Session I

Paper 1 12:50 PM

TRAUMA CORE MEASURES: CLINICAL PROCESSES THAT IMPROVE PATIENT OUTCOMES

Shahid Shafi*, MD MPH, Nadine Rayan, MHA, Sunni Barnes, PhD, Larry Gentilello*, MD, Neil S Fleming, PhD, David J Ballard, MD PhD. Baylor Institute for Health Care Research and Improvement.

Invited Discussant: Mark Hermila

Introduction: The Trauma Quality Improvement Program (TQIP) has shown that risk-adjusted mortality rates at some centers are nearly 50% higher than at others. The reasons for this significant "quality gap" are unknown, but may be due to different clinical practices or processes of care. We have previously shown that adoption of processes promoted as Core Measures by the Joint Commission (JC) and Center for Medicare and Medicaid Services (CMS) in hospitalized patients do not improve trauma patient outcomes. We hypothesized that improved compliance with trauma specific clinical processes of care (T-POC) is associated with reduced mortality.

Methods: Records of a random sample of 1000 patients admitted to a Level 1 trauma center who met TQIP criteria (AIS > 3) were retrospectively reviewed for compliance with twenty-five T-POC's endorsed by ATLS, EAST, the Brain Trauma Foundation, or the Glue Grant Consortium. All were evidence-based or expert consensus panel recommendations. Multivariate regression was used to determine the relationship between T-POC compliance and mortality, adjusted for age, gender, injury type, and severity.

Results: Median age was 41 years, 65% were males, 88% sustained a blunt injury, and mortality was 12%. Of these, 81% were eligible for at least one T-POC, and over 60% were eligible for 2 or more. There was wide variation in compliance with T-POC's, ranging from 99% for transfusions in hypotensive patients, to 8% for ICP monitoring in brain injured patients. Every 10% increase in compliance with T-POC's was associated with a 14% reduction in risk-adjusted mortality.

Conclusion: Unlike adoption of JC or CMS core measures, adoption of T-POC's is associated with reduced mortality in trauma patients. Trauma centers with excess mortality may improve patient outcomes by consistent application of T-POC. These processes should be explored for potential use as Core Trauma Center Performance Measures.

Session I

Paper 2 1:10 PM

COMPUTER PROTOCOL FACILITATES EVIDENCE BASED CARE OF SEPSIS IN THE SURGICAL ICU

Bruce A McKinley PhD, R Matthew Sailors BE, Alicia Valdivia RN, Laura J Moore MD, Joseph F Sucher MD, S Rob Todd MD, Krista L Turner MD, Frederick A Moore* MD. The Methodist Hospital, Department of Surgery.

Invited Discussant: Lena Naplitano

Introduction: Treatment of sepsis, a deadly complication, is complex requiring multiple interventions which, if administered in a timely fashion, reduce mortality.

Objective: To compare compliance rates (and associated mortality) of 6 hour (6h) resuscitation 'bundle' interventions for treatment of severe sepsis/septic shock.

Methods: Surviving Sepsis Campaign (SSC) guidelines (i.e. recommendations; little/no instruction for patient specific decision) were implemented over 2 yrs in 166 ICUs worldwide. Compliance and mortality were audited over 8 quarters (qtr). A guideline based comprehensive 24h protocol (i.e. logical, rule based, data driven care process; patient specific decisions, instructions) was implemented in 2008 (via a paper protocol) and 2009 (via a computer) in a 30 bed surgical ICU. 6h 'bundle' compliance and outcome are compared for published SSC results (qtr 1 vs 8; Levy et al CCM 2010) vs paper (2008) vs computer (2009) implementations. (*$p<0.05$; X^2; SSC qtr 8 compared to computer 2009)

Results	**SSC qtr 1**	**SSC qtr 8**	**2008**	**2009**
Interventions	n=15022		n=102	n=104
check [lactate]	61%	79%	99%	99%*
increase CVP > 8mmHg	26%	38%	86%	87%*
give antibiotics in 1st hr	60%	68%	36%	95%*
give IV fluid or vasopres	60%	77%	77%	74%
all 6h components	11%	31%	29%	79%*
hosp mortality (%)	**37%**	**31%**	**24%**	**12%***

SCC compliance with all 6h components increased from 11 to 31% and mortality decreased from 37 to 31%. 2008 paper protocol performance was similar to SCC (qtr 8); 2009 computer protocol had 79% compliance and 12% mortality. CVP > 8mmHg and antibiotics in 1st hr may be key components to improve outcome.

Conclusion: Timely evidence based care of severe sepsis/septic shock is facilitated using a computer protocol and is associated with reduced mortality.

Session I

Paper 3 1:30 PM

RESOURCE COMMITMENT TO IMPROVE OUTCOMES AND INCREASE VALUE AT A LEVEL I TRAUMA CENTER

Michael J Sise, MD*, C Beth Sise, JD, RN, MSN, Dorothy M Kelley, RN, MSN, CEN, Sarah B Walker, BA, Daniel I Sack, BA, Steven R Shackford, MD*, Barbara R Lome, RN, MSN, ACNP, Edward M Turk, MBA, Turner M Osler, MD. Scripps Mercy Trauma.

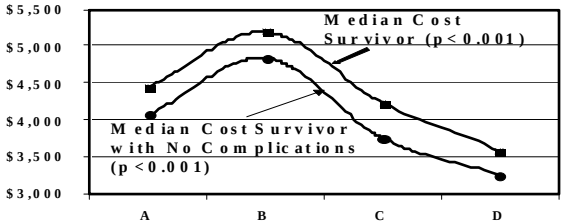
Invited Discussant: Roxie Albrecht

Introduction: Optimal care of trauma patients requires cost-effective organization and commitment of trauma center resources. We examined the impact of creating a dedicated trauma care unit (DTCU) and adding advanced practice nurses on the quality and efficiency of care at an adult level I trauma center.

Methods: Patient demographic and injury data, length of stay (LOS), complications, outcomes, and total direct cost of care were evaluated for four 1-year intervals in the recent history of our trauma center: (A) a trauma team of in-house trauma surgeons and resident physicians; (B) the addition of nurse practitioners (NP) to the trauma team 5 days/week; (C) the creation of a DTCU for all non-ICU trauma patients; and (D) the addition of a permanent clinical nurse specialist (CNS) and an increase in NP coverage to 7 days/week. Value (quality/cost) was determined by calculating the median cost for a survivor and the median cost for a survivor with no complications. Significance* was attributed to $p < 0.05$.

Results: Patient volume increased from 1,927 in interval A to 2,546 by interval D. Over the intervals of study, there was an increase in blunt trauma (87.1% to 89.9%*), mean ISS (8.2 to 8.5*), and patients aged ≥65 years (11.4% to 19.8 %*). However, risk-adjusted mortality was unchanged. There was a decrease in patients with ≥1 complication (20.8% to 14.9 %*), median ICU LOS (39.1 hrs. to 23.5 hrs.*), and median cost of care ($4,518 to $3,639*). Value increased: both the median costs for a survivor and for a survivor with no complications decreased from $4,450 to $3,595* and from $4,072 to $3,269,* respectively.

Figure 1: Value



Conclusion: Adding a dedicated trauma care unit and advanced practice nurses improved the quality and efficiency of care and increased value at an adult level I trauma center.

Session I

Paper 4 1:50 PM

POST-INJURY VAGAL NERVE STIMULATION PROTECTS AGAINST INTESTINAL EPITHELIAL BARRIER BREAKDOWN

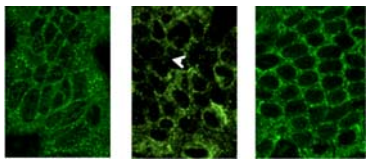
Michael J Krzyzaniak, MD, Carrie Y Peterson, MD, Luiz Reys, MD, Gerald Cheadle, James G Putnam, BS, William H Loomis, BS, Brain P Elicieri, PhD, Andrew Baird, PhD, Vishal Bansal, MD, Raul Coimbra*, MD, PhD. University of California San Diego.

Invited Discussant: Basil Pruitt

Introduction: Vagal nerve stimulation (VNS) can have a marked anti-inflammatory effect. We have previously shown that pre-injury VNS prevented intestinal barrier breakdown and preserved epithelial tight junction protein expression. However, a pretreatment model has little clinical relevance for the care of the trauma patient. Therefore, we postulated that VNS conducted post-injury would also have a similar protective effect on maintaining gut epithelial cell integrity.

Methods: Male balb/c mice were subjected to a 30% total body surface area, full-thickness steam burn followed by right cervical VNS at 15, 30 and 60 minutes post injury. Intestinal barrier dysfunction was quantified by permeability to 4kDa FITC-Dextran, histologic evaluation, gut TNF-α ELISA, and expression of tight junction proteins (MLCK, occludin, ZO-1) using immunoblot and immunoflourescence.

Results: Cervical VNS after injury decreased intestinal permeability to FITC-Dextran when VNS was performed at 15, 30 and 60 minutes after injury (223 ±28 µg/mL vs. 75±17, 104±17, 107±17 µg/mL, $p<0.001$, 0.002, 0.002 respectively). Burn injury caused a marked increase in intestinal TNF-α levels. VNS animals had TNF- α levels similar to sham. Tight junction protein levels were maintained at near sham values in VNS-treated animals, whereas they were significantly decreased in burn alone. Histologic examination documented mucosal integrity similar to sham in VNS-treated animals. The image represents occludin immunoflourescence captured via confocal microscopy with sham (left), burn (center), and burn with VNS at 60 minutes post injury (right). Significant gaps in occludin signaling occur in the burn animal (arrowhead).



Conclusion: Post-injury VNS prevents gut epithelial breakdown when performed within 60 minutes of thermal injury. This could represent a novel therapeutic approach to prevent distant organ injury after trauma.

Session I

Paper 5 2:10 PM

MANAGEMENT OF BLUNT TRAUMATIC OCCULT PNEUMOTHORAX: IS OBSERVATION HARMFUL? RESULTS OF A PROSPECTIVE MULTICENTER STUDY

Forrest O Moore, MD, Pam W Goslar, PhD, Lily R Stevens, BS, MSN, Scott R Petersen, MD*, Raul Coimbra, MD*, Carlos VR Brown, MD*, Kelli H Foulkrod, MS , Thomas B Coopwood, Jr, MD, Lawrence Lottenberg, MD*, Herb A Phelan, MD* , Brandon Bruns, MD, John P Sherck, MD*, Scott H Norwood, MD*, Stephen L Barnes, MD*, Marc R Matthews, MD*, William S Hoff, MD* , Marc A deMoya, MD*, George Velmahos, MD, Vishal Bansal, MD, Charles KC Hu, MD, Riyad C Karmy-Jones, MD*, Fausto Vinces, DO, Karl Pembaur, BS, David M Notrica, MD*, James M Haan, MD*. St. Josephs Hospital and Medical Center.

Invited Discussant: Susan Brundage

Introduction: An occult pneumothorax (OPTX) is found incidentally in 2-10% of all blunt trauma patients**.** The need for drainage remains controversial, especially for patients requiring positive pressure ventilation (PPV). We sought to determine which factors predicted failure of observation (F-Obs) in blunt trauma patients.

Methods: A prospective, observational, multicenter study was undertaken to identify patients with OPTX. Successfully observed and F-Obs patients were compared. Multi-variate logistic regression was used to identify predictors of F-Obs. Failure was defined as need for chest tube placement as judged by the admitting surgeon. OPTX size was calculated by measuring the largest air collection along a line perpendicular from the chest wall to the lung or mediastinum.

Results: Sixteen trauma centers identified 588 OPTX in 569 blunt trauma patients. One hundred-twenty-one patients (21%) were managed with immediate tube thoracostomy and 448 (79%) were observed. In the latter group, 27 patients (6%) failed observation and underwent tube thoracostomy for either OPTX progression, respiratory distress, or development of an associated hemothorax. Fourteen percent (10/74) failed observation while on PPV. Larger OPTX (>7mm), respiratory distress, and PPV were identified as significant predictors of F-Obs. No patient initially observed developed a tension pneumothorax or suffered an adverse event related to the delayed tube thoracostomy.

INDEPENDENT PREDICTOR OF F-OBS	ODDS RATIO (95% CONFIDENCE INTERVALS)	P-VALUE
OPTX > 7mm	2.37 [1.02-5.47]	.044
Respiratory distress	7.57 [2.79-20.59]	.000
PPV	2.53 [1.04-6.16]	.040

Conclusion: The majority of blunt trauma patients with OPTX can be carefully monitored without tube thoracostomy. However, patients on PPV should be closely monitored, particularly in the presence of an OPTX larger than 7mm.

Session I

Paper 6 2:30 PM

HEMOSTATIC AND PHARMACOLOGIC RESUSCITATION: RESULTS OF A LONG-TERM SURVIVAL STUDY IN A SWINE POLY-TRAUMA MODEL

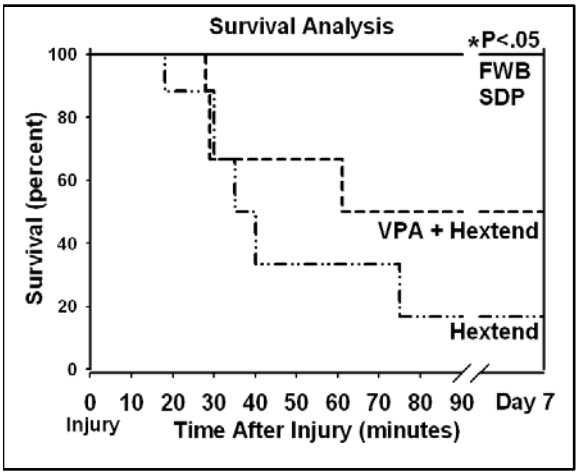
Kristopher B Hamwi, MD, Michael Duggan, DVM, Karim Fikry, MD, Jennifer Lu, BS, Wei Chong, MD, PhD, Athanasios Bramos, MD, Kyu Seok Kim, MD, PhD, Eugene Y Fukudome, MD, Fahad Shuja, MD, George Velmahos, MD, PhD*, Hasan B Alam, MD*. Massachusetts General Hospital/ Harvard Medical School.

Invited Discussant: Ron Maier

Background: We have demonstrated that valproic acid (VPA), a histone deacetylase inhibitor, and spray dried plasma (SDP) improve early survival following lethal hemorrhage, but their impact on long-term survival and organ function remains untested.

Methods: Yorkshire swine (n=24; 6 per group) underwent a protocol simulating different phases of trauma care: (1) Pre-hospital – rib fracture, soft tissue injury, hemorrhage (50% blood), 30 min of shock and infusion of 0.9% saline (3x shed blood); (2) Early hospital/treatment – grade IV liver and grade V splenic injuries (simulating rupture of contained hematomas) followed by 30 min of uncontrolled hemorrhage. Animals were randomly treated with: a) Hextend (6% hetastarch), b) fresh whole blood (FWB), c) SDP, and d) VPA (300 mg/kg) plus Hextend. VPA was given during the pre-hospital phase, and the volumes of Hextend, FWB and SDP (reconstituted in water) matched shed blood ; 3) Repair/resuscitation- 60 minutes after repair of injuries, surviving animals were fully resuscitated with packed red blood cells; 4) Monitoring- survival was monitored for 7 days (primary endpoint), and blood samples were drawn serially to measure organ function.

Results: Only 17% of the Hextend treated animals survived. Addition of VPA improved survival to 50% (p=0.28). Treatment with SDP and FWB increased survival to 100% (p<0.05). Surviving animals showed no long-term organ dysfunction.



Conclusions: In a clinically relevant lethal poly-trauma model, administration of spray dried plasma results in 100% survival without any long-term organ dysfunction.

Session I

Paper 7 2:50 PM

Damage Control Laparotomy and the Open Abdomen: Is There an Increased Risk of Colonic Anastamotic Leak?

Mickey M Ott, MD, Patrick Norris, PhD, Bryan Collier, DO, Oliver L Gunter, MD, William Riordan, MD, Jose J Diaz*, MD. Vanderbilt University Medical Center.

Invited Discussant: Martin Croce

Introduction: Primary colonic anastomosis in trauma patients has been demonstrated to be safe. However, few studies have investigated this in the setting of damage control laparotomy. We hypothesized that colonic anastomosis for trauma patients requiring an open abdomen (OA), would have a higher anastomotic leak (AL) rate compared to patients with immediate abdominal closure (IAC) following trauma laparotomy.

Methods: We performed a cohort comparison study of all trauma patients who underwent colectomy with primary anastomosis reconstruction from 2004-2009. Exclusion criteria were mortality within 24 hours of admission or colectomy for indications unrelated to injury. Data collected included age, gender, injury severity score, probability of survival P(S), mechanism, length of stay, and mortality. Multivariable logistic regression was performed to assess the relationship of OA and P(S) to our primary outcome measure, AL.

Results: 122 patients met study criteria. The mean age was 36.2 and 82% were male. Patients with OA had a clinically significant increase in AL rate compared to IAC (3% v. 29%, P<.001). Logistic regression demonstrated OA was independently associated with AL, with OA patients having more than a 10-fold increase in odds of AL compared to those who were closed (odds ratio=10.7, P=.003, AUC=.744).

	IAC	**OA**	**P**
N	70	52	
Age[1]	32 (23-41)	35 (27-47)	.101
ISS[1]	18 (9-24)	19 (16-27)	.203
P(S)[1]	98% (95-99)	97% (87-99)	.130
LOS[1]	**6 (4-11)**	**18 (10-36)**	**<.001**
Deaths	2 (3%)	5 (10%)	.135
Leak	**2 (3%)**	**15 (29%)**	**<.001**
[1]Median and intra-quartile range shown			

Conclusions: Patients with a colonic anastomosis and an open abdomen have an unacceptably high leak rate compared to those who undergo reconstruction with immediate closure. Given the significant risk of AL, primary colonic anastomosis should not be performed in patients with OA.

Session I

Paper 8 3:10 PM

ROLE OF BETA CATENIN IN REGULATING MICROVASCULAR ENDOTHELIAL CELL HYPERPERMEABILITY

Ed W Childs*, MD, Binu Tharakan, PhD, Devendra Sawant, MD, Felicia A Hunter, BS. Texas A&M Health Science Centre College of Medicine and Scott and White Memorial Hospital.

Invited Discussant: Larry Diebel

Introduction: Microvascular hyperpermeability, a clinical complication associated with conditions such as hemorrhagic shock occurs mainly due to the disruption of the endothelial adherens junction complex. β-Catenin which is an integral component of the adherens junction complex is cleaved by caspase-3. Our objective was to determine the functional role and fate of β-catenin during caspase-3 activation-induced microvascular hyperpermeability.

Methods: To study the effect of *in vivo* knockdown of β-catenin on microvascular hyperpermeability, β-catenin siRNA in TransIT transfection medium was administered to Sprague-Dawley rats via tail vein. Hyperpermeability of mesenteric post-capillary venules after 24 and 48 hours was studied using FITC-albumin under an intravital microscope. Rat lung microvascular endothelial cell (RLMEC) monolayers were transfected with β-catenin siRNA and hyperpermeability was determined using FITC-albumin. RLMEC monolayers were transfected with a β-catenin gene expression construct followed by transfection with pro-apoptotic BAK peptide (5μg/ml), an inducer hyperpermeability. RLMEC were transfected with active caspase-3 with or without pre-treatment of Z-DEVD, a caspase-3 specific inhibitor followed by immunofluorescence localization of β-catenin.

Results: β-Catenin siRNA induced significant increase in vascular hyperpermeability *in vivo* ($p<0.05$) and monolayer hyperpermeability *in vitro* ($p<0.05$). Transfection of the β-catenin gene expression construct attenuated BAK-induced monolayer hyperpermeability significantly ($p<0.05$). The caspase-3 inhibitor Z-DEVD prevented caspase-3-induced loss of β-catenin from the adherens junctions and its subsequent internalization.

Conclusion: Post-transcriptional gene silencing of β-catenin leads to microvascular hyperpermeability. Activation of caspase-3 induces disruption of the adherens junctional complex and internalization of β-catenin. The enhancement of β-catenin expression leads to protection against apoptotic signaling-induced endothelial cell hyperpermeability.

Session VI

Paper 9 8:00 AM

RAPID THROMBOELASTOGRAPHY (r-TEG) DELIVERS REAL-TIME RESULTS THAT PREDICT TRANSFUSION WITHIN ONE HOUR OF ADMISSION

Bryan A Cotton, MD, MPH*, Gabriel Faz, MD, Quinton Hatch, BS, Jeanette Podbielski, BSN, James McCarthy, MD, Yu Bai, MD, PhD, Charles Wade, PhD, Rosemary A Kozar, MD, PhD*, John B Holcomb, MD*. University of Texas Health Science Center-Houston.

Invited Discussant: Mitchell Cohen

Background: Recognition of trauma-induced coagulopathy by conventional coagulation testing (CCT) is limited by their slow results, incomplete characterization, and their poor predictive nature. r-TEG delivers a more comprehensive assessment of the coagulation system but has not been prospectively validated in trauma patients. The purpose of this pilot study was to evaluate the timeliness of r-TEG results, their correlation with CCTs, and the ability of r-TEG to predict early blood transfusion.

Methods: Over 120 days, 161 consecutive major trauma activations were prospectively entered into a database. r-TEG and CCTs (PT, INR, PTT, platelet count) were obtained on all patients. Graphical results for r-TEG were displayed "real-time" in the trauma bay. Pearson's correlation and regression models were used to evaluate r-TEG and CCTs.

