FORTY-SECOND ANNUAL MEETING

Vail 2012
Western Trauma Association

February 26 – March 2, 2012

Vail, Colorado

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.

AMA PRA Category 1 Credits™

Annual Meeting

The American College of Surgeons designates this live activity for a maximum of 19 *AMA PRA Category I Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

WESTERN TRAUMA ASSOCIATION
42nd Annual Meeting
Vail, Colorado
February 26– March 2, 2012

Speaker Disclosure Information

Alam, H	Nothing to disclose	Namias, N	Discussion Group Leader, Merck
Aaland, M	Nothing to disclose	Nunez, J	Nothing to disclose
Abraham, P	Nothing to disclose	Paulson, J	Nothing to disclose
Ballow, S	Nothing to disclose	Phelan, H	Nothing to disclose
Bein, T	Speaker - Novalung, KCI	Reed, L	Speaker, Pfizer, Merck, LifeCell
Berndtson, A	Nothing to disclose	Ross, E	Nothing to disclose
Brown, J	Nothing to disclose	Sagi, H	Speaker, Consultant, Investigator Smith & Nephew, Stryker, Synthes
Burlew, C Cothren	Nothing to disclose	Scherer, L	Investigator, Baxter
de Moya, M	Nothing to disclose	Sharpe, J	Nothing to disclose
Dua, A	Nothing to disclose	Stagg, H	Nothing to disclose
Echeverria, A	Nothing to disclose	Sugerman, D	Nothing to disclose
Feliciano, D	Nothing to disclose	Tapia, N	Nothing to disclose
Gentilello, L	Disclosure[1]	Todd, S	Nothing to disclose
Ginzburg, E	Nothing to disclose	Van Haren, R	Nothing to disclose
Goussous, N	Nothing to disclose	Villella, E	Nothing to disclose
Habib, F	Nothing to disclose	Weisbrod, A	Nothing to disclose
Hamblin, S	Nothing to disclose	West, M	Nothing to disclose
Harvin, J	Nothing to disclose	Wills, H	Nothing to disclose
Hecht, C	Nothing to disclose	Wyrzykowski, A	Nothing to disclose
Huntington, C	Nothing to disclose	**Program Committee**	
Inaba, K	Nothing to disclose	Shatz, D	Nothing to disclose
Johnson, L	Nothing to disclose	Alam, H	Nothing to disclose
Kulatunyou, N	Nothing to disclose	Chang, M	Nothing to disclose
Kutcher, M	Nothing to disclose	Coimbra, R	Nothing to disclose
Lee, T	Nothing to disclose	Dicker, R	Nothing to disclose
Livingston, D	Nothing to disclose	Karmy-Jones, R	Nothing to disclose
Martin, M	Nothing to disclose	Michaels, A	Nothing to disclose
Maxfield, M	Nothing to disclose	Namias, N	Discussion Group Leader, Merck
Michailidou, M	Nothing to disclose	Rhee, P	Nothing to disclose
Moore, F	Nothing to disclose	Thomas, H	Nothing to disclose

In accordance with the ACCME Accreditation Criteria, the American College of Surgeons, as the accredited provider of this activity, must ensure that anyone in a position to control the content of the educational activity has disclosed all relevant financial relationships with any commercial interest. Therefore, it is mandatory that both the program planning committee and speakers complete disclosure forms. Members of the program committee were required to disclose **all** financial relationships and speakers were required to disclose any financial relationship **as it pertains to the content of the presentations**. The ACCME defines a 'commercial interest' as "any entity producing, marketing, re-selling, or distributing health care goods or services consumed by, or used on, patients". It does not consider providers of clinical service directly to patients to be commercial interests. The ACCME considers "relevant" financial relationships as financial transactions (in any amount) that may create a conflict of interest and occur within the 12 months preceding the time that the individual is being asked to assume a role controlling content of the educational activity. ACS is also required, through our joint sponsorship partners, to manage any reported conflict and eliminate the potential for bias during the activity. All program committee members and speakers were contacted and the conflicts listed below have been managed to our satisfaction. However, if you perceive a bias during a session, please report the circumstances on the session evaluation form. **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.

[1] Disclosure: The WTA wishes to disclose that at the time of his presentation to the 2012 Annual Meeting, Dr. Gentilello was involved in litigation against the University of Texas Southwestern Medical Center.

42nd Annual Meeting
Vail, Colorado
2011-2012

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President	Year	Location
Robert G. Volz, M.D.	1971	Vail
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William R. Hamsa, M.D.	1974	Aspen
Arthur M. McGuire, M.D.	1975	Sun Valley
Lynn Ketchum, M.D.	1976	Snowmass
Fred C. Chang, M.D.	1977	Park City
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Gerald D. Nelson, M.D.	1979	Snowmass
Kevin G. Ryan, M.D.	1980	Snowbird
David S. Bradford, M.D.	1981	Jackson Hole
Erick R. Ratzer, M.D.	1982	Vail
William R. Olsen, M.D.	1983	Jackson Hole
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
Peter Mucha, Jr., M.D.	1992	Steamboat
David V. Feliciano, M.D.	1993	Snowbird
R. Chris Wray, M.D.	1994	Crested Butte
David 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
Herbert J. Thomas III, M.D.	1999	Crested Butte
Barry C. Esrig, M.D.	2000	Squaw Valley
Steven R. Shackford, M.D.	2001	Big Sky
James A. Edney, M.D.	2002	Whistler-Blackcomb
J. Scott Millikan, M.D.	2003	Snowbird
Harvey J. Sugerman, M.D.	2004	Steamboat
Scott R. Petersen, M.D.	2005	Jackson Hole
Harold F. Sherman. M.D.	2006	Big Sky
Frederick A. Moore, M.D.	2007	Steamboat Springs
James W. Davis, M.D.	2008	Squaw Valley
Grace S. Rozycki, M.D.	2009	Crested Butte
Robert C. Mackersie, M.D.	2010	Telluride
M. Gage Ochsner, M.D.	2011	Big Sky
R. Lawrence Reed, M.D.	2012	Vail

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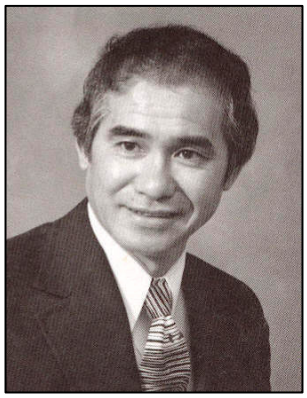
Earl G. Young, M.D.
(1928-1989)



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	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	Madigan Army Medical Center	2011
Phillip Letourneau	University of Texas at Houston	2011
Gerard De Castro	University of Maryland	2011

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

"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

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

WESTERN TRAUMA ASSOCIATION
Schedule of Events
February 26 – March 2, 2012

Sunday, February 26		**Room**
4:30pm – 7:30pm	Registration	Grand Foyer
5:00pm – 7:00pm	Welcome Reception	Colorado Ballroom
5:00pm – 7:00pm	Children's Reception	Mountain View Ballroom
7:00pm – 8:00pm	WTA Past Presidents Meeting	Sun Up
8:00pm – 9:00pm	WTA Foundation Meeting	Sun Down
Monday, February 27		
6:30am – 8:00am	Attendee Breakfast	Grand Foyer
7:00am – 9:00am	Scientific Session I	Grand Ballroom Salons E-J
7:30am – 9:00am	Friends & Family Breakfast	Colorado Ballroom
4:00pm – 6:00pm	Scientific Session II	Grand Ballroom Salons E-J
6:00pm – 7:00pm	WTA Board of Directors Meeting	Sun Down
7:00pm – 9:00pm	Family Movie Night	Grand Ballroom Salons A-D
Tuesday, February 28		
6:30am – 7:00am	Attendee Breakfast	Grand Foyer
7:00am – 9:00am	Scientific Session III	Grand Ballroom Salons E-J
7:30am – 9:00 am	Friends & Family Breakfast	Colorado Ballroom
4:00pm – 5:00pm	Scientific Session IV	Grand Ballroom Salons E-J
5:00pm – 6:00pm	Paint the Ceiling Lecture	Grand Ballroom Salons E-J
6:00pm – 7:00pm	Multi-Center Trial	Grand Ballroom Salons E-J
Wednesday, February 29		
6:30am – 7:00am	Attendee Breakfast	Grand Foyer
7:00am – 9:00am	Scientific Session V	Grand Ballroom Salons E-J
7:30am – 9:00am	Friends & Family Breakfast	Colorado Ballroom
10:00am – 12:00pm	WTA Ski Race	Mountain
12:00pm – 1:30pm	Mountain BBQ	Colorado Ballroom
4:00pm – 6:00pm	Book Club	Presidential Suite #750
4:00pm – 5:00pm	Scientific Session VI	Grand Ballroom Salons E-J
5:00pm – 6:00pm	WTA Business Meeting (Members only)	Grand Ballroom Salons E-J
7:00pm – 9:00pm	Ice skating / pizza party	Ice skating rink/Arrabelle BR
Thursday, March 1		
6:30am – 7:00am	Attendee Breakfast	Grand Foyer
7:00am – 9:00am	Scientific Session VII	Grand Ballroom Salons E-J
7:30am – 9:00am	Friends & Family Breakfast	Colorado Ballroom
4:00pm – 5:00pm	Scientific Session VIII	Grand Ballroom Salons E-J
5:00pm – 6:00pm	Presidential Address	Grand Ballroom Salons E-J
6:30pm – 7:30pm	Family game night / Reception	Mountain View Boardroom
7:00pm – 10:00pm	Children's Party	Sun Up/Sun Down
7:30pm – 10:00pm	Banquet	Colorado Ballroom
Friday, March 2		
6:30am – 7:00am	Attendee Breakfast	Grand Foyer
7:00am – 9:00am	Scientific Session IX	Grand Ballroom Salons E-J
7:30am – 9:00am	Friends & Family Breakfast	Colorado Ballroom
4:00pm – 6:00pm	Scientific Session X	Grand Ballroom Salons E-J

Exhibits and Registration daily 6:30 – 9:00 am and 3:30 – 6:00 pm in Grand Foyer

PROGRAM

Scientific Session 1

Monday AM, February 27, 2012
Moderator: Larry Reed, MD
Location: Grand Ballroom Salons E-J

Paper	Time	Title/Authors	Page
	7:00AM	**Welcome to the 42nd Annual Meeting of the WTA** R. Lawrence Reed, MD President, WTA 2012	
1	7:10 AM	**Argentina/CEDECEM Trauma Network: A Unique Public-Private Collaborative Model for Latin American Trauma Systems** E Ginzburg	28
2	7:20 AM	***Mortality is Not a Reliable Quality Metric in Trauma** RM Van Haren	30
3	7:40 AM	***A Comparison of Videolaryngoscopy to Direct Laryngoscopy for the Intubation of Trauma Patients in the Emergency Department** M Michailidou	32
4	8:00 AM	***Dampened Inflammation in Coagulopathy: Release of Extracellular Histones After Trauma and Implications for a Compensatory Role of Activated Protein C** ME Kutcher	34
5	8:20 AM	***Full-Time Orthopedic Traumatologists Enhance Value and Improve Pelvic Fracture Outcomes at a Rural Level 1 Trauma Center** MR West	36
6	8:40 AM	***ACGME Case Logs: General Surgery Resident Experience in Operative Trauma** CR Huntington	38

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*** Earl Young Competition**

Scientific Session 2
Monday PM, February 27, 2012
Moderator: Herbert Thomas, MD
Location: Grand Ballroom Salons E-J

Paper	Time	Title/Authors	Page
7	4:00 PM	***Impact of Location on Outcome Following Penetrating Colon Injuries: Much Ado About Nothing** JP Sharpe	40
8	4:20 PM	***Sexual Function, Body Image and Quality of Life Post Pelvic Trauma** N Goussous	42
9	4:40 PM	**Preoperative Fever and Leukocytosis Without Bacteremia Do Not Predispose to Deep Post Operative Wound Infection After Pelvic and Acetabular Surgery** HC Sagi	44
10	5:00 PM	***Long Term Follow-up and Amputation-Free Survival in 497 Casualties with Combat-Related Vascular Injuries and Damage Control Resuscitation** A Dua	46
11	5:20 PM	***Early Femur Fracture Fixation is Associated with a Reduction in Pulmonary Complications and Hospital Charges: A Decade of Experience with 1376 Diaphyseal Femur Fractures** J Harvin	48
12	5:40 PM	**Psychiatric Disorder is a Risk Factor for Tracheostomy** P Abraham	50
	6:00 PM	**Board of Directors Meeting**	

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*** Earl Young Competition**

Scientific Session 3
Tuesday AM, February 28, 2012
Moderator: Andrew Michaels, MD
Location: Grand Ballroom Salons E-J

Paper	Time	Title/Authors	Page
13	7:00 AM	*** Below Knee and Above Knee Deep Venous Thrombosis are Equivalent With Respect to Pulmonary Embolus Risk** T Lee	52
14	7:20 AM	*** Prospective Evaluation of Weight-Based Prophylactic Enoxaparin Dosing in Critically Ill Trauma Patients: Adequacy of Anti-Xa Levels is Improved** J Nunez	54
15	7:40 AM	*** Characterization of Acute Coagulopathy and the Gender Dimorphism Post-Injury: Females and Coagulopathy Just Don't Mix** J Brown	56
16	8:00 AM	**Transportable Extracorporeal Lung Support for Rescue of Severe Respiratory Failure in Combat Casualties** T Bein	58
	8:20 AM	**"Strategies for Translational Research" Founders' Basic Science Lecture** Fred Moore, M.D.	60

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*** Earl Young Competition**

Scientific Session 4
Tuesday PM, February 28, 2012
Moderator: Rochelle Dicker, MD
Location: Grand Ballroom Salons E-J

Paper	Time	Title/Authors	Page
17	4:00 PM	**Does Peri-Operative Crystalloid Choice Matter?** L Scherer	62
18	4:20 PM	**Protective Effects of Family on Burnout Among Trauma Surgeons** F Habib	64
19	4:40 PM	**A Medical Mission From an Artist's Perspective** D Livingston (Family Abstract)	66
	5:00 PM	**"Complying with Non-Compliance" Paint the Ceiling Lecture** Larry Gentilello, MD	68

*** Earl Young Competition**

Scientific Session 5
Wednesday AM, February 29, 2012
Moderator: Hasan Alam, MD
Location: Grand Ballroom Salons E-J

Paper	Time	Title/Authors	Page
20	7:00 AM	* **Impact of Adaptive Statistical Iterative Reconstruction on Radiation Doses in Evaluation of Trauma Patients** M Maxfield	70
21	7:20 AM	**Hypotensive Resuscitation Decreases Early Mortality in Penetrating Trauma: Preliminary Results of a Randomized Controlled Trial** N Tapia	72
22	7:40 AM	*** Long Term Outcomes of Combat Casualties Sustaining Penetrating Traumatic Brain Injuries** A Weisbrod	74
23	8:00 AM	**Micropower Impulse Radar: Pneumothorax Detection in Trauma Patients** M de Moya	76
24	8:20 AM	*** Efficacy of Physiological Indicators vs Mechanism of Injury Criteria for Trauma Activation in Pediatric Emergencies** H Wills	78
25	8:30 AM	**Infected Prosthetic Grafts in Vascular Trauma – A Rare Occurrence** A Wyrzykowski	80

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*** Earl Young Competition**

Scientific Session 6
Wednesday PM, February 29, 2012
Moderator: Riyad Karmy-Jones, MD
Location: Grand Ballroom Salons E-J

Paper	Time	Title/Authors	Page
26	4:00 PM	***A Standardized Rapid Sequence Intubation Protocol Facilitates Airway Management in Critically Injured Patients** S Ballow	82
27	4:20 PM	**The Way to a Man's Heart: Gunshot Wound to the Buttocks Resulting in a Penetrating Cardiac Injury and Concomitant Missile Embolization** L Johnson	84
28	4:30 PM	**Delayed Cardiac Tamponade From Gradual Bullet Fragment Erosion into the Right Ventricle: A Rare Injury** A Echeverria	86
	4:40 PM	**Point-Counterpoint: Pericardial Window – Dead or Alive?** David Feliciano, MD – Nicholas Namias, MD	88
	5:00 PM	**Business Meeting**	

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*** Earl Young Competition**

Scientific Session 7
Thursday AM, March 1, 2012
Moderator: Raul Coimbra, MD
Location: Grand Ballroom Salons E-J

Paper	Time	Title/Authors	Page
29	7:00 AM	**Neuroprotective Effects of Valproic Acid in a Large Animal Model of Traumatic Brain Injury and Hemorrhagic Shock** H Alam	90
30	7:20 AM	**Only Feed Some? A Western Trauma Association Multi-Institutional Study of Enteral Nutrition in the Post-Injury Open Abdomen** C Cothren Burlew	92
31	7:40 AM	**Impact of Prehospital Hyperglycemia in Trauma** E Villella	94
	8:00 AM	**Critical Decisions in Trauma**	96-102
		Resuscitative Thoracotomy C Cothren Burlew	98
		Parapneumonic Effusion H Moore	100
		Management of Complicated Diverticulitis F Moore	102

Scientific Session 8
Thursday PM, March 1, 2012
Moderator: Peter Rhee, MD
Location: Grand Ballroom Salons E-J

Paper	Time	Title/Authors	Page
32	4:00 PM	**Interfacility Transfer Of Patients With Severe Traumatic Brain Injury To A Level I Or II Trauma Center** D Sugerman	104
	4:20 PM	**Panel of Experts** Moderator: Peter Rhee Panel: Larry Reed, Gage Ochsner, Robert Mackersie	106
	5:00 PM	**"Asleep at the Wheel: The Consequence of Unfettered Commitment"** **Presidential Address** R. Lawrence Reed, M.D.	108

Scientific Session 9
Friday AM, March 2, 2012
Moderator: Michael Chang, MD
Location: Grand Ballroom Salons E-J

Paper	Time	Title/Authors	Page
33	7:00 AM	**A Randomized , Double-Blinded Placebo-Controlled Trail of Anticoagulation in Low-Risk Traumatic Brain Injuries: The Delayed vs Early Enoxaparin Prophylaxis (DEEP) Pilot Study** H Phelan	110
34	7:20 AM	**Prevention of Adverse Drug Events and Cost-Savings Associated with PharmD Interventions in an Academic Level 1 Trauma Center: A Conservative, Evidence-Based Approach** S Hamblin	112
35	7:40 AM	**Effective Utilization of Physician Assistants in the Performance of Percutaneous Tracheostomy** E Ross	114
36	8:00 AM	**Prospective Evaluation of Ambient Operating Room Temperature on the Core Temperature of Injured Patients Undergoing Emergency Surgery** K Inaba	116
37	8:20 AM	**Does Needle Thoracostomy Provide Adequate and Effective Decompression of Tension Pneumothorax?** M Martin	118
38	8:40 AM	**Small 14F Pigtail Catheter Placed by Surgeons for Traumatic Hemothorax Drains Blood as Well as Standard Sized Chest Tubes** N Kulvatunyou	120

Scientific Session 10
Friday PM, March 2, 2012
Moderator: David Shatz, MD
Location: Grand Ballroom Salons E-J

Paper	Time	Title/Authors	Page
39	4:00 PM	**Identification of Thyroid Dysfunction in Surgical Sepsis** S Todd	122
40	4:20 PM	**The Influence of Policy on Practice and Patient Management** C Hecht	124
41	4:40 PM	**The Lost to Follow-up Trauma Patient – A System Problem or a Patient Problem** M Aaland	126
42	5:00 PM	**Beware of Daggering: A Potentially High Risk Mechanism of Injury** J Paulson	128
43	5:15 PM	**Penetrating Cardiac Injury From a Fractured Rib with and ISS of 75: A Rare Case of Survival** H Stagg	130
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ABSTRACTS

Argentina/CEDECEM Trauma Network: A Unique Public-Private Collaborative Model for Latin American Trauma Systems

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Presenter: Enrique Ginzburg, MD **Senior Sponsor:** Enrique Ginzburg, MD

Objective: To communicate the progress of an ongoing novel project to establish a Trauma Network and Trauma Registry in Argentina through a collaborative public and private model.

