

KAPPAECL

THIRTIETH ANNUAL MEETING



February 27-March 4, 2000

Squaw Valley, Lake Tahoe

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WESTERN TRAUMA ASSOCIATION

30th Annual Meeting
Squaw Valley, Lake Tahoe
California
February 27 - March 4, 2000

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WESTERN TRAUMA ASSOCIATION

PAST PRESIDENTS

President	Year	Location
Robert G. Volz, M.D.	1971	Vail
Robert G. Volz, M.D.	1972	Vail
Peter V. Teal, M.D.	1973	Vail
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
Glen D. Nelson, M.D.	1978	Steamboat
Gerald D. Nelson, M.D.	1979	Snowmass
Kevin G. Ryan, M.D.	1980	Snowbird
David S. Bradford, M.D.	1981	Jackson Hole
Erick R. Ratzler, M.D.	1982	Vail
William R. Olson, 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. Neviasser, 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, M.D.	1999	Crested Butte
Barry C. Esrig, M.D.	2000	Squaw Valley

****The 2001 WESTERN TRAUMA ASSOCIATION Meeting will be:
Big Sky, Montana
February 24 - March 1, 2001**

Wloster
Feb 23 - March 3, 2002

WESTERN TRAUMA ASSOCIATION

EARL G. YOUNG, M.D.
(1928-1989)



RESIDENT PAPER COMPETITION

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, NY 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.

Dr. Young 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. Wagensteen Award for Academic Excellence from 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 at the Annual Meeting.

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

WESTERN TRAUMA ASSOCIATION

EARL G. YOUNG AWARD RECIPIENTS

<u>Resident</u>	<u>Institution</u>	<u>Year</u>
Joseph Schmoker, M.D.	University of Vermont	1991
Joseph Schmoker, M.D.	University of Vermont	1992
Charles Mock, M.D.	University of Washington	1993
Gino Travisani, M.D.	University of Vermont	1994
Phillip C. Ridings, M.D.	Medical College of Virginia	1995
David Han, M.D.	Emory University	1996
Preston R. Miller, M.D.	Wake Forest University	1997
Geoffrey Manley, M.D., PhD.	UC - San Francisco	1998
James M. Doty, M.D.	Medical College of Virginia	1999

WESTERN TRAUMA ASSOCIATION

Schedule

Sunday, February 27, 2000

- 1630 - 1930 Registration & Reception
- 1700 - 1800 Nominating Committee Meeting
- 1800 - 1930 Reception
- 1800 Past Presidents Meeting (Tom Thomas to announce time/location)

Monday, February 28, 2000

- 0630 - 0700 Breakfast
- 0720 - 0900 Scientific Session I
- 1600 - 1740 Scientific Session II
- 1740 WTA Board of Directors Meeting

Tuesday, February 29, 2000

- 0630 - 0700 Breakfast
- 0700 - 0800 Scientific Session III (Peds.)
- 0800 - 0900 Panel: Pediatric Trauma: Really They Are Just Small Adults
Moderator: Steve Cohn, M.D.
CON: Dennis Vane, M.D.
PRO: Peggy Knudson, M.D.
- 1000 - 1200 WTA Race *Give Cash? Life*
- 1600 - 1700 Scientific Session IV
- 1700 - 1800 Invited Guest Lecture: Jimmy Cornell "Between the Iron Curtain and The Deep Blue Sea"

Wednesday, March 1, 2000

- 0630 - 0700 Breakfast
- 0700 - 0800 Dr. Richard Gamelli "Cytokines: What are they, How do they Work, and Why do they Matter?"
- 0800 - 0900 Scientific Session V (Basic Science)
- 1200 Picnic at the Resort
- 1600 - 1645 Scientific Session VI
- 1645 - 1730 Presidential Address: Dr. Barry Esrig: "Old Concepts in a New Millennium"
- 1730 - 1900 WTA Business Meeting

Thursday, March 2, 2000

- 0630 - 0700 Breakfast
- 0700 - 0745 Dr. Leon Pachter: "Complex Liver Injuries"
- 0750 - 0830 Dr. Robert C. Mackersie " Pathophysiology of Brain Death and the Critical Care of The Potential Organ Donor"
- 0830 - 0850 Scientific Session VII
- 1600 - 1640 Scientific Session VIII
- 1700 - 1740 Case Report Session
- 1900 Annual Dinner/Banquet

Friday, March 3, 2000

- 0630 - 0700 Breakfast
- 0720 - 0840 Scientific Session IX
- 1600 - 1740 Scientific Session X

WESTERN TRAUMA ASSOCIATION

IN MEMORIAM

Earl G. Young, M.D.
February 27, 1989

Gerald S. Gussack
August 25, 1997

Scientific Paper Session I
Monday AM, February 28, 2000
Moderator: Barry Esrig, M.D.

0720 AM

PAGE

01 Outcome Following Major Renovascular Injuries: A WTA Multi-Center Report
MM Knudson, MD, PB Harrison, MD, DB Hoyt, MD, DV Shatz, MD, SP Zietlow, MD,
JM Bergstein, MD
San Francisco, Wichita, San Diego, Miami, Rochester, Peoria

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0720 AM

02 Efficacy of Fibrin Glue in a Novel Porcine Model of Hepatic Hemorrhage
CJ Hauser, MD, N Monajjem, MD, PF Glidden, PhD, S Herring, PhD, A Lagoo, MD,
G Bogen, MD
UMDNJ / NJ Medical School and U Miss Medical Center

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0800 AM

03 Management of Traumatic Rupture of the Aorta: Clinically Distinct Subgroups**
Y Carter, MD, S Demirer, J Borsa, MD, M Meissner, MD, S Brundage, MD,
G, Jurkovich, MD, R Karmey-Jones, MD
Depts. Of Surgery and Radiology, University of Washington

23

0820 AM

04 Long Term Beta-Blockade Decreases Hypermetabolism After Severe Burn
Injury**
DW Hart, MD, SE Wolf, MD, RR Wolfe, PhD, PI Ramzy, MD, DN Herndon, MD
The University of Texas Medical Branch

25

0840 AM

05 Are We Ready for the Blast? Terrorism: Prevention, Intervention Strategies**
MB Aboutanos, MD, MPH, J Yelon, DO, R Ivatury, MD, HJ Sugerman, MD
Medical College of Virginia of Virginia Commonwealth University

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** Earl Young Resident Competition

Scientific Paper Session II
Monday PM, February 28, 2000
Moderator: Steve Shackford, MD

1600 PM

PAGE

06 The Accuracy of Bed-Side Surgeon-Performed Ultrasound for the Detection of Pleural Effusion in Critically Ill Patients in the SICU
GS Rozycki, MD, DV Feliciano, MD, SD Pennington, BS, JP Salmone, MD,
WL Ingram, MD
Grady Memorial Hospital, Emory University

29

1620 PM

07 Utility of Futility of Cervical Flexion-Extension Radiographics in the Trauma Patient for Evaluating Cervical Spine Injury**
SM Patel, MD, JG Davalos, BA, D Hubbard, MD, J France, MD,
West Virginia University

~~31~~

1640 PM

08 Clearing the Cervical Spine with Dynamic Fluoroscopy: A Reappraisal
J W Davis, MD, KL Kaups, MD, SN Parks, MD, MA Cunningham, MD,
JF Bilello, MD, TP Nowak, MD
UCSF/Fresno, University Medical Center

33

1700 PM

09 Assessment of Tissue Viability in Complex Extremity Injuries: Utility of the Pyrophosphate Nuclear Scan**
DG Affleck, MD, L Edelman, RN, SE Morris, MD, JR Saffle, MD
University of Utah Department of Surgery

35

1720 PM

10 Efficacy of Thoracic Computerized Tomography in Blunt Chest Trauma**
W Yeane, MD, J Protetch, LA Omert, MD
Allegheny General Hospital

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To Follow:

WTA Board of Directors Meeting

** Earl Young Resident Competition

Scientific Session III - Pediatrics
Tuesday AM, February 29, 2000
Moderator: James W. Davls, MD

0700 AM

PAGE

11 Standardized Management of Pediatric Solid Organ Injury Based on Hemodynamic Status is Safe and Effective** 39
 JR Mehall, MD, RJ Jackson, MD, JS Ennis, BA, CW Wagner, MD, SD Smith, MD,
 Department of Pediatric Surgery, Arkansas Children's Hospital

0720 AM

12 Admission Base Deficit Predicts Outcome in Pediatric Trauma** 41
 EH Kincaid, MD, MC Chang, MD, JG Chen, PhD, RL Letton, MD, JW Meredith, MD
 Wake Forest University School of Medicine

0740 AM

13 Rib Fracture is Predictive of Non-Accidental Trauma in Children Less than 2 Years of Age 43
 DD Bensard, MD, ES Cha, MD, JD Strain, MD
 The Children's Hospital and University of Colorado

0800 - 0900 AM

Panel: Pediatric Trauma: Really They Are Just Small Adults 45
 Moderator: Steve Cohn, M.D.
 CON: Dennis Vane, M.D.
 PRO: Peggy Knudson, M.D.

*Svenson Annual Emergency Med 1996 ;
 pre hosp ped care 3 out of W. Va.*

*Colorado State System : 0-6 - Ped Trauma Center
 6-12 - Reg. Ped. Hosp or ATE
 12 + ATE*

** Earl Young Resident Competition

Scientific Session IV
Tuesday PM, February 29, 2000
Moderator: Harold Sherman, MD

1600 PM

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14 Acute Adrenal Insufficiency in the Integument-Compromised Patient **

47

A Fernandez, MD, JA Yelon, DO, RR Ivatury, MD

Dept. of Surgery, Section of Trauma, Critical Care & Burns, Medical College of Virginia

1620 PM

15 Steroid Rescue of Late ARDS Patients Decreases PMN Cytotoxicity and Cytokine Production**

49

DJ Ciesla, MD, PJ Offner, MD, EE More, WL Biffl, MD, JB Haenel, RT, G Zallen, MD
Denver Health Medical Care and University of Colorado HSC

1640 PM

16 The Importance of Gender on Outcome After Major Trauma: Functional and Psychologic Outcomes in Women Versus Men

51

TL Holbrook, PhD, DB Hoyt, MD

University of California, San Diego

1700 PM

Invited Guest Lecture: Jimmy Cornell

"Between the Iron Curtain and the Deep Blue Sea"

Sponsored by an unrestricted educational grant from Medtronic, Inc.

** Earl Young Resident Competition

Scientific Session V - Basic Science
Wednesday AM, March 1, 2000
Moderator: Harvey Sugerman, MD

0700 - 0800 AM

PAGE

Invited Lecture: Dr. Richard Gamelli, "Cytokines: What Are They, How Do They Work,
And Why Do They Matter"
Loyola University Medical Center

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0800 AM

17 The Development of Pathologic G-Protein Signaling in Trauma Neutrophils **
JM Adams, MD, CJ Hauser, MD, Z Fekete, MD, EA Deitch, MD, DH Livingston, MD
UMDNJ / NJ Medical School

55

0820 AM

18 Impaired Activation of ERK and p38 Mitogen Activated Protein Kinases and
Inhibition of TNF Secretion in Endotoxin Tolerant Human Monocytes
C Hansen, MD, W Heagy PhD, K Nieman, MS, JL Rodriguez, MD,
MA West, MD, PhD,
Hennepin County Medical Center, University of Minnesota

57

0840 AM

19 Effect of Small-Volume Resuscitation with Hemoglobin Substitute HBOC-201
on Brain Tissue Oxygenation Following Experimental Hemorrhagic Shock
G Mantley, MD, PhD, D Morabito, RN, MPH, J Hemphill, MD, V Erikson, BA,
J Holcroft, BA, N Derugin, MS, MM Knudson, MD
University of California San Francisco San Francisco Injury Center

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*7 applicable to ~~shaded~~ pts in WVa eventually
re HSD (Ingestor's Salivary Oxidation)*

R. Brown - Casson O3

Scientific Session VI
Wednesday PM, March 1, 2000
Moderator: Gage Ochsner, MD

1600 PM

PAGE

20 The Role of Ultrasonography (FAST) in Penetrating Abdominal Trauma**
KF Udobi, MD, A Rodriguez, MD, WC Chu, MD, TM, Scalea, MD
R Adams Cowley Shock Trauma Center, University of Maryland

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1620 PM

21 The Use of Ultrasound (US) for Blunt Abdominal Trauma: Resident Training,
Experience and Results
TM Willcox, MD, JR Wilcox, BS, K Bowiby, BA, SR Peterson, MD
St. Joseph's Hospital Trauma Center

63

1645 PM

Presidential Address: Dr. Barry Esrig
"Old Concepts In A New Millennium"
St. Michaels Medical Center, Heart Institute
Sponsored by an unrestricted educational grant from Guidant/CTS

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1730 - 1800 PM

WTA Annual Business Meeting

** Earl Young Resident Competition

Scientific Session VII
Thursday AM, March 2, 2000
Moderator: James W. Davis, MD

0700 - 0745 AM

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Invited Lecture: Dr. Leon Pachter, "Complex Liver Injuries"
NYU Medical Center

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0750 - 0830 AM

Invited Lecture: Dr. Robert Mackersie, "Pathophysiology of Brain Death and
the Critical Care of the Potential Organ Donor"
UCSF / San Francisco General Hospital
Sponsored in part by the California Transplant Donor Network

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0830 PM

22 Emotional Considerations and Attending Involvement Ameliorates Organ
Donation in Brain Dead Pediatric Trauma Victims
DW Vane, MD, KH Sartorelli, MD,
Department of Surgery, University of Vermont, College of Medicine

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monitoring
Support blood pressure >80
arginine vasopressin + epi or dopamine

DDAVP → DZ
AVA → DI, hypotension

keep volume up
central electrolytes during dialysis
tx hypothermia
tx coag w/protexin, c replacement

triiodothyronine

Scientific Session VIII
Thursday PM, March 2, 2000
Moderator: Tom Phillips, MD

1620 PM

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23 Trauma Surgeons' Guide to the Lunar Cycle
AC Praba, MD, CH Cook, MD, E McGuire, MD, LC Martin, MD,
The Ohio State University Department of Surgery

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1640 PM

24 Blunt Popliteal Artery Injury (BPAI): A Multispecialty Challenge
I Gregoric, MD, EB Akin, MD, R King, MD, P Adams, MD, M Kapusto, MD,
OH Frazier, MD, FA Moore, MD
University of Texas, Houston School of Medicine

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Case Reports Session
Thursday PM, March 2, 2000
Moderator: Tom Phillips, M.D.

1700 PM

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25 Management of Acute Epidural Hematomas in Remote Areas: A Vital Role for Telemedicine 77
BA Cairns, MD, JT Widergren, MD, R Whitton, BA, L Liem, MD
Section of Surgical Critical Care, Department of Surgery, University of North Carolina

1710 PM

26 Stent-Graft Repair of Acute Traumatic Thoracic Aortic Pseudoaneurysm with Intentional Occlusion of the Left Subclavian Artery: A Case Report 79
R Mattison, MD, IN Hamilton Jr., MD, DL Ciraulo, DO,
University of Tennessee College of Medicine

1720 PM

27 Blunt Injury to the Mitral and Tricuspid Valves: A Case Report and Review of the Literature 81
SH Bailey, MD, SK Karwande, MD, JR Saffle, MD
University of Utah Health Sciences Center

1730 PM

28 The Use of Sternocleidomastoid Muscle Flaps Combined Esophageal Common Carotid Injuries 83
A Losken, MD, G Rozycki, MD, DV Feliciano, MD
Grady Memorial Hospital, Emory University

1740 PM

29 Percutaneous Ultra-Sound Guided Thrombin Injection of Traumatic Pseudoaneurysms 85
KA Davis, MD, MA Mansour, MD, SS Kang, MD, N Labropoulos, PhD,
TJ Esposito, MD, MPH, GM Silver, MD, RL Reed II, MD
Loyola University Medical Center

** Earl Young Resident Competition

Scientific Session IX
Friday AM, March 3, 2000
Moderator: John McGill, MD

0720 AM

PAGE

30 Bone Transport: A Two-Stage Reconstruction for Septic Defects
G Cierny, MD
Resurgens Orthopaedics

87

0740 AM

31 Retrograde Nailing of Femoral Fractures: A Review of Twenty-Seven Cases
D DiPasquale, MD, C Spath, MD
Dept. of Orthopaedic Surgery, George Washington University Medical Center

89

0800 AM

32 Volume Performance Standards Beware: Quality Trauma Care Can be
Delivered by General Surgeons in Private Practice
V Sullivan, MD, RA Pomerantz, MD, S Huehl, RN, M. Walters, RN
St. Joseph Mercy Hospital

91

0820 AM

33 The Use of Trauma Data Bases to Determine Injury Survivability
WB Long, MD, WJ Sacco, PhD, G Burnstein, RN, MBA
Legacy Emanuel Hospital

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Scientific Session X
Friday PM, March 3, 2000
Moderator: James A. Edney, MD

