Session IV

Poster # 1

SECONDARY ABDOMINAL COMPARTMENT SYNDROME FOLLOWING SEVERE EXTREMITY INJURY: UNAVOIDABLE OR UNNECESSARY?

Bryan A Cotton MD, Michael C Madigan BS, Clinton D Kemp MD, J Chad Johnson MD PhD, John A Morris Jr MD*, Vanderbilt University Medical Center, Nashville, TN

Introduction: Secondary abdominal compartment syndrome (2ACS) is the development of ACS in the absence of abdominal injury. 2ACS is often viewed as an unavoidable sequela of the large volume crystalloid resuscitation "required" to treat severe shock. We hypothesized that early, aggressive resuscitation techniques place patients with severe extremity injuries at risk for developing 2ACS.

Methods: The TRACS database was queried for all patients with extremity AIS of 3 or greater and abdominal AIS of 0 treated at our institution between 01/01/2001-12/31/2005. The study group included those patients who developed 2ACS, while the comparison cohort included those who did not develop 2ACS.

Results: 48 patients developed 2 ACS and were compared to 48 randomly sampled patients who had extremity AIS of ? 3 and abdomen AIS of 0. There were no differences between the groups with respect to age, sex, race, or individual AIS scores. However, the 2ACS group had a higher ISS (25.6 vs 21.4, p=0.02), higher OR crystalloid administration (9.9 L vs 2.7 L, p<0.001), and more frequent use of a rapid infuser (12.5% vs 0.0%, p=0.01). 65% of those who developed 2ACS did so within 12 hours of admission. Multiple logistic regression identified pre-hospital and ED crystalloid volume as predictors of 2ACS.

	2ACS, n=48	No 2ACS, n=48	p-value
Pre-hospital crystalloids, mean	2.7 liters	1.3 liters	<0.0001
ED crystalloids, mean	2.7 liters	1.1 liters	0.0002
Aero-medical transport (%)	60.4%	39.1%	0.04
Pre-hospital/ ED femoral access	66.7 %	4.2 %	<0.0001

Conclusions: Aggressive resuscitation techniques, often begun in the pre-hospital setting, appear to increase the likelihood of patients with severe extremity injuries developing 2ACS. Early, large volume crystalloid administration is the greatest predictor of 2ACS.

Session IV

Poster # 2

A NOVEL, SELF-EXPANDING, HEMOSTATIC POLYMER TO CONTROL EXSANGUINATING EXTREMITY BLEEDING

George C. Velmahos MD PhD*, Malek Tabbara MD, Marco Serra PhD, Konstantinos Spaniolas MD, Liping Sun PhD, Michael Duggan DVM, Javier de Luis PhD, Hasan B. Alam MD*, Massachusetts General Hospital, Boston, MA

Background: Prehospital management of exsanguinating extremity injuries (EEI) includes direct compression and/or tourniquets. Direct compression may be ineffective in deep wounds and requires a person committed to compressing. Tourniquets may cause severe ischemic damage and be ineffective in proximal wounds. This study aims to examine a new self-expanding hemostatic polymer (SEHP) for control of EEI. The polymer is contained in 4" x 4" bags that allow expansion. In contact with blood the polymer: 1) absorbs the aqueous component of blood, concentrating the natural coagulation factors, 2) exerts a tamponade effect by expanding against the walls of the wound cavity.

Methods: 21 pigs were subjected to a validated and reproducible model of lethal proximal extremity injury by transecting soft tissues and the femoral vessels. The pigs were left to bleed uncontrollably for 3 minutes and then randomized to receive either a standard compression dressing (N=10) or SEHP (N=11). After 5 min of manual compression, the dressing or SEHP were left in the wound and the animals resuscitated over 2 hours.

Results: SEHP animals had lower blood loss and mortality than CONTROL animals.

	CONTROL (N=10)	SEHP (N=11)	p-value
pH Baseline	7.39±0.06	7.39±0.04	0.88
pH End	7.42±0.15	7.37±0.09	0.49
Lactate Baseline (mmol/L)	0.96±0.86	0.96±0.41	0.99
Lactate End (mmol/L)	8.3±3.9	3.7±2.4	0.01
MAP baseline (mmHg)	81±16	90±17	0.20
MAP end (mmHg)	21±14	47±17	0.002
Total Blood Loss (ml)	1989±516	1356±292	0.004
Mortality	6 (60%)	1 (9%)	0.02

Conclusions: SEHP is a novel, light, and portable material to control EEI effectively. It does not require another person for compression nor does it compromise the circulation. With the increasing significance of EEI in the battlefield, it may present an optimal hemostatic method for military applications but also be useful in any prehospital setting.

Session IV

Poster # 3

LUNG REPAIR AFTER INJURY INVOLVES BONE MARROW DERIVED PROGENITOR CELLS

SG Shah MD, ZC Sifri MD, A Penn MD, AM Mohr MD*, CD Badami MD, LM Bonilla BA, DH Livingston MD*, University of Medicine and Dentistry of New Jersey, Newark, NJ

Background: It has previously been shown that lung contusion causes a rapid and massive release of BMPC to the site of injury. The fate of these cells is unknown. The aim of our study was to determine the fate of these progenitor cells at the site of injury.

Methods: Male Sprague-Dawely rats were taken at weights of 300-350 g. The right femur BMC were harvested and tagged with CFDA-SE (Invitrogen) dye. These rats were then subjected to cannulation of femoral vein and a unilateral lung contusion. The tagged BM cells were then injected 90 minutes post contusion. At seven days the rats were sacrificed, portions of the lungs were morselized and placed in culture for BMPC and the remaining portion of lung was embedded in tissue freezing media. The lungs were processed and stained with antibodies to flourescein and SPB (type II pneumocytes) or T1alpha (type I pneumocytes). These sections were examined under fluorescent microscopy.

Results: Using direct immunoflourescence the initially tagged cells are still detected at 7 days within the injured lung, the contralateral noncontused lung has minimal fluorescence. At 7 days, the growth of CFU-E and BFU-E colonies in the injured lung equivalent is to contralateral noncontused lung (1.67±0.29 vs. 1.33±1.26 and 2.5± 0.87 vs. 1.5±0.5 colonies/plate, respectively). These tagged cells have taken the morphology of native lung cells (Fig. 1) and stain positive for SPB and T1alpha respectively.

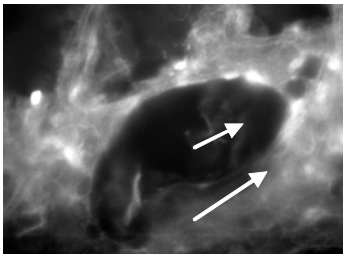


Fig 1. Tagged BMPC with native lung cell morphology

Conclusion: BM derived cells home to injured tissue and contributing to regeneration of lung following injury. These cells are no longer progenitor cells, have no colonogenic potential and have differentiated into type I and type II pneumocytes. The future studies will be directed to delineate the mechanism of homing at the injured tissue level and systemically.

Session IV

Poster # 4

PNEUMOMEDIASTINUM FOUND ON COMPUTED TOMOGRAPHY SCAN IN BLUNT TRAUMA PATIENTS: A MARKER FOR OCCULT INJURY OR A RED HERRING?

Daniela Molena MD, Nicole Burr. Medical Student, Andrea Zucchiatti MD, Mark L. Gestring MD*, Julius D. Cheng MD, Paul E. Bankey MD* and Nicole A. Stassen MD; University of Rochester, Rochester, NY

Background: With the increased use of chest CT scan (CT) in the initial evaluation of major trauma, findings that were not diagnosed with a conventional chest radiograph (CXR) are increasingly identified. Their clinical significance, however, is not always clear. Pneumomediastinum (PM) seen on CXR in blunt trauma patients is considered worrisome for airway and/or esophageal injury. The purpose of this study was to determine the clinical significance of PM found on CT scan in blunt trauma patients.

Methods: Blunt Trauma patients admitted to a single institution over a two year period were identified. Records were reviewed for demographics, mechanism, diagnostic evaluations performed, injuries sustained, procedures performed and outcome.

Results: 2052 patients met study criteria. 1417 (69%) had a CT. 55 (2.7%) had PM. 49 patients (89%) had PM identified on CT alone (PMCT), while 6 patients (11%) had it identified on both CXR and CT (PMCXR). There was no significant difference in gender or age between the two groups. MVC were more common in the PMCT group. Associated injuries were similar between groups, except the mean AIS head and neck was significantly higher in the PMCT group. The higher mean LOS, vent days, and increased mortality in the PMCT group was directly related to their higher head and neck AIS. No patients had tracheo-bronchial or esophageal injuries.

	PMCT (n=49)	PMCXR (n =6)
MVC	23 (47%)*	2 (33%)
Mean ISS	23 ± 13	19 ± 7
Mean AIS Head and Neck	1.10±1.76*	0.33±0.82
Mean LOS	13 ± 15*	7 ± 5
Mean ICU LOS	6 ± 10*	2 ± 4
Mean Vent Days	6 ± 11*	1.5 ± 4
Home	26 (54%)*	6 (100%)
SNF/Rehab	15 (30%)	0
Death	8 (16%)[$]	0

[$]Death not attributable to missed thoracic injury, *p<0.05

Conclusions: PM is found more frequently with the routine use of CT in the initial evaluation of blunt trauma than with CXR alone. In this study PM seen on CT was found to have little clinical significance other than as a marker for severe blunt trauma. No patients with airway or esophageal injuries were seen in any of the PM patients.

Session IV

Poster # 5

INDICATION FOR TRANSCATHETER ARTERIAL EMBOLIZATION IN PERSISTENT HEMOTHORAX CAUSED BY BLUNT TRAUMA

Akiyoshi Hagiwara MD, Youichi Yanagawa MD, Naoyuki Kaneko MD, Akira Takasu MD*, Kousuke Hatanaka MD, Toshihisa Sakamoto MD, Yoshiaki Okada MD, National Defense Medical College, Tokorozawa, Japan

Objective: To confirm the usefulness of contrast enhanced computer tomography (CECT) and the efficacy of transcatheter arterial embolization (TAE) in patients who had hemothorax and underwent tube thoracostomy following blunt chest trauma.

Materials and Methods: For patients who had blunt chest trauma but did not require acute thoracotomy, CECT was performed on admission. Homogeneous soft tissue opacity suggestive of intrapulmonary hematomas was identified by CT images, and that with pneumatoceles was diagnosed as a pulmonary laceration (PL). Size of PLs was measured as % volume (volume of a PL/volume of the lung). Patients with PLs with a residual pneumothorax of ?10% over the thoracic cavity were excluded. Degree of displacement of rib fractures was measured using CT images in terms of changes vertical to and parallel to the fractured ribs (VD and PD, respectively). Cases with an injury to the thoracic great vessels (cf. aortic injury) were excluded.

Results: Our trauma center received 267 consecutive patients with blunt chest traumas, and CECT was performed on 154 patients. Of the 154 patients, 34 had PLs without an injury to the thoracic great vessels. Tube thoracostomy was performed on 37 sites of 29 patients. Following initial blood discharge, mean blood discharge was 76.6±135.4 mL/h. Mean % volume of PLs was 30±15%. Mean PD was 12.1±10.6 mm. VD/PD and blood loss were significantly correlated ($p=0.028$, $p=0.032$, respectively). No significant correlation was found between % volumes of PLs and blood loss ($p=0.112$). Of the 37 thoracostomy sites, 6 had blood loss of ?200 mL/h. Contrast extravasation was observed in 5 of the 6 sites, and angiography was performed. All of the 5 sites had contrast extravasation from the intercostal artery, and TAE was successfully performed.

Conclusion: For cases with persistent hemothorax of ?200 mL/h, when a large degree of displacement of the rib fracture is identified, the hemothorax is possibly caused by intercostal arterial bleeding. In such cases, CECT should be performed to confirm the bleeding. If the CT shows contrast extravasation, TAE is indicated.

Session IV

Poster # 6

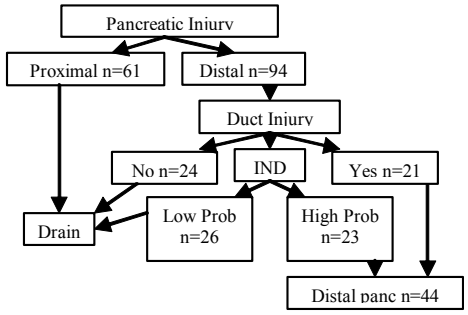
IMPROVING OUTCOMES FOLLOWING TRAUMATIC PANCREATIC INJURIES: APPLICATION OF A MANAGEMENT ALGORITHM

Shaun M. Stickley MD, Louis J. Magnotti MD, Matthew Mulloy MD, Peter E. Fischer MD, Stephanie A. Savage MD, Thomas J. Schroeppel MD, Martin A. Croce MD*, Timothy C. Fabian MD*, University of Tennessee Health Science Center, Memphis, TN

Background: The optimal management of pancreatic injuries, specifically with respect to defining ductal integrity, remains controversial. Our previous experience suggested that management decisions based on probability of ductal injury rather than intraoperative ductal imaging might improve outcome (*J Trauma, 1997)*. A management algorithm (ALG) was developed and implemented (Figure). Patients managed by the ALG were compared to the previous study (PS, n=124).

Methods: Consecutive patients with pancreatic injuries subsequent to the development of the ALG were evaluated. Pancreatic injuries were defined as proximal or distal based on relation to the mesenteric vessels. Distal ductal injuries were classified as definite, high, low or indeterminate (IND) probability. Pancreas-related morbidity (fistula, abscess, pseudocyst) and mortality were compared between the ALG and PS groups.

Results: 181 patients were identified. 26 died within 12 hours and were excluded. Demographics, injury severity and degree of shock (24-hour transfusions) were similar between groups. Pancreas-related morbidity for proximal injuries was 13% in the ALG group vs 11% in the PS group (p=ns). Pancreas-related morbidity was significantly reduced in the ALG group for both distal injuries requiring drainage alone (11% vs 21%) and for distal injuries requiring resection + drainage (19% vs 42%) when compared to the PS group ($p<0.05$). There was no pancreas-related mortality in the ALG group vs 1.6% in the PS group.



Conclusions: Implementation of the ALG resulted in zero pancreas-related mortality and a significant decrease in morbidity. Proximal pancreatic injuries can be treated with drainage alone; for distal injuries, a clinical decision based on defined parameters and suspicion of ductal injury leads to easily accomplished management techniques.

Session IV

Poster # 7

DIAGNOSIS OF BLUNT INTESTINAL AND MESENTERIC INJURY IN THE ERA OF MULTI-DETECTOR CT TECHNOLOGY - ARE RESULTS BETTER?

A. Peter Ekeh MD*, Jonathan M. Saxe, MD*, Mbaga Walusimbi MD, Kathyrn Tchorz MD, Randy J. Woods MD, Harry L. Anderson III MD*, Mary C. McCarthy, MD*, Miami Valley Hospital, Dayton, OH

Background: Blunt Bowel and Mesenteric injuries (BBMI) can present diagnostic difficulties and are occasionally sources of missed injuries. Most studies evaluating these injuries predate multi-detector CT scan technology. We set out to determine if the current era of multi-slice CT scanning has changed patterns of diagnosis of BBMI.

Methods: All patients with blunt small and large intestinal injury as well as mesenteric lacerations, recognized in the operating room (OR) between 11/2000 and 12/2006 were identified from the trauma registry. A 4-slice helical multi-detector CT scan was in use for abdominal CTs during the first portion of the study (11/2000 - 7/2005) while a 16-slice CT was in use in the second portion (7/2005 – 12/2006). Rectal injuries and serosal tears were excluded.

Results: Eighty-two patients were identified with BBMI. Twenty-five pts went directly to the OR for laparotomy for a positive DPL, FAST or other injury. Of 57 pts who underwent CT, findings indicating possible BBMI were present in 46 pts (80.7%). These included free fluid w/o solid organ injury (50.9%), free air (10.5%), active mesenteric bleeding (10.5%) & bowel swelling (5.3%). Majority of the patients with positive CTs (91.3%) proceeded promptly to the OR, while 7% had delayed surgery due to non-recognition of injury. Twelve patients (21%) had delayed bowel or mesenteric injury recognition with the diagnosis ultimately made by repeat CT or in the OR (range 1-17days)

	Negative CT	Free Fluid w/o Organ injury	Mesenteric Bleeeding	Delayed diagnosis
4 Slice	20%	17/40	4/40	17.5%
16 Slice	17.6%	12/17	2/17	29.4%
p value	1.0000	0.0819	1.000	0.4783

Conclusion: Missed injuries remain common in BBMI even in the current era of multi-slice CT Scanners. Free fluid w/o solid organ injury, though not specific, continues to be an important finding. Adjuncts to CT are necessary for the optimal diagnosis of bowel injuries.

Session IV

Poster # 8

CLOSING THE UNCLOSABLE ABDOMEN: IMPROVED SUCCESS WITH WITTMANN PATCH STAGED ABDOMINAL CLOSURE

Ashley H. Stewart MD, Jordan A. Weinberg MD, Richard L. George MD, Russell Griffin MPH, Sherry M. Melton MD*, Loring W. Rue III MD*, University of Alabama at Birmingham, Birmingham, AL

Background: While the application of both damage control and decompressive laparotomy has contributed to improved outcomes in trauma patients, new challenges of managing the "open abdomen" have emerged. Since mid-2004, we have incorporated Wittmann Patch (Star Surgical, Burlington, WI) staged abdominal closure (WPSAC) into our management of the open abdomen. The purpose of this study was to evaluate the impact of WPSAC on our incidence of fascial closure vs. planned ventral hernia.

Method: Patients who underwent damage control or decompressive laparotomy from 2001 through 2006 were identified from the TRACS® trauma registry. In 2004, a clinical pathway for the management of the open abdomen that included WPSAC was instituted. Patients managed prior to WPSAC (PRE-WP) were compared with those managed in the WPSAC era (WP).

Results: 57 open abdomens were managed in the PRE-WP group and 103 were managed in the WP group over the period of study. ISS was similar between groups, but the proportion of severe abdominal injury (abdominal AIS >3) was greater in the WP group (WP 73% vs. PRE-WP 55%; p ? 0.05). In the PRE-WP group, 24 (42%) could not be closed at the first subsequent laparotomy vs. 34 (33%) in the WP group (p NS). Among these patients, a higher rate of delayed fascial closure was achieved in the WP group vs. PRE-WP (76% vs. 29%; p ? 0.025). When combined with those closed at the first subsequent laparotomy, the incidence of ultimate fascial closure was higher in the WP group (WP 92% vs. PRE-WP 70%; p ? 0.025).

Conclusion: Incorporating WPSAC into a clinical pathway for management of the open abdomen has contributed to a reduced incidence of planned ventral hernia, despite a concomitant increase in abdominal injury severity. Fascial closure is achievable for the great majority of open abdomens.

Session IV

Poster # 9

IS SPLENIC EMBOLIZATION SUPERIOR TO OPERATION FOR BLUNT INJURIES?

Wendy L. Wahl MD*, Ben Wei MD, Paul Maggio MD, Mark Hemmila MD*, aul Taheri, MD MBA*, Sam Arbabi MD MPH*, Harborview Medical Center, University of Vermont, and University of Michigan, Ann Arbor, MI

Introduction: Non-operative management for blunt splenic injury (BSI) has become gold-standard but the role of embolization is still controversial for bleeding.

Hypothesis: We postulated that splenic embolization for BSI would have superior outcomes compared to operation.

Methods: This was a retrospective study of all adult trauma patients admitted to our ACS level I center from 2000 through 2006. Multivariate analysis adjusting for age, ISS and GCS was performed. Only operative patients who had a CT scans prior to surgery (CT+OR) were compared to those who had CT scans then angiographic embolization (CT+Angio)

Results: 87 of 317 patients required initial intervention for their BSI, for a nonoperative rate of 88.6% and no intervention rate (no OR or Angio) of 72.5%. The groups had similar ISS, mortality, and lengths of stay. The CT+Angio group was older ($p<0.01$), had higher spleen AIS ($p=0.02$) and required significantly lower packed RBC transfusions, $p<0.0001$. The overall hospitalization costs were not different, but the number of intraabdominal complications was higher for the CT+OR group (36% vs 6%, $p<0.01$). Pneumonia, thromboembolic events and pleural effusions were equivalent. There were no deaths from splenic hemorrhage.

Group	N	ISS	Spleen AIS	Age (Years)	LOS (Days)	Mort N(%)	# RBC N	Total Costs $K
CT+OR	36	34±12	3.4±1	38±14	14±10	2 (6)	6.2±5	47±11
CT+ANGIO	51	29±11	*3.8±.5	*47±19	12±12	4 (8)	*2.1±2	40±13

Conclusion: Despite recent concerns that angioembolization may be over-utilized for BSI, this study showed equivalent outcomes. There was a lower incidence of abdominal complications and blood utilization in the angiographically embolized group. The outcomes were similar in the face of an older age group and higher splenic AIS for the group treated with embolization.

Session IV

Poster # 10

LONG-TERM OUTCOMES AFTER ABDOMINAL WALL RECONSTRUCTION WITH ACELLULAR HUMAN DERMIS IN PATIENTS WITH ABDOMINAL INJURIES

William L. Newcomb MD, William W. Hope MD, Thomas M. Schmelzer MD, H. James Norton PhD, Amy E. Lincourt PhD, Gamal Mostafa MD, David A. Iannitti MD, Ronald F. Sing DO*, B. Todd Heniford MD, Carolinas Medical Center, Charlotte, NC

Introduction: Damage control celiotomy and intra-abdominal compartment syndrome in critically ill trauma patients can result in loss of abdominal domain or incisional hernia. Subsequent abdominal wall reconstruction often requires mesh to bridge a fascial gap. Long-term outcomes after placement of biologic prosthetics in this setting have not been well described.

Materials and Methods: Patients with abdominal injuries who received acellular human dermis (AHD) to bridge a ventral abdominal fascial defect at a single institution were retrospectively reviewed. The SAS® Version 9.1 software (SAS Institute, Cary, NC) was used for all statistical analyses; $p<0.05$ was considered statistically significant.

Results: Fourteen patients were identified with a mean age of 40 (19-70) years, body mass index of 31 (17-73) kg/m^2, ASA score of 2.5 (2-3), graft size of 231 (36-704) cm^2, operating room time of 328 (41-603) minutes and median LOS of 21 (4-164) days. The average prosthetic cost was $7,396 ($1,152-22,528). Wound classifications were clean (36%), clean-contaminated (21%), contaminated (36%), and dirty (7%). Mean follow-up was 7 (0-28) months. Recurrence rates were calculated for 5 follow-up groups: 0-3 months (0%), 3-6 months (0%), 6-9 months (33%), 9-12 months (33%), and ?12 months (100%). Patients with greater than 9 months follow-up (2/2) recurred. In most patients a progressive eventration of the mesh has been noted. ASA score (P=0.527), BMI (P=0.683), and graft size (P=0.292) did not affect recurrence.

Conclusions: When used to bridge a fascial defect in patients after abdominal injury, AHD stretches over time leading to recurrent herniation. A synthetic prosthetic should be used in clean repairs. When AHD is utilized in contaminated cases, a formal repair with a durable prosthetic should be considered following clinical improvement and resolution of infectious complications.

Session IV

Poster # 11

TRAUMATIC ENTEROCUTANEOUS FISTULAS: THE PRICE OF THE OPEN ABDOMEN

Peter E. Fischer MD, Timothy C. Fabian MD*, Thomas J. Schroeppel MD, Tiffany K. Bee MD, Louis J. Magnotti MD, George O. Maish III MD, Stephanie A. Savage MD, Martin A. Croce MD*, University of Tennessee Health Science Center, Memphis, TN

Introduction: In the era of open abdomen management, the complication of enterocutaneous fistula (ECF) seems to be increasing in frequency. In non-trauma patients, reported mortality rates are 7- 20 % and spontaneous closure rates are approximately 25%, with the majority being low output. This study is the largest series of ECF's reported exclusively due to trauma, and examines the characteristics unique to this population.

Methods: Trauma admissions at a single regional trauma center over a 10 year period (1996-2005) were reviewed for trauma laparotomy and ECF. Parameters studied included fistula output (>500mL high, 200-500 medium, <200 low), site, nutritional status (prealbumin at fistula development), operative history, and fistula resolution (spontaneous vs. operative).

Results: 2224 patients received a trauma laparotomy and survived longer than three days. Of these, 43 (1.9%) had ECF. There were 1,798 laparotomies performed in men with an ECF rate of 2.22%, and 404 laparotomies in women with an ECF rate of 0.74% ($p = 0.05$). Patients with open abdomen had a higher ECF incidence (25% vs. 0.5%) and lower rate of spontaneous closure (37% vs. 45%). ECF rate for blunt trauma was 1.65%, for gunshot wounds 2.90%, and 1.27% for stab wounds. Colon ECF rate was 1.1% (1031 patients), and the small bowel rate was 2% (1108 patients). Spontaneous closure occurred in 31% with high output fistulas, 13% with medium output, and 55% with low output. The mortality rate of ECF was 13.95% after an average stay of 59 days in the ICU. The average age of those that died was significantly higher 58 vs 38; $p < .05$) and their nutrition status worse at time of fistulization (prealbumin 7.8 vs 11.5). Of those that lived, 48% required operative ECF resection after a mean duration of 103 days.

Conclusion: With damage control laparotomies, the traumatic ECF rate is increasing and is a different entity than non-traumatic ECF. While the two populations have similar mortality rates, the trauma cohort demonstrates higher spontaneous closure rates and a curiously higher rate of development in men. Fistula output was not predictive of spontaneous closure.

Session IV

Poster # 12

HEPATIC ANGIOGRAPHY AND HEPATIC ANGIOEMBOLIZATION: INDICATIONS AND OUTCOMES

Timothy Misselbeck MD, Robert D. Barraco MD MPH, Mark D. Cipolle MD PhD*, Michael D. Pasquale MD*, James Reilly MD MBA, David Scaff DO, Rovinder Sandhu MD, Michael M. Badellino MD*, Lehigh Valley Hospital, Allentown, Pennsylvania

Objective: Hepatic angiography (HA) and hepatic angioembolization (HAE) are being increasingly used in the management of patients with hepatic injuries. This study reviews indications and outcomes of HA and HAE in the diagnosis and treatment of intra-hepatic arterial injuries.

Methods: A retrospective review of consecutive cases of HA/HAE at a level I trauma center over an 8-year period. Data analyzed include presenting physiologic condition, liver-injury grade, indications and outcomes of HA/HAE.

Results: 79 patients with hepatic injuries underwent diagnostic HA; 31 had subsequent therapeutic HAE. 21 hemodynamically unstable patients underwent damage control laparotomy (DCL) followed by HA with 11 (50%) requiring therapeutic postoperative HAE for continued hepatic bleeding despite operative packing. 58 hemodynamically stable patients had CT scan followed by HA. In this subset, HA was performed for: contrast blush-30/58 (30%); high-grade liver injury-3/58 (9%); development of subsequent hemodynamic instability-15/58 (31%); angiography planned for other purpose-10/58 (17%). HA demonstrated arterial injury and led to HAE in 50% of patients with contrast blush on CT. HA was always negative when performed for hemodynamic instability alone or for other purposes. Mortality in HAE group was 16% and liver-related morbidity 29%.

Conclusion: HA/HAE are critical adjuncts to damage control protocols as half of DCL patients may require postoperative HAE despite intraoperative packing of hepatic injuries HA should be performed in patients with suspected intra-hepatic arterial injuries and contrast blush on CT as over half will require embolization. Use of HA in hemodynamically stable patients with high-grade liver injuries and/or those who do not exhibit a contrast blush on CT, even with episodes of hemodynamic instability, appears unwarranted. Mortality related to HAE is uncommon, but morbidity occurs frequently, usually presenting as gallbladder or parenchymal necrosis.

Session IV

Poster # 13

A CASE-CONTROL STUDY OF VENTILATORY WEANING CHARACTERISTICS IN TRAUMA PATIENTS FOLLOWING DAMAGE CONTROL LAPAROTOMY. DOES EARLY ABDOMINAL CLOSURE AFFECT VENTILATORY WEANING?

Kevin M. Bradley MD, Sheryl M. Sahr MD, Julia M. Toto MD, John Gaughan PhD, Carol Fisher BA, Heather Kulp RN MPH, Paola G. Pieri MD, Thomas Santora MD*, Abhijit S. Pathak MD*, Amy J. Goldberg MD*, Temple University Hospital, Philadelphia, PA

Objective: The open abdomen is one consequence of damage control laparotomy. Delayed closure methods include fascia, skin only, and skin graft (STSG). To date, there have been no reports addressing effects of abdominal closure on ventilatory weaning. We sought to determine the relationship between both method and time to abdominal closure with liberation from the ventilator.

Methods: 430 trauma laparotomies were reviewed from July 2003 to November 2006. 41 patients with open abdomens who survived to be liberated from the ventilator were compared to 53 controls. Controls were survivors whose fascia were closed immediately and were similar based on ISS, age, BMI, gender, and mechanism of injury. Subgroup analysis was performed on delayed closure groups to examine effect of abdominal closure type on time to separation from ventilation. Time to wean was standardized from the first CPAP wean lasting ? 2 hours until day of extubation or tracheostomy collar.

Results: Compared to controls, patients with delayed closure had longer time on the ventilator (21.15 ± 17.62 days vs. 8.13 ± 8.88 days; p<.0001, t-test). Closure with STSG prolonged ventilatory support compared to fascia or skin (see table).

Delayed Closure Method	**Hospital Day # Closure**	**Hospital Day # CPAP time > 2 hrs**	**Hospital Day # Extubation or Trach Collar**	**ISS**
Fascia (n=23)	3.65±1.55*	11.3±8.9†	17.6±16.5**	20.4±11.2†
Skin (n=13)	5.46±3.27*	10.8±6.2†	19.2±11.9**	21.7±10.3†
STSG (n=5)	44.8±17.53	17.4±9.0†	36.9±17.7	22.0±5.9†

Values are expressed as mean ± standard deviation

* p<.0001 vs. STSG, t-test ** p<.05 vs. STSG, t-test † No significance

Conclusion: Delayed abdominal closure is associated with a longer course of mechanical ventilation when compared to immediate fascial closure. Fascia and skin-only delayed closures are similar, and have shorter ventilatory courses than STSG closure. Our results suggest that when fascia cannot be closed in a delayed fashion, skin-only closure should be considered.

Session IV

Poster # 14

SPLENIC EMBOLIZATION DECREASES INFECTIOUS COMPLICATIONS AND RESOURCE UTILIZATION COMPARED TO SPLENECTOMY IN SEVERELY INJURED PATIENTS

JM Haan MD*, G Bochicchio MD MPH, K Bochicchio RN MS, S Schaub RN MSN, W Meyer MA, TM Scalea MD*, University of Maryland Hospitals, Baltimore, MD

Introduction: With the increasing use of main coil angioembolization (MCE) for splenic injury, concerns have been raised of increased complication rates and resource utilization in comparison to splenectomy (SPL). This study examines complication rates for severely injured patients undergoing splenectomy vs. MCE.

Materials and Methods: Prospective data collection was performed on all patients admitted to the ICU with blunt splenic injury treated with SPL or MCE. Demographic data including; age, sex, race, ISS, and splenic injury grade and outcome measures (transfusion requirements, need for mechanical ventilation and duration, mortality, ICU and hospital length of stay (ILOS and HLOS), infection rate and SIRS score were reviewed daily. Student t-test and multiple logistic and linear regression were used to control for confounding variables and determine outcome significance.

Results: 116 patients were reviewed: 65 undergoing SPL and 51 patients underwent MCE. There was no statistical difference for age, sex, race, and mechanism of injury; but the splenectomized patients had a higher ISS (41 vs. 31) and splenic injury grade (3.7 vs. 3.2). When controlling for age, sex, ISS, and splenic injury grade, the MCE had a significantly lower transfusion requirement, HLOS, incidence of mechanical ventilation, and nosicomial infection rate, and SIRS score .

Table 1: Outcomes SPL vs. MCE

Tx	HLOS	VENT %	Vent days	PRBC	Nos Infect	SIRS	Mortality
SPL	30 days*	97%*	22	14.5u*	64%*	2.7*	22%
MCE	15 days*	67%*	15	6u*	39%*	2.2*	10%

HLOS= hospital length of stay, VENT% = % requiring mechanical ventilation, Vent days = days on mechanical ventilation, PRBC = packed blood cell transfusion requirements, Nos Infect = % with Nosocomial Infection Rate *= stastically significant value $p < 0.05$

Conclusion: Severely injured patients treated with SPL had statistically higher infection rates and resource utilization when compared to those treated with MCE.

Session IV

Poster # 15

BODY MASS INDEX AFFECTS TIMES TO DEFINITIVE CLOSURE FOLLOWING DAMAGE CONTROL LAPAROTOMY

Donald A. Reiff MD, Gerald McGwin Jr. MS PhD, Loring W. Rue III MD, University of Alabama at Birmingham, Birmingham, AL

Background: A growing body of literature demonstrates that irrespective of the mechanism of injury, obesity is associated with significantly worse morbidity and mortality following trauma. Among patients requiring damage control laparotomy, clinical experience suggests that obesity affects time to definitive closure though this association has never been demonstrated quantitatively.

