

TWENTY-THIRD ANNUAL MEETING



February 27 - March 6, 1993

Snowbird, Utah

Tickets for breakfast & banquet
 res. introduced moderators each session
 2am tags

Historic review - 5 min beginning of each session 9:45

9:45
 11:45
 Lobby
 By Entrance
 Ball Room Main Lobby

1000 NS
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 500 n Tolazolin
 30 u/lw injured
 upstream

Hendrick
 Berkman
 Lobby mt. climber
 Baker
 Astmann

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Consign. Ramsey

801-374-9734



**WESTERN TRAUMA ASSOCIATION
PAST PRESIDENTS**

President	Year	Location
Robert G. Volz, M.D.	1971	Vail
Robert G. Volz, M.D.	1972	Vail
Peter V. Teal, M.D.	1973	Vail
William R. Hamsa, M.D.	1974	Aspen
Arthur M. McGuire, M.D.	1975	Sun Valley
Lynn Ketchum, M.D.	1976	Snowmass
Fred C. Chang, M.D.	1977	Park City
Glen D. Nelson, M.D.	1978	Steamboat
Gerald D. Nelson, M.D.	1979	Snowmass
Kevin G. Ryan, M.D.	1980	Snowbird
David S. Bradford, M.D.	1981	Jackson Hole
Erick R. Ratzler, M.D.	1982	Vail
William R. Olsen, M.D.	1983	Jackson Hole
Earl G. Young, M.D.	1984	Steamboat
Robert B. Rutherford, M.D.	1985	Snowbird
Rudolph A. Klassen, M.D.	1986	Sun Valley
Robert J. Neviasser, M.D.	1987	Jackson Hole
Robert C. Edmondson, M.D.	1988	Steamboat
Ernest E. Moore, M.D.	1989	Snowbird
Stephen W. Carveth, M.D.	1990	Crested Butte
George E. Pierce, M.D.	1991	Jackson Hole
Peter Mucha, Jr., M.D.	1992	Steamboat

******The 1994 WESTERN TRAUMA ASSOCIATION MEETING will be:
February 26 - March 6, 1994
Crested Butte, Colorado**



1992 - 1993

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R. Chris Wray, M.D.	President-elect
David A. Kappel, M.D.	Vice President
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CME Credits from Gundersen Medical Foundation
20 Hours Category I

WESTERN TRAUMA ASSOCIATION
TWENTY-THIRD ANNUAL MEETING
SNOWBIRD SKI & SUMMER RESORT

SCHEDULE

Sunday, February 28, 1993

4:00 - 7:00 p.m.

Registration and Welcoming Reception

Monday, March 1, 1993

6:30 - 7:00 a.m.

Breakfast

7:00 - 9:00 a.m.

Earl Young Competition

4:00 - 5:00 p.m.

Earl Young Competition

6:00 - 7:30 p.m.

Past Presidents' Meeting

Tuesday, March 2, 1993

6:30 - 7:00 a.m.

Breakfast

7:00 - 9:00 a.m.

First Scientific Session

10:00 a.m.

NASTAR Race

12:00 noon

Picnic and Picture

4:00 - 5:00 p.m.

Guest Presentation - "Trauma Through Art History from Bible Times to the Present" - H. Leon Pachter, M.D.

6:00 - 7:30 p.m.

Board of Directors Meeting

Wednesday, March 3, 1993

6:30 - 7:00 a.m.

Breakfast

7:00 - 9:00 a.m.

Second Scientific Session

4:00 - 5:00 p.m.

Third Scientific Session

5:00 - 6:00 p.m.

Presidential Address

6:00 - 7:00 p.m.

Membership Meeting

Thursday, March 4, 1993

6:30 - 7:00 a.m.

Breakfast

7:00 - 9:00 a.m.

Fourth Scientific Session

4:00 - 5:00 p.m.

Fifth Scientific Session

5:00 - 6:00 p.m.

Community Surgeon Program

7:00 - 7:45 p.m.

Reception

8:00 - 12:00 midnight

Banquet and Awards

Friday, March 5, 1993

6:30 - 7:00 a.m.

Breakfast

7:00 - 9:00 a.m.

Sixth Scientific Session

4:00 - 5:00 p.m.

Seventh Scientific Session

5:00 p.m.

Adjourn

Spouses' Breakfast

Monday thru Friday 8:00 - 9:00 a.m.

**WESTERN TRAUMA ASSOCIATION
TWENTY-THIRD ANNUAL MEETING
SNOWBIRD, UTAH**

Day: Monday, March 1

MODERATORS: MORRIS/HOYT

SESSION: EARL YOUNG

TIME	TITLE	PRESENTER
7:10 am	Dexon Mesh Renorrhaphy: A Clinical and Experimental Study	Mark Christ
7:30 am	A New External Fixation Device for Emergent Reduction of Pelvic Fractures	Rosemary Buckle
7:50 am	Influence of Reamed vs Unreamed Intramedullary Femoral Nailing on Lung Function in Multiple Trauma Patients	Hans-Christoph Pape
8:10 am	Trauma Outcome in the Rural Developing World: Comparison with an Urban Level I Trauma Center	Charles Mock

MODERATORS: KNUDSON/SUGERMAN

4:00 pm	Duodenal Injuries: To Exclude or Not Exclude?	David Levi
4:20 pm	Is Pulse Oximetry Useful in the Surgical Intensive Care Unit?	Mark McKenney
4:40 pm	Improved Outcome Prediction Model with Apache-II Score Derived from 777 Intra-abdominal Infections (IAI)	D. H. Wittmann
5:00 pm	Non-operative Treatment of Compound Depressed Skull Fractures	Robert Heary
5:20 pm	Fibrin Glue in the Trauma Patient: Hemostasis, Hypotension and Abscess Formation	Robert Parry
5:40 pm	First-dose Aminoglycoside Pharmacokinetics in Burn Patients	Tim Hollingsed
6:00 pm	Multisystem Geriatric Trauma	Peter Capizzi
6:00 pm	Past Presidents' Meeting	

Day: Tuesday, March 2

MODERATORS: SHACKFORD/ROSEMURGY

SESSION: CLINICAL CRITICAL CARE

TIME	TITLE	PRESENTER
7:00 am	The Intravascular Oxygenator (IVOX): Preliminary Results of a New Means of Extra-Pulmonary Gas Exchange	Larry Gentilello
7:20 am	Reliability of Quantitative Cultures (QC) of Endotraqueal Aspirate (ETA) in mechanically Ventilated Trauma Patients	Angela Sauaia
7:40 am	A Prospective Evaluation of Candida Antigen Titers as a Predictor of Death After Severe Injury	Alexander Rosemurgy
8:00 am	A Risk Analysis of Pulmonary Complications Following Major Trauma	David Hoyt
8:20 am	Does PEEP Significantly Reduce Airway Blood Flow?	Joseph Stothert
4:00 pm	Guest Presentation "Trauma Through Art History from Biblical Times to the Present" H. Leon Pachter, M.D.	
6:00 pm	Board of Directors Meeting	

Day: Wednesday, March 3

MODERATORS: WEBSTER/LEWALLEN

SESSION: ORTHOPEDICS

TIME	TITLE	PRESENTER
7:00 am	Prompt Fixation of Isolated Femur Fractures in a Rural Trauma Center	Frederick Rog
7:20 am	A Prospective Study of Early Soft Tissue Coverage of Grade IIIB Tibial Fractures	Suzanne Kerle
7:40 am	Floating Knee Injuries and Compartment Syndrome	John Ruth
8:00 am	Pelvic Fracture Geometry Predicts Risk of Life Threatening Hemorrhage in the Child	Robert McIntyr
8:20 am	Biomechanical Evaluation of Anterior Cervical Spine Stabilization in a Procine Model	B. L. Currier

MODERATORS: ROSS/SHARP

SESSION: ABDOMINAL TRAUMA

4:00 pm	The Spleen at Risk After Penetrating Trauma	R. Ivatury
4:20 pm	Traumatic Cysts of the Spleen - The Role of Cystectomy and Splenic Preservation: Experience with Seven Consecutive Patients	H. Leon Pacht
4:40 pm	The White Blood Cell Response to Splenectomy and Sepsis	Edmund Ruthe
5:00 pm	PRESIDENTIAL ADDRESS David Feliciano, M.D.	
6:00 pm	Membership Meeting	

Day: Thursday, March 4

MODERATORS: SCALEA/BURCH

SESSION: CRITICAL CARE

TIME	TITLE	PRESENTER
7:00 am	The Role of Hypotension/Hypoxia in Severe Pediatric Head Injury	Steven Wald
7:20 am	Prospective Ultrasound Evaluation of Venous Thrombosis in High Risk Trauma Patients	Gerard Burns
7:40 am	Unilateral Facet Dislocations & Fracture-Dislocations of the Cervical Spine	M.E. Cabanela
8:00 am	Reintubation as a Predictor of Mortality	Krista Kaups
8:20 am	Leukocytes May Mediate a Global Cerebral Reperfusion Injury After Brain Trauma and Shock	Jing Zhuang

MODERATORS: F. MOORE/REED

SESSION: BASIC SCIENCE

4:00 pm	LPS Induced CD _{11b} Mediated Neutrophil-Endothelial Adhesion is Not Required for PMN Priming	Robert Read
4:20 pm	Impaired Hepatic Clearance Mechanisms Following Gut Ischemia/Reperfusion	Thomas Johns
4:40 pm	The Effects of Colloid Solutions on Lung Alveolar Fluid Clearance	Robert Macker
7:00 pm	Reception	
8:00 pm	Banquet and Awards	

4:00 Dick Bass - 7 Summits

Day: Friday, March 5

MODERATORS: JURKOVICH/KAPPEL

SESSION: MISCELLANEOUS

TIME	TITLE	PRESENTER
7:00 am	Extremity Venous Trauma: Ligation or Repair?	Larry Martin
7:20 am	Failure of Standard Ventilatory Parameters to Predict IRV Success	Ronald Simon
7:40 am	Post-traumatic Acetabular Dysplasia	R. T. Trousdale
8:00 am	Patterns of Splenic Injury Secondary to Ski Trauma	Kennith Sartorelli
8:20 am	Recurrent Dislocation of the Shoulder with Onset After Age Forty	Robert Neviasser

MODERATORS: FELICIANO/WRAY

SESSION: SOCIOECONOMIC

4:00 pm	The Effect of Alcohol (ETOH) Intervention on Recidivism of the Hospitalized Driver Under the Influence (DUI) Offender	LeeAnne Ammons
4:20 pm	Rural Pediatric Trauma: The Hidden Mortality	Dennis Vane
4:40 pm	Motor Vehicle Deaths: A Rural Epidemic	Robert Muelleman

ABSTRACTS



DEXON MESH RENORRHAPHY: A CLINICAL AND EXPERIMENTAL STUDY

M. Christ, R. Ivatury

Lincoln Medical & Mental Health Center/New York Medical College

Presenter: M. Christ

Senior Sponsor: S. Ross

Corresponding Author: R. Ivatury

The potential for renal pedicle fibrous constriction by Dexon (polyglycolic acid) mesh wrap has precluded its widespread use for major renal parenchymal injury. From 1988 to 1992, 3 patients with active bleeding from gunshot wounds of the kidney were treated by debridement and renal wrapping with Dexon mesh. The method produced hemostasis, the patients recovered uneventfully, and the postoperative CT scans were normal. One of the patients became hypertensive and had a nonfunctioning kidney on the side of the renorrhaphy at 3 months and was lost to follow-up.

The question of whether renal wrap is an element in the loss of renal function was studied in four adult mongrel dogs. After a base-line IVP, each animal received a laceration, 1.5 cm in length, breadth and depth in one kidney, assigned equally between the right and left. The bleeding laceration was controlled by a mesh wrap. Constriction of the renal pedicle was avoided by a standardized technique, leaving a space of 0.75 cm. between the mesh and the vessels. The dogs were studied with IVPs at 1 and 2 month intervals. Renal vein renin levels from all kidneys were measured before sacrifice at 2.5 months.

RESULTS: All of the dogs had normal IVPs. At necropsy the kidneys were unremarkable, the vessels were not constricted and there was complete healing of the lacerations. Renal vein renin levels ranged from 1.4 to 5.9 nanograms per ml and were not significantly different between the repaired and control kidneys.

CONCLUSION: Dexon mesh wrap is effective in preserving lacerated renal tissue. Renal nonfunction secondary to perihilar fibrosis due to the mesh in the experimental animal does not appear to be a real concern.