Methods: In June 2009, the Trauma Division of CEDECEM Foundation, a non-profit medical organization working with the Public Health Care System was established.. This program has obtained the approval of the Ministries of Health of Buenos Aires Province and Buenos Aires City Government. The Buenos Aires Metropolitan Area includes Buenos Aires City and its outskirts belonging to Buenos Aires Province (total population: 15.5 million). The goal of the program is to integrate a Trauma System including a Trauma Registry to be completed in 5 years from its inception through agreements and legislative actions between medical and scientific societies, CEDECEM Foundation, and the Ministries of Health.

Results: To date, 13 hospitals have been selected to join the network, 8 in the Province and 5 in the City (2 pediatric). The key element of this innovative model for Argentina is the development of web-based Trauma Registry with ability to provide real time accurate data. The registry is based on TRISS methodology through calculated ISS and NISS scores in order to perform analysis of each hospital to facilitate the proper allocation of human and medical resources. Every hospital participating has a 4 member core team: physician, nurse, administrative assistant and social worker. Currently 6 centers are actively participating and collecting data. Over 2,149 cases have been registered since inception. These accomplishments have provided the motivation for all medical centers to join the network and complete the program in the allotted time.

HOSPITAL	PATIENTS	CASES CLOSED	OPEN CASES	REGISTRY INITIATION
Erill	1033	692 (67%)	341(33%)	01/01/2010
San Martin	264	203 (77%)	61 (23%)	07/27/2010
San Roque	423	404 (96%)	19 (4%)	06/30/2010
Sor Ludovica	160	148 (93%)	12(7%)	02/10/2011
K32	223	95 (43%)	138 (57%)	03/27/2011
Luis Guemes	46	11 (24%)	35 (76%)	07/12/2011
Total	2149	1553 (72%)	596(28%)	

Conclusion: For the first time in Argentina an inclusive and sustainable trauma system program has been implemented to deal with the impact that trauma produces in our society and serve as a possible model for the rest of Latin America.

Mortality is Not a Reliable Metric in Trauma

RM Van Haren, CM Thorson, E Curia, CI Schulman, N Namias, AS Livingstone, KG Proctor

University of Miami School of Medicine

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

Objective: Hospital accreditation depends on safety and health care quality metrics, especially mortality. There have been few studies on how the exact definition of death can influence these metrics. Most studies suggest survival is near zero after blunt or penetrating trauma if vital signs are lost in the field or during pre-hospital transport. Nevertheless, many patients arrive at trauma centers in full arrest receiving CPR. In our state, if any intervention is performed in the resuscitation bay, even if futile, it is defined as a hospital death. However, some centers strictly comply with that definition and others do not. The purpose of this study was to test the hypothesis that a significant fraction of trauma deaths are unpreventable and erroneously contribute to higher mortality statistics.

Methods: All deaths from January 2009-April 2011 reported to the state department of health were reviewed. Mortality was re-calculated by excluding the patients who arrived from the field with no vital signs, receiving CPR, and expired in the trauma bay. Groups were compared with t tests.

Results: During the study period, there were 11,078 trauma admissions. The population was predominantly male (77%), 48 ± 23 yrs old, 63% blunt, 31% penetrating, and 6% burns. There were 582 "hospital deaths" plus an additional 79 classified as "dead on arrival", defined as no vital signs and no hospital intervention. Using this figure, the mortality rate each month averaged 5.3 ± 1.4%. Another fraction (n=136, 23%) arrived from the field with no vital signs but received an intervention. If those deaths were excluded, the mortality rate each month averaged 4.0 ± 1.2%. The two survival rates were significantly different ($p<0.001$). The most common interventions included tube thoracostomy (n=72, 53%), ED thoracotomy (n=48, 35%), and central venous catheter (n=20, 15%).

Conclusions: At some level 1 trauma centers, almost one-fourth of reported hospital deaths arrive with no vital signs. Compliance with the exact definition of death is not audited. Unless universal definitions for mortality are adopted, and that reporting is audited, evaluations about trauma center quality based on mortality could be questioned.

A Comparison of Videolaryngoscopy to Direct Laryngoscopy for the Intubation of Trauma Patients in the Emergency Department

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University of Arizona Health Network

Presenter: Maria Michailidou, MD **Senior Sponsor:** Peter Rhee, MD

Introduction: Direct laryngoscopy (DL) has long been the gold standard for tracheal intubation for emergency and trauma patients. Videolaryngoscopy (VL) has become an increasingly popular method of intubation but no study to date has directly compared its effectiveness to direct laryngoscopy in trauma patients intubated in the Emergency Department (ED). We hypothesized that the success rate of VL would be higher than that of DL in trauma patients

Methods: This was a retrospective analysis of prospectively collected data on all trauma patients intubated in an academic level I trauma center from Jan 2008 to June 2011. After each intubation, the intubating ED physician completed a structured data collection form that included: demographics, complications, and difficult airway predictors (DAPs). These included: short neck, cervical immobility, obesity, small mandible, large tongue, blood or vomit in the airway, airway edema, and facial or neck trauma. Additional data was obtained from the Trauma registry. Our primary outcome was successful tracheal intubation on the first attempt. Secondary outcomes included success in blunt trauma patients, those with cervical spine (C-Spine) immobilization, and success of subsequent intubation attempts. Chi-square testing was used to examine differences between groups. Multivariate logistic regression was performed to identify factors predictive of failure for initial intubation.

Results: We identified 729 trauma patients who were intubated in the ED by one of these two methods. DL was used in 46% and VL in 54% of cases respectively. The rate of successful intubation at the first attempt was 88.5% for VL vs. 83.1% for DL (P<0.05). Presence of C-Spine immobilization was predictive of higher initial success with VL (86.8% vs. 79.9%, p=0.05). There was a trend towards less esophageal intubation with VL (2.7% vs. 5.8%, P=0.06). In those patients with 5 or more DAPs, success rate of VL was clearly superior to DL (88.9% vs. 57.1%, P<0.05). Logistic regression of DAPs showed that the presence of blood in the oropharynx, small mandible, and facial trauma were all statistically significant risk factors for failure of initial intubation.

	N	Video	Direct	p
All patients	729	88.5 %	83.1 %	*0.03*
Blunt Trauma only	603	88.1 %	82.5 %	*0.05*
C-Spine immobilization	467	86.8 %	79.9 %	*0.05*
Success at 2nd Attempt	93	57.0 %	43.0 %	*0.03*
≥ 5 DAPs	24	88.9 %	57.1 %	*0.04*
Esophageal Intubation	603	2.7%	5.8%	0.06

Conclusions: In trauma patients intubated in the ED, VL was found to have a higher success rate than DL, especially in those patients with

multiple difficult airway predictors. In trauma patients VL should be the preferred technique of intubation in the ED.

Dampened Inflammation in Coagulopathy: Release of Extracellular Histones After Trauma and Implications for a Compensatory Role of Activated Protein C

ME Kutcher, J Xu, RF Vilardi, C Ho, CT Esmon, MJ Cohen

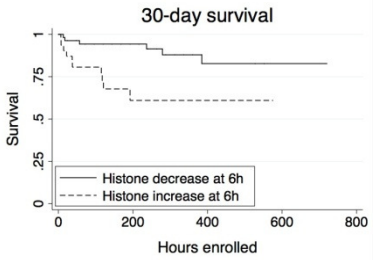
University of California, San Francisco

Presenter: Matthew E. Kutcher, MD **Senior Sponsor:** Mitchell Cohen, MD

Background: An emerging link exists between the innate immune and coagulation systems. Tissue injury leads to the release of damage-associated molecular patterns (DAMPs) such as histones that may drive the sterile inflammatory response after trauma. Acute traumatic coagulopathy-associated activated Protein C (aPC) is known to cleave histone proteins and has been shown to reduce mortality in sepsis; however, the role of circulating extracellular histones after traumatic injury remains unexplored. We therefore hypothesized that extracellular histones would be increased and associated with poor outcomes after traumatic injury, and that this effect would be ameliorated by aPC.

Methods: Plasma was prospectively collected from 132 critically injured trauma patients on arrival and 6h after admission to an urban level I trauma ICU. Circulating extracellular histone levels and plasma clotting factors were assayed, and linked to resuscitation and outcomes data.

Results: Of 132 patients, histone levels were elevated to a median of 14.0 absorbance units (AU) on arrival, and declined to 6.4 AU by 6h. Higher histone levels were found in patients with injury severity score >20 (p=0.034). Patients with the highest admission histone levels had higher injury severity score, lower admission GCS, more days of mechanical ventilation, and higher mortality (all $p \leq 0.05$). Elevated histones correlated with a prolonged prothrombin time (p=0.017) but normal partial thromboplastin time. Histone levels also correlated with the fibrinolytic markers D-dimer and tPA, as well as the systemic anticoagulants tissue factor pathway inhibitor (TFPI) and aPC (all $p < 0.03$). Mortality was increased in patients who had an increase in histone levels from admission to 6h (p=0.011; see figure); Cox regression models confirmed this increase in histones as a multivariate predictor of mortality (HR 1.005, p=0.013). Higher aPC levels were associated with lower histone levels over time, suggesting a protective proteolytic cleavage of histones by aPC (p<0.001). When aPC level trends were included in Cox models for mortality, the impact of histone level increase on mortality was abrogated (p=0.093) by a protective effect of increasing aPC levels (HR 0.782, p=0.004).



Conclusions: Circulating extracellular histones are elevated in response to traumatic injury, and correlate with elevated markers of fibrinolysis and systemic anticoagulants. An increase in histone levels from admission to 6h is predictive of mortality, representing evidence of ongoing cellular damage and release of intracellular antigens similar to that seen in sepsis. Concomitant elevation of aPC abrogates the deleterious effects of ongoing extracellular histone release, suggesting a possible role for aPC in mitigating the sterile inflammatory response after trauma through the proteolysis of circulating histones.

Full-Time Orthopedic Traumatologists Enhance Value and Improve Pelvic Fracture Outcomes at a Rural Level 1 Trauma Center

G Testerman, M West, S Easparam

Holston Valley Hospital Trauma Center

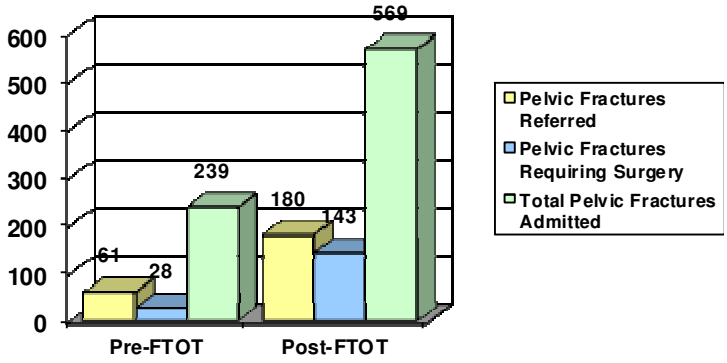
Presenter: Michael R. West, MD **Senior Sponsor:** Tom Scalea, MD

Background: Two full-time orthopedic traumatologists (FTOTs) were recruited to a rural Level 1 trauma center as part of an improvement process for American College of Surgeons Committee on Trauma verification. We hypothesized that FTOTs would increase interfacility transfer patients with complex pelvic / acetabular (P/A) fractures requiring operative procedures.

Methods: A trauma registry query identified 970 patients with P/A fractures admitted to the trauma critical and acute care surgery service over ten years. A medical records review determined patient demographics, interfacility transfer status, procedures, complications, and outcomes. The study groups included 239 P/A fracture patients four years before and 569 P/A fracture patients four years after recruitment of two FTOTs. Student's t-test and chi-square determined statistical significance at $p<0.05$. Multiple logistic regression analysis determined outcome predictors.

Results: Interfacility transfers of patients with complex P/A fractures requiring operative procedures were increased over 500% with FTOTs ($p< 0.01$). Minimally invasive pelvic fracture fixation techniques were used in 70% of cases. Financial analysis showed enhanced hospital margins and decreased direct costs per patient ($p<0.01$). Complications, mortality rates, and lengths of stay were decreased ($p<0.01$). Injury severity best predicted outcomes.

Conclusions: FTOTs enhance pelvic and acetabular fracture referrals, operative procedures, outcomes, and financials at a rural Level 1 trauma center.



ACGME Case Logs: General Surgery Resident Experience in Operative Trauma

CR Huntington, FT Drake, EG Van Eaton, S Aarabi, KW Gow

University of Washington

Presenter: Ciara R. Huntington, MD **Senior Sponsor:** Gregory Jurkovich, MD

Surgery resident education is based on experiential training: learning occurs by seeing and doing. However, experience-based education can be influenced by factors such as changes in management strategies. With respect to trauma, there has been a shift towards non-operative management of abdominal solid organ injuries. These changes have prompted concerns about adequate resident exposure to operative trauma. The Accreditation Council for Graduate Medical Education (ACGME) maintains a database of graduating residents' operative case logs. We sought to identify and quantify shifts in resident operative experiences in trauma over two decades. To our knowledge, we are presenting the first evaluation of nationwide trends over such an extended timeline.

For academic years (AY) 1989-90 through 2009-10, the ACGME operative logs were queried for data pertaining to operative trauma case numbers. Comparison was made between all residents graduating in an early 10-year time period (Period 1, AY 1989-90 to 1999-2000) and those graduating in a recent 11-year time period (Period 2, AY 2000-01 to 2009-10). Trends were also evaluated on a year-by-year basis, with special attention to changes after AY 2003-04 when work hour restrictions were instituted.

Total Major Cases were statistically unchanged between the two time periods. However, trauma operations decreased, including all trauma laparotomies and operations for splenic and hepatic injuries (Table 1). In our year-by-year analysis, the decline was most evident in the 1990s and leveled off over the subsequent decade.

Table 1: Average Number of Procedure per Graduating Resident in Period 1 and Period 2

Procedure Type (Average/Resident over Residency)	Period 1: 1989-1999	Period 2: 2000-2010	Statistics
Total Major Cases	927.4	940.6	NS
All ACGME-designated Trauma Cases	63.5	39.3	P<0.05
Intra-abdominal Trauma Operations	30.9	17.2	P<0.05
Operations for Splenic Trauma	4.2	3.1	P<0.05
Operations for Hepatic Trauma	3.5	2.0	P<0.05

Recent general surgery trainees are performing less trauma operations than previous trainees. This trend began prior to recently enacted work hour restrictions. While these changes may reflect current management practices, surgical educators must meet the challenge of training residents in procedures that are less frequently performed.

Impact of Location on Outcome Following Penetrating Colon Injuries: Much Ado About Nothing

JP Sharpe, LJ Magnotti, JA Weinberg, BL Zarzaur, GO Maish, NA Parks, CP Shahan, TC Fabian, MA Croce

University of Tennessee Health Science Center

Presenter: John P. Sharpe, MD **Senior Sponsor:** Ben Zarzaur, MD

Background: Most studies examining suture line failure following penetrating colon injuries have focused on right versus left-sided injuries rather than strict anatomic distinctions. In our institution, operative decisions (resection plus anastomosis vs diversion) for these injuries are based on a defined management algorithm (pre- or intra-operative transfusion requirements of >6 units PRBCs and/or presence of significant co-morbid diseases) regardless of injury location. The purpose of this study was to evaluate the impact of injury location on outcomes following penetrating colon injuries.

Methods: Consecutive patients over 13-years with full thickness penetrating colon injuries were stratified by gender, age, injury location and mechanism, and severity of shock. Patients with rectal injuries and early deaths (within 24 hours) were excluded. Patients with non-destructive injuries underwent primary repair. Patients with destructive wounds but no co-morbidities or pre- or intra-operative transfusion requirements of >6 units PRBCs underwent resection plus anastomosis, while patients with destructive wounds and significant co-morbidities or pre- or intra-operative transfusion requirements of >6 units of PRBCs were diverted. Colon-related morbidity (suture line failure and abscess) and mortality was recorded. Injury location was defined as ascending, transverse, descending (including splenic flexure) and sigmoid. Multivariable logistic regression was performed to determine whether injury location was an independent predictor of either morbidity or mortality following primary repair and resection.