Methods: All patients at an academic level I trauma center requiring a damage control laparotomy between 2002 and 2006 (N=153) were selected for inclusion in this study. Information pertaining to demographic, injury, and clinical characteristics was abstracted from patient medical records. The risk of specific complications including pneumonia, renal failure and sepsis was compared between normal and overweight/obese patients, as measured by body mass index (BMI). The lengths of intensive care unit (ICU) stay and mechanical ventilation as well as time to abdominal closure were also compared.

Results: Adjusted for age, gender, Injury Severity Score (ISS), and mechanism of injury, the risk of pneumonia, sepsis and renal failure was 2.0-, 1.2- and 2.1-times higher among overweight/obese patients compared to patients with a normal BMI; however, only the association with pneumonia was statistically significant ($p=0.0166$). Overweight and obese patients also had a significantly longer ICU length of stay (19.9 v. 16.1 days; $p=0.0015$) and time to definitive closure (6.1 v. 3.5 days; $p<0.0001$) compared with patients with a normal BMI. Trends toward higher cost ($180140 v. $141554; $p=0.24$) and longer duration of mechanical ventilation (16.9 v. 14.3 days, respectively; $p=0.13$) were found among the overweight/obese population.

Conclusions: Obesity is associated with prolonged time to definitive closure among patients requiring damage control surgery. As a consequence, these patients experience a significantly longer ICU course and incidence of pneumonia. Further, there are significant trends toward more days of mechanical ventilation, higher morbidity and inpatient costs.

Session IV

Poster # 16

HEPATECTOMY IS SAFE FOR HIGH-GRADE BLUNT HEPATIC INJURIES IN PATIENTS WITHOUT OTHER EXTRA-ABDOMINAL INJURIES.

Kazuhiko Sekine MD, Mitsuhide Kitano MD, Hiroshi Yoshii MD Atsushi Nagashima MD, Masakazu Doi MD, Masayuki Shimizu MD, Shokei Matsumoto MD, Tetsuya Yukioka MD*, Naoki Aikawa MD* DMSc, Saiseikai Kanagawa-ken Hospital, Yokohama, Japan

Background: Operative management is required for hemodynamically unstable patients with blunt complex hepatic injuries, American Association for the Surgery of Trauma (AAST) Organ Injury Scale (OIS) grades IV and V. Our surgical policy for the hepatic injuries relies basically on the resection of lacerated liver tissue by hepatectomy, but alternatively on perihepatic packing in case of intraoperative coagulopathy. Based on the strategy, the purpose of this study was to evaluate preoperative risk factors associated with the outcome and modality of operative procedures in patients with high-grade blunt hepatic injuries.

Methods: Patients admitted to Saiseikai Kanagawa-ken Hospital from 1990 to 2006 with operatively managed blunt hepatic injuries, such as AAST-OIS grades IV and V, were reviewed. We collected demographic and physiological data; the Abbreviated Injury Scale (AIS) according to initial computed tomography findings; and surgical procedures. Univariate and multivariate logistic regression analyses were used to identify important predictors of the outcome. The main outcome measure was survival.

Results: All 24 patients were managed operatively. Survival rates were as follows: AAST-OIS grade IV, 7 of 11 (64%); grade V, 10 of 13 (77%). The surgical procedures included formal hepatectomy in 16, resectional debridement in 1, and perihepatic packing in 7. Eleven patients without extra-abdominal injuries all survived with hepatectomy including the resection, whereas only 6 of the 13 patients with extra-abdominal injuries survived. Logistic regression analysis identified ‘pelvic-ring fractures’ (odds ratio [OR], 0.02; 95% confidence interval [CI], 0.00-0.44; p=0.01) and ‘severe chest injuries defined as AIS 4 or more’ (OR, 0.03; 95% CI, 0.00–0.73; p=0.03) as negative independent contributors to survival.

Conclusion: Hepatectomy is safe for high-grade blunt hepatic injuries in patients without other extra-abdominal injuries, such as pelvic-ring fractures and severe thoracic injuries.

Session IV

Poster # 17

THE ROLE OF ERCP IN MANAGEMENT OF LIVER AND PANCREATIC INJURIES

Glen A Franklin MD*, Aaron L Brown MD, Gary C Vitale MD, Matthew S Kozloff MD, Brian G Harbrecht MD*, Frank B Miller MD*, and J David Richardson MD*, University of Louisville, Louisville, KY

Background: Adjunctive techniques including ERCP are considered useful in the management of both liver and pancreatic injuries; however, few large reports document its utility. We examined our experience with ERCP following nonoperative or early operative management in patients with hepatobiliary and pancreatic injury.

Methods: 49 trauma patients underwent ERCP (33 for liver, 14 for pancreas, 2 combined). Indications, therapeutic interventions, and outcome were determined.

Results: Injuries were blunt liver (53%), penetrating liver (14%), blunt pancreatic (18%) and penetrating pancreatic (6%). Patients underwent ERCP for suspected main pancreatic duct injury (10) and hyperamylasemia (6) on average of post-injury day 21 (range 12-34 days). Four patients had pancreatic duct stenting and five studies led to other operations. In seven patients the duct was normal and no further intervention was needed. There were two late presentations of traumatic pancreatitis with pseudocyst formation treated with drainage procedures. Indications for ERCP in liver injury were bile leak (24) and unexplained jaundice (9) performed on average of post-injury day 19 (range 3-44 days). Hepatic stenting was performed in 27 patients, and the majority had rapid decreases in bile drainage. Only two patients required a delayed biliary reconstructive operation. No postoperative ERCP pancreatitis or other technical complications occurred. Overall, 70% of patients underwent stenting, or ERCP directed their operative planning.

Conclusions: ERCP was a useful adjunct for both pancreatic and liver injury. It was an important diagnostic and therapeutic procedure in selected patients with suspected main pancreatic duct injury and either provided or directed therapy in nine cases. It was even more useful as an adjunct to the management of bile leaks in complex liver injuries leading to resolution without operation in 93%. ERCP is an extremely important therapeutic adjunct in complex liver injuries and occasionally useful in selected patients with slowly resolving pancreatic injuries.

Session IV

Poster # 18

DELAYED ANASTOMOSIS OF THE DAMAGE CONTROL COLON: WHY NOT?

JH Patton MD*, N Durrani MD, I Rubinfeld MD, S Berry MD, Henry Ford Hospital, Detroit, MI

Introduction: The delayed definitive repair of injuries until after restoration of physiologic stability is a basic tenet of damage control laparotomy (DCL). While the practice of primary repair and even resection and anastomosis of penetrating colonic injuries has become widely accepted, the ability to safely perform delayed colonic anastomosis (DCA) after restoration of stability in a DCL setting has not been widely discussed or studied. This study examines our experience with penetrating colon injuries managed in the setting of DCL in an attempt to ascertain the safety of DCA.

Methods: The trauma registry of an urban Level 1 Trauma Center identified patients with colonic injuries who underwent DCL for penetrating abdominal trauma between 1/1/95 and 12/31/06. Data regarding demographics, injury severity, presence of shock at time of initial DCL, operative interventions, LOS, colon related morbidity, and outcomes were abstracted from the record.

Results: 46 patients met study criteria, 9 died prior to planned return to the OR after initial DCL and were excluded. 37 remaining patients were divided into 3 groups, REPAIR: Primary colonic repair without resection at DCL; OSTOMY: Colonic resection at DCL followed by delayed ostomy at subsequent OR; ANAST: Colonic resection at DCL followed by DCA at subsequent OR. Demographics and injury severity were not different between groups ($p > 0.05$). While LOS was higher in OSTOMY ($p<0.001$), there were no differences in outcome.

Group	Age	ISS	%Shock	Hosp LOS	ICU LOS	%Colon Morbidity	%Mortality
REPAIR n=10	34	28	70	27	15	20	10
OSTOMY n=18	29	24	77	43	24	33	11
ANAST n=9	34	17	89	20	14	22	11

Conclusion: In this series of patients undergoing DCL, DCA appears to be as safe as both initial primary repair and delayed ostomy formation. Further study is needed to confirm these results and to better define predictors of successful outcome.

Session IV

Poster # 19

ANALYSIS OF FACTORS PREDICTIVE OF MORTALITY IN PATIENTS WITH PENETRATING INFERIOR VENA CAVA INJURIES

EJ Silberfein MD, GM Riha MD, MA Guerrero MD, MM Carrick MD, PH Lin MD, RL Bush MD, BG Scott MD, KL Mattox MD*, AB Lumsden MD, Baylor College of Medicine, Houston, TX

Introduction: Penetrating injuries to the inferior vena cava (IVC) incur significant fatality rates. The purpose of this study is to determine factors that influence mortality in patients with penetrating IVC injuries.

Methods: A retrospective review was performed on all consecutive patients who sustained penetrating IVC injuries during a recent 14-year period.

Results: There were a total of 78 patients (74 male [95%], overall mean age 30.5 years, range 16 to 59 years). Mechanism of injury included gunshot wounds in 54 patients (69%), stab wounds in 15 patients (19%), and shotgun wounds in 9 patients (12%). The mean Injury Severity Score was 24. The overall mortality rate was 44% which included 13 (17%) intraoperative deaths. Among patients who underwent operative intervention, the survival rate was 68%. Caval injuries in the suprahepatic (n=7), retrohepatic (n=16), suprarenal (n=13) and infrarenal (n=42) segments were associated with 100%, 88%, 62%, and 19% mortality, respectively. Operative repair include primary repair in 68 (87%), prosthetic patch repair in 3 (4%), ligation in 7 (9%). There were 10 IVC-related postoperative complications among 44 survivors, which included venous compartment syndrome (n=2), IVC thrombosis (n=4), and pulmonary embolism (n=4). Risk factor analysis showed a trauma score of 9 or less, intraoperative base deficits > 10, shotgun injuries, presenting systolic blood pressure <70 mm Hg, anatomic level of injury, associated aortic injury, intraoperative core temperature <34 degrees C, and 12 or more blood transfusions in the first 24 hours are associated with fatality. Logistic regression analysis identified shotgun wounds, intraoperative base deficit, location of IVC injury, and associated aortic injury as independent predictors of fatality (P=0.001).

Conclusions: Penetrating injuries of the IVC are associated with significant mortality. Injuring mechanism, hemodynamic instability, anatomic level of injury, and associated aortic injury are predictive of poor outcome.

Session IV

Poster # 20

FIBRIN PATCH (FP) IS SUPERIOR TO TRADITIONAL SURGICAL REPAIR IN A LETHAL INJURY MODEL

Grant V. Bochicchio MD MPH, Kristian Ulloa MD, Bradley Zagol MD, Todd Fruchterman MD PhD, Rachel Bluebond-Langer MD, K. Shanmuganathan MD, Susan Trenka-Benthin DVM, Kaspar Keledjian MD, Stacey Schaub BSN, Kimberly Lumpkins MD, Walter Meyer MA, Thomas Scalea MD*, University of Maryland, Baltimore, MD

Objectives: Evaluate the efficacy of a hemostatic Fibrin Patch (FP) to achieve hemostasis and maintain vessel patency in a lethal Inferior Vena Cava (IVC) injury model and determine its subsequent impact on healing and thrombus/emboli formation. The FP is a conformable, combination product in development, composed of a unique composite matrix with a layer of dried human plasma-derived fibrinogen and thrombin.

Methods: Randomized prospective study in 4 groups of 30-40 kg female swine. Lethal group (n=4): 5.6mm vascular punch to IVC with no repair. Sham group (n=6): no IVC injury. Primary suture repair group (n= 24): 5.6mm vascular punch to IVC with 10-second hemorrhage. FP application (n= 24): 5.6mm vascular punch to IVC with 10-second hemorrhage. Angiography was performed pre-op, immediately post-op, day 7/8 and day 14. Animals were necropsied at day 14/15. Labs including ACT, PT/PTT and Hct were obtained pre and post-op.

Results: There were no significant differences between the injury groups with regard to acute blood loss, resuscitation fluid, ACT, Hct, platelet count and PT/ PTT. FP and suture repair achieved intraoperative and long term hemostasis in all animals. Time to hemostasis was significantly shorter with FP application compared to suture (3 min 30 seconds vs 9 minutes 20 seconds, p <0.0001). IVC repair with FP significantly preserved vessel diameter as assessed by angiography over the 2-week period (p=0.024). Two suture animals were found to have thrombus formation at the IVC defect site compared to none in the FP group. However, FP animals had a greater incidence of distal thrombi/emboli (5 animals had 7 thrombi/emboli) at necropsy (Suture =1/1, Sham = 1/1). This was not statistically significant and none of the thrombi/emboli were clinically significant.

Conclusion: Application of the FP is superior to traditional surgical repair in regards to time to hemostasis and vessel diameter preservation in a lethal IVC injury model, in which the animals were survived. Human studies are clearly warranted to determine the clinical benefit of the FP in critically injured trauma patients or military personnel.

Session IV

Poster # 21

QUANTIFICATION OF THE RISK OF AMPUTATION ASSOCIATED WITH THE SURGICAL MANAGEMENT OF POPLITEAL VESSEL INJURIES

Alberto García MD, Álvaro Sánchez MD, Mauricio Millán MD, Juan Pablo Carbonell MD, Mariley Pérez MD, Fernando Quiroz MD, Ricardo Ferrada MD, Juan Carlos Puyana MD*, Universidad del Valle, Cali, Colombia, South America

Injury to the popliteal vessels continues to be one of the most threatening peripheral vascular injuries. Despite improvements in outcome, the incidence of amputation and complications remains high.

Objective: To identify and quantify the magnitude of risk factors associated with amputation in a single center large series of popliteal vascular injuries managed by surgical intervention.

Methods: This is a retrospective cohort study of 185 patients with vascular injuries of the popliteal vessels subjected to surgical exploration in a level one university trauma center between January 1992 and December 2006. Multivariate analysis was performed using Poisson regression.

Results: Blunt trauma occurred in 38 cases (20.5%), signs of ischemia and/or absence of distal pulses were present in 98 (55.7%). Fractures were seen in 79 cases (42.7%). Fasciotomy was performed in 105 patients (56.7%). Amputation was performed in 30 (16.2%) patients. Risk factors for amputation were analyzed separately as preoperative factors and postoperative factors. Preoperative risk factors associated with amputation were blunt trauma independent of time between injury and surgery, venous injury, need for fasciotomy and age. (IRR 2.8; 95% CI 1.3 – 5.9). The presences of ischemia and/or absence of pulse was also associated with amputation independent of the mechanism of trauma, the presence of bleeding, time between injury and surgery, compartment syndrome, venous injury, fracture and age.(IRR 6.7; 95% CI 2.1–21). Thrombosis of the graft/repair and venous ligation were postoperative risk factors found to be associated with amputation (IRR 9.9, 95% CI 5.8-17 and IRR 2.5, 95% CI 1.1-5.7 respectively).

Conclusions: As described in previous studies, ischemia and blunt trauma continues to be highly associated with the risk for amputation. This current analytical study however allows for a more precise quantification of such risk and provides insight of the magnitude of the postoperative risks associated with technical aspects and postoperative complications such as venous ligation and thrombosis respectively.

Session IV

Poster # 22

INTRA-OPERATIVE DIAGNOSTIC ARTERIOGRAPHY IMPROVES LIMB SALVAGE RATES FOR TRAUMATIC POPLITEAL ARTERY INJURIES

RA Callcut MD MSPH, CW Acher MD, JR Hoch MD, G Tefera MD, WD Turnipseed MD, MW Mell MD, Sponsor: Kenneth A. Kudsk MD*, University of Wisconsin, Madison, WI

Background: Traumatic popliteal artery injuries are associated with high amputation rates, and time to revascularization is believed to be a major determinant of limb salvage. The purpose of this study was to determine if the location of diagnostic arteriography affected outcome.

Methods: From 1996 - 2006, all patients treated for traumatic popliteal vascular injuries were identified from our institutional trauma database. Demographic characteristics, physical exam, operative data, and follow-up were extracted from chart review/database. Amputation rates for those undergoing arteriography performed in radiology [ARAD] versus the operating room [AOR] were compared. Analysis was performed using SAS v. 8.0.

Results: Thirty-six limbs in 35 patients were treated for popliteal arterial injuries with 34 (94%) resulting from blunt mechanisms. The mean age was 37 years (11-69 years old), 81% were male, and the mean injury severity score (ISS) was 15 (4-38). The average mangled extremity severity scores (MESS) was 6 +/- 2 (3-10) with 64% (23/36) presenting with an associated fracture, 31% (11/36) with vein injury, 58% (21/36) with knee dislocation, and 69% (25/36) with sensorimotor deficits. Follow-up was available in 97% (34/35) patients with median of 14 months (4-82 mo.). Overall amputation rate was 16.7% (6/36). Extremities with MESS <=7 had 93% limb salvage, and those with MESS >7 had 55% limb salvage. Of those with diagnostic angiograms, ARAD (n=10) and AOR (n=15) groups were equivalent with regards to age, mechanism, ISS, MESS, time to presentation, exam findings, and associated injuries. The median time from emergency room arrival to operating room was shorter (125 min vs. 214 min, $p<0.05$) and the limb salvage rate was higher (100% vs 70%, $p=0.05$) in the AOR group compared to the ARAD group.

Conclusion: For popliteal artery injuries, diagnostic arteriography in the operating room reduces the likelihood of amputation by decreasing the time to initiating repair and thereby limiting limb ischemia. Limb salvage is still possible in the most severely injured extremities with rapid transport to the operating room.

Session IV

Poster # 23

OUTCOMES OF PTFE IN DAMAGE-CONTROL VASCULAR REPAIRS IN PATIENTS RETURNING FROM WAR

Amy Vertrees MD, David Gillespie MD, Reagan Quan MD, Mitch Cox MD, Eric Adams MD, Charles Fox MD, Sponsor: Norman Rich MD, Walter Reed Army Medical Center, Washington, DC

Objective: The use of synthetic vascular grafts has historically been contraindicated in military trauma. Late saphenous vein graft infection and exhaustion of autogenous conduits for limb salvage have prompted reconsideration a review of our own experience with the use of prosthetic grafts for combat-related vascular injuries.

Methods: From March 2003 to April 2006 trauma registry records of patients with combat-related vascular injuries repaired with Polytetrafluoroethylene (PTFE) grafts were reviewed including demographics, type of injury, complications and grafts patency.

Results: During these 38 months, 95 emergent bypasses were performed with fourteen (15%) performed using PTFE. The average patient age was 25 yrs. Injuries occurred by blast effect (6) GSW (6) MVC (1) or crushing injury (1). PTFE grafts were placed to repair injuries to the common carotid (1) subclavian (1) axillary (2) brachial (2) external iliac (1) and superficial femoral artery (7). Most patients sustained multisystem injuries and had significant soft tissue loss associated with vascular injury. Thirteen patients arrived an average of 7 days (range 3-9 days) after injury. Twelve PTFE grafts were placed prior to arrival. Two were placed emergently after evacuation for vein graft blow out. The mean follow-up period in this study was 427 days (range 49-1285). The majority of PTFE grafts (10 of 14) required removal. Replacement of PTFE bypasses with autogenous vein grafts were performed for thrombosis (3), graft exposure (4) or severe stenosis (3). Three of these ten patients required amputation for a nonviable extremity.

Conclusions: Use of prosthetic vascular grafts may be performed in military trauma patients without increased mortality. Wounds required continued need for wound débridement often leading to graft exposure and subsequent failure. Immediate reconstruction using PTFE may allow continued perfusion until wounds are closed and vascular reconstruction using autologous conduits can be performed.

Session IV

Poster # 24

DETERMINANTS OF FUNCTIONAL OUTCOME FOLLOWING PENETRATING TRAUMA TO THE BRACHIAL ARTERY

MA Guerrero MD, R Hammerton MD, EJ Silberfein MD, MM Carrick MD, PH Lin MD, RL Bush MD, BG Scott MD, KL Mattox MD*, AB Lumsden MD, Baylor College of Medicine, Houston, TX

Introduction: Penetrating vascular trauma in the upper extremity not only presents as a major surgical challenge, but can also incur high morbidity. This study was undertaken to identify factors that influenced long-term functional outcome in penetrating injury of the brachial artery (PIBA).

Methods: A retrospective review was performed on all consecutive patients who sustained PIBA during a recent 13-year period.

Results: A total of 185 patients were identified. The causes of injuries were gunshot wounds in 103 patients (56%), stab wounds in 54 patients (29%), shotgun wounds in 24 patients (13%). Concomitant injuries included brachial plexus in 91 patients (49%), brachial vein in 117 (63%), and humeral fracture in 48 (26%) patients. During a mean follow-up of 37 months, mean brachial artery patency rate was 94% and limb salvage rate was 97%. However, seventy patients (38%) experienced persistent functional disability, which included contracture (8%), paresis (12%), and pain (32%). Risk factors of functional disability include associated brachial plexus injury ($p<0.001$), associated open compound humeral fracture ($p<0.02$), shotgun wounds ($p<0.001$), and three or more associated injuries involving other structures ($p<0.02$). Logistic regression analysis showed associated brachial plexus injury and injuring mechanism are independent predictors of poor functional outcome ($p=0.001$).

Conclusions: Successful management of PIBA requires prompt operative intervention, which can lead to excellent patency and limb salvage rates. However, associated neurological or orthopedic injuries are common, which can affect functional recovery. Concomitant brachial plexus injury and shotgun wounds are significant determinants of functional disability in victims with PIBA.

Session IV

Poster # 25

UPPER EXTREMITY VASCULAR INJURY: HARD SIGNS, IMAGING AND OUTCOME

Joseph Scalea MD, James V. O'Connor MD, Thomas M. Scalea MD*, University of Maryland School of Medicine, Baltimore, MD

Introduction: Upper extremity vascular injuries (UXVI) are relatively rare but may be devastating. While patients with hard signs of vascular injury require immediate operation, those without, may benefit from pre-operative imaging. We reviewed patients with UEVI comparing those with and without hard signs. We also evaluated the accuracy of pre-operative angiography (angio) and computed tomographic angiography (CTA).

Methods: We reviewed trauma registry data from 2001 to 2006 identifying patients with axillary or brachial artery injuries. We recorded patient demographics, associated injuries, hemodynamics and exam at time of admission, the use of imaging studies, and outcome parameters.

Results: 83 patients were identified with a mean age of 31 years and ISS of 15. 90% percent were male, 72% had penetrating injuries, and 52% presented with hard signs. 62% had brachial injuries and the remainder were axillary artery injuries. 45% had associated fractures. 26 (31%) presented with neurological dysfunction which persisted in 19 patients. 66% were treated with vein interposition, 21% with primary repair, and 13% with prosthetic graft. 13% had temporary arterial shunts and 12% had fasciotomies. There was one death in the cohort from a traumatic brain injury. Two patients required delayed amputation and 5 (6%) had minor complications. Mean follow up was 22 months. Comparing those with and without hard signs there was no significant difference in age, ISS, admission systolic blood pressure, mechanism of injury, method of repair, presence of fractures, complications or neurological disability. Imaging studies were performed in 40 patients; angio in 17, CTA in 14. Nine had both angio and CTA and the results were concordant. CTA accurately diagnosed the arterial injury in all 23 patients.

Conclusions: There was no difference in outcome between patients with and without hard signs of UXVI. Only 2.4% of patients ultimately required amputation and no patients developed neurologic sequela following repair. CTA is an accurate modality for diagnosing UXVI.

Session IV

Poster # 26

CASPASE-3 IS A KEY MEDIATOR OF VASCULAR HYPERPERMEABILITY FOLLOWING HEMORRHAGIC SHOCK

E. W. Childs MD*, B. Tharakan PhD, F. A. Hunter BS, Texas A&M University Health Science Center College of Medicine and Scott & White Memorial Hospital, Temple, Texas

Objective: Hemorrhagic shock (HS) disrupts the microvascular endothelial cell barrier leading to hyperpermeability. We hypothesized that activation of caspase-3 and subsequent cleavage of endothelial cell junction protein beta catenin are key mechanisms leading to the hyperpermeability. The objective of this study was to determine the role of caspase-3 in vascular hyperpermeability following HS in rats.

Methods: HS was induced by withdrawing blood to reduce the MAP to 40 mmHg for 60 minutes followed by resuscitation to 90 mmHg. Following HS the mesenteric microvasculature was analyzed for caspase-3 activity. The caspase-3 inhibitors (Z-VED and Z-DEVD) were given intravenously before the shock period. The rats were injected intravenously with FITC-albumin (50 mg/kg) and the change in integrated optical intensity was obtained using intravital microscopy.

Results: HS increased caspase-3 activity in mesenteric vasculature ($p<0.05$). The caspase inhibitor Z-VED and Z-DEVD attenuated HS-induced hyperpermeability in rat mesenteric post-capillary venules ($p<0.05$).

Conclusion: These findings demonstrate that activation of an intrinsic apoptotic pathway via caspase-3 is a key event in vascular hyperpermeability following HS.

Session IV

Poster # 27

BRACHIAL ARTERY INJURIES IN A RURAL CATCHMENT TRAUMA CENTER: IMPACT OF DELAYED TREATMENT

Jon D. Simmons MD, Sean D'Souza MD, Juan C. Duchesne MD, Robert E. Schmieg Jr. MD, Marc E. Mitchell MD, Sponsor: Norman McSwain MD*, University of Mississippi Medical Center, Jackson, MS

Objective: To determine impact of delays in transport and treatment upon outcome of brachial artery injuries in a rural-catchment-area university trauma center.

Methods: Retrospective review of all brachial artery traumatic injuries presenting to a rural-state university trauma center. Patients were identified using the institutional Trauma Registry. Demographics and clinical data were abstracted from chart review. Mangled Extremity Severity Scores (MESS) and Injury Severity Scores (ISS) were calculated. Patients were grouped by need for amputation and by time from injury to operation of less than or greater than 6 hours. Statistical analysis was performed using Student's t-test or Fisher's exact test as appropriate.

Results: In a six-year period, 41 patients presented with brachial artery injuries. Operative management was performed in 38 (93%) patients; 2 patients were observed; 1 patient expired prior to operative intervention. Operations included 23 reversed saphenous vein grafts, 13 primary repairs, and 2 synthetic grafts. There were 4 (9.8%) amputations and 4 (9.8%) deaths. All amputations were from blunt trauma; three had open fractures. The amputation group patients were more severely injured compared to the non-amputation group (ISS 32 versus 12; MESS 7 versus 4.3). Five patients had a MESS score > 7; four (80%) of them had an amputation or died. Only 1 of 13 patients with greater than 6 hours from injury to operation required amputation. Amputation was required in 4 of 28 patients with neurological deficits. Limb salvage was successful in 24 of 28 patients without a palpable pulse (86%).

Conclusions: Predictors of amputation in brachial artery injuries differ from lower extremity vascular injuries. Delayed presentation greater than six hours, nerve deficits, and diminished capillary refill were not predictive of amputation. The delays of rural transport for brachial artery injuries did not adversely affect outcome.

Session IV

Poster # 28

SIGNIFICANCE OF TROPONIN ELEVATION AFTER SEVERE TRAUMATIC BRAIN INJURY

Ali Salim MD*, Pantelis Hadjizacharia MD, Matthew Martin MD, Kenji Inaba MD, Carlos Brown MD*, Peter Rhee MD*, Linda Chan PhD, Demetrios Demetriades MD*, University of Southern California, Los Angeles, CA

Background: Elevation of serum troponin (TnI) following non-traumatic cerebral insult has been associated with an adverse prognosis. This association has not been well documented in traumatic brain injury (TBI).

Objective: To evaluate the association and prognostic significance of TnI elevation in severe TBI.

Methods: Retrospective review of all blunt trauma patients with severe TBI (Head abbreviated injury score [ais] ? 3) admitted to the intensive care unit (ICU) with serial TnI measurements at a level – I trauma center from January 1998 to December 2005. Patients with ais ? 3 to other body regions were excluded. Univariate and multivariate logistic regression was performed to determine prognostic significance of TnI elevation.

Results: There were 445 severe blunt TBI patients who had serial TnI measurements during the study period. One hundred and forty one (31.7%) had an elevated admission TnI. TBI patients with an elevated TnI had a lower admission GCS (7.6 vs. 8.7, $p<0.05$), higher ISS (29.4 vs. 25.5, $p<0.01$), and increased hospital mortality (41% vs. 30%, $p<0.05$), compared to TBI patients with a normal TnI. Increasing severity of head injury was associated with an increasing TnI (TnI level 0.8 μg/L for head ais = 3 vs. TnI level 1.5 μg/L for head ais = 4, 5, $p<0.05$). After adjusting for injury severity, elevated TnI was an independent predictor for mortality (OR 1.79; 95% CI: 1.07-2.89, $p<0.05$).

Conclusion: Elevated TnI is frequently observed following severe TBI. The level of TnI correlates with the severity of head injury and is an independent predictor of adverse outcomes. Future research should focus on beta blockade in this group of patients.

Session IV

Poster # 29

THROMBOCYTOPENIA AND COAGULOPATHY AFTER CRANIOCEREBRAL GUNSHOT WOUND: FACTORS AFFECTING SURVIVAL

AH Tyroch MD*, SF McLean MD, AR Rivas BS, SR Todd MD, SC Agle MD, EA Gonzalez MD, MM Carrick MD, KD Kaups MD*, JW Davis MD*, JA Griswold MD*, M Lorenzo MD*, J Lunn, P Sandor, L Barat, EL McGuire MD, Texas Tech University Health Sciences Center, El Paso, TX

Objective: It is recognized that traumatic brain injury causes thrombocytopenia and/or coagulopathy. Prior studies, however, predominantly focused on patients with blunt TBI. This study demonstrates the incidence of thrombocytopenia and coagulopathy after isolated penetrating craniocerebral GSW and identifies factors associated with survival.

Methods: Multi-center retrospective analysis of patients with isolated craniocerebral GSW. Data collection included PT, PTT, platelet number, age, gender, GCS, GOS, $AIS_{cranial}$ score, mortality, donor status and bihemispheric injury.

Results: 229 patients were reviewed from seven Level I trauma centers. 84% were males with a mean age of 34 years. Overall mortality was 67% and 41% were organ donors.

Thrombocytopenia, Coagulopathy and Survival Status	Initial	Within 72 Hours	Survivors	Non-Survivors
Thrombocytopenia	21%	45%	25%	58%
Prolonged PT	38%	57%	38%	67%
Prolonged PTT	28%	42%	15%	56%

GCS: Mortality and Favorable Outcome			
GCS Group	Mortality	GOS - 4	GOS - 5
3 – 5	88%	5%	5%
6 – 8	56%	13%	13%
9 – 12	17%	50%	17%
13 – 15	8%	8%	70%

Factors associated with death were thrombocytopenia, prolonged PT or PTT, initial GCS, increased $AIS_{cranial}$ score, bihemispheric injury and self-inflicted injury.

Conclusion: Craniocerebral GSW is a highly lethal injury but a third of patients survive. Despite a low GCS or a high $AIS_{cranial}$ score, there are survivors and some have a favorable outcome (GOS 4 or 5). Even if the TBI is lethal, aggressive resuscitation is indicated because of the potential for organ donation. Patients with craniocerebral GSW are at risk for developing thrombocytopenia and coagulopathy, which is common and is associated with death. PT, PTT and platelet count should be closely monitored, and the use of FFP, platelets, cryoprecipitate, Vitamin K and Factor VII should be strongly considered.

Session IV

Poster # 30

NEUROCOGNITIVE EVALUATION OF MILD TRAUMATIC BRAIN INJURY IN THE HOSPITALIZED PEDIATRIC POPULATION

Michael L. Nance MD*, Alison Polk-Williams BA, Dennis R. Durbin MD, Thomas Drake MD, Michael W. Collins PhD, Douglas J. Wiebe PhD, Children's Hospital of Philadelphia, Philadelphia, PA

Background: Mild traumatic brain injury (MTBI) is common in the pediatric population. A standardized approach to determine optimal time to return to activity (school, sports, etc) is lacking. We tested the feasibility of inpatient neurocognitive testing and measured the degree of disability in children hospitalized for MTBI.

Methods: Pediatric blunt trauma patients (age 11-17 years) admitted for treatment of MTBI (GCS 14-15) were prospectively enrolled over a 1-year period. Consented patients were administered a previously validated neurocognitive test (ImPACT©). ImPACT© utilizes a battery of tests to assess neurocognitive performance. Patients were compared to age and gender matched normative values.

Results: For the year of study, 57 subjects were prospectively enrolled and tested. The overall population had a mean age of 14 years, and was 79% male. The mean GCS on arrival was 14.8 (15.8% GCS 14) with a mean ISS of 8.2. A prior history of concussion was reported in 12.2%. A loss of consciousness at the time of the injury was reported in 50.9%. The initial test was administered a mean of 2.1 days from the time of injury with a mean hospital length of stay of 2.5 days. The most frequent mechanism of injury was a fall (28.1%) followed by motorized vehicle (includes automobile, motorcycle and all-terrain vehicle, 19.3%), assault (17.5%), bicycle (15.8%), pedestrian (10.5%), sports (5.3%) and animal-related (3.5%). Results of ImPACT© testing are reported below (Table).

