

TWENTY-SEVENTH ANNUAL MEETING

*CME
20 Cat I*



*1998-21 CME
#1*

March 2nd - March 8th, 1997

Snowbird, Utah

**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 H
Erick R. Ratzer, M.D.	1982	Vail
William R. Olsen, M.D.	1983	Jackson H
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 H
Robert C. Edmondson, M.D.	1988	Steamboat
Ernest E. Moore, M.D.	1989	Snowbird
Stephen W. Carveth, M.D.	1990	Crested Bu
George E. Pierce, M.D.	1991	Jackson H
Peter Mucha, Jr., M.D.	1992	Steamboat
David V. Feliciano, M.D.	1993	Snowbird
R. Chris Wray, M.D.	1994	Crested Bu
David Kappel, M.D.	1995	Big Sky
Thomas H. Cogbill, M.D.	1996	Grand Targ
G. Jerry Jurkovich, M.D.	1997	Snowbird

*****The 1998 WESTERN TRAUMA ASSOCIATION MEETING will be
Chateau Lake Louise
Banff, Alberta, Canada
February 22-28, 1998**

WESTERN TRAUMA ASSOCIATION
27th ANNUAL MEETING
Snowbird, UT
1986-1987



OFFICERS:

G. Jerry Jurkovich, M.D.	President
James Benjamin, M.D.	President-Elect
Herbert Thomas, M.D.	Vice President
James A. Edney, M.D.	Secretary
Barry C. Esrig, M.D.	Treasurer
Gerald Gussack, M.D.	Historian

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TERM ENDS

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Dwight A. Webster, M.D.	1999

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Thomas H. Cogbill, M.D.	Chairman
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**EARL YOUNG AWARD
RECIPIENTS**

<u>Resident</u>	<u>University</u>	<u>Year</u>
Joseph Schmocker, M.D.-----	University of Vermont-----	1991
Joseph Schmocker, 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 Hahn, M.D.-----	Emory University-----	1996

**WESTERN TRAUMA ASSOCIATION
Schedule of Events**

Sunday, March 2, 1997

24 Hours/Daily	Speaker Ready Room	Coat Room
4:00 - 7:00 PM	Registration/NASTAR Sign-up Welcome Reception	2 Ballroom Sections
4:00 - 7:00 PM	Kids' Reception	

Monday, March 3, 1997

6:30 - 7:00 AM	Breakfast*	1 Ballroom Section
6:30 - 9:00 AM	Registration/NASTAR Sign-up	2 Ballroom Sections
7:00 - 9:00 AM	Scientific Paper Session I	1 Ballroom Section
4:00 - 6:00 PM	Scientific Paper Session II	1 Ballroom Section
6:00 - 7:00 PM	Members' Business Meeting	1 Ballroom Section

Past PRESIDENTS + Keynote

Tuesday, March 4, 1997

6:30 - 7:00 AM	Breakfast*	1 Ballroom Section
7:00 - 8:00 AM	Scientific Paper Session III	1 Ballroom Section
8:00 - 9:00 AM	Invited Guest Speaker Basil Pruitt, M.D. "Improvements in Care of the Burn Patient: The Successful Application of Multi-Disciplinary Integrated Biomedical Research"	1 Ballroom Section
10:00 AM	NASTAR Race	Race Hill
12:00 - 3:00 PM	Mountain Picnic & Picture	Race Hill
4:00 - 5:00 PM	Scientific Paper Session IV	1 Ballroom Section
5:00 - 6:00 PM	Presidential Address G. Jerry Jurkovich, M.D. "Paint the Ceiling"	
6:00 - 8:00 PM	WTA Board of Directors Meeting	1 Ballroom Section
6:00 PM	Family/Kids Night	

Wednesday, March 5, 1997

6:30 - 7:00 AM	Breakfast*	1 Ballroom Section
7:00 - 8:00 AM	Scientific Paper Session V	1 Ballroom Section
8:00 - 8:30 AM	Margaret Knudson, M.D. "Deep Venous Thrombosis: Diagnosis, Prevention, Treatment"	
8:30 - 9:00 AM	Harvey Sugerman, M.D. "Abdominal Compartment Syndrome"	
4:00 - 5:00 PM	Scientific Paper Session VI	1 Ballroom Section
5:00 pm	Business Meeting	

family / Kids Night

Thursday, March 6, 1997

6:30 - 7:00 AM	Breakfast*	1 Ballroom Section
7:00 - 9:00 AM	Scientific Paper Session VII	1 Ballroom Section
4:00 - 5:00 PM	Panel Discussion	1 Ballroom Section
5:00 - 6:00 PM	Scientific Paper Session VIII	
7:00 PM	Reception/Dinner	2 Ballroom Sections

Friday, March 7, 1997

6:30 - 7:00 AM	Breakfast*	1 Ballroom Section
7:00 - 9:00 AM	Scientific Paper Session IX	1 Ballroom Section
4:00 - 6:00 PM	Scientific Paper Session X	1 Ballroom Section

*Spouses', Children's, Significant Others' Continental Breakfast served daily from 8-9 AM in the Golden Cliff Room

SCIENTIFIC PAPER SESSION I

MONDAY AM, March 3, 1997

MODERATOR: G. Jerry Jurkovich, M.D.

- 7:00 AM #1. *"Ascorbic Acid Improves Survival and Decreases Pulmonary Neutrophil Sequestration in Hemorrhagic Shock"*
Authors: BW Mays, MD, and JR Wallace, MD
Presenter: Bradley W Mays, MD
Medical College of Wisconsin
**Earl Young Resident Competition
- 7:20 AM #2. *"Predicting Prolonged Ventilator Dependence (PVD) in Thermally Injured Patients"*
Authors: B Sellers, MD, B Davis, MD, P Larkin, MD, S Morris, MD, J Saffle, MD
Presenter: Barbara J Sellers, MD
Intermountain Burn Center, University of Utah Health Center
**Earl Young Resident Competition
- 7:40 AM #3. *"Early ID of Psychosocial Factors Limiting Outcome Following Traumatic Injury"*
Authors: AJ Michaels, MD, CE Michaels, MD, C Moon, MD, MA Zimmerman, PhD, C Peterson, PhD, JL Rodriguez, MD
Presenter: Andrew J. Michaels, MD
Trauma/Burn/Emergency Surgery Division, Department of Psychology and School of Public Health, University of Michigan
**Earl Young Resident Competition
- 8:00 AM #4. *"Modulation of Cytokine Response to Sepsis Through Sublethal Hemorrhage is Neither Cytokine nor Model Specific"*
Authors: E Zervos, MD, J Norman, MD, D Watkins, MD, A Rosemurgy, MD
Presenter: Emmanuel E Zervos, MD
Department of Surgery, University of South Florida
**Earl Young Resident Competition
- 8:20 AM #5. *"Ethanol Confounds Base Deficit Estimation of Injury Severity"*
Authors: KT Asgarian, MD, RM Price, PhD, KM Kelly, MD
Presenter: K.T Asgarian, MD
Department of Surgery, Morristown Memorial Hospital
- 8:40 AM #6. *"Early Bone Marrow Unresponsiveness to M-CSF and G-CSF Predisposes Burn Patients to Sepsis"*
Authors: K Pellegrin, MD, CH Rundus, MT, CE Hartford, MD, XW Wang, MD, VM Peterson, MD
Presenter: Katharina Pellegrin, MD
Department of Surgery, University of Colorado Health Sciences Center and The Children's Hospital, Denver
**Earl Young Resident Competition
- 9:00 AM Adjourn

SCIENTIFIC PAPER SESSION II

MONDAY PM, March 3, 1997

MODERATOR: Alexander S. Rosemurgy II, M.D.

- 4:00 PM #7. *"Early Predictors of the Need for Mechanical Ventilation in Blunt Trauma Patients with Pulmonary Contusion"*
Authors: J Collinge, MD, J. Tyburski, MD, S Eachempati, MD,
R Wilson, MD
Presenter: J Collinge, MD
Wayne State University
**Earl Young Resident Competition
- 4:20 PM #8. *"Base Deficit is Superior to Ph in Evaluating Clearance of Acidosis After Traumatic Shock"*
Authors: JW Davis, MD, KL Kaups, MD, SN Parks, MD
Presenter: James W Davis, M.D.
Valley Medical Center, Department of Surgery
- 4:40 PM #9. *"Initial Routine Labs in Trauma Patients are Neither Clinically Relevant nor Cost Effective"* ✓
Authors: D Kavouspour, MD, K Baker, MD, G Jans, RN
Presenter: Dar Kavouspour, MD
University of South Florida, Department of Surgery and Tampa General Hospital Trauma Center
- 5:00 PM #10. *"L-Arginine Decreases Alveolar Macrophage Proinflammatory Monokine Production in Endotoxin-Induced Acute Lung Injury"*
Authors: DR Meldrum, MD, RC McIntyre, Jr., MD, BC Sheridan, MD,
DA Fullerton, MD, A Banerjee, PhD, AH Harken, MD
Presenter: Daniel R Meldrum, M.D.
Department of Surgery, University of Colorado, Denver
** Earl Young Resident Competition
- 5:20 PM #11. *"Resolution of Pneumothorax with Oxygen Therapy is Dose Dependent"*
Authors: GJ England, MD, JD Harrah, BS, RC Hill, MD, GA Timberlake, MD,
JF Hill, BS, YL Shahan, MS, M Billie
Presenter: Gregory J England, MD
West Virginia University School of Medicine, Department of Surgery, Morgantown, W VA
**Earl Young Resident Competition
- 5:40 PM #12. *"Effects of Hypothermia on Neutrophil Function"*
Authors: JJ Fildes, S Fisher, MD, CM Sheaff, MD, PhD, JA Barrett, MD
Presenter: John J Fildes, MD
Department of Trauma Surgery, Cook County Hospital
- 6:00 PM Adjourn

SCIENTIFIC PAPER SESSION III

TUESDAY AM, March 4, 1997

MODERATOR: Barry C. Esrlg, M.D.

- 7:00 AM #13. *Saturation Kinetic Modeling of the Molecular Response to Altered Circulation Using the Michaelis-Menten Equation (MME)*
Authors: J St. Louis, MD, R Monroe, MD, RL Reed, MD
Presenter: James St Louis, MD
Duke University Medical Center
**Earl Young Resident Competition
- 7:20 AM #14. *Post-Traumatic Lymphocyte Function: Comparison Between Tissue and Peripheral Blood T-Cell Responses*
Authors: MM Aguilar, MD, FD Battistella, MD, JT Owings, MD, SA Olson, K MacColl
Presenter: Michael M Aguilar, MD
Department of Surgery, University of California, Davis
**Earl Young Resident Competition
- 7:40 AM #15. *An Episode of Prehospital Hypotension in Trauma Patients: A Marker for Injury or Just Crying Wolf?*
Authors: M Aranda, MD, SR Petersen, MD, Colleen Hunt, Brian Nelson, I
Presenter: Manual Aranda, MD
Trauma Center, St. Joseph's Hospital and Medical Center, and Texas Tech University Health Sciences Center Texas
**Earl Young Resident Competition
- 8:00 AM Basil A. Pruitt, M.D.
"Improvements in Care of the Burn Patient: The Successful Application of Multi-Disciplinary Integrated Biomedical Research"
- 9:00 AM Adjourn

SCIENTIFIC PAPER SESSION IV

WEDNESDAY PM, March 4, 1997

MODERATOR: James Benjamin, M.D.

- 12:00 PM #16. *"Immediate Neutrophil Activation after Hemorrhagic Shock and Resuscitation"*
Authors: P Rhee, MD, MPH, D Burris, MD, E Pikoulls, MD,
K Kaufmann, MD, J McKenzie, PhD
Presenter: Peter Rhee, MD, MPH
Armed Services University of the Health Sciences, Bethesda
- 1:20 PM #17. *"Secretory IgA Blocks Hypoxia Augmented Bacterial Passage Across MDCK Cell Monolayers"*
Authors: LN Diebel, MD, DM Liberati, MD, WJ Brown, MD, SA Dulchavsky, MD,
T Painter, BS, CA Diglio, PhD
Presenter: Lawrence N. Diebel, MD
Wayne State University, Departments of Surgery, Pathology and Microbiology
- 1:40 PM #18. *"Autotransfusion of Enterically Contaminated Intraoperative Shed Blood in Traumatic Gastrointestinal Perforation: Is it Safe?"*
Authors: JG Chipman, MD, SB Johnson, MD, D Scanzaroli, RPA, JF Fortune, MD
Presenter: Jeffrey Chipman, MD
University of Arizona Health Sciences Center
**Earl Young Resident Competition
- 2:00 PM G. Jerry Jurkovich, M.D.
Presidential Address - "Paint the Ceiling"
- 2:00 PM Board of Directors Meeting

SCIENTIFIC PAPER SESSION V

WEDNESDAY AM, March 5, 1997

MODERATOR: James A. Edney, M.D.

- 7:00 AM #19. *"Randomized Prospective Evaluation of the Effects of Increased Precl
Cardiopulmonary Function and Visceral Perfusion During Resuscitation"*
Authors: PR Miller, MD, MC Chang, MD, JW Meredith, MD
Presenter: Preston R Miller, MD
The Bowman Gray School of Medicine, Wake Forest University
**Earl Young Resident Competition
- 7:20 AM #20. *"The Effect of a Quality Assurance - Derived Trauma Airway Policy on Redu
Provider-Related Errors in the Emergency Department"*
Authors: JG Cushman, MD, GS Rozycki, MD, DV Feliciano, MD
Presenter: JG Cushman, MD
Grady Memorial Hospital/Emory University
**Earl Young Resident Competition
- 7:40 AM #21. *"Effects of Exogenous Cytokines on Intravascular Clearance of Bacteria
In Normal and Splenectomized Mice"*
Authors: JC Hebert, MD, M O'Reilly, MD, B Barry, L Shatney, K Sartorelli, MF
Presenter: James C Hebert, MD
University of Vermont College of Medicine
- 8:00 AM **Margaret Knudson, M.D.**
"Deep Venous Thrombosis: Diagnosis, Prevention, Treatment"
- 8:30 AM **Harvey Sugerman, M.D.**
"Abdominal Compartment Syndrome"
- 9:00 AM Adjourn

SCIENTIFIC PAPER SESSION VI

WEDNESDAY PM, March 5, 1997

MODERATOR: William M. Iannacone, M.D.

- 12:00 PM #22. *"Nonoperative Management of Splenic Injury: Are Follow-Up CT Scans of Any Value?"*
Authors: BC Thaemert, MD, TH Cogbill, MD, PJ Lambert, RN, CH Miller, III, MD
Presenter: Bradley C Thaemert, MD
Gundersen Lutheran Medical Center
**Earl Young Resident Competition
- 1:20 PM #23. *"A Cost Effective Method for Bedside Insertion of Vena Caval Filters in Trauma Patients"*
Authors: CR Nunn, MD, D Neuzil, MD, JG Bass, BA, R Pierce, RN,
JA Morris, Jr., MD
Presenter: Craig R. Nunn, MD
Vanderbilt University Medical Center
** Earl Young Resident Competition
- 1:40 PM #24. *"Fasciotomy, Chronic Venous Insufficiency and the Calf Muscle Pump"*
Authors: K Bermudez, MD, M Knudson, MD, D Morabito, RN, MPH, O Kessel, BS
Presenter: Kenneth M. Bermudez, MD
San Francisco General Hospital, University of California, San Francisco
** Earl Young Resident Competition
- 3:00 PM Business Meeting

SCIENTIFIC PAPER SESSION VII

THURSDAY AM, March 6, 1997

MODERATOR: James W. Davis, M.D.