Results: 469 patients were identified: 314 (67%) underwent primary repair and 155 (33%) underwent resection. The majority of injuries involved the transverse colon (39%), followed by the ascending (26%), descending (21%) and sigmoid (14%). Overall there were 13 (3%) suture line failures and 72 (15%) abscesses. The majority of suture line failures involved injuries to the descending colon ($p = 0.06$) while the majority of abscesses followed injuries to the ascending colon ($p = 0.37$). Overall colon-related mortality was 1.1%. Multivariable logistic regression failed to identify injury location as an independent predictor of either morbidity or mortality after adjusting for 24-hour transfusions, base excess, shock index, injury mechanism and operative management (Table).

	Morbidity		Mortality	
	OR	95%CI	OR	95%CI
Ascending	1.39	0.78 - 2.48	0.60	0.06 - 5.92
Transverse	0.68	0.38 - 1.18	0.65	0.06 - 6.53
Descending	1.31	0.71 - 2.42	0.58	0.06 - 5.52
Sigmoid	0.80	0.35 - 1.81	5.48	0.67 - 45.1

Conclusions: Injury location did not impact morbidity (suture line failure or abscess) or mortality following penetrating colon injuries. Non-destructive injuries should be primarily repaired. For destructive injuries, operative decisions based on a defined algorithm rather than injury location achieves an acceptably low morbidity and mortality rate and simplifies management.

Paper #8 4:20 pm, 2/27/12

Sexual Function, Body Image and Quality of Life Post Pelvic Trauma

N Goussous, CH Lohse, M Osborn, MD Sawyer, MD Zielinski

Mayo Clinic

Presenter: Naeem Goussous, MD **Senior Sponsor:** Mark Sawyer, MD

Background: Angioembolization (AE) for hemorrhage after pelvic trauma can be life saving, but reduces blood flow to the perineum, potentially exacerbating the damage inflicted by trauma. We hypothesize that patients treated with AE will have poorer long-term sexual function and quality of life (QOL) than those with similar fractures not undergoing AE as well as the general population.

Methods: Review of the institutional prospectively collected trauma database as well as prospective questionnaires of patients at least 1 year out from pelvic fracture occurrence between 1996 and 2009. Surveys included the Short Form 36 version 2 (SF36v2), Female Sexual Function Index (FSFI) and the International Index of Erectile Function (IIEF). Values for each domain were compared between patients treated with and without AE, and between the overall pelvic trauma cohort to national norms. Values are presented as percentages or means with 95% confidence as appropriate. A p value < 0.05 was considered statistically significant.

Results: 112 patients met inclusion criteria of which 42 completed the survey (38%). 13 of these were treated by AE (12 males), and 29 controls were treated without (22 males). 4 were bilateral AE and 62% were subselective. There was a higher ISS (32 vs 26; p=0.048) and a lower TRISS (0.80 vs 0.96; p=0.019) in the AE group. Both groups had similar pelvic AIS (3 vs 3) and GCS (11 vs 11). There was no difference in rates of urine leak (8% vs 22%) and appropriate bladder emptying (92% vs 72%). Both groups scored similarly in the SF36v2 in all domains, but the entire cohort scored lower than the national norms in the physical functioning (41.9 (37.8 - 46.0) vs 50.0), role physical (40.9 (36.2 – 45.7) vs 50.0), body pain 43.8 (40.7 – 46.9) vs 50.0), role emotional 46.3 (42.8 – 49.8) vs 50.0), and physical composite score (42.1 (38.0 – 46.3) vs 50.0). Male patients treated by AE had no difference in sexual function compared to those treated without except for a worse erectile function (7.0 vs 14.4 p=0.075).

Feature	Males (n=34)	Norms	Feature	Females (n=8)	Norms
Erectile function*	11.9 (7.7 – 16.0)	25.8	Desire*	2.4 (1.0 – 3.8)	4.1
Intercourse satisfaction*	4.7 (2.7 – 6.7)	10.6	Arousal*	1.8 (0.0 – 3.6)	5
Orgasm*	4.3 (2.7 – 6.0)	8.8	Lubrication*	1.8 (0.0 – 3.7)	5.6
Desire*	5.3 (4.5 – 6.2)	7	Orgasm*	2.2 (0.0 – 4.4)	5.1
Overall Satisfaction*	5.7 (4.7 – 6.8)	8.6	Satisfaction	3.6 (2.0 – 5.2)	5.1
* = statistically significant			Pain*	2.1 (0.0 – 4.5)	5.6
			Total score*	13.9 (3.4 – 24.2)	30.5

Conclusion: Pelvic fractures portend a worse long-term QOL and sexual function than the general population. AE, however, does not have an additive affect to these indices. Pelvic AE should be performed as indicated without concern for worsening long-term sexual function and QOL.

Preoperative Fever and Leukocytosis Without Bacteremia Do Not Predispose to Deep Post-Operative Wound Infection After Pelvic and Acetabular Surgery

HC Sagi, D Dziadosz, HR Mir, N Virani, C Olson

Florida Orthopaedic Institute, University of South Florida

Presenter: H. Claude Sagi, MD **Senior Sponsor:** H. Claude Sagi, MD

Objective: To determine independent risk factors for post-operative infection after treatment of pelvic fractures.

Design: Retrospective review with matched case-control.

Materials and Methods: 597 skeletally mature patients with pelvic and/or acetabular fractures requiring operative fixation. The following variables were analyzed: pre-operative fever, serum and urine white blood cell count; ICU admission, previous infection, de-gloving lesions, arterial embolization, intra-operative cell saver use, peri-operative blood transfusions, drains, antibiotic use and obesity (BMI>30). Open pelvic or acetabular fractures were excluded. Main outcome measure was diagnosis of deep post-operative wound infection (DPWI). Patients with a diagnosis of DPWI were then compared to a random 1:4 matched cohort of patients without a history of DPWI for statistical comparison. Patients were matched and grouped according to injury pattern, age, and surgical procedure.

Results: Seventeen patients (2.8%) developed deep post-operative wound infection. Eighty patients met inclusion criteria for the matched cohort comparison. The median age of the two groups was 43 and 41 years respectively. The average BMI of the case group was 33 compared to 29 for the control group. Of the variables examined, pre-operative leukocytosis, obesity, blood transfusion, and inter-facility transfer had a statistical association ($p<0.05$) with post-operative wound infection. Pre-operative angio-embolization reached near statistical significance ($p=0.07$). However, determination of positive predictive value (PPV) and Odd's ratio (OR) suggested that only obesity (OR 8, PPV 33%), obesity plus leukocytosis (OR 12, PPV 39%), and pre-operative angio-embolization (OR 11, PPV 67%) were strong predictors of post-operative infection.

Conclusion: Based on the findings of this analysis, patients requiring pre-operative angio-embolization and having a BMI > 30 have a significant increase in their risk of post-operative infection, particularly if associated with leukocytosis. Although there was a statistical association, pre-operative leukocytosis and peri-operative blood transfusion demonstrated a low Odd's Ratio and poor positive predictive value for infection. Fever plus leukocytosis, ICU admission, Morel-Lavallee lesions, open extremity fractures, cell saver usage, sub-fascial drains, and pre/post-operative antibiotic use were not predictive of deep post-operative wound infection after pelvic and acetabular surgery.

Long Term Follow-up and Amputation Free Survival in 497 Casualties with Combat-Related Vascular Injuries and Damage Control Resuscitation

A Dua, B Patel, JF Kragh, JB Holcomb, CJ Fox

Walter Reed National Military Medical Center

Presenter: Anahita Dua, MD **Senior Sponsor:** Charles Fox, MD

Objectives: The effectiveness of damage control resuscitation (DCR) has been demonstrated in recent US conflicts. We studied the outcome of wartime casualties treated for hemorrhagic shock from vascular wounds in order to report the mean transfusion requirements, graft patency and amputation free survival for combat-related vascular injuries.

Methods: Joint Theater Trauma Registry (JTTR) records from August 2006-October 2011 were retrospectively reviewed. Included were any casualties who presented to a US Combat Support Hospital located in Iraq or Afghanistan with a vascular injury. Physiology and 24 hour transfusion requirements were reported as Mean ± SD. Amputation free survival and graft patency was determined from chart analysis and completion imaging studies.

Results: The study group consisted of 497 severely wounded local national and military casualties (ISS 22.8 ± 8.5) presenting with acidosis (pH 7.29 ± 0.15), tachycardia (HR 110.24 ± 29.31) and coagulopathy (INR 1.62 ± 2.33). Following immediate DCR, and early management of the vascular injury, systolic blood pressure, heart rate, temperature, hemoglobin and base deficit significantly improved ($p<0.05$) upon ICU admission. Twenty-four hour transfusion requirements included: PRBCs (15 ± 13 Units, range 1-70), FFP/TP (14 ± 13 Units, range 1-72), cryoprecipitate (13 ± 15 Units, range 1-49), and platelets (8 ± 6 Units, range 1-36). Mean operative time was 232 minutes (range 16 to 763). Among US casualties (n=111) who underwent limb salvage there were 113 extremity vascular injuries distributed as follows: 3 (2%) iliac, 33 (30%) femoral, 23 (20%) popliteal, 13 (12%) tibial, 33 (30%) brachial, 4 (3%) ulnar, and 4 (3%) radial arterial injuries. In this subgroup, 28 (25%) were revascularized with a primary repair or end anastomosis, 80 (71%) by sapheno-venous grafts, and 5 (4%) by prosthetic grafts. Over a mean follow up of 347 days (range 29-1079), 96 (84.9%) remained patent, 16 (14.2%) required an amputation, and 110 (99.1%) survived. Popliteal injuries had the highest amputation rate (7/23, 30.4%). The amputation free survival was 84%.

Conclusion: Wartime surgical strategies for both life *and* limb-saving interventions appear to permit definitive procedures at the initial operative setting with excellent limb salvage results in severely wounded casualties. This report provides an outcome analysis in a large cohort that can serve to refine surgical judgment and support the contemporary DCR practices in the setting of major vascular injury.

Paper #11 5:20 pm, 2/27/12

Early Femur Fixation is Associated With a Reduction in Pulmonary Complications and Hospital Charges: A Decade of Experience with 1376 Diaphyseal Femur Fractures

JA Harvin, WH Harvin, E Camp, Z Caga-Anan, AR Burgess, CE Wade, JB Holcomb, A Cotton

University of Texas Health Science Center, Houston

Presenter: John A. Harvin, MD **Senior Sponsor:** John Holcomb, MD

Background: According to the "two-hit" hypothesis, an increase in pro-inflammatory markers during-post injury days 3-5 increases the risk of developing a pulmonary complication (PC). However, early fixation (< 24 hour) of femur fractures with an intramedullary nail (IMN) has been associated with a decreased incidence of PC in stable trauma patients. We hypothesized that early fixation of femur fractures with an IMN would be associated with a decreased incidence of PC, hospital stay, and overall costs.

Methods: A retrospective review of all trauma patients with diaphyseal femur fractures was performed from January 2000 through December 2010 at an academic Level 1 trauma center. The cohort was divided into those who underwent early fixation (< 24 hours) and delayed fixation (≥ 24 hours). Multiple logistic regression modeling was used to adjust for the anatomic (Injury Severity Score, ISS) and physiologic (Revised Trauma Score, RTS) severity of injury. The primary outcome of interest was PC, which was defined as the presence of pneumonia (PNA), pulmonary embolism (PE), or acute respiratory distress syndrome (ARDS). Continuous variables are expressed as mean ± standard deviation.

Results: 1376 patients underwent primary IMN for a diaphyseal femur fracture during the study period. 1032 (75%) underwent early fixation (mean time of 9±6.1 hr) and 344 (25%) underwent delayed fixation (mean time of 54±35.6 hr). The early fixation group had lower ISS (15±8.0 vs. 20±11.2, p <0.001), higher RTS (7.6±0.8 vs. 7.3±1.2, p <0.001), and lower AIS Chest (3±0.9 vs. 3±1.0, p 0.05). PC were reduced in the early fixation group, (3.9% vs. 13.4%, p <0.001). Specifically, there was a decreased incidence of PNA (2% vs. 11%, p<0.001), PE (2% vs. 4%, p 0.21), and ARDS (0.002% vs. 0.02%, p <0.003). After adjustment for anatomic (ISS) and physiologic (RTS) indices of injury severity, early fixation was independently associated with a reduction in PC (odds ratio 0.33, 95% CI 0.12-0.91, p 0.03). The early fixation group also had a decrease in hospital LOS (9±10.1 vs. 15±15.1 days, p <0.001), ventilator days (1±2.7 vs. 4±8.1 days, p <0.001), and hospital charges ($86,702±$100,900 vs. $153,835±$190,888, p <0.001). Mortality was low in both groups (0.4% vs. 1.7%, p 0.01) and did not affect the model.

Conclusions: Controlling for anatomic and physiologic severity of injury, early femoral IMN was associated with an almost 70% reduction in odds of developing pulmonary complications. Early fixation was also associated with a reduction ventilator days, hospital LOS, and overall hospital charges. As the list of "never events" grows and improving quality of care while reducing costs is emphasized, early fixation appears to provide an opportunity to decreased complications and reduce hospital charges.

Paper #12 5:40 pm, 2/27/12

Psychiatric Disorders is a Risk Factor for Tracheostomy

P Abraham, E Jeremitsky, RS Smith

Allegheny General Hospital

Presenter: Phoebe Abraham, MD **Senior Sponsor:** Steve Smith, MD

Background: There is a general perception that unplanned re-intubation in trauma patients necessarily leads to tracheostomy. We sought to examine the data and evaluate the risk factors that may lead to tracheostomy.

Methods: Over a two year period (2009 and 2010), unplanned re-intubations (in the first 48 hours following extubation) that were coded by the trauma registry were retrospectively analyzed. This cohort of patients was evaluated for demographics, injury severity score (ISS), body regional score for chest (AIS chest), and pre-existing conditions (PEC) and whether they were successfully weaned to extubation. Univariate and multivariate analysis was performed.

Results: Of the 39 patients identified, 15 patients underwent a tracheostomy (38.5%). Univariate analysis between the two groups (successfully weaned and tracheostomy) showed no differences in respect to age, ISS, or AIS chest. Patients who underwent tracheostomy had longer hospital stay and ventilator days. The presence of at least one PEC was associated with tracheostomy (93.3% of tracheostomy patients vs 62.5% extubated patients, p=0.032). No difference in the number of PEC was identified for the groups. The most common PEC conditions found were lung disease (COPD), alcohol abuse (ETOH), hypertension (HTN) and psychiatric disease (PSYCH). Analyzed individually the presence of PSYCH PEC was found to be associated with tracheostomy (53.3% vs 12.5%, p=0.006). Multivariate analysis showed PSYCH was a predictor for tracheostomy (OR 8.0, p=0.01, Confidence Interval 1.6-38.8). The number of PEC was not predictive of need for tracheostomy.

Conclusions: Unplanned reintubation does not necessarily lead to tracheostomy (61.5% of patients were successfully re-extubated). However, among patients who are unexpectedly re intubated, the existence of psychiatric disease does predict tracheostomy. No other individual PEC, such as COPD, nor total number of PEC, nor degree of chest trauma or injury severity, predicted the risk of tracheostomy. Traumatic injury and respiratory failure acts as an emotional trigger which seems to doom this psychologically vulnerable population to prolonged ventilator dependence.

Below Knee and Above Knee Deep Venous Thrombosis are Equivalent With Respect to Pulmonary Embolus Risk

TH Lee, JA Differding, I Kremenevskiy, BJ Alonzo, MA Schreiber

Oregon Health and Science University

Presenter: Tim H. Lee, MD **Senior Sponsor:** Martin Schreiber, MD

Introduction: The incidence of deep venous thrombosis (DVT) after trauma is 7% - 58%. Up to 33% of patients with proximal DVT also have detectable pulmonary embolism (PE). The traditional concept that below knee DVT is associated with a lower risk of subsequent pulmonary embolism (PE) may result in less aggressive therapy. We hypothesized that above knee DVT is associated with a similar risk of PE compared to below knee DVT.

Methods: This is a retrospective review of a trauma registry at a university Level 1 trauma center. The trauma registry was queried from 2005-2010 for patients diagnosed with lower extremity DVT. This institution performs routine weekly duplex screening examinations on all high risk trauma patients. Patients were classified as having above knee DVT or below knee DVT. Those patients who had both were placed in the above knee group. Demographics, total length of hospital stay (LOS), length of ICU stay, and injury severity score (ISS) data were collected on all patients.

Results: 317 trauma patients with lower extremity DVT were included. More patients developed below knee DVT (BK = 66.6%) compared to above knee DVT (AK = 33.4%), $p < 0.01$. The groups were similar with respect to age and gender. Increased LOS, ICU stay, and higher ISS were associated with development of above knee DVT. PE was diagnosed in 21 patients: 16 (7.6%) in the below knee group and 5 (4.7%) in the above knee group ($p = 0.237$)

	Above knee (n = 106)	Below knee (n = 211)	p = value
Age (years)	53 (IQR 36.8-68.3)	56 (IQR 41-72)	0.137
% Male	78.3%	73%	0.339
LOS (days)	23 (IQR 13.0-31.4)	12.7 (IQR 7.1-28.0)	< 0.01
ICU (days)	10.3(IQR 5.6-17.1)	7.0 (IQR 2.0-17.2)	0.021
ISS	26 (IQR 26-34)	19 (IQR 10-29)	< 0.01

Conclusion: In a screened population of trauma patients, below knee DVT is more common than above knee DVT. Despite the facts that above knee DVT patients were more severely injured, had longer ICU and hospital LOS, there was no difference in the incidence of PE between groups. These data suggest that below knee DVTs are not benign and should be treated as aggressively as above knee DVTs. Validation with a larger patient population is warranted.

Prospective Evaluation of Weight-Based Prophylactic Enoxaparin Dosing in Critically Ill Trauma Patients: Adequacy of Anti-Xa Levels is Improved

JM Nunez, R Becher, GJ Rebo, J Farrah, E Borderging, P Miller

Wake Forest University School of Medicine

Presenter: Jade M. Nunez, MD **Senior Sponsor:** Preston Miller, MD

Background: Venous thromboembolism (VTE) is a leading cause of death in multisystem trauma patients; the importance of VTE prevention is well recognized. Currently, standard dose enoxaparin (30mg BID) is used as chemical prophylaxis, regardless of weight or physiologic status. However, evidence suggests decreased bioavailability of enoxaparin in critically-ill patients. Therefore, we hypothesized that a weight-based enoxaparin dosing regimen would provide more adequate prophylaxis (as indicated by anti-factor Xa levels) for patients in our trauma intensive care unit (TICU).