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1600 PM	
34 Effect of Hemodilution on Intestinal Perfusion and Intramucosal pH Following Shock LN Diebel, MD, JG Tyburski, MD, SA Dulchavsky, MD Wayne State University	95
1620 PM	
35 Repair of Low Grade Penetrating Bladder Injuries: Few Adjuncts Required J Cuschieri, MD, KA Kralovich, MD Henry Ford Hospital	97
1640 PM	
36 Nipride in Resuscitation of Major Torso Trauma BA McKinley, PhD, RG Marvin, MD, CS Cocanour, MD, RM Pousman, DO, A Marquez, RN, DN Ware, MD, FA Moore, MD University of Texas-Houston Medical School / Hermann Hospital STICU	99
1700 PM	
37 Factors Associated with Abdominal Compartment Syndrome During Large Volume Shock Resuscitation RG Marvin, MD, BA McKinley, PhD, CS Cocanour, MD, RM Pousman, DO, A Marquez, RN, FA Moore, MD University of Texas-Houston Medical School / Hermann Hospital STICU	101
1720 PM	
38 Case Management and Clinical Pathways: An Objective Analysis of their Role in Clinical Trauma Care M Sugrue, MD, J Sesperez, MD, S Wilson, MD, M Seger, MD Trauma Department, Liverpool Hospital	103

ABSTRACTS





OUTCOME FOLLOWING MAJOR RENOVASCULAR INJURIES: A WTA MULTI-CENTER REPORT

MM Knudson, MD, PB Harrison, MD, DB Hoyt, MD,
DV Shatz, MD, SP Zietlow, MD, JM Bergstein, MD

M. Margaret Knudson, MD
M. Margaret Knudson, MD
San Francisco, Wichita, San Diego, Miami, Rochester, Peioria

Background: Major renal vascular injuries are uncommon and frequently associated with a poor outcome. In addition to renal dysfunction, posttraumatic renovascular hypertension may result, although the true incidence of this complication is unknown. **Objectives** To describe the factors contributing to outcome following major renovascular trauma. We hypothesized that the highest percentage of renal salvage would be achieved by minimizing the time from injury to repair. **Design:** Retrospective chart review over a 16-year period. **Setting:** Six university trauma centers. **Subjects:** Patients with AAST Grade IV/V renal injuries surviving > 24 hours. **Main Outcome Measures:** Post-injury renal function, with poor outcome being defined as: renal failure requiring dialysis, serum creatinine ≥ 2 mg/dl, renal scan showing less than 50% renal function, post-injury hypertension requiring treatment, or delayed nephrectomy. **Methods:** Data collected for analysis included demographics, mechanism of injury, presence of shock, presence of hematuria, associated injuries, type of renal injury (major artery, renal vein, segmental artery), type of repair (primary vascular repair, revascularization, observation, nephrectomy), time from injury to definitive renal surgery, type of surgeon performing operation (urologist, vascular surgeon, trauma surgeon). **Results:** 89 patients met inclusion criteria. 49% were injured from blunt mechanisms. Patients with blunt injuries were 2.27 times more likely to have a poor outcome than those with penetrating injuries. Similarly, the odds ratio for Grade V (n = 31) vs Grade IV (n = 58) severity was 2.6 (p=0.08, 95% CI=[1.02,6.63]. Artery repairs had significantly worse outcomes than vein repairs (p = 0.01). Neither the time to definitive surgery nor the operating surgeon's specialty significantly affected outcome. 10% (9 patients) developed hypertension or renal failure post-operatively: 3 with immediate

PROCEDURE	Outcome		Total Number
	% Good	% Poor	
Observation Only	52%	48%	21
Immediate Nephrectomy	79%	21%	33
Arterial Repair/Bypass	33%	67%	12
Venous Repair	91%	9%	11
Partial Nephrectomy/ Parenchymal Repair	67%	33%	12

nephrectomies, 4 had arterial repairs with 1 intra-op failure requiring nephrectomy, and 2 were observed. Of the 16 good outcomes for Grade V injuries, 15 had immediate nephrectomy and 1 was observed. **Conclusions:** It appears that the outcome following major renovascular

trauma is related to the mechanism and severity of the trauma, rather than to the treatment. Patients with blunt vascular injuries are likely to have associated major parenchymal disruption, which contributes to the poor function of the revascularized kidney. These patients may be best served by immediate nephrectomy, provided that there is a functioning contralateral kidney.

Notes

unstable - nephrectomy

GRADE IV - repair

GRADE V - nephrectomy unless bilateral then stent/repair
one in $< 4^\circ$

EFFICACY OF FIBRIN GLUE IN A NOVEL PORCINE
MODEL OF HEPATIC HEMORRHAGE

CJ Hauser MD, N Monajjem MD, PF Glidden PhD, S Herring
PhD, A Lagoo MD, G Bogen MD.

UMDNJ / NJ Medical School and U Miss Medical Center

CJ Hauser MD

DH Livingston MD

Newark, NJ

Background: Control of hepatic parenchymal hemorrhage can be a challenge. Advances in blood banking have allowed development of fibrin sealants free from infectious agents. Such agents are useful however, only if convenient, quick acting and effective. Evaluation of hemostatics has been limited by a lack of appropriate models of traumatic hepatic hemorrhage. We developed a non-anticoagulated porcine hepatic hemorrhage model calibrated to yield 8-10% total blood volume hemorrhage. We used this model to evaluate an all-human, rapidly soluble, high tensile strength fibrin glue in control of hepatic hemorrhage from parenchyma and medium sized vessels.

Materials and Methods: 35 Kg Yorkshire pigs underwent laparotomy (n=21). Hepatic artery pressure was limited by ligating the gastrohepatic trunk central to the proper hepatic artery. Hepatic arterial perfusion is thus based on retrograde flow from gastric collaterals. 10 cm mid-lobar amputations were created under hilar occlusion. After suture ligation of vessels $\geq 3\text{mm}$, animals were randomized to no treatment (CON, n=6), thrombin spray (THR, n=7), or fibrin glue spray (FG, n=8) for control of residual bleeding. After a one minute treatment hilar clamps were removed. Shed blood was collected for 10 min. Incisions were closed and animals recovered. Animals were sacrificed and hepatic healing was examined at 2, 7, and 21 days post operative. Statistical analysis was by Kruskal-Wallis' test followed by Dunn's pairwise analysis.

Results: All animals survived. There were no differences in the size of liver injuries in the three groups. Blood loss averaged 196 ± 38 grams (17.4 ± 3.9 grams per cm^2 of liver injury) in the CON group, 31 ± 12 grams (3.0 ± 1.2 g/cm^2) in the THR group, and 2 ± 1 grams (0.2 ± 0.1 g/cm^2) in the FG group. Kruskal-Wallis test showed that FG was superior to the THR and CON groups ($P < 0.001$). Dunn's pairwise analysis confirmed only FG treatment group results in less bleeding than CON. Necropsy revealed no blood, bile or pus collections. Pathologic evaluation revealed that healing of hepatic injuries was unaffected by these topical hemostatics.

Conclusions: FG is an effective topical hemostatic agent used for adjunctive control of parenchymal hepatic hemorrhage. Modern formulations can be shown in this model to achieve near total hemostasis of parenchymal and medium sized vessel bleeding when applied topically under in-flow control.

Notes

MANAGEMENT OF TRAUMATIC RUPTURE OF THE AORTA: CLINICALLY DISTINCT SUBGROUPS

Y. Carter MD, S. Demirer MD, J. Borsa MD*, M. Meissner MD, S. Brundage MD, G. Jurkovich MD, R. Karmy-Jones MD
Depts of Surgery and *Radiology, University of Washington
Yvonne M. Carter, MD

Riyad Karmy-Jones, MD

Seattle, Washington

Background: Until recently traumatic rupture of the aorta (TRA) has been treated, almost uniformly, as a surgical emergency. We propose that the contemporary management of TRA be based on specific factors – anatomy of the injury and presenting patient physiology – which are independent determinants of outcome.

Methods: A retrospective chart review was used to identify patients sustaining a blunt thoracic injury over a 14 year period. Data describing patient physiology, injury severity (ISS), and outcome were collected from medical charts, angiograms, operative notes, and medical examiner reports. Patients were classified based on presenting blood pressure (stable: SBP>90mmHg; unstable: ≤90mmHg, or >90mmHg with acute decompensation) Patients were assigned "low" or "high" operative risk based on the presence of one of the following: s/p CABG, blunt myocardial injury, pulmonary contusion, and coagulopathy. Injuries were defined as proximal (≤1cm) and distal (>1cm), based on distance from the left subclavian artery (LScA). The impact of cardiopulmonary bypass (CPB) was evaluated. Conditional logistic regression was used for statistical analysis.

Results: 122 patients (39.2 ± 18.7 years) were identified, with average TRISS 0.782 ± 0.345 and ISS 32.5 ± 14.8. The overall mortality for the study series was 36.1% (42/122). Preoperative physiology was found to impact on mortality. Death was inevitable for patients presenting without vital signs and/or in arrest with massive hemothorax. The overall 65.9% (27/41) mortality rate in unstable patients was significantly higher than in stable patients (18.5%, p=0.001). 107 patients were managed surgically, 38 of which were defined as "high" risk. The "high" risk group had a significantly higher mortality rate (19/38 vs. 16/69, p=0.001). Deliberate delay in surgical repair of "high" risk patients, resulted in a significantly reduced mortality (1/7 vs. 18/31, p=0.02). All except two injuries involved the isthmus of the descending aorta, of which 47 were proximal, 54 distal, and 19 undefinable. Injuries ≤1cm of the LScA were associated with significantly higher rates of rupture (16/47 vs. 6/54, p=0.003), vocal cord injury (10/47 vs. 0/54, p=0.02), and longer cross clamp times (44±12 min vs. 33±10 min, p<0.05). Univariate analysis identified a significant difference in postoperative paralysis when CPB was used (0/47 CPB vs. 8/60 no CPB, p=0.009); however, multivariate analysis did not identify CPB as an independent factor.

Conclusion: Ultimately the surgical management of this disparate patient population must consider the presenting physiology and exact anatomy of the aortic injury. We conclude that injuries within 1cm of the LScA are a distinct subgroup with increased morbidity, mortality, and technical difficulty. Left heart bypass is an important, but not independent factor of morbidity and mortality in this patient population.

Notes

LONG TERM BETA-BLOCKADE DECREASES HYPERMETABOLISM AFTER SEVERE BURN INJURY

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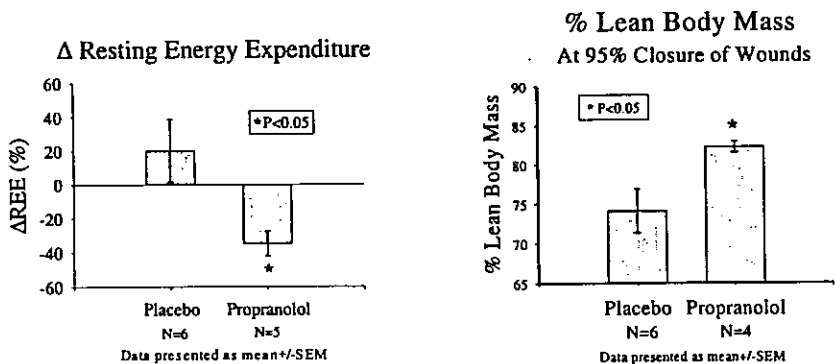
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Introduction: The catecholamine-mediated hypermetabolic response to severe burn directly causes tachycardia and increased energy expenditure. Protein catabolism, associated with the hypermetabolic response, may harm patients through muscle atrophy, weakness, delayed healing, and respiratory muscle insufficiency. Beta blockade with propranolol has been shown to decrease heart rate and cardiac work after burn. We hypothesize that propranolol may decrease systemic hypermetabolism as measured by resting energy expenditure and thus lead to less muscle atrophy.

Methods: Eleven severely burned (>40% TBSA) children over the age of two were studied in a prospective, randomized, double blind trial. All were clinically treated in a similar manner, including early excision and grafting, appropriate anti-microbial therapy, and nutritional support. Five of the subjects received oral propranolol for one month and six were placebo controls.

Indirect calorimetry was performed in a resting state before and after the treatment period to measure the subjects' resting energy expenditures. When judged to be 95% healed by the attending surgeon, the lean body mass of ten of the subjects was measured by dexamorphometry.

Results: Placebo and propranolol subjects were statistically similar in age, weight, %TBSA burned, %3rd degree, and time from injury. During beta blockade, the heart rates and cardiac work of the propranolol group were lower than baseline and lower than those of the matched control group ($p < 0.05$). Resting energy expenditure increased over 4 weeks in placebo treated subjects but decreased significantly in the propranolol group. Likewise, % lean body mass was higher in subjects who received propranolol.



Conclusion: Long term beta-blockade with propranolol decreases systemic hypermetabolism after severe injury. When given for at least one month, this treatment causes a significant sparing of lean body mass.

Notes

ARE WE READY FOR THE BLAST?
TERRORISM: PREVENTION, INTERVENTION STRATEGIES
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Background: Since 1968, Terrorism has escalated to a worldwide level with bombing accounting for nearly 50% of all international terrorists attacks. Domestically, terrorist bombing and bombing attempts increased by 400% in the last decade with noted targeting of federal and government facilities. Most efforts concentrated on the delineation of the pathophysiology of blast injuries and the resultant clinical presentations and management. Only minor references to injury control measures, mostly long-term measures are undertaken. Little, to no efforts fully addressed the various long term and short-term integrative strategies for injury prevention, intervention, and suppression measures to minimize the impact of terrorist bombing and optimize effective mass- casualty triage and management.

Methods: 1)Haddon's injury control paradigm of considering an injury through the interaction of several factors (host, agent, and environment) over distinct phases of time (pre-event, event, and post-event) was herein applied to review the current understanding of terrorist bombing injuries and to highlight the current and potential disaster preventive and management strategies 2) A review of published experiences and governmental documents providing a reference population of 6,470 casualties from 242 bombing incidents was carried out.

Results: Although the mechanisms of terrorist bombing are varied, their effects show a consistent pattern of injuries and death. In all setting, the majority of injuries are subcritical (67%-85%). Most common fatal injuries are multiple injuries (50-73%), head injuries (14-71%) and traumatic amputations (8-11%). Blast lung is uncommon (0.6-3%). Risk factors for fatal injuries include - the agent: high explosive charge, the environment: confined spaces, collapsible structures, upper floors, and the host: children. Most common non-fatal injuries are soft tissue injuries (55-90%) musculoskeletal damage (11-35%), and tympanic membrane ruptures (14-68%). Risk factors for minor and moderate injuries include: the Environment: open air, glass and flying debris; the Host: exposed skin areas, and the Agent: low explosive charge, bomb casing. Post-event risks of mortality include delay in treatment, undertriage and overtriage. Positive factors in disaster management include prior experience, advanced emergency preparedness, routine disaster drills, and evacuation and rescue capabilities.

Conclusions: Prevention and intervention strategies to minimize the impact of terrorist bombing demand an integrative approach that includes 1) environment modification (short-term: access limitation; long-term: structural changes 2) modification of host vulnerability and behavior, and 3) modification of availability and lethality of modern explosive agents. Finally, familiarity of all trauma centers with mass casualty management and spectrum of blast injury patterns is essential in all pre-event, event, and post-event phases.

Notes

Bill Haddon's injury control paradigm

Host Agent Environmental factors

Pre Event			
Event			
Post Event			

GO TEAMS

EMRT

Emergency and response teams

THE ACCURACY OF BED-SIDE SURGEON-PERFORMED
ULTRASOUND FOR THE DETECTION OF PLEURAL
EFFUSION IN CRITICALLY ILL PATIENTS IN THE SICU
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HYPOTHESIS: Surgeon-performed ultrasound (US) is an accurate technique for the diagnosis of pleural effusion in critically patients in the Surgical Intensive Care Unit (SICU).

METHODS: Serial focused thoracic bedside ultrasound examinations were performed for early detection of pleural effusion in patients admitted to the SICU. US examinations were performed with the patients in the supine position. Hard copies and videotapes were made of all examinations which were later reviewed by an experienced surgeon-sonographer. US results were compared with the radiologists' readings of the portable upright chest x-rays and/or CT scans or the effluent from the thoracentesis or tube thoracostomy. The patients were followed throughout their SICU course.

RESULTS: Serial focused thoracic ultrasound examinations were performed in 47 patients in the SICU. The mean age was 44.4 years, and the indication for SICU admission was trauma (55%) or other (45%). 140 thoracic cavities were evaluated yielding 85 true negatives, 46 true positives, 9 false negatives, and zero false positives (Sensitivity = 83.6%; Specificity = 100 %; Accuracy = 94%). Of those patients with true positive results, early thoracentesis or tube thoracostomy was performed in five patients. Eight of the 9 patients with false negative examinations had effusions detected on CT scans while the other patient had the effusion detected on a chest x-ray.

CONCLUSION: Surgeon-performed ultrasound is an accurate method to detect pleural effusion in critically ill patients.

RECOMMENDATION: Bedside ultrasound should be the initial way to detect pleural effusion in this patient population.

