Akash Bhakta, Randi Schutz, Tyler Ewing, Bryan Imayanagita, Daniel Margulies*, Cristobal Barrios, M.D., Michael Lekawa, M.D.*, Rex Chung, Marko Bukur, Allen Kong, M.D., UC Irvine

Invited Discussant: Robert Winchell

Introduction: Catheter-associated deep venous thromboses (CADVT) are a common occurrence in the surgical intensive care unit (SICU), necessitating central venous catheter (CVC) removal and replacement. The internal jugular vein has been implicated as the most common site of CADVT, but previous studies lack a true denominator of all CVC days in the SICU. We sought to determine the true incidence of and risk factors for CADVT based on patient characteristics as well as CVC site, type, and duration of insertion.

Methods: The following data from all patients in the SICUs of two urban level-I trauma centers were prospectively collected from 2009 to 2012: demographics, risk factors for DVT, CVC site/type/duration, and Duplex results. CVC sites included the internal jugular (IJ), subclavian (SC), arm (for PICC lines), and femoral. CVC types included triple lumen (TL), cordis/hemodialysis (C/HD), and PICC. High risk patients received weekly screening Duplex exams and a CADVT was defined as a DVT being detected on Duplex with a CVC in place or within 7 days of removal. Rates of CADVT were normalized per 1000 CVC days and independent predictors of CADVT were determined using logistic regression.

Results: Data were complete for 184 patients, 354 CVCs, and 2128 CVC days. 59 CADVT were diagnosed in 28% of patients. Rates of CADVT were 9/1000 catheter days for SC, 27 for arm ($p<0.01$ vs. SC), 36 for femoral ($p<0.01$), 61 for IJ ($p<0.01$), and 22 for TL, 27 for PICC ($p=0.24$ vs. TL), and 57 for C/HD ($p<0.01$). After adjusting for patient risk factors, predictors of CADVT were the IJ and arm sites (OR=5.5 and 3.1 compared to SC) and the C/HD type (OR=2.4 compared to TL, all $p<0.05$).

Conclusion: The IJ and arm sites and C/HD type are associated with increased CADVT. These data may be used to determine the optimal site and type of CVC for insertion.

Session XVIB: Neurological/Critical Care
Paper 63 4:00 PM

BICARBONATE THERAPY IN CRITICALLY INJURED PATIENTS WITH SEVERE ACIDOSIS INCREASES ARTERIAL-END TIDAL CO2 DIFFERENCES AND MORTALITY RATES

Robert F. Wilson*, M.D., Detroit Receiving Hospital

Invited Discussant: Therese M. Duane

Introduction: Normally end-tidal CO2 (ETCO2) is within 2 mmHg of arterial pCO2 (PaCO2). However, if dead space in the lungs increases due to shock, the arterial-end tidal pCO2 difference [P(a-ET)CO2) increases. We have found repeatedly that in severely injured patients, P(a-ET)CO2 <10 mmHg is associated with survival rate and P(a-ET)CO2 >16 mmHg is usually fatal. Although giving bicarbonate to patients with severe acidosis can improve arterial pH (pHa) and bicarbonate levels, if the patient is not ventilating adequately for the acidosis, usually to a PaCO2 ≤30 mmHg, CO2 can cause increasing cellular respiratory acidosis.

Methods: 209 critically injured patients with severe acidosis (pH≤7.10) during emergency surgery were reviewed. Mean initial pHa was 6.93±0.16 with HCO3 of 10.9±3.5 mEq/L. According to Winter's formula [pCO2=(HCO3)(1.5)+8±4], pCO2 should have been 24±4 mmHg but actually was 51±13 mmHg. HCO3 therapy in such circumstances produces even greater cellular respiratory acidosis.

