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Neurotrauma and Critical Care Sessions at 2017 CNS Annual Meeting

Chair's Message



Dear Members of the American Association of Neurological Surgeons (AANS)/Congress of Neurological Surgeons (CNS) Section on Neurotrauma and

Critical Care:

The section leadership has been working on your behalf to carry out our mission of improving care of our patients by providing education, advocacy and encouraging research.

The section has provided educational opportunities for obtaining neurotrauma credits needed to fulfill American College of Surgeons (ACS) requirements for neurosurgeons providing coverage at Level I & II trauma centers. At the 2017 AANS Annual Scientific Meeting in Los Angeles this spring, we coordinated the pre-meeting International Symposium at the invitation of Jacques Morcos, MD, FAANS, in cooperation with counterparts from the Asian Australasian Society of Neurological Surgeons (AASNS) and the European Association of Neurosurgical Societies (EANS). The neurotrauma session, chaired by Ross Bullock, MD, PhD, and me, was outstanding. We heard neurotrauma surgeons from around the world give their perspectives on the global impact and therapeutics needs. Of note, it was an honor to introduce Franco Servadei, MD, who is the first neurotrauma surgeon to be president of the World Federation of Neurosurgical Societies (WFNS). The discussion included a compelling exchange on the bioethics of neurotrauma. Giving bad news is the worst part of our jobs no matter where you practice, but perhaps even more painful when the surgeon knows that with some more resources their patient did not have to suffer so.

The section meeting at the AANS was replete with impressive Presentations – especially the “data blitz” where the researcher, often a student, basically has two minutes (an “elevator speech”) to summarize their work. Way cool! I was honored to introduce the Tator Lecture given by Stephen Papadopoulos, MD, FAANS(L), on promising treatment for spinal cord injury.

The National Neurotrauma Society (NNS) Meeting has become the de facto “summer meeting” of the section. This year, the 35th annual symposium, was held in Snowbird, Utah. The president, Candice Floyd, and our own Uzma Samadani, MD, PhD, FAANS, liaison, and Greg Hawryluk, MD, FAANS, local chair, put together one of the best meetings I have attended. The Women in Neurosurgery (WINS) had a pre-meeting where the AANS President-elect, Shelly Timmons, MD, PhD, FAANS, gave a thought-provoking talk on unconscious bias. Fortunately, I am mindful of all my biases. Four luminaries of neurotrauma research, John Polvishock; Ed Hall, PhD; Al Faden; and Wise Young, MD, PhD, gave keynote addresses covering their perspectives on basic neurotrauma research over the last 40 years. The good news? Dr. Young has a clinical protocol of umbilical cord stem cell transplantation and intense post-op physical therapy that has had some ASIA A paraplegics walking (see Aug 2016 *Cell Transplantation*)! I earned 25 neurotrauma credits and enjoyed every moment. Treat yourself to the next NNS meeting, held in conjunction with the International Neurotrauma Society, in Toronto, August 2018.

At the NNS meeting in Utah, Dr. Hawryluk hosted the first work group to devise practical decision support (an algorithm) based on the 4th Edition of the Guidelines for the Management of Severe TBI. Randy Chesnut was the keynote speaker. He crystalized many of our thoughts, stating that although the methodology for the

guidelines is “pure,” they are difficult to put into practice. The analogy he gave was putting 40-year-old scotch in a still to produce pure ETOH. The result is “pure but unpalatable.” Though Geoff Manley, MD, PhD, FAANS, and I prefer bourbon, we got the point. We have put together a task force with broad representation from all stakeholders to address this issue. Stay tuned.

Jamie Ullman, MD, FAANS, Immediate Past Chair, spearheaded a group that drafted a position statement on motorcycle helmet use. It is now AANS policy. I encourage you to check it out on the AANS website – it’s a good, concise statement on why motorcyclists should wear helmets (you neurosurgeons know who you are – let those who pay the bills decide!) Thanks to Debby Gerhardtstein and ThinkFirst for their help on this project.

Also check out the “Members Only” section of the Neurotrauma website. You can download a number of state-of-the-art presentations or images for your use. I only ask you to acknowledge the help of the author (mostly Martina Stippler, MD, FAANS) and the section. If you have trouble logging on, and I did, contact Kristin Zerfas (kfz@aans.org) and she will fix you up.

Some science: recently I read an article on the bioethical

implications of brain-machine interface. This has important potential for our patients (Clausen, et al. *Science*:356, 1338-1339, 2017). Consider the quadriplegic being able to direct prosthetics with thoughts, or even the unfortunate survivors of hemispherectomy in persistent vegetative state (PVS) being able to communicate using BMI. This is not science fiction, but a reality we must grapple with now, especially concerning the bioethical dimension.

Finally, I want to thank the financial supporters of the section, especially Codman, Integra, AOSpine and AONeuro. Unfortunately, times are changin’ and budgets to support our mission are becoming tighter. The impending acquisition of Codman Neuro by Integra and the dissolution of AONeuro (say it ain’t so) will likely result in less funding to our section. Your leadership is committed to maintaining our mission, even if the margin is slim. I am, as always, personally grateful for your membership.

Best,
Daniel B. Michael, MD, PhD, FACS, FAANS
Chair, AANS/CNS Neurotrauma and Critical Care Section



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Surgeons

AANS/CNS Section On
**NEUROTRAUMA &
CRITICAL CARE**



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PLEASE EMAIL KRISTIN ZERFAS AT kmz@aans.org
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AANS/CNS Section on Neurotrauma and Critical Care Subcommittee Update

Website committee update by Martina Stippler MD, FAANS

We started a member corner on the AANS/CNS Section of Neurotrauma and Critical Care webpage. Presentations on concussion, TBI treatment, 2016 Brain Trauma Foundation guidelines and many more relevant topics to neurosurgeons are available for download. All members should have received an email with their login information.

