PROGRAM

FIFTY-SECOND ANNUAL MEETING

OF

THE ROCKY MOUNTAIN NEUROSURGICAL SOCIETY, LLC

Honored Guests:

Dr. James Goodrich, MD

Dr. B. Gregory Thompson, MD

Dr. William Couldwell, MD, PhD

June 17-21, 2017

The Ritz Carlton Lake Tahoe

Truckee, California

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 2016-2017

President:	Kelly Schmidt, MD
President Elect:	Brett Dietze, MD
Vice President:	Michael Seiff, MD
Secretary:	Joseph Sramek, MD
Treasurer:	Brad Duhon, MD
Historian:	Albert H. Capanna, MD
Past President:	Richard Day, MD
Member at Large:	Bryan Wohlfeld, MD

Committees 2016-2017

Scientific Program Committee:	Mark Mahan, MD
CME Committee:	Erik Parker, MD
Local Arrangements:	Kris Smith, MD
Nominating Committee:	Paul Elliott, MD (2017) Paul House, MD (2018) Richard Day, MD (2019)
Membership Committee:	Kelly Schmidt, MD Paul House, MD Bryan Wohlfeld, MD
Website Administrator:	Joel D. MacDonald, MD
New Members:	Mark Mahan, MD Michael Finn, MD Joshua Krass, DO Stephen Campbell, MD Jeffery Larson, MD John McGregor, MD

MEETING AT A GLANCE

SATURDAY, JUNE 17, 2017

1:00 - 5:00 p.m.	**Registration**
1:00 - 5:00 p.m.	**Board Meeting**
6:30 - 9:30 p.m.	**Opening Reception (Ritz Backyard Patio)**
	Children's Fun Time

SUNDAY, JUNE 18, 2017

7:00 - 7:55 a.m.	**Physician Breakfast**
7:00 - 9:00 a.m.	**Spouse and Children's Breakfast**
8:00 a.m. - 12:00 p.m.	**Scientific Session I**
6:30—9:30 p.m.	**Lake Tahoe Dinner Cruise on The Tahoe Girl (Bus Departs Ritz at 5:30 pm)**

MONDAY, JUNE 19, 2017

7:00 - 7:55 a.m.	**Physician Breakfast**
7:00 - 9:^{00} a.m.	**Spouse and Children's Breakfast**
8:00 a.m. - 12:00 p.m.	**Scientific Session II**
1:00– 5:00 p.m.	**Tennis Tournament**
6:30 - 9:30 p.m.	**President's Dinner (executive board and guest speakers)**

TUESDAY, JUNE 20, 2017

7:00 - 7:55 a.m.	**Physician Breakfast**
7:00 - 9:00 a.m.	**Spouse and Children's Breakfast**
7:30 - 7:55 a.m.	**Annual Business Meeting**
8:00 a.m. - 12:00 p.m.	**Scientific Session III**
1:30 - 5:30 p.m.	**Golf Tournament at Old Greenwood, Tahoe Golf Club**
6:30 - 10:00 p.m.	**Annual Award Banquet and Dance (Ritz Pines Ballroom)**

WEDNESDAY, JUNE 21, 2017

7:00-7:55 a.m.	**Physician Breakfast**
7:00-9:00 a.m.	**Spouse and Children's Breakfast**
8:00 a.m.-12:00 p.m.	**Scientific Session IV**
12:00 p.m.	**Meeting Adjournment**

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).

Raffle

This year we will hold a raffle for a *brand new* **Apple TV.** To enter the raffle you must submit your completed entry card by 12:00 Noon, Tuesday, June 20th, 2017. Entry completion requires an exhibitor sign off from each booth.

The Ritz Carlton Lake Tahoe
13031 Ritz Carlton Highlands Court
Truckee, California 96161
1-530-562-3000

The 2017 Rocky Mountain Neurosurgical Society Meeting will be held from June 17th through June 21st at The Ritz-Carlton Lake Tahoe, Truckee, California. Dr. Kris Smith is serving as the local arrangements chairperson, and is putting together an exciting array of activities for members, guests, and their families at this wonderful resort.

The venue for the 52nd annual meeting is a family vacation resort tucked mid mountain at Northstar California Resort. This wonderful resort promises to offer the usual relaxing yet fun-filled experience that our membership and their families have come to expect. The usual robust scientific program will take place during the mornings, with the afternoons open to participate in one of our planned activities, or just relax and enjoy spending time with family or reconnecting with old friends. Social activities include a Lake Tahoe dinner cruise, our annual golf and tennis tournaments, and awards banquet and dance.

The Ritz-Carlton Lake Tahoe is a AAA Five Diamond mountain resort and is just a 10 minute drive from Lake Tahoe, the largest alpine lake in North America with crystal clear waters, many beaches and access to a plethora of water activities. The Village at Northstar is just a gondola ride away and has adventure activities for adults and kids, shopping and dining. Other nearby activities include fly fishing, hiking and mountain biking or explore the nearby mountain town of Truckee with it's quaint downtown full of unique dining options and specialty boutiques.

At the end of the day, gather around the fire pit, with the Ritz-Carlton Marshmologist to enjoy freshly made s'mores or an evening cocktail. The meeting will promise to provide not only stimulating scientific discussion, but lifelong memories!

Social Highlights - All attendees, including exhibitors, are invited to our social program*.
Breakfast Daily 7:00—9:00 a.m.
Opening Reception - *Ritz Backyard Patio* - ***Saturday, June 17th***
Lake Tahoe Dinner Cruise -Sunday, June 18th, 2017 (Transportation Provided)
Tennis Tournament - *Northstar Tennis Club* - **Monday, June 19th, 2017**
President's Dinner– *Wolfdale's*– **Monday, June 19th, 2017**
Golf Tournament - *Old Greenwood at Tahoe Golf Club* - **Tuesday, June 20th, 2017**
Annual Banquet-*Ritz Pines Ballroom*-**Tuesday, June 20th, 2017**
Enjoy dinner, dancing, with awards and prizes for outstanding categories in our Golf and Tennis tournaments.

LEARNING OBJECTIVES

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

1. Describe common neurosurgical injuries related to paragliding and hang-gliding.
2. Potential strategies to reduce cost while maintaining quality of care.
3. The staged surgical concept in separation of craniopagus twins.
4. Describe the appropriate role of joint denervation in the treatment of osteoarthritis
5. Discuss the use of stand-alone expandable interbody device as option for symptomatic adjacent segment disk degeneration in lumbar spine.