NOTES

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A NEW EXTERNAL FIXATION DEVICE FOR EMERGENT REDUCTION OF PELVIC FRACTURES

R. Buckle, B.D. Browner, M. Morandi, C.S. Cocanour
University of Texas Medical School at Houston

Presenter: R. Buckle
Senior Sponsor: R. Fischer
Corresponding Author: R. Buckle

Mortality from major pelvic fracture ranges from 10-50% and is largely due to associated head injury and massive pelvic bleeding. Early mechanical stabilization of the unstable pelvic ring fracture is the first step in controlling blood loss from pelvic fractures; yet, is often delayed by the diagnostic work-up and treatment of other injuries. A new external fixation device, that can be applied rapidly in the emergency room and does not interfere with diagnostic studies or resuscitation/treatment has been designed and tested at our institution. The clamp is constructed of two semi-circular aluminum I-beam limbs linked together by a central ratchet gear. At the end of each limb are threaded titanium pins similar to those used for halo placement that are brought into apposition against the external surface of the ilium. Inserted through small stab wounds under local anesthesia, the clamp is manually locked into position via the ratcheting gear. This closes the pelvis and stabilizes the ring. Once applied, the clamp can be swiveled across the chest or the thighs to allow access to the chest and abdomen. Efficacy of reduction with its subsequent decrease of blood loss into the pelvis is demonstrated by monitoring pulse, blood pressure, urine output and the amount of fluids used in resuscitation. The clamp has been used in the acute management of 8 patients with Tile type B and C pelvic ring fractures. The clamp was applied within the first hour following arrival in the ER. All patients had a systolic blood pressure of 80 mmHg or lower upon arrival to the ER. Injury severity scores ranged from 16-75 (mean = 46). Successful application and reduction was achieved in 7 cases. The pin-bolt system failed in one instance, making application of the clamp impossible. Two patients underwent ER thoracotomy for other injuries and expired. Reduction of the pulse and elevation of blood pressure was noted in three patients after clamp application. Two patients who required continued transfusions underwent pelvic angiography where pelvic arterial bleeding was identified and embolized. Four patients went on to definitive pelvic fixation. This clamp appears to be effective in reducing and stabilizing severe pelvic fractures. It was successful in improving hemodynamic stability and by providing early control of venous bleeding, it allowed identification of arterial bleeding requiring angiography and embolization to be more expedient. The clamp can be applied rapidly and concurrently with diagnostic and resuscitative procedures, nor does it interfere with treatment of other injuries, ie. exploratory celiotomy. Early clamp application avoids the delay in mechanical reduction usually associated with traditional placement of external fixation in the operating room.

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**INFLUENCE OF REAMED VS UNREAMED INTRAMEDULLARY FEMORAL NAILING
ON LUNG FUNCTION IN MULTIPLE TRAUMA PATIENTS**
H.C. Pape, A. Dwenger, M. Grotz, G. Regel, H. Tscherne
Departments of Trauma Surgery & Clinical Biochemistry
Hannover Medical School

Presenter: H.C. Pape
Senior Sponsor: D. Feliciano
Corresponding Author: H.C. Pape

INTRODUCTION: Primary stabilization of femoral shaft fractures in patients with multiple trauma is beneficial. However, in patients with associated lung contusion we have found an increased incidence of ARDS, apparently associated with primary Reamed Femoral Nailing (RFN). Previous animal studies revealed, that perioperative disturbances of lung function appear to be related to the reaming procedure, possibly due to pulmonary embolization of bone marrow fat. In a prospective clinical analysis we compared effects of intramedullary nailing with and without reaming on parameters known to be related to ARDS-pathogenesis. METHODS: Prospective evaluation, inclusion criteria: multiple trauma ISS >18, midshaft femur fracture, primary intramedullary femoral nailing (<24 hrs.post trauma). Group RFN: nailing after reaming of medullary canal, 11-14 mm diameter, group UDL: Unreamed Double Locked nailing, 9 mm diameter. Intra- and postoperative measurement of pulmonary artery pressure (Pap, mmHg) and lung function (PaO₂/FiO₂). Elastase (ARDS-related humoral mediator, u/l) from central venous blood. RESULTS: ISS of RFN-group (n=12):22.5 points; ISS of UDL-group (n=11): 24.1 points (n.s.). p < 0.05, Fischers exact Test, *=sign between groups, Δ= sign. to previous value, data as means ± std. deviation.

	pre-Op	IMN	30 min.p.Op	1d.p.Op	
PaO ₂ /FiO ₂	UDL	388±44	376±59	390±51	365±33
	RFN	378±31	218±41 *	271±41 *	320±52
Pap (mean)	UDL	25.1±5.3	25.6±5.1	26.2±4.8	26.2±4.1
	RFN	26.0±3.7	35.1±4.1 *	28.6±3.8	25.7±3.3
Elastase	UDL	092±33	110±31	102±41	105±51
	RFN	111±41	184±33 Δ	166±29	121±34

CONCLUSIONS: 1. Primary nailing with reaming (RFN) causes acute Pap increase, transient decrease of oxygenation, and liberation of humoral ARDS-predisposing factors (Elastase). 3. These disturbances are not seen with primary unreamed nailing (UDL). 4. Primary nailing with intramedullary reaming might be responsible for worsening of pulmonary function. In patients at high risk of ARDS (additional lung contusion) unreamed (UDL) nailing might be preferable.

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TRAUMA OUTCOME IN THE RURAL DEVELOPING WORLD: COMPARISON
WITH AN URBAN LEVEL I TRAUMA CENTER

C.N. Mock, E. Conklin, K. Adzotor, D.M. Denno, G.J. Jurkovich
Holy Family Hospital, Berekum, Ghana
Department of Surgery, University of Washington

Presenter: C. Mock
Senior Sponsor: G.J. Jurkovich
Corresponding Author: C. Mock

Trauma is a major cause of death and disability in developed nations, but has been infrequently studied in the developing world. We reviewed 539 trauma patients admitted from 1987 to 1991 to a hospital in a rural area of the developing world (RDW) to ascertain factors influencing survival and functional outcome and compared these to outcome data for 14,401 patients admitted during the same period to a Level I trauma center (TC) in the industrialized world. Blunt trauma was the most common mechanism for both RDW (63%) and TC (72%) patients. At RDW, burns caused 74% of injuries in patients aged <2 years, 56% of which were domestic scald burns. At RDW, 59% of patients presented >24 hours after injury, compared with only 9% of TC patients ($p<0.001$). Furthermore, major disability occurred in 7% of RDW patients and was associated with delayed presentation ($p=0.008$). Only 25% of RDW patients received any prehospital care, compared with 82% of TC patients ($p<0.001$). Comparison of mortality rates and ISS for patients admitted to both hospitals are as follows:

ISS	TC:#patients	%mortality	RDW:#patients	%mortality
1-8	6390	1	342	0.3
9-14	3709	2	146	5*
15-24	1811	6	25	32*
25-40	1327	39	25	68*
>40	193	57	1	100

*($p<0.01$). These data show no difference in survival for minimally injured patients, limited improvement for severely injured patients, but significant improvement for patients with moderate degrees of injury at TC compared to RDW. However, such improvement comes at a financial expenditure not attainable by most hospitals in the developing world. The lack of prehospital care and the considerable delays in presentation suggest improved prehospital care to be a potentially cost effective way to improve trauma care in the rural developing world. Furthermore, the preponderance of young patients with domestic scald burns suggests this to be a prime target for prevention work.

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DUODENAL INJURIES: TO EXCLUDE OR NOT EXCLUDE?

M.G. McKenney, D. Levi, L. Martin

University of Miami/Jackson Memorial Medical Center

Presenter: D. Levi

Senior Sponsor: J.A. Morris, Jr.

Corresponding Author: M.G. McKenney

We studied our experience with 40 consecutive penetrating duodenal injuries over a four year period through 1991. The 40 patients consisted of 35 males, 5 females and had an average age of 31 years (range 17 to 88 years). The site of duodenal injury was the first portion in 7, second portion in 12, third portion in 5, fourth portion in 7, and 9 patients with multiple areas. The most common treatment was primary repair in 20 patients followed by 8 duodenal resections, 5 primary repairs with pyloric exclusion and gastrojejunostomy, 3 duodenal diverticularizations and 4 Whipple procedures. Sixteen of the 40 patients had combined duodenal and pancreatic injuries. Five of the 16 patients with combined injuries developed pancreatitis, while no patient without pancreatic injury developed pancreatitis ($p < 0.05$). There were 16 patients with minor (Grade 1&2) or intermediate (Grade 3) injuries of the proximal duodenum treated with primary repair, including 5 that had combined duodenal and pancreatic injuries. Two of the 5 patients in this group suffered anastomotic leaks while none of the 11 patients without pancreatic injury had an anastomotic leak ($p < 0.05$). There is a significantly increased incidence of pancreatitis in patients with combined injuries and an increased incidence of leaks in proximal anastomoses that are treated with primary repair. Three patients were treated with pyloric exclusion that had combined injuries and none of these patients had a leak. We recommend that the treatment of duodenal injuries be based on location, grade of injury, and whether there is an associated pancreatic injury. Minor injuries of the duodenum without pancreatic injury are treated with primary repair. Minor or intermediate injuries of the proximal duodenum are best treated with primary repair and adding pyloric exclusion and gastrojejunostomy to protect the anastomosis if there is a significant pancreatic injury.

NOTES

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**IS PULSE OXIMETRY USEFUL IN THE SURGICAL INTENSIVE CARE UNIT?
M. McKenney, J. Hudson-Civetta, D. Levi, P. Mangonon, J.M. Civetta
University of Miami/Jackson Memorial Medical Center**

**Presenter: M. McKenney
Senior Sponsor: J.A. Morris, Jr.
Corresponding Author: M. McKenney**

The pulse oximeter (PO) is accurate but, in the awake Surgical Intensive Care Unit (SICU) patient, subject to frequent false alarms from motion. This study was designed to characterize PO alarms, to evaluate a new technology (C-lock) to reject motion artifact and to direct appropriate reactions. We studied 19 patients in our SICU over 77 different 12 hour nursing shifts using the Nellcor N-200 PO. Printers were attached and recorded all alarms, the value, and time of resolution. Nurses recorded alarms they perceived, the time and presumed etiology on a bedside data collection sheet. Data collection sheets were then compared to PO printouts. The printers recorded a total of 468 alarm activations, 263 (1 per 3.5 hours of continuous monitoring) for low saturation and 205 (1 per 4.5 hours of monitoring) for pulse search. Of the 263 low saturation alarms, 177 (67%) were noted by the nurse on the data collection sheet and printout while 86 (33%) were recorded only on the printout. The printout only alarms were significantly shorter than those perceived and recorded by the nurses (25 ± 31 seconds vs. 50 ± 90 seconds; Chi square $p = .01$). Of the nurse recorded alarms, 133 (75%) were associated with patient motion and 44 (25%) alarms denoted true low saturation. Thirty-four of the true low saturation alarms occurred during or after a maneuver in which hypoxia might be anticipated: 19 after a ventilator change, and 15 occurred during suctioning. Ten true low saturation episodes were unexpected. Termed safety alerts, they occurred during central venous catheterization (5), coughing (4), and after sedation (1). On average one safety alert will occur for every 3.9 days of PO monitoring or 2.8 safety alerts per day in a 10 bed SICU. The incidence of motion alarms was lower than previously reported. Since the motion was apparent, there was an immediate explanation for the alarm. Anticipated alarms aided management as an early warning signal. Unexpected alarms provided an additional measure of safety. Nurses perceived most alarms; missed alarms averaged less than 30 seconds, and resolved spontaneously without needing treatment. The addition of an ECG signal (C-lock) seemed to decrease pulse search artifact. An appropriately directed response/interpretation of PO alarms in the SICU can aid patient care.

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NOTES

IMPROVED OUTCOME PREDICTION MODEL WITH APACHE-II SCORE
DERIVED FROM 777 INTRA-ABDOMINAL INFECTIONS (IAI)
D.H. Wittmann, C. Arahamian, E.J. Quebbeman, N. Bansal,
M.J. Bohnen, R.A. Mustard, B.D. Shout, P. Nystroem
Medical College of Wisconsin, Marquette

Presenter: D.H. Wittman
Senior Sponsor: C. Arahamian
Corresponding Author: D.H. Wittman

PURPOSE: Outcome prediction with APACHE-II (AP2) uses the formula: $\text{LogR}/(1-R) = -3.517 + (\text{AP2} * 0.146) + \text{Diagnostic Weight}$. A diagnostic weight for patients with IAI has not been published. We created a large representative database of IAI to determine the diagnostic weight for intra-abdominal infections.

METHODS: We combined the databases from three prospective Studies of IAI (n=393, n=271, n=113) to obtain an actual outcome probability prediction by logistic regression.

RESULTS: The mean age of the 777 patients was 58 ± 18 , range 3-97 years. 28.6% died. The mean AP2 was 12.6 ± 7.4 for all, 10.1 ± 6.1 for survivors, and 18.9 ± 6.5 for non-survivors. Logistic regression yielded the formula: $\text{LogR}/(1-R) = -0.206 + (\text{AP2} * 3.825)$ with 80% overall correct prediction, a 91% correct prediction of survivors, and 53% correct prediction of non-survivors. Goodness of fit method gave a diagnostic weight of 0.007 which includes the weight for post-emergency surgery. Receiver-operator (ROC) analysis showed no significant difference between the two methods. Plotting probability curves for these two methods, however, gives better prediction for logistic regression analysis over curve fitting.

SUMMARY OF RESULTS: A diagnostic weight of 0.007 for IAI improves outcome prediction with AP2. A new logistic regression demonstrated a different prediction curve shape with better prediction.

CONCLUSION: As randomized studies are difficult to perform, this prediction model will be useful to compute expected outcome as a reference for evaluation of new treatments in IAI. Outcome will change with time as total treatment of such patients improves, making an update of the prediction model desirable in the future.