International Committee update by Andres Rubiano, MD

The international committee is supporting and actively involved in international activities of the World Federation of Neurosurgical Societies (WFNS) with the aim of improving neurotrauma care in developing countries.

Domenic Esposito, MD, FAANS(L), and Andres Rubiano, MD, are working on the project, “Stratification of TBI Guidelines According to Different Levels of Resources,” promoted by the WFNS and the Emergency and Essential Surgical Care Program of the World Health Organization (WHO). Previous work of section members developing TBI care guidelines in India and Colombia have been used as the basis for the adaptation of the AANS/CNS/Brain Trauma Foundation (BTF) guidelines in areas with fewer resources. This concept model will be moving forward soon to other neurosurgical diseases, like hydrocephalus and stroke with the support of Robert Dempsey, MD, FAANS, chair of the WFNS Coordinating Committee for International Initiatives.

Additionally, the section will be involved in a recent international project, lead by Cambridge University’s Peter Hutchinson, PhD, FRCS, called “NIHR Global Health Research Group on Neurotrauma.” This project will be focused on identifying the patient pathway and promoting strategies to improve the prevention, diagnosis, treatment and outcome of TBI patients in LMICs. The project will be performing on-site research in Asia and Latin America in order to establish an international network for TBI research in low-resource environments.

Publication Committee update by Martina Stippler MD, FAANS

The Publication Committee is soliciting submission and content ideas for the Spring 2018 issue. Please send any suggestions to mstippler@bidmc.harvard.edu.

BTF Committee by Gregory Hawryluk MD, FAANS

The Brain Trauma Foundation (BTF) continues to be very active. Following close on the heels of the new adult guidelines, the group is working on an update of the pediatric and pre-hospital guidelines. Consistent with the planned transition to living guidelines, an update of the decompressive craniectomy chapter of the adult guidelines is planned, which will incorporate the recently published RESCUEICP study. Work on this update will commence in the near future. The BTF is also exploring ways of strengthening its ties with the AANS/CNS Section on Neurotrauma and Critical Care. This may involve guidelines development and dissemination initiatives.

Lastly, the BTF has agreed to partner with the AANS/CNS Section on Neurotrauma and Critical Care to lead the development of an updated TBI treatment algorithm. This project is currently in the planning stages.

Award committee update by Eve Tsai, MD, PhD, FAANS

The 2016-2017 Codman Fellowship Award went to Jacob Joseph, MD, from the University of Michigan for his project entitled “Evaluating neurocognitive impairment and serum biomarkers of mild traumatic brain injury in high school football athletes with high acceleration head impact.” His supervisors are Paul Park, MD, FAANS, and Steven Broglio, MD.

The ThinkFirst Award winner was Brian Sindelar, MD, for his abstract entitled, “Internal Jugular Vein Compression: A Novel approach to mitigate blast induced hearing injury.”

The Fellowships and Awards Committee included: David Okonkwo, MD, PhD, FAANS; Jamie Ullman, MD, FAANS; Craig Rabb, MD, FAANS; and Eve C. Tsai, MD, PhD, FAANS. The section would like to thank Codman and ThinkFirst for their generous support of these awards.



Anticoagulation Reversal in Severe or Life-Threatening CNS Injury

James M. Wright, MD, and Alan Hoffer, MD, FAANS
University Hospitals Cleveland Medical Center, Cleveland, Ohio
Case Western Reserve University



Reversal of anticoagulation for surgical urgencies and emergencies has always been a significant challenge to the surgeon. In the past, when warfarin was the near-universal anticoagulant, fresh frozen plasma (FFP) was used to reverse the coagulopathy. New anticoagulants, such as the direct thrombin inhibitors and factor Xa inhibitors, increasingly used for their ease of compliance and therapeutic dosing, do not respond to FFP, necessitating the development of new reversal strategies and medications. Now also for warfarin, there are improved treatment options that decrease the time of reversal and avoid the complications of blood-type matching. Below is our protocol for reversal of anticoagulation.

Warfarin

IV Vitamin K 10mg every 8 hours until INR < 1.5
AND

Prothrombin Complex Concentrate (4-Factor)

- INR 2-3.9: 25 international units/Kg (Maximum 2500U) once
- INR 4-6: 35 international units/Kg (Maximum 3500U) once
- INR > 6: 50 international units/Kg (Maximum 5000U) once

Existing Heparin Allergy

- 3-Factor PCC +/- FFP (10-15mL/Kg)
- OR
- rFVIIa: 20-40mcg/Kg (Single Bolus)

Intravenous Heparin: Protamine: IV, Slow injection, 5mg/Minute (Maximum 50mg/10Min)

Time Since Administration:

- Immediate (based on prior 3 hour heparin dose total): Protamine 1mg per 100U Heparin received
- 30-90 Minutes: Protamine 0.5-0.75mg per 100U Heparin received
- 90 Minutes: Protamine 0.25-0.375 per 100U Heparin received

Subcutaneous (Therapeutic) Heparin

Protamine 1.0-1.5 mg per 100U Heparin received.