Methods: These data were prospectively collected in TICU patients admitted over a 2 month period given twice daily 0.6mg/kg enoxaparin (actual body weight). Patients were compared to a historical cohort receiving standard dosing. Anti-Xa levels were collected at 11.5 hours (trough, goal ≥0.1 IU/ml) after each evening administration. Patient demographics, daily weights, dose, and anti-Xa levels were recorded. Patients with brain, spine, or spinal cord injury were excluded.

Results: Data were collected from 54 patients; 31 in the standard-dose group and 23 in the weight-based group. Sixty-four trough anti-Xa measurements were taken in the standard dose group and 80 collected in the weight-based group. Evaluating only levels measured around the third dose, the change in dosing of enoxaparin from 30mg to 0.6mg/kg resulted in an increased percentage of patients with goal anti-factor Xa levels from 8.3% to 72.2% ($p<0.0001$). Examining all troughs, the change in dose resulted in an increase in patients with goal anti-Xa levels from 10.9% to 62.5% ($p<0.0001$).

Conclusions: Weight-based dosing of enoxaparin in trauma ICU patients yields superior results with respect to adequate anti-Xa levels when compared to standard dosing. These findings suggest that weight-based dosing may provide superior VTE prophylaxis in TICU patients. Evaluation of the effects of this dosing paradigm on actual VTE rate is ongoing at our institution.

Characterization of Acute Coagulopathy and the Gender Dimorphism Post-Injury: Females and Coagulopathy Just Don't Mix

J Brown, M Cohen, A Peitzman, T Biliar, R Maier, J Minei, J Cuschieri, E Moore, M West, J Sperry

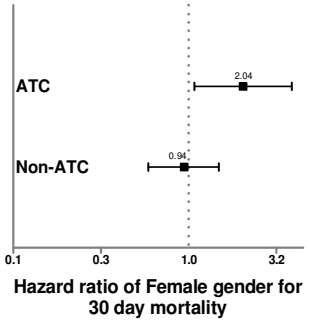
University of Pittsburgh

Presenter: Joshua B. Brown, MD **Senior Sponsor:** Jason Sperry, MD

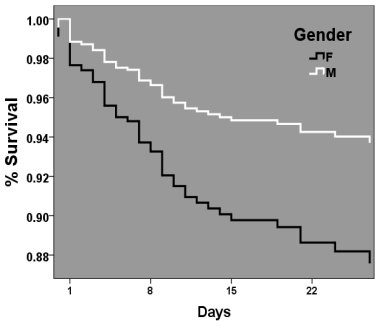
Objectives: Acute traumatic coagulopathy (ATC) is an independent determinant of poor outcome following injury. Differences in coagulopathy across gender post-injury have also been documented with females demonstrating hypercoagulable characteristics. It remains unclear whether the presence of ATC alters gender based outcome differences post-injury. The objective of this study was to characterize the gender dimorphism following severe injury in the presence or absence of ATC utilizing the hypothesis that females would be protected from the detrimental effects attributable to ATC.

Methods: Data were obtained from a multicenter prospective cohort study of blunt injured adults with hemorrhagic shock. Patients with isolated traumatic brain injury were excluded. ATC was defined as an arrival INR >1.5. Cox proportional hazard regression was utilized to determine the independent risks of mortality for female gender relative to the presence of ATC while controlling for differences in demographics, injury and shock severity, resuscitation requirements, temperature, comorbidities, and pre-hospital meds. The gender mortality differences were then characterized over time to determine at what point post-injury the mortality risks diverge.

Results: Of the 2,007 subjects enrolled in the study, 1,877 had an arrival INR with 439 (23%) having ATC (arrival INR>1.5). There was no difference in incidence of ATC across gender (24% vs. 23%, p=0.95). In the ATC group, no difference in ISS, arrival INR, base deficit, temperature or 24 hour blood requirements were found across gender, but males did receive greater amounts FFP and crystalloid. Cox regression revealed gender (F vs. M) was not a significant risk factor for mortality in Non-ATC patients (HR- 0.94, 95%CI 0.6-1.5). However, female gender, as compared to males, was associated with over a 2-fold higher independent risk of mortality in patients with ATC (HR-2.04, 95%CI 1.1-3.9, p=0.03, top figure). In the ATC group, the independent mortality risk differences across gender diverge within the first 24 hours post-injury (lower figure).



Hazard ratio of Female gender for 30 day mortality



Conclusions: An exaggerated gender dimorphism exists in patients with ATC, with females having over a 2-fold higher independent risk of mortality**.** These differential mortality risks across gender diverge early post-injury suggesting they may be due to ongoing hemorrhage. Females that present with ATC on admission have an unexpected greater risk of poor outcome. Further studies are required to decipher the mechanisms responsible for this gender dimorphism to improve outcomes in those patients with ATC.

Paper #16 8:00 am, 2/28/12

Transportable Extracorporeal Lung Support for Rescue of Severe Respiratory Failure in Combat Casualties

T Bein, A Phillip, M Zimmermann, EC Osborn, SM Wanke, C Schmid, M Nerlich, BM Graf, R Fang

University Hospital Regensburg, Regensburg, Germany

Presenter: Thomas Bein, MD **Senior Sponsor:** Thomas Scalea, MD

Background: Advances in membrane, vascular cannulae and centrifugal pump technologies led to miniaturization of extracorporeal lung support (ECLS) systems as well as simplified their insertion and use. Support of combat injuries complicated by severe respiratory frequently requires critical care resources not sustainable in the deployed combat environment. Through a unique collaborative, international military-civilian partnership, transportable ECLS became available for the rescue of combat casualties suffering from severe respiratory failure.

Methods: An extensive multi-disciplinary clinical training and support relationship developed between the US military and a German regional "Lung Failure" center with expertise in ECLS system application. One goal of this relationship was to establish an ECLS capability that was deliverable to the war zone for casualties with severe respiratory failure. US combat casualties supported by ECLS systems during this period were identified from the Trauma Program Registry for review of their clinical courses and outcomes.

Results: Between June 2005 and August 2011, a German regional "Lung Failure" center cared for ten US combat casualties supported by ECLS systems. The initial five patients were cannulated with pumpless arteriovenous circuits (NovaLung GmbH, Heilbronn, Germany) and the latter five were cannulated with pump-driven veno-venous circuits (Maquet-Cardiopulmonary-AG, Hirrlingen, Germany). Four patients were cannulated in the war zone and six patients were cannulated at a US military Level IV hospital for respiratory deterioration occurring after evacuation to Germany. All ten patients were subsequently transferred to the German civilian center for continued ECLS management (mean 9.6 days ECLS support). In all cases, hypoxemia improved and hypercapnia reduced with significantly decreased airway pressures (mean pre-ECLS values: PaO_2:FiO_2 86, $PaCO_2$ 84, PEEP 20 and Pplat 42). Nine patients were successfully weaned from ECLS support and eventually extubated. One soldier died from progressive multiple organ failure.

Conclusion: ECLS can be considered in the management algorithm for trauma complicated by severe respiratory failure. Modern ECLS technology allows these therapies to be transported for initiation outside of specialized centers even to austere wartime settings. Close collaboration with established ECLS centers may allow hospitals with infrequent patient requirements to utilize ECLS for initial patient stabilization prior to transfer for continued care.

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.

"Strategies for Translational Research"

Frederick A. Moore, M.D.

Paper #17 4:00 pm, 2/28/12

DOES PERI-OPERATIVE CRYSTALLOID CHOICE MATTER?

LA Scherer, CR Schermer, AD Shaw, JA Galante, SL Goldstein, SM Bagshaw, M Duan, JA Kellum

University of California, Davis Medical Center

Presenter: Lynette A. Scherer, MD **Senior Sponsor:** Carol Schermer, MD

Background: Plasma-Lyte (PLA) is a crystalloid solution with an electrolyte composition similar to plasma. Normal saline (NS), a frequently used crystalloid solution, has been shown to cause hyperchloremic metabolic acidosis (HCMA). HCMA is associated with electrolyte disturbances, GI dysfunction, inflammation, and decreased renal blood flow. The objective of this study was to assess whether type of peri-operative crystalloid affects outcomes after emergency major abdominal surgery. The hypothesis was that PLA compared with NS would be associated with fewer adverse outcomes for patients undergoing emergency major abdominal surgery.

Methods: We used Premier's Perspective Database to extract ICD-9 data for patients undergoing emergency major abdominal operations in 2009. The Premier database is the largest U.S. hospital clinical and economic database used for quality and utilization benchmarking. It includes data for patients from over 600 hospitals. Patients receiving only PLA on the day of operation were matched via propensity score and compared with patients receiving only NS. Outcomes were evaluated by Chi square and multivariate analysis.

Results:

	1:1 Match PLA:NS Odds Ratio	95% CI
Number of patients	102 PLA:117 NS	
Mortality	0.57	(0.24, 1.34)
Major Complication	0.60*	(0.41, 0.89)
Major infection	0.62*	(0.39, 0.99)
Major GI complication	0.55*	(0.32, 0.94)
Volume overload	0.71	(0.44, 1.15)
Electrolyte disturbances	0.56*	(0.34, 0.92)
Major hemorrhage	0.19*	(0.04, 0.87)
Acute renal failure	0.15	(0.02, 1.10)

*Denotes $p < .05$. In addition to fewer complications, a lower percentage of patients receiving PLA compared with NS required blood, electrolyte replacement, or buffering agents.

Conclusions: In this large database, perioperative PLA was associated with better outcomes than the use of NS.

PROTECTIVE EFFECTS OF FAMILY ON BURNOUT AMONG TRAUMA SURGEONS

F Habib, S Gonzalez, Z Khan, G Garcia, L Pizano, P Byers, N Namias, A Livingstone

University of Miami School of Medicine

Presenter: Fahim A. Habib, MD **Senior Sponsor:** Nicholas Namias, MD

Introduction: Burnout is a syndrome of emotional exhaustion (EE), depersonalization (DP), and lack of personal accomplishment (PA). One previous study, on subgroup analysis has identified trauma surgeons as being at a higher risk of developing burnout when compared to other physicians (nearly 40%). Factors that predispose to the development of the syndrome in this group have not however been previously defined.
As burnout is believed to result from not only from stress at work but also from difficulties in balancing ones personal and professional life, we hypothesized that that a positive family life as characterized by marital status and raising children would confer a protective effect against burnout.

Methods: With IRB oversight, an electronic survey was sent to all fellows who had graduated from our trauma fellowship program. A cover email stated the purpose of the study as being to better understand the factors that contribute to career satisfaction among trauma surgeons. Respondents were blinded to the fact that the survey sought to determine the presence of burnout. The Maslach Burnout Inventory (MBI), a validated 22-item questionnaire was used to identify burnout. Statistical analysis was performed using the chi square test, student's t-test and multiple logistic regression as appropriate.

Results: Of 105 trainees who graduated our program between 1985 and 2006, 104 could be located and 95 of these (91%) completed the survey. Eighty-two of the respondents currently practice trauma surgery representing an attrition rate of 13.3%. A high level of burnout in at least one of the three subscales was found in 24 of 95 (25.3%), with EE present in 16 (16.8%), DP in 14 (14.7%), and PA in 11(11.6%). Demographics including age, as well as practice characteristics notably: years in practice, hours worked per week, number of night calls, percentage of work that was clinical, and trauma volume were not significantly associated with burnout ($p=0.47$. $p=0.50$, $p=0.69$, $p=0.99$, $p=0.74$, and $p=0.80$ respectively). In contrast, marital status, having children, and willingness to have spouse/partner answer a similar survey were all significantly associated with a lower rate of burnout ($p=0.024$, $p=0.012$, and $p=0.003$ respectively).

Conclusions: One in four of the trauma surgeons who trained at our program have features suggestive of burnout in at least on of the three subscales. While lower than the incidence previously reported, this is significant. Demographic and practice characteristics failed to identify factors that were predictive of development of the burnout syndrome. In contradistinction, positive family attributes were associated with a lower incidence of burn out suggesting a protective effect.

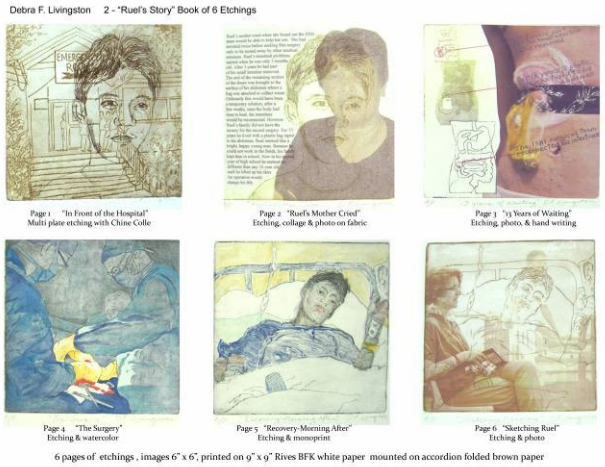
A Medical Mission From an Artist's Perspective

D Livingston, D Livingston

Presenter: Debbie Livingston **Senior Sponsor:** David Livingston, M.D.

I was the first in the family to volunteer abroad when I went to Tanzania in September 2009. A friend convinced me to go with her, so for 3 weeks I taught English and math to orphan kids. When I came home I told David that this was something we should do together, since his skills as a surgeon would make much more of an impact.

The following fall after graduating college, our son Jason left to volunteer as an engineer in the Philippines for a year. When David found out that ISHI, the organization that his partner Ziad founded, would be going to the Philippines we signed on for our first medical mission together. It was important to me that I would be of use to the mission, not just tagging along as David's wife. However the OR schedule was lighter than expected and there were enough nurses to do the data compiling, so I spent my days drawing. I wandered in and out of the OR and patient's rooms, giving me the opportunity to interact with the patients and even watch David operate for the first time. When I returned home I turned my sketches into art work to help promote ISHI and help with it's fundraising for future missions.

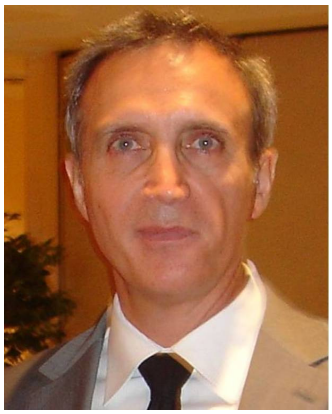


Paint the Ceiling Lecture

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".

"Complying with Non-Compliance"

Larry M. Gentilello, M.D.



Impact of Adaptive Statistical Iterative Reconstruction on Radiation Dose in Evaluation of Trauma Patients

MW Maxfield, KM Schuster, EA McGillicuddy, M Ghita, JA Brink, KA Davis

Yale University School of Medicine

Presenter: Mark W. Maxfield, MD **Senior Sponsor:** Kevin Schuster, MD

Introduction: A recent study showed that CT scans contributed nearly 93% of total radiation exposure of 177 patients admitted to our Level 1 trauma center. Adaptive Statistical Iterative Reconstruction (ASIR) is a newly developed iterative reconstructive algorithm that allows the use of less ionizing radiation during CT scans. ASIR was instituted as the algorithm on all CT scans on trauma patients in June 2009. The objective in this study is to determine if the implementation of ASIR led to a decrease in ionizing radiation exposure to trauma patients without compromising patient outcomes.

Study Design: We retrospectively reviewed 150 patients activating the trauma system before and after the implementation of ASIR imaging. Baseline demographics, initial presenting characteristics, number of delayed diagnoses and missed injuries were recorded. Volume CT dose index ($CTDI_{vol}$) and dose-length product (DLP) were measured on CT scans of the chest, abdomen, and pelvis and compared between the two groups. As a surrogate to measure effect on image quality, we examined rates of missed injury and diagnostic delay before and after ASIR use.

Results: The mean $CTDI_{vol}$ (17.07mGy vs. 14.19mGy; $p<0.001$) and DLP (1165.11 mGy x cm vs. 1004.20; $p<0.001$) were significantly lower for the studies performed with ASIR. Baseline characteristics including gender, age, injury severity score, revised trauma score, and length of hospital stay were similar between the two groups. There were no delayed diagnoses or missed injuries related to CT scanning identified in either group.

Conclusions: A 16.9% decrease in $CTDI_{vol}$ and a 13.8% decrease in DLP were obtained in scans with ASIR compared with scans without ASIR. There were no missed injuries or delayed diagnoses attributable to CT scanning. Implementation of ASIR imaging for CT scans performed on trauma patients at our institution led to a significant decrease in ionizing radiation dosage without compromising outcomes.

Hypotensive Resuscitation Decreases Early Mortality in Penetrating Trauma: Preliminary Results of a Randomized Controlled Trial

NM Tapia, CA Morrison, MA Norman, MM Carrick

Baylor College of Medicine

Presenter: Nicole M. Tapia, MD **Senior Sponsor:** Brian Tibbs, MD

BACKGROUND: Trauma mortality is a leading cause of death worldwide despite advances in operative strategies. This is a mid-study analysis examining the clinical outcomes of 128 penetrating trauma patients enrolled in a prospective, randomized controlled trial of permissive hypotension, with the hypothesis that mortality will decrease with implementation of hypotensive resuscitation.

METHODS: Patients in hemorrhagic shock following penetrating trauma with a systolic blood pressure (SBP) less than 90 prior to emergent laparotomy or thoracotomy, were randomized to one of two study arms for intraoperative resuscitation. Those in the experimental (low mean arterial pressure [LMAP]) arm were managed with a hypotensive resuscitation strategy with a target mean arterial pressure (MAP) of 50mmHg. Those in the control (high MAP [HMAP]) arm were managed with standard resuscitation to a target MAP of 65mmHg. Intraoperative and postoperative fluid requirements, mortality, postoperative complications, and other clinical data were prospectively gathered and analyzed as the patients were followed for 30 days.