Percentile Values for Post-injury Neurocognitive Evaluation					
	Verbal Memory (Norm=50)	Visual Memory (Norm=50)	Visual Motor (Norm=50)	Reaction Time (Norm=50)	Symptom Score (Norm 0-8)
Mean	25.06	26.00	15.00	22.56	27.12
St Dev	24.34	26.15	16.02	33.87	22.61

Conclusions: Inpatient neurocognitive testing is feasible in the pediatric MTBI patient. Abnormalities were noted on all components of the neurocognitive evaluation. Thus, return to activity recommendations should be deferred for most hospitalized MTBI children.

Session IV

Poster # 31

SPINAL CORD REGENERATION WITH BONE MARROW STROMAL CELL ADMINISTRATION IN THE CEREBRO-SPINAL FLUID: REPORT OF THE FIRST CASE AT 6 MONTHS

Toshio Nakatani MD*, Fukuki Saito MD, Masaaki Iwase MD, Yoshihisa Suzuki MD, Akihiko Hirakawa MD, Yoshinori Murao MD, Chizuka Ide PhD, Kansai Medical University, Kitano Hospital, and Aino University, Osaka, Japan

Objective: To report the safety and neurological improvement in the spinal cord regeneration in rats and the first case of clinical trial with the administration of bone marrow stromal cells (BMSCs) into cerebrospinal fluid (CSF).

Methods: In animal experiments, influence of BMSCs grafting on spinal cord regeneration was investigated in young rats with a standard spinal cord contusion at Th8-9 level. Immediately after injury, $1x10^6$ BMSCs were administered into the 4th ventricle.
The clinical trial has been approved by the Ethics Review Board of our institution. The first clinical case is a 35 year-old male with spinal cord crush at C5. BMSCs of iliac bone obtained during the operation for spine fixation were multiplied for 10 days, and $31x10^6$ BMSCs were administered into CSF by a lumbar puncture.

Results: The treated rats showed better performance exhibiting weight support and coordinated steps at 3 weeks leaving smaller cavities in the injured spinal cord. Injection of BMSCs into CSF of monkeys without spinal cord injury showed no adverse effect for a few years. In the patient, American Spinal Injury Association impairment scale was class A. Motor, pin prick, and light touch scores of the Standard Neurological Classification of Spinal Cord Injury were 6, 16, and 16, respectively on admission, but were improved to 17, 33, and 36, respectively at six months. Spinal cord atrophy was not observed in MRI. No adverse side effect of transplanting BMSCs into CSF is observed.

Conclusion: To our knowledge, this is the first case of spinal cord regeneration trial by transplanting multiplied his BMSCs. As own cells are used, there is no ethical and immunological problem. We are carefully observing the course of the case, and will accumulate trials so that the effectiveness and safety can be evaluated in a committee outside.

Session IV

Poster # 32

MAGNETIC RESPONCE IMAGING PREDICTING DELAYED ENCEPHALOPATHY AFTER CARBON MONOXIDE INTOXICATION

S Maekawa MD PhD, Y Shirakawa MD PhD, SOtubo MD, T Nishiyama MD PhD, KUmakochi MD, SKikuchi MD, M Aibiki MD PhD, Ehime University School of Medicine, Toon, Japan

Objective: Certain patients exposed to carbon monoxide (CO) may develop delayed encephalopathy. Since there has been the limited information on magnetic response imaging (MRI) predicting such neurological sequelae, we examined retrospectively whether MRI findings could be a reliable predictor for the onset of delayed CO encephalopathy.

Subjects and Methods: In sixteen consecutive patients demonstrating consciousness disturbances after acute CO exposure and undergoing hyperbaric oxygen therapy, MRI examinations were done serially before and after delayed neurological complications.

Main Results: All patients recovered consciousness, but six patients went into delayed encephalopathy (6/16pts, 37.5%). In four such patients, fluid-attenuated inversion recovery (FLAIR) images revealed bilateral diffused high intensities in the white matter of the centrum semiovale before developing encephalopathy. By contrast, in patients who did not show any neuropcychiatric symptoms after recovery, there were no such changes in MRIs (4/6 vs 0/10, Fisher's exact probability test, $p<0.01$). Regardless of the development of the neurological sequelae, T-2 weighted high intensities in the basal ganglia were found. Diffusion-weighted images, taken in 10 patients, did not provide any specific findings related to the occurrence of neuropathy.

Conclusion: This report poses the hypothesis that high intensities of FLAIR images in bilateral white matter is a reliable predictor for the development of delayed encephalopathy following acute carbon monoxide exposure.

Session IV

Poster # 33

OPTIC NERVE SHEATH DIAMETER VS. INTRACRANIAL PRESSURE IN A PORCINE MODEL

Alton Parker MD, David Kwon MD, Doug Hamilton MD PhD, Scott Dulchavsky MD PhD*,
Henry Ford Health System, Detroit, MI

Introduction: Closed head injury (CHI) is a leading cause of early death and disability among young adults. Continuous monitoring of intracranial pressure (ICP) is the gold standard for patients with severe traumatic brain injury. Studies suggest the optic nerve sheath diameter (ONSD) detected on ultrasound (US) may correlate with the ICP.

Hypothesis: We hypothesize that the ONSD measured by noninvasive ocular US can provide direct correlation to the ICP measured by a traditional invasive monitoring device.

Methods: A fiber-optic intracranial Camino® (Integra Neurosciences, Plainsboro, NJ) monitor was placed into the brain of a porcine model. Intraparenchymal placement was verified by presence of an ICP waveform. On the contralateral side of the skull, a fluid infusion catheter system was inserted into the cranial vault to induce a CHI model. A 10MHz "hockey-stick" and 6-10Mhz curved linear US transducers were placed over the porcine eyelids and directed toward the optic nerve to obtain long-axis views. Optic nerve sheath diameter and intracranial pressure were recorded for each change in volume administered. Images analysis and measurements were performed off-line. Statistical analysis was performed by correlation coefficient, and bivariate analysis; p ? 0.05 was considered statistically significant.

Results: Five pigs underwent ocular US examinations, with ICP pressures ranging from 10 to 90 mmHG. At each incremental increase in ICP, the ONSD diameter was recorded by an independent US operator. ONSD was then plotted against the ICP. Of these, four out of five were found to have intraocular pathology. There was strong correlation ($r= 0.82$ and $r^2= 0.67$) between US-measured ONSD and invasively monitored ICP

Conclusion: There is strong correlation between ICP and US-derived ONSD in a porcine model. Further investigation is warranted to identify its utility in traumatic conditions associated with elevated ICP. The ability to evaluate CHI in a rapid, safe, and noninvasive manner will be of tremendous value in the acute trauma setting.

Session IV

Poster # 34

THE IMPACT OF MISTRIAGE OF TRAUMATIC BRAIN INJURY PATIENTS

Daniel P. Davis MD, Michelle Jennings BS, Michael J. Sise MD*, Jennifer Serrano Johnson MD, Raul Coimbra MD PhD*, University of California, San Diego, CA

Background: In a trauma system, patients with traumatic brain injury (TBI) are identified in the prehospital environment and triaged as major trauma victims to designated trauma receiving centers. The impact of "mistriage" of TBI patients to a non-trauma facility or to the ED rather than the trauma resuscitation suite is unknown.

Objective: To determine the impact of mistriage of TBI patients on outcome. Methods: All TBI patients [head Abbreviated Injury Score (AIS) ?3] were identified from our institution over a 17-year time period. Demographic and clinical data were abstracted from our trauma registry. Patients were defined as either appropriately triaged to the trauma resuscitation suite as major trauma victims or as "mistriaged" to the ED as a non-major trauma victims or to another non-trauma facility then transferred to our trauma center. Logistic regression was used to quantify the independent association between mistriage and outcome, adjusting for age, gender, mechanism of injury, Glasgow Coma Scale (GCS) score, head AIS, presence of hypotension (SBP <90 mmHg), and injury severity score (ISS).

Results: A total of 3,851 TBI patients were identified; mistriage was identified in 346 (9%) of these. Mistriaged patients were older (43.1 vs. 36.1 years, $p<0.001$) with less severe injuries (ISS 22.5 vs. 27.4, $p<0.001$), higher GCS scores (11.8 vs. 9.5, $p<0.001$), and slightly less severe TBI (head AIS 3.9 vs. 4.1, $p=0.007$). There were no significant differences with regard to gender, the incident of hypotension. Overall mortality was similar between mistriaged and non-mistriaged patients (22% vs. 24%, $p=0.295$). However, adjusted mortality was increased in mistriaged patients (OR 0.48, 95% CI 0.31-0.75, $p=0.001$).

Conclusions: Although mistriaged TBI patients have less severe injuries overall, adjusted mortality is higher in these patients. This suggests a benefit to early triage of TBI patients to a trauma service.

Session IV

Poster # 35

CEREBRAL COMPUTERIZED TOMOGRAPHY SCAN FINDINGS PREDICT DEVELOPMENT OF COAGULOPATHY FOLLOWING MODERATE AND SEVERE HEAD INJURY

Matthew M. Carrick MD, C. Anne Morrison MD, Raul Barreda MD, Alan H. Tyroch MD*,
Texas Tech University and Baylor College of Medicine, Houston, TX

Objective: In order to minimize the devastating effects of traumatic brain injury, the causes of secondary brain injury need to be identified and their effects limited. The objective of this study is to determine which types of head injuries seen on cerebral computerized tomography (CT) predict coagulopathy and thrombocytopenia.

Methods: The charts of 131 patients with isolated moderate and severe head injuries were reviewed. Admission cerebral CT scans of these patients were evaluated for the presence of epidural hematoma, subdural hematoma, subarachnoid hemorrhage, skull fracture, effacement of ventricles, cerebral edema, infarction, midline shift, and pneumocephaly. These CT findings were evaluated for an association with coagulopathy and thrombocytopenia. Logistic regression analysis was performed on all CT findings found to have a significant association with coagulopathy or thrombocytopenia.

Results: Using chi square analysis, subdural hematoma, cerebral edema, effacement of the ventricles, midline shift, and pneumocephaly were all found to have a statistically significant association with the development of coagulopathy ($p<0.05$). Subdural hematoma, cerebral edema, and pneumocephaly were associated with thrombocytopenia. Logistic regression analysis revealed pneumocephaly and cerebral edema to predict coagulopathy. Pneumocephaly was the sole factor found to be predictive of thrombocytopenia by logistic regression analysis.

Conclusion: CT scan findings are often obtained long before coagulation results are available. Of all the CT scan findings examined, CT scan results showing cerebral edema or pneumocephaly predict coagulopathy and CT scan results showing pneumocephaly predict thrombocytopenia. These CT findings will often be seen before standard coagulation tests and labs are available, and preparations for therapy can be initiated sooner.

Session IV

Poster # 36

THE EFFECT OF THE INTRODUCTION OF THE AMSTERDAM TRAUMA WORKFLOW CONCEPT ON MORTALITY AND FUNCTIONAL OUTCOME OF TRAUMA PATIENTS WITH SEVERE TRAUMATIC BRAIN INJURY

PHP Fung Kon Jin MSc, N Penning MSc, AHJ Hijdra MD PhD, GJ Bouma MD PhD, KJ Ponsen MD, JC Goslings MD PhD*, Academic Medical Center, Amsterdam, the Netherlands

Objective: The purpose of this study was to analyze the effect of the introduction of an all-in workflow concept that includes direct CT scanning in the trauma room on mortality and functional outcome of trauma patients with severe traumatic brain injury (TBI) admitted to a Level-1 trauma center.

Methods: A retrospective comparison was made of a 1-year cohort prior to the implementation of the all-in workflow concept (Pre-CT in trauma room cohort; Pre-CTTR) and a 1-year cohort after the implementation (Post-CTTR). All severely injured TBI patients aged 16 years or older that were presented in our Level-1 trauma center and that underwent a CT of the head were initially included. Severe TBI was defined as an abbreviated injury scale (AIS) score of >2 of the head region following trauma. Primary outcome parameter was TBI-related mortality during primary hospital admission. Secondary outcome parameter was the functional outcome based on GOS-Extended.

Results: A total of 59 patients were included in the Pre-CTTR and 49 in the Post-CTTR. Median age was 49 years in the Post-CTTR and 44 years in the Pre-CTTR (NS). Median ISS was similar (ISS=25). Median Head-AIS was higher in the Post-CTTR (5 vs 4, NS). The number of neurosurgical sessions and ICU admittance was similar. In the Pre-CTTR, a total of 24 patients (41%) died during primary hospital admission due to TBI. In the Post-CTTR, a total of 9 patients (18%) died during primary hospital admission due to TBI. There was a significant difference in favor of the Post-CTTR for TBI-related mortality during primary hospital admission ($p<0.05$). Functional outcome for survivors was higher in the Post-CTTR (6 vs 5, NS).

Conclusion: In two 1-year cohorts of severe TBI patients (before and after the introduction of a new trauma workflow concept that includes CT scanning in the trauma room), a significant difference for primary and overall mortality in favor of the Post-CTTR was found. Functional outcome tended to be higher in the Post-CTTR (NS).

Session IV

Poster # 37

MILD TRAUMATIC BRAIN INJURY IN OPERATION IRAQI FREEDOM AND OPERATION ENDURING FREEDOM

Stephen F. Flaherty MD*, Warren Dorlac MD, Bruce Bennett MD, Raymond Fang MD, Valerie Pruitt MD, Landstuhl Regional Medical Center, Landstuhl, Germany

Objective: Quantify mild traumatic brain injury in personnel evacuated from Operations Iraqi Freedom (OIF) and Enduring Freedom (OEF).

Definitions: Mechanism (MECH) - history of exposure to a blast event or a history of direct head/neck trauma**.** Brain Dysfunction (BD) – history of either 1) loss of consciousness (LOC), 2) being dazed or confused (D/C), or 3) amnesia**.** mTBI – MECH with BD temporally related to the incident.

Methods: All personnel evacuated to Landstuhl Regional Medical Center in Germany (a military echelon 4 evacuation node) from OIF or OEF for continued medical care were screened for mTBI. This included trauma and non-trauma referrals. Patients with moderate or severe traumatic brain injury, intubated patients and patients admitted to the psychiatry ward were not assessed.

Results: 3,013 patients were screened during the period 1 May 2006 to 23 Feb 2007. mTBI was identified in 19.8%. MECH was present in 1,167 (38.7%) of which 597 (50.6%) had BD. Blast event was a cause of injury in 471 (78.9%). BD related to the event included LOC (48.6%), D/C (43.4%) and amnesia (8%). Post-concussive symptoms (headache, balance problems, nausea/vomiting, dizziness, sensitivity to light noise, memory, concentration) were identified in 63% of mTBI patients at the time of screening.

Conclusion: Mild TBI was present in 19.8% of the study population. Blast event was a remarkably common source of injury and many patients were symptomatic while at echelon 4. Routine screening for mTBI at a military echelon 4 evacuation node is warranted and may be applicable to all personnel returning from a combat zone. Further studies to evaluate the functional outcome of patients sustaining mTBI in a combat zone should be developed.

Session IV

Poster # 38

HOW SHOULD WE TRAIN ACUTE CARE SURGERY FELLOWS IN MAJOR VASCULAR TRAUMA?

Niels D. Martin MD, John P. Pryor MD*, Alix Morse BA, Patrick M. Reilly MD*, Annmarie Horan PhD, Snehankita Kulkarni MD, C. William Schwab MD*, University of Pennsylvania School of Medicine, Philadelphia, PA

Background: Care of vascular injury is a complex problem that overlaps the fields of trauma and vascular surgery. As new training paradigms are developed for Acute Care Surgery (ACS), we sought to define the trauma vascular experience in our trauma center to provide a framework for ACS training in vascular trauma.

Methods: All patients with a major vascular injury who presented between January 1999 and June 2005 to our urban, level 1 trauma center were reviewed. Major vascular injuries were defined as injuries to the aorta, subclavian, axillary, brachial, iliac, femoral, or popliteal vessels and the IVC. Study variables included demographics, injury types, management techniques, complications, and outcomes. In addition, staff on each case was evaluated to define responsibility of the care for the vascular injury, defined as trauma exclusively (T) or with vascular team involvement (T/V).

Results: There were 16,001 trauma contacts, with a 23% penetrating rate. Of these, 136 patients had vascular injuries needing operative repair, 72 of which were excluded for having minor injuries or incomplete data, leaving a study group of 64 major vascular injuries. There were 40 (62.5%) patients in group T and 24 (37.5%) in group T/V. There were no differences between the two groups in age, ISS, ICU and hospital length of stay, complications, or discharge destination (p=ns). Patients in group T/V were more likely to have systemic heparin used ($p<0.05$), and have a vein graft instead of PTFE ($p<0.05$).

Conclusions: At our center, major operative vascular injuries are treated with a team approach between trauma and vascular surgeons. There seems to be no appreciable differences in techniques or outcomes when these injuries are treated exclusively by the trauma team, or in conjunction with the vascular team. Even in a busy, high penetrating center, the surgical experience in major vascular injury appears inadequate to support exclusive training of ACS fellows in vascular trauma.

Session IV

Poster # 39

TEACHING TRAUMA ULTRASOUND TO MEDICAL STUDENTS: LESSONS LEARNED

Mark W. Bowyer MD*, William A. Liston MD, A. J. Copeland MD, Eric M. Ritter MD, Elisabeth A. Pimentel BA, David G. Burris MD*, David C. Wherry MD, Uniformed Services University, Bethesda, MD

Introduction: The Focused Assessment Sonography in Trauma (FAST) exam has become a mainstay in modern trauma care. We have added basic Ultrasound (US) and FAST exams to our student curriculum over the past 2 years and detail the results and lessons learned.

Methods: Prior to starting a surgical clerkship, 324 3rd year medical students completed a baseline questionnaire of general and FAST specific US knowledge. They then received a didactic lecture and a one hour hands-on training with a hand-held US using both an US simulator and a live patient model. Students were encouraged (but not mandated) to actively seek out opportunities to practice the FAST exam during their clinical rotation. At the end of the rotation, students repeated the questionnaire and were asked to rate the importance of learning US and to provide suggestions for improving the curriculum.

Results: General US Knowledge improved significantly over baseline ($p < 1^{-5}$), as did knowledge specific to the FAST exam ($p < 7^{-53}$). Students rated the need to learn this skill as being extremely important (avg. 4.5 on a 5 point Likert scale) and felt that it was important to learn it at their level of training (avg. 4.4). Though encouraged to seek out opportunities to practice the FAST, only 64 (19%) actually performed an exam (primarily a result of an active role of one faculty member). This subset performed an average of 5.25 + 2.3 exams with a range of 2-12. Notably, 80% of the students took the time to write comments that the curriculum would be improved providing more opportunities for practice and hands-on experience.

Conclusions: Introduction of US into a 3rd year curriculum significantly improved knowledge over baseline. Students believe that learning US is very important and that it is appropriate to learn this skill at their level. A major lesson learned from this study is that though the students felt it important to practice this skill they did not actively seek out opportunities. This observation will result in improvement of the curriculum by mandating the faculty to involve students in performing US studies while on clinical rotations.

Session IV

Poster # 40

ISS: JUSTIFICATION FOR DIFFERENTIAL RESOURCE ALLOCATION IN A TRAUMA PROGRAM

Karen J. Brasel MD MPH*, Clare Guse MS, Annette Bertelsen RN, Bonnie Krajcik, John A. Weigelt, MD*,Medical College of Wisconsin, Milwaukee, WI

Background: We hypothesized that ISS was increasing over time and could be used to help define resource needs for a trauma program.

Methods: Data from all admissions to the trauma program at a Level I center for 2000-2006 were reviewed. ISS, AIS, length of stay (LOS), gender, age, insurance, discharge destination, and mortality were abstracted. Average ISS, AIS, LOS, and daily census for each major admitting service (trauma, ortho, neuro) were calculated. Nonparametric tests for trend were used to analyze ISS and LOS. Multivariate analysis determined the impact of ISS on LOS.

Results: The percentage of patients with ISS>15 increased from 26-35%. The ISS increase reflected significant increases in AIS for abdomen and thorax. Head and extremity AIS did not increase. There was a corresponding increase in LOS for patients cared for by general trauma surgeons. Average daily census for the trauma service increased by 4 patients over the study period. There was no increase in ISS, LOS, or average census for the neurosurgery service. Increases in ISS and LOS did not increase average orthopaedic daily census. LOS was significantly associated with ISS after adjusting for age, gender, discharge destination, and insurance status. Mortality remained constant. *$p<0.05$

Year	LOS (mean)*			Avg ISS*			Avg daily census		
	trauma*	ortho*	neuro	trauma*	ortho*	neuro	trauma	ortho	neuro
2000	5.8	6.8	7.5	11.9	7.4	15.5	14	5	6
2001	5.4	6.8	6.3	13.1	8.2	15.2	12	5	6
2002	5.6	7.1	7.9	13.9	8.6	17.0	12	6	6
2003	5.8	7.1	7.2	14.3	8.6	15.0	12	6	6
2004	6.0	7.8	7.8	14.4	8.4	15.7	13	6	6
2005	6.2	7.1	6.9	14.1	9.1	15.8	16	5	5
2006	6.7	7.6	6.4	13.8	8.7	15.2	18	5	5

Conclusions: Over a 7 year period, ISS increases resulted in longer LOS and an increased average daily trauma census. AIS region scores and average daily service census increases demonstrate the resulting workload was borne preferentially by general trauma surgeons. This information can be used to direct future resource allocation in a trauma program.

Session IV

Poster # 41

GENDER MATTERS: DIFFERENCES IN ADOLESCENTS' ATTITUDES, PERCEPTION AND BEHAVIOURS REGARDING SUBSTANCE USE AND IMPAIRED DRIVING IN A HOSPITAL-BASED INJURY PREVENTION PROGRAM

Tanya Charyk Stewart MSc, Denise Polgar EMCA, Daniel Caro MSc, Evelyn Vingilis PhD, Bradley A. Corbett PhD, Murray Girotti MD*, Neil Parry MD, London Health Sciences Centre, London, Ontario, Canada

Objective: To examine the effects of gender on adolescents' attitudes, perception and behaviours regarding alcohol and drug use, driving and impaired driving. Teenagers' response to an injury prevention program IMPACT **(I**mpaired **M**inds **P**roduce **A**ctions **C**ausing **T**rauma) was also assessed by gender. IMPACT is an adolescent, hospital-based program aimed to prevent injuries and their consequences caused by impairment.

Methods: Self-reported data from a questionnaire collected over 6-month period as part of a randomized control trial with half of the students randomly selected to attend IMPACT. Descriptive statistics and logistic regression models were used to analyze gender differences and the effect of IMPACT on students' behaviours, attitudes and perception on substance use, driving and impaired driving.

Results: This study included 276 students (133 IMPACT; 143 control) with an overall response rate of 84%. Female students have less negative driving behaviours than males with double the odds of driving the speed limit (OR=1.93,CI=1.06-3.52) and better perception of the consequences of drinking and driving including feeling driving is worse after drinking (OR=1.93, CI=1.00-3.74). They also try to influence peers on road safety more than males (OR=2.15, CI=1.43-3.23). Substance use did not vary significantly between male and female students, but the decision to drive after using illegal drugs was reported more frequently in males (19%, OR=3.7, $p<0.05$). The risk of crashing and injuring themselves or someone else were more important factors influencing females' decision not to drink and drive. IMPACT had a greater effect on females in their reported behaviours, perception and attitudes. Some effects were sustained including decision not to drink and drive influenced by risk of seriously injuring someone else (OR=2.42, $p<0.05$).

Conclusions: Females reported safer driving behaviour and better perception of the negative consequences of impaired driving. The IMPACT program had a greater effect on female students. These gender differences in attitudes, perception and behaviours need to be considered for injury prevention programs such as IMPACT.

Session IV

Poster # 42

TARGETING URBAN GUN VIOLENCE: ONE CITY'S INITIAL EXPERIENCE WITH GUNSHOT LOCATION TECHNOLOGY.

Mark L. Gestring MD*, Christopher L. Delaney MS, Nicole A. Stassen MD, Julius D. Cheng MD and Paul E. Bankey MD PhD*, University of Rochester School of Medicine and the Rochester Police Department, Rochester, NY

Introduction: In response to an increase in urban gun violence, our city has joined several others around the nation by deploying the ShotSpotter® Gunshot Location System (GLS). By positioning specialized sensors throughout various parts of the city, this system is able to detect the audio signature of a gunshot (GS), determine its origin and instantly notify authorities. This report describes our early experience with this novel technology.

Methods: Police records were reviewed for the 7-month period following deployment of the GLS in July of 2006. Each activation of the GLS resulted in the dispatch of a police unit to investigate the reported location. If no evidence of GS activity was immediately apparent, a perimeter search would be conducted and no further action would be taken. Absolute evidence of GS activity in the form of obvious damage or injury, discovery of spent cartridges, or witness statements was required in order to confirm an event. In cases where GLS activation lead to the discovery of a confirmed GS event, dispatch records were reviewed to assess whether some other form of notification or request for assistance may have led authorities to the specific incident.

Results: Since its deployment, our city police department dispatched 2,133 calls related to activation of the GLS. Absolute evidence of gunshot activity was identified in 39 cases. Of these, 5 resulted in weapon recovery, 6 resulted in arrest and 3 led to the discovery of injured patients at the location suggested by the GLS. None of the incidents resulting in injury, arrest or weapon recovery triggered a traditional call for assistance through the 911 system.

Conclusion: We observed a rate of unreported GS activity that was higher than expected in areas where the GLS was deployed. Furthermore, this activity was not reliably reported through the conventional 911 system. Immediate GS detection combined with rapid police response can result in early capture of suspects, recovery of weapons and rapid identification of injured patients in need of assistance. In addition, this information can be useful in the planning of targeted gun violence prevention efforts and law enforcement initiatives.

Session IV

Poster # 43

THE EFFECT OF RECLINED SEATS ON MORTALITY IN MOTOR VEHICLE COLLISIONS

Sharmila Dissanaike MD, Rob Kaufman BS, Christopher Mack MS, Charles Mock MD PhD*, Eileen Bulger MD*, Harborview Medical Center, Seattle, WA

Background: There have not been any studies to date investigating the effect of reclined seatbacks on MVC outcome.

Methods: 1. We performed in-depth review of cases with reclined occupants using the Crash Injury Research Engineering Network database (CIREN). Each case contains 650 crash elements and 250 medical elements. The crash investigator, bioengineers, physicians and a research nurse review each case and establish mechanism of injury based on clinical and crash scene findings. We selected cases of reclined front-seat occupants with frontal impact for detailed review. 2. We analyzed outcomes of front-seat reclined occupants 1995 – 2005 using the National Automotive Sampling System (NASS). The NASS is a weighted probability sample database of all severe police-reported MVCs in the US each year.

Results: *1. CIREN*: A characteristic injury pattern was seen in restrained occupants. Seatbelt pretensioner firing resulted in the belt pulling taut prior to the body moving forward after collision. This resulted in a "clothesline" type injury with pivoting of the torso over the seatbelt, causing characteristic thoracic, abdomen and spine injuries and high mortality. *2. NASS/CDS*: There were 61,468 front seat occupants with seat position recorded in the database. There were 15,938 UP (25.9%), 45,250 PR (73.6%) and 280 FR (0.5%) occupants. FR occupants were significantly more likely to be young (29.6 vs. 39.4 years) and male (70.4% vs. 50%). There was a significantly lower rate of seatbelt use in FR (57.8%) compared to UP (77.9%) and PR (75.6%). FR displayed a trend toward increased severity in head, thoracic, spine and abdominal AIS. Overall injury severity was increased in FR, with an ISS of 7.2 compared to 5.5 in PR, and 5.7 in UP. Mortality was significantly increased in FR occupants (OR 1.77, 95% CI 1.13 – 2.78) and slightly increased in PR occupants (OR 1.14, 95%CI 1.02 – 1.22).

Conclusion: Fully reclined seats are an independent risk factor for mortality in MVC.

Session IV

Poster # 44

WHEN SHOULD PEDIATRIC HEAD TRAUMA BE A RED FLAG FOR CHILD ADVOCACY?

Peter Felice BS, Ankush Gosain MD, Fred A. Luchette MD*, Miriam Baron MD, R. Lawrence Reed, II MD*, John M. Santaniello MD, Thomas J. Esposito MD, MPH*, Loyola University Medical Center, Maywood, IL

Purpose: Traumatic brain injury (TBI) is the leading cause of mortality in infants that are victims of non-accidental trauma (NAT). Variability of clinical presentation can lead to missed diagnoses and subsequent re-injury and death. Additionally, infants with TBI as a result of NAT have increased short-term morbidity and mortality as compared to victims of unintentional trauma. Despite these facts, a standard of care for child abuse expert consultation has not been established. Our institution has developed a pediatric injury screening form to identify cases for investigation by the appropriate child protective agency (CPA).

Methods: A retrospective review was conducted of all children less than 36 months of age that presented with head trauma (fracture and/or extra-cranial blood) to a level I trauma center between January 2004 and December 2006. Data on demographic information, mechanism of injury, diagnoses, risk factors for NAT (including fractures, unusual wounds, burns, blunt abdominal trauma, ano-genital trauma, retinal hemorrhages), as well as referral to CPA were recorded.

Results: One hundred forty-six (n=146) children with head injury were identified during the study period, of which 123 (84%) had charts available for review. Sixty-four (n=64, 52%) cases were referred to a CPA and 12 (19%) children were identified as abused. Multiple logistic regression of these cases identified age less than 1 year (OR 0.58, CI 0.39-0.85) and inconsistency between the history and physical examination (OR 9.24, CI 1.02-83.61) as predictors of need for intervention. Based solely on these predictors, re-analysis of the initial data set reveals that 115 of the 123 patients (93.5%) would have been referred for further investigation.

Conclusions: Greater than half of all infants that presented with head injury were referred for investigation of NAT. Only age less than 1 year and inconsistency between the history and physical examination findings were predictive of the need for intervention. Given these results, we advocate that all children under the age of 36 months that present with head injury should be screened for NAT.

Session IV

Poster # 45

IMPACTING VIOLENT RECIDIVISM

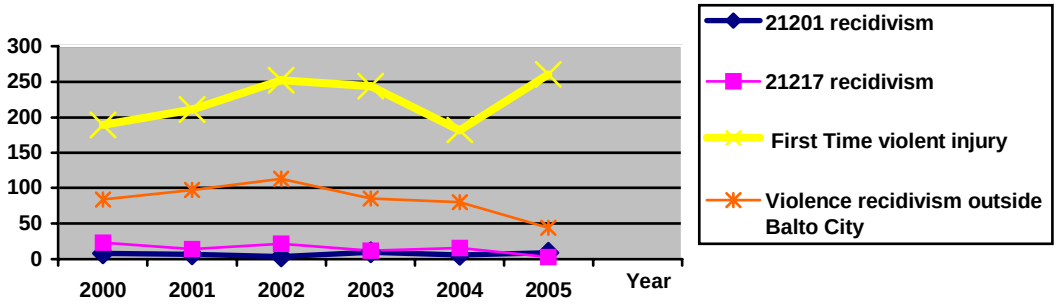
Carnell Cooper MD*, Dawn Eslinger MS, University of Maryland School Of Medicine, Baltimore, MD

We previously published the first randomized prspective study of a hospital-based violence intervention program(VIP). It revealed that a hospital-based violence intervention program is an effective means of reducing violence-related trauma recidivism. Our intial study evaluated only repeat victims of violence. We subsequently instituted the program for all victims of violence hypothesizing that VIP can result in a reduction in violent recidivism at our level I Trauma Center. To determine if the recidivism rate changed, we conducted a data review of all patients admitted with violence-related trauma.from 2000 (the year VIP was initiated)through 2005.

Method: Data from the trauma center registry data from 2000 through 2005 was reviewed by zip code and injury type.

Results: A evaluation of first time victims of violence reveal an overall increase # of admissions from 2000 through 2005. The violent recidivism rate of patients outside of Baltimore and consequently not elgible for VIP remained fairly constant with a slight downward trend. However evaluation of the violent recidivism rate of patients from the 2 most common zip codes of our clients elgible for VIP (21201 and 21217) reveals a significant downward trend.

Conclusion: This is the first study to show that a Hospital-based violence intervention program can reduce the violent recividism rate at a Level Trauma Center.