First dose 25-50mg slow IV infusion, followed by remaining dose over 8-16 hour continuous infusion



Enoxaparin: Protamine: IV, slow injection, 5mg/Minute (Maximum 50mg/10Min)

Time Since Administration:

- <8 hours: 1mg per 1 mg enoxaparin administered
- 8-12 hours: 0.5 mg per 1 mg enoxaparin
- >12 hours: Not recommended

Parenteral Direct Thrombin Inhibitors [Argatroban, Bivalrudin]

Maintain Diuresis (Especially with Bivalrudin)

Fresh Frozen Plasma (may antagonize thrombin inhibition)

Oral Direct Thrombin Inhibitors [Dabigatran]

- Ingestion within 2 hours presentation: Activated Charcoal
- Ingestion within 24 hours presentation: Idarucizumab 5Gm IV in two 2.5Gm doses, administered within 15min apart

Oral Factor Xa Inhibitors*

- Apixapan: Ingestion within 2-6 hours: Activated Charcoal
- Edoxaban: Ingestion within 1 hour: Activated Charcoal
- Rivaroxaban: Ingestion within 1 hour: Activated Charcoal

Parenteral Factor Xa Inhibitors* [Fondaparinux]:

none available

*There is currently a multi-center, randomized, prospective study evaluating a factor Xa decoy molecule to treat coagulopathies from factor Xa inhibitors.

Challenging Cases of Penetrating Brain Injury

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Introduction

Penetrating brain injury (PBI) presents a unique challenge to neurosurgeons. These injuries are far less common than closed head injuries, but they carry a higher mortality rate (1). Up to 71 percent of victims die at the scene, and up to 51 percent of those that reach the hospital expire. Reports indicate that less than 20 percent of victims will receive neurosurgical treatment (3).

General concepts

The initial approach to these patients follows the general management of all trauma patients, including stabilization of the airway, breathing and cervical spine. Circulatory status Traumatic coagulopathy is a known sequela of penetrating head injury, so coagulation laboratory studies are appropriate as well. A detailed neurologic exam and imaging are then obtained once resuscitation is completed. Computed tomography (CT) scan is the primary modality used in the imaging of PBIs.

Multiple studies have identified factors that are associated with poor outcomes in the PBI population. These factors include post-resuscitation Glasgow Coma Scale (GCS) score of less than 5, dilated/unreactive pupils, occipital entry wound, brainstem injury, high-velocity missile injury, hypotension on admission, major vascular injury, onset of diabetes insipidus, suicide attempt, increased retrieval time, advanced age and coagulopathy.

Vascular imaging either with CT angiogram (CTA) or catheter angiography is recommended in those at high risk of vascular injury based on the projectile trajectory. Our practice is to obtain a CTA at the time of first CT as the rate of vascular complications ranges from 5 to 40 percent. These complications include traumatic intracranial aneurysm, arteriovenous fistula, subarachnoid hemorrhage (SAH) and vasospasm.

Infections are associated with increased morbidity and mortality in PBI patients. Infections can be categorized into local wound infection, meningitis, ventriculitis or cerebral abscess formation. In the pre-antibiotic age, infection rates were as high as 58.8 percent, but in more recent studies, after the use of broad spectrum antibiotics, the rate of infection is thought to be 1 to 5 percent.

Much controversy remains over the use of antibiotic prophylaxis in PBIs. Not only is there a lack of evidence in support for

the use of antibiotics, there is also a lack of consensus on what antibiotics to use. Recent studies by Kaufman (4) and Liebenburg (5) showed that cephalosporins are the most commonly used antimicrobial for prophylaxis. The Working Party of British Society for Antimicrobial Therapy developed guidelines detailing antimicrobial prophylaxis in PBI. Their recommendations include: Augmentin 1.2g q8h, or IV cefuroxime 1.5g then 750mg q8h with IV metronidazole 500mg q8h for five days after the injury. Others recommended an antibiotic course of at least seven to 14 days. We administer antibiotics, but our duration of treatment is determined by the extent of contamination, ranging from perioperative (one day) to seven days.

Cerebrospinal fluid (CSF) leakage is a well-defined complication of PBI with incidence reported to be as high as 28 percent (6). CSF leakage can occur through the entry or exit site but also through the ear or nose depending on the integrity of the skull base (1).

Surgical Interventions and Cases

Case 1: The Difficult Wound (Figure 1): This is a 75-year-old male with a self-inflicted gunshot wound to the head. He was following commands but required a craniotomy for debridement. Preoperatively, there was significant concern for soft tissue coverage. Research has recommended immediate intervention to reduce the risk of infection (6). In cases of injury to open air sinuses, a water tight dural closure decreases that rate of fistula and abscess formation (1). Most wounds may be closed primarily with a variety of techniques including undermining, galeal scoring and relaxing incisions. When possible, the open wound should be incorporated into the incision itself or a large flap surrounding the incision should be used. When necessary, a plastic surgeon may be utilized if grafts or flaps are needed. In this particular case, a primary closure by the neurosurgeon was possible despite the concerning preoperative appearance.

Case 2: Deep Debris (Figure 2): This is a 35-year-old male with a gunshot wound to the head. The soft tissue injury was without gross contamination or debris. He was neurologically intact. We performed a focal craniectomy with titanium mesh cranioplasty without removal of the deep bony and metallic debris. The routine removal of bone fragments and bullet fragments distant from the surgical site is not recommended. The practice of removing these fragments has been shown to reduce the rate of posttraumatic epilepsy, but has also been shown to increase the morbidity and mortality (1). Rosenfeld et al. created a list of factors that are indicators of fragment removal (7). These include, superficial location, heavy metal toxicity, large fragment in the ventricle or cistern, mobile fragment with intermittent hydrocephalus or close relationship to large blood vessels.

continued on page 6

Case 3: Post-traumatic Pseudoaneurysm (Figure 3): This is an 18-year-old female with multiple gunshot wounds, including the head. On exam, she was localizing on the left with withdraw on the right. She had a CT with CT angiogram that demonstrated a pseudoaneurysm as it is our practice to obtain vascular imagery for all penetrating trauma. This was treated with endovascular obliteration, followed by hemicraniectomy for cerebral edema. Traumatic intracranial aneurysm (TICA) is the most common vascular injury following PBI with an estimated incidence of 20 to 50 percent, with the peripheral MCA and ACA branches being the most vulnerable. Once these injuries are identified, they should be treated either endovascularly or through open surgery, but given the nature of the injury, open surgery typically requires trapping or ligation of the damaged segment, secondary to fragility of the vessel. If open surgical treatment is planned, exposure of the cervical carotid should be considered.