- 7:00 AM #25. *"Significance of Free Fluid on Abdominal CT"*
Authors: K Brasel, MD, C Olson, MD, R Stafford, MD, T Johnson, MD
Presenter: Thomas J Johnson, MD
St. Paul-Ramsey Medical Center, University of Minnesota
**Earl Young Resident Competition
- 7:20 AM #26. *"Crotalid Envenomation, The Southern Arizona Experience"*
Authors: JT Tokish, MD, JB Benjamin MD, F Walter, MD
Presenter: JT Tokish, MD
The University of Arizona Health Sciences Center, Department of Surgery, Section
Orthopedic Surgery
**Earl Young Resident Competition
- 7:40 AM #27. *"Cost Analysis of Pediatric Trauma Care by Cost Centers and Mecha
Injury as a Basis for Injury Prevention and Clinical Guidelines"*
Authors: K Achanta, MD, Q Chu, MD, J Garbv, MS, B Simon, MD,
T Emhoff, MD, V Fiallo, MD, KF Lee, MD
Presenter: K Achanta, MD
Baystate Medical Center VA
**Earl Young Resident Competition
- 8:00 AM #28. *"Ultrasound is Cost-Effective Triage Tool to Evaluate Blunt Abdominal T
the Pediatric Population"*
Authors: DA Partrick, MD, DD Bensard MD, EE Moore, MD, FM Karrer, MC
SJ Terry, BSN
Presenter: David A Partrick, MD
Denver Health Medical Center, University of Colorado
**Earl Young Resident Competition
- 8:20 AM #29. *"Hypertonic Saline Is Not Beneficial for Resuscitation of Pulmonary Contu.*
Authors: SM Cohn, MD, BT Fisher, BS, AT Rosenfield, MD
Presenter: Stephen M Cohn, MD
Departments of Surgery and Radiology, Yale University School of Medicine
- 8:40 AM #30. *"Diagnostic Laparoscopy for the Evaluation of Penetrating
Abdominal Trauma"*
Authors: JE Mazuski, MD, PhD, MJ Shapiro, MD, DL Kaminski, MD,
C Andrus, MD, M Keegan, RN, W Luchtefeld, RN, RM Durham, I
Presenter: Rodney M Durham, MD
Department of Surgery, St. Louis University
- 9: 00 AM Adjourn

SCIENTIFIC PAPER SESSION VIII

THURSDAY PM, March 6, 1997

4:00 PM **PANEL DISCUSSION**

MODERATOR: Fred Moore, M.D.

5:00 PM **#31. *"Content Analysis of Pediatric Trauma in the Media"***

Authors: EJ Doolin, MD, AM Browne, MSN

Presenter: Anne M Browne, MSN

Cooper Hospital/University Medical Center, Camden, NJ

5:20 PM **#32. *"Neurosurgeons and Neurotrauma: Facts and Myths"***

Authors: TJ Esposito, MD, AM Kuby, AM, AS Zelby, MD, C Unfred, NA,

HL Young, MS, RL Gamelli, MD

Presenter: Thomas J Esposito, M.D.

Loyola University Medical Center

5:40 PM **#33. *"Management of Self-Inflicted Low-Energy Gunshot Wounds that Violate the Skull Base"***

Authors: DJ Kriet, MD, RB Stanley, MD, MS Grady, MD

Presenter: David J Kriet, MD

Harborview Medical Center, University of Washington School of Medicine

6:00 PM **Adjourn**

SCIENTIFIC PAPER SESSION IX

FRIDAY AM, March 7, 1997

MODERATOR: Larry Gentilello, M.D.

- 7:00 AM #34. *"Patients with Gunshot Wound to the Head Do Not Require Cervical Spine Immobilization and Evaluation"*
Authors: KL Kaups, MD, JW Davis, MD
Presenter: KL Kaups, MD
Valley Medical Center, Fresno
- 7:20 AM #35. *"Compelling Injuries: The Focus of Trauma Triage, Systems, and Care"*
Authors: HR Champion, FRCS (Edin), CM Cushing, MD, AC Malliaris, PhD,
WJ Sacco, PhD, LV Lombardo, BS
Presenter: Howard R. Champion, FRCS (Edin)
National Study Center for Trauma and EMS University of Maryland at Baltimore
- 7:40 AM #36. *"Maxillofacial Injuries in the National Hockey League"*
Authors: GL Lanzi, DMD, JE Burke, DMD, AJ Fedeli, DMD
Presenter: GL Lanzi, MD
Cooper Hospital/University Medical Center
- 8:00 AM #37. *"Cardiopulmonary and Visceral Effects of Operative Decompression on Patients with Intra-Abdominal Hypertension"*
Authors: MC Chang, MD, PR Miller, MD, JW Meredith, MD
Presenter: Michael C Chang, MD
The Bowman Gray School of Medicine, Wake Forest University
- 8:20 AM #38. *"Abdominal Ultrasound is Not a Sensitive Detector of Intra-Abdominal Injury"*
Authors: KF O'Malley, MD, H Sario MD, G Cains, MD, M DiMarcangelo, D
SE Ross, MD
Presenter: Cooper Hospital/University Medical Center
Cooper Hospital/University Medical Center
- 8:40 AM #39. *"Test-Based Improvements for Mobile Field Surgical Teams"*
Authors: AT Putnam, MD, R Karulf, MD, A Olsewski, MD, D Bradley, PhD,
D Kissinger, MD
Presenter: A Tyler Putnam, M.D.
Wilford Hall Medical Center, San Antonio
- 9:00 AM Adjourn

SCIENTIFIC PAPER SESSION X

FRIDAY PM, March 7, 1997

MODERATOR: Thomas H. Cogbill, M.D.

- 4:00 PM #40. *"A Changing Perspective of Odontoid Fractures: Implications for Evaluation and Management"*
Authors: W Iannacone, MD, J Naranja, MD, WG DeLong, Jr, MD,
C Born, MD, R Dalsey, MD, L Deutsch, MD, J Catalano, MD
Presenter: William M Iannacone, MD, Ph D
Cooper Hospital/University Medical Center
- 4:20 PM #41. *"The Efficacy of the Motor Component of the Glasgow Coma Scale in Trauma Triage"*
Authors: SE Ross, MD, C Leopold, MS, C Terrigino, MD, K O'Malley, MD
Presenter: Steven E Ross, MD
Cooper Hospital/University Medical Center
- 4:40 PM #42. *"Evaluation of Alpine Skiing and Snowboarding Injury in a Northeastern State"*
Authors: DE Sacco, K Sartorelli, MD, DW Vane, MD
Presenter: Diane E Sacco, MD
University of Vermont College of Medicine
- 5:00 PM #43. *"Can Surgeons Evaluate Emergency Ultrasound Scans for Blunt Abdominal Trauma?"*
Authors: MG McKenney, MD, L Fernandez, MD, D Shatz, MD, N Namias, MD,
D Levi, MD, A Arrillaga, MD, L Martin, MD, J Moylan, MD
Presenter: Mark G McKenney, MD
University of Miami
- 5:20 PM # 44. *"Operative Splenic Salvage? Contemporary Management of 1540 Blunt Splenic Injuries"*
Authors: DJ McMahon, MBBS, MD Nance, MD, MD Grossman, MD, AK May, MD
DR Kauder, MD, CW Schwab, MD
Presenter: Damian J. McMahon, MD
Division of Trauma and Surgical Critical Care, Hospital of the University of Pennsylvania, Philadelphia
- 5:40 PM #45. *"Randomized Multicenter Prospective Tracheostomy Study"*
Authors: HJ Sugerman, MD, FR Pasquale, MD, KF O'Malley, MD
Presenter: Harvey J. Sugerman, MD
Western Trauma Association Multicenter Study Group Medical College of Virginia,
Virginia Commonwealth University, Richmond
- 6:00 PM Adjourn

ABSTRACTS



ASCORBIC ACID IMPROVES SURVIVAL AND DECREASES
PULMONARY NEUTROPHIL SEQUESTRATION IN
HEMORRHAGIC SHOCK

B.M. Mays, M.D. and J.R. Wallace, M.D., PhD

Medical College of Wisconsin

Milwaukee, WI

B.M. Mays, M.D.

Charles Aprahamian

Milwaukee, WI

OBJECTIVE: To test if the aqueous antioxidant ascorbic acid (AA) given during resuscitation in a model of severe hemorrhagic shock will improve survival and prevent neutrophil sequestration in the lung.

METHODS: Fasted, male Sprague Dawley rats were anesthetized with halothane and body temperature was maintained at 37 degrees Celsius with a warming pad. The femoral artery and vein were cannulated and hemorrhagic shock maintained for one hour at 25mmHg with a gravitational column in the absence of heparin. After one hour of shock the animals (n = 15 in each arm) were randomized by card selection into two groups: 1) 0.9% saline alone or 2) 1 gm/kg AA in isotonic solution and survival was assessed at 72 hours. Total resuscitation volume was 40 ml/kg. Separate animals were treated as above but were sacrificed one hour after resuscitation to evaluate pulmonary neutrophil sequestration utilizing a myeloperoxidase spectrophotometric assay (MPO). Sham operated animals were anesthetized and MPO activity assessed (units/gm wet tissue).

RESULTS: Systolic blood pressure and final hematocrit prior to decannulation were not different between the two groups (AA = 63mmHg + 6.8) versus Saline alone = 55mmHg + 10.4) and (29% + 3.0 versus 30% + 4.0). Resuscitation with AA improved survival (10 lived/5 died 67%) versus Saline alone (3 lived/12 died 20%) $p < 0.05$ ++. Animals given AA had less lung MPO activity 0.89 units/gm tissue, S.E.M.=0.08 versus 1.47 units/gm tissue, S.E.M.=0.13, $p < 0.05^*$ in saline treated animals. Sham operated animals had 0.46 units/gm tissue, S.E.M.= 0.26.

CONCLUSION: These data show that ascorbic acid given during resuscitation improves survival and prevents neutrophil sequestration in this model of hemorrhagic shock.

++ Chi-square with Yate's correction

* Student's unpaired T-test

NOTES

PREDICTING PROLONGED VENTILATOR DEPENDENCE (PVD) IN THERMALLY INJURED PATIENTS

B Sellers, B Davis, P Larkin, S Morris, J Saffle,
Intermountain Burn Center, University of Utah Health Center
Barbara J. Sellers, MD

Jeffrey R. Saffle, MD

Salt Lake City, UT

Recent studies suggest that when PVD (≥ 14 days) can be predicted in trauma/ICU patients, early tracheostomy may reduce length of stay and pneumonia. This study was performed to develop early criteria predictive of PVD in burn patients.

METHODS: We reviewed all burn patients age ≥ 16 admitted between 1990-1994 who required ventilator support (VS) for ≥ 3 days. Using the variables total (TBSA) and full-thickness burn size (FTBSA), age, inhalation injury, and worst $\text{PaO}_2/\text{FiO}_2$ on post-burn day 3 (P/F), an equation predicting PVD for each patient was created using logistic regression. The equation was tested by applying it to 1995 patients.

RESULTS: 62 of 110 patients reviewed developed PVD

Variable	All pts	VS \leq 13d (n=48)	VS \geq 14d (n=62)
TBSA	33 \pm 19*	24 \pm 16	40 \pm 19
FTBSA	19 \pm 18	9.6 \pm 9.7	27 \pm 19**
Age (yrs)	41 \pm 16	38 \pm 14	44 \pm 17**
IN (%)	58/110 (53)	18/48 (38)	40/62 (65)**
P/F	181 \pm 16	212 \pm 70	155 \pm 62**
* mean \pm sd **p \leq 0.05 vs VS \leq 13days			

The following equation was created: $\ln[\text{Prob PVD}/(1-\text{Prob PVD})] = (-2.967) + (0.07)(\text{age}) + (0.116)(\text{FTBSA}) + (-0.014)(\text{P/F}) + (2.013)(\text{IN}; 1=\text{yes}; 2=\text{no})$. When a probability ≥ 0.5 was considered predictive of PVD, the equation correctly predicted PVD in 84% of the 1990-1994 sample, and 93% of the 1995 sample.

CONCLUSIONS: Prolonged ventilator dependence in burn patients can be predicted using objective variables available in the early post-burn period. These predictions can be used in planning resource utilization, and in selecting patients for prospective studies of early tracheostomy.

NOTES

**EARLY IDENTIFICATION OF PSYCHOSOCIAL FACTORS
LIMITING OUTCOME FOLLOWING TRAUMATIC INJURY**

AJ Michaels, MD*, CE Michaels, MD#, C Moon#, MA Zimmerman,
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The return of an injured patient to meaningful function is the central challenge facing trauma systems. We present a model which predicts psychosocial morbidity that compromises return to work independent of pre-injury function, injury severity, physical recovery, compensation or litigation status.

METHODS: A cohort of 56 patients without severe neurotrauma was evaluated prospectively for return to functional employment. Evaluation included data from the trauma registry [age, injury mechanism, and Injury Severity Score (ISS)], an expanded social history (gender, marital status, income, employment, education, and religious practice), and psychometric testing including: psychological [Brief Symptom Index (BSI), Impact of Events Scale (IES) and Mississippi PTSD scale], social (MSPSS and LES), and general health measures [Sickness Impact Profile (SIP) and SF-36]. Evaluation consisted of interviews and mailed self-report questionnaires at admission, one and four months following injury. Results were analyzed by a stepwise linear regression model and by Chi-square, student T-test and Spearman's correlations. Data are reported as percent (%) or mean \pm standard error of the mean. Significance is noted at the 95% confidence level.

RESULTS: 35 patients completed the protocol (64%). This population was 37 ± 2.9 years old, 77% male, 46% married, 52% high school and 28% college educated, and 80% earned $> \$20,000$. Injury mechanism was blunt force in 74%, penetrating in 9% and 17% burns. The ISS was 13.3 ± 1.8 , 28% required urgent operation and the length of stay was 7.8 ± 1.2 days. Poor SIP work score was due to physical disability ($p=.016$) and psychological pathology ($p=.015$) in a regression analysis of data collected at four months. Premorbid employment status, premorbid psychopathology, and ISS were not significant in this model. A high IES on admission correlated with delayed psychopathology in a X^2 analysis ($P<.001$, risk ratio of 4.8). Of interest, patients not completing the protocol were no different by any psychological measure, although they had lower education ($p=.001$) and income ($p=.009$) levels, were 90% male and had a higher proportion of penetrating injury.

CONCLUSIONS: Our regression model allowed us to identify several components of poor outcome as measured by the SIP work score. Psychological distress at four months following injury is associated with compromised return to work independent of premorbid employment or psycho-pathology, ISS, incomplete physical recovery or litigation. Significant psychopathology and poor outcome can be predicted at the time of admission by a high IES score. Early identification of risk factors may permit early intervention designed to limit psychosocial morbidity and potentially improve functional outcome.

NOTES

MODULATION OF CYTOKINE RESPONSE TO SEPSIS THROUGH SUBLETHAL HEMORRHAGE IS NEITHER CYTOKINE NOR MODEL SPECIFIC

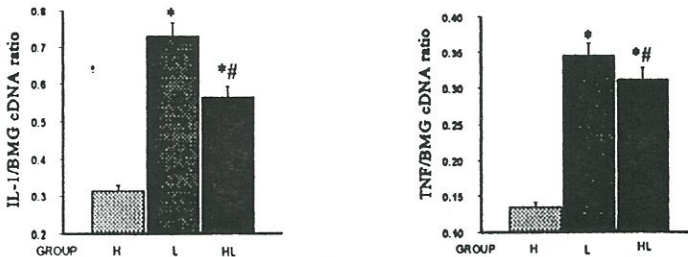
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Background: We have previously shown that tolerance to lethal endotoxic challenge can be induced in mice through sublethal hemorrhage. In these studies, LPS-induced serum IL-1 β was blunted following hemorrhage. This study was undertaken to determine if hemorrhage induces attenuation of the cytokine response to sepsis beyond IL-1 β , whether this response occurs at the level of gene transcription and whether it occurs in a non-murine model. **Methods:** Twelve Sprague Dawley rats (175-200 g) underwent either sublethal hemorrhage, 1cc/100g by cardiac puncture (Group H), lethal intraperitoneal endotoxin 40mg/kg (Group L) or sublethal hemorrhage followed by lethal endotoxin 24 hours later (Group HL). Animals were sacrificed by decapitation 12 hours following LPS (Groups L and HL) or hemorrhage (Group H). IL-1 β and TNF mRNA was determined on total splenic RNA isolates by quantitative differential RT-PCR. **Results:** * = $p < 0.05$ vs. H and # = $p < 0.05$ vs. L by Mann Whitney U-Test. Data are mean \pm SEM.