Results: In 65 patients the effect of an average of 2-3 vials of HCO3 (50 mEq/ampule) over 30-60 min increased HCO3 from 10.6±3.1 to 16.6±4.0 mEq/L. At the same time pCO2 rose from 44±9 to 56±11 mmHg and ETCO2 stayed relatively constant (26±6→25±5) resulting in a rise in P(a-ET)CO2 from 17±9 to 24±13 mmHg, far above survival levels. Indeed, in final values after resuscitation, P(a-ET)CO2 in the 71 patients who survived was 10±6 mmHg while the 94 patients who died in the OR or within 48 hr of surgery had P(a-ET)CO2 of 23±10 mmHg ($p < 0.001$).

Conclusion: In critically injured patients with severe acidosis, it is essential to attempt to reduce PaCO2 to ≤30 mmHg and decrease P(a-ET)CO2 to 10±6 mmHg, using HCO3 therapy only if proper PaCO2 levels can be obtained.

ATTRIBUTABLE IMPACT OF VENTILATOR ASSOCIATED PNEUMONIA IN TRAUMA PATIENTS: PROLONGED VENTILATION, INCREASED LENGTHS OF STAY, INCREASED COST BUT NOT INCREASED MORTALITY

Ajai Malhotra*, M.D., Therese Duane*, Michel B. Aboutanos*, M.D., M.P.H., Luke Wolfe, Kelly Guilford, Paras Gandhi, Paula Ferrada, Rahul Anand, Christopher Hogan, Rao R. Ivatury*, M.D., Virginia Commonwealth University

Invited Discussant: Steven Johnson

Introduction: The attributable impact of ventilator associated pneumonia (VAP) in trauma patients is unclear. We hypothesize that the development of VAP is an independent predictor of worse outcomes and increased cost.

Methods: The study population comprised of adult ventilated blunt trauma patients over a 10 year period (2002-11). Early (<48 hours) deaths were excluded. VAP was diagnosed by bronchoscopic broncho-alveolar lavage (BAL) and defined as >100,000 CFU/ml of BAL fluid. Unadjusted outcomes [ventilator days (Vdays), intensive care unit (ICU) and hospital lengths of stay (ICU & HLOS), and mortality], and cost of care (hospital charges and cost) were compared between patients that did and did not develop VAP. Additionally, to control for factors that increase the chance of VAP, 1:3 propensity matching was performed and the matched groups compared.

Results: Of the 2380 ventilated ICU patients, 309 underwent 406 BALs. 135 (17%) patients had VAP. VAP was associated with older age (41±19 vs 49±19), higher injury severity score (21±13 vs 29±12), shock (lactate: 3.7±3.7 vs 4.2±3.1), and higher chest & abdominal abbreviated injury score ($p<0.05$ for all). VAP resulted in increased Vdays, ICU & HLOS, and higher hospital charges and costs ($p<0.05$ for all – Table). The results were the same after propensity matching adjusting for variables associated with VAP. Unadjusted and matched mortality was similar between patients with or without VAP ($p>0.05$).

Table	No VAP	VAP
Vdays*	5.3±8.6	16.5±14.7
ICULOS*	8.1±10.1	22.4±16.9
HLOS*	14.7±18.3	33.2±25.3
Charges*	151±155	357±267
Cost*	50±56	120±86
Mortality	216/2245 (10%)	19/135 (14%)

Charges & Cost X1000 USD

Conclusion: VAP in traumatized patients is an independent predictor of increased Vdays, ICU & HLOS, higher cost, but NOT increased mortality.

Session XVII: Miscellaneous
Paper 65 8:00 AM

PREDICTING SEVERE INJURY USING VEHICLE TELEMETRY DATA

Patricia Ayoung-Chee, Christopher Mack, Robert Kaufman, Eileen M. Bulger*, M.D.,
Harborview Medical Center Sponsor: Eileen M. Bulger*, M.D.

Invited Discussant: Jeffrey P. Salomone

Introduction: In 2010, the National Highway Traffic Safety Administration standardized crash data stored by electronic data recorders (EDR). This data may help determine appropriate EMS crash response. Previous models (e.g. OnStar, URGENCY) predict severe injury (ISS≥16) using EDR data and remote occupant communication or on scene observation. Calls from automatic crash notification systems (ACN) are unanswered in 12% of cases and EMS triage is based on limited data. Our goal was to create a predictive model only using vehicle data that can potentially be transmitted by an EDR.