Notes

**UTILITY OR FUTILITY OF CERVICAL FLEXION-
EXTENSION RADIOGRAPHS IN THE TRAUMA PATIENT
FOR EVALUATING CERVICAL SPINE INJURY**

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Objective: The purpose of this study is to compare the sensitivity and specificity of complete cervical spine radiographs (CCS) to cervical flexion-extension radiographs (FE) in determining unstable fractures or dislocations in trauma patients.

Design: A two-year retrospective analysis of 1483 consecutive trauma patients, at a Level I Trauma Center, was conducted. Patients who underwent FE in addition to CCS (AP, Lateral, Odontoid, +/- Swimmers, +/- Obliques) were evaluated. Interpretations of the films were compared and classified as normal, equivocal, or abnormal. Abnormal films were defined as having >2mm translation, >11 degrees of angulation at any segment, or evidence of acute bony fracture. Exclusion criteria included those patients with prior surgical stabilization of the cervical spine, patients who underwent FE after surgical or halo stabilization, or patients that had FEs >1 month after injury. Abnormal plain films, MRI, or CT determined presence of disease. Unequivocally normal plain films, MRI, or CT determined absence of disease.

Results: Out of 299 patients, 21 had cervical spine injury. It should be emphasized that this does not include all trauma patients with cervical spine injuries, only those who underwent FE evaluation in addition to a CCS. The sensitivity and specificity of CCS for cervical spine injury were 95% and 96% respectively. Positive (PPV) and negative predictive values (NPV) were 70.4% and 98.8% respectively. The sensitivity and specificity of FE were 90.5% and 99.5% respectively. The PPV and NPV were 90.5% and 98.9% respectively. The differences between the two tests were not statistically significant by the Z test for proportional analysis. FEs were equivocal in 32.6% of the studies. Of these 35.6% were equivocal because of inadequate visualization of the cervicothoracic junction and 53.5% were equivocal secondary to inadequate range of motion (ROM). Of the inadequate ROM films, 85.2% were filmed within 48 hours of initial assessment.

Conclusions: The data demonstrates that CCS radiographs without FEs can adequately assess initial evaluation of the cervical spine in the trauma patient. Approximately one-third of all FEs were equivocal; greater than one-half of these were secondary to inadequate ROM. Furthermore, an overwhelming majority (85.2%) of these were filmed within 48 hours of presentation at which time the patient is generally experiencing the greatest amount of muscle spasm/guarding. Delaying FEs could prove useful in decreasing the number of equivocal studies secondary to poor ROM. The yield of FEs could be greatly increased by allowing resolution of the acute muscle spasm over a period of ten to fourteen days after unequivocally negative CCS films. In the event of an equivocal CCS with suspicion of injury, further investigation may be necessary which may or may not include FEs. For abnormal CCS, an FE may be indicated to determine the instability of the injury. The costs of equivocal FEs were substantial. The purpose of this study was not to eliminate the use of FEs but rather to promote measures that may increase its yield in this health cost conscious environment. The limitations of this study include an absence of a gold standard for ligamentous injury detection, lack of a defined protocol for obtaining FEs, as well as selection and recall bias due to the retrospective design. A prospective design with a defined algorithm and implementation of the current gold standard (MRI) would address these limitations and better elucidate the best indications for the use of FE radiographs.

Notes

CLEARING THE CERVICAL SPINE WITH DYNAMIC
FLUOROSCOPY: A REAPPRAISAL
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Background: Clearing the cervical spine (c-spine) in obtunded patients remains controversial. Recommendations include removal of the cervical collar after 48 hours (with normal radiographs), indefinite collar immobilization and dynamic fluoroscopy flexion-extension examinations. The purpose of this study was to evaluate the efficacy and safety of dynamic fluoroscopy flexion-extension examinations in identifying ligamentous cervical spine injury in obtunded patients.

Methods: Patients with a GCS < 13 for greater than 48 hours after admission, and normal cervical radiographs were candidates for fluoroscopic evaluation. The protocol required visualization of the entire c-spine (C1 through T1) through full extension and flexion, by a member of the trauma team under the direct supervision of a radiologist. Oblique fluoroscopic views were obtained, as necessary, to visualize the cervico-thoracic junction. Demographic data, fluoroscopy time, total time per study, and true and false positives and negatives were recorded. Data are presented as mean \pm SEM.

Results: From 7/92 through 9/99, fluoroscopic examinations were performed on 281 patients. Mean patient age was 33 ± 0.9 years, and 79 % were men. The mean ISS was 31 ± 0.8 , the head AIS score was 4 ± 0.1 and the mean GCS at the time of fluoroscopic examination was 8 ± 0.2 . Fluoroscopy was performed 6 ± 0.2 days after admission, and required approximately 18 minutes for the entire examination with 84 ± 2 seconds of fluoroscopy time.

True Negatives	True Positives	False Negative	False Positive
277	2	1	1

The incidence of ligamentous injury identified by fluoroscopy in this study was 2/281 (0.7 %). The true positive examinations revealed a 2 mm subluxation (treated conservatively), and a C1 transverse ligament disruption (treated with a halo brace). The false negative examination occurred after 2 protocol violations, including misreading the original c-spine series as “normal” (with C6-7 and C7-T1 subluxations) and failure to visualize the entire c-spine on fluoroscopy (C1 through C6 only). This patient became quadriplegic. The false positive examination was suspicious for widening of the C7 foramina on flexion, but MRI demonstrated no ligamentous injury.

Conclusions: Dynamic fluoroscopy can be used to both clear the cervical spine and identify occult ligamentous injuries. Although the incidence of ligamentous injury is low (0.7 %), it is real. The complication of fluoroscopy would not have occurred had either protocol violation not occurred.

Notes

ASSESSMENT OF TISSUE VIABILITY IN COMPLEX
EXTREMITY INJURIES: UTILITY OF THE PYROPHOSPHATE
NUCLEAR SCAN

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Introduction: Extensive extremity injuries may mandate difficult decisions regarding the necessity for amputation or radical debridement. Clinical assessment, microscopy, and angiography have all been used for this purpose. During the past decade, we have used Technetium-99 Pyrophosphate (PyP) scanning as an adjunct in this setting. In this technique, intravenous injection of Technetium-99 Pyrophosphate is followed by immediate scintigraphy. The isotope localizes to soft tissues with normal perfusion while non-vascularized areas appear as "cold" spots. This study was performed to assess the accuracy of the Technetium-99 Pyrophosphate (PyP) scan in predicting the need for amputation in relation to clinical, operative and pathological findings.

Methods: Review of our computerized registry identified 11 patients (10 male; age 36.1 ± 14.9 years) admitted from 1990-1999 who underwent PyP. Patient demographics as well as initial clinical impression of tissue viability and pulses were recorded. Accuracy of PyP was graded as supporting or refuting the clinical impression and as accurate or inaccurate compared to the operative and pathological findings.

Results: Eight patients suffered high-voltage electrical injuries, one had severe frostbite, and two suffered soft-tissue infections. Initial decompression/exploration of extremities was performed at 2.5 ± 1.6 hours following admission. PyP was obtained 3.8 ± 3.8 days following admission. In most cases, the scan showed clear demarcation of viable and non-viable tissue, verifying the need for amputation (positive); those which demonstrated viable distal tissues were considered negative. Nine patients required amputation, eight of which had positive scans (true positives), subsequently verified by operative and pathological examination of the specimen. In one case, the scan was negative but delayed amputation was eventually required (false negative). In two cases, surgeons delayed performing amputation based on PyP scan results, and the limbs eventually healed (true negatives). PyP thus had a sensitivity of 89%, specificity of 100% and an accuracy of 91% in this setting. Time from injury to admission correlated with disparity between clinical impression and PyP results ($p < 0.05$). Absence of pulses in the injured extremity on admission correlated with PyP scan accuracy ($p < 0.05$).

Conclusions: Technetium-99 Pyrophosphate scanning is a useful adjunct in predicting the need for amputation in extremities damaged by electrical injury, frostbite, or invasive infection. In addition, by providing an objective "picture" of extremity perfusion, PyP scans can be helpful in convincing patients of the need for amputation.

Notes

EFFICACY OF THORACIC COMPUTERIZED TOMOGRAPHY IN
BLUNT CHEST TRAUMA

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Background: A small number of studies have suggested that thoracic computed tomography (TCT) is superior to plain chest roentgenogram (CXR) in the detection of blunt chest injury. Controversy remains, however, on when to use TCT imaging in the acute evaluation of the trauma patient. This study was designed to determine whether TCT provides additional information to routine CXR findings, and whether that additional information results in a change in management. A second question is whether TCT is useful in patients with particular mechanisms of injury.

Methods: We performed a prospective study of patients presenting to a Level I Trauma Center over an eight month period. Patients were placed into 2 groups. In the control (CTL) group, patients underwent TCT due to either clinical chest symptoms/ signs or abnormal findings on CXR. The mechanism (MECH) group contained patients who had no thoracic complaints or signs and a negative CXR, but who had one of the following mechanisms of injury: motor vehicle crash (MVC) with ejection, rollover MVC, high speed MVC (> 55 mph), head on collision, t-bone MVC, and falls > 10 feet.

Results: 169 patients were enrolled in the study (110 CTL, 59 MECH). TCT identified injuries not seen on CXR in 70% of the CTL and 39% of the MECH group. The injuries identified included pulmonary contusion (18%), pneumothorax (17%), hemothorax (8%), rib fractures (10%) and aortic injury (4%). Identification of these injuries resulted in a change in clinical management in 26% of the CTL group and 10% of the MECH group. The change in management between the two groups is highly significant ($p < .001$ by t-test). Additionally, the CTL patients had significantly higher chest AIS scores and significantly longer lengths of stay (ICU and total) and number of days on the ventilator ($p \leq .005$). Within the MECH group, there was no statistically significant difference between mechanisms with respect to these variables.

Conclusions: TCT is a useful modality in the acute evaluation of trauma patients. It appears to be most helpful when roentgenographic evidence of chest injury exists and provides information that impacts on the care of the patient 26% of the time. Additionally, in patients with severe mechanisms of injury and normal CXRs, TCT expeditiously identifies occult chest injuries which require treatment in 10% of this population.

Notes

STANDARDIZED MANAGEMENT OF PEDIATRIC SOLID ORGAN INJURY BASED ON HEMODYNAMIC STATUS IS SAFE AND EFFECTIVE

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Nonoperative management of traumatic pediatric solid organ injury traditionally involves bedrest, intensive care monitoring, and activity restriction with duration of management based on injury grade as determined by CT. Adult literature and our data refute the use of injury grade to guide clinical management. Controversy still surrounds the need for intensive care monitoring, prolonged hospital stays, and the duration of activity restrictions. This study prospectively evaluated the safety and effectiveness of standardized management based on hemodynamic status.

A standardized clinical pathway for hemodynamically stable pediatric patients with blunt liver and/or spleen injury was developed and instituted from November 1, 1996 to October 1, 1999. Patient selection was based on vital signs without regard to injury grade on CT. Patients with head injury requiring ICU admission and those with injuries requiring hospitalization beyond 48 hours were excluded. The pathway involved admission to a pediatric surgical unit, Q2 hour vital signs for the first 8 hours, Q6 hour hematocrits, and bedrest for 18 hours. Patients with a stable hematocrit and no abdominal tenderness after 18 hours were allowed to ambulate and fed a regular diet. Discharge occurred 48 hours post injury if patients had no abdominal tenderness, tolerated a regular diet, and had a stable hematocrit. Patients were allowed regular activity, including school, after discharge. Patients were followed at one month with ultrasound imaging and allowed to return to full-contact sports if healing was documented. Pathway patients were compared to a matched cohort of patients collected from the previous year. Statistical significance was determined using a students t-test with $p < 0.05$ considered significant.

89 patients sustained blunt liver and/or spleen injury during the 35 month study period, 44 stable patients without excluding injuries entered the pathway (49%), 42 completed the pathway (95%). One patient left the pathway due to traumatic pancreatitis, and one left after developing a biloma. Grade III or IV injuries occurred in 14/42 (33%) pathway patients, and 6/16 (38%) of controls. Length of stay was significantly reduced compared to controls ($p = 0.005$) (Table 1).

Table 1	Pathway	Control	P value
Patients	42	16	n/a
Age (years)	8.5+/-4.8	8.5+/-5.4	0.83
Injury Severity Score	10.6+/-6.3	8.3+/-4.8	0.19
Liver injury grade	2.1+/-1.0	2.2+/-0.9	0.47
Splenic injury grade	2.3+/-1.0	2.2+/-0.9	0.79
Length of Stay (days)	2.3+/-0.8	3.4+/-1.7	0.005
Follow-up (days)	30.0+/-7.6	28.8+/-11.6	0.41

All patients were managed nonoperatively without transfusion. Ultrasound documented healing in 46 of 47 patients (98%), with one splenic pseudoaneurysm found on follow-up ultrasound. Follow-up was 31/42 (74%) and 12/16 (75%) without delayed bleeding or other complications.

Management of pediatric solid organ injury should be guided by hemodynamic status and not injury grade on CT. Children can be safely managed without intensive care monitoring, do not need prolonged bedrest or hospitalization, and can return to regular activity 48 hours after injury.

Notes

ADMISSION BASE DEFICIT PREDICTS OUTCOME IN PEDIATRIC TRAUMA

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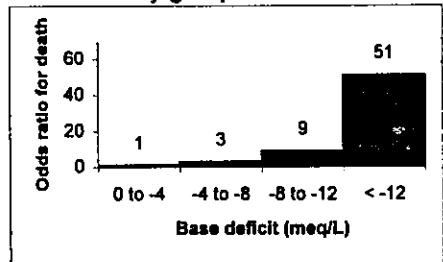
Background: Admission base deficit is an excellent indicator of injury severity and outcome in adult trauma but has not been studied in pediatric trauma.

Purpose: To study the association between admission base deficit and outcome in the pediatric trauma population.

Methods: The study population included all patients in the National Trauma Data Bank (NTDB) over a two year period aged 0-12 years with a base deficit recorded from the emergency department (ED). Age, presence of severe closed head injury (AIS \geq 3), and severity of base deficit were analyzed with respect to mortality using logistic regression and chi-square. A base deficit of 0 to -4 meq/L was assigned a mortality odds ratio (OR) of 1.

Results: Of 6,684 patients aged 0-12 years in the NTDB during the study period, 635 had a base deficit measured in the ED. Of these patients, 515 had a value between 0 and -30 and comprised the study group. The overall mortality for this group was 14%.

Base deficit was a strong predictor of death (see figure). Mortality for children with base deficit less than -12 was significantly worse than for those with base deficit between -8 and -12 (71% versus 33%, $p < 0.001$) and -4 to -8 (71% versus 12%, $p < 0.001$). The presence of a closed



head injury, controlling for base deficit, was associated with increased mortality (OR 2.6, $p = 0.004$). There was no relationship between age and mortality.

Conclusions: In injured children, a base deficit less than -12 meq/L is associated with profound physiologic derangement and an extremely high mortality.

Notes

RIB FRACTURE IS PREDICTIVE OF NON-ACCIDENTAL TRAUMA IN CHILDREN LESS THAN 2 YEARS OF AGE

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Purpose: Non-accidental trauma (NAT) is a mechanism of injury unique to children and accounts for two thirds of injuries occurring in children less than 2 years of age. Up to a third of abused children suffer rib fractures. Conversely, rib fractures in children unlike adults occur infrequently following major torso trauma. We hypothesized that rib fracture is predictive of NAT in young children.

Setting: Regional Pediatric Trauma Center / Children's Hospital

Methods: All imaging reports (chest film, skeletal survey, rib series) from 1992-1998 were reviewed to identify children with rib fracture. Age, sex, mechanism of injury, location of fractures were determined from a retrospective review of the medical record. For the purposes of analysis children were stratified according to age. All children suspected of abuse were evaluated by the Child Protection Advocacy (CAP) team and if confirmed given the diagnosis of NAT.

Results: Seventy-five children (ages 1 month to 15 years) with one or more rib fractures were identified: age < 2 years = 61 (80%); age > 2years = 17 (20%). Rib fracture(s) were determined to result from NAT = 51/73 (70%) ; NON-NAT (eg. skeletal dysplasia) = 19/73 (26%); BLUNT TRAUMA (eg. motor vehicle crash) = 8/73 (11%)

<u>AGE</u>	<u>NAT</u>	<u>NON-NAT</u>	<u>BLUNT TRAUMA</u>
< 2 years	51	9	1
> 2 years	0	10	7

Conclusions: We found that rib fractures resulting from blunt trauma are uncommon in children. Rib fracture in children less than 2 years of age is highly suggestive of non-accidental trauma. Excluding those children with known mechanism of injury or skeletal dysplasia, the positive predictive value of a rib fracture as an indicator of NAT is 98%. Therefore, NAT must be excluded in any young child with a single rib fracture and the absence of appropriate history.

Notes

**PANEL: PEDIATRIC TRAUMA:
REALLY THEY ARE JUST SMALL ADULTS**

**MODERATOR: STEVE COHN, M.D.
CON: DENNIS VANE, M.D.
PRO: PEGGY KNUDSON, M.D.**

Notes

ACUTE ADRENAL INSUFFICIENCY IN THE
INTEGUMENT-COMPROMISED PATIENT

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Hypothesis: Acute adrenal insufficiency is an uncommon cause of hemodynamic instability in the surgical patient. Substantial literature concerning the hypoadrenal state in Burn Unit patients is lacking. We recently identified a cohort of patients who either had a random cortisol level <15 mcg/dl or who had an inappropriate response to ACTH stimulation. Our hypothesis was that acute adrenal insufficiency worsens underlying disease prognosis integument-compromised patients.