Session IV

Poster # 46

LESSONS LEARNED FROM 8058 RECREATION BOATING FATALITIES

Stephen A. Rowe MD, John D. Berne MD*, David H. Villarreal MD, Thomas M. McGovern MD, Dell Moore MD, Scott H.Norwood MD*, East Texas Medical Center, Tyler, TX

Introduction: Recreational boating is second only to motor vehicle crashes as a cause of transportation related injury and death, leading the National Transportation Safety Administration to include improvement of recreational boating safety in its "most wanted safety improvements" program. Since 1995, the US Coast Guard has developed the Boating Accident Reporting Database (BARD). This database is underutilized by trauma investigators. The purpose of this paper is to identify unique characteristics of fatal boating accidents using the BARD database, in order to develop prevention strategies.
Methods: Vessels in which there were occupant fatalities were compared to those with no deaths. Risk factors were analyzed by logistic regression.
Results: From 1995 to 2005 there were 74,629 accidents, involving 104,513 vessels with 226,929 occupants, resulting in 8058 deaths. Twenty five percent of all vessels did not carry personal floatation devices (PFDs); an additional 23% did not have them readily accessible. Drowning was the most common cause of death (n=5756). There was no correlation between fatality and operator age, operator experience, boat length, water conditions, time of day, or visibility. Independent determinants of mortality are summarized in the table.

OR=Odds Ratio, CI=Confidence Interval

* p?0.005	OR	CI
Vessel vs. Vessel	6.3*	5.5-7.1
Alcohol	4.3*	3.9-4.8
No PFD on board	2.4*	2.1-2.7
Vessel vs. Swimmer	2.2*	1.7-2.9
PWC	2.0*	1.8-2.4
No Safety Course	2.0*	1.8-2.4
Reckless Operation	1.9*	1.6-2.3
Male Operator	1.5*	1.3-1.7
Equipment Failure	1.4*	1.3-1.6
Inaccessible PFD	1.4*	1.3-1.6

Conclusion: Boating safety courses should be mandatory and emphasize the "rules of the road (collision avoidance)," PFD use, vessel maintenance, and the high risk of alcohol on board. Such courses are especially important for personal watercrafts (PWC) operators. Current laws regarding alcohol and PFDs need to be vigorously enforced. Mandatory vessel inspections may reduce deaths associated with mechanical failure and PFD unavailability. We conclude that focused improvements in safety education and law enforcement should decrease boating fatalities.

Session IV

Poster # 47

CERVICAL SPINAL CORD INJURY WITHOUT RADIOGRAPHIC ABNORMALITY IN JAPAN

Hiroshi Kato MD, Akio Kimura MD*, Ryo Sasaki MD, Naoyuki Kaneko MD, Munekazu Takeda MD, Akiyoshi Hagiwara MD, Shinji Ogura MD, Takashi Mizoguchi MD, Tetsuya Matsuoka MD, Hidehumi Ono MD, Kenji Matsuura MD, Kazuhide Matsushima MD, Shigeki Kushimoto MD, Akira Fuse MD, Toshio Nakatani MD, Masaaki Iwase MD, Junmei Fudoji MD, Takeshi Kasai MD, on behalf of the General Planning Committee of the Japanese Association for the Surgery of Trauma, Tokyo, Japan

Objectives: To demonstrate the clinical characteristics of Japanese patients with cervical spinal cord injury without radiographic abnormality (SCIWORA).

Methods: A retrospective, multi-center study at the 11 tertiary emergency centers in Japan during the 34 months period, from January 2003 to October 2005.

Results: 127 patients between the ages of 19 and 90 (23 patients (18%) were under 45), were entered into this study. The incidence of SCIWORA accounted for 32.2% of patients with cervical cord injuries, and 0.81% of all the blunt trauma patients. Of the 127 patients, 19% had experienced high-energy trauma. In patients under 45, however, 35% suffered high-energy trauma. The mean scores of the injury severity score, the head-abbreviated injury scale and the Glasgow coma scale on admission were 17 (range 9-29), 0.6 (range 0-5) and 14 (range 3-15), respectively. 89% had incomplete spinal cord injuries. 74% of all patients had narrow spinal canals (spinal canal stenosis, cervical spondylosis, OPLL, etc). However, in patients aged under 45, 52% of them had normal cervical spine radiographs. All patients underwent MRI examination, within 1.9 days of admission on average. 82% of patients were treated conservatively and 18% underwent surgical spinal decompression.

Conclusions: SCIWORA appears to have a much higher incidence in Japan compared to the USA (8-15% of all the patients with cervical cord injuries, and 0.07-0.08% of all blunt trauma patients). Many of these injuries occurred from low-energy trauma in older patients with narrow spinal canals, which is more frequent in Asian people. In addition, this study revealed that SCIWORA may occur in younger adults without underlying cervical spinal disease.

Session IV

Poster # 48

YOU WERE RIGHT: TRAUMA PATIENTS DO DRINK MORE

Carol R. Schermer MD MPH*, David V. Feliciano MD*, David B. Hoyt MD*, Ernest E. Moore MD*, Grace S. Rozycki MD*, Loyola University Chicago Department of Surgery, Loyola, IL

Background: Heavy episodic alcohol consumption increases injury risk. An unanswered question is whether the alcohol consumption of patients admitted to Trauma Centers (TCs) is representative of alcohol consumption patterns of the general population. The hypothesis of this study was that TC patients compared to the general population are more likely to drink alcohol, to consume more alcohol when drinking, and to binge drink.

Methods: TCs in three states participated in an alcohol screening and intervention program. Trauma patients admitted to the floor were screened for alcohol consumption. The Behavioral Risk Factor Surveillance System (BRFSS), a yearly population based survey of health related behaviors, was used to represent the general population. The responses to each alcohol consumption screening question were compared to the responses contained in the BRFSS for the state where the trauma center was located. The differences in proportions between the BRFSS and TC were considered statistically significant if the 95% confidence interval for the proportions from the BRFSS did not overlap those from the TC for that state.

Results: Proportion answering question for the three TCs and their respective states:

	Drank in last 30 days (95%CI)	Drink 2 or more drinks/day (95%CI)	Drank more than 5 drinks (binge) in last 30 days (95%CI)
TC 1 (n=156)	.622 (.543-.694)*	.310 (.242-.386)*	.235 (.175-.309)*
State 1	.509 (.493-.525)	.053 (.045-.061)	.130 (.118-.142)
TC 2 (n= 357)	.885 (.848-.914)*	.409 (.359-.461)*	.204 (.166-.249)
State 2	.669 (.652-.686)	.063 (.054-.072)	.183 (.168-.198)
TC 3 (497)	.819 (.783-.850)*	.449 (.406-.493)*	.268 (.231-.309)*
State 3	.599 (.581-.617)	.057 (.049-.065)	.159 (.145-.173)

* = non-overlapping 95% CI

Conclusion: The population admitted to TCs is more likely to drink and consume alcohol at unhealthy levels than the general populations in which they live. These data can be used to provide feedback in alcohol interventions to reduce risky drinking.

Session IV

Poster # 49

GEOMETRY VS. VELOCITY: FACTORS INFLUENCING INJURY SEVERITY IN PEDESTRIAN-VEHICLE CRASHES

Jurek G. Grabowski PhD MPH, Christine Burke, Greg Stadter, Samir M. Fakhry MD*, Inova Fairfax Hospital, Falls Church, VA

Objective: To delineate the effects of vehicle design, velocity, and geometry, as well as pedestrian characteristics/stature on the type and severity of pedestrian injuries seen at a level one trauma center.

Methods: All car, light truck, van and sport utility vehicle crashes involving pedestrians were identified from Inova Fairfax Hospital's Crash Injury Research and Engineering Network (CIREN) Pedestrian Database. Data on vehicle weight and geometry (front bumper height, windshield height), impact speed, pedestrian stature/characteristics (gender, age, weight, and standing height), pedestrian injury type, and injury severity score (ISS) were extracted. Vehicle weight was calculated as curb weight plus cargo weight. Univariate/bivariate analysis and multivariate linear regression data analysis were performed to identify factors affecting injury severity score.

Results: A total of 58 injured pedestrians sustained 564 injuries. Most (72%) were male and on average were 38±20 years old, 72±21 Kg, and 166.3±20 cm tall. Pedestrians were struck by vehicles traveling an average of 49.6±16.3 Km/Hr (i.e., 31 mph) by vehicles weighing 1397±278 Kg with a front bumper height of 54±6 cm and top windshield height of 258±37 cm. The most common types of serious injuries were intracranial injury with prolonged loss of consciousness (14%), closed fractures of the pubis (19%), and closed fracture of the tibia/fibula shaft (24%). The overall ISS was 27±13. In a full multivariate regression model controlling for all aforementioned factors, ISS increased by one for every three Km/hr (i.e., 2 mph) increase in vehicle velocity ($p=0.03$).

Conclusion: Velocity is the major factor in affecting overall ISS in pedestrian-vehicle crashes. Vehicle geometry and pedestrian characteristics did not significantly contribute to increased ISS. This data suggest that injury prevention efforts should focus on reducing vehicle velocity prior to a pedestrian strike by developing pedestrian detection sensors in tandem with automated braking systems.

Session IV

Poster # 50

A MATURE TRAUMA SYSTEM: SURVIVAL OUTCOMES OF SEVERE INJURIES AT LEVEL I AND LEVEL II TRAUMA CENTERS IN NORTH CAROLINA

Kyla M. Bennett MD, Thomas V. Clancy MD*, Sharon Schiro PhD, Steven N. Vaslef MD PhD*, University of North Carolina and Duke University Medical Center, Durham, NC

Objective: In light of recent studies demonstrating improved outcomes in level I versus level II trauma centers, we analyzed data from the North Carolina (NC) trauma system. We hypothesized that, in a mature trauma system, the designated level of a trauma center does not affect survival outcomes.

Methods: The NC Trauma Registry was used for this analysis. We included trauma patients treated between 2001 and 2003 who were ?18 years of age, alive on admission, and who suffered ? one of the following injuries: penetrating cardiac, aortic, iliac vascular, quadriplegia, complex pelvic fractures or major liver injury. We compared in-hospital mortality rates for those patients treated at Level I trauma centers versus Level II centers adjusting for age (<65; ? 65 years old), mechanism (penetrating/blunt), hypotension on admission (<90 mmHg), Glasgow Coma Scale (?8 ; >8) and ISS (?25; >25). Univariate analyses were used to determine appropriate variables to enter into a multivariable logistic regression model of mortality.

Results:

	N		Unadjusted Mortality Rate		Level I Adjusted OR* (95% CI)	P
	I	II	I	II		
All 6 injuries	614	200	27.7%	31.5%	0.89 (0.58 to 1.37)	0.595
Cardiac	26	17	53.9%	58.8%	0.98 (0.10 to 9.51)	0.988
Aortic	107	37	37.4%	43.2%	0.70 (0.27 to 1.80)	0.463
Iliac Vasc	65	20	32.3%	40.0%	0.84 (0.18 to 3.85)	0.822
Quadriplegia	61	13	26.2%	30.8%	1.62 (0.17 to 15.44)	0.673
Pelvic Fxs	193	65	20.2%	16.9%	1.59 (0.66 to 3.81)	0.303
Major Liver	157	45	23.6%	26.7%	0.64 (0.26 to 1.57)	0.334

* adjusted odds ratios use level II as a comparator

Conclusion: In-hospital mortality rates for patients treated in Level II trauma centers were similar to those seen in Level I centers. This suggests that the statewide trauma system in North Carolina has reached a level of maturity such that severely injured patients can receive adequate care at both Level I and Level II centers.

Session IV

Poster # 51

IN-HOUSE ATTENDINGS DO NOT IMPROVE EMERGENCY DEPARTMENT EFFICIENCY IN TRAUMA - AN APPLES-TO-APPLES COMPARISON

Julius D. Cheng MD MPH, Mark L. Gestring MD*, Nicole A. Stassen MD, Paul E. Bankey MD PHD*, University of Rochester, Rochester, NY

Background: The presence of an in-house surgical hospitalist/attending 24/7/365 has been proposed to optimize patient outcomes, including operative decision making, efficiency of trauma evaluations and disposition from the Emergency Department. Studies that have evaluated outcomes with in-house (IH) vs. at-home (AH) attendings have done so with either same-hospital historical or comparison to other institutions as controls. This study is a concurrent evaluation of both IH and AH call at the same facility. Due to an unexpected shortage of residents at an academic trauma center, there was a 6-month period when attending surgeons rotated 24-hour IH and AH call. We hypothesized that mortality, ED disposition, and time to operative intervention would be improved with IH attendings.

Methods: Retrospective review of prospective registry data was performed to evaluate differences in outcomes.

Results: 575 patients were evaluated during the study period, with 329 IH and 246 AH. Age, sex, mechanism, average ISS and mortality were comparable between the two groups (p>0.05). Average overall ED disposition time, time to OR (all cases), and time to discharge from the ED were also not significantly different between the two groups. Subset analysis of those patients with an ISS>15, or those with penetrating injuries also demonstrated no significant delay in ED disposition and time to OR.

	At Home:	In House:	*p*
n	247	329	
Avg ISS:	13.85	12.93	0.37
% blunt:	88.98%	85.71%	0.94
Mortality:	5 (2.02%)	7 (2.13%)	0.57
Overall:	(hr:min)	(hr:min)	***p***
ED time:	6:50	6:17	0.27
Time to OR:	3:45	4:11	0.56
Time to Home:	10:40	8:05	0.14
ISS>15:			
ED time:	4:28	4:56	0.54
Time to OR:	2:37	3:01	0.66
Penetrating:			
Time to OR:	1:46	2:16	0.66

Conclusion: The presence of the attending IH did not improve ED efficiency as defined as overall ED disposition time, or time-to-OR. These data suggest that hospital trauma system design and capacity have a greater impact on system efficiency than attending presence.

Session IV

Poster # 52

TRAUMA TEAM ACTIVATION CAN BE TAILORED BY PREHOSPITAL CRITERIA

Jeffrey A. Claridge MD, Joseph Golob MD; Patty Wilczewski RN, Justin Kan BS, Charles Yowler MD*, Metrohealth Medical Center, Cleveland, OH

Background: Responses to trauma activations are triggered by predetermined criteria at individual trauma centers and utilize a large amount of resources to provide care for injured patients. The purpose of this study was to identify and evaluate which prehospital criteria did not require full trauma team activation while maintaining or improving current patient care.

Methods: A two phase, one year prospective study was carried out at a regional urban Level I trauma center. Phase I involved collecting observational data to determine which trauma criteria was associated with low likelihood of significant injury. These identified criteria would trigger a lower level trauma activation (LowAct) in phase II. Phase II involved implementing a LowAct and prospectively evaluating the outcomes related to resources and patient care. LowAct involved a smaller response team with priority access to imaging.

Results: A total of 3104 patients were evaluated with 2076 patients enrolled over 6 months in phase I and 1037 enrolled in phase II. Phase I identified 3 out of 36 prehospital activation criteria which were not associated with significant injuries requiring admission. These criteria were pedestrian struck by vehicle, high speed vehicular crash, and Glasgow Coma Score (GCS) 12 -14. These were then used as triggers for LowAct in phase II. Comparisons of patients with these three identified criteria are illustrated in the table. Follow-up (mean = 3.8 days) of discharged patients treated by the LowAct during phase II demonstrated that 78% of patients felt they had adequate treatment and 9% required additional unplanned health care.

	Phase I (n = 852)	Phase II (n = 306)	P value
Age (years)	35	35	
%admitted	46	23	< 0.001
Hours in ER/patient	3.9	4.2	NS
# of blood tests/patient	3.8	3.2	0.01
# of CT scans/patient	2.4	3.3	< 0.001
Charges /patient	8589	6432	< 0.001

Conclusion: LowAct was appropriate for the following three criteria: pedestrian struck by vehicle, high speed vehicular crash, and GCS 12-14. The utilization of LowAct resulted in a decrease utilization of many resources while maintaining care.

Session IV

Poster # 53

WERE RULES MADE TO BE BROKEN? ANALYSIS OF COMPLIANCE AND OUTCOME IN A TRAUMA SYSTEM WITH A TWO HOUR TRANSFER RULE

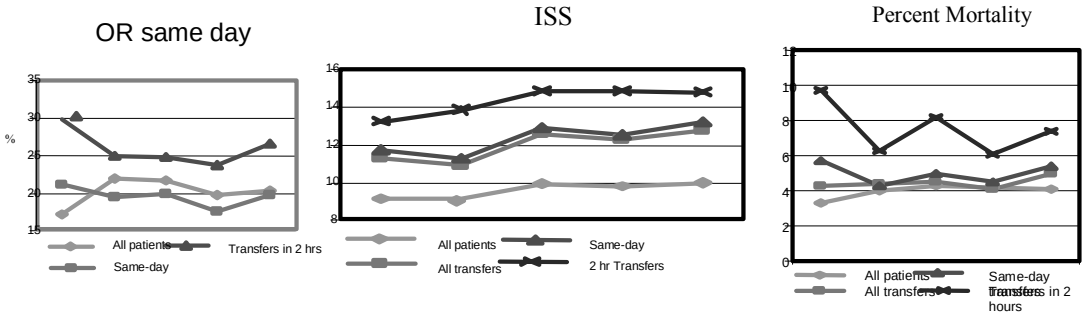
Thomas J. Esposito MD MPH*, Marie Crandall MD MPH, , R. Lawrence Reed II MD*, Fred A. Luchette, MD*, Richard L. Gamelli MD*, Northwestern University Memorial Hospital and Loyola University Medical Center, Maywood, IL

Introduction: Minimizing time to definitive care in an effort to reduce morbidity and mortality is the goal of trauma systems. Toward this end, some systems have imposed standards on time to interfacility transfer. The purpose of this study is to evaluate compliance and outcome in a system with a 2 hour transfer rule.

Methods: Retrospective review of state trauma registry data from 1999-2003 examining: time to transfer; ISS; mortality; time to OR at second facility and payor status; stratified by time to transfer.

Results: During the study period there were 22,447 interfacility transfers. Overall transfer rate was 10.4%. Of the transfers, 4,502 (20%) occurred within 2 hours. Median transfer time was 2 hr. 21 min. ISS, mortality, number of patients with operation performed on same day of transfer and proportion of self-payors, were all higher for the group transferred within 2 hours in comparison to patients transferred on the same day of injury at greater than 2 hours, for all transferred patients, and for all trauma patients.

Conclusions: While the majority of transfers occur at greater than the mandated 2-hour time interval, the most acutely injured patients are reaching definitive care within 2 hours. Markers of acuity for patients transferred at greater than 2 hours parallel those of the general trauma patient population. This data suggests that, in this system, provider determined transfer time that exceeds 2 hours has no adverse affect on patient outcome. It appears to accomplish recognition and rapid transport of the most acutely ill. This may obviate the need for onerous system mandates that are not feasible or poorly complied with.



Session IV

Poster # 54

TRAUMA EXPERTS SHOULD ALSO PERFORM AVIT FOR ACUTE TRAUMA CARE.

Junya Morozumi MD, Shouichi Ohta MD, Hiroshi Homma MD, Kaori Suzuki MD, Yuichi Ohtaka MD, Mariko Noda MD, Shirou Mishima MD, Tetsuo Yukioka MD*, Tokyo Medical University Hospital, Tokyo, Japan

Introduction: An angiographic imaging and endovascular catheter techniques are among the basic components of comprehensive acute trauma care and is referred to as acute vascular intervention for trauma (AVIT). In our tertiary emergency center (TEC), trauma experts who undergo radiological training perform AVIT and it is completed during the initial resuscitation period without moving the patient to radiological theater. For this purpose, a mobile Digital Subtraction Angiography (DSA) device was installed in our TEC-emergency room (ER). At the last AAST meeting, we reported that employing a mobile DSA device allowed us to shorten the time for hemostasis treatment by more than 1 hour ($p<0.05$).

Methods: From January 2001 to July 2002, an angiography suite located on 3rd floor was used for AVIT in 14 cases (group A). From August 2002 to December 2006, we rearranged the ER and installed a mobile DSA device (group B: 47). We newly analyzed the change of body core temperature and of pH from admission to completion of AVIT. The volume of packed red blood cells (PRBCs) administered within 24 hours from admission was also analyzed.

Results: The numbers of BT>35C patients on completion of endovascular hemostatic procedures who had not shown hypothermia on admission were significantly different (A: 6/12 vs. B: 31/36, $p=0.02$). Comparing the numbers of patients who did not have acidosis (pH<7.35) on admission, a significant difference was recognized in the number of cases in whom we could prevent acidosis on completion of AVIT (A: 2/9 vs. B: 19/27, $p=0.03$). In addition, comparing the numbers of patients who had acidosis (pH>7.35) on admission, the numbers of cases in whom we could prevent aggravation of acidosis on completion of AVIT was significantly different (A: 2/5 vs. B: 18/20, $p=0.04$). The mean volume of PRBC administration was about 500 ml less in group B, but this was not significant statistically.

Discussion: A mobile DSA is a good tool for acute trauma care with AVIT for trauma experts. AVIT consists of some unique techniques and standard training for trauma experts should be established to make it universal tactical regimen.

Session IV

Poster # 55

LEVEL III TRAUMA CENTERS CAN DECOMPRESS REGIONAL LEVEL I CENTERS

Anthony P Borzotta MD*, Jay Johannigman MD*, Robert Winkelman EMT-P, Diane Ferguson RN, Shelley Akin RN, MSN CS, Bethesda North Hospital and University of Cincinnati, Cincinnati, OH

Hypothesis: Level I center workload increases relentlessly as fewer hospitals maintain trauma programs and more community surgeons refuse to care for simple injuries. The addition of emergency general surgery responsibilities to trauma services will further tax manpower. We reviewed our Level III trauma center workload to define reserve capacity for potential decompression of the Level I center in a regional trauma system.

Methods: Retrospective 5 year audit of surgical workload in an ACSCOT verified Level III center using TraumaBase ver. 6 (CDM, Conifer, CO) and hospital information systems.

Results: 1912 patient encounters (37% ED release, 2% observation, 61% inpatient admissions) were caused by vehicle crash (1175), falls (430), violence (153) and other (154) with an overall mortality of 2.7%. There were 351 primary OR cases (18.4%). Initial OR use was emergent (<1 hour) in 5 (1.4%), urgent (1-4 hours) in 109 (31.1%), early (4-24 hours) in 164 (46.7%), and deferred (>24 hours) in 73 (20.8%). Almost 70% of cases started between 9PM and 7AM. Disciplines participating in operative care were general surgery 64; orthopedics 469; OMFS 63; cardiothoracic 28; vascular 39; and neurosurgery 47. Mean hospital length of stay for all patients rose from 2.47 in 2003 to 3.34 days in 2005.

Conclusions: A wide variety of injuries were cared for at a level III facility with minimal disruption of the OR schedule. Resources exist to significantly increase operative and nonoperative caseload. A Level III center is capable of decompressing the regional Level I center of simple and nonoperative trauma cases, enhancing regional system performance.

Session IV

Poster # 56

DO BLUNT TRAUMA PATIENTS UNDER THE AGE OF THREE NEED ROUTINE CERVICAL CT SCANS?

Joaquin J.Estrada MD, Mikael Petrosyan MD, Debi Balise RN, G.H.Mahour MD, Peter Masiakos MD, Henri R.Ford MD*, Jeffrey S.Upperman MD, Massachusetts General Hospital for Children and Childrens Hospital Los Angeles, Los Angeles, CA

Introduction: Cervical spine injuries occur in less than 2% of all children involved in blunt trauma. Cervical spine evaluation in children less than the age of 3 can be challenging. Three year olds often cannot give reliable information regarding their cervical spine examination. Thus physicians rely on radiographic studies such as plain films and CT scans to complete the clinical assessment.

Objective: To assess the utility of routine computer topography for cervical spine clearance in pediatric blunt trauma patients younger than 3 years of age.

Hypothesis: We hypothesize that clinical exams rarely miss cervical injuries and cervical CT exams are over utilized.

Methods: After obtaining HIPPA certified IRB approval, we retrospectively queried the Childrens Hospital Los Angeles trauma registry and medical records for all patients younger than 3 years old involved in blunt trauma over a five year period. We analyzed the mechanism of injury, Glascow coma scale, radiographic studies, and outcomes.

Results: Between the years of 2000-2005, 3244 trauma patients were admitted to Childrens Hospital Los Angeles. We identified 103 patients under the age of 3 involved in blunt trauma over this five-year period. A full cervical spine examination was performed on all patients. Fifty-four patients had there cervical spine evaluated by clinical exam alone while 49 patients (48%) also underwent radiographic imaging of there cervical spine. All but two patients had a normal clinical exam with no focal neurological findings suggestive of a cervical spine injury. Both patients with abnormal clinical exams underwent computer topography which failed to reveal clinically significant pathology. Furthermore, there was no statistical difference of injury detection between those patients that underwent clinical examination alone and those patients that also had a cervical CT scan.

Conclusion: Our data suggests that routine cervical CT scanning of children 3 years old involved in blunt trauma with a normal clinical exam is an ineffective tool for detecting cervical spine injury. Therefore, cervical computer topography does not offer any additional value to the clinical assessment. Our investigation is limited by sample size and warrants a large multi-center investigation.

Session IV

Poster # 57

AEROMEDICAL PROVIDERS CAN SAFELY DOWNGRADE TRAUMA CENTER ACTIVATION LEVEL

Peter G. Thomas DO, John P. Pryor MD*, Ronald Figueredo MD, Patrick M. Reilly MD*, Robert T. Higgins RN MREMT-P, C. William Schwab MD*, University of Pennsylvania, Philadelphia, PA

Background: Many trauma centers require the highest level of trauma team activation for patients transported by aeromedical transport. We hypothesized that aeromedical providers (AP), guided by a triage protocol, can accurately and safely downgrade trauma center activation level.

Methods: From January 2004 to December 2006, all patients transported to our level one trauma center by a single aeromedical carrier were abstracted from our trauma registry. Two groups were identified based on the AP's triage decision. A trauma alert (T1) is the highest response with blood sent to the bay, mandatory airway team, respiratory care presence and operating room notification. A trauma response (T2) involves only the trauma attending, residents and two emergency department nurses. Over triage was defined as a T1 patient who was discharged home from the bay. Under triage was defined as a T2 patient admitted to the surgical intensive care unit or taken directly to the operating room for non-orthopedic injuries.

Results: Summary of findings is listed below. The over triage rate was 22.6% and the under triage rate was 12.3%.

	T1	T2	*p value*
Total Patients (%)	1494 (54.9)	1224 (44.1)	n/a
Mean age	44.12	44.21	ns
% Male	69	64	<0.01
ISS	13	6	<0.001
Patients Transfused Bay (%)	108 (7.2)	1 (0)	<0.001
Hospital Length of Stay (days)	7.6	4.1	<0.001
Mortality (%) – Bay	15 (1.0)	0 (0)	<0.001
Mortality (%) – Overall	116 (7.8)	9 (0.7)	<0.001

Conclusions: APs are able to safely and accurately triage trauma patients. Aeromedical transport *per se* should not mandate the highest level of trauma center activation. By downgrading activation level, valuable hospital services such as respiratory care, airway teams, and blood bank are conserved.

Session IV

Poster # 58

A COOPERATIVE TRAUMA QUALITY IMPROVEMENT PROGRAM INVOLVING REFERRAL HOSPITALS RESULTS IN INCREASED APPROPRIATE REFERRALS TO A LEVEL I TRAUMA CENTER

JK Croston MD, L Becker RN, GJ Beilman MD*, North Memorial Medical Center, University of Minnesota, Minneapolis, MN

Introduction: As trauma delivery systems have matured, an issue has been the appropriate venue for feedback to referring hospitals to improve quality and facilitate patient care. We hypothesized that a formal case-based feedback process with referring hospitals would increase recognition of severely injured patients and appropriate triage to a Level I trauma center.

Materials and Methods: We initiated a cooperative formal feedback process with three emergency departments with frequent referrals to our Level I trauma center. This feedback process consists three parts: An immediate physician to physician phone call after initial stabilization of the patient, a telephone and FAX communication within 48 hours including quality indicators (scene time, ED time, and time to transfer) and quarterly case presentation at the referring facility where quality outliers (good and bad) are discussed by ED physicians at the referring facility, the trauma director, and the trauma program manager. Data was extracted from the trauma registry for patients referred from these three hospitals for a one year period before and after initiation of this program.

Results:

	2004	2006
Total patients sent from 3 sites	71	121
Total Trauma Activations at Trauma Center	37	69
Average ISS	15	14
Avg Scene time (minutes)	13	12
Avg time at referring hospital (minutes)	70	81
Avg time to decision to transfer (minutes)	27	57
Outcome (Percent of total)		
good	54	57
moderate	16	32
severe	5	7
death	24	4

Conclusions: A formal feedback program to referral hospitals has resulted in increased triage of patients to our Level I trauma center without significant overtriage We are currently using the same process with 7 referring hospitals in our area.

Session IV

Poster # 59

HYPOTENSION FOLLOWING PENETRATING TORSO TRAUMA: OR RESUSCITATION IMPROVES OUTCOMES

Jeanne G. Lee MD, Vishal Bansal MD, Bruce Potenza MD*, Dale Fortlage BA, Pat Stout RN, Raul Coimbra MD PhD*, University of California, San Diego, CA

Objective: Operating room resuscitation(OR RESUS) protocols allow for a quicker time to incision in critically injured patients. Triage from the scene to the OR in our center is based on several criteria, the most common being hypotension unresponsive to fluid resuscitation during transport. The decision to activate the OR RESUS protocol is based on pre-hospital vital signs. In an attempt to refine our protocol with a goal towards improving resource utilization and outcomes, we hypothesized that OR RESUS of hypotensive patients with penetrating trauma would lead to better outcomes compared to resuscitation in the trauma bay(TR BAY).

Methods: Trauma registry data from 1996-2005 was used for analysis. Survival, time to incision, and ISS of OR RESUS patients (SBP<90 mmHg) were compared to those with a normal blood pressure in the field but who were hypotensive upon arrival to the trauma bay.

Results: Overall, there were 144 OR RESUS patients with a mean ISS of 36 and survival rate of 44%. In contrast, there were 501 TR BAY patients whose mean ISS was 24 and survival rate was 68%. Blunt trauma OR RESUS patients had increased mortality (34% vs. 70%) and higher ISS (41 vs. 25). OR RESUS patients sustaining penetrating injuries had a higher survival rate than their TR BAY counterparts (65% vs. 58%), despite having higher ISS (30 vs. 23). Time to incision in OR RESUS was shortened by 20 minutes in average.

Conclusion: Our data indicates that blunt trauma patients do not benefit from an aggressive OR RESUS protocol, as many of these hypotensive patients do not require an operative intervention and persistent hypotension, per se, indicates a poor outcome. Hypotensive patients with penetrating injury benefited from OR RESUS as overall survival was higher despite a higher ISS. Patients that require an operation for hemorrhage control clearly benefit from OR RESUS, as it decreases time to incision and expedites hemostasis. Resuscitation of hypotensive penetrating trauma patients should occur in the operating room.

Session IV

Poster # 60

THE INTRODUCTION OF A TRAUMA TEAM LEADER PROGRAM WITHOUT SURGICAL ACTIVATION CRITERIA OR A TRAUMA SERVICE DOES NOT IMPROVE TRAUMA PATIENT OUTCOMES OR TRAUMA CARE MEASURES

Rardi van Heest MD, Richard K Simons MB, Royal Columbian Hospital, New Westminster, Canada

Background: Verified trauma centres must meet a broad array of performance criteria and have been able to demonstrate performance improvement (PI) in terms of both the process of care as well as patient outcomes. Some programs have taken a stepwise approach to PI. The purpose of this study was to assess the PI associated with the implementation of a non-surgeon trauma team leader (TTL) program in a designated regional trauma centre.

Methods: Institutional registry data one year proceeding and following the intervention (implementation of a TTL led trauma team for trauma activations) were compared for activity, performance measures, and patient outcomes. A post intervention chart review was done to audit compliance with performance criteria for laparotomy and surgical head injuries

Results:

Measure	Pre-TTL	Post TTL	P value
Trauma caseload	1039	1072	
ISS>15 caseload	240	360	
Emergency Dept. LOS < 4h (ISS > 15)	37%	32%	NS
Emergency Dept. LOS > 10h (ISS > 15)	30%	35%	NS
Laparotomy < 1h (hypotensive SBP < 90)	na	57%	na
Laparotomy < 4h (stable with SBP > 90)	na	62%	na
Surgical head injury time to OR < 4h	na	89%	na
Mortality (Overall)	8%	9%	NS
Mortality (ISS>15)	19%	18.8%	NS

Conclusion: Injury Severity Score **(**ISS) > 15 caseload increased as a result of implementing a concomitant no-refusal policy but there was no measurable PI effect associated with this volume increase or the TTL program implementation. Poor compliance with OR criteria for laparotomy, and good compliance with OR criteria for neurosurgical trauma may reflect lack of early surgical input in the trauma team. Improved process and outcome depends on a fully integrated program with early surgical decision-making as defined by national/international performance guidelines for trauma centres and cannot be expected after implementation of isolated interventions.

