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Division of Education

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19 *AMA PRA Category I Credits™*.

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Meeting Objective

A wide range of trauma topics are covered in the formats of scientific presentations, lectures and panel discussions. These topics, consistent with the format of the organization, are multidisciplinary in nature. Information and knowledge gained at this activity can be used immediately and/or lead to further investigations at individual institutions, either in the form of formal research or quality improvement.

Accreditation Statement

This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Counsel for Continuing Medical Education through the joint sponsorship of the American College of Surgeons and the Western Trauma Association.
The American College of Surgeons is accredited by the ACCME to provide continuing medical education for physicians.

WESTERN TRAUMA ASSOCIATION
43rd Annual Meeting
Snowmass, Colorado
March 3 – March 8, 2013

Speaker Disclosure Information

Alam, H	Nothing to disclose	Pakraftar, S	Nothing to disclose
Azarakhsh, N	Nothing to disclose	Porta, C	Nothing to disclose
Balbierz, K	Nothing to disclose	Sadoun, M	Nothing to disclose
Barbosa, R	Nothing to disclose	Sagi, H	Nothing to disclose
Barg, N	Nothing to disclose	Scalea, T	Nothing to disclose
Chapman, M	Nothing to disclose	Schinkel, C	Nothing to disclose
Cogbill, T	Nothing to disclose	Schreiber, M	Medtronic
Collins, N	Nothing to disclose	Shackford, S	Nothing to disclose
Crawford, E	Nothing to disclose	Sillesen, M	Nothing to disclose
Diebel, L	Nothing to disclose	Skanchy, J	Nothing to disclose
Elliot, P	Nothing to disclose	Song, K	Nothing to disclose
Faulk, L	Nothing to disclose	Stagg, H	Nothing to disclose
Gavitt, B	Nothing to disclose	Stringham, J	Nothing to disclose
Gonser, L	Nothing to disclose	Sumislawski, J	Nothing to disclose
Habib, F	Nothing to disclose	Swendsen, H	Nothing to disclose
Hauser, C	Nothing to disclose	Truitt, M	Nothing to disclose
Inaba, K	Nothing to disclose	Van Haren, R	Nothing to disclose
Joseph, B	Nothing to disclose	Warren, A	Nothing to disclose
Juillard, C	Nothing to disclose		
Jurkovich, G	Nothing to disclose		
Kornblith, L	Nothing to disclose	**Program Committee**	
Liou, D	Nothing to disclose	Shatz, D	Nothing to disclose
Livingston, D	Nothing to disclose	Alam, H	Nothing to disclose
Louis, S	Nothing to disclose	Chang, M	Nothing to disclose
Lubin, D	Nothing to disclose	Coimbra, R	Nothing to disclose
Mangram, A	Nothing to disclose	Dicker, R	Nothing to disclose
McCully, S	Nothing to disclose	Karmy-Jones, R	Nothing to disclose
Metzdorff, M	Nothing to disclose	Michaels, A	Nothing to disclose
Milia, D	Nothing to disclose	Namias, N	Discussion Group Leader, Merck
Moulton, S	Flashback Technologies, Inc.	Rhee, P	Nothing to disclose
Nelson, D	Nothing to disclose	Thomas, H	Nothing to disclose

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Please note we have advised the speakers that it is their responsibility to disclose at the start of their presentation if they will be describing the use of a device, product, or drug that is not FDA approved or the off-label use of an approved device, product, or drug or unapproved usage. The requirement for disclosure is not intended to imply any impropriety of such relationships, but simply to identify such relationships through full disclosure, and to allow the audience to form its own judgments regarding the presentation.

43rd Annual Meeting
Snowmass, Colorado
2012 - 2013

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Earl G. Young, M.D.	1984	Steamboat
Robert B. Rutherford, M.D.	1985	Snowbird
Rudolph A. Klassen, M.D.	1986	Sun Valley
Robert J. Neviaser, M.D.	1987	Jackson Hole
Robert C. Edmondson, M.D.	1988	Steamboat
Ernest E. Moore, M.D.	1989	Snowbird
Stephen W. Carveth, M.D.	1990	Crested Butte
George E. Pierce, M.D.	1991	Jackson Hole
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David V. Feliciano, M.D.	1993	Snowbird
R. Chris Wray, M.D.	1994	Crested Butte
David A. Kappel, M.D.	1995	Big Sky
Thomas H. Cogbill, M.D.	1996	Grand Targhee
G. Jerry Jurkovich, M.D.	1997	Snowbird
James B. Benjamin, M.D.	1998	Lake Louise
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Barry C. Esrig, M.D.	2000	Squaw Valley
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James A. Edney, M.D.	2002	Whistler-Blackcomb
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Harvey J. Sugerman, M.D.	2004	Steamboat
Scott R. Petersen, M.D.	2005	Jackson Hole
Harold F. Sherman. M.D.	2006	Big Sky
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Grace S. Rozycki, M.D.	2009	Crested Butte
Robert C. Mackersie, M.D.	2010	Telluride
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R. Lawrence Reed, M.D.	2012	Vail

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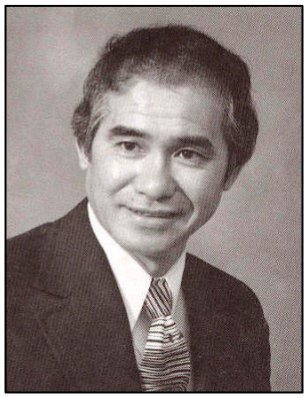
Earl G. Young, M.D.
(1928-1989)



Dr. Earl G. Young of Minneapolis was a founding member of the Western Trauma Association and its 14th President. He died of a myocardial infarction, Monday, February 27, 1989, while skiing at Snowbird during the 19th Annual Meeting of the Association.

Dr. Young received his medical degree from the University of Rochester, N.Y. and Ph.D. in surgery from the University of Minnesota. He completed advanced training in cancer research at Harvard, a fellowship in cardiovascular surgery at Baylor University in Houston and studied microvascular surgery at the University of California–San Diego.

He was a clinical professor of surgery at the University of Minnesota Medical School, and a practicing general and vascular surgeon at the Park-Nicollet Clinic in Minneapolis from 1960. He was nationally known and was actively involved in research and education throughout his career. In 1988, one year before his untimely death, he received the Owen H. Wangensteen Award for Academic Excellence from the University of Minnesota Health Science Center. It was awarded by an unprecedented unanimous vote of all 72 surgical residents.

The Residents Paper competition was begun in 1991 as a tribute to Dr. Young's memory and his "spirit of inquiry, love of learning … and commitment in service to mankind."* The award is given to the best resident paper presented at the Annual Meeting.

- Dr. John Najarian characterizing Earl at a memorial service in his honor at the University of Minnesota.

EARL G. YOUNG AWARD RECIPIENTS

Resident	Institution	Year
Joseph Schmoker, MD	University of Vermont	1991
Joseph Schmoker, MD	University of Vermont	1992
Charles Mock, MD	University of Washington	1993
Gino Travisani, MD	University of Vermont	1994
Phillip C. Ridings, MD	Medical College of Virginia	1995
David Han, MD	Emory University	1996
Preston R. Miller, MD	Wake Forest University	1997
Geoffrey Manley, MD, PhD	University of California, San Francisco	1998
James M. Doty, MD	Medical College of Virginia	1999
D.J. Ciesla, MD	Denver Health Medical Center	2000
Ricardo J. Gonzales, MD	Denver Health Medical Center	2001
Scott C. Brakenridge, MD	Cook County Hospital	2002
Adena J, Osband, MD	UMDNJ-New Jersey Medical School	2003
Cindy Lee, MD	UMDNJ-New Jersey Medical School	2004
Ernest A. Gonzalez, MD	University of Texas at Houston	2005
Jennifer M. Watters, MD	Oregon Health & Science University	2005
Jennifer J. Wan, MD	University of California, San Francisco	2006
Jennifer J. Wan, MD	University of California, San Francisco	2007
Keir J. Warner, MD	University of Washington	2008
T. W. Constantini, MD	University of California, San Diego	2009
C. Anne Morrison, MD	Baylor College of Medicine	2010
Marlin Causey, MD	Madigan Army Medical Center	2011
Phillip Letourneau, MD	University of Texas at Houston	2011
Gerard De Castro, MD	University of Maryland	2011
Matthew E. Kutcher, MD	University of California, San Francisco	2012

WESTERN TRAUMA ASSOCIATION

IN MEMORIAM

Earl G. Young, MD
February 27, 1989

Gerald S. Gussack, MD
August 25, 1997

Peter Mucha, Jr., MD
August 9, 2006

W. Bishop McGill, MD
October 14, 2007

Ronald P. Fischer, MD
January 25, 2013

"Paint the Ceiling" Lectureship

G. Jerry Jurkovich, M.D.	1997	Snowbird, Utah
John W. McGill, M.D.	1998	Chateau Lake Louise, Alberta
William T. Close, M.D.	1999	Crested Butte, Colorado
Jimmy Cornell	2000	Squaw Valley, California
Geoff Tabin, M.D.	2001	Big Sky, Montana
James H. "Red" Duke, M.D.	2002	Chateau Whistler, British Columbia
David V. Shatz, M.D.	2003	Snowbird, Utah
Susan and Tim Baker	2004	Steamboat Springs, Colorado
Alex Habel, M.D.	2005	Jackson Hole, Wyoming
Andrew Schneider	2006	Big Sky, Montana
Ernest E. Moore, M.D.	2007	Steamboat Springs, Colorado
Pamela Kallsen	2008	Squaw Valley, California
Sylvia Campbell, M.D.	2009	Crested Butte, Colorado
William Schecter, M.D.	2010	Telluride, Colorado
Jeff McKenney, M.D.	2011	Big Sky, Montana
Larry M. Gentilello, M.D.	2012	Vail, Colorado
Neil L. Barg, M.D.	2013	Snowmass, Colorado

Founders' Basic Science Lectureship

Raul Coimbra, M.D.	2009	Crested Butte, Colorado
Lawrence Diebel, M.D.	2010	Telluride, Colorado
Carl Hauser, M.D.	2011	Big Sky, Montana
Fred Moore, M.D.	2012	Vail, Colorado
Steve Shackford, M.D.	2013	Snowmass, Colorado

WESTERN TRAUMA ASSOCIATION
Schedule of Events

Sunday, March 3		**Room**
4:30pm – 7:30pm	Registration	Salon A
5:00pm – 7:00pm	Welcome Reception	Salon A
5:00pm – 7:00pm	Children's Reception	Westin Kids Club
6:30pm – 7:00pm	WTA Foundation Board	Alpine Springs
7:00pm – 8:00pm	WTA Past Presidents	Cirque Boardroom
Monday, March 4		
6:30am – 8:00am	Attendee Breakfast	Salon C/D
7:00am – 9:00am	Scientific Session I	Salon A
7:30am – 9:00am	Friends & Family Breakfast	Snowmass Kitchen
4:00pm – 6:00pm	Scientific Session II	Salon A
6:00pm – 9:00pm	WTA Board of Directors	Cirque Boardroom
4:30pm – 6:30pm	Family Movie (G-rated)	Castle Peak Auditorium
6:00pm – 9:00 pm	Family Games	Cathedral Peak
6:30pm – 8:30pm	Family Movie (PG)	Castle Peak Auditorium
Tuesday, March 5		
6:30am – 8:00am	Attendee Breakfast	Salon C/D
7:00am – 9:00am	Scientific Session III	Salon A
7:30am – 9:00am	Friends & Family Breakfast	Snowmass Kitchen
9:00am – 10:00am	Algorithms Committee	Cirque Boardroom
4:00pm – 5:00pm	Scientific Session IV	Salon A
5:00pm – 6:00pm	Presidential Address	Salon A
6:00pm – 7:30pm	Multi-Center Trials	Salon A
Wednesday, March 6		
6:30am – 8:00am	Attendee Breakfast	Salon C/D
7:00am – 9:00am	Scientific Session V	Salon A
7:30am – 9:00am	Friends & Family Breakfast	Snowmass Kitchen
10:00am – 12:00pm	WTA Ski Race	Mountain
11:30pm – 1:30pm	Mountain BBQ	Base Camp Bar & Grill
4:00pm – 6:00pm	Book Club	Room 212
4:00pm – 5:00pm	Scientific Session VI	Salon A
5:00pm – 6:30pm	WTA Business Meeting (Members only)	Salon A
6:30pm – 7:30pm	Ice Age lecture – Dr. Ian Miller	Salon A
Thursday, March 7		
6:30am – 8:00am	Attendee Breakfast	Salon C/D
7:00am – 9:00am	Scientific Session VII	Salon A
7:30am – 9:00am	Friends & Family Breakfast	Snowmass Kitchen
4:00pm – 5:00pm	Scientific Session VIII	Salon A
5:00pm – 6:00pm	Paint the Ceiling Lecture	Salon A
6:30pm – 7:30pm	Reception	Salon C/D/E
7:00pm – 10:00pm	Children's Party	Castle Peak/Cathedral Peak
7:30pm – 10:00pm	Banquet	Salon A/B
Friday, March 8		
6:30am – 8:00am	Attendee Breakfast	Salon C/D
7:00am – 9:00am	Scientific Session IX	Salon A
7:30am – 9:00am	Friends & Family Breakfast	Snowmass Kitchen
4:00pm – 6:00pm	Scientific Session X	Salon A

Exhibits and Registration daily 6:30 – 9:00 am and 3:30 – 6:00 pm in Salon C/D

PROGRAM

Scientific Session 1

Monday AM, March 4, 2013
Moderator: Mark Metzdorff, MD
Location: Salon A

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*** Earl Young Competition**

Scientific Session 2
Monday PM, March 4, 2013
Moderator: Hasan Alam, MD
Location: Salon A

_____

*** Earl Young Competition**

Scientific Session 3
Tuesday AM, March 5, 2013
Moderator: Rochelle Dicker, MD
Location: Salon A

_____

*** Earl Young Competition**

Scientific Session 4
Tuesday PM, March 5, 2013
Moderator: Riyad Karmy-Jones, MD
Location: Salon A

*** Earl Young Competition**

Scientific Session 5
Wednesday AM, March 6, 2013
Moderator: Andrew Michaels, MD
Location: Salon A

Scientific Session 6
Wednesday PM, March 6, 2013
Moderator: Tom Thomas, MD
Location: Salon A

Scientific Session 7
Thursday AM, March 7, 2013
Moderator: Raul Coimbra, MD
Location: Salon A

Scientific Session 8
Thursday PM, March 7, 2013
Moderator: Peter Rhee, MD
Location: Salon A

Scientific Session 9
Friday AM, March 8, 2013
Moderator: Nick Namias, MD
Location: Salon A

Scientific Session 10
Friday PM, March 8, 2013
Moderator: Michael Chang, MD
Location: Salon A

ABSTRACTS

VASOPRESSIN FOR CEREBRAL PERFUSION PRESSURE MANAGEMENT IN PATIENTS WITH SEVERE TRAUMATIC BRAIN INJURY: PRELIMINARY RESULTS OF A RANDOMIZED CONTROLLED TRIAL

RM Van Haren, CM Thorson, MP Ogilvie, EJ Valle, MR Bullock, JR Jagid, AS Livingstone, KG Proctor

University of Miami School of Medicine

Presenter: Robert Van Haren, MD **Senior Sponsor:** Nicholas Namias, MD

INTRODUCTION: After traumatic brain injury (TBI), catecholamines (CA) may be needed to maintain adequate cerebral perfusion pressure (CPP). Adverse events are common and refractoriness can develop, but there are no recommended alternative pressor therapies. This is the first report to test the hypothesis that arginine vasopressin (AVP) is a safe effective alternative to CA for the management of CPP in patients with severe TBI.

METHODS: Since 2008, all TBI patients requiring intracranial pressure monitoring were consented and randomized to receive either CA or AVP if pressors were required to maintain CPP. Data are M±SD or median (IQR) and compared with ANOVA and Bonferroni analysis.

RESULTS: 83 patients were analyzed, age 38±17, 82% male, 94% blunt mechanism, and ISS 26±12. 51 required no pressors and were the least severely injured group with the best outcomes. 20 patients received CA (65% levophed, 25% dopamine, 10% phenylephrine) and 12 patients received AVP. The two pressor groups had similar demographics, but ISS and fluid requirements on ICU Day 1 were worse in AVP vs. CA (all $p<0.05$). These differences indicate more severe injury and hemodynamic instability. Nevertheless, adverse events were not increased with AVP. Most outcome trends favored AVP, but no apparent differences were statistically significant. There was no difference in mortality rates between CA and AVP.

	None	**CA**	**AVP**	**p=**
ISS	24±10*	28±13	33±12*	**0.028**
Fluid Requirements ICU Day 1				
Mannitol, mL	0(45) *	0(295)	313(496) *	**0.009**
PRBC, mL	0(0) *	0(0) †	500(1249) * †	**0.018**
Outcomes				
Pressor duration, hrs	--	60(119)	52(156)	0.105
Sinus Tach, hrs/day	8±6	9±6	5±5	0.321
Ventriculostomy, hrs	188(210)	279(252)	166(127)	0.127
ICP >20, hrs	2(2)	2(3)	2(6)	0.153
CPP < 60, hrs	0(1)	1(2)	1(2)	0.207
ICU days	21(15)	25(30)	19(15)	0.384
Mortality, n=	3*	4	5*	**0.005**

CONCLUSION: AVP is a safe and effective alternative to CA for the management of CPP after TBI. These preliminary results support the continued investigation and use of AVP when pressors are required for CPP management in TBI patients.

ISOLATED FREE FLUID ON ABDOMINAL COMPUTED TOMOGRAPHY IN BLUNT TRAUMA: WATCH AND WAIT OR OPERATE?

LN Gonser, JW Davis, JF Bilello, SL Ballow, LP Sue, KM Cagle, C Venugopal

UCSF Fresno

Presenter: Laura Gosner, DO **Senior Sponsor:** James Davis, MD

INTRODUCTION: Controversy exists between mandatory exploration and careful observation for blunt trauma patients with isolated abdominal or pelvic free fluid (FF) without solid organ injury (SOI) on computed tomography (CT) scan. With wide spread use of multi-detector CT (MDCT) scanners with 2.5-5mm slices, there has been an increasing incidence of isolated FF and the majority of these patients undergo successful nonoperative management. The purpose of this study was to determine the frequency of isolated FF with MDCT and to identify characteristics which could help discriminate those who should undergo operative exploration versus those that may be carefully observed.

METHODS: We retrospectively reviewed adult blunt trauma patients at a level 1 trauma center from 7/2009-3/2012. Patients with isolated FF on initial MDCT (64 slice) with IV contrast were included and the following data was collected: age, initial abdominal exam, presence/absence of abdominal contusions, associated injuries, Focused Assessment with Sonography for Trauma (FAST) exam results, MDCT results, abdominal AIS, ISS, surgical findings and interventions when applicable, length of stay, and outcomes. Analysis was performed with the Mann-Whitney U test, Fisher's exact test and Mantel-Haenszel odds ratio; significance was attributed to $p<0.05$.

RESULTS: 2,899 adult blunt trauma patients had MDCT scans. 171 (5.9%) had FF without SOI and no evidence of peritonitis on initial abdominal exam. 160 (93.6%) underwent close observation and 4 of these eventually had surgical exploration. 11 (6.4%) underwent immediate surgery. Of the 15 patients who had surgical exploration, 13 had injuries requiring repair and two had nontherapeutic operations. One had FF, a positive FAST, but no abdominal tenderness or contusions; the other had FF, abdominal tenderness and contusions, and no documented FAST.

FF with abdominal tenderness, contusion and +FAST had a positive predictive value of 100% for therapeutic laparotomy and a negative predictive value of 92%.

	N	Abd Tenderness	+ FAST	Abd Contusion	Abd AIS	ISS
Operative	15	67%	67%	27%	2.2	21
Non-Op	156	21%	< 1%	13%	0.45	14
P value		< 0.001	< 0.001	NS	< 0.001	<0.02
Odds Ratio		7.5	34	2.5		

CONCLUSION: Blunt trauma patients with isolated FF on MDCT, abdominal tenderness, and positive FAST, with or without abdominal contusion should undergo surgical exploration. Those without these signs can be carefully observed.

EARLY TREATMENT WITH LYOPHILIZED PLASMA PROTECTS THE BRAIN IN A LARGE ANIMAL MODEL OF COMBINED TRAUMATIC BRAIN INJURY AND HEMORRHAGIC SHOCK

AM Imam, G Jin, M Duggan, M Sillesen, CH Jepsen, JO Hwabejire, J Lu, MA deMoya, D Deperalta, GV Velmahos, S Socrate, HB Alam

Massachussetts General Hospital

Presenter: Martin Sillesen, MD **Senior Sponsor:** Hasan Alam, MD

INTRODUCTION: Combination of traumatic brain injury (TBI) and hemorrhagic shock (HS) can result in significant morbidity and mortality. In a large animal model of TBI+ HS, we have previously shown that early administration of fresh frozen plasma (FFP) reduces brain lesion size as well as edema. However, FFP is a perishable product that is not well-suited to the austere pre-hospital settings. In this study, we tested whether a shelf-stable, low-volume, lyophilized plasma (LSP) product was as effective as FFP.

METHODS: Yorkshire swine (42-50kg) were instrumented to measure hemodynamic parameters, intracranial pressure (ICP) and brain tissue oxygenation ($PbtO_2$). A prototype, computerized, cortical impact device was used to create TBI through a 20 mm craniotomy: 15 mm cylindrical tip impactor at 4 m/s velocity, 100 ms dwell time and 12 mm penetration depth. Volume-controlled hemorrhage was induced (40-45% total blood volume) concurrent with the TBI. After 2 hours of shock, animals were randomized to one of three resuscitation groups: 1) Normal saline (NS; n=5), 2) FFP (n=5) and 3) LSP (n=5). The volume of FFP and LSP matched the shed blood volume whereas NS was 3x the volume. Six hours post-resuscitation, brains were sectioned and stained with TTC (2, 3, 5-Triphenyltetrazolium chloride), and lesion size (mm^3) and swelling (% change in volume compared to the contralateral, uninjured side) were measured.