Rats hemorrhaged prior to lethal LPS mounted a cytokine response greater than rats exposed to hemorrhage alone but less than rats receiving LPS alone. **Conclusions:** Sublethal hemorrhage induces early IL-1 β and TNF gene expression which blunts their expected rise following subsequent endotoxic challenge. This study demonstrates that this effect is neither model nor cytokine specific. Blunting of inflammatory cytokine gene expression by sublethal hemorrhage prior to LPS challenge supports the host protection and survival benefit observed in the murine model.

NOTES

ETHANOL CONFOUNDS BASE DEFICIT ESTIMATION OF
INJURY SEVERITY

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The literature supports the use of the base deficit (BD) calculation from arterial blood gas determination as a guide for resuscitation (*J Trauma* 28:1464, 1988) and as a marker for injury severity (*J Trauma* 33:417, 1992). Although serum lactate may be more specific for end organ hypoperfusion, the minimum turnaround time for standard wet chemistry lactate analysis is approximately one hour. BD has been described as stoichiometric to lactate (*Surg Clin N Am* 62:31, 1982). Because of this, our trauma surgeons use BD as one indicator of injury severity. BD may be reflective of many acid-base disorders but during trauma resuscitation abnormal BD levels (BD < -2) are almost always due to hypothermia, hypovolemia or alcohol-induced ketoacidosis. Since no previous authors have described the effect of alcoholic ketoacidosis on BD in the trauma patient, we sought to determine if alcohol (EtOH) ingestion affected BD.

In a retrospective analysis of 104 trauma patients who had serial arterial blood gas determinations, we noted the following: (1) no patients had a core temperature less than 35 °C, i.e., none were hypothermic; (2) for equal severity of injury, the initial BD was significantly (*p ≤ 0.001) lower in those patients with EtOH levels > 10 mg/dl (Table 1).

Table 1: Comparison of Patients With and Without EtOH > 10 mg/dl (mean ± S.D.).

	<u>EtOH +</u>	<u>EtOH -</u>
n	28	76
EtOH	197.4±89.2	0.2±0.7
ISS	23.5±13.0	23.5±9.1
RTS	6.3± 2.0	6.5±1.9
GCS	11.7± 4.8	11.9±4.7
BD _i *	-6.3± 3.8	-3.8±3.3
BD _f	-1.5± 5.3	-1.7±3.5

*Significance at p<0.001

ISS = Injury Severity Score (1-75)

RTS = Revised Trauma Score (0-7.84)

GCS = Glasgow Coma Score (3-15)

BD_i = initial BD

BD_f = final BD after resuscitation

In patients with EtOH < 10 mg/dl, the degree of BD abnormality was consistent with the severity of injury, as previously reported. However, in those patients with EtOH > 10 mg/dl, the degree of BD abnormality was greater than had been previously correlated with the same severity of injury. In all previous studies, more severe derangements in BD were correlated with increased injury severity. Our data show equal injury severity in the two comparison groups as measured by ISS or RTS. In multiple pairwise comparisons (Tukey test), only the initial BD was significantly (*p ≤ 0.001) different between the EtOH + and EtOH - groups.

We conclude that alcoholic ketoacidosis exaggerates BD abnormalities. This is an important consideration during resuscitation since the degree of BD abnormality is often used to judge the degree of hypovolemia and is acted on accordingly.

NOTES

EARLY BONE MARROW UNRESPONSIVENESS TO M-CSF AND G-CSF PREDISPOSES BURN PATIENTS TO SEPSIS

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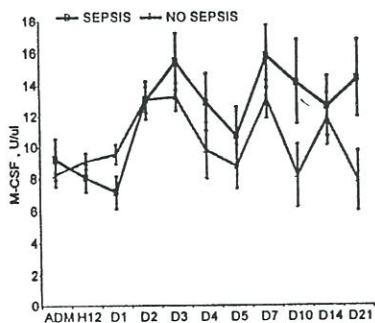


Figure 1 Sepsis and M-CSF levels

39 ± 17; mean burn size, 36 ± 23%) and related CSF levels to burn size, sepsis, survival and white cell count. Sera were assayed for G-CSF and GM-CSF by ELISA, and for M-CSF by radio-immunoassay. Admission M-CSF was 60-fold above normal controls (0.14 ± .018 U/μl), peaked at days 3 & 7, and was higher (p < .05) in septic patients as early as day 3 (Fig 1). Admission and days 2 & 3 G-CSF levels were also higher (p < .05) in septic patients (Fig 2). GM-CSF was undetectable in normal and postburn sera. WBC were paradoxically lower in septic than nonseptic burn patients at day 2 (7,500 vs 11,300; p < .05), despite the fact that serum levels of both M-CSF and G-CSF were greater in septic patients in the early postburn period. In summary, elevations in M-CSF and G-CSF failed to increase WBC production, indicating an early bone marrow failure in patients who subsequently became septic. We therefore conclude that high serum levels of M-CSF and G-CSF, in conjunction with a low WBC, appear to be sensitive, early predictors of postburn sepsis.

Previous data in our laboratory indicate that bone marrow failure invariably precedes postburn sepsis. Macrophage-colony-stimulating factor (M-CSF), granulocyte-CSF (G-CSF), and GM-CSF stimulate growth and function of granulocyte and macrophage progenitors. We hypothesized that early alterations in the production of CSFs may predate postburn marrow failure and predict sepsis. Serial serum levels of M-CSF, G-CSF and GM-CSF were obtained in 70 adult burn patients (59 survivors, 11 nonsurvivors; 23 septic patients with mean time to onset of sepsis = 9 days; mean age,

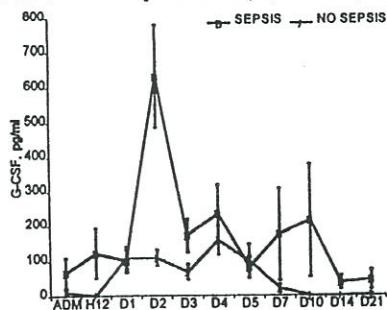


Figure 2 Sepsis and G-CSF levels

NOTES

EARLY PREDICTORS OF THE NEED FOR MECHANICAL VENTILATION IN BLUNT TRAUMA PATIENTS WITH PULMONARY CONTUSION

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OBJECTIVE: To evaluate early predictors of the need for mechanical ventilation in patients with pulmonary contusion.

METHODS: The medical records and chest x-rays of 103 consecutive trauma patients with the diagnosis of pulmonary contusion admitted to a Level One Trauma Center from 1993 to 1995 were evaluated for Injury Severity Score (ISS), Glasgow Coma Score (GCS), shock on admission, number of rib fractures (RibFx), presence of flail chest (3 or more consecutive ribs broken in more than one place), extent of contusion (mild, moderate, severe) evident within 24 hours on chest x-ray, and initial arterial partial pressure of oxygen to fraction of inspired oxygen ratio (PaO₂/FiO₂). Patients were divided into two groups based on ventilator requirements. A subdivision of ventilated patients with GCS ≥ 9 (n=38) was identified to exclude patients intubated solely on the basis of neurologic status.

RESULTS: Fifty-six patients required mechanical ventilation and 47 did not. The overall mortality rate was 22%. There were no differences in age, sex, or mechanism of injury between the groups. Predictions of the need for mechanical ventilation in these groups were:

	Pts with ISS ≥ 20	Pts with Shock on Admission	Pts with Flail Segment	Mean RibFx ± SEM	Pts with Mod-Severe Contusion on CXR	Mean PaO ₂ /FiO ₂ ± SEM
Non-vent (n=47)	14 (30)	2 (4)	13 (28)	2.9 ± 0.4	35 (75)	417 ± 42
Total Vent (n=56)	* 39 (70)	* 18 (32)	// 11 (20)	// 3.6 ± 0.6	* 53 (95)	* 284 ± 25
Vent with GCS ≥ 9 (n=38)	* 23 (61)	* 10 (26)	// 8 (21)	// 3.8 ± 0.7	+ 36 (98)	* 267 ± 29

* P = <.01 vs non-vent; // P = NS vs non-vent; + P = <.002; () = %

CONCLUSION: Early predictors of the need for mechanical ventilation in patients with pulmonary contusion were ISS ≥ 20, shock on presentation, moderate or severe contusion on CXR within 24 hours, and a PaO₂/FiO₂ <350. These predictors were accurate independent of intubation for associated neurologic injury. The number of rib fractures and the presence of a flail segment were not predictive of the requirement for intubation. The PaO₂/FiO₂ ratio and the appearance of the CXR are highly predictive of the need for mechanical ventilation in patients with pulmonary contusions.

NOTES

BASE DEFICIT IS SUPERIOR TO PH IN EVALUATING
CLEARANCE OF ACIDOSIS AFTER TRAUMATIC SHOCK

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PURPOSE: Previous studies have demonstrated the utility of admission Base Deficit (BD) in assessing shock, resuscitation and predicting complications. This study was done to evaluate the differences in BD clearance, pH normalization and complications between Survivors (S) and Non-Survivors (NS) after traumatic shock.

METHODS: Patients entered into the trauma registry from 7/90 through 8/95 with arterial blood gases performed within an hour of arrival, and an admission BD ≤ -6 , were included. Data is grouped by BD category (Moderate, -6 to -9, Severe ≤ -10) and survival. Group mean \pm SEM were compared with two-tailed T test.

RESULTS: Over the study period, 674 patients met entry criteria and had medical record review with recording of serial blood gas data.

BD Category	Admit	4 hr	8 hr	16 hr	24 hr
Moderate					
BD_S	-7.0 \pm .1	-5.4 \pm .3	-4.2 \pm .4	-1.2 \pm .3	0.6 \pm .3
BD_NS	-7.3 \pm .1	-7.7 \pm .9	-6.2 \pm .8	-3.5 \pm .9	-1.9 \pm .9
p Value	.02	.004	.011	.002	.001
pH_S	7.32 \pm .00	7.37 \pm .01	7.38 \pm .01	7.41 \pm .01	7.43 \pm .01
pH_NS	7.31 \pm .01	7.33 \pm .02	7.37 \pm .02	7.40 \pm .02	7.43 \pm .02
p Value	.15	.07	.3	.3	.3
Severe					
BD_S	-14.1 \pm .4	-7.5 \pm .6	-4.9 \pm .5	-1.7 \pm .4	0.4 \pm .5
BD_NS	-15.9 \pm .5	-10.0 \pm 1.1	-7.1 \pm 1.1	-5.4 \pm 1.2	-3.4 \pm 1.2
p Value	.002	.03	.034	.001	.001
pH_S	7.18 \pm .01	7.32 \pm .01	7.36 \pm .01	7.40 \pm .01	7.43 \pm .01
pH_NS	7.12 \pm .02	7.29 \pm .03	7.34 \pm .02	7.36 \pm .02	7.39 \pm .02
p Value	.001	.134	.3	.024	.041

Multi-organ failure was significantly more frequent in NS vs. S, in both moderate (16% vs 2%, $p < 0.001$) and severe (13% vs. 3%, $p < 0.001$) BD categories.

CONCLUSIONS: S in both the moderate and severe groups had improved their BD by one category at 4 hr and normalized their BD by 16 hr. NS did not improve BD category until 8 hr (severe) and 16 hr (moderate) and did not normalize their BD until 24 hr. BD revealed differences in metabolic acidosis between S and NS not shown by pH and is clearly a better marker of acidosis clearance after shock.

NOTES

**INITIAL ROUTINE LABS IN TRAUMA PATIENTS ARE
NEITHER CLINICALLY RELEVANT NOR COST EFFECTIVE**

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Objective: To determine if routine CBC (WBC, Hgb, HCT, Plt.), Chem7 (Na⁺, K⁺, Cl⁻, HCO₃⁻; BUN, Creatinine, Glucose), PT, PTT, serum alcohol (ETOH) and urine drug screen (UDS) have clinical significance in the initial evaluation of severely injured adults.

Methods: Over 4 months, 193 consecutive adult trauma alert patients were prospectively randomized to Limited Lab Profile (LLP = U/A, Hgb) vs Complete Lab Profile (CLP = U/A, CBC, Chem7, PT, PTT, ETOH/UDS) via an envelope pull method. Age >60, sternotomy scar, and coumadin history were used as strict criteria to add Chem7 or PT, PTT for those randomized to LLP.

Results: 95 adults randomized to LLP and 98 to CLP. Injuries were 114 (59%) blunt, 47 (24%) penetrating, 7 (4%) burn, and 25 (13%) other. Data are mean ± S.D.

	#	Male	Age	ISS	RTS	GCS	Hgb(gm/dl)
LLP	95	67(70%)	33±15	12.7±14.5	10.6±2.8	13.2±4.5	13.5 ± 2.9
CLP	98	75(77%)	33±15	9.9±10.1	11.1±1.9	13.0±3.7	13.6 ± 1.9

Those undergoing CLP had abnormalities in Na⁺ (8%), K⁺ (36%), Creatinine (22%), Plt (2%), PT (61%), and ETOH/UDS (63%). Of the 98 patients in CLP, 76 (78%) had abnormal lab values. Correction was undertaken in only 2 patients (3%), that being FFP to correct prolonged PT. The difference in cost between CLP and LLP is \$86.91 per patient in our institution, which translates to an estimated annual hospital cost of \$174,000.

	Chem7	Plt	ETOH/UDS	PT
# of abnormalities in CLP	35(36%)	2(2%)	62(63%)	60(61%)
# of interventions in CLP	0	0	0	2

Conclusion: This prospective randomized study documents that routine labs do not add substantively to the care of a broad range of notably injured trauma patients. Abnormalities on CLP occurred in over 75% of the subjects and corrective intervention was virtually never undertaken, without ill effect. Chemistry profile, CBC, alcohol and drug screens, and coagulation profiles obtained on admission of trauma alert patients are often abnormal and are seldom corrected, thus being generally superfluous and excessively expensive.

NOTES

L-ARGININE DECREASES ALVEOLAR MACROPHAGE PROINFLAMMATORY MONOKINE PRODUCTION IN ENDOTOXIN-INDUCED ACUTE LUNG INJURY.

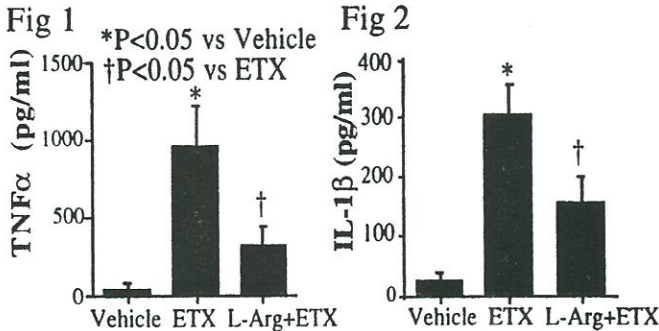
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Recent clinical reports (Chollet et al, Am J Respir Crit Care Med, 1996) indicate that inhaled nitric oxide (NO) reduces alveolar macrophage proinflammatory monokine (TNF α and IL-1 β) production which are purported to promote acute lung injury. We hypothesized that the provision of substrate for local NO production (L-arginine) would reduce alveolar macrophage proinflammatory monokine production following endotoxin (ETX)-induced acute lung injury. The purpose of this study was to determine the effect of L-arginine on tumor necrosis factor α (TNF α) and interleukin 1 β (IL-1 β) production in ETX-induced acute lung injury. **Methods:** Rats received ETX (0.5 mg/kg IP) or vehicle, with or without L-arginine supplementation (300 mg/kg IP). 4 hours later, alveolar macrophage were harvested by bronchoalveolar lavage and incubated at 10^6 cells/ml+1 ug/ml PMA for 24 hours. Cell-free supernatants were collected and assayed (ELISA) for TNF α and IL-1 β . **Results:** L-arginine decreased alveolar macrophage TNF α (Fig 1) and IL-1 β (Fig 2) release during acute lung injury ($P<0.05$, ANOVA and Tukey's, $n=6$ /group).