Case 4: Hemispheric Injury (Figure 4): This is a 19-year-old male with a gunshot wound to the face. He is localizing on the left with no movement on the right. The surgical management occurs along a gradation based on the severity of the injury. For example, the patient may require simple local debridement with closure of the superficial wound if the patient is awake, or an extensive decompressive craniectomy with possible removal of bone and bullet fragments, evacuation of hematoma and/or placement of intracranial pressure (ICP) monitor (7) may be needed for comatose patients. As this patient had sizeable diffuse hemorrhage and cerebral edema, a large hemicraniectomy with minimal brain debridement was performed.

Case 5: Skull Base Injury with Cerebrospinal Fluid Leakage (Figure 5): This is a 21-year-old female with self-inflicted gunshot wound to the temple. She was neurologically intact except for blindness. She was initially managed with lumbar drain, but when the leak recurred, a bicoronal craniotomy with cranialization of the sinus and repair of the anterior skull base with bone graft and pericranium was performed. The presence of CSF leak has a strong effect on the morbidity and mortality of PBI patients. Meirowsky et al. reported the rate of infection to be 49.5 percent in those with CSF fistula versus 4.6 percent in those without CSF fistula (8). Although transient CSF diversion may be attempted, open surgical obliteration of the fistula is often necessary.

Conclusion

PBI is a complex and challenging area of management for neurosurgeons. Unfortunately, there remains little quality evidence guiding the management of these patients. We present general considerations pertaining to penetrating brain trauma as well as complex cases experienced at our institution.

Work Cited

1. Esposito, D. P., & Walker, J. B. (2009). Contemporary Management of Penetrating Brain Injury. *Neurosurgery Quarterly*, 19(4), 249-254.
2. Joseph, B., Aziz, H., Pandit, V., Kulvatunyou, N., Okeeffe, T., Wynne, J., . . . Rhee, P. (2014). Improving Survival Rates after Civilian Gunshot Wounds to the Brain. *Journal of the American College of Surgeons*, 218(1), 58-65.
3. Aarabi, B., Tofghi, B., Kufera, J.A., Hadley, J., Ahn, E.S., Cooper, C., . . . Uscinski, R.H. (2014). Predictors of outcome in civilian gunshot wounds to the head. *Journal of Neurosurgery* 120(5), 1138-1146.
4. Gönül, E., Erdoğan, E., Taşar, M., Yetişer, S., Akay, K. M., Düz, B., . . . Timurkaynak, E. (2005). Penetrating orbitocranial gunshot injuries. *Surgical Neurology*, 63(1), 24-31.
5. Kim, T.W., Lee, J.K., Moon, K.S., Kwak, H.J., Joo, S.P., Kim, J.H., & Kim, S.H. (2007). Penetrating gunshot injuries to the brain. *Journal of Trauma* 62(6), 1446-1451.
6. Kim, K. A., Wang, M. Y., Mcnatt, S. A., Pinsky, G., Liu, C. Y., Giannotta, S. L., & Apuzzo, M. L. (2005). Vector Analysis Correlating Bullet Trajectory to Outcome after Civilian Through-and-Through Gunshot Wound to the Head: Using Imaging Cues to Predict Fatal Outcome. *Neurosurgery*, 737-747.
7. Rosenfeld, J. V. (2002). Gunshot injury to the head and spine. *Journal of Clinical Neuroscience*, 9(1), 9-16.
8. Kaufman, H. H., Makela, M. E., Lee, F. K., Haid, R. W., & Gildenberg, P. L. (1986). Gunshot Wounds to the Head: A Perspective. *Neurosurgery*, 18(6), 689-695.



Figure 1: Open wound following gunshot injury to the head

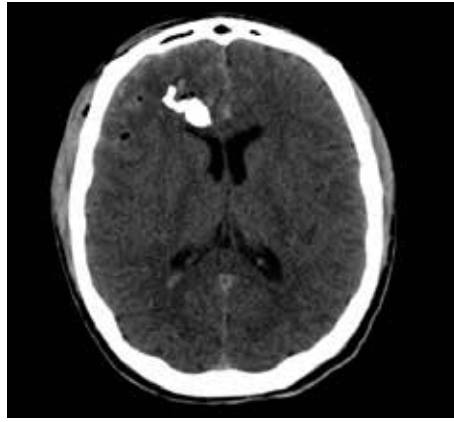
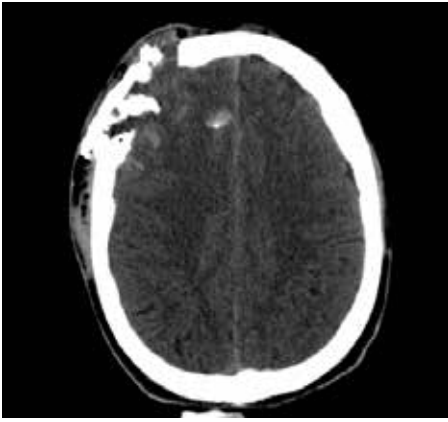


Figure 2: CT brain demonstrating deep debris following gunshot wound to the head.