RESULTS: This protocol resulted in a highly reproducible brain injury, with clinically relevant changes in blood pressure, cardiac output, systemic venous saturation, ICP and $PbtO_2$. Compared to NS, treatment with LSP significantly ($p<0.05$) decreased brain lesion size and swelling (51% and 54% respectively; Figure).

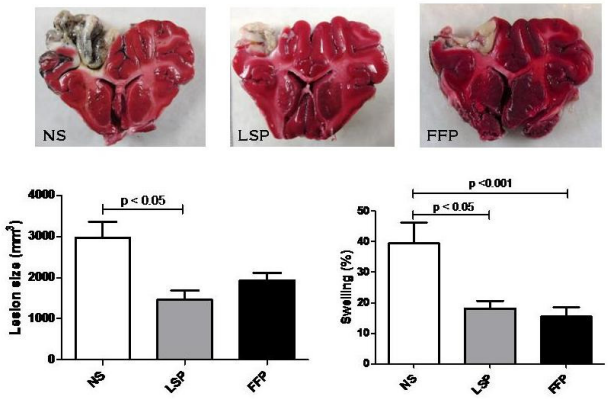

Figure: Quantification of Traumatic Brain Injury. The top panel shows representative brain slices whereas the bottom panel displays lesion size and swelling. Data presented as group means +/- SEM

CONCLUSIONS: In a clinically realistic combined TBI+HS model, early administration of plasma products deceases brain lesion size and edema. LSP proved to be as effective as FFP, while offering many logistical advantages.

DIAGNOSTIC LAPAROSCOPY AFTER ANTERIOR ABDOMINAL STAB WOUNDS: WORTH ANOTHER LOOK?

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University of Tennessee Health Science Center

Presenter: Joshua Sumislawski, MD **Senior Sponsor:** Ben Zarzaur, MD

INTRODUCTION: The National Institute of Medicine's report "Hospital-Based Emergency Care: At the Breaking Point" highlighted the critical issue of emergency department (ED) overcrowding and challenged physicians to focus on efficient and timely use of already constrained hospital resources. The recent Western Trauma Association (WTA) anterior abdominal stab wound (AASW) algorithm suggested that serial abdominal exams (SAE) is preferred over other methods to determine the need for laparotomy after positive local wound exploration (LWE). At our institution, patients with AASW have been managed with a protocol that uses diagnostic laparoscopy (DL) instead of SAE after positive LWE since the 1990's. Patients with negative DL are eligible for discharge directly from the recovery room, thus relieving hospital and ED overcrowding. The purpose of this study was to evaluate the use of DL in the setting of AASWs in light of the recent WTA recommendations.

METHODS: Consecutive patients admitted to a single level one trauma center from 1/1/2010 through 8/31/2012 with AASWs were included (contemporary period to WTA study). Information regarding mechanism and location of injury, baseline characteristics of shock, diagnostic work-up and results, injury management, and outcomes were retrospectively reviewed and compared to the results from the WTA AASW algorithm (J Trauma, Dec 2011).

RESULTS: 158 patients with AASWs were evaluated using our institutional algorithm. 38 (24%) went directly to the operating room for peritonitis, shock, or evisceration. 120 underwent local wound exploration; 99 were positive (82%). 28 had immediate laparotomy due to worsening clinical exam and 23 were therapeutic. 70 had diagnostic laparoscopy. Of those, 38 were negative and 19 patients (50%) were discharged home directly from the recovery room with a mean length of stay of 6.4 hours. 32 patients had peritoneal penetration on DL and 20 had therapeutic laparotomies. Comparing patients managed using the DL algorithm to the WTA algorithm, there were fewer nontherapeutic laparotomies, though not statistically significant. However, the DL algorithm produced a significantly higher percentage of patients discharged directly home following LWE compared to the WTA algorithm (Table).

*p<0.05	WTA	DL
Nontherapeutic lap after LWE	43%	28%
Discharge after LWE	18%	33%*

CONCLUSIONS: This is an era of constrained resources at trauma centers due to increased operative volume from emergency general surgery cases, decreased resident duty hours, and fewer available hospital beds. With some trauma centers suffering from ED overcrowding, DL may offer an alternative to SAE in an effort to efficiently utilize available hospital and human resources. Negative DL allows for prompt discharge of patients with positive LWE, negating the need for admission for SAE. Both SAE and DL are safe alternatives and offer similar therapeutic laparotomy rates. The method utilized to evaluate patients after AASW should be tailored to institutional needs and resources.

MESENTERIC LYMPH DIVERSION ABROGATES THE ELEVATION OF SP-A IN BAL FLUID FOUND IMMEDIATELY AFTER TRAUMA AND HEMORRHAGIC SHOCK

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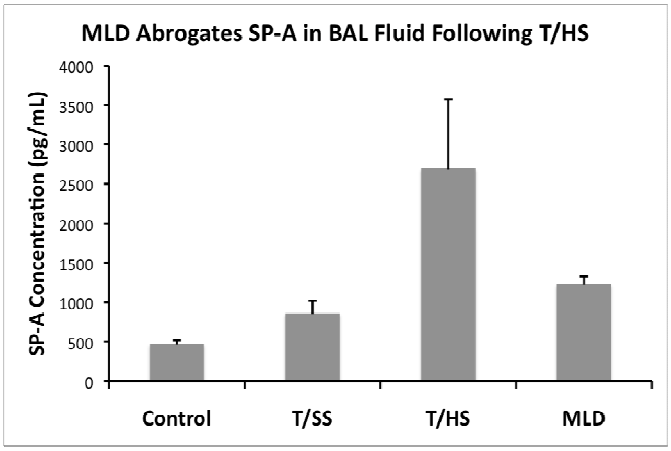
Presenter: John Stringham, MD **Senior Sponsor:** Ernest Moore, MD

INTRODUCTION: Type II pneumocytes produce and store surfactant-associated protein A (SP-A), which aids in innate immunity and surfactant function. Studies in trauma patients at risk for acute lung injury (ALI) demonstrate a decrease in SP-A in bronchoalveolar lavage (BAL) fluid 24 hours after injury. Mesenteric lymph diversion (MLD) prior to trauma and hemorrhagic shock (T/HS) has been shown to abrogate ALI. The effect of MLD on SP-A expression in BAL fluid is unknown. We hypothesize that SP-A will decrease in BAL fluid after T/HS, and MLD will attenuate this effect.

METHODS: Rats were subjected to control, trauma with sham shock (T/SS; femoral artery cannulation and laparotomy), T/HS (artery cannulation, laparotomy and hemorrhage to a MAP of 30 mmHg for 45 min) or MLD treatments (cannulation of mesenteric duct prior to hemorrhage). T/SS animals were observed under anesthesia for 3 hours, while animals that underwent hemorrhage received resuscitation with crystalloid and blood for two hours, followed observation for one hour. BAL fluid was then collected and analyzed for SP-A via ELISA.

RESULTS: BAL fluid SP-A in T/SS was elevated 1.8-fold vs. control (861.9±154.4 pg/mL vs. 474.6±43.7 pg/mL). Surprisingly, SP-A in T/HS was significantly elevated 5.7-fold over control three hours after injury (2699.5±873.6 pg/mL; $p<0.01$). MLD abrogated this effect, decreasing SP-A to near the T/SS level (1232.8±94.9 pg/mL; $p<0.01$).



CONCLUSION: Immediately following T/HS, SP-A increases in BAL fluid. MLD performed prior to T/HS abrogates this effect. This phenomenon parallels prior work, which shows that MLD will abrogate the lung injury seen in T/HS. This suggests that post-shock mesenteric lymph is involved in abnormal surfactant synthesis and recycling, thus priming the lung for injury. Previous studies in patients 24 hours after injury have found that decreased SP-A in BAL fluid correlates with increased risk for ALI. Taken together, these data suggest the initial rise in SP-A after T/HS will exhaust SP-A in Type II pneumocytes, predisposing the lung to injury.

EFFICACY OF TOPICAL VASOACTIVE AGENTS IN HEPATIC HEMORRHAGE CONTROL

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University of California, Davis

Presenter: Brian Gavitt, MD, MPH **Senior Sponsor:** David Shatz, MD

INTRODUCTION: Patients hemorrhaging from severe liver trauma are particularly challenging for surgeons at rural hospitals with limited surgical support and transfusion capabilities. This pilot study aimed to determine whether the hemostatic efficacy of damage control liver packing could be improved using adjuncts present in every practice setting. We compared the hemostatic effectiveness of epinephrine- or vasopressin-soaked laparotomy pads with standard laparotomy pads and a commercial hemostatic dressing in swine with lethal liver injuries.

METHODS: Anesthetized, splenectomized swine had a grade IV liver injury created. After 30 seconds of free bleeding, damage control liver packing was performed with plain laparotomy pads, laparotomy pads soaked in epinephrine (1 mg / 300 ml normal saline), laparotomy pads soaked in vasopressin (40 IU / 300 ml normal saline), or a Qwick-AID^{TM} dressing. Hemodynamics and laboratory data were recorded, and blood loss was measured for two hours. Post-mortem histopathology was performed on the liver injury sites.

RESULTS: There were no pre-injury differences between groups, and all animals survived the entire two hours. The control group had a mean blood loss of 29 mL/kg, whereas animals treated with either epinephrine-soaked dressings or Qwick-AID^{TM} dressings had 30% less blood loss (17.6 mL/kg, $p = 0.02$ and 17.5 mL/kg, $p = 0.01$, respectively). Animals treated with vasopressin-soaked dressings had blood loss equivalent to controls (28.1 mL/kg, $p = 0.85$). There were no significant hemodynamic or histologic differences between groups.

CONCLUSION: Epinephrine-soaked laparotomy pads worked better than standard laparotomy pads and just as well as a commercially-produced hemostatic dressing at achieving hemostasis in swine with severe liver injuries without significant alterations in animals' hemodynamics or evidence of tissue damage.

THE BIG (BRAIN INJURY GUIDELINES) PROJECT: DEFINING THE MANAGEMENT OF TRAUMATIC BRAIN INJURY BY ACUTE CARE SURGEONS

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University of Arizona

Presenter: Moutamn Sadoun, MD **Senior Sponsor:** Peter Rhee, MD

Introduction: It is becoming standard that any "positive" identification of a radiographic intracranial injury requires transfer and management to a trauma center for observation and repeat head CT. The purpose of this study was to define guidelines as to who may require observation; repeat head computed tomography (RHCT), or neurosurgical consultation (NSC).

Methods: We performed a retrospective cohort analysis of 3,803 blunt traumatic brain injury patients over a 3-year period. We classified patients according to neurological exam, intoxicants, anticoagulation, and CT scan findings. Brain Injury Guidelines (BIG) were then developed based on the need for NSC, routine hospitalization, and RHCT.

Results: A total of 1232 patients had an abnormal head CT. In the BIG1 category no patients worsened clinically, radiographically, or required any intervention. BIG2 category had radiographic worsening in 2.7% patients. All patients who required Neurosurgical intervention (13%) were in BIG3. There was excellent agreement between assigned BIG and verified BIG. Kappa statistic=0.98.

Conclusion: Patients in BIG categories 1 and 2 can be managed by the acute care surgery service without the need for NSC or RHCT. The adoption of BIG would reserve health care resources for those who need it.

Variables	BIG 1 (n=112)	BIG 2 (n=330)	BIG 3 (n=790)
LOC	Yes	Yes	Yes
Neurological Exam	Normal	Normal	Abnormal
Intoxication	No	No/Yes	No/Yes
CAMP	No	No	Yes
Skull Fracture	No	Non – Displaced	Displaced
SDH	≤ 3mm	3 – 10 mm	≥ 10mm
EDH	≤ 3mm	3 – 10 mm	≥ 10mm
IPH	≤ 3mm, 1 Location	3-10mm, 2 Location	≥ 10mm
SAH	Trace	Localized	Scattered
IVH	No	No	Yes
THERAPEUTIC PLAN			
Hospitalization	No	Yes	Yes
RHCT	No	No	Yes
Neurosurgery Consultation	No	No	Yes

MODIFIED VERESS NEEDLE FOR TENSION PNEUMOTHORAX DECOMPRESSION: A RANDOMIZED TRIAL

D Lubin, A Tang, R Freise, L Gries, R Means, T Jones, B Joseph, T O'Keefe, N Kulvatunyou, D Green, G Vercruysse, J Wynne, P Rhee

University of Arizona

Presenter: Dafney Lubin, MD **Senior Sponsor:** Peter Rhee, MD

INTRODUCTION: Tension pneumothorax (tPTX) is a potentially fatal condition that is reversible with adequate thoracic decompression. The current prehospital standard of care using a large bore intravenous catheter for tPTX decompression is associated with a high failure rate. We have developed an 11-ga modified Veress needle (mVN) with a safety indicator for this condition. The purpose of this study was to evaluate the effectiveness and safety of the mVN as compared to a 14-ga needle thoracostomy (NT) in a swine tPTX model.

METHODS: tPTX was created in sixteen adult swine via CO2 insufflation at 1L/min through a thoracoscopic port. After tension physiology had been achieved at 15mmHg intrathoracic pressure, the swine were randomized to undergo either NT or mVN decompression. Each swine underwent 3 runs of tPTX creation and rescue. Unsuccessful rescue was defined as failure to restore 80% baseline systolic blood pressure within 5 minutes. The swine that were not successfully rescued after 5 minutes of using the randomized device were then treated with the alternate device. The success rate of each device and complications defined as death or the need for crossover were analyzed using Chi-square.

RESULTS: Forty-three tension events were created in 16 swine (24 mVN, 19 NT) at 15mmHg intrathoracic pressure with a mean CO2 volume of 3.8 liters. tPTX resulted in a 48% decline of systolic blood pressure from baseline; 73% decline of cardiac output; and 42% had equalization of central venous pressure with pulmonary capillary wedge pressure. Of the 24 tension events randomized to mVN, 100% were successfully rescued within an average 70±86 seconds. NT resulted in 4 (21%) successful decompressions within an average 157± 96 seconds. 4 swine died within 5 minutes after decompression with NT. Of those persistent tension events where the swine survived past 5 minutes (11/19 NT tension), all underwent crossover mVN decompression, which yielded 100% rescue. Neither the mVN nor the NT was associated with inadvertent injuries to the viscera.

Table 1: NT vs mVN Outcome

	NT (n=19)	mVN (n=24)	p-value
Successful Decomp	**21%**	**100%**	**<0.001**
Time to Success (sec)	**157± 96**	**70 ±86**	**0.08**
Complication*	**78.9%**	**0%**	**<0.001**

***Death within 5 minutes or need for crossover rescue**

CONCLUSION: Thoracic insufflation produced a reliable and highly reproducible model of tPTX. The mVN is vastly superior to NT for effective and safe tPTX decompression and physiologic recovery. Further research should be invested in the mVN for device refinement and replacement of NT in the field.

THE EFFECTS OF TRANEXAMIC ACID AND PROTHROMBIN COMPLEX CONCENTRATE ON THE COAGULOPATHY OF TRAUMA

CR Porta, DW Nelson, DP McVay, MJ Eckert, SD Izenberg, MJ Martin

Madigan Health Care System

Presenter: Christopher Porta, MD **Senior Sponsor:** Matthew Martin, MD

INTRODUCTION: Bleeding is the most frequent cause of preventable death after severe injury. Our purpose was to1) Study the *in vitro* efficacy of tranexamic acid (TXA) and prothrombin complex concentrate (PCC) on a traumatic coagulopathy 2) To evaluate the effects of metabolic acidosis on the *in vitro* function of TXA and 3) Compare the efficacy of PCC vs. fresh frozen plasma (FFP) to reverse a dilutional coagulopathy.

METHODS: *In vitro* effects of TXA and PCC were assessed with standard lab analysis (PT/INR) and rotational thromboelastometry (ROTEM) in a porcine hemorrhage with ischemia-reperfusion (H/I) model. Autologous FFP was used as a comparison to PCC. *In vitro* doses were calculated to be the equivalent of: 1g TXA, 100mg tPA, 45 IU/kg PCC, and 4 U FFP. Agents were tested at baseline and then with severe metabolic acidosis after 6 hours of resuscitation.

RESULTS: Thirty-one swine were studied. Baseline Hct was 24%, pH 7.56, and INR 1.0. Six hours after H/I the Hct was 15.9%, pH 7.1, and INR 1.7. ROTEM revealed that maximum clot firmness (MCF) at baseline was 71.71 mm and decreased to 0.29 mm representing severe fibrinolysis. Following TXA dosing, the MCF immediately corrected to 69.06 mm (**Figure 1**). There was no difference (p = .48) between TXA function at baseline pH (mean 7.56) or acidotic pH (mean 7.11). The mean baseline prothrombin time (PT) was 13 ± 0.49 sec (INR 1). After H/I and resuscitation, the mean PT was 23.03 sec (INR 2.1). PCC reduced the PT to 20 (INR1.75, p = .001) and FFP to 17.44 (INR 1.47, p = .001). FFP had superior PT reduction than PCC (5.58 sec vs. 3.03 sec, p = .013).

CONCLUSION: It is critical to test potential resuscitation adjuncts under conditions of severe physiologic stress such as major metabolic acidosis. Both TXA and PCC appear to function well in reversing coagulopathy even with co-existing metabolic acidosis in-vitro, and further in-vivo studies are indicated.

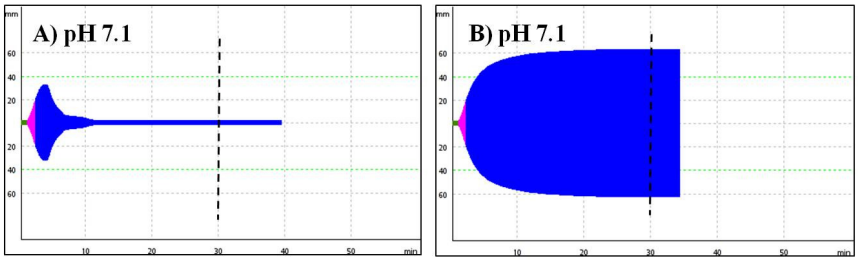

Figure 1. ROTEM analysis of TXA. Thirty minutes after starting the ROTEM, maximum clot firmness (MCF) was measured (vertical dashed line). A) severe fibrinolysis in the absence of TXA and B) complete reversal after a single dose of TXA.

EARLY TRANEXAMIC ACID ADMINISTRATION CONFERS EARLY MORTALITY BENEFIT IN CIVILIAN TRAUMA

H Swendsen, CR Schermer, S Bateni, JM Galante, LA Scherer

University of California, Davis

Presenter: Haruka Swendsen, BS **Senior Sponsor:** Carol Schermer, MD

INTRODUCTION: Early administration of tranexamic acid (TXA) is associated with reduced mortality in civilian and military settings. The purpose of this study was to assess the institution of a treatment guideline for administration of TXA to patients with traumatic injury in a Level I trauma center. The guideline was to give TXA to any patient going directly to OR, or with SBP < 90, or for whom our massive transfusion guideline was activated. The hypothesis was that receipt of TXA would confer a mortality benefit without increasing thromboembolic complications.

METHODS: Records of patients receiving TXA in the first 6 months after adopting the guideline were reviewed for mortality, transfusions, PE, DVT, MI, and stroke. TXA recipients were compared to a concurrent random sample of controls that met criteria for administration but did not receive TXA. Outcomes were compared for patients meeting any criteria for TXA administration and also for those going directly to the OR.

RESULTS: There were 52 TXA patients and 74 randomly selected controls.

	NO TXA Any criteria	TXA Any criteria	p	Operation NO TXA	Operation TXA	P
N	74	52		47	46	
Operation %	63.5	88.5	.002	100	100	
Male	66.2	71.2	.558	74.5	71.7	.767
Age	47.6	44.6	.402	43.70	45.02	.757
SBP	73.7	82.8	.029	77.04	84.65	.109
initial pH	7.22	7.23	.692	7.20	7.23	.465
Death 24 H %	17.6	5.8	.050	19.1	4.3	.027
Death D/C %	23.0	17.3	.439	25.5	15.2	.217
MI %	2.7	0.0	.513	0.0	0.0	
Stroke %	0.0	3.9	.165	0	4.4	.237
DVT/PE %	0	11.5	.004	0	13	.012
PRBCs, units	7.92	11.62	.170	11.70	12.54	.803
FFP units	4.01	5.79	.218	5.96	6.3	.848
Plts, 6-packs	1.25	2.15	.104	1.81	2.41	.392

CONCLUSION: In a civilian trauma setting, early TXA administration appears to confer an early survival advantage while possibly increasing the risk of thromboembolic complications without affecting overall blood product usage.

THROMBOELASTOGRAPHY AFTER TRAUMATIC BRAIN INJURY AND IMPLICATIONS OF BETA-ADRENERGIC RECEPTOR KNOCKOUT

DZ Liou, MA Clond, O Tcherniantchouk, S MacNab, AW Lamb, P Rajput, P Lyden, D Marguiles, M Martin, A Salim, EJ Ley

Cedars-Sinai Medical Center

Presenter: Douglas Liou, MD **Senior Sponsor:** Matthew Martin, MD

INTRODUCTION: Thromboelastography (TEG) may detect coagulopathy, abnormal platelet function or fibrinolysis after severe injuries. The source of coagulopathy is multifactorial and includes adrenergic stimulation. The aim of this study was to investigate TEG after traumatic brain injury (TBI) and the implications of beta-adrenergic receptor knockout.