NOTES

NON-OPERATIVE TREATMENT OF COMPOUND DEPRESSED SKULL FRACTURES

**R.F. Heary, C.D. Hunt, A.J. Krieger, M. Schulder, C. Vaid
University of Medicine & Dentistry of New Jersey
New Jersey Medical School**

**Presenter: R. Heary
Senior Sponsor: S.R. Shackford
Corresponding Author: R. Heary**

The purpose of this investigation was to evaluate whether a specific subset of patients sustaining non-missile, compound depressed skull fractures could be safely managed in a conservative manner. Classical treatment of compound depressed skull fractures has included operative debridement and closure of all scalp wounds to minimize the risk of delayed intracranial infection. In selected situations, a non-operative approach may prove to be equally safe, more cost effective, and avoid overutilization of the operating room.

Over a 30 month period, we have evaluated 975 patients for head trauma. Of these, there were 58 patients with non-missile, compound depressed skull fractures (9 of these 58 patients have been excluded for deaths which occurred within 4 days of admission and were unrelated to any infectious cause). Conservative treatment was utilized if there was no clinical or radiographical evidence of violation of the dura mater. If the following criteria were satisfied, then the non-operative approach was employed: no evidence of exposed brain or a cerebrospinal fluid leak, no pneumocephalus related to the fracture, no depressed fragments of bone more than 1 cm below the inner table of the skull, and no gross wound contamination. Conservative therapy consisted of immediate wound irrigation, debridement, and closure in the emergency department using a strict aseptic technique. This was followed by 5-7 days of intravenous antibiotics and 2 additional days of observation, off antibiotics, prior to discharge.

Of the 49 patients reviewed, formal operative therapy was performed on 26 patients (53%; age 33 +/- 16 years; mean ISS 23 +/- 8). Operative therapy included intravenous antibiotics and craniotomy with debridement, elevation of depressed fragments, repair of dural tears, and evacuation of hematomas, as necessary. Conservative therapy, consisting of intravenous antibiotics and local wound care, was used on 23 patients (47%; age 35 +/- 17 years; mean ISS 18 +/- 8). In all 49 patients comprising both subsets of patients, there were no infectious complications related to the central nervous system.

Patients with significant intraparenchymal injuries must be treated operatively. We believe that patients with dural violations over the convexity of the brain should also undergo formal operative therapy. However, patients with open skull fractures that do not demonstrate evidence, either clinically or radiographically, of violation of the dura mater or a significant underlying brain injury may be treated with local wound care and intravenous antibiotics without an increased risk of a subsequent central nervous system infection.

NOTES

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**FIBRIN GLUE IN THE TRAUMA PATIENT:
HEMOSTASIS, HYPOTENSION AND ABSCESS FORMATION**
R. Parry, M.G. Ochsner, H.R. Champion
Washington Hospital Center

Presenter: R. Parry
Senior Sponsor: H.R. Champion
Corresponding Author: M.G. Ochsner

Episodes of severe, even fatal, hypotension have been reported with the use of fibrin glue (FG) in the trauma patient and is thought to represent a systemic response to vascularity disseminated FG. Concerns have also been raised regarding intraabdominal abscess formation associated with FG use. To evaluate these risks, as well as the hemostatic efficiency of FG, a two year retrospective review was conducted of 270 trauma patients with hepatic and/or splenic injuries. FG was used in 107 patients (39%) as an adjuvant or as the sole agent for hemorrhage control and its effect was assessed for injury grades I-V. The remaining (no FG) 163 patients served as case controls.

Hemostasis was achieved in 26/32 (81%) splenic and 66/78 (85%) hepatic injuries treated with FG. Splenectomy was required in all patients with splenic injury that failed treatment with FG. The incidence of hypotension (systolic BP <90) with FG was 2/32 (6.2%) among patients with splenic injury and 4/78 (5.1%) for liver injury. Typically, the episodes of hypotension were brief (<2min), resolved spontaneously and would not have been detected without arterial line monitoring. The incidence of abdominal abscess formation in those patients with liver and spleen injuries surviving 96 hours was 7/95 (7.4%) for patients treated with FG and 15/144 (9.7%) for those without FG (NS). Preliminary results of an ongoing prospective study include 17 patients, 9 liver (three grade IV) and 8 splenic (two grade IV) injuries, with successful hemostasis in all and no hypotension or abscess formation associated with FG application.

We conclude that FG is an effective hemostatic agent for liver and spleen injuries with no increased risk of abdominal abscess formation associated with its use. A limited, but real risk of hypotension with FG application exists and continuous arterial monitoring may be necessary to identify this complication.

NOTES

7

FIRST-DOSE AMINOGLYCOSIDE PHARMACOKINETICS IN BURN PATIENTS

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University of Utah Health Science Center

Presenter: T. Hollingsed

Senior Sponsor: J. Saffle

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Aminoglycoside antibiotics are frequently used in burn victims. However, aminoglycoside kinetics are greatly altered in these patients, and traditional dosing often fails to achieve therapeutic efficacy. Determination of first dose kinetics may facilitate effective use of aminoglycosides. This study reviews our experience with this technique in a group of severely burned patients.

METHODS: We instituted the routine performance of first dose aminoglycoside pharmacokinetics in our burn center in July, 1991. We compared 12 patients treated since that time (Group I; 15 courses of aminoglycosides) with 14 patients (Group II; 17 courses of aminoglycosides) treated before that time. In group I, drug levels were obtained 1, 3, and 5 hours after an initial loading dose, and used to calculate the volume of distribution and clearance rates for the drug, and an appropriate dosing regimen, which was then administered. In group II, peak and trough levels were drawn with the third dose of the drug, and dosing adjusted by physicians as indicated. Additional peak and trough levels were drawn at least twice weekly in both groups. All patients received antibiotics for at least three days. In all patients, the time in hours and the number of doses needed to achieve therapeutic levels were calculated, in addition to the number of dosing adjustments required during treatment.

RESULTS

	Burn Size (% TBSA)	Age (years)	Therapeutic levels obtained		
			Time (hrs)	No. doses	No. changes
Group I	28.1 ± 13.9 ¹	25.2 ± 20	44.4 ± 31.4	6.6 ± 3.3	2.1 ± 1.0
Group II	42.5 ± 21.8	31.3 ± 30	97.1 ± 51.5*	11.8 ± 7.1**	3.7 ± 1.8*

¹Values are mean ± s.d. * p<0.005, ** p<0.05 by t-test

Group I patients received mean loading doses of 3.1 mg/kg gentamicin and 9.4 mg/kg amikacin, compared to 2.1 mg/kg gentamicin (p<0.05) and 6.4 mg/kg amikacin (NS) in group II. In group I, the first peak level obtained (on the third dose) was therapeutic in 10/15 instances (67%), compared to 2/17 (11%) for group II patients. Four Group I and 2 Group II patients had at least one trough level above recommended range, but these levels were only slightly high, and no patient suffered renal impairment. The dose finally required to produce therapeutic levels of gentamicin was 11.2 ± 4.6 mg/kg/day in Group I, compared to 6.4 ± 4.2 mg/kg/day in group II (p< 0.005).

CONCLUSIONS: These data illustrate the wide variation in aminoglycoside requirements exhibited by burn patients. The use of first-dose pharmacokinetics can significantly reduce the time required to achieve therapeutic efficacy in these patients, and may facilitate determination of a dosing schedule, thus avoiding frequent dosing complications.

NOTES



MULTISYSTEM GERIATRIC TRAUMA
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Mayo Clinic

Presenter: P. Capizzi
Senior Sponsor: D.G. Lewallen
Corresponding Author: S.P. Zietlow

Purpose: To analyze the demographics, hospital course, functional outcome and reimbursement of elderly patients sustaining multisystem trauma.

Methods: The Trauma Registry was accessed for one year (1/91-1/92) for patients age ≥ 65 years with an ISS ≥ 10 admitted with multisystem trauma. Hospital data was obtained from the Trauma Registry, reimbursement generated from the business office, and complete follow-up (mean=12 months) performed by telephone survey on all patients.

Results: Of 1931 admitted trauma patients during this period, 601 (31%) were ≥ 65 and 94 (5%) met the study criteria. There were 52 females and 42 males with a mean age of 79 years (range 65-100). Falls (59%) and MVA's (36%) were the predominant mechanisms with closed head injury (CHI) and fractures representing the most frequent injuries. The mean ISS=18 (range 10-57) and hospital stay averaged 10 days. ICU admission was necessary for 37% and 38% required surgical intervention. Factors associated with mortality included previous MI, chronic renal insufficiency, ventilatory and/or inotropic support, shock on admission, and severe CHI (GCS ≤ 8). Mortality was 23% (22/94) with 3/4 of the deaths occurring in the first 24 hours - mostly from severe CHI. Upon dismissal, 53% (38/72) of patients went home and 36% (26/72) went to a nursing home. At a mean follow-up of 12 months, 3/4 of the patients were living at home. The percent of reimbursement for care provided for all patients was 2/3 of cost.

Conclusion: 1) Mortality rates are high for elderly patients sustaining multisystem trauma (2) The majority of deaths are within the first 24 hours, most of which are from severe CHI. (3) Over half of the survivors are dismissed to home and at long-term follow-up the majority are independent. (4) Reimbursement is not commensurate with the functional outcome achieved and care provided.

NOTES

6

**THE INTRAVASCULAR OXYGENATOR (IVOX): PRELIMINARY RESULTS OF
A MEANS OF EXTRA-PULMONARY GAS EXCHANGE**
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Presenter: L. M. Gentilello
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Conventional management of ARDS with high minute ventilation, PEEP and inspired O₂ concentration may worsen pulmonary injury. The Intravascular Oxygenator (IVOX) is a device made up of several hundred hair thin gas permeable hollow fibers that are bundled together, and inserted into the vena cava via femoral venous cutdown. High flow of gas through each fiber adds O₂ and removes CO₂ from the bloodstream. The purpose of this study was to determine if IVOX can be used to reduce potentially harmful levels of mechanical ventilatory support. Study entry required a PaO₂ < 60 mmHg while on ≥ 15 cm H₂O PEEP and FiO₂ ≥ 0.5. Ten patients were deemed appropriate IVOX candidates. IVOX was inserted in nine patients, and aborted in one case due to blood loss at the venotomy site which resulted in cardiac arrest.

	pre IVOX	post-insert (IVOX off)	IVOX on	24 hours	48 hours
PaO ₂ mmHG	77 ± 8	77 ± 11	121 ± 23	74 ± 7	69 ± 3
PaCO ₂ mmHG	50 ± 4	50 ± 5	42 ± 5	45 ± 3	42 ± 3
FiO ₂ %	65 ± 7	85 ± 7	85 ± 7	62 ± 6	62 ± 6
PEEP cm H ₂ O	22 ± 3	20 ± 3	20 ± 3	21 ± 3	18 ± 3
Min Vent L/min	17 + 2	16 + 1	16 + 2	18 + 2	19 + 3
PaO ₂ /FiO ₂	125 ± 14	101 ± 20	147 ± 26	130 ± 19	118 ± 9
Cardiac Index	4.1 + 0	3.1 + .3	2.7 + .3	3.3 + .5	3.7 + .7
DO ₂ index	648 + 55	423 + 39 *	371 + 38 *	445 + 50 *	442 + 57 *

(* p < .05 vs. pre IVOX insertion value, Wilcoxon Rank Sign Test)

Compared to pre-insertion values, IVOX transiently increased PaO₂, and caused a sustained decrease in cardiac index and oxygen delivery (DO₂), despite maximum fluid and inotropic support. FiO₂, minute ventilation, PEEP and mean airway pressure during the first 48 hours were not clinically significantly different from pre-IVOX values. Mortality was 80%. In conclusion, although gas exchange occurs, the efficiency of the current device does not allow a significant sustained reduction in level of mechanical ventilatory support.

NOTES

RELIABILITY OF QUANTITATIVE CULTURES(QC) OF ENDOTRAQUEAL
ASPIRATE(ETA) IN MECHANICALLY VENTILATED TRAUMA PATIENTS
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Presenter: A. Sauaia
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Differentiating colonization from infection in the mechanically ventilated(MV) trauma patient remains a challenge. Standard non quantitative ETA cultures are usually unreliable. Bronchoalveolar lavage (BAL) with QC has been suggested to be more accurate. Since BAL is an invasive procedure, we questioned whether QC/ BAL offer a significant advantage over QC/ETA. We , therefore, prospectively compared standard ETA culture, QC/BAL and QC/ETA in 18 consecutive MV trauma patients(Mean \pm SEM, age :39 \pm 3.4 yrs.; Injury Severity Score:23 \pm 2.3) who developed clinical signs of pneumonia . Standard ETA cultures recovered a potential pathogen in all study patients. BAL and ETA were obtained by standard procedures. QC/BAL was considered positive if microorganism growth was greater than 10⁴ colony forming units/ml(cfu/ml) (Pang et al,Lung 167:261, 1989) while for QC/ETA cut-off was 10⁵ cfu/ml(El-Ebiary et al,Am Rev Respir Dis 143:A109, 1991). By these criteria, five patients had a positive BAL and in four of these, QC of ETA were positive for the same microorganisms. QC/BAL were negative in the other 13 patients and QC/ETA were also negative in 12 of these. These data indicate a general agreement of 89%. Of note , 5 (28%) of the 18 patients experienced a decrease in PaO₂/FiO₂ (>10% of previous value) two hours after BAL, and in 3 (17%) this alteration persisted for 24 hours. These data suggests that QC/BAL do not offer a significant advantage over QC/ETA in MV trauma patients.