Results: Early r-TEG values (ACT, k-time, and r-value) were available within 5 min, late r-TEG values (mA and alpha) within 15 min, and CCTs within 48 min ($p<0.001$). ACT, r-value, and k-time showed strong correlation with PT, INR, and PTT (all $r > 0.70$; $p<0.001$), while mA ($r= -0.49$) and alpha ($r=0.40$) correlated with platelet count (both $p<0.001$). Linear regression demonstrated ACT predicted RBC (coef. 0.05, 95% CI 0.04-0.06, $p<0.001$), plasma (coef. 0.03, 95% CI 0.02-0.04, $p<0.001$), and platelet (coef. 0.06, 95% CI 0.04-0.07, $p<0.001$) transfusions within the first 2-hours of arrival. Controlling for all demographics and ED vitals, ACT≥128 predicted transfusion of ≥3U PRBC in the first hour (OR 5.15, 95% CI 1.36-19.49; $p=0.01$) and ≥3U plasma in the first two hours (OR 3.81, 95% CI 1.02-14.22; $p=0.04$). INR≥1.5 failed to predict PRBC transfusion in the first hour or plasma in the first two hours. Additionally, ACT <105 predicted patients who did not receive any transfusions in the first 24 hours (O.R. 2.80, C.I. 1.02-7.07, $p=0.04$)

Conclusions: Graphical r-TEG results are available within minutes of patient arrival, correlate with conventional coagulation test that are not as readily available, and are predictive of early transfusions of PRBC, plasma, and platelets.

Session VI

Paper 10 8:20 AM

MULTIPLE LEVELS OF DEGRADATION DIMINISH STORED PLASMA'S HEMOSTATIC POTENTIAL

Nena Matijevic, PharmD, PhD, Yao-Wei W Wang, MD, Vadim Kostousov, MD, Phillip Letourneau, MD, John B Holcomb*, MD. University of Texas Health Science Center Houston.

Invited Discussant: Martin Schreiber

Background: Severe bleeding following injury requires massive transfusion of blood products including fresh frozen plasma (FFP), the early use of which has been associated with improved survival. According to AABB protocols, thawed plasma (TP) is approved for transfusion up to five days after thawing, when stored at 1-6°C. However, no quality control measures are required to document the hemostatic potential of freshly thawed FFP (FFP-0) vs. plasma stored for 5 days (FFP-5). We, and others, have shown that aged plasma degrades with storage. In this study, we applied a comprehensive set of in vitro measures to better characterize changes in hemostatic potential of FFP-0 and FFP-5.

Methods: FFP was obtained from 33 single donor commercial units, thawed at 37°C, and kept refrigerated at 4ºC for 5 days. Hemostatic potential of TP was evaluated at day 0 and 5 by: a) the Calibrated Automated Thrombogram (CAT), measuring plasma capacity to generate thrombin (TG); b) thromboelastography (TEG), which measures kinetics of clot formation, clot strength and stability; c) assays of 21 clotting factors and inhibitors; and d) phenotyping of the procoagulant microparticles (MP) by flow cytometry.

Results: In FFP-5 the overall plasma hemostatic potential diminished, as did multiple (12 of 21) coagulation factors, particularly FV, FVIII, VWF, and free Protein S, by 31%, 29%, 26%, and 30%, respectively. FFP-5 exhibited only 60% the potential for thrombin generation as FFP-0 (16.62 vs. 27.31 nM/min, $p=0.001$), while TEG values illustrated a slower clotting response (R: 2.6 vs. 3.6 min, $p<0.001$; TMA: 13.3 vs. 15.5 min, $p<0.01$), and a longer delay in reaching maximum thrombus generation (3.5 vs. 4.9 min, $p<0.01$). A decrease of 48% in MP counts (8052 vs. 3834 /µL, $p<0.001$) was also noted in FFP-5.

Conclusion: Freshly thawed plasma may have greater ability to restore hemostasis and correct coagulopathy compared to plasma stored for 5 days. The effects of multiple levels of degradation in FFP-5's hemostatic potential on its clinical effectiveness, especially in massively transfused patients, are uncertain and deserve further exploration.

Session VI

Paper 11 8:40 AM

THE REWARD IS WORTH THE WAIT: A PROSPECTIVE ANALYSIS OF 100 CONSECUTIVE ORGAN DONORS

A Britton Christmas*, MD, Tyson A Bogart, RN, Kristina E Etson, BS, Brett A Fair, BS, Harold R Howe, MS, David G Jacobs*, MD, Ronald F Sing*, DO. The F.H. Sammy Ross Trauma Center at Carolinas Medical Center.

Invited Discussant: Carrie Sims

Introduction: An increasing disparity exists between the need and the availability of transplantable organs. We undertook this study to assess the effects of donor management time o the number and types or organs procured with the hypothesis that shorter management time yield increased organ procurement and transplant rates.

Methods: A prospective analysis of 100 organ donors managed by a regional organ procuremen organization (OPO) was performed during 2007-2008. Data collected included patient demographics, number and types of organs procured and transplanted, time of patient management by the OPO, and achievement of donor pre-procurement goals.

Results: One hundred consecutive organ donors were managed over the course of the study with a mean age of 41+18 years and mean management time (Mgt Time) of 23+9 hours. A total of 37(organs were procured (Pr) and 327 were successfully transplanted (Trans). Sub-analysis was performed comparing donors managed < 20 hours to those managed > 20 hours.

	Mgt Time	Organs Pr	Organs Trans	Hearts Pr	Lungs Pr	Livers Pr	Kidneys Pr
= 20 Hrs (n=42)	15 ± 4.2	133 (3.2/pt)	110 (2.6/pt)	5 (12%)	6 (7%)	38 (90%)	72 (85%)
> 20 Hrs (n=58)	28 ± 7.4*	243 (4.2/pt)*	217 (3.7/pt)*	26 (45%)*	40 (34%)*	52 (90%)	106 (91%)

* p<0.05 comparing donors managed = 20 hours to donors managed > 20 hours.

Patients Meeting Pre-procurement Management Goals n (%)

	MAP N(%)	CVP Avg	pH	PO_2	Na^+	Glucose	Urine Output
Goals:	60-100	4-10	7.3-7.45	>100	=155	<150	0.5-3 ml/kg/hr
= 20 Hrs	30 (71%)	26 (62%)	24 (57%)	41 (98%)	39 (93%)	11 (26%)	18 (43%)
> 20 Hrs	38 (66%)	37 (64%)	38 (66%)	57 (98%)	49 (84%)	14 (24%)	26 (45%)

No significant differences were discerned with regards to donor age, race, or cause of death.

Conclusion: Contrary to our initial hypothesis, donor management times > 20 hours yielded increased organ procurement and transplant rates, particularly for hearts and lungs, despite no differences in the achievement of donor pre-procurement management goals. Perhaps, the reward really ***is*** worth the wait.

Session VI

Paper 12 9:00 AM

DYNAMIC THREE-DIMENSIONAL SCORING OF CEREBRAL PERFUSION PRESSURE AND INTRACRANIAL PRESSURE PROVIDES A BRAIN TRAUMA INDEX THAT PREDICTS OUTCOME IN PATIENTS WITH SEVERE TRAUMATIC BRAIN INJURY

Sibel Kahraman, MD, Richard P Dutton, MD, MBA, Peter Hu, MS, Lynn G Stansbury, MD, MPH, John R Hess, MD, Yan Xiao, PhD, Deborah M Stein, MD, MPH , Thomas M Scalea,* MD. R Adams Cowley Shock Trauma Center, University of Maryland Medical System.

Invited Discussant: Alex Valadka

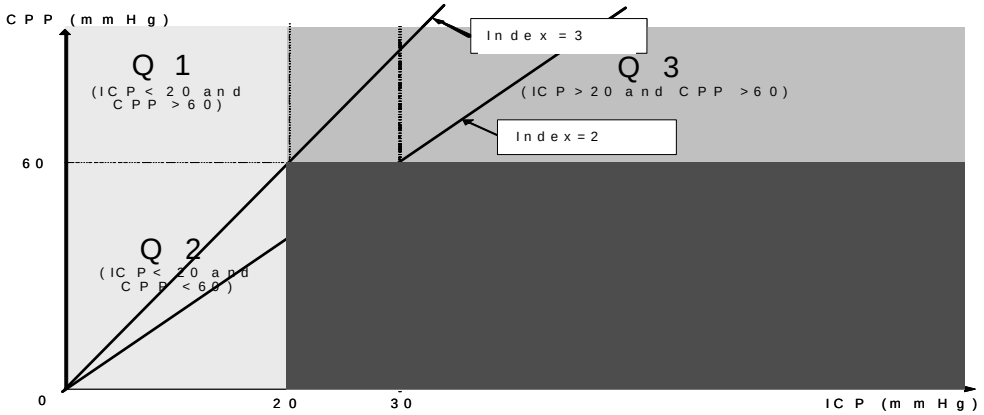
Background: Data on intracranial and cerebral perfusion pressure (ICP, CPP) guide therapy in severe traumatic brain injury (TBI), but current linear analytic methods are insufficiently sensitive and specific for prognosis in dynamic situations over time.

Methods: We have developed algorithms incorporating continuous, automated, digital ICP and CPP monitoring data into a pressure-times-time 'dose' (PTD) function. In the present study, we calculated cumulative doses using thresholds of ICP>20 mmHg and CPP <60 mmHg and graphed these as a Brain Trauma Index (BTI). Using receiver operator characteristics (ROC) analysis, we then compared the predictive power of BTI <3 and <2 for 30-day mortality and 3- and/or 6-month Extended Glasgow Outcome Scale (GOSE)<5. We then graphed BTI values for each patient as linear functions over time as a step toward development of a real-time bedside monitoring tool.

Results: Twenty eight subjects yielded 2858.4 hrs of data (1,715,040 data points). BTI<3 and <2 were better than ICP>20 mmHg in predicting mortality (p=0.001). BTI<2 was more powerful than CPP<60 mmHg in predicting unfavorable GOSE at 3and 6 months (p<0.05).

Conclusion: Calculation of a BTI from continuous digital data predicts outcome in severe TBI and has potential for the design of real-time bedside early-warning systems.

Figure 1: **Slopes defining critical quadrants of Brain Trauma Index**.



Session VI

Paper 13 9:20 AM

LIVING WITHOUT THE "PAN-SCAN": THE IMPACT OF A SELECTIVE TRAUMA CT PROTOCOL ON SAFETY AND COST.

Karina A McAthur, MD, Xzabia Caliste, MD, Susan Kennedy BSN, Jack Sava,* MD.
Washington Hospital Center.

Invited Discussant: Charles Adams

Background: To avoid missed injuries, many trauma centers employ routine head-to-toe computed tomography (CT) for patients at risk for significant injury. "Pan-scan" typically includes head, cervical spine, chest and abdomen/pelvis scans. This study evaluates the clinical and financial implications of a selective CT protocol implemented in 2007.

Methods: The registry of a Level I trauma center was used to identify blunt trauma patients meeting criteria for triage to a trauma center over a two year period. Initial CT scans performed were tallied, and morbidity and mortality (M&M) records were used to identify missed injuries. For each missed injury, we documented whether initial CT of the relevant area was done, whether the missed injury was amenable to CT diagnosis, and whether findings on CT were overlooked. Total cost was defined as a sum of direct and indirect costs for the relevant scan.

Results: A total of 3223 patients were identified with 6399 scans. Head CT was performed in 66% of patients, cervical spine CT in 55%, chest CT in 34%, and Abdomen/Pelvis CT in 43% (Table 1). 744 patients received no CT scans. M&M records identified 23 patients with missed injuries (0.71 %). Of these, 5/23 had missed extremity injury. One of 23 was too unstable for CT. 16/23 had injury which was missed on CT. One patient had a missed minor renal injury that resolved without intervention.

	Head	*C-spine*	*Chest*	*Abdomen/Pelvis*	**Total**
Scans Performed	2121	1782	1108	1388	6399
Percentage	66%	55%	34%	43%	50%
Potential Scans*	3223	3223	3223	3223	12892
Scans Saved **	1102	1441	2115	1835	6493
Cost Savings ($)	125,066	189,736	240,031	449,869	1,004,702

** Scans that would have been done with a "Pan-scan" protocol*
*** Difference between potential scans and scans performed*

Discussion: A selective CT protocol results in a 50 % reduction in CT scans compared to the number of computed tomography scans that would have performed under a "Pan-scan" policy. This translates into an approximate cost savings of over one million dollars over two years, while maintaining a low missed injury rate.

Session VI

Paper 14 9:40 AM

THE EFFECT OF FEDERAL FUNDING ON CLINICAL PRODUCTIVITY: THE PRICE OF ACADEMICS

Mark McKenney*, MD MBA; Carl Schulman* MD MPH, Alan Livingstone MD. University of Miami.

Invited Discussant: Timothy Fabian

Introduction: Research is time consuming and expensive. To offset this expense federal agencies fund research but the financial impact of funded research on clinical productivity and professional revenue has not been studied.

Objective: To determine departmental impact of federal funding

Methods: The Relative Value Units (RVUs), professional revenue, and funding were evaluated for clinical Faculty in the Surgery Department for fiscal year 2008. Means were compared using t test, significance defined as $p < 0.05$.

Results: The Department has 61 clinical surgeons. The Department was divided into 3 groups based on research funding; unfunded, industry funded, and federally funded. Surgeons with both federal funding and other funding were only included in the federally funded group. There were 42 unfunded surgeons, 8 industry funded, and 11 federally funded. RVU's, revenue, and salary with benefits of the 3 groups were compared.

Type of funding	Avg RVUs	Avg collections for clinical work	Avg salary support from grants	Total Revenue	Net profit/(loss)	p compared to unfunded
Unfunded	7693	$553,896	0	$553,896	$103,896	
Industry Funded	9578	$689,616	$8,275	$697,891	$239,616	0.16#
Federally Funded	4105*	$295,560	$43,819	$339,379	($110,621)**	0.001*

#compared to group 1; *compared to group 1 and group 2; **Compared to average "all in cost" of clinical Faculty

Conclusions: Federal funding is associated with a significant reduction in clinical work and clinical reimbursement. Federally funded research results in a net loss of revenue for the Surgery Department. The net effect is that the Surgery Department sponsors Federal Research and this has not been previously reported in the literature.

Session VI

Paper 15 10:00 AM

Prospective Evaluation of Multidetector Computed Tomography for Extremity Vascular Trauma

Kenji Inaba*, MD, Bernardino C Branco*, MD, Sravanthi Reddy, MD, Donald Green*, MD, David Plurad*, MD, Peep Talving*, MD, Lydia Lam*, MD, Demetrios Demetriades*, MD, PhD.
University of Southern California.

Invited Discussant: David Spain

Background: Multidetector computed tomographic angiography (MDCTA) is increasingly being utilized for the assessment of extremity vascular injury. However, to date there is only a single small prospective study evaluating its efficacy. The purpose of this study was to assess the sensitivity and specificity of MDCTA for detecting arterial injury in the traumatized extremity.

Methods: After IRB approval, all trauma patients aged =16 years admitted to a level 1 Trauma Center who sustained extremity trauma and underwent initial evaluation with MDCTA from Mar 2009-Jan 2010 were prospectively enrolled. 64-channel MDCTA was used. The sensitivity and specificity of MDCTA was tested against an aggregate gold standard of operative intervention and clinical follow-up.

Results: During the 11-month study period, 47 MDCTAs were performed in 43 patients. The mechanism of injury was penetrating in 65.1% (24 GSWs, 2 shotguns and 2 SWs). There were 17 positive studies, all confirmed at operation (3 brachial, 2 radial, 1 ulnar, 3 common femoral, 6 superficial femoral and 2 popliteal arteries). There were 26 negative studies, with clinical follow-up available in 100%, for a mean of 9.8 days (median 5 days, range 1-54). No missed injuries were identified during the follow-up period. MDCTA was non-diagnostic in 3 patients (6.9%); 2 secondary to technical errors in reformatting and 1 secondary to artifact from retained missile fragments. MDCTA achieved 100% sensitivity and 100% specificity in detecting clinically significant arterial injury.

Conclusions: MDCTA is a sensitive and specific non-invasive imaging modality for arterial evaluation of the injured extremity and may replace conventional angiography as the diagnostic modality of choice for the evaluation of the acutely injured extremity.

Session VI

Paper 16 10:20 AM

BRAIN TISSUE HYPOXIA IN TRAUMATIC BRAIN INJURY: ARE MOST COMMONLY USED INTERVENTIONS SUCCESSFUL AT CORRECTING BRAIN TISSUE OXYGEN DEFICITS?

Jose L Pascual, MD, PhD, Patrick Georgoff, Annamarie Horan, PhD, Carrie Sims* MD, Babak Sarani*, MD, Michael F Stiefel, MD, PhD, Peter D LeRoux, MD, C William Schwab*, MD.
University of Pennsylvania School of Medicine.

Invited Discussant: William Chiu

Introduction: Brain hypoxia is associated with worse outcome after severe traumatic brain injury (TBI). No study to date has defined how best to correct compromised brain oxygen**.**

Objective: To determine which interventions experienced intensivists most often use and which are most effective to correct compromised PbtO2 in severe TBI (GCS<9, sTBI).

Methods: Consecutive sTBI patients with a brain O2 monitor were identified in level 1 trauma center registry from 2001-09. Compromised PbtO2 (<20mmHg X 0.25-4hrs) episodes and how each was treated using one or more interventions (narcotics/sedation, pressors, repositioning, FiO2 increase, fluid boluses or osmotherapy) were identified. Response to treatment was how rapidly PbtO2 normalized >20mmHg (delta T) and extent of PbtO2 rise (delta PbtO2). ANOVA determined significance between strategies.

Results: 345 treated episodes of PbtO2<20mmHg in 92 consecutive patients were identified. Mean age was 41.2 years and 77.2% were males. Mean ISS and AIS head/neck were 33.91±9.21 and 4.88±0.42. Three month GOS-E score favored females (4.5+/-2.9 vs 2.9+/-2.5, p=0.02). Most commonly used management strategies are listed in table. Using any single intervention or any combination of 2 interventions always resulted in lower delta T and higher delta PbtO2 than using combinations of 3, 4 or 5 interventions (p<0.001). Osmotherapy + narcotics/sedation resulted in the best delta T (0.82hrs) as well as the greatest increase in delta PbtO2 (+16.9 mmHg).

Most used strategies		Delta	
Intervention	Frequency	T(h)	PbtO2 (mmHg)
Narcotics/sedatives	60	1.02	10.62
Pressors	51	0.94	7.86
Repositioning	27	1.11	9.11
FiO2 increase	24	0.99	9.49
Pressors + narc/sed	19	0.99	8.42
FiO2 + narc/sed	9	1.74	8.18
Fluid bolus	9	1.22	11.91
Osmother + narc/sed	5	0.82	16.92

Conclusion: Although narcotics/sedation may be the most commonly used strategy to correct PbtO2, osmotherapy appears to provide additional benefits.

Session VIIIA

Paper 17 2:00 PM

NOT ALL MASSIVE TRANSFUSION TRIGGERS ARE CREATED EQUAL - DEFINING THE PREDICTIVE VALUE OF INDIVIDUAL TRIGGERS TO BETTER DETERMINE WHO NEEDS BLOOD

R Callcut, MD, MSPH, J Johannigman*, MD, K Kadon, BA, D Hanesman, PhD, B Robinson, MD. Stanford University.

Invited Discussant: Peggy Knudson

Introduction: Military massive transfusion [MT] triage criteria have been applied in civilian trauma settings to aid in early initiation of a 1:1 (PRBC:FFP) resuscitation goal. In clinical practice, hemorrhaging patients not meeting 3 of the 5 original triggers often still are resuscitated in this same manner. Individual triggers likely do not have equal predictive value for transfusion needs and this study defines the individual contribution of each to clarify the application of these criteria in all hemorrhaging trauma patients.

Methods: All patients presenting to a level one trauma center from Oct 2007 – Sept 2008 requiring immediate operation with a trauma surgeon were included. Emergency department records, operative logs, and blood transfusion data from arrival to procedure end were analyzed using multivariate regression techniques (SAS v. 9.2).

Results: 170 patients (ISS 19 +/- 12) required immediate operative intervention with an overall survival of 91%. Transfusion of PRBCs was noted in 46% (78/170) with the mean number of transfused units highest in those meeting SBP (12.9 units) or INR (12.3 units) triggers (Table 1). The triggers do not contribute equal predictive value for the need for transfusion with INR being the most predictive (OR 16.7, 2 – 137, table 1). In fact, if patients met either INR or SBP triggers alone, they required massive transfusion (>10 units PRBCs) within the initial operative intervention (p = 0.018 and 0.003, respectively).

Conclusion: Triggers have differential predictive values for the amount and need for transfusion. Defining the individual utility of each criterion will help to identify those most likely to benefit from early 1:1 resuscitation.