Methods: Using the Crashworthiness Data System dataset, we included all front seat occupants in late model vehicles (2000 and later) in non-rollover crashes (2000-2010). Variables included were change in velocity, force direction, seatbelt use, vehicle type and curb weight, single or multiple impact, maximum intrusion, narrow impact and passenger ejection. Missing data was multiply imputed. Using the CDC Field Triage Guidelines, the model was tested to predict severe injury prior to EMS arrival (Step0) and with EMS on scene (Step3). The probability threshold was chosen to maximize sensitivity and specificity.

Results: There were 28,633 crashes, involving 33,956 vehicles and 52,033 occupants of whom 7.6% had a severe injury. Using a probability threshold of 25% for ISS≥16, the model sensitivity was 43.3% at Step0. At Step3 the model sensitivity was 37.3% with probability threshold of 30%. Although a strong independent predictor, exclusion of compartment intrusion did not affect sensitivity. The OnStar and URGENCY models were re-created and tested at Step0: sensitivities were 41.3% and 31.7% respectively.

Conclusion: We designed a model using only data that can be transmitted by an EDR, that was as sensitive as the OnStar and URGENCY models. These models demonstrate the potential use of ACN in planning EMS response.

Session XVII: Miscellaneous
Paper 66 8:20 AM

BACK TO THE FUTURE: REDUCING RELIANCE ON TORSO CT IN THE INITIAL EVALUATION OF BLUNT TRAUMA

Michael J. Sise*, M.D., Jessica Kahl, B.A., Richard Y. Calvo, M.P.H., C. Beth Sise, J.D., R.N., Jessica Morgan, M.D., Meghan C. Shackford, Jesse Bandle, M.D., Seth Krosner, M.D. , Kimberly Peck, M.D.*, Steven R. Shackford*, M.D., Jack Yang, M.D., Scripps Mercy Hospital Trauma Service

Invited Discussant: William Bromberg

Introduction: Current reliance on chest-abdomen-pelvis (CAP) computed tomography in the initial evaluation of blunt trauma is a major source of patient radiation exposure. Our Level I trauma center surgeon practice group (SPG) modified its guideline in 2011 to limit the use of CAP. We evaluated the effect of this practice change on CAP use and diagnostic accuracy.

Methods: We compared data on blunt injury trauma activations evaluated by the 5-member SPG for two 6-month intervals, before (T1) and after (T2) instituting the practice change. Patient demographic and injury data, complications, torso imaging and radiation dosage in millisieverts per patient (msv/pt) were collected. Following analysis of T1, the surgeon with the lowest CAP use was identified and found to have no errors or delays in diagnosis. The SPG agreed to adopt this surgeon's focus on findings of the physical exam and FAST to reduce CAP use in the initial evaluation. T2 was analyzed to assess the effect of implementation of this guideline.

Results: There were 897 patients in T1 and 948 in T2 (Table). Patients did not differ by age, gender, mortality, or probability of survival (Ps). Rate of CAP use decreased by 38.5% with a significant drop in mean radiation exposure ($p<0.01$). There were no missed injuries or delays in diagnosis in either interval.

	T1	T2	p-value
Patients	897	948	
Age, mean	46.5	46.4	p=NS
Female, %	68.5	67.4	p=NS
Mortality, %	2.9	2	p=NS
Ps, mean	96.1	96.6	p=NS
CAP, %	67.1	41.3	p<0.01
msv/pt, mean	14.04	8.58	p<0.01

Conclusion: The use of CAP and its associated radiation burden in the initial evaluation of blunt trauma can be reduced without diagnostic errors by comparing utilization and identifying best practice. This process has implications for trauma resource utilization, patient safety, and quality of care.