NOTES

**A PROSPECTIVE EVALUATION OF CANDIDA ANTIGEN TITERS AS A
PREDICTOR OF DEATH AFTER SEVERE INJURY**
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Presenter: A. Rosemurgy
Senior Sponsor: A. Rosemurgy
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Opportunistic Candida infections are increasingly recognized after severe injury and are associated with high mortality. Recently, a latex agglutination test (CandTec[®]) has become commercially available, allowing for detection of occult Candida invasion. The utility of this test has not been established in severely injured adults.

Prospectively, Candida antigen titers were determined weekly in injured adults with ISS \geq 18. Of 130 consecutive patients, 65 (50%) developed at least one elevated (\geq 1:4) titer (+ titer) while 65 (50%) did not (- titer). All patients received antibiotics. For patients with - titers vs + titers, there were no differences in age (35 years \pm 1.7 (SEM) vs 38 years \pm 1.9), or in the distribution of sex (78% men vs 72% men), blunt injury (82% vs 88%), patients transfused (58% vs 55%), ISS (28 \pm 1.1 vs 28 \pm 1.1), or predicted survival by TRISS methodology (89% \pm 0.03 vs 83% \pm 0.03).

	BLOOD GIVEN	BACTERIAL INFECTION	ANTIBIOTIC DAYS	%MORTALITY
⊖TITER	3.4units \pm 0.6	32%	18 \pm 3.1	0.0%
⊕TITER	7.1units \pm 1.5 [@]	68% ⁺	34 \pm 4.2 [‡]	12.3% [*]

greater than in patients with negative titers:

- @ = P<0.02 Student's t-test
- + = P<0.00 Yates' Chi square
- ‡ = P<0.002 Student's t-test
- * = P<0.003 Fischer's exact test

By multivariate regression analysis, eliminating factors with multiple collinearity, only age (p<0.02), units of blood transfused (p<0.02), and candida antigen titers (p<0.03) correlated with mortality. Adults that survive at least one week after serious injury often (50% of the time) develop at least one elevated titer during hospitalization. Blood transfusions are known to depress immune response, while bacterial infections and antibiotic therapy are known to predispose to fungal infections, and, thereby, their significant relationships with elevated titers are expected. An elevated candida antigen titer is, by itself, a predictor of death after severe injury.

NOTES

A RISK ANALYSIS OF PULMONARY COMPLICATIONS FOLLOWING MAJOR TRAUMA
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Presenter: D.B. Hoyt
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Introduction: Varying institutional definitions and degrees of surveillance limit awareness of the true incidence of post traumatic pulmonary complications.

Methods: Prospective review with standardized definitions of 25 categories of pulmonary complications was applied to a University Level I trauma service over three years to establish the true incidence. Potential injury related predictors of individual complications were determined using multiple logistic regression analysis. Adjusted odds ratios were calculated thereby controlling for the effect of other co-variants. Significance was attributed to $P < 0.05$.

Results: 709 pulmonary complications occurred in 3,327 patients meeting MTOS criteria (70% of all admissions). Adjusted odds ratios for four common and significant complications are shown below.

Pneumonia (N=246)	Blunt trauma	3.1**
	Age (>55)	2.0**
	ISS (>16)	9.6***
	Shock (admission)	2.0***
	CHAMP < 13 (admission)	2.6***
	Head (AIS >=3)	2.3***
	Surgery to Head	1.9**
ARDS (N=40)	Surgery to Chest	2.5***
	Blunt trauma	3.2**
	ISS (>16)	15.5***
	CHAMP < 13 (admission)	3.0**
Respiratory Failure (N=54)	Surgery to Head	4.5***
	Pedestrian Struck	2.4*
	Age (>55)	4.3***
	ISS (>16)	6.3***
Pulmonary Embolism (N=22)	Head (AIS >=3)	4.2***
	ISS (>16)	19.7***
	Shock (admission)	5.0#
	EXPEL (AIS >=3)	3.5**

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$, # $0.05 \leq P < 0.06$

Conclusions: Pulmonary complications account for one third of all complications. The true incidence of pulmonary complications is established with this kind of analysis and focuses attention on: 1) groups at high risk for developing complications, 2) groups for which current therapeutic modalities are still ineffective, and 3) defines the need to refocus on prospective research rather than on an ineffective process of care.

NOTES

DOES PEEP SIGNIFICANTLY REDUCE AIRWAY BLOOD FLOW?

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Presenter: J. Stothert
Senior Sponsor: J. Stothert
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Positive end-expiratory pressure (PEEP) is a common modality used to treat critical hypoxia following lung injury. Barotrauma may be a sequela of reduction of nutritive blood flow to injured or normal areas of the lung as a result of increased pressure in the airway limiting blood flow. This experiment was designed to examine the role of the systemic nutritive blood flow in the airway and its response to injury and PEEP.

METHODS: Six sheep underwent operation for placement of invasive cardiovascular monitors. Each animal was anesthetized and underwent unilateral (single lung) smoke inhalation injury using split ventilation. Bronchial blood flow was measured 24 hours after this injury at randomized levels of PEEP (0, 5, 10, 20 cm H₂O) using a radiolabeled microsphere technique. Both lungs were then harvested and systemic blood flow to the injured (I) and normal (N) airways were determined.

RESULTS: Values are mean \pm S.D. in ml/min/100 grams. *p<0.05 from control (0 PEEP) using Dunnett's test.

		<u>Peep (cm H₂O)</u>			
		<u>Airway Size (mm)</u> 0	5	10	20
8-12	(I)	161 \pm 41	118 \pm 48	122 \pm 53	109 \pm 38*
	(N)	31 \pm 8	20 \pm 10	21 \pm 7	31 \pm 14
4-8	(I)	214 \pm 42	150 \pm 68	128 \pm 66	107 \pm 38*
	(N)	31 \pm 11	19 \pm 11	18 \pm 7	38 \pm 29
2-4	(I)	292 \pm 106	208 \pm 137	136 \pm 88*	121 \pm 83*
	(N)	44 \pm 17	25 \pm 24	21 \pm 10*	50 \pm 60
0.5	(I)	357 \pm 147	230 \pm 200	160 \pm 104*	119 \pm 81*
	(N)	57 \pm 31	30 \pm 44	28 \pm 28	49 \pm 85

CONCLUSION: Unilateral lung injury from smoke results in significant elevation in airway blood flow. PEEP significantly lowers airway blood flow at higher airway pressures in the smoke injured areas of the lung. This reduction in airway blood flow at high PEEP levels does not appear to cause a significant reduction in airway blood flow to the uninjured lung. These data do not support the concept of reduced blood flow causing airway damage and necrosis following increasing levels of PEEP

NOTES

**PROMPT FIXATION OF ISOLATED FEMUR FRACTURES
IN A RURAL TRAUMA CENTER
F.B. Rogers, S.R. Shackford, F. Harris
University of Vermont**

**Presenter: F. Rogers
Senior Sponsor: S.R. Shackford
Corresponding Author: F. Rogers**

Early fracture fixation (EF: fixation within 24 hours) reduces post-injury morbidity and mortality and has become the standard of care. EF may not be achievable in a rural setting where prolonged interhospital transfer is often required and operating room resources are constrained. We hypothesized that prompt fixation (PF: fixation between 24 and 72 hours) was as effective as EF and was more effective than late fixation, (LF: fixation >72 hours) in terms of morbidity, mortality and resource utilization. Between 10/01/87 and 12/31/90, 164 patients with isolated femur fractures were admitted and stratified into one of three groups based on the timing of fixation. (Data: mean \pm SEM)

	N	ISS	Pulm. Morbidity(%)	Infections (%)	Mortality (%)	Operating time (min)	% Emergency operations	Length of stay (days)
EF	35	10 \pm 1	1(3)	7(20)	1(2.8)	201 \pm 19*	91*	15 \pm 2
PF	97	9 \pm 1	2(2)	26(27)	4(4.1)	149 \pm 4	47	16 \pm 1
LF	32	11 \pm 1	11(34)*	15(55)**	4(12.2)**	147 \pm 9	0	23 \pm 2**

* p < 0.0001 (x² vs I, II), ** p < 0.05 (x² vs I, II), + p < 0.001 (x² vs II, III)

Patients in the EF and PF groups had similar charges and morbidity and mortality rates, which were significantly less than the LF group. Operations done in the first 24 hours (EF) were more likely done as an emergency and took significantly longer to complete. These data suggest that: 1) fracture fixation within 72 hours of injury does not increase morbidity or mortality compared to fixation within 24 hours; and 2) LF is associated with significantly increased morbidity and mortality and hospital charges. Extending the time of fixation from 24 to 72 hours without increasing morbidity or mortality could allow more time for evaluation and treatment of associated injuries and decrease emergency use of the operating room and operative time - important logistical considerations in a community hospital setting.

NOTES

**A PROSPECTIVE STUDY OF EARLY SOFT TISSUE COVERAGE
OF GRADE IIIB TIBIAL FRACTURES**

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**Presenter: S. Kerley
Senior Sponsor: M.M. Knudson
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INTRODUCTION: Traditional methods of treatment of the Grade IIIB tibial fractures have reported failure rates exceeding 50%. More recently, reports of early debridement followed by muscle flap coverage have yielded success rates between 80%-95%. Our institution has established a protocol using a combined orthopedic and plastic surgical approach to severe complex tibial fractures yielding a 98% success rate.

PURPOSE: The present prospective study was established to evaluate the efficacy of aggressive early debridement and soft tissue coverage of Grade IIIB tibial fractures. In addition, a new approach to bony fixation with non-reamed intramedullary rods is evaluated.

METHODS: Between 1987-1990, 45 patients with Grade IIIB tibial fractures were treated by the established protocol. Age range 17-60 years. Follow up averaged 36 months, minimum 24 months. Protocol guidelines include 1) debridement of the wound within 6 hours; 2) immediate fixation with an external fixator or intramedullary rod, 3) soft tissue coverage with muscle flaps within 7 days; 4) angiograms prior to all flap procedures; 5) bone grafting is performed as needed 2 months after stable soft tissue coverage.

RESULTS: 48 muscle flaps were utilized in 45 patients. 34 free muscle transfers (15 rectus abdominus, 15 latissimus dorsi, 3 gracilis, and 1 serratus anterior) and 14 local muscle flaps were used (9 gastrocnemius, 3 tibialis anterior and 2 soleus muscle flaps). Free flap success was 33/34 (97%). Local flap success rate 13/14 (93%). The 2 flap losses were successfully reconstructed with a second flap procedure. Bony union is present in 44/45 (98%) of patients while osteomyelitis occurred in 1/45 (2%) patients leading to the single amputation of the series. The 44 remaining patients are ambulatory at one year post injury. **CONCLUSION:** 1) This protocol yields high success rate with respect to bony union and ambulatory status. 2) The incidence of osteomyelitis and limb loss is extremely low. 3) Non reamed intramedullary rods often are excellent alternatives to the traditional external fixator device. 4) An algorithm will be presented outlining the treatment protocol of severe open fractures of the tibia.

NOTES

FLOATING KNEE INJURIES AND COMPARTMENT SYNDROME
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Maryland Institute for Emergency Medical Services Systems

Presenter: J. Ruth
Senior Sponsor: J.B. Benjamin
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A retrospective review of 101 patients with 102 ipsilateral fractures of the femoral and tibial shafts was undertaken to determine the incidence and factors relating to the development of compartment syndromes.

Sixteen patients were excluded because they underwent primary amputation or were victims of penetrating trauma. Thus, 85 patients with 86 floating knee injuries were studied. Mechanism of injury included MVA (38), MCA (28), pedestrian struck (11), bicyclist struck (5), and miscellaneous (3). The average ISS in this population was 24, indicative of multiple injury (ISS > 18). All patients clinically suspected of having compartment syndrome underwent intracompartmental pressure monitoring.

The overall incidence of compartment syndrome was 31% (27 extremities). This included 4 thigh (average interstitial pressure 57mmHg) and 23 calf compartment (average interstitial pressure 51mmHg) syndromes. In comparing patients who developed compartment syndrome with those who did not, no statistical significance was associated with the average ISS, level or type (open vs. closed) of fracture, type of stabilization, nor the use of MAST. Statistical significance was associated with the average admission blood pressure (112 vs. 123mmHg, $p=0.05$), the total administered blood products during the first 24 hours (3985 vs. 2580cc, $p<0.05$), and total administered fluids over initial 24 hours (19,076 vs. 15,050cc, $p<0.03$).

The reported incidence of compartment syndromes complicating floating knee injuries is significantly higher than the incidence of compartment syndrome with a femoral or tibial fracture alone. The association of systemic hypotension may be a predisposing factor. Orthopedists and traumatologists should have a heightened awareness for compartment syndromes which might complicate ipsilateral femoral and tibial shaft fractures.