Table 1: Trigger	**Mean units PRBCs transfused**		**p-value**	**Likelihood of transfusion OR (95 % CI)**
	Trigger – Yes	Trigger –No		
INR >1.5	12.3	2.2	**0.018**	**16.7 (2.0 – 137)**
SBP <90	12.9	2.8	**0.003**	**9.7 (3.2-29.4)**
Hgb <11	6.2	2.9	**0.05**	**5.7 (2.2-14.5)**
Base Deficit =-6	8.9	1.3	**0.001**	**5.7 (2.1-15.5)**
Temp <35.5	6.7	3.7	0.10	**3.4 (1.5-7.7)**

Session VIIIA

Paper 18 2:20 PM

EARLY VASOPRESSOR USE IN CRITICAL INJURY IS ASSOCIATED WITH MORTALITY INDEPENDENT FROM VOLUME STATUS

David Plurad*, MD, Peep Talving, MD, Lydia Lam, MD, Kenji Inaba*, MD, Donald Green, MD, Demetrios Demetriades*, MD, PhD. LAC + USC Medical Center.

Invited Discussant: Pat Offner

Background: Complications of excessive crystalloid infusion after critical injury has increased interest in vasopressor support. However, it is hypothesized that vasopressor use in patients wh are under-resuscitated is associated with death. We performed this study to determine if volum status is associated with increased mortality in critically injured exposed to early vasopressors.

Methods: The Intensive Care Unit (ICU) database at a level I center was queried for all adult admissions from January, 01, 2001 to December, 31, 2008. Patients with spinal cord and severe traumatic brain injury were excluded. The vasopressor group [vaso (+)] were exposed to dopamine, epinephrine, phenylephrine, levophed, or vasopressin within 24 hours of admission. Demographic and injury data were studied including admission central venous pressure (CVP). Hypovolemia [hypov (+)] was considered a CVP < 8 mmHg. Also, the vaso (+) group was analyzed to determine if hypov (+) was independently associated with death in this group.

Results: Out of 1349 eligible patients, 26% (351) were vaso (+). Mortality was 43.6% (153) in the vaso (+) vs. 4.2% (42) in the vaso (-) group [17.60 (12.10-25.60), <0.01]. Vasopressor exposure was associated with death independent of age and injury severity. In vaso (+) patients, hypov (+) was not associated with mortality while GCS and multiple vasopressor use were.

Variables associated with overall mortality		
Vasopressors	11.51(7.76-17.09)	<0.01
Age ≥ 55 yrs	2.30 (1.51-3.51)	<0.01
GCS ≤ 8	4.10 (2.74-6.12)	<0.01
ISS ≥ 35	2.71 (1.74-4.22)	<0.01

Variables associated with mortality in patients exposed to vasopressors		
GCS ≤ 8	4.33 (2.68-7.02)	<0.01
> 1 pressor	3.93 (2.43-6.35)	<0.01
Hypov (+)	1.29 (0.79-2.10)	0.31

Conclusions: Vasopressor exposure early after critical injury is independently associated with death and mortality is greatly increased regardless of fluid status. Use of any vasopressor during ongoing resuscitation should be approached with extreme caution regardless of volume status.

Session VIIIA

Paper 19 2:40 PM

ADMISSION IONIZED CALCIUM LEVELS FACILITATE EARLY INSTITUTION OF MASSIVE TRANSFUSION PROTOCOLS IN MULTIPLY-INJURED TRAUMA PATIENTS

Ann P O'Rourke, MD, Louis J Magnotti*, MD, Peter E Fischer, MD, Ben L Zarzaur*, MD, Thomas J Schroeppel, MD, Stepheny D Berry, MD, Timothy C Fabian*, MD, Martin A Croce*, MD. University of Tennessee Health Science Center.

Invited Discussant: Matt Rosengart

Introduction: In contrast to other causes of traumatic death, deaths from uncontrolled exsanguinating hemorrhage occur rapidly post-injury. Massive transfusion protocols allow for aggressive resuscitation in multiply-injured trauma patients. However, regardless of the resuscitation strategy employed, it must be implemented early to be successful. Previously, low ionized calcium (iCa) levels were shown to function as a predictor of the need for multiple transfusions. We hypothesized that admission iCa levels could potentially predict the need for massive transfusion in multiply-injured trauma patients.

Methods: Admission iCa was collected on consecutive trauma activations over an 18-month period. Youden's index was used to determine the appropriate cut-point for iCa. Outcomes (mortality, coagulopathy [initial INR] and massive transfusion [≥10 units PRBCs in 24 hours]) were compared using Wilcoxon rank-sum and chi-square tests where appropriate. Multivariable logistic regression (MLR) was performed to determine whether iCa was an independent predictor of massive transfusion.

Results: 694 patients were identified: 531 (77%) men and 163 (23%) women. Cut-point was identified as 1.00. iCa was <1.00 (lo-Cal) in 403 patients and ≥1.00 (hi-Cal) in 291 patients. Mortality was significantly increased in the lo-Cal group (21% vs. 13%, $p = .016$). In addition, both coagulopathy (1.46 vs. 1.19, $p = .0016$) as well as massive transfusion (29% vs. 12%, $p < .001$) were significantly increased in the lo-Cal group. MLR analysis identified iCa <1 as an independent predictor of massive transfusion after adjusting for age, gender, coagulopathy and injury severity (OR = 2.557, $p = .0004$).

Conclusions: Low iCa levels at admission were associated with increased mortality, coagulopathy and massive transfusion. Multivariable logistic regression analysis identified low iCa levels as an independent predictor of massive transfusion. Thus, admission iCa levels rapidly identify patients requiring massive transfusion, allowing for earlier institution of appropriate resuscitation protocols.

Session VIIIA

Paper 20 3:00 PM

ESTROGEN IMPAIRS PULMONARY MICROVASCULAR RESPONSE TO GUT DERIVED MEDIATORS FOLLOWING SHOCK CONDITIONS

Lawrence N Diebel*, MD , David M Liberati, MS. Wayne State University.

Invited Discussant: Raul Coimbra

Objective: Female gender may protect against infectious complications following injury. This protection may be due to a beneficial effect of estrogen (E2) as the salutary effects are age and estrus cycle related. However, outcome may be worse in females developing infectious complications or organ failure following injury. To assess the role of E2 in post shock organ failure we studied the effect of E2 on parameters of lung injury in an *in vitro* cell culture model.

Methods: Confluent HT-29 intestinal epithelial cells were established in a two chamber culture system. E2 (1.0μM) was added in subsets for 72 hours. A commensal strain of *E. coli* was then added to the apical chamber and cell cultures subjected to normoxic (21% O_2) or hypoxic (5%O_2 x 90 minutes)-reoxygenation (H/R) for 3 hr. HT-29 cell culture supernatants were then co cultured with human pulmonary microvascular endothelial cell monolayers (HMVEC) for 90 minutes. HMVEC injury was indexed by apoptosis determined by flow cytometry, permeability to FITC-albumin, and ICAM-1 expression determined by flow cytometry. HMVEC monolayer integrity was indexed by transepithelial electrical resistance (TEER).

Results: Mean±S.D., N = 3 for each group.

Supernatant source	Apoptosis (%)	Permeability (%)	ICAM-1(MFI)
HT-29 + E. coli	8.2 ± 1.1	0.09 ± 0.01	10.6 ± 1.0
HT-29+E.coli+E2	9.4 ± 0.9	0.25 ± 0.09*	24.3 ± 2.6*
HT-29+E.coli+H/R	13.2 ± 1.8*#	0.15 ± 0.05*	14.8 ± 2.8
HT29+E.coli+H/R+E2	17.2 ± 2.0*#	0.36 ± 0.10*#	34.3 ± 3.8*#

*p<0.001 vs. HT-29+E.coli, #p<0.001 vs. HT-29+E.coli+E2. There were no differences in TEER (pre vs. post experiment) data in these experiments.

Conclusion: Exposure of HT-29 cells to either H/R or E2 had a deleterious effect on HMVEC monolayers. In addition there appeared to be a synergistic effect of H/R and E2 on pulmonary endothelial injury. This study supports the findings noted in recent clinical studies suggesting E2 decreases infectious complications but may be associated with poorer outcomes if complications occur.

Session VIIIA

Paper 21 3:20 PM

INCIDENCE AND OUTCOMES OF OVERTRANSFUSION IN THE ERA OF DAMAGE CONTROL RESUSCITATION

Bryan C Morse MD, Christopher J Dente MD*, Beth H Shaz MD, Jeffrey M Nicholas MD*, Amy D Wyrzykowski MD, Jeffrey P Salomone MD*, Gary A Vercruysse MD, Walt L Ingram MD, Grace S Rozycki MD*, David V Feliciano MD*. Emory University.

Invited Discussant: Walt Biffl

Introduction: Damage control resuscitation has changed the approach to massive transfusion (MT) and MT protocols (MTP) have improved access to blood components. Still, there is no consensus definition of "overtransfusion" (OT) and the incidence, predictors, and outcomes of patients (pts) receiving excess blood products is unknown.

Methods: Prospective data from pts receiving MT via a MTP (2/07-12/09) were collected and compared to data from pts receiving MT the two years prior to institution of the MTP (pre-MTP) to determine OT rates. OT was defined as a hemoglobin (hb) concentration = 13 g/dl at post-operative intensive care unit (ICU) admission. Additionally, demographic, transfusion and outcome data of OT and non-OT patients in the MTP era were compared.

Results: Of 125 MTP and 68 pre-MT pts, OT rates were similar (37/125, 30%-MTP; 17/68, 25%-pre-MTP; p=0.50). Of MTP pts, OT were younger (29 vs. 38 yr, p=.002), had lower mean ISS (22 vs. 27, p=.04) & were more likely victims of penetrating trauma (61% vs 32%, p=.003). OT pts also received fewer PRBC (17 vs. 22 units, p=.03), fewer FFP (10 vs. 14 units, p=.03) and less crystalloid (5.6 vs. 7.1 L, p=.03). On admission, there was no difference in SBP (102 vs 95,p=0.31), base deficit (-12.6 vs -10.9, p=0.79), heart rate (113 vs. 116, p=0.56) or hb (11.9 vs. 11.2, p=0.61). Outcome data are listed in the table.

Outcome	OT pts	Non-OT pts	p value
24 hour mortality	3% (1/37)	14% (12/88)	.068
30 day mortality	**14% (5/37)**	**42% (37/88)**	**.002**
Hospital Length of Stay	18.1 days	17.7 days	.92

Conclusions: 1. A significant number of patients receive excess blood products during MT, although it is unchanged in the current era with a mature MTP. 2. OT does not affect overall outcome but seems to be a marker of early bleeding control, occurring more commonly in younger patients and victims of penetrating trauma. 3. To conserve scarce resources, prompt termination of a MTP should occur when bleeding is controlled.

Session VIIIA

Paper 22 3:40 PM

TRANSTHORACIC FOCUSED RAPID ECHOCARDIOGRAPHIC EVALUATION (FREE): REAL TIME EVALUATION OF FLUID STATUS IN CRITICALLY ILL TRAUMA PATIENTS

Paula Ferrada, MD, Thomas M Scalea *, MD, John S Gottdiener, MD, John R Hess *, MD, MPH, Sarah B Murthi, MD. R Adams Cowley Shock Trauma Center, University of Maryland Medical Center.

Invited Discussant: Fred Moore

Background: Evaluating the cardiac function and the fluid status of critically ill trauma patients is an ongoing challenge. A transthoracic focused rapid echocardiographic evaluation (FREE) was developed to answer specific questions about treatment options regarding the use of fluid vs. iotropes in trauma patients. Our objective is to evaluate the clinical utility of the information obtained by this diagnostic test.

Methods: The FREE was performed by an ultrasonographer or an intensivist and interpreted by a surgical intensivist using a full service portable echo machine (Vivid i, GE Healthcare).Cardiology evaluation of the FREE was available upon request. The clinical team ordering the exam was surveyed before and after the test was performed.

Results: During a nine-month study period the FREE exam was performed in 53 trauma patients. In 80% of the patients an estimated ejection fraction (EF) was obtained. Moderate and severe left ventricular dysfunction was diagnosed in 56% of the patients and right heart dysfunction was found in 25% of the patients. Inferior vena cava (IVC) diameter and IVC diameter respiratory variation was visualized in 80% of the patients. In 22 patients (58%) the IVC was found to have a diameter larger than 2 cm, fifteen of those patients had no respiratory variation of the IVC indicating fluid overload. In 87% of the patients, (46 of 53), the FREE was able to answer the clinical question asked by the primary team and in 54% of patients the plan of care was modified as a result of the FREE.

Conclusions: IVC diameter and IVC respiratory variation was able to be obtained in the majority of the cases, giving an estimate of fluid status. Estimation EF was useful in guiding the treatment plan regarding the requirement of fluid boluses vs. isotropic support. From our experience we can conclude that the FREE exam can provide meaningful data in difficult to image critically ill trauma patients.

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Session VIIIA

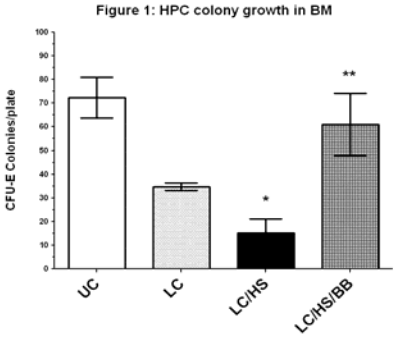
Paper 23 4:00 PM

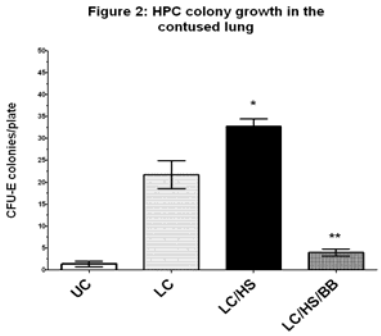
DOES BETA BLOCKADE POST INJURY PREVENT BONE MARROW SUPPRESSION?

Ihab Elhassan, MD, Edward Hannoush, MD, Ziad Sifri, MD*, Walter Alzate, MS, David Livingston, MD*, Alicia Mohr, MD*. UMDNJ - University Hospital.

Invited Discussant: Paul Bankey

Introduction: The hypercatecholaminergic state after severe injury negatively impacts bone marrow (BM) function by suppressing BM hematopoietic progenitor cell (HPC) growth and increasing HPC egress to injured tissue. Previously, beta blockade (BB) given prior to lung contusion (LC) has been shown to prevent BM suppression. In a clinically relevant model, we examine the effect of BB given after both severe injury and hemorrhagic shock (HS).





Methods: Male Sprague-Dawley rats (n = 4-5/group) were assigned to groups: naïve (UC), LC, and LC/HS ± BB. LC was caused by a blast wave from a nail gun. HS was achieved after LC with a MAP of 35mmHg for 45 minutes. Following resuscitation with shed blood, Propranolol 10 mg/kg IP was given and the second dose was given at 12h. Animals were sacrificed at 24h and the BM and lung were harvested for growth of HPCs. *$p < 0.01$ vs. UC; **$p < 0.01$ vs. LC and LC/HS.

Results: Both LC alone and LC/HS significantly suppressed BM HPC growth as compared to UC (Figure 1) and increased HPC growth in the injured lung (Figure 2). BB given after resuscitation significantly reduced both the BM suppression and HPC growth in the injured lung 24 hours following injury and shock.

Conclusion: HS worsens BM suppression following injury and increases HPC growth in injured tissues. BB administered after adequate resuscitation continues to protect against BM suppression one day following injury and shock. Therefore, the use of BB following trauma and resuscitation may minimize long term BM suppression after injury.

Session VIIIA

Paper 24 4:20 PM

FACTOR IX COMPLEX FOR CORRECTION OF TRAUMATIC COAGULOPATHY

Bellal Joseph, MD, Albert Amini, MD, Matthew Houdek, BS, Randall Friese*, MD, Terence O'Keeffe, MD, Julie Wynne, MD, Narong Kulvatunyou, MD, Daniel Hayes, Pharm D, Rifat Latifi, MD, Peter Rhee*, MD. The University of Arizona.

Invited Discussant: Carl Hauser

Objective: Damage control resuscitation advocates correction of coagulopathy, however options are limited and expensive. The use of Prothrombin Complex Concentrate (PCC), also known as Factor IX Complex, can quickly accelerate reversal of coagulopathy at relatively low cost. The purpose of this study is to describe our experience in the use of Factor IX Complex in coagulopathic trauma patients.

Methods: All patients receiving PCC at our level I trauma center over a 2-year period (2008-2010) were reviewed. PCC was used at the discretion of the trauma attending for treatment of coagulopathy, reversal of Coumadin, or when rFVIIa was indicated.

Results: 45 trauma patients received 51 doses of PCC. 62% were male and mean ISS was 23(±14.87). Standard dose was 25 units per kg and mean cost per patient was $1,022 (504-3484). Fifty-eight percent of patients were on Coumadin prior to admission. Subsequent thromboembolic events were observed in 3 of the 45 patients (7%). Mortality was 16 of 45 (36%). Overall mortality for all patients remained constant over the study period 2.9%.

	Pre PCC Mean	**Post PCC Mean**	***p Value***
No Coumadin N =18			
INR	2.0	1.4	*<0.0001*
RBC transfused	9.8 units	3.6 units	*<0.001*
FFP transfused	5.9 units	2.8 units	0.069
Coumadin Use N=27			
INR	2.6	1.5	*<0.0001*
RBC transfused	0.3 units	0.6 units	0.163
FFP transfused	0.8 units	1.4 units	0.300

Conclusion: PCC rapidly and effectively treats coagulopathy following traumatic injury. PCC therapy leads to a significant correction in INR in all trauma patients, regardless of coumadin use, and concomitant reduction in blood product utilization. PCC should be considered as an effective tool to treat Acute Coagulopathy of Trauma. Further prospective studies examining the safety, efficacy, cost, and outcomes comparing PCC and rFVIIa are needed.

Session VIIIA

Paper 25 4:40 PM

LYOPHILIZED PLASMA RECONSTITUTED WITH ASCORBIC ACID SUPPRESSES INFLAMMATION AND OXIDATIVE DNA DAMAGE.

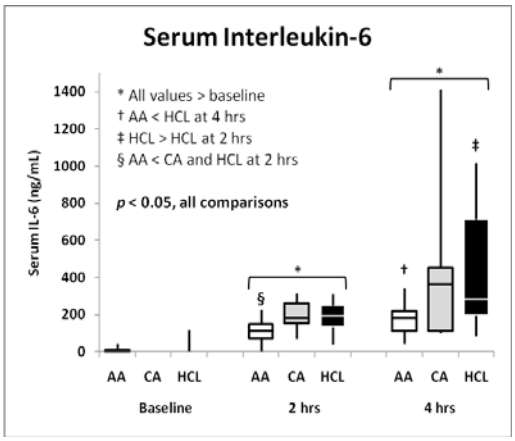
Philbert Y Van, MD, Gregory J Hamilton, BS, Modjgan L Keyghobadi, MD, Jerome A Differding, MPH, Igor V Kremenevskiy, MD, PhD, Chitra N Sambasivan, MD, Nicholas J Spoerke, MD, Martin A Schreiber*, MD. Oregon Health & Science University.

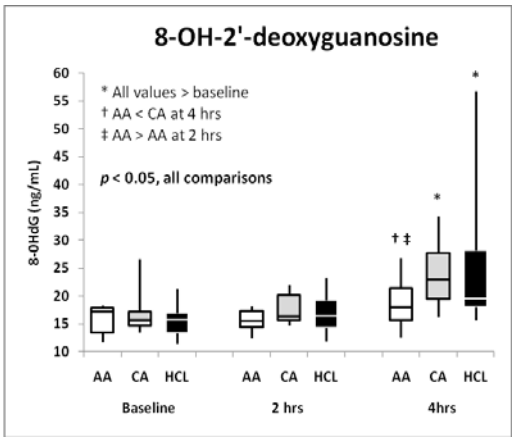
Invited Discussant: Robert Cooney

Background: Lyophilized plasma (LP) has been shown to be as effective as fresh frozen plasma (FFP) for resuscitation in polytrauma and hemorrhagic shock. LP reconstituted with ascorbic acid is associated with suppression of pro-inflammatory cytokines when compared to FFP. We aimed to determine the effect of using alternate LP reconstitution acids on physiologic parameters, blood loss, coagulation profiles, oxidative DNA damage, and pro-inflammatory cytokines in a polytrauma and hemorrhagic shock model.

Methods: Thirty swine were anesthetized, subjected to polytrauma and hemorrhagic shock, and randomized to resuscitation with LP-ascorbic acid (AA), LP-citric acid (CA), or LP-hydrochloric acid (HCL). Physiologic data were continuously monitored, blood loss measured, and serum collected at baseline, 2, and 4 hours for ELISA assays. Measured 8-OH-2'-deoxyguanosine (8-OHdG) was a biomarker of oxidative DNA damage.

Results: No differences were observed in physiologic measures, blood loss, or coagulation parameters. IL-6 increased over time for all groups, but at 2 hours, expression in AA was suppressed compared to CA and HCL. In comparing 4 hours to baseline, a significant increase in oxidative DNA damage was observed in CA and HCL, but not in AA.





Conclusion: Reconstitution of LP with AA suppresses IL-6 expression and oxidative DNA damage compared to CA and HCL.

Session VIIIB

Paper 26 2:00 PM

MECHANISM OF INJURY AND SPECIAL CONSIDERATION CRITERIA STILL MATTER: AN EVALUATION OF THE NATIONAL TRAUMA TRIAGE PROTOCOL.

Joshua B Brown, BA, Nicole A Stassen*, MD, Paul E Bankey*, MD PhD, Ayodele T Sangosanya, MD, Julius D Cheng*, MD, Mark L Gestring*, MD. University of Rochester School of Medicine.