METHODS: Adult male wild type c57/bl6 (WT) and β_1/β_2-adrenergic receptor knockout (BARKO) mice were assigned to either TBI (WT-T, BARKO-T) or sham injury (WT-C, BARKO-C). All mice were anesthetized and those assigned to TBI were subject to controlled cortical impact (CCI) with 3 m/s strike velocity, 30 ms impact time, and 2 mm strike depth. At 24 hours post-injury, blood samples were obtained from the inferior vena cava using 23-gauge sodium citrate-flushed needles. Whole blood samples were then transferred to pediatric-sized citrated tubes and taken immediately for TEG.

RESULTS: WT-C and BARKO-C had a baseline hypercoagulable state (R 2.02 vs. 2.66, p=0.13). Sham BARKO-C noted higher fibrinolysis (EPL, LY30) compared to WT-C (EPL 2.90% vs. 0%, p=0.003; LY30 2.47% vs. 0%, p=0.007). Increased fibrinolysis was noted after TBI in WT-T (EPL 8.14% vs. 0%, p=0.03). BARKO-T had increased MA (76.59 vs. 68.63, p=0.03) and G (18.17 vs. 11.31, p=0.03) compared to BARKO-C. BARKO-T also had higher G than WT-T (18.17 vs. 12.34, p=0.05).

CONCLUSION: In a mouse TBI model, hypercoagulability was noted in both sham WT and BARKO. WT sustaining TBI demonstrate increased fibrinolysis at 24 hours after injury; BARKO do not. TEG can be useful in detecting coagulation alterations and the mechanism for these alterations.

	WT-C (n=11)	WT-T (n=8)	p-value		BARKO-C (n=7)	BARKO-T (n=9)	p-value
R (min)	2.02 ± 0.77	2.14 ± 0.90	0.76		2.66 ± 0.91	3.00 ± 1.05	0.50
K (min)	0.83 ± 0.09	1.13 ± 0.52	0.08		0.81 ± 0.04	0.81 ± 0.03	0.86
Angle, a (deg)	80.28 ± 2.79	76.05 ± 6.94	0.08		79.53 ± 1.39	80.91 ± 2.20	0.17
MA (mm)	71.23 ± 2.50	70.08 ± 5.84	0.56		68.63 ± 5.50	76.59 ± 7.15	0.03
EPL (%)	0	8.14 ± 11.76	0.03		2.90 ± 2.86	3.37 ± 7.73	0.88
LY30 (%)	0	2.49 ± 4.34	0.07		2.47 ± 2.71	2.59 ± 5.55	0.96
G (d/cm^2)	12.50 ± 1.54	12.34 ± 3.71	0.90		11.31 ± 2.46	18.17 ± 6.95	0.03

	WT-T (n=8)	BARKO-T (n=9)	p-value		WT-C (n=11)	BARKO-C (n=7)	p-value
R (min)	2.14 ± 0.90	3.00 ± 1.05	0.09		2.02 ± 0.77	2.66 ± 0.91	0.13
K (min)	1.13 ± 0.52	0.81 ± 0.03	0.09		0.83 ± 0.09	0.81 ± 0.04	0.73
Angle, a (deg)	76.05 ± 6.94	80.91 ± 2.20	0.06		80.28 ± 2.79	79.53 ± 1.39	0.52
MA (mm)	70.08 ± 5.84	76.59 ± 7.15	0.06		71.23 ± 2.50	68.63 ± 5.50	0.19
EPL (%)	8.14 ± 11.76	3.37 ± 7.73	0.33		0	2.90 ± 2.86	0.003
LY30 (%)	2.49 ± 4.34	2.59 ± 5.55	0.97		0	2.47 ± 2.71	0.007
G (d/cm^2)	12.34 ± 3.71	18.17 ± 6.95	0.05		12.50 ± 1.54	11.31 ± 2.46	0.22

R - clot time; K, a - clot rate; MA - maximum clot strength; EPL - estimated percent lysis;
LY30 - percent lysis at 30 min; G - overall clot strength

FIBRINOLYSIS ABOVE 3% IS THE CRITICAL VALUE FOR INITIATION OF ANTI-FIBRINOLYTIC THERAPY

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University of Colorada, Denver

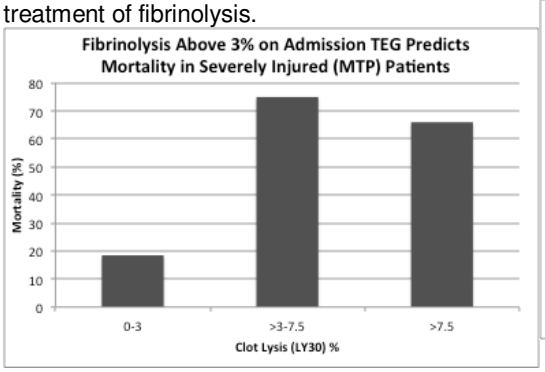
Presenter: Michael Chapman, MD **Senior Sponsor:** Eugene Moore, MD

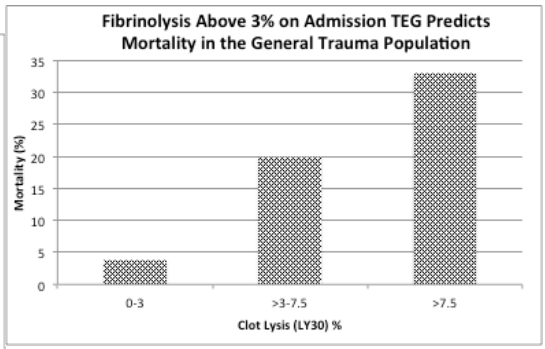
INTRODUCTION: Recent retrospective data suggest that the accepted normal upper bound for fibrinolysis of 7.5% by thromboelastography (TEG) is inappropriate in severe trauma. In fact, the data imply that the risk of death rises at much lower levels of clot lysis. We wished to determine the validity of this hypothesis in the most severely injured trauma patients at our center and establish a threshold value to treat fibrinolysis. We then sought to determine whether this threshold was generalizable to our entire trauma population, regardless of injury severity.

METHODS: Patients with uncontrolled hemorrhage, meeting the massive transfusion protocol (MTP) criteria on admission (n=64), represent the most severely injured trauma population at our center (ISS: 34±15; base deficit: 12.2±4.7). TEG was performed on field blood samples, stratified according to 30-minute lysis (LY30), and evaluated for 30-day mortality. The same analysis was conducted on available field blood samples from all non-MTP trauma patients (n=153) in the same time period. These represent the general trauma (GT) population.

RESULTS: Overall mortality in the MTP group was 26.6% compared to 6.8% for the GT group. Within the MTP group, patients with LY30 ≤3% had a mortality of 18.5%, while patients with LY30 >3% had a mortality of 70% (p=0.002; Fisher's exact test). There was no significant difference in mortality between patients with LY30 3-7.5% and those ≥ 7.5%. Similarly, in the GT population, patients with LY30 ≤3% had a mortality of 3.8%, while patients with LY30 >3% had a mortality of 22% (p=0.01) and there was no significant difference in mortality between patients with LY30 3-7.5% and ≥7.5%. Neither group showed a correlation between admission LY30 and ISS, transfusion requirement, base deficit, lactate or admission systolic blood pressure.

CONCLUSION: LY30 >3% strongly predicts mortality in trauma, independent of injury severity and thus represents a critical indication for treatment of fibrinolysis.





EFFECTS OF HISTONE DEACETYLASE INHIBITION ON SURVIVAL AND END-ORGAN INJURY IN A SWINE

DW Nelson, CR Porta, DP McVay, S Salgar, MJ Martin

Madigan Army Medical Center

Presenter: Daniel Nelson, DO **Senior Sponsor:** Matthew Martin, MD

INTRODUCTION: Valproic acid (VPA) is a histone deacetylase inhibitor that has been shown to improve early resuscitation from hemorrhagic shock. We sought to examine whether there is a sustained benefit of VPA in a survival model of severe injury.

METHODS: *Yorkshire* swine (n = 36) were randomized to three groups: A) Control; B) VPA (single dose), and C) VPA (two doses at 12h apart). Animals underwent a 35% volume-controlled hemorrhage followed by aortic cross clamping for 50 minutes duration, at which time VPA (400 mg/kg) was administered intravenously. Animals then underwent protocol guided resuscitation with crystalloid and vasopressor infusions for up to 24 hours. The primary endpoint was animal survival, secondary endpoints included hemodynamics, physiology, and histologic evidence of end-organ injury.

RESULTS: Mean duration of survival was significantly longer in the control group (15.8h; n=11) compared to single dose VPA (12.6h; n=9, $p<0.02$; **see Figure**). Re-dosing VPA at 12 hours provided no survival benefit. During cross clamp, animals that received VPA required significantly less lidocaine than control animals (32.8mg vs. 159.4mg; $p=0.03$). Animals that received VPA also required significantly greater quantities of intravenous fluids per hour ($p<0.01$) and higher epinephrine doses ($p=0.01$). VPA administration was associated with earlier evidence of cardiac suppression (decreased cardiac output, increased pulmonary wedge pressures and systemic vascular resistance, $p<0.05$). VPA was associated with renal end-organ histologic protection and improved levels of blood urea nitrogen and creatinine at all time points ($p<0.05$).

CONCLUSION: Despite previous reports citing improved early outcomes with VPA administration, VPA did not improve resuscitation or mortality in a survival model with severe injury. VPA did show some evidence of prolonged renal protection. No benefit of re-dosing VPA was identified. VPA had a cardiac depressant effect that may be dose-dependent and should be studied further.

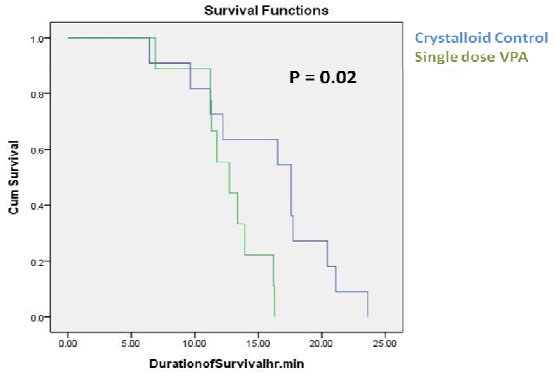


Figure. Duration of survival (hours) in crystalloid control and single dose VPA groups

TRANSFUSION BEGETS ANEMIA: THE EFFECT OF AGED BLOOD ON HEMATOPOIESIS

KJ Song, ZC Sifri, WD Alzate, AM Mohr, DH Livingston

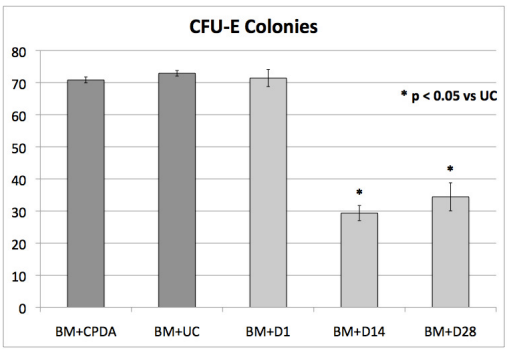
UMDNJ – New Jersey Medical School

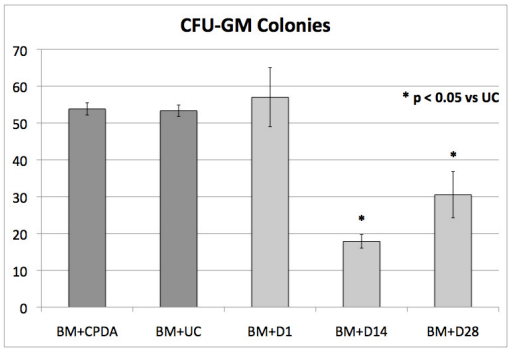
Presenter: Kimberly Song, MD, MA **Senior Sponsor:** David Livingston, MD

INTRODUCTION: Following trauma, transfusion of aged stored blood is often necessary yet it is associated with increased risk of infection. Despite blood replacement transfusions, many patients have a prolonged anemia requiring further transfusions. The effects of aged blood on bone marrow (BM) hematopoiesis have not been studied and we hypothesized that stored blood suppresses BM function.

METHODS: Fresh blood from Sprague-Dawley rats was stored for 1, 14, or 28 days with the industry standard preservative 12% Citrate Phosphate Dextrose Adenine (CPDA). At each time period, 5% plasma was incubated with fresh rat BM (n=6-7/group) and cultured for Erythroid (CFU-E) and Granulocyte-Macrophage (CFU-GM) colony forming units. Data was compared to cultures of BM alone, with 5% unmanipulated control (UC) plasma, and with 12% CPDA. Data presented as means (± SEM). * $p < 0.05$ Kruskal Wallis.

RESULTS: Data for CFU-E and CFU-GM are shown below. Incubation with CPDA, UC plasma, or Day 1 plasma had no effect on BM growth compared to BM alone (CFU-E: 73 ± 1; CFU-GM: 53 ± 1). Incubation with Day 14 and Day 28 plasma significantly suppressed CFU-E and CFU-GM growth compared to fresh blood (Day 1).





CONCLUSION: Plasma from aged blood adversely affects CFU-E and CFU-GM colony growth in rats. The effect is not mediated by CPDA. Ironically, transfusion of aged stored blood contributes to BM dysfunction in critically ill patients, resulting in persistent anemia and the need for further transfusion. Transfusion induced BM dysfunction may also partly explain the observed increased susceptibility to infection.

THE INTERNATIONAL NORMALIZED RATIO OVERESTIMATES COAGULOPATHY IN STABLE TRAUMA AND SURGICAL PATIENTS

SP McCully, LJ Fabricant, NR Kunio, DT Le, KM Watson, JA Differding, MA Schreiber

Oregon Health and Science University

Presenter: Sean Patrick McCully, MD, MS **Senior Sponsor:** Martin Schreiber, MD

INTRODUCTION: The international normalized ratio (INR) was developed to assess adequacy of coumadin dosing. Its use has been generalized to guide fresh frozen plasma (FFP) therapy in stable patients. Thrombelastography (TEG) is a whole blood assay measuring the viscoelastic properties of the clot in near real-time. This study hypothesized that INR does not reflect coagulopathy and should not be used to guide FFP therapy in stable trauma and surgical patients.

METHODS: Prospective observational data were collected from stable trauma and surgical patients (n=108) who received FFP transfusions. Pre- and post-transfusion blood samples were obtained to assess complete blood count, standard coagulation parameters (INR, PT, fibrinogen and D-Dimer), TEG, soluble clotting factors (II, V, VII, VIII, IX, X, XI, XII) and proteins C and S. Data were analyzed using a Mann-Whitney U test. Significance was $p < 0.05$.

RESULTS: 262 units of FFP were transfused and 89% of patients received >2 units. Despite a reduction in INR (table), median TEG values remained within normal limits and clotting factor levels retained adequate function to produce normal clotting prior to and following FFP transfusion.

TEST	REFERENCE	PRE FFP	POST FFP	P VALUE
INR	< 1.5	1.9 (1.5, 2.4)	1.5 (1.3, 1.8)	< 0.01
R (min)	4.0 - 9.0	7.2 (5.5, 9.2)	6.9 (5.2, 8.4)	< 0.05
K (min)	1.0 - 3.0	1.7 (1.3, 2.7)	1.6 (1.3, 2.1)	< 0.01
α (deg)	59.0 - 74.0	66.7 (56.1, 70.9)	66.5 (58.0, 71.1)	0.11
MA (mm)	55.0 - 74.0	66.1 (57.7, 72.5)	66.6 (60.2, 73.1)	0.13
CI	0 +/- 3	-0.1 (-2.3, 1.7)	0.4 (-1.6, 1.9)	< 0.05
aPTT (sec)	20 - 39	38 (32, 46)	34 (31, 41)	< 0.01
Fibrinogen (mg/dL)	150 - 400	330 (182, 482)	340 (218, 468)	< 0.05
D-Dimer (µg/mL)	< 0.5	3.3 (1.9, 7.2)	3.4 (1.9, 6.7)	< 0.01
FV (%)	50 - 150	44 (29, 59)	44 (28, 64)	< 0.05
FVII (%)	50 - 150	36 (26, 59)	44 (29, 68)	< 0.01
FVIII (%)	50 - 150	172 (98, 259)	167 (109, 272)	0.79
FIX (%)	50 - 150	68 (42, 109)	77 (53, 121)	< 0.01
FX (%)	50 - 150	40 (26, 54)	48 (35, 61)	< 0.01
FXI (%)	60 - 150	72 (51, 100)	76 (52, 107)	0.06
FXII (%)	40 - 150	75 (56, 103)	70 (51, 97)	0.29
Protein S (%)	70 - 140	36 (26, 49)	46 (32, 59)	< 0.01
Protein C (%)	70 - 140	29 (13, 55)	41 (27, 68)	< 0.01

Data are given as median (IQR); Factors represented as percent of normal

CONCLUSION: INR is a poor predictor of coagulopathy and should not be used to guide coagulation factor replacement in stable trauma and surgical patients. The use of FFP in this population did not affect the coagulation status in a clinically relevant manner based on TEG values and coagulation factor function.

IMPACT OF AN ACTIVE PERFORMANCE IMPROVEMENT PROCESS ON BLOOD PRODUCT UTILIZATION AND PATIENT SURVIVAL: AN ASSESSMENT OF 340 MASSIVE TRANSFUSION PROTOCOL ACTIVATIONS

J Skanchy, M Pommerening, Y Bai, EG Pivalizza, JJ McCarthy, JB Holcomb, BA Cotton

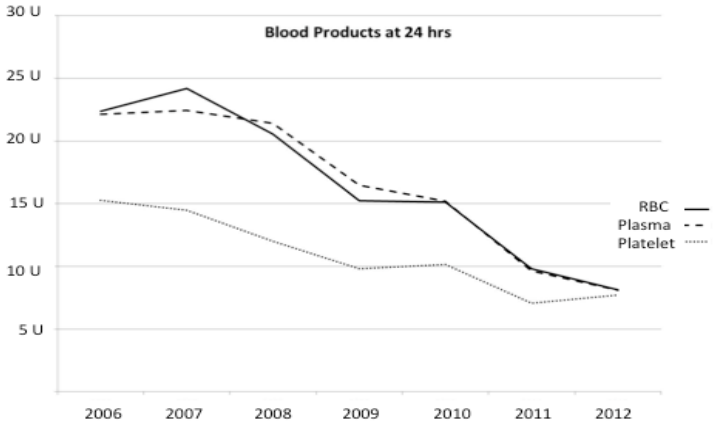
University of Texas, Houston

Presenter: Jeff Skanchy, BS **Senior Sponsor:** John Holcomb, MD

INTRODUCTION: Massive transfusion protocols (MTP) expedite the delivery of predefined products to rapidly bleeding patients. To facilitate the maturation of our MTP, we developed a robust performance improvement (PI) program in 2007. Since its initiation, this PI program has implemented several major changes to the MTP delivery and content. The purpose of this study was to assess if these changes were associated with a decrease in overall blood product use.

METHODS: All trauma MTP activations were reviewed (01/2006 to 09/2012). The MTP was initiated 01/2006 with the PI program developed 02/2007. Four major initiatives were evaluated: (PI#1) change of plasma: RBC ratio of 1:3 to 1:1 (06/2007), (PI#2) addition of platelets to the MTP in a 1:1:1 fashion (09/2008), (PI#3) placement of 4 RBC and 4 thawed plasma to ED fridge whose use triggers MTP activation (02/2010), and (PI#4) addition of 2 RBC and 2 thawed plasma to each of our 6 helicopters (08/2011). Univariate, multivariate, and time-series analyses were performed to assess the effects of these changes.

RESULTS: 340 consecutive MTP activations were evaluated. Demographics, arrival vitals and injury severity (by ISS and w-RTS) were similar by year. Mortality was reduced with MTP changes of PI#2 (69 to 50%; p=0.081) and PI#4 (34 to 19%; p=0.014). All 4 PI initiatives were associated with reductions in 24-hour RBC, plasma and platelet use; all p<0.05. (FIGURE)



CONCLUSION: An active and aggressive PI process is associated with improved outcomes and continued reductions in blood product use. Through these PI initiatives, we reduced the mean 24-hour RBC, plasma and platelet transfusions among MTP activations to 8 units.

ALCOHOL CONSUMPTION LEADS TO RELATIVE HYPOCOAGULABILITY AND DECREASED DVT RATES IN TRAUMA PATIENTS

SG Louis, R Stucke, SP McCully, S Fabricant, SJ Underwood, JA Differding, MA Schreiber

Oregon Health and Science University

Presenter: Scott Louis, MD **Senior Sponsor:** Martin Schreiber, MD

INTRODUCTION: Trauma patients exhibit a complex coagulopathy which is not fully understood and deep venous thrombosis (DVT) rates remain high. The effects of alcohol consumption on coagulopathy in trauma patients have not been studied. We hypothesized that alcohol consumption would alter coagulation as measured by thrombelastography (TEG) and influence DVT rates.

METHODS: Data were prospectively collected on 213 trauma patients at a level 1 trauma center. TEG, standard laboratory tests and ETOH levels were performed at the time of admission. Patients were grouped as EtOH positive if EtOH was detected. High risk patients were screened for DVT utilizing a standard protocol. Statistical significance was $p < 0.05$.

RESULTS: There were no inter-group differences in ISS, sex, or gender. The non-alcohol group was older (45 vs 38) ($p<0.05$). TEG values in the alcohol group demonstrated a relative hypocoagulable state when compared to the non-alcohol group (table). Conventional coagulation parameters were similar in both groups. DVTs occurred less frequently in the alcohol group, 4% vs 17% ($p<0.01$). A bivariate logistic regression was performed controlling for common risk factors for DVT (AIS Head/extremity >3, age >40). ETOH was associated with a decreased risk of DVT with an odds ratio of 0.21 (95% CI 0.55, 0.81).