RESULTS: Patients in the HMAP group had 8 deaths within 24 hours of admission after being transferred to the SICU, whereas the LMAP group had 0 deaths, which was statistically significant (p=0.003). Of the cohort of patients who died, the HMAP group had statistically significant coagulopathy with elevated postoperative prothrombin time (PT) (p=0.043). There were no significant differences in demographics, trauma scores, mechanism of penetrating injury, or baseline vitals or labs of the patients enrolled in the study. Time to operating room (OR), intraoperative fluid resuscitation volumes, and case duration were not significantly different. Postoperatively, there was no difference in incidence of acute kidney injury (AKI) or pulmonary function ratios (PaO2/FiO2) while ventilated. There was no significant difference in operating room deaths or overall deaths at 30 days.

Mortality <24 hours	MAP=50 (n=65)	MAP=65 (n=63)	p-value
Died in OR	8	6	0.779
Died <24h in SICU	0	8	0.003*
Total deaths <24h	8	14	0.137
Died 2-10 days	3	2	0.515
Died >10days	3	1	0.321
Overall deaths 30 days	14	17	0.461

Deceased Cohort	MAP=50			MAP=65			
	n	mean	SD	n	mean	SD	p-value
PTT	6	74.4	59.0	10	121.3	50.2	0.112
PT	6	16.2	3.74	11	42.4	37.3	0.043*
INR	6	1.6	0.66	11	4.5	3.6	0.076

CONCLUSION: Preliminary findings of this study suggest that a permissive hypotension resuscitation strategy significantly reduces the incidence of SICU mortality in the first 24 hours of admission.

Long Term Outcomes of Combat Casualties Sustaining Penetrating Traumatic Brain Injuries

A Weisbrod, C Rodriguez, W Dorlac, M Schreiber, R Bell, C Neal, J Dunne

Walter Reed National Military Medical Center

Presenter: Allison Weisbrod, MD **Senior Sponsor:** Martin Scheiber, MD

Background: Previous studies have documented short term functional outcomes in civilian and military patients sustaining traumatic brain injuries. However, little is known regarding the long term functional outcomes in this patient population. We sought to describe the long term functional outcomes of combat casualties sustaining penetrating brain injury (PBI).

Methods: Prospective data were collected on 2,443 patients admitted to a single military institution (which serves as the Department of Defense referral center for PBI) over an 8 year period from 2003 to 2011. PBI was identified in 137 patients and comprised the study cohort. Patients were stratified by age, ISS and admission GCS. Glasgow Outcome Scores (GOS) were calculated at discharge (D/C), six months, 1 and 2 years with GOS ≥ 4 = functional independence. * $P < 0.0001$, † $P < 0.05$ compared to D/C GOS, Students t test.

Results: The mean age of the cohort was 25±7, mean ISS was 28±9**,** mean admission GCS was 8.8±4.0. PBI mechanisms included gunshot wounds (31%, n=43) and blast injuries (69%, n=94). Invasive intracranial monitoring was used in 80% (n=109) of patients and 86.9% of the study cohort underwent neurosurgical intervention (craniotomy 8.8% and craniectomy 78.1%). Complications included cerebrospinal fluid leak (8.3%), venous thromboembolic events (15.3%), meningitis **(**24.8%), systemic infection (27.0%) and mortality (5.8%).

	Admission GCS	***D/C GOS***	***6 month GOS***	***1 year GOS***	***2 Year GOS***	***% GOS ≥4***
Overall (n=137)	8.8±4.0 n=137	3.1±0.9 n=133	3.5±1.2 n=106	3.9±1.3 n=92	4.0±1.2* n=78	66%
GCS 3-5 (n=31)	3.7±0.8 n=31	2.3±0.9 n=31	2.4±1.1 n=26	2.4±1.3 n=20	2.9±1.4† n=20	35%
GCS 6-8 (n=38)	6.8±0.7 n=38	3.1±0.7 n=36	3.5±1.1 n=28	3.9±1.6 n=25	4.0±1.2* n=21	63%
GCS 9-11 (n=39)	10.3±0.8 n=39	3.3±0.5 n=38	4.0±0.7 n=28	4.2±0.8 n=26	4.3±0.8* n=18	69%
GCS 12-15 (n=29)	14.6±0.7 n=29	3.9±0.7 n=28	4.3±0.6 n=24	4.7±0.6 n=21	4.8±0.4* n=19	100%

Conclusions: Combat casualties with PBI continued to show significant improvement in function status up to two years from discharge. A large proportion of combat casualties with severe PBI attained functional independence (GOS ≥ 4). Further studies are warranted to determine the etiology of improvement in functional status/independence in these patients and the effects that aggressive surgical care have on outcomes.

Micropower Impulse Radar: Pneumothorax Detection in Trauma Patients

G van der Wilden, C Albers, H Zimmerman, A Exadaktylos, O Birkhan, A Sideris, M Michailidou, H Alam, G Velmahos, D King, D Yeh, P Fagenholz, M de Moya

Massachusetts General Hospital

Presenter: Marc A. de Moya, MD **Senior Sponsor:** Marc A. de Moya, MD

Introduction: Pneumothoraces are a common entity in thoracic trauma. Micropower impulse radar (MIR) has been able to detect pneumothoraces in surgical patients. However, this technology has not previously been tested on trauma patients. The purpose of this study was to determine the sensitivity and specificity of MIR to detect clinically significant pneumothoraces. We hypothesized that MIR technology can effectively screen trauma patients for clinically significant pneumothoraces.

Methods: This was a prospective observational study in Level I trauma centers in Boston, Massachusetts and Bern, Switzerland. All trauma patients undergoing chest ct-scan were eligible for the study. Consent was obtained and readings were performed within 30 minutes before or after the CT scan. The patients had eight lung fields tested (four on each side). The qualitative and quantitative MIR results were blinded, and stored on the device. We then compared the results of the MIR to the CT scan and the need for chest tube drainage. We defined pneumothoraces as clinically significant if they required a chest tube.

Results: 75 patients were enrolled, with a mean age of 46 ± 16 years. Eighty-four percent were male. The screening test took approximately 1 minute. All but two patients had blunt chest trauma. We had six true positives, 6 false positives, 63 true negatives, and 0 false-negatives resulting in an overall sensitivity of 100%. (Table 1)

Table 1

Variable	Outcome
Sensitivity	100%
Specificity	91%
Positive Predictive Value (PPV)	50%
Negative Predictive Value (NPV)	100%

Conclusions: MIR is an easy to use handheld technology that effectively screened patients for clinically significant pneumothoraces, with a sensitivity and negative predictive value of 100%. MIR may be used for rapid, repeatable, and on-going surveillance of trauma patients.

Efficacy of Physiological Indicators vs Mechanism of Injury Criteria for Trauma Activation in Pediatric Emergencies

HE Wills, AR Kreiger, MC Green, DW Vane

Cardinal Glennon Children's Medical Center, St Louis University College of Medicine

Presenter: Hale E. Wills, MD **Senior Sponsor:** Dennis W. Vane, MD

Purpose: In pediatric trauma patients, the use of adult triage criteria emphasizing mechanism of injury (MOI) has been shown to result in over activation of trauma teams. Physiology-based (PB) triage criteria have been recommended to improve the accuracy of trauma activations (TA). At our level 1 academic tertiary pediatric trauma referral center, we recently changed our triage criteria by de-emphasizing MOI for major TA and favoring PB criteria. This study was conducted to analyze the resulting change in accuracy of activations.

Methods: We conducted a criterion standard, cohort-controlled retrospective study comparing patients triaged by MOI criteria (Jan. 2006 to March 2009) to those triaged by PB criteria (April 2009 to June 2010). We subdivided patients by trauma activation level major (TMaj), minor (TMin), consult (TC). We collected demographic, vital sign, injury pattern, TA level, and ER disposition data and retrospectively applied the triage criteria to the patients. We assigned patients to either high (HR) or low risk (LR) groups based on need for urgent intervention (ER procedure, emergent OR, blood transfusion), admission to ICU, ISS > 12 or death. We calculated sensitivity and specificity of major activations using the following groups: true positive (TP) = TA and HR, false positive (FP) = TA and LR, false negative (FN) = no TA and HR, true negative (TN) = no TA and LR. We then compared the MOI to the PB patients.

Results: The MOI and PB patients were similar in race (X^2, p=.201), gender (X^2, p=.605) and age (Student's t, p=.632). The PB criteria resulted in 13% TMaj, 34% TMin and 53% TC compared to 40%, 23% and 37%, respectively for MOI. Mean ISS in the PB group was 15.6 for TMaj, 7.15 for TMin and 5.12 for TC compared to 10.0, 5.26 and 5.23, respectively for MOI. Sensitivity for TA of high risk patients was 85.1% vs. 84.5% (equivalent) while specificity increased from 45.2% to 65.3% for MOI vs. PB, respectively.

Conclusion: For pediatric trauma patients, the emphasis on PB triage criteria and de-emphasis on MOI results in selection of higher acuity patients for major activation while maintaining acceptable under and over triage rates overall. This improved accuracy of major activation results is more cost efficient resource utilization and fewer unnecessary disruptions for the surgeon, operating room and other staff while maintaining appropriate capture and evaluation of trauma patients. The low sensitivity noted in both the MOI and PB groups is largely due to the broad definition of "high risk" patients used in this study. We recommend using PB based criteria for trauma activations in children.

Paper #25 8:40 am, 2/29/12

Infected Prosthetic Grafts in Vascular Trauma – A Rare Occurrence

AD Wyrzykowski, CG Ball, GS Rozycki, DV Feliciano

Emory University School of Medicine

Presenter: Amy D. Wyrzykowski, MD **Senior Sponsor:** Amy D. Wyrzykowski, MD

Introduction: Prosthetic grafts are used in vascular trauma when a suitable vein graft cannot be located. In spite of continued usage over the past 30 years, neither the rate of nor the risk factors for infection have been clearly delineated recently.

Methods: Retrospective review of the TRACS registry and concurrently maintained in-house trauma database. Data collected included epidemiology, mechanism of injury, use of temporary intravascular shunts, infections and risk factors for infection. Standard statistical methodology was employed; $p < 0.05$ was considered significant.

Results: From 1998 to 2011, 130 patients sustained traumatic vascular injuries (penetrating 87.6%, blunt 10.7%, other 1.5%) treated with implantation of a polytetrafluoroethylene (PTFE) graft or patch. The most common mechanism of injury was a GSW (107/130, 82.3%). Peripheral vascular injuries were present in 126 patients; 4 patients had truncal injuries.

PTFE was implanted in 79 arteries and 66 veins, including 140 interposition grafts and 5 patch angioplasties. Only 15 patients had insertion of PTFE in both an artery and a vein. Temporary vascular shunts were placed in 22 patients, including 15 shunts removed during the initial operation and 7 left in place 1-7 days (mean 2.4 days). Overall, the infection rate for patients having a PTFE graft or patch placed was 5.4% (7/130). All infections occurred in patients who sustained GSWs ($p=0.21$). Of the 22 patients who had shunts in place, 3 (13.6%) developed infections. There were no infections in patients who had shunts removed at the initial operation. Patients who left the first operation with a shunt in place had an infection rate of 42.8% ($p = 0.008$). In terms of outcome following an infection, one patient with a graft infection underwent an above knee amputation. Another patient with infection of a PTFE graft from the common iliac artery to the common femoral artery died from blowout of the proximal anastomosis following a planned ventral hernia and application of a split thickness skin graft to an open abdomen. The remaining 5 patients with infections were managed successfully with removal of the infected PTFE graft and insertion of an extra-anatomic bypass graft. All five patients were discharged in satisfactory condition.

Conclusions: 1. Regardless of mechanism of injury, placement of a PTFE interposition graft or patch is associated with a low rate of infection (<6%). 2. Due to the high rate of infection with indwelling shunts beyond the operating room, every attempt should be made to limit the dwell time. 3. When PTFE graft infections occur, they can be successfully managed with resection of the graft and insertion of an extra-anatomic bypass graft.

A Standardized Rapid Sequence Intubation Protocol Facilitates Airway Management in Critically Injured Patients

SL Ballow, KL Kaups

UCSF Fresno/Community Regional Medical Center

Presenter: Shana L. Ballow, DO **Senior Sponsor:** Krista L. Kaups, MD

Background: Securing the airway in a critically injured patient is an essential part of the initial resuscitation. In the ED of a teaching hospital, rapid sequence intubation (RSI) is performed by physicians with a wide range of experience. A variety of medications have been used for RSI, with potential for inadequate or excessive dosing as well as complications including hypotension and the need for re-dosing. Etomidate, a frequently used medication has been associated with adrenal insufficiency. We hypothesized that the use of a standardized RSI medication protocol (for both adult and pediatric trauma patients), has facilitated endotracheal intubation requiring less medication re-dosing, and less medication-related hypotension.

Methods: An RSI medication protocol (ketamine 2mg/kg IV and rocuronium 1mg/kg IV or succinylcholine 1.5mg/kg IV) was jointly implemented by Trauma Surgery and Emergency Medicine for all trauma patients undergoing ED intubation at a busy Level I trauma center. Compliance was encouraged but not mandated. We retrospectively reviewed patients for the one-year period before PRE) and after (KET) the protocol was instituted. Patients were identified from the trauma registry; data collected included age, sex, ISS, AIS head/face, AIS chest, RSI drugs, need for re-dosing, time to intubation, indication for RSI, and number of RSI attempts. Vital signs before and for 30 min after intubation were also noted. Patients intubated prior to ED arrival or without ED drug administration were excluded.

Results: During the study period, 439 patients met inclusion criteria; 266 without protocol (PRE) and 173 with protocol (KET). The mean age of patients was 40 years (1-91). Patients were severely injured with a mean ISS of 24 and mean AIS head/face of 3. PRE and KET groups were comparable in ISS, AIS, and age. Dosing in the KET group was appropriate with a mean dose of 1.9 mg/kg ketamine administered. Compliance after KET introduction approached 90%. At least 20 different providers, primarily EM R-2s and 3's performed RSI. Nine patients in the PRE group required re-dosing of medication versus 3 in the KET group ($P < .05$, X^2). In patients $\leq$14 years, (23 in PRE, 9 in KET), 2 patients in the PRE group required redosing, with none in the KET group. In all patients, mean time from drug administration to intubation decreased from 4 to 3 minutes. No patient in either group required a surgical airway. Post-RSI hypotension was recorded in 6.0% of PRE patients and 3.6% of KET patients (NS).

Conclusion: Institution of a standardized medication protocol simplifies RSI and allows efficient airway management of the critically injured trauma patient in the ED of a teaching hospital. Incorporation of ketamine avoids potential complications of some other commonly utilized RSI medications.

The Way to a Man's Heart: Gunshot Wound to the Buttocks Resulting in a Penetrating Cardiac Injury and Concomitant Missile Embolization

LA Johnson, RD Rice, BC Morse, DV Feliciano

Emory University School of Medicine

Presenter: Laura S. Johnson, MD **Senior Sponsor:** David V. Feliciano, MD

CASE REPORT: 42-year-old Caucasian male arrived by ambulance to an urban, level I trauma center after sustaining three gunshot wounds (GSWs). On arrival, the patient's primary survey was normal (GCS = 15, SBP=139 mmHg, HR=106 bpm). Secondary survey revealed 3 GSWs (1-left buttock, 2-left lateral thigh), a palpable projectile over the left lateral hip, and no signs of peritonitis. Pericardial (Fig 1) and pelvic fluid was noted on FAST examination. Because the likelihood for a cardiac injury was low given location of the bullet wounds, the patient was moved to the OR for a subxiphoid pericardial window (SPW) and DPL versus laparotomy. While performing SPW, the peritoneal cavity was entered with moderate hemoperitoneum noted. A laparotomy was immediately performed with abdominal packing. Subphrenic pericardial window confirmed hemopericardium. Following median sternotomy, a single posterior cardiac injury (grade IV) was noted and repaired by the trauma team without cardiopulmonary bypass. Intraoperative transesophageal echocardiography showed no retained missile and normal cardiac function. Intraoperative chest x-ray was normal with no projectiles, but pelvis x-ray revealed two missiles – one in the right pelvis and a second in the left lateral thigh associated with a trochanter fracture (Fig 2). Intraoperative examination revealed a palpable projectile in a branch of the right hypogastric artery, but the decision was made not to attempt extraction. Abdominal injuries included: 1) a grade II renal and adrenal laceration requiring no intervention 2) grade I splenic injury, requiring only topical hemostasis, and 3) through-&-through grade II gastric injuries, which were repaired primarily. Postoperative CT scan confirmed the missile's intra-arterial position. The patient did well, and was discharged home on hospital day #22.