Methods: Random serum cortisol levels were obtained on patients in whom physiologic response to fluid or inotropic therapy was thought to be inadequate. All patients presented with systemic inflammatory response syndrome or sepsis. ACTH stimulation tests were then performed by administering 250 mcg Cosyntropin intravenously, and serum cortisol levels obtained at 30 and 60 minutes post stimulation. Data was then collected on cortisol levels, average length of stay (LOS) and ICU LOS, APACHE II scores on admission and at the time of diagnosis of hypoadrenalism. Survival was the outcome measured. Once a diagnosis of acute adrenal insufficiency was made all patients were treated with hydrocortisone.

Results: Over a period of eight months a total of 9 patients, in our burn center, were identified with acute adrenal insufficiency. There were 4 women and 5 men. The etiology of integument compromise was 5 thermal injuries, 2 necrotizing fasciitis, and 2 calciphylaxis. Results, expressed as mean, are:

Age (yrs)	LOS Total/ICU	Cortisol (mcg/dl)	Δ cortisol 30 min/60 min	Admission APACHE	↓ cortisol APACHE
52.6	77/61.9	15.1	4.7/6.7	17.4	27.1*

* $p < 0.05$

Six patients died.

Conclusion: In our patient group the APACHE II disease severity score was found to be significantly elevated at the time of diagnosis with acute adrenal insufficiency compared to the score at admission. Six of our nine patients died as a result of their disease. In our experience, acute adrenal insufficiency is a marker of poor prognosis in the integument compromised critically ill patient.

Notes

STEROID RESCUE OF LATE ARDS PATIENTS DECREASES PMN CYTOTOXICITY AND CYTOKINE PRODUCTION

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 Denver, Colorado

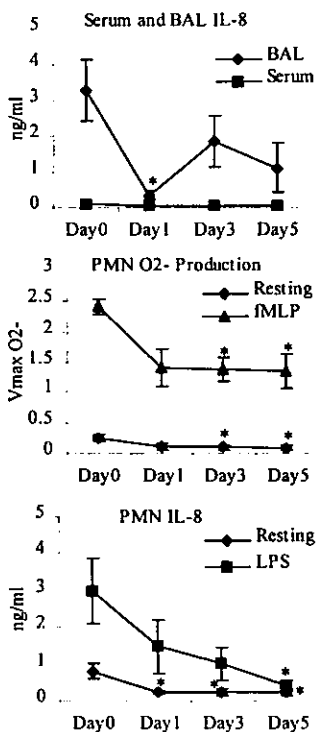
Background: Recent clinical trials have redirected interest to corticosteroid treatment (CS rescue) of patients in the late stage progressive of ARDS. PMN cytotoxicity is a key component to the pathogenesis of ARDS. In vitro CS treatment of isolated PMNs decreases the stimulated respiratory burst and inflammatory cytokine production. We hypothesized that CS rescue of patients in late ARDS decreases circulating PMN

superoxide (O_2^-) and inflammatory cytokine (IL-8) production.

Methods: Blood and BAL samples were obtained from ICU patients (n=7) with non-resolving ARDS (ARDS day 8-12) on days 0, 1, 3, and 5 of a CS rescue protocol. Serum and BAL IL-8 levels were measured by ELISA. Circulating PMNs were isolated by density gradient centrifugation and O_2^- and IL-8 production measured by reduction of cy c and ELISA in resting and stimulated PMN.

Results: CS rescue reduced serum and BAL IL-8 to $54 \pm 44\%$ and $11 \pm 4\%$ of pretreatment levels by Day 1. CS rescue also decreased O_2^- and IL-8 production in both resting and stimulated PMNs. (Data=mean \pm SEM, *p<0.05 vs. Day0 by ANOVA)

Conclusions: Corticosteroid rescue of patients in late ARDS decreases PMN cytotoxicity and inflammatory cytokine production. Attenuation PMN mediated tissue damage is therefore a likely mechanism by which CS rescue improves outcome in late ARDS patients.



Notes

THE IMPORTANCE OF GENDER ON OUTCOME AFTER
MAJOR TRAUMA: FUNCTIONAL AND PSYCHOLOGIC
OUTCOMES IN WOMEN VERSUS MEN

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Introduction: Outcome after major trauma is an increasingly important focus of injury research. The effect of gender on functional and psychologic outcomes has not been examined. A prospective epidemiologic study was conducted to examine multiple outcomes after major trauma in adults aged 18 and older, including quality of life, functional outcome, and psychologic sequelae such as Depression (DEPR) and post-traumatic stress disorder (PTSD). The specific objectives of the present report are to examine gender differences in short and long-term functional and psychologic outcome after major trauma.

Methods: 1048 eligible trauma patients were enrolled in the study. Admission criteria for patients were as follows: (1) age 18 or older, (2) Glasgow Coma Scale on admission of 12 or greater, and (3) length of stay (LOS) greater than 24 hours. Functional outcome after trauma was measured using the Quality of Well-being (QWB) scale (range; 0 = death to 1.000 = optimum functioning). Depression was assessed using the Center for Epidemiologic Studies CES-D scale and PTSD was assessed using the Impact of Events (IES) scale. Patient outcomes were assessed at discharge, and at 6, 12, and 18 months after discharge.

Results: Functional outcome was significantly worse at each follow-up timepoint in women (N = 314) versus men (N = 734).

<u>QWB Score</u>	<u>Women</u>	<u>Men</u>	
6-Month	0.606	0.646***	
12-Month	0.637	0.685***	***P < 0.0001
18-Month	0.646	0.696***	

Women were also significantly more likely to be depressed at all follow-up timepoints (Discharge Odds Ratio (OR) = 1.4, P < 0.05; 6-Month OR= 2.4, P < 0.001; 12-Month OR = 2.2, P < 0.001; 18-Month OR= 2.6, P < 0.05) and to have PTSD at discharge (OR = 1.3, P < 0.05). These differences remained after adjusting for injury severity, mechanism and sociodemographic factors.

Conclusions: Women are at risk for markedly worse functional and psychologic outcomes after major trauma than men, independent of injury severity and mechanism. Gender differences in short and long-term trauma outcomes have important implications for future studies of recovery from trauma.

Notes

CYTOKINES: WHAT ARE THEY, HOW DO THEY WORK, AND WHY DO THEY MATTER?

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***SUPPORTED IN PART BY AN UNRESTRICTED
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Cytokines are protein cell regulators that are the mediators of cellular communications. Cytokines provide the critical link in humoral and cellular mediated immunity. Cytokines amplify the immune response and allow cells to communicate locally, as well as, systemically. They act at concentrations similar to endocrine hormones and can function in an autocrine, paracrine or endocrine fashion to effect changes in cell responsiveness. Cytokines are either homo or heterodimeric polypeptides containing 70-100 amino acids. They can activate genes by increasing mRNA and stimulate protein secretion. Almost all cytokines have more than one function. Some are stimulatory for certain cell types and inhibitory for others. Most cytokines can be expressed by a wide variety of immune and non-immune cells. Cytokine responses are not antigen specific but can and do rise after antigen specific T and or B cell activation. Various immune effector cells are able to "fine tune" the cytokine response not only by varying the type and amount of cytokines produced but also the density and affinity of the cytokine receptors. Cytokines act through cell surface receptors which results in signal transduction and the conveyance of the stimulus to the cell leading to an increased mRNA within hours which results in various factor being elaborated by the now cytokine stimulated cell. Classic examples of cytokines that mediate natural immunity are interferon, which inhibit viral replication, increases Class I and II molecule expression and Tumor necrosis Factor, which is a co-stimulator of both T and B cells, neutrophil activation and endothelial cell activation. Antigen specific immune effector cells and their non-antigen specific counter parts such as monocytes and macrophages and dendritic cells "talk" to each other via cytokine production, release and cytokine receptor display. Most cell-cytokine systems have agonist/antagonists (Yin/Yang) dynamics in order to prevent runaway immune reactions. These growth promotion and communication links are critical for immune effector cells to be able to integrate human immune responses and the maintenance of health. However, when the cytokine response is excessive or deficient then a pathologic process likely will occur. Certain of the cytokines have an important role in the immune response. Groups of cytokines have been catalogued as pro-inflammatory which facilitate the host response to stress and infection i.e. IL-1, IL-6, IL-2 and TNF- α . Counterbalancing the pro-inflammatory response are a series of molecules which exert anti-proliferative and immuno-suppressive effects on activated helper cells and macrophages. Such molecules as transforming growth factor beta, IL-4 and IL-10 serve to balance the pro-inflammatory response.

Recently, it has been noted that patients may have a genetic predisposition for their TNF response. Patients homozygous for the TNF β gene had an odds ratio of 5.22 for the development of severe sepsis as compared to the heterologous genotype. This work, as well as, others suggest that patient specific responses as the result of genetic make-up, determines whether an individual will have a dysfunctional cytokine response, which in the end might prove to be destructive. Understanding patient specific responses may well provide an opportunity for new therapeutic strategies, as well as, identify high risk patients who might benefit from alternative treatment schemes and allow refinement of cytokine directed therapies.

Notes

THE DEVELOPMENT OF PATHOLOGIC G-PROTEIN
SIGNALING IN TRAUMA NEUTROPHILS
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Background: Trauma first activates and later suppresses neutrophil (PMN) function, thus predisposing to early organ injury and subsequent infection. The evolution of PMN responses to G-Protein coupled (GPC) agonists after injury is unstudied. Calcium mobilization ($[Ca^{2+}]_i$) by GPC agonists reflects PMN activation status, and is normally primed by exposure to sequential stimuli. We serially evaluated PMN responses to a variety of GPC agonists during the first week after major trauma.

Methods: PMN isolated from 8 major (ISS=33±3) trauma patients (5M / 3F, age 41±4 yr) were studied 10-18 hours, 2, 3 and 7 days after injury. Organ failure developed in 7/8, 1/8 died. PMN aliquots were stimulated with IL-8, $GRO\alpha$, PAF and fMLP individually or serially. PMN $[Ca^{2+}]_i$ was measured by spectrofluorometry. Responses were recorded as the area under the calcium concentration curve (AUC) for each agonist.

Results: Given individually, all agonist response patterns peaked on day 2-3, and decreased to baseline by day 7. Given sequentially, $GRO\alpha$ suppressed IL8 responses ($p < 0.02$), and IL8 suppressed PAF responses ($p < 0.05$) whereas in normal PMN such sequential exposure primed the cells. PAF enhanced IL-8 responses normally in trauma PMN ($p < 0.002$) except on day three, at which time PMN IL8 responses are already maximally primed. Calcium entry blockade (SKF96365) eliminated $GRO\alpha$ suppression of IL8 and IL8 suppression of PAF, but did not effect PAF priming of IL8.

Conclusions: PMN exhibit hyper-reactivity followed by hypo-reactivity to a wide variety of GPC agents after major trauma. This corresponds to and may be mechanistically linked to previously recognized phasic changes in PMN function. Suppressivive and priming elements in G-Protein stimulus-response coupling appear to coexist in trauma PMN populations and reflect changes in all calcium mobilization pathways. The eventual outcome of such interaction; priming or suppression; may depend upon the sequence of biochemical stimuli which are generated by specific clinical events.

Notes

IMPAIRED ACTIVATION OF ERK AND p38 MITOGEN ACTIVATED PROTEIN KINASES AND INHIBITION OF TNF SECRETION IN ENDOTOXIN TOLERANT HUMAN MONOCYTES

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Introduction: Dysregulation of macrophage (MØ) cytokine production after exposure to multiple inflammatory stimuli may contribute to multi-organ failure and sepsis. Endotoxin (LPS) activation of murine macrophage (MØ) results in phosphorylation of the mitogen activated protein kinases (MAPK, ERK 1/2 and p38). Pretreatment of murine MØ with LPS induces LPS-tolerance, with inhibition of LPS-stimulated MAPK activation and TNF release. These alterations were reversed if the PKC activator phorbol myristate acetate (PMA) was added before the 2nd LPS stimulus. We sought to determine if similar alterations in LPS-dependent signal transduction were present in LPS-tolerant human peripheral blood monocytes (PBMNC).

Methods: PBMNC were obtained from normal volunteers (N=12) and isolated using ficoll-hypaque. PBMNC were incubated in RPMI ± 10 ng/mL LPS for 24 hr, then stimulated with 0-100 ng/mL of LPS. PMA was added prior to the 2nd LPS stimulus to see if it reversed LPS-tolerance effect. Supernatant TNF release was determined 5 hr after LPS by ELISA. ERK and p38 MAPK's were measured 15 min. after LPS with monoclonal antibodies to diphosphorylated (active) ERK1/2 and p38 using a novel flow cytometry technique. Statistical analysis by t-test.

LPS (ng/mL)	Pretreatment: None		10 ng/mL LPS	
	0	100	0	100
TNF (pg/mL)	10±5	8012±439*	50.8±5.4	76.0±28.3#
% ERK 1/2 PBMNC	1.31±0.28	32.5±5.4*	5.8±2.6	1.03±0.27*
ERK 1/2 Stim. Index	-	21.5±7.9*	-	0.99±0.23#

#p = not significant, *p<0.05 vs no LPS, †p<0.05 vs no pretreatment

Results: The table shows that LPS tolerant (10 ng/ml LPS pretreated) PBMNC had significant inhibition of LPS-stimulated TNF secretion (p<0.05). Non-tolerant PBMNC had a dramatic increase in the % of ERK and p38 (shown) positive cells in response to LPS-stimulation compared to a decrease in ERK and p38 activity in LPS tolerant cells. The ERK and p38 stimulation indices of LPS tolerant PBMNC were inhibited (p<0.05). PMA restored TNF secretion and ERK1/2 activation in LPS tolerant PBMNC (data not shown).

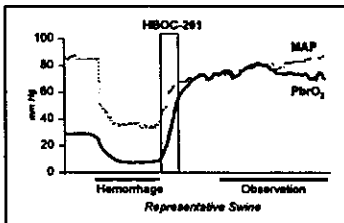
Conclusion: LPS tolerance in human PBMNC is associated with inhibition of LPS-stimulated TNF secretion and defective activation of MAPK (ERK1/2 and p38). These results suggest a method of identifying LPS tolerance and monocyte dysfunction in ICU patients with sepsis.

Notes

EFFECT OF SMALL-VOLUME RESUSCITATION
WITH HEMOGLOBIN SUBSTITUTE HBOC-201 ON
BRAIN TISSUE OXYGENATION FOLLOWING
EXPERIMENTAL HEMORRHAGIC SHOCK

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Background: Hemorrhagic shock, hypoxia and hypotension are significant causes of brain ischemia and death following major trauma. To improve outcome, aggressive crystalloid fluid resuscitation is used to restore hemodynamic parameters. However, this approach has recently been shown to be detrimental in some trauma patients without head injury. It may also exacerbate cerebral edema in patients with head injuries. To satisfy the requirements of adequate cerebral resuscitation with minimal fluid administration, we have investigated the effects of small-volume resuscitation with a hemoglobin based oxygen carrier on brain tissue oxygen tension (P_{brO_2}), mean arterial pressure (MAP), and cardiac output (CO) in hemorrhaged swine. **Methods:** We developed a prehospital resuscitation model using clinically relevant intervals to reflect response time, assessment, intervention and transport. Clark-type polarographic probes were inserted into the brain tissue of 7 swine to measure P_{brO_2} directly. After instrumentation and stabilization, the animals were hemorrhaged to a MAP of 40mmHg and maintained at that pressure for 20 minutes. P_{brO_2} and other physiological variables were monitored continuously. Following institution of high flow oxygen, resuscitation was performed with a bolus infusion of HBOC-201 (6 cc/kg; Biopure Corp.) Maintenance fluids (8 cc/kg, Ringer's lactate) were resumed after HBOC-201 infusion and swine were observed for an additional 2 hours. **Results:** The mean hemorrhage volume was 1203 ± 137 cc (42% of estimated blood volume, Grade IV shock). The mean P_{brO_2} prior to hemorrhage was 25.7 ± 1.4 mm Hg. P_{brO_2} declined rapidly to 6.9 ± 4.8 mm Hg in response to hemorrhage. As expected MAP and CO decreased significantly with hemorrhage ($p < 0.01$). High flow oxygen resulted in a small but significant increase in P_{brO_2} to 14.8 ± 4.4 mm Hg ($p = 0.003$). Small-volume resuscitation (mean = 239 cc) with HBOC-201 resulted in a significant increase ($p < 0.01$) in P_{brO_2} to 42.6 ± 4.8 mm Hg, representing a 65% overshoot from baseline. MAP increased to 83% and CO to 84% of baseline within 25 minutes of HBOC-201 administration. The elevation in P_{brO_2}



was sustained during the 2 hour observation period. MAP returned to baseline values and CO was maintained at resuscitation levels by the end of 2 hours. The mean hematocrit values decreased steadily from 34.2 at baseline, to 29 at end hemorrhage, 23.9 at 25 minutes post resuscitation, and 22.3 at the end of observation. **Conclusions:** Small volume resuscitation with HBOC-201 can restore and sustain cerebral oxygenation, MAP and cardiac output following severe hemorrhagic shock. These results suggest that HBOC-201 is an ideal cerebral resuscitation fluid, particularly in the pre-hospital arena where a small-volume bolus may provide adequate oxygen and pressure support during transport and initial hospital management.