We conclude that: 1) L-arginine decreases alveolar macrophage proinflammatory monokine production during ETX-induced acute lung injury; 2) L-arginine is an immunomodulating nutritional supplement; and 3) the provision of exogenous substrate for local NO production may reduce the deleterious clinical effects of acute lung injury.

NOTES

RESOLUTION OF PNEUMOTHORAX WITH OXYGEN THERAPY IS DOSE DEPENDENT

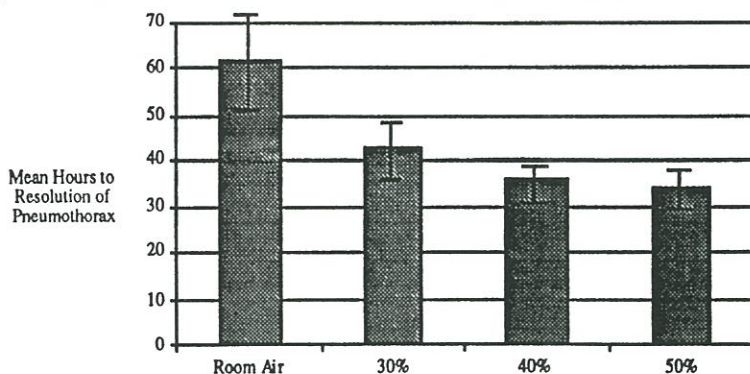
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The treatment of asymptomatic patients with small pneumothoraces has included observation and tube thoracostomy. Our laboratory has shown previously that high dose oxygen therapy (FiO₂ 60%) improves resolution of pneumothoraces significantly when compared with room air. This study was designed to evaluate lower levels of inspired oxygen and to establish a dose response curve in the resolution of experimental pneumothoraces.

Forty New Zealand white rabbits were randomly divided into four groups of inspired oxygen: room air (21%), 30%, 40%, and 50% FiO₂. Experimental pneumothoraces were created in the rabbits and they were placed in cages with the designated level of inspired oxygen. Serial chest x-rays were performed until the pneumothoraces resolved. Statistical analysis was performed using the Jonckheere-Terpstra test for ordered alternatives.



Results are given as mean \pm standard error of the mean. Room air pneumothoraces resolved in 61.7 ± 12.3 hours, 30% FiO₂ in 42.9 ± 6.0 hours, 40% FiO₂ in 35.8 ± 4.3 hours, and 50% FiO₂ in 33.8 ± 4.7 hours.

These results show a statistically significant dose dependent improvement in resolution of pneumothoraces with increasing levels of inspired oxygen ($p < 0.01$). Supplemental oxygen in lower concentrations may be utilized to facilitate the resolution of small pneumothoraces.

NOTES

EFFECTS OF HYPOTHERMIA ON NEUTROPHIL FUNCTION

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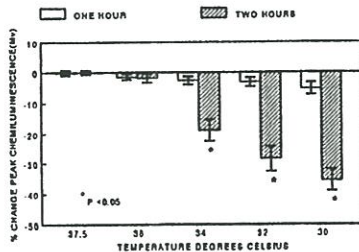
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Objective: We will determine if neutrophil function, as measured by oxidative burst, is decreased by mild to moderate levels of hypothermia.

Methods: Blood was collected from healthy adult volunteers. The neutrophils were isolated and divided into 2 aliquots. One was incubated at the control temperature of 37.5°C, and the other at an experimental temperature of either 30°C, 32°C, 34°C, or 36°C. The peak chemiluminescence and the time required to reach the peak were determined at 1 and 2 hours for each sample. The percent change of the peak chemiluminescence and the time to reach the peak were calculated for each temperature at 1 and 2 hours. These values were compared to control using ANOVA with $p < 0.05$ indicating significance.

Results: The percent change of the peak chemiluminescence was significantly decreased after 2 hours at temperatures of 34°C ($-18.76\% \pm 3.45$), 32°C ($-28.39\% \pm 4.19$), and 30°C ($-35.57\% \pm 3.54$). The percent change of the time required to reach the peak was significantly increased after 1 hour at temperatures of 34°C ($31.5\% \pm 3.40$), 32°C ($33.7\% \pm 4.5$), and 30°C ($32.1\% \pm 3.61$).

Temperature vs % Chemiluminesc



Conclusions: Hypothermia (30°-34°C) causes significant levels of neutrophil dysfunction. Neutrophils are the first line of defense against infection. Additional studies are required to determine if this in-vitro observation correlates with increased infection rates.

NOTES

**SATURATION KINETIC MODELING OF THE MOLECULAR
RESPONSE TO ALTERED CIRCULATION USING THE
MICHAELIS-MENTEN EQUATION (MME)**

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Adequate circulatory performance should ensure sufficient oxygen delivery to prevent cell stress. A mathematical model of saturation kinetics, such as MME ($VO_2 = [DO_2 \times V_{max}] / [K_m + DO_2]$), should accurately define the oxygen delivery (DO_2)-oxygen consumption (VO_2) relationship, as well as the cellular response pattern. Heat Shock Proteins (HSP72) are a unique class of proteins believed to be responsible for the prevention of abnormal protein unfolding during cellular stress. Ten Dekalb pigs (30-80kg) were fibrillated and DO_2 controlled by use of Direct Mechanical Ventricular Actuation. VO_2 was measured independently of DO_2 using spirometry. Six additional pigs (50-80kg) were used as controls. RT-PCR was performed on kidney and liver biopsies to analyze the expression of RNA for HSP72. Least-squares regression techniques were used to curve-fit data points to the MM model.

Curve-fitting of VO_2 vs. DO_2 using the MME produced individual VO_2 - DO_2 curves with a mean R^2 of 0.91 ± 0.05 , whereas curve-fitting of HSP72 mRNA expression vs. DO_2 using an inverse MME produced a mean R^2 of 0.8 ± 0.12 for kidney and 0.71 ± 0.18 for liver. Analysis of pooled VO_2 - DO_2 data revealed a VO_{2max} of $10.8 \text{ mlO}_2/\text{min/kg}$ (fig. #1). An arbitrary point at which HSP72 mRNA expression was greater than two SD above the mean control levels was used as the critical DO_2 , corresponding to a DO_2 of $3.2 \text{ ml O}_2/\text{min/kg}$ for kidney (fig.#2, point B) and $1.4 \text{ ml O}_2/\text{min/kg}$ for liver. This critical DO_2 extrapolates to a VO_2 that is 29% and 12% of maximal VO_2 in the kidney (fig.1, point A) and liver, respectively.

Figure #1

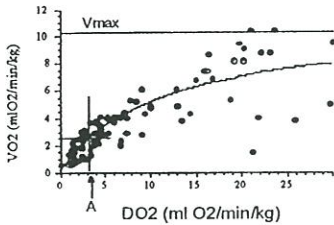
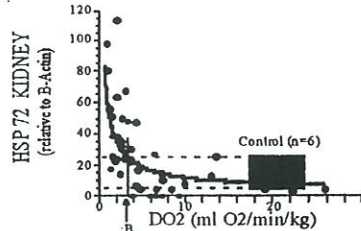


Figure #2



These data confirm that a definable kinetic relationship exists between DO_2 and VO_2 as well as between DO_2 and the expression of HSP72 mRNA. Using such a model, critical DO_2 can be defined based upon the molecular response to anaerobic stress. These current studies also confirm that the kidney appears more sensitive to circulatory insufficiency than the liver.

NOTES

POST-TRAUMATIC LYMPHOCYTE FUNCTION:
COMPARISON BETWEEN TISSUE AND PERIPHERAL
BLOOD T-CELL RESPONSES

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The majority of T-cells (97%) reside in lymphoid tissues and lymphatic channels (tissue T-cells). T-cell response to injury has been assessed largely by sampling blood lymphocytes which represent < 3% of total body T-cells. We hypothesized that tissue T-cells are stressed by injury and hypoperfusion to a greater extent than blood T-cells. Anesthetized adult sheep (n=10) instrumented with a pre-femoral lymphatic fistula were subjected to lower extremity fractures, a fixed volume hemorrhage, and a fixed volume resuscitation. Blood and tissue T-cells were characterized at baseline and 2 hours after trauma using monoclonal antibodies and flow cytometry.

Results: Mean arterial blood pressure and cardiac output fell by 50% with hemorrhage and were restored to baseline with resuscitation. Compared with blood, tissue T-cell composition demonstrated a higher percentage of CD4 (helper) and a lower percentage of CD8 (suppressor) T-cells. A much larger percentage of tissue lymphocytes expressed the adhesion molecule L-selectin (L-Sel). Poly-trauma induced a relative decrease in tissue CD8 and $\gamma\delta$ -TCR T-cell subpopulations while blood T-cell subpopulation composition remained unchanged.

Markers	Blood T-cells		Tissue T-cells	
	Baseline	Post-Trauma	Baseline	Post-Trauma
% CD4	31 \pm 14	31 \pm 5	42 \pm 10*	48 \pm 14*
% CD8	40 \pm 11	37 \pm 12	21 \pm 9 *	14 \pm 5 *†
% $\gamma\delta$ -TCR	11 \pm 5	10 \pm 6	12 \pm 4	7 \pm 2 *†
% L-Sel	44 \pm 9	44 \pm 10	86 \pm 3 *	84 \pm 12*
% MHC II	20 \pm 8	20 \pm 9	20 \pm 6	16 \pm 3

* = p < 0.05, blood vs. lymph; † = p < 0.05, baseline vs. post-trauma (repeated measures ANOVA, mean \pm SD).

Conclusions: The trauma induced decreases in tissue CD8 and $\gamma\delta$ T-cells suggest that evaluating T-cell response to injury by sampling peripheral blood lymphocytes underestimates the T-cell's role in the post-traumatic inflammatory response. Considering the immunologic activity of T-cells and the direct access lymphatic cells have to the lungs via the thoracic duct, activated tissue lymphocytes may play an integral role in the development of ARDS, SIRS, and post-traumatic immunosuppression.

NOTES

AN EPISODE OF PREHOSPITAL HYPOTENSION IN TRAUMA PATIENTS: A MARKER FOR DOOM OR JUST CRYING WOLF?

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Background: Overtriage to trauma centers continues to be a problem for trauma systems, especially in blunt injured patients who are triaged by mechanism of injury. In patients who have associated persistent hypotension or other physiologic derangements, the decision to triage to a trauma center is clear.

Study Design: To assess the importance of a single episode of prehospital hypotension on the outcome of blunt injured trauma patients who are triaged primarily by mechanism of injury. Outcomes studied were: need for urgent operative intervention (thoracotomy, laparotomy or craniotomy), ICU admission, ICU and hospital LOS, and survival.

Design: Retrospective, trauma registry based, clinical review.

Setting: ACS Level I Trauma Center

Type of Participants: Blunt injured patients who experienced one episode of prehospital hypotension ($SBP \leq 90$) ($n = 103$) which corrected upon arrival to the trauma center were compared to patients who remained normotensive throughout the prehospital phase and upon initial presentation ($n = 103$). The patients were matched for age (mean 31.4 years, range 6-82 years), sex (65.3% males), GCS (13 ± 0.2 , range 3-15), and RTS (7.47 ± 0.5 , range 2.9304-7.8408)

Results: (mean \pm SEM)

	SBP \leq 90 mm Hg	SBP $>$ 90 mm Hg	p Value
Age (years)	31.4 ± 0.6	31.4 ± 1.8	NS
Systolic BP	76 ± 2	133 ± 2	0.026
RTS	7.3 ± 0.1	7.7 ± 0.1	NS
GCS	12.2 ± 0.4	13.8 ± 0.3	NS
ISS	12.9 ± 1.1	8.5 ± 0.8	0.022
LOS (days)	6.2 ± 0.7	3.7 ± 0.6	0.006
ETOH (mg/dl)	80 ± 11	53 ± 10	0.041

Although there was no difference in the requirement for urgent operations (6.8% $SBP \leq 90$ vs. 1.9% $SBP > 90$), patients who sustained one episode of prehospital hypotension had longer ICU stays (ICU ≥ 3 days, 21.4% vs. 8.7%; $p = 0.025$) and higher mortality (5.8% vs. 1.9%; $p = 0.05$).

Conclusions: An episode of hypotension that responds to prehospital fluid administration and is alleviated upon arrival to the emergency department selects a group of trauma patients that are more seriously injured, have longer hospital and ICU lengths of stays, and have a higher mortality. Even a single episode of hypotension warrants activation of the trauma team.

NOTES

IMMEDIATE NEUTROPHIL ACTIVATION AFTER
HEMORRHAGIC SHOCK AND RESUSCITATION
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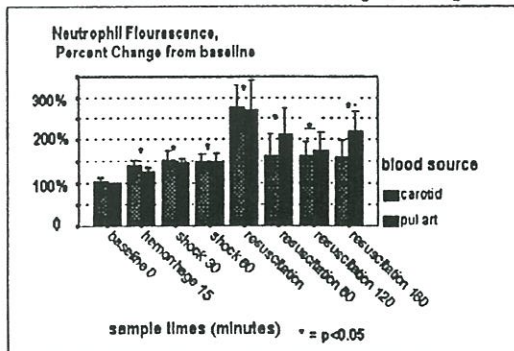
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OBJECTIVE: Primed or activated neutrophils play a major role in tissue injury following trauma. Our hypothesis was that neutrophils are primed and activated early during hemorrhagic shock and resuscitation.

METHODS: Eight awake pigs were subjected to a 40% volume hemorrhage (28ml/kg) over 15 minutes, followed by a 60 minute shock period and then resuscitation of 3X blood volume lost (84ml/kg) with Ringer's shock Lactate solution over one hour. Four control animals underwent the same volume of fluid infusion without hemorrhage. Through previously placed pulmonary artery and carotid artery catheters blood was collected serially throughout the experiment. Whole blood were stained with 2',7'dichlorofluorescein-diacetate and leukocyte burst activity was measured with flow cytometry. CD18b expression was measured utilizing monoclonal antibodies and flow cytometry.

RESULTS: While there was a significant increase in fluorescence of the neutrophils ($p < 0.05$, ANOVA) immediately following hemorrhage, a greater peak in fluorescence was observed after resuscitation ($p < 0.01$). During the same time period, the CD18b expression on neutrophils in blood progressively decreased to 70% of baseline ($p < 0.05$).

CONCLUSIONS: These data demonstrate that circulating neutrophils are activated early during hemorrhage as evidenced by increased oxidative burst activity. However, a greater activation of neutrophils occurred at resuscitation (reperfusion) than during ischemia. The decline in surface adhesion antigens (CD18b) expression during the burst activity may suggest that this burst activity is non-CD18 mediated.



NOTES

SECRETORY IgA BLOCKS HYPOXIA AUGMENTED BACTERIAL
PASSAGE ACROSS MDCK CELL MONOLAYERS

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Secretory IgA (sIgA) is the primary antibody for mucosal immunity. However, the importance of sIgA in gut barrier function following shock is unknown. Tissue hypoxia is a likely primary contributing factor to bacterial translocation (BT) following shock. We, therefore, studied the impact of hypoxia and sIgA on BT in an *in-vitro* system.

Madin-Darby Canine Kidney (MDCK) epithelial cells were grown as a polarized monolayer in a two chamber tissue culture system. Monolayer integrity was assessed periodically by measurement of transepithelial resistance (TEER). Tissue culture media was replaced with fresh media or media containing polymeric sIgA (100µg/ml). Stationary growth phase *E. coli* M14 (10⁶ CFU/ml) was inoculated in the apical chamber. Tissue culture dishes were then placed in a 21% or 5% O₂ incubator environment for 90 minutes followed by a 21% O₂ environment. Aliquots were obtained from the basal compartment of the culture dishes at the end of the hypoxic period (90 minutes) and at intervals thereafter for culture.