Lab	EtOH (-)	EtOH (+)	P
R time	**4.8**	**5.7**	**0.02**
K time	**1.4**	**1.7**	**<0.01**
A-angle	**68.4**	**66.5**	**0.02**
MA	**64.1**	**61.5**	**0.02**
CI	**1.2**	**0.3**	**<0.01**
Ly 30	0.4	0.4	0.75
INR	1.1	1.1	0.67
PTT	26.6	26.9	0.58
Fibrinogen	276	259	0.18

CONCLUSION: While not detected by conventional assays, TEG demonstrated a relative hypocoagulable state in trauma patients who consumed alcohol. These patients also had a decreased rate of DVT formation when compared to patients who did not consume alcohol. Alcohol alters coagulation in trauma patients and confers protection from DVT.

SURGEONS AS ADVOCATES: TRAUMA SURGEON GOES TO WAR FOR A MARINE

AJ Mangram, JK Dzandu, AK Hollingworth, IJ Thomas, CE Justiniano, MG Corneille

John C. Lincoln North Mountain Hospital

Presenter: Alicia Mangram, MD **Senior Sponsor:**

The American College of Surgeons (ACS) strongly encourages fellows to be advocates. In response, many surgeons have become actively involved in state and federal advocacy efforts. Unavailability of insurance coverage and safety net programs for Americans is well documented. However, in spite of a guarantee of coverage for veterans, we present a case of a Marine Corps veteran who after sustaining a major trauma, had no healthcare coverage available. This case highlights unique challenges facing our troops returning home from IRAQ and Afghanistan.

A 29 y/o man had recently been honorably discharged from the Marine Corps after serving two tours of duty and was attending college. He was struck by a bus while riding his bicycle on a side street. He sustained multiple injuries, including open complex pelvic fracture, perineal destruction including the anorectum, urethral transection and femur fracture.

On arrival he was hypotensive from significant blood loss. He underwent urgent pre-peritoneal packing followed by pelvic vessel embolization. He underwent a massive resuscitation including 50 units of blood components and factor 7 in the first 24 hours. He remained in the ICU for several weeks and underwent many takebacks to address his open abdomen and perineum as well as pelvic and femur fractures. Approximately one week into the hospital course the trauma team was informed that the patient had no apparent funding including commercial insurance, Veteran Administration, Medicaid or social security. Due to the severity of injuries, extensive post discharge care at long term acute care and rehabilitation facilities was necessary, however not accessible without funding.

Multiple efforts were undertaken by the trauma surgeon which included calls to local congressman, state representative and senators. The result was securing VA benefits which allowed for further care and rehab. In order to deliver the care required for this patient, diligent efforts of the trauma surgeon as the patient's advocate were necessary. We believe cases like this are the tip of the iceberg.

DOXYCYCLINE ATTENUATES BURN INDUCED MICROVASCULAR HYPERPERMEABILITY

HW Stagg, JG Whaley, FA Hunter, B Tharakan, D Jupiter, WR Smythe, DC Little, ML Davis, EW Childs

Scott and White Memorial Hospital

Presenter: Hayden Stagg, MD **Senior Sponsor:** Matthew Davis, MD

INTRODUCTION: Burns induce systemic microvascular hyperpermeability resulting in shock, and if untreated, cardiovascular collapse. Damage to the endothelial cell adherens junctional complex plays an integral role in the pathophysiology of microvascular hyperpermeability. Previous studies in our laboratory have demonstrated endothelial adherens junctional complex damage as a result of increased Matrix Metalloproteinase-9 (MMP-9) following burn. We hypothesized that doxycycline, a known inhibitor of MMPs, could attenuate burn induced adherens junction damage and microvascular hyperpermeability.

METHODS: All procedures were approved by the Institutional Animal Care and Use Committee. Male Sprague-Dawley rats were divided into sham, burn, and burn + doxycycline (n=5). The experimental groups underwent a 30% total-body surface area full-thickness burn. FITC-albumin was administered intravenously. Mesenteric post-capillary venules were examined with intravital microscopy to determine flux of albumin from the intravascular space to the interstitium. Fluorescence intensity was compared from the intravascular space to the interstitium at 30, 60, 80, 100, 120, 140, 160, and 180 minutes post-burn. Parallel experiments were performed in which rat lung microvascular endothelial cells (RLMECs) were treated with sera from sham or burn animals, as well as separate groups pre-treated with either doxycycline or a specific inhibitor of MMP-9. Monolayer permeability was determined by FITC albumin-flux across Transwell plates, and immunofluorescense staining for the adherens junction protein β-catenin was performed. Statistical analysis was carried out with two-way ANOVA or paired t-test where appropriate, and a p-value of 0.05 was considered statistically significant.

RESULTS: Microvascular permeability was significantly increased post-burn, and this was significantly attenuated by doxycycline ($p<0.05$). Monolayer permeability was significantly increased with burn serum treatment; this was attenuated with doxycycline as well as the specific MMP-9 inhibitor ($p<0.05$). Damage of the endothelial cell adherens junction complex was induced by serum from burned rats, and doxycycline restored the integrity of the adherens junction similar to the MMP-9 inhibitor.

CONCLUSION: Burns induce microvascular hyperpermeability via endothelial adherens junction disruption. We conclude that doxycycline attenuates microvascular hyperpermeability associated with burn shock, and that this is accomplished through protection of the adherens junction complex.

Paper #20

BEYOND MORTALITY: USING DISABILITY ADJUSTED LIFE YEARS AND NEIGHBORHOOD LEVEL SOCIOECONOMIC STATUS TO UNDERSTAND BURDEN OF PEDESTRIAN VERSUS AUTO INJURIES

SK Dobbins, J Mah, SJ Chan, CJ Juillard, CK Robinson, KS Balhotra, RA Dicker

University of California, San Francisco

Presenter: Catherine Juillard, MD, MPH **Senior Sponsor:** Rochelle Dicker, MD

INTRODUCTION: Pedestrian versus auto (PVA) injury represents significant burden of disease, under-represented by mortality rates alone. This burden has previously been demonstrated in calculation of disability adjusted life years (DALYs). This measure of burden takes into account social and economic factors, which also contribute to the true burden of injury. We hypothesized that individuals with lower neighborhood level socioeconomic status (nSES) would have more DALYs after pedestrian injury.

METHODS: Retrospective case series analysis from 2007-2008 of 356 injured patients at a city's only level I trauma center. Age weighted and discounted DALY calculations used disability weights from the World Health Organization and previously established methodology. nSES was determined using census tract data and divided into quintiles using established methodology.

RESULTS: Incidence of patients admitted for pedestrian injury was 45/100,000 population, comprising 13% of hospital trauma admissions. Mean age was 50 years and mean injury severity score (ISS) was 17. DALYs lost ranged from 0 – 33 years, with a mean of 1.3 years; mortality was 9.8%. There was a high rate of homelessness (7.6%). In adjusted ANCOVA analysis, age, ISS, and mean DALY were found to be significantly different among nSES levels, with an increasing trend associated with decreasing nSES. Race was not found to be an independent predictor of DALY. Neither nSES nor race significantly predicted mortality.

CONCLUSION: Estimation of DALYs using nSES elucidates the true burden of PVA injury and identifies the most vulnerable populations. Calculations of community burden and true societal cost of PVA injuries should influence priorities in prevention resources, urban planning and policy recommendations.

Table 1. DALYs lost, Mortality and Incidence in PVA injury

nSES level	**DALYs lost**	**Mortality**	**Incidence**
Highest nSES	1.11 years	6%	19.7
High mSES	1.28	19%	19.1
Medium nSES	1.66	10.6%	14.6
Low nSES	1.55	7.9%	21.3
Lowest nSES	2.00	16.6%	18.2

MECHANICAL VENTILATION WEANING AND EXTUBATION AFTER SPINAL CORD INJURY: A WESTERN TRAUMA ASSOCIATION MULTICENTER STUDY

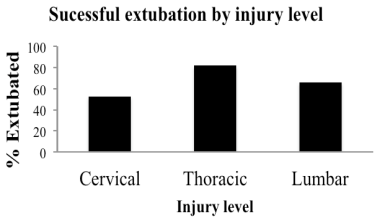
LZ Kornblith, ME Kutcher, BJ Redick, CK Hu, TH Cogbill, CC Baker, ML Shapiro, CC Burlew, KL Kaups, MA DeMoya, JM Haan, CH Koontz, S Zolin, SE Rowell, DV Shatz, DB Paul, MJ Cohen

Presenter: Lucy Kornblith, MD **Senior Sponsor:** Mitchell Cohen, MD

INTRODUCTION: Respiratory failure after acute spinal cord injury (SCI) is a well-recognized sequela, but data defining which patients need long-term ventilator support, and criteria for weaning and extubation are lacking. To address this, we performed a multicenter study of the demographics, predictors, and outcomes related to ventilator management and extubation in patients with SCI. We hypothesized that many patients with high SCI can be successfully managed without long-term mechanical ventilation and its associated morbidity.

METHODS: The Western Trauma Association Multi-Center Trials Committee conducted a study of patients with SCI at 14 major trauma centers. Comprehensive injury, demographics, clinical and outcome data on patients with acute SCI was compiled from medical records, ICU databases and trauma registries at each center. The primary outcome variable was the need for mechanical ventilation at discharge. Secondary outcomes included the use of tracheostomy, the development of acute lung injury (ALI) and ventilator-associated pneumonia (VAP).

RESULTS: 368 patients with SCI requiring mechanical ventilation were included in the compiled data set. 64.4% of patients had a cervical SCI, 23.6% thoracic SCI, and 11.1% lumbar SCI. Of the patients who survived to discharge, 81.6% of those with thoracic, and 65.9% of those with lumbar SCI were ventilator-free by discharge. Notably, 52.7% of patients with cervical SCI were also ventilator-free by discharge (Figure). Among all 368 patients, 149 (40.5%) underwent tracheostomy. 45.0% of the patients with tracheostomy were successfully weaned from the ventilator compared to a 71.2% success rate among those with no tracheostomy. Interestingly, regression analysis suggests more severe injury (ISS, AIS-head, AIS-chest and GCS) was not predictive of tracheostomy (p=.001). Of the 237 patients with cervical SCI, 51.5% underwent tracheostomy with a 41.8% extubation rate, compared to a 64.4% extubation rate without a tracheostomy. Overall, patients who underwent tracheostomy had significantly higher rates of VAP (61% vs 18.3%, p=.0001), ALI (12.3% vs 3.7%, p=.004) and fewer ventilator-free days (1 vs 23 p=.0001). When controlled for injury severity, thoracic injury, and respiratory comorbidities, tracheostomy is associated with 5.8 times incidence of prolonged mechanical ventilation (OR 5.82, CI 2.05-16.52, p=.001), suggesting that tracheostomy is an independent predictor of ventilator dependence.

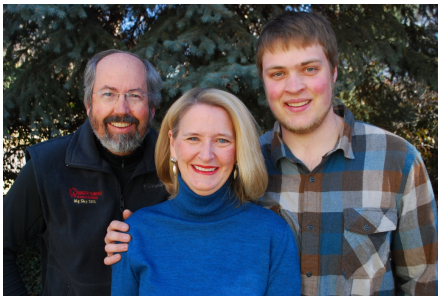


CONCLUSION: While many patients with SCI require short-term mechanical ventilation, the majority can be successfully weaned prior to discharge. In patients with SCI, tracheostomy is associated with major morbidity and its use, especially among patients with high cervical SCI deserves further study. A prospective trial is warranted to specifically identify criteria for extubation in these difficult patients.

Presidential Address

"Evidence Based Medicine"

Mark T. Metzdorff, M.D.



From our family to the WTA family: Thanks for 27 years of great memories, and for the privilege of serving.

Mark, Marie-Louise (M-L) and Alex Metzdorff

DIFFERENTIAL EFFECTS OF FRESH FROZEN PLASMA AND NORMAL SALINE ON CEREBRAL METABOLISM, EXCITOTOXICITY AND SECONDARY BRAIN DAMAGE IN A LARGE ANIMAL MODEL OF POLYTRAUMA, TRAUMATIC BRAIN INJURY AND HEMORRHAGIC SHOCK

JO Hwabejire, AM Imam, G Jin, B Liu, Y Li, M Duggan, M Sillesen, CH Jepsen, J Lu, MA deMoya, D Deperalta, HB Alam

University of Michigan

Presenter: Hasan Alam, MD **Senior Sponsor:**

INTRODUCTION: We have previously shown that the extent of traumatic brain injury (TBI) in large animal models can be reduced with early infusion of fresh frozen plasma (FFP), but the precise mechanisms remain unclear. In this study we investigated whether resuscitation with fresh frozen plasma (FFP) or normal saline (NS) differed in their effects on cerebral metabolism and excitotoxic secondary brain injury in a model of polytrauma, TBI and hemorrhagic shock.
METHODS: Yorkshire swine (n=10) underwent grade III liver injury, rib fracture, standardized TBI and volume-controlled hemorrhage, (40 ± 5 %) and were randomly resuscitated with either FFP or NS. Hemodynamic parameters and brain oxygenation were continuously monitored while microdialysis was used to measure the brain concentrations of pyruvate, lactate, glutamate and glycerol at baseline (BL), 1 and 2 h post-shock (PS), immediate post-resuscitation (PR), and 2, 4 & 6 hrs PR. Cells from the injured hemisphere were separated into mitochondrial and cytosolic fractions, and analyzed for activity of the pyruvate dehydrogenase complex (PDH).
RESULTS: There were no baseline differences in cerebral perfusion pressure (CPP), brain oxygenation and concentrations of pyruvate, lactate, glutamate and glycerol between the groups. At 2h and 4h PR, the FFP group had significantly higher CPPs (51.6±5.3mmHg vs. 42.7±2.1 mmHg, p=0.04 and 50.4±7.4mmHg vs. 37.0±1.7mmHg, p=0.02 respectively). There was a sustained and significant ($p<0.05$) drop in the glutamate and glycerol levels in the FFP group (Figure 1), implying a decrease in excitotoxicity and brain damage, respectively. Mitochondrial PDH activity was significantly higher (2666.2 ±638.2 INTmm^2 vs. 1293.4±88.81INTmm^2, p=0.001) and cytosolic PDH activity was correspondingly lower (671.4±209.2 INTmm^2 vs. 3070.7±484.3 INTmm^2, $p<0.001$) in the FFP group, suggesting an attenuation of mitochondrial dysfunction and permeability.
CONCLUSION: In this model of TBI, polytrauma and hemorrhage (HS), FFP resuscitation confers neuroprotection by improving cerebral perfusion, diminishing glutamate-mediated excitotoxic secondary brain injury, and reducing mitochondrial dysfunction.

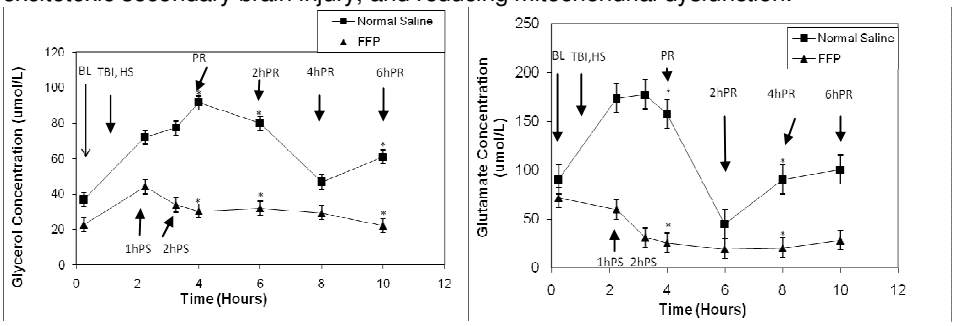


Figure. Cerebral microdialysis: Data presented as group means +/- SD, *=$p<0.05$

MECHANISM OF INJURY ALONE DOES NOT JUSTIFY CT IMAGING OF BLUNT INJURED CHILDREN

L Faulk, C Holscher, E Moore, H Moore, F Pieracci, C Burlew, C Barnett, J Jurkovich, D Bensard

University of Colorado School of Medicine

Presenter: Leonard Faulk, MS IV **Senior Sponsor:** Denis Bensard, MD

Introduction: The liberal use of computed tomography (CT) scanning during the evaluation of injured children has increased their exposure to the risks of ionizing radiation. We hypothesized that CT imaging done for mechanism of injury alone leads to unnecessary CT imaging and that serious or life-threatening injury is rarely identified in this group of children.

Methods: All pediatric blunt trauma team evaluations (age < 15 years) at an academic level 1 trauma center over 72 months were reviewed. Significant positive findings on CT imaging were defined: head: extra-axial blood, parenchymal injury; neck: bony, vascular injury; chest: great vessel injury; abdomen: solid organ, hollow visceral injury. Imaging in patients with normal GCS score, vital signs and physical examination were considered imaged on mechanism alone. Variables analyzed included age, mechanism, ISS, GCS, HR, SBP, and RR. Variables associated with any positive finding were entered into a multiple logistic regression model to assess for independent contributions. Each patient's total effective radiation dose from CT scans was calculated using an age-adjusted scale and represented in millisieverts (mSv).

Results: 174 children met trauma team activation criteria (mean age = 7 + 5 years, 63%male, ISS = 7 + 5). 153 (88%) were imaged by CT. Mortality was 4%; 6 died due to brain injury and 1 polytrauma. By univariate analysis, ISS ($p<0.01$), GCS<14 ($p<0.01$), and RR>30 ($p=0.09$) were associated with a positive CT finding. No patient imaged based on mechanism alone had a positive CT finding. By logistic regression analysis, GCS<14 remained the only variable associated significantly with a positive finding (OR 6.7, 95% CI 3-14, $p<0.01$).

	Mechanism Alone Normal GCS/VS/PE	Abnormal GCS	Abnormal VS/PE	Abnormal GCS/VS/PE
Number of pts (n)	66	25	57	26
Age (years)	7 ± 3	7 ± 4	8 ± 5	6 ± 5
ISS	7 ± 5	17± 9	9 ± 6	16 ± 9
Mortality	0	12%	0	15%
Imaged by CT	82% (54/66)	100% (25/25)	86% (49/57)	96% (25/26)
Radiation Dose (mSEV)	17 ± 12	29 ± 11	21 ± 13	27 ± 15
Positive CT (Head/Neck/Chest/Abd)	0 (0/114) 0/0/0/0	22%(17/77) 13/2/0/2	23%(25/111) 4/3/0/18	25%(18/72) 13/2/0/3

Conclusion: In children imaged based only on mechanism, no patient had a serious positive finding but was subjected to radiation doses associated with an increased risk of future malignancy. The use of CT imaging in injured children in the absence of a physiologic or anatomic abnormality does not appear justified, and should be abandoned in an effort to reduce radiation exposure.

BLUNT CEREBROVASCULAR INJURY IN CHILDREN: UNDER REPORTED OR UNDER RECOGNIZED?

N Azarakhsh, S Grimes, D Notrica, D Tuggle, NM Garcia, RT Maxson, A Alder, J Recicar, P Garcis-Filion, C Greenwell, KA Lawson, A Raines, JY Wan, JW Eubanks

University of Tennessee Health Science Center

Presenter: Nima Azarakhsh, MD **Senior Sponsor:** David Tuggle, MD

INTRODUCTION: Blunt cerebrovascular injury (BCVI) has been well described in the adult trauma literature. Numerous prior studies characterize adult risk factors, proper screening techniques, and treatment options. In pediatric trauma patients there has been very little research done regarding this injury. We hypothesize that the incidence of BCVI in children is lower than the 1% reported incidence in adult studies. Further, we believe that despite universal awareness of BCVI in adult trauma patients, many children at risk are not being screened properly, which may contribute to a lower incidence of diagnosis rather than a lower incidence of injury.

METHODS: This is a multi-institutional retrospective cohort study of all pediatric patients (<15yo) admitted with blunt trauma to one of six American College of Surgeons verified Level 1 Pediatric Trauma Centers (PTCs). After obtaining IRB approval at each institution, trauma registries were used to identify all pediatric blunt trauma patients admitted between October 2009 and June 2011. Using Abbreviated Injury Scale (AIS), all patients with blunt injuries to the head, face, or neck were identified. From this subset, data was collected and analyzed including demographics, mechanism of injury, Injury Severity Score (ISS), presence of injuries considered high risk for BCVI based on the Memphis criteria (anisocoria, basilar skull fracture, cervical spine fracture, neck soft tissue injury, LeFort II or III fracture, neurological exam unexplained by brain imaging), angiography results, presence of stroke, presence and characteristics of BCVI, and treatments methods used.

RESULTS: During the study period there were 5829 blunt trauma admissions to our centers, including 3140 with injuries to the head, face, and/or neck. Of this subset, 548 patients had at least one of the Memphis criteria. Only 89 (16%) of these “high risk” patients were screened (16 patients had more than one test) by angiography (64 CTA, 39 MRA, 2 conventional angiography) while 459 (84%) were not screened. Screened patients differed from unscreened patients in ISS (23+/- 13 vs. 13+/- 10, $p<0.0001$) and Head and Neck AIS (3.7+/- 1.2 vs. 2.8+/- 1.2, $p<0.0001$). The incidence of BCVI in our total population was 0.4% (24 patients). Three of 24 patients with BCVI (12.5%) had no risk factors for the injury.

CONCLUSION: BCVI in children treated at Level 1 Pediatric Trauma Centers is diagnosed less frequently than in adult patients. Our multi-institutional study, however, noted that screening was performed in a minority of high risk patients who met the Memphis criteria. Lower screening rates at PTCs may explain the reported lower incidence of BCVI in children. Pediatric Surgeons need to become more familiar with the currently accepted high risk criteria for BCVI and become more vigilant about screening.