NOTES

**PELVIC FRACTURE GEOMETRY PREDICTS RISK
OF LIFE THREATENING HEMORRHAGE IN THE CHILD**
R.C. McIntyre, D.D. Bensard, E.E. Moore, J. Chambers, F.A. Moore
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University of Colorado

Presenter: R. McIntyre
Senior Sponsor: E.E. Moore
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PURPOSE: Recent studies conclude that pelvic fractures in the child, unlike the adult, are not a source of life-threatening hemorrhage. The purpose of this study was to test this hypothesis in our trauma consortium.

METHODS: The trauma registries for the three level I trauma centers within our state identified 57 of 1044 pediatric patients admitted with a pelvic fracture during a 2 year period ending 12/91. Fractures were separated by geometry: I-unilateral anterior, II-unilateral posterior, III-unilateral anterior and posterior, IV-bilateral anterior and posterior. Independent risk factors predictive of hemorrhage were identified by multivariate analysis and compared using ANOVA. Results are shown as group mean \pm SD.

RESULTS:

PELVIC FRACTURE	AGE (yrs)	ISS	RTS	BLOOD (ml/kg)	FIXATION	ANGIO (A/E)
Type I (23)	13 \pm 5	12 \pm 7	7.55 \pm 0.53	2.5 \pm 7.2	1	0
Type II (7)	15 \pm 4	15 \pm 7	7.65 \pm 0.42	0	0	0
Type III (23)	14 \pm 4	14 \pm 9	7.69 \pm 0.44	27.0 \pm 64.8	7	2
Type IV (4)	12 \pm 3	18 \pm 15	6.97 \pm 1.51	96.3 \pm 108.0*	2	2

Multivariate analysis identified fracture geometry as an independent risk factor for major hemorrhage (>20ml/kg, p<0.05). Nine of 27 type III/IV fractures required fixation, and 4/9 patients required embolization.

CONCLUSIONS: Fracture complexity is predictive of patients who benefit from skeletal fixation and embolization for control of major hemorrhage; whereas age, ISS, and RTS are not. This experience confirms that complex pelvic fractures can be a source of major hemorrhage in the child and require an aggressive multispecialty approach similar to the adult.

NOTES

**BIOMECHANICAL EVALUATION OF ANTERIOR CERVICAL SPINE
STABILIZATION IN A PORCINE MODEL**

**M.R. Grubb, B.L. Currier, V. Bonin, J.J. Grabowski, E.Y.S. Chao
Mayo Clinic**

Presenter: B. Currier

Senior Sponsor: R.A. Klassen

Corresponding Author: B. Currier

Anterior plate fixation in cervical spine surgery may be useful for high grade mechanical insufficiency and may prevent the need for a second procedure. This study is intended to develop a model simulating a severe flexion compression injury and to determine the relative stability of two different anterior instrumentation systems and three different screw insertion techniques.

The cervical spine of 45 porcine specimens were equally divided to undergo either flexion, lateral bending, or torsional testing on a modified Instron 1125 universal testing machine (Instron Corp. Canton, MA). Nondestructive testing was performed for intact and plated specimens to evaluate their structural stiffness. After completion of the nondestructive intact testing, a C5 corpectomy with transection of ligamentous and capsular structures between C5 and C6 was performed in each specimen. A porcine iliac strut graft was inserted and an anterior plate was applied from C4 to C6. Three subgroups were tested: Group A--Cervical spine locking plate (CSLP) with unicortical screws (Synthes Inc.); Group B--Caspar plate with unicortical fixation (Aesculap); and Group C--Caspar plate (Aesculap) with bicortical fixation. Stiffness, ultimate strength, energy to failure, and mechanism of failure were determined for each specimen. Stiffness calculations were performed on the plated specimens and normalized to the intact values. The data was analyzed using paired t-test and ANOVA.

The instrumented constructs had flexural, lateral bending, and torsional stiffness values which were comparable to their paired intact specimens under physiologic loads. Group A had a statistically significant higher energy to failure than Group B ($p < 0.05$). A significantly higher ultimate torsional strength was noted for Group A than other groups ($p < 0.05$). Group A plates failed by screw pullout (mean 2.0mm) from the vertebral body; the screws remained securely fixed to the plate. Group B plates failed by screw pullout (mean 3.5mm) from the vertebral body with loosening at the screw plate interface. Group C plates failed primarily by plate deformation associated with screw loosening. The screws generally did not pull out of the posterior cortex. Plate deformation after flexion testing was qualitatively much greater in Groups B and C than Group A.

The porcine model was chosen for its specimen uniformity and good bone quality. Anterior plate fixation produced stiffness properties similar to the intact state under physiologic loading. During destructive testing, the CSLP system clearly showed a greater ultimate strength and energy to failure. Insertion of a second screw into the expansion head of the unicortical anchor screw of the system created improved stability between the plate and anchor screw preventing screw backout. In contrast, unicortical fixation of the Caspar plate allowed screw backout from the plate. The possible differences in the pullout strength between the two unicortical techniques may also be explained by the fact that the CSLP screws have a larger core diameter (4.0 mm vs 3.5 mm). Screw backout was not seen in the Caspar plate with bicortical fixation. However, such fixation relies on screw penetration of the posterior cortex for stability which involves the risk of damaging the spinal cord.

NOTES

THE SPLEEN AT RISK AFTER PENETRATING TRAUMA
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New York Medical College

Presenter: R. Ivatury
Senior Sponsor: S. Ross
Corresponding Author: R. Ivatury

In contrast to blunt splenic trauma where non-operative management is an option, operative splenorrhaphy is the current preferred approach for penetrating trauma. Splenectomy, however, may be required due to hemodynamic instability, extent of trauma or when a pancreatic injury requires distal pancreatectomy. We evaluated our attempts at splenic preservation in 96 patients (1984-1992) in whom the spleen was at risk for removal. 78 patients had penetrating injury to the spleen and 18 patients had distal pancreatectomy.

SPLENIC TRAUMA (n=78): 9 patients (mean Abdominal Trauma Index 45) died within 24 hours from extensive injuries. All had splenectomy. 45 of the remaining 69 (65.2%) had successful splenorrhaphy, 80% with SW and 60% with GSW. Splenic salvage was 100%, 100%, 86%, 29%, and 0% respectively for Grades I-V injuries. The overall splenic salvage was 72% in the second half as compared to 54% in the first half of the study period ($p < 0.05$). Absorbable mesh splenorrhaphy improved splenic salvage in Grade III and IV injuries from 35% in the first half to 79% in the second half of the study period ($p < 0.002$). The use of the mesh did not increase septic complications, even in the presence of enteric perforation.

DISTAL PANCREATECTOMY (n=18): 4 died intraoperatively. The spleen was not injured in 6 and was preserved in all 6. 8 patients had associated splenic trauma, with preservation in 1. The overall 50% (7 of 14) splenic salvage was achieved without increasing morbidity or the number of transfusions.

CONCLUSIONS: 1. Splenorrhaphy should be possible in the great majority of stable patients after penetrating trauma. 2. Absorbable mesh is a valuable adjunct that may facilitate the repair of more severe grades of splenic trauma. 3. Distal pancreatectomy with splenic preservation can safely be accomplished in hemodynamically stable patients, especially if the spleen is uninjured.

NOTES

TRAUMATIC CYSTS OF THE SPLEEN -
THE ROLE OF CYSTECTOMY AND SPLENIC PRESERVATION:
EXPERIENCE WITH SEVEN CONSECUTIVE PATIENTS
H.L. Pachter, S. Hofstetter, A. Elkowitz, L. Harris, H. Li
New York University Medical Center

Presenter: H.L. Pachter
Senior Sponsor: H.L. Pachter
Corresponding Author: H.L. Pachter

Non-paracystic secondary cysts of the spleen are uncommon and usually result from blunt abdominal trauma. Recent experience with 7 consecutive traumatic splenic cysts over a three year period would suggest an increased prevalence of this clinical entity. Contributing factors may be the almost routine use of CAT scanning for vague abdominal complaints, but more concerning may be a potential increase in cyst formation after nonoperative management of blunt splenic injuries. Although nonoperative management of blunt adult splenic injuries is predicated on CAT documentation of improvement of the injury, little data exists substantiating *complete* resolution on long term radiographic imaging techniques. Hypothetically, partially resolved splenic injuries could go on to cyst formation.

This report describes 7 adult patients (5 men & 2 women) with a mean age of 32, all of who sustained relatively minor abdominal trauma, within 5 years of admission. Most common causes for radiographic imaging of the abdomen were persistent left upper quadrant or left flank pain. Sonography was followed by CAT in each instance, documenting unilocular splenic cysts varying in size from 7cm to 15cm. All patients underwent resection of the cyst bearing area of the spleen with preservation of normal splenic parenchyma. There were no deaths or complications in the entire group.

CONCLUSIONS: 1) The diagnosis of traumatic splenic cysts may become more prevalent with the almost casual use of CAT scanning; 2) Nonoperative management of blunt splenic injuries may contribute to the formation of traumatic splenic cysts if resolution of injury is not followed to completion; 3) Splenectomy can almost always be avoided if techniques of splenic preservation are strictly adhered to.

NOTES

THE WHITE BLOOD CELL RESPONSE TO SPLENECTOMY AND SEPSIS

E.J. Rutherford, J. Van Aalst, K.S. Hall, G.W. Reed
Vanderbilt University School of Medicine

Presenter: E. Rutherford
Senior Sponsor: J.A. Morris, Jr.
Corresponding Author: E. Rutherford

OBJECTIVE: To determine 1) the normal white blood cell (WBC) response to splenectomy, 2) the relationship of the WBC count to sepsis, and 3) the risk of sepsis after splenectomy.

DESIGN/SETTING: Case series/University Level I trauma center.

PATIENTS: Of 11,870 consecutive trauma admissions, 258 required a splenectomy or splenorrrhaphy (191 splenectomy, 67 splenorrrhaphy).

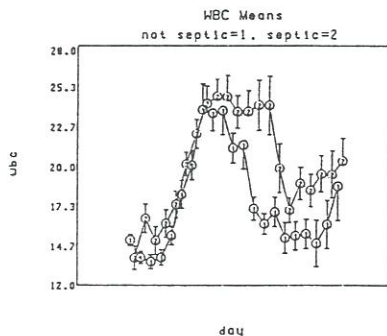
METHODS: Sepsis was defined as the presence of a positive blood culture. Statistical analysis included

ANOVA and forward stepwise logistical regression.

RESULTS: 42 of the splenectomy patients (22%) had positive blood cultures, while only 6 (9%) of the splenorrrhaphy patients had positive cultures. The figure shows the mean WBC count as a function of time and sepsis (splenectomy only).

Logistic regression demonstrates that type of surgery is not significant for sepsis after accounting for severity of injury (TRISS).

CONCLUSIONS: 1) The severity of injury (not splenectomy/splenorrhaphy) accounted for the increased risk of sepsis. 2) The peak WBC count after splenectomy with sepsis is higher and more persistent than that which occurs after splenectomy without sepsis. 3) The WBC count cannot be used to predict sepsis, but a WBC count 20,000 after 10 days should initiate a vigorous search for infection.



NOTES

THE ROLE OF HYPOTENSION/HYPOXIA IN SEVERE PEDIATRIC HEAD INJURY
S.L. Wald, S.R. Shackford, D. Vane
College of Medicine, University of Vermont

Presenter: S. Wald
Senior Sponsor: S.R. Shackford
Corresponding Author: S. Wald

Systemic hypotension (HYPO) doubles the incidence of adverse outcome of adults with serious head injuries (SHI) while the effect of hypoxia (HPX) is debated. The outcome of children with (SHI) is reportedly better than that of a matched adult population but the effect of HYPO and/or HPX is less well known. We hypothesized that HYPO and/or HPX are equally as detrimental to the outcome of children with SHI. We reviewed the data for children (≤ 16 yrs) with a Glasgow Coma Score (GCS) of ≤ 8 from our trauma registry and from the National Pediatric Trauma Registry-Phase II.

Of 2896 children, 1323 were admitted with a $GCS \leq 8$. Both systolic blood pressure (SBP) and arterial blood gases (ABG) were available for 733 patients. HYPO was defined as a $SBP \leq 90$ and HPX as a $p_aO_2 \leq 60$ torr. Outcome is presented as alive or dead.

The average age was 8.26 years \pm 5.14 (\pm SD). There were 480 males (65%) and 253 females (35%).

Group	No.	%	Avg. GCS	No. Alive	No. Dead	% Alive	% Dead
Neither	528	72	5.15 \pm 1.89	390	138	74	26
HYPO only	112	15	4.22 \pm 1.70	45	67	40	60*
HPX only	61	8	5.52 \pm 1.77	50	11	82	18
Both	32	5	3.53 \pm 1.35	6	26	19	81*
Total	733	100	4.97 \pm 1.90	491	242	67	33

Neither = $SBP > 90$ and $p_aO_2 > 60$ * $p < 0.001$, χ^2

HYPO alone doubled mortality while HPX has no effect on outcome. The combination of these two insults is devastating. Additional factors which result in significantly higher mortality include a pulse < 50 , a $pCO_2 < 20$, a $pH < 7.20$, or a $pH > 7.60$. There is no difference in outcome when analyzed by yearly epochs although the youngest group of children (less than 1 year) had a significantly worse outcome. Using "age-appropriate" definitions of SBP and HYPO resulted in no significant change in outcome for any of the groups.

