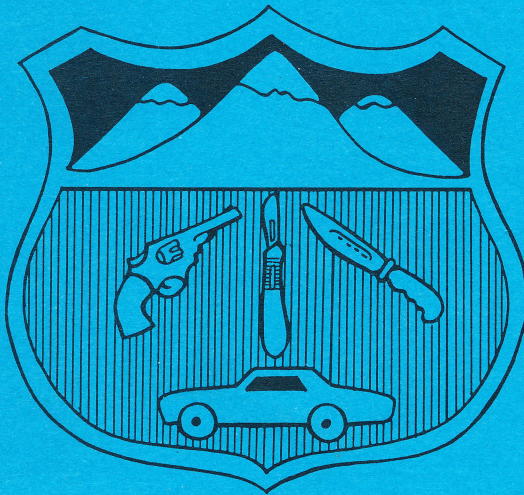


Sherman  
CA

# Western Trauma Association

## 21st Annual Meeting



February 23 - March 2, 1991

Jackson Hole, Wyoming

*The Western Trauma Association  
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to the printing of the program*

## Western Trauma Association Tentative Schedule

### SUNDAY, February 24, 1991

4:00 - 7:00 P.M. Registration and Welcoming Reception

### MONDAY, February 25, 1991

6:30 - 7:00 A.M. \*Breakfast  
7:00 - 9:00 A.M. First Scientific Session  
4:00 - 4:30 P.M. Invited Lecture: Sigvard T. Hansen  
"Management of Grade III C Tibial Fractures"  
4:30 - 6:00 P.M. Board of Directors Meeting  
6:00 P.M. Special Guest Presentation  
Will Steger - "Six Across Antarctica"

### TUESDAY, February 26, 1991

6:30 - 7:00 A.M. \*Breakfast  
7:00 - 9:00 A.M. Second Scientific Session  
Earl Young Resident Paper Competition  
4:00 - 6:00 P.M. Third Scientific Session  
Earl Young Resident Paper Competition  
6:00 - 8:00 P.M. WTA Business Meeting

### WEDNESDAY, February 27, 1991

6:30 - 7:00 A.M. \*Breakfast  
7:00 - 9:00 A.M. Fourth Scientific Session  
10:00 A.M. NASTAR Race (families included)  
12:00 - 3:00 P.M. Picnic and Picture  
4:00 - 5:30 P.M. Fifth Scientific Session  
5:30 - 6:00 P.M. Invited Lecture: Sigvard T. Hansen  
"The Economics of Traumatology"

### THURSDAY, February 2, 1991

6:30 - 7:00 A.M. \*Breakfast  
7:00 - 9:00 A.M. Sixth Scientific Session  
4:00 - 4:30 P.M. Seventh Scientific Session  
4:30 - 5:00 P.M. Presidential Address - George E. Pierce  
5:00 - 6:00 P.M. Panel Discussion  
7:00 P.M. Reception  
8:00 P.M. Annual Banquet  
NASTAR Awards  
Introduction of New Members  
9:00 - 12:00 Midnight Band - Dancing

### FRIDAY, March 1, 1991

6:30 - 7:00 A.M. \*Breakfast  
7:00 - 9:00 A.M. Eighth Scientific Session  
4:00 - 6:00 P.M. Ninth Scientific Session  
6:00 P.M. Adjournment  
\*Spouse's Breakfast Monday thru Friday 8:00 - 9:00 A.M.



## 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

The  
1992 WESTERN TRAUMA ASSOCIATION MEETING  
will be:  
February 29 - March 7, 1992  
Steamboat Springs, Colorado

**Western Trauma Association  
Twenty First Annual Meeting  
Jackson Hole, Wyoming**

**MONDAY, February 25, 1991**

7:00 A.M.            Welcome from President George E. Pierce, M.D.

7:05 A.M.            Program introduction by Steven R. Shackford, M.D.

**Moderator:**        Dwight A. Webster

<b>Time</b>	<b>Page</b>	<b>Title</b>	<b>Presenter</b>
7:10 A.M.	12	Biomechanical & clinical assessment of ankle arthrodesis	M. Dohm
7:30 A.M.	13	External fixation in pediatric fractures	M. Rasmussen
7:50 A.M.	14	Revision surgery for rerupture of the rotator cuff	R. Neviasser
8:10 A.M.	15	Management of open pelvic fractures	S. Zietlow
8:30 A.M.	16	What do state-of-the-art prosthetics have to offer the highly-motivated lower extremity amputee?	W. Koniuk
4:00 - 4:30 P.M.		<b>INVITED LECTURE:</b> "Management of Grade III C Tibial Fractures"	Sigvard T. Hansen
4:30 - 6:00 P.M.		Board of Directors Meeting	
6:00 P.M.		<b>SPECIAL GUEST PRESENTATION:</b> "Six Across Antarctica"	Will Steger

**Western Trauma Association  
Twenty First Annual Meeting  
Jackson Hole, Wyoming**

**TUESDAY, February 26, 1991**

**Moderator:** Steven R. Shackford

<b>Time</b>	<b>Page</b>	<b>Title</b>	<b>Presenter</b>
7:00 A.M.	44	Delayed diagnosis of cervical spine injuries	B. Gerrelts
7:20 A.M.	46	Hemoccult testing in rectal trauma. Is it enough?	H. Levine
7:40 A.M.	48	Open fractures of the patella	M. Torchia
8:00 A.M.	49	Radioulnar dissociation: The spectrum of Essex-Lopresti injury	R. Trousdale
8:20 A.M.	51	Alternative approaches to difficult abdominal wound closure	P. Smith
8:40 A.M.	41	Post-traumatic renal failure: A multi-institutional study	J. Morris

**Moderator:** David V. Feliciano

4:00 P.M.	43	Neurologic consequences of traumatic asphyxia	W. Jongewaard
4:20 P.M.	45	Results of an organized disaster plan in trauma management in a war zone	Z. Nassoura
4:40 P.M.	42	Hypertonic fluid resuscitation improves cerebral oxygen delivery and reduces intracranial pressure after hemorrhagic shock	J. Schmoker
5:00 P.M.	47	Acute adrenal insufficiency presenting as shock after trauma and surgery: Three cases and review of the literature	M. Claussen
5:20 P.M.	50	Percutaneous antegrade ureteral stenting as an adjunct for treatment of penetrating ureteral injuries	B. Toporoff
5:40 P.M.	17	Distal pancreatectomy for trauma - Multicenter review	T. Cogbill
6:00 P.M.		WTA Business Meeting	

**Western Trauma Association  
Twenty First Annual Meeting  
Jackson Hole, Wyoming**

**WEDNESDAY, February 27, 1991**

**Moderator:** Gregory Jurkovich

<b>Time</b>	<b>Page</b>	<b>Title</b>	<b>Presenter</b>
7:00 A.M.	18	Management of patients with indeterminant diagnostic peritoneal lavage following blunt trauma	E. DeMaria
7:20 A.M.	11	Treatment & morbidity of transperitoneal gunshot wound of spine	T. Kihitir
7:40 A.M.	19	Minor splenic trauma: Associated injuries and transfusion requirements	L. Flaherty
8:00 A.M.	20	Use of skin staples in experimental gastrointestinal injuries	J. Coil
8:20 A.M.	21	Outcome of delayed operations for penetrating colon injuries	R. Martin
10:00 A.M.		NASTAR Race (families included)	

**Moderator:** Barry Esrig

4:00 P.M.	22	The use of osseointegrated implants in the reconstruction of dental avulsion injuries	G. Lanzi
4:20 P.M.	23	A rational screening and treatment strategy based on the electrocardiogram alone for suspected cardiac contusion	K. Illig
4:40 P.M.	24	Blunt trauma during pregnancy: utilizing monoclonal antibodies to cardiac myosin	R. Scorpio
5:00 P.M.	25	Unexpected deaths in geriatric patients: Failure of the discriminant value of TRISS methodology	C. McAuley
5:30 P.M.		<b>INVITED LECTURE:</b> "Economics of Traumatology"	Sigvard T. Hansen

**Western Trauma Association  
Twenty First Annual Meeting  
Jackson Hole, Wyoming**

**THURSDAY, February 28, 1991**

**Moderator:** John Morris

<b>Time</b>	<b>Page</b>	<b>Title</b>	<b>Presenter</b>
7:00 A.M.		<b>TOPIC REVIEW:</b> "Pharmacokinetics: A Primer for Clinicians"	Larry Reed
7:30 A.M.	26	Altered pharmacokinetics for prophylactic antibiotics in trauma patients	R. Reed
7:45 A.M.	29	Candidosis after injury: Impaired neutrophil function	A. Rosemurgy
8:10 A.M.	28	Mucormycosis in the trauma patient	C. Cocanour
8:30 A.M.	27	Blood loss and transfusion requirements in patients with isolated femur fractures	R. Lieurance

**Moderator:** David Kappel

4:00 P.M.	30	The role of early surgical intervention in civilian gunshot wounds to the head	T. Helling
4:30 P.M.		<b>PRESIDENTIAL ADDRESS:</b>	George E. Pierce
5:20 P.M.		<b>PANEL DISCUSSION:</b> "The management of complex frontal basilar skull fractures with and without brain injury: A multidisciplinary approach" PANELISTS: James Johnson, Austen Mehrof, Gerald Gussack	
7:00 P.M.		Reception	
8:00 P.M.		Annual Banquet NASTAR Awards Introduction of New Members	
9:00 P.M.		Band - Dancing	



**Western Trauma Association  
Twenty First Annual Meeting  
Jackson Hole, Wyoming**

**FRIDAY, March 1, 1991**

**Moderator:** Peter Mucha

<b>Time</b>	<b>Page</b>	<b>Title</b>	<b>Presenter</b>
7:00 A.M.	31	Results of a multi-institutional outcome assessment	W. Copes
7:20 A.M.	32	Thromboembolism following multiple trauma	M. Knudson
7:40 A.M.	33	Conservative management of penetrating neck wounds: A year experience	A. Mansour
8:00 A.M.	34	Zone two penetrating neck injuries in children	J. Hall
8:20 A.M.	35	A revision of TRISS for intubated patients	P. Offner

**Moderator:** Tom Cogbill

4:00 P.M.	36	Comparison of suture technics in extensor tendons	R. Wray, Jr.
4:15 P.M.	37	Liver recovery following shock/ischemia is temperature dependant	J. Johannigman
4:30 P.M.	38	Peritoneal lavage in the diagnosis of abdominal sepsis in the ICU	J. Saffle
4:45 P.M.	39	Intraarterial urokinanase in extremity vascular trauma	T. Whitehill
5:30 P.M.	40	Enteral feeding reduces postoperative septic complications	F. Moore
6:00 P.M.		Adjournment	

# TREATMENT & MORBIDITY OF TRANSPERITONEAL GUNSHOT WOUND OF SPINE

T. Kihitir, R. Ivatury, R. Simon, W. Stahl  
Lincoln Medical & Mental Health Center

Resident Presenter: T. Kihitir  
Senior Sponsor: D.V. Feliciano  
Corresponding Author: R. Ivatury

## ABSTRACT

Few reports have addressed the optimal management of transperitoneal gunshot wounds (GSW) of the spine. One previous study recorded a 90% incidence of spinal and paraspinal infectious complications when associated with colon injury treated by spinal debridement or laminectomy. The present report analyzes a 4-year experience with 21 patients with GSW of the lower thoracic or lumbar spine after a transperitoneal trajectory.

The protocol for these patients consisted of laparotomy, standard treatment of intraabdominal injuries, vigorous irrigation of the missile tract and the vertebral injury and a 48-hour course of cephalosporin therapy.

Eleven patients (52%) were paraplegic on admission. One of them died in O.R. from extensive injuries. Ten other patients had fixed partial neurologic injury. Early morbidity (pneumonia, ARDS) correlated with ISS >40 and Spinal AIS of >3. Non-neurologic morbidity after the first week was independent of these factors. Late complications (UTI, decubiti) occurred in three patients. One patient had a retroperitoneal abscess, related to a leak from a ureteric repair. Another patient had a retroperitoneal fluid collection which spontaneously resolved.

The follow-up period extended up to 3 months. There were no instances of meningitis, osteomyelitis, or paraspinal abscess in patients with small (n=5) or large (n=5) bowel injuries, nor in patients with only solid organ injury (n=10) despite the retention of the bullet or fragments in the spine.

These preliminary data suggest that conservative therapy with prompt laparotomy, extensive irrigation without laminectomy or removal of bullet fragments yields optimal results without increasing infectious spinal complications in transperitoneal GSW of spine.