Log₁₀ *E. Coli* (mean ± SD) CFU in Basal Compartment

Group	90 minutes	240 minutes
I -Control - no IgA (n=8)	1.51 ± 0.8	2.91 ± 0.27
II -Control + IgA (n=11)	0.58 ± 0.57*	2.16 ± 0.42#
III -Hypoxia- no IgA (n=22)	1.44 ± 0.83	3.52 ± 0.47\$
IV - Hypoxia + IgA (n=18)	0.52 ± 0.62**	2.16 ± 0.41##

*p < 0.01 Gp I vs. Gp. II

** p < 0.01 Gp III vs. Gp IV

by ANOVA

#p < 0.01 Gp I vs. GpII

\$p < 0.01 Gp II vs. Gp III

p < 0.001 Gp III vs. Gp IV

TEER remained stable throughout the experiment. BT increased with incubation time in all groups. Hypoxia facilitated BT and this effect was blocked by sIgA. Secretory IgA is important in mucosal defense during shock states.

NOTES

**AUTOTRANSFUSION OF ENTERICALLY CONTAMINATED
INTRAPERITONEAL SHED BLOOD IN TRAUMATIC
GASTROINTESTINAL PERFORATION: IS IT SAFE?**

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Introduction: Autologous transfusion of enterically contaminated shed intraperitoneal blood is controversial.

Purpose: To evaluate the risk of autologous shed intraperitoneal blood transfusion on post-operative infections in patients with traumatic gastrointestinal perforations (GIPerf).

Methods: The medical records of all patients admitted to a level 1 trauma center in a 4 year period with traumatic GIPerf were reviewed. Age, ISS, abdominal organs injured, abdominal trauma index (PATI), extent of intraabdominal contamination (EDIC), operative blood loss (EBL), volume of blood transfused (autologous and banked; intraoperative and first 24 hours), and antibiotics were collected. Dependent variables of incidence and type of postoperative infection (excluding *C. difficile* colitis) and mortality were collected. Patients were divided into: Group 1) GIPerf with autotransfusion, and Group 2) GIPerf without autotransfusion. Data: mean±S.D., significance: $p < 0.05$.

Results: There were 51 patients with traumatic GIPerf who required blood transfusion. Six (11.8%) patients died including 4 intraoperatively. Groups 1 and 2 were similar in age (35 ± 15 vs 31 ± 14), ISS (26 ± 17 vs 21 ± 8), PATI (30 ± 20 vs 24 ± 16), EDIC (2.6 ± 0.9 vs 2.9 ± 0.8), volume of banked blood transfused ($4.2 \pm 4.1L$ vs $3.1 \pm 3.8L$), and total volume of blood transfused ($5.4 \pm 5.2L$ vs $3.1 \pm 3.8L$, $p = 0.07$). Group 1 had significantly greater EBL ($6.0 \pm 4.6L$ vs $2.6 \pm 2.7L$, $p > 0.01$) and received $1.3 \pm 1.2L$ of autologous blood. There was no difference between groups in the incidence of stomach, small bowel or large bowel injuries.

	Mortality	Incidence of Infectious Complications		
		All patients	Adequate Antibiotics	Inadequate Antibiotics
Group 1 n=16	2 (12.5%)	4 (29%)	0/8 (0%)	4 (66%)
Group 2 n=35	4 (11.4%)	18 (56%)	12 (60%)	6 (50%)
p value	ns	0.08	0.004	ns

Conclusion: If adequate antibiotics are administered, autotransfusion of enterically contaminated blood results in fewer infectious complications than banked blood transfusion alone.

NOTES

**RANDOMIZED PROSPECTIVE EVALUATION OF THE
EFFECTS OF INCREASED PRELOAD ON
CARDIOPULMONARY FUNCTION AND VISCERAL
PERFUSION DURING RESUSCITATION**

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Purpose: To evaluate the effects of maintaining increased levels of preload on cardiopulmonary function and visceral perfusion during resuscitation.

Design/Setting: Randomized prospective study of 39 consecutive trauma patients with a low right ventricular ejection fraction (RVEF < 40%) admitted to a university level I trauma center over a 1 year period. Patients were randomized to one of two groups, increased preload (PRE), or normal preload with inotropes (INO). The PRE group received fluid administration to maintain a target right ventricular end diastolic volume index (RVEDVI) of ≥ 120 mL/m² during resuscitation. The INO group had inotropes added per a prospectively determined protocol, and were maintained at a RVEDVI of 90-100 mL/m².

Main Outcome Measures: Cardiac index (CI), PaO₂/FiO₂ ratio, dynamic compliance (C_{dyn}), ventilator days, and incidence of Adult Respiratory Distress Syndrome (ARDS). Gut perfusion was assessed by measuring gastric intramucosal pH (pHi). Data are expressed as mean±SD.

Results: PRE patients (n=19) were maintained at significantly higher RVEDVI than INO patients (n=20, Table). There was no difference in CI or studied pulmonary variables between the groups.

The incidence of ARDS was not significantly different (PRE 31% vs INO 50%, p>0.01, chi-square) between groups. In the patients who had pHi measured sequentially during resuscitation (PRE=13, INO=17), the final pHi was significantly higher in the PRE group (7.31±0.14 vs 7.16±0.15, p=0.03).

Table	PRE	INO	p
RVEDVI	119±18	102±22	0.01
CI (L/min/m ²)	3.9±1.1	3.9±0.9	0.96
PaO ₂ /FiO ₂	266±115	217±77	0.13
C _{dyn} (mL/cmH ₂ O)	28±9	28±9	0.85
Vent Days	8±8	11±10	0.26
Unpaired t-test, significance @ p<0.05			

Conclusions: Maintaining higher levels of preload during resuscitation is safe and has beneficial effects on gut perfusion. The development of pulmonary failure is determined by the injury and its metabolic consequences, not the style of resuscitation.

NOTES

THE EFFECT OF A QUALITY ASSURANCE - DERIVED
 TRAUMA AIRWAY POLICY ON REDUCING PROVIDER -
 RELATED ERRORS IN THE EMERGENCY DEPARTMENT
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Objective: The purpose of this study was to determine the effect of a QA-derived trauma airway policy (TAP) on reducing provider related errors in the emergency department in patients who subsequently died of their injuries.

Methods: From 1994-1995, 206 consecutive trauma deaths over a 24 month period at a Level I trauma center were reviewed at a monthly peer review "death audit". The period of study was divided into 8 months prior to implementation of the TAP {Period A: Trauma airway management solely by Emergency Medicine (EM)} and 16 months following implementation {Period B: Trauma airway management shared by EM and Anesthesiology}. The TAP was developed after an unacceptable rate of provider-related errors in airway management (error in judgement/delay in intubation / error in technique) was noted during Period A. TAP mandated that an in-house anesthesiologist would perform/supervise intubations in the following circumstances: (1) < 8 years old; (2) predictably difficult airway (inability to intubate in field, severe maxillofacial injury, obesity); (3) systolic blood pressure < 100 mm Hg in ED. Errors in management were defined according to the ACS-COT Resources Document, while the periods were compared using chi-square test to assess statistical significance.

<u>Results:</u>	<u>Period A</u>	<u>Period B</u>	<u>p-Value</u>
Deaths reviewed	73	133	----
Blunt/penetrating/other	38/28/7	75/55/3	n.s
Mean ISS	35.3	34.1	n.s
Intubation delay errors	20 (27.4%)	13 (9.8%)	<0.001

Conclusions: 1. Concurrent quality assurance data identified provider-related errors in airway management, leading to the development and implementation of a hospital TAP. 2. Reassessment of this policy's effect on airway management demonstrated a significant reduction in intubation delays and errors in technique as possible contributing factors in patients dying from their injuries.

NOTES

EFFECTS OF EXOGENOUS CYTOKINES ON INTRAVASCULAR CLEARANCE OF BACTERIA IN NORMAL AND SPLENECTOMIZED MICE.

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Exogenous cytokine (IL-1, G-CSF and GM-CSF) pretreatment can improve alveolar macrophage bactericidal activity against *S. pneumoniae* (pneumococcus). These effects vary in eusplenic and asplenic mice. Likewise, these cytokines have been shown to improve survival following an aerosol pneumococcal challenge. Mice dying in these studies had positive blood cultures and disseminated infection. The purpose of this study was to determine the effect of cytokine pretreatment on intravascular clearance of bacteria from eusplenic and asplenic mice. Two weeks after splenectomy (splx) or sham operation, mice were pretreated for various times with either IL-1, G-CSF, GM-CSF, or their corresponding vehicles. Mice then received tail vein injections of bacteria (0.1 ml) and quantitative blood cultures were performed at various times thereafter. (Table)

Log₁₀ Pneumococci in Blood (cfu/ml) (t=30 min)

	IL-1	PBS	G-CSF	D5W	GM-CSF	PBS
Splx	3.22±.04	4.05±.01	4.35±.02	4.32±.03	0	4.06±.01
Sham	3.87±.02	3.75±.01	1.73±.55	3.66±.06	0	2.79±.01

Splx mice had impaired clearance of pneumococci compared to shams ($p < .01$). IL-1 enhanced clearance in splx mice ($p < .001$) but not shams ($p = ns$). G-CSF enhanced clearance in shams ($p < .001$) but not splx mice ($p = ns$). GM-CSF enhanced clearance in both groups ($p < .001$). The net in vitro effects of exogenous cytokine therapy for infections depends upon the state of the host defenses at the time of therapy. These agents may be useful as adjuvants for the treatment of infections but further study is warranted.

NOTES

**NONOPERATIVE MANAGEMENT OF SPLENIC INJURY:
ARE FOLLOW-UP CT SCANS OF ANY VALUE?**

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Hypothesis: Follow-up abdominal CT scans in patients with splenic trauma managed nonoperatively are not necessary.

Patients: 109 patients with proven splenic injuries treated at a single trauma center from 1990 to 1996. Patients who presented more than 24 hours after injury were excluded.

Methods: Retrospective review of hospital chart and outpatient clinic records. All abdominal CT scans were reviewed by the authors.

Results: Initial management was surgical in 35 (32%) patients and intentionally nonoperative in 74 (68%) patients. Nonoperative management was successful in 46 (92%) of 50 adults and 22 (92%) of 24 children. 61 follow-up abdominal CT scans were obtained in 44 patients. Multiple, asymptomatic intrasplenic pseudoaneurysms were demonstrated on a follow-up CT scan in one patient. Information which affected management was not evident on any of the remaining follow-up CT scans in the absence of a change in clinical findings. Potential savings in hospital charges for these routine follow-up CT scans approaches \$100,000.00.

Conclusion: Follow-up abdominal CT scans are not routinely necessary in patients with splenic injuries managed nonoperatively. Clinical indications should dictate the need for follow-up imaging techniques.

NOTES

A COST EFFECTIVE METHOD FOR BEDSIDE
INSERTION OF VENA CAVAL FILTERS IN
TRAUMA PATIENTS

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Objective: The benefit of inferior vena cava (IVC) filter placement in select trauma patients has been reported. The charges related to IVC filter placement are substantial. The need for patient transport to the operating room or the radiology suite impacts patient charges, patient comfort and nursing care. We hypothesized bedside, ultrasound guided IVC filter placement to be an acceptable, cost effective alternative.

Design: Prospective cohort study of 55 consecutive trauma patients requiring IVC filter placement at a single level one trauma center.

Methods: During a thirteen month period (8/95 - 9/96), all trauma patients meeting criteria for IVC filter were evaluated for ultrasound guided filter placement. Complications during and after placement were recorded. The financial savings attributable to bedside, ultrasound guided IVC filter placement were determined by subtracting the common charges of all methods of filter placement from the total charges.

Results: Of 3,172 trauma admissions, 55 patients (1.7%) met IVC filter criteria and 49 patients (89.1%) had IVC filters placed at the bedside under ultrasound guidance. 67% percent of the cohort group were male and the mean age was 31 years. The mean ISS was 30.3 (16-54). In six patients (10.9%), ultrasound guided filter placement failed. Failure resulted from non-visualization of the right renal vein in 5 patients and the IVC was too large (>3.4cm) for the available filters in the remaining patient. There were 4 complications (8.2%) in 4 patients including: 1 tilted filter, 1 DVT at the needle puncture site, 1 IVC occlusion and 1 minor filter migration. Over 13 months, charges were reduced by \$76,500 when compared to radiology suite placement (\$1,500 / pt) and \$107,100 when compared to operative placement (\$2,100 / pt).

Conclusions: Ultrasound guided, bedside placement of IVC filters is a safe, cost effective method of providing pulmonary embolism prophylaxis in select trauma patients.

NOTES

FASCIOTOMY, CHRONIC VENOUS INSUFFICIENCY AND THE CALF MUSCLE PUMP

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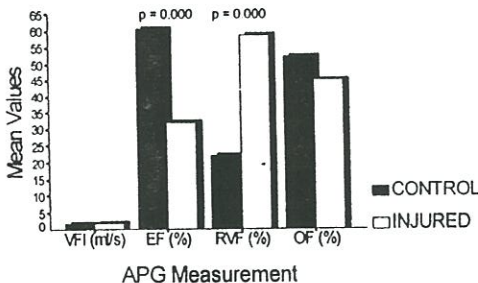
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Objectives: The long term effects of lower extremity fasciotomy are largely unknown. We hypothesized that fasciotomy may impair the calf muscle pump, which in turn could result in the development of chronic venous insufficiency.

Methods: To test this hypothesis, patients with a history of unilateral lower extremity fasciotomy were invited to participate in the study. All patients received a review of their medical and functional history, a detailed physical exam of both lower extremities, and air plethysmography (APG) studies. The contralateral limb was used as a control. **Results:** Of 17 patients who completed the study, eight had vascular injuries, six had fractures, and three had soft tissue infections as a primary diagnoses. The time frame from injury to exam ranged from 6 months to 20 years. The APG data showed significant mean differences between fasciotomy and controlled extremities in ejection fraction (EF) ($p=0.000$) and residual volume fraction (RVF) ($p=0.000$), both measures of calf muscle pump function. There were no significant changes in either venous filling index (VFI), which is a measure of venous reflux, or outflow fraction (OF), which correlates with venous obstruction (see graph). Furthermore, there were no differences in APG variables between vascular and orthopedic or soft tissue injuries. **Conclusions:** Lower extremity fasciotomy impairs long term calf muscle pump function, as measured by APG, in patients with and without vascular injuries. Fasciotomy independently may lead to the development of

chronic venous insufficiency following lower extremity trauma.



NOTES

SIGNIFICANCE OF FREE FLUID ON ABDOMINAL CT

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In evaluation of blunt abdominal trauma, free fluid on abdominal CT scan without solid organ injury is considered by many to be evidence of hollow viscus injury requiring laparotomy. Others suggest this is normal or requires only close observation or further diagnostic tests. The purpose of this study was to determine the incidence and significance of free fluid on abdominal CT scan obtained in evaluation of blunt trauma.

All patients with an abdominal CT scan obtained in the initial evaluation of blunt trauma from 8/93-12/95 were identified from the trauma registry at a level 1 trauma center. All CTs were performed on a GE HiSpeed Advantage helical scanner with 10 mm cuts through the abdomen and pelvis. Intravenous contrast was used for all; the use of oral contrast was variable due to a concurrent prospective, randomized study evaluating its use. 1159 CT scans were performed during this period; records of 36 patients were excluded due to incomplete medical records. The remaining 1123 patients comprise this review. Patient records were reviewed for age, sex, ISS, length of stay, ICU length of stay, abdominal injuries, bladder injury, and pelvic fracture. Records were also reviewed for additional evaluation with DPL, whether the patient underwent a laparotomy, and postoperative complications. Official CT reports were reviewed for the presence of free fluid, solid organ injury, bladder injury, and pelvic fracture.

The incidence of free fluid on abdominal CT scan was 12.8%. Free fluid without solid organ injury was found in 3% (34/1123). Two patients had a DPL prior to CT and 4 had bladder rupture accounting for the free fluid. Fluid was attributed to pelvic fracture in 3 patients. Two patients died from severe head injury before laparotomy.