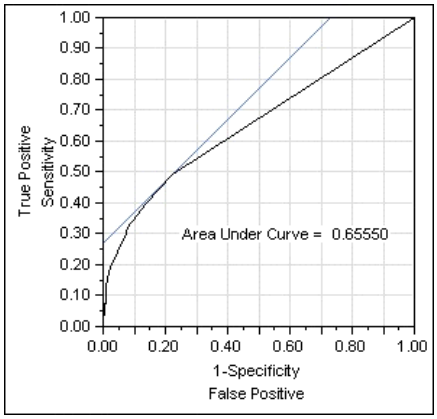
Invited Discussant: Eileen Bulger

Introduction: The CDC recently updated the National Trauma Triage Protocol. This field triage algorithm guides EMS through four decision steps (physiologic (PHY), anatomic (ANA), mechanism and special considerations) to identify patients who would benefit from trauma center care. The study objective was to analyze whether trauma center need (TCN) was accurately predicted solely by the PHY and ANA criteria using national data.

Methods: Trauma patients = 18yo were identified in the NTDB® (2002-06). PHY data and ANA injuries (ICD-9 codes) were collected. TCN was defined as ISS>15, ICU admission, or need for urgent surgery. Test characteristics were calculated according to steps in the triage algorithm. Logistic regression was performed to determine independent association of criteria with outcomes. ROC curves were constructed for each model.

	PHY	ANA	PHY or ANA
Sensitivity	32%	26%	49%
Specificity	91%	86%	78%
PPV	72%	49%	62%
NPV	65%	68%	68%
Undertriage	68%	74%	51%
Overtriage	9%	15%	22%
OR	4.58	2.04	3.36
(95%CI)	(4.53-4.63)	(2.01-2.06)	(3.33-3.39)

Results: 1,086,764 subjects were identified. Test characteristics for TCN are shown (Table). Sensitivity of PHY criteria was highest for ISS>15 (42%), and of ANA criteria for urgent OR (37%). Using PHY and ANA steps, sensitivity was highest (56%) and undertriage lowest (45%) for ISS>15. The regression ROC curve of TCN for all criteria is shown in the figure. Undertriage for TCN based on actual treating trauma center level was 11%.



Conclusion: Current PHY and ANA criteria are highly specific for TCN but result in a high degree of undertriage when applied independently. This implies that additional factors such as mechanism of injury as well as the special considerations included in the CDC decision algorithm contribute significantly to the effectiveness of this field triage tool.

Session VIIIB

Paper 27 2:20 PM

EMERGENCY DEPARTMENT LENGTH OF STAY IS AN INDEPENDENT PREDICTOR OF HOSPITAL MORTALITY IN TRAUMA ACTIVATION PATIENTS

Nathan T Mowery, MD, Stacy D Dougherty, MD, Preston R Miller*, MD, Michael C Chang*, MD, Robert S Martin, MD, Amy N Hildreth, MD, J Wayne Meredith*, MD. Wake Forest University School of Medicine.

Invited Discussant: Glen Tinkoff

Introduction: The concept of the "Golden Hour" of trauma has suggested that early intervention leads to improved outcomes. The early resuscitation often occurs in the emergency department (ED) where ICU protocols do not always extend and monitoring capabilities vary. Our hypothesis is that increased ED length of stay (LOS) leads to increased hospital mortality in patients not undergoing immediate surgical intervention.

Methods: We examined all trauma activation admissions from 1/2002 – 7/2009 admitted to the Trauma Service at an ACS verified academic Level 1 trauma center (n=3754). Exclusion criteria were: patients taken to the operating room within the first 2 hours of ED arrival, non-survivable brain injury and ED deaths. Patients spending more than 5 hours in the ED where not included in the analysis due to significantly lower acuity and mortality.

Results: Patients spent a mean of 3.2 ±1 hours in the ED during their initial evaluation. The mean ISS for the cohort was 17 ± 13. Hospital mortality rises for each additional hour a patient spends in the ED with 8.0% of the patients staying in the ED between 4-5 hours ultimately dying (p=.037). ED LOS measured in minutes is an independent predictor of mortality (OR 1.003, 95% CI 1.000-1.006, p=.02) when accounting for ISS, RTS and age. The area under the curve for the ROC curve for the model was 0.727. Linear regression showed that a longer ED LOS was associated with anatomic injury pattern rather than physiologic derangement.

	OR	95% CI	p
ED LOS (min)	1.003	1.000-1.006	.02
RTS	.759	.726-.794	<.001
Age	1.053	1.044-1.061	<.001
ISS	1.091	1.078-1.105	<.001

Conclusion: In patients not going for emergent surgery it appears that longer ED LOS is associated with an increased hospital mortality even when controlling for physiologic, demographic and anatomic factors. We believe this highlights the importance of rapid progression of patients through the initial evaluation process to facilitate placement in a location that allows implementation of early goal directed trauma resuscitation.

Session VIIIB

Paper 28 2:40 PM

Long-lasting performance improvement after institution of a dedicated trauma service

Torsten Eken, MD PhD, Sigrid Groven, MD, Nils O Skaga, MD PhD, Paal A Naess, MD PhD*, Christine Gaarder, MD PhD*. Oslo University Hospital.

Invited Discussant: David Hoyt

Introduction: Few studies have evaluated intra-institutional improvement of trauma care. We hypothesized that the institution of a formalized multidisciplinary trauma service in a major Scandinavian trauma centre in 2005, with educational and performance improvement programs, would result in improved outcome.

Methods: Institutional trauma registry data for 7,243 consecutive trauma patients from the years 2002–2008 were retrospectively evaluated using Variable Life-Adjusted Display (VLAD) as one of several performance indicators. VLAD is a refinement of the cumulative sum method that adjusts death and survival by each patient's risk status (probability of survival, Ps) and provides a graphical display of performance over time. Ps was calculated according to both TRISS with NTDB 2005 coefficients and the TARN Ps04 model. Population characteristics between groups were compared using Mann-Whitney U and Chi Square tests, and $p<0.05$ regarded as significant.

Results: VLAD demonstrated a sharp increase in cumulative survival starting at the beginning of 2005 and continuing linearly throughout the study period, amounting to 68 additional saved lives according to the TRISS model. The increase was mainly caused by improved survival among the critically injured (ISS 25–75). Results for TARN Ps04 were comparable. Thus, a cutoff point t_0 for analysis of differences between time periods was set at 01.01.2005. Mortality in the whole trauma population showed a 33 % decrease after t_0, and W statistics confirmed the increased survival to be significant. There were no significant changes in age, gender, or injury mechanism after t_0, but ISS was lower. However, ISS differences were adjusted for in the survival prediction models.

Conclusion: We have shown that the start of the long-lasting performance improvement coincided with formation of a dedicated trauma service providing increased multidisciplinary focus on all aspects of trauma care.

Session VIIIB

Paper 29 3:00 PM

EARLY LOWER EXTREMITY FRACTURE FIXATION AND THE RISK OF EARLY PULMONARY EMBOLUS: FILTER BEFORE FIXATION?

Raquel M Forsythe, MD, Thomas DeCato, BS, Matthew R Rosengart, MD*, Timothy R Billiar, MD*, Andrew B Peitzman, MD*, Jason L Sperry, MD. University of Pittsburgh.

Invited Discussant: Kim Davis

Objective: Venous thromboembolism is a major cause of morbidity and mortality after injury. Prophylactic anticoagulation is often delayed as a result of injuries or required procedures. Those at highest risk in this vulnerable window are not well characterized. We sought to determine those at high risk for an early pulmonary embolism (PE) post injury.

Methods: A retrospective analysis using data derived from a large state wide trauma registry (2001-2008) was performed. Patients with a documented PE and time of occurrence were selected (n=712). Lower extremity vascular injuries were excluded. Patients with a PE within the first 72hrs of admission (EARLY, n=122) were compared to those with DELAYED presentation. Backward stepwise logistic regression was used to determine independent risk factors for EARLY PE. (Table)

Initial Model Risk Factors Tested	
Age	**Injury Type**:
Gender	Brain
ISS	Spinal Cord
ED GCS	Spine Fracture
ED SBP	Thoracic
Mechanism	Abdominal
Intubation status	Lower Ext Fx
Early Procedures (<48hrs)	**Lower Extremity (LE) Fx Subtype**:
Intracranial	Pelvis
Spinal	Femur
Thoracic	Tib/fib/ankle
Abdominal	Multiple LE Fx
LE Ortho Fixation	Any LE Fx

Results: EARLY and DELAYED groups were similar in age, gender, GCS, ED SBP, and injury mechanism. The EARLY PE group had a lower ISS, but injuries more commonly included femur fracture. Regression analysis revealed that the only independent risk factor for EARLY PE was lower extremity orthopedic fixation < 48hrs from injury. The risk of EARLY PE was over 3-fold higher (OR 3.8, 95%CI 2.0-7.9, p =0.002) for those who underwent early lower extremity orthopedic fixation vs. those who did not.

Conclusion: Early lower extremity orthopedic fixation is the single independent predictor of EARLY PE in this patient cohort. DVT/PE prevention strategies should be made a priority in this group of patients, including early preoperative institution of anticoagulation prophylaxis. These results suggest that those with contraindications to early anticoagulation may benefit from insertion of retrievable IVC filters pre-operatively.

Session VIIIB

Paper 30 3:20 PM

EARLY VATS: A MANAGEMENT TECHNIQUE UNDERUTILIZED BY ACUTE CARE SURGEONS

Jason W Smith, MD, Matthew V Benns, MD, Keith R Miller, MD, Jason D Sciarretta, MD, Glen A Franklin*, MD, Brian G Harbrecht*, MD, J David Richardson*, MD. University of Louisville.

Invited Discussant: Matt Wall

Background: Blunt chest trauma common and complications after chest trauma including retained hemothorax and empyema often require Video Assisted Thoracoscopy (VATS) for management.

Methods: A retrospective review of Trauma Center admissions between 1/2007 and 12/2009 was performed to identify blunt thoracic injured patients requiring VATS.

Results: 83 patients required a VATS to manage thoracic complications arising from their blunt chest trauma. 100% of these were performed by Acute Care Surgeons. 73% of patients (61/83) required VATS for a retained hemothorax, 18% for empyema (15/83), and 8 for persistent air leak (8/83). All (15/15) patients developing empyema had their chest tubes placed in the emergency department. No patient with a persistent air leak required further surgery or conversion to thoracotomy. There were no operative complications requiring further surgery or comversion to open. VATS $\leq$ 5 day after injury was associated with a lower conversion to open thoracotomy (8.3% vs 29.4%, $p<0.05$). Hospital LOS was significantly lower for those patients receiving VATS < 5 days after injury (11 ± 6 vs. 16 ± 8, $p<0.05$). No patient treated with VATS <5 days developed empyema, however 5 patients treated with VATS for retained hemothorax >5 days required further intervention for empyema. Multivariate analysis demonstrated that both a diagnosis of empyema and VATS > 5 days after injury were predictors of increased LOS and increased conversion to thoracotomy.

Conclusions: Early VATS can decrease hospital length of stay and thoracotomy rate in patient suffering blunt thoracic injuries. Acute Care Surgeons can perform this procedure safely and effectively with conversion rates similar to thoracic specialists.

Session VIIIB

Paper 31 3:40 PM

MORTALITY AFTER ANGIOEMBOLIZATION IN PELVIC FRACTURES: A TEN YEAR REVIEW.

Christy M Lawson, MD, Emily Anne Black, MD, Scott Smith, MD, Brian J Daley, MD, MBA*.
University of Tennessee Medical Center at Knoxville.

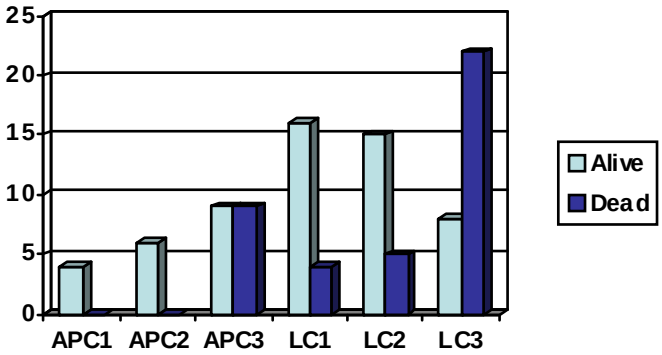
Invited Discussant: Tom Scalea

Objective: Review mortality after pelvic angiographic embolization.

Methods: Review of the last ten years of patients undergoing pelvic visceral angiography (ANG) at a mature Level I center after IRB approval. Demographic data from TRACS was collected and fracture patterns were scored using the Young-Burgess Classification System of 3 grades of anterior posterior (APC) or lateral compression (LC).

Results: From 1999 to 2009, 3053 patients had pelvic fractures; 56 were open fractures. There were 231 deaths or 6% of the population and 98 patients were taken for ANG due unresponsive hypotension with a known pelvic fracture or after CT pelvis demonstrated active extravasation. All patients had pelvic splinting; no patients underwent pelvic packing. There were 43 deaths or 44% mortality in the ANG group. Seventy one percent had a LC mechanism. Many deaths occurred in the first 24 hours (18) and were directly attributable to exsanguination from pelvic vessels. Late deaths occurred on average of day 9 and were attributed to infectious causes including six cases of necrotizing fasciitis. Patients dying after ANG were likely to be older, have a higher ISS and with a Young-Burgess LC3 injury (Table 1).

Conclusion: We present a large series of pelvic fractures undergoing ANG. In distinction to other reports, deaths were most associated with uncontrolled hemorrhage, or sequelae of hemorrhage (i.e. infections or tissue necrosis) rather than associated injuries. High grade LC injuries are highly fatal in our system.



Session VIIIB

Paper 32 4:00 PM

ACS COT PIPS PROGRAM: MAXIMAL IMPACT IN A MATURE TRAUMA CENTER

Beda Sarkar MD PhD, Melissa Brunsvold MD, Jill Cherry MD, Mark Hemmila MD *, Pauline Park MD *, Krishnan Raghavendran MD *, Kristen Sihler MD, Wendy Wahl MD *, Stewart Wang MD *, Lena M Napolitano MD *. University of Michigan.

Invited Discussant: David Harrington

Objective: To examine the impact of a comprehensive performance improvement/patient safety program (PIPS) on mortality at a mature ACS-verified Level I Trauma Center.

Methods: A comprehensive PIPS was implemented in 2005, including revision of trauma activation criteria, development of standardized protocols for initial resuscitation, massive transfusion, avoidance of over-resuscitation, tourniquet use, pelvic fracture management, timely angiographic embolization and surgical intervention, spine clearance, reduced time to CT imaging, reduced time in emergency department, evidence-based traumatic brain injury management, and all efforts to reduce healthcare-associated infections.

Results: Despite increasing elderly trauma admissions (from 23.48% in 2004 to 30.64% in 2008; p=0.0002, Fisher's exact) in-hospital mortality significantly decreased (11.72% reduction, p=0.0116 Fisher's exact) in patients with severe injury (ISS > 24) compared to baseline and NTDB benchmarks (30% mortality for ISS>24). Class I activations increased, (5.5%-2004 to 15.5%-2008) and ICU admission increased (25.8%-2004 to 30.4% in 2008).

Year	2006 NTDB	2007 NTDB	2008 NTDB	2009 NTDB	2004 UMich	2005 UMich	2006 UMich	2007 UMich	2008 UMich
ISS 1-8	1.1% (751128)	0.7% (671798)	1.09% (249799)	0.81% (310902)	0.00% (0/243)	0.00% (0/268)	0.51% (1/197)	0.00% (0/216)	0.55% (1/183)
ISS 9-15	2.2% (150804)	1.9% (480520)	2.40% (121786)	2.51% (154687)	0.00% (0/415)	0.00% (0/418)	0.22% (1/446)	0.65% (3/458)	0.70% (3/426)
ISS 16-24	5.8% (139771)	5.3% (190647)	6.56% (67005)	6.67% (85684)	1.51% (3/198)	1.40% (3/214)	2.28% (5/219)	1.29% (3/233)	0.00% (0/180)
ISS > 24	30.6% (106013)	29.3% (142133)	30.65% (27795)	30.19% (33417)	30.07% (46/153)	25.38% (50/197)	21.05% (44/209)	22.50% (54/240)	18.35% (38/207)
% Age = 65	19.1% (1191215)	18.66% (1485198)	19.09% (506452)	20.79% (627664)	23.48%	22.04%	23.25%	28.90%	30.64%

Conclusion: Implementation of a multi-faceted trauma PIPS aimed at improving trauma care significantly reduced in-hospital mortality in a mature ACS Level I trauma center. Optimal care of the injured patient requires uncompromising commitment to PIPS.

Session VIIIB

Paper 33 4:20 PM

Mortality Factors in Geriatric Blunt Trauma Patients: Creation of a Highly Predictive Statistical Model for Mortality Using 50,765 Consecutive Elderly Trauma Admissions from the National Sample Project

Tjasa Hranjec, MD, MS, Jessica L Keim, RN, Brian R Swenson, MD, MS, Jeffrey S Young*, MD, Robert, G Sawyer, MD, James F Calland, MD. University of Virginia.

Invited Discussant: Mike Rotondo

Introduction: Elderly patients are physiologically different from adults. We sought to identify predictors of mortality of elderly patients following blunt trauma and evaluate outcomes of elderly versus adult patients by facilities.

Methods: De-identified data of 30,428 elderly patients were obtained from the National Trauma Data Bank (NTDB) National Sample Program (NSP). Patients = 65 years of age, admitted to Level I or II trauma center between 2003 and 2006 were used to estimate a multivariable logistic regression model that could predict mortality of the aged population after a blunt injury.

Results: Excellent correlation was seen between mortality rate and SBP ($R^2 = 0.84$), temperature, GCS motor score (rho = -0.926, $R^2 = 0.86$), age ($R^2 = 0.89$) and ISS (rho = 0.91, $R^2 = 0.82$). Age, gender, ISS, GCS motor score, systolic blood pressure (SBP), low temperature, intoxication and mechanical ventilation were found to be highly statistically significant independent predictors of mortality in elderly patients after blunt trauma (maximum R^2 value 0.35, c-statistic 0.85). Variables, most highly predictive of poor patient outcomes were age, ISS, GCS motor score, and mechanical ventilation ($p<0.0001$). When facility outcomes of elderly and adult patients were compared to each other, 56.1% of centers differed in their performance by at least 1 quartile, 21.2% differed by 2 or more quartiles and 7.6% by at least 3 quartiles.

Conclusions: Effectiveness of elderly care cannot be predicted from centers' overall clinical expertise. Geriatric-specific protocols and research may enable appropriate use of resources in order to improve elderly outcomes.

Risk factor		Odds ratio	95% CI
Age (ref. 65-75)	75 - 85	2.074	1.734 - 2.481
	> 85	3.27	2.682 - 3.988
ISS (ref. <16)	16-20	2.382	1.961 - 2.895
	20-25	5.525	4.473 - 6.826
	25-30	5.473	4.237 - 7.068
	> 30	8.258	6.266 - 10.882
Gender	Female	0.691	0.588 - 0.785
Mechanical ventilation	-	6.241	5.283 - 7.373
GCS motor score (ref. 6)	1	1.899	1.616 - 2.231
	2 - 5	2.532	1.954 - 3.280
SBP (ref. 90-120)	< 60	4.236	1.875 - 9.567
	120 - 150	0.664	0.538 - 0.829
	150 - 180	0.679	0.547 - 0.844
Temperature (ref. normal)	Low	1.247	1.080 - 1.440

Session VIIIB

Paper 34 4:40 PM

A MEASURE OF APPLICABILITY OF WHO'S "GUIDELINES FOR ESSENTIAL TRAUMA CARE" IN THE LATIN AMERICA REGION**

Michel B Aboutanos, MD, MPH*, Juan carlos Puyana, MD*, Francisco Mora, MD, Andres Rubiano,MD, Gustavo Fraga,MD, Alberto Concha-Eastman,MD,MS, Charlie Mock, MD,PhD*, Rao Ivatury,MD*, Andrew Peitzman,MD*. Panamerican Trauma Society.

Invited Discussant: Juan Asensio

Objective: To evaluate the ability of the *Guidelines for Essential Trauma Care* (EsTC) developed by the International Surgical Society and World Health Organization (WHO) to provide a global standardized template to assess trauma care capabilities in the Latin American Region (LAR).

Methods: 260 EsTC elements addressing human and physical resources for essential trauma care were evaluated via a questionnaire format developed by WHO and adapted to LAR. International trauma experts (TE) from 15 countries in LAR were asked to classify EsTC elements as "essential", "desirable", or "irrelevant" for 1. Rural (RH) 2. General (GH) & 3. Tertiary (TH) care hospitals. % agreement with EsTC classification was noted.

Results: 48 leaders in trauma care (12 Panamerican Trauma Society board members) and 36 representatives of national trauma and prehospital emergency care societies representing Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, the Dominican Republic, Ecuador, Guatemala, Mexico, Panama, Peru Paraguay, Uruguay, & Venezuela) participated in the evaluation. 83% of the EsTC elements were classified as applicable to LAR especially for acute resuscitation (88.7%) and specific injury management (Table). This was mostly noted for GH (83%) and TH (84%). Significant discordance occurred for RH (70%) especially for management of specific injuries.