We conclude that the improved outcome for children with SHI compared to adults is abrogated by HYPO. We suspect that the inability to augment blood flow during HYPO causes irreversible cerebral ischemia while HPX alone can be compensated for by increased O_2 extraction.

NOTES

PROSPECTIVE ULTRASOUND EVALUATION OF VENOUS THROMBOSIS
IN HIGH RISK TRAUMA PATIENTS

G.A. Burns, S.M. Cohn, R. Frumento, L.C. Degutis, L. Hammers
Yale School of Medicine

Presenter: G. Burns
Senior Sponsor: S.M. Cohn
Corresponding Author: S.M. Cohn

To determine the incidence of venous thrombosis (VT), high risk trauma patients (PTS) were prospectively evaluated with serial, biweekly, doppler ultrasound (US) until discharge or death. Fifty-seven PTS over 8 months met high risk criteria for VT: age over 45, >2 days bedrest, coma, para/quadruplegia, pelvic fracture, lower extremity injury, or femoral vein catheter. US showed 23 VT in 12 PTS. Pulmonary embolus occurred in 2 of these PTS. VT occurred despite prophylaxis in 11/12 PTS, [sq Heparin (3), compression boots (4), or IVC filter (4)].

Iliac VT was noted in 4 PTS (7%), 2 of whom had no lower extremity VT. The IVC was visualized in 81% of cases but no VT was seen. Upper extremity VT occurred in two high risk trauma PTS (3.5%), both after CVP lines. Fourteen lower extremity VT were seen in 8 PTS (14%), 4 with femoral vein catheters.

CONCLUSION: 1. VT is common in high risk trauma PTS (21%), even with prophylactic measures. 2. Serial US of the upper extremity and abdominal venous system is advocated as 33% (4/12) PTS in our study developed isolated VT, which would not have been identified using routine lower extremity US.

NOTES

**UNILATERAL FACET DISLOCATIONS AND FRACTURE-DISLOCATIONS
OF THE CERVICAL SPINE**

**M.E. Cabanela, M.J. Ebersold
Mayo Clinic**

**Presenter: M. Cabanela
Senior Sponsor: M. Cabanela
Corresponding Author: M. Cabanela**

We undertook this study to elucidate the best method of treatment of unilateral facet injuries in the cervical spine.

Different management attitudes still exist regarding unilateral facet injuries of the cervical spine. The records of 34 patients treated for this condition between 1975 and 1986 were reviewed and all the patients were reevaluated with an average follow-up of 9 years post-injury.

Twenty-eight patients were men and the average age of the group was 33 years. The most commonly involved levels were C5-6 and C6-7. At presentation 8 patients had no neurological findings, 23 presented with an isolated radiculopathy and three with a partial cord lesion. Twenty-four patients were treated nonoperatively: 1) 19 by halo traction followed by halo-thoracic immobilization; 2) 4 by cervical brace and 3) 1 with no treatment. Ten patients were treated operatively by initial halo-traction followed by open reduction and posterior fusion.

Halo traction was effective in achieving and maintaining alignment in only 36% of patients. Halo-thoracic treatment was not well tolerated. Anatomic reduction was achieved more frequently in the operative group. Surgical treatment achieved solid fusion in all patients, and solid fusion occurred spontaneously in 55% of patients treated nonoperatively.

Cervical translation at a level other than the injury was observed in patients treated nonoperatively and those that did not achieve anatomic reduction. Lack of anatomic reduction and cervical translation were associated with a lesser quality clinical result. Operative treatment yielded a better result.

Because of the above our current treatment of unilateral facet injuries consists of posterior open reduction with wiring of the dislocated facet to the spinous process below and a single level fusion. Decompressive foraminotomy is associated if clinical evidence of root compression exists.

NOTES

REINTUBATION AS A PREDICTOR OF MORTALITY
K.L. Kaups, T. Shinozaki, R.S. Deane, S.R. Shackford
University of Vermont

Presenter: K. Kaups
Senior Sponsor: S.R. Shackford
Corresponding Author: K. Kaups

Previous literature has correlated length of intubation and mechanical ventilation with increased mortality. Although reintubation is viewed as an adverse event, no study has reviewed the occurrence of reintubation in relation to patient outcome. We analyzed reintubation events for patients admitted to a 16-bed surgical intensive care unit over a 22 month period to determine if those patients requiring reintubation differed from those who did not, causes contributing to reintubation and whether the reasons for reintubation affected patient outcome. 1753 patients were intubated and 133 of these died during hospitalization (7.6%). In the 83 patients who were reintubated within 10 days of extubation, 20 deaths occurred (24.1%). A highly significant difference in death rate was found between patients requiring reintubation and those intubated only once ($p < .0005$; χ^2). Cardiothoracic patients requiring reintubation demonstrated the highest mortality rate (31.2%), when compared with general surgery (25.0%), trauma (25.0%) and neurosurgical (8.0%) patients. No deaths were associated with reintubation necessitated by "self-extubation". Patients reintubated for airway obstruction accounted for 12.5% of reintubation deaths. Reasons cited for reintubation among all patients were most often primarily pulmonary causes (32.5%) (retained secretions, aspiration, etc) and those related to circulatory dysfunction (25.0%) (pulmonary edema, cardiac arrest, etc), representing 29.0% and 30.0% respectively of deaths in reintubated patients. Patients needing reintubation are clearly at higher risk for dying, both due to worsening of underlying disease and to progressive respiratory failure, while primary airway problems play a much lesser role. Reintubation thus serves as an important marker of overall physiologic deterioration.

NOTES

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**LEUKOCYTES MAY MEDIATE A GLOBAL CEREBRAL REPERFUSION
INJURY AFTER BRAIN TRAUMA AND SHOCK**
J. Zhuang, S.R. Shackford, J.D. Schmoker
Department of Surgery, University of Vermont

Presenter: K. Zhuang
Senior Sponsor: S.R. Shackford
Corresponding Author: S.R. Shackford

Shock increases the mortality of brain injury but the mechanism is poorly understood. We hypothesized that shock and resuscitation lead to a global reperfusion injury which may be mediated by polymorphonuclear leukocytes (PMNs). In a porcine model of focal cryogenic brain injury and hemorrhagic shock, we studied intracranial pressure (ICP), cerebral blood flow (CBF) and cortical specific gravity (CSG) at baseline (BL), 45 minutes after shock (H45), 6, 12 and 24 hours (H) after resuscitation. Cerebral PMN accumulation was determined as total PMNs in 5 high power (400X) fields in histologic slices. Group (G) 1 was control. G2 had brain injury only. G3 had brain injury and shock. Data are mean±SEM.

	Group	BL	H45	6H	12H	24H
ICP (mmHg)	1	8±1	8±1	10±1	11±1	11±1
	2	6±1	15±1*	18±1 [^]	18±1 [^]	19±1 [^]
	3	9±2	6±2	26±2*	27±3*	33±4*
CBF (% BL)	1	100	109±13*	83±4*	80±8	92±10*
	2	100	75±5 [^]	63±3	61±3	63±3
	3	100	56±4	67±8	67±5	67±8

*ANOVA; [^] G2 vs. G3, p<0.05.

G3 had a lower CSG (more edema) than either G2 or G1 (p<0.05). PMNs in lesioned (L) and unlesioned (U) hemisphere were greater in G3 (L: 36±2; U: 26±2, p<0.001) than either G1 (L: 4±1; U: 4±1) or G2 (L: 22±2; U: 15±1). The PMN accumulation significantly correlated with ICP (r=0.72, p=0.003) and CSG (r=-0.69, p=0.009). These data suggest that infiltration of PMNs after brain injury and shock may play a role in cerebral edema formation and that the brain may be susceptible to a reperfusion injury seen in other organs.

NOTES

LPS INDUCED CD_{11b} MEDIATED NEUTROPHIL-ENDOTHELIAL ADHESION IS NOT REQUIRED FOR PMN PRIMING

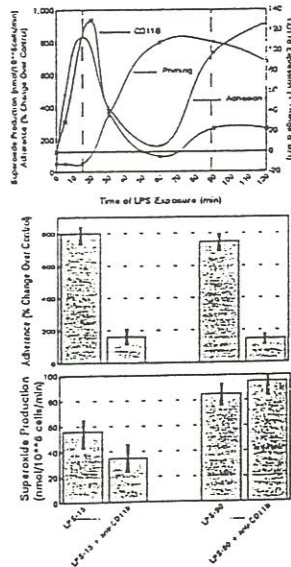
R.A. Read, E.E. Moore, F.A. Moore, V.S. Carl
Denver General Hospital

Presenter: R. Read
Senior Sponsor: E.E. Moore
Corresponding Author: R. Read

Previous work has implicated both neutrophil-endothelial cell (PMN-EC) adhesion and PMN priming (enhanced superoxide production following activation) in the development of post inflammatory end organ dysfunction. The glycoprotein CD_{11b} of the integrin family of PMN surface receptors has been purported to have a prominent role in these inflammatory PMN-EC processes. The purpose of the present study was to test the hypothesis that CD_{11b} mediated PMN-EC adhesion is necessary for LPS induced PMN priming. Human neutrophils, isolated by Percoll gradient centrifugation, were exposed to LPS (100ng/ml). At fixed times over 120 min a) superoxide production following fMLP activation (i.e. priming), b) PMN-EC adhesion, and c) expression of CD_{11b} were assayed. Superoxide production was measured by cytochrome C reduction, PMN-EC adhesion with indium labelled PMN adherence to human umbilical vein endothelial cell monolayer cultures, and CD_{11b} expression with fluorescent labelled anti-CD_{11b} (60.1) antibodies.

PMN-EC adhesion was biphasic with an early maximum at 15 minutes, followed by a nadir at 60 minutes and secondary rise through 120 min of LPS exposure. CD_{11b} expression changed dramatically in temporal association with early PMN-U adhesion, but the secondary increase in adhesion was associated with only a mild rise in CD_{11b} expression. PMN priming increased after a latency of 15 min to a maximum of 800nmol/10⁶ cells/min after 60 min of LPS exposure. The role of CD_{11b} in PMN-EC adhesion and PMN priming was further investigated with CD_{11b} blockade using specific monoclonal anti-CD_{11b} antibodies at times of maximum priming and adhesion (i.e. 15 and 90 minutes of LPS exposure). CD_{11b} blockade dramatically reduced adhesion at both 15 and 90 mins, but had no effect on the priming of PMNs exposed to LPS.

In summary, the kinetics of LPS induced CD_{11b} expression correlate temporarily with PMN-EC adhesion, but not with the induction of PMN priming. Moreover, although CD_{11b} may have an important role in LPS induced PMN-EC adhesion, CD_{11b} mediated adhesion is not required for PMN priming.



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NOTES

IMPAIRED HEPATIC CLEARANCE MECHANISMS FOLLOWING GUT ISCHEMIA/REPERFUSION

T.D. Johnston, R.P. Fischer, Y. Chen, R.L. Reed

Departments of Surgery

UTMSH-Houston & Duke University Medical Center

Presenter: T. Johnston

Senior Sponsor: R.L. Reed, II

Corresponding Author: R.L. Reed, II

Gut ischemia/reperfusion (I/R) appears to produce pulmonary vascular injury through endotoxin release and cytokine activation. The ability of hepatic reticuloendothelial cells to clear bacterial products may be also be impaired during I/R. To test this, diversion of splanchnic blood flow from the liver into the systemic circulation was performed via a microsurgical portocaval transposition in anesthetized Sprague-Dawley rats (275-375 gm). Shunted animals underwent portocaval transposition and were allowed to recover for 7-10 days; sham animals underwent exploration but no shunt was created. Shock animals were subjected to 60 minutes of mesenteric ischemia followed by 60 minutes of reperfusion. All shunts were patent at autopsy. Pulmonary vascular permeability, assessed by measuring the tissue retention (%) of Evan's blue dye, is shown:

Group	Sham (n)	Shunted (n)
Control	16.4 ± 3.8 (6)*	10.0 ± 1.4 (5)§
Shock	46.2 ± 11.0 (6)*	32.7 ± 9.0 (7)§

(* , § = p < 0.05 between control and shock groups)

Gut I/R produced significant increases in pulmonary vascular permeability regardless of the presence of hepatic bypass. These data indicate that mediator(s) of gut origin are responsible for pulmonary vascular permeability changes following gut I/R and are not appreciably modulated by the liver.

NOTES

THE EFFECTS OF COLLOID SOLUTIONS
ON LUNG ALVEOLAR FLUID CLEARANCE

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Departments of Surgery
University of California, San Francisco
University of California, San Diego

Presenter: R.C. Mackersie
Senior Sponsor: R.C. Mackersie
Corresponding Author: R.C. Mackersie

The issue of using colloid versus crystalloid solutions in the treatment of lung injury and edema states (pulmonary contusion, ARDS) is not completely resolved. While several studies have examined the effects of these solutions on the formation of pulmonary edema, little is known about their effects on the clearance of pulmonary edema. Our purpose was to determine the effect that colloid solutions have on lung alveolar fluid clearance relative to crystalloid, and the potential role of surfactant inhibition and PMN migration produced by alveolar colloid in retarding or enhancing fluid clearance.