Session IV

Poster # 61

IMAGING THAT MAY DELAY INTER-FACILITY TRANSFER OF TRAUMA VICTIMS: A SURVEY STUDY OF REFERRING PHYSICIANS

Cortney Lee MD, Andrew Bernard MD, Lisa Fryman RN, Jeff Coughenour MD, Bernard Boulanger MD*, Phil Chang MD, Paul Kearney MD*, University of Kentucky, Lexington, KY

Background: Delay in transfer to a trauma center due to unnecessary imaging results in suboptimal patient outcome and increases healthcare costs. In a state with no trauma system, standards for pre-transfer imaging are non-existent. Misperception of receiving center requirements, misunderstanding of the Emergency Medical Treatment and Active Labor Act (EMTALA) and perceived malpractice liability lead to unnecessary imaging and transport delays. We sought to determine the factors influencing referring physicians' decision to order imaging studies prior to transfer of trauma patients.

Methods: A mail survey was conducted of 218 referring physicians to a Level 1 trauma center eliciting information on factors affecting decision to obtain imaging studies prior to transfer.

Results: Fifty-eight of 218 surveys were returned (27%). Twenty of 55 (36%) of respondents currently obtain imaging because of perceived expectations of the receiving trauma center -independent of patient acuity. Eleven of 58 (19%) incorrectly believe that the law prohibits transfer before patients are stabilized. Sixteen of 57 (28%) obtain imaging because of liability concerns even if that imaging delays transfer. Overall 26/58 (45%) obtain imaging for either perceived requirement or liability concern. Given a scenario of an unstable trauma patient, physicians not certified in ATLS order more imaging studies prior to transfer than their ATLS-certified counterparts. 38% of uncertified physicians believe incorrectly that it is illegal to transfer an unstable patient versus 14% of ATLS-certified physicians.

Conclusions: Factors other than patient care dictate imaging acquisition in almost half of those surveyed. Misperception of expectations, misunderstanding of legal imperatives and liability concerns all delay transport of the injured. ATLS certified individuals use imaging more appropriately and promote more timely patient transfer. A statewide trauma system, better education and liability reform may reduce transport delays.

Session IV

Poster # 62

ARE NTDB BENCHMARKS VALID?

Darrell W. Graham MD, Joseph Tepas MD*, Andrew Kerwin MD*, Miren Schinco MD*, Eric Frykberg, MD*, University of Florida, Jacksonville, FL

Background: The efficacy of non-operative management of hepatic injury can be objectively defined by analysis of mortality of these patients. Using five years of data in the American College of Surgeons' National Trauma Data Bank (NTDB) as a benchmark, we compared experience at our LI trauma center in regard to proportion of non-op mgmt, non-operative mortality, and severity of concomitant injury.

Methods: The NTDB was queried for all diagnoses of blunt hepatic injury, specifically defined by ICD codes 864.01 through 864.04 entered between 1999 and 2003. Injuries were stratified by severity and proportion undergoing non-op mgmt. Proportion and mortality of non-operative cases were calculated for each of the five years and compared to a similar cohort treated at our trauma center. Population differences were then analyzed by tiered comparison that focused first on hepatic injury, then sequentially evaluated demographics, presenting physiology, and severity distribution of associated injuries. Hepatic injury mortality, demographics, and physiology were analyzed by Ttest or Chi-square. Associated injury severity was compared by AIS codes using ANOVA.

Results: During the 5 yr. period the NTDB proportion and mortality of non-operative management remained constant at approximately 80% and 14% respectively. Our proportion of non-operatively managed patients paralleled the NTDB, however mortality was significantly higher (mean 33%, p=.016, unpaired Ttest). Analysis of patient demographics and presenting physiology were similar, however associated injury AIS codes demonstrated a disproportion of severe TBI in our population (ANOVA F=5.06, p=.054).

Conclusions: These data demonstrate the value of a national database in establishing trends, which can be used as benchmarks. The disproportion of incidence and severity of associated injuries reflects individual institutional characteristics, which must be considered in any effort to compare performance and outcome.

Session IV

Poster # 63

TIMING FOR DEFINITIVE OSTEOSYNTHESIS OF ORTHOPEDIC TRAUMA AFTER INITIAL DAMAGE CONTROL SURGERY

Thomas Lustenberger MD, Ladislav Mica MD, Otmar Trentz MD*, Marius Keel MD, University Hospital of Zürich, Zurich, Switzerland

Introduction: Severely injured patients with a high trauma impact should be supplied with a sequential surgical management (damage control, DC) to limit systemic inflammation (SIRS) and infection. The aim of this study was to evaluate the DC-concept in orthopedic trauma.

Methods: Over a ten year period 301 severely injured patients with orthopedic trauma and Injury Severity Score (ISS) ? 17 points were included, if they were transferred to ICU after primary damage control procedures. Time of definitive osteosynthesis for the three different areas (extremities, pelvis/acetabulum, spine) were retrospectively analyzed.

Results: Additional to their extremity, pelvic or spine injuries, in 56% head, in 61% thoracic and in 38% abdominal injuries could be observed. ISS was 33.0 ± 13.6 points (mean ± SD). Catheters for neuromonitoring were installed in 20%, craniotomies were carried out in 5%, thoracotomies in 4% and laparotomies in 19%. 91 % of the patients had extremities, 34% pelvic and 38% spine injuries. Initially 267 external fixators for extremity injuries, 21 pelvic clamps and 7 external anterior pelvic fixators were attached at admission. The definitive osteosynthesis for extremities (nails, plates; n=337) was carried out at day 7.8 ± 5.8, for pelvic and acetabular fractures (n=54) at day 4.9 ± 4.2 and for spine fractures (n=82) at day 6.3 ± 5.3.

Conclusion: The DC-concept includes sequential treatment of orthopedic trauma. After initial treatment with externals fixators for pelvic ring fractures and shaft or severe joint fractures, the definitive osteosynthesis begins with pelvic or acetabular fractures, followed by spine and extremity injuries.

Session IV

Poster # 64

TO FAST OR NOT TO FAST: THAT IS THE QUESTION

Nirav Y. Patel MD, Thomas H. Cogbill MD*, Pamela J. Lambert RN, Michelle A. Mathiason MS, Gundersen Lutheran Medical Center, La Crosse, WI

Background: Focused assessment with sonography for trauma (FAST) has become the initial screening modality for abdominal blunt trauma injuries. Yet injury or clinical criteria that may optimize its yield and enable selective application remain poorly defined.

Methods: Medical records of patients with blunt mechanisms of injury who underwent FAST scans between June 2002 and December 2005 were retrospectively reviewed. Injury, demographic, radiographic, and clinical (nausea, emesis, loss of consciousness [LOC], external stigmata [ES], hypotension [SBP<90mmHg], and abdominal pain, tenderness, and firmness [AP, AT, and AF]) information was captured. Positive FAST scans were those that demonstrated free intraperitoneal fluid (FF). Results were validated against computerized tomography (CT) scans, operative findings, or autopsy reports. Data were analyzed using univariate and multivariate logistic regression models. A $p<0.05$ was considered significant.

Results: 1277 patients met inclusion criteria. Overall, FAST had 68.7% sensitivity, 95.4% specificity, 68.7% positive predictive value, and 95.4% negative predictive value. Hypotension, AT, AF, ES, age<15, female gender, LOC, and motor vehicle collision (MVC) were most frequently associated with a positive confirmatory test.

	N	Incidence FF (%)	Sensitivity (%)	Specificity (%)
Hypotension	147	40	68	90
AT, AF, ES or age<15	304	20	73	96
Female, LOC, and MVC	57	16	89	94
All others	769	5	57	96

Conclusions: Based on FF incidence and FAST sensitivity and specificity, we recommend FAST scans as a initial screening modality for patients with hypotension or constellation of female, MVC, and LOC. In hemodynamically stable patients with AT, AF, ES, or age<15 however, alternate modalities such as CT appear more appropriate.

Session IV

Poster # 65

PROTEOMIC AND FUNCTIONAL ANALYSIS OF CEREBROSPINAL FLUID DERIVED FROM TRAUMATIC BRAIN INJURED PATIENTS

Dieter Cadosch MD, Matthew Thyer PhD, Soenke P. Frey MD, Günter Lochnit PhD, Luis Filgueria MD, René Zellweger MD*, Royal Perth Hospital, Perth, Western Australia

Introduction: Patients with traumatic brain injury (TBI) and bone fracture are predisposed to heterotopic ossification and accelerated fracture healing. The mechanisms for this phenomenon remain unknown. However, it is hypothesized that osteoinductive factors are released from the injured brain. The aim of this study is to identify the specific osteoinductive factors in human cerebrospinal fluid (CSF) of TBI patients.

Materials and Methods: CSF samples were collected from seven severe TBI patients. CSF was also obtained from nine patients with no pathology of the central nervous system. Proteomic analysis, including two-dimensional gel electrophoresis combined with mass spectrometry based peptide finger printing and database searches, were used to compare the CSF of severe TBI patients with controls. In addition, the osteoinductive effect of CSF was measured repeatedly in proliferation assays using a fetal human osteoblast cell line (hFOB1.19).

Results: 32 protein spots were exclusively present on two-dimensional gels from the CSF of TBI patients. Peptide fingerprinting elucidated that most proteins represent either proinflammatory cytokines, cytoplasmic or mitochondrial proteins, as well as serum proteins. However, five spots represent yet unknown proteins. All tested samples derived from TBI patients had a significantly higher mean proliferation rate in the osteoindutive in vitro test using hFBO in comparison with the control group.

Conclusions: CSF of TBI patients contains particular proteins, of which five may be potential osteoinductive factors. The proteins will be further analysed and tested for their osteoinductive function. Identification of the osteoinductive factor(s) will explain physiopathological processes involved in the interaction between the injured brain and bone.

Session IV

Poster # 66

DETERMINANTS AND OUTCOMES OF DO-NOT-RESUSCITATE ORDER DISCUSSIONS (DRODS) IN THE SURGICAL INTENSIVE CARE UNIT (SICU): A PROSPECTIVE EVALUATION

Fredric M. Pieracci MD MPH, Soumitra R. Eachempati MD*, Brant W. Ullery BA, Lynn J. Hydo MBA*, Joseph J. Fins MD, Philip S. Barie MD MBA*, Weill Medical College of Cornell University, New York, NY

Introduction: Retrospective studies of issuance of DNR orders in the SICU have not captured important elements of DNR decision-making, such as the triggers, initiators, temporality, and fate of DRODs. We studied these parameters prospectively in a cohort of SICU patients to determine why, when, and by whom DRODs are initiated.

Methods: Consecutive series of patients for whom a DROD occurred (6/06–1/07). In each case, a 20-item questionnaire was administered to involved housestaff within 24 hours of the first and any subsequent DRODs. Data included age, gender, APACHE II score (A2), SICU length of stay (ULOS), mortality, and times from admission to DROD (t_{DROD}), DROD to DNR (t_{DNR}), and DNR to death (t_{death}). Patients with pre-existing DNR orders were excluded. Continuous data expressed as median (range). Statistics: *t*-test, χ^2.

Results: 51 DRODs occurred in 39 of 423 admissions (9.2%); DRODs/patient=1 (1-6), age=79 years (52-96), male=59.0%, A2=28 (12-50), t_{DROD}=3 days (0-36), t_{DNR}=0 days (0-40), t_{death}=1.5 days (0-13), ULOS=7.5 days (1-140), mortality=67%. Physicians initiated 65% of DRODs; patient surrogates initiated the remainder. The most common reason for DROD was deterioration of clinical status when physician-initiated (53%) and failure to improve when surrogate-initiated (67%, p=0.10). DNR orders were enacted after the first DROD for 25 patients (64%), after multiple DRODs for 5 patients (12.8%), and never enacted for 9 patients (23.0%). Enactment after DROD proved independent of age (p=0.12), gender (p=0.81), A2 (p=0.56), initiator (p=0.85), $DROD_t$ (p=0.67), or number of DRODs (p=0.19). However, enactment was associated with a trend toward increased mortality (73.3% vs. 44.4%, p=0.10).

Conclusions: The majority of DRODs are isolated events that occur soon before death and result in rapid issuance of DNR orders. However, creation of a DNR order fails to result after nearly one-fourth of DRODs. Whereas physicians and surrogates share responsibility for initiating DRODs, they may do so for different reasons. Future analysis of DRODs may facilitate communication and improve quality of end-of-life care.

Session IV

Poster # 67

PREVENTABLE MORBIDITY AT A MATURE TRAUMA CENTER

Pedro G. R. Teixeira MD, Kenji Inaba MS MD, Ali Salim MD, Peter Rhee MD MPH, Carlos Brown MD, Timothy Browder MD, Shirley Nomoto RN MSN, Demetrios Demetriades MD PhD*, University of Southern California, Los Angeles, CA

Objective: The objective of this study was to analyze the preventable and potentially preventable complications occurring at a mature Level 1 trauma center.

Methods: All complications occurring at the LAC+USC Medical Center are comprehensively reviewed at a mandatory weekly Morbidity & Mortality conference and classified according to preventability. The cause, effect on outcome, preventability (preventable, potentially preventable, non-preventable) and loop closure recommendations are documented. All M&M reports from January 1998 to December 2005 were reviewed and all of the preventable and potentially preventable complications were identified. Clinical data related to each complication was retrieved from the trauma registry and individual medical records.

Results: During the eight-year period, 35,311 trauma registry patients were admitted. There were a total of 2,560 complications. 351 patients (0.99% of all patients) had 403 preventable or potentially preventable complications. The most common preventable or potentially preventable complications were: unintended extubation (63 patients or 17.1% of complications), surgical technical failures (61 patients or 15.4% of complications), missed injuries (58 patients or 14.4% of complications) and intravascular catheter related complications (48 patients or 12.4% of complications). These complications were clinically relevant, as 258 (64% of complications) resulted in a change in management, including 61 laparotomies, 52 reintubations, 41 chest tube insertions and 19 vascular interventions.

Conclusion: The incidence of preventable or potentially preventable complications at an academic, Level 1 trauma center is low. These complications often require a change in management and cluster in four major categories, which must be recognized as critical areas for quality improvement initiatives.

Session IV

Poster # 68

NON-OPERATIVE MANAGEMEMENT OF PENETRATING ABDOMINAL TRAUMA AND SOLID ORGAN INJURY: INCIDENCE AND SUCCESS

Juan C Duchesne MD, Robert E Schmieg MD, Jon Simmons MD, Yi-Zarn Wang DDS PC MD, Mary Jo Wright MD, Norman E McSwain Jr MD*, Tulane University School of Medicine, New Orleans, LA

Objective: Selective non-operative management (NOM) of penetrating injuries of the liver, spleen and kidney has recently been reported with acceptable success rates. The incidence, management, outcome, and hospital costs for those patients failing NOM for penetrating abdominal injuries have not been reported.

Methods: Retrospective study over a five-year period of all patients with penetrating abdominal injuries managed in a Level I Trauma Center. Data collected included details of organ injury, type of initial management, failure rate, outcome, hospital costs, and hospital length of stay.

Results: In a five-year period, 597 patients sustained penetrating injuries to the abdominal cavity: stab wound, n=158 (26%); GSW, n=439 (74%). There were a total of 249 injuries to solid organs (kidney, n=60; spleen, n=37; liver, n=152). The majority of patients (n=419, 70%) had unstable hemodynamic status and/or peritoneal signs and underwent operative management (OM), of which 52 (12%) were non-therapeutic. NOM was selected in 169 patients (28%), with failure of NOM and subsequent therapeutic laparotomy in 9 patients (5%).

	OM (n=419)	**NOM** (*p<.001)		
		Total (n=169)	Successful (n=160)	Failed (n=9)
Mortality	40 (9.5%)	3 (1.8%)	2 (1.1%)	1 (11%)
LOS*	11 days	NA	6.5 days*	17 days*
Cost*	$ 38,743	NA	$ 18,684*	$86,015*
Kidney	54 (90%)	6 (3.6%)	6 (100%)	0 (0%)
Spleen	32 (86%)	8 (4.7%)	5 (63%)	3 (38%)
Liver	134 (88%)	20(11.8%)	18 (90%)	2 (10%)

Conclusion: NOM of penetrating abdominal injuries may be successful in appropriately selected patients. NOM was successful in penetrating injuries to the kidney and liver compared to splenic injuries. In order to prevent the significant use of hospital resources, delineation of guidelines for NOM of penetrating solid organ injuries needs further validation.

Session IV

Poster # 69

ESTRADIOL AS A PREDICTOR OF MORTALITY IN CRITICALLY ILL TRAUMA PATIENTS

Lesly A Dossett MD, Addison K May MD*, Robert G Sawyer MD, University of Virginia Health System and Vanderbilt University Medical Center, Nashville, TN

Objective: While animal models of trauma hemorrhage demonstrate survival benefits for esterous females, human observational studies of outcomes related to gender have been inconsistent. Estrogen biosynthesis differs significantly in primate versus non-primate animals and estrogens are known to have diverse immunologic activity. We, and others, have demonstrated that estrogens are elevated in response to critical illness (regardless of gender) and that elevated levels of serum estradiol are associated with increased mortality in medical and mixed surgical ICU patients. Our objective was to determine the relationship between sex steroid hormones and mortality in critically ill trauma patients.

Methods: Prospective cohort of 209 critically ill trauma patients remaining in the ICU for at least 48 hours at two academic tertiary care centers. Sex hormones (estradiol, progesterone, testosterone, prolactin and dehydroepiandrosterone) were assayed at 48 hours and 28-day all cause mortality was assessed.

Results: While there was no detectable difference in mortality among genders (survivors 75.2 percent male vs. non-survivors 76.0 percent male, $p=0.30$), serum estradiol was significantly elevated in non-survivors (median of 16.4 pg/ml [IQR 9.99—39.4] in survivors and 53.5 pg/ml [IQR 11.6—92.7] in non-survivors, $p<0.001$). The area under the receiver operating characteristic (AUROC) curve for serum estradiol in predicting mortality was 0.67. The single covariate with the largest AUROC curve was APACHE II (0.76). A multivariate logistic regression model using serum estradiol, age and APACHE II was the best predictor of mortality (AUROC=0.83). These covariates were superior to both the injury severity score (ISS) and TRISS in predicting outcome.

Conclusion: Serum estradiol is a marker of injury severity and a predictor of death in the critically ill trauma patient, regardless of gender.

Session IV

Poster # 70

POST-INJURY DEPRESSION IS A SERIOUS COMPLICATION IN ADOLESCENTS AFTER MAJOR TRAUMA: INJURY SEVERITY, AND INJURY-EVENT FACTORS PREDICT DEPRESSION AND LONG-TERM QUALITY OF LIFE DEFICITS

Peggy P. Han BA MPH, Troy Lisa Holbrook MS PhD, Michael J. Sise MD*, Daniel I. Sack BA, David B. Hoyt MD*, Raul Coimbra MD*, Bruce Potenza MD*, John P. Anderson PhD,
University of California, San Diego, CA

Introduction: Little is known about the impact of post-injury depression (DEPR) after major trauma in adolescents. A prospective epidemiologic study was conducted to examine DEPR in injured adolescents. Specific objectives of this report are to identify risk factors for DEPR onset and the impact of DEPR on quality of life (QoL) outcomes.

Methods: 401 trauma patients were enrolled (Ages 12-19; ISS >= 4). DEPR diagnosis was based on the Children's Depression Inventory (CDI). QoL outcomes were measured using the Quality of Well-being Scale (QWB) at 3, 6, 12, 18, and 24-month follow-up.

Results: The discharge DEPR rate was 41%. Multivariate logistic regression identified ISS, 3+ body regions injured, low socioeconomic status, family members injured at the scene, and thoughts or attempted suicide before injury as strong and independent predictors of DEPR risk.

ODDS RATIO PREDICTORS OF PRE-DISCHARGE DEPRESSION

ISS ? 17 (vs. < 17)	**2.0****	**P < 0.01**
3+ Body Regions Injured	**2.1****	**P < 0.01**
Low Socioeconomic Status	**2.2***	**P < 0.05**
Family Members Injured at the Scene	**3.3****	**P < 0.01**
Thoughts or Attempted Suicide Before Injury	**2.8***	**P < 0.05**

QWB scores were significantly and markedly lower in patients with DEPR across the 24-month follow-up (3-18 Month Follow-up; ***P < 0.0001; 24-Month DEPR+ = 0.738 vs. DEPR- = 0.784, ***P < 0.0001). Patients were DEPR were also significantly more likely to develop acute stress disorder (ASD) and long-term PTSD (OR = 1.8***, P < 0.001).

Conclusions: Post-injury depression is a major and important complication in seriously injured adolescents. Adolescent trauma survivors have high rates of pre-discharge DEPR. DEPR severely impacts QoL outcomes and is associated with injury severity, injury event-related factors, social factors, ASD and PTSD. Early recognition and treatment of DEPR in seriously injured adolescents will improve acute trauma care and long-term QoL outcomes.

Session IV

Poster # 71

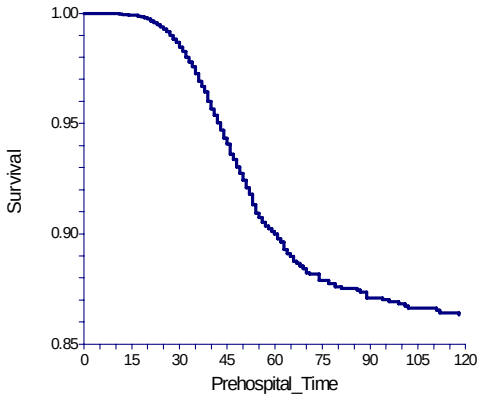
THE GOLDEN HOUR VERSUS A PLATINUM 30 MINUTES: THE INFLUENCE OF PREHOSPITAL TIMES ON OUTCOME

Ronald J. Manning RN BSN, Fahim Habib MD, Lora Fleming MD PhD MPH MSc, Kris Arheart PhD, Katie Reid BS, Mark G. McKenney MD*, Carl I. Schulman MD MSPH,. University of Miami Miller School of Medicine, Miami, FL

Introduction: The "Golden Hour" continues to be a factor in the development and regionalization of trauma systems. Although the urgency for definitive care is unarguable, the relationship between prehospital time and outcome has not been clearly defined. We hypothesized that mortality within the first 24 hours would increase as prehospital time increased.

Methods: A retrospective cohort study of adult trauma patients was conducted with the database of an urban Level 1 trauma center. Variables were chosen to assess the validity of whether definitive care within the "Golden Hour" (defined as 60 minutes after receiving the dispatch call) would be associated with survival in trauma patients. Adjustments were made for confounding factors including: age, measures of injury severity, physiologic presentation upon arrival and early mortality.

Results: Of the 12,542 patients from 2000 to 2005, those arriving within 60 minutes (83%) were similar in mean age (36yo), injury severity (ISS=15), and signs of shock compared to the 17% of patients who arrived after 60 minutes. There was however, increased mortality at 24 hours (7% vs 3%) in those arriving in less than 60 minutes and associated with lower systolic blood pressure (54 vs 75, p = 0.007) upon arrival. Interestingly, survival analysis showed that mortality sharply increases for patients arriving after only 30 minutes from the time of injury (Fig. 1). The decline was greater for penetrating versus blunt, and for those with multi-system trauma (including the head).



Conclusion: These data suggest mortality begins to increase precipitously after only 30 minutes into the "golden hour". Providing definitive care earlier after injury may decrease trauma mortality.

Session IV

Poster # 72

"YOU DRINK & DRIVE. YOU LOSE." AND "ZERO TOLERANCE." DO THESE LAWS APPLY TO THE INJURED DRUNK DRIVER?

Marianne M. Franco MD, Regina M. Franco JD, Holly A. Bair NP, Philip J. Bendick PhD, Greg A. Howells MD*, William Beaumont Hospital, Royal Oak, MI

Introduction: NHTSA reported that >99% of arrested drunk drivers were convicted of an alcohol-related offense in Michigan from 1980 to 2001. However, in 1998, a study from our institution demonstrated 51% of *injured* drunk drivers ≥21 y/o in Michigan were convicted of an alcohol-related offense. In response to the national Transportation Appropriations Bill signed in 2000, Michigan lowered its prohibited blood alcohol content (BAC) from .10 (g/dL) to .08 in September 2003. Michigan has also had a "Zero Tolerance" law in effect since 1994 prohibiting anyone under the age of 21 from drinking alcohol and operating a motor vehicle with a BAC > .02. The purpose of this study was to evaluate the conviction rate of injured drunk drivers after lowering the prohibited BAC from .10 to .08 and to evaluate the conviction rate of underage injured drinking drivers.

Methods: A query of our trauma registry identified 51 patients ≥ 21 y/o with a BAC ≥ .08 from September 2003 to July 2006 and 22 underage patients with a BAC >.02 from October 1998 to July 2006. Medical, court, police and EMS records were reviewed.

Results: 51% of injured drunk drivers ≥ 21 y/o and 38% of injured drinking underage drivers were convicted of an alcohol related offense. Age, sex, BAC, ISS and length of stay were not significant predictors of a conviction in either group. The police obtaining a BAC via search warrant in the EC was a significant predictor of conviction in the ≥ 21 y/o group ($p<.0001$) but not in the underage group ($p<.793$). For those not convicted, the police had BAC levels in nine drivers (38%) in the ≥ 21 y/o group and in nine drivers (75%) in the underage group. Two drivers (4%) in the ≥ 21 y/o group had BACs <.10 and one of these two were convicted. Of the 22 underage drivers, 17 (77%) had BACs >.08, qualifying them for the ≥ 21y/o prohibited limit, and six were convicted.

Conclusion: Despite harsher legislation and increased awareness among the public, law enforcement agencies, and the medical community regarding drunk driving, the injured drunk driver continues to escape conviction.

Session IV

Poster # 73

IMPROVED PERFORMANCE OF BASE DEFICIT IN A PROGNOSTIC TRISS LIKE MODEL AFTER CORRECTION FOR ALCOHOL

LPH Leenen MD PhD*, L Buijteweg MD, Trauma UMC, Utrecht, The Netherlands

Objective: evaluation of the correction of Base Deficit (BD) for Alcohol (EtOH) on the performance of a newly developed TRISS-like prognostic model for outcome in trauma. **Background:** Base deficit is an independent prognostic measure of outcome after trauma. In an earlier study we showed that replacing the RTS by BD as the measure of physiological disturbance in the TRISS formula performs at least as good as the original formula in a Dutch trauma population. As the base deficit is influenced by alcohol ingestion we hypothesized that correction would improve the performance of the model. **Methods:** From our prospectively filled trauma database from a Dutch trauma centre we retrospectively evaluated those patients between 2000 and 2005, having an arterial blood gas as well as blood alcohol levels determined. Results: From a total of 1635 admitted patients, 356 had a blood gas and blood alcohol levels determined. The mean age was 39.2 ± 21.5 years, with 70 % male patients. Of these 152 did not survive. Survivors had a significant higher RTSc (7.84 vs 4.50), TRISS survival probability (0.99 vs 0.64) and BD at arrival (-2.40 vs -5.55) than non-survivors. There was no difference in blood alcohol level between survivors and non-survivors. The median RTSc was influenced by alcohol. EtOH positive patients showed a RTSc of 6.90 compared to EtOH negative patients with 7.84. EtOH positive patients had a significant lower BD at admission than EtOH negative patients (-1,8 vs -4.6). An on/off phenomenon was noted where generally EtOh positive patients had a 2 point lower BD than their EtOH negative counterparts. The Area Under the Curve of the ROC curves for TRISS was 0.913, for BISS in which the RTS was swapped for BD was 0.894, however for the BISS with correction for alcohol was 0.917. **Conclusion:** EtOH consumption influences the outcome of base deficit determination negatively by 2 points. Correction of the base deficit with 2 points in EtOH pos patients in a newly developed model improves its performance and can replace RTS as the determinant of physiological disturbance.

Session IV

Poster # 74

PREHOSPITAL INTUBATION IN SEVERELY HEAD INJURED PATIENTS IS NOT ASSOCIATED WITH INCREASED MORTALITY WHEN ADJUSTING FOR MARKERS OF INJURY SEVERITY

Jeffrey D. Kerby MD PhD*, Paul McLennan PhD, Russell L. Griffin MPH, Shannon W. Stephens EMT-P, Todd B. Brown MD MSPH, Phillip R. Fine PhD, Loring W. Rue, III, MD*, University of Alabama at Birmingham, Birmingham, AL

Objective: While it has been shown that patients with severe head injuries intubated in the pre-hospital (PH) setting have a higher mortality, a direct causal association between PH intubation and mortality has not been proven. This study examined the influence of injury severity on mortality in this patient population.

Methods: Over a four year period, head injured patients with a PH Glasgow Coma Scale (GCS) score $\leq$ 8 were identified. PH patient care records (PCRs) were reviewed and only patients with PCRs definitively linked to in-hospital care records were included in the analysis. Differences in injury characteristics between PH intubated and non-intubated patients were compared using Student t-tests and Chi square techniques. For mortality differences, crude and adjusted risk ratios (RRs) and 95% confidence intervals (CIs) were calculated using proportional hazards modeling.

Results: A total of 131 patients (50 intubated, 81 non-intubated) were identified. Overall mortality was higher for the intubated group (52% vs. 12.3%; $p < 0.05$; crude RR 4.2, 95% CI = 2.0 – 8.7). However, when adjusted for key markers of injury severity, RR of mortality was not significantly different between the groups (adjusted RR 1.9, 95% CI = 0.7 – 5.3). Physiologic measures were found to be worse for intubated patients with regard to PH GCS (3.5 vs. 5.3), ED GCS (5.0 vs. 8.4), and mean PH systolic blood pressure (69.4 vs. 123.7; all $p < 0.0001$). Injury severity scores (33.5 vs. 19.1, $p < 0.05$) and head AIS scores (4.3 vs. 3.2, $p < 0.0001$) were also significantly increased in the intubated group.

Conclusions: Patients undergoing PH intubation had higher crude mortality but after accounting for their severity of injuries, the RR decreased and was no longer statistically significant. While this study is limited, it suggests that the severity of injury is a significant contributor to the increased mortality observed in the PH intubated head injured patient. Further studies with an expanded dataset will need to be conducted to confirm these findings.

Session IV

Poster # 75

YIELD OF LABORATORY AND RADIOLOGY PANELS IN TRAUMA MANAGEMENT

Mark Janzen MD, James Tasse MD, Sarah Smalley, Medical Student, Thomas Chirichella, Medical Student, Naveed Ahmed MD, Cleveland Clinic Health System, Cleveland, OH

Background: Routine use of laboratory and radiology "panels" before initial trauma evaluation remains a common practice. This is a study of cost effectiveness of this practice.

Study design: Over a three-month period, trauma "panels" in our trauma center were retrospectively analyzed for cost and impact on patient care. All ACS verified adult trauma centers in the northeast Ohio were surveyed for use of trauma panels.

Results: Trauma centers in our region continue to use trauma panels. In our center 410 consecutive patients had 4264 ($510,858) studies performed of which 1534 ($145,414) were abnormal and only 204 ($28,850) were clinically contributory. Most studies had little impact on patient care.

TABLE

Test	***# Performed ($)***	***# Abnormal ($)***	***# Clinically significant ($)***
CBC	*401(30,504)*	*178(13,540)*	*1(76)*
CMP	*397(65,652)*	*347(57,383)*	*6(992)*
Amylase	*366(29,456)*	*64 (5,151)*	*0(0)*
ABG	*22(4,246)*	*16(3,088)*	*7(1,351)*
CK	*385(18,600)*	*227(10,966)*	*0(0)*
PT/PTT	*379(39,693)*	*30(3,142)*	*2(209)*
Urine Tox	*344(12,109)*	*205(7,216)*	*0(0)*
UA	*338(15,649)*	*242(11,205)*	*0(0)*
ETOH	*396(49,706)*	*155(19,456)*	*155(19,456)*
HCG	*36 (6,112)*	*0(0)*	*0(0)*
Type&S	*378(65,848)*	*NA*	*NA*
CXR	*338(66,238)*	*44(8,623)*	*19(3,723)*
C-spine	*246(60,209)*	*11(2,692)*	*6(1,469)*
Pelvis	*238(46,836)*	*15(2,952)*	*8(1,574)*
Total	***4264(510,858)***	***1534(145,414)***	***204(28,850)***

 # Number of tests, $ cost

Conclusion: Routine panels are expensive, and of little clinical value. Selective studies should be ordered at the end of the secondary survey. Anticipated cost savings would be greater than $500,000 per year.

Session IV

Poster # 76

HEMORRHAGE IS MORE PREVALENT THAN BRAIN INJURY IN EARLY TRAUMA DEATHS: THE GOLDEN SIX HOURS

Vishal Bansal MD, Dale Fortlage BA, Jeanne G. Lee MD, Bruce Potenza MD*, Raul Coimbra MD PhD*, University of California, San Diego, CA

Objective: It is widely accepted that brain injury is the most common cause of trauma deaths in the first hour after injury. Determining cause of death without autopsy review is inaccurate. The goal of this study is to uncover whether autopsy determined cause of death identifies, on hourly intervals, injuries other than brain injury that may be responsible for deaths in the first 24 hours.

Methods: All trauma deaths that occurred within 24 hours at a Level I trauma center were reviewed over a 6 year period ending December 2005. Timing of death was divided into 0-1, 1-3, 3-6, 6-12 and 12-24 hour intervals. Cause of death was determined by clinical course, AIS scores in several body areas and was confirmed by autopsy analysis.