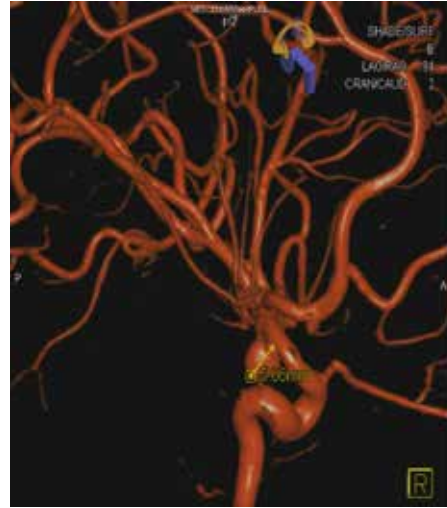
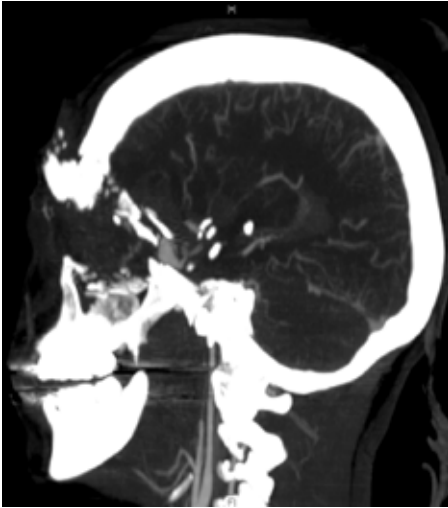


Figure 3: CT angiogram and conventional angiogram three dimensional reconstruction

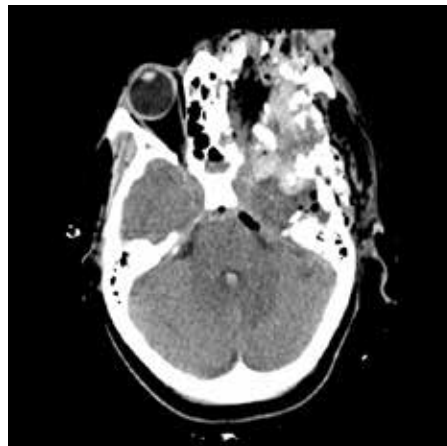


Figure 4: CT of the head and face with left sided face and hemispheric injury

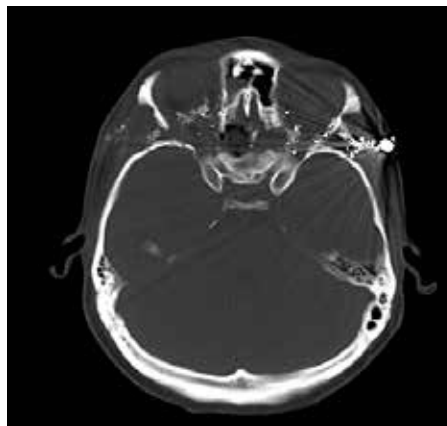


Figure 5: CT of the head with bone windows demonstrating a gunshot wound with destruction of the anterior skull base



Dear AANS/CNS Neurotrauma and Critical Care Section Supporters:

This is to announce the establishment of an “Honor Your Mentor” fund in honor of one of the true pioneers in neurotrauma research, Anthony Marmarou, PhD. Marmarou’s seminal work in the physiology of brain edema and intracranial pressure form the foundations of treatment of traumatic brain injury and other neurological diseases in common use today.

I established this fund because Marmarou was not only an outstanding scientist, but he was also responsible for welcoming so many burgeoning neurotraumatologists into the field. His intelligence, vision and enthusiasm for improving the treatment of traumatic brain injury patients was matched only by his warmth, humor and desire to educate and foster the careers of young people in the field. He meant a great deal to me and many of my colleagues who were lucky enough to consider him a colleague and a friend. A complete biography of Marmarou is posted at <http://www.nref.org/en/Honor-Your-Neurosurgical-Mentor/Anthony-Marmarou-Fund>.

The fund will be used for a two-fold purpose: 1.) To fund the annual Anthony Marmarou Lectureship to be held at the AANS Annual Scientific Meeting during the Section on Neurotrauma and Critical Care scientific session, and 2.) To fund young investigator research in intracranial pressure and cerebral edema management and physiology.

The Neurosurgery Research and Education Foundation (NREF) is a not-for-profit 501 (C)(3) organization, created in 1980 by the American Association of Neurological Surgeons (AANS) to support research and educational efforts in neurosurgery. The NREF is dedicated to providing education to neurosurgeons at all stages of their careers, as well as funding research into new and existing neurosurgical treatments, in order to identify links between best practices and improved outcomes in patient care.

Any donation amount is welcomed and thank you for considering. Please visit our section webpage at <http://www.neurotraumasection.org> or the NREF website to contribute!

Shelly D. Timmons, MD, PhD, FACS, FAANS

Professor of Neurosurgery

Vice Chair for Administration

Director of Neurotrauma

Penn State University Milton S. Hershey Medical Center

Past President AANS/CNS Section on Neurotrauma and Critical Care

Neurotrauma and Critical Care Sessions at 2017 CNS Annual Meeting

Saturday, October 7, 2017

12:30 - 4:00 p.m.