Notes

**THE ROLE OF ULTRASONOGRAPHY (FAST) IN
PENETRATING ABDOMINAL TRAUMA**

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MD

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BACKGROUND: FAST is rapidly establishing its place in the evaluation of blunt abdominal trauma. However, no prospective study specifically evaluates its role in penetrating abdominal trauma.

STUDY: Data was collected prospectively in 75 consecutive stable patients with penetrating trauma to the abdomen, flank or back from December 1998 to June 1999. Those with an obvious need for emergent laparotomy were excluded. FAST was performed as the initial diagnostic study on all patients. Wound location, type of weapon, findings of DPL, triple contrast CT or laparotomy were recorded. The presence of peritoneal blood was noted. Data was analyzed using the chi square test.

RESULTS: Of the 75 patients, there were 32 stab and 43 gunshot wounds, 66 were male and 9 were female. The mean age was 30 years. 41 had proven abdominal injury and 34 had no injury. 21 patients had a positive FAST. 19 had peritoneal blood and injuries requiring repair at time of laparotomy. There were 2 false positive studies. 54 patients had a negative FAST. In 32 patients this was a true negative study. 13 patients had a false negative FAST and had peritoneal blood and significant injury on further evaluation. Nine patients had a negative FAST and no peritoneal blood but still had abdominal injuries requiring operative repair, including liver (4), small bowel (4), diaphragm (3), stomach (3) and colon (3). Overall sensitivity of FAST was 46% and specificity 94%. The positive predictive value was 90%, while the negative predictive value was 60%.

CONCLUSION: FAST can be a useful initial diagnostic study following penetrating abdominal trauma. A positive FAST is a strong predictor of injury and patients should proceed directly to laparotomy. If negative, additional diagnostic studies should be performed to rule out occult injury.

Notes

THE USE OF ULTRASOUND (US) FOR BLUNT ABDOMINAL TRAUMA: RESIDENT TRAINING, EXPERIENCE AND RESULTS

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Objective: The Focused Abdominal Sonogram for Trauma or FAST examination has been shown to be an efficient, cost effective method of screening for blunt abdominal trauma. Recommendations for resident training have included a combined didactic and practical US course ranging from 8 hours to 2 days. The objective of this study was to determine whether formal classroom training is required for trauma residents to become proficient and accurate with FAST.

Methods: US was used prospectively at a Level I trauma center for suspected blunt abdominal injury in patients over a 6 month period. Trauma residents were given basic hands on instructions with the techniques of FAST by an US credentialed attending trauma surgeon. Didactic instruction was not routinely utilized, but residents were provided selected literature for review. US findings were not used for clinical decision making. Standard diagnostic modalities including computed tomography (CT), diagnostic peritoneal lavage (DPL), laparotomy (LAP) and clinical observation (OBS) were used at the discretion of the attending trauma surgeon based on the status of the patient. US results were compared to DPL, CT, LAP, and OBS for determination of usefulness. Resident performed scans were then compared to attending studies for errors and accuracy.

Results: (Mean \pm SEM) Over a six month period, 1545 patients were evaluated at the trauma center. Of those, 316 patients with blunt abdominal trauma were prospectively examined with FAST (age-30 \pm 6 years; 65% male; Injury Severity Score-9 \pm 1; Glasgow Coma Scale-14 \pm 1). In addition to FAST, 123 patients (39%) underwent CT, 6 (2%) DPL, 13 (4%) had LAP and 174 (55%) were observed clinically. We reviewed results of all US performed as well as the performance of proctored trauma residents.

<u>Group Results:</u>		
True Positive: 10	Sensitivity: 71%	Accuracy: 97%
True Negative: 244	Specificity: 98%	
False Positive: 4	Positive Predictive Value: 71%	
False Negative: 4	Negative Predictive Value: 98%	
<u>Resident Results:</u>		
True Positive: 5	Sensitivity: 83%	Accuracy: 97%
True Negative: 86	Specificity: 99%	
False Positive: 2	Positive Predictive Value: 71%	
False Negative: 1	Negative Predictive Value: 99%	

Conclusions: Our experience has shown that trauma residents can learn to use US effectively with proctored hands-on instruction and limited didactic teaching. Sensitivity and specificity are equivalent to results achieved by attendings with more extensive training. The frequency of utilization also increases with familiarity and surgeon confidence. Twenty-five proctored patient examinations provides an adequate experience to learn the FAST exam during surgical training.

Notes

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"OLD CONCEPTS IN A NEW MILLENNIUM"

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Notes

COMPLEX LIVER INJURIES

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Notes

THE PATHOPHYSIOLOGY OF BRAIN DEATH &
THE CRITICAL CARE OF THE POTENTIAL
ORGAN DONOR.

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- I. Donor organ procurement: general overview & results from Trauma Centers
- II. The cultural, ethical, scientific, and legal foundations of neurological death
- III. Physiological changes in patients with lethal head injury: the challenge of donor organ survival.
 - Neurogenic pulmonary edema
 - Central hypotension
 - Hypothermia
 - Diabetes insipidus
 - Coagulopathies
 - Changes in the hormonal milieu
- IV. Specific goals & problems in donor organ survival
 - Heart: avoiding overdistention & optimizing RV function
 - Lungs: low pressure, low volume.
 - Liver: are catecholamines bad?
 - Kidneys: maintaining pressure & flow
- V. Therapeutic options for monitoring and treatment
 - Monitoring: what are the best options?
 - vasopressors & inotropes
 - ventilator management
 - fluids, electrolytes, & volume
 - hormonal replacement
 - blood factor replacement
- VI. Summary: the potential value of management protocols

Notes

EMOTIONAL CONSIDERATIONS AND ATTENDING INVOLVEMENT AMELIORATES ORGAN DONATION IN BRAIN DEAD PEDIATRIC TRAUMA VICTIMS

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Purpose: To ascertain the optimal strategy for maximizing parental consent for organ donation in traumatically injured children suffering from brain death.

Hypothesis: Appropriate attending surgeon involvement and delay in evaluating children for brain death leads to an increased percentage of organ donors.

Materials & Methods: From January 1993- July 1999 the records of all children who died in a level 1-trauma center were evaluated. Those children suffering brain death that were suitable for organ donation were entered into the study. Cases were reviewed for patient demographics, time to entry into brain death protocol (measured from time of admission), time to parent notification about brain death (measured from time of admission), specific attending involved in the case (with level of involvement), and success of organ donation request. In all 42 charts were reviewed.

Results: Of 42 deaths 32 were deemed suitable for donation. Age of suitable donors ranged from 1 month to 18 years. There were 26 males and 6 females evaluated. In all 11 attending physicians were involved in the care of these children. Overall 19/32 were organ donors (59%). Mean age of the donors was 8.13 years vs. 11.69 years for non-donors. When the attending surgeon was involved, donation success for organ retrieval was 84% while if the attending was not involved personally the success rate dropped to 23% ($p < 0.04$). Pediatric Surgeons had a 16/21 success rate in obtaining consent for donation, while the Transplant Surgeon had a 1/1, Neurosurgeons a 1/4, Adult Trauma surgeons 1/6, and Pediatric intensivists a 0/1 success rate. One senior pediatric surgeon obtained a success rate of 11/11 children. It was this surgeon's policy to not initiate brain death protocols in children immediately upon entry into the emergency room. Rather, to delay initiation until family could be gathered and spend time with the affected child in order that the family could recover from the initial shock of trauma (always at least overnight). When time to initiation of brain death protocol was examined, success was obtained when a delay of 15.52 hours was respected, vs. 7.0 hours when donation was requested but denied. Since 1/1/97 the Pediatric Surgeons in the facility initiated a policy of informing parents that the outcome for their child was extremely grim when the prognosis for brain death was high, but not initiating brain death protocols until the following morning after admission. Since that time their donation rate improved to 100% when organs were requested (5/5).

Conclusion: These data indicate that attending involvement is important when parents of brain dead children are asked about organ retrieval ($p < 0.04$). Delay in initiating brain death protocols in order for family members to deal with the shock of the initial trauma appears to increase willingness to participate in organ donation. As previously reported by Jurkovitch, attention to the emotional state of the family seems to ameliorate their acceptance of the child's death.

Notes

TRAUMA SURGEONS' GUIDE TO THE LUNAR CYCLE
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TRAUMA SURGEONS GUIDE TO THE LUNAR CYCLE

Introduction: Modern folklore attributes significant influences of lunar synodic cycles upon human behavior. Many practitioners have theorized that trauma may occur disproportionately during the full moon. We sought to answer this most compelling question; does the lunar cycle really influence our fate, and should we be consulting the *Farmer's Almanac* to plan our trauma call schedules?

Methods: All patients admitted to our urban Level I Trauma Center on days of the full moon and new moon from 1993 to 1998 were retrospectively reviewed. Full moon and new moon days were defined as the 48-hour period surrounding the time described in the *Farmer's Almanac* as "full moon" or "new moon." Statistical analysis was performed using the Chi-squared test or student t-test (p-value <0.05 considered significant).

Results: During the five year period 510 patients were admitted to our trauma service during full moon, and 483 patients admitted during new moon. Full moon trauma was associated with a significantly higher mortality (7% vs. 4%, $p=0.028$) as well as significantly higher injury severity score (11.9 vs. 9.7, $p=0.005$). Analysis of the mechanism of injury revealed a significantly higher incidence of motor vehicle crashes (MVC) on full moon days ($p<0.001$), and a higher incidence of burn admissions on new moon days ($p=0.006$). Patients injured on full or new moons were equally likely to require surgery. The incidences of motorcycle crashes, violent trauma, suicide attempts, and blunt versus penetrating injuries were not statistically different. Mean age and gender distribution were not significantly different between the two groups, and there was not any difference in the use of helmets or seat belts amongst trauma victims with respect to lunar cycle.

Conclusion: This study demonstrates significantly increased mortality and ISS associated with the full moon, supporting centuries-old suspicions that the lunar cycle may indeed influence human behavior. This behavioral influence appears not to have a predilection for a particular sex or age group, although it appears to primarily effect individuals driving automobiles. Further investigations will require a large-scale multi-disciplinary effort involving surgeons, psychologists, epidemiologists, meteorologists, and experts from the astrologic community.

Notes

BLUNT POPLITEAL ARTERY INJURY (BPAI): A MULTISPECIALTY CHALLENGE

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Despite tremendous advances in the management of extremity trauma, BPAI remains a challenge. The purpose of this retrospective review is to report our recent operative experience. Over a 10 year period ending 12/31/98, we treated 31 patients with 32 BPAI of which 26 (81%) were male, mean age was 35.4 yrs and 26 (81%) were vehicular related (14 auto-pedestrian, 8 MVC, and 4 MCC). Mean Injury Severity Score (ISS) was 15.4 [ISS \geq 25 in 14 (44%) patients]. Mean Mangled Extremity Severity Score (MESS) was 6.4 [MESS \geq 7 in 19 (56%) extremities]. No Doppler signals were present in 29 extremities and associated extremity injuries included 30 soft tissue, 22 fractures, and 15 nerve. Mean injury to ED time was 53 min, but ED to OR time was 9.5 hrs. Diagnostic angiography was performed in 28 (90%) cases (3 were done in the OR). There was 1 primary amputation and 32 arterial repairs (25 vein interpositions, 1 PTFE interposition, 5 primary repairs, 1 vein patch). There were 5 associated vein injuries and all were repaired (4 vein interpositions, 1 primary repair). Of the 20 orthopedic procedures (14 external fixations, 6 ORIF), 8 were done prior to the vascular repair. Twenty primary fasciotomies were performed (16 were done for time delays, 4 for vein injuries). There were 2 delayed fasciotomies and nonviable muscle was found in both cases. Two arterial anastomoses were revised (based on completion OR angiograms); there were no delayed arterial occlusions. Delayed OR washouts were done in 27 soft tissue injuries of which 7 (26%) required STSG and 10 (37%) flap closures. Hospital stay ranged from 3 to 56 days (mean 21).

	Amp (n=5)	No Amp (n=27)
Mean ED to OR Time ED to OR Time \geq 6 hrs	19 hrs 4 (80%)	7 hrs 6 (22%)
Mean MESS MESS \geq 6	8.6 hrs 5 (100%)	6.4 hrs 14 (56%)
Ortho Procedure first	2 (40%)	6 (22%)
Delayed Fasciotomy	0%	2 (7%)

In conclusion, BPAI requires intensive commitment from multiple specialties and inordinate ED to OR delays is an issue which needs improvement. Abbreviated ED evaluations for other injuries and OR angiography are logical alternatives.

Notes

MANAGEMENT OF ACUTE EPIDURAL HEMATOMAS IN REMOTE AREAS: A VITAL ROLE FOR TELEMEDICINE

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Introduction: Acute epidural hematomas that develop after severe head injury and cause mass effect and/ or neurologic deterioration require emergent craniotomy. In some areas of the remote Western Pacific, neurosurgeons are not available and consequently, emergent craniotomies must be performed by general surgeons. However, optimal management of these patients mandates that access to neurosurgical expertise be available. To address this problem, we developed a unique telemedicine system that allows general surgeons and neurosurgeons to collaborate over a distance of greater than 3000 miles and successfully manage a patient with a large, acute, traumatic epidural hematoma.

Case Report: A 44-year-old, previously healthy woman fell in her kitchen and sustained a seemingly mild head injury. Upon arrival to the emergency room, the patient rapidly deteriorated, developed left hemiplegia, marked anisocoria, and her Glasgow Coma Scale (GCS) score dropped from 13 to 6. A head CT scan revealed a 3cm x 9cm x 10cm right epidural hematoma with a 14mm shift and no skull fracture. The patient underwent an emergent, full flap, decompressive craniotomy performed by two general surgeons. After an initial telephone consult to a neurosurgeon several thousand miles away, CT radiographs were scanned using an x-ray digitizer populating a DICOM server over a local area network. Images were viewed using a Web browser and a DICOM viewer plug-in. The images were then transferred to a secure, hospital-based Internet Web site, which allowed for password protected visualization of images and clinical data, as well as immediate feedback using Internet-based forms. On the tenth postoperative day, the patient had a normal neurological exam, but her white blood cell (WBC) count had progressively increased to 18,000/mm³. Concerned about a potentially devastating neurosurgical infectious complication, we conducted a video-teleconference (VTC) using two separate yet compatible VTC systems utilizing a low bandwidth (112 kbps) network. With the VTC, the neurosurgeon was able to satisfactorily perform a remote, rudimentary neurological and physical exam and in conjunction with the Internet based data, determine that a neurosurgical issue was not the cause of her elevated WBC. The patient was discharged uneventfully from the hospital several days later.

Discussion: This case demonstrates that telemedicine has a vital role in the optimal management of acute, life-threatening epidural hematomas in remote areas without a neurosurgeon. While the issues addressed in this case study may not be practical or appropriate for many locations, the success of this telemedicine project should stimulate the search for similar solutions to a variety of other urgent trauma and surgical related problems, especially for remote and under-served areas.

Notes

**STENT-GRAFT REPAIR OF ACUTE TRAUMATIC
THORACIC AORTIC PSEUDOANEURYSM WITH
INTENTIONAL OCCLUSION OF THE LEFT SUBCLAVIAN
ARTERY: A CASE REPORT**

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Introduction: The standard treatment for acute thoracic aortic pseudoaneurysm (TAP) remains primary repair or interposition grafting via a left thoracotomy. Associated injuries may make conventional repair a prohibitive risk. Stent-grafts are in clinical trials in the United States for treatment of atherosclerotic aortic aneurysms. We present a case of acute TAP in a high risk, multiply injured patient treated on a compassionate use basis with a stent-graft, avoiding left thoracotomy, aortic cross-clamping and left heart bypass. Additionally, due to injury proximity, the left subclavian artery ostium was intentionally covered occluding antegrade subclavian artery flow.

Case: Following a motor vehicle collision, a 21 year old female was found to have a positive diagnostic peritoneal lavage. Laparotomy revealed a grade IV splenic injury, left diaphragm rupture, liver lacerations, perinephric and pelvic hematomas. Non-abdominal injuries included bilateral pulmonary contusions, pelvic fractures, and a closed head injury. Following splenectomy and diaphragm repair, CT scan and aortogram revealed a mediastinal hematoma with TAP distal to the left subclavian artery. Associated injuries made conventional repair a prohibitive risk. Conservative medical management was instituted with beta-blockers and nitrates. On post-injury day eight, the TAP was treated using a Talent stent-graft (World Medical Corporation) via a left common iliac artery approach. Intravascular ultrasound demonstrated intimal disruption within 5mm of the left subclavian artery origin requiring intentional stent-graft coverage to provide adequate proximal device seating. The left upper extremity has remained viable with an arterial index of 0.36.