Results: Overall, 9,388 trauma patients were admitted with 342 total deaths (4%) of which 185 (54%) occurred in the first 24 hours. Of those, 173 had available autopsies (94%), mean age was 44 (± 18), and mean ISS was 41 (± 21). Blunt trauma was the mechanism of injury in 123 (71%). Distribution of cause of death at hourly intervals, is displayed in the table below.

	0-1 hrs.**	1-3 hrs.	3-6 hrs.	6-12 hrs	12-24 hrs.
Total Deaths n=173	76 (44%)	39 (23%)	17 (10%)	18 (10%)	23 (13%)
Hemorrhage* n=69 (40%)	41 (54%)	18 (46%)	6 (35%)	4 (22%)	0
Brain Injury n=92 (53%)	30 (39%)	17 (44%)	10 (59%)	13 (72%)	22 (96%)
Other n= 12 (7%)	5 (7%)	4 (10%)	1 (6%)	1 (6%)	1 (4%)

*Hemorrhage from cardiac, pulmonary, great vessel, solid organ, mesentery or vascular.
** Percentages represent percent of death at each time interval.

Conclusions: Hemorrhage is more prevalent than brain injury in causing death during the first 3 hours and remains important beyond 6 hours, as 94% of hemorrhage related death and 62% of brain injury related deaths occurred within 6 hours. No deaths were attributable to hemorrhage after 12 hours. Understanding the temporal relationship in injuries causing early death can help target management, maximize resource utilization and direct surgical training to optimize patient outcome.

Session IV

Poster # 77

MINIMAL INJURY IN THE OLDER ELDERLY RESULTS IN SIGNIFICANT LIFE ALTERATION

Robert D. Barraco MD MPH, Catherine Glew MD, Karin McConville MD, James Reed PhD, Mark D. Cipolle MD, PhD* , Michael M. Badellino MD,* Michael D. Pasquale MD* , Lehigh Valley Hospital, Allentown, PA

Objective: Previous reports suggest that the majority of elderly patients (age >65) hospitalized for trauma are discharged home. This study focused on outcomes of the older elderly (age >80) with minimal injury (ISS<10).

Methods: The National Trauma Data Bank (NTDB) Version 5.0 was used to assess outcomes of minor injuries (Injury Severity Scale [ISS]<10) in older elderly trauma patients. Data collected included mortality, hospital length of stay (LOS), functional independence measurement (FIM), and discharge disposition.

Results: There were 23,068 older elderly trauma patients with an ISS<10 in the NTDB. Of these, 18,299 were admitted from home and 4,769 were admitted from a residential institution. The mortality rate was 3.4% and 4.1%, respectively. After eliminating the 816 deaths, the final cohort consisted of 22,252 patients.

Admission	Discharge	N	LOS*	FIM* (Total)
Home	Home	4,537 (25%)	4.7 ± 5.1	11.2 ± 1.2
Home	SNF or NH	9,863 (54%)	6.6 ± 6.0*	10.1 ± 1.5*
Home	Rehab	3,279 (18%)	6.2 ± 4.6*	10.2 ± 1.2*
Residential institution	Home	356 (7%)	5.3 ± 5.5	10.9 ± 1.6
Residential institution	SNF or NH	3,816 (80%)	5.6 ± 3.9	9.5 ± 2.0*
Residential institution	Rehab	401 (8%)	5.9 ± 3.8*	9.3 ± 1.9*

*p = 0.001 (ANOVA), SNF = skilled nursing facility; NH = nursing home.

Conclusion: Even minimal injury can negatively affect the older elderly in a significant life altering manner. 72% of survivors >80 years of age admitted from home with minimal injury were discharged to SNF or nursing home. 88% of patients admitted from a residential institution returned to a SNF or nursing home. All survivors who discharged to a SNF or nursing home had a significant reduction in functionality compared to patients who returned home. Further prospective studies are needed to determine the root cause of this deterioration.

Session IV

Poster # 78

THE ROLE OF HIDA AND ERCP IN PENETRATING HEPATIC TRAUMA

Suresh Agarwal MD*, Graciela Bauza MD, David Lichtenstein MD, Erwin Hirsch MD*, Peter Burke MD*, Boston University School of Medicine, Boston, MA

Introduction: Biliary complications following penetrating liver injuries remain a challenge. The increasing availability of endoscopic retrograde cholangiopancreatography (ERCP) and radiologic techniques has allowed us to modify our approach to these complications and reduced morbidity.

Design: Retrospective, descriptive study reviewing complications after penetrating liver injuries.

Setting: Urban, level 1 trauma center

Outcome Measures: Demographic, radiologic, operative, and clinical outcomes were examined.

Results: Over 53 months, 59 patients (30 gunshot wounds and 29 stab wounds) were treated. Thirty patients received a HIDA scan for clinical indications on post-injury day five. In 14 cases (24% of all patients) a bile leak was demonstrated. There were 11 intra-hepatic (contained) and 3 extra-hepatic leaks. Ten patients (17%) underwent ERCP, which revealed 7 extra-hepatic leaks, 2 intra-hepatic leaks, and 1 patient with no biliary leak. Bile leaks on ERCP were treated with stenting +/- sphincterotomy. In five cases that contained leaks on HIDA scan were found to be extrahepatic on ERCP. There were no post-ERCP complications and all biliary leaks resolved after ERCP. No patients with an initial negative HIDA scan developed evidence of delayed biliary complications.

Conclusions: In patients with penetrating liver injuries, significant bile leaks occur commonly. A clinically indicated HIDA scan around hospital day five is sufficiently sensitive to diagnose bile leaks following penetrating liver trauma. ERCP is well tolerated, better distinguishes extra-hepatic biliary leaks than HIDA scan, and successfully treats both intra- and extra-hepatic leaks.

Session IV

Poster # 79

ISOLATED CERVICAL SPINE FRACTURES IN THE ELDERLY: A DEADLY INJURY

Joseph F. Golob Jr. MD, Joel R. Peerless MD, Charles J. Yowler MD*, John J. Como MD, MetroHealth Jeffrey A. Claridge MD, MetroHealth Medical Center, Cleveland, OH

Background: Traumatic injury in the elderly is an increasing problem and studies have shown that elderly patients (?65 years-old) with cervical spine fractures (CSF) and spinal cord injury (SCI) carry a mortality rate of 21-30%. However, little has been described with regard to outcomes for elderly patients with isolated CSF.

Hypothesis: Outcomes for elderly patients with isolated CSF will be similar to elderly patients with CSF and associated injuries or SCI.

Methods: A 9-year retrospective analysis was performed on all patients ?65 years-old admitted to a level I trauma center with any CSF. Primary outcomes were defined as favorable (discharge to home or rehabilitation hospital) or unfavorable (death, discharge to a long term acute care facility or a skilled nursing facility). Isolated CSF was defined as those fractures without associated injuries or SCI. Long-term mortality data was gathered from the Social Security Death Index.

Results: A total of 177 patients with mean age of 78 ± 1 and injury severity score of 17 ± 1 were evaluated. Fifty-six percent were male and falls were the most common mechanism (62%). An unfavorable outcome was seen in 56% of the study population with a mortality rate of 25%. Associated injuries were seen in 57% of the population and 22% had SCI. Patients with SCI had a significantly higher mortality compared to patients without SCI (38% vs. 22%, p=0.032). However, there was no difference in unfavorable outcomes. Patients with isolated CSF had no differences in unfavorable outcomes compared to patients with SCI or associated injuries. Long-term survival analysis after discharge (mean = 2.8 y) demonstrated that patients with a favorable outcome had a significantly improved survival compared to patients with unfavorable outcomes ($p < 0.001$).

Conclusion: Isolated CSF were associated with an unfavorable outcome in the elderly population regardless of additional associated injuries or SCI. These unfavorable outcomes were also associated with long term mortality. Strategies to reduce morbidity and mortality in this devastating injury will be essential to improve outcomes and maximize resource utilization.

Session IV

Poster # 80

RETROPERITONEAL PACKING FOR PELVIC FRACTURES: WHO NEEDS IT?

Michael J. Sise MD, Gabrielle M. Paci BA, Daniel I. Sack BA, Darcy Fox BA, Seon Jones MD, Michael S. Bongiovanni MD, Scripps Mercy Trauma, San Diego, CA

Background: Retroperitoneal pelvic packing (RPP) independent of exploratory laparotomy (Ex Lap) for significant retroperitoneal hemorrhage (SRH) associated with pelvic fractures is used in Europe and is gaining popularity in the United States. Before including RPP in our practice guidelines, we analyzed its potential benefit to our patients.

Methods: We conducted a retrospective registry-based review of trauma patients with pelvic fractures at our Level I trauma center over a six and one half year period. An analysis of the opportunity to use RPP was performed by identifying patients with SRH. The impact that early RPP would have had on their course was evaluated.

Results: There were 488 patients with pelvic fractures. Fifty-one (10.5%) patients had SRH. Six (11.8 %) of these patients required immediate operation for intra-abdominal injuries. Forty-three (84.3%) patients with SRH underwent early angiographic embolization (AE) of pelvic vessels at a mean of 2.6 hours after arrival. Six (14.0%) of these patients underwent subsequent Ex Lap for associated injuries within the first 48 hours after admission. External fixation (Ex Fix) was performed in nine (1.8%) patients. The indication for Ex Fix was orthopedic stabilization in seven patients. Two patients went directly to the operating room and had Ex Fix placed for SRH; one was performed in conjunction with a damage control Ex Lap for abdominal injuries. Both of these patients underwent AE immediately after surgery. Three (5.9%) patients with SRH and severe associated injuries who died appeared to be potential candidates for RPP. Two died during attempted AE and one died in the operating room shortly after AE. However, each of these patients also had intra-abdominal injuries and should have had a damage control Ex Lap.

Conclusion: RPP would have benefited very few patients with SRH in our trauma center with readily available AE. In our practice guidelines, we will limit RPP to patients who have continued significant SRH after AE, and who do not require damage control Ex Lap.

Session IV

Poster # 81

USE OF PREOPERATIVE MEDICAL OPTIMIZATION PROTOCOL TO IDENTIFY HIGH RISK PATIENTS WITH ISOLATED HIP FRACTURES CAN IMPROVE OUTCOMES

Noreen K Durrani MD, Ilan Rubinfeld MD, J.H Patton MD*, Henry Ford Hospital, Detroit, MI

Introduction: Morbidity and mortality associated with hip fractures is substantial, ranging from 4.9% during index hospitalization up to 24% at 12 months. Multiple issues affect care and influence outcomes. Protocol driven guidelines can stratify patients, provide prompt attention to all systems and achieve optimal clinical results.

Objective: Use of a preoperative medical optimization protocol to identify high risk patients can improve outcomes in comparable patient populations.

Methods: Records of patients with hip fractures identified from the trauma registry over two analogous six month periods, 7/2005 through 12/2005 (Group 1) and 7/2006 through 12/2006 (Group 2), were reviewed for demographic variables and outcomes. Inception of a protocol for hip fracture patients designating service assignment and preoperative workup occurred between these two time periods.

Results: 63 patients sustained an isolated hip fracture in Group 1, compared to 58 in Group 2. Demographic data by group is summarized in table format.

	Total Patients	Average Age (years)	Operative No. (%)	Pts. with 2 or more comorbidities (%)
Group 1	63	81.4	53 (84)	41 (65)
Group 2	58	81.1	51 (88)	34 (59)

Further comparisions between the two groups revealed that 13 patients had one or more complications in Group 1, compared to five in 2006, after protocol inception.

	Hospital LOS (days)	ICU LOS (days)	No. Complications (Avg)	Mortality (%)
Group 1	6.1	0.97	0.26	4.5
Group 2	8.0	0.59	0.189	3.4

Conclusion: Institution of a protocol-driven stratification and management policy results in decreased ICU days ($p<.001$), and a trend towards decreased number of complications and mortality. Stratification of patients by risk allows appropriate preoperative planning and perioperative care for patients with significant potential morbidity and mortality.

Session IV

Poster # 82

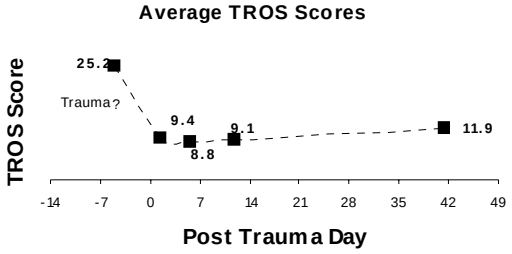
THE FIRST QUICK, USABLE, AND COMPREHENSIVE TRAUMA AND REHABILITATION OUTCOME ASSESSMENT — THE T.R.O.S.

Douglas JE Schuerer MD*, David A Horwitz MS, Linda Ferber RN MS, Thy N Huskey MD, William Carroll CSTR , Julie Nash RN MSN, Timothy G Buchman PhD MD*, E. Rene Schreier BS PT, Clayton Karr MS OTR/L, John P Kirby MD, Washington University in St. Louis, St. Louis, MO

Objectives: Commonly used rehabilitation scores have several limitations. Many are time-consuming and often omit assessment of pre-trauma performance. Our trauma service has developed a Trauma Rehabilitation Outcome Score (TROS) that is simple, yet captures deterioration and recovery of function and quality of life as compared to the patient's pre-trauma status.

Methods: The TROS assessment consists of 7 categories of function scored on a scale from 1-4, with "4" denoting full function. The categories include motor two assessments of self-care and mobility and five categories reflective of the developments in rehabilitation: return to work/convocation, activities of enjoyment, activities of daily living, medical status and cognition. Two extra assessments scored by the patient are reflective of the patient's self-perception of recovery and quality of life. Adult trauma patients admitted to an academic ACS Level I trauma service were prospectively evaluated using the TROS, which takes less than 5 minutes to use.

Results: 84 patients have been evaluated. TROS scores decrease markedly after trauma and slowly increase over time. Presenting GCS deficits correlate with early TROS scores. Prolonged LOS and discharge facility need are predicted by lower early TROS scores.



Conclusions: This initial data set shows that the TROS may be a valid method of tracking a trauma patient's course through hospitalization and rehabilitation. TROS scores slowly increase over time, but fail to reach the pre-trauma baselines even after prolonged intervals. Low initial TROS scores correlate with GCS deficits and predict prolonged LOS and need for an outpatient discharge facility. Further data collection and validation is needed.

	Average All	GCS		LOS		Dispo Location	
		15	< 15	< 10	≥ 10	Home	Facility
Pre TROS	26.3	26.2	27.2	26.8	25.3	27.4	24.7
Post TROS D1-3	9.5	10.6	7	10.8	7.5	10.5	8.5

Session IV

Poster # 83

EVIDENCE OF HORMONAL BASIS FOR IMPROVED SURVIVAL AMONG FEMALES WITH TRAUMA ASSOCIATED SHOCK: AN ANALYSIS OF THE NATIONAL TRAUMA DATA BANK

Adil H Haider MD MPH, David C Chang MPH MBA PhD, David T Efron MD, Elliott R Haut MD, Neal Hadley MD, Edward E. Cornwell III MD*, Johns Hopkins School of Medicine, Baltimore, MD

Background: Basic science research suggests that sex hormones affect survival following trauma associated shock. Analyzing a clinical pediatric trauma registry, we recently reported that critically injured adolescent females have lower mortality than equivalently injured males following traumatic shock.

Objective: To determine the independent effect of gender (across all age groups) on mortality among trauma patients.

Methods: Review of National Trauma Databank (NTDB; between 2001- 2005). Multiple logistic regression was used to analyze the independent effect of gender on mortality, adjusting for: age, severity of injury (Injury Severity Score (ISS) and Revised Trauma Score), severity of head injury, severity of extremity injury and mechanism of injury. Analysis focused on severely injured patients (ISS $\geq$16) with shock (systolic blood pressure $\leq$ 90; age adjusted for children < 8 years). Patients were placed in 3 groups according to age and likely sex hormone status: a) age 0-12; b) age 13-64 and c) $\geq$ 65 years.

Results: Of 1,466,887 patients in the NTDB, 65% were males. Upon subset analysis: 48,394 patients met the criteria for severe injury with shock. Table presents their crude mortality and odds of death by age and gender:

	Ages 12 and below		Age 13- 64		Ages 65 and above	
	Males	Females	Males	Females	Males	Females
n	3,553	1,831	26,778	8,677	4,280	3,275
Crude Mortality %	29	24	34	30	36	31
Adjusted odds of death 95% Confidence Interval (males= reference group)	1	0.92 0.74-1.14	1	**0.86*** 0.76-0.93	1	0.90 0.76-1.05

Conclusion: Females between the ages of 13 to 64 exhibit lower mortality than males following traumatic shock. This effect is lost at the extremes of age (pre-adolescent children and age $\geq$ 65) where the effects of sex hormones are absent or diminished. These findings suggest that hormonal differences may play a role in the gender based outcome disparities following traumatic shock.

**Significantly different than males*

Session IV

Poster # 84

OUTCOMES OF COCAINE POSITIVE TRAUMA PATIENTS UNDERGOING SURGERY THE FIRST DAY OF ADMISSION

Gabriel E. Ryb MD MPH*, Carnell Cooper MD*, University of Maryland School of Medicine, Baltimore, MD

Background: Patients with positive urine cocaine toxicology (UCT) will frequently have procedures delayed because of concerns regarding poor outcomes due to complications of cocaine use. There is no evidence to support this practice. We investigated whether the UCT+ trauma center patients experience a different outcome when undergoing surgery the first day of admission.

Methods: Cases of adult trauma patients undergoing surgery during the first 24 hours were selected from our database. Patients without UCT testing were excluded. UCT+ and UCT- patients were compared in relation to mortality, length of stay (LOS) and the development of cardiac, infectious and neurologic complications. Possible confounders were analyzed. Student t test, $\chi 2$, and log rank test were used for statistics (alpha=0.05). Multiple logistic regression (MLR) models and Cox proportional hazard (CPH) methods were used to adjust for possible confounders. Analysis was repeated for patients undergoing surgery during the first 8 hours.

Results: Of the 670 patients studied 15% (n=99) tested + for cocaine. UCT+ patients had a different age distribution, were more likely to be male, penetrating injury victims and had a lower ISS than UCT- patients. They did not differed in relation to the time elapsed from admission to surgery. Outcomes were similar for mortality (3% vs 4%) and for the development of infectious (14% and 21%), neurologic (0 vs 2%) and cardiac (12% vs 10%) complications. Median LOS was lower for UCT+ (5 vs 6 days, p=0.04). MLR models and CPH revealed no association of +UCT with the outcomes. While the univariate analysis revealed similar results among the 350 patients undergoing surgery during the first 8 hours, MLR models revealed higher adjusted odd ratios (OR) for the development of cardiac complications [OR 4.00 (1.41-11.1)] for UCT+ patients. Mortality and LOS remained similar within groups.

Conclusion: outcomes of patients undergoing surgery during the first 24 hours are not affected by the presence of +UCT. While cardiac complications are more common among +UCT patients undergoing surgery during the first 8 hours, LOS and mortality are not affected.

Session IV

Poster # 85

MINIMALLY INJURED PREGNANT PATIENTS REQUIRE RAPID TRAUMA EVALUATION

Erik Teicher MD, Robert D. Barraco MD, James Reed PhD, Michael M. Badellino MD,* Mark D. Cipolle MD PhD,* Michael D. Pasquale MD* , Lehigh Valley Hospital, Allentown, PA

Purpose: A prior report from this institution suggested that admission, observation, and monitoring of pregnant trauma victims with minimal injury (ISS<4) are unwarranted. This study was designed to validate this finding in a large national database. Based on our previous retrospective study, we hypothesized that the yield of admission for observation and monitoring in the pregnant victim of trauma who suffers minimal injury is low and that those patients with an ISS under 4 do not need monitoring.

Methods: A retrospective review of the National Trauma Data Bank (NTDB) was performed of all pregnant trauma admissions with ISS ?8 from January 1, 2000 to December 31, 2005. Data gathered included age, ISS, head, chest and abdomen AIS, delivery, c-section, mortality rates, and time to cesarean section.

Results: There were 1767 pregnant victims of trauma with ISS ?8. Average ISS was 1.98. Average age was 26 years. Mean AIS of head, abdomen, and chest of the total 1767 patients were 1.4, 1.2, and 1.2, respectively. Delivery rates, cesarean section rates and mortality are as follows. Time to c-section was 19.8 min for all patients, range 0-59 min, consistent with urgent c-section.

	N	Delivery N (%)	C-section N (%)	Mortality N (%)
ISS <4	1377	11 (0.8)	10 (0.7)	1 (0.1)
ISS ?4,?8	390	3 (0.8)	7 (1.8)	1 (0.3)
ISS ?8	1767	14 (0.8)	17 (1.0)	2 (0.1)

Conclusions: Delivery, c-section, and mortality rates in the pregnant trauma patient with minimal injury (ISS<8) are low but not insignificant. This data suggests the need for rapid trauma clearance prior to expeditious obstetric observation and monitoring of the pregnant patient despite little or no injury. The NTDB does not include critical elements relative to pregnancy, such as gestational age, fetal distress, and reason for distress. This shortcoming should be corrected to allow for meaningful outcomes research.

Session IV

Poster # 86

DEFINING THE OPTIMAL TIME INTERVAL FOR THE RETRIEVAL OF PROPHYLACTIC VENA CAVA FILTERS

A. Britton Christmas MD, David G. Jacobs MD*, Dennis A. Taylor ACNP, Ronald F. Sing DO*,
Carolinas Medical Center, Charlotte, NC

Objective: Extended intervals for the retrieval of prophylactic vena cava filters (VCF) has been demonstrated to be a safe and feasible practice. The aim of our current study was to assess our experience with retrievable VCF in our trauma population.

Methods: A review of prospectively collected data on prophylactic VCF insertion performed in high risk trauma patients was conducted over a 19-month period. The prophylactic filters were placed per our institutional practice guideline for venous thromoembolism prophylaxis. All filters were inserted by either an interventional radiologist (IR) or a trauma surgeon (TS). Duplex imaging of the lower extremities and pre- and post-retrieval cavagrams were performed on all patients. Demographics, injury severity score (ISS), duration of implantation, and complications were recorded.

Results: Prophylactic VCF were performed on one hundred fifty-three patients with a mean ISS of 27.3 $\pm$ 9.6. Thirty-two filters were performed by IR while 121 were performed by TS. All retrieval attempts were successful with 11 performed by IR and 45 performed by TS. Median duration of implantation was 117 $\pm$ 74 days (range 13-423). A single pulmonary embolus occurred while the filter was in place, and we also encountered a single device malfunction (broken strut). Ninety-seven patients (63.4%) were lost to follow-up despite aggressive efforts by our trauma service. TS recovered 37% of their respective filters (45/121), while IR recovered 34% (11/32).

Conclusion: While we previously demonstrated that extended intervals for the retrieval of VCF may be a safe practice, this study questions its feasibility in a noncompliant trauma population that is easily lost to follow-up. Perhaps more aggressive retrieval practices should be employed with removal of VCF prior to discharge from the hospital and/or rehabilitation facilities.

Session IV

Poster # 87

BLOOD GLUCOSE LEVELS AT 24 HOURS AFTER TRAUMA FAILS TO PREDICT OUTCOMES

Therese M. Duane MD*, Rao R. Ivatury MD*, Tracey Dechert MD, Holly Brown, Luke G. Wolfe MS, Ajai K. Malhotra MD*, Michel B. Aboutanos MD MPH, Virginia Commonwealth University Medical Center, Richmond, VA

Hypothesis: Blood glucose (BG) on admission and at 24 hours correlate with lactate and outcomes.

Methods: ***Prospective*** analysis of 278 trauma patients. 105 patients at admission and 55 patients at 24 hours had HBG (> 150 mg/dl).

Results: Admission HBG group had higher ISS with worse outcomes (Table 1). There was a significant linear relationship between ISS and BG (r^2 =0.05, p=0.0001) as well as ISS and lactate (r^2 = 0.05, p=0.0004). Lactate correlated well with BG (r=0.27, p<0.0001). 24 hour HBG failed to correlate with worse outcomes (Table 2). With lactate < 2.2 mmol/L at 24 hrs (n=232), there was no difference in mortality between the HBG and LBG groups (7.9% vs 7.7 %, p=1.0). In LBG at 24 hrs group (n=223) there was a significant difference in mortality with a lactate > 2.2 mmol/L (34.5% vs. 7.73%, p=0.0002). Using logistic regression, only lactate at 24 hours (odds ratio 1.93, CI 1.35-2.76) and ISS (odds ratio 1.1, CI 1.06-1.14) were independently predictive of death.

Conclusions: Blood glucose levels at 24 hours do not correlate with outcome, particularly if the patient is adequately resuscitated (normal lactate), calling into question the importance of strict glucose control in the trauma population.

Table 1	**HBG (>150 mg/dl)**	**LBG (? 150 mg/dl)**	**p value**
Lactate mmol/liter	4.2 ± 2.7	3.4 ± 2.3	0.0017
ISS	25.1 ± 13.8	20.3 ± 11.5	0.0046
Ventilator LOS (days)	1.7 ± 4.3	0.8 ± 2.7	0.07
ICU LOS (days)	8.0 ± 10.7	4.9 ± 7.8	0.0011
Hospital LOS (days)	15.3 ± 14.6	10.4 ± 12.2	0.0005
Mortality %	16.2 (17/105)	8.67 (15/173)	0.08

Table 2	**HBG 24 hr**	**LBG 24 hr**	**p value**
Ventilator LOS	1.1 ± 3.4	1.2 ± 3.4	0.75
ICU LOS	7.4 ± 12.5	5.7 ± 8.0	0.0.85
Hosp LOS	14.9 ± 15.8	11.6 ± 12.6	0.15
Mortality %	12.7 (7/55)	11.2 (25/223)	0.81

Session IV

Poster # 88

SYSTEMIC INFLAMMATORY RESPONSE SYNDROME SCORE ON ADMISSION PREDICTS INJURY SEVERITY, ORGAN DAMAGE AND SERUM NEUTROPHIL ELASTASE PRODUCTION IN TRAUMA PATIENTS

Yuichiro Sakamoto MD PhD, Kunihiro Mashiko MD PhD*, Hisashi Matsumoto MD PhD, Yoshiaki Hara MD, Noriyoshi Kutsukata MD PhD, Kenkichi Takei MD PhD, Katsuhiro Kanemaru MD, Yoshiteru Tomita MD, Nobuyuki Saito MD, Takanori Yagi MD, Takahiko Mine MD and Yasuhiro Yamamoto MD PhD, Chiba Hokusou Hospital, Chiba, Japan

Background: Systemic Inflammatory Response Syndrome (SIRS) is a clinical condition brought on by a complex reaction of acute endogenous mediators such as inflammatory cytokines.

Material and Methods: A retrospective analysis of 212 trauma patients was performed. We investigated both the relationship between SIRS assessments in trauma patients at the time of their arrival at the hospital and trauma severity (ISS, RTS and the probability of survival) as well as serum neutrophil elastase production. We then considered whether SIRS assessments could be used to predict the development of organ dysfunction complications in trauma patients after admission. The serum neutrophil elastase levels were measured in 46 other cases within 10 minutes of their arrival at the hospital.

Results: The presence of SIRS (two or more diagnostic criteria) at the time of admission was seen in 113 of the 212 patients (53.3%). The SIRS cases had significantly higher ISS values and lower RTS values. Twenty-two cases developed organ dysfunction, and this condition was correlated with the presence of SIRS (86.4%; 19 /22 cases, P = 0.0007) at the time of their arrival at the hospital. The average serum neutrophil elastase level of the cases who did not fulfill any of the SIRS diagnostic criteria was was 106.6 ng/mL, while that of those who fulfilled one criteria was 184.2 ng/mL, that of those who fulfilled two criteria was 145.6 ng/mL, that of those who fulfilled three criteria was 191.8 ng/mL, and that of those who fulfilled four criteria was 364.3 ng/mL.

Conclusion: The present results showed that as the SIRS score at the time of arrival at the hospital increased, the anatomic and physiological severity of the trauma also increased. Correlations between the SIRS assessments and each of the anatomic and physiological severity scores were also found. The SIRS score at the time of admission can be considered a valuable supplementary diagnostic criterion for the early identification of patients who may develop multiple organ failure after admission. In addition, a correlation between the SIRS assessments and the serum neutrophil elastase levels was also found.

Session IV

Poster # 89

SIGNIFICANCE OF MOTOR VEHICLE CRASHES AND PELVIC INJURY ON FETAL MORTALITY: A 5 YEAR INSTITUTIONAL REVIEW

Sharline Z. Aboutanos MD, Michel B. Aboutanos MD MPH, Therese M. Duane MD*, Ajai K. Malhotra MD*, Rao R. Ivatury MD*, Virginia Commonwealth University, Richmond, VA

Introduction: Motor vehicle crashes (MVC) are the leading cause of maternal injury during pregnancy. It is estimated that 1,300 – 13,000 fetal deaths/year result from maternal MVC.

Methods: Pregnant women with injuries were identified by ICD-9 codes containing pregnancy and injury from hospital medical records and Trauma/ ER registries. Records were reviewed for demographic data, fetal gestational age, mechanism of injury, injuries sustained, GCS, loss of consciousness (LOC), ISS, and maternal and fetal outcome. Fisher's exact and *t*-test analysis was performed to determine statistical analysis.

Results: From 2001-2005, 29,066 pregnant patients were seen at our institution. 5,244 of these patients visited the ER, and 294 of them reported injuries. 148 (52%) patients were involved in MVC. The average maternal age was 23.8 years. The mean gestational age was 20 weeks (range 6-40 weeks). The majority of patients were drivers (n=97, 65.5%) vs. passengers (n=42, 28.4%), and 37.8% were restrained vs. 18.2% unrestrained. There were no maternal deaths; however seven mothers (4.7%) had poor fetal outcome (six fetal deaths and one fetalis hydrops). Of these women, five sustained pelvic fractures. 24 patients (16.2%) had ISS $\geq$9 (range 9-50), and of those, four (16.7%) had poor fetal outcome. Pelvic injury and high ISS were found to be statistically significant risk factors for poor fetal outcome (p=0.0001 and p=0.0001, respectively). Position in the vehicle, restraints, LOC, GCS, and trimester were not significant risk factors for poor fetal outcome.

Conclusion: Maternal pelvic fractures sustained during MVC contribute towards high ISS and significantly impacts fetal outcome. Beyond first trimester, aggressive radiographic pursuit of pelvic fracture may be warranted.

Session IV

Poster # 90

ATTRIBUTABLE COSTS AND LOS OF POST-TRAUMATIC MULTIPLE ORGAN FAILURE

B. Haas MD, M.R. Rosengart MD MPH, T. Nelson MS, A. B. Nathens MD* PhD MPH,
University of Toronto, Toronto, Ontario, Canada

Introduction: Severely injured patients are at significant risk of developing multiple organ dysfunction syndrome (MODS). While there are potential novel interventions that might impact on the risk of post-traumatic MODS, their cost-effectiveness cannot be evaluated without an assessment of the attributable resource utilization related to this complication. To better inform the development of new strategies and their potential impact, we evaluated the excess costs and length of stay attributable to the development of MODS.

Methods: Data were derived from a multicenter prospective cohort study designed to identify trauma patients at high risk of developing MODS. Attributable resource utilization was assessed using a matched cohort design. Subjects with and without MODS were matched based on mechanism of injury, gender, age, ISS and volume of early transfusion. Costs were estimated from a subgroup analysis of hospital charges.

Results: 383 patients from 7 trauma centers were enrolled in this study. 50 (13.1%) patients subsequently developed MODS. Successful matching was achieved in 92% of patients with MODS. Compared to patients without MODS, MODS patients had a 229% increase in their ICU length of stay, and a significantly longer hospital length of stay. Costs were 110% higher among patients with MODS compared to those without.

	MODS (n = 46)	No MODS (n = 46)	p
Median ICU length of stay	23	7	<0.0001
Median hospital charges	$312,104	$148,384	0.0404

Conclusion: The excess costs and length of stay attributable to post-traumatic MODS are significant, suggesting that even costly therapeutic interventions in high risk patients might be cost-effective. These data can be used to guide the strategic development of novel interventions and better direct evaluation of their cost-effectiveness, and have implications for translation of new therapeutic strategies to the bedside.

Session IV

Poster # 91

ACTIVATED PROTEIN C RESTORES TIME-DEPENDENT HEPATIC INTEGRITY AFTER SEPSIS

Toan Huynh MD*, Steve Keller MS, William S Miles MD, Min Shin PhD, Mark G Clemens PhD, Carolinas Medical Center, University of North Carolina, Charlotte, NC

Introduction: Activated protein C (aPC) provides survival benefit in sepsis; yet its protective mechanisms remain unclear. We aimed to determine the time-dependent severity of hepatic injury after cecal ligation and puncture (CLP). Our hypothesis was that aPC restores hepatic integrity by reducing systemic inflammation.