PC13: Sports Concussions: Acute Management, Return to Activity and Possible Short and Long Term Sequelae

Course Directors: Domenic P. Esposito, David O. Okonkwo

Faculty: Robert C. Cantu, Ann McKee, Allen K. Sills, Philip E. Stieg, Shelly D. Timmons

Course Description: This course is designed to allow the practicing neurosurgeon, as well as the neurotraumatologist, to review older as well as more recent definitions and concepts of the concussed athlete. Attention will be paid to the common, as well as less common activities associated with these injuries. Classic and more recent concepts for the return to limited and full activities following one or more concussive or sub-concussive episodes will be presented. The extensive Boston University Brain experience will be presented by the investigators from both a pathological as well as clinical perspective. The spectrum of disorders from transient and resolving, to more persistent and refractory as well as delayed long term diseases thought to be related to repetitive injury will be critically analyzed. Multiple neurosurgeons with extensive clinical experience ranging from youth athletics, to the professional athlete will share their experience and recommendations. Finally, standard approaches, as well as novel and experimental treatment options for the clinical care of these patients will be outlined. The basic necessities for the development of a "Concussion Center" will be discussed.

Learning Objectives: Upon completion of this course, participants will be able to:

- Review the mechanisms, pathophysiology, and acute management of sports concussions.
- Understand the timing and conditions for return to limited and full activities following one or more concussions.
- Understand the possible short and long term consequences of single and multiple concussive and sub-concussive injuries, as well as standard and novel treatment modalities for these conditions.

Sunday, October 8, 2017

8:00 - 11:30 a.m.

PC21: Spinal Trauma: Case-based Presentations and Guidelines Update

Course Director: Michael G. Fehlings

Faculty: Bizhan Aarabi, Andrew T. Dailey, Sanjay S. Dhall, James S. Harrop, Daniel J. Hoh, Paul K. Kim, Allan D. Levi, Patrick R. Pritchard

Course Description: Use case-based learning to describe the diagnosis and treatment of cervical, thoracic and lumbar trauma and spinal cord injury.

Learning Objectives: Upon completion of the course, participants will be able to:

- Discuss techniques and approaches to treat spinal trauma.
- Discuss guidelines for spinal trauma and spinal cord injury treatment.
- Identify and avoid common complications associated with thoracolumbar and cervical deformity.

8:00 a.m. - 4:00 p.m.

SYM3: Neurocritical Care and Neurosurgical Emergencies Update

Course Directors: Kathryn M. Beauchamp, Jamie S. Ullman,

Speakers: Kathryn M. Beauchamp, Michael Finn, Alia M. Hdeib,

Alan S. Hoffer, Gregory Kapinos, Joshua E. Medow, Ramesh C.

Mishra, Gregory J. Murad, Craig H. Rabb, Patricia B. Raksin, Gary

T. Schwartzbauer, Eve C. Tsai, Jamie S. Ullman

Course Description: This symposium provides a forum for attendees to obtain the latest information about current management of neurosurgical emergencies and common neurocritical care scenarios. Management of brain and spine injuries will be discussed as well as issues related to spinal tumor and infections. This symposium features interactive case presentations of common scenarios encountered in an emergency neurosurgical practice.

Learning Objectives: Upon the completion of this course, participants will be able to:

- Review current recommendations for treatment of traumatic brain injury.
- Apply recent literature to the management of spinal infections and spinal tumors.
- Interpret recent clinical trials evaluating surgical decompression for intracranial hypertension.
- Discuss common systemic complications after neurologic injury.

8:00 - 8:15 a.m.

Introduction

Kathryn M. Beauchamp, Jamie S. Ullman

8:15 - 9:30 a.m.

Didactic Session 1

8:15 - 8:30 a.m.

Seizures and Status Epilepticus

Joshua E. Medow

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8:30 - 8:45 a.m.

Intracranial Hypertension

Gregory J. Murad

8:45 - 9:15 a.m.

Tools of the Trade: Neuromonitoring

Gregory Kapinos

9:15 - 9:30 a.m.

Discussion of Cases

9:30 - 10:00 a.m.

Beverage Break with Corporate Sponsor

10:00 - 11:30 a.m.

Didactic Session 2

10:00 - 10:15 a.m.

Head Injury in Polytrauma

Patricia B. Raksin

10:15 - 10:30 a.m.

Pulmonary Complications of Neurological Injuries

Alan S. Hoffer

10:30 - 11:00 a.m.

On-Call Support Group: Small Group Discussions About On-Call Experiences

11:00 - 11:30 a.m.

Discussion of Cases

11:30 a.m. - 12:00 p.m.

Beverage Break with Corporate Sponsor

12:00 - 12:45 p.m.

Lunch

12:45 - 2:15 p.m.

Didactic Session 3

12:45 - 1:00 p.m.

Prehospital Management of TBI

Gary T. Schwartzbauer

1:00 - 1:15 p.m.

Traumatic Intracranial Hemorrhages

Eve C. Tsai

1:15 - 1:30 p.m.

Neurotrauma in India

Ramesh C. Mishra

1:45 - 2:15 p.m.

Discussion of Cases

2:15 - 2:45 p.m.

Beverage Break with Corporate Sponsor

2:45 - 4:00 p.m.

Didactic Session 4

2:45 - 3:00 p.m.

Spine Trauma

Craig H. Rabb

3:00 - 3:15 p.m.

Tumors and Infections of the Spine

Alia M. Hdeib

3:15 - 3:45 p.m.

Tools of the Trade: Spinal Instrumentation - Open and Percutaneous

Michael Finn

3:45 - 4:00 p.m.

Discussion of Cases

Monday, October 9, 2017

7:00 - 8:30 a.m.