Session XVII: Miscellaneous
Paper 67 8:40 AM

APPLICABILITY OF AN ESTABLISHED MANAGEMENT ALGORITHM FOR COLON INJURIES FOLLOWING BLUNT TRAUMA

John Sharpe, M.D., Louis J. Magnotti*, M.D., Jordan Weinberg*, M.D., Martin Croce*, M.D., Timothy C. Fabian*, M.D., University of Tennessee Health Science Center - Memphis Sponsor: Louis J. Magnotti*, M.D.

Invited Discussant: Demetrios Demetriades

Introduction: For over a decade, operative decisions at our institution for colon injuries have followed a defined algorithm (ALG) based on risk factors originally identified for penetrating injuries. The purpose of this study was to evaluate the applicability of that ALG to blunt colon injuries.

Methods: Blunt colon injuries over 13-years were identified. Per the ALG, non-destructive (ND) injuries are treated with primary repair. Destructive wounds (serosal tear ≥ 50% colon circumference, mesenteric devascularization and perforations) with concomitant risk factors (pre- or intra-op transfusion >6 u PRBCs and/or significant co-morbidities) are diverted. Destructive wounds with no risk factors undergo resection plus anastomosis (RA). Suture line failure (SLF), abscess and mortality were compared. Stratification analysis was performed to determine if additional risk factors should be considered in the management of blunt colon injuries.

Results: 151 patients were identified: 75 ND and 76 destructive injuries. All ND injuries underwent primary repair. 44 destructive injuries underwent RA and 29 diversion. Adherence to the ALG was 95%: 3 patients with destructive injuries underwent primary repair and 5 patients with risk factors underwent RA. There were 3 (2%) SLFs (one involved deviation from the ALG) and 8 (5%) abscesses. Colon-related mortality was 2.1%. Stratification analysis based on degree of mesenteric involvement, base excess, shock index and need for abbreviated laparotomy failed to identify further risk factors for SLF following RA for blunt colon injuries.

Conclusion: Adherence to an ALG, originally defined for penetrating colon injuries, simplified the management of blunt colon injuries. ND injuries should be primarily repaired. For destructive injuries, operative decisions based on a defined ALG achieves an acceptably low morbidity and mortality rate following blunt colon trauma.

Session XVII: Miscellaneous
Paper 68 9:00 AM

PROSPECTIVE COMPARISON OF PRBC TO FFP TRANSFUSION RATIO OF 4:1 vs. 1:1 DURING ACUTE MASSIVE BURN EXCISION

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Invited Discussant: Nicholas Namias

Introduction: Acute burn excision results in >50% blood volume loss. The study purpose is to prospectively compare the impact of a 4:1 vs a 1:1 PRBC:FFP transfusion strategy in children with burns >20% TBSA.

Methods: Children with >20% TBSA burn were randomized to a 1:1 or 4:1 PRBC:FFP ratio during burn excision. We measured demographics, burn size, and PRISM scores on admit. A t pre-op, 1hr,12hrs, 24hrs and 1 wk we measured PT/PTT, INR, fibrinogen (fib), protein C (prot C), and antithrombin C (AIII). Total number of blood units(u) were recorded.

Results: Groups were similar in age(6.5±2.0 in 1:1 vs 6.8±2.7 yrs in 4:1), weight (26.8±6.8 in 1:1 vs 27.0±8.8 kg in 4:1), or TBSA(41.5±11.0 in 1:1 vs 37.7±8.8% in 4:1), preop fib, AIII, prot C, hemoglobin(hb), PT/PTT, INR, and platelets. The 1:1 group received 35u FFP, 35u PRBC vs 13u FFP, 65u PRBC in the 4:1 group. >50% blood volume was replaced with PRBC intra-op. AIII, prot C, and fib were higher in 1:1 at 1 and 12 hr(table). There was no difference in PT/PTT, INR, hb, or platelets. Total transfusion for 1:1 was 38u FFP, 69u PRBC vs. 21u FFP, 84u PRBC in the 1:4 group.