Laparotomy was performed solely because of free fluid in 13 patients. Small bowel injuries were found in 6, and a diaphragm injury in 1. Five patients had non-therapeutic laparotomies (1 without injury, 2 non-significant mesenteric injuries, 1 non-bleeding omental injury, 1 non-bleeding liver laceration, and 1 extraperitoneal pelvic hematoma). Ten patients had trace amounts of free fluid (6 female, 4 male) and did not undergo laparotomy; none had a missed small bowel injury.

In patients with more than a trace of unexplained free fluid on abdominal CT scan the therapeutic laparotomy rate is 54%. This confirms that free fluid without solid organ injury or other explanation should mandate exploratory laparotomy.

NOTES

CROTALID ENVENOMATION,
THE SOUTHERN ARIZONA EXPERIENCE
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INTRODUCTION: To characterize the experience with snakebite injures, records were reviewed for pre-hospital management, patient demographics, and treatment protocol, including surgical intervention. The charts of all patients admitted to the five major hospitals, including two level one trauma centers, in Southern Arizona following venomous snake bites between 7/90 and 3/96 were reviewed.

RESULTS: Of the 170 patients admitted during the study period, 164 charts were available for review. Seventy-two percent of those admitted were male. A majority of the admissions occurred between April and October and resulted from a single rattlesnake bite. Eighteen patients self-administered field treatment following envenomation, such as "cut and suck" and tourniquets. Thirty-eight percent were transported to treating hospitals via helicopter. Seventy-three percent were admitted to the ICU and the mean hospital stay was 2.8 days (range 1-8). A vast majority (94%), received antivenin and 20% experienced an anaphylactoid reaction resulting from this treatment. Patients were monitored with serial laboratory studies with frequently noted elevation of the PT and PTT as well as abnormal fibrinogen and fibrin spit product levels. Thrombocytopenia was noted in 47% of patients and was frequently severe. Eleven percent required a surgical procedure as a result of the envenomation including six who required fasciotomy for compartment syndrome. There were no fatalities, however one patient required an amputation.

CONCLUSION: As a result of this review it was felt that field management of snake bites, including tourniquet application and "cut and suck," was ineffective and often detrimental to outcome. Helicopter transport and ICU was, in many cases, over-utilized. Compartment syndrome is a rare but real complication of rattlesnake envenomation and compartment pressures should be monitored in cases where this diagnosis is considered. Although hospital stays were short, the treatment of snake envenomations utilizes significant medical resources.

NOTES

COST ANALYSIS OF PEDIATRIC TRAUMA CARE BY COST CENTERS AND MECHANISMS OF INJURY AS A BASIS FOR INJURY PREVENTION AND CLINICAL GUIDELINES
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In response to capitated managed care, clinical guidelines are often developed to reduce unnecessary hospital expenditure. Injury prevention programs are also implemented to decrease major trauma cases requiring hospital admission. Yet the financial data detailing potential areas of cost-reduction for these programs are lacking. The purpose of our study was to evaluate the cost profile of pediatric trauma care in order to identify major target areas of cost reduction.

In a retrospective analysis, we studied all pediatric trauma patients aged between 0-18 years admitted to a Level I Trauma Center between 1/93 and 1/96. We used a cost-accounting system based on relative value units assigned to fixed overhead expenses such as salary, institutional operating costs, and capital, as well as variable costs of goods and services which vary with usage. For each patient we calculated the fixed cost (FC), the variable cost (VC), and the total cost of care (TC). We then further divided these costs into cost centers relating to type of patient care: Nursing, Emerg.-Dept., ICU, Operating Room, Radiology, Laboratory, Pharmacy, and Physiatry.

For each cost center (CC) and mechanism of injury (MOI), we calculated the mean TC. Using a repeated measures analysis of variance, we tested the null hypothesis that the differences in costs across CC's and MOI's were due to chance.

There was a significant difference in mean TC among the CC's. The CC's with the highest mean (\pm SE) TC were, in decreasing order, Nursing (\$2,126 \pm 203), Operating Room (\$584 \pm 74), Radiology (\$516 \pm 26), Laboratory (\$483 \pm 81), Physiatry (\$426 \pm 53), Emergency Department (\$361 \pm 8), Pharmacy (\$317 \pm 44), and ICU (\$302 \pm 93). ($p < 0.0001$.) The cost of nursing far surpassed the next three highest CC's. Considering that nursing cost is directly related to the length of stay (LOS), these data suggested reduction of LOS as the principal strategy for clinical guidelines. But the evaluation of variable-to-fixed cost ratio (VFR) revealed specific cost-saving strategies for different CC's. Pharmacy had a high variable cost component (VFR 2.53), indicating containment of incremental usage of goods and services as a major cost-saving strategy. Operating Room, Radiology and Laboratory had a relatively high fixed cost component (VFR 0.55 to 0.68), suggesting containment of overhead expenditures as a more effective means of cost reduction.

MOI's with a significantly higher mean TC were gunshot (\$11,408 \pm 3266) and pedestrian (\$9,086 \pm 1902) injuries, compared to a MOI with significantly lower mean TC, fall (\$4,066 \pm 657). ($p = < 0.0001$)

The frequency of individual MOI's varied significantly across age groups. ($P < 0.05$.) Analysis of the total cumulative cost (mean TC x frequency) identified a specific MOI that expended the most healthcare dollars for each age group. Age 0-5: fall injuries (\$113,440/yr). Age 6-10: pedestrian injuries (\$145,755/yr). Age 11-15: bicycle injuries (\$90,775/yr). Age 16-18: unbelted motor vehicle injuries (\$208,442/yr).

Our study provides a useful cost-accounting model which can assess pediatric trauma care cost based on CC's and MOI's. Prevention strategies should be targeted towards MOI that generates the highest cost in each age group. Development of clinical guidelines should include analysis of variable and fixed costs of each CC. Consideration of economic factors that identify high-expenditure cost centers and mechanisms of injury will become increasingly important for Level I Trauma Centers in the managed care, capitated system.

NOTES

**ULTRASOUND IS A COST-EFFECTIVE TRIAGE TOOL
TO EVALUATE BLUNT ABDOMINAL TRAUMA IN THE
PEDIATRIC POPULATION**

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Background: The appropriate cost-effective evaluation of injured children presenting with blunt abdominal trauma (BAT) continues to be a challenge for regional trauma centers. Computed tomography (CT) has been considered the diagnostic modality of choice for pediatric patients with BAT. However, CT is costly, time-consuming, requires sedation, and may be associated with complications in young children. Abdominal ultrasonography (US) is a promising modality in the evaluation of BAT that is quick, noninvasive, repeatable, and cost-effective. Although evaluated in adult trauma, US has not been studied as thoroughly in injured children. We hypothesized that emergency department US, performed by trauma surgeons, is a useful triage tool for pediatric BAT that reduces the need for CT.

Methods: An US based key clinical pathway was implemented after an US training program. From 7/94 to 4/96, 188 children (2 months-17 years of age) with suspected BAT were evaluated with emergent US by surgeons. The presence of intraperitoneal (IP) fluid or parenchymal injury was interpreted as a positive result. Subsequent CT scan or exploratory laparotomy was performed as indicated by the key clinical pathway. Data were collected retrospectively and are reported as mean \pm SEM.

Results: The mean age of the 188 study patients was 10.3 ± 0.4 years, 116 (61%) were male and their mean ISS was 6.5 ± 0.8 . Only 8 of these children (4.3%) had documented intraabdominal injuries. Results were compared between US and CT.

BAT Evaluation (US and CT)	Number
US (-) and no CT	106
US (-) and CT (-)	74
US (-) and CT (+)	6
US (+) and CT (+)	2

All injured children with significant IP fluid were identified by US. Of the six pediatric patients who had a negative US followed by a positive CT scan, five sustained minor solid organ injuries that were managed nonoperatively (three liver hematomas, one renal laceration, and one adrenal hemorrhage). One child had gas in the soft tissues around the bladder, evidenced by CT, and was found to have a bladder neck laceration on exploration. No false negative US exam had significant IP fluid by CT. Extrapolated reductions in hospital charges based on the reduced number of CT scans total \$231,080 (106 patients who did not have a CT, [106CT x \$2180]).

Conclusions: We have confirmed that pediatric BAT patients referred to an urban level 1 trauma center have a low incidence of intraabdominal injury. US had a positive predictive value of 100% and a negative predictive value of 99.5% for detecting intraabdominal injuries requiring emergent laparotomy. Therefore, similar to the adult trauma population, using US as a triage tool may dramatically decrease the cost of pediatric BAT evaluation while being able to quickly identify injuries that require emergent exploratory laparotomy.

NOTES

HYPERTONIC SALINE IS NOT BENEFICIAL FOR RESUSCITATION OF PULMONARY CONTUSION

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OBJECTIVE: We postulated that hypertonic solutions could minimize the accumulation of lung water and subsequent respiratory derangements which occur after pulmonary contusion in a porcine model.

METHODS: Anesthetized pigs (15-20kg) underwent contusion to the right chest at t=0min; were hemorrhaged (30cc/kg) from t=0-20min; resuscitated with 7.5% NaCl (HTS-4cc/kg, n=10) or 0.9% saline (NS-90cc/kg, n=8) from t=20-40min, and observed to t=240min. Gravimetric lung weights, and spiral CT scan (n=4 scans/group) quantitated lung water.

RESULTS:

GROUP		t=0	t=20	t=40	t=120	t=240
MAP	NS	89±3	50±4*	91±3#	94±4	87±8
	HTS	93±2	52±3*	72±3*	83±3	78±5
MPAP	NS	15±2	13±2	22±2*	17±2	17±2
	HTS	17±2	12±2	16±2	14±1	11±1
PaO ₂	NS	110±12			90±8	82±8*
	HTS	100±5			84±3	82±3
COMP	NS	20±1			15±1*	15±1*
	HTS	19±1			16±1*	16±1

Values=means±SEM, *=value vs t=0 within group, #=value vs HTS group, p<0.05 ANOVA-Tukey's test, MAP=mean arterial pressure [mmHg], MPAP=mean pulmonary arterial pressure [mmHg], PaO₂= arterial oxygen tension [mmHg], COMP=static compliance [ml/mmHg].

Lung weights were similar in both groups: %lung water [g/Kg BW]= Right: NS-12.5±2.1 vs. HTS-13.2±1.1, Left: NS-8.4±0.6 vs. HTS-10.3±1.3. CT volumes were not statistically different (NS-5.9±2.7 vs. HTS-4.5±1.0, L/kg BW).

CONCLUSIONS: HTS did not prevent the accumulation of lung water or the subsequent hypoxemia and worsening of compliance after traumatic lung injury. Resuscitation with small volumes of HTS, therefore, does not appear to provide benefit over large volumes of isotonic crystalloids in this porcine pulmonary contusion model.

NOTES

DIAGNOSTIC LAPAROSCOPY FOR THE EVALUATION OF PENETRATING ABDOMINAL TRAUMA

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Diagnostic laparoscopy has been advocated as a means of selecting patients requiring laparotomy for penetrating abdominal trauma. To evaluate the use of laparoscopy for this purpose, we performed a prospective trial in which consenting, hemodynamically-stable patients undergoing exploratory laparotomy for penetrating abdominal trauma had a preliminary diagnostic laparoscopy performed prior to laparotomy. All patients underwent laparotomy regardless of the laparoscopic findings. A total of 77 patients were entered into the trial; 73% had suffered gunshot wounds, 5% shotgun injuries, and 22% stab wounds. The entrance site was the anterior abdomen in 47%, the lower chest in 16%, the flank in 17%, the back in 13%, and multiple sites in 8%. In 53 patients, laparoscopy was considered positive because it revealed peritoneal penetration (74%), hemoperitoneum (70%), or an injury to an abdominal organ (55%). At subsequent laparotomy, injuries requiring operative repair were identified in 47 (89%) of these patients; 6 patients (11%) had nontherapeutic laparotomies. In 24 patients, laparoscopy was considered negative because it did not reveal peritoneal penetration, hemoperitoneum, or an injury to an abdominal organ. At laparotomy, 23 (96%) of these patients had no significant injury. One patient with a gunshot wound to the back and gross hematuria had an isolated injury to the kidney. Overall, 47 of 48 patients requiring operative repair of an injury were identified based on positive laparoscopic findings, resulting in a sensitivity of 98%. In addition, 23 of 29 patients who had nontherapeutic laparotomies were identified by negative laparoscopic findings, giving it a specificity of 79%. However, laparoscopy did not accurately predict which abdominal organs were actually injured. At least one significant injury was missed on initial laparoscopy in 77% of the 47 patients who had therapeutic laparotomies. Thus, laparotomy can be deferred in stable patients with penetrating trauma if laparoscopy shows no evidence of peritoneal penetration, hemoperitoneum, or an abdominal organ injury. Exploration is warranted in patients with any one of these positive laparoscopic findings, even in the absence of an obvious injury.

NOTES

CONTENT ANALYSIS OF PEDIATRIC TRAUMA IN
THE MEDIA

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OBJECTIVE: To analyze information distributed in local newspapers related to pediatric trauma.

METHOD: Articles related to pediatric trauma were collected from two newspapers for six months (n=400). Data included mechanism, outcome, size and location of article in newspaper. Data was compared to incidence of injuries and outcomes as reported by the National Pediatric Trauma Registry (NPTR).

RESULTS: 400 articles were reviewed, 317 feature and 83 capsule reports. Mechanism of injury and outcome were compared to the NPTR (media/NPTR): assaults (25%/7%), gunshot wounds (24%/5%), stab wounds (4%/5%), motor vehicle crash (7%/19%), bicycle (<1%/9%), pedestrian (5%/15%), falls (2%/26%), recreational injuries (2%/6%), intentional injuries (58%/13%), death (56%/3%), sexual abuse/neglect (13.5%/4%). Article type analysis revealed: case reports (63%), public opinion (33%), objective evaluations (4%). Front page articles (12%) related to violent crimes 70% of the time. Article size was not a function of mechanism of injury, but fewer reports of death appeared in capsule articles (7%) than overall (56%). Safety articles accounted for 5%.

CONCLUSION: Media over reports violent crimes and death, and under reports motor vehicle crashes, falls, and unintentional injuries. Safety and prevention are lacking, anecdotal and opinion oriented articles are the majority. Trauma education efforts must recognize the misrepresentation of this disease.

CONCLUSION: In-house personnel improved efficiency for the less severely injured, and an in-house attending surgeon reduced mortality in the severely injured older patient. None of the other variables were found to have a significant impact on outcome.

NOTES

NEUROSURGEONS & NEUROTRAUMA: FACTS & MYTHS

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Neurotrauma care is integrally related to the pool of neurosurgeons available and willing to treat injured patients. Many factors can influence the commitment of neurosurgeons to participate in trauma care. This study seeks to determine the degree of reluctance to care for trauma patients and those factors associated with such a reluctance among neurosurgeons in comparison to other surgical specialties.

A national sample of 2503 general, orthopedic and neurological surgeons was scientifically selected from the AMA Masterfile of Physicians and surveyed by mail regarding a number of trauma care issues. The neurosurgical sub-sample numbered 215 and is representative of their geographic and professional distribution among all surgeons. Analysis for this study is limited primarily to neurosurgical respondents.

Response rate was 60%. 20% of neurosurgeons reported that they prefer not to care for trauma patients. This was less than the reluctance expressed by other surgical specialties. One third, however, expressed that they would not take trauma call were it not required. Preference to treat varied by geographic region and community size. Neurosurgeons between the ages of 40 and 50 were the most reluctant to treat trauma patients. Compensation was not a major factor associated with reluctance to treat these patients. Perceptions of increased time commitment, personal factors (such as family stress, physical demands and risk of infection) and perceived commitment of the hospital and other providers appeared to be greater factors in a surgeon's decision. Perception of increased medicolegal risk was also an important factor in reluctance to treat trauma patients, however, neurosurgeons are less likely to be influenced by malpractice litigation than other surgical specialists.