Discussion: To our knowledge, previous reports of stent-graft repair of TAP have not included intentional left subclavian artery occlusion. Stent-graft devices require 1-2 cm of proximal uninvolved artery for device seating and adequate aneurysm exclusion. Injury proximity to the left subclavian artery mandated its coverage if stent-graft techniques were to be used in this particular patient. Stent-graft technology holds promise in the treatment of TAP. However, intimal disruption may closely approximate the origin of the left subclavian artery. We report the ability to intentionally cover the subclavian artery without short-term arterial sequelae to the left arm. This capability may expand the application of stent-graft techniques in the treatment of acute TAP.

Notes

BLUNT INJURY TO THE MITRAL AND TRICUSPID VALVES:
A CASE REPORT AND REVIEW OF THE LITERATURE
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Blunt cardiac injury constitutes a wide range of pathology, ranging from contusion to myocardial rupture. Clinical presentations vary from asymptomatic ectopy to profound shock. We present the fourth documented case of acute mitral and tricuspid valve rupture, secondary to apparently minor blunt trauma.

A forty two-year-old male fell approximately six feet from a ladder, landing on his sternum. He arrived in the emergency department within minutes of the injury complaining of shortness of breath and chest pain. He was alert and oriented with a systolic blood pressure of 70, a pulse of 120 and an SpO₂ of 90% on room air. Initial evaluation revealed chest abrasions, a sternal fracture, multiple left sided rib fractures, a left pulmonary contusion and an enlarged heart shadow. There was no obvious extrathoracic trauma. The patients' unstable hemodynamics deteriorated despite volume resuscitation. Endotracheal intubation was performed after the development of respiratory distress and clinical evidence of pulmonary edema. Pericardial decompression was attempted after the development of worsening hypotension and distended neck veins. Pericardiocentesis produced 30 cc of nonclotting blood but no hemodynamic improvement. Diagnostic peritoneal lavage was negative. Anterolateral thoracotomy revealed a normal ventricle and no evidence of tamponade. Echocardiography was then performed and revealed severe mitral regurgitation. The patient was taken emergently to the operating room. Intraoperative transesophageal echocardiography confirmed the mitral valve injury and revealed a previously unsuspected regurgitant tricuspid valve. The anterior papillary muscle of each valve was completely avulsed and a prosthetic replacement of each valve was performed. The patients perioperative course was complicated by a right hemothorax and a mild embolic CVA, both of which resolved. He was discharged on post operative day ten.

This case represents the fourth documented report of combined blunt mitral and tricuspid valve injury. Atrioventricular valve injury is thought to occur when external compression of the thorax coincides with the isovolemic contraction phase of early systole. This produces high intraventricular pressures and structural damage. The most common pathology induced by this "blowout" phenomena is papillary rupture. Chordae tendinae and valve leaflet injury occur less frequently. The onset of symptoms can range from minutes to years after injury; however, patients with severe valve damage typically present within hours. A high index of suspicion and prompt echocardiography are critical to early diagnosis of this injury. Definitive management is determined by the exact anatomic insult. Valve repair and replacement have each been successfully employed.

Notes

THE USE OF STERNOCLEIDOMASTOID MUSCLE FLAPS IN COMBINED ESOPHAGEAL COMMON CAROTID INJURIES

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CASE REPORT: Although combined esophageal and common carotid injuries are uncommon, the potential complications associated with incorrect management include breakdown of the esophageal repair with subsequent fistula formation or rupture of the arterial repair. The purpose of this report is to describe the use of a sternocleidomastoid muscle flap as a buttress for the esophageal repair when the ipsilateral common carotid artery is also injured.

A 22-year old white male sustained a single gunshot wound that entered the right submandibular area and exited the right posterior neck. He was alert and hemodynamically normal but had an expanding hematoma in the right neck with profuse bleeding from the mouth. X-rays showed a left pneumothorax and subcutaneous emphysema in the neck. He underwent a tracheostomy, a left tube thoracostomy, and a right neck exploration. A 6mm polytetrafluoroethylene interposition graft was used to repair the common carotid artery laceration which was 2 cm proximal to the bifurcation. Further exploration showed a defect in the esophagus which was repaired primarily. Considering the proximity of both injuries, the sternal head of the sternocleidomastoid muscle was dissected free and rotated medially as a superiorly based muscle flap to reinforce the esophageal repair. A drain was placed in the right paraesophageal area and after copious irrigation, the wound was closed in two layers. A direct laryngoscopy showed normal findings. The remainder of his hospital course was unremarkable except for a right eyelid ptosis and a chronically constricted right pupil. He was discharged on post-operative day twelve and was followed as an outpatient in clinic.

The sternocleidomastoid muscle flap is a reliable and convenient buttress to reinforce an esophageal (or tracheal) repair when combined with a vascular injury. We encourage its use as a buttress to aid in healing select wounds and minimize potential complications such as disruption of the arteriography or esophageal repair.

Notes

PERCUTANEOUS ULTRASOUND-GUIDED THROMBIN
INJECTION OF TRAUMATIC PSEUDOANEURYSMS.
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Although most iatrogenic pseudoaneurysms of the lower extremities are amenable to nonoperative management, subacute traumatic pseudoaneurysms occasionally cannot be managed using such techniques as ultrasonographic compression. Recently, there have been a few reports describing the use of ultrasound-guided thrombin injection for treatment of postprocedure pseudoaneurysms of the femoral artery. We report two cases of post-traumatic pseudoaneurysms of the leg without associated fracture treated with thrombin injection. **Case reports:** **1.** BB is a 43 yo male pedestrian struck at low speed who presented complaining of low back pain. On exam, the patient was hemodynamically normal, with mild paresthesias in his L5 distribution bilaterally. He had a normal motor examination, and no evidence of extremity fracture. Workup revealed an L5 burst fracture, and he underwent ORIF with posterior fixation on PID #1. On POD#2, the patient complained of LLE swelling and pain. Duplex examination revealed no evidence of deep venous thrombosis, but did demonstrate a significant left posterior tibial pseudoaneurysm with surrounding hematoma. The patient underwent ultrasound-guided local injection of thrombin (0.5 ml thrombin solution [1000U/ml]), with resolution of his pseudoaneurysm. Follow up examination on postprocedure day (PPD) two revealed a minor recurrence of his pseudoaneurysm, with spontaneous thrombosis PPD #7. There has been no recurrence. **2.** SW is 59 yo male who presented one month after an MVC with left thigh swelling. He had been managed elsewhere, where he underwent ORIF of his left ankle. Ultrasonography demonstrated a pseudoaneurysm of the left superficial femoral artery. He underwent ultrasound-guided thrombin injection (0.5 cc) with complete resolution. He has had no recurrence. **Conclusion:** Post-traumatic pseudoaneurysms of the lower extremity can present as swelling and tenderness in a nonfractured extremity. Percutaneous ultrasound-guided thrombin injection is a safe and expeditious method of obliterating symptomatic pseudoaneurysms and obviates the need for operative exploration in selected patients.

Notes

BONE TRANSPORT: A TWO-STAGE
RECONSTRUCTION FOR SEPTIC DEFECTS
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Between 1988 and 1998, 120 of 824 patients with osteomyelitis underwent transport protocols with an initial success rate of 74% and overall rate of 96%. Thirty-two patients suffered major complications (27%). Here, we compare our first and last 20 cases to document protocol change(s) and introduce the concept of salvage enhancement utilizing staged methodologies.

The average defect size (6cm) and treatment morbidity remained constant. Cost, operating room time, frame time and disability time decreased. With the two-stage protocol ($p=0.05$) healing disturbances were anticipated, sought and acknowledged within 3 months of docking. Problems requiring surgery increased (61% vs 38%) in this group as intervention took pace before failure. Resolution (93%) of problems and failures was achieved in both groups with conventional techniques (grafts, ORIF) and/or simple Ilizarov constructs (13%).

Transport methodologies enhance the patient selection process for salvage by gradually increasing the number of available therapeutic options. Following a predictable phase of limb restoration (1st stage), a seemingly hopeless clinical situation is dramatically transformed. The wound, now covered, vital and replenished, responds to routine orthopaedic intervention should healing prove inadequate. Our exhaustive efforts to achieve success with one protocol failed to improve outcomes...The two-stage approach combines a relaxed restoration with a "doable" salvage procedure, proving more efficient and less demanding for all concerned.

Notes

RETROGRADE NAILING OF FEMORAL FRACTURES: A
REVIEW OF TWENTY-SEVEN CASES

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The use of antegrade intramedullary nails has become the standard form of treatment for femoral shaft fractures. Distal femur fractures were more difficult to manage with antegrade techniques. Nail fatigue, malalignments, and fracture through interlocking screw holes were the most likely complications to occur. Technique, indications, and efficacy of the retrograde device and procedure have developed since 1993. Recent reviews of retrograde nailing report union rates of 85-95% & problems with malalignment. Since introduction, retrograde rods are used with increasing frequency and indication.

Material & Methods: Between January 1997 and December 1998, 109 polytrauma patients with femur fractures were triaged at our level-one regional trauma facility.

There were 27 cases (5 bilateral), where 32 retrograde rods were used. Data base included: MOI, GCS, associated injury, operative time/ blood loss, anticoagulation , & outcome. Fractures were classified according to AO and Winquist/Hansen.

Results: There were 13 males & 14 females, average age 41. MOI-18 MVA, 13 MCA, 2 PED, 2 falls, 1 GSW, & 1 plane crash. GCS-average 13 (5-15). Assoc. injury-8 CHI, 9 Pulmonary, 4 visceral, 1 (43%) Burn, 16 ipsilateral LE fxs, 8 contralat. LE fxs, 13 acetabular/pelvic fxs, 3 spine, & 4 UE fxs. **Blood loss/Operative time-240cc/145min.** one femur, 481cc/220min. two procedures, & 760cc/370min. three procedures.

Anticoagulation-7 none, 9 Lovenox, 4 coumadin, 2 sub-Q heparin, 1 ASA, 4 IVC filter, & 1 IVC/coumadin. **Outcome:** F/U 8mo.(3-20 mo.), union rate 30/32, *Knee ROM/flexion:* aver. 110°, *malalignment* by XR 2 varus (5,10°), 1 valgus (5°), 1 procurvatum (10°). 2 use canes, 1 limb causalgia. 1 late infection (bilateral). 2 knee manipulations. 3 knee instability/+ Lachman's & 1 DVT. **Fracture pattern:** 7 open injuries in 6 pt.s (4-Grade I, 1-Grade II, 2-Grade III). 4 distal diaphyseal intrarticular, 11 distal third, 15 mid-third, & 2 proximal third. 6 Winquist/Hansen type I, 11 type II, 10 type III, & 5 type IV.

Discussion: Review of the literature reports a range of 78-100% union rates. Secondary procedures are reported in all series. Intercondylar starting points have decreased malunion. Knee motion varies in the literature as well. Patients in this review were predominately polytrauma. Application of the retrograde nail has variable applications consistent in our review. Indications include: Ipsilateral acetabular, femoral neck, and tibia fxs; antegrade access difficult/impossible, distally located fractures with minimal intrarticular component, required multiple simultaneous procedures, and pregnancy. Our review was comparable to other reports of retrograde nailing. They are not equal to that of antegrade techniques and Ostrum et al. may be premature in declaring that there is parity in the two methods.

Notes

**VOLUME PERFORMANCE STANDARDS BEWARE:
QUALITY TRAUMA CARE CAN BE DELIVERED BY
GENERAL SURGEONS IN PRIVATE PRACTICE**

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**VOLUME PERFORMANCE STANDARDS BEWARE: QUALITY TRAUMA CARE
CAN BE DELIVERED BY GENERAL SURGEONS IN PRIVATE PRACTICE**

Purpose: The purpose of this study is to determine whether busy general surgeons in private practice can provide quality trauma care, despite failure to meet volume performance criteria for trauma patients, by maintaining skills and decision-making capabilities in the course of general surgery practice that routinely involves major operative procedures and experience with critically ill surgical patients.

Methods: A two year retrospective review of patient outcomes and trauma surgeon patient care volumes at this community-based ACS-verified Level II trauma center, covering the period Jan. 1, 1996 through Dec. 31, 1997, was undertaken. The overall inpatient operative experience and the intensive care unit volume of the eight general surgeons taking trauma call was also collected for this same time period. Outcomes reviewed included overall and preventable trauma mortality, splenic salvage rate and resuscitation time for blunt traumatic rupture of the thoracic aorta.

Results: From Jan. 1, 1996 through Dec. 31, 1997, there were 1861 admissions to this institution for trauma. There were 70 deaths, for a 2 year mortality rate of 3.82%. One of these deaths was considered preventable, one possibly preventable. 72 patients incurred an injury to the spleen, and the splenic salvage rate was 57%. 8 patients incurred blunt traumatic disruption of the thoracic aorta, one of whom arrived in extremis and expired in the ED. Mean time to operation for the other 7 patients was 3 hours 52 minutes.

Over this time period, the 8 general surgeons taking trauma call performed a mean of 487 operative cases per year, of which 131 per year were major abdominal cases. These surgeons admitted a mean of 13 patients to the surgical intensive care unit per year, in addition to the trauma patient volume. Each responded to a mean of 15 trauma team activation calls per year, and admitted a mean of 15 patients per year with an ISS>13.

Conclusions: Based upon the outcomes of preventable trauma mortality, splenic salvage rate and time to operation for blunt traumatic disruption of the thoracic aorta, the surgeons taking trauma call at this institution provide care that is within nationally-accepted standards of care. Factors other than trauma patient volume, including overall operative experience and critical care volume, are relevant to the ability to provide trauma care and should be taken into consideration when granting privileges on the trauma call roster and in trauma center verification.

Notes

THE USE OF TRAUMA DATA BASES TO DETERMINE
INJURY SURVIVABILITY

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Introduction: Expert witnesses frequently provide testimony in malpractice suits. Survivability of an injury or a group of injuries can be stated as a matter of opinion, based on anecdotal experience or a review of the literature. Trauma data bases can provide accurate information from large populations of trauma patients. Data from four state trauma registries and two trauma centers proved the rarity of the injury and poor survival in contrast to TRISS and expert witnesses.

Methodology: The patient's injuries were coded according to AIS-90 after a review of the ED records, operating report and autopsy. The .38 caliber bullet injured the liver, duodenum, pancreas, and origin of superior mesenteric artery and vein. The probability of survival according to TRISS was .65 and ACSOT .80. Registry personnel in four states and two trauma centers did a retrospective review of years 1985 - 1994 for total number of patients with ICD 9 Codes 902.25 (SMA) and 902.31 (SMV) and outcomes (live/die).

RESULTS

<u>TOTAL # OF PATIENTS</u>	<u>SMA/SMV</u>	<u>SURVIVAL</u>	
	#	#	%
12,416	5	1	20
35,206	7	0	0
14,067	2	0	0
3,180	2	0	0
111,863	1	0	0
<u>24,554</u>	<u>6</u>	<u>2</u>	<u>33</u>
201,289	23	3	(13)

Conclusion: Combined injuries to the SMA and SMV are rare injuries (.01%) and no civilian surgeon is likely to accumulate any personal experience. The devascularization of the bowel makes the combined injuries highly lethal. TRISS and ASCOT Ps calculations overestimate actual survival. Trauma data bases can be useful for determining actual survival for injuries treated at trauma centers.

Notes

**EFFECT OF HEMODILUTION ON INTESTINAL PERFUSION
AND INTRAMUCOSAL pH FOLLOWING SHOCK**
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Introduction

Restoration of oxygen delivery (DO_2), especially to the splanchnic bed, is of critical importance during trauma resuscitation. DO_2 may be improved by allogenic blood transfusion but this has immunosuppressive effects and is a risk factor for posttraumatic multiple organ failure. Normovolemic hemodilution has been used to reduce blood transfusion requirement during elective surgery. The effect of hemodilution on the splanchnic circulation following hemorrhagic shock (HS) is not well defined.

Methods

Anesthetized swine (n=5) were instrumented to measure mean arterial blood pressure (MAP), and cardiac output (CO). A laparotomy was performed to allow measurement of superior mesenteric artery (SMA) blood flow by an ultrasound flow probe and small bowel mucosal blood flow by a laser Doppler flowmeter (LDF). Adequacy of splanchnic blood flow was assessed by small bowel tonometry (mucosal pH, pHi) and portal venous blood O_2 saturation (PVO_2 sat). Animals were bled to a MAP of 45mmHg for 45 minutes and resuscitated and maintained at baseline MAP and CO using lactated Ringers (LR). Hemodynamic data was obtained at baseline, HS, and 15 and 60 minutes postresuscitation (R_{15}, R_{60})

Results

	C.O. l/min	SMA ml/min	LDF (% baseline)	pHi	PVO_2 sat
Baseline	5.3 ± 0.5	625 ± 149	100	7.28 ± 0.05	0.82 ± 0.09
Shock	$2.1 \pm 0.6^*$	$187 \pm 55^*$	$54 \pm 13^*$	$7.02 \pm 0.04^*$	$0.45 \pm 0.18^*$
R_{15}	5.4 ± 0.9	590 ± 160	$66 \pm 14^*$	---	0.84 ± 0.07
R_{60}	5.0 ± 1.1	515 ± 130	$64 \pm 16^*$	7.24 ± 0.05	0.80 ± 0.11

* $p < 0.05$ vs. baseline by ANOVA

The initial resuscitation fluid volume was 2130 ± 703 ml. An additional 924 ± 287 ml was given thereafter to maintain MAP and CO. The baseline hematocrit of $31 \pm 3\%$ fell to $18 \pm 2\%$ following resuscitation ($p < 0.001$).