Fig 1

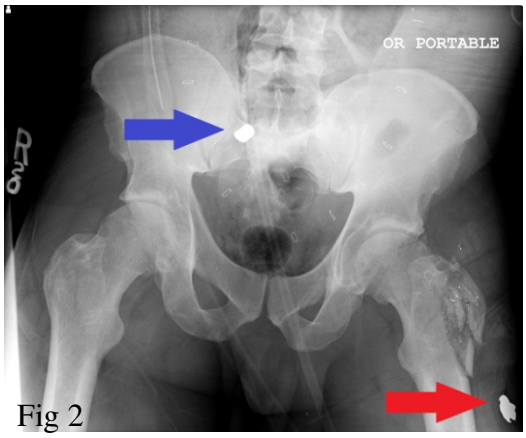


Fig 2

Paper #28 4:30 pm, 2/29/12

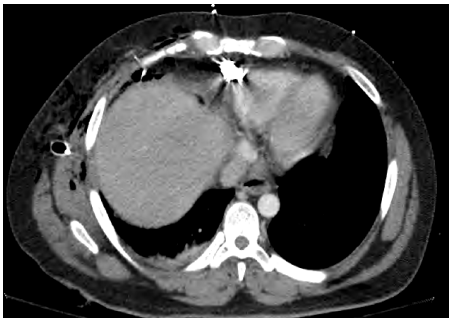
Delayed Cardiac Tamponade From Gradual Bullet Fragment Erosion Into the Right Ventricle: A Rare Injury

A Echeverria, M Aman, A Tang, R Friese, B Joseph, T O'Keefe, N Kulvatunyou, J Wynne, P Rhee

University of Arizona

Presenter: Angela Echeverria, MD **Senior Sponsor:** Peter Rhee, MD

CASE REPORT: Penetrating cardiac injuries are among the most lethal of traumatic injuries with mortality rates of 70-90%. We report a case of delayed right ventricular (RV) rupture from a bullet fragment erosion, and the subsequent successful repair. The patient is a 29-year-old male who sustained multiple thoracic and truncal gunshot wounds. He was hemodynamically stable upon presentation with a negative FAST in the abdominal and cardiac windows. CT scan demonstrated free intraperitoneal air and fluid, and a metallic fragment abutting the right ventricle with no associated hemopericardium. The patient remained hemodynamically stable during resection and primary anastomosis for three destructive small bowel injuries. Due to the proximity of the bullet fragment to the heart and the concern for cardiac erosion through normal cardiac motion, the operating surgeon proceeded with a subxiphoid window with the intention of bullet removal. Upon entrance into the pericardium, there was an immediate release of large volume of pulsatile venous blood indicating the presence of a cardiac injury. A median sternotomy was quickly performed while applying digital pressure through the pericardial window to achieve temporary hemostasis. A 2cm full-thickness RV laceration was found to be actively bleeding with the 1.7cm bullet fragment lodged against it. The RV laceration was repaired with a single pledgetted horizontal mattress suture of 2-O Prolene on an MH needle. The patient's 2-week post cardiorrhaphy surveillance echocardiogram demonstrated an ejection fraction of 55%, normal wall motion and minimal tricuspid regurgitation. Although the patient's postoperative course was complicated by transfusion related acute lung injury and acute kidney injury, he has achieved a full recovery with 7 months of follow-up. We report this case to illustrate the importance of high index of suspicion in achieving optimal outcome in traumatic cardiac injuries. Based on the experience gained from this patient, we advocate removal of all foreign substances that abut the heart and present a risk for cardiac erosion through normal cardiac motion.



POINT : COUNTERPOINT

PERICARDIAL WINDOW: DEAD OR ALIVE?

Nicholas Namias, M.D.
University of Miami School of Medicine

David V. Feliciano, M.D.
Emory University School of Medicine

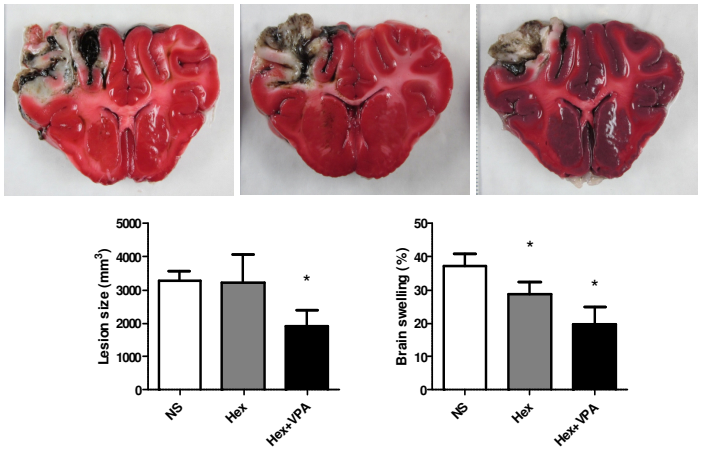
Neuroprotective Effects of Valproic Acid in a Large Animal Model of Traumatic Brain Injury and Hemorrhagic Shock

G Jin, M Duggan, G Kasotakis, T Knightly, AY Mejaddam, J Hwabejire, J Lu, MA deMoya, GC Velmahos, S Socrate, HB Alam

Massachusetts General Hospital/Harvard Medical School

Presenter: Hasam B. Alam, MD **Senior Sponsor:** Hasam B. Alam, MD

Introduction: We have previously demonstrated that valproic acid (VPA), a histone deacetylase inhibitor (HDACI), can improve animal survival after hemorrhagic shock (HS), and protect neurons from hypoxia-induced cell death. We have also shown that administration of 6% hetastarch [Hextend (Hex)] after traumatic brain injury (TBI) decreases brain swelling, without effecting size of the lesion. This study was performed to determine whether treatment with VPA would decrease the *lesion size* in a clinically relevant large animal model of TBI+HS.
Methods: Yorkshire swine (42-50 kg) were instrumented to measure hemodynamic parameters, intracranial pressure (ICP) and brain tissue oxygenation (PbtO2). A prototype, computer-controlled 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% blood volume) concurrent with the TBI. Animals were randomized to receive one of three different types of resuscitation after 2 hours of shock (n=5/group): 1) normal saline (NS), 2) 6% hetastarch (Hex), and 3) 6% hetastarch and VPA 300 mg/kg (Hex+VPA). Volume of Hex matched the shed blood, whereas NS was 3X the volume. VPA was given IV after an hour of shock. Six hours post-resuscitation, animals were sacrificed and their brains sectioned and stained with TTC (2, 3, 5-Triphenyltetrazolium chloride) to quantify the lesion size (mm^3) and brain swelling (% change compared to uninjured side).
Results: The combined TBI and HS resulted in a highly reproducible brain injury, with changes in blood pressure, ICP and PbtO2 that were clinically relevant. Hex treatment decreased swelling (29 ± 3.6%) without reducing the lesion size. Addition of VPA significantly decreased lesion size & brain swelling (1914 ± 468.2 mm^3, and 19 ± 5.2% respectively) compared to the NS group (3285 ± 292.5 mm^3, and 37 ± 3.6% respectively; Figure).



Conclusions: In a highly reproducible model of TBI+HS, administration of artificial colloid (Hex) improved hemodynamic parameters and reduced brain swelling. Addition of VPA treatment significantly reduced the size of the lesion as well as the associated swelling.

Paper #30 7:20 am, 3/1/12

Only Feed Some? A Western Trauma Association Multi-Institutional Study of Enteral Nutrition in the Post-Injury Open Abdomen

CC Burlew, EE Moore, J Cuschieri, GJ Jurkovich, P Codner, R Nirula, D Miller, MJ Cohen, ME Kutcher, J Haan, HG MacNew, MG Ochsner, SE Rowell, MS Truitt, F Moore, KL Kaups

Denver Health Medical Center

Presenter: Clay Cothren Burlew, MD **Senior Sponsor:** Clay Cothren Burlew, MD

Background: The open abdomen is a requisite component of damage control surgery (DCS) and the treatment for the abdominal compartment syndrome (ACS). Enteral nutrition (EN) has proven benefit in the critically injured, but its broad application in those with an open abdomen has not been embraced. The *purpose* of this study was to analyze the use of EN in patients with open abdomen after trauma and the impact on closure rates and nosocomial infections.

Methods: Patients with a post-injury open abdomen from January 2002 to January 2009 from 11 trauma centers were reviewed.

Results: During the 8 year study period, 596 patients required an open abdomen following trauma. The majority were men (77%) sustaining blunt trauma (70%) with a mean age of 38 ± 0.7, ISS 31 ± 0.6, and AIS 4.0 ± 0.1. 547 (92%) patients had an open abdomen following DCS while the remainder suffered the ACS. Of the 596 patients, 230 (39%) had EN initiated prior to closure of the abdomen at post-injury day 3.6 ± 1.2. 62% were maintained at trophic level while 38% were advanced to full goal EN. EN was delivered to the stomach in 139 (60%) patients, duodenum in 37 (16%), jejunum in 49 (21%), and unknown in 5 (3%). One-third of patients with bowel injuries had EN started with an open abdomen. In patients not given EN while open, 198 (54%) were closed at second laparotomy; these were excluded from final analysis:

		ISS	# of Xlaps	Fascial closure	Abdominal Closure Day	VAP	Abscess
BOWEL INJURY (n=180)	EN (n=73)	32 ± 1.7	5.8 ± 0.4	41 (56%)	12.8 ± 1.4	25 (34%)	22 (30%)
	No EN (n=107)	29 ± 1.4	4.7 ± 0.2*	76 (71%)	8.7 ± 0.7 *	34 (32%)	33 (31%)
NO BOWEL INJURY (n=218)	EN (n=157)	35 ± 1.1	3.5 ± 0.2	130 (83%)	6.7 ± 0.4	73 (46%)	11 (7%)
	No EN (n=61)	33 ± 1.8	3.9 ± 1.7	31 (51%)	5.3 ± 0.4	32 (52%)	4 (7%)

$p < 0.05$

Ventilator days, ICU days, and hospital length of stay were all significantly longer in bowel injury patients receiving EN while their abdomen was open.

Conclusions: Enteral nutrition in the post-injury open abdomen is feasible. In patients without bowel injury there is an increased incidence of fascial closure in those receiving EN. EN in patients with bowel injuries, however, shows an increase in the number of laparotomies, decreased incidence of facial closure, and increased time of the open abdomen. Incidence of

pneumonia and intraabdominal abscess appears similar between open abdomen patients receiving EN and those that do not.

Paper #31 7:40am, 3/1/12

Impact of Prehospital Hyperglycemia in Trauma

A Philp, DW Moorman, S Smith, E Villella, D Chappel

Allegheny General Hospital

Presenter: Eddie R. Villella, MD **Senior Sponsor:** Stephen Smith, MD

Purpose: There is increasing evidence that euglycemia plays a critical role in optimizing outcomes in trauma and critical care. A number of series have demonstrated negative outcomes associated with hyperglycemia in these patient populations. National combined rates of diagnosed and undiagnosed diabetes range from 3.7-27% depending on age, with as many as 35% falling into a CDC category of "pre-diabetes." Since elevation of glycated hemoglobin A1c (HbA1c) implies hyperglycemia over a longer period than the acute hyperglycemia associated with injury, we sought to quantify HbA1c in our trauma population and investigate the impact of prehospital hyperglycemia on outcomes.

Methods: After IRB approval, 678 consecutive admissions to a Level I trauma center with a LOS > 24 hours had assessment of HbA1c in addition to standard evaluation and management. The trauma registry was queried to elicit length of stay (LOS), mortality, injury severity score (ISS) and disposition for this group.

Results: Our population revealed a higher than anticipated rate of HbA1c elevation (normal range ≤ 5.6), with 378 (55.7%) having an HbA1c > 5.6%. Of these, the expected group of diagnosed and undiagnosed diabetes was at the predicted value of 104 (15.3%) compared to current CDC age group estimates. However, the "pre-diabetic" group (274) significantly exceeded that predicted (201, $p < 0.0001$). The group with elevated HbA1c had an equivalent ISS to the normal subset (10.9 vs. 10.6, $p = 0.64$). A trend towards increased mortality did not reach statistical significance (2.1% vs. 0.7%, $p = 0.20$). However, disposition was impacted, as only 54.1% of the elevated HbA1c group were discharged home compared to 69.4% in the normal group ($p<0.0001$). Significance was noted in the increase for both overall LOS (7.6 vs. 6.4 days, $p = 0.04$) and ICU LOS (3.2 vs. 2.3 days, $p = 0.047$) in the group with elevated HbA1c.

Conclusions: These data suggest there is a rate of HbA1c elevation in our trauma population significantly above that predicted by national data. Prehospital hyperglycemia is associated with a significant increase in ICU and overall LOS. There were also a significantly larger number of the patients with elevated HbA1c requiring a discharge destination other than home (nursing facility or rehabilitation). Further information is being accrued to follow this trend over time in a larger population and also to assess other possible complications. Although not clearly causative, these data suggest that long term glucose control and wider identification of pre-diabetics could favorably impact trauma outcomes.

Critical Decisions in Trauma

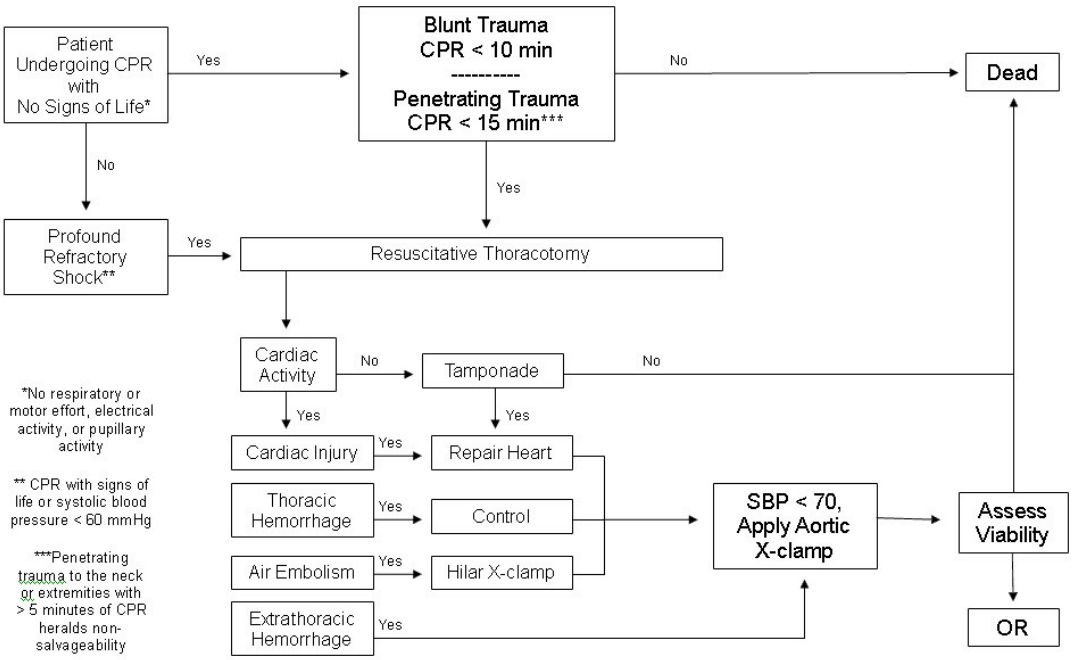
Moderator: Raul Coimbra, MD

Resuscitative Thoracotomy
Clay Cothren Burlew, MD

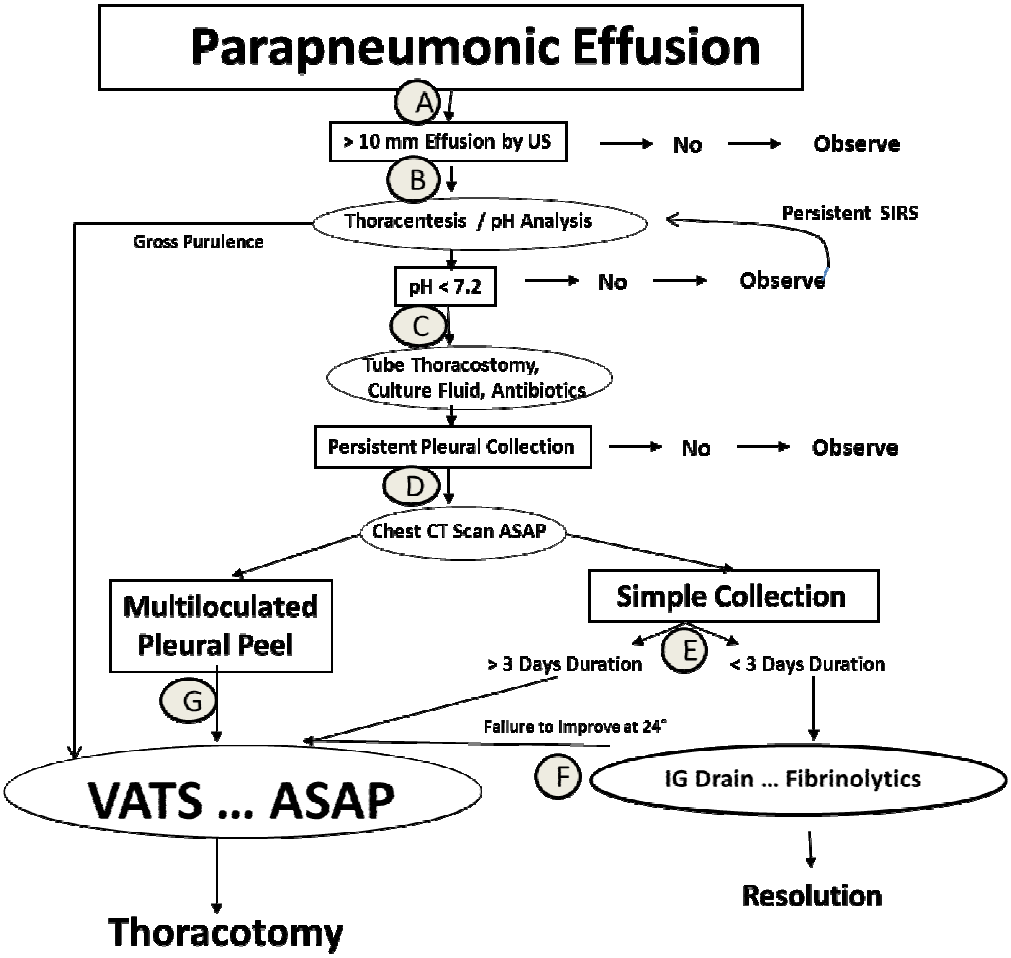
Parapneumonic Effusion
Hunter Moore, MD

Management of Complicated Diverticulitis
Fred Moore, MD

Resuscitative Thoracotomy



Parapneumonic Effusion



A. The standard method to estimate the amount of pleural fluid has been the lateral decubitus chest x-ray. Recent comparative studies indicate that ultrasound is a more reliable method to quantitate a pleural effusion. Infections involving an effusion of less than 10mm will resolve with antibiotics alone, and ultrasound-guided thoracentesis is recommended for effusions greater than 10 mm.

B. Gross purulence evident at the time of thoracentesis is unusual, but constitutes an indication for prompt VATS decortication. In all other circumstances the pleural fluid should be submitted for laboratory analysis. The most cost effective means to determine infection is to measure the pH of the pleural fluid in a standard blood gas analyzer. A pH < 7.2 is the threshold, although < 7.3 is considered high risk. A notable exception is a Proteus infection where the pH may exceed 7.4 due to ammonia production. An alternative criteria is a glucose < 60 mg % when infection is suspected. Because the evolution of an empyema may extend over days to weeks and the early phase is a sterile effusion, a repeat thoracentesis should be done in the patient with a persistent unexplained SIRS.