Methods: *Sprague Dawley* rats underwent sham or CLP. At 12 or 24 hours after injury, liver function and damage were assessed by bile production and AST levels; respectively. In separate studies, two groups of rats underwent sham or CLP. After 24 hours, animals in group 1 received saline, and group 2 received aPC (1mg/kg) for four days. Plasma was harvested for AST; IL-2 and IL-6 were measured by ELISA. Hepatic tissue O_2 (tPO_2) was assessed by NADH autofluorescence.

Results: Lactate and AST levels increased with duration of sepsis, bile production decreased and liver tPO_2 declined. Treatment with aPC reduced plasma AST and restored tPO_2. After CLP, IL-2 and IL-6 levels increased, aPC therapy abrogated this response.

Group	Lactate (mg/dL)	NADH (AU)	AST (IU/L)	Bile (µL/kg/min)
Sham	13 ± 1	729 ± 2	45 ± 3	1508 ± 184
CLP (12hr)	26 ± 2*	797 ± 3*	119 ± 8*	1206 ± 125
CLP (24hr)	38 ± 2†	1313 ± 14†	116 ± 8*	103 ± 86*†
Group	IL-2 (pg/mL)	IL-6 (pg/mL)	NADH (AU)	AST (IU/L)
Sham+Saline	68 ± 2	0 ± 0	927 ± 13	29 ± 4
Sham+aPC	77 ± 8	0 ± 0	995 ± 7	31 ± 4
CLP+Saline	167 ± 39*	5806 ± 3389*	1149 ± 19*	229 ± 36*
CLP+aPC	101 ± 17§	0 ± 0§	924 ± 8§	64 ± 7§

* $p<0.05$ vs. sham; † $p<0.05$ vs. CLP (12hr); § $p<0.05$ vs. CLP+Saline; n=4-5/group.

Conclusion: Changes in tPO_2 occur as early as 12 hours after onset of sepsis; and continue to decline thereafter. Biochemical markers for liver injury are detected by 12 hours; while hepatic function deteriorates by 24 hours. Treatment with aPC restores hepatic integrity by improving tPO_2 and reducing systemic inflammation.

Session IV

Poster # 92

MONOTHERAPY FOR THE TREATMENT OF GRAM NEGATIVE VENTILATOR-ASSOCIATED PNEUMONIA IN TRAUMA PATIENTS

Louis J. Magnotti MD L. Paige Clement PharmD, Joseph M. Swanson PharmD, Peter E. Fischer MD, Stephanie A. Savage MD, Thomas J. Schroeppel MD, Martin A. Croce MD*, Timothy C. Fabian MD*, University of Tennessee Health Science Center, Memphis, TN

Background: Controversy persists regarding the optimal treatment regimen for the management of Gram-negative (GN) ventilator-associated pneumonia (VAP). Combination antibiotic therapy is often used to broaden the spectrum of activity of empiric treatment and provide synergistic bacteriocidal activity. The relevance of such "synergy" is commonly supposed but poorly supported. It is our contention that monotherapy is sufficient for the treatment of GN VAP. The purpose of this study was to evaluate the efficacy of monotherapy in the treatment of GN VAP as measured by quantitative culture on bronchoalveolar lavage (BAL).

Methods: Patients admitted to the trauma intensive care unit with GN VAP diagnosed on initial BAL (>10^5 CFU/ml in the effluent) were evaluated. All patients received empiric antibiotic monotherapy based on the duration of ICU stay, either ampicillin/sulbactam 3 gms IV every 6 hours ($\leq$ 7 days) or cefepime 2 gms IV every 8 hours plus vancomycin 20 mg/kg IV every 12 hours (>7 days) or equivalent alternative in penicillin allergic patients. These were adjusted based on culture data. Repeat BAL was performed on day 4 of appropriate antibiotic therapy. Microbiological resolution was defined as $\leq 10^3$ CFU/ml. Combination therapy with an aminoglycoside (either intravenous or aerosolized) was reserved for patients with either persistent positive or increasing colony counts on repeat BAL. Recurrence was defined as >10^5 CFU/ml on subsequent BAL following 2 weeks of appropriate therapy.

Results: 175 patients were identified. Overall, there were 207 GN (late isolates) VAP episodes (1.2 episodes per patient). Monotherapy alone achieved microbiological resolution in 187 isolates with only 2% recurrence. 95 isolates were completely eradicated at repeat BAL. 9.7% required combination therapy to achieve resolution.

Conclusions: The routine use of monotherapy in the treatment of Gram-negative VAP has a >90% success rate in trauma patients. Combination therapy should be reserved for those patients with persistent microbiological evidence of VAP despite adequate therapy.

Session IV

Poster # 93

POST-INJURY NEUTROPHILS EXPRESS T CELL REGULATORY MOLECULES PD-L1 AND ILT-3

Andrea Zucchiatti MD, Asit De PhD, Mita De MS, Carol Miller-Graziano PhD, and Paul Bankey MD PhD*, University of Rochester Medical Center, Rochester, NY

Post-injury neutrophils (PMN) have a well-established role in innate immunity; however, their participation in adaptive immunity has been largely ignored. Antigen presenting cell (APC) expression of MHC and co-stimulatory molecules is well characterized; however, they also regulate T cells through expression of the negative regulatory molecules such as program death-ligand (PD-L1) and immunoglobulin-like transcripts (ILT3). Recently, PMN have been shown to express co-stimulatory molecules therefore we investigated the expression of the negative regulatory molecules following injury.

Methods: human PMN (CD66b positive) from healthy subjects and trauma ICU patients (ISS >24) were cultured with or without GM-CSF (100pg/ml) + IFNγ (100U/ml) (CSF+I). Regulatory molecule expression was measured by flow Cytometry (isotype controls). Results: (Table: Mean % Positive ± SEM # $p< 0.05$ vs. Day 0 ** $p<0.05$ vs. Normal) Post-injury PMN demonstrate delayed apoptosis (Annexin V).

PMN Expression Following Culture with GM-CSF+IFN

Marker	Normal Day 0	Normal Day 2	Trauma Day 0	Trauma Day 2
HLA-DR	1.2 ± 1.0	17.4 ± 3.0 #	2.1 ± 1.6	24.6 ± 8.1 #
CD 86	1.8 ± 0.3	7.8 ± 1.9 #	2.6 ± 1.0	1.9 ± 1.2 **
PD-L1	0.1 ± 0.2	39.6 ± 4.7#	0.2 ± 0.6	54.1 ± 10.1#
ILT3	5.1 ± 1.6	6.1 ± 2.2	31.2 ± 11.4**	27.5 ± 10.2**
% Viable	96 ± 3	41 ± 8#	94 ± 4	64 ± 9#**

Neutrophils from both normals and trauma patients increase HLA-DR, CD86, and PD-L1 expression after 2 days of culture with CSF+I; however, CD86 did not increase in the post-injury PMN. In contrast, the negative regulatory molecule ILT-3 was markedly induced by trauma alone. This study demonstrates simultaneous expression of T cell co-stimulatory and negative regulatory molecules by post-injury PMN including PD-L1 and ILT-3. These data suggest that neutrophils may differentiate following injury into cells with T-cell co-stimulatory/regulatory activity and an underappreciated role contributing to post-injury adaptive immune responses.

Session IV

Poster # 94

SECRETORY IMMUNOGLOBULIN A BLUNTS GUT-MEDIATED PRIMING OF NEUTROPHILS IN VITRO

Parth B. Amin MD, Lawrence N. Diebel MD*, David M Liberati MS, Wayne State University, Detroit, MI

Introduction: Gut ischemia may prime neutrophils to produce an exaggerated inflammatory response when challenged with bacterial pathogens. Secretory immunoglobulin A (sIgA) is the first line of defense against potential pathogens, but may also exert its anti-inflammatory effects on potentially destructive neutrophil functions. We hypothesized that sIgA would blunt the gut-mediated priming events which lead to neutrophil hypersensitivity to bacterial challenge.

Materials and Methods: Confluent Caco2 cell monolayers were grown in a two-chamber culture system under normoxic or hypoxic conditions for 90 minutes followed by a 90 minute reoxygenation period (H/R). Secretory immunoglobulin A was placed in apical chamber media in experimental groups prior to H/R. Supernatants were then collected and incubated with neutrophils. LPS was then used to activate neutrophils. Measurements of CD11b expression, elastase and superoxide anion production, and chemotaxis were undertaken.

Results (n=4, *p<0.001)

	%CD11b	%Elastase	%SOD	Chemotaxis
PMN alone	44.54±3.8	32.25+4.1	6.15+0.3	750±125
Caco2	48.65+2.6	33.14+1.6	7.65+1.2	1600±225*
Caco2 + H/R + LPS	71.1±5.6*	49.75+4.3*	30.95+1.5*	5300±375*
Caco2 + H/R + LPS + sIgA	54.96±4.5*	38.12+3.6*	20.78+1.3*	3225±250*

Conclusion: Secretory IgA is the principal defense against potential pathogens at mucosal surfaces. Additional protective activity of sIgA may be found in its ability to downregulate gut-mediated neutrophil priming. Furthermore, the priming event may not require bacterial products. Transport of sIgA may be a potential mechanism by resistance against the promulgation of an exaggerated, and potentially destructive, inflammatory response at the gut barrier occurs.

Session IV

Poster # 95

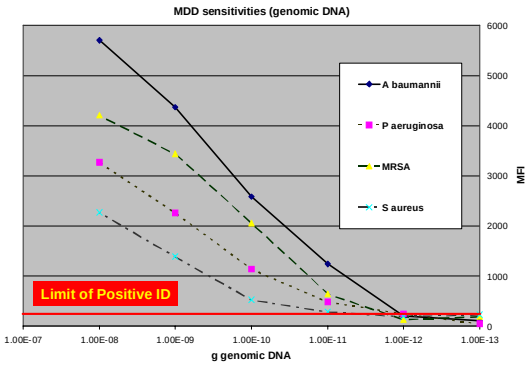
RAPID BACTERIAL PATHOGEN IDENTIFICATION WITH THE MOLECULAR DIFFERENTIAL DIAGNOSTIC SYSTEM

Roger R. Price PhD, Charles H. Guymon MA, Clinton K. Murray MD, Edward E. Horvath DO, John B. Holcomb MD*, US Army Institute of Surgical Research, Fort Sam Houston, TX

Objective: Current microbiology methods can require from 3-5 days for useful bacterial identification. This extended timeframe influences selection of antibiotics and also infection control procedures. Although use of rapid molecular methods of bacterial identification is common for select agents and beginning for clinically important organisms, assays are not yet available for the most common pathogens. The Molecular Differential Diagnostic (MDD) system allows simultaneous (multiplex) identification of multiple clinical pathogens in several hours by detection of target pathogen DNA polymerase chain reaction (PCR) products using Luminex xMAP-based array suspensions of fluorescent microspheres. We tested the MDD system for its specificity and detection sensitivity of several pathogen targets (including *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and MRSA), as well as its ability to identify pathogens in human urine and blood samples.

Methods: Three stages comprise the MDD System: 1) DNA extraction (1-4 hr); 2) multiple template PCR (TEM-PCR) amplification of pathogen DNA (3 hr); and 3) PCR product detection with xMAP technology (30 min). Total time required for complete sample analysis was <8 hr.

Results: The MDD system accurately identified all examined pathogen targets with no cross-reactivity between organisms, although lower limits of pathogen detection varied widely. Identification of bacteria in spiked urine samples was reliable; however, assay sensitivity was reduced in bacteria-spiked blood samples, with increased false positive "noise."



Conclusion: Less-than-desired sensitivity of pathogen identification in blood samples is a current hurdle to clinical use of the rapid MDD system, while spiked urine samples can be rapidly and accurately identified.

Session IV

Poster # 96

THE EFFECTS OF SMOKING IN TRAUMA PATIENTS: THE INCIDENCE OF SEPSIS, ARDS, MODS AND SURVIVAL

T. Ferro-Nguyen DO, P. Goslar PhD, A. Romanovsky MD PhD, SR Petersen MD*, St. Joseph's Hospital and Medical Center, Phoenix, AZ

Cigarette smoking is a major risk factor for cardiovascular disease, stroke and chronic lung disease. In addition, smoking has been associated with the development of ALI/ARDS in critically ill patients. It is well documented that nicotine exerts immunosuppressive, as well as, anti-inflammatory effects with chronic use. Several animal studies, including our own, have demonstrated that nicotine can modulate the immune response which may be beneficial in the setting of sepsis, septic shock and multiple organ dysfunction syndrome (MODS).

Hypothesis: Chronic nicotine exposure is protective against an overwhelming inflammatory response, particularly reducing the incidence and progression of sepsis and organ failure.

Methods: A retrospective cohort of trauma patients with documented smoking status was randomly selected from the trauma registry and individual charts were removed. Criteria for selection included: ISS $\geq$ 20, age 18-65, hospital LOS > 72 hrs. Smokers and non-smokers were compared with respect to mortality, incidence of MODS, ARDS, pneumonia, sepsis, ventilator support, ICU and hospital LOS.

Results: Overall 327 patients were reviewed: 171 smokers, and 156 non-smokers. Males outnumbered females in the smoking group 4-fold (p=0.03 versus non-smokers). Age, ISS, shock on admission, blunt/penetrating, ICU and hospital LOS, ventilator days were similar between smokers and non-smokers. Table 1 demonstrates outcomes of smokers and non-smokers.

Outcome	Overall (%)	Smokers (%)	Non-smokers (%)	P value
Prophylactic Abx	216 (66.1)	112 (71.8)	104 (60.8)	0.047*
Sepsis	143 (43.7)	70 (44.8)	73 (42.7)	0.738
Pneumonia	123 (37.6)	61 (39.1)	62 (36.3)	0.596
ARDS	35 (10.7)	17 (10.9)	18 (10.5)	0.962
MODS	33 (10.1)	15 (9.6)	18 (10.5)	0.855
Survival	3 (0.9)	2 (1.2)	1 (0.6)	0.595

Conclusions: Although smokers received more prophylactic antibiotics than non-smokers, the incidence of sepsis, pneumonia, ARDS and MODS were not different. Chronic tobacco use plays a minimal role in the outcome of critically injured trauma patients.

Session IV

Poster # 97

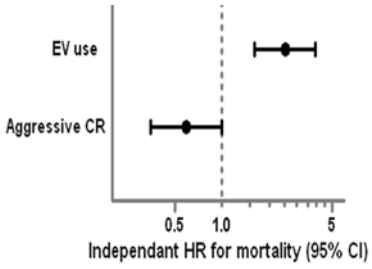
CHARACTERIZATION OF EARLY VASOPRESSOR USE AND AGGRESSIVE CRYSTALLOID RESUSCITATION FOLLOWING INJURY AND HEMORRHAGIC SHOCK

Jason L. Sperry MD MPH, Ram Nirula MD MPH, Heidi L. Frankel MD, Michael A. West MD PhD, Brian G. Harbrecht MD, Ernest E. Moore MD*, Ronald V. Maier MD, Jospeh P. Minei MD*, University of Texas Southwestern, Dallas, TX

Objective: Recent evidence suggests that overly aggressive crystalloid resuscitation is associated with iatrogenic complications following injury. This has lead to increasing use of vasopressors for hemodynamic support during resuscitation. We sought to characterize early vasopressor (EV) use and crystalloid resuscitation volume (CR) and their effect on mortality in severely injured patients.

Methods: Data were obtained from a multi-center, prospective, cohort study designed to evaluate the outcome of blunt injured adults in hemorrhagic shock. Patients with isolated brain or cervical cord injury, and early deaths (<48hrs) were excluded from the analysis. A single Cox proportional hazard regression model was used to evaluate the effects of EV use (within 24hrs; levophed, phenylephrine, dopamine or vasopressin) and aggressive CR (within 12 hrs) on mortality while controlling for all important physiologic, injury, resuscitation, and patient demographic confounders.

Results: After excluding early deaths, overall mortality (n=823) was 12.6% and mean ISS was 31±13. EV use occurred in 19.3% of patients and the mean CR was 11.9L (range 1.2L – 58L). More than 16L of CR (75th percentile) was deemed aggressive CR. Our model was a good predictor of mortality by ROC curve analysis (AUC = 0.87). In a single regression model, EV use was associated with a 2.5 fold higher mortality (95%CI 1.6-3.9), while aggressive CR was associated with a 40% reduction in mortality (95%CI 0.3-0.9) (Fig). **Conclusion**: Early vasopressor use is independently associated with increased mortality, while aggressive crystalloid resuscitation is associated with a significant protective effect. Although vasopressors may reduce fluid requirements and complications out from the initial resuscitation, this analysis suggests they should not be used early in the resuscitation phase. Instead, early hemodynamic support should rely primarily upon aggressive crystalloid resuscitation in severely injured patients with hemorrhagic shock.



Session IV

Poster # 98

MINIMAL IMPACT OF ESCALATING DOSES OF ACTIVATED FACTOR SEVEN TO HBOC-201 RESUSCITATION FROM UNCONTROLLED HEMORRHAGIC SHOCK

Lewis J. Kaplan MD*, Jennifer Rice MS, Francois Arnaud PhD, Chuck Aucker MD, Bruce Pearce PhD, Daniel Freilich MD, Naval Medical Research Center and Yale University School of Medicine, New Haven, CT

Purpose: This study determines whether adding escalating doses of recombinant activated factor VIIa (rfVIIa) to hemoglobin-based oxygen carrier (HBOC) resuscitation reduces blood loss, and improves hemodynamics and survival from uncontrolled hemorrhage.

Methods: Pigs underwent a surgically created AAST Grade III liver laceration and 15 min. of uncontrolled hemorrhage, and randomization top(n=8/gp) to resuscitation with HBOC alone *or* HBOC plus 90, 180, or 360 mcg/kg bw of rfVIIa x 4 doses by protocol. Lab data, hemodynamics, blood loss, fluids, and survival were recorded. Simulated hospital arrival at 4 hrs provided blood for severe anemia, crystalloids for hypotension, and surgical hemostasis. Pigs were followed for 72 hours. Data are means ± SEM; intergroup comparisons were by Mixed Procedure, t-test, and Fischer's Exact test.

Results:

Element	**HBOC**	**HBOC/90**	**HBOC/180**	**HBOC/360**	**p**
Post-injury MAP	32.4±10	30.3±7.1	34.2±13.6	37.4±9.3	0.62
Δ baseline MAP@45 min	-6.63	0.38	-8.32	-5.25	0.42
4 hr survival (%)	62.5	75	62.5	75	0.37
24 hr survival (%)	25	62.5	62.5	50	0.37
Lactate @ 4 hr.	2.62±2.9	0.87±0.4	1.76±1.4	2.1±0.8	0.17
EBL (ml/kg/survival hr)	13.8±5.8	6.9±4.3	9.4±5.1	4.5±2.6	0.26
Base excess	-1.03±2.8	1.84±1.0	-0.3±1.6	N/A	0.28

Conclusions: Adding rfVIIa to a HBOC-based resuscitation regimen improved lactate clearance, base excess, survival and blood loss trends. Dose escalation data does not support using greater than 90 mcg/kg bw in this model of uncontrolled hepatic hemorrhage. A more lethal model may be required to discern whether trends reflect true differences between groups treated with HBOC and rfVIIa.

Session IV

Poster # 99

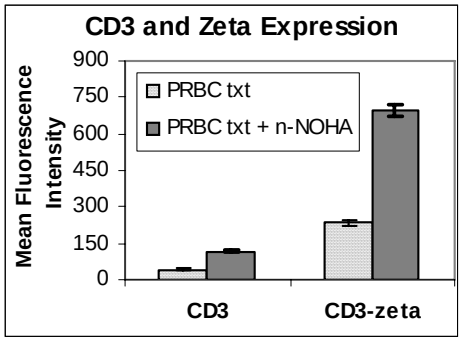
T-CELL CD3 AND ZETA CHAIN EXPRESSION ARE SUPPRESSED BY RED BLOOD CELL ARGINASE

Andrew Bernard MD, Cynthia Meier MS, Charles Snow PhD, Erin Manning MD PhD, Jeff Coughenour MD, Bernard Boulanger MD*, Phil Chang MD, Paul Kearney MD*, University of Kentucky, Lexington, KY

Background: Transfusion of packed red blood cells (PRBC) is associated with immune suppression manifested as higher infection rates, organ failure and mortality. RBCs contain the enzyme arginase which depletes arginine and has been shown to impair T-cell proliferation. Since arginine deprivation by arginase within other cell types impairs expression of CD3 receptor and CD3 zeta chain, a key protein chain in the T-cell CD3 receptor, we hypothesize that PRBC arginase causes decreased CD3 and CD3 zeta chain expression.

Methods: Culture media with physiologic arginine (150uM) was exposed to PRBC at 20% by volume. Select cultures contained the arginase blocker nor-N-OH-L-arginine (nor-NOHA). After 24hrs of incubation, and PRBC removal, stimulated fresh human peripheral T-cells (PBMC) were cultured in the PRBC pre-treated media. CD3 receptor and CD3 zeta chain expression were determined at 48 hours using flow cytometry.

Results: The percentage of PBMC expressing CD3-zeta chain was decreased in cultures exposed to PRBC media vs control media (41% vs 71%, p=0.03); this decrease was partly normalized when nor-NOHA was added (41% vs 54.3%, p=0.03). In addition, T cell CD3 and CD3 zeta chain mean fluorescence intensity were suppressed in PRBC media but this effect was reversed using the arginase blocker nor-NOHA (Figure, CD3: p=0.004, zeta: p=0.0003, PRBC vs PRBC + nor-NOHA).



Conclusion: Total CD3 and CD3-zeta chain expression are suppressed by PRBC arginase. Since CD3 and CD3-zeta chain are essential for normal T-cell proliferation, PRBC arginase and subsequent depletion of arginine comprise a potential novel mechanism for transfusion-associated immune suppression.

Session IV

Poster # 100

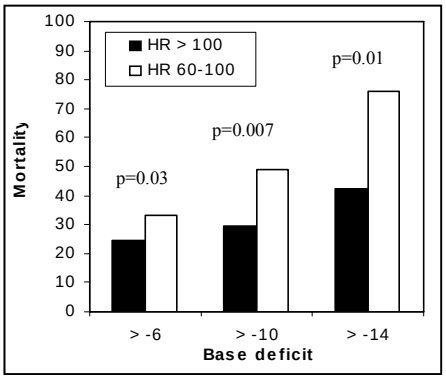
EVALUATION OF NORMAL HEART RATE IN THE SETTING OF SHOCK AFTER INJURY

R. Shayn Martin MD, J. Jason Hoth MD, James H. Holmes MD, Preston R. Miller MD, J. Wayne Meredith MD*, Michael C. Chang MD*, Wake Forest University School of Medicine, Winston-Salem, NC

Introduction: Tachycardia is a well accepted early indicator of shock after injury. Despite the presence of acidosis indicating poor perfusion, some patients demonstrate a normal heart rate (HR) that may underestimate a patient's physiologic insult. The inability to vary one's HR in response to stress has recently been associated with increased mortality. The purpose of this study was to evaluate those patients who presented in shock but with a normal HR and determine their outcomes.

Methods: A Level I trauma center registry was queried and patients with various levels of elevated base deficit (BD) (? 6) were grouped by high (?100 bpm) or normal (60-100 bpm) HR on ED admission. Mortality as well as injury severity (ISS), systolic blood pressure (SBP), and transfusion requirements were compared between groups. Factors associated with mortality were analyzed using logistic regression.

Results: Over 3 years, 825 patients presented with an elevated BD of which 336 had a normal HR. At each level of elevated BD, there was a trend towards increased mortality in the normal HR group. When only brain-injured patients were included (n=458), the normal HR group (n=178) demonstrated significantly greater mortality than the tachycardic group (n=280) despite equivalent ISS, SBP, and transfusion requirement (Figure). Logistic regression identified inappropriately normal HR as an independent predictor of death in all patients, as well as the brain-injured group (OR 1.8, 95%CI 1.1-3.1, p=0.01 and OR 2.2, 95%CI 1.3-3.6, p=0.01, respectively).



Conclusion: Failure to mount a tachycardic response in patients with an elevated BD is a concerning sign and was associated with death in trauma patients. These data may further support the association of poor heart rate variability with increased mortality. A lack of tachycardia in the setting of shock should not be misinterpreted as an indication of patient stability.

Session IV

Poster # 101

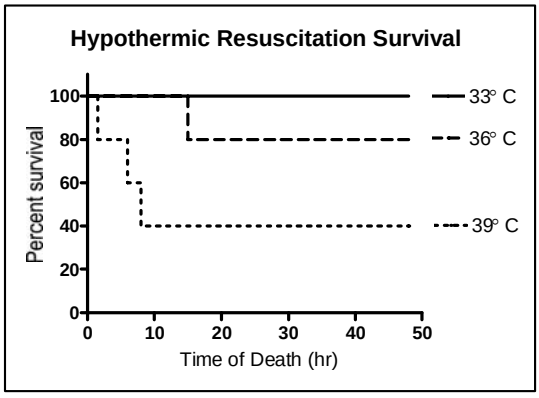
INDUCED HYPOTHERMIA REDUCES MORTALITY IN A PORCINE HEMORRHAGIC SHOCK MODEL

ME George MD, ME Mulier MS, GJ Beilman MD*, University of Minnesota Medical Center. Minneapolis, MN

Objective: Previous animal studies have shown benefit for induced hypothermia (IH) in hemorrhagic shock. This study was performed to explore the effects of moderate and profound cooling during resuscitation following hemorrhage in pigs.

Methods: 15 pigs were anesthetized and hemorrhaged to a mean arterial pressure of 45-55 mmHg for 45 minutes. Three groups (n = 5 in each) were then randomized to an 8 hour resuscitation period: normothermic (39° C), moderate hypothermic (36° C), and profound hypothermic (33° C). Cooling was achieved with ice packs. After 8 hours, animals were rewarmed, resuscitated for 16 hours, and survivors were extubated and observed for an additional 24 hours before being euthanized.

Results: The mortality rate was significantly higher for the normothermic group compared to all hypothermic animals (60% vs 10%, p = 0.039) and the normothermic group compared to the profound hypothermic group (60% vs 0%, p = 0.038). Rates between normothermic and moderate hypothermic groups were not significantly different (60% vs 20%, p = 0.197). Survival is illustrated in the Kaplan-Meier curve. AST, creatinine kinase, and lactate dehydrogenase levels 8 hours post-hemorrhage and lactate levels at 48 hours were significantly higher in the normothermic group compared to all hypothermic animals.



Conclusions: Inducing hypothermia during resuscitation after hemorrhagic shock in pigs was associated with significantly lower mortality rates and lowered markers of organ system dysfunction. There has been renewed interest lately for applying principles of IH to select trauma and critical care patient populations.

Session IV

Poster # 102

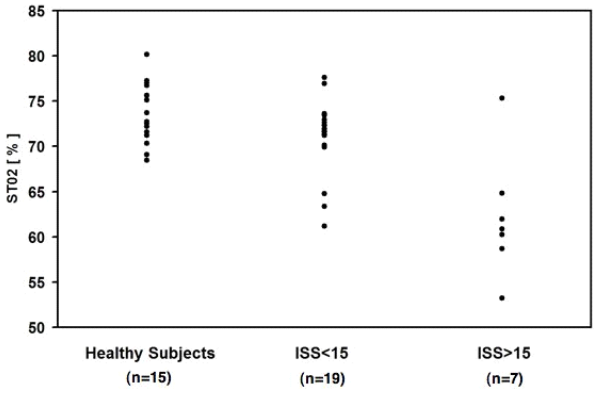
DIFFUSE OPTICAL SPECTROSCOPY: A NEW TOOL FOR INITIAL RESUSCITATION

Michael E. Lekawa MD, Boris H. Borazjani MD MPH, Matthew O. Dolich MD, Marianne E. Cinat MD, Darren J Malinoski MD, Cristobal Barrios MD, Matthew Brenner MD, Richard Kwong BS, Jangwoen Lee PhD, Albert Cerussi PhD, Bruce J. Tromberg PhD, David B. Hoyt MD*, University of California, Orange, CA

Introduction: Diffuse optical spectroscopy (DOS) uses near infrared (NIR) light to quantify absolute tissue hemoglobin saturation (StO_2), which is in contrast to conventional NIR spectroscopy that provides only relative StO_2. An absolute StO_2 may represent a more relevant assessment of significant injury. We hypothesized that a DOS prototype instrument measurement of StO_2 would discriminate injury severity and early fluid resuscitation requirements in traumatized patients.

Methods: Twenty-six patients admitted to a level I trauma center were prospectively evaluated. DOS StO_2 was measured from a standard anatomic location within 20 minutes of arrival. All injuries were identified and Injury Severity Score (ISS) was calculated. A standard resuscitation protocol was utilized and twenty-four hour fluid requirements were recorded. DOS StO_2 was measured in 15 healthy volunteers for comparison.

Results: Seven trauma patients had an ISS>15 while 19 had an ISS<15. Mean StO_2 was significantly lower in the severely injured group (62±7% vs. 71±4%, p<0.004). Six of 7 severely injured patients (86%) had a StO_2 below 67% while 16 of 19 less-injured patients (84%) had StO_2>67% (PPV 67%, NPV 94%). A two-fold increase in initial 24-hour IV fluid requirements was observed in patients with StO_2<67% (4.7 ± 1.9L vs. 2.0±1.1 L, p<0.0001) and in patients with ISS>15 (4.8±2.2L vs. 2.2±1.3L, p<0.001).



Conclusions: DOS-derived StO_2 effectively predicts injury severity and early volume resuscitation requirements. This novel technology shows promise as a non-invasive tool for triage, anticipation of injury, and assessment of resuscitation requirements.

Session IV

Poster # 103

EARLY PREDICTION OF MASSIVE TRANSFUSION IN COMBAT CASUALTIES

John B. Holcomb MD*, Daniel F. McLaughlin MD, E. Darrin Cox MD, Jeremy G. Perkins MD, Don H. Jenkins MD*, Sarah E. Niles MD MPH, Jay A. Johannigman MD*, Jose Salinas PhD, Charles E. Wade, PhD, University of Cincinnati, Cincinnati, OH and US Army Institution of Surgical Research, Fort Sam Houston, TX

Objective: Massive transfusion associated with coagulopathy or surgical bleeding increases mortality in severely injured patients. Early intervention may improve outcomes, however reliable identification of patients requiring MT is difficult in the emergency department. We hypothesized that an algorithm from clinical information routinely assessed upon admission could be developed that would allow early identification of these patients.

Methods: A retrospective study was conducted at a Combat Support Hospital in Iraq to identify risk factors for MT in patients with traumatic injuries. Demographic, diagnostic, and laboratory variables obtained upon admission were analyzed. Univariate and multivariate analyses determined independent risk factors. An algorithm was formulated to predict MT and validated with an independent data set.

Results: 3442 patient records were reviewed and 688 received at least one unit of blood. Patients were excluded for being prisoners, transferred form another medical facility, or inadequate data, resulting in 288 patients. 24.3% required massive transfusion. Patients with MT had a higher mortality rate, 25.7% versus 6.9% ($p < 0.001$) and increased ISS, 26 versus 18, ($p < 0.001$). Multivariate analysis identified five independent risk factors for MT: systolic blood pressure <110 mmHg, heart rate >105 beats per minute, body temperature <36.0°C, pH <7.25 and base deficit ?7. An algorithm was created to determine the relative risk of MT (AUC = 0.833). In an independent data set of 535 patients the ability to identify those requiring MT was validated, resulting in an AUC = 0.737.

Conclusions: Independent risk factors for MT were identified and validated in patients with traumatic injuries that required transfusions due to coagulopathy or surgical bleeding. Patients requiring a massive transfusion can be identified early with information routinely obtained upon hospital admission, potentially leading to earlier, more successful interventions and improved outcomes.

Session IV

Poster # 104

INFECTIOUS RISKS FOLLOWING MASSIVE TRANSFUSION ARE COMPONENT DEPENDENT

Javid Sadjadi MD, Patrick Twomey MD, Richard Ha MD, Gregory Victorino MD*, University of California San Francisco-East Bay, San Francisco, CA

Introduction: Blood products are recognized as immunosuppressants, however, adequate resuscitation results in fewer infectious and non-infectious complications. Achieving a balance between the risks and the benefits of massive transfusions is problematic.

Hypothesis: Massive transfusion resuscitation leads to increased infections.

Methods: During a 17 month period, 67 patients presented to our urban university-affiliated trauma center that required a massive transfusion (greater than 20 units of blood products in the first 24 hours of admission). Of these, 44 patients survived for at least three days and were included in the study. The comparison group consisted of contemporaneous intensive care (ICU) patients with similar injury severity scores (ISS) who did not receive any blood products. Infection was defined as intraperitoneal or intrathoracic abscesses, clinical pneumonia, urinary tract infection, or bacteremia. Multivariate logistic analysis was performed with age, ISS, Glasgow coma scale, ICU length of stay, and transfusion as variables and infection as outcome.