EsTC Criteria	RH	GH	TH
Resuscitation	**% agreement**		
Airway	76	84	100
Breathing	100	100	80
Circulation	66	89	86
Specific Injury			
H&N injuries	42	58	87
Thorax	93	86	83
Abdomen	58	67	83
Extremities	86	81	100
Back	54	71	91
Service			
Pain control	72	75	88
Monitoring	87	83	70
Rehabilitation	91	82	45
Safety/Security	100	100	100

Conclusion: Standardized EsTC guidelines can be universally applicable in LAR for tertiary centers and general hospitals. Significant modification would be needed for EsTC guidelines prior to its endorsement for rural trauma care in LA. ***supported by AAST research scholarship*

Session XI

Paper 35 9:10 AM

INTERRUPTED PHARMOCOLOGIC THROMBOPROPHYLAXIS INCREASES VENOUS THROMBOEMBOLISM IN TRAUMATIC BRAIN INJURY

Kristin Salottolo, MPH; Patrick Offner*, MD; AStewart Levy, MD; Charles W Mains, MD; David Bar-Or, MD. St. Anthony Central Hospital.

Invited Discussant: Tom Esposito

Introduction: Pharmacologic thromboprophylaxis (PTP) is frequently withheld, begun late, or interrupted in patients with traumatic brain injury (TBI). The purpose of this study was to determine whether late or interrupted administration of PTP increases the risk of venous thromboembolism (VTE) in patients with TBI.

Methods: We retrospectively studied patients with blunt TBI and stable head CT scans who were admitted to our Level I trauma center over 19 months. PTP use was analyzed as an independent risk factor for VTE using multiple logistic regression. PTP use was examined three ways: 1. Timing of PTP [early (< 72 hours) vs. late (= 72 hours) vs. no PTP]; 2. Any exposure to PTP (receiving PTP before potential development of VTE); 3. Continuous vs. interrupted use of PTP. Separate logistic regression models were developed for each definition of PTP use.

Results: 248 TBI patients were identified. VTE occurred in 11 patients (4.4%), including 8 DVTs, 4 PEs, with 1 patient who developed both DVT and PE. VTE developed in eight patients despite early PTP (9.1%), 2 patients with late PTP (2.7%), and one with no PTP (1.2%). Neither timing of PTP nor exposure to any PTP were independent predictors of developing a VTE (early PTP vs. no PTP: OR=1.92, p=0.61; late PTP vs. no PTP: OR=0.31, p=0.43; any exposure to PTP: OR=0.39, p=0.35). PTP was administered continuously in 109 patients (66.9%). Patients with interrupted PTP had a significant increased odds of developing VTE compared to patients continuously treated with PTP (OR=14.54, p=0.02). Other risk factors for developing a VTE included hypotension on admission (OR=11.27, p=0.03).

Conclusions: Interrupted administration of PTP in patients with TBI is associated with significantly increased risk of VTE. These findings underscore the importance of continuous PTP administration once it is begun and every effort should be made to avoid interruption if possible.

Session XI

Paper 36 9:30 AM

HIGH PLASMA TO RED BLOOD CELL RATIOS ARE ASSOCIATED WITH LOWER MORTALITY RATES IN PATIENTS RECEIVING MULTIPLE TRANSFUSION (4<=RBC-UNITS<10) DURING ACUTE TRAUMA RESUSCITATION

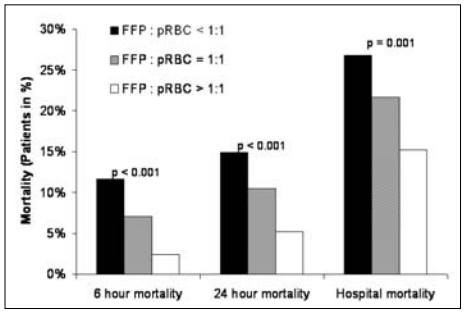
Arasch Wafaisade, MD, Marc Maegele, MD, Rolf Lefering, PhD, Sigune Peiniger, MD, Edmund Neugebauer, PhD, Bertil Bouillon*, MD. Department of Trauma and Orthopedic Surgery, University of Witten/Herdecke, Cologne-Merheim Medical Center.

Invited Discussant: EE Moore

Objective: We have previously shown benefits of high FFP:RBC ratios in massively transfused trauma patients. This study aimed to assess the effect of higher FFP:RBC ratios on outcome in patients receiving less than massive transfusion during acute trauma care.

Methods: The prospective, multi-centre Trauma Registry of the German Trauma Society (01/2005-12/2008) was analyzed for patients =16 years with an ISS=16 that received multiple but not massive transfusion (4 = RBC-units < 10) between ER arrival and ICU admission. Patients who died within 1 hour after admission were excluded. Three groups were analyzed according to FFP:RBC ratio: Low (<1:1, LR), balanced (1:1, BR) and high ratio (>1:1, HR). BR was defined as RBC-units=FFP-units±1FFP-unit.

Results: 1362 patients met study criteria (LR=760, BR=392, HR=210). Demographic data, injury characteristics, admission vital signs and laboratory values were similar among groups. For the three groups (LR, BR and HR) thromboembolic events were reported in 4.0%, 3.8% and 1.9% (p=0.42), sepsis occurred in 17.1%, 18.2% and 17.6% (p=0.9), incidence of MOF was 49.1%, 47.9% and 52.4% (p= 0.6), while mortality was 26.8%, 21.7% and 15.2% (p=0.001), respectively (figure). Ongoing RBC-transfusion following ICU admission occurred in 68.1%, 66.7% and 53.9% (p<0.001), respectively. ICU/hospital lengths of stay were comparable between groups. Multivariate adjustment by logistic regression identified a high FFP:RBC ratio as independent predictor for survival (OR 0.52, p=0.013).



Conclusion: Trauma patients receiving less than massive transfusion might also benefit from higher FFP:RBC ratios, since these were associated with significantly lower mortality rates and decreased blood product utilization during subsequent ICU treatment, while morbidity was comparable among groups. However, prospective trials are necessary.

Session XI

Paper 37 9:50 AM

THE EPIDEMIOLOGY OF SEPSIS IN GENERAL SURGERY PATIENTS

Laura J Moore, MD, Krista L Turner, MD, S Rob Todd, MD, Joseph F Sucher, MD, Bruce McKinley, PhD, Frederick A Moore, MD*. The Methodist Hospital.

Invited Discussant: Phil Barie

Introduction: Sepsis is increasing in hospitalized patients. Our purpose is to describe its current epidemiology in a general surgery (GS) ICU where patients are routinely screened and aggressively treated for sepsis by an established protocol.

Methods: Our prospective, IRB approved sepsis research database was queried for demographics, biomarkers reflecting organ dysfunction (OD) & mortality. Patients were grouped as sepsis, severe sepsis or septic shock using refined consensus criteria. Data are compared by ANOVA, expect for mortality which is compared using X^2, p value <0.05 considered significant.

Results: During 24 months ending Sept 2009, 231 patients (59±3yr, 43% male) were treated for sepsis. The abdomen was the source of infection in 64%. Baseline OD (BOD) biomarkers & outcomes are presented below.

Variable (BOD) mean ± SEM	**Sepsis (n = 39)**	**Severe Sepsis (n = 131)**	**Septic Shock (n = 61)**	**p**
BNP (cardiac)	111±24	390±91	682±198	0.06
lactate (cardiac)	1.6±0.2	2.8±0.3	3.8±0.4	<0.01
creatinine (renal)	1.1± 0.1	1.5±0.2	2.3±0.3	<0.01
PaO_2/FiO_2 (lung)	248±51	239±12	193.4±16	0.07
INR (DIC)	1.3±0.02	1.6±0.1	1.8±0.1	<0.01
platelet count (DIC)	304±25	225±12	208±16	<0.01
D-dimer (DIC)	5.09±0.66	4.94±0.51	7.62±0.94	<0.01
ICU free days	21±1	18±2	12±2	<0.01
hospital mortality	5%	13%	36%	<0.01

Most patients present with severe sepsis (56%) or septic shock (26%) with respectively increasing multiple BODs. Septic shock has a prohibitive mortality (36%) and those who survive septic shock have prolonged ICU stays.

Conclusion: In GSICU patients, sepsis is predominantly due to intra-abdominal infection. Multiple BODs are present in both severe sepsis and septic shock but are notably advanced in septic shock patients. Despite aggressive sepsis screening and treatment, septic shock with BODs remains a morbid condition.

Session XI

Paper 38 10:10 AM

THE BURDEN OF "SECONDARY OVERTRIAGE": A CALL FOR SYSTEM DEVELOPMENT

Eric A Toschlog* MD, Brett H Waibel MD, Kimmerle C Cohen MD, Gregory P Schaefer DO, Scott G Sagraves MD, Michael F Rotondo* MD. East Carolina University.

Invited Discussant: C. William Schwab

Introduction: Secondary overtriage (SO) has been defined as overtriage to trauma centers from referring hospitals. Given the resource constraints afflicting trauma centers, our objective was to characterize the SO patient and to analyze the associated financial impact.

Methods: We queried NTRACS for all trauma patients admitted to our rural level I center referred from outlying hospitals (2007-09). Patients were divided into two cohorts: SO and secondary appropriate (SA). SA were defined by death, length of stay > 48 hours, ICU admission, and need for urgent surgery. Groups were compared across clinical and financial variables using univariate and multivariate analyses where appropriate.

Results: 2,486 transfer patients were admitted to the trauma service during the study period, of which 374 (15%) met criteria for SO. Selected variables associated with SO are shown in the multivariate regression analysis below:

	Adjusted Odds Ratio	95% Conf. Interval	*p*
Log Age	0.710	0.616-0.819	< 0.001
Arrival Time 7pm to 7am	1.326	1.024-1.719	0.033
Aeromedical Transport	0.533	0.403-0.703	< 0.001
Uninsured	1.881	1.433-2.469	< 0.001
RTS ≥ 7	31.709	7.750-129.741	< 0.001

Financial comparisons per patient (mean dollars) are shown below.

	Total Costs	Total Charges	Total Payments	Contribution Margin	Profit-Loss
SA	$24,892.93	$57,096.31	$25,585.72	$9,435.99	-$2,196.64
SO	$4,946.51	$9,355.29	$3,589.58	$656.45	-$1,520.16
p	< 0.001	< 0.001	< 0.001	< 0.001	0.373

Conclusion: The SO patient is significantly younger, less injured, transferred at night by ground, and uninsured. The SO contribution margin is significantly lower per patient, costing our center over one half million dollars for the study period. The SO patient challenge should be managed with outreach and regional development. Applied to other trauma centers, this analysis has the potential to lead to system development that refines triage, minimizes unnecessary transfer, and reduces associated financial burden.

Session XI

Paper 39 10:30 AM

ADVANCED HEMOSTATIC DRESSINGS ARE NOT SUPERIOR TO GAUZE FOR CARE UNDER FIRE SCENARIOS

Jennifer M Watters, MD, Modjgan L Keyghobadi, MD, Philbert Y Van, MD, Gregory J Hamilton, BS, Jerome A Differding, MPH, Martin A Schreiber*, MD. Oregon Health & Science University.

Invited Discussant: John Holcomb

Introduction: Hemorrhage remains a leading cause of preventable death on the battlefield. Advanced hemostatic dressings are superior to standard gauze in animal models of hemorrhage but require 2-5 minutes of application time which is not feasible on the battlefield. Tourniquets are the only device recommended for care under fire scenarios.

Methods: 24 swine received a femoral artery side wall injury, followed by 30 seconds of uncontrolled hemorrhage and randomization to packing with standard gauze (SG), Combat Gauze (CG), or Celox Gauze (XG) without external pressure for hemostasis. Animals were resuscitated to baseline mean arterial pressures with lactated Ringers and monitored for 120 minutes prior to euthanasia. Physiologic and coagulation parameters were collected at baseline and throughout. Dressing failure was defined as overt bleeding outside the wound cavity. Femoral artery tissues were collected for histological and ultra-structural studies.

Results: There were no differences in baseline physiologic or coagulation parameters. All animals survived to study end. There was no difference in dressing success or blood loss between groups. The SG packed significantly faster than either the CG or XG.

Dressing	Success/Failure	Blood Loss (ml)	Pack Time (sec) *p <0.001
SG	8/0	260.4 (178.5, 297.0)	40 ± 0.9*
CG	4/4	374.1 (228.2, 541.7)	52 ± 2.0
XG	6/2	203.9 (140.5, 250.6)	59 ± 1.9

At 120 minutes, all groups had a significantly shorter time to clot formation compared to baseline (p <0.01). At 30 minutes, the XG animals had shorter time to clot compared to SG and CG animals (p<0.05). Histological evaluations showed all sections had mild intimal and medial edema at injury margins attributable to the injury, not the dressings. No inflammation, necrosis or deposition of dressing particles in vessel walls was observed. No histological or ultra-structural differences were found between any of the study dressings.

Conclusions: Advanced hemostatic dressings do not perform better than conventional gauze in an injury and application model similar to a care under fire scenario.

Session XI

Paper 40 10:50 AM

HEART RATE VARIABILITY AS AN INDEPENDENT PREDICTOR OF MORBIDITY AND MORTALITY IN HEMODYNAMICALLY STABLE TRAUMA PATIENTS

Mark L Ryan, MD, Michael P Ogilvie, MD, MBA, Bruno MT Pereira, MD, Juan Carlos Gomez-Rodriguez, MD, Ron J Manning, RN, MPH, Kenneth G Proctor*, PhD. University of Miami.

Invited Discussant: Leopoldo Cancio

Objective: Heart rate variability (HRV), a measure of autonomic dysfunction, can discriminate patients with and without brain injury during resuscitation and triages severe injury better than routine trauma criteria or enroute prehospital vital signs in patients transported by helicopter. This supports the concept that HRV may be a new vital sign and/or a useful trauma triage tool. The purpose of this study was to evaluate HRV in hemodynamically stable trauma patients.

Methods: The protocol was IRB approved and conducted with waiver of informed consent. The study population was comprised of 161 hemodynamically stable adults (3:1 M:F; 95:5 blunt:penetrating; 49±2 yrs old, M±SE) receiving computed axial tomography during initial trauma work-up and resuscitation. Patients were prospectively instrumented with a 2-Channel SEER Light recorder (GE Healthcare, Milwaukee, WI). HRV was analyzed from 15 min EKG recordings with a Mars Holter monitor system. SDNN (standard deviation of the normal-to-normal R-R interval), plus other measures of HRV in the frequency domain were correlated with vital signs, Glasgow Coma Scale (GCS), injury severity score (ISS), mortality and length of stay (LOS). Significance at $p<0.05$ was denoted by * and determined using ANOVA, regression, or Fisher test.

Results In unsedated patients (n=135), SDNN>50 msec was associated with a mortality rate of 1.8% vs 9.8% in those with SDNN<50*. In the subset of survivors (n=126), similar SDNN values* were seen in those with GCS<10, 11-13 or 14-15 and with ISS<15 or >15. However, SDNN was 65±6 msec in those with <1 day LOS, 51±11 for 2-4 d LOS and 46±4 for >5 d LOS, which reflects increasing morbidity*. Similar patters were evident in the frequency domain. In sedated patients (n=26), these relationships were not significant.

Conclusion HRV is an independent predictor of morbidity/mortality in stable, unsedated trauma patients.

Session XIIIA

Paper 41 1:30 PM

Initial Hospital Evaluation of Trauma Patients: Does Age Play a Role in Trauma Admission?

Peschman, Jacob BS, Brasel, Karen MD, MPH*, Neideen, Todd MD. Medical College of Wisconsin.

Invited Discussant: David Jacobs

Background: Age is suggested as triage criteria for transfer to a trauma center, despite poor outcomes after similar injury regardless of trauma center level. The effect of differential triage to a trauma center is unknown. We hypothesized that there would be a difference in the admission rates of geriatric patients compared to the rest of the adult trauma population, impacting center and system resources.

Methods: Records of 1970 adult patients evaluated by the trauma team at a Level 1 trauma center and discharged directly from the ED were reviewed. Data abstracted included demographics, injuries, and physiologic information. These data were compared to 3232 trauma patients admitted over the same time period who had similar information abstracted via record review. Chi-squared analysis of the admission rates of geriatric patients was performed, followed by a binomial logistic regression to determine factors that affected the odds of admission.

Results: 8.68% (451) of the patients were age 65 or older. 62.2% of the population was admitted. Significantly more geriatric patients (82%) were admitted (χ^2=126.24, p<0.001). Age, head injury, ISS, TCS, and initial blood pressure were significant independent factors in predicting hospital admission (p <.001).

	Discharged	Admitted	Odds Ratio	Confidence Interval
Older than 65 (%)	3.05**	12.10**	3.761**	2.646 - 5.350
Head Injury (%)	1.58**	28.07**	5.302**	3.490 - 8.053
ISS moderate (%)	0.86**	24.69**	17.526**	10.570 - 29.079
GCS on arrival	14.87**	12.55**	0.749**	0.702 - 0.801
ED systolic BP	135.20**	124.87**	0.988**	0.984 - 0.992

** p <0.001

Conclusions: Age alone is associated with increased odds of being admitted to the hospital independent of injury severity and other physiologic parameters. This has implications for trauma centers that see a significant proportion of geriatric trauma patients, as well as for trauma systems that must prepare for the "aging of America".

Session XIIIA

Paper 42 1:50 PM

SUCCESSFUL RESCUE OF PATIENTS WITH SERIOUS COMPLICATIONS: A CHARACTERISTIC OF HIGH PERFORMING TRAUMA CENTERS

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University of Toronto.

Invited Discussant: Len Jacobs

Introduction: "Failure to rescue" patients with complications is a factor contributing to high mortality rates following elective surgery. In trauma, where early deaths are the primary contributors to a trauma center's (TC) mortality rate, the rescue of patients with complications might not be related to overall TC mortality. We assessed the extent to which trauma center mortality was reflected by the TC's ability to rescue patients with major complications.

Methods: Data were derived from NTDB, and limited to age > 18, ISS = 9 and to centers with adequate complication reporting. Only patients surviving >1 day were included in evaluating complications. Regression models were used to produce TC adjusted rates for mortality and complications. TC were ranked on their adjusted mortality rate and divided into quintiles. To determine whether mortality was influenced by rescue after complications we created an additional mortality model with adjustment for complications.

Results: Of 73,608 patients, 10% had a major complication and 8% died. Complication rates and mortality among those with complications increased across mortality quintiles. Adjusting for complications did not alter the mortality trend across quintiles.

* $p < 0.05$	**Quintiles of mortality Highest ⇨ Lowest**				
Adj. mortality rate (%)*	10	9	8	7	5
Adj. complication rate (%)*	11	9	11	8	8
Adj. mortality (patients with complications) (%)*	22	17	16	12	11
Mortality rate after adj for complications (%)	10	9	8	7	6

Conclusion: Unlike reports from elective surgery, complication rates following severe injury differ across centers and parallel mortality rates. Adjustment for complications did not affect mortality rates, suggesting that both rates of complications AND rescue following complications are contributory. A lower risk of complications and better care of those with complications are both at play in high performing trauma centers.

Session XIIIA

Paper 43 2:10 PM

IMPROVING THE SCREENING CRITERIA FOR BLUNT CEREBROVASCULAR INJURY (BCVI): THE APPROPRIATE ROLE FOR COMPUTED TOMOGRAPHY ANGIOGRAPHY (CTA)

Katrina P Emmett, MD, Timothy C Fabian*, MD, Jennifer M DiCocco, MD, Ben L Zarzaur*, MD, MPH, Martin A Croce*, MD. University of Tennessee Health Science Center.

Invited Discussant: WJ Bromberg

Background: Screening criteria and diagnostic methods for BCVI are evolving. Using current screening guidelines, up to 20% of injuries are not recognized until symptoms occur, thus missing the therapeutic window. CTA has been rapidly adopted by many institutions to replace digital subtraction angiography (DSA). All patients who meet screening criteria at our institution undergo DSA due to conflicting sensitivity data reported for CTA. We sought to refine screening criteria for BCVI to optimize patient care.

Methods: All trauma admissions screened for BCVI over a 29-month period ending May 2009 were analyzed. 32-channel CTA was obtained at the time of initial radiologic evaluation. Patients underwent DSA for conventional screening criteria or abnormal CTA. Demographics, criteria for BCVI screening, fracture patterns, associated injuries, and results of CTA and DSA were analyzed.

Results: 748 patients were screened (Table), 143 injuries (79 carotid, 64 vertebral) were diagnosed in 118 (16%) patients. Of the 96 injured patients screened for conventional criteria, 40% were undetected by CTA. 22 of the 118 (19%) patients with BCVI had no conventional criteria and were only screened for a CTA abnormality.

	Screening Criteria	Patients	% with BCVI
Conventional	Skull base fracture	121	16
	Horner's syndrome	49	18
	Cervical spine fracture	405	15
	Le Fort fracture	76	11
	Neck soft tissue defect	134	14
	Unexplained deficit	32	25
	Conventional subtotal	**699**	**14**
	CTA as only criterion	**49**	**45**
	Total screened	**748**	**16**

Conclusions: The conventional screening criteria identify most patients with BCVI (81%). CTA as a screening criterion captures nearly all remaining patients prior to symptoms developing. This allows for detection and treatment of injuries in patients that otherwise would be missed, until symptomatic. CTA should be part of the radiologic evaluation for potential head, neck, and facial injuries. Unfortunately, CTA is not sensitive enough to detect 40% of injuries, but should be added as a screening criterion. DSA remains the gold standard for BCVI diagnosis.

