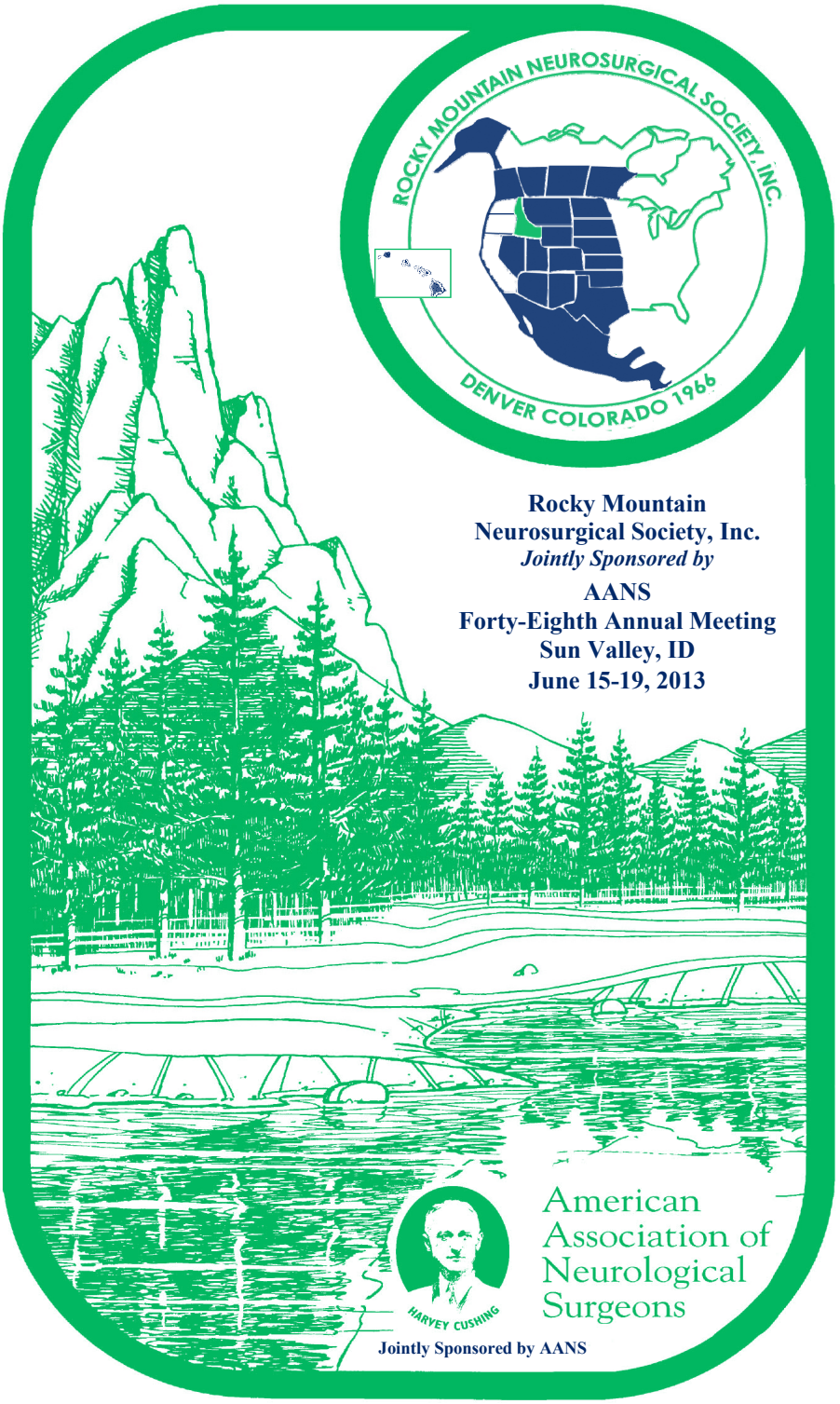

Rocky Mountain
Neurosurgical Society, Inc.
Jointly Sponsored by
AANS
Forty-Eighth Annual Meeting
Sun Valley, ID
June 15-19, 2013

American Association of Neurological Surgeons

Jointly Sponsored by AANS

www.rmns.org

PROGRAM

THE FORTY-EIGHTH ANNUAL MEETING

OF

THE ROCKY MOUNTAIN NEUROSURGICAL SOCIETY, LLC

American Association of Neurological Surgeons

Jointly Sponsored by AANS

Honored Guests:

Frederick F. Lang, Jr. MD

Jamie Ullman, MD

June 15-19, 2013
Sun Valley Resort
Sun Valley, ID

THE ROCKY MOUNTAIN NEUROSURGICAL SOCIETY, INC.

www.rmns.org

Founded 30 April, 1966, in Denver, Colorado
Incorporated 1974 in Houston, Texas

Officers and Executive Committee 2012-2013

President:	Stewart Levy, MD
President Elect:	Paul Elliott, MD
Vice President:	Paul A. House, MD
Secretary:	Richard A. A. Day, MD
Treasurer:	Kelly Schmidt, MD
Historian:	Albert H. Capanna, MD
Past President:	Randy L. Jensen, MD, PhD
Member at Large:	Yevgeniy Khavkin, MD

Committees 2012-2013

Scientific Program Committee:	Todd Hankinson, MD
Local Arrangements:	Randy L. Jensen, MD, PhD
Membership Committee:	Mark Robinson, MD (2013) Paul Elliott, MD (2014) Stewart Levy, MD (2015)
Nominating Committee:	Jonathan White, MD (2013) Michael Brown MD (2014) Randy L. Jensen, MD, PhD (2015)
CME Committee:	Brett Dietz, MD
Website Administrator:	Joel D. MacDonald, MD

MEETING AT A GLANCE

SATURDAY, JUNE 15, 2013

1:00 - 5:00 p.m.	Registration
1:00 - 4:00 p.m.	Executive Committee Meeting
6:30 - 9:30 p.m.	Opening Reception, Children's Fun Time

SUNDAY, JUNE 16, 2013

7:00 - 7:55 a.m.	Physician and Exhibitors Breakfast*
7:00 - 11:00 a.m.	Spouse and Children's Breakfast*
8:00 a.m. - 12:00 p.m.	**Scientific Session**
6:30 - 9:30 p.m.	Wagon Ride, Barbecue, Skeet Shoot

MONDAY, JUNE 17, 2013

7:00 - 7:55 a.m.	Physician and Exhibitors Breakfast*
7:00 - 11:00 a.m.	Spouse and Children's Breakfast*
8:00 a.m. - 12:00 p.m.	**Scientific Session**
12:30 – 6:00 p.m.	Golf Tournament -
6:30 - 10:00 p.m.	President's Dinner (Executive Board and Guest Speakers)

TUESDAY, JUNE 18, 2013

7:00 - 7:55 am.	Physician and Exhibitors Breakfast*
7:00 - 11:00 a.m.	Spouse and Children's Breakfast*
7:30 - 8:00 a.m.	*Annual Business Meeting*
8:00 a.m. - 12:00 p.m.	**Scientific Session**
12:30 - 4:00 p.m.	Tennis Tournament
6:30 - 10:00 p.m.	Annual Award Banquet and Dance
5:30 - 9:00 p.m.	Kids' Party

WEDNESDAY, JUNE 19, 2013

7:00-7:55 a.m.	Physician and Exhibitors Breakfast*
7:00-11:00 a.m.	Spouse and Children's Breakfast*
8:00 a.m.-12:00 p.m.	**Scientific Session**
12:00 p.m.	Meeting Adjournment

***Breakfast - Continental A Room** (Physician and Exhibitors/ Spouse and Children)

Resident Award

First place award for the best resident paper presented at the meeting now includes a $750 cash award. There will also be awards for second place ($500) and third place ($250) resident papers. Each of the first 10 residents to register will receive $500 travel reimbursement.

Academy Cup

Best paper from a practicing neurosurgeon (Active or Associate member).

Firing Line

Present cases for discussion with attendees.

Raffle

This year we will hold a raffle for a *brand new* **Mini iPad.** To enter the raffle you must submit your completed entry card by 12:00 Noon, Tuesday, June 18, 2013. Entry completion requires an exhibitor sign off from each booth.

The Sun Valley Resort

1 Sun Valley Road, Sun Valley, ID 83353

Tel. 208-622-4111

The 2013 Rocky Mountain Neurosurgical Society Meeting will be held from June 15th through June 19, 2013 at The Sun Valley Resort in Sun Valley, ID. Dr. Randy Jensen is serving as the local arrangements chairperson, and is putting together an exciting array of activities for members, guests, and their families. Sun Valley is a resort city in Blaine County in the central part of the U.S. state of Idaho, adjacent to the city of Ketchum, situated within the greater Wood River valley. The population was 1,406 at the 2010 census, down from 1,427 in 2000. The elevation of Sun Valley is 5,920 feet (1,804 m) above sea level. The area is served by Friedman Memorial Airport in Hailey, approximately 15 miles (24 km) south. Visitors to Sun Valley are relatively close to the **Sawtooth National Recreation Area**, accessed over Galena Summit on Highway 75, the Sawtooth Scenic Byway. The Sun Valley Inn is one of the oldest resorts in North America with a colorful history, full of regal and theatrical prestige. It was the first destination winter resort in the U.S. and was developed by **W. Averell Harriman**, the chairman of the Union Pacific Railroad. It was the success of the 1932 Winter Olympics in Lake Placid, New York, that spurred an increase in participation in winter sports (and alpine skiing in particular). A lifelong skier, chairman Harriman determined that America would embrace a destination mountain resort, similar to those he enjoyed in the Swiss Alps, such as St. Moritz and Davost. He also saw it as a unique way to increase ridership on U.P. passenger trains in the West. In 1935 Harriman hired **Count Felix Schaffgotsch**, to set out in search of the perfect spot for a grand American resort. Upon reaching the Ketchum valley, the Count was overwhelmed by the 4,300 acre area and wired his employer, saying: "This combines more delightful features than any place I have ever seen in Switzerland, Austria or the U.S. for a winter resort." The resort was an instant success. Local wildlife was seen sharing the mountain with European nobility and Hollywood royalty. **Clark Gable**, Errol Flynn, Claudette Colbert, Bing Crosby and Gary Cooper were all regulars in the lodge, while world champions including Don and Gretchen Fraser, Gracie Carter Lindley and Andy Hennig used the mountain for Olympic training. Many of their pictures are still posted in hotel hallways and are an interesting view for your after dinner stroll. **Ernest Hemingway's** time in Sun Valley began in 1939 when he came to the area after Union Pacific Railroad chairman invited Hemingway and other celebrities to Sun Valley. In the fall of 1939, he finished his novel For Whom the Bell Tolls. He worked on it while staying in suite 206 at the Sun Valley Lodge. After 1948, Hemingway stayed at the Ketchum Korral room 38, along State Highway 75 at the south end of town. Then known as MacDonald Cabins, Hemingway stayed while the Sun Valley Lodge was being used as a hospital by the Navy during World War II. In Ketchum, he often went to the Alpine Club (now Whiskey Jacques) and the Casino Club, which still exists on Main Street.

Social Highlights - All attendees, including exhibitors, are invited to our social program*.

Breakfast Daily at *Continental A*- 7:00– 11:00 AM

Opening Reception at *Limelight Terrace* - Saturday, June 15th, 2013

Western Barbecue at *Trail Creek Cabin* - Sunday, June 16th, 2013

Transport via Wagon Ride with Skeet Shoot Sun Valley Gun Club (12 and Older), Miniature Golf

Golf Tournament at *Trail Creek Course* - Monday, June 17th, 2013

Tennis Tournament at *Sun Valley Tennis* -Tuesday, June 18th, 2013

Annual Banquet Lodge *Terrace Duchin/ Lodge Dinning Room*, Tuesday, June 19th, 2012

Enjoy dinner, dancing, with awards and prizes for outstanding categories in our Golf and Tennis tournaments.