# BIOMECHANICAL & CLINICAL ASSESSMENT OF ANKLE ARTHRODESIS

M. Dohm, B. Purdy, J. Benjamin  
University of Arizona

Resident Presenter: M. Dohm  
Senior Sponsor: J. Benjamin  
Corresponding Author: J. Benjamin

## ABSTRACT

Failure and complications of ankle arthrodesis have been reported to be as high as 40%. In a retrospective review and a biomechanical study, we evaluated factors associated with the success or failure of different types of arthrodesis.

We reviewed the records of 37 patients who underwent ankle arthrodesis over a twelve-year period at University Medical Center. Records were analyzed for the type of procedure performed, complications and time to union. A biomechanical study was then performed on 30 cadaver ankles to evaluate the stability of three types of ankle arthrodesis: R.A.F. fibular strut, internal compression with T-plates, and oblique screw fixation. Lower extremities were stripped of soft tissue and the foot was disarticulated at the talocalcaneal joint. The talus was then fixed to the tibia using one of the techniques described above. This construct was then mounted in an MTS machine and the talus was cyclically loaded in an eccentric cantilever fashion to produce failure of fixation.

The case reviews revealed a wide variety of techniques for arthrodesis with a trend towards internal fixation in recent years. Our failure rate for the primary procedure was high, 40%. Arthrodesis performed with rigid internal fixation including the three methods described above had a 23% initial failure rate and fewer complications when compared to external fixation and interposition grafting. There were 7 cases performed with internal compression arthrodesis using plates, all of which went on to primary arthrodesis. The biomechanical study demonstrated that despite the variable quality of the cadaver bone, internal compression arthrodesis using two T-plates proved consistently superior to oblique screw and fibular strut (R.A.F.) fixation.

Failure rates for ankle arthrodesis remain high. Biomechanical factors may play an important role in the success or failure of the procedure. Our results would indicate that internal compression arthrodesis using two T-plates provides the most biomechanically stable construct.

## EXTERNAL FIXATION IN PEDIATRIC FRACTURES

M. Rasmussen, R. Klassen  
Mayo Clinic

Resident Presenter: M.R. Rasmussen  
Senior Sponsor: R.A. Klassen  
Corresponding Author: R.A. Klassen

### ABSTRACT

**PURPOSE:** To determine the success in the use of an external fixation device in the treatment of closed pediatric femur and tibia fractures, as well as both closed and open humerus fractures. The maintenance of bone length, alignment, joint range of motion, time to union, and length of hospital stay, as well as pin tract infections, refractures and other complications were assessed.

**METHODS:** From June 1982 to January 1990, we assessed 17 femur, 5 tib/fib and 4 humerus fractures in 17 boys and 8 girls with age ranges from 3-16 years. All were closed injuries except for 2 humerus fractures. Indications for external fixation included either multiple trauma patients or unstable fractures failing closed treatment. The majority of injuries were secondary to MVA's. All fractures were reduced to anatomic alignment with no bayonetting of fracture ends. External fixators included Orthofix in 19, Ace-Fischer in 4, and Wagner apparatus in 3. Follow-up averaged 19 months. Fracture length and alignment assessed by scanogram in 11/17 femur fractures and 1/5 tib/fib fractures.

**RESULTS:** All fractures went on to union. Twenty-four out of 26 had full range of motion of joints both above and below the fracture site. Average hospital stay was 12.7 days for the entire group. Time to union averaged 16.5 weeks and 15 weeks respectively for tib/fib and femur fractures. In fractures with no physeal involvement, leg length discrepancies were all less than 3 mm as measured by scanogram. Complications included 4 pin tract infections, 2 refractures, 1 loose pins requiring reinsertion, 1 rotational malunion, and 1 case of knee stiffness requiring manipulation.

**CONCLUSION:** External fixation in the treatment of closed lower and upper extremity fractures is a viable alternative in the properly selected patient. One can expect excellent joint mobility, maintenance of bone length and alignment, as well as shortened hospital stays when compared to some of the conventional treatment options. One should also be aware of the potential complications associated with the use of external fixation.

# REVISION SURGERY FOR RERUPTURE OF THE ROTATOR CUFF

R.J. Neviaser

George Washington University Medical Center

Member Presenter: R.J. Neviaser

Senior Sponsor: R.J. Neviaser

Corresponding Author: R.J. Neviaser

## ABSTRACT

The purpose of this report is to test the prevailing opinion that the reoperation for failed repair of rotator cuff rupture can improve pain but has little chance of restoring function. This study analyzed 46 cases of reoperation for failed cuff repair with special attention to postoperative motion. Surgery included repeat decompression--emphasizing a generous anterior acromioplasty--as well as cuff repair or reconstruction.

Ten females and 36 males underwent re-repair of persistent cuff ruptures after previous surgical attempts. Average age was 54.5 years. Average interval between prior surgery and reoperation was 16.9 months (3-60). Average number of prior cuff surgeries was 1.6 (1-4). Follow-up mean was 30 months (24-48).

Forty-two patients noted improvement in pain postoperatively; 4 reported no change in their pain. Twenty-two patients gained motion (range 10-130°, average 45°); 22 had no change; 2 lost motion (range 30-60°, average 45°). Only 6 had less than 90° final motion, while 22 had 150° or more. Preoperatively, 13 patients had less than 90°, and 13 had more than 150° elevation. Of the 6 with less than 90° final motion, 4 had preoperative deltoid detachment, and 1 had extensive deltoid scarring from a previous postoperative infection. Five patients (10.9%) expressed dissatisfaction with their final results, while 41 (89.1%) were pleased.

We conclude that the outlook for repeat operation (decompression and repair) for failed rotator cuff surgery is not as bleak as commonly thought. If the deltoid origin remains intact from previous surgery, there is reasonable expectation for improved or satisfactory postoperative motion.

**MANAGEMENT OF  
OPEN PELVIC FRACTURES**  
S.P. Ziethow, M.B. Farnell, D.G. Lewallen  
Mayo Clinic

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

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**ABSTRACT**

Open pelvic fractures, with their attendant morbidity and mortality, remain a challenging multidisciplinary injury to manage. Over an 11-year period (7-79 to 7-90), 21 patients (9 females, 12 males) with open pelvic fractures were definitively cared for. This represents 1.8% (21/1191) of all pelvic fractures during this time period. All patients had associated injuries. The average age was 26 yrs. (12-56) with an average ISS=43 (survivors = 36, nonsurvivors = 60) and an average blood transfusion requirement of 29 units (survivors = 22, nonsurvivors = 47). Motorcycle accidents represented the most frequent mechanism of injury with six patients; followed by pedestrian/MVA - 5; tractor rollovers - 3; industrial accidents - 2; and bicycle/MVA, MVA rollover, boating, snowmobile and equestrian accidents - 1 each. Rectal and perineal wounds were managed with a diverting colostomy; however, anterior soft tissue and buttock injuries were managed selectively. External pelvic fixation and angiography with embolization were utilized with increasing frequency over the course of this study period. Six of 21 patients died for a mortality rate of 28.5%. The causes of death included: severe closed head injury - 3, exsanguination - 2, and sepsis - 1. The average hospital stay for the survivors was 60 days. Major morbidity for the survivors related mainly to the associated genitourinary, peripheral orthopedic, and peripheral nerve injuries. No deep infections or osteomyelitis of the pelvis occurred. While the mortality of these devastating open pelvic fractures remains significant, an aggressive multidisciplinary approach allows for salvage of the majority of patients.

# WHAT DO STATE-OF-THE-ART PROSTHETICS HAVE TO OFFER THE HIGHLY-MOTIVATED LOWER EXTREMITY AMPUTEE?

W. Koniuk, C.P. Phillips, T. Phillips  
San Francisco Prosthetics and Orthotics Service and UCSF

Guest Presenter: W. Koniuk  
Senior Sponsor: T. Phillips  
Corresponding Author: T. Phillips

## ABSTRACT

In spite of advances in salvaging severely injured extremities, an evolving consensus has begun to advocate early amputation over heroic reconstruction attempts for the most severely damaged limbs. Progress in prosthetics has also improved the quality and versatility of lower extremity prostheses. Weight reductions, improved socket fitting techniques, shock absorbing liners, and energy-storing feet have begun to minimize many problems with the prosthesis-residual limb interface. The average weight of a BK prosthesis has decreased from 8 to 3 1/2 lbs. The most advanced designs now weigh as little as 1 1/2 lbs. These advances allow motivated and physically fit BK and AK amputees to engage in recreational sports, and in some cases competitive athletics. We administered a detailed confidential questionnaire to young and middle-aged amputees who are using advanced prosthetics, and who were pre-selected as being highly motivated individuals, to investigate the level of function achieved by this specific subgroup. The average age of 20 respondents was 41 years. The average age at amputation was 24 yrs. 33% described their current walking endurance as "unlimited", and 78% had either "no" or mild, occasional pain. 88% of those who had engaged in pre-amputation athletics have returned to sports, (frequently the same sports), but only 40% were capable of competitive athletics. The factors which appeared to correlate best with non-participation in sports were age, the length of the residual limb segment, and AK amputation. 73% stated that their current prosthesis was either a "great" or "revolutionary" improvement over their previous one. 7 patients had had attempts at limb salvage. Although 6 of 7 were more functional and had less pain after amputation, only 2 would have chosen to have their amputation performed sooner.

**Conclusions:** State-of-the-art prosthetics are successful in allowing athletic amputees to continue to engage in demanding occupations and some sports. Although costs are high for the most advanced designs, technology adequate to permit vigorous activity is available at a moderate price. Familiarity with the prosthetic options available and their functional results in highly-motivated patients will assist the trauma surgeon in making an informed decision about amputating mangled extremities in active patients of this type. Preservation of residual limb length should be a priority.

# DISTAL PANCREATECTOMY FOR TRAUMA - MULTICENTER REVIEW

18 Authors from 9 WTA member institutions

LaCrosse, WI, Denver, CO, Rochester, NY, San Diego, CA Seattle, WA,  
Nashville, TN, Allentown, PA, Camden, NJ, Burlington, VT

Member Presenter: T. Cogbill

Senior Sponsor: T. Cogbill

Corresponding Author: T. Cogbill

## ABSTRACT

During the 5-year period ending December 1989, 61 patients with pancreatic injuries were managed by distal pancreatectomy at nine referral trauma centers. Patient ages ranged from 4 to 72 years. There were 45 (74%) males and 16 (26%) females. Injury mechanism was blunt trauma in 25 (41%) patients, gunshot wound in 24 (39%), stab wound in 11 (18%), and shotgun blast in one (2%). The extent of resection comprised up to 33% of the pancreas in 14 (23%) patients, from 34 to 66% in 39 (64%), and greater than 67% in 8 (13%). The pancreas resection margin was closed with staples in 37 (61%), interrupted silk suture in 14 (23%), and running polypropylene suture in 8 (13%). Of 31 patients in whom the spleen was uninjured, the spleen was left intact in 16 (52%). Splenectomy was performed in 24 (89%) of 27 patients in whom the spleen was also injured.

There were seven (11%) deaths. The cause of death was irreversible shock in two patients, multiple organ failure in four, and severe head injury in one. Complications related to the pancreas occurred in 24 (44%) survivors. Intra-abdominal abscess developed in 17 patients; nine were managed by percutaneous drainage and eight by laparotomy. Pancreatic fistula developed in seven patients; six closed spontaneously from 6 to 54 days. Other pancreas-related morbidity included pancreatitis (4), pseudocyst (2), and hemorrhage (2). Exocrine insufficiency was not evident in any patient and diet-controlled diabetes occurred in one individual following 80% pancreatic resection.

We conclude: 1) Distal pancreatectomy can be safely performed without concomitant splenectomy. 2) Pancreas-related morbidity is frequent after pancreatic resection for trauma, regardless of method of pancreatic closure.

3) Endocrine and exocrine insufficiency are rare after distal pancreatectomy for trauma.



# MANAGEMENT OF PATIENTS WITH INDETERMINANT DIAGNOSTIC PERITONEAL LAVAGE FOLLOWING BLUNT TRAUMA

E.J. DeMaria

Brown University/ RI Hospital

Guest Presenter: E.J. DeMaria

Senior Sponsor: S.R. Shackford

Corresponding Author: E.J. DeMaria

## ABSTRACT

Diagnostic peritoneal lavage (DPL) results in the range of 20,000 to < 100,000 rbc/mm<sup>3</sup> are considered negative by many institutions, however a number of these patients may have injury that will require operation. Since the management of patients with indeterminate (IND) DPL results is controversial, we reviewed our DPL experience to determine the incidence of IND-DPL and whether repeat (R) DPL, CT scan, or observation alone provides optimal management for these patients. During the 30 month study, 1196 patients had DPL fluid analyzed in the laboratory. Only 4% (48) had indeterminate DPL results. Patients requiring laparotomy (LAP) were judged therapeutic (T-LAP) or non-therapeutic.

	n=	positive	negative	LAP	T-LAP
R DPL	33	6	25	9	2
CT scan	12	6	6	2*	1
Observation	10	NA	NA	6	0

Seven patients had both CT and R-DPL. \*These patients also had negative R DPL.