Clearance of the Cervical Spine in the Trauma Patient

Gregory J. (Jerry) Jurkovich, M.D.
Denver Health Medical Center
Denver, Colorado

John Paul Elliot, M.D.
Colorado Brain and Spine Institute
Denver, Colorado

THE AMERICAN BIRKEBEINER CROSS-COUNTRY SKI MARATHON AND ITS PROGENITOR – THE NORWEGIAN BIRKEBEINERRENNET: A 25 YEAR EXPERIENCE

TH Cogbill

Gundersen Lutheran Health System

Presenter: Tom Cogbill, MD **Senior Sponsor:**

The American Birkebeiner cross-country 51 Km Skate / 54 Km Classic ski marathon from Cable to Hayward, Wisconsin is the largest (9,000 participants) cross-country ski race in North America. This race was modeled after the Norwegian Birkebeinerrennet 54 Km classic technique Nordic ski race from Rena to Lillehammer which ascends and then descends a mountain range in south central Norway. The Norwegian Birkie is steeped in tradition as each of the 16,000 participants must carry a backpack weighing at least 3.5 Kg – the approximate weight of the Norwegian baby prince Haakon Haakonsson who was rescued by local warriors on skis over the same route in 1206.

In a feeble attempt to explain where the author has been on the weekend preceding the Western Trauma Association meeting each year since 1988, the author will present a personal pictorial account of 25 American Birkebeiner 51 Km ski marathons and the 2012 Norwegian Birkebeinerrennet.

PROSPECTIVE EVALUATION OF THE UTILITY OF ROUTINE POST-OPERATIVE CYSTOGRAM AFTER TRAUMATIC BLADDER INJURY

K Inaba, O Okoye, T Browder, C Best, BC Branco, PG Teixeira, G Barmparas, D Demetriades

Los Angeles County – University of Southern California Medical Center

Presenter: Kenji Inaba, MD **Senior Sponsor:**

INTRODUCTION: The value of routinely testing bladder repair integrity with a cystogram prior to urinary catheter removal is unclear. The purpose of this study was to prospectively evaluate the utility of routine post-operative cystogram after traumatic bladder repair.

METHODS: All patients sustaining a bladder injury requiring operative repair at two Level I trauma centers were prospectively enrolled over a 5-year study period ending 01/2011. Injury demographics, imaging results and outcomes were abstracted. All patients were evaluated post-operatively with either a plain or computed tomography cystogram.

RESULTS: 127 patients were enrolled (mean age 30.4 ± 13.5, 63.8% blunt, mean ISS 17.7±10.6). 75 patients (59.1%) had an intraperitoneal (IP), 44 (34.6%) extraperitoneal (EP) and 8 (6.3%) IP/EP bladder injuries. All patients with IP and IP/EP injuries (83) underwent operative repair and a post-operative cystogram at 8.6±1.8 (5 – 13) days. Sixty-eight (81.9%) IP injuries were simple (dome or body disruption/penetrating injury) while 15 (18.1%) were complex (trigone/requiring ureter implantation). There were no deaths during the follow-up period. With the exception of 1 patient (0.7%) with a complex injury requiring ureteric implantation, there were no leaks demonstrated on cystogram and all urinary catheters were successfully discontinued.

CONCLUSION: In this prospective evaluation of the role of bladder evaluation after operative repair, routine use of follow-up cystograms for simple injuries did not impact clinical management. For complex repairs to the trigone or those requiring ureter re-implantation, a follow-up cystogram should be obtained prior to catheter removal.

Orthopedic Controversies in Trauma

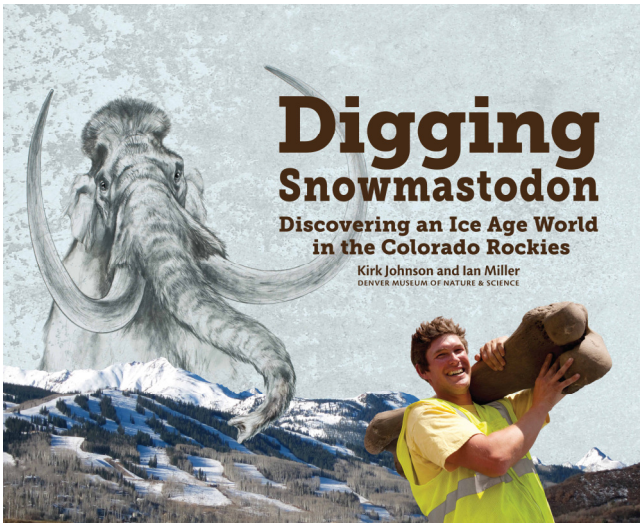
Henry C. Sagi, M.D.
Orthopedic Trauma Service
Tampa, Florida

Thomas M. Scalea, M.D.
Shock Trauma Center
Baltimore, Maryland

Special WTA Invited Lecturer

Ian Miller, Ph. D.

Ian Miller is Curator of Paleontology and Director of Earth & Space Sciences at the Denver Museum of Nature & Science. He earned a Ph. D. in geology and paleobotany at Yale University in 2007 and has been at DMNS since 2007. His research focuses on fossil plants and their applications for understanding ancient ecosystems and climate. He is presently working on projects in the Colorado Rockies, the Grand Staircase Escalante National Monument in Utah, and Madagascar. Dr. Miller is the co-leader of the Snowmastodon Project.



On October 14, 2010, a bulldozer operator uncovered a partial mammoth skeleton in the Ziegler Reservoir near Snowmass Village, Colorado. Within two weeks, it was clear that the site also contained the bones of Mastodon and other ice age mammals. The Denver Museum of Nature & Science responded with one of the largest fossil digs in the state's history, deploying more than 200 diggers and assembling a team of 38 scientists to analyze the results. The excavation revealed an amazing series of high elevation ice age ecosystems and yielded more than 5,000 bones from over 40 species of mammals, amphibians, reptiles, and birds.

Critical Decisions in Trauma

Moderator: Raul Coimbra, MD

Penetrating Neck Trauma

Jason Sperry, MD

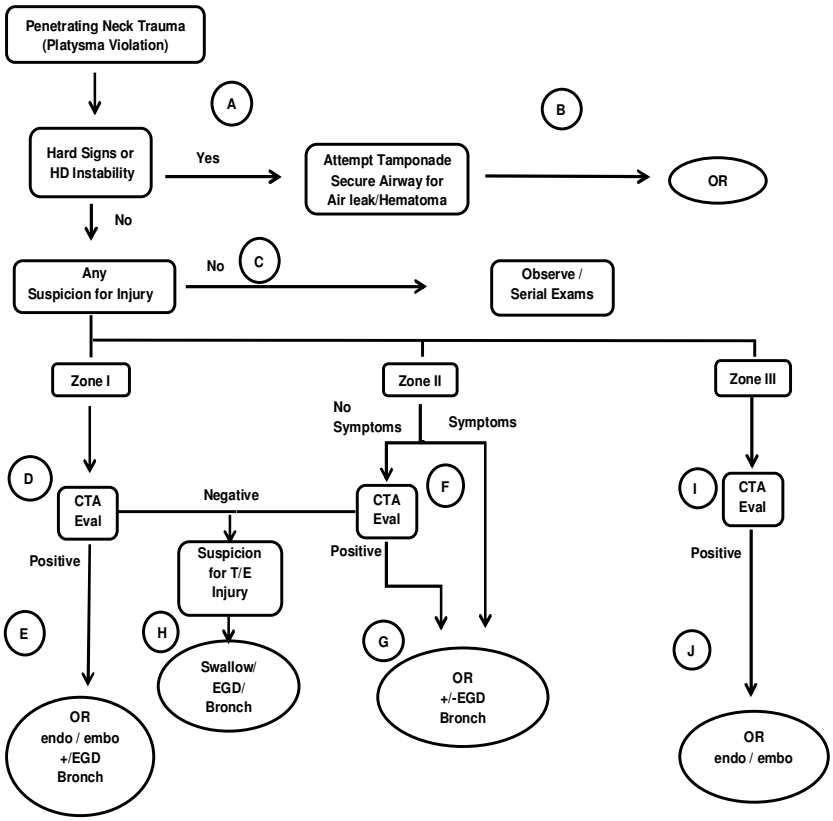
Pancreatic Trauma

Walt L. Biffl, MD

Abdominal Vascular Trauma

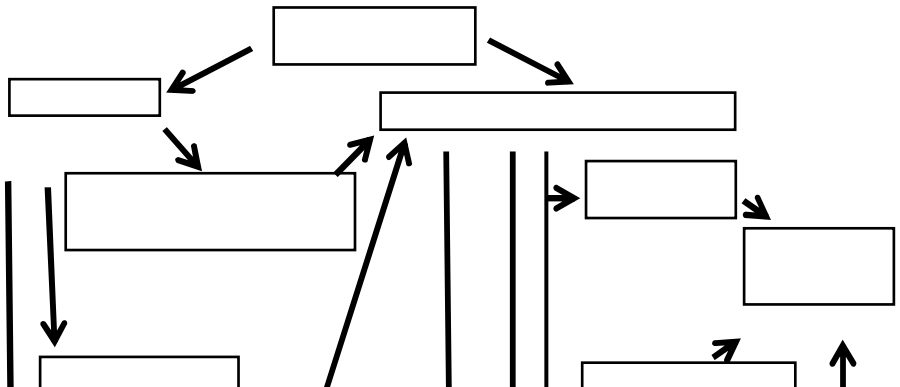
David V. Feliciano, MD

PENETRATING NECK TRAUMA

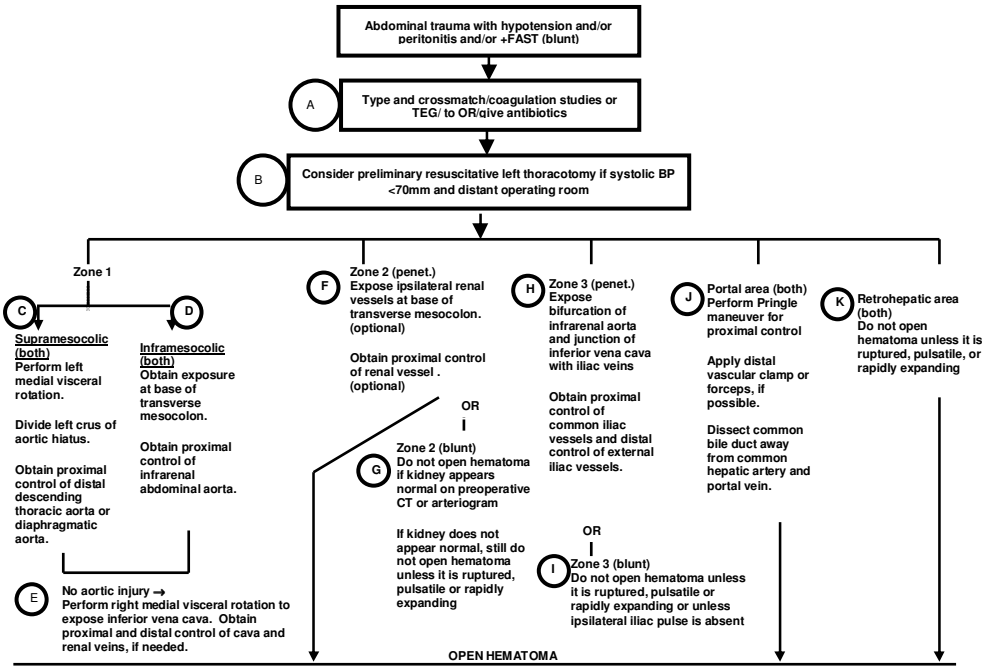


A. Patients who during their Primary Survey demonstrate 'Hard Signs' or hemodynamic instability require expeditious transfer to the operating room limited only by securing an unstable airway, with a surgical airway if attemtps at oral-tracheal intubation are unsuccessful, and attempting tamponade of active bleeding while en route.
B. Operative exposure for penetrating neck injuries with 'Hard Signs' or hemodynamic instability are dictated by the anatomical zone of injury.[7] Most injuries can be approached via an anterior sternocleidomastoid incision.
C. Patients without indications for mandatory neck exploration who remain hemodynamically stable can be managed expectantly with observation/serial exams or undergo further radiographic evaluation, depending on the level of suspicion for injury, the symptoms demonstrated by the patient and the anatomic zone of injury.
D. Stable Zone I patients without indications for mandatory neck exploration should undergo CTA of the chest and neck to evaluate for both vascular and aerodigestive injuries.
E. In those hemodynamically stable patients with CTA evidence of Zone I injury, further intervention is typically required**.** Successful endovascular approaches for arterial injuries using covered stents for zone I injuries have been well documented, primarily as case reports and increasingly small series. When endovascular techniques are not indicated, unavailable or are unsuccessful, standard open surgical techniques using proximal and distal vascular control may be required for arterial/venous injuries.
F. Those patients with Zone II injuries and physical exam symptoms should undergo early operative neck exploration by either the standard anterior sternocleidomastoid incision or cervical collar incision depending on the lateral or bilateral nature of the injury. Hemodynamically stable Zone II patients with suspicion for injury but without physical exam symptoms should undergo computed tomographic angiography (CTA) of the neck to evaluate for both vascular and aerodigestive injuries.
G. In those stable patients with CTA evidence of Zone II injury, further intervention is typically required**.** Despite much enthusiasm for endovascular techniques, the majority of zone II vascular injuries should be managed via standard open operative techniques.
H. In those patients with Zone I and II injuries who undergo CTA evaluation without direct evidence of aerodigestive tract injury but either secondary to wound trajectory, proximity to other injuries, or any evolving symptomatology, should undergo additional evaluation.
I. Hemodynamically stable Zone III patients with suspicion for injury should undergo CTA of the neck and head to evaluate for both vascular and aerodigestive injuries.
J. In those stable patients with radiographic evidence of Zone III injury, further diagnostic or therapeutic intervention is typically required**.** Inaccessible arterial injuries may be addressed with embolization when a vessel can be sacrificed or with covered stenting when patency is required. Penetrating vertebral artery injuries are relatively rare but can be challenging.

MANAGEMENT OF PANCREATIC INJURIES



ABDOMINAL VASCULAR TRAUMA -- APPROACH TO HEMATOMA AT LAPAROTOMY



RUNNING ON EMPTY? USING PULSE OXIMETRY TO MONITOR COMPENSATORY RESERVE

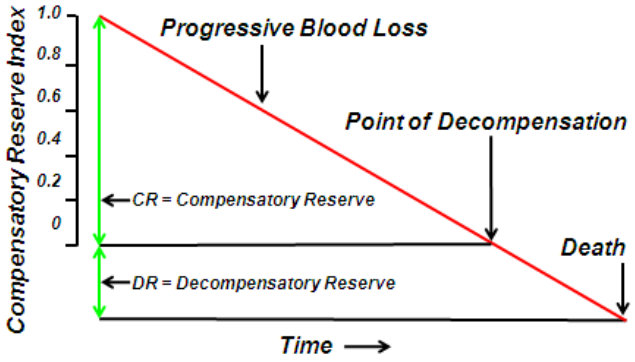
SL Moulton, J Mulligan, GZ Grudic, VA Convertino

Children's Hospital Colorado

Presenter: Steven Moulton, MD **Senior Sponsor:**

INTRODUCTION: Hemorrhage is a leading cause of traumatic death. We hypothesized that state-of-the-art machine learning and feature extraction techniques could be used to discover, detect and continuously trend beat-to-beat changes in pulse oximetry waveforms associated with progression to hemodynamic decompensation.

METHODS: We exposed 201 healthy humans to progressive central hypovolemia using lower body negative pressure to the point of hemodynamic decompensation (SBP < 80 mmHg +/- bradycardia). Initial models were developed using continuous noninvasive blood pressure waveform data. Subsequent models were developed using pulse oximetry waveforms from 30 subjects. Accuracy of the models to estimate hemodynamic decompensation was obtained by building models using 29 subjects and testing on the 30th. This process was repeated 30 times, each time using a different subject. Results are an average of these 30 experiments.



RESULTS: The resulting algorithm calculates a compensatory reserve index (CRI), where 1 represents supine normovolemia and 0 represents the circulatory volume at which hemodynamic decompensation occurs. Values between 1 and 0 indicate the proportion of reserve remaining before hemodynamic decompensation—much like the fuel gauge of a car tells you how much fuel is left in your tank. A CRI estimate is produced after the first 30 heartbeats, followed by a new CRI estimate after each subsequent beat. A pulse oximetry-based model with a 30 beat window is 96% accurate in estimating hemodynamic decompensation well before it occurs (mean absolute difference between actual and expected CRI is 0.1, with a standard deviation of 0.09).

CONCLUSION: Machine modeling can quickly and accurately detect and trend central blood volume reduction in real-time, as well as *estimate* when an individual will decompensate (CRI=0), well in advance of meaningful changes in traditional vital signs.

FAST EXAM IN HYPOTENSIVE TRAUMA PATIENTS FREQUENTLY MISSES SIGNIFICANT ABDOMINAL INJURIES

S Rowell, R Barbosa, S Gordy, J Watters, E Bulger, K Brasel, J Holcomb, M Cohen, H Phelan, B Cotton, J Myers, M Rahbar, P Muskat, L Alarcon, C White, E Fox, M Schreiber

Oregon Health and Science University

Presenter: Ronald Barbosa, MD **Senior Sponsor:** Susan Rowell, MD

INTRODUCTION: Previous data suggest that Focused Assessment with Sonography for Trauma (FAST) as a screening tool for abdominal injury in hemodynamically stable patients results in under diagnosis of injuries using CT scan as the confirmatory test. The sensitivity and specificity of FAST for detecting clinically significant abdominal hemorrhage in hypotensive trauma patients is unknown. We sought to describe the sensitivity and specificity of FAST in hypotensive injured patients using findings at laparotomy as the confirmatory test.

METHODS: Patients with blunt and penetrating injury from the Prospective Observational Multicenter Major Trauma Transfusion study that received at least 1 unit of packed red blood cells during the first 6 hours after injury and underwent FAST during initial workup were analyzed. Hypotension was defined as a systolic blood pressure (SBP) < 90 mmHg either during transport or upon arrival. FAST exam results were compared to findings at laparotomy. A therapeutic laparotomy (T-LAP) was defined as an abdominal operation within 24 hours of injury in which a definitive procedure was performed. Definitions for sensitivity and specificity calculations were as follows:
True Positive: FAST(+), required a T-LAP; False Positive: FAST(+), did not require T-LAP;
False Negative: FAST(-), required a T-LAP; True Negative: FAST(-), did not require a T-LAP.

RESULTS: The cohort included 317 hypotensive patients [median SBP 80 (IQR 70-89) mmHg] that received a FAST [FAST(+) n=108; FAST(-) n= 209]. Seventy-six percent of patients sustained blunt injury. Median Injury Severity Score was 26 (IQR14-34) and base deficit was 8 (IQR 4-12). T-LAP was performed in 69% of FAST(+) patients and 23% of FAST(-) patients. In the cohort of patients with a false negative FAST (n=48), the median 6-hour red blood cell requirement was 8.5 (IQR 4-18) units. Sixty-three percent (n=30) received damage control abdominal surgery with abdominal packing and 17% died (n=8). Of those that died, 75% were due to exsanguination. Using a T-LAP as the confirmatory test, FAST had an overall sensitivity of 61%, specificity of 83%, positive predictive value of 69%, negative predictive value of 77%, and accuracy of 74%. When patients with blunt and penetrating injury were analyzed separately, the sensitivity and specificity were 63% and 85% for blunt injury, and 56% and 77% for penetrating injury, respectively.

CONCLUSION: In this study of severely injured hypotensive trauma patients, FAST obtained on arrival to the ED was unable to detect a clinically significant injury in 39% of patients that received a therapeutic laparotomy. In hypotensive injured patients with a negative FAST and no other obvious source, either a confirmatory test such as diagnostic peritoneal lavage or immediate laparotomy should be strongly considered.

Founders' Basic Science Lecture

Throughout the years, the Western Trauma Association has matured as an academic society while maintaining the cherished elements of friendship, collegiality and family. In honor of this unique spirit, a founding member has generously provided the idea and most of the financial support for an annual *Founders' Basic Science Lectureship*. The purpose of this Lecture is to further enhance the educational value of our Scientific Meeting relative to the area of basic science research. This Lecture reflects the vision and dedication of our founding members and will hold a prominent place in all future programs.

"The Role of Hypertonic Saline Resuscitation in Trauma and Acute Care Surgery: Size Matters"

Steven R. Shackford, M.D.

Paper #29 4:00 pm, 3/7/13

INTRAOSSEOUS BALLOON TAMP (IBT) IN TIBIAL HEAD FRACTURES - A HELPFUL TOOL TO IMPROVE PATIENT CARE?

C Shinkel, S Gaum

Klinikum Memmingen, Germany

Presenter: Christian Schinkel, MD **Senior Sponsor:** Christine Cocanour, MD

INTRODUCTION: Tibial head fractures occur in high and low energy trauma. Soft tissue injuries are frequent, preventing early surgery and increasing the risk of wound infections. Because tibial head fractures are prearthrotic injuries, exact joint line reconstruction is mandatory. Numerous techniques are used to achieve this but all have risk. The use of minimally invasive bone tamps through transosseous approaches may result in additional cartilage damage. More invasive open procedures have a high risk of wound complications. Insufficient filling of the intraosseous void may result in secondary loss of reduction despite plate or screw fixation. Intraosseous balloon inflation has been successfully used for years in kyphoplasty but its use in limb fractures is new. Cadaver studies have shown improved joint line reduction and increased load stability. Our study evaluated its role in the repair of tibial head fractures.

METHODS: In the reported clinical series we investigated 16 patients with tibial head fractures Schatzker type II-VI. 12 women and 4 men, mean age 51 yrs (33-75) were treated with a standard approach and using a percutaneously placed intraosseous balloon (Medtronic, Minneapolis) as a reduction tool. Good or anatomical reduction was achieved in all but two patients. Standard stabilization was completed by screw or plate osteosynthesis. The void was filled CaPo4 cement (Medtronic, Minneapolis).

RESULTS: One patient showed loss of reduction after 8 weeks due to partial osteonecrosis of a significantly dislocated fragment. All others had a full weight-bearing recovery after 12 weeks without loss of reduction. No wound complications occurred.