Conclusion

Splanchnic blood flow was reduced following HS and was incompletely restored following crystalloid resuscitation. Despite severe hemodilution to a hematocrit of 18%, intestinal mucosal perfusion was adequate to meet the metabolic needs of the gut as indexed by the mucosal pHi and PVO_2 sat. Hemodilution is well tolerated by the gut following hemorrhage and concern about adequacy of gut perfusion should not be a transfusion trigger following HS.

Notes

REPAIR OF LOW GRADE PENETRATING BLADDER INJURIES
: FEW ADJUNCTS REQUIRED

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INTRODUCTION: Historically, intraperitoneal bladder injuries were primarily repaired and then drained with suprapubic tubes, closed suction drains, or both. Many authors recommend cystograms prior to removing the drains. This algorithm has been proven to be effective, however, the need for and safety of this complex scheme has been questioned for low grade injuries not involving the trigone. We compared the outcomes of suprapubic tube, and urethral catheter drainage for low grade (II and III) penetrating injuries to the urinary bladder.

METHODS: The trauma registry of an urban Level 1 trauma center was used to identify patients who suffered intraperitoneal penetrating bladder injuries between January 1996 and June 1999. Records were reviewed for patient demographics, degree of injury, type of bladder drainage, length of hospital stay, length of bladder decompression, and complications. Data was analyzed using χ^2 and ANOVA, with a $p > 0.05$ considered statistically significant.

RESULTS: 34 patients were identified. 24 patients were treated with foley catheter drainage, while 10 were treated with suprapubic catheter drainage. There was no significant difference between the two groups with respect to age, the degree of bladder injury, coexisting medical illness, or the technique in bladder repair. The average length of stay for urethral catheter drainage was 7.5 ± 3.8 days, in comparison to 9.0 ± 4.1 days for suprapubic drainage (NS). The average length of decompression was 5.1 ± 1.9 days with a foley, compared to 24.1 ± 6.8 days with a suprapubic tube ($p < 0.05$). No complications were noted in the foley-drained patients (0/24, 0%) while three patients with suprapubic tubes developed urinary tract infections (UTI) (3/10, 30%) ($p = 0.05$). Cystography revealed no bladder leaks in either treatment group.

CONCLUSION: Grade II and III penetrating injuries to the bladder are not uncommon. when combined with operative repair, urethral drainage provides a safe and effective methods of treatment, while avoiding the prolonged treatment course and increased risk of UTI associated with suprapubic drainage.

Notes

NIPRIDE IN RESUSCITATION OF MAJOR TORSO TRAUMA

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Introduction: IV nitroprusside (Nipride) has been proposed as a useful adjunct in resuscitation of major torso trauma (MTT). Patients with blunt aortic injury (BAI) frequently meet criteria for our MTT ICU shock resuscitation (resus) protocol, and our thoracic surgeons request Nipride to maintain MAP<90mmHg in the immediate post repair period. Our purpose is to contrast the resus response of patients who sustained MTT w/ BAI with that of patients who had MTT w/o BAI to determine if: 1) MAP can be controlled; and 2) resus indices are affected.

Methods: A standardized resus protocol emphasizing volume and hemoglobin loading to maintain $DO_2 \geq 600 \text{ mL/min/m}^2$ for the 1st 24 ICU hours was utilized with all MTT patients (ISS>15, base deficit (BD) $\geq 6 \text{ mEq/L}$, requiring ≥ 6 units PRBC) during 9mo ending Sep '99. For patients who had emergent repair of BAI, post op management included Nipride to maintain MAP<90mmHg during the same 24hr. Data were prospectively collected during MTT resus and retrospectively analyzed using ANOVA and t tests (mean \pm sem; *p<0.05 MTT w/ BAI vs MTT w/o BAI, ^p<0.05 re 0 hr).

Results: Of 49 patients meeting resus criteria and surviving >24hr, 38 (78%) had MTT w/o BAI (87% blunt, 43 \pm 3yr, 46% ♂, ISS 28 \pm 1, 63% survival, ICULOS 12 \pm 2dy) and 11 (22%) had MTT w/ BAI and repair (91% blunt, 32 \pm 4yr, 82% ♂, ISS *39 \pm 2, 90% survival, ICULOS *23 \pm 6dy). All BAI patients received Nipride. MAP was effectively controlled; no aortic graft revisions were required. Data for the 1st 8 resus hours are tabulated:

resus time	MTT w/ BAI (n=11)			MTT w/o BAI (n=38)		
	0 hr	4 hr	8 hr	0 hr	4 hr	8 hr
MAP(mmHg)	87 \pm 3	*85 \pm 4	82 \pm 3	87 \pm 4	95 \pm 3	93 \pm 3
PAWP(mmHg)	14 \pm 2	14 \pm 1	*13 \pm 1	13 \pm 1	17 \pm 1	17 \pm 1
SVRI(dyn-s/cm ²)	2039 \pm 221	^1433 \pm 115	^*1237 \pm 88	2166 \pm 170	^1788 \pm 103	^1675 \pm 104
DO ₂ (mL/min-m ²)	511 \pm 56	*643 \pm 47	^664 \pm 33	441 \pm 42	495 \pm 27	^598 \pm 29
lactate(mM)	7.0 \pm 1.4	^4.2 \pm 1.1	^3.6 \pm 1.4	5.6 \pm 0.5	5.2 \pm 0.5	4.4 \pm 0.6

At 0hr, the groups were not different. At 4hr, MAP was less and DO₂ was greater for MTT w/ BAI compared to MTT w/o BAI patients. At 8hr, PAWP and SVRI were less for MTT w/ BAI compared to MTT w/o BAI patients. On average, the resus goal of $DO_2 \geq 600 \text{ mL/min/m}^2$ was attained at 4 hr for MTT w/ BAI patients, and at 12 hr for MTT w/o BAI patients. 24hr fluid (20 \pm 5 vs 24 \pm 2 L), blood (16 \pm 5 vs 16 \pm 2 U PRBC), and urine volumes (5.2 \pm 1.0 vs 5.6 \pm 0.7 L) were not different between the groups.

Conclusion: In summary, SVRI was decreased and DO₂ was increased in the group that received Nipride compared to the group that did not, consistent with its peripheral vasodilatory effects. During large volume resuscitation, control of MAP using Nipride is feasible and is associated with more favorable resus response. Nipride may be a useful adjunct during resuscitation of MTT as a vasoactive agent that promotes peripheral tissue perfusion.

Notes

**FACTORS ASSOCIATED WITH ABDOMINAL
COMPARTMENT SYNDROME DURING LARGE VOLUME
SHOCK RESUSCITATION**
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Introduction: Abdominal Compartment Syndrome (ACS) is a common complication of severe trauma. Edema of the small intestine is thought to be exacerbated by large volume IV fluid resuscitation. Monitoring for the development of ACS with gastric mucosal PrCO₂ (gPrCO₂) has been advocated, as well as routine measurement of Bladder Pressure (BIPr). Decompressing Laparotomy is the treatment of choice for ACS.

Purpose: To determine the incidence and factors associated with the development of ACS during large volume resuscitation from trauma shock.

Methods: Patients with an elevated base deficit (BD) and an anticipated need for 6 U PRBCs who sustain major injury are resuscitated by a standardized protocol using blood, isotonic crystalloid, and inotropes to maintain a DO₂I > 600ml O₂/m²/min for 24 hours. BD, lactate and coagulation factors are measured q4 hrs. Gastric mucosal PrCO₂ is measure semi-continuously BIPr measurements (q4hrs) are instituted at the surgeon's discretion. From Jan to Sept 1999, 52 patients were resuscitated under this protocol. The factors above and the development of ACS were reviewed. Data are expressed as mean ± SD, * denotes p<0.05.

Results: Of the 52 patients, seven (13%) developed ACS during resuscitation and required decompressing laparotomies. Three had no intra-abdominal injury (6%). Five had continuing hemorrhage (2 abd, 2 retroperitoneal, 1 thoracic). There were no significant differences in the incidence of pre-resuscitation hypotension (SBP <90), or the development coagulopathy during resuscitation between the groups. Initial lactate levels were higher in those with ACS (p<0.05) but initial BD was similar. Further comparison of ACS to no ACS patients is shown below:

	Age	ISS	IVF (L)	PRBCs (U)	Ave BD	Ave Lac	PrCO ₂ (mmHg)	BIPr (mmHg)
ACS	46±15	30±7	41±16	32±24	7±1	10±5	78±29	41±13
No ACS	41±21	30±10	20±8 *	14±13 *	3±3 *	5±2 *	52±14 *	18±7 *

Although age and ISS were not significantly different, these patients required much higher volumes of IVF and PRBCs. In addition, indices of systemic and regional hypoperfusion (i.e. BD, Lac and PrCO₂) were significantly higher. Mortality was 71% (ACS) vs 27% (no ACS).

Conclusions: Patients who develop ACS demonstrate persistent abnormalities of systemic perfusion during resuscitation. A much higher volume of blood and IVF must be administered (frequently for poorly controlled hemorrhage). Gastric PrCO₂ is elevated and serves as useful indicator for the development of ACS. BIPr should be done routinely in patients who fail to correct the indices of hypoperfusion or manifest an elevated PrCO₂.

Notes

Case management and clinical pathways: an objective analysis of their role in clinical trauma care.

M. Sugrue, J. Sesperez, S. Wilson, M. Seger

Trauma Department, Liverpool Hospital

M. Sugrue

M. Knudson

Liverpool, NSW 2170, Australia

Objective: Clinical Pathways and Case Management have lacked objective evidence to support their use. This study evaluated the development of Clinical Pathways and Case Management in 5 key trauma conditions.

Design: A prospective ethically approved study between July 1998 and July 1999 in patients with severe head injury, fractured ribs, fractured pelvis, blunt abdominal trauma and fractured femur. Twelve key elements of care with expected outcomes were defined for each group. Deviations from expected outcome were defined as variances, one point for each failure to reach an outcome. Potential variances were adjusted for length of stay. The study was undertaken in 3 stages: pre-implementation (Stage 1), introduction at ward level (Stage 2) and a final reinforcement (Stage 3).

Results: 235 patients (mean age 41.4 years \pm 20.8) were studied. 10 were excluded due to non-compliance with the pathway.

Stage	ISS	LOS (days)	Potential Variance	Observed Variance
1 (n=89)	12.7 \pm 11.5	17.2 \pm 26.5	704 \pm 437	62 \pm 50
2 (n=85)	11.1 \pm 11.3	12.6 \pm 16.6	654 \pm 353	41 \pm 31*
3 (n=61)	11.1 \pm 9.1	10.8 \pm 9.4	708 \pm 431	20 \pm 18 [^]

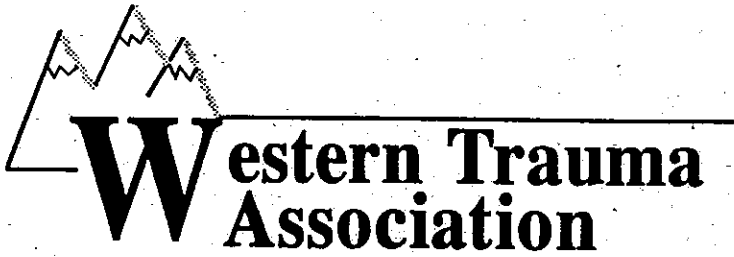
(mean \pm sd, * p <0.05, * 95%CI 8.5-33.5; [^] 95%CI 28.2-55.2)

Variances were related to system errors in 0.2%, to patient factors in 24.9% and staff related in 74.8%. The 5 most common sources of variances were clinical assessment, medications, pain management, elimination, and physiotherapy.

Conclusions: Clinical Pathways in Case Management, while not suitable for all trauma patients, improved delivery of trauma care in our population, and identified areas in need of remedial action.

Notes

BYLAWS





BYLAWS OF
WESTERN TRAUMA ASSOCIATION

ARTICLE I

Name, Objectives, Organization, and Jurisdiction

SECTION 1: Name

The name of this organization is the Western Trauma Association.

SECTION 2: Objectives

The objectives of the Association are to promote the exchange of educational and scientific information on principles, at the highest level, in the diagnosis and management of traumatic conditions and to advance the science and art of medicine.

SECTION 3: Organization

This is a non-profit membership corporation entity, duly incorporated on this 25th day of January, 1971 under, and by virtue of, the provisions of the laws of the State of Colorado.

SECTION 4: Territory

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

SECTION 5: Governing Board

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

ARTICLE II

Membership

SECTION 1: Membership Limitation

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

SECTION 2: Qualifications

Active members shall be limited to Doctors of Medicine who are Board Certified in their particular medical specialty. The Board of Directors is hereby given discretionary powers to interpret if foreign physicians who apply for membership have the credentials comparable to Board Certification. Certified members of other (non-M.D.) health care disciplines with a special interest or expertise in trauma may be elected to associate membership with the approval of the Board of Directors and the membership. Associate members shall have the rights and privileges and must satisfy the same requirements for election to and retention of membership as active members except the right to vote or hold office. For applications to be considered, candidates must submit a completed application with a letter of support (sponsorship) from a member of the Association, and submit an abstract for consideration by the Program Chairman. A new member must attend a prior meeting in which he/she is voted on for membership in the capacity of a resident, physician or certified specialist.

SECTION 3: Membership Retention

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

-) Be a physician in good standing before his or her professional specialty board.
-) Attend at least one out of every three consecutive meetings of the Association.
-) Agree to be responsible for annual membership dues and any assessments as set by the Board of Directors at a special or the annual meeting and to remain current in the payment of same.

Age 55, members in good standing will automatically accept the position of senior membership in the West Virginia Association. A senior member must pay dues annually and retains all voting privileges and rights of active members, but does not have to attend the meetings, and his membership is not counted as part of a specialty's membership quota or the total membership number.

SECTION 4: Board Action Concerning Membership

Applicants to the Association can obtain membership on a two-thirds vote of the Board of Directors.

Termination of membership can only be obtained on a two-thirds vote of the Board of Directors for a violation of one or more of the items set forth in Article II, Section 3 of the Bylaws of this association.

ARTICLE III

Meetings

SECTION 1: Annual Meetings

There shall be an annual meeting of the membership of the Association held in some suitable location chose by the Board of Directors. Funds shall be made available for the conduct of the scientific program at the annual meeting (the exact amount of the funds shall be set by the Board of Directors).

SECTION 2: Special Meetings

Special meetings of the Association may be called by the Board of Directors or two-thirds of the membership in good standing, entitled to vote. The location for a special meeting of the Association shall be chosen by the Board of Directors.

SECTION 3: Notice

Notice of the time and place of the annual or special meetings of the Association shall be mailed by the secretary of the Association to each and every member at his address as it last appears on the records of the Association with postage thereon prepaid. Notice shall be deemed delivered when deposited in the United States Mail, so addressed to the respective member.

SECTION 4: Quorum

One-fourth of the membership present at any meeting of the Association shall constitute a quorum.

ARTICLE IV

Meetings of the Directors

Section 1: Annual Meetings

The annual meetings of the Board of Directors shall be held on the same day or days and at the same place as the annual meeting of the Association.

SECTION 2: Special Meetings

Special meetings of the Board of Directors may be held at any time and place upon the call of the president or a majority of the Board providing ten days prior written notice shall be given to each director, stating the time, place and purpose of the special meeting. Notices of special meetings shall be mailed to the director by the secretary of the Association in the same form and manner as provided above for mailing notices of meetings for the general membership of the Association.

SECTION 3: Quorum

A majority of the Board of Directors shall constitute a quorum.

ARTICLE V

Registration, Fees, Dues, and Assessments

SECTION 1: Registration Fees

Registration fees for annual meetings shall be paid and used to defray the cost of the functions of the annual meeting. The amount of the registration fee shall be determined by the treasurer and president and notice thereof shall be sent to the membership along with the written notice of the annual meeting.

SECTION 2: Dues

Dues of the Association shall be set by the Board of Directors. Each member shall pay dues to the Treasurer of the Association prior to the annual meeting. Failure to pay dues shall be considered cause for termination of membership.

SECTION 3: Assessments

A two-thirds majority vote of the Board of Directors of the Association can institute a special assessment of the general membership. Special assessments can be voted by the Board of Directors only for the promotion of scientific programs at the annual meetings, research papers or other purposes designed to achieve the change of ideas and principles pertaining to the diagnosis and management of traumatic injuries and conditions. Notice of any special assessment of the membership so voted by the Board of Directors shall be sent to respective members at their last address on record with the Association, postage pre-paid.