Negative R DPL led to successful nonoperative management in 24 of 25 patients. Similarly, none of the 6 patients with a negative CT following IND-DPL required T-LAP. Although negative results were reliable for both tests, a positive R DPL did not predict the need for T-LAP as only 2 of 6 patients in this group underwent T-LAP. In contrast, 4 patients with injuries demonstrated by CT were managed successfully without operation. These included 2 splenic injuries, 1 liver injury, and 1 renal hematoma. Only 2 patients with positive CT underwent laparotomy. The first had a renovascular injury diagnosed by CT after negative R DPL. The second had a minor splenic injury on CT after an initial IND-DPL. Despite hemodynamic stability, a second DPL revealed > 100,000 rbc/mm<sup>3</sup> prompting operation which was non-therapeutic.

Intra-abdominal injury was confirmed by LAP or CT in 19 patients (39%) with IND-DPL. However only 4 patients(8%) required a therapeutic LAP. Initial DPL red cell counts did not predict the need for therapeutic laparotomy. All 4 therapeutic laparotomies were in patients with initial rbc < 30,000/mm<sup>3</sup>.

The data suggest a high incidence of abdominal injury in patients with IND-DPL, but that the injury may be managed without surgery in most cases. Furthermore, the technique of R DPL appears to increase the rate of non-therapeutic LAP when compared to CT scan followed by observation in patients with indeterminate DPL.

DPL → CT

# MINOR SPLENIC TRAUMA: ASSOCIATED INJURIES AND TRANSFUSION REQUIREMENTS

L.C. Flaherty, G.J. Jurkovich  
Harborview Medical Center, University of Washington

Guest Presenter: L.C. Flaherty  
Senior Sponsor: G.J. Jurkovich  
Corresponding Author: L.C. Flaherty

## ABSTRACT

### MINOR SPLENIC TRAUMA: ASSOCIATED INJURIES AND TRANSFUSION REQUIREMENTS

Nonoperative management of splenic trauma has been criticized as exposing the patient to increased risk from associated abdominal injuries and avoidable transfusions. Reviews of nonoperative management have reported few patients who eventually require laparotomy for associated injuries. We hypothesized that 1) patients with minor splenic injuries have a lower risk of associated visceral damage than patients with splenic injuries in general, and 2, routine exploration of these patients does not decrease their blood requirements.

To test these hypotheses, we reviewed the charts of 182 patients suffering blunt splenic trauma between 1983 and 1988. 67 patients sustained minor injuries, defined as requiring no operative therapy or responding to topical hemostatic agents alone. 23 of these patients were initially managed nonoperatively, with 3 patients subsequently explored for falling hematocrit; no associated injury requiring therapy was found. The average transfusion requirement in these 23 patients was 2 units. 44 patients were immediately explored, 11 for readily diagnosed non-splenic injuries mandating laparotomy. The other 33 were explored for hemoperitoneum alone. One patient had an unsuspected bowel injury. The average blood requirement in these 33 patients was 1.8 units.

We conclude that patients with minor splenic injuries who have no other indication for laparotomy have a very low incidence of associated significant abdominal injury. In addition, their transfusion requirements are not reduced by routine exploration. Therefore, these two arguments should not be used to support the decision to explore patients who are otherwise candidates for non-operative management.

**USE OF SKIN STAPLES IN  
EXPERIMENTAL GASTROINTESTINAL INJURIES**

D. Dawson, J.A. Coil, M. Jadali, G. Hammonds  
Iowa Methodist Medical Center

Guest Presenter: J.A. Coil  
Senior Sponsor: E.E. Moore  
Corresponding Author: J.A. Coil

**ABSTRACT**

INTRODUCTION: Two recent patients injured by shotgun blast had multiple gastrointestinal perforations which were laborious to repair. Lengthy surgery and hypothermia contributed to their demise.

PURPOSE: There are undocumented reports of using the skin stapler to close small perforations of the gut. This study examined this device in experimental gastrointestinal injuries in the dog.

METHODS: Eighteen conditioned, anesthetized mongrel dogs were studied to determine if uniform gut perforations created with a sterile leather punch could be closed safely with the regular wire staple device. A series of matching perforations was created and closed with 3-0 silk as control and stapler techniques as study. Gut injuries included stomach (80 wounds), small intestine (230 wounds) and colon (140 wounds). Wounding sizes in sequence were a progression from 1.5 mm. to 5 mm. holes, and various lacerations.

RESULTS: Unrepaired intestinal wounds leaked and were lethal. No post-closure gastric, jejunoileal or colonic leaks were identified in either the silk suture or wire staple wounds provided that closure was complete. Speed of closure was faster for stapler (1.2 seconds vs. 16.0 seconds) for suture closure. Ease of closure was similar for both techniques.

CONCLUSIONS:

1. The skin staple device is safe for repair of small wounds in the gastrointestinal tract created under ideal conditions in the dog.
2. Similar injuries in the traumatized human deserve study since this technique is occasionally employed.

## OUTCOME OF DELAYED OPERATION FOR PENETRATING COLON INJURIES

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Baylor College of Medicine

Guest Presenter: R.R. Martin

Senior Sponsor: L.R. Pickard

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### ABSTRACT

In urban trauma centers, where the number of patients needing immediate laparotomy often exceeds the ability to provide that service, patients are triaged with the hemodynamically unstable given priority. It has been stated that delay in operative repair of penetrating injuries to the gastrointestinal tract will result in a high rate of complications related to infection. To test this assertion, a group of patients was studied who had operative repair of penetrating injuries to the colon delayed (usually due to triage considerations) for 6 or more hours after admission to the hospital.

Records for 984 patients with penetrating colon injuries treated at one hospital were reviewed. The time from admission to operation was noted, and patients were divided into two groups for analysis. The immediate group of 822 patients (83.5%) was treated before 6 hours elapsed, and the delayed group of 162 patients (16.5%) was operated on 6 or more hours after admission. The average times to surgery for the two groups were 117 minutes (median 90 minutes) for the immediate group and 637 minutes (median 480 minutes) for the delayed group.

The mortality rates for the immediate and delayed groups were 12% (100 patients) and 1.2% (2 patients) respectively, reflecting the greater severity of injuries in the immediate group. Sixty-five of the 100 deaths in the immediate group were from exsanguination. When these patients were excluded, the mortality rate was 4.6% for this group. The two deaths in the delayed group were due to multiple organ failure.

Complications which could be attributed to delay in control of fecal peritoneal contamination were anastomotic leak, abscess, and wound infection. Of the 757 patients in the immediate group at risk, (those who did not exsanguinate) these complications developed in 127 (16.8%). In the delayed group, these complications occurred in twelve patients (7.4%).

The differences in outcome between the immediate and delayed groups emphasize that the patients in the immediate group had more severe injuries. Control of intra-abdominal hemorrhage must be the priority in these patients if maximum survival is to be achieved. However, the data for the delayed group demonstrate that even patients with fecal contamination can have operative repair delayed for 6 hours without undue morbidity related to infection.

**THE USE OF OSSEOINTEGRATED IMPLANTS  
IN THE RECONSTRUCTION OF DENTAL AVULSION INJURIES**

G.L. Lanzi

Cooper Hospital/ University Medical Center

Guest Presenter: G.L. Lanzi

Senior Sponsor: S.E. Ross

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**ABSTRACT**

The loss of teeth is commonplace in patients with maxillofacial injuries. Defects range from single tooth loss to complex avulsion of multiple dental segments and supporting structures. Though few of these injuries are immediately life threatening, traumatic tooth loss particularly in young victims with otherwise excellent dental health, can be functionally devastating. Prior to the development of osseointegrated implants, tooth loss was managed with fixed and/or removable dental prostheses. Single tooth or small segmental loss was best managed via fixed bridgework. Larger rehabilitations often required removable partial dentures or combinations of bridgework and removable prostheses. Removable dentures are poor substitutes for natural teeth and often poorly accepted by patients. Fixed bridgework often requires the cutting down of healthy adjacent teeth to serve as abutments, and life expectancy of these restorations averages only about ten years.

The discovery of osseointegration led to the development of titanium dental implants revolutionizing prosthetic replacement of lost teeth. One particular implant, the Branemark implant, has achieved a success rate in excess of 93% and has become the standard in implant dentistry. Pioneering fixtures placed in Swedish patients over 25 years ago are still in healthy service.

The use of Branemark implants to restore lost teeth provides trauma patients a new state of the art level of rehabilitation. Three case histories involving the use of osseointegrated implants in the multiple trauma patient will be presented. Included will be the replacement of a single avulsed tooth in an eleven year old and the use of multiple fixtures to replace an entire posterior quadrant of lower teeth shattered in a young adult with a mandibular fracture. Finally, reconstruction of a severe fracture/avulsion injury of the mandible secondary to a gun shot wound will be presented including bone graft augmentation and placement of 5 implants to replace eight avulsed teeth.

The use of predictable osseointegrated implants to restore missing teeth is an exciting new phase of reconstructive dentistry. The application of implant technologies and procedures to the trauma patient with dentofacial injuries is a most appropriate natural extension of the goal of optimal rehabilitation and return to function.

# A RATIONAL SCREENING AND TREATMENT STRATEGY BASED ON THE ELECTROCARDIOGRAM ALONE FOR SUSPECTED CARDIAC CONTUSION

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University of Rochester Medical Center

Resident Speaker: K.A. Illig  
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## ABSTRACT

Uncertainty as to the incidence and significance of cardiac contusion has recently increased, in part due to the multiplicity of tests currently being used to arrive at the diagnosis. A review of the recent literature, however, suggests that all patients who experience cardiac problems requiring treatment or observation have abnormal admission electrocardiograms (EKG's) in the emergency department (ED).

To test this hypothesis, the charts of 133 patients admitted to two teaching institutions from 1985-1989 with a variety of injuries and some suspicion of cardiac contusion were reviewed. The purpose of the review was to determine if mortality or morbidity would have occurred if all patients with normal EKG's in the ED were discharged without further testing (or admitted to unmonitored beds for other injuries). Entirely normal EKG's were noted in 53 patients, and none suffered cardiac problems during admission; 32 of these without other injuries could have avoided admission. Minor EKG abnormalities, primarily sinus tachycardia and nonspecific ST changes, were noted in 67 patients, and none suffered cardiac problems during admission. In this group there were 67 sets of unnecessary CPK-MB determinations, 45 unnecessary echocardiograms, and four inappropriate SICU admissions, none of which changed management or outcome. Only 13 patients developed problems, and 12 of these had an obvious arrhythmia and/or conduction defect on the EKG in the ED. Hemodynamic instability was present in five of the 13 patients, including one who had sinus tachycardia only on the EKG in the ED. Five patients with problems had CPK-MB fractions of 0, and five had normal echocardiograms. The ED course for the 13 patients included 10 with immediate arrhythmias or, less commonly, pump failure, two who expired, and one with a treatment-related complication. In the entire series, operation was necessary in 26 patients, and none experienced cardiac morbidity.

A normal EKG in the ED precludes the need for CPK-MB determinations, echocardiography, and admission for the stable patient whose only injury is "rule out cardiac contusion". Had a normal EKG been used as the sole screening tool to exclude admission to the two centers, no patient would have experienced any morbidity, management would have been vastly simplified, and patient charges would have decreased by a minimum of \$70,000.

**BLUNT TRAUMA DURING PREGNANCY:  
FACTORS AFFECTING FETAL OUTCOME**

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Maryland Institute for Emergency Medical Services Systems

Guest Speaker: R. Scorpio  
Senior Sponsor: G. Jurkovich  
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**ABSTRACT**

Pregnant females comprise a small portion of trauma patients. Much has been written concerning the management and resuscitation of the mother, little has been written concerning factors that affect fetal survival. During a nine and one-half year period, 76 pregnant females who sustained blunt trauma were admitted to a Level I trauma center. Fetal outcome was ascertained in 58 patients (76.3%). Successful delivery was noted in 36 patients (47.4%). Eight patients (10.5%) elected to undergo a therapeutic abortion. 14 patients (18.4%) sustained fetal death. 18 patients (23.7%) were lost to follow-up.