CONCLUSION: IBT is a helpful add-on tool to achieve a good reduction in tibial head fractures using minimally invasive techniques early after trauma. Our data, in conjunction with previously published data from cadaver studies, suggest that IBT will allow early surgery and full weight bearing that result in early reintegration without increased risk of wound complications. A prospective trial is necessary to prove our conclusions.

PANEL OF EXPERTS

Moderator: Peter Rhee, MD

David Livingston, MD

Nicholas Namias, MD

Martin Schreiber, MD

5:00 pm, 3/7/13

Paint the Ceiling Lecture

In 1997, Dr. Gregory “Jerry” Jurkovich delivered his Presidential Address entitled “Paint the Ceiling: Reflections on Illness”. This was a personal account of his battle with non-Hodgkin’s lymphoma. His deep insights were shared from a patient’s perspective, even that of a stained ceiling that he observed while lying on his back. He proposed that future WTA Scientific Programs have some time “dedicated to our patients and to the Art of Medicine”.

“Things That Go Bump in the Day”

Neil L. Barg, M.D.

Paper #30 7:00 am, 3/8/13

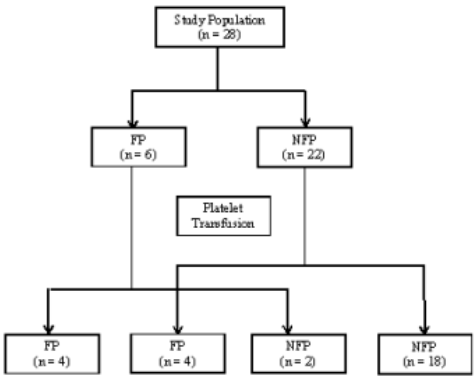
ASPIRIN AND TRAUMATIC INTRA-CRANIAL HEMORRHAGE: IS PLATELET TRANSFUSION BENEFICIAL?

B Joseph, M Sadoun, V Pandit, CG Larkins, N Kulvatunyou, A Tang, JL Wynne, T O'Keefe, RS Friese, P Rhee

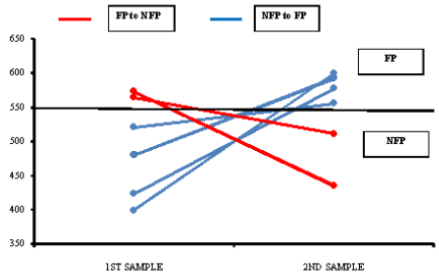
University of Arizona

Presenter: Bellal Joseph, MD **Senior Sponsor:** Peter Rhee, MD

INTRODUCTION: Platelet transfusion is increasingly utilized in patients with traumatic intracranial hemorrhage (ICH) who are on aspirin to minimize progression of intracranial bleed. We hypothesized that platelet transfusion in this cohort of patients does not affect platelet function.



METHODS: We performed a prospective interventional trial enrolling convenience sample of patients on daily aspirin with traumatic ICH. All patients received 1 pack of aphaeresis platelets. Blood samples were collected before and one hour after platelet transfusion. Platelet function was assessed utilizing Verify Now Assay® and the cutoff for functioning platelets (FP) was defined as ≥ 550 Standardized Aspirin Reaction Units (ARU).



FP – Functional Platelet, NFP – Non –Functional Platelet

RESULTS: Twenty Eight patients were enrolled with mean age 72 ± 9.5, median Glasgow Coma Scale (GCS) score 15 [6-15], and median head Abbreviated Injury Score (AIS) 3 [2-4]. On presentation, 79% (22/28) of patients had non-functioning platelets (NFP) and transfusion of platelets did not improve platelet function as 81% (18/22) still had NFP. Four of the 22 patients converted from NFP to FP after transfusion. Six patients had FP on admission, of which 2 patients converted to NFP after transfusion. There was no difference in age (70±9 v/s 75± 10, p=0.287) and severity of injury (18±7 v/s 15±7, p=0.418) among patients with FP and NFP. Progression of ICH occurred in 32% (n=9) patients and 67% (6/9) of these patients still had NFP after platelet transfusion. Neurosurgical intervention was performed in 4 patients, 3 of which had NFP post transfusion. There was no difference in the progression of ICH (p=0.682) or neurosurgical intervention (0.863) between patients with FP and NFP after platelet transfusion.

CONCLUSION: Platelet function did not improve despite platelet transfusion in patients with traumatic ICH on daily aspirin therapy. Progression of ICH and the need for neurosurgical intervention was independent of platelet function. Further randomized clinical trials are required.

HUMAN ABDOMINAL INFLAMMATION DECREASES REGULATORY T-CELLS IN THE OMENTUM AND INCREASES THEM IN THE CIRCULATION

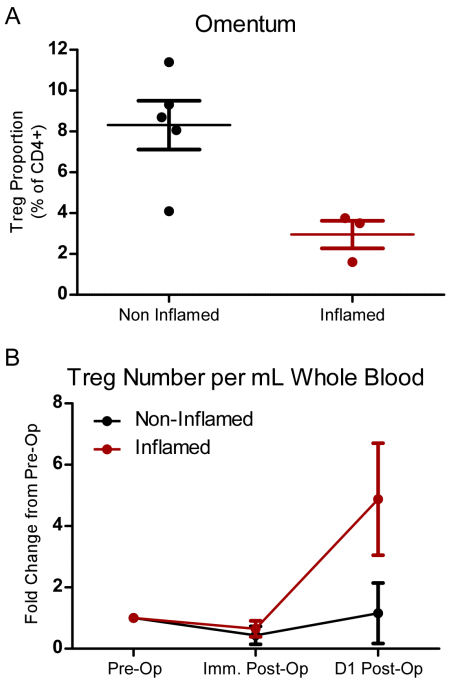
CJ Hauser, A Gupta, SR Odom, KP Hopson, WG Junger, MB Yaffe, LE Otterbein, JA Lederer, K Itagaki

Beth Israel Deaconess Medical Center/Harvard Medical School

Presenter: Carl Hauser, MD **Senior Sponsor:**

INTRODUCTION: Regulatory T-cells (Tregs) are specialized $CD4^+$ lymphocytes that strongly regulate inflammation despite circulating at low levels. The specific role of Tregs in abdominal inflammation is unstudied, but they are likely to regulate events like 1) resolution of infection vs peritonitis vs abscess formation; 2) adhesion formation, wound and anastomotic healing; and 3) acute as well as chronic insulin resistance. We have begun a prospective, systematic study of Tregs in the abdomen and circulation in health, obesity and inflammatory abdominal disease.

METHODS: After informed consent, human omentum was prospectively sampled at the time of operations done for inflammatory pathology or non-inflammatory disease. Blood was sampled pre-op, at the end of operation, and at days 1, 3, 7-14 and 30. Omentum was digested in collagenase. Mononuclear cells were isolated from blood or dissociated tissue on a Ficoll gradient. Tregs were counted by flow cytometry as CD14-, CD19-, CD206-, CD3+, CD4+, CD25hi and CD127lo cells. Diagnoses, demographics and BMI were recorded prospectively.



RESULTS: Pre-op patients with and without abdominal inflammation show no differences in circulating Tregs. Yet omentum from inflammatory abdomens showed marked decreases in Tregs compared with omentum from patients without abdominal inflammation (8% vs 3% of CD4+ cells, $P<0.018$, T-test, Figure A). A strikingly different pattern was seen in blood on Day 1 after surgery: patients with inflammatory abdominal pathology showed a 5-fold increase in circulating Tregs (ANOVA <0.001, Figure B). Omental Tregs were markedly suppressed as BMI increased (not shown).

CONCLUSION: Tregs normally reside in the omentum and their abundance is tightly controlled in the periphery. These translational studies are the first to show abdominal inflammation and operations decrease Treg numbers in the omentum and increase Treg numbers in the circulation. The relationships of Treg trafficking to abdominal inflammation and systemic immunity after surgery clearly warrant further study. Longitudinal studies in this patient group are planned to assess clinical relevance. Significant interactions between Tregs, omental macrophages and adipocytes could make them key targets for interventions in abdominal inflammation, wound healing and glucose metabolism.

Paper #32 7:40 am, 3/8/13

ORGAN FAILURE IN THE OBESE ADIPOCYTES PRIME PMN INFLAMMATION UNDER STRESS CONDITIONS IN VITRO

LN Diebel, DM Liberati, DA Edalman, JD Webber

Wayne State University

Presenter: Lawrence Diebel, MD **Senior Sponsor:**

INTRODUCTION: Obesity is associated with a higher risk of remote organ failure after shock and trauma. The mechanism(s) are poorly understood. Polymorphonuclear cell (PMN) inflammatory responses are important in the pathogenesis of organ injury following shock. Recent studies also demonstrate that the systemic sympathetic response following trauma is related to injury severity; this may serve to prime PMN inflammatory response following injury. Morbid obesity is a low grade inflammatory state associated with proinflammatory mediator production from adipose tissue. We hypothesized that adipose tissue may modulate PMN inflammatory potential and is dependent on the magnitude of the injury related stress response. This was studied in an *in vitro* model.

METHODS: Adipose derived stem cells (ADSC) conditioned to behave as mature adipocytes were incubated with physiologic and stress concentrations of adrenaline (adren) for 12 hours and cell culture supernatants obtained. PMNs from normal human volunteers were co cultured with the ADSC supernatants (priming) followed by addition of 1μM fMLP (activation). PMNs alone served as control. PMN activation was indexed by superoxide anion (O_2^-) production, elastase release (%) and CD11b expression (mean fluorescent intensity, MFI).

RESULTS: Mean ± S.D.**,** N = 5 for each group.

	CD11b (MFI)	O_2- (nmol/ml)	Elastase (%)
PMN baseline	95.5 ± 3.8	6.0 ± 1.1	9.0 ± 1.6
PMN + physio adren	107.9 ± 4.0*	8.4 ± 1.5*	13.5 ± 2.5*
PMN + stress adren	126.6 ± 2.9*#	10.1 ± 1.6*	15.9 ± 2.1*
PMN + ADSC sup.	116.7 ± 2.8*#	10.1 ± 2.1*	18.9 ± 2.2*#
PMN + ADSC sup. + physio adren	115.4 ± 2.1*#	12.2 ± 2.6*#	25.3 ± 2.9*#
PMN + ADSC sup. + stress adren	201.9 ± 5.8*#$	23.4 ± 3.4*#$	44.8 ± 3.6*#$

*p<0.001 vs. PMN baseline, #p<0.001 vs. PMN + physio adren, $p<0.001 vs. all groups

CONCLUSIONS: Adipocyte derived mediators prime PMNs *in vitro***.** There was a graded PMN response to adrenaline concentration +/- adipocytes in these experiments. The most profound increase in PMN inflammatory potential was noted with the adipocyte supernatant + stress adrenaline group. The clinical impact of obesity on remote organ injury is likely dependent on patient body mass index and the injury related sympathetic responses. These data suggest a potential role for βeta blockade in this patient population.

Paper #33 8:00 am, 3/8/13

GUNSHOT WOUNDS AND BLAST INJURIES OF THE FACE ARE ASSOCIATED WITH SIGNIFICANT MORBIDITY AND MORTALITY: RESULTS OF A 10-YEAR MULTI-INSTITUTIONAL STUDY

SR Shackford, JE Kahl, RY Calvo, MC Shackford, J Bandle, R Kozar, C Haugen, K Kaups, K Cagle, B Tibbs, C Cothren-Burlew, EE Moore, A Rizzo, C Lormel, T Cogbill, KJ Kallies, J Haan, J Ward

Scripps Mercy

Presenter: Steve Shackford, MD **Senior Sponsor:**

INTRODUCTION: Gunshots and blast injuries of the face (GSBF) produce complex wounds requiring management by multiple surgical specialties. Previous work is limited to single institution reports with little information on outcome. We sought to determine those factors associated with hospital complications (CXS) and mortality.

METHODS: We performed a 10-year multicenter retrospective cohort analysis of patients (pts) sustaining GSBF. The face was defined as the area anterior to the external auditory meatus from the top of the forehead to the chin and categorized into 3 zones: I=chin to base of nose; II= base of nose to eyebrows; III=above the brows. We examined the effect of multiple factors, including zone of injury and specialty management, on outcome using logistic regression.

RESULTS: From 1/1/2000 to 12/31/2010, we treated 624 pts with GSBF (549 males [88%]; 74 female) with a mean age of 36 years. The wounding agent was: handgun=249 (40%), shotgun=87 (14%), explosive=43 (7%), rifle=36 (6%), and unknown or other= 209 (33%). Prehospital airway was required in 162 (26%). After resuscitation, definitive care was rendered by multiple specialties in 145 (23%), solely plastic surgeons in 95 (15%), neurosurgeons in 91 (14%), oral surgeons in 91 (14%), otolaryngologists in 57 (9%). Overall 132 pts died (21%); 120 within 48hours. 181 pts suffered complications (29%). Factors significantly associated with mortality were: zone of injury (table), GCS (OR: 0.68; 95% CI: 0.63-0.75) and age (for each year of increase, OR: 1.02; 95% CI: 1.01-1.04).

	n	**Mortality Rate (%)**	**CXS Rate (%)**
Zone I only	165	15.2	27.3
Zone II only	198	9.6	31.2
Zone III only	116	54.3	27.6
Blast	54	5.6	31.5
Zone I & II	27	14.8	25.9
Zone I/II + III	34	41.1	47.1

CONCLUSION: In this large multicenter study, we have shown that GSBF have a high mortality and are associated with significant morbidity. The multispecialty involvement required for definitive care necessitates triage to a trauma center and underscores the need for an organized approach and the development of effective guidelines.

Paper #34 8:20 am, 3/8/13

OCTOGENARIANS AND MOTOR VEHICLE COLLISIONS: POST-DISCHARGE MORTALITY IS LOWER THAN EXPECTED

K Balbierz, F Dong, G Crawford, JG Ward, ML Lemon, SD Helmer, RJ Nold, JM Haan

University of Kansas School of Medicine - Wichita

Presenter: Kathryn Balbierz, MS III **Senior Sponsor:** James Haan, MD

Introduction: Motor vehicle collisions (MVC) are the second leading cause of injury among octogenarian trauma patients. Currently, physicians and families lack outcomes-based data to assist in the decision-making process concerning injury treatment in this population. The purpose of this study was to evaluate mortality rates within 12 months of discharge and causes of death in octogenarian MVC patients who survived their initial hospitalization, and to determine if any specific injury patterns affect post-discharge survival.

Methods: A 10-year retrospective chart review was conducted of all trauma patients 80 years of age and older who were involved in an MVC and subsequently discharged alive from an ACS verified Level 1 Trauma Center. Data collection included demographics, injury severity score (ISS), injury patterns, hospitalization details and outcomes. A state death database and hospital records were queried to identify patients who died within 12 months of hospital discharge and to determine their cause of death. Analyses were conducted to explore the relationship between severity of injury and injury patterns to 12-month post-discharge mortality.

Results: Among the 199 patients included in this study, 22 (11.1%) died within 12 months. Average age and ISS was 85.2 ± 3.3 years and 9.3 ± 8.2, respectively. Cause of death was not available for 7 (31.8%) patients. For the remainder, the most common causes of death were respiratory (40%) and cardiovascular-related (26.7%). More severely injured patients and those admitted to the ICU were more likely to die within 12 months of discharge (See Table). Results indicated a trend toward higher mortality in patients with pneumonia, while rib, hip, and pelvic fractures; spinal injuries; intubation upon hospital arrival; and need for mechanical ventilation were not associated with higher post-discharge mortality rates.

Parameter	Survival status at 12 months		P-value
	Died (n=22)	Alive (n=177)	
ISS	15.1 ± 9.1	8.6 ± 8.0	0.0006
ISS ≥ 15	10 (21.7%)	36 (78.3%)	0.0084
ISS <15	12 (7.8%)	141 (92.2%)	
ICU Admission - Yes	14 (18.2%)	63 (81.8%)	0.0109
ICU Admission - No	8 (6.6%)	114 (93.4%)	
Number of days in ICU	4.9 ± 7.8	2.1 ± 5.6	0.0079
Pneumonia – Yes	3 (27.3%)	8 (72.7%)	0.0776
Pneumonia – No	19 (10.1%)	169 (89.9%)	

Conclusions: The commonly held belief that the majority of octogenarians with MVC-related trauma die within one year of hospital discharge is refuted by this study. Only injury severity, ICU admission and ICU duration were predictive of mortality within 12 months following discharge.

Paper #35 8:40 am, 3/8/13

CLINICAL UTILITY OF FLAT INFERIOR VENA CAVA BY AXIAL TOMOGRAPHY IN SEVERELY INJURED ELDERLY PATIENTS

DJ Milia, JS Paul, P Tolat, A Dua, KJ Brasel

Medical College of Wisconsin

Presenter: David Milia, MD **Senior Sponsor:** Karen Brasel, MD

INTRODUCTION: Flat IVC (FI) has been associated with shock and mortality in young trauma patients (age < 55). Due to the greater possibility of non-hypovolemic shock in the elderly, we hypothesized that although FI may predict shock in the elderly the converse may not be true.

METHODS: Retrospective cohort study of all severely injured (ISS ≥ 15), blunt trauma patients ≥55 years old from April 2006-April 2011. Only patients undergoing axial imaging of the IVC within one hour of transport were considered. Anterior-Posterior (AP) and Transverse diameter of the IVC were measured 2.5mm above the renal veins. Transverse to AP IVC ratios of 2, 3, and 4 were analyzed. Hemodynamic (HR, BP, SBP, Shock Index (SI), and Adjusted Shock Index (ASI)) and laboratory (Hgb, HCO3, BE) markers of shock were reviewed. Correlation between shock markers, IVC ratio and death was performed using multivariate logistic regression. Relationship between shock and IVC ratio was performed with logistic regression and Chi squared where appropriate.

RESULTS: 308 patients met our inclusion criteria during the assigned study period. The IVC ratio was ≥2, ≥3, and ≥4 in 180, 85, and 46 patients respectively. The IVC ratio (viewed continuously) correlated with mortality ($p < 0.05$). Ratios of ≥3 and ≥4 predicted a 2.0 and 2.2 times mortality increase (C.I 1.00-5.00, 1.00-4.95) respectively. Among patients presenting in clinical shock (ASI≥50) there was no correlation with IVC ratio.

	ASI < 50	ASI ≥ 50	p
Number Pts	203	104	
Age	65	73	p<0.001
TV/AP	2.5	2.7	NS
TV/AP>=2	112(55)	68(65)	NS
TV/AP>=3	51(25)	34(33)	NS
TV/AP>=4	28(14)	18(17)	NS
Mortality	24(11)	15(14)	NS

CONCLUSION: As in previous studies with younger inured patients, a flat IVC is predictive of increased mortality risk. There is a linear relationship between IVC ratio and probability of death in elderly injured trauma patients. Presence of a shock state, as defined by ASI, does not predict a flat IVC. Moreover, almost one-third of patients presenting in clinical shock had a round IVC. This is consistent with our hypothesis that shock in the elderly trauma population may be multifactorial and the risk of non-hypovolemic shock must be considered.

Paper #36 4:00 pm, 3/8/13

DRIVING INTOXICATED: IS HOSPITAL ADMISSION PROTECTIVE AGAINST LEGAL RAMIFICATIONS?

SM Cheek, JS Murry, MS Truitt, EL Dunn

Methodist Dallas Medical Center

Presenter: Michael Truitt, MD **Senior Sponsor:**

Introduction: According to the U.S. Department of Transportation National Highway Traffic Safety Administration, in 2010 alone, 10,228 people were killed in alcohol-impaired driving crashes. Intoxicated drivers are seen in trauma centers across the country on a daily basis. Patients are brought from the accident scene to the hospital without time for the police to question the patient or to determine if there is suspicion for intoxicated driving. At our trauma center, we sought to determine the number of drivers who had a documented elevation in their blood alcohol content (BAC) and compare this to county police records to evaluate how many charges for driving while intoxicated were issued.

Methods: A retrospective chart review was done for all patients who presented as trauma activations over a 3 year period that had a blood alcohol level drawn in the trauma bay. Any patient with a BAC of less than 0.08 mcg/dl was excluded. Any patient not clearly identified as driver was also excluded. This group of intoxicated drivers was then compared against public records from Dallas County for any record of a charge for driving under the influence of alcohol.

Results: Over a 3 year period, from 2009-2011, there were 118 drivers who had a confirmed blood alcohol content above the legal limit of 0.08 mcg/dl. Seventy three percent of patients were uninsured. Fifty two percent were Hispanic, 24% were African American and 24% were Caucasian and less than 1% were Asian. Average BAC level was 0.217 mcg/dl, with a range from 0.087-0.353 mcg/dl. Urine drug screen was positive for other substances in 13% of patients. Of that twelve percent, 60% were positive for cocaine and 28% for cannabis. Injuries varied widely between patients with an average injury severity score (ISS) of 11. Extremity fractures were seen in 27%, facial fractures in 16% and intracranial hemorrhage was seen in 7%. Forty eight percent of patients were admitted to the ICU initially with an average length of ICU stay of 1.5 days (Range 0-25 days). Ninety-two percent of patients (108) were discharged home and two percent were discharged to jail. Only eighteen percent of our patients (21) received a charge of driving under the influence. Four patients were charge with related offenses, ranging from driving on a suspended license to intoxicated manslaughter. This was the second offense for DUI in 38% (8) of the patients.

Conclusions: A motor vehicle accident may be protective against the legal ramifications of drinking and driving. Less than 20% of patients that were driving under the influence incurred any legal repercussion. Deterrents that prevent law enforcement from being able to obtain evidence needed for prosecution should be eliminated. Healthcare providers and law enforcement agencies should work as a team to help mitigate the incidence of drunk driving and its burden on society.