Session XIIIA

Paper 44 2:30 PM

CAN WE DODGE THE BOOMERANG: ANALYSIS OF TRAUMA PATIENT UNPLANNED HOSPITAL RE-ADMISSIONS

Thomas J Esposito*, MD, MPH, Melissa Crowe, RN, MSN, Evelyn Clark-Kula, RN, BSN, Hieu Ton-That, MD, Casey Thomas, DO. Loyola University Medical Center.

Invited Discussant: John Fildes

Introduction: Performance monitoring and performance improvement (PI) are increasingly important in the era "pay for performance." Little is currently known regarding unplanned re-admission (UPR) in trauma patients. This study characterizes UPRs at one institution.

Methods: Retrospective descriptive review of UPR to a Level I Trauma Center after primary admission for trauma care. Information was obtained on: initial trauma diagnoses, diagnosis precipitating UPR, discharge interval, treatment rendered and length of stay (LOS) during both encounters, and PI committee judgments. Descriptive statistics were applied.

Results: Over 2.5 years there were 2827 discharges and 58 UPR (2%). The majority of original diagnoses were related to blunt trauma and head injuries. UPR occurred at a median of 3 days, with 54% re-admitted to the trauma service. Operative rate for UPR patients during the initial admission was 48% (vs 36% for all primary trauma admissions) with 28% requiring operation on the UPR. Headache and wound issues were responsible for 42% of UPR. Diagnosis precipitating UPR was primarily related to post-operative complications in 26% of all UPR and 57% of those undergoing operation on the initial admission. Median LOS for UPR was 3 days with ICU care being required by 13%. PI review found that 33% of UPRs were attributable to opportunities for improved care (OFI) during the first admission. Identified OFIs were related to errors in technique (53%), errors in judgment (27%), and system issues (20%). Of UPR without OFI, 87% were related to disease and13% systems issues.

Conclusion: UPR at a Level I trauma center is rare, occurs shortly after discharge, is brief in duration and usually related to wound issues or headache. Post operative patients seem at greater risk for UPR and a noteworthy number require operation and/or ICU care. While most UPR are considered non-preventable, attention to clear discharge instructions and education, along with tertiary survey and outpatient support, may obviate a number of preventable UPR.

Session XIIIA

Paper 45 2:50 PM

A RISK ADJUSTED MORTALITY ANALYSIS OF RIB FRACTURE PATIENTS REVEALS IMPORTANT TREATMENT VARIATIONS BETWEEN TRAUMA CENTERS(A RECONECT STUDY)

BZ Phillips, MD, DT Harrington, MD*, Jason Machan, PhD, N Zacharias, MD, G Velmehos, MD, M Rosenblatt, MD, E Winston, MD, L Patterson, MD, S Desjardins, MD, R Winchell, MD, S Brotman, MD, J Schulz, MD, A Maung, MD, K Davis, MD. Rhode Island Hospital.

Invited Discussant: Ronald Stewart

Objective: Trauma case fatality rate begins to increase for individuals over the age of 45. Senior patients who sustain rib fractures have higher rates of morbidity and mortality when compared to younger patients. Given the negative impact of this injury, identifying therapies that positively impact outcomes in this population would be valuable. The aim of this study is to look at the treatment variability and outcomes between multiple institutions and identify those modalities that reduce mortality.

Methods: Using the NTDB and medical records, 1621 patients were retrospectively reviewed from 8 institutions between Jan 1, 2002 – Dec 31, 2007. Variation between centers in patient demographics, injury patterns, treatments and mortality were evaluated. A predictor of mortality was created using a random ½ of the data and was then used against the remaining data to create an observed/expected (O/E) ratio for mortality. Institutions were grouped into high and low O/E ratio centers and differences in treatment were compared.

Results: Differences ($p<0.05$) existed between centers in respect to age, rate of pre-existing CHF, AIS head, AIS abdomen, ISS, # of rib fractures, rates of intubation and mortality. Statistical difference ($p<0.05$) in the utilization of epidural, catheters, CPAP/BiPAP, ketorolac, PCA and transdural narcotics existed. Utilization of therapies between high and low O/E centers was compared. Low O/E centers used more Toradol (0.008) and transdural narcotics (0.048), with a trend towards statistical significance seen in the use of PCA and CPAP/BiPAP (0.055).

Conclusion: In our large regional trauma cooperative we demonstrated that treatment utilization varies between centers, and that the use of ketorolac and transdural narcotics positively impacted mortality. The next step in our cooperative is to develop a standard treatment protocol to treat these at risk patients and follow outcomes prospectively follow treatment outcomes.

Session XIIIA

Paper 46 3:10 PM

INJURY SEVERITY, INTERVENTIONS, AND OUTCOMES AMONG HELICOPTER AND NON-HELICOPTER TRANSPORT PATIENTS AT A URBAN LEVEL 1 TRAUMA CENTER

R Scott Hannay, MD, Amy D Wryzykowski*, MD, Chad G Ball, MD, Kevin B Laupland, MD, David V Feliciano*, MD. Columbus Regional Healthcare.

Invited Discussant: Norm McSwain

Introduction: Air ambulance transport for injured patients is vitally important given increasing patient volumes, a limited number of trauma centers, and inadequate subspecialty coverage in non-trauma hospitals. Despite a paucity of reported objective data air ambulance services have been shown to improve patient outcomes when compared to ground transport in select circumstances. The primary goal of this study was to compare injuries, interventions, and outcomes in patients transported by helicopter versus non-helicopter transport. Cost and safety of air transport were also reviewed.

Methods: A retrospective review of 14,465 patients (10 years) transported to an urban level 1 trauma center by helicopter or other means of transport was performed. Severity of injury, interventions, and mortality were compared. Standard statistical methodology was employed ($p<0.05$ = significant).

Results: Patients transported by helicopter had higher mean Injury Severity Scores (ISS) whether the mechanism was penetrating or blunt and were more likely to: (1) have Glasgow Coma Scale of = 8; (2) require airway control; (3) receive blood transfusions; and (4) require admission to the intensive care unit or operating room. Helicopter transport was associated with improved overall survival (OR= 0.41, 95% CI = 0.33-0.39). Patients transported by other methods were more likely to die in the Emergency Department. Mean ISS, regardless of transport method, rose from 12.3 to 15.1 ($p= 0.011$).

	Helicopter (2394)	Non-helicopter (12071)	*p*
Median ISS	17	9	<0.001
GCS = 8	799/2300 (35%)	1402/11645 (12%)	<0.001
Required transfusion	730/2251 (32%)	2418/10930 (22%)	<0.001
Required airway	826/2394 (35%)	1929/12071 (16%)	<0.001
Admission to OR	826/2394 (35%)	3830/12071 (32%)	0.008
Admission to ICU	1107/2394 (46%)	3711/12071 (31%)	<0.001
ED death	43/2394 (2%)	585/12071 (5%)	<0.001

Conclusions: Patients transported by helicopter to an urban trauma center were more severely injured, required more interventions, and had improved survival than those arriving by other means of transport. Injury severity also rose among all patients during the study period

Session XIIIA

Paper 47 3:30 PM

VARIATIONS IN PRACTICE PATTERNS OF DUPLEX ULTRASOUND SCREENING FOR DEEP VEIN THROMBOSIS (DVT) IN ASYMPTOMATIC TRAUMA PATIENTS: A RECIPE FOR DISASTER IN BENCHMARKING HOSPITAL QUALITY

Elliott R Haut*, MD, Eric B Schneider, PhD, Adil H Haider, MD, MPH, Amar Patel, BA, Michael B Streiff, MD, Kent A Stevens, MD, MPH, Avery Nathens*, MD, PhD, Melanie L Neal, Edward E Cornwell 3rd*, MD, Peter J Pronovost, MD, PhD, David T Efron*, MD. The Johns Hopkins Medical Institutions.

Invited Discussant: Hasan Alam

Background: Many national agencies have suggested using DVT rates to measure quality of health care, but none provide recommendations for a standardized approach to surveillance or screening. Data have shown that trauma centers (TCs) which perform more duplex ultrasounds find and report more DVTs, calling into question the validity of DVT rates in benchmarking trauma care.

Objective: We sought to characterize variations in practice patterns regarding the use of duplex ultrasound for DVT screening in asymptomatic trauma patients.

Methods: We prospectively surveyed National Trauma Data Bank (NTDB) participating hospitals regarding their current protocols, pathways, and written guidelines regarding duplex ultrasound screening for DVT in asymptomatic trauma patients.

Results: 213 surveys were received from approximately 775 NTDB participating hospitals (27.5% response rate). TCs of all levels responded (27% level I, 39% level II, 18% level III, 10% level IV, 6% not indicated). All TC types were represented (27% university, 45% community, and 28% non-teaching). 28% (n=60) of TCs have a written guideline regarding duplex screening for DVT, however, this proportion varied significantly by TC level (43% I, 32% II, 21% III, 0% IV or unspecified, $p < 0.001$). In the 46 TCs that gave specific information regarding their guideline, there was wide variation in when screening is initiated (59% <4 days, 15% 4-6 days, 9% >6 days, 17% other) and how often it is performed (17% once, 50% weekly, 9% every 3 days, 24% other). For the TCs with no written guideline (n=153), 21% reported there is a "general culture" of duplex screening and 75% reported that screening decisions are left to individual trauma surgeons.

Conclusions: Trauma centers have wide variations in practice for screening asymptomatic trauma patients for DVT with duplex ultrasound. This screening variability, combined with the fact that performing more duplex ultrasounds finds more DVTs, will influence reported DVT rates. Therefore, DVT rate alone should not be used to benchmark trauma care.

Session XIIIA

Paper 48 3:50 PM

WHOLE BODY COMPUTED TOMOGRAPHIC IMAGING IN THE ASYMPTOMATIC PEDIATRIC BLUNT TRAUMA PATIENT

Tammy R Kopelman, MD*, Patrick J O'Neill, PhD, MD, Dario Pasalic, Krista L Wilhelmson MD , Sydney J Vail, MD, Melissa Pressman, PhD, Daniel G Gridley, MD. Maricopa Medical Center.

Invited Discussant: Barbara Gaines

Introduction: Recent reports support the liberal use of computed tomography (CT) in asymptomatic adult patients after significant blunt trauma as occult injuries have been identified that alter management. The purpose of our study was to demonstrate if liberal whole body CT (Chest/Abdomen/ Pelvis with thoracolumbar Spine reconstruction; CAPS), is warranted in evaluable pediatric blunt trauma patients without obvious signs of injury.

Methods: A retrospective study of pediatric (6–14 years) blunt trauma patients who underwent CT of CAPS over a 3–year period was performed at a Level I trauma center. Inclusion criteria were significant mechanism of injury, neurologically evaluable, hemodynamically stable, and no clinical evidence of trauma to the body region being studied. Patient demographics, radiographic findings, and treatment plans based on these findings were collected. Abnormal CT findings were defined as any traumatic abnormality interpreted by an attending radiologist. Change in management was defined as the need for additional evaluation, diagnostic study, or intervention based upon CT interpretation.

Results: 421 patients met inclusion criteria. While asymptomatic, the incidence of abnormal CT scans was: chest 16% (43/276), abdomen 19% (59/306), pelvis 3% (12/383), and thoracolumbar spine 5% (11/217). The sensitivity of chest radiograph as a screening tool for thoracic trauma was only 28% (12/43). Importantly, 27% (16/59) of the injuries seen in the abdominal CT scan group were solid organ injuries. The need for a change in clinical management occurred as follows: chest 35% (15/43), abdomen 100% (59/59), pelvis 50% (6/12), and thoracolumbar spine 27% (3/11).

Conclusion: The liberal use of CAPS CT imaging based on mechanism of injury in the evaluable, asymptomatic pediatric trauma patient is warranted as significant injuries that changed clinical management were identified. Further study is necessary to determine if this clinical benefit outweighs the potential downside of medical-grade radiation exposure to pediatric patients.

Session XIIIA

Paper 49 4:10 PM

OPEN TIBIA FRACTURES: TIMELY DEBRIDEMENT LEAVES INJURY GRADE AS THE ONLY DETERMINANT OF POOR OUTCOME.

Natalie Enninghorst, MD, Debra McDougall, RN, Laszlo Toth, MD, Joshua Hunt, MD, Zsolt J Balogh*, MD, PhD, FRACS. Department of Traumatology, John Hunter Hospital, University of Newcastle.

Invited Discussant: Greg Beilman

Objective: Recent retrospective orthopedic studies suggest that time to debridement of open tibia fractures is not a major determinant of the outcome. The aim of this prospective study was to determine the modifiable independent predictors of poor outcomes.

Methods: A 36-month prospective observational study ending in December 2009 was performed on consecutive open tibia shaft fracture patients (age>18yrs) admitted to a Level-1 trauma center. Demographics, mechanism, injury severity score (ISS), fracture type/grade, local contamination, time to debridement, time to antibiotics and interventions were prospectively recorded. Outcome measures were: length of stay (LOS), deep infection, secondary procedures, and presence of union at 6 and 12 months. Data are presented as mean+/-SEM or percentages. Univariate, multivariate and logistic regression analysis was performed. Statistical significance was determined at $p< 0.05$.

Results: Seventy-two consecutive patients (74% male, age 40±2 years, ISS: 15±1, 42% multiply injured, 3% bilateral fractures) met inclusion criteria. The mean time to surgical debridement and operative stabilization was 9±6 hrs (54% within 6 hrs). The average LOS was 20±2 days. Ten patients (15%) had deep infection and four (6%) required amputation (1 acute and 3 late due to infection) The six and twelve month union rate was 42% and 71% respectively. Forty-five (63%) patients required further (a total of 232) procedures. The multivariate (18 variables) regression model showed Gustilo-Anderson grading was the only significant predictor of nonunion at 6 months. There were no identifiable predictors for nonunion at 12 months (polytrauma and smoking were closest to reach significance $p=0.08$). There were no identifiable predictors for deep infection.

Conclusion: Timely management of open tibia fractures (mean 9 hrs) eliminates time to debridement and contamination as predictors of poor outcome. Patient factors, local and general injury severity determine the outcomes. Aiming for the earliest safe time to debridement minimizes the negative effects of modifiable factors on the outcome.

Session XIIIB

Paper 50 1:30 PM

A NEW CLOPIDERGEL (PLAVIX) PONT-OF-CARE ASSAY: RAPID DETERMINATION OF ANTIPLATELET ACTIVITY IN TRAUMA PATIENTS

Vishal Bansal, MD; Dale Fortlage, BS; Todd Costantini, MD; Jeanne Lee, MD; Jay Doucet*, MD; Bruce Potenza*, MD; Raul Coimbra*, MD. Univeristy of California San Diego.

Invited Discussant: Clay Cothern

Introduction: An increasing proportion of trauma patients are on anticoagulation or antiplatelet therapy. Unlike warfarin, where measuring INR can help direct management, measuring platelet inhibition from clopidogrel (Plavix ™) is not standardized. We report the use of a new P2Y12 point-of-care assay (VerifyNow®) to determine the magnitude of platelet inhibition in trauma patients using clopidogrel.

Methods: Trauma patients in 2009 were queried for clopidogrel use by pre-hospital personnel and the trauma team. Blood was obtained upon admission for patients reportedly taking clopidogrel and was assayed for platelet inhibition using the VerfiyNow-P2Y12 device which measures P2Y12 reaction units and photometrically determines platelet inhibition percentage within 30 minutes. Patient demographics including age, ISS, mechanism of injury and complications from hemorrhage were also analyzed.

Results: In the time studied, 46 patients taking clopidogrel were assayed for platelet inhibition. The mean age was 75.9 ± 11.8 and the most common mechanism of injury was fall (86.9%). Platelet inhibition ranged from 0-89% (See Table). There were no deaths and only two patients, from the 0% and over 30% inhibition group, had hemorrhagic complications (increased intracranial hemorrhage).

Distribution of Platelet Inhibition	0%	0-20%	20-30%	>30%
Patients (%)	13 (28.2)	10 (21.7)	4 (8.7)	19 (41.3)

Conclusions: The P2Y12 point-of-care assay determined that a large percentage of patients had undetectable or low platelet inhibition despite reportedly being on clopidogrel therapy. These patients may be clopidogrel non-responders or non-compliant. It is unlikely that clopidogrel reversal therapies, such as platelet transfusions or DDAVP, would be beneficial in this group. Further studies stratifying the percent platelet inhibition needed to increase bleeding complications is warranted to optimize management strategies.

Session XIIIB

Paper 51 1:50 PM

CATHETER-RELATED BLOODSTREAM INFECTIONS CANNOT BE A "NEVER EVENT" IN CRITICALLY ILL ACUTE CARE SURGERY PATIENTS

Kara A Snyder, RN, MS, Terence S O'Keeffe, MBChB, Connie Moore, RN, MBA, Peter Rhee*, MD, MPH. University Medical Center.

Invited Discussant: Tina Palmeri

Introduction: Catheter-related Bloodstream Infections (CRBSIs) are a cause of mortality, morbidity, and increased cost. Complications during critical illness are now scrutinized as potential "never events" and therefore all opportunities for improvement must be identified. It is not known if contamination from other sites, such as open abdominal wounds from DCL, can play a role in the development of CRBSI. We noted an association between decreasing DCL rates and CRBSIs in our Intensive Care Unit. We hypothesized that as the rate of DCL declined, so would the CRBSI rate.

Methods: A retrospective observational design was used for our trauma center and surgical-trauma critical care unit to evaluate the incidence of CRBSI and DCL. CRBSI rates are prospectively collected according to standard definition. All DCL were identified using the trauma registry, defined as surgery where the fascia was left open at the end of the operation.

Results: Over the 4-year time period, CRBSI rate decreased by 74%. We noted a temporal relationship between the decreasing CRSBI and DCL percentage. Central line utilization increased over the study period.

	CRBSI Rate	CVL Utilization	Percent DCL	Major Quality Improvement Interventions
2006	4.99	57.6%	32.1%	Participation in Institute for Healthcare Improvement CRSBI collaborative
2007	5.10	34.0%	26.4%	100% compliance to insertion bundle; Hemostatic resuscitation
2008	3.63	58.3%	7.9%	Antiseptic impregnated central lines
2009	1.29	70.5%	7.9%	CRBSI root cause analyses

CRBSI = Catheter related infections/1000 central line days
CVL Utilization = Central Lines/ Patient Days
Percent DCL = #laparotomies with fascia open at surgery end / total laparotomies

Conclusion: There is a temporal relationship between declining CRBSI and DCL rates despite increasing CVL utilization. Despite implementation of all possible recommendations for CRBSI prevention, we were unable to achieve a rate of zero. We feel that despite best practice, CRBSIs can never become a "never event".

Session XIIIB

Paper 52 2:10 PM

ISOLATED SEVERE TRAUMATIC BRAIN INJURIES SUSTAINED DURING COMBAT OPERATIONS: DEMOGRAPHICS, MORTALITY OUTCOMES AND LESSONS TO BE LEARNED FROM CONTRASTS TO CIVILIAN COUNTERPARTS

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Invited Discussant: Don Trunkey

Introduction: Severe traumatic brain injuries occurring in the context of modern combat are unique entities about which little has been reported. We reviewed the epidemiology of these injuries from the Joint Trauma Theater Registry (JTTR), contrasting these results with civilian counterparts from the National Trauma Databank (NTDB).

Methods: Isolated severe brain injuries (defined as Head AIS = 3 and no other body region AIS > 2) were queried from the JTTR over a period from 2003-2007. The demographics and outcomes of these injuries were reviewed. These results were then contrasted to findings of similar patients, age 18-55, over the same period from the NTDB using Propensity score matching derived from age, gender, SBP, GCS, and AIS.

Results: JTTR review identified 604 patients meeting study criteria, with a mean age of 25.7. GCS was = 8 in 27.8%, and 98.0% were male. Hypotension at presentation was noted in 5.5%. Explosive (61.9%) and GSW (19.5%) mechanisms accounted for the majority of combat injuries. ICP monitoring was utilized in 15.2% and 27.0% underwent some form of operative cranial decompression, lobectomy or debridement. When compared to matched civilian NTDB counterparts, JTTR patients were significantly more likely to undergo ICP monitoring (13.8% vs. 1.7%, $p<0.001$) and cranial decompression or debridement (21.5% vs. 7.2%, $p<0.001$). Mortality was also significantly better after combat injury overall [7.7% vs. 21.0%, $p <0.001$; OR 0.32(0.16,0.61)], and particularly following penetrating mechanisms of injury [5.6% vs. 47.9%, $p <0.001$; OR 0.07 (0.02, 0.20)] compared to propensity score matched NTDB counterparts.

Conclusion: Patients sustaining severe traumatic brain injury after combat represent a unique population. Comparison to civilian counterparts has inherent limitations, but reveals higher decompression rates performed following penetrating injuries and a corresponding improvement in survival. Many factors likely contribute to these findings, which highlight the need for additional research on the optimal management of penetrating brain injury.

Session XIIIB

Paper 53 2:30 PM

SAFETY AND EFFICACY OF HEPARIN OR ENOXAPARIN PROPHYLAXIS IN BLUNT TRAUMA PATIENTS WITH A HEAD ABBREVIATED INJURY SEVERITY SCORE(HAIS)>2.

Christian T Minshall, MD PhD, Stuart M Leon, MD, Andrew R Doben, MD, Brian P McKinzie, PharmD, Mary M Bradbury, PharmD, Samir Fakhry*,MD, Evert Eriksson, MD. Medical University of South Carolina.