Conclusion: A 1:1 PRBC:FFP transfusion strategy decreased PRBC use, and resulted in higher AIII, prot C, and fib postoperatively with difference in INR, PT/PTT. This may represent compensatory changes in the 4:1 group in response to intraoperative blood loss.

*P<.05	% AIII	% AIII	Fib (mg/dL)	Fib (mg/dL)	%Prot C	% Prot C
	1:1	4:1	1:1	4:1	1:1	4:1
Preop	77.4±5.5	65.1±7.4	453.7±27.2	431.8±35	74.1±5.3	65.9±9.4
1 hr	75.1±3.3	53.6.1±5.9*	369.1±16.4	321.5±32.5*	73.7±4.5	58.82±6.4*
12 hr	75.0±3.7	60.7±5.9*	394.1±14.3	360.2±28.2*	77.1±6.6	57.3±8.4*
24 hr	82.0±8.7	64.0±6.1	427.6±16.3	387.9±19.9	75.2±6.8	70.6±9.5
1 wk	88.6±4.6	87.8±5.5	433.8±18.2	458.9±45.9	86.8±6.8	88.7±23.7

SCREENING, BRIEF INTERVENTION AND REFERRAL TO TREATMENT (SBIRT) REDUCES ALCOHOL RELATED TRAUMA READMISSIONS

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Invited Discussant: Michael J. Sise

Introduction: Excessive alcohol consumption is the third leading preventable cause of death in the United States and is associated with multiple adverse health consequences, unintentional injuries, and violence. We started a SBIRT program with a full-time counselor in 2008. This study was performed to test the hypothesis that institution of the SBIRT program would reduce alcohol related trauma readmissions at our trauma center.

Methods: This study was approved by our IRB and was conducted from the inception of our SBIRT program, February 2008, until August 2011. SBIRT referrals were obtained on all patients with a positive blood alcohol concentration (BAC) on admission or by referral from any clinician caring for the patient regardless of admission BAC status. To check for trauma recidivism, we compared readmission rates to the trauma service for all patients who had participated in our SBIRT program to an immediate historic trauma registry control group (April 2006 to March 2008) admitted with a BAC $\geq$0.08 prior to the initiation of the SBIRT program. Chi Square was used to test for differences between groups.

Results: From February 2008 to August 2011, 12,635 patients were admitted to the trauma service with 1,273 patients being referred to the SBIRT counselor. In patients initially admitted with a BAC$\geq$0.08, trauma readmission rates, regardless of readmission blood alcohol status, tended to be lower in patients that underwent SBIRT compared to the pre-SBIRT cohort, 2.35% (30/1237) vs. 3.54% (39/1103) ($p=0.1$). However, there were significantly less SBIRT patients readmitted with a positive BAC compared to the pre-SBIRT cohort, 0.63% (8/1273) vs. 1.45% (16/1103) ($p=0.046$).

Conclusion: These results suggest that institution of the SBIRT program has resulted in a greater than 50% reduction in alcohol related trauma readmissions at our trauma center.

Session XVII: Miscellaneous
Paper 70 9:40 AM

REFINING THE ROLE OF SPLENIC ARTERY EMBOLIZATION IN HIGH GRADE SPLENIC INJURIES

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Invited Discussant: Donald D. Trunkey

Introduction: The justification and safety of splenic artery embolization (SAE) as an adjunct to non-operative management (NOM) in high-grade splenic injuries are matters of controversy. In our institution, mandatory SAE was introduced in hemodynamically stable OIS grade 3–5 injuries in 2002. From October 2008 mandatory SAE was restricted to OIS grade ≥4 injuries. Recently published data confirm increased splenic preservation rates with SAE in grade 4 and 5 injuries. The aim of the present study was to evaluate clinical outcome in patients with high-grade splenic injuries and further define the role of SAE.