Guidelines on Neurotrauma Update

Moderator: Odette Harris

Speakers: Sanjay S. Dhall, Deepak K. Gupta, Gregory W.J. Hawryluk, Mark R. Proctor, Patricia B. Raksin, Timothy C. Ryken

Course Description: The latest updates in Guidelines for Neurotrauma will be discussed. All neurosurgeons should be knowledgeable of the recent updates. Authors will present key elements in order to fully equip you with what you need to know, and a panel of experts will comment on the guidelines for further perspective. Don't miss out on this chance to get an essential summary and expert perspective on these guidelines.

Learning Objectives: Upon completion of this course, participants will be able to:

- Discuss current management guidelines regarding ICP monitoring for severe traumatic brain injury.
- Review current management guidelines regarding hypothermia for severe traumatic brain injury.
- Discuss current management guidelines regarding thresholds for surgery for severe traumatic brain injury.
- Determine current management guidelines regarding DVT prophylaxis for severe traumatic brain injury.
- Apply these guidelines in their management of patients with neurotrauma.

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- Analyze the most up-to-date guidelines on traumatic brain injury.

7:00 - 7:15 a.m.

Traumatic Brain Injury (Surgical)

Gregory W.J. Hawryluk

7:15 - 7:30 a.m.

Traumatic Brain Injury (Non-surgical)

Patricia B. Raksin

7:30 - 7:45 a.m.

Traumatic Brain Injury (Pediatric)

Mark R. Proctor

7:45 - 8:00 a.m.

Cervical Spine

Sanjay S. Dhall

8:00 - 8:15 a.m.

Thoracolumbar Spine

Timothy C. Ryken

8:15 - 8:30 a.m.

International Practices

Deepak Kumar Gupta

12:15 - 1:45 p.m.

Lunch Seminar M10: Diagnosis and Management of Concussion and Athletic Clearance

Moderator: Kerry E. Brega

Faculty: Julian E. Bailes, Michael L. Levy, David O. Okonkwo, Chad J. Prusmack

Learning Objectives: Upon completion of this course, participants will be able to:

- Analyze guidelines for diagnosis and management of sports concussion.
- Evaluate newest technology for concussion testing in athletes.
- Evaluate the latest guidelines for return to play / school after sports concussion.
- Examine how multidisciplinary teams can create systems to treat athletes with TBI.

2:45 - 4:15 p.m.

Section on Neurotrauma and Critical Care

Moderators: Kathryn M. Beauchamp, Gary T. Schwartzbauer

Speakers: Rocco Armonda, Kathryn M. Beauchamp, Deepak K. Gupta, Allan D. Levi, Daniel B. Michael, David O. Okonkwo, Martina Stippler, Shelly D. Timmons

Learning Objectives: Upon completion of this course, attendees will be able to:

- Define the considerations for decompressive craniectomy in the traumatic brain injury patient.
- Analyze the indications for hypothermia in the brain injury population.
- Compare and contrast the treatment of brain injury in the US and India.

2:45 - 2:48 p.m.

Introduction of Marmarou Lecturer

Kathryn M. Beauchamp

2:48 - 3:18 p.m.

Marmarou Lecturer: Mechanisms of TBI: Can We Learn the Meaning of the Message by Studying the Chemistry of the Ink?

Daniel B. Michael

3:18 - 3:34 p.m.

Debate: Decompressive Craniectomy: Is It Over?

3:18 - 3:26 p.m.

Yes, It's Over

Martina Stippler

3:26 - 3:34 p.m.

No, It's Not Over

Shelly D. Timmons

3:34 - 3:50 p.m.

Debate: Hypothermia in Neurotrauma: Past or Future?

3:34 - 3:42 p.m.

Past

David O. Okonkwo

3:42 - 3:50 p.m.

Future

Allan D. Levi

3:50 - 4:05 p.m.

Traumatic Brain Injury

Rocco Armonda

4:05 - 4:15 p.m.

Neurotrauma in India

Deepak Kumar Gupta

4:15 - 6:15 p.m.

Case-based Discussion Session - Traumatic Brain Injury

Moderator: Jamie S. Ullman

Faculty: Randy S. Bell, Odette Harris, Gregory W.J. Hawryluk, Daniel B. Michael, Uzma Samadani, Eve C. Tsai

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Learning Objectives: Upon completion of this course, participants will be able to:

- Discuss various treatment options for the management of traumatic brain injury.
- Strategize how to identify and avoid complications in surgery for traumatic brain injury.
- Discuss new technologies and monitoring for traumatic brain injury.

Tuesday, October 10, 2017

12:15 - 1:45 p.m.

Lunch Seminar T24: Managing ICP in the Trauma Patient

Moderator: Ryan S. Kitagawa

Faculty: Randy S. Bell, Jamshid Ghajar, Martin C. Holland, Gregory J. Murad

Learning Objectives: Upon completion of the course, participants will be able to:

- Discuss the utility of multimodal monitoring in the management of patients with elevated ICP.
- Review the non-surgical interventions such as hyperosmolar therapy and perfusion augmentation.
- Analyze the data for surgical decompression of intracranial hypertension.

2:45 - 4:15 p.m.

Section on Neurotrauma and Critical Care

Moderators: Odette Harris, Craig H. Rabb

Learning Objectives: Upon completion of this course, participants will be able to:

- Analyze the findings of novel neurosurgical studies; critique the design and methodology of these studies.
- List important areas for further knowledge development and research.
- Identify important ongoing clinical trials.
- Apply lessons from areas of active clinical research to their management of spinal disease patients.

2:45 - 4:15 p.m.