Three colloid solutions and isotonic saline were instilled into the lower lobes of New Zealand rabbits, (4cc/Kg.). Prior to instillation, plasma colloid osmotic pressure was measured, and the colloid solutions were diluted to produce a fixed osmotic gradient of 8 mm Hg. across the alveolar-capillary barrier in each animal. Fluid clearance (cc/Kg.) was calculated at 3 hrs., relative to control animals using gravimetric lung water methods. The degree of surfactant inhibition produced by each colloid was measured in vitro using bubble surfactometry and autologous rabbit surfactant. Neutrophil and WBC migration was determined using bronchoalveolar lavage (BAL) in separate experiments. Data was analyzed using ANOVA with Tukey test for multiple comparisons.

Group (n=9-13)	Fluid clearance (cc/Kg) at 3 hrs	Surface tension (mN/meter)	BAL WBC (/cu.mm)	BAL PMNs (percent)
control	---	---	212	2.2±4.2
saline	2.0±.12	0.40±.30	349	32 ±210
dextran 70	1.8±.33	0.48±.66	306	28 ±410
hetastarch	.72±2.8	0.23±.44	412	29 ±130
plasma (aut)	-.04±1.7*	3.9±3.7*	337	60 ±980*

(mean ± SD)

* p < .05 (vs. other solutions)

The presence of alveolar colloid per se, did not decrease fluid clearance relative to isotonic saline, although fluid clearance varied substantially with the type of colloid used. Despite PMN migration, rapid resolution (48% at 3 hrs.) of instilled fluid occurred in two of the groups. Markedly diminished fluid clearance was associated with surfactant inhibition in the plasma group. Protein may act in retarding clearance by affecting surface tension (and hydrostatic pressure) within the alveoli. The results suggest that interference with the surfactant monolayer may play a role in alveolar fluid clearance, and that protein solutions may act to retard edema resolution through this mechanism.

NOTES

EXTREMITY VENOUS TRAUMA: LIGATION OR REPAIR?
L. Martin, P. Byers, J. Augenstein, G. Gomez, R. Zeppa
University of Miami/Jackson Memorial Medical Center

Presenter: L. Martin
Senior Sponsor: J.A. Morris, Jr.
Corresponding Author: L. Martin

There are several areas of controversy as to the optimal management of venous trauma. We examined our records from September 1987 to April 1992 to help clarify these issues. One hundred and twenty-three patients (92.2% males) underwent surgical therapy for an injured major vein of the extremities. The majority of the patients had GSW's (87.5%) and only 1 patient (0.8%) had blunt trauma. Associated arterial injury occurred in 55 patients (44.7%) and 68 patients (55.3%) underwent repair of isolated venous injuries for either bleeding or the suspicion of an abdominal injury. No specific diagnostic studies were performed to identify venous injuries. The location and repair type are listed in Table 1.

	Subclavian	Axillary	Brachial	Iliac	Femoral	Popliteal
Ligation	5	2	1	15	16	1
Primary Repair	2	0	0	18	20	11
PTFE Graft	1	1	0	5	10	4
Vein Graft	0	0	0	3	4	4
TOTAL	8	3	1	41	50	20

TABLE 1. Upper and Lower Extremity Venous Injuries

Upper extremity venous injuries were managed primarily by ligation and there were no complications, although there were 4 deaths. Injured iliac and femoral veins were ligated if primary repair could not be accomplished, but polytetrafluoroethylene (PTFE) or vein grafts were used for extensive injuries. The popliteal vein was routinely repaired.

Early edema (6 weeks) of the lower extremity was higher in those with ligation, 7 (22%) vs. 3 (4%) patients ($p < 0.01$), but there was no difference in late edema. Intraoperative bleeding and venous hypertension were reduced with repair. There were no graft infections or pulmonary embolism related to repair. Iliac vein injuries resulted in 15 of 18 deaths (83%).

In conclusion, upper extremity veins can be ligated. Iliac and femoral veins can be ligated without significant long term morbidity, but repair may facilitate early post-operative recovery. There were no complications related to the use of synthetic grafts in the venous system.

NOTES

**FAILURE OF STANDARD VENTILATORY PARAMETERS
TO PREDICT IRV SUCCESS**
R. Simon, R. Ivatury, V. Bayard
Lincoln Medical and Mental Health Center
New York Medical College

Presenter: R. Simon
Senior Sponsor: S. Ross
Corresponding Author: R. Simon

Adequate pulmonary function in patients with severe respiratory disease often necessitates high PEEP and concentrations of inspired oxygen(F_{IO_2}). High peak inspiratory pressures(PIP), barotrauma, and oxygen toxicity may exacerbate the ongoing pathophysiology. Inverse ratio ventilation(IRV) appears to reduce these factors in some patients. We prospective analyzed 16 patients placed on IRV in an attempt to define the population of patients that maximally benefit from this modality.

METHODS: IRV was instituted for: $PIP > 45\text{cm H}_2\text{O}$ or $\text{PaO}_2/\text{FIO}_2$ ratio (PFR) < 200 . Volume control IRV(VC-IRV) was used. Respiratory and cardiovascular parameters before and after institution of VC-IRV were collected. The physiologic lung injury score(LIS) was calculated on each patient for individual comparison.

RESULTS: The average LIS was 2.9. The table demonstrates the effects of VC-IRV on PIP, PFR, cardiac output(CO), and oxygen delivery(DO_2I). There was a significant decrease in PIP in all patients. PFR significantly improved in 13/16. Neither initial PIP, PFR, LIS, pulmonary compliance, nor oxygen delivery and consumption variables predicted response to VC-IRV. Auto-PEEP was measured in four patients and was not found to be significant. Transient adverse hemodynamic sequela occurred in 2/16 patients after initiation of VC-IRV which resolved with fluid administration.

BEFORE VC-IRV				AFTER VC-IRV			
PIP	PFR	CO	DO_2I	PIP	PFR	CO	DO_2I
51.2	136	9.8	774	40.8*	178*	8.9*	721*
				* $p < .0005$ * $p < .05$ †NS			

CONCLUSION: VC-IRV ameliorates factors that may exacerbate pulmonary dysfunction without significant adverse cardiovascular effects. There is a subgroup of patients in whom VC-IRV does NOT achieve improved oxygenation despite reduction in PIP. Commonly measured values of pulmonary function do not appear to predict success. Further analysis is necessary to better define this population.

NOTES

POST-TRAUMATIC ACETABULAR DYSPLASIA

R.T. Trousdale, R. Ganz
Mayo Clinic

Presenter: R. Trousdale
Senior Sponsor: M.E. Cabanela
Corresponding Author: R. Trousdale

Significance/Purpose: Injury to the triradiate physeal cartilage is a rare but potentially serious injury. This report is the largest series to date of patients that sustained triradiate injuries and subsequently developed acetabular dysplasia. This is also the first report evaluating the results of surgical treatment for patients with post-traumatic acetabular dysplasia.

Methods/Results: In the series we reviewed six patients who sustained injury to the triradiate cartilage with five of them subsequently developing symptomatic acetabular dysplasia. The average age at the time of injury was 2.8 years (range 2-4). Three patients had associated femur fractures and two had associated pelvic injuries. Five of the six patients were treated nonoperatively for their pelvic injuries. One patient had an open reduction of his acetabular injury after failed attempt at closed reduction. Three patients have undergone surgical reconstruction for symptomatic dysplasia at an average age of 18 years (range 15-25). One patient had a Chiari osteotomy and two had Bernese periacetabular osteotomies. The follow-up after the initial injury averaged 20 years (range 15-26). All three patients undergoing surgical reconstruction have had a satisfactory clinical and radiographic result at an average of six years from their surgery.

Conclusion: Children with significant pelvic injuries should be closely followed to rule out the development of post-traumatic acetabular dysplasia. If symptomatic acetabular dysplasia develops, it can be successfully treated with a pelvic osteotomy.

NOTES

PATTERNS OF SPLENIC INJURY SECONDARY TO SKI TRAUMA

**K.H. Sartorelli, F.B. Rogers, D.B. Pilcher
University of Vermont College of Medicine
Medical Center Hospital of Vermont**

**Presenter: K. Sartorelli
Senior Sponsor: S.R. Shackford
Corresponding Author: K. Sartorelli**

Splenic injury due to skiing appears to fall into two distinct patterns: high speed impact with stationary objects and simple falls (Mogul injury). Of 18 splenic injuries treated over 12 years, 12 were falls impacting on moguls, the trail or low speed impact with a trailside object after a fall (Group I). Six were high speed collisions with trees or other solid objects (Group II). Those in Group I frequently skied down the mountain without assistance (8/12), and had no other significant injuries other than minor (Grade I) renal contusions compared to Group II ($p < .05$). The rate of splenic salvage was higher in Group I than in Group II (68% vs 17% $p = .06$). Grade IV spleen injuries were most common in each group.

The six Group II patients were all transported down the mountain by toboggan, and had significant associated injuries. 5/6 had fractured ribs, 5/6 had renal injuries, 3/6 had long bone fractures, 2/6 had hemothoraces, and there was one cardiac contusion, one closed head injury, and one liver laceration. The mean ISS of Group II was higher than Group I (21.7 vs 11.8, $p < .05$). There were no group differences in length of hospital/ICU stay, transfusions requirements or complications .

It is suggested that those who suffer a "mogul injury" may present in a delayed fashion to medical facilities. This group of people may still have serious splenic injury, but appear to have a potentially higher rate of spleen salvage than skiers injured in high speed collisions.

NOTES

**RECURRENT DISLOCATION OF THE SHOULDER
WITH ONSET AFTER AGE FORTY**

R.J. Neviaser

**Department Orthopaedic Surgery
George Washington University**

Presenter: R. Neviaser

Senior Sponsor: R. Neviaser

Corresponding Author: R. Neviaser

The onset of recurrent dislocation of the shoulder after age 40 is an unusual event. It has been attributed to rupture of the anterior/inferior glenohumeral ligaments as occurs in younger patients. Although rotator cuff rupture is known to occur with dislocations it has rarely been thought to be the cause of recurrence. The purpose of this report is to emphasize the relationship between rotator cuff ruptures and recurrent anterior and posterior dislocations in patients with onset of primary and recurrent instability after age 40.

12 Patients have been studied with a mean age of 62.7. 11 had recurrent anterior instability while one had recurrent posterior dislocation. All sustained the initial dislocation after age 40 and had early symptoms of persistent instability. All underwent surgical repair. Those with anterior instability all had rupture of the subscapularis and capsule from the lesser tuberosity. The patient with posterior dislocations had torn the infraspinatus with the posterior capsule from the greater tuberosity. No patient had a Bankart lesion. Stability was restored in all cases by repairing the ruptured tendon and capsule to the tuberosity. Follow-up was from 2 to 12 years.

It is concluded that recurrent instability of the shoulder with onset after age 40 is most likely due to rupture of the rotator cuff and underlying capsule from the tuberosity rather than from capsulolabral detachment. It is also concluded that repair of the cuff and capsule is sufficient to restore stability and reconstruction of the glenohumeral ligaments or labrum is not necessary.

NOTES

THE EFFECT OF ALCOHOL (ETOH) INTERVENTION
ON RECIDIVISM OF THE HOSPITALIZED DRIVER
UNDER THE INFLUENCE (DUI) OFFENDER
L.A. Ammons, F.A. Moore, E.E. Moore, D. Lezotte, W. Marine
Denver General Hospital

Presenter: L. Ammons
Senior Sponsor: F.A. Moore
Corresponding Author: L. Ammons

Vehicular accidents are the leading cause of trauma deaths; over half involve ETOH. Previous studies suggest that the Health Care Professionals overlook this accessible group because of their own pessimistic views of these individuals. We, therefore, established a prospective study which randomized 100 consecutive drivers admitted to our trauma service with a blood alcohol level (BAL) > 100 mg/dl. Patients were randomized to an early intervention involving an ETOH social worker (study group, $n = 47$) vs no formal in-hospital intervention (control group $n = 53$). Recidivism is defined as repeat DUI-related offense within 2 years. 76 were male, mean age was 31.1 ± 1.2 years. Despite documented BAL ranging from 100 to 390 mg/dl (mean 198 ± 12), only 72 were arrested and 63 eventually convicted of a DUI-related offense; of which 45 entered an ETOH program and 25 completed. 12 of 45 (27%) patients entering treatment were recidivists. Of note, in 7 (58%) cases the repeat DUI offense occurred prior to treatment completion. The time from arrest to court action was 196 ± 31 days and the interval from arrest to ETOH treatment was 259 ± 22 days.

Success of the early ETOH counseling program was determined by comparing recidivism rates among the study and control groups. There was no significant difference ($p = .423$) between the number of recidivists in the early intervention group (11 of 47, 23%) and in the control cohort (9 of 53, 17%). Multivariate analysis identified previous DUI offense as the significant independent variable ($p < .001$, odds ratio = 3.4).

In summary, despite committed efforts by our multidisciplinary group to optimize early intervention, we could not reduce recidivism. We can identify a high risk group (those with previous DUI) for repeat offense who should be targeted for a prompt mandatory remedial program, but this study confirms failure of the current judicial system in our state.