Methods: All patients with splenic injuries admitted from August 1, 2002 to July 31, 2010 were included. Patient charts, computed tomographic scans, and trauma registry data were reviewed. The cut-off point for change of the OIS grade 3 protocol was set at October 1, 2008.

Results: A total of 353 patients with splenic injuries (mean splenic OIS 3.1) resulted in a 76% attempted NOM rate with 96% success rate, and a 78% splenic preservation rate. Comparing OIS grade 3 injuries admitted before (n=96) and after (n=36) October 2008, we found similar admission physiology and ISS. In spite of the reduction in SAE rate (from 62% to 34%), the NOM rate remained unchanged (76% vs 81%), as did NOM failure rate (4% vs 3%), rate of rebleeding, complications, and mortality. NOM with SAE was attempted in 80% of the 108 OIS grade 4 and 53% of the 19 OIS grade 5 injuries, with 2 failures in each group, yielding a 96% success rate and a total 75% NOM rate

Conclusion: A protocol with mandatory SAE in OIS grade 4 and 5 injuries resulted in an overall 96% success rate among the 76% eligible for NOM. In OIS grade 3 splenic injuries, mandatory SAE does not seem justified.

Session XVII: Miscellaneous
Paper 71 10:00 AM

A QUICK AND SIMPLE TRAUMA REHABILITATION SCORE (TROS) IS BETTER THAN THE FUNCTIONAL INDEPENDENCE MEASURE (FIM) IN EVALUATING TRAUMA PATIENT FUNCTIONAL ABILITIES.

Douglas J.E. Schuerer*, M.D., Sharon Allen, OTD/S, Cresencia Burhans, OTD/S, M Carolyn Baum, PhD, OTR/L, FAOTA, Washington University

Invited Discussant: Karen J. Brasel

Introduction: The FIM is currently used to evaluate the motor and cognitive function of trauma patients, but takes significant time and is complicated in its administration. We developed a quick and simple tool, the Trauma Rehab Outcome Score (TROS), to rapidly assess trauma patient's function and discharge needs. This study examined the internal reliability and the validity of the TROS compared to the FIM and the Montreal Cognitive Assessment.

Methods: This prospective trial on trauma patients at our level 1 trauma center compared the TROS, FIM, and MoCA on each patient after consent. Evaluations were done by 5 FIM trained OT students. Baseline demographic and mechanism data were collected. The TROS is a quick screening tool that takes less than 5 minutes to administer and evaluates 7 categories of function; convocation, enjoyment, self-care, medical, ADLs, mobility, and cognition. Each category is scored on a scale of 1-4, with 4 indicating independence.

Results: 109 patients were enrolled over 5 months. The average age was 40 and 64% were male. The FIM took over 40 minutes per patient, the TROS only 5-10. The Cronbach Alpha for the TROS was 0.801.

The TROS correlated well with the total FIM and the motor components of the FIM, and less so to the MoCA. The FIM cognitive (FIMcog) components and the TROS cognition item did not correlate well with the MoCA.

Conclusion: The TROS is highly internally reliable across all 7 components. The TROS correlates well with the FIM, but uses less time and can be administered without extensive training. The TROS cognitive component requires improvement in recognizing deficits but still outperforms the FIMcog. This quick and effective new tool should be used in studies of functional improvement and resource needs after trauma.

Session XVII: Miscellaneous
Paper 72 10:20 AM

EXCEPTION FROM INFORMED CONSENT FOR EMERGENCY RESEARCH: CONSULTING THE TRAUMA "COMMUNITY"

Carrie Sims*, MD, MS, Joshua Isserman, Latha Mary Sundaram , Nikolai Tolstoy, Sarah Greer, MD, MPH, Jose Pascual, MD, PhD, Patrick Reilly*, M.D., Daniel Holena, MD*, University of Pennsylvania

Invited Discussant: Joseph P. Minei

Introduction: Because consent for research is impossible in emergencies, the FDA established an Exception from Informed Consent (EFIC) Policy mandating "community consultation". This study investigates trauma "community" attitudes regarding EFIC and willingness to participate.