Paper #37 4:20 pm, 3/8/13

OUTCOMES OF ADDING ACNPS TO A LEVEL ONE TRAUMA SERVICE WITH THE GOAL OF DECREASED LENGTH OF STAY AND IMPROVED PHYSICIAN AND NURSING SATISFACTION

N Collins, M Forrester, M Morton, A Kapu, R Miller

Vanderbilt University Medical Center

Presenter: Nina Collins, ACNP-BC **Senior Sponsor:** Richard Miller, MD

INTRODUCTION: With resident work hour restrictions and an increased census, the Trauma service experienced preventable delays in moving patients through the trauma stepdown area, a 17-bed unit. In addition, the bedside nurses expressed the need to have a consistently accessible provider for coordination of patient care. We hypothesized that adding experienced Trauma Acute Care Nurse Practitioners (ACNPs) would decrease length of stay and improved nurse and physician satisfaction. On December 1, 2011, we launched a pilot program of expanding the trauma ACNP's role on Monday-Friday from 6 am – 6 pm.

METHODS: Using the data collected from Medipac tables in the institution's enterprise data warehouse (EDW), we compared the average length of stay (ALOS) for patients admitted and discharged between December 1, 2011 and June 30, 2012 to the previous two years for the same time period. Using the average Injury Severity Score data from the trauma registry, we compared December 1, 2011 through March 31, 2012 to the previous two years December 1 – June 30. From the Medipac tables in EDW, we compared ACNP and physician patient discharges directly from the stepdown area to home or outpatient facilities. Lastly, we conducted physician and nursing surveys using REDCap electronic data capture (Research Electronic Data Capture), which is a secure, web-based application designed to support data capture for research studies.

RESULTS: The ALOS in the stepdown unit from 2010 (n= 972, average ISS 19.575) and 2011 (n=999, average ISS 19.071) was 2.65 days. After the addition of an experienced ACNP, the ALOS decreased to 2.3 days (n=972, average ISS 19.398) resulting in a 0.35 day reduction. For the overall Trauma Service, including ICU, stepdown and floor patients who had circulated through the Trauma stepdown at some point during their hospitalization, 2012 (n=1667) was compared to the average of 2010 (n=1358) and 2011 (n=1412), resulting in reduction in ALOS by 0.55 days ($p = .0239$). Per case, there was a $5,326 difference in hospital charges, resulting in a reduction of $ 8,878,000 in hospital charges. 2010 and 2011 discharges from the Trauma stepdown unit directly to home or outpatient facility were averaged, indicating 727 patients were discharged by an ACNP and 572 patients were discharged by a physician. For 2012, the ACNP discharged 1222 patients directly from the stepdown unit whereas a physician discharged 340 patients. The results of the physician and nursing REDCap survey indicated a 96% or greater degree of satisfaction in each category.

CONCLUSION: After the addition of experienced Trauma ACNPs to the multidisciplinary team, both the Trauma stepdown and overall Trauma Service ALOS decreased significantly, resulting in a reduction of approximately 9 million dollars in hospital charges. The physician and nursing satisfaction with this change resulted in a high degree of satisfaction.

Paper #38 4:40 pm, 3/8/13

'NEVER EVENTS" IN TRAUMA: A NATIONAL COST ESTIMATE

F Habib, K Gutierrez, P Parikh, A Wilson, C Schulman, A Martos, N Namias, A Livingstone

University of Miami School of Medicine

Presenter: Fahim Habib, MD, MPH **Senior Sponsor:** Nicholas Namias, MD

INTRODUCTION: The Centers for Medicare and Medicaid Services (CMS) has decided that certain clinical events would not occur if appropriate care were delivered, designating these as 'Never Events' (NE). Consequently, CMS has mandated that it will no longer reimburse the healthcare facility for the portion of care directed towards these conditions. The financial implication of such unilateral mandates on the finances of an already struggling trauma system remains unknown. We hypothesized that never events among trauma patients are associated with significantly increased costs.

METHODS: The Healthcare Cost and Utilization Project (HCUP) Nationwide Inpatient Sample (NIS) Database is the largest publicly available all-payer database. Cases with a primary injury related diagnoses for the years 2005-2009 were first selected. The International Statistical Classification of Diseases Ninth Revision (ICD-9) codes for conditions designated as NE by CMS were then used to identify cases with a NE. Comparisons between trauma patients with and without NE's were made. Statistical analysis was performed using the chi-square test and Student's t test as appropriate.

RESULTS: Among the 1,247,5309 patients with a primary diagnosis of a traumatic injury, a total of 350,919 NE were identified. The majority developed a single NE (91.6 vs. 8.2%). Deep Vein thrombosis (DVT), Pulmonary Embolism (PE) and Skin and Soft tissue Infections (SSI) were the three most common NE seen. NEs were associated with a longer hospital stay (13.84 ± 17.17 days vs. 5.51 ± 7.56 days, $p<0.0000001$) and carried a higher mortality (6.31 vs. 2.49%, $p<0.0000001$). Further, NE's were more likely in patients treated at large, urban teaching centers (all $p<0.0000001$). Patients with a NE had significantly higher hospital costs than those that did not ($29236 ± $40989 vs. $11487 ± $16519, $p<0.0000001$). Costs directly attributable to the NEs that will not be reimbursed range from $258,327,252 - $409,544,647 per year for the three most common NE alone.

CONCLUSION: Never Events are not infrequent among trauma patients. Especially among those treated at large, urban teaching hospitals. When present, they are associated with increased health care resource utilization including significantly increased costs. The mandate not to reimburse for these conditions will have a major negative financial impact for already struggling trauma centers in the tune of hundreds of million dollars. The continued adoption of these polices needs to be carefully reconsidered.

Paper #39 5:00 pm, 3/8/13

PSYCHOLOGICAL OUTCOMES OF PATIENTS AFTER EXPERIENCING A TRAUMATIC INJURY

AM Warren, M Self, K Roden-Foreman, M Foreman, TJ Littleton, TE Rives

Baylor University Medical Center

Presenter: Ann Marie Warren, PhD **Senior Sponsor:** Terry Rives, DrPH

INTRODUCTION: While survival remains of paramount importance as a measure of the quality of trauma care, physical, psychological, and social factors impacting trauma patients remain under-developed. Therefore, measuring quality of survival will likely yield opportunities for improvement in patient outcomes beyond survival itself. The primary objective in the current study was to measure psychological response following injury using the Primary Care-PTSD Screen (PC-PTSD) during admission at a Level I trauma center and at 3 month follow up discharge.

METHODS: This prospective cohort study included patients at least 18 years of age admitted to a Level 1 trauma service for at least 24 hours. Exclusion criteria included cognitive deficits that prevented the patient from providing informed consent. The PC-PTSD screener was given at baseline and three months. This study was approved by the hospital's institutional review board.

RESULTS: Over the course of five months, 208 patients were enrolled in the trauma outcomes project, ranging from 18 to 88 years of age ($M = 44$). Premorbid posttraumatic stress disorder (PTSD) was reported in 6.47% of participants while at baseline measurement, 31.8% of participants screened positive for PTSD. Through three months of follow-up data collection among 61 participants (n = 93, 66%), 40.9% of participants screened positive for PTSD. Of the 40.9% of participants screening positive for PTSD at three month follow up, 24.6% experienced new symptoms of PTSD while 16.4% continued to demonstrate PTSD symptoms.

CONCLUSION: These preliminary findings suggest that traumatic injury may increase the risk for developing PTSD, in addition to other forms of psychological distress. Through further research, we hope to be able to better identify, address, and moderate these psychological consequences among trauma patients. As the measurement of patient survival has driven the development and implementation of a myriad of improvements in all aspects of trauma care, measuring the *quality* of survival will also likely improve patient outcomes such as experiencing PTSD symptoms in the months after injury.

Paper #40 5:20 pm, 3/8/13

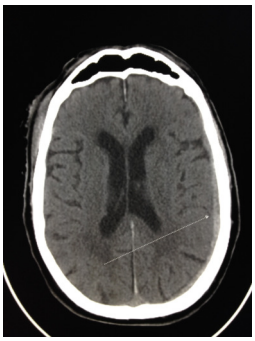
OUTCOMES OF TRAUMATIC BRAIN INJURY ON PATIENTS ON DABIGATRAN ETEXILATE

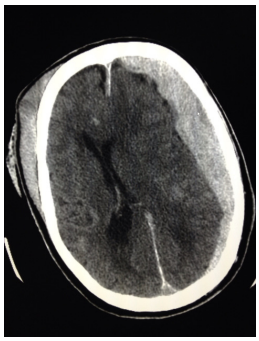
S Pakraftar, KR Stahlfield, AC Corcos, JL Sperry

University of Pittsburgh Medical Center. Mercy Hospital

Presenter: Sam Pakraftar, MB, BCh, BAO **Senior Sponsor:** Alain Corcos, MD

INTRODUCTION: An 88 yo male taking Dabigatran Etixalate (DE) for atrial fibrillation was admitted following a fall from standing. Admission GCS was 14, INR 1.8, PTT 61, and computed tomography showed a 5mm left tempo-occipital subdural hematoma and right temporal sub-arachnoid hemorrhage (Figure 1). Consensus treatment recommendation was serial exams withholding intervention such as factor VII or hemodialysis. Follow-up CT scan 6 hours later due to GCS deterioration to 6 revealed significant increase in the SDH to 25mm with mass effect and progression of the SAH (Figure 2). Comfort measures were instituted and the patient expired.





RESULTS: Following this case, we identified 20 of 4310 trauma admissions from 10/2011 to 9/2012 taking DE, 9 of whom were admitted with traumatic brain injury. Of these nine, average age was 83.4 years, 5 were using concurrent antiplatelet agents, admission INR/PTT was 1.8/51, 8 required ICU admission with LOS of 2 days, overall LOS was 6.4 days, and 2 received factor VII and dialysis in an attempt to correct coagulopathy. Neither of the two patients who died underwent attempts to reverse coagulopathy. No patient underwent surgical intervention.

CONCLUSION: DE poses a significant risk to the trauma population because of an extended half-life, the inability to monitor the effect of the drug, and the lack of a reversal agent. The increased utilization due to recent class 1 recommendations and lack of practice guidelines makes managing trauma patients taking DE frustrating and provider specific. Novel oral anticoagulants are being used with increased frequency and governing bodies should be proactive in developing multi-institutional trials and timely practice guidelines when these drugs are approved.

Paper #41 5:40 pm, 3/8/13

THEY SHOOT HORSES, DON'T THEY?

R Karmy-Jones, EK Crawford, R Kansal, D Waliezer

University of California, Davis Medical Center/Shriners Hospitals for Children Northern California

Presenter: Elizabeth Crawford, MS, PA-C **Senior Sponsor:** Riyad Karmy-Jones, MD

INTRODUCTION

A 76-year old male felt that a loyal horse had reached the natural end of life. Being a life-long farmer, he chose to euthanize his beloved animal (Nellie*) himself. After digging a narrow grave and saying goodbye, he dispatched Nellie with a single gunshot to the head. At the time of the shot, he was standing beside Nellie, between the mare and her grave site. Nellie bucked once, throwing him into the grave, then tumbled tail-over-head on top of him, landing across his lower body, thus pinning his legs. Because he did not wish to distress his wife, he spent about 1-hour trying to reach neighbors, but realized the cell battery was running out, and finally called his wife. As the farm is located in a remote logging area, there was an extended EMS response time.

During this extended response time, the family attached tackle to Nellie's front legs and partially lifted the animal off of the patient. As the animal was lifted, family noted an approximately 90-second loss of consciousness. Upon EMS arrival, a technical trench-rescue was performed, and the patient was transported via helicopter to our level-II trauma center.

On arrival, the patient was alert, complaining of leg pain. Initial vital signs were BP 68/42, HR 98, RR 18, and temp 34.5 ^{O} C. He was resuscitated with blood products prior to CT evaluation which showed right rib fractures 6-9, C2 lateral mass fracture with epidural hematoma, left trochanteric fracture, bilateral inferior and superior pubic rami fractures, left sacro-iliac fractures, with associated pelvic hematoma and blush. He was taken directly to the cath lab where the bleeding was controlled with coil embolization of the right internal iliac artery. Left-sided bleeding appeared to have tamponaded. The femoral sheath was left in place, and the patient was admitted to the ICU. As he was more fully-resuscitated, he required return to the cath lab later that evening for further hemorrhage. Gel foam embolization of the left internal iliac was required.

After control of the hemorrhage, the patient did quite well. His cervical spine injury was managed non-operatively. He underwent operative fixation of his pelvic ring and percutaneous pinning of his femoral neck. On hospital day 26, he was discharged to a skilled nursing facility for further rehabilitation before returning home with his wife.

CONCLUSION

In the United States, the farming fatalities are more often associated with vehicles or equipment (53%) and only 5% related to livestock. Severe injuries and fatalities and their association with livestock vary based on region and the animal in question. In Texas, horses were responsible for 75% of traumas sustained by ranchers, while bulls were responsible for 83% of injuries to cowboys. The risk of severe injury or death is greater in farmers older than 55, who use hearing aids, and/or have a history of arthritis (all three present in this case). In this case, the guidelines for euthanizing a horse by gunshot recommend approaching from the head, shooting directly down, which is associated with instant death and less chance of injury.

*Note: The name of the animal has been changed at the request of our IRB.

BY-LAWS

BYLAWS OF THE WESTERN TRAUMA ASSOCIATION

ARTICLE I

Name, Objectives, Organization, and Jurisdiction

SECTION 1: Name

The name of this organization is the Western Trauma Association, henceforth referred to as the Association.

SECTION 2: Core Values and Mission Statement

Section 2.1 Mission Statement

The Western Trauma Association is committed to the improvement of trauma care through research, education, sharing of clinical experiences, and the development of physicians of all specialties who are involved in the care of trauma patients. The goals of the Association are not only the intellectual growth attained through increased knowledge, but also the emotional growth attained through camaraderie and interaction with family and friends in an environment conducive to winter sports.

Section 2.2 Core Values

1. Continuing education by participation in a diverse, multidisciplinary scientific program with the goal of improving the care of injured patients
2. Outdoor activity by participation in winter sports in a mountainous setting
3. Interaction with friends and family in a spirit of collegiality

SECTION 3: Organization

This is a non-profit membership corporation entity, duly incorporated on the 25th day of January 1971 under, and by virtue of, the provisions of the laws of the State of Colorado. The Association received a final determination of its 501(c)(3) status in October 2002.

SECTION 4: Jurisdiction and Territory

The territory in which this Association shall act will be the United States of America. It shall not be constrained, however, from holding its annual meetings at any designated site.

SECTION 5: Governing Board

The affairs of the Association shall be conducted by the Board of Directors.

ARTICLE II

Membership

SECTION 1: Membership Limitation

Membership shall be limited to125 active members. No single specialty shall comprise more than 40% of this total membership of 125.

SECTION 2: Membership and Qualifications

There shall be 5 classes of membership: Active, Associate, Senior, Retired and Honorary Life Member.

Section 2.1 Active members shall be limited to Doctors of Medicine or Doctors of Osteopathy who are Board Certified in their particular medical specialty and are under the age of 55 years. The Board of Directors is hereby given discretionary powers to interpret if foreign physicians who apply for membership have credentials comparable to Board Certification. Active status is conferred by a two-thirds vote of the Board of Directors. Active members have the right to vote on any business presented to the organization during the business meeting, to serve on or chair any committee and be elected to any position within the organization.

Section 2.2. Associate members include qualified members of other (non-M.D/non-D.O.) health care disciplines with a special interest or expertise in trauma. Approval of a two-thirds vote of the Board of Directors is required. Associate members must satisfy the same requirements for election to and retention of membership as active members. Associate members may not vote, serve on committees or hold office.

Section 2.3. Senior membership is automatically conferred on all members in good standing upon reaching the age of 55. A senior member retains all voting privileges and rights of active members, and must pay dues annually but is exempt from attendance requirements. The senior member is not counted as part of a given specialty's membership quota or membership total.

Section 2.4 Retired membership: Members in good standing who retire from practice are, upon notification of the Secretary and/or Treasurer, entitled to continued membership, but are exempt from all membership requirements, including the payment of dues. They shall not have the right to vote and their membership shall not be counted towards specialty or membership quotas. The change to “retired status” is voluntary.

Section 2.5 Honorary Life Membership is bestowed on those whom the Association deems worthy of special honor because of notable contributions to the field of trauma or because of longstanding service and commitment to the Association. Honorary Life Members retain all voting privileges and rights of active members, and must pay dues annually but are exempt from attendance requirements. Honorary Life Members who are retired from the practice of medicine are exempt from all membership requirements, including the payment of dues. They shall not have the right to vote and their membership shall not be counted towards the specialty or membership quotas.

Section 2.6 Candidates for membership must submit a completed application and a letter of support from a sponsoring member of the Association. They must also have submitted an abstract for consideration by the Program Committee. A prospective member must attend a meeting within three (3) years prior to the meeting in which he/she is voted on for membership.

Section 2.7 The Association shall present to each new Member a certificate of membership signed by the President and Secretary at the Annual meeting following his/her election to membership. If a new member fails to attend the Association’s meeting after the election to membership, his/her membership shall be withheld until the following year. If he/she fails to attend two (2) consecutive meetings immediately following his/her election to membership without a valid excuse approved by the Board of Directors, his/her membership shall be forfeited.

SECTION 3: Membership Retention

To retain membership in the Association, each member must comply with the following:

Section 3.1 Be a physician in good standing before his or her professional specialty board

Section 3.2
a) Attend at least one out of every three consecutive meetings of the Association
b) Members who are active duty military personnel will be relieved of their attendance obligation for the time of their deployment.
c) A member may petition the Secretary of the organization for a single year waiver of attendance at the annual meeting. Members who fail to attend the meeting after the waiver year are subject to termination of membership as outlined in Section 4.

Section 3.3 Timely payment of annual membership dues as outlined in Article V, Section 2, and payment of any assessments as set by the Board of Directors at a special meeting or the annual meeting. He/she must remain current in the payment of dues and assessments. Failure to pay dues for three (3) years shall be considered cause for termination of membership.

Section 3.4 Maintain behavior befitting a physician by adhering to the code of ethical and moral standards as described by either the American College of Surgeons or the American Medical Association.

SECTION 4: Termination of Membership

Section 4.1 Membership can be terminated for a violation of one or more of the items set forth in Article II, Section 3, of the Bylaws of the Association by a vote of two-thirds of the Board of Directors.

Section 4.2 Any member may resign by filing a written resignation with the Secretary; however, such resignation shall not relieve the member so resigning of the obligation to pay any dues or other charges accrued and unpaid.

ARTICLE III

Meetings

SECTION 1: Annual Meetings

Section 1.1 There shall be an annual meeting of the membership of the Association held in a location chosen by the President-elect and approved by a majority vote of the Board of Directors. The annual meeting shall consist of the scientific sessions, annual business meeting and other business and events of the Association. Funds shall be made available for the conduct of the scientific program at the annual meeting.

Section 1.2 The annual meeting of the Board of Directors shall be held during and in the same general location as the annual meeting of the Association, but at least one day in advance of the general business meeting. The agenda will be determined by the President of the Association who will preside at the meeting. Additional agenda items may be proposed for discussion and/or vote by any Board member.

SECTION 2: Special Meetings

Section 2.1 Special meetings of the Board of Directors may be held at any time and place upon the call of the President, or a majority of the Board providing ten days prior written notice shall be given to each Director, stating the time, place and purpose of the special meeting. Notices of special meetings shall be made to the Directors by the Secretary of the Association in a form and manner that documents mailing and receipt of said notifications.

Section 2.2. The Board of Directors may conduct business by conference telephone call including a quorum of Members of the Board. The same rules for notification of special meetings shall apply to conference calls.

SECTION 3: Notice

Notice of the time and place of the annual or special meetings of the Association shall be made available to the membership at least 30 days prior to the annual meeting.

SECTION 4: Quorum

Subject to provisions of Article VI, Section 3, one-fourth of the membership present at any meeting of the Association shall constitute a quorum.

ARTICLE IV

Board of Directors, Meetings, and Responsibilities

Section 1. The business of the Association shall be managed by the Board of Directors.

Section 2. The Board of Directors shall consist of the following voting members: President, President-elect, Vice- President, Secretary, Treasurer, Three (3) Immediate Past Presidents, Program Committee Chair, Publication Chair and six (6) members-at-Large. The President of the Association shall serve as Chair of the Board of Directors.

Section 3. Members-at-Large

Section 3.1 Members-at-Large shall serve a three (3) year term beginning at the close of the Annual Meeting at which they were elected and terminating at the close of the third succeeding Annual Meeting. Members-at-Large are not eligible for re-election.

Section 3.2 At each annual meeting, two (2) members of the Association in good standing named by the Nominating Committee and elected by the membership shall replace the two outgoing members-at-large of the Board.

Section 3.3 The tenure of elected members of the Board of Directors shall be for no more than three years unless such member shall be elected to a position as an officer in the Association.

Section 3.4 In the event of resignation or incapacity of a member-at-Large, a nominating committee shall be reconvened to select a candidate for the vacant position. The nominee will be voted upon at the next Board Meeting of the Association.

SECTION 4: Quorum

A majority of the Board of Directors shall constitute a quorum. No member of the Board may vote by proxy.

SECTION 5: Duties of the Board of Directors

Section 5.1 The Board of Directors shall manage the affairs of the Association and determine its policies and procedures, shall receive and consider the reports of committees and review their activities, shall approve accept, reject, or defer all actions on membership in the Association, shall review and approve the annual budget for the Association, and shall review and approve initiatives, programs, expenditures and other Association business as they deem appropriate.

Section 5.2 The Board of Directors may propose the creation or dissolution of standing committees to the membership pursuant to changes in the bylaws of the Association.

Section 5.3 Subject only to the limitations of the provisions of the Colorado Nonprofit Corporation Act, all corporate powers shall be exercised by or under the authority of, and the affairs and activities of the Association shall be controlled by, or under the authority of, the Board of Directors.

ARTICLE V

Registration, Fees, Dues, and Assessments

SECTION 1: Registration Fees

The amount of the registration fee shall be determined by the Board of Directors, in consultation with the Treasurer, and notice thereof shall be sent to the membership along with the written notice of the annual meeting.