METHODS OF INSTRUCTION

Live Program with didactic lectures, case presentations/discussion, panel discussions and oral paper presentations

INTENDED AUDIENCE

The Target Audience includes Attending Neurosurgeons in Academic and Private Practice, Neurosurgical Residents, Interns, Medical Students, Neurosurgical Nurses, Nurse Practitioners and Physicians Assistants.

Notes

SCIENTIFIC PROGAM - JUNE 18th - 21st

Rocky Mountain Neurosurgical Society

52nd Annual Meeting

The Ritz Carlton, Lake Tahoe

SUNDAY, JUNE 18th

07:00-07:55	**Breakfast**
08:00-12:00	**SCIENTIFIC SESSION I**
Moderator:	**Joe Sramek, MD**
08:00-08:10	**Introductory Remarks and Welcome** **President Kelly Schmidt, MD**
08:10-08:30	**Ilyas Eli MD** ****** Endonasal operative corridor expansion by sphenoidal pneumosinus dilatans in tuberculum sellae meningiomas
08:30-08:50	**Cody Smith** Long-Term Follow-up of 25 Cases of Biopsy-Proven Radiation Necrosis or Post-Radiation Treatment Effect Treated with Magnetic Resonance-Guided Laser Interstitial Thermal Therapy
08:50-09:10	**Andrea Brock MD** ****** Quantification of Interleaving for the Activa PC™

09:10-09:30	**Al Capanna MD** A Uniform Definition of Death
09:30-10:00	**Break**
10:00-10:20	**Local Host Welcome to Lake Tahoe** **Kris Smith, MD** *Vendors Welcome*
10:20-10:40	**Andrea Brock MD** ****** Assessment of Cost Drivers in Transsphenoidal Approaches for Resection of Sellar and Para-sellar Tumors using the Value-Driven Outcome Database
10:40-11:00	**Marshal Fairres** Long term outcome data from 121 patients treated with Gamma Knife radiosurgery as salvage therapy for focally recurrent high grade glioma
11:00-12:00	**SPECIAL GUEST LECTURE – James Goodrich, MD** **Chief, Division of Pediatric Neurosurgery at the Montefiore Medical Center, in the Bronx, NY** History of the craniotomy, from antiquity to the present
NOON	**ANNOUNCEMENTS & ADJOURN**

** Resident Award Candidate

MONDAY JUNE 19th, 2017

07:00-07:55	**Breakfast**
08:00-12:00	**SCIENTIFIC SESSION II**
MODERATOR:	**Brad Duhon MD**
08:00-08:20	**Leslie C Robinson MD, PharmD, MBA ****
	Endoscopic Spine Training for Neurosurgical Residents
08:20-08:40	**Mark Mahan MD**
	Denervation for Pain – Joints
08:40-09:40	**SPECIAL GUEST LECTURE – William Couldwell MD PhD**
	Chair, Department of Neurosurgery at the University of Utah in Salt Lake City, UT
	Skull Base Surgery: Quo Vadis?
09:40-10:10	**Break**
10:10-11:10	**SPECIAL GUEST LECTURE – B. Gregory Thompson MD**
	Chief, Vascular Neurosurgery and
	Residency Program Director at the
	University of Michigan in Ann Arbor, MI
	Advances in hearing preservation using the middle cranial fossa approach

11:10-11:30	**Jian Guan MD ****
	Development of a Predictive Score for Discharge Disposition After Lumbar Fusion Using the Quality Outcomes Database
11:30-11:50	**Bryan Wohlfeld MD**
	Patient Outcomes Following Posterior Lumbar Interbody Fusion for Adjacent Segment Disease Using VariLift as a Standalone Interbody Device
NOON	**ANNOUNCEMENTS & ADJOURN**

**** Resident Award Candidate**

TUESDAY JUNE 20th, 2017

07:00-07:55	**Breakfast**
07:30-07:55	**ANNUAL BUSINESS MEETING FOR *ALL* RMNS MEMBERS**
08:00-12:00	**SCIENTIFIC SESSION III**
MODERATOR:	**Joel MacDonald MD**
08:00-08:10	**Introduction to RMNS 53rd Annual Meeting in Fairmont Banff Springs, Banff, AB** **Kelly Schmidt MD**
08:10-08:30	**Bornali Kundu MD **** Local brain tissue water content, a novel measure of injury in traumatic brain injury patients
08:30-08:50	**Jian Guan MD **** A Randomized Clinical Trial for Hypovitaminosis D in the Neurocritical Care Unit
08:50-09:10	**Mark Mahan MD** Pathologic remodeling of endoneurial tubules in human neuromas
09:10-09:30	**Brad Duhon MD** Blast Injuries, TBI, and Mass Casualties
09:30-10:00	**BREAK**

10:00-11:00	**SPECIAL GUEST LECTURE – James Goodrich MD** Craniopagus twins and their surgical separation
11:00-11:20	**Michael Finn MD** 3D Printing in Spine Surgery: From Pre-Operative Planning to Patient Specific Implants
11:20-12:00	**Brad Duhon MD** Difficult cases in spine surgery
NOON	**ANNOUNCEMENTS & ADJOURN**

**** Resident Award Candidate**

WEDNESDAY JUNE 21th, 2017

07:00-07:55	**Breakfast**
08:00-12:00	**SCIENTIFIC SESSION IV**
MODERATOR:	**Mark Mahan MD**
08:00-08:20	**Joel MacDonald MD** Neurosurgical Injuries Related to Paragliding and Hang-gliding Accidents in Utah
08:20-09:20	**SPECIAL GUEST LECTURE – B. Gregory Thompson MD** The limits of evidence-based treatment selection in contemporary intracranial aneurysm surgery
09:20-09:50	**Break**
09:50-10:40	**SPECIAL GUEST LECTURE – James E. Faulds, Ph.D. [Local guest lecture]** **NBMG Director/State Geologist/Professor** **Nevada Bureau of Mines and Geology** **University of Nevada, Reno** Why is Nevada in hot water?
10:40-11:00	**Kris Smith MD** Early Experience with 3-D Stereo EEG Electrodes for Seizure Focus Localization in Non-temporal, Non-lesional medically refractory Epilepsy

11:00-11:20	**John B Dietze MD** Avoiding Burnout and Finding Purpose in Neurosurgical Practice
11:20-11:40	**Theodore Larson MD** Cannabis, Reversible Cerebrovascular Syndrome, and Cerebral Hemorrhage
11:40-11:55	**Joseph Sramek MD** Non-compressive intrathecal pain pump catheter granuloma with signal change in the spinal cord and neurologic deficit.
11:55-12:00	**Closing Remarks and meeting adjourn** **Kelly Schmidt MD**

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.

Abbott Movement Disorders
Baxter Healthcare Corporation
Boston Scientific Neuromodulation
Codman
Cyberonics/ Livanova
DAY Surgical
DePuy Synthes
Integra Ipsen Biopharmaceuticals
Isto Biologics
K2M
KLS Martin
Leica
Medtronic
Nevro
NICO Corporation
Orthofix
Osteomed
Providence Medical Technology
SI Bone
Southwest Surgical, LLC
Stryker
Sutter Medical USA
Synaptive Medical
Vertex Pharmaceuticals
Wenzel Spine
Zimmer Biomet Spine

*Visit each booth and qualify to win an **Apple TV!***

Notes:

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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
Brad Duhon, MD*	SI-Bone, Inc	Consultant
	Boston Scientific	Consultant
	Synaptive Medical (Wife)	Consultant
Mark Mahan, MD*	University of Utah	Grant
	NREF	Grant
Kelly Schmidt, MD*	Cyberonics/Livanova	Honorarium
Bryan Wohlfeld*	Nuvasive	Honorarium

*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:

Andrea Brock, MD

John B. Dietze,MD*

Jian Guan, MD

Bornali Kundu, MD

Theodore Larson, MD

Erik Parker, MD*

Cody Smith

Joseph Sramek, MD*

* Educational content planner of this meeting

Accreditation/Continuing Medical Education

This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (AACME) through the joint providership 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 **16.0** *AMA PRA Category 1 Credits*TM. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Joint Providership Disclaimer

The material presented at the 52nd 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 provided 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 52nd 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 appoint-

ed 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	1992	Sedona, AZ
1967	Tucson, AZ	1993	Bigfork, MT
1968	Banff, AB	1994	Snowmass, CO
1969	McAllen, TX	1995	Sun Valley, ID
1970	Sun Valley, ID	1996	Telluride, CO
1971	Colorado Springs, CO	1997	Jasper Park Lodge, AB
1972	Guadalajara, Mexico	1998	Vail, CO
1973	Scottsdale, AZ	1999	Coeur D'Alene, ID
1974	Victoria, BC	2000	Alyeska, AK
1975	Cozumel-Merida, Mexico	2001	Steamboat Springs, CO
1976	Las Vegas, NV	2002	Santa Ana Pueblo, NM
1977	Lake Tahoe, NV	2003	Big Sky, MT
1978	Colorado Springs, CO	2004	Squaw Creek, CA
1979	Jackson Hole, WY	2005	Whistler, BC
1980	Park City, UT	2006	Sedona, AZ
1981	Durango, CO	2007	Jackson Hole, WY
1982	Big Sky, MO	2008	Park City, UT
1983	Mescalero, NM	2009	Girdwood, AK
1984	Colorado Springs, CO	2010	Telluride, CO
1985	Banff, AB	2011	Taos, NM
1986	Keystone, CO	2012	Maui, HI
1987	Deer Valley, UT	2013	Sun Valley, ID
1988	Lake Tahoe, NV	2014	Victoria, BC
1989	Durango, CO	2015	Colorado Springs, CO
1990	Vail, CO	2016	Whitefish, MT
1991	Jackson Hole, WY	2017	Lake Tahoe, CA

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**
2013	**Paul Elliott**	**Denver, CO**
2014	**Paul House**	**Salt Lake, UT**
2015	**Richard Day**	**Hamilton, MT**
2016	**Kelly Schmidt**	**Las Vegas, NV**

Abstracts RMNS 2017:

Endonasal operative corridor expansion by sphenoidal pneumosinus dilatans in tuberculum sellae meningiomas

Ilyas Eli, MD, Amol Raheja, MBBS, Michael Karsy, MD, PhD, Jian Guan, MD, William T. Couldwell, MD, PhD

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Department of Neurosurgery, All India Institute of Medical Sciences, New Delhi, 110029, India

Abstract

Objective: Tuberculum sellae meningiomas (TSMs) account for 5–10% of intracranial meningiomas, and they are occasionally associated with sphenoidal pneumosinus dilatans (PSD). The authors systematically evaluated the impact of sphenoidal PSD– associated skull base morphology in expanding the endonasal operative corridor to TSM tumors.

Methods: The authors retrospectively reviewed the charts of patients with TSMassociated sphenoidal PSD who were treated at our institution over a recent epoch. Clinical and radiographic features were noted. Skull base morphology of patients with TSM-associated sphenoidal PSD patients was compared with that of non-tumor controls by using propensity-matched analysis.

Results: A total of 38 patients with TSM and sphenoidal PSD were identified and matched by age and sex to 32 patients without tumors (controls). Overall, no significant difference between test and control groups was noted in sphenoid sinus size or other parameters; however, significantly greater mean distance from the posterior margin of the planum sphenoidale to the diaphragma sella (0.76 ± 0.23 vs. 1.03 ± 0.27, $p = 0.0001$) and angle between the planum sphenoidale to anterior face of sella turcica (113.41 ± 10.58 vs. 123.21 ± 12.55, $p=0.001$) were seen in patients with TSM and PSD, suggestive of a selective expansion of the tuberculum sellae region. TSM/sphenoid sinus morphologies were

divided into three types (A, B, C) based on the extent of tumor and sinus morphology. There was progressive increase in tumor volume and anteroposterior sinus diameter from sphenoidal PSD types A through C. Because of the limited number of endonasal cases in the cohort, the surgical corridor Raheja et al. 3 used did not differ significantly based on the TSM/PSD morphologies ($p = 0.58$); however, three of the four endonasal approaches performed in this study were used in patients with type A morphology (small tumors limited to tuberculum sellae region and posterior half of planum sphenoidale).

Conclusions: The findings of this propensity-matched morphometric study suggest that TSM-associated sphenoidal PSD leads to more selective splaying of the tuberculum sellae region rather than cumulative increase in sinus volume. This may lead to operative corridor expansion for endonasal access to TSM associated with sphenoidal PSD. This one factor may be weighed in the context of others, such as tumor extent, in the decision to use the endonasal corridor for resection. The authors propose a radiological classification scheme for sphenoidal PSD associated with TSM, which may be helpful in standardizing the sphenoid sinus morphology across studies of TSM tumors and analyzing the potential role of splanchnocranial bony sinuses in aiding surgical decision-making for choosing an appropriate operative corridor.

Long-Term Follow-up of 25 Cases of Biopsy-Proven Radiation Necrosis or Post-Radiation Treatment Effect Treated With Magnetic Resonance-Guided Laser Interstitial Thermal Therapy

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*School of Medicine, University of Arizona,Tucson, Arizona; ‡Department of Neuro-surgery, St.

Joseph's Hospital and Medical Center, Barrow Neurological Institute, Phoenix, Arizona

BACKGROUND: Magnetic resonance-guided laser-induced thermal therapy (MRgLITT) is a minimally invasive surgical treatment for progressive neoplasms and post-radiation treatment effect (PRTE).

OBJECTIVE: To evaluate the radiographic response and efficacy of MRgLITT for biopsy confirmed PRTE and the quality-of-life outcomes of patients following MRgLITT.

METHODS: We conducted a single-center retrospective study of radiographic responses and clinical outcomes of 25 patients with previously treated primary or secondary brain neoplasms (World Health Organization grades 4 [n = 8], 3 [n = 5], 2 [n = 5]) and metastatic brain tumors (n = 7). MRgLITT was applied directly following stereotactic needle biopsy confirming PRTE without any evidence of tumor presence.

RESULTS: Mean overall survival times (months) for grades 4 and 3 and for metastatic brain tumors were 39.2 (standard error [SE], 7.6; 95% confidence interval [CI], 24.3-54.1), 29.1 (SE, 7.7; 95% CI, 14.0-44.2), and 55.9 (SE, 10.0; 95% CI, 36.3-75.4), respectively. Mean progression-free survival times after MRgLITT were 9.1 (SE, 3.6; 95% CI, 2.1-16.1), 8.5 (SE, 2.4; 95% CI, 3.9-13.2), and 11.4 (SE, 3.9;

95% CI, 3.8-19.0), respectively. Mean survival times after MRgLITT were 13.1 (SE, 2.3; 95% CI, 8.5-17.6), 12.2 (SE, 4.0; 95% CI, 4.4-20.0), and 19.2 (SE, 5.3; 95% CI, 8.9-29.6), respectively. The SF-36 indicated significant overall effects on mental health (P = .029) and vitality (P = .005).

CONCLUSION: MRgLITT may be a viable option for patients with symptomatic advancing PRTE and is less invasive than open craniotomy. Although our results suggest a positive effect for MRgLITT on PRTE, prospective randomized trials with larger numbers of patients are needed to validate the study

KEY WORDS: Laser-induced thermal therapy, Laser interstitial thermal therapy, Minimally invasive

neuro-surgery, Post-radiation treatment effect, Radiation necrosis, Stereotactic laser ablation,

Thermocoagulation, Thermotherapy

TITLE: Quantification of Interleaving for the Activa PC

AUTHORS: Andrea Brock, MD, MSCI[1]; Alberto Fuentes, BS[2]; Christopher R. Butson, PhD [1,2]

[1]Department of Neurosurgery, University of Utah, Salt Lake City, Utah. [2]Department of Bioengineering, University of Utah, Salt Lake City, Utah

Introduction

Deep brain stimulation (DBS) is currently FDA approved for treatment ofmovement disorders. Newer commercially available stimulators, such as the Activa PC (Medtronic Model 37601 Minn.), offer the ability to rapidly alternate two stimulation programs at a fixed frequency, known as interleaving. Interleaving allows additional programming strategies when conventional monopolar or bipolar settings fail to relieve patient symptoms, however full characterization of the capabilities and limitations of interleaving has not been investigated.

Methods

All contact wires from an Activa PC were removed from the contact casingand isolated. A Power 1401 (CED, Cambridge, UK) recording system withcomplementary recording software, Spike 2 (CED Cambridge UK), were used to record the voltages generated by the pulse generator on each electrode contact wire. Five-second trials were recorded while varying stimulus amplitude, frequency, and pulse width for the following stimulation settings: monopolar, bipolar, single lead monopolar and bipolar interleaving, and dual lead monopolar and bipolar interleaving. Quantification of these recordings was conducted using Matlab (MathWorks Inc, Natick, MA, USA).

Results

For a given programmed voltage, the majority of measured voltages delivered by the pulse generator were lower in amplitude. The largest discrepancy between programmed and measured voltages occurred with varying pulse width. There was better fidelity between programmed and measured voltages with monopolar and bipolar

settings alone than with interleaving. For monopolar and bipolar settings, voltages ranged from 92.5%-100% and 88.6-97.6% of programmed values respectively. When single lead interleaving was used, voltages ranged from 81.9-99% and 80-98.9% of programmed values for monopolar and bipolar settings respectively. For dual lead monopolar interleaving voltages were 80-103.7% of programmed values while dual lead bipolar interleaving voltages ranged from 77.8- 100%.

Conclusions

Interleaved settings give practitioners programming alternatives not previously offered. However one must be cognizant of the restrictions placed on the pulse generator in order to achieve maximum patient benefit.

keywords: deep brain stimulation (DBS), interleaving, movement disorders

Objectives:

1. Participants identify interleaving as a programming strategy
2. Participants distinguish the importance of characterizing the output of DBS stimulators
3. Participants recognize when stimulator output does not match programmed settings

Title: Neurosurgical Injuries Related to Paragliding and Hang-gliding Accidents in Utah

Authors: Erinc Akture, MD and Joel D. MacDonald, MD

Keywords: Paragliding, hang-gliding, neurosurgical injuries

Study Design: Retrospective Chart review

Introduction: Airborne sports such as paragliding and hang-gliding have gained popularity recently. We present our experience in the management of neurosurgical injuries associated with paragliding (PG) and hang-gliding (HG) at a regional level 1 trauma center.

Methods: We retrospectively reviewed the Utah state trauma registry to identify patients injured while participating in PG and HG between January 2000 and February 2012. We identified a subset of patients who required treatment for acute injuries to the head, spine, peripheral nerves.

Results: We identified 45 patients with injuries resulting from PG and HG accidents treated at our institution. Age range was 14 to 67 years with a mean age of 39. Almost all of the patient were male (44/45). Of the 37 patients with neurosurgical injuries, there were 4 closed skull fractures, 4 intracranial hemorrhagic injuries, 3 spinal cord injuries (one with persistent deficits), and 2 peripheral nerve injuries. The spinal injuries included one cervical, 14 thoracic, 27 lumbar, 6 sacral/coccygeal fractures. Twelve patients required surgery including one for depressed skull fracture and 11 for spinal fractures.

Conclusion: Paragliding and hang-gliding accidents represents a small and unique subset of outdoor sports injuries. Injuries generally occur during landing and take-off. Spinal injuries were most common and resulted from axial loading. The lumbar spine was found to be the most common site of injury.

Learning Objectives: At the completion of the session or demonstration, participants should be able to... (Please provide three learning objectives)

Describe common neurosurgical injuries related to paragliding and hang-gliding.

Discuss common mechanisms of spinal injuries in airborne sports.

A Uniform Definition of Death

Al Capanna, Dawn Capanna, Gianna Capanna, Brianna Capanna, Beau Capanna and Gabriella Santacruz

There is not a uniform definition of death in the United States, nor throughout the world. Despite extensive study and attempts at uniformity there remains a wide variation about the definition of death. In 2015, the case of a 20 year old college student in Nevada, Aden Hailu, again painfully brought home the need for unanimity and caused the topic to explode again in the medical, legal and ethical realms.

As neurosurgeons, we are often involved with a patient with cerebral death. It is important to know what the state law in regard to the pronunciation of death where the patient physically is located. In 2014, the lack of uniformity in state laws allowed the body of Jahi McMath, a brain dead teenager, to be transported from California to New Jersey, because her family, after a declaration of brain death, objected to the discontinuation of organ support.

We are constantly fighting for our patients lives and are often looked to for guidance as to the prognosis for our patients. It is important for all of us to understand the situation, to know the law, to know our own ethical and religious beliefs. We must try to be honest, ethical, know the law, and be a source of accurate information and guidance to our patient's families at these difficult times.

An overview of the history, and how it has changed with the advent of ventilators, transplantation and societal beliefs will be presented. The current situation among the states will be reviewed and what we need to know to intelligently proceed into the future.

Keywords: brain death, law, ethics

Objectives:

Describe ethical concerns regarding brain death declaration

Identify challenges between clinical ethics and state laws

Understand the potential hazards of brain death declaration in clinical practice

Assessment of Cost Drivers in Transsphenoidal Approaches for Resection of Sellar and Parasellar Tumors using the Value-Driven Outcome Database

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Department of Neurosurgery, University of Utah, Salt Lake City, Utah.

Abstract

Introduction: Reducing healthcare costs while maintaining and improving patient quality of care has become imperative in the neurosurgical care of patients. The recently implemented Value-Driven Outcome (VDO) database at the University of Utah is one approach that is useful in identifying cost drivers and tracking changes over time. We used the database in the study of transsphenoidal approaches for pituitary tumor resection.

Methods: A retrospective review by common procedural terminology code was performed for transsphenoidal resection approaches for patients with pituitary adenoma from July 2012 to September 2016. Total cost, subcategory costs, and potential cost drivers were evaluated via the VDO database.

Results: A total of 272 patients (mean age 51.1±17.7 years, 45.6% male) with a mean length of stay of 4±4 days were evaluated. Total costs were divided into facility utilization and other services (60%), physician professional fees (16%), pharmacy (11%), supplies and implants (7%), laboratory studies (5%), and imaging (1%). Facility costs were driven by neurocritical care unit (30.7%), neurosurgical operating room (16.6%), and neurosurgical floor (11.2%) costs. Subcategories in surgical supplies (e.g., BioGlue, fibrin sealants, absorbable gelatin, and carotid stent and delivery systems), and pharmaceuticals (e.g., thrombin, miscellaneous treatments, and remifentanil) could be identified and compared. Multivariable linear regression analysis, after adjusting for length of stay and American Society of Anesthesiologists grade, showed that overall cost and imaging (ρ=0.045, p=0.0001).

was heavily influenced by facility utilization (ρ=0.581, p=0.0001), pharmacy (ρ=0.115, p=0.0001), supplies and implants (ρ =0.351, p=0.0001), The top ten outlier cases accounted for 18.7% of total costs charged in relation to neurosurgical care during the time period while the average case accounted for a mean of 0.24±0.29% of the total cost.

Discussion: The results of this study highlight the importance of facility utilization and pharmaceutical, supply/implant, imaging, and laboratory costs as drivers in overall cost for transsphenoidal pituitary tumor resection. Moreover, facility utilization accounted a stronger cost driver than any other aspect of care. Various strategies may offer the opportunity to mitigate cost while maintaining quality of care, including stratifying low-risk patients to an intermediate care unit and reducing length of stay. The VDO database provides a method to identify important changes, implement a protocol, and track progress.

Key words: cost effectiveness, value driven outcome, pituitary adenoma

Objectives:

1. Participants will classify cost-effectiveness research at the University of Utah utilizing the Value Driven Outcome (VDO) database

2. Participants will identify cost drivers important in the treatment of pituitary adenomas by a transsphenoidal approach

3. Participants will employ potential strategies to reduce cost while maintaining quality of care

Long term outcome data from 121 patients treated with Gamma Knife radiosurgery as salvage therapy for focally recurrent high grade glioma.

Fairres M, Smith C, Myers C, Chapple K, Youssef E, Smith K

BACKGROUND:

GBM is the most common primary brain tumor in adults that accounts for approximately 15% of all brain tumors. Due to their generally highly infiltrative nature and relative resistance to radiation and chemotherapy, most patients experience a recurrence within one year. An option for focal reoccurrence is gamma knife stereotactic radio surgery (GKSRS).

METHODS:

This is a single center, retrospective study of radiographic response and clinical outcomes following GKSRS treatment of recurrent malignant gliomas. Patients were treated between January 2005 and March 2014. 121 patients met inclusion criteria and were treated at a large academic, medical center in South Western USA. Patients were selected for salvage SRS when surveillance MRI imaging demonstrated relatively small areas of nodular tumor recurrence, without significant mass effect or an alternative to surgery for deeper, or more eloquent regions. Pretreatment biopsy was not performed.

RESULTS:

Patients were divided by baseline tumor WHO grade, lesions were 61.3 % (n=73) WHO grade 4, 22.7% (n= 27) WHO grade 3 and 16.0% (n=19) WHO grade 2. WHO grade tumors had progressed to high grade prior progressed to high grade prior to GK treatment. Prior treatments included: 100% (n=121) of the patients underwent resection, 71.1% (n=86) underwent re-resection (for recurrence), 91.7% (n=111) underwent intensity-modulated radiation therapy, 14.0% (n=17) had Gliadel wafers placed, 21.5% (n=26) had been treated on clinical trial and 28.9% (n=35) had received bevacizumab. The percentage of the target volume coverage was calculated in all cases with 100% coverage

by the 50% isodose line achieved in nearly all cases, with the 50% isodose line receiving a 12-15 Gy dose. Median overall survival from the date of GK salvage treatment in months was 16.8 for the combined cohort, and respectively 127.2, 21.6, and 14.4 for grade 2, grade 3 and grade 4 lesions. Median progression free survival in years post GK Salvage was 8.4 months for the cohort combined, 13.2 for grade 2, 9.6 for grade 3, and 8.4 for grade 4 lesions.

CONCLUSION:

Our outcomes suggest that GKSRS offers an effective and appropriate treatment modality for properly selected patients with focal recurrent high grade gliomas.

Special guest Lecture—James Goodrich, MD

Craniopagus

Learning Objectives

1. Distinguish the staged surgical concept in separation of craniopagus twins.
2. Recognize the history of the medical and surgical management of craniopagus twins.
3. Demonstrate the use of 3-D modeling in surgical management and surgical planning in craniopagus twins.

Craniopagus twins are a very rare event with only 2-3 cases being born a year around the world. The talk will review the history of neurosurgical treatment in this disorder. Historically the surgical separation was done in a single stage surgery. More recent work has shown these children do much better with staged separation, typical 3-4 stages over a year. The preparation and surgical nuances will be reviewed.

History of the Craniotomy

1. Understanding the origins of the craniotomy.
2. The evolution of the surgical techniques in designing a craniotomy
3. The influence of the craniotomy on surgical exposure in neurosurgical cases.

One of the oldest operation in the world's history has been the craniotomy/craniectomy. A historical review of the various surgeries and techniques will be reviewed along with the development of the neurosurgical profession as we know it today.

Special Guest Lecturer—B. Gregory Thompson, MD

The limits of evidence-based treatment selection in contemporary intracranial aneurysm surgery

Will discuss recently published evidence based guidelines for the treatment of ruptured and unruptured intracranial aneurysms. The presentation will also emphasize the limits of those evidence based guidelines, and discuss a practical treatment algorithm based on clinical and imaging characteristics of patients with aneurysms. New treatment alternatives such as Flow Diverting stents will also be discussed as examples of novel techniques which are rapidly changing our field and illustrate the limits of evidence based recommendations.

Learning Objectives:

1) Discuss recent Evidence based Treatment recommendations for management of Ruptured Intracranial Aneurysms

2) Discuss recently updated Evidence based Treatment recommendations for Unruptured Intracranial Aneurysms

3) Discuss the limits of Evidence based analysis for treatment of intracranial Aneurysms with novel techniques such as Flow Diverting Stents

Advances in Hearing Preservation using the middle cranial fossa approach

Will illustrate the advantages of this approach for Hearing and facial nerve preservation with resection of vestibular schwannomas. The presentation will emphasize selection of the ideal candidate, recognition of key microsurgical anatomy, and use of technical pearls for Cranial Nerve preservation. Facial and Hearing outcomes and complication avoidance will be points of emphasis.

Learning Objectives:

1) Identify imaging and clinical features that most strongly indicate a marked advantage for the Middle Cranial Fossa Approach in Treatment of Vestibular Schwannomas

2) Identify key surgical anatomy and discuss technical pearls to optimize the chance for Facial and Hearing Preservation with the Middle Cranial Fossa Approach

3) Discuss Key Outcome Metrics and Complication Rates with resection of Vestibular Schwannomas via the Middle Cranial Fossa Approach

Endoscopic Spine Training for Neurosurgical Residents

Leslie C Robinson MD, PharmD, MBA and J Peter Witt MD, PhD

University of Colorado, Aurora

Endoscopic and laparoscopic techniques have become increasingly more prevalent throughout multiple surgical fields over the past several decades. As surgical indications for use of these techniques increases, the need for defined training programs becomes necessary. Different surgical specialties have developed different methods to ensure competency when performing these procedures. A position statement by the Society of American Gastrointestinal Endoscopic Surgeons (SAGES) regarding laparoscopic surgical training states that laparoscopic operations are an integral component of general surgery training and that the minimum defined case numbers set by the Residency Regulatory Committee (RRC) should be used as a reference point for the required basic and advanced laparoscopic exposure needed for competency. The use of the endoscope in neurosurgical spine procedures is an emerging field with no defined training program established. We have developed a curriculum for training neurosurgical residents to develop the appropriate skills to become competent to perform endoscopic spine procedures. The first step in this program is attend a lecture series that covers the use of the spinal endoscope, pertinent surgical anatomy, and different surgical indications and approaches. The second step involves training on an endoscopic training device that allows practice of targeting and approach on an image-guided, realistic physical feedback saw bones model. The third step involves a hands-on cadaver lab that covers the handling of the endoscope and the surgical procedures. The final step involves exposure to the procedures in the OR as an assistant and as skills improve transitioning to performing the procedure independently under the supervision of a trained faculty member.

There is currently no minimum case number set by the RRC for neurosurgical endoscopic spine procedures. We proposed a study where we assess the utility of this training program. We will take all residents through the lecture series. We will then take half of the residents and complete a training session on the training device. We will then have all the residents complete localization of a target on a cadaver comparing time to target, xray use, accuracy, and incidence of nerve injury. We hypothesize that the use of the training device will improve resident skills and suggest that it will be a useful adjunct in neurosurgical training prior to transitioning skills into the OR.

Denervation For Pain—Joints

Mark Mahan, MD

Introduction:

Diarthrodial joint osteoarthritis is one of the most common surgical indications, with an estimated number of 1 million joint replacement surgeries per year in the US alone. Most joint replacement surgeries are for pain, not mechanical instability or ankylosis. Since pain is transmitted along specific nerve branches to joints, specially designed denervation surgeries can help treat osteoarthritis pain without joint replacement.

Methods:

Treatment options for joint denervation will be reviewed, including pre-operative assessments, surgical details, and post-operative outcomes.

Results:

Joint denervation demonstrates a substantial decrease in pain and improved patient functioning. They can be performed with little morbidity or decrease in strength. Long-term results are still pending.

Conclusions:

Peripheral denervation adds a low-risk option for the treatment of refractory osteoarthritic pain.

Objectives

- Describe the scientific rationale of joint denervation
- Describe the appropriate role of joint denervation in the treatment of osteoarthritis
- Describe the surgical technique of joint denervation

Notes

TITLE: Development of a Predictive Score for Discharge Disposition After Lumbar Fusion Using the Quality Outcomes Database

AUTHORS: Jian Guan; John J Knightly; Erica Bisson

STUDY DESIGN: Retrospective chart review

INTRODUCTION:
Lumbar fusion remains the treatment of choice for a variety of degenerative pathologies. Healthcare costs related to the procedure are an area of concern, and post-discharge needs often contribute to greater expenditure. The Quality Outcomes Database (QOD) is a prospective, multi-center clinical registry designed specifically to analyze outcomes after neurosurgical procedures. We sought to create a simple scoring system to predict discharge needs after lumbar fusion using the QOD.

METHODS:
Institutional QOD data from two high-volume neurosurgical centers were collected for analysis. Univariate and multivariable logistic regression analyses were used to identify factors for our model. A receiver operating characteristic curve was used to set cutoff scores for patients likely to discharge home without needing ongoing services and those likely to require additional services/alternative placement after hospital discharge.

RESULTS:
Two hundred seventeen patients were included to build our model. Five variables—osteoporosis, predominant preoperative symptom, need for assistive device for ambulation, American Society of Anesthesiologist grade, and age—were included in our final scoring system, in which patients with higher scores are less likely to need additional services. In patients with high scores (8–10), our scale correctly predicted discharge needs in 88.7% of cases. In patients with low scores (0–5), our scale predicted discharge needs (additional home services/alternative placement) in 75% of cases. For our final instrument, the area under the curve for our receiver operating characteristic curve was 0.809 (95% CI 0.720–0.897).

CONCLUSIONS:
We present a simple scoring system that may be utilized to assist in predicting post discharge needs for patients undergoing lumbar fusion for degenerative disease. Further validation studies are needed to assess the generalizability of our scale.

KEYWORDS: Lumbar fusion, predictive scores, quality outcomes database, discharge disposition

OBJECTIVES: By the conclusion of this session, participants should be able to:

1) Describe the importance of discharge planning in lumbar fusion surgery.
2) Discuss, in small groups the utility of our scoring system for predicting discharge needs following lumbar fusion.
3) Identify an effective intervention for possibly reducing costs related to lumbar fusion using our scoring system.

Title: Patient Outcomes Following Posterior Lumbar Interbody Fusion for Adjacent Segment Disease Using VariLiftÒ as a Standalone Interbody Device

Authors: Bryan J. Wohlfeld MD, Diana Cardenas del Monaco PhD

Abstract

Purpose: Adjacent segment disease (ASD) is a notable complication following lumbar fusion surgery. Many clinicians use various surgical techniques to correct the progression of spine deterioration and reduce the risk of continued adjacent segment disease. The aim of this study is to provide patient outcomes following posterior lumbar interbody fusion (PLIF) using the VariLift standalone interbody device (without supplemental fixation) for the treatment of ASD.

Methods: This retrospective study reviewed 9 cases involving patients who underwent a singlelevel PLIF for the treatment of ASD. Patient demographics, comorbidities, surgical complications, time to fusion, Visual Analog Scales for Pain (VAS), and overall recovery were used as outcome measures. The 9 patients (8 males, 1 female) with a mean age of 62.3 (42 to 72) years underwent a single level procedure. Preoperative symptoms requiring surgical intervention included intractable low back pain, spondylosis or stenosis, and/or recurrent disk herniation of the level above or below prior surgical intervention with a minimum of 6 months failed conservative treatment. The standalone VariLift® interbody fusion system was used in all 9 patients regardless of the type of fusion/fixation instrumentation previously used. A standalone device is described as one that does not require supplemental fixation (pedicle screws and rods). Surgical technique consisted of diskectomy and generous bilateral laminotomies or laminectomy with medial facetectomies.

Results: Radiographic ASD was confirmed in 100% of all cases. Each of these 9 cases had a history of a lumbar fusion. Preoperatively, 89% of patients (8 of 9)reported 9-10 VAS pain levels. All 9 cases underwent a second surgery for the treatment of symptomatic ASD using the standalone VariLift interbody device. All patients experienced

symptomatic improvement and, by 12 months postoperatively, average VAS pain scale for all patients was 2. Overall, pain scores improved significantly from baseline to 12 months ($p = 0.129$). Solid interbody fusion without implant failure was observed in all cases with averaged time to fusion at 346 days (min = 181 days).

Conclusion: Posterior lumbar interbody fusion using the VariLift device to treat symptomatic ASD offers significant clinical success and solid fusion rates without the need for supplemental fixation or extension of previous supplemental fixation.

Keywords: Posterior lumbar interbody fusion (PLIF), adjacent segment disease (ASD), standalone, VariLift, complications

Learning objectives:

Discuss the use of stand-alone expandable interbody device as option for symptomatic adjacent segment disk degeneration in lumbar spine.

Review patient selection, technical details, postoperative management and outcome.

TITLE: Local brain tissue water content, a novel measure of injury in traumatic brain injury patients

AUTHORS: Bornali Kundu; James Gee; Al-Wala Awad; Min S Park; Gregory W Hawryluk

STUDY DESIGN: Retrospective chart review

INTRODUCTION:

Brain edema predicts poor neurological outcomes in traumatic brain injury (TBI) patients, however, it is indirectly assessed by intracranial pressure (ICP) monitoring. Intraparenchymal thermal conductivity-based probes measure local cerebral blood flow but more recently have been used to derive a measure of tissue water (TW) content in the brain (i.e. local cerebral edema). Hypertonic saline boluses lower the TW content measure in neurosurgical patients. However, how this measure responds over time through a patientâ€™s ICU course has yet to be established. We investigated whether TW content responds to hyperosmolar and hypothermic therapy administered over time in neurosurgical patients.