Methods: In the context of an upcoming trial, trauma pts, family and community members were asked to rank statements regarding EFIC and willingness to participate in emergency research (WILLINGNESS) using a 5 point Likert Scale. Higher total scores reflected a more positive attitude regarding EFIC (range 4-20, neutral=12) and WILLINGNESS (range 19-95, neutral=57). The influence of demographics, education, and interpersonal violence were evaluated by Kruskall-Wallis and Mann Whitney ($p<0.05$).

Results: Overall, the 309 participants (trauma pts=172, family=73, community=64) were positive about EFIC (median 16 (IQR 14-18)) and demonstrated high WILLINGNESS scores (median 75 (IQR 69-81)). EFIC and WILLINGNESS were not influenced by age, sex, race, or education. Victims of interpersonal violence and their family members had lower EFIC scores than those with other mechanisms (median 16 (IQR 14-18) vs 16 (IQR 13-16), $p=0.04$), but similar WILLINGNESS. Although EFIC scores were similar between groups, trauma pts had significantly lower WILLINGNESS than family (median 74 (IQR 68-77) vs 77 (IQR 70-85), $p=0.03$) and community members (median 76 (IQR 70-840, $p=0.01$).

Conclusion: Trauma pts, their families, and the surrounding geographic community expressed a high degree of support for EFIC and willingness to participate in emergency research, although support was influenced by injury mechanism and group status. Consultation efforts for emergency research should extend beyond the geographic "community" to include trauma victims and their families.

Session XVII: Miscellaneous
Paper 73 10:40 AM

ASSOCIATION BETWEEN CREATININE KINASE AND COMPARTMENT SYNDROME

Carrie Valdez, MD, Elizabeth Schroeder, MD, Jose Pascual, Assistant professor, Richard Amdur, Babak Sarani*, M.D., The George Washington University Hospital Sponsor: Babak Sarani*, M.D.

Invited Discussant: Sharon Henry

Introduction: Diagnosis of limb compartment syndrome (CS) is difficult. Although elevated serum creatine kinase (CK) titer is known to be associated with muscle injury, it is unknown if there is a threshold level predictive of CS. We hypothesized that there is a threshold CK titer that is more predictive of CS than HCO3, lactate or extremity fracture (tib/fib fx).

Methods: A retrospective review of ICD9 codes from 2001-2011 at a level I trauma center was used to identify patients with isolated tib/fib fx or lower extremity CS. Demographic variables, CK, basic metabolic panel, and lactate titers were abstracted. Univariate and multivariate logistic regression (MVR) analyses were used to determine the best predictors of CS.

Results: A total of 97 patients were identified with isolated tib/fib fx or CS. CK was measured in 58 patients. Median CK (25-75 IQR) levels in patients with isolated tib/fib fx or CS was 715 U/L (271-2,061 U/L) and 17,145 U/L (3,451-36,720 U/L), respectively. Univariate comparisons are shown in table. MVR found that CK alone had the highest accuracy for predicting CS.

Conclusion: This is the first study to examine the predictive relationship between CK and CS. CS is associated with significantly higher CK levels than isolated tib/fib fx. CK > 1000 U/L can be used as a screening tool for CS, but still requires clinical validation, whereas CK > 4000 U/L is highly specific for CS. Compared to HCO3 and lactate, CK alone has the highest accuracy for predicting CS.

Univariate analysis of factors associated with CS

Variable	OR (95% CI)	Sensitivity	Specificity	Accuracy	p-value
HCO3 < 25 mmol/L	4.3 (1.4-13.3)	84%	44%	61%	0.0002
Lactate > 6 mmol/L	4.2 (1.0-17.2)	46%	83%	59%	0.0015
CK > 1000 U/L	10.8 (2.6-44.9)	91%	52%	74%	0.001
CK > 4000 U/L	26.45 (5.2-134.2)	70%	92%	79%	<0.0001