**Additional Fees Apply for all participants.*

LEARNING OBJECTIVES

Upon completion of this program, participants should be able to:

Scientific Session I

1. Identify the subset of patients with mild TBI and small intracranial hemorrhage that do not require transfer to a trauma center with neurosurgical capability.
2. Understand the criteria for safely selecting patients that do not require transfer to a trauma center with neurosurgical capability.
3. Understand the benefits of developing a non-transfer protocol for rural hospitals without neurosurgical capabilities, to select and manage patients with mild TBI and small ICH, in order to optimize safety, efficiency and resource utilization in the care of this subset of patients.
4. Better understand the surgical management strategies that exist today for treatment of frontal sinus fractures.
5. Recall the most common complications (short and long term) associated with frontal sinus fractures.
6. Understand that most patients with posterior wall frontal sinus fractures have similar post-operative complications and complication rates following cranialization versus a more conservative management of their fracture.
7. Understand the importance of helmet use and others risk factors for the outcome of patients with vehicular TBI.
8. Understand the risks of hemorrhage progression following PTP administration in patients with TBI.
9. Understand the increased risk of VTE when PTP is interrupted in patients with TBI.
10. Understand reasonable options for VTE prophylaxis in patients with hemorrhagic TBI.

Scientific Session II

1. Understand the causes and symptoms of hyperprolactinemia.
2. Understand the possible sequela of dopamine-agonist treatment of prolactinomas in the setting of pre-existing psychotic disorders.
3. Formulate neurosurgical treatment strategies in patients with prolactinomas and concurrent psychotic disorders.
4. Recognize the potential for perfusion MRI to predict intratumoral microenvironment.
5. Understand the role of tissue biomarker discovery and patient outcome.
6. Discuss the correlation of tissue biomarker information and DCE-MRI parameters.
7. Understand the clinical problem of pseudoprogression.
8. Describe a rodent model that can mimic this unique clinical situation.
9. Discuss potential imaging methods to differentiate pseudoprogression and true tumor progression.
10. Understand the reason for increased surgical risk for transsphenoidal surgery in growth hormone secreting pituitary adenoma patients compared to those with other pituitary adenomas.
11. Understand the different intracranial vascular anatomy in patients with acromegaly.
12. Be able to evaluate for fusiform dilatation of the cavernous carotid artery using coronal thin-cut magnetic resonance imaging.
13. Understand the increasing use of the intraoperative MRI.
14. Understand the increased utilization of different imaging modalities in intraoperative MRI.
15. Recognize the difference between intraoperative and postoperative imaging findings with the intraoperative MRI.

Scientific Session III

1. Understand the intellectual basis for ascribing patient symptoms to diagnostic findings.
2. Discuss the epidemiologic data regarding the association of low back pain with spondylolysis and isthmic spondylolisthesis.
3. Evaluate the empiric support for the hypothesis that spondylolysis and isthmic spondylolisthesis are causes of back pain.
4. Understand the history of surgical randomized controlled trials and sham controlled interventional trials.
5. Understand current and future trends in surgical trials.
6. Identify situations in which nonspecific treatment effects and sham controlled trial design should be considered.
7. Gain a conceptual understanding of cortical spreading depression including associated changes in K and field potential voltage.
8. Understand associated cerebral blood volume changes that accompany cortical spreading depression.
9. Learn the usefulness of OIS in detecting regional blood volume changes in response to stimulation (maps)
10. Understand the different findings of CSD characteristics between KO and Control mice.
11. Understand the definition of whole blood platelet aggregometry.
12. Relate NSAID medications to WBPA results.
13. Understand surgical safety relating WBPA results and NSAID medication use.
14. Discuss the radiographic features of subacute subdural hematoma.
15. Discuss the indications for less invasive treatment of sub-acute subdural hematoma.
16. Discuss the anticipated outcome for burr hole or twist drill drainage of sub-acute subdural hematoma.
17. Discuss the definition of fractionated stereotactic radiosurgery.
18. Discuss the role of fractionated stereotactic radiosurgery in pediatric neuro-oncology.
19. Understand some differences in the use of fractionated stereotactic radiosurgery in the pediatric and adult populations.

Scientific Session IV

1. Recognize basal ganglia cavitation as possible neuroferritinopathy.
2. Understand neuroferritinopathy as a rare genetic disorder.
3. Recognize what constitutes a curbside consult.
4. Realize some of the practical, ethical and legal risks of curbside consultation.
5. Recognize how to avoid the liability risks associated with curbside consultation.
6. Discuss the history and symptoms consistent with Mal de Debarquement.
7. Explain the natural history and prognosis of Mal de Debarquement.
8. Identify the differential diagnosis for Mal de Debarquement.
9. Demonstrate how to perform a laminoplasty.
10. Identify the various indications for laminoplasty.
11. Understand the benefit of laminoplasty vs. laminectomy.
12. Describe the frequency of medical marijuana use in a tertiary care spine population.
13. Describe the most common routes of delivery of medical marijuana.
14. Describe the most common side effects of medical marijuana use in the spine population.
15. Discuss barriers to the use of penetrating electrode arrays.
16. Explain that chronic stimulation did not seem to cause functional harm to visual cortex.
17. Discuss strategies for producing artificial vision.
18. Discuss the need to be objective in evaluating sports participants with suspected concussions.
19. Create awareness of the potential long term ramifications of multiple concussions.
20. Identify criteria that will aid the development of a comprehensive and reliable system for evaluating athletes with concussions.

SCIENTIFIC PROGRAM - JUNE 16th – 19th

Rocky Mountain Neurosurgical Society

SUNDAY, JUNE 16, 2013

MODERATOR:	Randy Jensen, MD. Ph.D
07:00-07:55	Breakfast
08:00-12:00	**SCIENTIFIC SESSION I: Trauma**
08:00-08:10	**Introductory Remarks and Welcome** President A. Stewart Levy, MD
08:10-08:30	**A. Stewart Levy** *Non-Transfer Protocol for mild Traumatic Brain Injury with Small Intracranial Hemorrhage in a Rural Hospital*
08:30-08:50**	**Jacob Freeman** *Breach of Posterior Wall of the Frontal Sinus: Management Without Cranialization*
08:50-09:10	**Ha D. Duong, MD PhD** *Risk Factors Affect Outcome of Head Injury Patients after Helmet Law Application in Viet Nam*
09:10-09:30	**A. Stewart Levy** *Pharmacologic Thromboprophylaxis is a Risk Factor for Hemorrhage in a Subset of Patients with Traumatic Brain Injury*
09:30-10:00	**A. Stewart Levy** *Interrupted Pharmacologic Thromboprophylaxis Increases Venous Thromboembolism in Traumatic Brain Injury*

10:00-10:20	**Break**
10:20-10:50	**Introduction of 2014 Annual Meeting in Victoria, Vancouver Island Canada.** Lee Krauth, MD *Vendors Welcome*
10:50-11:50	**SPECIAL GUEST LECTURE:** **Jaime Ullman, MD** *Update on Severe TBI Guidelines*

NOON **ADJOURN**

NOTES

MONDAY, JUNE 17, 2013

MODERATOR:	Todd C. Hankinson, MD, MBA
07:00-07:55	Breakfast
08:00-12:00	**SCIENTIFIC SESSION II: Neoplasia**
08:00-08:20**	**Jeremy J. Lewis, MD** *Prolactinomas, Psychosis and Medical-Surgical Strategies: Report of 2 Cases and Review of the Literature*
08:20-08:40	**Randy Jensen, MD PhD** *Tissue Biomarkers Of Hypoxia And Vascularity Taken From Specific Intratumoral Areas Correlate With Preoperative DSC And DCE MRI And Are Predictive Of Malignant Glioma Patient Outcome.*
08:40-09:00	**Randy Jensen, MD PhD** *Development Of An Animal Model Of Post-Treatment Pseudoprogression*
09:00-09:20**	**Walavan Sivakumar, MD** *Fusiform Dilatation of the Cavernous Carotid Artery in Acromegalic Patients*
09:20-09:40**	**Walavan Sivakumar, MD** *Magnetic resonance FLAIR and T2 tumor volumes obtained intraoperatively compared to post-operative volumes in high and low grade gliomas*
09:40-10:00	**Break**

10:00-11:00*	**SPECIAL INTEREST LECTURE:** **Ralph Harris** *The Local History of Sun Valley, ID*
11:00-12:00	**SPECIAL GUEST LECTURE:** **Frederick Lang, MD** *Oncolytic Virus Delta-24-RGD: Clinical Trial Results and Implications for Viro-immunotherapy*
NOON	**ADJOURN**

NOTES

TUESDAY, JUNE 18, 2013

MODERATOR:	A. Stewart Levy, MD
07:00-07:55	Breakfast
07:30-07:55	**ANNUAL BUSINESS MEETING FOR RMNS MEMBERS**
08:00-12:00	**SCIENTIFIC SESSION III:**
08:00-08:45	**SPECIAL GUEST LECTURE:** **Frederick Lang, MD** *Surgical Resection of Insular Gliomas*
08:45-09:05**	**Nicholas Andrade, MD** *Spondylolysis and Isthmic Spondylolisthesis--Can They Be Considered Pathological?*
09:05-09:25**	**Nicholas Andrade, MD** *Sham Controlled Trials--The Next Step in Evidence-Based Surgery?*
09:25-09:45**	**Khaled M. Krisht, MD** *Cortical Spreading Depression (CSD) in a CCM (Cerebral Cavernous Malformation) Mouse Model*
09:45-10:05**	**William W. Scott, MD** *Platelet Aggregometry Results after the Use of Common Non-Steroidal Anti-inflammatory Medications: Evaluation for the Perioperative Setting*
10:05-10:25	**Break**

10:25-10:45**	**Sarah T. Garber, MD** *Radiographic Assessment of Sub-acute Subdural Hematomas*
10:45-11:05	**Todd C. Hankinson, MD** *Fractionated Stereotactic Radiosurgery is Efficacious and Well-tolerated in Pediatric Intracranial Neoplasms*
11:05-12:00	**SPECIAL GUEST LECTURE:** **Jaime Ullman, MD** *Decompressive Craniectomy, Indications, Outcomes and Controversies*
NOON	**ADJOURN**

NOTES

WEDNESDAY, JUNE 19, 2013

MODERATOR:	Paul Elliott, MD
07:00-07:55	Breakfast
08:00-12:00	**SCIENTIFIC SESSION IV: Vascular/Functional**
08:00-08:20	**Chris Graham, MD** *First North American case of Neuroferritinopathy with 16bp heterozygous duplication of the C terminus on the FTL gene*
08:20-08:40	**Howard Morgan, MD** **"***Hold me liable for what?" The Ethical and Practical Pitfalls of the Curbside Consult*
08:40-09:00	**J. Brett Dietze** *Case Report: Mal de Debarquement, an unusual condition following boat travel*
09:00-9:20	**Albert H. Capanna, MD** *Laminoplasty for Spinal Tumors a Twenty-Five Year Experience*
09:20-09:40	**Paul Elliott, MD** *Cervical Spine Clearance following Trauma*
09:40-10:10	**Break**
10:10-10:30	**Michael A. Finn, MD** *Medical Marijuana use characteristics in patients with chronic spine pain disorders*
10:30-10:50	**Paul A. House, MD** *Analysis of Direct Stimulation of Primate Visual Cortex over 2 Years*

10:50-11:10	**J. Brett Dietze** *Concussion in Sports Injuries - The Return to Play Question*
11:10:12:00	**Interesting/Complex Case Presentations and Discussion**
12:00	**Closing Remarks:** A. Stewart Levy, MD
12:05	**MEETING ADJOURN**

**No CME awarded*

*** Denotes consideration for Resident Award*

NOTES

Mark your calendars, the 49th Annual Meeting of the Rocky Mountain Neurosurgical Society, Inc. will be held in:

VICTORIA ISLAND

BRITISH COLUMBIA, CANADA

WESTERN BEAR MOUNTAIN GOLD RESORT AND SPA

JUNE 14-18, 2014

Vendor Participants

This year we have the pleasure of welcoming the following exhibitors to the Rocky Mountain Neurosurgical Society's Annual Meeting. Please stop by their booths to thank your representatives for their company's support.

Amedica
Carl Zeiss
Codman
DePuy Spine
IMRIS
Integra
Leica Microsystems
Medtronic - Navigation
Medtronic - Neuromodulation
PMT
Southwest Surgical
Stryker Spine
Synthes CMF
Wenzel Spine

*Visit each booth and qualify to win a **Mini iPad!***

Disclosure Information

The AANS controls the content and production of this CME activity and attempts to ensure the presentation of balanced, objective information. In accordance with the Standards for Commercial Support established by the Accreditation Council for Continuing Medical Education (ACCME), speakers, paper presenters/authors and staff (and the significant others of those mentioned) are asked to disclose any relationship they or their co-authors have with commercial interests which may be related to the content of their lecture. The ACCME defines "relevant financial relationships" as financial relationships in any amount occurring within the past 12 months that create a conflict of interest.

Speakers, paper presenters/authors and staff (and the significant others of those mentioned) who have disclosed a relationship* with commercial interests whose products may have a relevance to their presentation are listed below.

Name	Disclosure	Type of relationship
Michael Finn	K2M	Consultant

*Relationship refers to receipt of royalties, consultantship, funding by research grant, receiving honoraria for educational services elsewhere, or any other relationship to a commercial interest that provides sufficient reason for disclosure.

Educational committee members, Speakers, paper presenters/authors and staff (and the significant others of those mentioned) who have reported they do not have any relationships with commercial interests:

Richard A. A. Day*	Paul House*	Frederick Lang
Michael Brown*	Yevegiy Khavin *	Howard Morgan
Albert H. Capanna*	Randy Jensen*	Lee Krauth
John B. Dietze*	Jonathan White*	
Stewart Levy*	Kelly Schmidt*	
Joel D. MacDonald *	Todd Hankinson*	
Jonathan A. White*	Jacob Freeman	
Mark Robinson*,	Ha D. Duong, MD PhD	
Paul Elliott*	Jaime Ullman	
Jeremy J. Lewis	Walavan Sivakumar	
Ralph Harris	Nicholas Andrade	
Khaled M. Krisht	William W. Scott	
Sarah T. Garber	Chris Graham	

* Educational content planner of this meeting

Accreditation/Continuing Medical Education

This activity has been planned and implemented in accordance with the Essential Areas and policies of the Accreditation Council for Continuing Medical Education through the joint sponsorship of the AANS and the Rocky Mountain Neurosurgical Society. The AANS is accredited by the ACCME to provide continuing medical education for physicians.

The AANS designates this live activity for a maximum of 13.5 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity .

Our audience includes neurosurgeons and neuroscience medical professionals, including those that may be in training. Our education program is primarily a didactic series of lectures and oral paper presentations, but may also include opportunities for case presentation and panel discussion.

Joint Sponsorship Disclaimer

The material presented at the 48th Annual Rocky Mountain Neurosurgical Society Meeting has been made available by the Rocky Mountain Neurosurgical Society and the AANS for educational purposes only. The material is not intended to represent the only, nor necessarily the best, method or procedure appropriate for the medical situations discussed, but rather it is intended to present an approach, view, statement, or opinion of the faculty, which may be helpful to others who face similar situations.

Neither the content (whether written or oral) of any course, seminar or other presentation in the program, nor the use of specific product in conjunction therewith, nor the exhibition of any materials by any parties coincident with the program, should be construed as indicating endorsement or approval of the views presented, the products used, or the materials exhibited by the Rocky Mountain Neurosurgical Society and jointly sponsored by the AANS, or its Committees, Commissions, or Affiliates.

Neither the AANS nor the Annual Rocky Mountain Neurosurgical Society makes any statements, representations or warranties (whether written or oral) regarding the Food and Drug Administration (FDA) status of any product used or referred to in conjunction with any course, seminar or other presentation being made available as part of the 48th Annual Rocky Mountain Neurosurgical Society Meeting. Faculty members shall have sole responsibility to inform attendees of the FDA status of each product that is used in conjunction with any course, seminar or presentation and whether such use of the product is in compliance with FDA regulations.

Historical Notes

Eight neurological surgeons from the Rocky Mountain States met informally in Denver, CO on April 30, 1966, and a Founders meeting was held which established The Rocky Mountain Neurosurgical Society.

Harry Boyd, MD	Denver, CO
Thomas Craigmile, MD	Denver, CO
Charles Elkins, MD	Tucson, AZ
Robert Imler, MD	Tulsa, OK
Alexander Johnson, MD	Great Falls, MT
Homer McClintock	Denver, CO
Chester Powell, MD	Salt Lake City, UT
William McKinney, MD	Fort Worth, TX

Because of the growth and complexity of the society in which we now live, Articles of Incorporation were approved in December 1974, in the State of Texas as a non-profit organization and The Rocky Mountain Neurosurgical Society, Inc. was established and obtained a tax exempt status.

RMNS Constitution - Revised June 1999

Article I - Name

The organization shall be known as The Rocky Mountain Neurosurgical Society, Inc.

Article II - Purpose

The corporation is organized for exclusively educational and other charitable purposes, and is a nonprofit corporation and the period of its duration is perpetual. The purpose of the Society shall be (1) to promote knowledge within the fields of neurological surgery and allied branches of medicine. It shall be within the purposes of the corporation to use any means to such end as may from time to time seem expedient to its members or trustees, including study, investigation, research, publication, publicity, instruction, the organization of educational or other charitable activities, agencies and institutions and the aid of any such educational or other charitable activities, agencies and institutions already established; (2) the promotion of fellowship and the exchange of ideas among its members.

Article III - Membership

Section 1 - The membership of Society shall consist of five categories: ACTIVE, ASSOCIATE, SENIOR, INACTIVE, and HONORARY.

(A) ACTIVE MEMBERS shall consist of neurological surgeons who have been certified by the American or Mexican Board of Neurological Surgery, or Fellowship in the Royal College of Surgeons (Canada), and also members of allied fields who have been certified by their appropriate board in that allied specialty. Active members in allied fields shall not exceed twenty per cent (20%) of the total membership of the Society.

(B) ASSOCIATE MEMBERS will include physicians and doctors of philosophy qualifying in one of the following categories:

1) Neurological surgeons living in the geographic confines of the Society who have completed their training and have met all the requirement for Board Certification but who have not been certified by the American or Mexican Board of Neurological Surgery, or Fellowship in the Royal College of Surgeons (Canada). Following certification an Associate Member shall become eligible for Active Membership and may apply to the Membership Committee for change in classification.

2) Neurological surgeons who have an outstanding record in the field over a period of years due to high standard and quality of work.

3) Members in the Neurosciences who have had acceptable academic training equivalent to the requirements for board certification in that field.

(C) SENIOR MEMBERSHIP shall be accorded to those members over the age of sixty who have been active dues-paying members for ten (10) years or greater. Senior members will be relieved of the payment of dues and rules of attendance. They may not hold office but will retain all other privileges of membership.

(D) INACTIVE MEMBERSHIP shall be accorded to members who no longer practice in the geographic domain of the Society or members who are physically disabled or retired from practice. Inactive members shall be relieved of payment of dues. They may attend meetings of the Society but shall not vote or hold office.

(E) HONORARY MEMBERS shall be chosen from recognized leaders in the field of neurological surgery and allied fields who are neither active nor associate members. They shall not be required to pay initiation fees or dues and shall enjoy all of the privileges of active membership except those of voting or holding office. There shall be no limitation on their selection.

Section 2- Membership, except for Honorary and Inactive Members, shall consist of those physicians residing in Alaska, Arizona, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, Wyoming, adjacent provinces of Canada, and The Republic of Mexico.

Article IV Founders Group - Executive Committee

The Founders Group shall act as an Executive Committee until the time of the First Annual Meeting. They will assume all the duties of the Executive Committee, including those of the Nominating Committee, the Program Committee, and any other duties being deemed necessary. This committee will submit a nomination slate, which will be voted upon by all the Active Members. This committee has the power to accept as members of the Society any that they feel meet the requirements as outlined by the By-Laws. The power is given to the committee until the First Annual Meeting, after which time all membership applications will be acted upon as outlined in the By-Laws.

Article V - Officers

Section 1 - The officers of the Society shall consist of a President, President-Elect, Vice-President, Secretary, Treasurer and Historian. The President and Vice-President shall be elected for a period of one year and neither may succeed himself. The President-Elect shall succeed to the office of President one year following his election. The Secretary and Treasurer shall be elected for a period of three years and the Historian shall be elected for a period of five years.

Section 2 - The Executive Committee (9) shall be comprised of the President, Immediate Past-President, the President-Elect, Vice-President, Secretary, Treasurer, Historian and one Member-at-Large appointed by the President and a Continuing Medical Education (CME) liaison also

appointed by the President.

Article VI - Duties of Officers

Section 1 - The President shall preside at all meetings of the Society and of the Executive Committee. He shall appoint all committees. He shall cast the deciding vote in any ties resulting from balloting of the members of the Society.

Section 2 - The Vice-President shall preside in the absence of the President and be the Society Parliamentarian.

Section 3 - The Secretary shall record the proceedings and attendance of each meeting and shall report this record at the succeeding meetings. He shall collect an preserve all records, including the membership roll, and shall forward to the Historian all paper which are of documentary or historical value to the Society. He shall send notice to the membership of all meetings two months in advance, and shall notify all members of appointments and assigned duties. He shall carry on all other correspondence and business essential for the proper function of the Society. The Secretary shall forward to the Membership Committee all completed applications for membership within three months prior to the date of the Annual Meeting.

Section 4 - The Treasurer shall collect the dues and assessments and carry out the fiscal transactions of the Society. The Treasurer shall keep an accurate record of these transactions and render an annual report. The Treasurer shall submit records annually to a certified public accountant for report to the President. The Treasurer shall notify all members who are delinquent in payment of dues or assessments.

Section 5 - The Historian shall compile and retain all pertinent data relative to the founding, programs and functioning of the Society.

Section 6 - The Executive Committee shall have general supervision over the affairs of the Society. They shall:

(A) Make recommendations as to the time and place of the Annual Meeting.

(B) Review all applications from the Membership Committee and make their recommendations at the Annual Meeting.

(C) Have the power of decision in the consideration of each candidate's personal and professional qualifications.

(D) Upon request make a careful investigation as to a candidate's personal and professional qualifications.

(E) Call special meetings when deemed necessary.

(F) Invite official guests and, in consideration with the host for said meeting, limit their number.

(G) Review all matters concerning fiscal delinquency and absence of members and make appropriate recommendations to the Society regarding these matters.

Article VII - The Constitution

The Constitution shall be in effect from the time of its adoption. It shall be amended only by written resolution at an annual Meeting. Such resolutions must be circularized to the membership by the Secretary two months before the Annual Meeting at which time a vote will be taken. Approval by three-fourths of the voting members present will be necessary for acceptance.

RMNS By-Laws - Revised June 1999

Article I - Application and Election to Membership

Section 1 - The President shall appoint a Membership Committee of three members whose duties shall be to review all applications for membership and to conduct careful investigations as to per-

sonal and professional qualifications of all applicants. The recommendations of this Committee shall be presented to the Executive Committee at the Annual Meeting.

Section 2 - Every candidate for active, associate, senior, inactive or honorary membership shall be proposed by at least two active, associate or senior members of the Society on the required application form furnished by the Society. Appropriately completed membership applications shall be in the hands of the Secretary at least four months before the date of the Annual Meeting. Two months before the Annual Meeting the Secretary shall send to each member of the Society a list of all candidates for membership. Members are urged to submit to the Executive Committee written comments on the candidate's qualifications for membership.

Section 3 - The Executive Committee shall have power of decision in the consideration of each candidate's eligibility and its judgment upon each eligibility shall be final. No candidate for membership shall be voted upon at the Executive Session of the Society unless recommended by the Executive Committee.

Section 4 - Election to the membership shall be at the Executive Session of each Annual Meeting and if three-fourths of the votes are favorable, the candidate shall be declared elected.

Section 5 -The names of all candidates who have not been recommended for membership by the Executive Committee three years after nomination shall be withdrawn and their sponsor notified. A subsequent application of such candidate can be made after a period of two years. Any candidate for membership who has been recommended by the Executive Committee but not elected by the Society cannot be proposed again for a period of two years.

Section 6 - Any Active or Senior member in good-standing may prefer charges alleging that a member is failing to maintain good professional conduct. Such charges may be made against any class of member. All charges shall be in writing and shall specify the basis thereof. These charges shall be delivered to the Secretary who shall immediately forward a copy to the accused, by registered mail sent to his last known address, a copy to the Executive Committee, and retain the original copy. The Executive Committee shall investigate the charges and shall call on the members who file the charges for such information, witnesses, evidence etc. as may be necessary for a full investigation. Both the accused and accuser or accusers shall be given a full hearing by the Executive Committee at its next regularly scheduled meeting. The accused may conduct his own defense or shall be entitled to counsel of his own selection, but counsel for the accused shall also be allowed to secure, at the Society's expense, through the use of a competent stenographer, a verbatim report of the hearing of his case by the Executive Committee in the absence of the accused at the hearing, unless he expressly waives participation therein, the Presiding Officer shall appoint a member to represent him and the hearing shall proceed as though he were present. The hearing shall be closed to all except members of the Society and the counselors chosen for the purpose of this hearing.

Provided the investigation is satisfactorily completed and the accused has been given a hearing, if he so desires, the Executive Committee shall within ten days of the completion of the hearing, determine:

(A) That the charges are not sustained, and that no further action be taken; or

(B) That the charges are sustained and that the accused be:

1) censured, or

2) suspended for a definite time, or

3) expelled from the society.

The accused shall be notified by the President in writing, by registered mail sent to his last known address, the date of the meeting in which the recommendation of the Executive Committee will be made. At that meeting the accused shall be given an opportunity to make any statement that he desires before action is taken on the recommendations of the Executive Committee. The President

may also make a statement and explain and define findings of the Executive Committee, but there shall be no examination of witnesses or introduction of further evidence before the Executive Committee. Censure or supervision shall require an affirmative vote of at least 2/3 of the voting members of the Executive Committee present. Expulsion shall require an affirmative vote of at least 3/4 of the voting members of the Executive Committee. Any members of this Society who may feel aggrieved by the action of the Executive Committee in censuring, suspending, or expelling him shall have the right to appeal to the entire membership at the time of the next annual meeting. At this time, the accused shall be given the opportunity to make any statements he desires and may have counsel present if he so desires. The President of the Rocky Mountain Neurosurgical Society may also make a statement and explain and define the findings of the Executive Committee, but here shall be no examination of witnesses or introduction of further evidence before the membership. At the conclusion of the meeting, the Membership shall, by secret ballot, determine whether it will sustain or change the action of the Executive Committee. An affirmative vote of at least a majority of the voting members present shall sustain or change the action of the Executive committee.

Article II - Election of Officers

Section 1 - The officers of the Society shall be elected from the Active Membership at each Annual Meeting and shall take office at the close of that meeting. The President shall not be eligible for re-election at any time. The Vice-President, as well, may not be re-elected to the Vice-Presidency but may be eligible for any other office in the Society. The nominating committee shall notify the membership of a proposed slate of officers before the Annual Meeting. Additional nominations may be made from the floor. The election shall be by ballot and the member receiving the greatest number of votes shall be declared elected to the office for which he was a candidate.

Section 2 - In the case of a vacancy in an office, it shall be filled by appointment by the Executive Committee.

Article III - Initiation Fees and Dues

Section 1 - Every Active and Associate Member on his election to membership shall pay an initiation fee of twenty-five dollars ($25.00) by which act he acknowledges and accepts the Constitution and By-Laws. Honorary members shall not pay an initiation fee.

Section 2 - Every Active and Associate member shall pay annual dues. The amount of the dues shall be determined by the vote of the Executive Committee, so as to maintain the Society in a financially stable condition. Payment of dues shall be received by January 1 and if unpaid by March 1, shall become delinquent.

Section 3 - Any member in arrears for two years shall be notified by the Treasurer in writing, and if he fails to pay his dues within two months thereafter shall forfeit his membership. It shall be the duty of the Treasurer to notify the Executive Committee of this forfeiture.

Section 4 -The expenses of the Annual Meeting shall be paid principally from funds received as registration fees for that meeting. The amount of the registration fee for each Annual Meeting will be set by the Executive Committee.

Section 5 - The prorated expense of an invited guest shall be borne by his host.

Section 6 - While on temporary duty with the Armed Forces, any Active or Associate Member shall be exempt from paying dues.

Article IV - Guests

Section 1 - Any member may invite a guest to attend the annual meeting. The fees for non-member guests are set by the Executive Committee.

Section 2 - The Executive Committee shall be empowered to select official guests. These shall be local physicians and surgeons at the place of the meeting or especially invited guests to participate in the program.
Section 3 - The prorate share of the officially invited guests will be borne by the Society, and determined/limited at the time of the invitation.
Section 4 - The limitation of the number of guests to attend any given meeting shall be at the discretion of the Executive Committee and the host for said meeting.
Section 5 - Invited guests shall be entitled to all the privileges of the Society during the annual session except attendance at business or Executive Sessions.

Article V - Meetings
Section 1 - The Rocky Mountain Neurosurgical Society, Inc. shall meet annually at such time and place as may be designated by the Executive Committee.
Section 2 - There shall be at least one annual Executive Session of Active Members of the Society at which the order of business shall be as follows:

1. Reading of the minutes of the last meeting.
2. Report of the Secretary.
3. Report of the Treasurer.
4. Report of the Executive Committee.
5. Report of the Historian.
6. Report of the review of the Treasurer's Account
7. Reports of Special Committees.
8. Unfinished Business.
9. New Business.
10. Election of Members.
11. Report of the Nominating Committee.
12. Election of Officers.

Section 3 - Members shall sign the permanent register of the Society as a record of their attendance. A special register shall be provided for guests.
Section 4 - Special meetings of the Society may be called on the advice of the Executive Committee. Every member shall be notified of the place and time of the meeting at least two weeks in advance.

Article VI - Quorum
Only Active Members shall attend any Business Session and shall constitute a quorum for business.
Article VII Parliamentary Authority
"Robert's Rules of Order - Revised Edition" shall be parliamentary authority in all matters not specified by the Constitution or By-Laws.

Article VIII - Committees
Section 1- The President shall appoint with the approval of the Executive Committee, the following committees:
(A) Program Committee, of which the Secretary is a member ex officio;
(B) Committee on Arrangements for the Annual Meeting;
(C) Membership Committee, consisting of three members;
(D) Nominating Committee, consisting of the immediate three Past Presidents.
Section 2 - The President shall appoint such other committees as indicated.

Article IX - Forfeiture of Membership
Membership may be forfeited for reasons deemed sufficient by the Society, which may be effected by a three-fourths majority vote.

Article X - Scientific Papers

Section 1 - An abstract of all papers to be read must be submitted to the Program Committee three months before the meeting, excluding those presented by invited guests of the Society. The Committee shall exercise the right of accepting or rejecting papers.

Section 2 -The time allotted for the presentation and discussion of a paper shall be at the discretion of the Program Committee subject to approval of the Executive Committee. A tentative program shall be sent to each member by the Secretary two weeks prior to the stated meeting.

Section 3 - A Resident award paper will be selected for presentation t the Annual Meeting by the Program Committee and an award will be given.

Article XI - Amendments

These By-Laws may be amended at the Annual Meeting by approval of three-fourths of the voting members present, provided due notice of the proposed changes has been given to the membership at least two months before said meeting.

Past Meetings of the Society

1966	Colorado Springs, CO	1991	Jackson Hole, WY
1967	Tucson, AZ	1992	Sedona, AZ
1968	Banff, AB	1993	Bigfork, MT
1969	McAllen, TX	1994	Snowmass, CO
1970	Sun Valley, ID	1995	Sun Valley, ID
1971	Colorado Springs, CO	1996	Telluride, CO
1972	Guadalajara, Mexico	1997	Jasper Park Lodge, AB
1973	Scottsdale, AZ	1998	Vail, CO
1974	Victoria, BC	1999	Coeur D'Alene, ID
1975	Cozumel-Merida, Mexico	2000	Alyeska, AK
1976	Las Vegas, NV	2001	Steamboat Springs, CO
1977	Lake Tahoe, NV	2002	Santa Ana Pueblo, NM
1978	Colorado Springs, CO	2003	Big Sky, MT
1979	Jackson Hole, WY	2004	Squaw Creek, CA
1980	Park City, UT	2005	Whistler, BC
1981	Durango, CO	2006	Sedona, AZ
1982	Big Sky, MO	2007	Jackson Hole, WY
1983	Mescalero, NM	2008	Park City, UT
1984	Colorado Springs, CO	2009	Girdwood, AK
1985	Banff, AB	2010	Telluride, CO
1986	Keystone, CO	2011	Taos, NM
1987	Deer Valley, UT	2012	Maui, HI
1988	Lake Tahoe, NV		
1989	Durango, CO		
1990	Vail, CO		

Past Presidents

1966	**Homer G. McClintock**	**Denver, CO**
1967	**Charles Elkins**	**Tucson, AZ**
1968	**William McKinney**	**Ft. Worth, TX**
1969	**Chester Powell**	**Salt Lake City, UT**
1970	**Thomas K. Craigmile**	**Denver, CO**
1971	**Alexander C. Johnson**	**Great Falls, MT**
1972	**Joseph W. Robertson**	**Houston, TX**
1973	**Robert G. Fisher**	**Oklahoma City, OK**
1974	**Michael Pollay**	**Albuquerque, NM**
1975	**Robert L. Imler, Jr.**	**Tulsa, OK**
1976	**Javier Verdura**	**Mexico City, Mexico**
1977	**George T. Hoffman**	**Phoenix, AZ**
1978	**Michael McNally**	**Colorado Springs, CO**
1979	**Richard Moiel**	**Houston, TX**
1980	**R. Barton Carl**	**Oklahoma City, OK**
1981	**Ralph J. Kaplan**	**Oklahoma City, OK**
1982	**Paul Turner**	**Roswell, NM**
1983	**Charles Clough**	**Kansas City, MO**
1984	**Robert Partain, III**	**San Antonio, TX**
1985	**Ronald D. Clark**	**Greeley, CO**
1986	**Richard F. Tenney**	**Tulsa, OK**
1987	**Robert S. Hood**	**Salt Lake City, UT**
1988	**Henry Fieger**	**Denver, CO**
1989	**Franco Erculei**	**Las Vegas, NV**
1990	**Harry B. Tate**	**Oklahoma City, OK**
1991	**David Fell**	**Tulsa, OK**
1992	**Wayne Paullus**	**Amarillo, TX**
1993	**Kenyon Kugler**	**Tulsa, OK**
1994	**Volker Sonntag**	**Phoenix, AZ**
1995	**Lee Krauth**	**Denver, CO**
1996	**Robert Morelli**	**Reno, NV**
1997	**Larry Tice**	**Grand Junction, CO**
1998	**Ronald Apfelbaum**	**Salt Lake City, UT**
1999	**Charles Fullenwider**	**Muskogee, OK**
2000	**Kevin Lillihei**	**Denver, CO**
2001	**Howard Morgan**	**Dallas, TX**
2002	**Al Capanna**	**Las Vegas, NV**
2003	**Vance MacDonald**	**Las Vegas, NV**
2004	**Richard Schmidt**	**Salt Lake City, UT**
2005	**John McVicker**	**Englewood, CO**
2006	**Mary Kay Gumerlock**	**Oklahoma City, OK**
2007	**Robert Beatty**	**Kansas City, KS**
2008	**Joel MacDonald**	**Salt Lake City, UT**
2009	**Jonathan White**	**Dallas, TX**
2010	**Michael Brown**	**Colorado Springs, CO**
2011	**Randy Jensen**	**Salt Lake City, UT**
2012	**Stewart Levy**	**Denver, CO**

Abstracts RMNS 2013:

Title: Non-Transfer Protocol for Mild Traumatic Brain Injury with Small Intracranial Hemorrhage in a Rural Hospital Setting

Authors: A. Stewart Levy; Allesandro Orlando; Kristin Salottolo; David Bar-Or

Introduction: Recent literature examining mild traumatic brain injury (mTBI) with small intracranial hemorrhage (ICH) has suggested that the neurosurgical intervention rate is between 0% and 3%, and that these injuries do not always necessitate a transfer to a higher-level trauma center with neurosurgical capabilities.

Methods: In 2007, a non-transfer protocol was implemented at a rural Level III Trauma Center in the mountains of Colorado. Adult patients with mTBI (GCS 13-15), CT showing small ICH, and no coagulopathy were included in the protocol. CT scans were reviewed by the on-call neurosurgeon at an affiliated Level I Trauma Center, and consensus was obtained on the suitability for non-transfer. Early and long-term outcomes were evaluated using a trauma registry and telephone interviews.

Results: A total of 57 patients met the criteria to stay at the rural Level III Trauma Center. The median hospital LOS was one day (IQR=1d). No patient required a neurosurgical intervention or post-admission transfer to a Level I facility. No patients deteriorated after admission, there were no in-hospital deaths, and all patients were discharged home. There were no re-admissions or late complications that we could identify.

Conclusions: There is a sub-population of mTBI patients with small ICH that do not require transfer to a higher level Trauma Center with neurosurgical capability. A non-transfer protocol for mTBI patients with small ICH can lead to a more efficient use of hospital resources while providing safe, effective and economical healthcare.

Keywords: Traumatic Brain Injury, Subarachnoid Hemorrhage, Transfer Protocol, Rural Hospital

Objectives: 1. Identify a subset of patients with mild TBI and small intracranial hemorrhage that do not require transfer to a trauma center with neurosurgical capability. 2. Understand the criteria for safely selecting this subset of patients. 3. Understand the benefits of developing a non-transfer protocol for rural hospitals without neurosurgical capabilities, to select and manage patients with mild TBI and small ICH, in order to optimize safety, efficiency and resource utilization in the care of this subset of patients.

Title: Breach of Posterior Wall of the Frontal Sinus: Management Without Cranialization

Authors: Jacob L Freeman; Ken R Winston

Introduction: Cranialization is a frequently practiced surgical intervention in the management of fractures of the posterior wall of the frontal sinus, especially those that are displaced, comminuted or associated with CSF leak. While this procedure has been shown to decrease the risk of subsequent intracranial infection it is not always effective and carries with it its own set of risks. It is therefore both reasonable and important to examine the efficacy and complication rate of fracture management without cranialization.

Methods: The authors conducted a retrospective analysis of prospectively accrued data from 1998 to 2013 on 34 patients with posterior wall frontal sinus fractures that were managed without cranialization. Hospital charts and CT scans were reviewed in detail to assess specifics of each injury, operative details, and the most common post-operative outcomes associated with posterior wall fractures including CSF leak, intracranial infection (meningitis, abscess) and mucocele.

Results: 33 of the 34 patients are currently alive. Five patients (14.7%) developed a new CSF leak. Four of these were successfully stopped with CSF diversion (lumbar drain or ventriculostomy) and one stopped on its own. None of these patients developed subsequent intracranial infection or required conversion to a permanent shunt. One patient (3%) had persistent CSF leak despite initial diversion and surgery. This patient required reoperation to stop the leak. One patient (3%) developed new post-operative intracranial infection and another suffered from persistent meningitis that was present prior to first operation. None of the patients in this series had developed a mucocele by the time of their last follow-up. Neither degree of posterior wall displacement nor presence of nasofrontal duct obstruction predicted higher complication rates. We report one complication associated with iatrogenic breech of the posterior wall of the frontal sinus. This was a new CSF leak which was quickly stopped with CSF diversion. Follow-up times ranged from 2 days to 6 years with a median follow-up time of 1 month. Overall, new/early complications were found in five of the 34 patients (14.7%) in this series however only one (3%) of these was of

any real detriment to the patient. There were no late complications (>6 months).

Conclusions: The results of this investigation support the position that management of posterior wall fractures without cranialization is safe and well tolerated. Complication rates are similar to those of patients who undergo cranialization. Furthermore, the majority of the complications following our management strategy were CSF leaks that were easily stopped with CSF diversion and did not result in subsequent intracranial infection. Therefore, cranialization should not be performed in the majority of patients with fractures of the posterior wall of the frontal sinus.

Keywords: Cranialization of Frontal Sinus, CSF Rhinorrhea, Frontal Sinus Fracture, Frontal Sinusitis

Objectives: 1. Better understand the surgical management strategies that exist today for treatment of frontal sinus fractures. 2. Recall the most common complications (short and long term) associated with these fractures.
3. Understand that most patients with posterior wall frontal sinus fractures have similar post operative complications and complication rates following cranialization versus a more conservative management of their fracture.

Title: Risk Factors Affect Outcome of Head Injury Patients after Helmet Law Application in Viet Nam

Authors: Ha D. Duong, He V. Dong, A. Stewart Levy

Introduction: A helmet law was instituted in Vietnam for motorbikes in December 2007. The incidence of helmet use among injured patients has been shown to be significantly lower than in the non-injured general population. The use of helmets has a significant effect on the outcome of patients with traumatic brain injuries (TBI). There are also other factors such as age, gender, alcohol use, admission Glasgow Coma Scale, clinical findings, imaging studies, and treatments that can have an effect on outcome after TBI. Our objective is to evaluate these risk factors and their effects on the outcome of patients with TBI.

Methods: This is a retrospective study of 318 patients with traumatic brain injury treated at Viet Duc University Hospital in Hanoi, Vietnam, from January 2011 to June 2011. These cases were reviewed for demographics, mechanism of injury, associated injuries, clinical and imaging studies, treatment, and outcomes, with 6 months follow-up.

Results: We noted a significant correlation between helmet use and patient outcome (OR=1.647; 95% CI 1.010-2.982). TBIs occurred more often in men (83.6%) than in women (16.4%). The most common mechanism of injury was motorbike crash (48.9%). Only 44.6% of injured patients were wearing a helmet, compared to 55.4% that were not. None of the patients under 16 years old were wearing a helmet at the time of their accident. Not surprisingly, there was a statistically significant difference between the outcome of the severe TBI patients (GCS 3-8) and the moderate and mild TBI patients (GCS 9-15) (OR=36.667; 95% CI 17.386-77.329). Our data did not demonstrate that alcohol use or associated injuries had a significant effect on the outcome of TBI patients. The outcome of patients with Marshall's grade I and II CT-scan classification was better than the patients with grade III, IV and V (OR=1.742; 95% CI 1.325-9.815). The overall mortality rate (include the mortality during admission and after 6 months follow-up) was 11.0%.

Conclusions: This review suggests that the use of helmets improves the outcome of TBI patients. Our data show that the motorbike collision is the most frequent cause of TBI in Vietnam. None of the chil-

dren admitted to our hospital under 16 years of age were wearing a helmet. It is our opinion that the Government should approve the helmet law for children. Additional studies are needed to confirm these findings and to find the solution to decrease the severity rate and improve the outcome of TBI patients of traffic accidents.

Keywords: Helmet law, TBI, risk factors, motorbike collision, outcomes.

Objectives: Understand the importance of helmet use and others risk factors for the outcome of patients with TBI admitted in Viet Duc University Hospital, Hanoi, Vietnam.

Title: Pharmacologic Thromboprophylaxis is a Risk Factor for Hemorrhage in a Subset of Patients with Traumatic Brain Injury

Authors: A. Stewart Levy; Kristin Salottolo; Patrick Offner; Charles Mains; David Bar-Or

Introduction: Patients with Traumatic Brain Injury (TBI) may be at increased risk for venous thrombo-embolism (VTE), but routine Pharmacologic Thromboprophylaxis (PTP) with agents such as Lovenox or subcutaneous Heparin may result in an increased risk of intracranial hemorrhage (ICH) progression in a subset of patients with TBI and ICH. There is very little evidence regarding the risks and benefits of PTP in patients with hemorrhagic TBI.

Methods: We retrospectively reviewed patients with blunt TBI and ICH who were admitted to our Level I trauma center. In order to assess the efficacy of PTP use in patients with TBI, PTP use was analyzed as an independent risk factor for VTE using separate logistic regression models for each definition of PTP use: (1) administration of PTP; (2) timing of PTP early [<72 hours] vs. late [>72 hours]). In order to assess progression of hemorrhage we analyzed the patients in two groups: patients with a stable initial follow-up (F/U) computed tomography (CT) and patients with hemorrhage progression on initial F/U CT. Risk factors potentially associated with hemorrhage progression were analyzed using logistic regression.

Results: Four hundred eighty patients with TBI were identified for the study. VTE occurred in 15 patients (3.13%). VTE developed in six patients despite early PTP (5.56%), four patients with late PTP (2.72%), and five with no PTP (2.22%). Neither administration of PTP nor timing of PTP was an independent predictor of developing a VTE (PTP vs. none: odds ratio [OR] = 0.36, p = 0.18; early PTP vs. late PTP: OR = 2.00, p = 0.41). Walking before discharge significantly decreased the odds of developing a VTE (OR = 0.19, p = 0.02). In patients with ICH progression on initial F/U CT, predictors of subsequent hemorrhage progression included exposure to PTP (odds ratio [OR]: 13.07, p = 0.01), extradural/subdural hemorrhage (OR: 5.15, p = 0.03), Glasgow Coma Score 3–8 (OR: 4.64, p = 0.03), and body mass index >25 (OR = 4.32, p = 0.03). PTP was not significantly associated with hemorrhage progression in patients with a stable initial F/U CT.

Conclusions: The administration of PTP in patients with TBI was not associated with decreased risk of VTE, even when given early or without interruption. PTP use was associated with a 13-fold increased odds of further hemorrhage progression in patients whose F/U CT within 1 day of admission showed ICH progression. PTP may be safe in a subgroup of patients with TBI and no ICH progression on initial F/U CT, but we have not been able to demonstrate that it reduces the risk of VTE in this population.

Title: Interrupted Pharmacologic Thromboprophylaxis Increases Venous Thromboembolism in Traumatic Brain Injury

Authors: A. Stewart Levy; Kristin Salottolo; Patrick Offner; Charles Mains; David Bar-Or

Introduction: This study represents a subset of the previous work, with specific analysis of patients who were treated with continuous versus interrupted use of Pharmacologic Thromboprophylaxis (PTP)

Methods: We retrospectively reviewed patients with blunt TBI and ICH who were admitted to our Level I trauma center. In order to assess the efficacy of PTP use in patients with TBI, PTP use was analyzed as an independent risk factor for VTE using separate logistic regression models for each definition of PTP use: (3) continuous versus interrupted use of PTP.

Results: Four hundred eighty patients with TBI were identified for the study. VTE occurred in 15 patients (3.13%). PTP was administered continuously in 188 patients (73.7%). Patients with interrupted PTP had a significant increased odds of developing VTE compared with patients with continuous PTP (OR = 7.07, p = 0.04).

Conclusions: While the administration of PTP in patients with TBI does not appear to be associated with decreased risk of VTE, even when given early or without interruption; interrupted administration of PTP may be associated with significantly increased risk of VTE.

Keywords: Traumatic Brain Injury, Pharmacologic Thromboprophylaxis, DVT/PE, Lovenox

Objectives: 1. Understand the increased risk of VTE when PTP is interrupted in patients with TBI.

2. Understand reasonable options for VTE prophylaxis in patients with hemorrhagic TBI.

Title: Prolactinomas, Psychosis and Management Strategies: Report of 2 Cases and Review of the Literature

Authors: Daniel R Klinger; Jeremy J. Lewis; Sam Barnett

Introduction: Prolactinomas are the most common pituitary tumors, and their first-line therapy involves treatment with dopamine agonists that carry a side effect of induced psychosis. Patients with psychotic disorders such as schizophrenia are typically treated with dopaminergic-receptor inhibitors which can elevate serum prolactin levels leading to symptomatic hyperprolactinemia. The treatment of prolactinomas in patients with psychotic disorders presents a unique challenge as therapy aimed at treating one pathology (prolactinoma) may worsen or complicate the treatment of the other (psychosis), and vice versa.

Methods: We present two cases of patients with known histories of paranoid schizophrenia who each presented with large, symptomatic prolactin-secreting macroadenomas. We subsequently reviewed the existing medical literature regarding the treatment of prolactinomas in the context of concurrent psychotic disorders.

Results: Patient A is a 37 year-old man with paranoid schizophrenia who presented in 2011 with psychiatric medication non-compliance and aggressive, erratic behavior. He was found to have significant visual field loss in all quadrants of the right eye and temporal field cut in the left eye as well as a prolactin level over 11K. Further workup revealed a giant, partially cystic prolactinoma. He was initially treated with cabergoline and aripiprazole. His tumor progressed at follow-up and he developed worsening vision in the right eye and mild left hemiparesis secondary to an expanded cystic component of the tumor compressing the right temporal lobe. He underwent a right frontal craniotomy with cyst decompression. Post-operatively his hemiparesis resolved but he developed a third nerve palsy. He is currently being treated by Neuro-oncology with temodar. Patient B is a 72 year-old man with paranoid schizophrenia who initially presented in 2004 with bilateral vision loss and a large prolactin-secreting macroadenoma. He underwent transsphenoidal resection with initial tumor control and improved vision. Subsequently, he had a psychotic episode requiring hospitalization. Further follow-up revealed tumor recurrence requiring CyberKnife radiosurgery and several years later repeat transsphenoidal resection after his vision deteriorated further. He currently has stable vision, mild stable hyprolactinemia and is being treated with aripiprazole by Psychiatry.

Conclusions: The treatment of prolactinomas in the setting of concurrent psychotic disorders presents an unusual clinical dilemma in that first-line medical therapy may worsen the patient's psychiatric disease. Early surgical intervention for large or symptomatic lesions may be the best strategy although es-

tablishing reliable clinical follow-up and preventing psychiatric decompensation are unique considerations in this patient subgroup. Coordinated care between neurosurgical, endocrine and psychiatric services is recommended.

Keywords: prolactinoma, psychosis, dopamine-receptor antagonists.

Objectives: 1. Understand the causes and symptoms of hyperprolactinemia

2. Understand the possible sequela of dopamine-agonist treatment of prolactinomas in the setting of pre-existing psychotic disorders.

3. Formulate neurosurgical treatment strategies in patients with prolactinomas and concurrent psychotic disorders.

Title: Tissue Biomarkers Of Hypoxia And Vascularity Taken From Specific Intratumoral Areas Correlate With Preoperative DSC And DCE MRI And Are Predictive Of Malignant Glioma Patient Outcome.

Authors: Randy L. Jensen; David L. Gillespie

Introduction: Measures of tumor vascularity and hypoxia have been correlated with glioma grade and outcome. Recently developed modeling methods for analysis of dynamic contrast-enhanced MRI (DCE-MRI) data have demonstrated the potential to noninvasively map a broad range of parameters potentially relevant to tumor hypoxia, blood flow, and vascularity. In this prospective observational cohort pilot study, we used preoperative imaging to correlate specific areas of glioma tissue? with molecular markers of hypoxia, tumor vascularity, and tumor proliferation along with progression free and overall patient survival.

Methods: A distributed parameter (Gamma Capillary Transit Time) model was used to generate maps of tumor blood flow (F), extraction fraction (E), permeability-surface area product (PS), transfer constant (Ktrans), washout rate (kep), interstitial volume (ve), blood volume (vb), capillary transit time (tc), and capillary heterogeneity (α(-1)) from pre-operative DCE-MRI data in human glioma patients. Multiple tissue samples were obtained from specific areas from each tumor with an MRI-guided intraoperative navigation system. These areas included peritumoral edema (PE, non-enhancing area surrounding tumor, bright on T2-weighted MRI), active tumor (AT, nodular enhancing tissue at the outer edge of tumor), hypoxic penumbra (HP, enhancing area immediately surrounding areas of necrosis), and necrotic core (NC, heterogeneous non-enhancing tumor core). Each of these areas was evaluated for the expression of hypoxia-regulated molecules including hypoxia inducible factor 1α (HIF-1α), vascular endothelial growth factor (VEGF), carbonic anhydrase nine (CA-IX), and glucose transporter-1 (GLUT-1) as well as for tumor vascularity, and tumor proliferation (MIB-1 labeling index). Mean DCE-MRI parameter values were computed in regions of interest corresponding to tissue sample sites and marker expression compared with imaging results.

Results: Patient survival was found to correlate with DCE parameters in two cases: α(-1) in AT (p=0.005), and ve in areas of PE (p=0.020). Statistically significant correlations between several of the DCE parameters and tissue markers were also observed. Specifically: 1). vb is correlated with VEGF (R2=0.475, p=0.0092) and HIF-1 (R2=0.323, p=0.043) expression in AT, 2). tc is correlated with HIF-1 in AT (R2=0.527, p=0.005), HP (R2=0.761, p=0.023), and PE (R2=0.696, p=0.0052), and with VEGF in AT (R2=0.346, p=0.034) and HP (R2=0.793, p=0.0173), 3). α(-1) is correlated with VEGF in AT (R2=0.442, p=0.013) and PE (R2=0.951, p<0.0001), and 4). kep is correlated with VEGF in PE (R2=0.579, p=0.0065) and NC (R2=0.868, p=0.0069). In addition, MIB-1 in-

dex is correlated with VEGF expression in HP (R2=0.7933, p=0.0071) and PE (R2=0.4546, p=0.033), and HIF-1 and VEGF expression are correlated in all tumor areas.

Conclusions: Our pilot study findings suggest that with further work it may be possible to use DCE-MRI to make noninvasive preoperative predictions of areas of tumor with increased hypoxia and proliferation. This has the potential to both make unprecedented prognostic decisions and to guide therapies to specific tumor areas.

Keywords: perfusion MRI, hypoxia, microenvironment,

Objectives: 1. Recognize the potential for perfusion MRI to predict intratumoral microenvironment.

2. Understand the role of tissue biomarker discovery and patient outcome.

3. Discuss the correlation of tissue biomarker information and DCE-MRI parameters.

Title: Development Of An Animal Model Of Post-Treatment Pseudoprogression.

Authors: Authors: Randy L. Jensen; David L. Gillespie

Introduction: The lack of a definitive imaging modality to distinguish post-treatment radiographic imaging changes (PTRIC), including pseudoprogression and radiation necrosis, from true tumor progression presents a major unmet clinical need in the management of GBM patients. At present there are no animal models of PTRIC

Methods: We developed a rodent model of PTRIC by intracranially implanting rats with either preirradiated (2-10 Gy) or nonirradiated glioma cells transfected with a constitutively active luciferase reporter. The rats were treated with or without temozolomide (TMZ) chemotherapy and rats implanted with nonirradiated cells were treated with focused tumor irradiation (2-10 Gy) to the implanted tumor cells and surrounding brain. Cell growth was monitored by bioluminescence imaging of the luciferase reporter and brain MRI measurement of tumor growth. Tumor histology was confirmed by light microscopy and immunohistochemistry.

Results: Animals implanted with irradiated cells did not produce PTRIC even when co-treated with TMZ. Rats considered to have tumor progression demonstrated steadily increasing luciferase activity coupled with increasing gadolinium-enhanced tumor volume and were found in animals receiving radiation doses less than 2Gy X3 without TMZ chemotherapy. Conversely, pseudoprogression was manifest by decreasing luciferase activity with increasing gadolinium volume over time found in tumors treated with 2Gy X3 and concurrent TMZ. Tumor histology was correlated with luciferase activity.

Conclusions: Our preliminary data suggests a potential model of pseudoprogression and/or radiation necrosis. This model needs to be further characterized with advanced imaging techniques including perfusion MR and multitracer PET imaging. We plan to use this model for future molecular and cellular studies to understand the cause and potential exploitation of these effects for better patient care.

Keywords: Pseudoprogresssion, imaging, rodent, enhancement

Objectives: 1. Understand the clinical problem of pseudo progression.

2. Describe a rodent model that can mimic this unique clinical situation.

3. Discuss potential imaging methods to differentiate pseudoprogression and true tumor progression.

Title: Fusiform Dilatation of the Cavernous Carotid Artery in Acromegalic Patients

Authors: Walavan Sivakumar; William Couldwell; Jay Riva-Cambrin; Karen L Salzman; Roukoz Chamoun

Introduction: Surgeons undertaking transsphenoidal surgery in patients with acromegaly confront multiple unique challenges secondary to the anatomic alterations caused by growth hormone–secreting tumors. The senior author has noted a fusiform dilatation to the cavernous carotid artery in many acromegalic patients. The authors aim to quantify this dilatation and correlate it with potential contributing factors.

Methods: Clinical and radiographic data were retrospectively assessed in acromegalic patients undergoing transsphenoidal surgery from 2000 through 2011. Randomly selected patients with nonsecreting pituitary adenomas were used as the control cohort. Demographic information, comorbidities, and preoperative growth hormone and insulin-like growth factor-1 levels were recorded. Magnetic resonance (MR) imaging variables included tumor size, diameters of the petrous, cavernous, and supraclinoid segments of the carotid artery and extent and location of cavernous sinus invasion. Independent correlations between acromegaly and each variable were assessed with multivariate regression analysis.

Results: Forty randomly selected patients with growth hormone–secreting adenomas who underwent surgery and had MR imaging with thin coronal slices of the pituitary region were enlisted in our study cohort. The mean age was 45.7 years. Forty-two males (52.5%) were included in the study. Mean carotid artery diameter measurements for acromegalic and control patients, respectively, were 4.2 vs. 3.8 mm (petrous carotid), 5.0 vs. 4.0 mm (cavernous carotid), and 3.3 vs. 2.9 mm (supraclinoid carotid). Multivariate analysis showed only age and cavernous carotid diameter were statistically significant independent variables ($p = 0.02$, $p < 0.001$, respectively). Age, tumor size, growth-hormone or insulin-like growth factor-1 levels, and cavernous sinus invasion did not correlate with cavernous carotid artery diameter.

Conclusions: In patients with acromegaly, there is a fusiform dilatation of the cavernous carotid artery that must be considered when planning transsphenoidal surgery.

Keywords: pituitary adenoma, acromegaly, growth hormone, transsphenoidal surgery

Objectives: 1. Understand the reason for increased surgical risk for transsphenoidal surgery in growth hormone secreting pituitary adenoma patients compared to those with other pituitary adenomas.

Title: Magnetic resonance FLAIR and T2 tumor volumes obtained intraoperatively compared to post-operative volumes in high and low grade gliomas

Authors: Randy L. Jensen; Walavan Sivakumar; Karen L Salzman; Forrester Lensing

Introduction: Intraoperative MRI is a useful tool in the operative management of human gliomas. In non-contrast enhancing gliomas, and to a lesser extent enhancing tumors, the T2 and FLAIR signals are important targets to determine target volumes for resection margins. We hypothesized that intraoperatively obtained MRI T2 and FLAIR signal volumes might not reflect corresponding post-operative volumes due to tumor edema after resection and brain manipulation.

Methods: We examined 12 low-grade gliomas (LGG, 9 low-grade astrocytomas and 3 oligodendrogliomas) and compared them to 13 high-grade tumors (HGG, 4 anaplastic astrocytomas, 3 anaplastic oligodendrogliomas, and 5 glioblastomas). Volumetric assessment of T2 and FLAIR signals were performed using the OSRIX image analysis program and ratios calculated for preoperative, intraoperative, and post-operative MRI images for each patient.

Results: Not surprisingly, for both LGG and HGG intraoperative and postoperative FLAIR and T2 signal volumes were significantly lower than post-operative volumes. Interestingly, for LLG the ratio of intraoperative FLAIR volume was on average 249% higher than postoperative FLAIR volume (range of 11-982%) and intraoperative T2 volume was 56% (range 0-149%). of post-operative T2 signal volume. For HGG, the ratio of intraoperative FLAIR volume was on average 255% higher than postoperative FLAIR volume (range of 19-1432%). Intraoperative T2 volume was 79% (range 27-168%) of postoperative T2 signal volume. When all tumor grades are analyzed together similar trends are found.

Conclusions: Postoperative FLAIR signal volumes are significantly lower and T2 signal volumes significantly higher than intraoperatively obtained corresponding volumes for LGG. HGGs demonstrated a similar trend for FLAIR signal volumes while T2 signal volume was similar for both intraop and post-op images.

Keywords: Glioma, Magnetic resonance imaging, Intraoperative, Tumor

Objectives: 1. Understand the increasing use of the intraoperative MRI.

2. Understand the increased utilization of different imaging modalities in intraoperative MRI.

3. Appreciate the difference between intraoperative and postoperative imaging findings with the intraoperative MRI.

Title: Spondylolysis and Isthmic Spondylolisthesis--Can They Be Considered Pathological?

Authors: Nicholas Andrade; Viktor Bartanusz

Introduction: Surgical treatment is widely applied in patients with low back pain (LBP) and spondylolysis (SL) or isthmic spondylolisthesis (IS), on the assumption that this imaging abnormality is the cause of the patient's symptoms. However, given that back pain and asymptomatic imaging abnormalities are both ubiquitous, this assumption of causality should be tested rigorously prior to recommending surgical intervention. Statistical association is one of several generally accepted criteria to establish causation. Our goal was to assess the primary data supporting or contradicting the hypothesis that spondylolysis or isthmic spondylolisthesis is associated with low back pain.

Methods: We searched Pubmed using Title=isthmic spondylolisthesis OR spondylolysis. Papers were then reviewed by hand. Primary data papers were defined as either 1) a cross-sectional study of the association of either imaging finding and low back pain in the general population, or 2) a longitudinal study that compared the incidence of low back pain in subjects with or without spondylolysis or spondylolisthesis. We also reviewed the reference section of all primary data papers and review articles to identify any other articles that might have been missed in the primary search.

Results: We identified 19 primary data papers. Of 14 cross sectional reports evaluating the association of SL or IS with LBP, five found an association, two were inconclusive, and seven found no such association. Of four longitudinal studies comparing the incidence of LBP in subjects with and without SL or IS, only one found an association, and the other three found no difference in the incidence of LBP in subjects with SL or IS compared to those without.

Conclusions: Existing data do not support an association between SL or IS and LBP, casting doubt on claims of causality. An alternative explanation for the observed benefits of surgery noted in some trials is that they are entirely due to nonspecific treatment effects, as has been shown for other interventional procedures directed at the relief of pain.

Keywords: spondylolysis, isthmic spondylolisthesis, causality, back pain

Objectives: 1. Understand the intellectual basis for ascribing patient symptoms to diagnostic findings.

2. Be familiar with the epidemiologic data regarding the association of low back pain with spondylolysis and isthmic spondylolisthesis.

3. Evaluate the empiric support for the hypothesis that spondylolysis and isthmic spondylolisthesis are causes of back pain.

Title: Sham Controlled Trials--The Next Step in Evidence-Based Surgery?

Authors: Nicholas Andrade

Introduction: Allocation concealment, via randomization, blinding, and placebo control, is a crucial safeguard against bias in the evaluation of therapeutic effectiveness. Meta-epidemiologic studies confirm the importance of adequate concealment for accurate estimates of treatment effect. For invasive procedures, use of a sham control procedure is necessary for optimal allocation concealment, and allows separation of specific (physiological) from nonspecific (psychological) treatment effects.

Methods: We searched for all sham-controlled trials of invasive procedures and analyzed them by disease, procedure, specialty, publication date, citation frequency, and impact on clinical guidelines. Next we focused specifically on neurosurgery, and analyzed relevant sham-controlled trials with respect to date, subject matter, and trial result.

Results: Across medicine, the frequency of sham-controlled trials is increasing (pre-1980--3; 1980-89--18; 1990-99--41; 2000-09--95). Nearly all interventional specialties have seen the publication of at least one sham-controlled trial. Most sham-controlled trials have evaluated “minimally invasive” procedures directed at subjective or fluctuating outcomes. 21 sham-controlled trials of neurosurgical procedures have been published to date, all since 2000. Neurosurgical procedures studied in sham-controlled trials include shunting, various forms of neurostimulation, cell transplantation, and vertebroplasty.

Conclusions: Sham-controlled trial design is increasingly employed to evaluate invasive procedures, especially those aimed at improving subjective or fluctuating outcome measures. This is probably due to increasing recognition of the importance of allocation concealment and control for nonspecific (“placebo”) treatment effects. In some fields, eg. interventional pain management, use of sham controls appears to be becoming a de facto standard, and neurosurgical trials are increasingly using sham controls as well. The distinction between specific and nonspecific treatment effects may help to maximize the benefit/risk ratio of therapeutic interventions.

Keywords: Evidence, placebo, sham, controlled trials

Objectives: 1. Understand the history of surgical randomized controlled trials and sham controlled interventional trials.

2. Understand current and future trends in surgical trials.

3. Identify situations in which nonspecific treatment effects and sham controlled trial design should be considered.

Title: Cortical Spreading Depression (CSD) in a CCM (Cerebral Cavernous Malformation) Mouse Model

Authors: Khaled M Krisht; KC Brennan; Kevin Whitehead

Introduction: Inducible knockout (KO) of the 3 cerebral cavernous malformation (CCM) genes, Krit-1, CCM2 and Pdcd10 has been used to study the functional and structural endothelial cell aberrations associated with CCM and to help elucidate the molecular mechanisms involved in lesion formation in a murine model. Recent studies on middle cerebral artery vessels from Krit-1 and CCM2 KO mice demonstrated a deficiency in endothelial-dependent vasodilation that can be rescued with the superoxide scavenger, Tempol. To date there has been no in-vivo investigation into the neurovascular behavior in CCM knockout mice with cortical and subcortical vascular lesions. Our study evaluates neurovascular coupling in CCM mice using optical intrinsic signaling (OIS) to study cerebral blood volume responses to direct visual and sensory stimulation and to study cortical spreading depression (CSD) induced with increasing concentrations of KCl.

Methods: KO mice induced between postnatal days 1-7 as well as their non-induced control litter mates were subject to a controlled experimental design utilizing optical intrinsic signal imaging of the fronto-parieto-occipital cortex to evaluate for sensory responses to visual and hindpaw stimulation as well as KCl-induced CSD (see figure).

Results: 83.3 % of KO mice had a second CSD versus 20 % of control mice. CSD in KO mice seems to be more often facilitated (4/6 vs 0/5) by sensory input and has a lower propagation velocity compared to control.

Conclusions: A mutation in any one of the 3 CCM genes leads to dysfunctional endothelial cells, which perturbs normal endothelial dependent vascular response. Cortical spreading depression, a well-conserved phenomenon involving neurovascular coupling appears to be different in CCM KO mice versus control mice. KO mice are more likely to have multiple CSDs that are more often facilitated by sensory input with a lower propagation velocity. This may have important clinical and therapeutic implications.

Keywords: CCM, CSD, Optical Intrinsic Signaling (OIS), Endothelial

Objectives: 1. Gain a conceptual understanding of cortical spreading depression including associated changes in K and field potential voltage.

2. Understand associated cerebral blood volume changes that accompany cortical spreading depression.

Title: Platelet Aggregometry Results after the Use of Common Non-Steroidal Anti-inflammatory Medications: Evaluation for the Perioperative Setting

Authors: William W. Scott

Introduction: Because of the concern for possible bleeding related with the use of NSAID medications, it has been common practice to postpone certain invasive procedures, withhold these medications after surgery, or in some emergent instances administer expensive treatments (i.e. administration of platelets, DDAVP). There is a paucity of data in the neurosurgical literature on the effects of NSAID medications on platelet function, and guidelines for perioperative surgical planning are needed. To provide further understanding of platelet function for the surgical setting, 5 commonly used NSAIDs were studied through whole blood platelet aggregometry (WBPA).

Methods: In addition to ASA, two COX-1 medications (naproxen and ibuprofen) and 2 COX-2 medications (celecoxib and meloxicam) were analyzed in healthy males and females between the ages of 20 to 55. Each individual initially underwent a baseline WBPA study, and then took the recommended daily dosage of a particular medication for 3 days with subsequent WBPA testing until aggregation normalized. Results were interpreted as the medication "having effect" on platelet aggregation if the WBPA agonist values were less than or equal to 4 ohms.

Results: Twelve individuals with normal baseline platelet functions on initial or subsequent WBPA testing were enrolled, including 6 males and 6 females (mean ages 42 and 40 years). The COX-2 inhibitor meloxicam had no effect against platelet aggregation at 24 hours in either males or females. At 24 hours, the COX-2 inhibitor celecoxib had no effect against platelet aggregation in females, and no effect in 67% of males. In the celecoxib group, differences against arachidonic acid, collagen and ADP levels at 24 hours between genders was found to be statistically significant ($p=0.001$, $p=0.047$ and $p=0.039$, respectively). The COX-1 inhibitor ibuprofen had no effect against platelet aggregation at 24 hours in females, and no effect in 83% of males at 24 hours. In the ibuprofen group, differences against arachidonic acid, collagen and ADP at 24 hours between genders was found to be statistically significant ($p=0.045$, $p=0.007$, and $p=0.023$, respectively). The COX-1 inhibitor naproxen had no effect against platelet aggregation in 83% of females at 48 hours, no effect in 50% in males at 48 hours, and no effect against platelet aggregation at 72 hours in either males or females. When comparing the naproxen group against ASA results,there were no statistically significant differences at 24 hours against arachidonic acid or ADP($p=0.338$ and $p=0.486$, respectively).

Conclusions: Variations from baseline platelet aggregometry values can occur in individuals taking NSAID medications; however, in individuals who are oth-

erwise healthy and take no additional dietary supplements, these variations are short-lived and are not necessarily physiologically relatable to platelet aggregation function. This data suggests, as it relates to the above medications and perhaps to a wider variety of COX-1 and COX-2 inhibitor medicaitons, that surgery is probably safe at a time interval between 24 and 72 hours, depending on type of medication and gender of the patient.

Keywords: Non-steroidal anti-inflammatory medications, Whole Bloood Platelet Aggregometry

Objectives: 1. Understanding of whole blood platelet aggregometry.

2. Relate NSAID medications to WBPA results.

3. Surgical safety relating WBPA results and NSAID medication use.

Title: Radiographic Assessment of Sub-acute Subdural Hematomas

Authors: Joel D. MacDonald; Sarah T Garber

Introduction: Treatment of sub-acute subdural hematoma remains a challenge in neurosurgery. Often, subdural hematomas arise in elderly patients with multiple medical comorbidities who may not be optimal surgical candidates. Several prior studies have examined the effectiveness of bedside twist drill craniostomy in this patient population for treatment of subdural hematoma versus operative evacuation under general anesthesia. These studies have shown equivalency in terms of recovery of neurologic function and date of discharge from the hospital. However, to date no study has examined radiological factors that may predict whether or not a patient with a subacute subdural hematoma could benefit from a bedside twist drill evacuation in lieu of an operative procedure.

Methods: The goal of our study was to analyze radiographic characteristics of operative subdural hematomas to try and determine predictive factors that would lead to successful evacuation via a bedside twist drill procedure. These radiographic factors included chronicity of subdural blood (acute, subacute, chronic), size of the hematoma, shape, Hounsfield units (density), presence of septations, midline shift, ventricular/sulcal effacement, and presence of thrombosed cortical veins if a study performed with contrast was available. We retrospectively examined the records of 104 patients treated for symptomatic subdural hematoma either via bedside twist drill or in the operating room between January 1, 2008 and December 31, 2011.

Results: Among these 104 patients, 21 patients underwent bedside twist drill craniostomy and 83 patients underwent operative evacuation. A total of 11 patients required a repeat intervention following their initial procedure, 2 in the bedside twist drill group and 9 in the operative intervention group. Presence of sulcal and/or ventricular effacement as well as midline shift were not found to be statistically significant in terms of outcome following intervention, while size > 12 mm and hyperdense hematomas (Hounsfield units > 30) favored operative intervention.

Conclusions: Bedside twist drill craniostomy is an effective option in patients with smaller subacute hematomas who may not be optimal surgical candidates.

Keywords: Subdural hematoma; Chronic subdural hematoma; Twist drill; Burr hole

Objectives: 1. Discuss the radiographic features of subacute subdural hematoma.

2. Discuss the indications for less invasive treatment of sub-acute subdural

hematoma.

3. Discuss the anticipated outcome for burr hole or twist drill drainage of sub-acute subdural hematoma.

Title: Fractionated Stereotactic Radiosurgery is Efficacious and Well-tolerated in Pediatric Intracranial Neoplasms

Authors: Todd C. Hankinson; S. Reed Plimpton; Nicholas K. Foreman; Michael H. Handler; Arthur K. Liu

Introduction: While data in the adult population indicates that fractionated stereotactic radiosurgery (fSRS) is associated with high degrees of efficacy and tolerability, there is little published experience dedicated to the treatment of children using fSRS.

Methods: We retrospectively reviewed the experience at Children's Hospital Colorado/University of Colorado Denver in treating 24 lesions in 15 pediatric patients (age 2.6-24.9y, median 10.0y) using fSRS between 2007-2012.

Results: Patients received a median of 24Gy (range 20-25Gy) in 3 fractions (range 3-5). Two patients, one with a multiply recurrent astroblastoma and one with an Ewing's Sarcoma metastasis, had not received previous radiation therapy. Twenty-three lesions (95.8%) were WHO Grade III-IV, with the exception being a pilomyxoid astrocytoma. Median tumor volume was 2.7 cc (0.4-94.5 cc). Median follow-up was 12.5 months (range 1.0-47.1 months). The local control rate was 91% at 2 years and overall survival was 76% at 2 years post-fSRS. Radiation necrosis was seen at 7 of the treated sites (29.2%) with a median onset time of 4.1 months (range 1.4-8.4 months).

Conclusions: fSRS is an effective and well-tolerated treatment for multiple types of intracranial pediatric neoplasms. Radiation necrosis may be more common than in the adult population.

Keywords: Stereotactic Radiosurgery, Pediatric Brain Tumor, Radiation Necrosis

Objectives: 1. Discuss the definition of fractionated stereotactic radiosurgery

2. Discuss the role of fractionated stereotactic radiosurgery in pediatric neuro-oncology.

3. Understand some differences in the use of fractionated stereotactic radiosurgery in the pediatric and adult populations.

Title: First North American case of Neuroferritinopathy with 16bp heterozygous duplication of the C terminus on the FTL gene

Authors: Chris Graham; Stuart Goodman

Introduction: Neuroferritinopathy is a rare, autosomal dominant, adult-onset movement disorder, associated with iron and ferritin deposition in the basal ganglia, secondary to mutations in the ferritin light chain gene (FTL).1 There are fewer than 100 reported cases worldwide. This is the first identification of a 16bp heterozygous duplication of the C terminus on the FTL gene in North America. Clinical, radiologic and genetic findings are presented.