The 50 patients who either delivered successfully or sustained a fetal death were analyzed to determine the factors that affected fetal outcome. Information was obtained in a prospective fashion concerning admission data of trimester, ISS, age, GCS, serum bicarbonate, pH, PCO<sub>2</sub>, PO<sub>2</sub>, BP, pulse and whether or not surgery was performed. Telephone interviews were conducted to document fetal outcome. A regression analysis revealed that ISS and admitting serum bicarbonate have the best correlation with fetal outcome with an  $r^2$  of .55 for the combined score. Analysis of the data found the average ISS for a successful delivery was 10.8 and for fetal death was 32.2. Admitting bicarbonate was an average of 20.3 for successful delivery and an average of 16.3 for fetal death.

This information documents that fetal survival is based on the severity of the injury to the mother. The higher ISS corresponds to a high degree of anatomic injury and a lower serum bicarbonate corresponds to a more severe degree of shock and tissue hypoxia both of which have detrimental effects on the fetus.

# UNEXPECTED DEATHS IN GERIATRIC PATIENTS: FAILURE OF THE DISCRIMINANT VALUE OF 'TRISS' METHODOLOGY

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The Mercy Hospital of Pittsburgh & Duquesne University

Guest Speaker: C.E. McAuley

Senior Sponsor: H.F. Sherman

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## ABSTRACT

TRISS methodology and recent modifications (i.e., ASCOT) provide standard approaches for evaluating patient outcome, identifying quality assurance issues, and comparing differing populations of trauma victims. We reviewed TRISS probability of survival predictions for an accredited Level I trauma center located in the country's oldest "per capita age" county and metropolitan region in order to determine the utility of TRISS methodology for evaluating trauma care delivery under demographic conditions that will soon be common throughout the United States.

Two groups of patients were evaluated: (1) "young" patients (YNG), ages 1 to 64, and; (2) "geriatric" patients (GER), ages 65 and older. The age, revised trauma score (RTS2), injury severity score (ISS), predicted TRISS survival (PS2), and patient outcome (survival vs. death) were retrospectively reviewed for 2864 patients admitted over a 30-month period of time: 2242 YNG (mean age = 31.2 years, range = 0-64), and 614 GER (mean age = 76.6 years, range = 65-106).

ISS, RTS2, and Glasgow coma scales were statistically equivalent for GER and YNG ( $p > 0.05$ , Mann-Whitney test). The institutional Z-statistic documented overall patient survival comparable to that of the Major Trauma Outcome Study. GER patients, who represented 21.4% of all admissions, represented 61% (42/69) of all unexpected deaths. The incidence of "unexpected deaths" for GER patients was almost six-fold that of YNG (6.8% vs. 1.2%,  $p < 0.0001$  by Yates corrected Chi-square). The percentage of "unexpected deaths" compared to all deaths was 58% for GER (versus 24% for YNG), while the ratio of unexpected: expected deaths was four-fold higher in GER patients (1.35:1 vs. 0.32:1,  $p < 0.0001$ ). For patients 80 years of age and older, "unexpected deaths" represented 73% of all deaths.

We conclude that: (1) the present TRISS methodology requires greater refinement to accurately predict expected survival for populations of trauma victims in regions with high concentrations of geriatric patients; (2) age must be evaluated as a continuous (versus categorical) variable to accurately reflect the contribution of age to outcome, and; (3) failure to appropriately modify present methodologies will complicate future institutional quality assurance and accreditation processes as the population of the United States ages.



# ALTERED PHARMACOKINETICS FOR PROPHYLACTIC ANTIBODIES IN TRAUMA PATIENTS

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Member Presenter: R.L. Reed  
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## ABSTRACT

Prophylactic antibiotics are routinely used for patients at risk for developing infectious complications from abdominal injuries, but infection rates for these patients remain high. A previous study from our institution indicated that higher doses of prophylactic antibiotics in trauma patients could significantly reduce subsequent infection rates. To test the hypothesis that antibiotic pharmacokinetic profiles were altered in trauma patients to account for the increased antibiotic requirements, we prospectively studied the drug pharmacokinetics in a sample from this patient population. 63 patients undergoing abdominal trauma laparotomies received amikacin + clindamycin preoperatively. Amikacin pharmacokinetics were analyzed on each initial dose. Timed post-infusion amikacin levels were used to determine the individualized drug elimination half-times ( $t_{1/2}$ ), elimination rates ( $K_d$ ), and apparent volumes of distribution ( $V_d$ ). Patients with low infection risk received no further antibiotics. 29 high-risk patients received prophylactic antibiotics for 72 hours with pharmacokinetics determined every 24 hours (mean  $\pm$  1 standard deviation):

	Expected	Day 1	Day 2	Day 3
$V_d$ (l/kg)	0.21 $\pm$ 0.03	0.35 $\pm$ 0.20*	0.30 $\pm$ 0.08*	0.29 $\pm$ 0.08*
$K_d$ (hr <sup>-1</sup> )	0.24 $\pm$ 0.07	0.35 $\pm$ 0.11*	0.37 $\pm$ 0.13*	0.37 $\pm$ 0.13*
$t_{1/2}$ (hrs)	2.87 $\pm$ 0.83	2.28 $\pm$ 1.32	2.21 $\pm$ 1.13	2.71 $\pm$ 2.76

\*  $p < 0.001$  (paired  $t$ -tests using Bonferroni's correction)

These data show a significant expansion in the volume of distribution for amikacin secondary to vigorous fluid resuscitation, with a significant increase in the elimination rate. Both of these conditions, consistent with an expanded, hyperdynamic circulation, explain the failure to achieve adequate amikacin levels using standard dosage regimens, previously documented by this center. This underdosing clearly contributes to the relatively high infection rates following major abdominal injury.

# BLOOD LOSS AND TRANSFUSION REQUIREMENTS IN PATIENTS WITH ISOLATED FEMUR FRACTURES

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University of Arizona

Guest Presenter: R. Lieurance  
Senior Sponsor: J. Benjamin  
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## ABSTRACT

A retrospective study was performed on patients treated for isolated femoral fractures to evaluate the blood loss and transfusion requirements associated with this common injury. Medical records were reviewed on 53 patients treated for fracture of the diaphysis of the femur. Patients with other long bone fractures, abdominal, chest, mediastinal and vascular injuries were excluded.

The study group consisted of 11 females and 42 males. Ages ranged from 13 to 93 years. Preoperative blood loss was calculated by using sequential hematocrits taken at admission and immediately preoperatively when surgery was delayed >24<sup>o</sup>. Intraoperative blood loss was obtained from anesthesia and surgical operative notes. Twenty-one patients required transfusion during their initial hospitalization, averaging 3 units each. Thirty-two patients did not require blood transfusion. The profile for each group is outlined in the following.

	Male	Female	Weight	Preop EBL	Primary vs Delay ORIF	EBV
Transfusion (30)	14/7	67kg	1022	3/18	4633	
No Transfusion (34)	28/4	74kg	575	18/14	5170	

Significant variables in determining the need for transfusion included sex, weight and delayed stabilization of the fracture. Estimated preoperative blood loss averaged 575cc in the non-transfused group vs 1022 in the transfused group. Acute blood loss of this magnitude can be responsible for hemodynamic shock and stresses the importance of long bone fractures in trauma patients with multiple injuries. The results of this review stress the magnitude of blood loss in closed femur fractures and the value of immediate fracture stabilization in decreasing the need for transfusion in the same group of patients.

## MUCORMYCOSIS IN THE TRAUMA PATIENT

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The University of Texas Medical School at Houston

Guest Presenter: C.S. Cocanour

Senior Sponsor: R.P. Fischer

Corresponding Author: C.S. Cocanour

### ABSTRACT

Primary cutaneous mucormycosis is a rare, but often fatal infection which is most often encountered in transplantation and in patients with diabetes, malignancy, renal failure, burns, or multiple injuries. We retrospectively reviewed a nine year experience with mucormycosis among injured patients. Eleven patients had biopsy or culture proven mucormycosis. Nine patients were victims of blunt trauma, two patients had >50% TBSA burns. No patient was at increased risk due to underlying disease or immunosuppression prior to injury. The average injury severity score was 24 (range 9-41). All eleven patients had open wounds on admission. Four of these eleven patients died from mucormycosis. There was no significant difference in the injury severity score between survivors and nonsurvivors. Mucormycosis was diagnosed during the second and third week of hospitalization. Treatment included debridement and IV amphotericin B. In two patients, mucormycosis was identified in superficial wounds and was felt to be a contaminant and not an active infection. All nonsurvivors had cutaneous mucormycosis of the head and/or trunk. Mucormycosis in the nonsurvivors was characterized by continued spread to contiguous structures despite aggressive debridement and IV amphotericin B. In contrast, survivors had involvement of only the extremities. Mucormycosis needs to be recognized early, aggressive debridement and IV amphotericin B instituted, but despite this therapy, mucormycosis involving the head and/or trunk has been a fatal infection in our hands.

# CANDIDOSIS AFTER INJURY: IMPAIRED NEUTROPHIL FUNCTION

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Member Presenter: A. Rosemurgy  
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## ABSTRACT

Candidosis is a vexing problem in seriously injured patients. This study was undertaken to determine if specific immune defects are associated with candidosis after injury.

Injured patients with an ISS $\geq$ 18 had Candida antigen titers weekly. If titers were  $\geq$ 1:4, heparinized peripheral blood was obtained and polymorphonuclear leukocytes (PMN's) isolated. PMN's were assessed by a rapid  $^3\text{H}$ -glucose incorporation assay for their ability to inhibit Candida albicans growth in cell culture medium (MED). Additionally, PMN's were assessed for their capacity to be stimulated by cytokines to inhibit C. albicans growth. Cytokines utilized were granulocyte/macrophage colony stimulating factor (CSF), interferon (INF), and interleukin 8 (IL8). Results were compared to those from recovering injured patients (ISS $\geq$ 18) with negative Candida antigen titers and healthy volunteers. Assays were done in triplicate and results averaged. Results are reported in growth inhibitory units per  $10^7$  neutrophils (average $\pm$ SEM).

	N	MED	CSF	INF	IL8
Candidosis patients	5	85 $\pm$ 33*	749 $\pm$ 94*	272 $\pm$ 63*	325 $\pm$ 84*
Injured patients	3	563 $\pm$ 256	1722 $\pm$ 164	930 $\pm$ 118	1193 $\pm$ 154
Volunteers	4	380 $\pm$ 53	2598 $\pm$ 497	1209 $\pm$ 298	977 $\pm$ 103

\*Results less than those in other groups, Students t-test,  $p < 0.05$

PMN's from injured patients with Candida antigen titers  $< 1:4$  and from healthy volunteers have similar ability to inhibit C. albicans growth in vitro. PMN's from severely injured adults with Candida antigen titers  $\geq 1:4$  have a suppressed ability to inhibit the growth of C. albicans in vitro. The capacity of PMN's from all patients to inhibit Candida growth in vitro is stimulated by cytokines. However, the PMN's from patients with Candida antigen titers  $\geq 1:4$  are stimulated to a significantly lesser degree than those from patients with titers  $< 1:4$  or volunteers. Previous studies from our laboratory have shown increased mortality from sepsis in injured patients with positive Candida antigen titers. This study demonstrates that injured patients with positive Candida antigen titers have impaired PMN function and PMN response to cytokines.

# THE ROLE OF EARLY SURGICAL INTERVENTION IN CIVILIAN GUNSHOT WOUNDS TO THE HEAD

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## ABSTRACT

Surgical management of civilian gunshot wounds of the head has remained a controversial issue in the care of these patients. In an attempt to determine who might benefit from aggressive surgical intervention, we examined 89 patients over a three year period who had suffered cranial gunshot wounds and had at least one computerized head scan after admission. Patients were divided into those receiving early (< 24 hours) surgical intervention (ES, N=27), late (> 24 hours) surgical intervention (LS, N=6) or no surgical intervention (NS, N=56). Overall mortality was 63 percent. Ten of 27 patients (37 percent) in the ES group died compared to 46 of 56 patients (82 percent) in the NS group ( $p < 0.0001$ ). Glasgow coma scores (GCS) in the ES group averaged  $7.86 \pm 4.72$  and in the NS group  $5.59 \pm 4.42$  ( $p < 0.05$ ). GCS in the LS group (all of whom survived) were significantly higher than the other two groups,  $12.17 \pm 4.10$ . However, the GCS of survivors in the ES and NS groups was not significantly different. The number of patients with GCS of three or four on admission was significantly less in the ES (41 percent) than in the NS group (66 percent,  $p=0.035$ ) and survival was better with surgery (36 percent) than without (three percent,  $p=0.007$ ). Patients with mass lesions (clot, ventricular blood) were more often found in the ES group (17/27) than in the NS group (18/56) ( $p=0.008$ ). Patients with bihemispheric injuries, fared better with surgery (7 of 14 survivors) than without (2 of 33 survivors,  $p=0.0003$ ). No delayed intracranial complications in survivors in the NS group were seen. From this review early surgical intervention seemed to result in better survival but was frequently undertaken in those patients who were less neurologically impaired and who manifested evidence of mass lesions on scanning. There was evidence to suggest that even pessimistic situations (severe neurologic deficit, bihemispheric injuries) might benefit from aggressive management.

**RESULTS OF A  
MULTI-INSTITUTIONAL OUTCOME ASSESSMENT**

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Washington Hospital Center

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**ABSTRACT**

A quality assurance (QA) methodology, developed on a quantitative basis where unexpected outcomes are highlighted and then subjected to peer review, was tested in three Level I trauma centers. TRISS survival probabilities were estimated for 2023 consecutive trauma patients admitted to 3 Level I trauma centers during a 6 month period. A structured peer review of the 50 patients (2.1%) identified as having statistically unexpected outcomes was performed. For 23 (18 survivors, 5 deaths) the TRISS-designated outcomes were sustained in peer review.

<u>Outcome</u>	<u>Reason</u>	<u>Number</u>	
Death	Pulmonary Embolism	3	
	Sepsis/MOF	1	
	Increasing ICP	1	
	Survival	Short Prehospital Time	6
		Prehospital Intervention	2
	Trauma Center Care	10	

In 27 cases (1 survivor, 26 deaths) TRISS-designated outcomes were not sustained by peer review. Limitations in TRISS methodology were identified in each case.

<u>Outcome</u>	<u>Reason</u>	<u>Number</u>
Death	ISS Limitations	13
	AIS Limitations	9
	RTS Biased by treatment	1
	Comorbid Condition	3
Survival	RTS Biased by Treatment	1

A structured approach to QA utilizing evaluations of both process of care and patient outcomes, combined with peer review, is essential for consistency and accuracy. The value of multiinstitutional peer review are seen in the fact that of 5 preventable/unexpected deaths (0.25% of the patient population), 3 were due to pulmonary embolism, prompting a convergence in prophylaxis strategy.

# THROMBOEMBOLISM FOLLOWING MULTIPLE TRAUMA

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Member Presenter: M. Knudson  
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## ABSTRACT

**PURPOSE/METHODS:** The safety and effectiveness of methods preventing deep venous thrombosis (DVT) have not been established in patients who have been seriously injured. In this prospective study, 113 trauma patients were randomized on admission to receive either low-dose (5000 units subcutaneously q 12 hrs.) heparin (H) or sequential compression devices (SCD) as prophylaxis against the development of DVT. Patients were serially studied with duplex Doppler imaging to detect thrombus in the thigh. Ventilation-perfusion scans and/or pulmonary angiograms were performed when clinically indicated.

**RESULTS:** There were 12 patients who had thromboembolic complications: 9 of 76 in SCD (12%) and 3 of 37 receiving H (8%). Five patients had DVT only, 4 had pulmonary emboli (PE) without detectable lower extremity DVT and 3 had both DVT and PE. None of the patients with PE died and there were no complications associated with either prophylactic method. The patients with thromboembolism were generally older (mean age 50 versus 38 years), were more likely to have sustained lower extremity fractures (75% vs 51%) and had received an average of 16 units of blood as opposed to 7 units in those without such complications.

**CONCLUSIONS:** Despite attempted prophylaxis, trauma patients remain at risk for thromboembolic events. Duplex Doppler imaging is an excellent method of detecting clinically silent thrombosis in the thigh, but other sources of emboli must be considered in these patients. Based on this study, it appears that older patients with lower extremity fractures and significant trauma requiring blood replacement are at highest risk for pulmonary embolism.

Group		Average			Presence of (%)				
Name	Pts.	Age	ISS	Days Immob.	Fx	Shock	LoTemp	PE	DVT
Boots	76	38±19	18±12	11±12	47	34	36	8	12
Heparin	37	38±16	16± 8	12±17	59	41	30	3	8

# CONSERVATIVE MANAGEMENT OF PENETRATING NECK WOUNDS: A 12 YEAR EXPERIENCE

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Senior Sponsor: E.E. Moore

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## ABSTRACT

### CONSERVATIVE MANAGEMENT OF PENETRATING NECK WOUNDS A TWELVE YEAR EXPERIENCE

Routine exploration of penetrating neck wounds has been challenged because of the high rate of negative explorations. In 1979, we established a protocol for selective operation for penetrating injuries violating the platysma. The purpose of this study is to review our prospective clinical experience with neck wounds.

**METHODS:** In this 12 year period, 148 males and 26 females sustained penetrating neck injuries. Mandatory neck exploration was performed for significant bleeding, crepitations, dysphagia, dysphonia or impaired mental status. Zone I and II injuries underwent angiography based on trajectory. Patients lacking these criteria were kept in the hospital for a minimum of 12 hours observation.

**RESULTS:** Immediate exploration was done in 59 (34%) and the remaining were observed for a mean length of stay of 1.8 days. Findings at operation are tabulated below:

		EXPLORED		OBSERVED		SPECIFIC		INJURIES
			(+)	(+)		Art	Ven	Aerodig
Zone I	GSW	3	3	3	-	0	2	1
	SW	-	-	13	-	-	-	-
Zone II	GSW	11	9	13	-	4	2	9
	SW	37	30	64	1	5	22	8
Zone III	GSW	5	4	3	-	1	-	3
	SW	4	4	18	-	4	2	2
-----								
TOTAL		60	50	114	1	14	28	23

Only one of the 114 patients initially observed subsequently required exploration and this was for a small SW to the esophagus.

**CONCLUSION:** We conclude that selective neck exploration of penetrating neck wounds is both safe and cost effective.



## ZONE TWO PENETRATING NECK INJURIES IN CHILDREN

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### ABSTRACT

The treatment of penetrating injuries to the neck remains a controversial issue. We present the first review limited to penetrating zone 2 injuries of the neck in children.

Treatment protocol: 1) Injuries which penetrated the platysma muscle undergo mandatory exploration if any of the following are present: an expanding or pulsatile hematoma; shock or active bleeding; subcutaneous air on x-ray; respiratory distress; blood in the oropharynx; presence of a bruit, thrill, crepitus or dysphagia on physical exam; the need for anesthesia to close the wound; or inability to follow or study the child due to other injuries. 2) If a neurological deficit is present or if the clinical exam is equivocal, the child is studied by angiogram, esophagram, esophagoscopy, and/or bronchoscopy. If negative, the child is observed. 3) All other wounds are observed for 48 hours.

Over the past 46 months, 1186 children (<16 years of age) have presented to our level one pediatric trauma unit of which 24 (2.0%) (age range 1-15 years, mean age 10.6 years) have had zone 2 (angle of the mandible to level of the clavicle) injuries. Four patients were operated on due to significant bleeding or expanding hematomas (3 gsw and 1 stab) and exploration was positive in all four. Two patients had negative clinical exams but were explored because they underwent general anesthesia; one 3 year old to close a large stab wound to the neck and one 14 year old who was in shock due to a concomitant gunshot wound to the abdomen. Both of these explorations were negative. Four children (3 gsw and 1 stab) underwent diagnostic studies; all were negative and the children were observed. The remaining 14 children (6 gsw, 7 stab and 1 glass wound) had negative clinical exams and were observed. No sequela have been seen in follow-up exams (minimum of two clinic visits). There was one death (4%) due to anoxic encephalopathy in a child who arrived in arrest from a gunshot wound to the carotid; following open-chest resuscitation in the trauma unit, he underwent repair of the carotid artery. The four morbidities (17%) were all neurologic injuries secondary to the mechanism of injury (gsw) and not the treatment approach.

We believe that zone 2 neck injuries in children are safely managed by a selective approach. This approach is not, however, the "conservative" approach and should not be followed unless close observatio can be preformed by the responsible surgeon and operative facilities are immediately available.

## A REVISION OF TRISS FOR INTUBATED PATIENTS

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### ABSTRACT

#### A Revision of TRISS for Intubated Patients

TRISS analysis is an important, widely-used method for predicting survival in trauma patients. It is used for quality assurance as well as for comparing patient populations in research. One significant shortcoming of present TRISS methodology is its inability to include intubated patients in survival probability analysis because the respiratory rate and the verbal response component of the Glasgow Coma Score are not obtainable. Both of these are essential components of the revised trauma score used in TRISS analysis. This report describes one potential approach to addressing this problem. Our hypothesis is that survival probability can be accurately predicted using a TRISS-like analysis where the revised trauma score is replaced by only the systolic blood pressure and the motor response component of the Glasgow Coma Score.

Data from 994 consecutive patients admitted to a level I trauma center with blunt trauma were examined. Patients who died at the scene and those who were pharmacologically paralyzed were excluded. 23% of this study population was intubated either in the field or the emergency department. Overall mortality rate was 6.0%. Similar to TRISS, patient survival probability was estimated using a logistic regression model that includes the patient's age(AGE), and injury severity score(ISS); the patient's best motor response(BMR) and systolic blood pressure(SBP) were used in place of the revised trauma score. The logistic regression model predicts the probability of survival,  $P_s$ , as follows:

$$P_s = 1 / (1 + e^{-B})$$

where

$$B = b_0 + b_1 \text{ BMR} + b_2 \text{ SBP} + b_3 \text{ ISS} + b_4 \text{ AGE}.$$

BMR and SBP were obtained on admission to the emergency department. ISS is based on AIS-85 scores assigned to individual injuries. AGE=0 if the patient is <55 years, otherwise AGE=1.

The logistic regression analysis revealed each of these variables to be significant predictors of survival in this model (p-values were <.002 for each). Using the decision rule that  $P_s \geq 0.5$  predicts survival and  $P_s < 0.5$  predicts death, the sensitivity and specificity of this model are 57% and 98.9%, respectively. The misclassification rate is 3.6%. With TRISS, the sensitivity, specificity, and misclassification rate are 58.8%, 99.3%, and 3.0%, respectively.

These results confirm that our model, which uses best motor response and systolic blood pressure in place of the revised trauma score, has predictive performance comparable to TRISS. More importantly, this model is applicable to intubated patients who are not pharmacologically paralyzed and allows more general application of TRISS-like methodology to trauma patients. Further investigation of this problem with larger data bases is warranted.

# COMPARISON OF SUTURE TECHNICS IN EXTENSOR TENDONS

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## ABSTRACT

Although there are reports comparing a variety of suture techniques for repair of flexor tendons, no experimental or clinical study has evaluated the effects of different suture techniques for extensor tendon repair.

In 80 white leghorn chickens we compared the gain in tensile strength of repaired extensor tendons using either horizontal mattress or simple sutures. The tendon dimensions and the rupture strengths were measured at 1, 2, 3, and 6 weeks after repair. The controls had a mean tensile strength of 99 - 111 NT/MM<sup>2</sup>. The repaired tendons had mean tensile strengths of 3.6 NT/MM<sup>2</sup>, 10.1 NT/MM<sup>2</sup>, 13.9 NT/MM<sup>2</sup>, and 36.9 NT/MM<sup>2</sup> for the simple suture technique and 3.4 NT/MM<sup>2</sup>, 7.2 NT/MM<sup>2</sup>, 16.2 NT/MM<sup>2</sup>, and 40.8 NT/MM<sup>2</sup> for the horizontal mattress technique at 1, 2, 3 and 6 weeks respectively. Thus, for both techniques we found a slow but steady gain in tensile strength during the first 3 weeks following repair with a more significant increase in strength at 6 weeks. In addition, we could find no significant difference in tensile strength between those tendons repaired with a horizontal mattress technique and those repaired with simple sutures at any of the four intervals tested.

In conclusion, it is our believe that a surgeon could expect equal results from either horizontal mattress or simple suture techniques for the repair of extensor tendons.

# LIVER RECOVERY FOLLOWING SHOCK/ISCHEMIA IS TEMPERATURE DEPENDANT

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## ABSTRACT

Liver Adenosine Tri-phosphate (ATP) levels fall during both ischemia and hemorrhagic shock. Incomplete ATP recovery correlates with cell death and organ dysfunction. Liver ATP recovery following combined shock and ischemia was evaluated under normothermic and hypothermic conditions. Paired groups of rats were subjected to vascular cannulation, laparotomy and isolation of liver vasculature. All animals were bled to, and maintained at, a systolic blood pressure of 90 mm. Hg during the study. Both groups underwent 60 min. of liver ischemia followed by 90 minutes of reperfusion. One group of animals (n=6) was cooled to 28°C and the second (n=6) maintained at 37°. Liver biopsies for ATP levels were obtained pre-shock, post-shock, post-ischemia, and at 30, 60 and 90 min. of reperfusion. Partial results are shown below: ( umole ATP/gm dry wt. liver; values are means + SEM ).

	<u>pre-shock</u>	<u>post-shock</u>	<u>post-isch</u>	<u>90'reperf</u>
28°	11.2 +/- .5	11.6 +/- .5	1.9 +/- .3	8.7 +/- .4
37°	11.5 +/- .7	9.2 +/- .6*	1.7 +/- .2	4.9 +/- .5*

\* =  $p < 0.05$  compared to 28° by ANOVA

Liver ATP was not affected by shock in the hypothermic group. Both groups showed a similar fall in ATP following ischemia. The hypothermic animals displayed a significant recovery of ATP at 90 min. reperfusion while the normothermic animals showed little recovery. These data demonstrate a beneficial effect of hypothermia on liver ATP during shock, ischemia, and reperfusion. Hypothermia may impart a protective benefit during surgery for severe liver injuries.

# PERITONEAL LAVAGE IN THE DIAGNOSIS OF ABDOMINAL SEPSIS IN THE ICU

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## ABSTRACT

In critically ill patients, sepsis may be suggested by cardiopulmonary dysfunction or the "sepsis syndrome", but even when bacteremia is documented, the source may be unclear. Abdominal sepsis is often suspected, but may be difficult to demonstrate. Comatose or ventilated patients are hard to examine; CT scanning may miss acute perforations or mesenteric ischemia, and transportation of unstable patients is hazardous. On the other hand, empiric abdominal exploration is equally dangerous and costly. This presentation reviews experience with the use of peritoneal lavage in the diagnosis of abdominal sepsis in selected patients in an ICU setting.

Over the past three years, seven adults (5 men), with mean age of 37 years (range 19-61 years) were evaluated with this technique. All were critically ill, with respiratory and cardiovascular failure, and suspected sepsis without a source. Four patients had burns of 27-46% TBSA (mean 36% TBSA); the other three were admitted to the medical ICU, two with unexplained respiratory failure and shock, and one following tricyclic antidepressant overdose. Peritoneal lavage was performed using standard technique, at a mean 8.1 days after admission (range 0-20 days). The lavage was considered positive if fluid contained  $> 500$  white blood cells/mm<sup>3</sup>, or if bacteria were present on gram stain.

In three patients, positive lavage led to immediate laparotomy, where dead bowel was found in all cases. Two of these patients died. The remaining four patients had negative lavages: one survived without evidence of abdominal sepsis, and two were eventually explored with no source of sepsis found (both died). The final patient died without exploration, but had no abdominal pathology at autopsy. Thus, peritoneal lavage proved accurate in every case. The overall mortality of 71% reflects the severity of illness in this population.

Increased awareness of the role of abdominal sepsis in multiple organ failure mandates for sensitive and aggressive diagnosis of abdominal pathology. Peritoneal lavage has several advantages in this setting: it is rapid, inexpensive, easy to perform, and quite sensitive. If patient selection is done carefully, this technique can be useful in the diagnosis and treatment of critically ill patients with trauma, burns, and sepsis.

## INTRAAARTERIAL UROKINASE IN EXTREMITY VASCULAR TRAUMA

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### ABSTRACT

This report comprises a retrospective evaluation of our experience with the use of intraoperative, intraarterial urokinase [UK] during arterial repair/thrombectomy in patients with extremity vascular injury.

**METHODS:** Forty-four patients with complex extremity vascular trauma were treated during a 47-month period. Of 51 vessel injuries, causes included penetrating (90%) and blunt (10%) mechanisms. Arteries injured were brachial (10), radial/ulnar (12), superficial femoral (10), popliteal (6), and infragleniculate (13). Associated injuries involved veins (28), nerve (21) bone (9), and soft tissue (31). Thirteen patients (29%) underwent preoperative angiography. Time to heparinization was  $87.4 \pm 17.6$  minutes. In addition to appropriate arterial repair, all patients underwent distal arterial thrombectomy followed by intraoperative arteriography; in 34 patients, significant residual distal thrombus was demonstrated. In these patients, regional [limb] intraarterial thrombolysis was performed under conditions of arterial inflow occlusion using 250,000 IU Urokinase/1000 IU Sodium Heparin in 250 ml 0.9% NaCl infused over 30 minutes. Immediate, 2-week, and one-month patency rates as well as complications were analyzed.

**FINDINGS:** Extensive mechanical thrombectomy was not required due to effective thrombolysis. Popliteal arterial cutdown with trifurcation thrombectomy was obviated in 100% (8) of superficial femoral arterial injuries. Initial and 2-week patencies were 100% as determined by return of palpable or Dopplerable distal pulses. One-month patency was 95%. Moderate bleeding developed in 2 patients (6%), and wound hematomas occurred in 7 patients (21%). Systemic fibrinolysis and/or hypofibrinogenemia was not significant. Nine patients (26%) required fasciotomy for compartment syndrome; amputation was required in 2 (6%).

**CONCLUSIONS:** This data supports the safe and effective use of intraoperative, intraarterial urokinase infusion as an adjunct to thrombectomy in complex extremity vascular injuries where residual distal thrombosis is present. The liberal use of intraoperative angiography is also well endorsed.

## ENTERAL FEEDING REDUCES POSTOPERATIVE SEPTIC COMPLICATIONS

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### ABSTRACT

Preliminary analysis of the VA Cooperative Trial suggested patients fed preoperative TPN had higher infection rates than controls (Buzby, ASPEN Clin Cong 2/89). To evaluate relative complication risks of TPN and enteral nutrition (TEN), combined data from 8 prospective, randomized studies were subjected to an intent-to-treat meta-analysis (including drop-outs). Complications, nutrition and GI effects were assessed for 10 days except when hospitalization ended earlier. 230 patients received TEN (Vivonex T.E.N.) or TPN (nutritionally similar to TEN formula), after elective (n=60) or major trauma (n=170; ISS 9-40, ATI 15-40) surgery. Baseline demographics were comparable between the groups. 87% of the TEN group tolerated feeding while the TPN group had fewer side effects. Biochemical parameters and Day 7 nitrogen balance were comparable in the 2 groups (p-NS). Twice as many TPN patients had septic complications, which were catheter-related in only 7%. Breakdown by patient type is as follows:

COMPLICATIONS	TOTAL PATIENTS		BLUNT TRAUMA		PENETRATING TRAUMA		ELECTIVE SURGERY	
	TEN (n=118)	TPN (n=112)	TEN (n=48)	TPN (n=44)	TEN (n=38)	TPN (n=40)	TEN (n=32)	TPN (n=28)
Abdominal Abscess	5	7	2	1	2	6	1	0
Pneumonia	6	14	4	9	1	2	1	3
Wound Infection	4	3	0	2	3	1	1	0
Bacteremia	2	5	1	4	0	1	1	0
UTI	1	3	1	1	0	1	0	1
Line Sepsis	0	7	0	4	0	1	0	2
Other	7	5	6	4	1	1	0	1
<b>Total</b>	<b>25</b>	<b>44</b>	<b>14</b>	<b>25</b>	<b>7</b>	<b>13</b>	<b>4</b>	<b>7</b>
<b>Number of Patients</b>	<b>19</b>	<b>39</b>	<b>10</b>	<b>22</b>	<b>6</b>	<b>11</b>	<b>3</b>	<b>6</b>
<b>Percent Patients</b>	<b>16</b>	<b>39*</b>	<b>21</b>	<b>50*</b>	<b>16</b>	<b>27.5</b>	<b>9</b>	<b>21</b>

\*P < .05

This multi-institutional experience confirms TEN is well-tolerated in stressed patients. When compared with TPN, TEN patients had less septic complications, presumably by maintaining vital gut function. TPN should be reserved for those patients in whom TEN is contraindicated.

**POST-TRAUMATIC RENAL FAILURE:  
A MULTI-INSTITUTIONAL STUDY**

Western Trauma Study Group

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**ABSTRACT**

The Western Trauma Study Group reviewed all trauma patients requiring hemodialysis over a five-year period in nine institutions. Of 72,757 admissions, 78 patients developed acute renal failure (ARF) requiring dialysis (0.11%). Mean age was 47, mean ISS was 31, and mean probability of survival P(s) was 70%. 97% of survivors were nonoliguric at discharge. Survivors were younger ( $p=0.12$ ), more severely injured, and required more blood transfusions (PRBC) ( $p=0.04$ ) than patients who died. Only 6% of survivors were discharged to a nursing home. 45 patients (58%) died, 37 from multiple organ failure/sepsis (82%). 100% of patients who remained anuric died. A high percent of patients with preexisting liver disease died ( $p=0.01$ ).

The following factors contributed to ARF in these 78 patients: hypoperfusion (Hypo) - 62%, multiple organ failure (MOF) - 50%, nephrotoxins (Toxin) - 36%, rhabdomyolysis (Rhab) - 28%. ARF could be attributed to more than one cause. The table demonstrates outcome criteria by cause of ARF.

	N	% Mort	P(s)	PRBC	BD	Initial	Duration	Cr
Hypo	48	60	.63	19	-12	11	20	5.9
Toxin	28	50	.75	12	-10	16	17	6.5
Rhab	22	50	.68	23	-13	8	17	5.6
MOF	39	69	.69	17	-11	18	22	5.9

Mort=Mortality, PRBC=units in first 24 hours, BD=worst base deficit in first 24 hours, Initial=Hospital days prior to initial hemodialysis, Duration=Days from first to last dialysis session, Cr=last creatinine prior to dialysis.

- Conclusions: 1) ARF requiring hemodialysis following major trauma is very rare.
- 2) ARF carries a 58% mortality and 82% of these deaths are secondary to multiple organ failure/sepsis.
- 3) 97% of survivors were nonoliguric at discharge. All patients that remained anuric died.



# HYPERTONIC FLUID RESUSCITATION IMPROVES CEREBRAL OXYGEN DELIVERY AND REDUCES INTRACRANIAL PRESSURE AFTER HEMORRHAGIC SHOCK

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## ABSTRACT

It has been shown in prospective clinical studies that hypotension from hemorrhage (HEM) contributes to increased morbidity and mortality in patients with traumatic brain injury (BI). It is implied that poorer outcome is due to secondary BI from impaired oxygen delivery (O2DEL). We hypothesized that fluid resuscitation (RESUS) with hypertonic sodium lactate (HSL: 479 mosm/L; Group II, n=7) would improve cerebral blood flow (CBF), O2DEL and cerebral metabolic rate for O2 (CMRO2), and would decrease mean intracranial pressure (MICP) when compared to Ringer's lactate (RL: 274 mosm/L; Group I, n=7). In a porcine model of hemorrhagic shock, we measured study variables at baseline (BL), 45 minutes post HEM (H45), and 1, 12 and 24 hours post RESUS (R1H, R12H, R24H). Fluid was given to maintain mean arterial pressure and central venous pressure at BL values and urine output at 0.5 cc/kg/hr. Shed blood was returned after R1H. Fluid balance (FLD BAL) and cortical water content (CWC) were measured at R24H. Serum osmolality (OSM) was recorded for each time period. Control animals (Group C, n=7) were instrumented only.

	GROUP	BL	H45	R1H	R12H	R24H
MICP (torr)	C	8±1	8±1*	9±2	11±1	11±1
	I	7±1	2±1	18±2*	18±2*	16±1*
	II	7±1	3±1	5±1	12±1	11±1
CBF (%BL)	C	100	106±11*	91±5	76±9	89±10
	I	100	60±7	100±11	86±9	85±5
	II	100	70±4	135±10*	137±13*	118±10*
O2DEL (%BL)	C	100	109±9*	96±9	68±8	69±6
	I	100	55±6	65±9*	74±7	68±5
	II	100	61±4	90±8	123±9*	97±7*
OSM (mosm/l)	C	294±2	286±4	291±4		289±3
	I	282±3	295±2	292±4	283±3	292±7
	II	297±3	293±12	341±4*	324±8+	333±10*
CWC (spec grav)	C				1.046±0.0023	
	I				1.045±0.0003	
	II				1.049±0.0004+	
FLD BAL (cc)	C				2266±210	
	I				7814±332*	
	II				4430±743	

\*p<0.05, ANOVA; +p<0.05, Student's t vs Group I

CMRO2 was higher in Group II at 12H and 24H when compared to Group I, but did not reach significance.

We conclude that HSL resuscitation in a porcine model of hemorrhagic shock reduces MICP secondary to cortical dehydration, and improves CBF and O2DEL when compared to LR. These data suggest that by decreasing ICP and improving cerebral O2DEL after shock, HSL could decrease secondary brain injury when brain injury and shock occur together.