SECTION 2: Dues

Dues of the Association shall be set by the Board of Directors. Each member shall pay dues to the Association for each fiscal year, beginning with the first new fiscal year after election to membership. The Treasurer shall notify each member of his/her dues obligation during the first quarter of the fiscal year by regular or electronic mail. This notification shall follow the rules for notification of the annual meeting. Associate members shall be required to pay the same dues required of active members. Failure to pay dues for three (3) years shall be considered cause for termination of membership.

SECTION 3: Assessments

A two-thirds majority vote of the Board of Directors of the Association can institute a special assessment of the general membership. Special assessments can be voted by the Board of Directors and used only to further the goals and mission of the Association. Notice of any special assessment of the membership so voted by the Board of Directors shall be sent, by either regular or electronic mail, to all active and senior members at the last address on record with the Association, postage pre-paid.

SECTION 4: Waiver of Dues and Responsibilities

All requirements for retention of membership including payment of dues and attendance at meetings may be waived by a vote of the majority of the Board of Directors upon petition. Eligibility for such waivers shall include induction into the Armed Forces of the United States on a temporary basis, physical disability, or other reasons that would place unreasonable hardship, physical disability, or other reason upon the petitioner.

ARTICLE VI

Voting

SECTION 1: Voting Rights

Each active member or senior member in good standing shall be entitled to one vote on each matter submitted to a vote of the membership.

SECTION 2: Majority

A majority of the votes entitled to be cast on a matter at a meeting at which a quorum, defined as one-fourth of the voting membership, is present shall be deemed necessary for the adoption of such matters unless otherwise noted in the Bylaws.

SECTION 3: Manner of Voting

Each member of the Association is entitled to vote in one of three following manners:

1) In person.
2) With respect to matters described in any notice of meeting, by written instruction or ballot, delivered by United States Mail, postage pre-paid, addressed to the secretary of the Association at the Association's registered office or such other address as specified in any notice of meeting, postmarked and received seven (7) days before the date of the meeting of the membership where the vote is to be taken. A member who has voted by such written instruction or ballot shall be counted for purposes of determining whether quorum of members is present at a meeting, but only with respect to the matter voted upon by such Member.
3) By proxy duly executed in writing by the member or his authorized attorney-in-fact. No voting member in attendance at a meeting shall hold or vote more than one duly executed proxy for absent members.

SECTION 4: Amendments

As to the Articles of Incorporation, consolidation or dissolution of the Association shall be passed only in the event of a two-thirds vote of the voting members in good standing.

SECTION 5: Elections

Elections and all other matters raised to a vote of the membership cannot be held unless a quorum is present and shall be by majority vote.

ARTICLE VII

Officers

SECTION 1: Officers

The officers of the Association shall consist of the President, President-Elect, Vice-President, Secretary and Treasurer. The President, President-Elect, Vice-President, Secretary, and Treasurer shall be elected at the annual meeting of the membership by simple majority.

SECTION 2: Terms and Vacancies

The President, President-Elect, and Vice-President shall hold office for one (1) year. The Secretary and Treasurer shall each hold office for the term of three (3) years. All elected officers, except the Treasurer, shall be automatically inaugurated at the close of the annual meeting at which they are elected. The newly elected treasurer shall assume the responsibilities of his/her office at the beginning of the next fiscal year following his/her election. If an officer cannot complete his/her term, his/her successor shall be chosen by the Board of Directors by special meeting to fill the vacancy for the unexpired term of the office. No officer shall serve more than one term.

SECTION 3: Removal

Any officer may be removed, with or without cause, by a vote of a majority of the members of the Board of Directors present at any meeting for that purpose.

SECTION 4: Resignation

Any officer may resign at any time by giving written notice to the Board of Directors and receiving their approval.

SECTION 5:

In the event of the death, resignation, incapacity or removal of the President, President-Elect, Vice-President, Secretary, or Treasurer, the Nominating Committee in place at the last Annual Business Meeting shall be reconvened to select a nominee for the vacant office. The Board of Directors may elect the nominee to office, by majority vote, to serve the remainder of the term of the office which is vacant.

ARTICLE VIII

Duties and Authority of Officers

SECTION 1: President

The President shall:
(a) preside at all meetings of the Association and of the Board of Directors, shall serve as ex-officio member of all committees and shall serve as the chief executive officer of the Association
(b) appoint members to all committees, and create ad hoc committees not otherwise provided for in these By-Laws
(c) shall act for the Association in the event of any contingency not covered by the bylaws
(d) shall assume other specific responsibilities as determined by the Board of Directors, (e) shall serve or appoint his/her designee as the liaison to other professional organizations as needed

SECTION 2: President-Elect

The President-Elect shall preside at all business meetings in the absence of the President. The President-Elect shall plan and organize the next annual meeting and assume whatever responsibilities the president or Board of Directors shall assign.

SECTION 3: Vice President

The Vice President shall preside at all business meetings in the absence of the President or President -Elect. The Vice-President shall also perform such other duties as requested and assigned by the President or the Board of Directors.

SECTION 4: Secretary

The secretary shall:
(a) Keep minutes of all meetings of the Association and the Board of Directors
b) Be responsible for applications for membership, elections and terminations of members and communications to the membership, especially those whose membership is in jeopardy because of violations of the bylaws
c) Record the reports from the other officers and committees and any bylaw changes
d) Maintain copies of all corporate documents, including contracts, except for those that specifically relate to financial matters
e) Prepare a report for the membership at the annual business meeting and for the Board of Directors at each of their annual meetings

SECTION 5: Treasurer

The treasurer shall:
a) Keep the books of account of the Association
b) Have custody of, and be responsible for, all funds, securities, financial documents, and other properties of the Association and shall deposit all such funds in the name of the Association in such banks or other depositories as shall be approved by the Board of Directors
c) Engage a certified public accountant, approved by the President, to prepare such tax documents as are required by law and file said documents in a timely manner. He/she will require said certified public accountant to audit the books of the Association upon the request of the Board of Directors and present the report of that audit to the Board.
d) Manage all accounts receivable and payable, including such expenses as may be incurred in the name of the Association
e) Send to all active and associate members a statement of dues in the first quarter of the fiscal year, and make all necessary efforts to collect those dues
f) Prepare a report regarding the finances of the organization for the membership and for the Board of Directors at each of their annual meetings

ARTICLE IX

Historian

SECTION 1: Term

The Historian shall be appointed by the President for a five (5) year term which may be renewed indefinitely by a vote of the Board of Directors.

SECTION 2: Duties

The Historian shall:
a) Maintain and safeguard the archives of the Association
b) Keep a continuous account of the history of the Association for the use of the membership. This shall include but are not limited to significant information concerning each annual meeting, including the site of the meeting, recipients of honors, invited lecturers, highlights of the scientific program, and important actions arising from the conduct of the business of the Association.
c) Prepare a report for the membership at the annual business meeting and for the Board of Directors at each of their annual meetings.

d) Each five years the Historian shall prepare the history of the Association from the time of the last recorded history to be part of the archives of the Association. Memorabilia of the Association shall be retained by the Historian.

SECTION 3.

In case of a vacancy by reason of death, resignation, or inability to fulfill the responsibilities of the office, the vacancy may be filled by the Board of Directors until the next annual meeting of the members.

ARTICLE X

Webmaster

SECTION 1: Term

The webmaster is appointed by the President and approved by the Board of Directors. The term of service is 5 years and may be renewed indefinitely by a vote of the Board of Directors.

SECTION 2: Duties

The Association Webmaster serves as an interface between the Association and the website hosting company.

The Webmaster shall:
a) Serve as primary contact for any website change or enhancements
b) Evaluate all website requests for appropriateness in the context of the Association's Mission and Core Values and bring any questionable requests to the Board of Directors for approval
c) Support the offices of the Secretary and Treasurer in maintenance of the online membership database and dues payments
d) Provide a written report of website activities which include but are not limited to an accounting of time and dollar amounts devoted to the website to the Board of Directors at the annual Board meeting.
e) Submit an annual budget to the Board of Directors for review
e) Other website functions as determined by the Board of Directors

SECTION 3.

In case of a vacancy by reason of death, resignation, or inability to fulfill the responsibilities of the office, the vacancy may be filled by the Board of Directors until the next annual meeting of the members.

ARTICLE XI

Committees

SECTION 1: Nominating Committee

The Nominating Committee shall be composed of the three (3) Immediate Past Presidents and two (2) members of the Association appointed by the President. The Chair of this Committee shall be the Immediate

Past President. This committee shall submit a slate of nominees for the various offices of the Association to the annual meeting of the members.

SECTION 2: Program Committee

Section 2.1 The Program Committee will be responsible for the organization and conduct of the program at the annual meeting.

Section 2.2 The Chair of the Program Committee will be appointed by the President and serve a two (2) year term.

Section 2.3 The Chair of the Program committee is a voting member of the Board of Directors as outlined in Article IV, Section 2.

Section 2.4 The Program Committee shall consist of the Chair and include other members of the Association to a maximum of ten (10) members. The Chair and the President will appoint the committee members. Consideration should strongly be given to ensure representation of specialists given the multidisciplinary nature and history of the Association. The President and the Chair of the Publications Committee shall serve as ex-officio members and not count towards the total maximum number of committee members.

Section 2.5 The Program Chair shall prepare a report for the membership at the annual business meeting and for the Board of Directors at each of their annual meetings.

SECTION 3: Publications Committee

Section 3.1 The Publications Committee will be responsible for reviewing all manuscripts submitted to the Association in conjunction with the annual meeting.

Section 3.2 The Chair will serve as the liaison to The Journal of Trauma.

Section 3.3 The Chair of the Publications Committee will be appointed by the President and serve a two (2) year term.

Section 3.4 The Chair of the Publications Committee is a voting member of the Board of Directors as outlined in Article IV, Section 2.

Section 3.5 The Publications Committee shall consist of the Chair and include other members of the Association to a maximum of ten (10) members. The Chair and the President will appoint the committee members. Consideration should strongly be given to ensure representation of specialists given the multidisciplinary nature and history of the Association. The President and the Chair of the Program Committee shall serve as ex-officio members and not count towards the total maximum number of committee members.

Section 3.6 The Publications Chair shall prepare a report for the membership at the annual business meeting and for the Board of Directors at each of their annual meetings.

Section 4: Multicenter Trials Committee

Section 4.1 The Multicenter Trials committee will be responsible for fostering, facilitating and reviewing all the multicenter trials conducted under the aegis of the Association.

Section 4.2 The Chair of the Multicenter Trials committee will be appointed by the President to a three (3) year term.

Section 4.3 The committee is open to all members of the Association.

Section 4.4 The Chair shall encourage membership participation in the Multicenter Trials Committee and will report on the activities of the committee at the annual Board of Directors and business meetings.

Section 5: Algorithm Committee

Section 5.1 The Algorithm Committee will be responsible for the development and dissemination of evidenced based algorithms in the care and treatment of trauma and critically ill patients.

Section 5.2 The Chair of the Algorithm Committee will be appointed by the President to a three (3) year term.

Section 5.3 The Algorithms Committee shall consist of the Chair and include other members of the Association to a maximum of ten (10) members. The Chair and the President will appoint the committee members.

Section 5.4 The Chair shall prepare a report for the membership at the annual business meeting and for the Board of Directors at each of their annual meetings.

Section 6: Past-Presidents Committee

Section 6.1 The Past Presidents Committee provides institutional memory and consistency of vision for the Association in accordance with the Association's Core Values and Mission Statement. In that respect The Past-Presidents Committee serves as an advisory body to the current Board of Directors.

Section 6.2 The Immediate Past President of the Association serves as the Chair of the Committee.

Section 6.3 The Past Presidents Committee shall meet at the annual meeting of the Association and provide a report to the Board and the annual business meeting.

Section 7: Other Committees

Section 7.1 and Ad Hoc Committees dealing with issues of importance to the Association may be created appointed at the discretion of the President or Board of Directors.

Section 7.2 Members of an Ad Hoc Committee and the Chair of the Committee shall be appointed by the President as necessary to fulfill the Committee's mandate.

Section 7.3 Ad Hoc Committees will remain in effect for three (3) years, after which it will be automatically disbanded. An Ad Hoc Committee may be renewed for additional two (2) year terms at the discretion of the President.

ARTICLE XII

Conduct and Order of Business

SECTION 1: Business Sessions of the Members

There shall be an annual business meeting of the members during the annual meeting. It shall be preceded by a meeting of the Board of Directors also held during the annual meeting of the Association.

SECTION 2: Order of Business

The President shall set the agenda and where possible should follow Robert's Rules of Order.

ARTICLE XIII

Amendments to Bylaws

These Bylaws may be amended at any annual meeting of the Association provided that a notice stating the purpose of each proposed amendment and the reason therefore, and a copy of the proposed amendment is sent to every member in good standing not less than thirty (30) days prior to the date of the meeting at which the proposed amendment is to be voted upon. It shall require a two-thirds vote of a quorum of the membership present at the meeting to amend a Bylaw.

ARTICLE XIV

Indemnification

Section 1: Definitions

For purposes of this Article:

Section 1.1. The terms “director or officer” shall include a person who, while serving as a director or officer of the Association, is or was serving at the request of the Association as a director, officer, partner, member, manager, trustee, employee, fiduciary or agent of another foreign or domestic Association. The term “director or officer” shall also include the estate or personal representative of a director or officer, unless the context otherwise requires.

Section 1.2 The term “proceeding” shall mean any threatened, pending, or completed action, suit, or proceeding, whether civil, criminal, administrative, or investigative, whether formal or informal, any appeal in such an action, suit, or proceeding, and any inquiry or investigation that could lead to such an action, suit, or proceeding.

Section 1.3 The term “party” includes an individual who is, was, or is threatened to be made a named defendant or respondent in a proceeding.

Section 1.4 The term “liability” shall mean any obligation to pay a judgment, settlement, penalty, fine or reasonable expense incurred with respect to a proceeding.

Section 1.5 When used with respect to a director, the phrase “official capacity” shall mean the office of director in the Association, and, when used with respect to a person other than a director,

shall mean the office in the Association held by the officer or the employment, fiduciary or agency relationship undertaken by the employee or agent on behalf of the Association, but in neither case shall include service for any foreign or domestic Association or for any other person.

Section 2: General Provisions

Section 2.1 The Association shall indemnify any person who is or was a party or is threatened to be made a party to any proceeding by reason of the fact that such person is or was a director or officer of the Association, against expenses (including attorneys' fees), liability, judgments, fines, and amounts paid in settlement actually and reasonably incurred by such person in connection with such proceeding if such person: (a) acted in good faith; (b) reasonably believed, in the case of conduct in an official capacity with the Association, that the conduct was in the best interests of the Association, and, in all other cases, that the conduct was at least not opposed to the best interests of the Association; and (c) with respect to any criminal proceeding, had no reasonable cause to believe that the conduct was unlawful.

Section 2.2 However, no person shall be entitled to indemnification under this Section 2 either: (a) in connection with a proceeding brought by or in the right of the Association in which the director or officer was adjudged liable to the Association; or (b) in connection with any other proceeding charging improper personal benefit to the director or officer, whether or not involving action in that person's official capacity, in which the officer or director is ultimately adjudged liable on the basis that the director or officer improperly received personal benefit.

Section 2.3 Indemnification under this Section 2 in connection with a proceeding brought by or in the right of the Association shall be limited to reasonable expenses incurred in connection with the proceeding. The termination of any action, suit, or proceeding by judgment, order, settlement, or conviction or upon a plea of solo contender or its equivalent shall not of itself be determinative that the person did not meet the standard of conduct set forth in this Section 2.

Section 3: Successful Defense on the Merits; Expenses

To the extent that a director or officer of the Association has been wholly successful on the merits in defense of any proceeding to which he was a party, such person shall be indemnified against reasonable expenses (including attorneys' fees) actually and reasonably incurred in connection with such proceeding.

Section 4: Determination of Right to Indemnification

Any indemnification under Section 2 of this Article (unless ordered by a court) shall be made by the Association only as authorized in each specific case upon a determination that indemnification of the director or officer is permissible under the circumstances because such person met the applicable standard of conduct set forth in Section 2. Such determination shall be made: (a) by the Board of Directors by a majority vote of a quorum of disinterested directors who at the time of the vote are not, were not, and are not threatened to be made parties to the proceeding; or (b) if such a quorum of the Board of Directors cannot be obtained, or even if such a quorum is obtained, but such quorum so directs, then by independent legal counsel selected by the Board of Directors in accordance with the preceding procedures, or by the voting members (other than the voting members who are directors and are, at the time, seeking indemnification). Authorization of indemnification and evaluation as to the reasonableness of expenses shall be made in the same manner as the determination that indemnification is permissible, except that, if the determination that indemnification is

permissible is made by independent legal counsel, authorization of indemnification and evaluation of legal expenses shall be made by the body that selected such counsel.

Section 5: Advance Payment of Expenses; Undertaking to Repay

The Association may pay for or reimburse the reasonable expenses (including attorneys' fees) incurred by a director or officer who is a party to proceeding in advance of the final disposition of the proceeding if: (a) the director or officer furnishes the Association a written affirmation of the director's or officer's good faith belief that the person has met the standard of conduct set forth in Section 2; (b) the director or officer furnishes the Association with a written undertaking, executed personally or on the director's or officer's behalf, to repay the advance if it is determined that the person did not meet the standard of conduct set forth in Section 2, which undertaking shall be an unlimited general obligation of the director or officer but which need not be secured and which may be accepted without reference to financial ability to make repayment; and (c) a determination is made by the body authorizing indemnification that the facts then known to such body would not preclude indemnification.

Section 6: Reports to Members

In the event that the Association indemnifies, or advances the expenses of, a director or officer in accordance with this Article in connection with a proceeding by or on behalf of the Association, a report of that fact shall be made in writing to the member with or before the delivery of the notice of the next meeting of the members.

Section 7: Other Employees and Agents

The Association shall indemnify such other employees and agents of the Association to the same extent and in the same manner as is provided above in Section 2 with respect to directors and officers, by adopting a resolution by a majority of the members of the Board of Directors specifically identifying by name or by position the employees or agents entitled to indemnification.

Section 8: Insurance

The Board of Directors may exercise the Association's power to purchase and maintain insurance (including without limitation insurance for legal expenses and costs incurred in connection with defending any claim, proceeding, or lawsuit) on behalf of any person who is or was a director, officer, employee, fiduciary, agent or was serving as a director, officer, partner, member, trustee, employee, fiduciary of another domestic or foreign corporation, nonprofit corporation against any liability asserted against the person or incurred by the person in any such capacity or arising out of the person's status as such, whether or not the Association would have the power to indemnify that person against such liability under the provisions of this Article.

Section 9: Nonexclusivity of Article

The indemnification provided by this Article shall not be deemed exclusive of any other rights and procedures to which one indemnified may be entitled under the Articles of Incorporation, any bylaw, agreement, resolution of disinterested directors, or otherwise, both as to action in such person's official capacity and as to action in another capacity while holding such office, and shall continue as to a person who has ceased to be a director or officer, and shall inure to the benefit of such person's heirs, executors, and administrators.

Section 10: Notice to Voting Members of Indemnification

If the Association indemnifies or advances expenses to a director or an officer, the Association shall give written notice of the indemnification in advance to the voting members with or before the notice of the next voting members' meeting. If the next voting member action is taken without a meeting, such notice shall be

given to the voting members at or before the time the first voting member sign a writing consenting to such action.

ARTICLE XV

Conflicts of Interest, Loans and Private Inurement

Section 1: Conflicts of Interest

Section 1.1 If any person who is a director or officer of the Association is aware that the Association may or is about to enter into any business transaction directly or indirectly with himself, any member of such person's family, or any entity in which he has any legal, equitable or fiduciary interest or position, including without limitation as a director, officer, shareholder, partner, beneficiary or trustee, such person shall: (a) immediately inform those charged with approving the transaction on behalf of the Association of such person's interest or position; (b) aid the persons charged with making the decision by disclosing any material facts within such person's knowledge that bear on the advisability of such transaction from the standpoint of the Association; and (c) not be entitled to vote on the decision to enter into such transaction.

Section 1.2 Voting on such transaction shall be conducted as follows. Discussion of the matter, with the interested officer or director, shall be held by the board with such person present to provide information and answer any questions. The interested office or director shall then withdraw from the meeting. Further discussion of the matter shall be held by the Board outside of the presence of the interested officer or director followed by a vote on the matter by the remaining members of the Board. Such voting shall be by written ballot and such ballots shall not reflect the name or identity of the person voting.

Section 2: Loans to Directors and Officers Prohibited

No loans shall be made by the Association to any of its directors or officers. Any director or officer who assents to or participates in the making of any such loan shall be liable to the Association for the amount of such loan until it is repaid.

Section 3: No Private Inurement

The Association is not organized for profit and is to be operated exclusively for the promotion of social welfare in accordance with the purposes stated in the Association's articles of incorporation. The net earnings of the Association shall be devoted exclusively to charitable and educational purposes and shall not inure to the benefit of any private individual. No director or person from whom the Association may receive any property or funds shall receive or shall be entitled to receive any pecuniary profit from the operation thereof, and in no event shall any part of the funds or assets of the Association be paid as salary or compensation to, or distributed to, or inure to the benefit of any member of the board of directors; provided, however, that:

(a) reasonable compensation may be paid to any director while acting as an agent, contractor, or employee of the Association for services rendered in effecting one or more of the purposes of the Association
(b) any director may, from time to time, be reimbursed for such director's actual and reasonable expenses incurred in connection with the administration of the affairs of the Association; and

(c) the Association may, by resolution of the board of directors, make distributions to persons from whom the Association has received contributions previously made to support its activities to the extent such distributions represent no more than a return of all or a part of the contributor's contributions.

Approved by the membership February 29, 2012

The Western Trauma Association would like to thank the following exhibitors for their support of the 2013 Annual Meeting: