



# DAY OF TRAUMA



M. Gage Oschner Resident Paper Competition



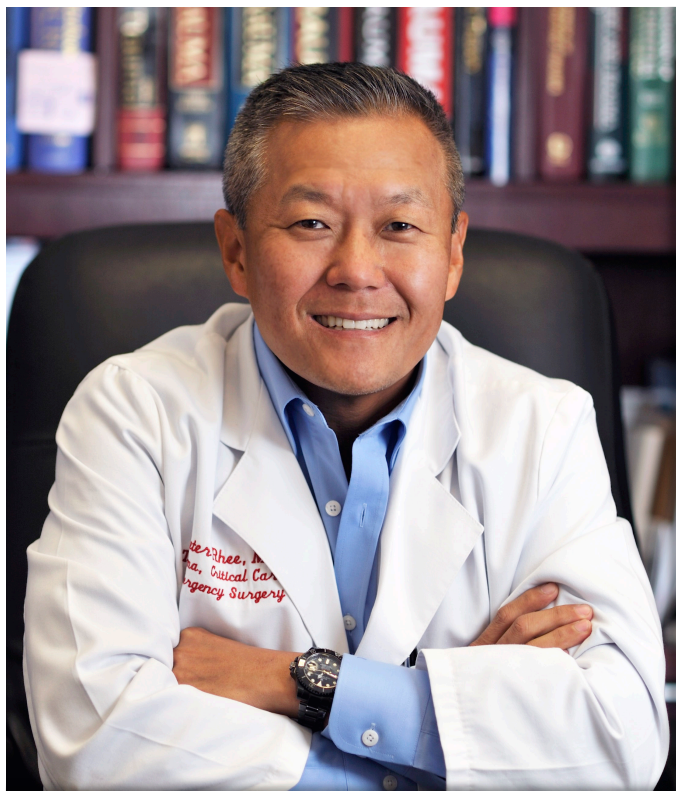
August 19, 2016

Hyatt Regency Savannah, Georgia



## DAY OF TRAUMA, KEYNOTE PRESENTER

Peter Rhee, MD, MPH, FACS, FCCM, DMCC



Dr. Rhee is currently the Senior Vice President and Chief of Trauma at Grady Memorial Hospital. Dr. Rhee held appointments as Chief of Trauma, Critical Care, Burns and Emergency Surgery at The University of Arizona Medical Center; Professor of Surgery and held the Martin Gluck Endowed Chair at the University of Arizona; Director of the Navy Trauma Training Center; Attending Surgeon at Los Angeles County Medical Center; Professor of Surgery at the University of Southern California; and Professor of Surgery at the Uniformed Services University of the Health Sciences (USUHS). Dr. Rhee received a BS in Health Systems Engineering from the Georgia Institute of Technology (summa cum laude, 1983), a MD from USUHS (1987), a MPH in Health Services from the University of Washington (1995), and a Diploma in the Medical Care of Catastrophes from the Society of Apothecaries of London (1999). He completed his Fellowship in Trauma and Critical Care at the University of Washington's Harborview Medical Center (1993-1995). He is double boarded in general surgery and surgical critical care.

Dr. Rhee is a retired US Navy Captain following 24 years of active duty with numerous shipboard deployments and with the US Marines. He has served in Afghanistan and Iraq during Operation Enduring Freedom and Operation Iraqi Freedom. He is a Fellow of the American College of Surgeons and a Fellow of Critical Care Medicine. He is a founding member of the Tactical Combat Casualty Care Committee (TCCC) and also serves on National steering committees and national trauma research committees including the Defense Health Board's Subcommittee on Trauma & Injury and the Committee on Tactical Combat Casualty Care as well as the Federal Drug Administration's blood products advisory committee, the Resuscitation Outcomes Consortium's protocol review committee and drug safety and monitoring board. He serves on numerous national and university committees, is a member of numerous Editorial Boards. Dr. Rhee has also authored or co-authored over 320 peer reviewed publications, 3 books, and 22 book chapters. He is a highly sought after speaker as he has delivered over 1,000 talks including being invited as the commencement speaker at the University of Arizona in 2012. His honors include being a guest of President Obama State Dinner at the White House honoring South Korean President Lee. His areas of research interest include hemorrhagic shock, suspended animation for trauma, hemostatic agents, resuscitation immunology and formulation of resuscitation fluids, Traumatic brain injury, transfusion and coagulopathy, trauma training, and advanced portable electronic medical devices including ones for communication and documentation. His national interests includes improved trauma on the Indian reservations, improved gun control and prevention of gun violence, suicide prevention and finally improved disaster preparedness. He is also the author of the book "Trauma Red: Making of a surgeon in war and America's cities".

# THE DAY BEFORE

Thursday, August 18<sup>th</sup>

8:30a – 9:30a	Breakfast Buffet	Hyatt Regency Savannah, Plimsoll Room
10:00a – 1:00p	Georgia Trauma Commission Meeting	Hyatt Regency Savannah, Scarborough I
1:00p – 2:00p	Break	
2:00p – 5:00p	Georgia Committee for Trauma Excellence	Hyatt Regency Savannah, Scarborough I
6:00p – 9:00p	Networking Reception	The Whitman Mansion

## NETWORKING RECEPTION WITH A LITTLE SOUTHERN CHARM!



Location: The Whitman Mansion  
611 Whitaker St

Trolley Shuttle: Old Savannah Tours  
From Hyatt: Boarding starts at 5:30p  
and will run continuously until  
everyone has been transported.  
(Last trolley leaves at 6:30p)

From Whitman: Boarding starts at 8:30p  
and will run continuously until  
everyone has been transported.  
(Last trolley leaves at 9:15p)

*Built in 1895, and overlooking Forsyth Park, the Whitman Mansion is one of the finest historic restorations in the city and offers a luxury escape you'll never forget. Every detail was seen to with the most discerning guests in mind. From the full gourmet kitchen to the master bathroom's sumptuous antiques and heated tile floor, this award-winning mansion defines the Modern South. Elegant furnishings, modern conveniences and even a stylish billiard room with exquisite turn of the century details all ensure that The Mansion provides guests with an oasis within Savannah's Historic District.*

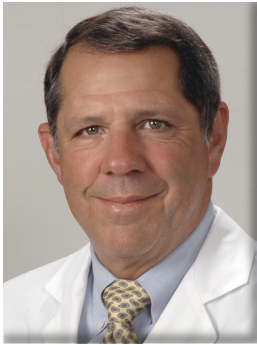
# DAY OF TRAUMA AGENDA

Friday, August 19<sup>th</sup>



	TRAUMA MEDICAL DIRECTORS	TRAUMA PROGRAM MANAGERS	REGISTRARS
8:00a - 8:30a	Breakfast	Breakfast	Breakfast
8:30a - 10:00a	Joint Session w/ Trauma Program Managers Ballroom A	Joint Session w/ Trauma Medical Directors Ballroom A	Data Management: Registry Maintenance & Statistics <i>T. Johns</i> Scarborough IV
10:00a - 11:00a	Business Meeting Ballroom A	Getting the Most Out of Your V5 Report Writer <i>T. Volrath</i> Scarborough IV	Getting the Most Out of Your V5 Report Writer <i>T. Volrath</i> Scarborough IV
11:00a - 11:30a	Executive Business Meeting Ballroom A	Getting the Most Out of Your V5 Report Writer (continued) <i>T. Volrath</i> Scarborough IV	Getting the Most Out of Your V5 Report Writer (continued) <i>T. Volrath</i> Scarborough IV
11:30a - 1:00p	Lunch	Lunch	Lunch
1:00p - 2:00p	Traumatic Brain Injury: what are we really doing differently? <i>Dr. Peter Rhee</i> Ballroom A	Traumatic Brain Injury: what are we really doing differently? <i>Dr. Peter Rhee</i> Ballroom A	Traumatic Brain Injury: what are we really doing differently? <i>Dr. Peter Rhee</i> Ballroom A
2:00p - 2:45p	Data Driven Hospital Performance Metrics: lessons learned from a one year pilot <i>E. Atkins, R. Morgan, M. Probst</i> Ballroom A	Data Driven Hospital Performance Metrics: lessons learned from a one year pilot <i>E. Atkins, R. Morgan, M. Probst</i> Ballroom A	Data Driven Hospital Performance Metrics: lessons learned from a one year pilot <i>E. Atkins, R. Morgan, M. Probst</i> Ballroom A
2:45p - 3:00p	Break	Break	Break
3:00p - 5:00p	M. Gage Oschner Resident Paper Competition <i>COT – GA Chapter</i> Ballroom A	M. Gage Oschner Resident Paper Competition <i>COT – GA Chapter</i> Ballroom A	Data Management: Registry Maintenance & Statistics <i>T. Johns</i> Scarborough IV
5:00p - 5:30p	Joint Session: Next Steps and Feedback Ballroom A	Joint Session: Next Steps and Feedback Ballroom A	Joint Session: Next Steps and Feedback Ballroom A

## RESIDENT PAPER COMPETITION NAMED IN MEMORY OF:



**MIMS GAGE OCHSNER, JR.** was born in New Orleans, Louisiana to his urologist father M. Gage Ochsner and mother Paddy Ochsner on May 10, 1953. He was named for the best friend and colleague of his grandfather Dr. Alton Ochsner, who was one of the founders of the Ochsner Clinic. Gage attended Southern Methodist University in Dallas, Texas and then was graduated from Tulane University School of Medicine in 1979. During his medical school years, he was awarded the United States Naval Reserve Health Professions Scholarship. He completed a surgical internship at the National Naval Medical Center in Bethesda, Md. He completed his residency in surgery at the Naval Regional Medical Center in San Diego, Ca. In 1985, Dr. Ochsner then became the Chief of General Surgery and Director of Intensive Care at the Naval Hospital at Subic Bay, Philippines. From 1988-1990, he completed a fellowship in Trauma Critical Care at the Washington Hospital Center under the tutelage of his longtime friend and colleague Dr. Howard Champion. Following his fellowship training, he stayed on there to become an attending surgeon in trauma critical care and an Associate Professor of Surgery.

In 1994, Dr. Ochsner left the military and moved to Savannah, Georgia to become Chief of Trauma and Surgical Critical Care at Memorial Health University Hospital. He became a full Professor of Surgery and was then appointed as Academic Chairman of the Mercer University School of Medicine Department of Surgery in 2011.

Dr. Ochsner served on numerous surgical society boards of directors and played a leadership role in many national surgical organizations. He was the president of the Ambrose Pare Society, the president of the Western Trauma Association, the president of the Georgia Surgical Society, the vice president of The American Association for the Surgery of Trauma, the vice president of the Southeastern Surgical Congress, and the Secretary-Treasurer of the Georgia Surgical Society. M. Gage Ochsner, Jr. authored more than 50 peer reviewed scientific publications and contributed eleven book chapters in major texts on trauma surgery. He was the principal investigator on four grant-funded studies at Memorial Health and directed fifteen separate educational courses in Savannah.

During his tenure at Memorial University Medical Center, Dr. Ochsner grew the Trauma Service from 900 admissions per year to 2,700 admissions per year, developed a respected and admired surgical critical care service, developed an Orthopedic Trauma Service, and expanded the full time Trauma Faculty from 3 to 9 surgeons. He played a major role in the development of the statewide Georgia Trauma System.

Dr. Ochsner received many awards and accolades, including the Memorial Health Lifetime Achievement Award and the Georgia Medical Society Health Hero Award. A \$300,000 gift was donated in his name to start the M. Gage Ochsner, M.D. Institute for Injury Research & Prevention.

Always the professor, Gage was a commanding presence on rounds, in the operating room, or running a meeting. His patients appreciated his skill and bedside manner; the medical students adored him and always asked him to be part of their graduation ceremony. His residents hung on his every word, and their great fear was that they would disappoint his expectations.

Some men make a difference in this world and M. Gage Ochsner, Jr., M.D. was certainly one of them. M. Gage Ochsner Jr., M.D. had a major impact on Memorial University Medical Center, the trauma/critical care service, and the surgical residency training program as well as the lives of all those he touched. He will remain in our hearts and minds for many, many years to come.



# M. GAGE OSCHNER RESIDENT PAPER COMPETITION

## 1. Effective Regionalization of Care For Traumatic Brain Injury in Southeastern Georgia

Audrey Butcher, MD

*Mercer University School Of Medicine At Memorial University Medical Center*

### Introduction:

Patients with traumatic brain injury (TBI) treated in Level I trauma centers have improved survival. Regionalization of trauma care also improves survival in TBI; therefore, we sought to determine the effectiveness of regionalization of rural trauma care for TBI patients in Southeastern Georgia by examining clinical data and mortality for TBI patients treated at a Level I trauma center with a large rural catchment area.

### Methods:

Retrospective data on age, mechanism of injury, Injury Severity Score (ISS), Glasgow Coma Score (GCS), time from injury to arrival at a Level I trauma center, and mortality were collected on 2333 patients who sustained a TBI over a 3-year period. Data analysis was performed using the Students t,  $\chi^2$  and Fisher's exact tests, and multivariate logistic regression.

### Results:

Mean age of the cohort was  $50.3 \pm 21.7$ , mean ISS was  $15.1 \pm 9.2$ , mean GCS was  $12.9 \pm 3.7$ , mean time from injury to arrival was  $199.0 \pm 243.0$  min, and overall mortality was 6%. The cohort was divided into patients that were transported directly to a Level I trauma center (n=1403) and those that were transferred from another facility (n=930). Patients transported directly to a level I trauma center were significantly younger ( $46.8 \pm 20.3$  vs.  $55.3 \pm 22.6$ ,  $p < 0.001$ ), more critically injured (ISS  $15.9 \pm 10.1$  vs.  $14.0 \pm 7.6$ ,  $p < 0.001$ ), had lower initial GCS ( $12.7 \pm 3.9$  vs.  $13.4 \pm 3.5$ ,  $p < 0.01$ ), took less time to arrive at a Level I trauma center ( $102.0 \pm 185.0$  min vs.  $377.0 \pm 217.0$  min,  $p < 0.0001$ ) and had increased mortality (6.9% vs. 4.7%,  $p < 0.001$ ) compared to patients transferred from referring facilities.

### Conclusion:

TBI patients directly transported to the Level I trauma center were more critically injured, had lower GCS and increased mortality compared to patients transferred in. Direct transport was a significant risk factor for mortality in this patient population. Regionalization of rural trauma care appeared extremely effective in that more critically injured patients were transported directly to a Level 1 trauma center.

# M. GAGE OSCHNER RESIDENT PAPER COMPETITION

## 2. Hemodynamic Optimization of the Brain Dead Trauma Patient Utilizing Hemodynamic Transesophageal Echocardiography (hTEE)

Trine Engebretsen, MD

*Mercer University School of Medicine at Medical Center at Navicent Health*

### Introduction:

Over 120,720 patients are currently waiting for a vital organ transplant in the United States and 22 patients will die every day waiting for an organ donor due to an ongoing critical shortage of available organs. Optimizing donor physiology after brain death can be challenging as various aberrations of cardiovascular performance can be expected, and if poorly managed can result in donor organ injury and subsequently, a lost transplant opportunity. We hypothesized that performance of serial hemodynamic transesophageal echocardiography (hTEE) assessments to monitor the ongoing hemodynamic needs of the organ donor would improve end-organ physiology at the time of organ procurement and secondarily increase the number of organs transplanted per donor.

### Methods:

With Internal Review Board approval, all trauma patients age >18 admitted to a Level I a Trauma Center, who progressed to brain death from February 2015 through May 2016 were considered for study inclusion. An injury and age matched control group of organ donors was selected from our institution's organ donor registry in order to compare outcomes. 10 patients consented to organ donation and were converted to organ donors and comprised the study group. Serial hTEE examinations utilizing a miniaturized monoplane transesophageal echocardiography probe (ImaCor, Garden City, NT, USA) were performed with a target interval time of every 5 hours from the declaration of brain death to the time of organ procurement. Complete, 3 view hTEE examinations were obtained by a surgical critical care attending or surgical resident proficient in hTEE. The images were evaluated and assessments of global cardiac function and volume status through SVC Collapsibility Index and Left Ventricular End Diastolic Area (LVEDA) were rendered. Blinded to the hTEE examination findings, the organ recovery coordinator provided an independent written assessment of the patients hemodynamic and volume status, and plan of care. Both evaluations were discussed by the critical care team and the organ recovery coordinator whereupon a definitive plan of care was made while noting any changes in the organ recovery coordinators plan of care. At the time of organ recovery, the post-procurement intent of each individual organ, vasopressor requirements, and volume status was recorded.

### Results:

Patients who consented for organ donation and were subsequently managed with the hTEE modality ranged in age from 19 to 53 years of age. Mechanism of death included GSW to head (5), MVC (2), and blunt head trauma (3). The hTEE examination was performed a total of 66 times with a subsequent change in donor management regarding volume status 12 times or 18% of examinations. Only 1 of the 10 patients was on vasopressor support at the time of organ procurement in the form of 5mcg/min of Levophed. 41 organs were recovered for organ transplantation in the study group resulting in an average yield of 4.1 organs per donor. Patients in the control group ranged in age from 18 to 51 years of age. Mechanism of death included GSW to head (4), MVC (3), and blunt head trauma (3). 9 of 10 patients were on vasopressor support at the time of organ procurement, with 3 patients on multiple vasopressor support. In this historical control group, 38 organs were recovered for organ transplantation with an average yield of 3.8 organs per donor.

### Conclusion:

The profound medical derangements that occur in brain death pose particular challenges in fluid balance and hemodynamic management of the potential organ donor. The application of hTEE to the potential donor population has not been published to date. In our study, the utilization of the hTEE modality resulted in a change in management in 18% of patient assessments, a decrease in the number of vasopressor agents required by 80%, and an increase in organ transplanted per donor rate from 3.8 to 4.1. We concluded that these promising findings warrant further investigation of hTEE's utility in the hemodynamic optimization and management of potential organ donors. As even one additional organ transplanted is one less patient on the national waiting list and a life saved.



## M. GAGE OSCHNER RESIDENT PAPER COMPETITION

### 3. The Impact of Hemodynamic Transesophageal Echography on Continuous Renal Replacement Therapy Use in the Trauma Population

Madison Griffin, MD

*Mercer University School of Medicine at Medical Center at Navicent Health*

#### Introduction:

Post-traumatic patient management strategy is a constantly debated topic and no general, best-practice consensus exists. Unwanted patient outcomes such as acute kidney injury or volume overload however are common and can complicate or prolong a patient's recovery, creating added morbidity and mortality risks. Continuous renal replacement therapy (CRRT) has been increasingly utilized as a supplement to clinical management in the face of renal insufficiency with electrolyte or acid-base imbalances and volume overload. While effective, CRRT is also expensive, and the modality's capacity to sustain human physiology creates ethical dilemmas at end of life scenarios. It also dramatically impacts care delivery costs. Hemodynamic transesophageal echography (hTEE) has been widely accepted as a reliable means to monitor volume status and fluid responsiveness of patients in the intensive care unit (ICU). It allows physicians to answer resuscitation questions quicker and more accurately. While data exists evaluating hTEE and CRRT separately, there is a lack of research regarding CRRT in the trauma population. We hypothesize that the use of hTEE in the trauma population reduces the need for CRRT through avoiding renal injury by allowing for better fluid management strategies.

#### Methods:

A retrospective review of a level I Trauma Center from 2009 to 2015 was performed. We then performed a chart review of all trauma patients who had acute kidney injuries in our trauma database and included the ones that had required CRRT. We also cross referenced this with our CRRT database from 2009 to 2015 to ensure that we had captured all patients. In our hospital, the use of hTEE was widely instituted in 2013. Through a protocolized delivery of care, any patient who would be considered for CRRT is captured in our hTEE population. We compared trauma patients requiring CRRT prior to the use of hTEE to evaluate fluid status ("pre-hTEE") to the trauma patients requiring CRRT whose volume status was evaluated using the hTEE probe ("post-hTEE"). We analyzed injury severity score, the level of acute kidney injury as assessed by the acute kidney injury network classification system, and number of days on CRRT. A multivariate analysis was then performed using a combination of two sample t-test and chi-squared test of the odds ratio.

#### Results:

We identified a total of 5037 trauma patients in the pre-hTEE use group and 6699 in the post-hTEE group. In the pre-hTEE group, 24 trauma patients required CRRT. In the post-hTEE group, 15 trauma patients required CRRT. The difference in number of trauma patients requiring CRRT pre-hTEE and post-hTEE was significant with a p-value of 0.023 and an odds ratio of 2.1. The 95% confidence interval was (1.1, 1.4). Therefore, the odds of a trauma patient requiring CRRT pre-hTEE use is twice the odds of CRRT being required for a trauma patient in which hTEE is used. The mean ISS score in the CRRT trauma patient pre-hTEE was 22.25 and post hTEE-use 27.75 with a p-value of 0.192. The average AKIN classification of the CRRT trauma patients pre-hTEE use was 2.68 and post-hTEE was 2.67 with a p-value of 0.989. The number of days on CRRT pre-hTEE probe per trauma patient was 8.33 and post-hTEE was 7.25 with a p-value of 0.663.

#### Conclusion:

An hTEE probe costs approximately thirty three dollars a day. One day of CRRT costs approximately three thousand dollars a day. Given the odds of using CRRT prior to the use of hTEE probes in our trauma population are twice that of the trauma patients evaluated with the hTEE probe, it is highly cost effective and we conclude that the use of hTEE is associated with a decreased use of CRRT in our trauma patient population.

# M. GAGE OSCHNER RESIDENT PAPER COMPETITION

## 4. Understanding the Influence of Malnutrition on Outcomes Following Orthopaedic Trauma: A Systematic Review

Rishin Kadakia, MD

*Emory University Hospital*

### **Introduction:**

Malnutrition is suggested to increase the rate of perioperative complications following orthopaedic trauma, including delayed fracture healing, and increased soft-tissue complications. The purpose of our study was to systematically evaluate the literature for associations between nutrition and outcomes after operative treatment of long-bone fractures.

### **Presentation Objectives:**

Determine if malnutrition is associated with poor outcomes in the orthopaedic trauma patient.

### **Methods:**

Pubmed, MEDLINE, Embase, and Cochrane computerized literature databases and manual search of bibliographies were performed. Search terms included: nutrition, albumin, calcium, vitamin D, with the terms fracture, nonunion, delayed union, and healing. Randomized controlled trials and cohort studies (prospective and retrospective) evaluating the association between nutrition and outcomes following operative treatment of long bone fractures were included. Descriptive and qualitative data were extracted for associations between nutritional parameters and post-operative outcomes.

### **Results:**

Our initial search identified 6,607 articles. After further review, twenty-four studies (15 prospective and 9 retrospective) were included. No studies offered sufficient data for meta-analysis of any complication, including fracture healing, nonunion rates, or soft tissue complications for any specific nutrition parameter. Delayed union or nonunion was associated with low levels of Vitamin D (N=2 studies), low albumin (N=1), and low lymphocyte count (N=1). Several studies did not show an association between the following parameters and fracture healing: vitamin D (N=1), calcium (N=1), parathyroid hormone (N=1). For soft tissue complications, the following parameters were associated with delayed wound healing: albumin (N=1), and pre-albumin (N=2). Wound complications were not associated with: total dietary intake (N=1) and albumin (N=1). Pressure ulcers following hip fractures were associated with: Vitamin C (N=1), but were not associated with albumin (N=1), total dietary intake (N=1), and zinc (N=1).

### **Conclusion:**

The association between nutrition and post-operative complications, how to supplement, and how supplementation affects post-operative outcomes after orthopaedic trauma is very poorly understood. Multiple studies have independently assessed associations between individual nutritional parameters and outcomes following orthopaedic trauma, including delayed fracture healing, soft tissue complications, and mortality. However, future studies are desperately needed that rigorously assess associations between outcomes and nutritional parameters in orthopaedic trauma patients, so that directed treatment protocols can be devised to improve nutritional status, and reduce complications.



## M. GAGE OSCHNER RESIDENT PAPER COMPETITION

### 5. The Predictive Value of Neuromarker S100B Protein in Determining Optimal Duration of Targeted Normothermia in Traumatic Brain Injury

Joey Jarrard, MD

*Mercer University School of Medicine at Medical Center at Navicent Health*

#### Introduction:

Fever burden after severe traumatic brain injury is common, occurring in up to 70% of neurologically injured patients. Observational studies have found that the occurrence of fever the first week after brain injury is associated with increased intracranial pressure, neurologic impairment, prolonged ICU length of stay. The risk of untreated hyperthermia in patients with a neurologic injury is the propagation and additive effect of secondary brain injury. In recent years, the availability of intravascular cooling catheters has allowed for a more precise and active treatment of fever by setting a target temperature of normothermia. Now that it is technically feasible to control for fever, further research is needed to determine how long active fever prevention is beneficial in traumatic brain injury.

#### Methods:

With IRB approval, patients admitted to a Level I Trauma Center with predominately isolated head injuries from blunt mechanisms were reviewed. Six trauma patients with severe traumatic brain injury (GCS  $\leq$  8) received induced normothermia at a target temperature goal of 37°C. Induced normothermia was maintained with placement of an intravascular cooling catheter (Cooline®, Alsius Corporation, Irvine CA) by the critical care team upon ICU admission. Serum S100B levels were obtained prior to initiation of normothermia and daily thereafter for the initial 5 days during the induced normothermia experience. Induced normothermia was stopped after day 5 and a follow-up S100B level was obtained 24 hours after completion of the normothermia protocol. In three patients, the clinical decision was made to continue induced normothermia due to rebound hyperthermia and/or neurosurgical management for elevated intracranial pressures. For this subset of patients, S100 B levels were monitored intermittently during the remaining duration of induced normothermia.

#### Results:

In all six patients who underwent induced normothermia (37°C), the S100B level sequentially decreased over the 5 day period of induced normothermia. At day 5, induced normothermia was completely stopped in 3 of 6 patients, restarted after a standby period in 2 of 6 patients due to rebound hyperthermia, and continued uninterrupted in 1 patient. In the 5 of the 6 patients who had a cessation or pause in the induced normothermia protocol, a corresponding increase in S100B levels was not appreciated. In the three patients who were continued on induced normothermia for 15, 21, and 24 days, the temporal S100B value at day 5 to 7 appeared to level off and then subsequent trending of S100B throughout the remaining duration of TTM therapy did not deviate from this new baseline low.

#### Conclusion:

Our data is limited by patient numbers, but demonstrates a serum reduction of S-100B during the time period of induced normothermia with an observed trend of S-100B reaching its lowest levels around day 5 to 7 following TBI. Cessation of induced normothermia did not result in a rebound increase in the S100B levels despite the majority of patients developing fevers upon completion of active fever prevention. When induced normothermia was continued for an extended periods of time (2-3 weeks), it was observed that the S100B level declined to a low point between days 5 to 7 and remained at similarly low levels even as far out as 15 to 24 days post TBI. Thus, our preliminary results suggest that by day 5 to 7, secondary brain injury as monitored by S100B levels may reach a predictable low level and past this temporal period, the active prevention of fever may not offer any positive association with improving parameters of brain physiology and or neurologic outcome.

# M. GAGE OSCHNER RESIDENT PAPER COMPETITION

## 6. Peritoneal Cavity Lavage Reduces the Presence of Mitochondrial DAMPs in the Open Abdomen

Patricia Martinez Quinones, MD

*Medical College of Georgia at Augusta University*

### Introduction:

Tissue injury causes the release of endogenous molecules known as damage-associated molecular patterns (DAMPs) that may mediate the development of the Systemic Inflammatory Response Syndrome (SIRS). Mitochondrial DAMPs, such as mitochondrial DNA and N-formyl peptides, share similarities with bacterial DNA and N-formylated peptides and are potent immune system activators.

Since the recognition and definition of the Abdominal Compartment Syndrome (ACS) during the late 1980's to early 1990's, the standard of care has evolved to feature leaving the midline abdominal incision unclosed in order to minimize the intraabdominal pressure. The abdominal viscera are covered with some variant of the sutured fascial closure (Wittmann patch, etc.) non-sutures fascial closure (Barker or VAC closure). According to the Eastern Association for the Surgery of Trauma guidelines (2011) the patient is returned to the operating room every 48 hours for re-exploration, irrigation, and any indicated definitive procedures based on class II-III evidence only. Once the patient has recovered from the initial insult (trauma, bowel perforation, peritonitis, etc.) and the bowel edema has subsided sufficiently, the abdominal fascia is closed.

These patients are critically ill and frequently manifest full blown Systemic Inflammatory Response Syndrome (SIRS) and may develop Multiple Organ System Dysfunction. Recent studies have implicated the release of mitochondrial Damage Associated Molecular Patterns (DAMPs) as an inciting factor in the development of the SIRS seen in the clinical setting. We hypothesized that mitochondrial DAMPs are present in the peritoneal cavity fluid in this setting and that they accumulate during the interval between washouts.

### Methods:

Critically ill patients admitted to our surgical intensive care unit undergoing open abdomen management due to concerns of an Abdominal Compartment Syndrome (ACS) developing if the abdominal incision were closed after severe trauma, sepsis, or peritonitis were considered for enrollment.

Peritoneal fluid was collected daily (5-7days) from 9 open abdomen patients for Western blot analysis of the ND6 subunit of the NADH: ubiquinone oxidoreductase (complex I of the mitochondrial respiratory chain), and an N-formylated peptide.

### Results:

We observed a reduction in the expression of ND6 the day following lavage of the peritoneal cavity in the operating room, that was statistically different from the days with no lavage (% change in ND6 expression, Wash:  $-50 \pm 11$  vs. No Wash:  $42 \pm 9$ ,  $p < 0.05$ ).

### Conclusion:

These results indicate the peritoneal cavity washout reduces the presence of mitochondrial DAMPs in the open abdomen. Therefore, increased frequency of peritoneal cavity lavage may lead to decreased systemic absorption of deleterious DAMPs and ultimately a reduced risk of SIRS.



## M. GAGE OSCHNER RESIDENT PAPER COMPETITION

### 7. Pediatric All-terrain Vehicle Trauma: a single center 10-year experience

Patricia Martinez Quinones, MD

*Medical College of Georgia at Augusta University*

#### **Introduction:**

All-Terrain Vehicle (ATV) accidents are a significant source of morbidity and mortality in the pediatric population. Approximately 36,000 children are seen annually in US hospital emergency departments secondary to ATV accidents. Because of the danger that these vehicles pose to the pediatric population, the American Academy of Pediatrics recommends that children under the age of 16 not be allowed to operate these vehicles. However, ATVs do not fall under federal highway safety regulations. Instead, individual states are responsible for policies surrounding ATV use. Thus, regulations vary greatly between the states. Georgia does not have laws in place to regulate ATV use.

#### **Methods:**

We conducted a retrospective review of our trauma registry for pediatric trauma activations involving all-terrain vehicles. Patients age 1-17 were included. Variables studied included age, gender, helmet status, ICD 9 injury codes, Glasgow Coma Scale, Injury Severity Score (ISS), hospital length of stay, discharge status.

#### **Results:**

We conducted a retrospective review of our trauma registry for pediatric trauma activations involving all-terrain vehicles. Patients age 1-17 were included. Variables studied included age, gender, helmet status, ICD 9 injury codes, Glasgow Coma Scale, Injury Severity Score (ISS), hospital length of stay, discharge status.

#### **Conclusion:**

Many users underestimate the danger associated with all-terrain vehicles. Helkamp's study found that states with no ATV safety laws had a fatality rate of 0.17 per 100 000 persons, compared with 0.08 per 100 000 persons in states with helmet and other safety requirements. Another study comparing crash patterns in Pennsylvania, a state with driving age and safety regulations, and North Carolina, a state with no regulations, showed that Pennsylvania had increased age, a higher percentage of helmet use, and fewer crashes (Keenan 1999). Georgia currently does not have laws to regulate driving age, safety equipment use, maximum passenger number regarding all-terrain vehicles. We were unable to demonstrate any statistical significance between helmet use, GCS and ISS. Our results are likely to our limitation of sample population and unknown protective device status in 19.5% of patients. Further studies need to be conducted with the state of Georgia population regarding ATV use and injury prevention.

# M. GAGE OSCHNER RESIDENT PAPER COMPETITION

## 8. Outcomes of Cardiopulmonary Resuscitation in Traumatic Arrest: An Opportunity for Change at a Level One Trauma Center

Katherine McBride, MD

*Mercer University School of Medicine at Memorial University Medical Center*

### Introduction:

Recent studies have show that pre-hospital CPR in traumatic arrest has survival rates of only 0-3% with survivors having poor functional outcomes. However, CPR is often continued in the resuscitation area regardless of the mechanism of injury or duration of pre-hospital CPR. Therefore we sought to determine the outcomes of patients undergoing pre-hospital CPR in patients sustaining traumatic arrest.

### Methods:

A retrospective review was performed on 15,749 trauma patients admitted to a Level 1 trauma center from 2003-2013. A total of 340 patients underwent CPR before admission during this time period and comprised the study cohort. Of these patients, 167 had CPR at the scene/enroute/ED, 62 enroute/ED, and 103 in the ER alone. Data included mechanism of injury, location and duration of CPR. Outcomes included mortality and hospital disposition.

### Results:

The mean age of the study cohort was 38.4 +/- 20.5 years, with 79.4% of the patients being male. Of the 340 patients, 152 (44.7%) sustained penetrating trauma, 184 (54.1%) sustained blunt trauma, and 4 (1.2%) thermal injuries. Overall mortality was 96.5% (n=328) for patients receiving CPR both pre-hospital and in the ED. Mortality rate was 100% in patients who had CPR initiated at the scene, 96.7% for patients who those who had CPR initiated enroute, and 90.3% for patients who received CPR in the ED alone. Patients who received pre hospital CPR had significantly increased mortality compared to patients receiving CPR in the ED alone ( $p < 0.0005$ ). The duration of CPR was identified as a significant risk factor in mortality (OR 0.914, 95% 95% CI 0.887-0.941,  $p < 0.0005$ ). The average duration of CPR for all patients was 29.4 +/- 15.4 minutes. The average duration of CPR for those who had CPR started enroute was 28.4 +/- 12.1 minutes and the average duration for those who received CPR in the ED alone was 20.4 +/-14.7 minutes. Of the 12 patients who survived to leave the hospital, 42% sustained blunt trauma. Dispositions included home (n=5), rehabilitation center (n=3) and skilled nursing facility (n=4).

### Conclusion:

Patients undergoing CPR due to a traumatic arrest have extremely poor outcomes. In addition, trauma patients undergoing pre-hospital CPR have a significantly increased mortality compared to patients undergoing CPR in the hospital. Therefore, consideration should be given to the rapid assessment for reversible causes of shock but not the continuation of CPR in patients with pre-hospital traumatic arrest.



# M. GAGE OSCHNER RESIDENT PAPER COMPETITION

## 9. Treatment of Traumatic Vascular Injury using Endovascular Techniques: A Paradigm Shift

Phillip Rideout, MD

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### Introduction:

Major vascular injury after blunt or penetrating mechanisms is life threatening and can lead to rapid exsanguination if not expeditiously controlled. Open management of major vascular injuries has historically required rapid exposure, large incisions, and tissue disruption which often lead to complicated postoperative wounds, chronic pain and physical disabilities. We hypothesized that endovascular therapy for major vascular injury after trauma is a safe and effective means to accomplish definitive hemorrhage control with decreased morbidity and mortality when compared to conventional, open surgical techniques.

### Methods:

We performed a retrospective review of patients treated at a Level I Trauma Center who received endovascular therapy for major vascular injury following penetrating and blunt trauma from 2007 through 2015. Demographic and clinical data was captured along with vessels injured, mechanism of injury, and repair technique employed. Our trauma registry was then reviewed and a matched subset of control patients with comparable trauma acuity was compiled over a previous five year time period. Outcomes such as hospital length of stay (LOS), effectiveness of repair, complications, physical disability, and mortality were compared and long-term outcomes were reviewed.

### Results:

From April 2007 through April 2015, twenty-one patients (n=21) were identified with blunt (n=5, 23.81%) and penetrating (n=16, 76.19%) extremity vascular injuries. Vessels include: Subclavian (n=2), Axillary (n=8), Brachial (n=1), Carotid (n=2), Superficial Femoral (n=4), Popliteal (n=1), External Iliac (n=2) and Tibial Trunk/Posterior Tibial (n=1). Endovascular repair was successful in all patients with no conversion to open repair. There was one (n=1) death as a result of poly trauma within 24 hours of admission with an Injury Severity Score (ISS) of 29. Two patients required bypass revascularization due to covered stent occlusion. Stent patency in our bare metal stent group was 100%. Our endovascular group exhibited decreased hospital length of stay as well as decreased overall morbidity and mortality.

### Conclusion:

Our experience with covered and bare metal stents for blunt and penetrating vascular trauma demonstrate excellent short and long-term outcomes with decreased hospital LOS, limited postoperative complications, and no reported physical disabilities. While definitive guidelines for endovascular therapy for major vascular injury have yet to be formally adopted, we conclude that endovascular therapy is a safe and effective strategy to achieve hemorrhage control of traumatic major vascular injuries.

# M. GAGE OSCHNER RESIDENT PAPER COMPETITION

## 10. Frailty is a Better Marker than Age in Predicting Post-Operative Mortality and Complications Following Pelvis and Lower Extremity Trauma

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### Introduction:

"Frailty" has been described as a physiologic marker of decline of multiple organ systems and identifies patients who are more susceptible to complications following the external stress of trauma. Multiple medical and surgical specialties have shown higher complication rates in frail patients, including increased mortality and need for long-term care. The purpose of this study was to evaluate frailty as an independent predictor of postoperative complications in elderly patients with pelvis and lower extremity trauma.

### Methods:

The American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database from 2005-2014 was queried for patients 60 years and older who underwent surgery for pelvis, acetabular, and lower extremity trauma. A previously described modified frailty index (MFI) was utilized. In this, the presence of 11 variables are summated, including diabetes, congestive heart failure, hypertension, myocardial infarction, cerebrovascular accident with and without neurological deficit, peripheral vascular disease, functional status, COPD or pneumonia, prior percutaneous coronary intervention, cardiac surgery or angina, and history of impaired sensorium. The MFI score was then calculated for each patient, resulting in a fractional index. Given the smaller sample size in higher MFI scores, we combined patients with MFI scores of 0.45 and above for statistical analysis. Multivariate logistic regression was performed to determine the primary outcome of association between MFI score and age with 30-day mortality, and univariate analysis was performed for secondary outcome measures (all occurrence of adverse events, cardiac, pulmonary, hematologic, renal, reoperation, adverse discharge disposition) with odds ratios and p-values reported. Linear regressions were performed to analyze lengths of hospital and ICU stays relative to MFI scores. Significance was established at  $p < 0.05$ .

### Results:

This study included 32,535 patients over age 60, with injuries of the pelvis and acetabulum (0.9%), hip (73.2%), femur (4.1%), knee (7.4%), tibia (1.8%), and ankle (12.5%). Based on the MFI thresholds, 86.5% were non-frail, 11.4% were moderately frail, and 0.93% were severely frail. There was a stronger association between MFI score and 30-day mortality (OR for MFI: 10.59, 95% CI: 5.95-18.82) as compared to age and 30-day mortality (OR for age: 1.05, 95% CI: 1.04-1.06;  $p < 0.001$ ). As MFI score increased, 30-day mortality increased from 1.9% in an MFI score of 0 to 40.0% for MFI score 0.64 and above ( $p < 0.001$ ) (Figure 1). Higher rates of post-operative complications were observed as MFI scores increased, including: any occurrence excluding mortality (OR: 1.21, 95% CI: 1.18-1.24,  $p < 0.001$ ), cardiac (OR: 1.64, 95% CI: 1.54-1.76,  $p < 0.001$ ), pulmonary (OR: 1.42, 95% CI: 1.34-1.49,  $p < 0.001$ ), and renal complications (OR: 1.65, 95% CI: 1.41-1.93,  $p < 0.001$ ). Frail patients also had increasing odds of adverse hospital discharge disposition with increasing MFI score (OR: 1.64, 95% CI: 1.59-1.70,  $p < 0.001$ ). Length of hospital stay increased from 5.38 days ( $\pm 6.0$  days) to 9.66 days ( $\pm 7.9$  days;  $p < 0.001$ ) while length of ICU stay increased from 4.0 days ( $\pm 4.3$  days) to 8.45 days ( $\pm 5.9$  days;  $p < 0.001$ ) between MFI score 0 and 0.45+. Hematologic complications (OR: 1.06, 95% CI: 0.96-1.17,  $p = 0.23$ ) and reoperations (OR: 1.17, 95% CI: 0.97-1.42,  $p = 0.10$ ) were not associated with frailty.

### Conclusion:

Frailty is a stronger predictor of 30-day mortality than age in elderly patients with pelvis, acetabular, and lower extremity trauma. Given the strength of association between frailty and postoperative complications, evaluation of patients based on a modified frailty index can provide an effective and robust risk assessment tool to more appropriately counsel patients and direct inter-disciplinary care.

Thank you for attending the 2016 Day of Trauma  
and we look forward to seeing next year!

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