Methods/Results: Proband JF is a 42-year-old male of Dutch and Swedish ancestry who presented with a progressive history beginning in his late teens of diffuse dystonic posturing, choreathetoid movements, and ataxia. He also developed an orolingual dyskinesia evidenced by the absence of expressive speech, but he retained the ability to demonstrate comprehension by holding up 1 or 2 fingers for "yes" or "no." His mother had similar progressive symptoms beginning in her early twenties that led to immobility and ultimately her death at age 34. JF had multiple neurologic work-ups resulting in various diagnoses, from progressive neurodegenerative process, to spastic quadraparesis, to progressive dystonia musculorum deformans. Treatments included physical therapy, Botox injections, and oral and intrathecal Baclofen, none of which provided more than minimal symptomatic relief. JF was referred to the neurosurgery service with a diagnosis of spasticity for replacement of his intrathecal Baclofen pump that had reached end-of-service. His clinical presentation however was more consistent with generalized dystonia, and he was considered for deep brain stimulator therapy. His preoperative MRI imaging revealed not only extensive volume loss with symmetrically enlarged sulci and ventricles, but also a striking complete cavitation of the basal ganglia, suggesting the possibility of a genetic metabolic disorder. His surgery was cancelled and a broader work up began, including repeat MRI with multiple acquisition sequences, metabolic blood tests, and genetic sequencing. Normal serum iron and ferritin levels were found. Gene sequencing of exon 4 of the ferritin light chain (FTL) gene revealed a 16bp heterozygous duplication (c.469_484dupGGCCCGGAGGCTGGGC).

Conclusions: Hereditodegenerative disorders and secondary dystonias should be considered in the differential diagnosis in all cases of movement disorders. The possibility of encountering one of these rare disorders warrants ordering MR imaging in the work-up of Parkinsonism, Huntington's chorea, or dystonia. Clearly, further research into the distinguishing features of FTL mutations is important. Our understanding of the differences in clinical presentation, MRI findings, and penetrance may increase with the diagnoses of more FTL mutations.

Keywords: neuroferritinopathy, Parkinson's Disease, dystonia, cavitation

Objectives: 1. Recognize basal ganglia cavitation as possible neuroferritinopathy. 2. Avoid a potential pitfall in the work up of a patient for DBS 3. Understand neuroferritinopathy as a rare genetic disorder.

Title: "Hold me liable for what?" The Ethical and Practical Pitfalls of the Curb-side Consult

Authors: Howard Morgan

Introduction: The curbside consult is a long-standing part of the practice of medicine. What does and does not constitute a curbside conslut is not always clear in practice, and court decisions seemingly have placed the practice in jeopardy.

Methods: The medical literature was searched regarding what constitutes and does not constitute a curbside consult. Some recent court decisions were re-viewed.

Results: Recommendations for reducing the risks of the curbside consult are made.

Conclusions: Curbside consultation will likely continue in the practice of medi-cine in general and neurosurgery in particular. A few simple rules will held reduce the risks of this practice.

Keywords: Curbside consult, informal consult, medical ethics

Objectives: 1. Recognize what constitutes a curbside consult.

2. Realize some of the practical, ethical and legal risks of curbside consultation.

3. Recognize how to avoid these risks.

Title: Case Report: Mal de Debarquement, an unusual condition following boat travel

Authors: J. Brett Dietze

Introduction: Mal de Debarquement is a condition which consists of a lingering perception of movement which occurs following travel,usually by boat.

Methods: A 61 year old healthy female presented with a 2 1/2 year history of a persistent sensation of rocking movement after disembarking from a Mediterranean cruise. She was referred for neurosurgical consultation due to the identification of diffuse dural enhancement on MRI.

Results: Serial imaging revealed progression of dural enhancement and thickening ultimately resulting in biopsy. Biopsy revealed a resolving subdural hematoma. The patients symptoms have remained unchanged.

Conclusions: The pathophysiology of Mal de Debarquement remains elusive. It is a condition not likely to be encountered in neurosurgical practice, however should be considered when evaluating patients with similar history and symptoms when other etiologies are ruled out.

Keywords: Mal de Debarquement, dural enhancement, visual motion intolerance

Objectives: 1. Be familiar with the history and symptoms consistent with Mal de Debarquement.

2. Be aware of the natural history and prognosis of this condition.

3. Be familiar with the differential diagnosis for this condition.

Title: Laminoplasty for Spinal Tumors a Twenty Five Year Experience

Authors: Albert H. Capanna; Dawn M. Capanna

Introduction: Laminoplasty for Spinal Tumors a Twenty Five Year Experience

Methods: The use of laminoplasty when removing spinal tumors greatly improves healing. Epidural, intradural and intramedullary tumors are removed and the spinal reconstruction aids in healing and decreases post-operative scar formation. Pediatric patients do particularly well at healing the laminar openings. All patient age groups do not develop the sometimes seen scalloping in their spine post complete laminectomy.

Results: The laminae and spinous processes are removed en-bloc regardless of how many segments are removed. This is accomplished through small laminotomies at the superior and inferior laminae and then using a craniatome with dura guard to cut along the laminae on both sides of the spinal canal. The bones are the removed en-bloc.

Conclusions: After removal of the tumor and pia-arachnoidoplasty and duraplasty are completed, the laminae are brought back into position. Originally, the laminae were sutured together at each level with nylon sutures. Instrumentation with plates and screws are now available. There were no complications secondary to the procedure and no hematoma formation or remote take backs to surgery.

Keywords: Laminoplasty, Spine, Tumor

Objectives: 1. Know how to perform a laminoplasty.

2. Know the various indications for laminoplasty.

3. Understand the benefit of laminoplasty vs. laminectomy.

Title: Cervical Spine Clearance Following Trauma

Authors: Paul Elliott

Introduction:

Methods:

Results:

Conclusions:

Keywords:

Objectives:

Title: Medical Marijuana use characteristics in patients with chronic spine pain disorders

Authors: Michael A. Finn; Chris Cain; Evaline Burger; Emily Lindley; Vikas Patel; Devin Razavi-Shearer; Sarah Henry

Introduction: The use of marijuana, or cannabinoids, as a pharmacologic treatment option for chronic pain syndromes has recently become a topic of great medical and social interest. In the state of Colorado, marijuana was legalized for medical purposes in 2000 and there are currently more than 115,000 patients registered to receive marijuana from over 800 dispensaries. More than 900 applications for medical marijuana cards are received by the state every day. In the last decade, research examining the role of cannabinoids in pain signaling pathways has begun to increase dramatically. However, there have been fewer clinical studies on the efficacy of cannabinoids for pain control or on the use characteristics of specific patient populations.

Methods: All adult patients presenting for initial evaluation at our institution were offered study enrollment. After informed consent, a brief survey regarding marijuana use was administered.

Results: Of the 200 patients offered enrollment, 184 (92%) agreed to participate. The sample consisted of 83 males (45%) and 101 females (55%). Of the 184 participants, 35 patients (19%) reported marijuana use for pain, most commonly via inhalation of smoked plant material (90%), followed by oral ingestion (45%), and inhalation of vaporized plant material (29%). While 31 of these patients (89%) used marijuana only for medical purposes, 4 patients (11%) also used marijuana recreationally. Marijuana users were significantly younger than non-users (44 vs. 54, $p<0.05$), but had similar educational and employment characteristics. There was a tendency towards a higher rate of usage in Hispanic patients (28.6%) than in White or African-American patients (18.4% and 12.5% respectively), but this difference did not reach statistical significance. Of the patients who reported marijuana use for their pain, 45.5% had a prescription, and 73% of these prescriptions were for spine pain. The majority of patients using marijuana (83%) also took other pain medications, primarily narcotics. Eighty-nine percent of users reported that marijuana "greatly" or "moderately" relieved their pain and eighty-one percent felt that marijuana worked better than or equal to narcotics. Patients typically used marijuana less than 1-2 times a day, and 14% reported negative side effects of marijuana use, including depressed mood (5.7%), difficulty concentrating (20%), memory problems (8.6%), weight gain (25.7%), and paranoia (11.4%). Forty-three percent of these patients felt the negative side effects were significant.

Conclusions: Marijuana use for pain control is surprisingly frequent in our spine patient population. However, less than half of all users in our survey had

a legal prescription for medical marijuana use. While marijuana users were younger than non-users, other demographic factors surveyed were comparable. Most patients using marijuana for their spine pain reported moderate to great alleviation of painful symptoms with tolerable side effects. However, negative side effects were reported. Further research is needed to ascertain whether marijuana use for chronic pain is truly efficacious in this population and to determine whether it has any effects on surgical outcomes.

Keywords: Medical Marijuana, Chronic Pain, Spine Pain

Objectives: 1. Describe the frequency of medical marijuana use in a tertiary care spine population.

2. Describe the most common routes of delivery of medical marijuana.

3. Describe the most common side effects of medical marijuana use in the spine population.

Title: Analysis of direct stimulation of primate visual cortex over 2 years

Authors: Tyler Davis; Paul A. House; Bradley Greger

Introduction: It has been hypothesized that a vision prosthesis capable of evoking useful visual perceptions can be based upon electrically stimulating the primary visual cortex (V1) of a blind human subject via penetrating microelectrode arrays.

Methods: As a continuation of earlier work, we examined several spatial and temporal characteristics of microstimulation using an array of 100 penetrating microelectrodes chronically implanted in V1 of a behaving macaque monkey. The principal finding was that two years after implantation we were able to evoke behavioural responses to electric stimulation across the spatial extent of the array using groups of contiguous electrodes.

Results: Consistent responses to stimulation were evoked at an average threshold current per electrode of 204 ± 49 μA (mean ± std) for groups of four electrodes and 91 ± 25 μA for groups of nine electrodes. Saccades to electrically-evoked targets using groups of nine electrodes showed that the animal could discriminate spatially distinct percepts with groups having an average separation of 1.6 ± 0.3 mm (mean ± std) in cortex and 1.0 ± 0.2 degrees in visual space.

Conclusions: These results demonstrate chronic perceptual functionality and provide evidence for the feasibility of a cortically-based vision prosthesis for the blind using penetrating microelectrodes.

Keywords: vision, stimulation

Objectives: 1. Discuss barriers to the use of penetrating electrode arrays.

2. Note that chronic stimulation did not seem to cause functional harm to visual cortex.

3. Discuss strategies for producing artificial vision.

Title: Concussion in Sports Injuries - The Return to Play Question

Authors: J. Brett Dietze

Introduction: Recent events within organized sports have brought the issue of concussion into the limelight. Much of this attention is due to controversy that has arisen regarding the long term impact of multiple concussions occurring throughout the careers of professional athletes.

Methods: A survey of current literature is performed with emphasis placed on identifying specific evaluation criteria which will hopefully allow neurosurgeons to establish guidelines providing a more consistent means of making decisions about an athlete's ability to return to play.

Results: The issue of sports related concussion has come to the forefront of public scrutiny in light of several recent high profile tragedies involving former professional athletes with histories of multiple concussions. Furthermore there is a growing body of evidence which suggests that a plurality of even mild injuries can result profound and devastating long term functional disabilities. As neurosurgeons we are called to task in an effort to set standards for our non-neurosurgical colleges who are on the sidelines or in the locker rooms to follow in their decisions of whether or not to allow athletes to return to the field of play.

Conclusions: In light of the significant role that sports plays in our culture, we are faced with competing agendas. There are often considerable ramifications behind benching an injured athlete, frequently resulting in pressure from coaches, front offices and players themselves to overlook injuries. Because of the reliance on the athlete to honestly and accurately report symptoms, which are often vague and highly subjective, there is great need for a reliable, and structured system to evaluate athletes with suspected concussions.

Keywords: Concussion, Contact Sports, Return to Play

Objectives: 1. Discuss the need to be objective in evaluating sports participants with suspected concussions.

2. Create awareness of the potential long term ramifications of multiple concussions.

3. Identify criteria that will aid the development of a comprehensive and reliable system for evaluating athletes with concussions.

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Mark your calendars, the 49th Annual Meeting
of the
Rocky Mountain Neurosurgical Society, Inc.
will be held in:

VICTORIA ISLAND
BRITISH COLUMBIA, CANADA
WESTERN BEAR MOUNTAIN GOLD RESORT AND SPA
JUNE 14-18, 2014