Invited Discussant: Wendy Wahl

Objective: To evaluate the efficacy and safety of subcutaneous heparin 5000 U tid or enoxaparin 30mg bid in patients suffering blunt traumatic brain injury.

Methods: The charts of all patients sustaining blunt trauma with a head abbreviated injury severity score (HAIS) =3and an ICU length of stay > 48h admitted between July, 2006 and December, 2009 were reviewed. Chemical DVT prophylaxis was initiated in these patients after an intracranial hemorrhage was considered stable by clinical exam and/or radiologic evaluation and with neurosurgical approval. The decision to treat with heparin or enoxaparin was made by the attending physician. We reviewed all operative notes and any radiological reports of venous duplex or CT pulmonary angiography studies performed in these patients to determine the rate of clinically significant intracranial hemorrhagic complications, deep venous thrombosis (DVT) or venous thromboemoblism (VTE).

Results: A total of 423 patients with HAIS =3 and an ICU LOS > 48h were admitted during this period; 191 patients were treated with heparin and 170 patients were treated with enoxaparin. The age, ISS, HAIS, hospital LOS, ICU LOS and time to initiation of DVT prophylaxis was not significantly different between the two groups.

*, p<0.05	Heparin %(n)	Enoxaparin %(n)
Hemorrhage	1.0 (2)	0 (0)
DVT	1.0 (2)	0.5 (1)
VTE	3.6 (7)	0 (0)*

Conclusions: Both heparin and enoxaparin have low rates of hemorrhagic complications requiring surgical intervention. Enoxaparin also seems to provide better protection from DVT and VTE. This study is the largest published comparison of heparin and enoxaparin in patients with significant traumatic brain injury; however, it lacks power due to its small size. A large, prospective, randomized study is needed to better evaluate the safety and efficacy of these two therapies in patients suffering blunt traumatic brain injury.

Session XIIIB

Paper 54 2:50 PM

OUTCOMES FOLLOWING HEAD INJURY ARE NOT AFFECTED BY SOCIO-ECONOMIC STATUS

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Invited Discussant: LD Britt

Background: It was recently reported that "ethnic minorities and low income families tend to be in poorer health." Further, low socioeconomic status (SES) is associated with poor health care and worse outcomes for a spectrum of diseases. More than any other condition, trauma is perceived as a disease of the poor and medically-underserved. However there is a paucity of literature detailing how outcomes in trauma patients with head injuries differ among socioeconomic strata.

Methods: A 5 year retrospective chart review of admitted trauma patients 18 years and older to a Level 1 trauma center (September 2003 to September 2008). We used Zip code of residency as a surrogate marker for socioeconomic status. Median income for each Zip code is available from the US Census. The data was divided into quartiles, allowing comparisons between patients in the highest versus the lowest income quartile. Charts were reviewed for demographics, mechanisms of trauma, presence of head injury, length of hospital and ICU stay, ventilator days, and mortality. We also assessed for discharge status, AMA, rehabilitation and home.

Results: 8,594 patients were admitted for whom Zip code data was available. 3,222 sustained head injury. Lowest quartile SES had higher male gender (70% vs 63%,p=0.048). Highest quartile SES patients had higher rates of head injury (39% vs 31%, $p < 0.0001$). Groups were matched for ISS (17.9 vs 17.7 p=0.5) and Head AIS (3.2 vs 3.3 p=0.4). There was no difference in mortality between the groups (Low SES 11% vs High SES 14% - p=0.08. There was also no difference in hospital length of stay (Low SES 10.8 days versus 9.2 days – p=0.3) or in ICU need or ICU length of stay (Low SES 7.9 days versus 6.6 days – p=0.5)

Conclusions: Although patients in the highest SES class have higher rates of head injury, there were no differences in significant outcomes following head injury between the SES strata. Unlike other diseases, traumatic head injury outcomes are unaffected by SES.

Session XIIIB

Paper 55 3:10 PM

SIGNALS FROM FAT METABOLISM AFTER INJURY: A METABOLOMIC ANALYSIS IN THE SEVERELY BURNED

CE Wade*, PhD, AG Mora, BS, BA Shields, BS, HF Pidcoke MD, LA Baer, BS, KK Chung MD, SE Wolf*, MD. USAISR.

Invited Discussant: Sam Arbabi

Introduction: Hypermetabolism is universal in the severely burned, characterized by catabolism of lean mass and body fat associated with insulin resistance. Adipokines are likely to play a role in these changes, but have not been identified to date in patients.

Methods: From a single burn ICU, 18 burn patients with an expected stay >14 days were studied. Over 7 days, beginning within 14 days of admission, plasma samples were taken for measurement of leptin, adiponectin, resistin, ghrelin, insulin, and cortisol by ELISA. For comparison samples were obtained from 15 healthy controls of similar age and BMI. Values are mean±SD; $p<0.05$ was considered significant.

Results: Mean age was 35±17 yrs and BMI 26±3.4. Average burn size was 43±20 %TBSA and ISS 32±10 with 72% having inhalation injury; mortality was 28%. Estimated energy needs were 3476±726 kcal of which 86±17.7% were met by enteral feeding with insulin treatment (glucose 80-110 mg/d). Using the homeostasis model assessment of insulin resistance, burned subjects were more resistant than controls (17±11.3 and 8±10.0). Insulin levels were elevated (56±32.5 in burned subject vs. 26±31.1 µU/ml in controls), and cortisol concentrations increased (50±35.9 vs. 12±2.9 µg/dl). These traditional hormone changes were associated with increased resistin (16.4±5.3 vs. 3.8±0.94 ng/ml) and decreased leptin (9.0±9.0 vs. 19.3±23.5 ng/ml), adiponectin (9.6±3.8 vs. 16.6± 10.2 ng/ml), and ghrelin (0.37±0.13 vs.0.56±0.26 ng/ml). Adipokine levels were not associated with burn size, ISS, or met caloric needs.

Conclusion: Patients with burns, who are hypermetabolic, insulin resistant and hypercortisolism, have significant changes in adipokine levels that appear independent of the magnitude of injury or metabolic derangement. In addition, suppression of ghrelin in the presence of decreased leptin and adiponectin and increased insulin and resistin levels represent unexpected changes in the metabolic milieu of the injured patient possibly due to dramatic activation of inflammatory pathways, indicating strategies for treatment.

Session XIIIB

Paper 56 3:30 PM

75 IS THE NEW 65; THE MORTALITY INFLECTION POINT FOR AGE AND ACUTE CERVICAL SPINAL CORD INJURY

Niels D Martin, MD, Joshua A Marks, MD, Joshua Donohue, BA, Michael S Weinstein, MD, Babak Sarani*, MD, Murray J Cohen, MD. Thomas Jefferson University.

Invited Discussant: Rob Mackersie

Purpose: Acute cervical spinal cord injury (cSCI) is associated with significant morbidity and mortality. Vertebral level and ASIA score influence both hospital course and ultimate outcome. While controlling for these variables, herein, we describe the effect of age on common cSCI morbidities such as pneumonia and mortality.

Methods: All patients treated at our regional spinal cord injury center and level one trauma center with an acute cSCI during a 5 year study period (2005-2009) were reviewed retrospectively. Patient demographics, injury level, ASIA score, length of ICU and hospital stay, surgical procedures, radiologic, laboratory, and microbiology data were reviewed. Pneumonia was defined as an infiltrate on chest x-ray along with two of the following: elevated white blood cell count, fever greater than 101 degrees Fahrenheit, or positive bronchial alveolar lavage cultures; all occurring within the same 24-hour period.

Results: There were 244 cSCI during the study period. Mortality rates were significantly higher in patients older than 75 years in age, 4.0% vs. 40.5%, $p<0.0001$. ISS and pneumonia rates were not significantly different between these groups although there was a trend for an increased tracheostomy need in the older age group. In all age groups, high ASIA scores (A & B) were associated with increased pneumonia (61.9% vs. 17.4%, $p<0.0001$) and mortality (16.7% vs. 3.5%, $p=0.002$). Similarly, cervical injury level showed higher pneumonia rates with injuries C4 and above (39.5% vs. 25.9%, $p<0.05$) and mortality rates trended higher as well.

Conclusions: Age greater than 75 was associated with a profound increase in mortality among patients with an acute cSCI. Injury level and ASIA score contributed significantly to overall pneumonia rate and mortality in all age groups. Understanding these risks and outcomes may guide care and family counseling in elderly patients with an acute cSCI.

Session XIIIB

Paper 57 3:50 PM

DOES HYPOXIA AFFECT ICU DELERIUM OR LONG TERM COGNITIVE IMPAIRMENT FOLLOWING MULTIPLE TRAUMA WITHOUT INTRACRANIAL HEMORRHAGE?

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Invited Discussant: Steve Johnson

Introduction: ICU delirium and long-term cognitive impairment (LCTI) are more likely in multiple trauma patients with a hypoxic event within the first 48 hours of ICU admission.

Methods: 173 multiple trauma patients (Injury Severity Score >15) without intracranial hemorrhage who presented to a Level 1 trauma center from July 2006 to July 2007 were prospectively enrolled in a study on LTCI. 97 patients required ICU management. All had continuous oxygen saturation data collected. ICU patients underwent a Confusion Assessment Method for the ICU (CAM-ICU) twice a day to determine delirium. 108/173 (62%) were evaluated 12 months post-discharge by neuropsychological testing. Demographics, Injury Severity Score (ISS), initial 24 hour blood requirements, hypoxia (SpO2 <90%, <85%), hypotension (systolic <90 mmHg), emergency department (ED) pulse and GCS, ventilator (Vent) and ICU days were recorded. Significant univariate data of clinical variables was utilized for multivariate analysis.

Results: 55 of 97 ICU patients (57%) were CAM-ICU positive for delirium and 59/108 (55%) demonstrated LTCI at 12-month follow-up. Mean hypoxia in ICU Delirium grp: O2 <90%: 29.8 +/- 38.66 min ;<85% 7.45 +/- 9.48 min, LTCI grp: <90%: 26 +/- 57.27 min; <85% 6.85 +/- 2.12 min. No association with cumulative hypoxia (O2<90%, <85%) of greater than 5 minutes during initial 48 hours of ICU stay and ICU delirium (74.5% vs. 74%; p=0.9) or LTCI (89% vs. 83%; p=0.5) was noted. By univariate analysis, vent days, ED pulse, and blood transfusions were predictors of delirium. Vent days (OR: 1.16, 95% CI 1.05-1.29; p=0.004) and ED pulse (OR: 1.02, 95% CI 1.00-1.04; p=0.03) remained predictors of ICU delirium after multivariate analysis with ISS, hypoxic state, transfusions, and ED BP. No association of LCTI noted with ED GCS, ISS, vent days, blood transfusions or delirium.

Conclusions: Hypoxic events in the ICU do not have a direct correlation with ICU delirium or LTCI in the multi-trauma patient without evidence of intracranial hemorrhage.

Session XIIIB

Paper 58 4:10 PM

POST TRAUMATIC CONTRAST INDUCED ACUTE KIDNEY INJURY: MINIMAL CONSEQUENCE OR SIGNIFICANT THREAT?

Kazuhide Matsushima, MD, Monica Peng, BS, Eric W Schaefer, MS, Jeffrey H Pruitt, MD, Jeffry L Kashuk*, MD, Heidi L Frankel*, MD. Penn State Milton S. Hershey Medical Center.

Invited Discussant: Eric Barquist

Background: Recent enthusiasm for the use of iodinated contrast media and progressive adaption of modern imaging techniques suggests the increased risk of contrast-induced acute kidney injury (CIAKI) in trauma patients. We hypothesized that CIAKI incidence would be higher than that previously reported (3.5-5%).

Methods: A one-year retrospective review of our prospective data based was performed. Low-osmolar, nonionic, iodinated contrast was used exclusively. CIAKI was defined as serum creatinine >0.5 mg/dl, or > 25% increase from baseline within 72 hours of administration. The association between CIAKI and risk factors were explored.

Results: Of 3775 patients, 1184 (31.4%) received IV contrast and had baseline and follow-up serum creatinine. Mean age was 41.5(±17.8) and Mean ISS was 17.4(±11.7). 8% of patients had history of diabetes mellitus (DM).

Variable	*p*value	OR	95% CI
Age (10 years)	0.01	1.19	(1.04 – 1.35)
Male	0.04	1.86	(1.04 – 3.32)
SBP <90	0.03	2.64	(1.07 – 6.48)
Initial Cr >1.5	0.35	1.51	(0.64 – 3.57)
ISS (10 points)	0.01	1.28	(1.05 – 1.56)
History of DM	0.17	1.65	(0.81 – 3.35)
Contrast dose (100 ml)	0.17	0.76	(0.51 – 1.12)

CIAKI was identified in 78 (6.6%). One patient required long-term hemodialysis. On univariate analysis, age>65 (p=0.01), male gender (p=0.05), history of DM (p=0.01), initial Cr>1.5 (p=0.01), ISS=16 (p=0.04) and initial systolic BP<90 (p=0.01) were risk factors for CIAKI. Of note, no association with the dose of IV contrast administered (p=0.07) was identified. On logistic regression model, variables independently identified as risk factors for CIAKI were: higher age, male gender, SBP<90 and higher ISS (Table).

Conclusion: Current trauma management places patients at substantial risk for CIAKI, and risk stratification can be assessed by common clinical criteria. IV contrast dose alone is not an independent associated risk factor. How these data would be extrapolated to an older cohort remains to be determined.

Session XIV

Paper 59 8:00 AM

SCREENING FOR MENTAL ILLNESS IN A TRAUMA CENTER: ROOTING OUT A RISK FACTOR OF UNINTENTIONAL INJURY

Rochelle A Dicker*, MD, Jennifer Mah, BS, M Margaret Knudson, MD, Nola He, BA, Catherine Tran, BA, Rosemary Reidy, BS, moon Li, RN, NP, Rebecca Menza, RN, NP, Megan Moore, BA, Phil Kreniske, BA, Ian Crane, BS, Dahianna Lopez, RN, MSN, Jennifer Alvidrez, PhD. University of California, San Francisco.

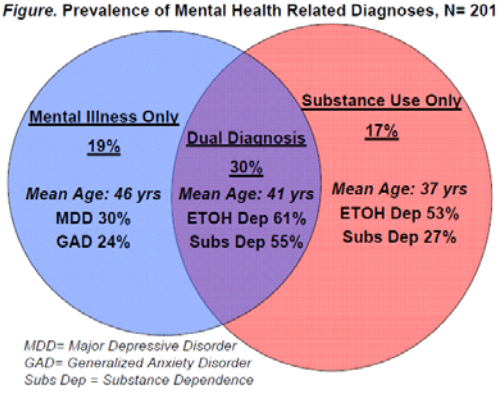
Invited Discussant: Larry Gentilleo

Introduction: Injury prevention and screening efforts have long targeted risk factors for injury recurrence. Retrospectively, our group found mental illness (MI) is an independent risk factor for unintentional injury and reinjury. The purpose of this study was to administer a standard validated screening instrument and psychosocial needs assessment to admitted patients who suffer unintentional injury. We aimed to measure the incidence of MI. We hypothesize that screening for psychiatric disorders in trauma patients is feasible and identifies people with preexisting MI as a high-risk group for unintentional injury.

Methods: Prospectively we recruited patients admitted for unintentional injury over 17 months. A bedside structured interview, including the mini international neuropsychiatric interview(MINI), and a validated psychosocial needs assessment was performed by researchers trained by Department of Psychiatry faculty. Screening and needs assessment results, as well as demographic characteristics, are reported as descriptive statistics.

Results: 1829 inpatients were reviewed. Of the 854 eligible people, 348 were approached by researchers prior to discharge with a positive response rate of 58% (N=201 enrolled). Interviews took 35min ± 12. Chi squared analysis revealed no difference in mechanism in those with MI versus no MI. 4-way diagnostic grouping revealed the incidence of MI (figure).

Figure. **Prevalence of Mental Health Related Diagnoses, N= 201**



Conclusions: This inpatient pilot screening program prospectively identified preexisting MI as a risk factor for unintentional injury. Implementation of validated psychosocial and mental health screening instruments is feasible and efficient in the acute trauma setting. Screening can lead to identification and treatment of MI as a strategy for unintentional injury prevention and recidivism.

Session XIV

Paper 60 8:20 AM

BRIEF VIOLENCE INTERVENTIONS (BVI) WITH COMMUNITY CASE MANAGEMENT SERVICES (CCMS) ARE EFFECTIVE FOR HIGH RISK TRAUMA PATIENTS

Michel B Aboutanos*,MD, MPH , Anne Jordan, MSW, Robert Cohen, PhD, Robin Foster, MD, Kimberly Goodman, PhD, Raquel W Halfond, PhD , Rachel Poindexter, RN, RaShel Charles,MPH , Bonita Hogue,MSW, Rao R Ivatury*, MD. Virginia Commonwealth University Medical Center.

Invited Discussant: Carol Schermer

Objective: Currently no evidence exists that BVI +/- CCMS are effective for trauma patients admitted for interpersonal violence in terms of recidivism, service utilization or alcohol abuse. The objective of this study is to assess outcomes for a cohort of young trauma patients in a prospective, randomized trial comparing BVI with BVI + CCMS.

Methods: Intentionally-injured patients, aged 10-24, admitted (2007-2009) to a level 1 trauma center, were randomized to receive a brief in-hospital psycho-educational violence intervention alone (Group I) or in combination with a 6 months wraparound community case management services (Group II) that included vocational, employment, educational, housing, mental heath and recreational assistance. Recidivism, alcohol use, hospital (HSU) & community (CSU) service utilization were assessed at 6 weeks (6W) & 6 months (6M).

Results: 50 out of 874 eligible injured patients were randomized into Group I & II. The 2 groups had similar demographics, injuries, and clinical outcomes(Table). Post discharge, % clinic visits maintained was 52% in both groups. Group II showed better HSU, CMS, and risk factor reduction at 6W and 6M. One patient in Group I was readmitted for reinjury at 6M.

Conclusion: In-hospital BVI with community wraparound case management interventions can improve HSU and CSU both short and long-term for high risk injured patients. Longer follow up is needed to show sustained reduction.

Table *p <0.05	Group 1 BVI (n=25)	Group II BVI + CCMS (n=25)
Age	19.5	19.3
gender (M:F)	21:1	22:2
Hosp LOS (d)	7	6.25
ICU LOS (d)	1.4	1.25
Ave ISS	13.2	11.25
No Insurance	32%	37.5%
Drug use	27%	33%
Appropriate ED visits- 6W	13%	33%
Appropriate ED visits -6M	8%	25%
CSU(6W)	22%	60%*
CSU(6M)	18%	95%*
Alcohol - 6W	75%	19%*
Alcohol- 6M	67%	50%
Re-injury -6W	0%	0%
Re-injury -6M	4.5%	0%

Session XIV

Paper 61 8:40 AM

POSTINJURY ABDOMINAL COMPARTMENT SYNDROME: THE MISSION COMPLETED

Zsolt J Balogh*, MD, PhD, FRACS, Andrew Martin, MD, Karlijn P van Wessem, MD, Kate L King, RN, Peter Mackay, RN, Ken Havill, MD. Department of Traumatology, John Hunter Hospital, University of Newcastle.

Invited Discussant: Joe Cushieri

Introduction: Postinjury abdominal compartment syndrome (ACS) is a known harbinger of poor outcome. The significance of sub-ACS Intra-abdominal hypertension (IAH) in shock/trauma resuscitation patients is unknown. *Purpose:* to determine (1) the effect of IAH on trauma outcomes and (2) potential independent predictors of postinjury IAH. **Methods:** 24-month prospective study was performed on consecutive shock/trauma admissions to a Level-1 trauma center's ICU. Intra-abdominal pressure (IAP) was measured 2-hourly. ACS and IAH were defined based on the World Society on ACS criteria. Demographics, injury and shock severity parameters, fluid and blood resuscitation volumes, interventions and outcomes (mortality, MOF, ICU LOS) were prospectively collected. Univariate and multiple logistic regression (MLR) analysis were performed. **Results:** Eighty-one polytrauma patients (Age: 41±2 years, 70% males, ISS: 29±1, BD:6±0.5mmol/L, Lactate: 3.3±0.5mmol/L, transfusions: 5±0.5U/24hrs, mort: 2.5%, MOF: 6%) met inclusion criteria. The average IAP was 14±1mmHg. None of the patients developed ACS. Sixty-one (75%) patients had sustained IAH. Patients with IAH and no-IAH had similar demographics, injury severity, injury pattern, shock severity and shock resuscitation. One IAH and 1 no-IAH patient died. MOF: 1 (5%) no-IAH vs 4 (7%) IAH. ICU LOS: 9+/-1 days in both IAH and no-IAH patients. IAH was poorly predictive of MOF (OR: 1.17 95%CI: 0.96-1.43, p=0.13). Of the 30 variables in MLR only base deficit, laparotomy and ED crystalloids identified as weak predictors of IAP>12mmHg. No predictors were found for the clinically more relevant IAP>15 mmHg and IAP>18mmHg. **Conclusions:** Most of the severe shock/trauma patients develop sustained IAH. Based on uni- and multivariate analysis, there is no difference in outcomes of IAH and no-IAH in trauma patients. MLR failed to show IAH as a predictor of MOF. The attenuation of the deadly ACS to IAH, which has no deleterious effect on outcomes, could be considered as one of the successes of the last decade in trauma and critical care.