## NEUROLOGIC CONSEQUENCES OF TRAUMATIC ASPHYXIA

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### ABSTRACT

Traumatic asphyxia is an unusual syndrome of craniocervical cyanosis, facial edema, petechiae, subconjunctival hemorrhage, and occasional neurologic symptoms resulting from severe crush injury to the thorax. Patients with traumatic asphyxia treated at a single institution during a 10-year period were studied to determine the incidence and sequelae of neurologic impairment associated with this entity. Traumatic asphyxia was identified in 14 patients from 4 to 73 years old. Each had sustained thoracic crush injuries from objects weighing more than 1000 pounds. Injury mechanism was crush by farm implement in 6 patients, entrapment beneath vehicle in 4, motor vehicle crash in 2, crush by farm animal in 1 and ditch cave-in in 1. Cranio-cervical cyanosis and subconjunctival hemorrhage were apparent in all patients. Associated chest wall and intrathoracic injuries were common. Neurologic abnormalities included loss of consciousness in 7 patients, prolonged confusion in 5, seizures in 2, and pronounced visual disturbances in 2. There were no deaths in this series and no long-term neurologic sequelae were evident.

The recent English literature is divided into reports of fatalities and survivors of traumatic asphyxia. Autopsy studies document cerebral edema and petechiae without intracranial hemorrhage in the vast majority of victims. Loss of consciousness, seizures, coma, temporary and permanent blindness, brachial plexopathy, and quadriplegia have been reported in survivors. Mortality is primarily related to associated injuries and long-term neurologic sequelae are rare. However, careful neurologic assessment should be performed in serial fashion and other causes of neurologic symptoms excluded.

## DELAYED DIAGNOSIS OF CERVICAL SPINE INJURIES

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### ABSTRACT

The limitations of cervical spine radiographs (CSR) in detecting cervical spine injuries in trauma patients have been well documented. Up to 15% of cervical fractures will not be demonstrated on lateral cervical radiographs taken during initial evaluation. Little attention has been given to the clinical consequences of these missed injuries, despite the potential tragic ramifications for patients and physicians, alike. Over a 32 month period, all multiply injured patients who had CSR during blunt trauma evaluation in a trauma center were reviewed to determine the incidence, outcome, and clinical consequence of delayed diagnosis of cervical spine injuries.

From January, 1988 through August, 1990, 1331 patients had CSR following blunt injury. Sixty-one (4.6%) of the patients had documented cervical fractures and/or dislocations. MVA accounted for 67.2% of the injuries. The patients were seriously injured (mean TS 12; mean GCS 11; and mean ISS 30.3). Eleven of the patients died in the trauma room; 9 with fatal atlanto-axial dislocation. Of the 50 survivors (81.9%), neurologic deficits were present in 15 patients (30%), and 8 of those had complete spinal cord injuries. The diagnosis of the cervical spine injury was made during the initial evaluation in 56 of the 61 patients (91.8%). Five patients had delayed recognition of their cervical spine injury (Range 2 - 21 days). The reason for the delay was due to inadequate or incomplete CSR in all patients, despite multiple views (up to 13). The missed injuries occurred in patients in whom complete visualization of the spine was most difficult (i.e. severe DJD of spine in 2 patients; previous cervical fractures in 1 patient; instability during resuscitation in 1 patient). Radiologic misinterpretation occurred in one patient. The diagnosis of cervical spine injury was pursued because of persistent neck pain in 2 patients, and the development of subtle neurologic findings in 3. The neurologic deficits in the 3 patients have resolved. The sensitivity of CSR in this series in detecting cervical injuries was 85.2%. Although CT scan was obtained in 72% of patients, it demonstrated injuries in only 3 additional patients which were not seen or suspected on CSR. One patient's injury was not seen on CT (transverse odontoid fracture). The sensitivity of CT was 97.2%.

The occurrence of missed cervical spine injuries in multiply injured patients was 0.4% in this series. The overwhelming cause of the delay in diagnosis was due to incomplete visualization of the cervical spine on CSR.

In patients in whom CSR was inadequate or not possible, early cervical CT was the most sensitive method of diagnosis. Maintenance of cervical spine precautions in high risk blunt injured patients until complete visualization of the spine has been determined by either CSR or CT will minimize the consequences of missed injuries.

# RESULTS OF AN ORGANIZED DISASTER PLAN IN TRAUMA MANAGEMENT IN A WAR ZONE

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## ABSTRACT

Lessons learned from the Vietnam and Korean conflicts have emphasized the necessity of an organized preparedness for optimal management of casualties. The present report summarizes the experience of a tertiary care center in the present war zone of Lebanon to illustrate the efficiency of such an approach.

Between 1975 and 1986, approximately 30,000 war casualties were treated at a tertiary care center. A disaster plan was implemented whenever >25 major trauma victims were received within one hour. The plan consisted of a defined centralization of emergency personnel including the hospital director, nursing director and Chief of Staff; rapid triage in the ED and mobilization to the OR, recovery room or radiology. Blood transfusion was commenced with packed red cells and followed by whole blood donated by the families. In-field stabilization, ED thoracotomy or ED stabilization were not employed. The results are illustrated by an analysis of 1500 cases of abdominal trauma (High velocity GSW 1314, SW 29, blunt from falls 157):

1420 patients were operated within 6 hours of admission and 711 within the first hour. Overall mortality was 130,8.7%; 9.5% for GSW, 3.4% for SW and 2.5% for blunt trauma. 145 or 9.7% had a negative laparotomy. The factors affecting mortality were hypotension on admission (26.5% for B.P.<90 and 2.8% for >90,  $p < 0.001$ ) and the presence of extraabdominal injuries (14.4% with and 4.4% without,  $p < 0.002$ ).

The chief causes of death were hemorrhage (3.7%), sepsis (2.1%) and ARDS (1.2%).

These results are comparable to those reported by civilian series and compare favorably to those from the Vietnam and Korean conflicts. A well conceived and practiced disaster plan is effective in providing optimal results in trauma management in the most extenuating circumstances.

# HEMOCCULT TESTING IN RECTAL TRAUMA. IS IT ENOUGH?

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## ABSTRACT

Rectal exam with hemoccult testing (HT) is a standard part of the emergency department evaluation of the acutely traumatized patient. Its major role is in the recognition of occult bowel injury. We questioned its reliability in detecting occult rectal injury (RI) in patients with penetrating trauma.

We reviewed the charts of patients with suspected RI over a 4 year period. All patients had HT in the ED, followed by operating room sigmoidoscopy (S), and/or exploratory laparotomy (EL). RI was defined as injury occurring below the peritoneal reflection. S was considered positive if gross blood or the actual injury was visualized.

**RESULTS:** There were 16 patients with suspected RI. They received a total of 17 high risk gunshot wounds. Eight were to the abdomen, 7 to the buttock, and 2 to the thigh. There were 15 males and 1 female with an average age of 26. There were 14 rectal injuries. No mortalities occurred in this group. Table 1 describes the relationship between HT, S, and EL. HT was 71% (10/14) sensitive and 50% (1/2) specific. S was 100% (10/10) sensitive and 50% (1/2) specific. When HT is combined with S the sensitivity becomes 100% (7/7). 12 patients underwent S. It was positive for blood in 11/12 and visualized an injury in 2/12 patients. In 1 HT positive patient, S was negative, and EL was not performed.

**CONCLUSION:** Our findings suggest that HT is not sensitive enough to rule out the presence of occult RI. The result of HT must not influence the decision to perform S in high risk injuries.

TABLE 1

	HEMOCCULT POS	HEMOCCULT NEG
	=====	=====
S+, EL+	7	3
* , EL+	3	1
S+, EL-	0	1
S-, EL-	1	0

\*= S not performed.

**ACUTE ADRENAL INSUFFICIENCY PRESENTING AS SHOCK  
AFTER TRAUMA AND SURGERY:  
THREE CASES AND REVIEW OF THE LITERATURE**

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**ABSTRACT**

Massive fluid administration and aggressive inotropic drug support were required for profound non-hemorrhagic shock in one postoperative and two trauma patients. Cardiovascular collapse was characterized by severe hypotension (systolic blood pressure  $< 80$  mm Hg), supranormal cardiac indices (C.I.  $> 4$  L/min/m<sup>2</sup>), low systemic vascular resistance (S.V.R.  $< 500$  dyne  $\cdot$  sec/cm<sup>5</sup>·m<sup>2</sup>), and multiple organ failure. Sepsis was eliminated as an explanation for cardiovascular collapse by cultures and laparotomy. Screening cortisol levels were low ( $< 2$  mcg/dl in two patients) and did not respond in any patient to synthetic ACTH (cosyntropin) challenge. Administration of exogenous glucocorticoids promptly and dramatically reversed the hemodynamic picture of high output circulatory failure and shock. Reversal of multiple organ failure occurred in two patients. Oral glucocorticoid and mineralocorticoid supplementation were required at hospital discharge.

Acute adrenal insufficiency is rare after trauma ( $< 1:800$ ) but must be recognized to potentially reverse shock and prevent death. Experience with these three patients prompted a review of the literature concerning the incidence, differential diagnosis, hemodynamic response and normal relationship between cortisol, ACTH and injury severity in traumatized patients. Baseline serum cortisol levels correlate with injury severity scores in patients with intact hypothalamic-pituitary-adrenal axes. The adrenal insufficiency syndrome may mimic septic shock with hyperkinetic cardiac indices and low systemic vascular resistance. When adrenal failure is suspected, treatment should begin with I.V. dexamethasone. Cosyntropin stimulation testing confirms the diagnosis and is accurate in the traumatized patient. In summary, acute adrenal failure after trauma or surgery may present with life-threatening cardiovascular collapse, mimicking the culture-negative, "septic" shock state. Outcome is dependent upon early recognition and exogenous glucocorticoid administration. Appropriate endocrine evaluation prevents unnecessary use of steroids in a population of trauma patients who are already immunosuppressed.

# OPEN FRACTURES OF THE PATELLA

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## ABSTRACT

Because the topic of open patellar fractures has not been specifically addressed in the literature, we retrospectively reviewed the Mayo Clinic experience.

During the period from 1976 through 1989, 813 fracture of the patella were treated at our institution. Fifty-seven (7%) were open fractures of which 56 records were available for review with an average follow-up of 22 months (range 1-132 months).

The average age at the time of injury was 28 years. Male to female ratio was 1.1:1. Right to left ratio was 1.5:1. Bilateral open fractures occurred in 3 patients. Automobile accidents were most frequently responsible (66% of cases) followed by motorcycle accidents, falls, airplane crashes and farm injuries.

Comminuted fractures were the most common (68% of cases) followed by transverse (16%) and avulsion fractures (16%). Gustilo and Anderson type II wounds occurred in 73% of the cases with type I wounds in 14% and type III wounds in 13% of cases. Associated multiple fractures were present in 68% of cases.

The most common form of wound management was initial I&D the day of injury followed by delayed primary closure of the wound. Local muscle flap coverage was required in 4 cases. The average number of debridements prior to wound closure was 1.9, and wound closure was performed an average of 3.1 days after injury.

Excision of comminuted bone fragments the day of injury was the most common form of fracture management. Partial patellectomy was done in 30 cases, and total patellectomy was done in 7 cases. Internal fixation using multiple K-wires, cerclage wiring, intraosseous wiring, multiple screws, tension band wiring or combinations of these was performed in 23 cases an average of 2.3 days post injury. In 7 cases with grade I or II wounds, internal fixation with primary wound closure was done the day of injury, and in 8 cases internal fixation was combined with partial patellectomy. Closed treatment (cylinder casting) was performed in 4 cases.

Initial operative cultures were positive in 46% of cases. Deep infection occurred in 6 cases (10.7%). In 4 of the 6 infections, the initial cultures grew organisms not responsible for the subsequent infection. All 6 infections were treated successfully with multiple debridements and antibiotics. The rate of infections correlated with the grade of the wound (grade I=0, grade II=7.3%, grade III=50%).

The average time to union was 2.7 months. There were 2 nonunions. One required two bone grafting procedures and the other was treated with partial patellectomy. Neither of the nonunions became infected.

At follow-up 67% of patients had no pain, 28% had mild pain and 5% had moderate pain. The average range of knee motion was 1-114 degrees.

Other complications included: DVT in one patient, stiff knee requiring manipulation in 3 patients, painful hardware requiring removal in 3 patients, and post-traumatic patellofemoral arthrosis in 2 patients, one of which eventually required total patellectomy.

**CONCLUSIONS:** Open fractures of the patella are relatively infrequent injuries for which treatment must be individualized based on grade of soft-tissue injury, extent of wound contamination, and degree of bony comminution. The overall infection rate in this series was 10.7%, but the rate of infection correlated closely with the degree of soft-tissue injury. The ultimate clinical result at final follow-up was satisfactory in 95% however, and did not correlate with the type of fracture, the method/timing of treatment, or the early presence of infection.