Neurosurgical participation in trauma care is vital both to the injured and the public perception of neurosurgeons as serving community needs. Further efforts to discern myth from fact and dispel myths while addressing true problems, where possible, seem warranted.

NOTES

MANAGEMENT OF SELF-INFLICTED LOW-ENERGY
GUNSHOT WOUNDS THAT VIOLATE THE SKULL BASE
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Self-inflicted ballistic wounds aimed at the brain through the mouth or from below the chin are usually shotgun or high-energy gunshot wounds. Management of these wounds, which typically produce large avulsion-type injuries of the bone and soft tissue of the face, has been extensively discussed in the literature. Management of self-inflicted low-energy gunshot wounds with the same sites of entrance has not been specifically addressed. We, therefore, present our experience with nine of these self-inflicted, low-energy gunshot wounds seen during a 2 year period.

All patients underwent a frontal craniotomy, and two developed serious postoperative intracranial complications not related to the brain injury itself. One patient developed an extradural frontal abscess, and one developed progressive pneumocephalus. The common factor for these patients was an injury through the roof of the ethmoid sinus that was not repaired with a bone graft. The patients were retreated using split cranial bone grafts, and both healed without further difficulty. Three other patients with similar injuries repaired initially with bone grafts experienced no complications. Four patients with injuries anterior (floor of frontal sinus) or lateral (orbital roof) to the ethmoid sinus were also successfully treated without bone grafts.

Low-energy submental or transoral gunshot wounds, in particular those created by a handgun, appear less likely to exit through the face without violating the skull base than wounds caused by shotguns or high powered rifles. Instead, they follow the usually intended path through the palate, nose, paranasal sinuses, and skull base into the brain. The lack of external evidence of destruction of the facial skeleton, as well as the need for urgent attention to the brain injury, may lead to an overlooked serious anterior skull base injury. Split cranial bone grafts should be considered as a supplement to dural repair for injuries involving the central third of the anterior skull base, even if a pericranial flap is used. The bone grafts provide the best initial seal of the skull base for protection against ingress of air and/or bacteria from the nose and ethmoid sinuses.

NOTES

PATIENTS WITH GUNSHOT WOUND TO THE HEAD DO NOT
REQUIRE CERVICAL SPINE IMMOBILIZATION & EVALUATION
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Purpose: Cervical spine injury (CSI) has been reported as occurring in up to 20% of head injured patients. Patients with gunshot wounds to the head (GSW-H) do not incur the same forces as those having blunt head trauma, but have customarily had cervical spine immobilization (IMMOB) and subsequent evaluation. This study was undertaken to determine the necessity of IMMOB and cervical spine evaluation in patients with GSW-H.

Methods: Trauma registry records of all patients sustaining GSW to the head from 7/90 to 9/95 were reviewed. Data abstracted from the records included age, sex, ED GCS, other injuries, IMMOB, intubation, survival and autopsy data.

Results: There were 215 patients identified with GSW-H during the study period. The average age was 28 years (range 2-87 years) and the average ED GCS was 8 ± 0.36 . There were 123 deaths (57%) and 64 patients (29%) died in the ED.

Of the 215 patients, 180 (84%) had IMMOB. Cervical spine clearance was performed in 199 patients (93%), either clinically (42), radiographically (84) or at autopsy. Twelve suicide patients had no autopsies performed and the autopsy report on one homicide patient could not be located. There was no clinical suspicion of CSI in any of these patients. There were no missed CSI and no CSI from indirect injury. Three patients had CSI from direct bullet injury, but all had CSI suspected based on their wounds.

Field intubation was attempted in 38 patients and was unsuccessful in 16 (42%); all but 2 of these patients had IMMOB during these intubation attempts. Thirty-four IMMOB patients had 49 intubation attempts versus 5 in the 4 non-IMMOB patients (χ^2 , $p = 0.008$). Additionally, six field intubation patients required reintubation at ED arrival; all but one had IMMOB (χ^2 , $p < 0.001$). Twenty-two patients had successful field intubation.

Conclusions: IMMOB of the patient with GSW-H is unnecessary and may delay definitive airway management and in-hospital care. In the patient who does not have direct bullet injury to the neck, "clearing" the neck adds unnecessary time and expense to the resuscitation.

NOTES

COMPELLING INJURIES: THE FOCUS OF
TRAUMA TRIAGE, SYSTEMS, AND CARE

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No clear definition exists for the anatomical injuries that require the focused attention of and triage to prompt definitive trauma care. Evaluation of triage guidelines has relied on dependent variables such as ISS \geq 15, need for ICU or surgery, etc., all of which have widely documented problems. In an age of managed care, cost efficiency and accountability, triage guidelines for trauma care need to be more precise.

Objective: Define injuries that need prompt definitive trauma care--termed "compelling injuries".

Methods: HICDA-9-CM, AIS-85 and AIS-90 anatomical taxonomies were reviewed and, from each a threshold of severity or urgency was used to define "compelling injuries". Each compelling injury in each taxonomy was noted. The definition was tested on two datasets to determine whether it crisply captured the defined patient population and identified predictors of such injuries in automobile crashes subjects. The two datasets were (i) National Accident Sampling System (NASS), a DOT NHTSA dataset of some 15,000 injured patients collected between 1988-1995, and (ii) MTOS Controlled Sites database, composed of about 13,500 patients from four Level I Trauma Centers.

Results: In NASS, 4% of all injured occupants had compelling injuries or died. In MTOS, 37% of motor vehicle occupants had compelling injuries or died.

	<u>Compelling</u>	<u>Non-Compelling</u>
<u>NASS Database of Deaths and Injuries in Towaway Crashes</u>		
Hospitalized & Alive	60.5%	9.5%
Dead Prehospital or In-hospital	34.7%	0%
Transported, but not admitted	4.8%	53.5%
<u>MTOS Database of Controlled Site Admitted Auto Crash Patients</u>		
In-hospital mortality	22%	0.5%

In the NASS database, "compelling injuries" captured all pre- and in-hospital deaths; the MTOS database contains only in-hospital deaths. The death rates are thus highly compatible. Compelling injuries were then used as a dependent variable to redefine relationships with crash signature data, e.g., Delta Velocity, Speed, Direction of Force, Rollover, Occupant Age. The results provide an essential basis for scientific re-evaluation of triage from the scene of automobile crashes and for the Automated Crash Notification systems currently being tested. (Funded by NHTSA contract

NOTES

MAXILLOFACIAL INJURIES IN THE NATIONAL
HOCKEY LEAGUE: A SINGLE TEAM EXPERIENCE
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Maxillofacial injuries are commonplace in the National Hockey League. The size and speed of the players along with speed and nature of the game contribute to the likelihood of trauma. Injuries range from simple contusions, lacerations and dental injuries to more complex problems including severe lacerations, fractures, brain injuries and eye injuries. Causative agents include sticks, the puck, skate blades, physical contact (legal and illegal) and of course fighting. Mandatory helmets have helped to reduce injury, and increasing use of mouthguards and face shields throughout all levels of hockey have further lessened the frequency and severity of maxillofacial trauma. One team's recent experience with maxillofacial injuries will be discussed including injury severity, causality, disability relative to playing time and methods of repair. Data from the National Hockey League injury registry will be reviewed.

NOTES

CARDIOPULMONARY AND VISCERAL EFFECTS OF
OPERATIVE DECOMPRESSION ON PATIENTS WITH
INTRA-ABDOMINAL HYPERTENSION

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Objective: Increased intra-abdominal pressure (IAP) compromises cardiopulmonary function and visceral perfusion. Our goal was to characterize acute changes in these subsystems associated with operative abdominal decompression.

Patient Population: Consecutive series of 11 injured patients monitored with a pulmonary artery catheter and nasogastric tonometer in whom operative decompression was performed. Indications for decompression included oliguria or progressive acidosis despite aggressive resuscitation in the presence of an elevated IAP (>25mmHg).

Main Outcome Measures: Studied hemodynamic variables included pulmonary artery occlusion pressure (PAOP), right ventricular end-diastolic volume index (RVEDVI), and cardiac index (CI). Pulmonary variables included shunt fraction (Qs/Qt) and dynamic compliance (C_{dyn}). Visceral perfusion was assessed using urine output 4 hrs pre- and post-decompression (UOP) and gastric intramucosal pH (pHi). Mean values before (PRE) and after (POST) decompression were compared using the paired t-test. Linear regression and Fisher's z transformation were used to evaluate the relationships between RVEDVI, PAOP, CI, and IAP. IAP was transduced via bladder pressures. Significance was defined as p<0.05. Data expressed as mean ± std dev.

Results: PRE and POST values of the studied variables are shown in Table 1.

RVEDVI improved independent of CI, and correlated better (p<0.01) with CI (r=.49, p=0.04) than PAOP did (r= -0.36, p=0.09). PAOP correlated significantly with IAP (r=0.45, p=0.04). Decompression resulted in significant improvements in Qs/Qt, C_{dyn}, UOP and pHi.

Table 1	PRE	POST	p
IAP (mmHg)	49±11	19±6.8	<.001
RVEDVI (mL/m ²)	83±18	110±24	0.01
CI (L/min/m ²)	3.7±0.6	3.9±0.8	0.44
Qs/Qt (%)	33±12	21±12	0.04
C _{dyn} (mL/cmH ₂ O)	13±5.0	24±6.8	.002
UOP (mL)	422±340	753±507	0.01
pHi	7.15±.13	7.20±.14	0.01

Conclusions: Abdominal decompression in patients with increased IAP improves preload, pulmonary function, and visceral perfusion. Elevated IAP has important effects on PAOP, and makes the PAOP an unreliable index of preload in these patients.

NOTES

50 cc NS in Foley via aspiration part, then needle in port connected to arterial pressure monitor, clamp Foley distally

ABDOMINAL ULTRASOUND IS NOT A SENSITIVE
DETECTOR OF INTRAABDOMINAL INJURY
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We conducted a prospective study in order to assess the efficacy of abdominal ultrasound (US) by surgeons with limited US training in a Level I trauma center. Eight attending trauma surgeons performed US on 455 patients over an 18 month period. US was followed by CAT scan or diagnostic lavage as clinically indicated. Blinded radiologist ultrasonographers reviewed 400 of these studies. Actual diagnoses were obtained on all cases from medical record. Results are tabulated below:

	True(+)	False(+)	True(-)	False(-)
Trauma	44	7	382	22
Radiology	35	2	340	23

Sensitivity in both groups was poor (66.6% vs 60.4%). Although most false negatives were trivial injuries accompanied by small amounts of fluid, there were a number of missed injuries which were potentially life threatening. Sensitivity was much better in the 54 unstable patients (87%), presumably due to larger volumes of intraperitoneal blood simplifying the interpretation.

Although abdominal US promises to be a valuable tool in the initial evaluation of trauma victims, particularly those with hemodynamic instability, it is unlikely to completely replace CAT scan or diagnostic peritoneal lavage.

NOTES

TEST-BASED IMPROVEMENTS FOR MOBILE FIELD
SURGICAL TEAMS

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INTRODUCTION: The Mobile Field Surgical Team (MFST) is a five person military field trauma surgical unit. Carrying 300 pounds of surgical equipment and supplies, the team is tasked to perform 10 "damage control" trauma procedures in a 24-hour period. Weight restrictions limit surgical instrumentation and supplies. Before utilization in combat or disaster roles, studies were conducted to evaluate the team's overall capability, ability to function in a light-limited environment, and a new untested disinfection technique. All team surgeons regularly practice "damage control" techniques at a military ACS Level One trauma center.

METHODS: Ten anesthetized multiply-injured swine underwent sequential surgical procedures in a field setting. Surgeons evaluated their ability to adequately perform necessary damage control using only MFST equipment. Aerobic and anaerobic cultures of surgical instruments were obtained following disinfection between cases. Thereafter, in the laboratory, instruments underwent ten serial stool contamination/disinfection cycles, with subsequent cultures. To assess low-light capabilities, damage control procedures were performed on nine anesthetized multiply-injured swine in a darkened environment. Surgeons wearing various models of night vision goggles subjectively assessed their ability to perform the necessary procedures. Operations were timed and compared to procedures in the lighted field environment. In a subsequent evaluation, 25 cm of porcine mid-jejunum was rendered ischemic by mesenteric artery ligation. Surgeons assessed bowel viability by gross visualization, pulse palpation, doppler, intravenous fluorescein with Wood's lamp illumination, night vision goggles with infrared illumination, and thermal imaging technology. The limits of bowel ischemia were identified for each technique. Bowel segments were then sent for pathologic evaluation/confirmation.

RESULTS: Surgeons successfully completed necessary damage control procedures on swine in a field setting. Equipment and resuscitative fluid deficiencies were identified. Hypothermia presumably resulted in the early death of one pig. Instrument cultures obtained in the field experiment revealed no growth, while those obtained in the laboratory experiment revealed minimal growth. Utilizing the most advanced night vision goggles, surgeons successfully completed damage control procedures with operative times comparable to those performed in previous field lighting conditions. Earlier generation night vision goggles were inadequate for damage control surgery. Night vision goggles with infrared illumination were ineffective for evaluating bowel ischemia, however, thermal imaging was comparable to traditional techniques.

CONCLUSIONS: Thorough evaluation of revolutionary field surgical concepts have confirmed their feasibility and have suggested additional refinements. Additional testing of MFST equipment and concepts is ongoing.

NOTES

A CHANGING PERSPECTIVE OF ODONTOID FRACTURES:
IMPLICATIONS FOR EVALUATION AND MANAGEMENT
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Introduction: Odontoid fractures have been classified by the Anderson and D'Alonzo method since 1974: Type I involve the tip of the dens; Type II occur at the base, but not into the body; Type III extend into the vertebral body. Management and prognosis have been based on classification of odontoid fractures from plain radiographs. The use of CT scans and tomograms has essentially been ignored in evaluating acute injuries. The purpose of this study was to classify and evaluate odontoid fractures using plain radiographs in conjunction with CT scans and/or tomograms.

Methods: 57 consecutive acute odontoid fractures, occurring between April 1987 and November 1995, were retrospectively evaluated. An analysis of plain radiographs, CT scans and/or tomograms was completed, along with an evaluation of demographics, mechanism of injury, associated injuries, neurologic sequelae, mortality, treatment outcomes and rate of nonunion.

Results: After classifying the fractures, we found a distinctly different incidence of the different subtypes. There were no Type I, 16 (28%) Type II, and 41 (72%) Type III fractures. Several fractures, initially felt to be Type II with a plain radiograph, were re-classified as Type III after review of the CT scan. The primary mechanism of injury (motor vehicle accident) was 73% and multiple injuries were present in 51% of the patients evaluated. Neurologic sequelae were present in 7% and 11 patients died (19%). Halo immobilization was used in 44 cases (77%), Minerva jacket in 3 (5%), Philadelphia collar in 3 (5%), and a SOMI brace in 3 (5%). Four patients underwent posterior spinal fusion (7%). The distribution of treatment outcomes, excluding those who expired, was: 44 (96%) healed within 13 weeks; there was 1 (2%) asymptomatic nonunion; and 1 patient was lost to follow-up. There was no significant difference in age between those who healed (average age - 45) and those with a nonunion (average age - 75). There was a significant difference between those who expired (average age-69) and those who healed ($p < 0.05$).

Discussion and Conclusion: With the use of CT scans and tomograms, a much higher incidence of Type III odontoid fractures was identified. This implies a better prognosis for patients with these fractures. The use of halo immobilization should result in high union rates for those who survive this injury. We were unable to correlate the traditional negative prognostic determinators of healing, such as age, probably because of the limited number of non-unions in this series of patients.

NOTES

THE EFFICACY OF THE MOTOR COMPONENT OF
THE GLASGOW COMA SCALE IN TRAUMA TRIAGE
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Camden, New Jersey

National guidelines recommend that patients with Glasgow Coma Scale (GCS) lower than 14 be taken to trauma centers. Such scaling systems may be too complex for pre-hospital applications. We hypothesized that the motor component (GCSM) of the GCS would be as effective as total GCS for head injury triage.