Oral Abstract Presentations

2:45 - 2:51 pm

186 Predicting the Requirement for Intracranial Pressure Monitoring in Pediatric Traumatic Brain Injury

Saeed Kayhanian, Adam M.H. Young, Ross Ewen, Rory Piper, Mathew R. Guilfoyle, Joseph Donnelly, Helen M. Fernandes, Matthew Garnett, Peter Smielewski, Marek Czosnyka, Shruti Agrawal, Peter J. Hutchinson

2:51 - 2:57 p.m.

187 Early Post-traumatic Seizures are Associated with Valproic Acid Plasma Concentrations and UGT1A6/CYP2C9 Genetic Polymorphisms in Patients with Severe Traumatic Brain Injury

Yirui Sun, Jian Yu, Qiang Yuan, Jin Hu

2:57 - 3:03 p.m.

188 Predicting Post-traumatic Hydrocephalus: Derivation and Validation of a Risk Scoring System Based on Clinical Characteristics

Hao Chen

3:03 - 3:09 p.m.

189 Elevated Inflammation and Decreased Platelet Activity is Associated with Poor Outcomes After Traumatic Brain Injury

Cole T. Lewis, Jude P. Savarraj, Mary F. McGuire, H. Alex Choi, Ryan S. Kitagawa

3:09 - 3:15 p.m.

190 Time Course and Physiological Determinants of Cerebral Lactate/Pyruvate Ratio Following Traumatic Brain Injury

Mathew R. Guilfoyle, Ivan Timofeev, Adel Helmy, Keri Carpenter, David K. Menon, Peter Smielewski, Marek Czosnyka, Peter J. Hutchinson

3:15 - 3:21 p.m.

192 Craniotomy for Acute Subdural Hematoma—Outcomes in Patients Over 70 Years

Daniel R. Monsivais, Alexandra Fonseca, Ryan S. Kitagawa, Davis So, Melisa French, Chunyan Cai

3:21 - 3:27 p.m.

193 Does Stem Cell Therapy Hold Promise in the Management of Traumatic Brain Injuries? A Literature Review of Animal Studies

Ayaz M. Khawaja, Maira Mirza, Gabriel Rodriguez, Hassan Aziz

3:27 - 3:33 p.m.

194 Endoscopic-assisted Evacuation of Chronic Subdural Hematoma: A Paradigm Shift or a Waste of Time?

Netanel Benshalom, Sagi Harnof, Uzi B. David

3:33 - 3:39 p.m.

195 Chronic Traumatic Encephalopathy (CTE): Clinical and Pathological Insights

Domenic P. Esposito

3:39 - 3:45 p.m.

196 Meta-analysis of the Effect of Intracranial Infections on Morbidity and Mortality of Civilian Craniocerebral Gunshot Injuries

Georgios Maragos, Katharine M. Cronk, Efstathios Papavassiliou, James W. Holsapple, Aristotelis Filippidis

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3:45 - 3:51 p.m.

197 The Relative Odds of Sustaining a Sport-related Concussion: A Study of 12,320 Student-athletes

Benjamin L. Brett, Andrew W. Kuhn, Aaron M. Yengo-Kahn, Gary Solomon, Scott L. Zuckerman

3:51 - 3:57 p.m.

198 Outcomes Following Exploratory Burr Holes for Traumatic Brain Injury in a Resource-poor Setting

Jessica C. Eaton, Asma Bilal Hanif, Gift Mulima, Chifundo Kajombo, Anthony Charles

3:57 - 4:03 p.m.

199 Impact of Frailty on Complications in Patients with Thoracic and Thoracolumbar Spinal Trauma

Remi A. Kessler, Taylor E. Purvis, Rafael De la Garza Ramos, Ali K. Ahmed, C. Rory Goodwin, Daniel M. Sciubba

4:03 - 4:09 p.m.

200 A Retrospective Study of Thoracolumbar Burst Fractures Treated with Fixation and Non-fusion Surgery of Intra-vertebral Bone Graft Assisted with Balloon Kyphoplasty

Chengmin Zhang, Paul M. Arnold, Qiang Zhou

4:15 - 6:15 p.m.

Case-based Discussion Session - Thoracolumbar Spine

Moderator: James S. Harrop

Faculty: Paul M. Arnold, Jennifer S. Kang, Manish K. Kasliwal, Wilson Z. Ray

Learning Objectives: Upon completion of this course, participants will be able to:

- Discuss various treatment options for the management of thoracolumbar spine surgery.
- Describe common complications in surgery for thoracolumbar spine.
- Strategize how to identify and avoid complications in surgery for thoracolumbar spine.

Wednesday, October 11, 2017

12:15 - 1:45 p.m.

Lunch Seminar W33: Pediatric Head Trauma

Moderator: Mark R. Proctor

Faculty: Gerald A. Grant, Lauren F. Schwartz, Krystal L. Tomei

Learning Objectives: Upon completion of this course, participants will be able to:

- Identify unique challenges in pediatric patients who suffer head trauma.
- Outline the strategies for managing pediatric head trauma.
- Assess current practice standards and practical issues surrounding management of pediatric patients with head injury.



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Chair-elect: Julian Bailes (2016-18)

Secretary/Treasurer: David Okonkwo (2016-18)

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Nominating Committee: Geoffrey Manley

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AANS BOD: Jamie Ullman

Joint WC: Stacy Quintero-Wolf

QIW: Stacy Quintero-Wolf, Ben Rodgers, Chris Zacko

ACS/COT: Jamie Ullman (Chair, COT Neurosurgery Subspecialty Group)

National Neurotrauma Society: Geoffrey Manley

Spine Section: Paul Arnold

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Pediatric Section: Pending

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Physician Extenders: Twyila Lay, NP; Marianne Langlois, PA

SNS: James Ecklund

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