Session XIV

Paper 62 9:00 AM

PERSISTENT FUNCTIONAL IMPAIRMENT IN OLDER TRAUMA PATIENTS: A PROSPECTIVE EVALUATION OF GERIATRIC CONSULTATION

Areti Tillou*, MD, MSEd, Lillian C Min, MD, Lorraine Kelley-Quon, MD, Eric A Morley, MPH, Jonathan R Hiatt*, MD, Henry G Cryer*, MD, PhD. University of California, Los Angeles.

Invited Discussant: John Morris

Introduction: Our recent retrospective study showed that geriatric patients have significant functional decline that persists for one year after injury. In this study we prospectively investigated function of daily living over 1 year and tested the effect of geriatric medicine consultation on long term functional outcome after injury.

Methods: Prospective comparison of Short Functional Status (SFS) pre and at 3,6, and 12 months post injury between 37 control patients (CG) admitted 2006-7 and 48 intervention patients (IG) admitted 2007-9, all aged =65 years. SFS rates 5 activities of daily living from 0 to 5 and has expected decline of 0 over 9-18 months in community-dwelling elders.

Results: IG and CG were similar (age 78±8 vs 77±7, white race 90% vs 86%, Injury Severity Score [ISS] 13±9 vs 12±7, Charlson Comorbidity Index 4±2 vs 4±1, and living alone 33% vs 16%), but the IG had fewer males (46% vs 71%, p=0.02). Not all patients completed all interviews. Pre and post injury SFS scores were:

	Mean SFS Intervention Group			Mean SFS Control Group		
	n	Pre-injury	Post-injury	n	Pre-injury	Post-injury
3 months	43	4.7	3.6*	12	4.6	3.7
6 months	38	4.6	3.9*	17	4.5	3.8
12 months	26	4.6	3.7*	35	4.5	3.3**

p<.05 for pre versus post injury SFS score within IC* and CG.**

Decline in SFS was not significantly different between the IC and CG at any time-point (p=.3 at 12 mo). Sole significant predictors of decline in multivariable analysis were higher ISS (β=.04 per ISS point, p=.04) and longer hospitalization (β=.05 days, p=.009).

Conclusion: This is the first prospective study to document substantial functional decline during the year following injury in older patients. This impairment was not affected by the geriatric consultation in this interim analysis. A better understanding of factors leading to decline will be necessary to design future interventions.

Session XIV

Paper 63 9:20 AM

Non-Trauma Surgical Emergencies: Transfers vs. Direct Admissions An Argument For Regionalizing Care

Heena P Santry, MS MD, Sumbal Janjua, MD, Yuichao Chang, PhD, Laurie Petrovick, CSTR, George Velmahos, MSEd MD PhD*. Massachusetts General Hospital.

Invited Discussant: Wayne Meredith

Introduction: Patients with major non-traumatic surgical emergencies are commonly transferred from smaller hospitals to a tertiary care center. Severe illness and delays in transfer may affect their outcomes. We hypothesize that transferred patients (TRANS) have worse outcomes than patients admitted directly to the tertiary center (DIRECT).

Methods: We reviewed all patients admitted to the acute care surgery service of our tertiary center (9/06-10/09) with one of eight diagnoses indicating a significant surgical emergency. Patients transferred for reasons other than the severity of illness were excluded. Uni- and multivariate analysis was used to compare TRANS and DIRECT patients.

Results: Of 319 patients, 103 (34%) were TRANS and averaged 3.8 days in the referring hospital before transfer. TRANS patients were more likely to be hypotensive (9% vs. 2%, p=0.021), tachycardic (20% vs. 12%, p=0.036), anemic (16.5% vs. 7%, p=0.013), hypoalbumenemic (50% vs. 14%, p=0.001), obese (18.5% vs. 8%, p=0.006), alcohol users (20% vs. 9%, p = 0.006) and to have cardiac (24% vs. 14%, p = 0.022) or pulmonary co-morbidities (25% vs. 12%, p = 0.003). Mortality and length of stay were higher for TRANS patients; controlling for co-variates describing co-morbidities and physiologic compromise eliminated these differences.

Outcome	DIRECT (N = 216)	TRANS (N = 103)	Univariate p-value	Multivariate p-value
Mortality rate	0.9%	4.9%	0.038	NS
Hospital stay (days)	8±9	12±12	< 0.001	NS
ICU stay (days)	1±4	3.5±8	0.002	NS

Conclusions: TRANS patients comprise a significant portion of the severely ill acute care surgery population managed at a tertiary center. They are sicker and have worse outcomes than DIRECT patients. If transferred before physiologic compromise occurs, they may have outcomes equivalent to DIRECT patients. This finding supports the argument for regionalization of non-traumatic surgical emergencies similar to trauma systems established for severely injured patients.

Session XIV

Paper 64 9:40 AM

SAFETY OF PERFORMING DELAYED ANASTOMOSIS DURING DAMAGE CONTROL LAPAROTOMY (DCL) FOR DESTRUCTIVE COLON INJURIES.

Carlos Ordonez,MD, Luis Pino, MD, Marisol Badiel, MD, MSc, John Loaiza, BSc, Juan Carlos Puyana*, MD. FundaciÃƒÂ³n Valle del Lili, Department of Surgery and Critical care.

Invited Discussant: Grace Rozycki

Background: Primary colonic anastomosis following penetrating abdominal trauma can be safely performed in the majority of patients. Recent reports raise concern over the safety of performing a delayed anastomosis (DA) in patients with destructive colon injuries (DCI) during DCL. Our current protocol is to perform a definitive closure of the colon in DCL unless there is persistent acidosis, bowel wall edema or evidence of peritonitis. We evaluated the safety of this approach by comparing the outcome of patients with DCI who underwent definitive closure of the colon during DCL versus patients managed with colostomy with or without DCL.

Methods: We performed a retrospective chart review of patients with penetrating DCI from 2003 to 2009. Variables of interest included severity of injury, surgical management and clinical outcome.

Results: 60 patients with severe gunshot wounds (GSW) and 3 patients with stab wounds were evaluated. DCL was required in 30 patients, all with GSW. Three patients died within the first 48 hours, 3 underwent colostomy and 24 were managed with delayed anastomosis. There were 33 patients managed without DCL: 26 were managed with primary anastomosis (PA) and 7 with colostomy. The overall mortality rate was 9.5 %. Three late deaths occurred in the DCL group; only one death was associated with an anastomotic leak.

Variable	DCL		Non-DCL	
	DA (n=24)	Colostomy (n=3)	PA (n=26)	Colostomy (n=7)
Age, mean±SD, yr	29.2 ± 12.2	35.1±7.9	32.1 ± 9.3	36.3 ± 7.2
ISS, mean±SD	25.7 ± 6.34*	27.7±2.3	21.6 ± 7.2*	28.8 ± 8
BE, mean±SD	-9.7 ± 4.7	-9.56±3.7	-8.21 ± 2.5	-8.3 ± 5.1
APACHE II, mean±SD	20.3 ± 7.1*	22±5.3	10.5 ± 6.5*	9 ± 6.6
ATI, mean±SD	38.5 ± 18.6*	46.5 ± 3.5	28 ± 10.2*	30.8 ± 17.1
Complications, %(n)				
Leak	7.7 (2) &	0	3.8 (1) &	0 (0)
Intra-abdominal abscess	54.2 (13) &	100 (3)	46.2 (12) &	42.8 (3)
Fascitis	12.5 (3) &	0(0)	11.5 (3) &	33.3 (1)
DCI related mortality	1	0	0	0

Conclusions: Delayed anastomosis in destructive colon injury during DCL is feasible and safe as long as persistent acidosis, bowel wall edema and/or peritonitis are not present.

Session XIV

Paper 65 10:00 AM

GLOBAL SURGICAL PACKAGE REIMBURSEMENT AND THE ACUTE CARE SURGEON: A THREAT TO OPTIMAL CARE

Eric B Schneider, PhD, Adil Haider, MD MPH, Cassandra Villegas, MPH, Anne O Lidor, MD MPH, Jonathan E Efron, MD, Kent A Stevens, MD MPH, Elliott R Haut*, MD, David T Efron*, MD. Johns Hopkins School of Medicine.

Invited Discussant: Samir Fakhry

Background: Emergency surgery patients have greater risk of mortality and morbidity compared to patients who undergo the same procedure electively. The differential effort required for the care of emergency surgical patients is poorly defined and is likely underappreciated. This study sought to characterize costs and outcomes of undergoing elective and emergent right hemicolectomy.

Methods: Data from the 2006 Nationwide Inpatient Sample were examined. Total charges and LOS were compared between patients undergoing emergency or elective right hemicolectomy (primary ICD-9 procedure code 45.73). Mann-Whitney tests examined the equality of charges and LOS between groups. In hospital mortality was examined using multivariable regression models controlling for age, gender and underlying comorbidities.

Results: Among 8,074,825 inpatient admissions, 8,056 emergent and 10,626 elective right hemicolectomies were identified. Emergent patients were slightly older (67.4 vs. 65.9 years, $p < 0.001$), more likely to be female (43.7% vs.42.3%, $p = 0.048$) and had a higher mean Charlson score (3.47 vs. 3.07, $p < 0.001$) than elective patients. LOS for emergent patients was nearly double that of elective patients (13 vs. 7 days respectively, $p < 0.001$). Mean total charges were $78,718 in the emergent vs. $39,296 in the elective group ($p < 0.001$). Emergent patients had six-fold greater odds of in-hospital mortality (O.R. = 6.15, 95% CI, 5.06 – 7.48).

Discussion: Emergent patients carry greater co-morbidity, experience longer lengths of stay, accrue twice the total hospital charges and have a markedly increased risk of death. Together, these reflect the heightened effort required to care for these patients, however, Global Surgical Package reimbursement remains procedurally based and does not account for this. The concentration of emergency surgical patients in the realm of acute care surgery necessitates accounting for these predictable risks to ensure optimal care of the patient.

Session XIV

Paper 66 10:20 AM

TEMPORARY ABDOMINAL CLOSURE: LONG-TERM COMPLICATIONS

Nirav Y Patel, MD, Thomas H Cogbill*, MD, Kara J Kallies, BA, Michelle A Mathiason, MS.
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Invited Discussant: Rosemary Kozar

Introduction: Temporary abdominal closure (TAC) is a valuable tool utilized by surgeons caring for critically ill/injured patients. The objective of this study was to determine the incidence of hernia formation and intestinal obstruction in patients who underwent TAC.

Methods: A retrospective review of patients who underwent TAC from September 2000 to December 2007 was completed. Patients were stratified by indication for TAC. Statistical analysis included chi square, fisher exact test, and Wilcoxon rank sum test.

Results: 117 patients underwent TAC during the study period. 30-day mortality was 18%. Seventy-eight (66%) patients survived = 6 months after discharge, follow-up was established in 96%, with a median follow-up of 34.7 months. Three patients were lost to follow-up.

		Patients with = 6 months follow-up		
	Overall	Planned Second Look	Abdominal Compartment Syndrome/Unable	*P* value
N	117	55	20	
Temporary closure, n (%)				0.002
VAC	23 (20)	9 (16)	8 (40)	
Skin only	36 (31)	27 (49)	1 (5)	
1010 drape/Bogota Bag	58 (50)	19 (35)	11 (55)	
Days open, median	3	2	5	0.009
Final Closure, n (%)				0.198
Primary	103 (88)	51 (93)	16 (80)	
Skin	9 (8)	4 (7)	4 (20)	
Expired prior to closure	5 (4)	NA	NA	
Complication per patient, n (%)				
Hernia	NA	13 (24)	6 (30)	0.575
Obstruction	NA	3 (5)	2 (10)	0.605

Conclusion: Primary final closure was afforded in 88%. Delayed (> 6 months) abdominal wall hernias and intestinal obstructions developed in 25% and 7% of patients with follow-up. No difference in these complications was observed based on TAC indication.

Session XIV

Paper 67 10:40 AM

THE EFFECT ON MORTALITY PREDICTION OF THE MODIFIED GCS CRITERIA FOR MILD TRAUMATIC BRAIN INJURY FROM A GCS SCORE OF 14 TO A GCS SCORE OF 13

Jorge Mena, MD, Andres Rubiano, MD, Alvaro Sánchez, MD, Jason Sperry, MD, Andrew B Peitzman, MD, Juan Carlos Puyana*, MD. University of Pittsburgh.

Invited Discussant: James Dunne

Objective: Traditionally, Glasgow coma scale (GCS) was used to classify Traumatic Brain Injuries (TBI) into Mild (14-15); Moderate (9-13) and Severe (3-8). Recently, ATLS modified this classification to include a GCS score of 13 within the mild category of TBI (Mild 13-15). We performed a statistical comparison in order to measure the effect on mortality prediction for an admission GCS score of 13 classified as moderate (Model 1) versus an admission GCS score of 13 classified as mild TBI (Model 2).

Methods: We queried a state wide trauma database for patients between 18 and 65 years of age who sustained TBI from 1998 to 2007. Multivariate logistic regression analysis adjusting for age, sex, cause, severity, trauma center level, comorbidities, and isolated TBI was performed for both models. Discrimination, defined as the ability of the models to accurately predict mortality was evaluated using the area under receiver operating characteristic curve (AUC). Calibration, defined as the ability of the models to accurately quantify the risk of mortality was evaluated using the Hoslmer-Lemershow goodness of fitness (GOF) test.

Results: There were 63.795 patients with TBI. Mortality rate was 6%. The AUC of model 1 was 0.91 (95 %CI, 0.90 - 0.92) and the AUC of model 2 was 0.85 (95 %CI, 0.84 - 0.86). The lack of overlap between confidence intervals for the two models reveals a statistically significant difference in their ability to predict mortality.

Conclusion: The classification of an admission GCS score of 13 as moderate TBI in a multivariate logistic regression model results in better discrimination than a model where a GCS of 13 is classified as mild. This analysis does not support the recent ATLS recommendation to reclassify a GCS score of 13 as mild TBI. Further analyses are required to adequately determine the appropriateness of this new classification.

Session XIV

Paper 68 11:00 AM

SWALLOWING DYSFUNCTION IN TRAUMA PATIENTS WITH CERVICAL SPINE FRACTURES TREATED WITH HALO-VEST FIXATION

Joel F Bradley III, MD, Mark A Jones, MD, Elizabeth Farmer MS, CCC-SLP, Stephen A Fann, MD, Raymond P Bynoe*, MD. University of South Carolina/Palmetto Health Richland.

Invited Discussant: David Wisner

Introduction: Cervical spine fractures are common in traumatically injured patients. The halo-vest brace is a treatment used in our institution for a select group of these patients. Our hypothesis is that the use of halo-vest fixation is associated with a high incidence of dysphagia.

Methods: All trauma patients at our Level I Trauma Center from 8/05 to 8/07 were analyzed retrospectively via the trauma registry (N=3702). Included were adult patients with cervical spine fractures treated with halo-vests and evaluated formally by speech-language pathologists for dysphagia and aspiration.

Results: Of the 3702 trauma patients in our time period, 369 (10%) had cervical spine fractures from blunt trauma. 79 of these 369 (21%) were treated with halo-vests. 56 of the 79 (71%) were formally evaluated by speech language pathologists. Out of the study population (N=56), 19 (34%) had no evidence of swallowing dysfunction and the remaining 37 (66%) had evidence of dysphagia. 13 (23%) exhibited symptoms of aspiration. Patients were categorized into mild, moderate, and severe dysphagia by speech pathologists. There was no significant difference in age, gender, ISS, arrival RTS or GCS. Dysphagia is associated with longer ICU stays ($p=0.019$) and trends towards a longer hospital stay ($p=0.083$). In trauma patients with halo-vests, increasing severity of dysphagia from mild to moderate is associated with longer vent days ($p=0.005$), ICU days ($p=0.001$), and hospital length of stay ($p=0.015$). In patients with dysphagia the number of levels of c-spine fracture is predictive of severity ($p=0.036$).

Conclusion: Patients with cervical fractures treated with halo-vest fixation have a significantly high incidence of dysphagia and aspiration. Dysphagia in trauma patients treated with halo-vests for c-spine fractures is common, associated with worse outcomes, and difficult to predict. Therefore all of these patients should be formally evaluated for dysphagia.

Session XIV

Paper 69 11:20 AM

CAN ACUTE CARE SURGEONS PERFORM EMERGENCY COLORECTAL PROCEDURES WITH GOOD OUTCOMES?

Kevin M Schuster, MD, Edward McGillicuddy, MD, Adrian Maung, MD, Felix Y Lui, MD, Lewis J Kaplan*, MD, Kimberly A Davis*, MD. Yale University School of Medicine.

Invited Discussant: George Velamahos

Introduction: Acute care surgeons (ACS) perform emergency colorectal procedures but may have lower case volumes as compared to their general surgical and colorectal colleagues which may compromise outcomes. The elderly may be at particular risk.

Methods: Records of all elderly patients (age>65) presenting to a tertiary center with a colorectal emergency requiring operation over a 7 year period were reviewed. Data abstracted included presenting characteristics, pre and post-operative diagnosis, procedural details, surgeon and outcomes. Chi-square, Fisher's exact test, and t-test were used and, logistic regression models controlled for patient characteristics. $p<0.05$ was significant.

Results: There were 293 emergent colorectal operations. Mortality was 15% (43/293). The table identifies differences in presenting patient characteristics.

Patient Characteristic	ACS	Other Surgeons	Odds Ratio (95%CI)
Total patients	60 (26%)	233 (74%)	
Asthma	5 (8.1%)	5 (2.3%)	4.15 (1.16 – 14.82)*
Insulin dependent	16 (26.7%)	36 (15.5%)	1.99 (1.02 – 3.90)*
Extended care facility patient	11 (18.3%)	19 (8.2%)	2.53 (1.13 – 5.65)*
Hypotensive (SBP<90)	12 (20%)	21 (9.0%)	2.52 (1.16 – 5.48)*
Febrile	11 (18.3%)	11 (4.7%)	4.53 (1.86 – 11.05)**
Diagnosis unknown pre-op	25 (41.7%)	55 (23.6%)	2.31 (1.27 – 4.20)**
No fascial closure	9 (15.0%)	9 (3.9%)	4.38 (1.66 – 11.62) **
Time to OR (hours)	3.07	4.34	p=0.096

*p<0.05, **p<0.01

ACS mortality was higher than other surgeons 32.6% vs. 12.4% (OR 2.14, p=0.034). Length of stay (LOS), ICU LOS, and vent days were longer for ACS although not significant. On multivariate analysis pre-op hypotension ($p<0.001$), a-fib (p=0.028), COPD (p=0.036), age ($p<0.001$), time to OR (p=0.002), and management with an open abdominal technique ($p<0.001$) predicted mortality but surgeon type was not significant.

Conclusion: Acute care surgeons caring for colo-rectal emergencies encounter critically ill patients with significant co-morbidities, often from extended care facilities. Therefore patient characteristics must be considered when scrutinizing their outcomes.

Session XIV

Paper 70 11:40 AM

NON-TRAUMA EMERGENCY SURGERY: OPTIMAL CASEMIX FOR GENERAL SURGERY AND ACUTE CARE SURGERY TRAINING

Jill Cherry-Bukowiec MD, Melissa Brunsvold MD, Kristen Sihler MD, Mark Hemmila MD*, Pauline Park MD*, Krishnan Raghavendran MD*, Wendy Wahl MD*, Stewart Wang MD*, Barbra S Miller MD, Gerard M Doherty MD, Lena M Napolitano MD*. University of Michigan.

Invited Discussant: Jerry Jurkovich

Objective: To examine the case mix and patient characteristics and outcomes of the Non-Trauma Emergency (NTE) service in an academic Division of Acute Care Surgery.

Methods: An NTE service (attending, chief resident, PGY-3 and PGY-1 residents) was created in July 2005 for all emergent general surgery patient admissions. An NTE database was created with prospective data collection of all admissions to the NTE service from 11-1-07 through 12-31-09. Prospective data were collected by a dedicated trauma registrar and APACHE-ICU coordinator daily. NTE case mix & ICU characteristics were reviewed.

Results: 1262 operative cases were performed on the NTE service during this time period. A significant portion of NTE patients required ICU admission, with higher admission APACHE 3 scores (61.2 vs. 58.8; 58.2 vs. 55.8), increased mortality and increased readmission rates (15.5% vs. 7.4%) compared to the total SICU admissions.

Total Cases	Lap Appe	Open Appe	Lap Chole	Open Chole	Laparotomy, Major Abdominal Procedures	Hernia	Debride skin, I&D abscess	Other (Trach, PEG,
1262	192	68	242	64	418	58	136	84
100%	15.2%	5.4%	19.2%	5.1%	33.2%	4.6%	10.8%	6.5%

Year	NTE ICU Admits	% of Total ICU Admits	APACHE 3 ICU Day 1 Mean Median (Min – Max)	ICU LOS Mean Median (Min-Max)	NTE ICU Deaths	Total ICU Deaths	NTE ICU Re-admits
2008	101	7.9%	61.2 60 (19 – 124)	7.73 4.03 (0.03 – 91.81)	10 (9.71%)	53/1083 4.89%	12 11.9%
2009	116	9.0%	58.2 55.5 (8 – 141)	4.91 2.88 (0.22 – 33.52)	8 (6.78%)	52/1007 5.16%	18 15.5%

Conclusion: In an era of declining operative caseload in trauma, the NTE service provides ample opportunity for complex general surgery decision-making and operative procedures for surgical residency education, including complex surgical critical care management.