**RADIOULNAR DISSOCIATION:  
THE SPECTRUM OF ESSEX-LOPRESTI INJURY**  
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**ABSTRACT**

Purpose: To review the clinical features of an injury which may be more common than generally supposed, for which diagnosis is typically delayed, and for which delay in diagnosis exacts a great functional penalty.

Brief Description of Methods: Retrospective chart review.

Summary of Results:

Twenty patients (12 men, mean age 34.6) with combined injuries to the lateral compartment of the elbow and ipsilateral distal radial ulnar joint (DRUJ) were reviewed. Mean follow-up was 106.9 months (range, 4 to 324). Elbow injuries included radial head fracture (10), radial head fracture with an elbow dislocation (2), radial head fracture with capitellum fracture (1), Monteggia fracture-dislocation (4), simple elbow dislocation (2), and an elbow dislocation with capitellum fracture (1). Wrist injuries included a Galeazzi fracture-dislocation in three patients (3) and DRUJ (17).

Five patients were correctly diagnosed and were treated at the initial time of injury. In four patients the radial head was preserved. Four of the five healed without impairment and one treated two weeks after injury had severe heterotopic ossification with severe limitation of motion.

In fifteen patients the combined injury was correctly diagnosed after a mean delay of 94.8 months (range, 1 to 312). In all of these patients the radial head had been excised, worsening the distal radial ulnar joint symptoms and ultimately leading to a correct diagnosis. Seven of these patients had no further treatment, but all had significant impairment, including painful wrists (7), elbow pain (5), and significant heterotopic ossification (4). The other eight patients in this group had treatment including radial head replacement (1), radial head replacement with a Darrach procedure (1), radial head replacement with ulnar shortening (1), Darrach procedure (1), ulnar shortening (2), ulnar shortening with interosseous membrane tightening (1), and ulnar shortening with DRUJ reconstruction (1). One patient who had an ulnar shortening and one patient who had ulnar shortening with DRUJ ligament reconstruction were improved. The other six patients remain impaired from heterotopic ossification (2), significant elbow joint contractures (3), reflex sympathetic dystrophy (1), and significant elbow or wrist pain (4).

Conclusions:

In addition to the classic Essex-Lopresti radial head fracture and DRUJ dislocation, radioulnar dissociation involves the spectrum of injury having in common injury to the lateral compartment of the elbow and instability of the DRUJ, with presumed disruption of the interosseous membrane. Often diagnosis is delayed, compromising the potential result. Any injury to the lateral compartment of the elbow should prompt close attention to the DRUJ for possible associated instability.



# PERCUTANEOUS ANTEGRADE URETERAL STENTING AS AN ADJUNCT FOR TREATMENT OF PENETRATING URETERAL INJURIES

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## ABSTRACT

### Percutaneous Antegrade Ureteral Stenting as an Adjunct for Treatment of Penetrating Ureteral Injuries

Complications of ureteral injuries include free urinary ascites, contained urinoma, urinary obstruction, abscess and sepsis. Nephrectomy or reconstructive procedures may be required. We report on our use of percutaneous antegrade nephrostomy with antegrade stenting of the ureteral injury site and percutaneous drainage of the urinary leak as adjuncts in the management of ureteral injuries.

Six patients with ureteral injury had these procedures performed. Four patients had dehiscence of a lacerated ureter which had been primarily repaired. Two other patients had ureteral contusions which subsequently became full thickness disruptions in the post-operative period. One patient also developed a pancreatic fistula. Associated injuries included colon (four patients), duodenum (three patients), small bowel (two patients), pancreas (two patients), inferior vena cava and external iliac artery (one each).

All six patients were treated by percutaneous nephrostomy and antegrade placement of internal-external ureteral stents across the injured area. Retrograde cystoscopic stenting was attempted in all four failed ureteral repairs. It was not attempted in the two patients with leaking ureteral contusions, who were managed only by the percutaneous approach. Two of the three patients with stented repairs required antegrade retrieval of misplaced stents. All six patients had fluoroscopically guided percutaneous drainage of the periureteral area.

Five of the six patients healed the ureteral disruption within two months without operative intervention. One patient healed the ureter with stricture necessitating ureteral reanastomosis. All urinomas resolved with percutaneous drainage.

In conclusion, percutaneous antegrade stenting successfully treated four dehisced ureteral repairs. It was the primary method used to manage two ureteral contusions that subsequently developed transmural disruption. These techniques can be utilized for complex ureteral injuries associated with pancreatic leaks, colon or duodenal injuries and multiple abscesses.

# ALTERNATIVE APPROACHES TO DIFFICULT ABDOMINAL WOUND CLOSURE

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## ABSTRACT

Following exploration for severe abdominal trauma, massive edema of the small bowel and retroperitoneum may make primary closure of the incision difficult or impossible. The suture line tension required can lead to fascial necrosis and wound sepsis. We evaluated two alternative approaches over a two year period in 12 patients with severe abdominal trauma (2 blunt, 10 penetrating) whose midline incisions could not be closed primarily at initial operation due to massive visceral edema.

In five patients synthetic mesh was used to bridge the fascial defect (polyglycolic acid in 4, polypropylene in 1). One patient had concomitant severe head trauma and died early post-operatively. The other four patients were left with open midline wounds which complicated their post-operative management and required one or more delayed procedures to close the wound. One wound was closed primarily several weeks following injury after granulation tissue covered the exposed viscera. Attempted delayed closure of the wound managed initially with polypropylene mesh was unsuccessful due to dense adhesions, serosal stripping, and consequent bowel edema. Polyglycolic acid mesh was then used and a skin graft was applied later. In two patients the wounds were ultimately covered with split-thickness skin grafts. In one of these the skin graft was excised and the fascia closed primarily four months following injury. Two patients currently have large abdominal wall hernias.

In the other seven patients the skin was reapproximated over the visceral mass utilizing towel clips at the initial operation. Laparotomy pads were left in place in six patients because of diffuse bleeding and coagulopathy. Two patients remained in profound shock and died early post-operatively. The remaining five patients were reoperated within 48-72 hours. In all cases acute hemorrhage had stopped, the edema of bowel and retroperitoneum had largely resolved, and the fascia could be closed primarily without excessive tension. The skin and subcutaneous tissue were packed open and all wounds went on to heal satisfactorily.

When massive edema makes primary fascial closure at initial operation for severe abdominal trauma difficult or impossible, closure of the skin over the visceral mass promotes resolution of the edema and allows primary closure within 48-72 hours. The use of synthetic mesh results in an open wound, may require multiple delayed procedures for closure, and may not ultimately restore abdominal wall integrity. Synthetic mesh should be reserved for cases of abdominal wall tissue loss or dehiscence associated with wound sepsis.

## **Bylaws of Western Trauma Association**

*(Includes all revisions discussed at the 1987, 1988, and 1989 meetings, and then approved at the 1990 meeting. Does not include revisions suggested at 1991 meeting. They will be voted upon at 1991 meeting).*

### **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 one-third of the membership.

**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 disciples with a special interest or expertise in trauma may be elected to associate membership with the approval of 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 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 treasurers 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 of 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 argue 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.



**Western Trauma Association  
1990 - 1991  
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PACHTER, H. Leon (Rena)	530 First Avenue, NY/6C N.Y.C., NY 10016	O:212-340-7302 H:212-679-9633 Gen/Trauma Surg
PALMER, Andrew K. (Nicki)	550 Harrison Center Syracuse, NY 13202	O:315-472-2015 H:315-446-1128 Orthopedics (Hand)
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PICKARD, Laurens (Bonnie)	One Baylor Plaza Houston, TX 77030	O:713-799-4599 H:713-669-9722 Gen/Thor/Ped Surgery

PIERCE, George (Carolyn)	U. of Kansas Med Ctr 39th and Rainbow Blvd. Kansas City, KA 66103	O:913-588-6128 H:913-268-5631 Gen/Thor/Vasc Surgery
POLACK, Edward P. (Wendy)	Professional Bldg. IV Medical Park Wheeling, WV 26003	O:304-242-0590 H:304-233-6132 Plastic Surg
RATZER, Erick R. (Jeanne)	3 Cimmaron Drive Littleton, CO 80121	O:303-399-1194 H:303-781-2002 Gen/Oncology Surgery
REED, R. Lawrence, III (Geraldine)	UTHSC at Houston 6431 Fannin, MSB 4.284 Houston, TX 77004	O:713-792-5456 H:713-578-3012 Gen/Trauma Surg
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SAFFLE, Jeffrey R. (Susan)	50 N Medical Dr, #3B-306 Salt Lake City, UT 84132	O:801-581-3595 H:801-582-6603 Gen Surg/Burns
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YAUN, Hansen	550 Harrison Center Syracuse, NY 13202	O:315-473-4472 H:315-446-6921 Orthopedics



## GEOGRAPHICAL ROSTER

### Arizona

Phoenix  
MacCollum, M.S.  
Tucson  
Benjamin, James  
Volz, Robert G.

### California

Davis  
Metheny, Jeffrey  
Pasadena  
Esrig, Barry C.  
San Diego  
Davis, James W.  
Hoyt, David B.  
Mackersie, Robert C.  
San Francisco  
Knudson, Mary Margaret  
Phillips, Thomas F.  
San Mateo  
Tawes, Roy L.  
Woodland  
Edmondson, Robert C.  
Yamuchi, Hiroshi

### Colorado

Denver  
Ammons, Peter C.  
Moore, E. Eugene  
Moore, Fred  
Rutherford, Robert B.  
Thomas, Herbert, III  
Englewood  
Carter, Donald R.  
Littleton  
Ratzer, Erick R.  
Seibert, Charles E.  
Wheat Ridge  
Moore, John

### District of Columbia

Champion, Howard R.  
Neviasser, Robert J.  
Ochsner, M. Gage

### Florida

Jacksonville  
Lucie, Stephen R.  
Tampa  
Rosemurgy, Alexander S.

### Georgia

Atlanta  
Broecker, Bruce H.  
Gussack, Gernald S.

### Hawaii

Honolulu  
Lau, Jeffrey M.

### Iowa

Des Moines  
Coil, James A., Jr.

### Kansas

Kansas City  
Pierce, George  
Overland Park  
McCroskey, Brien L.  
Wichita  
Chang, Frederic C.  
Ferris, Bruce C.  
Harrison, Paul B.  
Nelson, Gerald D.  
Street, David E.

### Michigan

Ann Arbor  
Olsen, William E.  
Bloomfield Hills  
Wilson, Robert F.

### Minnesota

Edina  
Waldron, John F.  
Minneapolis  
McGill, John W.  
McKinley, Richard C.  
Olfelt, Paul C.  
Seymour, John  
Rochester  
Cabanela, Miguel E.  
Klassen, Rudolph A.  
Lindscheid, Ronald L.  
LeWallen, David G.

### Montana

Billings  
Johnson, James H., Jr.  
Millikan, J. Scott  
Teal, Peter V.

### Missouri

Kansas City  
Helling, Thomas C.

## Nebraska

### Lincoln

Carveth, Stephen

### Omaha

Edney, James A.

## New Jersey

### Camden

O'Malley, Keith F.

### Cherry Hill

Ross, Steven E.

## New York

### Brooklyn

Scalea, Tom M.

### New York City

Pachter, H. Leon

### Rochester

Feliciano, David V.

Webster, Dwight A.

Wray, R. Chris

### Syracuse

Palmer, Andrew K.

Webster, Dwight, A.

Yaun, Hansen

## Oklahoma

### Oklahoma City

Tuggle, David W.

## Oregon

### Eugene

Beal, Sandra L.

### Portland

Metzdorff, Mark T.

## Pennsylvania

### Allentown

Mucha, Peter A., Jr.

### Pittsburg

Sherman, Harold

## Tennessee

### Nashville

Morris, John A., Jr.

Sharp, Kenneth W.

## Texas

### Galveston

Stothert, Joseph C.

### Houston

Fischer, Ronald P.

Pickard, Laurens

Reed, R. Lawrence, III

### Lackland

Roettger, Richard

### Temple

Frazee, Richard C.

## Utah

### Salt Lake City

Saffle, Jeffrey R.

## Vermont

### Burlington

Shackford, Steven R.

### Rutland

Bahnsen, David H.

## Virginia

### Richmond

Mehrhof, Austin I., Jr.

Sugerman, Harvey J.

Whitley, Ronald

## Washington

### Seattle

Jurkovich, Gregory

### Tacoma

Osborne, Robert W., Jr.

## West Virginia

### Wheeling

Kappel, David A.

Polack, Edward P.

## Wisconsin

### LaCrosse

Cogbill, Thomas H.

Landercasper, Jeffrey

### Madison

Gall, Warren