Retrospective review of our two year experience revealed that only 1410 of 3235 adults (44%) brought directly to the center alive, had field GCS and GCSM recorded. 265 had GCS<14, while 252 had GCSM<6. Triage of 129/209 (62%) patients with major AIS-4 or AIS-5 head injury was accomplished by GCS; Similar triage of 127/209 (61%) would have occurred by GCSM [p=ns; chi squared]. GCS identified 92% (56/61) of those with AIS-5 injuries, while GCSM found 90% (55/61) [p=ns]. 24 patients required emergent craniotomy: 17 (71%) had GCS<14; 18 (75%) had GCSM<6 [p=ns]. None of the 15 with GCS<14 and GCSM=6 required craniotomy.

We conclude that pre-hospital GCSM is equal to the pre-hospital GCS in sensitivity for major head injury. In view of the simplicity of a one dimensional score, we recommend that GCS motor component replace the total GCS for triage.

NOTES

EVALUATION OF ALPINE SKIING AND SNOWBOARD-
ING INJURY IN A NORTHEASTERN STATE

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Purpose: To demonstrate the injury patterns of Alpine Skiing and Snowboarding in a northeastern state and evaluate potential risk factors.

Materials and Methods: The medical records of a single pediatric and adult level one trauma center were evaluated from January 1, 1990 through December 31, 1995. All admissions with injuries caused by Alpine Skiing or Snowboarding were reviewed. Those patients arriving from 2 local ski resorts, all of whose injuries are referred to the institution for care were separated out for consideration. Age, sex, type of injury, date of injury, ISS, operations performed and outcome were evaluated. In addition, number of skiers and snowboarders per week was also recorded.

Results: For the six year period of the study approximately 2,978,000 skier and snowboarder days were recorded at the study sites. Approximately 447,000 of those were attributed to snowboarders (15%). In all, 279 patients were admitted for injuries (0.01%), 238 related to skiing (incidence 0.01%) and 41 for snowboarding (incidence 0.01%). Snowboarders were statistically younger (20 years range 4-44) than skiers (29 years range 6-70) ($p < .05$), and had a significantly lower ISS (15 snowboarders vs 27 skiers, $p < .03$). One female was injured snowboarding and 68 females were injured skiing. 7% of injured snowboarders and 16% of injured skiers sustained multiple injuries ($p < .01$). Injury patterns were significantly different. Upper extremity injuries were almost exclusively found in snowboarders *24% vs 7%, and cruciate ligament injuries far more commonly in skiers (*45% vs 4%). Lower extremity injuries were far more common in skiers in general (78%) than snowboarders (17%)*. CNS injuries including head and spine injuries were evenly distributed, although the snowboarders with CNS injuries were significantly younger. In addition, splenic injuries were more common in snowboarders (12% vs 2%*) than skiers. Snowboarding accidents were far more common in December, March and April than other months. 51 patients sustained abdominal or chest trauma necessitating admission. None of these patients required surgical intervention for these injuries. All operative interventions were limited to extremity injuries, injuries of the spine, or placement of an intracranial pressure monitor. (*= $p < .05$) There were no fatalities from injury recorded during this period in this population, however two patients in each group sustained injuries which left them with permanent significant handicaps. No head injuries occurred in helmeted skiers; spine injuries were only recorded in very young snowboarders and skiers out of control.

Conclusions: Snowboarders and Alpine Skiers are equally prone to injury. Snowboarding accidents are typically less severe and show significantly different injury patterns than skiing accidents. Abdominal and chest injuries in this population generally appear amenable to non-operative management. Injuries in snowboarders occur more frequently when snow conditions are marginal, and skiers are less likely to be on the slopes. Prevention programs are best targeted at safe skiing practices; not skiing or snowboarding in poor conditions, use of helmets for skiers, and restraint of snowboard use in very young children.

NOTES

Can Surgeons Evaluate Emergency Ultrasound Scans For Blunt Abdominal Trauma?

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M.D. N. Namias M.D. D. Levi, M.D. A.
Arrillaga, M.D. L. Martin, M.D. J. Moylan M.D.

Objective: To determine if surgeons and surgical residents with minimal training can accurately evaluate emergency ultrasound examinations (US) for blunt abdominal trauma (BAT).

Methods: Over 7 months we conducted a prospective study comparing the evaluation of emergency US for BAT by surgeons and attending radiologists. The surgical team evaluated the ultrasound from the real time images and recorded the results prior to the radiologist. US readings from the surgical team and the radiologist were correlated with patient outcome. The surgical team consisted of 2 attending surgeons, 2 trauma fellows and 2 surgery residents. Minimal training in US was provided to the surgical team. All surgical interpretations of US were completed from the real time images before a radiologist was present.

Results: One hundred-twelve patients were evaluated with US by the surgical team and radiology service. Ninety-two patients had an US read as negative by the surgical and radiology services with no subsequent injuries identified. Eighteen patients had an US deemed positive by the surgical service and radiologists. Injuries were confirmed in this group by operation or computed tomography. One patient had an US deemed positive by the surgical team and subsequently negative by the radiologist. A subsequent DPL was performed which was negative. Another patient had an US interpreted as negative by the surgical evaluator and positive by the radiologist. Exploratory laparotomy was negative for intraabdominal hemorrhage or organ injury. Overall results reveal an accuracy of US reading of 99% for the surgical team and 99% for the radiology attending.

Conclusion: Surgeons and residents at different levels of training can accurately interpret emergency ultrasound examinations from the real time images, saving critical time in the work up of blunt abdominal trauma. Minimal training is required to accurately evaluate ultrasound scans. Surgeons can utilize ultrasound even if not supported by the radiology service.

NOTES

OPERATIVE SPLENIC SALVAGE? - CONTEMPORARY MANAGEMENT OF 1540 BLUNT SPLENIC INJURIES.

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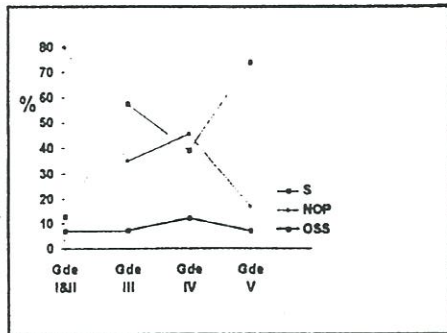
Presenter: Damian J McMahon, MBBS, FRACS.

Senior Sponsor: Thomas J Esposito, M.D.

Objective: Rates of operative splenic salvage (OSS) greater than 50% are reported. We sought to measure the rate and circumstances of OSS in a large population of bluntly injured patients to determine if contemporary management reflected these reports. **Method:** All patients age > 12 yr with blunt abdominal trauma and spleen injury (AIS ≥ 2) admitted to one of 25 Pennsylvania trauma centers over a 3.5 year period were included. Data was extracted from the state trauma registry. Injury grades I and II (AIS = 2) were combined. **Results:** From 56,226 pts there was 1540 instances of splenic injury. The mode of management, by injury grade, is displayed in Figure 1. There was 813 non-operative (NOP), 135 OSS and 592 splenectomy (S). The grade of injury did not impact on the rate of OSS. NOP and OSS had similar physiology except for SBP at presentation,

	NOP	OSS	S
SBP	125.9	116.8*	111.6‡
GCS	13.3	12.7	12.1‡
RTS	7.15	6.98	6.53‡**
Age	28.1	28.0	37.4‡**
ISS	18.6	26.5*	30.9‡**

p<.05 for *NOP Vs OSS, ‡NOP Vs S, and **OSS Vs S.



while the S pts were significantly different. The splenectomy rate doubled when another abdominal injury was present, (23.8% Vs 48.3%) but at laparotomy an isolated splenic injury was 50% more likely to be conserved (14% Vs 21%). There was 5 OSS that became S (3.7%) at separate operations. The average trauma center experience with OSS is 1.5 cases per year. **Conclusion:** OSS is uncommon in the operative management of blunt splenic injury across all grades of injury. Similarities between NOP and OSS groups suggest OSS will become even less frequent.

NOTES

RANDOMIZED MULTICENTER PROSPECTIVE TRACHEOSTOMY STUDY

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5 institutions participated in this multicenter, prospective trial of early (days 3 to 5) or late randomization (days 10 to 14) to tracheostomy (T) in injured or critically ill patients. The primary goals were: pneumonia frequency, duration of ICU stay and death; secondary goals were frequency of pharyngeal, vocal cord or laryngeal injury at T or extubation and long-term injury. **Methods:** Data obtained included Apache I Score (A), Glasgow Coma Score (GCS), Emergency Room Trauma Score (ERTS), Injury Severity Score (ISS), Acute Injury Score (AIS). Patients were to undergo laryngoscopy at extubation and 3-5 mos after discharge. **Results:** 155 patients were randomized; however, only 101 patients had completed data forms for the primary study goals: 58 head trauma (HT) patients (28 T+, 30 T-), 31 non-head injury trauma (NHT) patients (12 T+, 19 T-), and 12 non-trauma (NT) patients (5 T+, 7 T-). The A was higher ($p < 0.05$) in the HT T+ (64 ± 4) than T- (50 ± 4) and NT T+ (93 ± 6) than T- (68 ± 7) but equivalent in NHT. GCS, ERTS, ISS, AIS were not significantly different in any of the groups. There were no significant differences in ICU stay, frequency of pneumonia or death.

	HT		NHT		NT		Total	
	T-	T+	T-	T+	T-	T+	T-	T+
ICU Stay	17 ± 1	16 ± 1	31 ± 5	26 ± 4	28 ± 5	28 ± 9	23 ± 2	19 ± 2
Pneumonia	14/28	15/30	12/18	6/12	2/5	2/5	28/51	23/47
Death	0/28	3/30	7/19	6/12	3/7	2/5	10/54	11/47

Only 40 patients underwent early post-extubation laryngoscopy. The only significant laryngoscopic findings were a higher ($p < 0.05$) frequency of vocal cord (17/24 vs 5/14) and laryngeal (10/20 vs 3/14) inflammation in the T- patients. The frequency of vocal cord and laryngeal ulcers were insignificantly higher in the T- vs T+ groups. No patient was seen in this study with late vocal cord or laryngeal stenosis; there were no tracheal-inominate artery fistulae. Six patients had normal 3-5 mos post-extubation laryngoscopy. **Conclusions:** Physician bias limited patient entry into the study. Although there were higher Apache scores in the HT and NHT T+ patients, there were no significant differences in the primary endpoints of ICU stay, pneumonia or death in any of the groups studied. Although long-term follow-up was poor, no late tracheal stenoses were seen.

NOTES

BY-LAWS



**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 corporate 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 100 members. No single specialty shall comprise more than 40% of the total membership of 100.

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 all 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, submit an abstract for consideration by the Program Chairman, and attend the entire meeting during which their application is being considered. 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:

- (a) Be a physician in good standing before his or her professional specialty board.
- (b) Attend at least one out of every three consecutive meetings of the Association.
- (c) Tender to the Program Chairman for consideration an abstract relating to the diagnosis or management of traumatic conditions within the particular medical specialty of the member at one out of every three consecutive meetings of the Association. An invited active panelist can fulfill this requirement.
- (d) 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.

At age 55, members in good standing will automatically accept the position of senior membership in the Western Trauma 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, or submit an abstract once every three years, 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 By-Laws 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 directors 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 exchange 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

All requirements for retention of membership including payment of dues, submission of abstract, 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 place unreasonable hardship, physical disability, or other reason upon the petitioner.

ARTICLE VI

Voting

SECTION 1: Voting Rights

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

SECTION 2: Majority

A majority of the votes entitled to be cast on a matter at a meeting at which a quorum 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 as 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

The 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:

- (1) Shall keep the books of account of the Association and shall cause to be prepared an annual audit for presentation at the annual meeting.
- (2) 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.
- (3) Shall assist the secretary in keeping the roster of the membership which is current and accurate.
- (4) 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 corporate 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, and 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

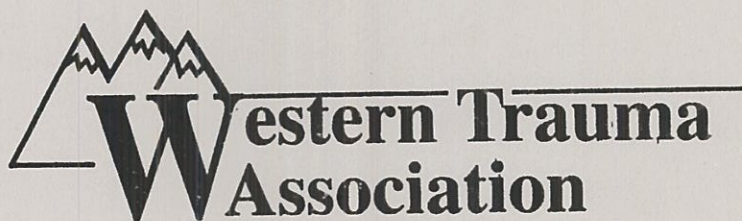
The President shall set the agenda and where possible should follow Robert's Rules of Order.

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.

MEMBERSHIP



WESTERN TRAUMA ASSOCIATION
1996 - 1997
MEMBERSHIP LISTING

AMMONS, Mark A. (Lee Anne)	2005 Franklin Midtown II, #410 Denver, CO 80205	O: 303-832-6165 H: 303-355-5709 Gen/Thoracic Surgery
*APRAHAMIAN, Charles (Patricia)	8700 W. Wisconsin Ave. Milwaukee, WI 53226	O: 414-257-5022 H: 414-781-2209 Surgery
BARTON, Richard G. (Janet)	50 N. Medical Dr. #3B313 Salt Lake City, UT 84132	O: 801-581-4314 H: 801-582-4202 Surgery
BENJAMIN, James (Laurie)	Univ. of Arizona Health Sciences Ctr. 1501 N. Campbell Avenue Tucson, AZ 85724-5064	O: 520-626-4024 H: 520-297-9418 F: 520-626-2473 Orthopaedics
BERGSTEIN, Jack M.	8700 W. Wisconsin Avenue Milwaukee, WI 53214	O: 414-257-5023 H: 414-962-0949
BINTZ, Marilu	610 E. Taylor St. Prairie du Chien, WI 53821	O: 608-236-6466 H: 608-326-4306 Surgery
BOYD, Allen D., Jr. (Claire)	601 Elmwood Avenue Box 665 Rochester, NY 14642	O: 716-275-7938 H: 716-264-9489 Orthopaedics
BROECKER, Bruce H.	1901 Century Blvd. Atlanta, GA 30345	O: 404-320-9179 H: 404-325-2297 Urology
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CHERRY, Kenneth J. (Robin)	Mayo Clinic 200 First St., S.W. Rochester, MN 55905	O: 507-284-2644 H: 507-288-3131 Vascular Surgery
COBEAN, Roy A. (Linda K. Rathburn)	Maine Medical Center Surgical Associates 229 Vaughan Street Portland, ME 04102	O: 207-774-2381 H: 207-781-4735 Surgery
COCANOUR, Christine S. (David McCloskey)	6431 Fannin, MSB 4.167 Houston, TX 77030	O: 713-792-5407 H: 713-432-0253 Gen/Trauma Surg/Crit Care
COGBILL, Thomas H. (Jan)	Gundersen Clinic, Ltd. 1836 South Avenue La Crosse, WI 54601	O: 608-782-7300 H: 608-788-7808 Gen/Vascular Surgery
COHN, Stephen M., FACS (Kelly)	Yale School of Med. 350 Congress Avenue Suite 3A New Haven, CT 06510	O: 203-785-2572 H: 203-458-2362 Surgery
*COIL, James A., Jr. , (Sharon)	Dept. of Surgery St. Vincent's Med. Ctr. 355 Baird Ave. Staten Island, NY 10310	O: Not available H: Not available General Surgery
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EBERSOLD, Michael J. (Janet)	Mayo Clinic 200 First St., S.W. Rochester, MN 55905	O: 507-284-3714 H: 507-288-5781 Neurosurgery
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ESRIG, Barry C.	USC Cardiothoracic Surgery 1510 San Pablo Street Suite 415 Los Angeles, CA 90033	O: 818-683-9000 H: 818-355-1893 F: 213-342-5956 Thoracic Surgery
FELICIANO, David V.	Dept. Surg. Glenn Bldg. Grady Mem. Hospital 69 Butler Street Atlanta, GA 30303	O: 404-616-5456 H: 404-875-1648 Gen/Trauma Surgery
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