Results: The incidence of infectious complications in those who receive a massive transfusion was 62% compared to controls who had an incidence of 23% (Chi Square, p=0.001). In the multivariate logistic model, odds of infection were more than fivefold greater in massively transfused patients (Odds ratio of 5.1; 95% CI 1.9-13.6). This effect was independent of ISS, GCS, and age. Within the transfused group we found a strong trend toward increased sepsis with greater administration of cellular blood components, especially packed red blood cells. No relation to infection was found with plasma.

Conclusions: Trauma patients who received a massive transfusion had 5 times the odds of infectious complications as compared to nontransfused patients with similar injury severity scores. Modifying the ratio of components used in transfusion protocols to favor plasma over cellular elements may lead to less coagulopathy, hence less red blood cell transfusions, and consequently less infectious complications following severe injury.

Session IV

Poster # 105

PHYSIOLOGIC ESTROGEN LEVELS DOES NOT ENHANCE PROTECTION AGAINST ISCHEMIA AND REPERFUSION INJURY IN HERBIMYCIN A AND ANTI-CD18 TREATED RATS

Damon Clark MD, Gregory Rushing MD, L. D. Britt MD MPH, Eastern Virginia Medical School, Norfolk, VA

Background: Recent data at our institution have shown that NF-kB inhibitor Herbimycin A and anti-CD18 attenuate ischemia/reperfusion injury in female rats. We repeated the same study using male rats to determine if lack of an estrogen "protective effect" would demonstrate a more severe insult.

Methods: Twenty male rats undergoing hemorrhage were placed into the following treatment arms: 1) no treatment; 2) Herbimycin A; 3) anti-CD18; 4) Herbimycin A and anti-CD18. Serum IL-1, TNF alpha, and lactate levels were measured. Gross lung weight and myeloperoxidase were obtained to determine extent of injury.

Results: After two hours of resuscitation, the non-treatment group had a lactate level of 5.38 mmol/L; TNF alpha level - 466 pg/ml; IL-1 level - 535 pg/ml. Herbimycin A group (post resuscitation) had a lactate level of 4.1mmol/L; TNF alpha level - 172 pg/ml; IL-1 level - 217 pg/ml. The anti- CD18 group (post resuscitation) had a lactate level of 3.6 mmol/L; TNF alpha level - 235 pg/ml; IL-1 level - 291 pg/ml. The combined treatment group (post reperfusion) had a lactate of 3.2 mmol/L ($p=0.3$); TNF alpha level - 96 pg/ml ($p< 0.001$); IL-1 level - 120 pg/ml ($p<0.001$). Along with decreased weight of the gross lung tissue, there was a statistically significant ($p<0.05$) decrease in the myeloperoxidase levels when compared to the no treatment group.

Conclusion: Other investigators have demonstrated the protective effect of estrogen in ischemia/reperfusion injury. In our ischemia/reperfusion treatment model, using Herbimycin A and anti-CD18, physiologic estrogen levels did not appear to have any protective effects.

Session IV

Poster # 106

INCIDENCE, RISK FACTORS, AND OUTCOMES FOR ATRIAL ARRHYTHMIAS IN TRAUMA PATIENTS

Carlos V.R. Brown MD*, Pantelis Hadjizacharia MD, Linda S. Chan PhD, Jennifer Law MS4, Hakan Yanar MD, Kenji Inaba MD, Ali Salim MD*, Peter Rhee MD MPH*, Demetrios Demetriades MD PhD*, University of Southern California, Los Angeles, CA

Objective: To determine the incidence of, risk factors for, and outcomes after atrial arrhythmias (AA) in trauma patients and to identify independent risk factors for mortality in trauma patients who develop an AA.

Methods: Seven year (1998 – 2005) retrospective study of all trauma patients admitted to the ICU at an academic level I trauma center. Patients with AA (atrial fibrillation, atrial flutter, paroxysmal supraventricular tachycardia) were identified through the computerized ICU database and compared to patients without AA. Groups were compared by univariate and multivariate analysis.

Results: There were 3,500 trauma patients admitted to the ICU during the study period, of which 210 (6%) developed an AA. AA patients sustained more blunt trauma, were older, more often female, more severely injured, and sustained more head injuries. The only independent risk factor for developing an AA was age $\geq$ 55 years (odds ratio = 4.6, $p < 0.0001$). Mortality was higher in the AA group (33% vs. 14%, $p < 0.0001$) and AA was an independent risk factor for dying (odds ratio = 1.7, $p = 0.01$). When investigating only the 210 AA patients, independent risk factors for mortality included injury severity score (odds ratio = 1.2, $p = 0.01$) and severe head injury (odds ratio = 2.9, $p = 0.004$). Overall, 72% (n = 151) of AA patients received beta-blockers in the post-injury period. AA patients who received beta-blockers had a lower mortality (22% vs. 37%, $p = 0.04$) and, after adjusting confounding variables, AA patients who received beta-blockers had an odds ratio for mortality of 0.41 ($p = 0.03$).

Conclusions: AA occurs in 6% of trauma patients admitted to the ICU. The only independent risk factor to develop AA in trauma patients is older age. Trauma patients who manifest an AA have a higher mortality, and AA is an independent risk factor for mortality after trauma. Almost three-quarters of AA patients received beta-blockers, and beta-blocker therapy is associated with decreased mortality in trauma patients with AA.

Session IV

Poster # 107

AUTOMATED DETECTION OF SIGNIFICANT CLINICAL EVENTS IN THE INTENSIVE CARE UNIT USING HEART RATE VARIABILITY

Jose Salinas PhD, Andriy I Batchinsky MD, Lee C. Cancio MD*, John G. McManus MD, Victor A. Convertino PhD, Kathy L. Ryan PhD, William H. Cooke PhD, Brian J. Eastridge MD*, Steven E. Wolf MD, Charles E. Wade PhD, John B. Holcomb MD*, U.S. Army Institute of Surgical Research, Fort Sam Houston, TX

Objective: Previous studies have shown a significant mortality relationship with changes in heart rate variability (HRV) obtained from an electrocardiogram (ECG) in both prehospital trauma patients and those in the intensive care unit (ICU). The objective of this study was to determine the feasibility of developing an automated HRV detection system for early identification of "significant clinical events" in the ICU.

Methods: A computerized algorithm for detection of clinical events (abnormal physiologic parameters or need for clinical interventions) as well as organic (conduction disturbances, etc.) and mechanical noise (ECG artifact) using the ratio of the HRV high-frequency-to-low-frequency (HF/LF) powers was developed. Sequences with elevated HRV values were assigned to 1 of 3 categories: CAT1 (1.0<HF/LF<2.0), CAT2 (2.0?HR/LF<3.0) and CAT3 (HF/LF?3.0). 35 patients with significant clinical events classified as respiratory, cardiovascular, or death were evaluated. A 96-hour ECG tracing with 69,120,000 ECG data points containing the clinical event was exported and analyzed for each patient.

Results: The algorithm detected an average number of 29±24 CAT1 sequences, 21±17 CAT2 sequences, and 21±17 CAT3 sequences per 24-hour period. 8 of 10 (80%) respiratory events, 13 of 16 (81%) cardiovascular events, and 5 of 9 (55%) deaths fell within 1 of these abnormal CAT sequences. Mean delay between start of abnormal CAT sequence to actual event was 117 ± 357 SD minutes, while standard vital signs recorded at 120 minutes before events were: 123±28 mmHg systolic blood pressure, 64±17 mmHg diastolic blood pressure, 112±20 heart rate, 20±6 respiratory rate.

Conclusion: This HRV system may provide a screening tool for preemptive identification of significant ICU events of various origins based on ECG analysis. An early warning system integrated into standard ECG monitors may be possible. Prospective validation of the system is warranted.

Session IV

Poster # 108

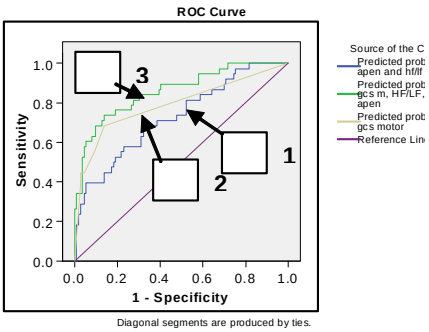
NOVEL METHODS OF HEART-RATE-VARIABILITY ANALYSIS PREDICT LIFESAVING INTERVENTIONS IN PREHOSPITAL TRAUMA PATIENTS

AI Batchinsky MD, J Salinas PhD, LC Cancio MD*, MA Boehme MS, TH Kuusela PhD, VA Convertino PhD, CE Wade PhD, JB Holcomb MD*, University of Turku, Turku, Finland, and U.S. Army Institute of Surgical Research, Ft. Sam Houston, TX

Objective: Analysis of heart-rate variability (HRV) has been previously shown to be associated with mortality in prehospital trauma patients. There are several methods of measuring this new vital sign. We applied 2 computationally different but complementary techniques of HRV determination to assess its relationship with life-saving interventions (LSIs) performed in a prehospital setting.

Methods: EKGs from 192 patients, en route to a Level I trauma center were analyzed. HRV Method 1 (HRV_1) is based on quantification of the strength of periodic oscillations in the HR. HRV Method 2 (HRV_2) quantifies the amount of irregularity in the HR. Mental status (motor GCS score, GCSm), heart rate (HR), and systolic blood pressure (SBP) were recorded in the field. Logistic regression was used to model the need for LSI; odd ratios (ORs) and areas under the curve of receiver-operating-characteristic curves (ROC_{AUC}) were calculated. Data are means ± SEM.

Variable	LSI	NonLSI	p	OR (model 3)
Survivors	85%	98%	.002	--
HR	108±5	99±2	<.001	--
SBP	120±5	125±2	.287	--
GCSm	3.5±0.4	5.7±0.1	<.001	0.50
HRV_1	0.51±0.08	0.29±0.03	.001	3.31
HRV_2	0.91±0.04	1.09±0.02	<.001	0.07



Results: Univariate results are given in the Table. By logistic regression, GCSm, HRV_1, and HRV_2, but not HR or SBP, were dependently associated with LSI. For HRV_1 and HRV_2 (model 1 in the Figure), ROC_{AUC}=.70. For GCSm alone (model 2), ROC_{AUC}=.79. For all 3 combined (model 3), ROC_{AUC}=.86.

Conclusion: Consistent with prior studies suggesting that abnormal HRV and GCSm are associated with death, we found that both also relate to the need for LSI. These data could be used to improve triage, as well as to identify those relatively stable casualties in need of LSIs prior to cardiopulmonary collapse.

Session IV

Poster # 109

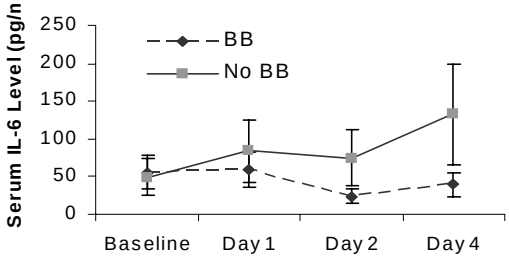
BETA-BLOCKERS MODULATE CIRCULATING IL-6 PROFILES AFTER INJURY

Randall S. Friese MD, Robert Barber PhD, Dara McBride RN, Jessica Bender BS, Larry M. Gentilello MD*, University of Texas Southwestern Medical Center, Dallas, TX

Objectives: Cardioprotection with rate limiting agents (beta-receptor antagonists, BB) improves outcome in high risk patients undergoing elective surgery. Recent trials have demonstrated an association between BB use and improved outcomes after injury. The mechanisms through which BB result in improved outcomes remain poorly elucidated. In vitro evidence supports that BB modulate the inflammatory response after injury. The purpose of this study was to examine the effects of BB on inflammatory profiles in injured patients at risk for heart disease.

Methods: A randomized controlled trial of injured patients over 55 years of age admitted to the intensive care unit was conducted. Patients were randomized to receive continuous BB or standard of care (no BB). Patients with a documented history of pre-hospital BB use were enrolled into an observational arm of the trial, continued on BB, and analyzed with the continuous BB group. Serum IL-6 levels were measured by ELISA at baseline (prior to BB) as well as day 1, 2, and 4 after BB initiation. Cytokine data was log transformed for normality assumptions. Repeated measures ANOVA was used to test for within group differences in IL-6 levels over time.

Results: 39 patients were enrolled. 17 patients were randomized to receive standard of care (controls) and 22 patients received continuous BB (10 randomized/12 observational). There was no difference in gender or Injury Severity Score between groups. Patients not receiving BB were slightly older (72 years) than those receiving BB (66 years)(p=0.045). Levels of IL-6 in patients receiving BB decreased over time (p=0.04) whereas levels in controls remained unchanged (p=0.27). **Conclusions:** Use of BB decreases IL-6 expression in injured patients. This may contribute to the improved outcomes noted in trauma patients receiving BB.



Session IV

Poster # 110

EN ROUTE COMBAT CASUALTY CARE AT 37000 FEET: OXYGEN USE AND OXYGENATION IN A HYPOBARIC ENVIRONMENT

Stephen L Barnes MD, Richard D.Branson MSc RRT, Karen L. Huezo MD, Peter Muskat MD*, Jay A. Johannigman MD*, USAF C-STARS, Cincinnati, OH

Background: En route casualty care necessitates evacuation of wounded service members requiring ventilation in cargo aircraft where low light, noise, vibration, and barometric pressure create a unique environment. We evaluated ventilation, oxygenation, and oxygen use in flight and assessed the feasibility of computer interface in this austere environment.

Methods: A PC was integrated with the pulse oximeter and ventilator data port used in the evacuation of wounded service members from Iraq to Germany. Ventilator settings, monitored values, HR and SpO2 were recorded continuously. Oxygen use was determined using the equation {((FiO2-21)/79)* (MV_E)}.

Results: 117 hours of recording was accomplished in 22 patients.

	Mean ± SD	Max	Min	# of Changes
FiO_2 (%)	49 ± 13	100	24	32
Tidal Volume (cc)	611 ± 75	700	390	20
Set Resp Rate (bpm)	15 ± 2.4	22	10	26
PEEP (cm H_20)	6 ± 2.5	17	0	18
Peak Inspiratory Pressure (cm H_20)	25 ± 4	90	3	
Minute Ventilation (cc/min)	9160 ± 1434	14000	6240	
Heart rate (bpm)	98 ± 20	145	42	
SpO_2 (%)	98 ± 2	100	85	
Oxygen Requirements (ml/min)	3216 ± 1878	14000	1382.28	

All patients survived transport. Five patients underwent no ventilatory changes. Three desaturation events (<90%) were recorded lasting 35, 115, and 280 secs. No interventions were recorded during desaturation events. Ventilatory changes averaged < 1 per hour.

Conclusions: Computer interface is feasible in the austere environment. Implications to military operations and civilian homeland defense include understanding O2 requirements for resource planning. Further study to evaluate closed loop autonomous control of mechanical ventilation should be pursued and may improve patient safety.

Session IV

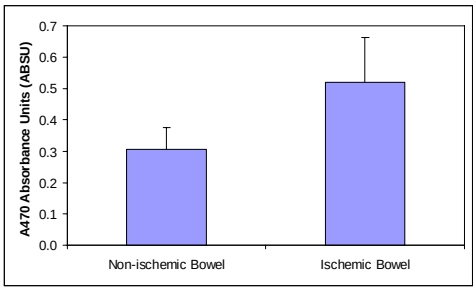
Poster # 111

USE OF THE ALBUMIN-COBALT BINDING DIAGNOSTIC TEST TO RULE OUT INTESTINAL ISCHEMIA

Leonard T. Rael MS, Jonathan D. Polk MD, Deborah Davis-Merit MD, Donald J. Tillman PharmD, Gregory W. Thomas BS, Michael L. Craun MD*, David Bar-Or MD, Swedish Medical Center, Englewood, CO

Objective: To evaluate the albumin-cobalt binding (ACB) test as a diagnostic marker for short-term risk stratification of Emergency Department patients presenting with symptoms of intestinal ischemia.

Methods: This preliminary study includes patients scheduled for exploratory laparotomy with symptoms of ischemic bowel and/or bowel obstruction. Approximately 10mL of blood was drawn from each patient 1 hour pre-operatively into a serum separator gel tube. After 30 minutes of clotting time, serum was collected and frozen at -80°C. The ACB test was performed on the samples by an investigator blinded to the patient's condition, and values were compared to the clinical/pathological diagnosis of ischemic bowel post-operatively. ACB test values are reported as absorbance units (ABSU) at 470nm.



Results: Of the 26 patients enrolled in the study, 12 were clinically diagnosed with intestinal ischemia. These patients had significantly higher ACB test values (0.52 ABSU ± 0.14 SD) than patients without intestinal ischemia (0.31 ABSU ± 0.07 SD, p = 0.00023). Only 2 false positives and no false negatives were recorded. This resulted in a sensitivity of 100% and a specificity of 85.7% for the ACB test for these particular samples.

True Positive (TP):	12
True Negative (TN):	12
False Positive (FP):	2
False Negative (FN):	0
Sensitivity :	100.0%
Specificity:	85.7%
Accuracy:	92.3%

Conclusion: The ACB test could be a useful tool for clinicians in the risk stratification of intestinal ischemia.

Session IV

Poster # 112

ENDOTHELIN-1 AND PROSTACYCLIN MEDIATE MICROVASCULAR FLUID LEAK DURING INFLAMMATION

Alexander Q. Ereso MD, Brian Curran MS, Michael Cripps MD, Gregory P. Victorino MD* ,
University of California San Francisco - East Bay, San Francisco, CA

Introduction: Data on the interaction between endothelin-1 (ET-1) and prostacyclin (PGI2) in modulating microvascular fluid leak (Lp) during inflammation is conflicting. Our hypothesis was that both ET-1 and PGI2 attenuate Lp during inflammation and that the permeability-decreasing effect of ET-1 is mediated through PGI2.

Methods: Lp was measured using an *in vivo* micro-cannulation technique in rat mesenteric post-capillary venules. To examine if ET-1 or PGI2 could prevent or attenuate the permeability-increasing effect of PAF, each was perfused before or after PAF exposure. Next, we explored if ET-1 acts via PGI2 release. This was accomplished by: 1) a PGI2 synthase inhibitor (tranylcypromine; 100uM and 500uM), and 2) a PGI2 receptor antagonist (CAY10441; 2uM and 20uM). Venules were first perfused with either the PGI2 synthase inhibitor or PGI2 receptor antagonist and the above experiments repeated.

Results: Exposure to PAF increased Lp 3.7-fold ($p<0.001$). ET-1 or PGI2 prior to PAF prevented the increase in Lp due to PAF ($p<0.001$). After PAF, both ET-1 and PGI2 attenuated the Lp increase due to PAF ($p<0.001$). ET-1 and PGI2 synthase inhibition prior to PAF prevented the Lp-decreasing effect of ET-1 dose dependently ($p<0.01$). ET-1 and PGI2 receptor antagonism prior to PAF prevented the Lp-decreasing effect of ET-1 only at the higher dose ($p<0.01$). After PAF, ET-1 and PGI2 synthase inhibition prevented the Lp-decreasing effect of ET-1 dose dependently ($p<0.02$). However, after PAF, PGI2 receptor antagonism further decreased Lp from ET-1 ($p<0.04$).

Discussion: ET-1 and PGI2 can prevent PAF-induced elevations in Lp. In a more clinically relevant situation, ET-1 and PGI2 attenuated the increase in Lp after endothelial activation with PAF. When given before PAF exposure, ET-1 mediates its effect via PGI2. However, when ET-1 is given after PAF, the mechanism of ET-1 is more complex. We conclude that ET-1 and PGI2 decrease microvascular fluid leak during inflammation and this interaction may allow pharmacological manipulation in the treatment of shock.

Session IV

Poster # 113

INTESTINAL EPITHELIAL CELLS MEDIATE LUNG INJURY FOLLOWING ETHANOL EXPOSURE AND HYPOXIC INSULT

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

Introduction: Alcohol (EtOH) use may potentiate acute lung injury and development of Acute Respiratory Distress Syndrome (ARDS) in patients with shock or sepsis. Gut ischemia/reperfusion (I/R) episodes are common in these settings and may have systemic effects. Human pulmonary microvascular endothelial cells (HMVEC) and Caco-2 intestinal epithelial cells were used to study gut-lung interactions following EtOH exposure *in vitro*.

Methods: Confluent HMVEC monolayers were established and transmembrane epithelial electrical resistance (TEER) measured (T =0 min.). Polarized Caco-2 monolayer's were challenged with 0.1% EtOH under normoxia (21%O_2) or with hypoxia (5%O_2) followed by reoxygenation (H/R). Basal chamber supernatants were obtained and incubated with the HMVEC monolayers. Direct exposure of HMVEC to 0.1% EtOH was used in some experiments and media served as control. Monolayer integrity was assessed by permeability to FITC-dextran (10,000mw) and TEER (T = 90 min.). HMVEC apoptosis and necrosis were determined by staining with Hoechst 33258 and propidium iodide.

Results: (mean ± SD, N=4)

Group	% Apoptosis	% Permeability	TEER(ohms)	
			T=0	T=90
Media Control	8.3±1.0	22.0±1.9	140±4.4	142±5.9
Media+0.1% EtOH	9.5±1.0	27.5±2.1#	187±4.8	170±6.4
0.1% EtOH sup	10.4±0.6	23.4±1.2	179±6.2	160±7.0
H/R no EtOH	11.7±1.1	24.5±1.3	182±4.1	170±5.8
0.1% EtOH+H/R	23.2±1.9*	84.4±2.4*	187±3.7	156±7.0$

*p<0.001 vs. All groups, #p<0.05 vs. Media control, $p<0.001 vs. 0.1% EtOH+H/R T=0
HMVEC necrosis showed no significant differences between groups and was less than 10% for all groups.

Conclusion: Gut-lung interactions following EtOH exposure and I/R insults lead to lung injury and may potentiate the clinical evolution to ARDS. These *in vitro* findings confirm clinical experience and provide a model to further elucidate the pathogenic mechanisms.

Session IV

Poster # 114

GLUCOSE CONTROL IN CRITICALLY ILL TRAUMA PATIENTS: THE ROLE OF SLIDING SCALE INSULIN PROTOCOLS

Deborah A. Kuhls MD, Tamara B. Lee PharmD, Mark K. Markarian MD MSPH, Allan D. MacIntyre DO, Jay E. Coates DO, John J. Fildes MD*, University of Nevada School of Medicine, University Medical Center of Southern Nevada, Las Vegas, NV

Objective: To determine if glucose control in critically injured adult trauma patients can be achieved with sliding scale insulin protocols.

Methods: A retrospective review was conducted on adult trauma ICU patients who were on a glucose control protocol from 10/23/06 through 12/5/06. One infusion protocol (INF) and three subcutaneous sliding scale protocols (SS) were utilized. Chi-square analysis was used to determine if glucose control on SS patients differed significantly from INF patients.

Results: During the study period, 113 TICU patients were admitted with an average age of 42 and an average ISS of 21. 57 patients were on insulin protocols. Their average age was 44.6 and average ISS was 26.7. 19 patients utilized more than one protocol during the study period. The frequency and percentage of glucose values within each discrete range is stratified by the corresponding insulin protocol in the table below.

	Glucose <70	Glucose 70-116	Glucose 117-130	Glucose 131-150	Glucose* 151-180	Glucose 181-220	Glucose >220	Total
Sliding scale protocol	23 1.7%	548 39.6%	267 19.3%	281 20.3%	163 11.7%	57 4.1%	46 3.3%	1385
Infusion protocol	4 1.0%	147 37.4%	69 17.6%	71 18.1%	63 16.0%	21 5.3%	18 4.6%	393

*$p<0.05$ (Patients on sliding scale were less likely to have glucose values in the range of 151-180.)

Among patients with glucose levels in 6 of the above 7 discrete ranges, no significant difference existed between patients on sliding scale protocols and those on infusion protocols. Among those ranges, patients on sliding scale protocols had the same distribution of glucose values as did those patients on the infusion protocol.

Conclusion: In critically ill adult patients, sliding scale insulin protocols achieve similar glucose control to those patients on infusion protocols. A randomized prospective trial would help us better understand the efficacy of each protocol in glucose control.

Session IV

Poster # 115

HIGH DOSE STEROID ADMINISTRATION IN ACUTE SPINAL CORD INJURY - A RISK FACTOR FOR LAPAROTOMY AFTER PEG TUBE INSERTION

Rachit D Shah MD, Nabil Tariq MD, Charles J Shanley MD, James M Robbins MD, Randy J Janczyk MD, Sponsor: Greg A Howells MD*, William Beaumont Hospital, Royal Oak, MI

Background: Patients with acute spinal cord injury (SCI) receive a large dose steroid bolus based on the national acute spinal cord injury study (NASCIS) recommendation. A large number of these patients also need long term enteral feeding access.

Hypothesis: Steroids when used in the recommended high dosages for SCI interfere with healing after percutaneous gastrostomy tube (PEG) insertion compared to their use in other surgical intensive care unit (SICU) patients in which they are used for medical reasons.

Methods: We conducted a retrospective chart review assessing steroid use in SICU patients undergoing PEG tube insertion–comparing those with spinal trauma versus patients without spinal trauma. BMI, organ dysfunction and nutritional status were recorded and a laparatomy performed for peritonitis was noted. Data was analyzed using SAS (v9.1).

Results: Of 37 patients with spinal trauma, 16(43.2%) received the steroids on admission and 19 (51%) did not; data on 2 patients were missing. Mean duration between steroid administration and PEG tube placement was 12 days. Four patients in the steroid group required a laparotomy versus none in the non-steroid group (p = 0.03, Chi-squared analysis). None of these 4 patients died.

Steroids	Laparotomy NO	Laparotomy YES	p-value	Steroids	Laparotomy NO	Laparotomy YES	p-value
NO	19(61.3%)	0(0%)		NO	241(79.8%)	12(75%)	
YES	12(38.7%)	4(100%)	0.03	YES	61(20.2%)	4(25%)	0.75
Spinal Trauma Patients N=37				SICU Patients without Spinal Trauma N=323			

Of 323 SICU patients without spinal trauma, the use of steroids did not correlate with the need for laparotomy (p-value 0.75 OR 95% CI 0.41-4.23). There was no significant difference in BMI, serum albumin level and organ dysfunction score between patients who received steroids and patients who did not in either group.

Conclusion: Steroid use based on the NASCIS protocol when used for SCI injury patients may interfere with healing after PEG tube insertion and increase morbidity. An alternative feeding route, such as a naso-jejunal tube should be considered in these patients.

Session IV

Poster # 116

ELEVATED OXIDANT ADVANCED GLYCOSYLATED END PRODUCTS IN TRAUMA MAY ADVERSELY EFFECT OUTCOME

Carl I Schulman MD MSPH, Ron Manning RN, Margaret Gallardo MD, Nicholas Namias* MD, Weijing Cai MD, Gary Striker MD, Helen Vlassara MD, University of Miami Miller School of Medicine, Miami, FL

Introduction: Oxidant stress (OS) increases after trauma and has been implicated in the development of complications such as multiple organ failure. Glucose-derived advanced glycosylated end products (AGEs), such as N-carboxymethyllysine (CML) and methylglyoxal (MG), are known inflammatory oxidants in diabetes and aging and are affected by AGEs in the diet, including enteral nutrition. Their effects on trauma outcome, however, are unknown. We hypothesized that elevated AGEs after traumatic injury would contribute to oxidant stress and increased morbidity.

Methods: An observational study was performed at a large Level 1 Trauma Center from March thru November 2006. Blood samples were obtained at admission and serial blood samples were obtained if patients were admitted to the ICU. AGE levels were assessed by CML and MG specific ELISAs. Demographics, markers of injury severity and ICU morbidity and mortality were collected.

Results: 118 trauma patients (TP) (37$\pm$16 y.o.), 85% males (ISS of 17$\pm$14) and 70 non-trauma (non-TP) male subjects (50$\pm$2.6 y.o.) were included in the study. 30 TP were admitted to the ICU**.** TP had significantly higher serum AGE levels than non-TP (CML, TP 12.6$\pm$5.4 vs non-TP 8.9$\pm$5.3, $p<0.001$; MG, TP 2.06$\pm$1.17 vs non-TP 0.79$\pm$0.3, $p<0.001$). In ICU subjects AGEs increased markedly during the first week and remained elevated. A 63% increase in ICU serum AGEs above baseline corresponded to the start of enteral nutrition.

Conclusions: Circulating AGEs are increased after trauma, rise markedly during the course of severe injury, and in relation to feeding. Oxidant stress during severe injury may be enhanced by exogenous AGEs, adversely influencing outcome.

Session IV

Poster # 117

EFFECT OF INTRAVENOUS ATRIAL NATRIURETIC PEPTIDE ON PULMONARY DYSFUNCTION AND RENAL FUNCTION FOLLOWING BURN SHOCK

Jun Oda MD*, Kosuke Kasai MD, Mitsuhiro Noborio, MD, Yoshiki Aoki MD, Katsuyuki Yamashita MD, and Masashi Ueyama MD, Social Insurance Chukyo Hospital, Nagoya, Japan

Background: The response to burn stress causes burn shock, followed by a diuretic phase; however, fluid management remains crucial in this phase in the treatment of the elderly, patients with preexisting cardiac or renal diseases, and patients developing acute renal failure. We have studied the effects of human atrial natriuretic peptide (hANP), which is a renal vasodilator, natriuretic, and inhibitor of renin secretion, on renal function in these patients with burn injuries.

Methods: Thirty-three severely burned patients (44.8±20.6 % total burn surface area) prolonged with cardiovascular overload and pulmonary edema after burn shock received a continuous infusion of hANP (0.025 and 0.05 μg/kg/min). Vital signs, urine output (UO) and blood gas analysis were compared before and 72h after the start of hANP. Creatinine clearance (Ccr), free water clearance (C_{H2O}), and fractional excretion of sodium (FE_{Na}) were also calculated.

Results: Sixteen (48%) patients were elderly, over 80 years old. Twenty (60%) had preexisting cardiovascular disease, renal insufficiency, or diabetes. hANP infusion increased UO in 25 (66%) cases, and improved oxygenation in 31 (82%) cases. Treatment with hANP increased Ccr, FE_{Na} and UO, except in four cases that had already progressed to complete renal failure before starting hANP. The amount of fluid required to maintain adequate UO decreased substantially.

Conclusions: Intravenous hANP seems to have favorable efficacy for postresuscitative pulmonary dysfunction and renal function after burn shock in the vulnerable elderly, or patients with preexisting disease, suggesting that hANP could be utilized effectively to facilitate fluid management in the acute phase in severely burned patients.

Parameters (n=33)	Baseline	72h
UO (mL/h/kg)	1.14 ± 0.60	1.79 ± 0.94 #
PaO_2/F_IO_2 ratio	172.3 ± 76.6	289.7 ± 105.4 #
Ccr (ml/min)	53.3 ± 42.3	81.3 ± 57.5 #
C_{H2O} (ml/min)	-0.25 ± 0.54	-0.61 ± 0.77 #
FE_{Na} (%)	1.09 ± 1.24	1.44 ± 1.48 *

*Data are expressed as means ± SD. * p<0.05 # p<0.01 vs Baseline.*

Session IV

Poster # 118

INSULIN DECREASES CINC-1, CINC-2 AND INTERLEUKIN-6 IN THERMALLY INJURED RATS

Marc G. Jeschke MD PhD*, Juquan Song MD, Celeste C. Finnerty PhD, David N. Herndon MD*, Shriners Burn Hospital for Children and University of Texas Medical Branch, Galveston, TX

Background: Insulin attenuates hypermetabolism, decreases mortality, and prevents the incidence of multi organ failure in critically ill and burn patients. The molecular mechanisms by which insulin improves survival have not been defined. The purpose of the present study was two fold: to determine whether cytokine-induced neutrophil chemoattractant (CINC) reflect the systemic inflammatory response in thermally injured rats and to determine the effect of insulin administration on the systemic inflammatory response.

Materials and Methods: Thermally injured rats (60% TBSA) were randomly divided to receive either saline (control) or insulin (5 IU/kg i.m. q.24 hrs). Animals were sacrificed 6, 12, 24, and 48 hours postburn with 4 animals per group and time point. Four animals did not receive any treatment and were used as normals. Outcome measures were CINC-1, CINC-2, CINC-3, interleukin (IL)-6, -10 and tumor necrosis factor (TNF). Significance was accepted with $p<0.05$.

Results: A thermal injury caused a 10 fold increase in CINC-1, 5 fold increase in CINC-2 and 2-3 fold increase in CINC-3, $p<0.05$. Increased CINC's correlated with serum IL-6 and TNF. Insulin significantly decreased CINC-1 and CINC-2 at 6 and 12 hours postburn when compared to controls, $p<0.05$. Insulin had no effect on CINC-3. Insulin significantly decreased serum IL-6 at 6 hours postburn, $p<0.05$. There was no difference between insulin and control rats for serum TNF and IL-10 at all time points.

Conclusions: CINC-1, -2, and -3 can be used to determine the inflammatory response in thermally injured rats. Insulin attenuates the inflammatory response by decreasing CINC-1, -2, and IL-6 at early time points after burn.