C. A pleural pH < 7.2 (or glucose < 60 mg %) is diagnostic of infection and warrants prompt tube thoracostomy. Gram stain and culture of the pleural fluid should be obtained at the time of thoracostomy to differentiate the organisms, although in 20-40% there is no identifiable pathogen. In empyema associated with community-acquired pneumonia, the most common pathogen is Streptococcus milleri (32%), while hospital-acquired is MRSA (28%). Patient characteristics, including diabetes, alcoholism, age greater than 60, and trauma are associated more frequently with anaerobic and resistant gram positive organisms. Hospital acquired pathogens have a much worse prognosis with a relative risk of death four fold greater than community acquired infections. The relatively poor outcome with Streptococcus milleri may be the frequent association of anaerobes. Thus, presumptive antibiotics should be based on the type of pneumonia (community vs hospital acquired), the pathogens identified in tracheal cultures, as well as patient comorbidities.

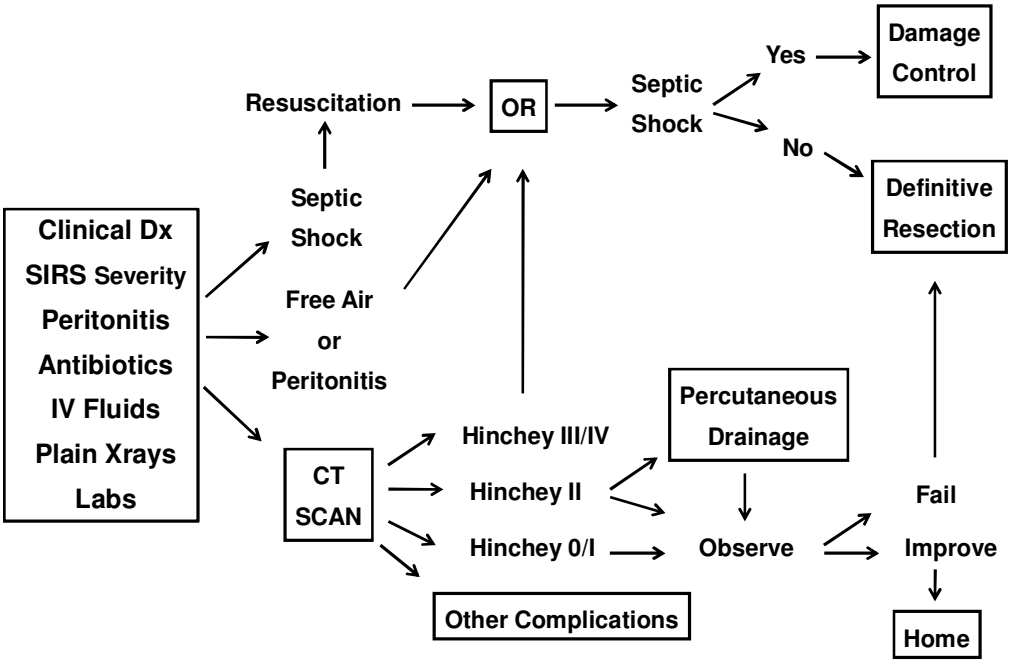
D. Persistent pleural collections after tube thoracostomy require urgent CT imaging for evaluation of the entire thoracic space. Delay in diagnosis of an undrained simple fluid collection allows progression to a complex multilocular process and the final organization stage.

E. Early recognition of a persistent pleural collection allows the potential to employ fibrinolytics to release the fluid for chest tube removal, but fibrinolytic therapy remains controversial. A Cochrane review in 2009 concluded that fibrinolytics should be used cautiously as proven benefit has not been demonstrated. Studies have shown tissue plasminogen activator (tPA) with no benefit over no fibrinolytic treatment. The combination of tPA and DNAase, however, may be beneficial for radiographic clearance, need for thoracotomy, and hospital length of stay.

F. The role of fibrinolytics in the management of pleural collections is debatable. Most believe fibrinolytic treatment should be limited to early empyema with simple collections separated by thin septa documented by CT scan. Image-guided direct infusion of fibrinolytics is superior to tube thoracostomy delivery. The combination of tPA and DNAase appears to be the most effective regimen. Simple collections that do not demonstrate substantial improvement after 24 hours of fibrinolytic infusion should undergo prompt VATS to avoid the need for thoracotomy.

G. Multiloculated empyemas with a pleural peel evident on CT should undergo prompt VATS. Lateral decubitus positioning with dual lung ventilation is recommended to facilitate evaluation of the involved pleural cavity and decortication. A key maneuver is to enter the pleural space without injuring the underlying lung due to extensive pleural adhesions. Careful exploration in the upper thorax where the empyema is least developed is usually the safest entry strategy. Alternatively, the existing chest tube site can be accessed to free the lung. With the thoracoscope in place and the lung partially deflated, additional ports can be added under direct vision. The objectives of VATS are to unroof all loculated collections, including those in the fissures, and to free the lung of the visceral pleural fibrous encasement.

Complicated Diverticulitis



Paper #32 4:00 pm, 3/1/12

INTERFACILITY TRANSFER OF PATIENTS WITH SEVERE TRAUMATIC BRAIN INJURY TO A LEVEL I OR II TRAUMA CENTER

DE Sugerman, WS Pearson, L Xu, M Faul

National Center for Injury Prevention, Centers for Disease Control and Prevention

Presenter: David E. Sugerman, MD, MPH **Senior Sponsor:** Harvey Sugerman, MD

Background: Patients with severe TBI (traumatic brain injury), head Abbreviated Injury Score (AIS) ≥3, who are indirectly transported from the scene of injury to a non-level I or II trauma center may experience delays to definitive neurosurgical management. Transport to a trauma hospital with appropriate initial emergency department (ED) treatment and rapid admission has been shown to reduce mortality in one state's trauma system. This study was conducted to see if the same trend holds with a nationally representative sample of severe TBI patients seen at Level I and II trauma centers, despite missing patient disposition and transfer times at referral facilities.

Methods: This report is based on adult patients with severe TBI treated in a nationally representative sample of 47 Level I and 35 Level II trauma centers submitting data to the 2007 National Trauma Databank (NTDB) National Sample Program (NSP). Analyzed independent variables included age, sex, race/ethnicity, mode of transport, injury type (blunt vs. penetrating), primary payer, trauma center level, AIS, initial Glasgow Coma Scale (GCS), Injury Severity Score (ISS), systolic blood pressure (SBP), and neurosurgical procedures stratified by interfacility transfer status; while the primary outcome variables were inpatient death, discharge disposition, and mean hospital, intensive care unit (ICU), and ventilator days.

Results: After exclusion criteria were applied (air transport, ISS<16, and non-head AIS ≥3) a weighted sample of 13,523 patients was eligible for analysis. In bivariable analysis, transferred patients were older (≥ 60 years of age), white, insured, and less severely injured (AIS <5, GCS >8, ISS <30), and less likely to sustain penetrating trauma ($p<0.001$). Transferred patients were less likely to die and had shorter ICU stays ($p<0.01$). After controlling for all significant variables (sex, age, ISS, race/ethnicity, injury type, and initial GCS), the odds of death for transferred patients was nearly half that of patients taken directly to a Level I or II trauma center (aOR 0.65; 95% CI 0.53-0.80), though the difference was not significant after excluding ED deaths. Age, sex, initial GCS, and ISS were all found to be significant predictors of mortality in this population.

Conclusions: Patients who were transferred to a Level I or II trauma center were less likely to die compared to patients who were directly admitted. Patients with severe TBI who survive initial injury and are stabilized at non-trauma centers, can be safely transferred to a Level I or II trauma center. The American College of Surgeons should consider collecting information on patient outcomes at referral facilities and total transport time after injury, to better address the outcomes of patient triage decisions.

PANEL OF EXPERTS

Moderator: Peter Rhee, MD

M. Gage Ochsner, MD

Robert Mackersie, MD

Lawrence Reed, MD

5:00 pm, 3/1/12

Presidential Address

"Asleep at the Wheel: The Consequences of Unfettered Commitment"

R Lawrence Reed II, M.D.

Paper #33 7:00 am, 3/2/12

A Randomized, Double-Blinded, Placebo-Controlled Trial of Anticoagulation in Low-Risk Traumatic Brain Injuries: The Delayed vs Early Enoxaparin Prophylaxis (DEEP) Pilot Study

HA Phelan, SH Norwood, AL Eastman, SC Brakenridge, C Madden, K Aldy, PA Nakonezny, L Yang, D Chason, G Arbique, J Berne, JP Minei

UT Southwestern Medical Center

Presenter: Herb A. Phelan, MD **Senior Sponsor:** Carlos Brown, MD

Introduction: Our group has created a novel algorithm for VTE prophylaxis after TBI which stratifies patients into Low-, Moderate-, and High-Risk for spontaneous expansion of their injury and tailors a prophylaxis regimen to each arm. We present the results of a double-blind, placebo-controlled, pilot RCT on the Low-risk arm.

Methods: In this two-institution study, TBI patients presenting within 6 hrs of injury with pre-specified small TBI patterns and stable scans at 24 hrs post-injury were randomized to receive enoxaparin 30 mg SQ q 12 hrs or placebo from 24-96 hrs post-injury. An additional CT was obtained on all patients 24 hrs after starting treatment and 48 hrs post-injury. The primary endpoint was radiographic worsening of TBI; secondary endpoint was VTE occurrence. All CT reads were blinded to the patient's treatment arm.

Results: A total of 683 consecutive TBI patients were screened over 28 center-months. The most common exclusions were for injury larger than the pre-specified criteria (n=199) and pre-injury anticoagulant use (n=138). Consent rate was 71%. Sixty two patients were randomized to enoxaparin (n=34) or placebo (n=28). Subclinical, radiographic TBI progression rates on the scans performed 48 hrs post-injury and 24 hrs after start of treatment were 5.9% (95% CI: 0.7 - 19.7%) for enoxaparin and 3.6% (95% CI: 0.1% - 18.3%) for placebo for a treatment effect difference of 2.3% (95% CI: -14.42 - 16.5%). No clinical TBI progressions occurred. One DVT occurred in the placebo arm.

Conclusion: A power analysis shows that 216 patients will be needed to demonstrate non-inferiority of enoxaparin to placebo for TBI progression rates at a non-inferiority margin of 10% (two-tailed α=0.05, β=90%). We are currently applying for extramural funding to support this definitive investigation.

Prevention of Adverse Drug Events and Cost-Savings Associated with PharmD Interventions in an Academic Level 1 Trauma Center: A Conservative, Evidence Based Approach

S Hamblin, R Miller

Vanderbilt University Medical Center

Presenter: Susan E. Hamblin, PharmD **Senior Sponsor:** Richard S. Miller, MD

Background: The financial benefit of an established clinical pharmacy service in the Trauma Intensive Care Unit (TICU) has not been well-described. This study was conducted to identify adverse drug events prevented by the clinical pharmacy team and to determine the net cost-savings associated with their input on a multidisciplinary trauma service.

Methods: Between July 2010 and June 2011, we conducted a retrospective analysis of clinical pharmacy activities and interventions on our 31 bed trauma unit managed by a multidisciplinary team. At the initiation of the study, a Web-based pharmacy documentation system (*Quantifi*) was officially integrated into the trauma pharmacy work process. Based on this system, the type of intervention and a value of cost-savings ($0-$6,000) were assigned to each activity. Cost-saving values for interventions were calculated from literature describing the costs of adverse drug events and average drug costs.

Results: Over the year, a total of 2,574 pharmacy activity entries were documented in the *Quantifi* system. The total conservative estimate of cost-savings associated with clinical pharmacy interventions amounted to $565,664. Considering the mean US hospital pharmacist salary and the highest quoted cost associated with the *Quantifi* program, the net cost savings associated with our clinical pharmacist interventions on the trauma service was $428,327. The majority (53%) of the interventions fell under the category of Pharmacotherapy Improvement, with 21% in the category of Quality/Safety Improvement and 18% as Antibiotic Stewardship. Prevention of 34 serious adverse drug events was documented. The total cost-savings associated with prevention of these adverse events does not include the cost of injury to the patient or any potential legal fees. Antimicrobial medications (668), anticoagulants (270), and GI medications (231) were the most common medication classes involved in pharmacy interventions.

Conclusions: Using a Web-based pharmacy documentation system, we were able to demonstrate prevention of serious adverse drug events and a significant cost-savings by including clinical pharmacy in a multidisciplinary approach to caring for the seriously injured.

Paper #35 7:40 am, 3/2/12

Effective Utilization of Physician Assistants in the Performance of Percutaneous Tracheostomy

E Ross, E Vieux, R O'Connor, A Mikulaschek, D Goldberg, N Fonte, M Donnelly, D Zimmerman, S Smith

Lee Memorial Hospital

Presenter: Erin E. Ross, PC-C **Senior Sponsor:** Christopher C. Baker, MD

Introduction: Percutaneous Tracheostomy (PT) has been increasingly used and accepted as a safe, cost effective procedure in patients requiring surgical airways. A review of the current literature does not address the utilization of physician assistants in performing this procedure. This is a review of our experience utilizing physician assistants and a programmed procedure approach at our Level II trauma center.

Methods: A retrospective review of patients admitted to the trauma center from Jan 2005 to Dec 2010 and undergoing tracheostomy was performed.
Inclusion criteria consist of trauma and medical patients. The procedures were performed in the operating room and at the bedside. High risk patients were defined as those with a cervical spine injury, systemic anti-coagulation, obesity and previous tracheostomy. A protocol was developed to ensure a uniform approach to the procedure. The physician assistant underwent training and a credentialing process.

Results: During the study period, 6,218 patients were admitted to the trauma service. We identified 461 tracheostomies, following E.A.S.T. guidelines. Three hundred seventeen were performed using the percutaneous dilation technique. One hundred twenty were performed by physician assistants, directly supervised by the surgeon. Twenty-Seven patients were defined as high risk. Two patients experienced complications. Both of these patients were in the high risk group. One was a dislodged tracheostomy tube, requiring oral tracheal intubation and a return to the operating room. The second complication was loss of the airway at bedside. The tracheostomy was ultimately completed without adverse outcome to the patient. To date, we have zero long term complications and there were no deaths.

Conclusions: Our experience of one hundred twenty patients suggests the PT can be safely and effectively performed by the supervised physician assistant with the proper training and experience. This review is on-going.

Paper #36 8:00 am, 3/2/12

Prospective Evaluation of Ambient Operating Room Temperature on the Core Temperature of Injured Patients Undergoing Emergency Surgery

K Inaba, R Berg, G Barmparas, P Rhee, G Jurkovich, G Recinos, PG Teixeira, D Demetriades

Los Angeles County-University of Southern California Medical Center

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

Introduction: Although uncomfortable for the operating team, trauma operating room (OR) temperatures have traditionally been kept warm in an attempt to mitigate intraoperative heat loss. The purpose of this study was to examine how ambient OR temperatures impact core temperature in patients undergoing emergent surgery for trauma.

Methods: Injured patients requiring emergent surgery at a Level 1 trauma center were prospectively enrolled between 07/2008 and 1/2010. Standardized warming measures were used for all patients. Ambient OR temperature was recorded in 5-minute intervals with the Fourier Microlog EC600 temperature data logger. Intraoperative core temperatures were compared to ambient OR temperature. Patients experiencing intraoperative core temperature decreases were compared to those who did not, to examine the impact of ambient temperature changes on the risk of perioperative hypothermia.

Results: During the 18 month study period, 118 patients requiring emergent surgery (73% laparotomy, 5% thoracotomy, 7% combined, 15% other) were enrolled. Incidence of hypothermia (<350C) on admission to the OR was 29.7%. Crude mortality increased as the final patient core temperature achieved in the OR decreased (4.2% for temperatures >35℃ and as high as 50% for temperatures ≤32℃). Overall, core temperature decreased in 46 patients (39.0%) but remained stable or increased by the end of the procedure in 72 (61%). There were no significant differences in the admission temperature, clinical demographics or volume of fluids and blood products between the two groups. In a forward logistic regression analysis, decreasing ambient OR temperature was not associated with a drop in the patient's core temperature.

Conclusion: In this prospective study, the ambient operating room temperature did not affect the core temperature of injured patients undergoing emergent surgery.

Paper #37 8:20 am, 3/2/12

Does Needle Thoracostomy Provide Adequate and Effective Decompression of Tension Pneumothorax?

M Martin, S Satterly, K Inaba, K Blair

Madigan Army Medical Center

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

Background: Tension pneumothorax (tPTX) is a common and potentially fatal event following thoracic trauma. Needle decompression is the currently accepted first-line intervention, but has not been well validated. The purpose of this study was to evaluate the effectiveness of a properly placed and patent needle thoracostomy (NT) compared with standard tube thoracostomy (TT) in a swine model of tPTX.

Methods: Six adult swine underwent instrumentation and creation of tPTX using thoracic CO2 insufflation via a balloon trocar. A continued 1 L/min insufflation was maintained to simulate an ongoing air leak. The efficacy and failure rate of NT (14 gauge) compared with TT (34 French) was assessed in 2 separate arms: 1) tPTX with hemodynamic compromise and 2) tPTX until pulseless electrical activity (PEA) obtained. Hemodynamics were assessed at 1 and 5 minutes after each intervention.

Results: A reliable and highly reproducible tPTX was created in all animals with mean insufflation volume of 2441 ml. Tension pneumothorax resulted in the systolic blood pressure declining 54% from baseline (128 mmHg to 58), cardiac output declining by 77% (7 L/min to 1.6), and equalization of CVP and wedge pressures. In the first arm there were 19 tPTX events treated with NT placement. All NT were patent on initial placement, but 5 (26%) demonstrated mechanical failure (due to kinking, obstruction, or dislodgment) within 5 minutes of placement, all associated with hemodynamic decline. Among the 14 NTs that remained patent at 5 minutes, 6 (43%) failed to relieve tension physiology for an overall failure rate of 58%. Decompression with TT was successful in relieving tPTX in 100%. In the second arm, there were 21 tPTX with PEA events treated initially with either NT (n=14) or TT (n=7). The NT failed to restore perfusion in 9 events (64%), while TT was successful in 100% of events as a primary intervention and restored perfusion as a rescue intervention in 8 of the 9 NT failures (88%).