SECTION 4: Waiver of Dues

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

ARTICLE VI

Voting

SECTION 1: Voting Rights

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

SECTION 2: Majority

A majority of the votes entitled to be cast on a matter at a meeting at which a quorum is present shall be deemed necessary for the adoption of such matters unless otherwise noted in the Bylaws.

SECTION 3: Manner of Voting

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

(1) In person.

(2) By United States Mail, postage pre-paid, addressed to the secretary of the Association at the Association's registered office, postmarked on or before the date of the meeting of the membership where the vote is to be taken.

(3) By proxy duly executed in writing by the member or his authorized attorney-in-fact. No voting member in attendance at a meeting shall hold or vote more than one duly executed proxy for absent members.

SECTION 4: Cumulative Voting

Cumulative voting shall not be allowed.

SECTION 5: Amendments

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

SECTION 6: Elections

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

ARTICLE VII

Officers

SECTION 1: Officers

The officers of the corporation shall consist of the President, President-Elect, Vice-President, Secretary, Treasurer, Historian, and such other officers as from time to time may be appointed by the Board of Directors. The President, President-Elect, Vice-President, Secretary, Historian, and Treasurer shall be elected at the annual meeting of the members.

SECTION 2: Terms and Vacancies

The Secretary, Historian, and Treasurer shall each hold office for the term of three years. The remaining officers shall be elected at the annual meeting of the members. In the event that an officer cannot fill his term, his successor shall be chosen by the Board of Directors to fill the vacancy for the unexpired term of the office.

SECTION 3: Removal

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

SECTION 4: Resignation

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

ARTICLE VIII

Duties of Officers

SECTION 1: President

Following his ascension to the chair, the president shall preside at all meetings of the members and shall serve ex-officio member at all committees. The president shall be Chairman of the Board of Directors and shall be as the liaison to the American Association for the Surgery of Trauma.

SECTION 2: President-Elect

A president-elect shall plan and organize the next annual meeting and assume whatever responsibilities the president shall assign to him.

SECTION 3: Vice President

A vice president shall preside at all business meetings in the absence of the president.

SECTION 4: Secretary

A secretary shall keep the minutes of all meetings of the members and the Board of Directors; shall keep all records and information pertaining to the history of the Association; and be responsible for applications for membership, approvals, and deletions as well as communications to the membership, especially those whose membership is in jeopardy.

SECTION 5: Treasurer

A treasurer shall have the following duties:

- | Shall keep the books of account of the Association and shall cause to be prepared an annual audit for presentation at the annual meeting.
- | Shall have custody of, and be responsible for all funds, securities, and other properties of the Association and shall deposit all such funds in the name of the Association in such banks or other depositories as shall be selected by the Board of Directors.
- | Shall assist the secretary in keeping the roster of the membership which is current and accurate.
- | Shall engage a certified public accountant, approved by the president, to audit annually the books of the Association. The accountant's report shall be reviewed by the auditing committee.

SECTION 6: Historian

The Historian should maintain and safeguard archives of the Association. The Historian shall be an ex-officio member of the Board of Directors. In case of a vacancy by reason of death, resignation, or otherwise, the vacancy may be filled by the Board of Directors until the next annual meeting of the members. The historian shall keep a continuous account of the history of the Association for the use of the membership. This shall include significant information concerning each annual meeting, including the site of the meeting, recipients of honors, invited lecturers, highlights of the scientific program, and important actions arising from the Business Meeting. The historian shall also record significant action of the Board of Directors at its meeting. Each five years the historian shall prepare the history of the Association from the time of the last recorded history to be part of the archives of the Association. Memorabilia of the Association shall be retained by the Historian.

ARTICLE IX

Board of Directors

SECTION 1: Composition

The Board of Directors of the Association shall consist of the following individuals:

(1) The president, president-elect, vice president, secretary, and treasurer, immediate past president, and six members-at-large.

(2) Two members of the Association in good standing shall be elected annually to replace two existing members-at-large of the Board unless the membership should, by majority vote, elect to retain the then existing Board of Directors.

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

SECTION 2: Powers

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

ARTICLE X

Committees

SECTION 1: Nominating Committee

The Nominating Committee shall be composed of three (3) members of the Association appointed by the President. These individuals should represent General Surgery, Orthopedic Surgery, and another specialty. The Chairman of this Committee shall be the immediate past president. This committee shall submit a slate of nominees for the various offices of the Association to the annual meeting of the members.

SECTION 2: Program Committee

The Program Committee shall consist of a Chairman and a Committee including a General Surgeon, an Orthopedic Surgeon, another specialist, and the Chairman of the Publications Committee (ex-officio), all appointed by the President. The Chairman is appointed for a two year term. This Committee will be responsible for the organization and conduct of the program at the annual meeting.

SECTION 3: Membership Committee

The Membership Committee shall consist of the Board of Directors. The secretary shall present to the Board of Directors at its annual meeting a list of candidates who have satisfied the requirements for membership. Upon approval of the Board of Directors, this group shall be then presented to the membership for its approval as previously outlined.

SECTION 4: Publications Committee

The Publications Committee will consist of a Chairman and a Committee including a General Surgeon, an Orthopedic Surgeon, a Plastic Surgeon, another specialist, and the Chairman of the Program Committee (ex-officio), all appointed by the President. This committee will be responsible for reviewing all manuscripts submitted in association with presentations at the annual meeting and for choosing those which will be submitted to *The Journal of Trauma*. The Chairman will serve as the liaison to *The Journal of Trauma*. Should the Chairman not be an Editorial Consultant to *The Journal of Trauma*, the Chairman will consult with a member of the Editorial Board of *The Journal of Trauma* designated by the President.

ARTICLE XI

Conduct and Order of Business

SECTION 1: Business Sessions of the Members

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

SECTION 2: Order of Business

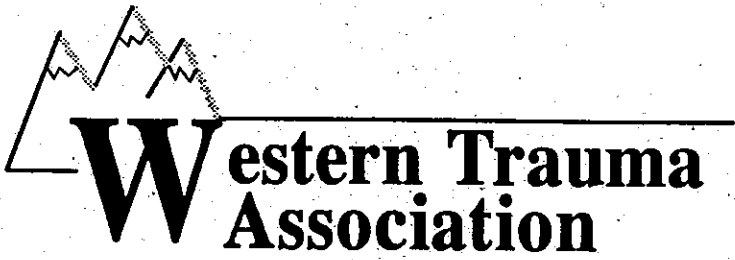
The President shall set the agenda and where possible should follow Robert's Rules of Order.

ARTICLE XII

Amendments

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

BYLAWS





BYLAWS OF
WESTERN TRAUMA ASSOCIATION

ARTICLE I

Name, Objectives, Organization, and Jurisdiction

SECTION 1: Name

The name of this organization is the Western Trauma Association.

SECTION 2: Objectives

The objectives of the Association are to promote the exchange of educational and scientific information and principles, at the highest level, in the diagnosis and management of traumatic conditions and to advance the science and art of medicine.

SECTION 3: Organization

This is a non-profit membership corporation entity, duly incorporated on this 25th day of January, 1971 under, and by virtue of, the provisions of the laws of the State of Colorado.

SECTION 4: Territory

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

SECTION 5: Governing Board

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

ARTICLE II

Membership

SECTION 1: Membership Limitation

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

SECTION 2: Qualifications

Active members shall be limited to Doctors of Medicine who are Board Certified in their particular medical specialty. The Board of Directors is hereby given discretionary powers to interpret if foreign physicians who apply for membership have the credentials comparable to Board Certification. Certified members of other (non-M.D.) health care disciplines with a special interest or expertise in trauma may be elected to associate membership with the approval of the Board of Directors and the membership. Associate members shall have the rights and privileges and must satisfy the same requirements for election to and retention of membership as active members except the right to vote or hold office. For applications to be considered, candidates must submit a completed application with a letter of support (sponsorship) from a member of the Association, and submit an abstract for consideration by the Program Chairman. A new member must attend a prior meeting in which he/she is voted on for membership in the capacity of a resident, physician or certified specialist.

SECTION 3: Membership Retention

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

-) Be a physician in good standing before his or her professional specialty board.
-) Attend at least one out of every three consecutive meetings of the Association.
-) Agree to be responsible for annual membership dues and any assessments as set by the Board of Directors at a special or the annual meeting and to remain current in the payment of same.

After age 55, members in good standing will automatically accept the position of senior membership in the West Virginia Association. A senior member must pay dues annually and retains all voting privileges and rights of active members, but does not have to attend the meetings, and his membership is not counted as part of a given specialty's membership quota or the total membership number.

SECTION 4: Board Action Concerning Membership

Applicants to the Association can obtain membership on a two-thirds vote of the Board of Directors.

Termination of membership can only be obtained on a two-thirds vote of the Board of Directors for a violation of one or more of the items set forth in Article II, Section 3 of the Bylaws of this Association.

ARTICLE III

Meetings

SECTION 1: Annual Meetings

There shall be an annual meeting of the membership of the Association held in some suitable location chosen by the Board of Directors. Funds shall be made available for the conduct of the scientific program at the annual meeting (the exact amount of the funds shall be set by the Board of Directors).

SECTION 2: Special Meetings

Special meetings of the Association may be called by the Board of Directors or two-thirds of the membership in good standing, entitled to vote. The location for a special meeting of the Association shall be chosen by the Board of Directors.

SECTION 3: Notice

Notice of the time and place of the annual or special meetings of the Association shall be mailed by the secretary of the Association to each and every member at his address as it last appears on the records of the Association with postage thereon prepaid. Notice shall be deemed delivered when deposited in the United States Mail, so addressed to the respective member.

SECTION 4: Quorum

One-fourth of the membership present at any meeting of the Association shall constitute a quorum.

ARTICLE IV

Meetings of the Directors

Section 1: Annual Meetings

The annual meetings of the Board of Directors shall be held on the same day or days and at the same place as the annual meeting of the Association.

SECTION 2: Special Meetings

Special meetings of the Board of Directors may be held at any time and place upon the call of the president or a majority of the Board providing ten days prior written notice shall be given to each director, stating the time, place and purpose of the special meeting. Notices of special meetings shall be mailed to the director by the secretary of the Association in the same form and manner as provided above for mailing notices of meetings for the general membership of the Association.

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A majority of the Board of Directors shall constitute a quorum.

ARTICLE V

Registration, Fees, Dues, and Assessments

SECTION 1: Registration Fees

Registration fees for annual meetings shall be paid and used to defray the cost of the functions of the annual meeting. The amount of the registration fee shall be determined by the treasurer and president and notice thereof shall be sent to the membership along with the written notice of the annual meeting.

SECTION 2: Dues

Fees of the Association shall be set by the Board of Directors. Each member shall pay dues to the Treasurer of the Association prior to the annual meeting. Failure to pay dues shall be considered cause for termination of membership.

SECTION 3: Assessments

Two-thirds majority vote of the Board of Directors of the Association can institute a special assessment of the general membership. Special assessments can be voted by the Board of Directors only for the promotion of scientific programs at the annual meetings, research papers or other purposes designed to achieve the change of ideas and principles pertaining to the diagnosis and management of traumatic injuries and conditions. Notice of any special assessment of the membership so voted by the Board of Directors shall be sent to respective members at their last address on record with the Association, postage pre-paid.

SECTION 4: Waiver of Dues

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

ARTICLE VI

Voting

SECTION 1: Voting Rights

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

SECTION 2: Majority

A majority of the votes entitled to be cast on a matter at a meeting at which a quorum is present shall be deemed necessary for the adoption of such matters unless otherwise noted in the Bylaws.

SECTION 3: Manner of Voting

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

(1) In person.

(2) By United States Mail, postage pre-paid, addressed to the secretary of the Association at the Association registered office, postmarked on or before the date of the meeting of the membership where the vote is to be taken.

(3) By proxy duly executed in writing by the member or his authorized attorney-in-fact. No voting member in attendance at a meeting shall hold or vote more than one duly executed proxy for absent members.

SECTION 4: Cumulative Voting

Cumulative voting shall not be allowed.

SECTION 5: Amendments

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

SECTION 6: Elections

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

ARTICLE VII

Officers

SECTION 1: Officers

The officers of the corporation shall consist of the President, President-Elect, Vice-President, Secretary, Treasurer, Historian, and such other officers as from time to time may be appointed by the Board of Directors. The President, President-Elect, Vice-President, Secretary, Historian, and Treasurer shall be elected at the annual meeting of the members.

SECTION 2: Terms and Vacancies

The Secretary, Historian, and Treasurer shall each hold office for the term of three years. The remaining office shall be elected at the annual meeting of the members. In the event that an officer cannot fill his term, his successor shall be chosen by the Board of Directors to fill the vacancy for the unexpired term of the office.

SECTION 3: Removal

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

SECTION 4: Resignation

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

ARTICLE VIII

Duties of Officers

SECTION 1: President

Following his ascension to the chair, the president shall preside at all meetings of the members and shall serve ex-officio member at all committees. The president shall be Chairman of the Board of Directors and shall serve as the liaison to the American Association for the Surgery of Trauma.

SECTION 2: President-Elect

A president-elect shall plan and organize the next annual meeting and assume whatever responsibilities the president shall assign to him.

SECTION 3: Vice President

The vice president shall preside at all business meetings in the absence of the president.

SECTION 4: Secretary

The secretary shall keep the minutes of all meetings of the members and the Board of Directors; shall keep all records and information pertaining to the history of the Association; and be responsible for applications for membership, approvals, and deletions as well as communications to the membership, especially those whose membership is in jeopardy.

SECTION 5: Treasurer

The treasurer shall have the following duties:

-) Shall keep the books of account of the Association and shall cause to be prepared an annual audit for presentation at the annual meeting.
-) Shall have custody of, and be responsible for all funds, securities, and other properties of the Association and shall deposit all such funds in the name of the Association in such banks or other depositories as shall be directed by the Board of Directors.
-) Shall assist the secretary in keeping the roster of the membership which is current and accurate.
-) Shall engage a certified public accountant, approved by the president, to audit annually the books of the Association. The accountant's report shall be reviewed by the auditing committee.

SECTION 6: Historian

The Historian should maintain and safeguard archives of the Association. The Historian shall be an ex-officio member of the Board of Directors. In case of a vacancy by reason of death, resignation, or otherwise, the vacancy may be filled by the Board of Directors until the next annual meeting of the members. The historian shall keep a continuous account of the history of the Association for the use of the membership. This shall include significant information concerning each annual meeting, including the site of the meeting, recipients of honors, invited lecturers, highlights of the scientific program, and important actions arising from the Business Meeting. The historian shall also record significant action of the Board of Directors at its meeting. Each five years the historian shall prepare the history of the Association from the time of the last recorded history to be part of the archives of the Association. Memorabilia of the Association shall be retained by the Historian.

ARTICLE IX

Board of Directors

SECTION 1: Composition

The Board of Directors of the Association shall consist of the following individuals:

(1) The president, president-elect, vice president, secretary, and treasurer, immediate past president, and six members-at-large.

(2) Two members of the Association in good standing shall be elected annually to replace two existing members-at-large of the Board unless the membership should, by majority vote, elect to retain the then existing Board of Directors.

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

SECTION 2: Powers

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

ARTICLE X

Committees

SECTION 1: Nominating Committee

The Nominating Committee shall be composed of three (3) members of the Association appointed by the President. These individuals should represent General Surgery, Orthopedic Surgery, and another specialty. The Chairman of this Committee shall be the immediate past president. This committee shall submit a slate of nominees for the various offices of the Association to the annual meeting of the members.

SECTION 2: Program Committee

The Program Committee shall consist of a Chairman and a Committee including a General Surgeon, an Orthopedic Surgeon, another specialist, and the Chairman of the Publications Committee (ex-officio), all appointed by the President. The Chairman is appointed for a two year term. This Committee will be responsible for the organization and conduct of the program at the annual meeting.

SECTION 3: Membership Committee

The Membership Committee shall consist of the Board of Directors. The secretary shall present to the Board of Directors at its annual meeting a list of candidates who have satisfied the requirements for membership. Upon approval of the Board of Directors, this group shall be then presented to the membership for its approval as previously outlined.

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The Publications Committee will consist of a Chairman and a Committee including a General Surgeon, an Orthopedic Surgeon, a Plastic Surgeon, another specialist, and the Chairman of the Program Committee (ex officio), all appointed by the President. This committee will be responsible for reviewing all manuscripts submitted in association with presentations at the annual meeting and for choosing those which will be submitted to *The Journal of Trauma*. The Chairman will serve as the liaison to *The Journal of Trauma*. Should the Chairman not be an Editorial Consultant to *The Journal of Trauma*, the Chairman will consult with a member of the Editorial Board of *The Journal of Trauma* designated by the President.

ARTICLE XI

Conduct and Order of Business

SECTION 1: Business Sessions of the Members

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

SECTION 2: Order of Business

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

ARTICLE XII

Amendments

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

MEMBERSHIP





WESTERN TRAUMA ASSOCIATION
2000
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WESTERN TRAUMA ASSOCIATION

**30th Annual Meeting
Squaw Valley, Lake Tahoe
California
February 27 - March 4, 2000**

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