NOTES

RURAL PEDIATRIC TRAUMA: THE HIDDEN MORTALITY
D.W. Vane, S.R. Shackford, S.L. Wald, F.B. Rogers, A.R. Hong
University of Vermont

Presenter: D. Vane
Senior Sponsor: S.R. Shackford
Corresponding Author: D. Vane

To determine the epidemiology of traumatic death in pediatric patients in a rural state we reviewed all deaths due to injury in victims <18 years old between 1985-1990. We hypothesized that mortality would be higher than equivalent populations in urban areas. Five thousand three hundred and twenty-two children were hospitalized for trauma (14% of total admissions); 36 died (0.67%). Head injury was the most frequent cause of death (72%). When compared to the National Pediatric Trauma Registry (NPTR), (urban based), statistics appear favorable for this population (mortality NPTR = 2.7% vs study = 0.67%). When all deaths in children in the state were analyzed, however, hospital data was found to significantly understate the problem. Of the 731 children who died during the study period, 283 died of trauma (38.7%). Eighty-seven percent of children who died never reached the hospital. Mortality (age adjusted) was highest in the 15-18 years (68.5/100,000), then <1 year (26.8/100,000), 1-5 years (15.6/100,000), and 5-14 years (11.8/100,000).

Data on children admitted to the hospital in this rural state underestimate mortality due to trauma. Population-based studies are therefore optimal to accurately assess incidence and outcome. Although overall mortality in children is higher than urban rates, medical care in this population compares well with statistics reported in predominantly urban centers for similar ISS scored patients. These data substantiate that programs to improve trauma mortality in this rural state must be concentrated on enhancing access to the hospital system in order to have a significant effect.

NOTES

MOTOR VEHICLE DEATHS: A RURAL EPIDEMIC
R.L. Muelleman, R.A. Walker, E.J. Mlinek, J.A. Edney
University of Nebraska Medical Center

Presenter: R. Muelleman
Senior Sponsor: J.A. Edney
Corresponding Author: R. Muelleman

Objective: To determine the magnitude of the discrepancy in injury death rates between urban and rural counties and which types of injury deaths contribute most to this discrepancy.

Design: A review of Nebraska death certificates over the period 1985-1989 was undertaken. Counties were divided into 4 groups according to population. Group I: urban counties (n=3); Group II: counties with a town of greater than 10,000 (n=9); Group III: counties with a total population of greater than 10,000 (n=19); Group IV: counties with a total population of less than 10,000 (n=62). Age-adjusted death rates for heart disease, cancer, cerebrovascular disease, pneumonia, and injury were tabulated. Injury deaths were further categorized by: intentional injury, (homicide, suicide), and unintentional injury (motor vehicle, falls, drownings, poisoning, farm machinery, choking, firearms, fires and burns).

Interventions: None

Results: Age-adjusted death rates per 100,000 population (with 95% confidence intervals) in Group IV were lower than Group I for heart disease: 209 (193.9-224.1) vs 227.4 (216.3-238.5); cancer: 135.9 (123.7-148.1) vs 176.3 (166.6-186.0); cerebrovascular disease: 39.9 (33.3-46.5) vs 44.6 (39.7-49.5); pneumonia: 19.6 (15.0-24.2) vs 23.4 (19.8-27.0); and intentional injury deaths: 13.3 (9.5-17.0) vs 15.1 (12.2-18.0). However, age-adjusted unintentional injury death rates were 54.2% higher in Group IV than Group I: 42.7 (35.9-49.5) vs 27.7 (23.8-31.6). Motor vehicle related death rates were 93% higher: 23.3 (18.2-28.4) vs 12.1 (9.5-14.7); and farm machinery deaths were 1250% higher: 2.7 (1.0-4.4) vs 0.2 (-0.1-0.5).

Conclusion: Age-adjusted unintentional injury death rates are higher in the rural counties of Nebraska, even though death rates for the four other leading causes of death (heart disease, cancer, cerebral vascular disease, and pneumonia) and intentional injury are lower. Although farm machinery deaths have the largest percentage difference between rural and urban counties, motor vehicle deaths are the major contributor to the unintentional injury death rate discrepancy in rural Nebraska. It is unknown if this is due to differences in crash and victim characteristics, or prehospital and hospital care.

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, and such other officers as from time to time may be appointed by the Board of Directors. The president, president-elect, vice president, secretary, and treasurer shall be elected at the annual meeting of the members.

SECTION 2: Term and Vacancies

The secretary and treasurer shall each hold office for the term of three (3) 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.

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
1992 - 1993
MEMBERSHIP LISTING

AMADIO, Peter C. (Bari)	Mayo Clinic 200 First Street, SW Rochester, MN 55905	O: 507-284-2806 H: 507-281-3772 Orthopedics/Hand
AMMONS, Mark A. (Lee Anne)	2005 Franklin Midtown II, Ste. 410 Denver, CO 80205	O: 303-832-6165 H: 303-355-5709 General/Thoracic Surgery
*APRAHAMIAN, Charles (Patricia)	8700 W. Wisconsin Ave. Milwaukee, WI 53226	O: 414-257-5022 H: 414-781-2209 Surgery
BAHNSON, David H. (Peggy)	3 Albert Cree Drive Rutland, VT 05701	O: 802-775-2937 H: 802-773-4143 Orthopedics
BEAL, Sandra L. (Steve Smith)	655 East 11th Eugene, OR 97401	O: 503-485-8331 General Surgery
BENJAMIN, James (Laurie)	Univ. Medical Center Room 4318 Tucson, AZ 85724	O: 602-626-4024 H: 602-795-7015 Orthopedics
BROECKER, Bruce H.	1901 Century Blvd. Atlanta, GA 30345	O: 404-322-9179 H: 404-325-2297 Urology
BURCH, Jon M. (Rita)	Denver General Hospital 777 Bannock St. Denver, CO 89229	O: 303-893-7045 Surgery/Vascular
CABANELA, Miguel E. (Rosa)	200 First Street, SW Rochester, MN 55905	O: 507-284-2226 H: 507-285-1045 Orthopedics
CARTER, Donald R.	8200 E. Belleview, #400 Englewood, CO 80111-2807	O: 303-740-7760 H: 303-671-0250 Head & Neck Surgery
*CARVETH, Stephen (Kay)	6200 Old Cheney Road Lincoln, NE 68516	O: 402-489-6553 H: 402-423-1768 Thoracic/Cardiovascular Surgery
CHAMPION, Howard R. (Maria)	1900 Quincy St., NW Washington, D.C. 20010	O: 202-877-6424 H: 202-829-3486 General/Trauma Surgery

*CHANG , Frederic C. (Jan)	14809 Willowbend Circle Wichita, KS 67230	O: 316-268-0296 H: 316-753-0627 General Surgery
CHERRY , Kenneth J. (Robin)	Mayo Clinic 200 First St., S.W. Rochester, MN 55905	O: 507-284-2644 H: 507-288-3131 Vascular Surgery
COGBILL , Thomas H. (Jan)	1836 South Avenue LaCrosse, WI 54601	O: 608-782-7300 H: 608-788-7808 General Surgery
COHN , Stephen M. (Kelly)	Division of Trauma 47 College St. College Plaza, #218 New Haven, CT 06510	O: 203-785-2572 H: 203-466-0006 Surgery
*COIL , James A., Jr. (Sharon)	Conemaugh Valley Memorial Hospital 1086 Franklin Johnstown, PA 15905	O: 515-283-6076 H: 515-224-4745 General Surgery
DAVIS , James W.	Department of Surgery Valley Medical Center 445 South Cedar Fresno, CA 93701	O: 619-294-6287 H: 619-295-8552 General/Trauma Surgery
EBERSOLD , Michael J. (Janet)	Mayo Clinic 200 First Street, SW Rochester, MN 55905	O: 507-284-3714 H: 507-288-5781 Neurosurgery
*EDMONDSON , Robert C. (Ann)	1207 Fairchild Court Woodland, CA 95695	O: 916-666-1631 H: 916-662-7856 Internal Medicine (Oncology)
EDNEY , James A. (Patricia)	U. of Nebraska Med. Ctr. 42nd & Dewey Omaha, NE 68150	O: 402-559-4075 H: 402-592-4335 General Surgery
ESRIG , Barry C. (Ann)	50 Bellefontaine St. Ste. 403 Pasadena, CA 91105	O: 818-793-1135 H: 818-355-1883 Thoracic Surgery
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*FISCHER, Ronald P. (Nancy)	UTHSC @ Houston 6431 Fannin, #4.284 Houston, TX 76508	O: 713-792-5407 H: 713-827-7925 General/Trauma Surgery
FRAZEE, Richard C. (Debbie)	2401 S. 31st St. Temple, TX 76508	O: 817-774-4976 H: 817-939-6009 General Surgery
GALL, Warren (Beth)	345 W. Washington Madison, WI 53703	O: 608-252-8473 H: 608-276-8605 Thoracic/Cardiovascular Surgery
GENTILELLO, Larry M. (Olivia)	Harborview Medical Center 325 Ninth Avenue, ZA-16 Seattle, WA 98104	O: 206-223-3956 H: 206-641-4191 General Surgery
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HALL, John R.	Cook County Hospital 700 S. Wood Street Chicago, IL 60612 B-40	O: 312-633-8583 H: 312-383-5724 Surgery
HANSEN, Arlen D.	200 First Street, SW Rochester, MN 55905	O: 507-284-2884 H: 507-281-3511 Orthopedic Surgery
HARRISON, Paul B. (Carolyn)	3243 E. Murdock, #404 Wichita, KS 67208	O: 316-685-6222 H: 316-686-3075 General Surgery
HAUTY, Michael (Rose)	800 SW 13th Street Portland, Or 97205	O: 503-221-0161 H: 503-294--754 Surgery
HEBERT, James C. (Mary Ellen)	Dept. of Surgery Fletcher 301 Medical Center Hospital Burlington, VT 05401	O: 802-656-5354 H: 802-985-3937 Surgery
HELLING, Thomas C. (Linda)	4320 Wornell, #308 Kansas City, MO 64111	O: 816-753-7460 H: 913-649-6164 General Surgery
HOYT, David B. (Beth)	Division of Trauma, H-640B UC San Diego Medical Center 225 Dickinson Street San Diego, CA 92103	O: 619-294-6400 H: 619-272-5893 Surgery

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JOHNSON, James H., Jr. (Lynn)	1145 North 29th Billings, MT 59101	O: 406-252-7115 H: 406-652-2401 Neurosurgery
JURKOVICH, Gregory (Deanne)	Harborview Medical Center 325 9th Ave., ZA-16 Seattle, WA 98104	O: 206-223-5912 H: 206-232-2153 General/Trauma Surgery
KAPPEL, David A. (Charl)	Professional Bldg. IV Ste. 200, Medical Park Wheeling, WV 26003	O: 304-242-0590 H: 304-277-3018 Plastic Surgery
KEARNEY, Robert E. (Becky)	Harbourside Tower Ste. 730 4 Columbia Dr. Tampa, FL	General Surgery
*KLASSEN, Rudolph A. (Frieda)	200 First Street, SW Rochester, MN 55905	O: 507-284-3662 H: 507-288-4879 Orthopedics
KNUDSON, Mary Margaret (Stephen A. Delateur)	San Francisco Gen. Hosp. Ward 3A, 1001 Potrero San Francisco, CA 94110	O: 415-821-8820 H: 415-948-3419 General/Trauma Surgery
LANDERCASPER, Jeffrey (Betty)	1836 South Avenue LaCrosse, WI 54601	O: 608-782-7300 H: 507-895-6222 General Surgery
LANZI, Guy L. (Maureen) (Associate Member)	15 E. Euclid Avenue Haddonfield, NJ 08033	O: 609-429-1711 H: 609-427-0722 Oral & Maxillofacial Surgery
LAU, Jeffery M. (Diane)	1329 Lusitana Street Suite 108 Honolulu, HI 96813	O: 808-537-1974 H: 808-595-7039 Thoracic/Cardiovascular Surgery
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*LINDSCHEID, Ronald L. (Carol)	200 First Street, SW Rochester, MN 55905	O: 507-282-2511 H: 507-282-5598 Orthopedics (Hand)

PHONE-O-GRAM[®]

for:

Mr. Kappel

From

Mike

Company

Bob Robinson

City

Area Code

304

Phone

233-6537

- Telephoned Please return the call Returned your call Will call again Came in See me

Message

Re: scheduling van to come in for its new parts.

Thurs

Date

7/26/94

Time

10:30

Taken by

Sarah A. Kovach

Action Wanted

Action Taken

ORTHO

Peter Amadio
 David Bahnson
 James Benjamin
 Allen Boyd
 Miguel Cabanella
 Arlen Hanssen
 William Iannacore
 Rudy Klassen
 David Lewallen
 Jelf Metheny
 Bob Neisner
 Tom Phillips
 Wm Simonet
 Peter Teal
 Herbert Thomas
 Bob Volz
 Dwight Webster

Hansen Joan

[Faint handwritten notes and signatures, including "Hansen Joan" and "Bill"]

MARG-O-GRAM

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