Conclusions: Thoracic insufflation produced a reliable and easily controlled model of tension pneumothorax. NT was associated with high failure rates for relief of tension physiology and for treatment of tPTX induced PEA, and was due to both mechanical failure and inadequate tPTX evacuation. This performance data should be considered in future NT guideline development and equipment design.

Small 14F Pigtail Catheter Placed by Surgeons for Traumatic Hemothorax Drains Blood as Well as Standard Sized Chest Tubes

N Kulvatunyou, D Green, L Gries, R Friese, B Joseph, T O'Keefe, A Tang, J Wynne, P Rhee

University of Arizona

Presenter: Narong Kulvatunyou, MD **Senior Sponsor:** Peter Rhee, MD

Background: The use of a small 14F pigtail catheter (PC) may make sense for pneumothorax but its feasibility to drain hemothorax is doubted. The primary purpose of this study was to review our early experience and determine the safety and efficacy of PCs placed by trauma surgeons for traumatic hemothorax (HTX) or hemo-pneumothorax (HPTX).

Methods: We prospectively collected data on all PCs used for HTX or HPTX over the past 24 months. PCs were placed by the trauma team using a Seldinger technique, and the decision to use PC was at the discretion of the trauma attending. We compared PC outcome data to those treated with the standard chest tube (CT) (28F – 36F).

Results: PCs were placed in older patients with more blunt mechanism. PCs had similar efficacy and complication rates compared to the standard sized CTs.

	T-HTX/HPTX N=190	**PC-HTX/HPTX N=28**	***P* value**
Age, years, mean	41±1.4	54±4	**<0.001**
ISS, mean	21±0.8	18±1.6	0.204
Chest-AIS, median	3(3,3)	3(3,3)	0.152
Mechanism, blunt	62%	89%	**0.004**
Initial output (cc), mean	426±37	559±103	0.19
Insertion complication	4.2%	10.7%	0.14
Tube duration, day, median	5(4,7)	4(3,7)	0.135
Failure rate	44(23%)	4(14%)	0.290
2nd Tube, n	29(15%)	3(11%)	
VATS, n	31(16%)	3(11%)	
Ventilator day, median	0(0,3)	0(0, 0.5)	0.078
ICU day, median	2(0,5)	2(0,5.5)	0.940
Mortality	7.4%	3.6%	0.459

Conclusion: Smaller caliber PCs can have similar success and equal complications rate to those larger sized CTs when used to drain blood. Retained HTX may not be effected by a smaller tube. A larger study and a growing experience with PCs will further clarify its role.

Paper #39 4:00 pm, 3/2/12

Identification of Thyroid Dysfunction in Surgical Sepsis

S Todd, L Moore, K Turner, J Sucher, B McKinley, F Moore

New York University Langone Medical Center

Presenter: S. Rob Todd, M.D. **Senior Sponsor:** S. Rob Todd, M.D.

Introduction: The sick euthyroid syndrome represents a set of complex (and often confusing) alterations within the thyroid axis during critical illness. During the acute phase of critical illness, these include increased free thyroxin (T_4) levels, decreased tri-iodothyronine (T_3) levels, increased reverse T_3 (rT_3) levels, and increased thyrotropin-stimulating hormone (TSH) levels. Studies have documented a correlation between hypothyroxinemia and mortality in critically ill patients; however, there is limited data in the adult sepsis population. The objective of this study was to assess baseline thyroid function studies and their association with mortality in surgical sepsis. We hypothesized that relative decreased levels of free T_4, decreased levels of T_3, and increased TSH levels would be associated with mortality.

Methods: This was a retrospective review of a prospectively collected sepsis database in a surgical intensive care unit at an academic tertiary care referral center. Data evaluated included patient demographics, baseline (at the time of enrolment in the sepsis protocol) thyroid function studies, and mortality. Patients were categorized as having sepsis, severe sepsis, or septic shock based on refined consensus criteria. Univariate analyses were performed using the one-way ANOVA and chi-square tests. A *p* value of < 0.05 was considered significant.

Results: Over 24 months, 231 septic patients were accrued. The mean age was 59 ± 3 years and 43% were male. Thirty-nine patients were diagnosed with sepsis, 131 patients with severe sepsis, and 61 patients with septic shock. There were no statistically significant differences between the T_3, free T_4, or TSH levels at baseline and the different categorizations of sepsis. The baseline thyroid function studies in relation to mortality are presented below.

	Survived (n=190)	Died (n=41)	*p* value
Free thyroxin (T_4) (normal: 0.8-1.8ng/dL)	5.8 ± 0.2	4.6 ± 0.6	0.01
Tri-iodothyronine (T_3) (normal: 60-181ng/dL)	72.2 ± 2.1	57.3 ± 5.2	0.01
Thyrotropin-stimulating hormone (TSH) (normal: 0.55-4.78ulU/mL)	2.4 ± 0.6	5.1 ± 1.6	0.06

T_4 levels were increased in all patients, but to a significantly lesser extent in those who died. Similarly, T_3 levels were significantly decreased in those patients who died.

Conclusions: In surgical sepsis, decreased T_3 levels at baseline are associated with mortality. These data do not support the administration of levothyroxine (T_4) because it is already elevated and would preferentially be converted to rT_3 in critical illness; however, replacement with liothyronine (T_3) might be rationale. Further studies are required to assess its effectiveness in surgical sepsis.

Paper #40 4:20 pm, 3/2/12

The Influence of Policy on Practice and Patient Management

C Hecht, T Littleton, T Rives, R Gandhi

JPS Heath Network

Presenter: Carrie Hecht, RN **Senior Sponsor:** Roxie M. Albrecht, MD

Introduction: In order to optimize neurosurgical resources, in January 2008, a protocol was instituted at our hospital allowing trauma surgeons to manage intracranial hemorrhage (ICH) less than or equal to 1 centimeter ($\leq$1 cm). Our objective was to see if a protocol allowing trauma surgeons to manage small ICH decreased neurosurgical consultations for those patients, as well as to see if trauma surgeons can safely manage small ICH rather than a neurosurgeon.

Methods: We reviewed data collected from our trauma registry for patients who presented between 2006 and 2011. Protocol was put in place as of January 2008 in our Level I Trauma Center allowing trauma surgeons to manage patients with an ICH $\leq$1 cm and a Glasgow Coma Score greater than 10. Patients with fall as the primary mechanism of injury with a TBI resulting in an ICH $\leq$1 cm were included in the study. Patients with comorbidities were excluded. This study was approved by our hospital's institutional review board.

Results: Between 2006 and 2011, 2,109 patients had trauma activations resulting from a fall. Of those patients, 323 presented with a TBI resulting in an ICH ≤1 cm. One hundred twenty-four patients with TBI were treated prior to initiation of protocol and 199 were treated after protocol. Neurosurgery consults decreased from 93.5% to 83.4% for TBI patients after protocol initiation, $p < 0.01$. Patients ranged in age from 13 to 100 years, with a mean age of 58.05 (SD = 21.48). Sixty-six percent were male (n = 225), 70% were white (n = 239), 88% (n = 302) received a neurosurgeon consult, and 13% (n = 44) died. No significant differences exist between patients' condition on discharge, $\chi^2(2) = 1.28$, *ns*, where patients were discharged to, $\chi^2(4) = 1.47$, *ns*, or length of stay, $F(1, 341) = 2.46$, *ns,* between neurosurgeon management and trauma surgeon management.

Conclusion: This homogenous sample of patients enables us to examine patient outcomes in the absence of comorbidities. We found the number of neurological consultations significantly reduced after protocol implementation. These data suggest patients managed by trauma surgeons did not have outcomes different from those managed by neurosurgeons for ICH $\leq$1 cm. This data may be applicable to other injuries treated by specialty services, enabling those physicians to treat patients with the most severe injuries.

Paper #41 4:40 pm, 3/2/12

The Lost to Follow-up Trauma Patient: A System Problem or a Patient Problem?

M Aaland, K Marose, T Zhu

Sandord Health Fargo

Presenter: Mary O. Aaland, MD **Senior Sponsor:** R. Lawrence Reed, MD

Objective: The objective of this study was to explore the reasons for trauma patients failure to follow-up (FTF) in the trauma clinic(TC).

M**ethods:** A one year retrospective analysis was conducted on t Trauma Service patients who were discharged from Parkview Hospital in 2009 who failed to follow-up in the TC. Hospital electronic medical records were examined to identify variables of interest, phone interviews were attempted on those patients that failed to follow-up, and calls were made to the offices of involved subspecialists (SS) to determine if any discharge follow-up had occurred. Data analysis was performed by Microsoft Excel and SPSS.

Results: 233 patients were identified as having FTF in the TC. 86(36.9%) were due to system errors (internal errors). However, 37 of those individuals did see a SS. 147(63.1%) failed to follow-up due to patient errors (external causes) but yet 66(44%) of those patients saw a SS post discharge. Of the 750 patients that had follow-up appointments made with a SS or the TC, 669 appointments were kept for an overall patient follow-up compliance rate of 89.2%. No demographic differences were noted between those patients that failed to follow-up with the TC but were seen by a SS. Telephone contact was made with 28.5% of the patients that FTF in the TC. The number one reason for FTF was lack of awareness of the appointment.

Conclusion: Only 10.8% of the trauma patients that had appointments for any post trauma follow-up had FTF. The main reasons for FTF were due to system errors, i.e. no appointment made with the TC or poor communication with the patient for the need for follow-up. With improved patient education on the day of hospital discharge and improved physician discharge orders, trauma patient follow-up could approach 100%.
This study demonstrates that the trauma patient is compliant with follow-up and that failure to follow-up is mostly a system problem and not a patient problem

Paper #42 5:00 pm, 3/2/12

Beware of Daggering: A Potentially High Risk Mechanism of Injury

JM Paulson, CL Desmond, BJ Baron

SUNY Downstate Medical Center/Kings County Hospital Medical Center

Presenter: Jessica M. Paulson, MD **Senior Sponsor:** Bonny J. Baron, MD

Background: Jamaican dancehall music and dance have been an integral part of Jamaican culture for decades. In recent years, a dance style known as "Daggering" has become popular in Jamaican dancehalls and abroad. Daggering includes aggressive, sexually explicit dance moves whereby couples simulate various sex positions and rough sex. Dancing is characterized by pelvic thrusting and often involves dancers flipping their partners or leaping onto one another (Sky Daggering). Injuries secondary to Daggering have been reported by the Jamaican media. However, a search of the medical literature reveals no prior case descriptions of Daggering injuries. We describe two recent cases of patients who presented to our emergency department (ED) after sustaining Daggering injuries.

Case 1. Fractured Penis: A 25 year old healthy man presented to the ED with acute pain and swelling of his penis, of approximately 12 hours duration. He injured his penis while engaging in vigorous dance on the evening prior to ED admission. He described a dance mechanism that included repetitive pelvic thrusting and frontal contact with his dance partner. At one point he felt severe pain and observed penile swelling. He went home, hoping that his injury would improve by the morning. His symptoms persisted and he came for ED evaluation. Physical examination revealed an anxious 25 year old man. He had no difficulty voiding and denied hematuria. His penis showed symmetrical edema of the distal shaft without a palpable defect. There was no blood at the urethral meatus, scrotal edema or testicular tenderness. Based on his clinical presentation, the patient was urgently taken to the operating room for urologic exploration and repair of an acute penile fracture.

Case 2. Fracture-Dislocation Thoracic Spine: A 21 year old woman with no prior medical history was Daggering and experienced sudden onset of severe back pain and loss of motor-sensory function in her bilateral lower extremities. Prior to her injury she was supine on the ground with her hips flexed. She described a mechanism of injury whereby her male partner jumped from a five foot height and landed on her lower extremities, causing them to extend backward toward her head. Her ED physical examination demonstrated a thoracic step off, absent sensory function below the umbilicus, complete loss of motor function in her lower extremities and absent rectal tone. CT scan and subsequent MRI showed a severe fracture-dislocation of T11 on T12 with near complete transection of the spinal cord at the T11/12 level. The patient received high dose Methylprednisolone. She underwent surgical decompression and stabilization. She had no signs of neurologic recovery from her complete spinal cord lesion. Following six days of acute inpatient hospitalization she was transferred to a Rehabilitation facility.

Conclusions: Aggressive dance may result in severe injuries. Our cases highlight the importance of heightened physician awareness of Daggering as a potentially serious mechanism of injury. Physicians should thoroughly question patients as to specific mechanisms of dance injury in order to fully appreciate the spectrum of injuries that may have occurred.

Paper #43 5:15 pm, 3/2/12

Penetrating Cardiac Injury From a Fractured Rib With an ISS of 75: A Rare Case of Survival

H Stagg, D Ciceri, C Chaput, M Davis

Texas A&M University Scott & White Hospital

Presenter: Hayden W. Stagg, MD **Senior Sponsor:** Matthew L. Davis, MD

A 26 year old female presented to our ACS Level 1 trauma center status-post MVC as a restrained driver struck by an 18-wheeler. On scene she was combative with a GCS of 8 but moved all extremities and was intubated. On arrival, SBP was 80 mmHg with HR in the 130s. Resuscitation with blood was initiated. On physical exam she was found to have significant instability of the pelvis. CXR revealed a left pneumothorax and a chest tube was placed. AP film of the pelvis showed lateral compression fractures and a sheet was utilized as a pelvic binder. FAST scan was positive and the patient was taken to the OR urgently

Celiotomy revealed 500 cc of hemoperitoneum. Other findings included a grade I liver laceration, a grade II splenic laceration, intra-peritoneal bladder rupture, a large retroperitoneal pelvic hematoma, a peri-duodenal hematoma, and a small bowel mesenteric rent. Operative maneuvers included splenectomy, bladder repair, Kocher maneuver, evaluation of the duodenum, and pre-peritoneal pelvic packing via a separate Pfannenstiel incision. The patient stabilized, the abdomen was packed open and interventional radiology arrived for intra-operative pelvic angiography. During angiogram prep, she became significantly hypotensive and hypoxic. Her left chest tube had evacuated 800cc since placement. A right chest tube was place empirically. Repeat CXR was obtained which revealed a new finding of widened mediastinum. Intraoperative TEE revealed hemodynamically significant cardiac tamponade. As the patient was in extremis, the abdominal packing was quickly removed and a subxiphoid pericardial window produced approximately 200 cc of blood. A left clamshell thoracotomy was quickly performed, revealing a severely lacerated lung and a bleeding defect in the pericardium. The pericardial sac was widely opened, revealing a jagged 1 cm laceration on the left ventricle near the AV junction. Pledgeted sutures were used to repair the laceration. The cause of the patient's cardiac injury was found to be a broken rib, which had penetrated the lung and the left ventricle. After cardiorrhaphy she again stabilized. Pelvic angiography revealed several bleeding branches of bilateral internal iliac arteries, which were gel-foam embolized.

Other significant injuries were: atlanto-occipital and atlanto-axial dissociation, found on CT performed post-operatively, a small intracranial subdural hematoma and several long-bone fractures. Despite a difficult operative course and an overall ISS of 75 on presentation, she was able to undergo fixation of her cervical injury and long bone fractures once stabilized. She spent 1 month in the hospital, was discharged to a rehab facility for several weeks, and then was discharged home completely neurologically normal. Penetrating cardiac injury from a fractured rib is a rare occurrence and survival has been rarely reported. Survival of this extremely rare injury, in combination with the often-fatal occipito-cervical ligamentous injury and an ISS of 75, has never been reported. This case report outlines how the modern, multidisciplinary approach to care at an advanced trauma center can enable optimal outcomes even in patients with the combination of rare, lethal injuries and tremendous injury burden.

Paper #44 5:30 pm, 3/2/12

White Phosphorus Burns and Arsenic Inhalation – A Toxic Combination

AE Berndtson, a Fagin, S Sen, DG Greengage, TL Palmier

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

Presenter: Allison E. Berndtson, M.D. **Senior Sponsor:** Christine Cocanour M.D.

We present the case of a 45 year old man with 8% TBSA 3rd-degree white phosphorus thermal and chemical burns to the face and upper extremities, as well as arsenic trioxide inhalation that occurred during an industrial explosion. White phosphorus is an incendiary agent that most often affects those exposed to wartime munitions; however, it also has numerous industrial uses. It spontaneously ignites in the presence of oxygen causing severe chemical and thermal burns. It also results in systemic toxicity due to absorption through damaged skin. Arsenic toxicity has similar manifestations including icterus, hemoglobinuria, anemia, seizures and hypocalcemia. In addition, arsenic poses long-term risks including malignancies of multiple organ systems. Crystals of arsenic with other heavy metals are components of transistors, semi-conductors, lasers and light-emitting diodes. These high technology applications often also include white phosphorus, thus putting skilled workers at risk of simultaneous exposures.

Our patient was injured in an industrial explosion causing aerosolization of these chemicals, with exposure of the patient's face and upper extremities. He was extensively decontaminated with water guided by the use of a blacklight lamp. Copper sulfate was not used given the risk of systemic toxicity and hemolysis. He underwent a full trauma workup in addition to assessment of his burns. His decontamination was complicated by a ruptured left globe with embedded phosphorus particles, ultimately requiring enucleation. His burns were treated with tangential excision and grafting.

His course was complicated by respiratory failure requiring extracorporeal membrane oxygenation (ECMO) and prolonged ventilator support, refractory hypotension despite resuscitation and use of vasopressors, small bowel ischemia requiring resection, acute renal failure treated with continuous renal replacement therapy, neuropathy and post-traumatic stress disorder. White phosphorus inhalation is known to induce chemical pneumonitis and non-cardiogenic pulmonary edema, which contributed to his severe pulmonary disease. Arsenic trioxide is the most toxic variant of inorganic arsenic, and was likely a contributing factor in his severe early hypotension and shock. Long term effects include peripheral neuropathy and delirium, which later arose in this patient. Diagnosis of arsenic toxicity proved challenging as blood arsenic levels required a multi-day turnover time; he ultimately underwent chelation therapy with succimer. He is currently recovering and undergoing intensive inpatient rehabilitation. This case highlights the complex nature of multiple chemical toxicities in the setting of severe thermal and chemical burns.