METHODS:

TBI patients with ICP monitoring placed due to poor neurological status were reviewed. A Camino Bolt (Integra Life Sciences Inc) monitoring system or an extraventricular drain was used. Patients were chemically paralyzed and cooled to a goal temperature of 34-35 degrees Celsius. A QFlow500 probe (Hemedex Inc.) was placed in the hemisphere containing more intact brain tissue according to current guidelines. Patient were monitored for several days. Correlation between TW and ICP, TW and serum sodium, and TW and temperature were calculated.

RESULTS:

N=15 patients were included in this study. Results showed that an ICP of 17-20 mmHg is related to 75-76% TW content. Overall, there is a negative relationship between TW and serum sodium, though this seems to depend on the prior state of the brain, i.e. time from injury. Bolusing with hypertonic saline was related to lower TW content. Finally, there is a positive correlation between TW and body temperature over time for the patients whom were cooled (n=3).

CONCLUSIONS:

Local TW content is a novel measure that can be used as part of current multimodal neuromonitoring systems to allow for both global and local, targeted treatment of brain injury.

KEYWORDS:

cerebral blood flow, traumatic brain injury

OBJECTIVES:

1. State the principles of elevated ICP management in traumatic brain injury patients.

2. Identify the recommended ranges of normal ICP, serum sodium, etc as stated in in the Brain Trauma Foundation Guidelines.

3. Describe the use of cerebral blood flow monitoring as a component of neuromonitoring in the ICU.

A Randomized Clinical Trial for Hypovitaminosis D in the Neurocritical Care Unit

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Introduction: Hypovitaminosis D is endemic with over 20% of the population showing deficient levels (≤20ng/ml). Not only does vitamin D play a role in bone metabolism, but it is implicated in cardiovascular, and inflammatory molecular signaling. Multiple studies have shown that patients with deficiency show worse prognosis for the intensive care unit (ICU), during treatment of asthma, and during acute respiratory distress syndrome. Our group was the first to evaluate vitamin D deficiency in a neurocritical care setting (Guan et al. JNS 2016). To further extend that work, we sought to perform phase 2/3 randomized clinical trial for hypovitaminosis D (NCT02881957).

Methods: After Institutional Review Board approval, patients underwent screening for eligibility if they were admitted to the neurocritical care unit emergently. These patients included both neurology and neurosurgery patient to encompass a broad spectrum of disease. Patients with a level ≤20ng/ml were randomized to receive vitamin D (540,000 IU, oral once) or placebo and vitamin D levels were redrawn 3 days after administration. Demographic and clinical variables were evaluated. The primary outcome of length-of-stay (LOS) was captured with secondary variables including ICU LOS, in-hospital complications, in-hospital mortality, EQ-5D quality-of-life scores, and functional mobility.

Results: A total of 103 patients of 436 planned patients have been enrolled to date. No significant adverse events have been reported during safety and data integrity evaluations. The expected date of trial completion is in October of 2018.

Discussion: Vitamin D may play a potential role in the future treatment of neurocritical care patients. It has a significant safety profile and can be rapidly normalized with adequate dosing. In addition, vitamin D is cost-effective, costing ~$15/patient. For example, a single day reduction in LOS for an ICU patient could cover the drug cost for over 400 patients. This analysis may be potentially impactful for multiple neurosurgical patient types and rapidly deployed to ICUs.

Keywords - Vitamin D, glasgow outcome scale, neurocritical care

Learning Objectives:

By the conclusion of this session, participants should be able to:

1) Describe the importance of hypovitaminosis D in post-discharge outcomes in neurocritical care patients.
2) Discuss, in small groups, ways in which hypovitaminosis D testing may be useful for patients admitted to the neurocritical care unit.
3) Identify an effective intervention for detecting hypovitaminosis D in the neurocritical care population.

Pathologic remodeling of endoneurial tubules in human neuromas

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Abstract

Introduction: Laminins are a family of extracellular matrix proteins that participate in the formation of endoneurial tubules and are important in regeneration and repair of nerves. They act as scaffolds to guide nerves to distal targets and play a key role in neurite outgrowth. There is evidence that laminin architecture affects nerve regeneration, and we sought to evaluate endoneurial tubules by examining laminin structure in clinical samples from patients with nerve injury.

Methods: In a retrospective review of 8 nerve injury cases, we evaluated neuroma histology in relation to clinical history and injury type. Immunohistochemical delineation of laminin structure in relationship to neuromas was performed.

Results: Five cases of upper trunk stretch injuries—four from childbirth injury and one from a motorcycle accident—and three cases of nerve laceration leading to neuroma formation were examined. In the upper trunk stretch injuries, avulsed nerves demonstrated no neuroma formation with linear laminin architecture, fibrous tissue deposition, and regular Schwann cell arrangement. In regenerative neuromas, laminin immunohistochemistry demonstrated a double-lumen laminin tubule, with encapsulation of Schwann cells and axonal processes. Neonatal stretch injuries displayed significantly greater disorganized regeneration compared to adult stretch injuries. Nerve laceration leading to neuroma formation had a similar double-lumen laminin tubule, but less severe fibrosis.

Conclusions: In nerve injuries with regenerative capacity, endoneurial tubules become pathologically disorganized. A double-lumen endoneurial tubule develops, which appears to be related to frustrated regeneration. The appearance of the abnormal channels suggests paired pathology between axon migration and Schwann cell remodeling of fiber architecture. Further exploration of this feature may aid in the generation of novel modes of treatment.

Key words: peripheral nerve, neuroma, trauma

Objectives: describe what a neuroma is and when it forms

Describe key pathology of a neuroma

Describe the novel findings in neuromas with regard to laminin

Blast Injuries, TBI, and Mass Casualties

Brad Duhon, MD

Abstract:

Most of our experience with Blast-Type Traumatic Brain Injuries are from active military. That being said, the numbers of mass casualties within the US are on the rise. In this presentation, we will discuss the pathophysiology, treatment, and expected outcomes of Blast-Type TBI via literature review.

Learning Ojectives:

1. Identify intracranial injury patterns with blast injuries
2. Construct an ability to triage multiple patients with intracranial injuries
3. State the physiology and outcomes of blast and penetrating head injuries.

Disclosures:

1. SI-Bone, Inc. Consultant and Educator. No Royalties and not relevant.
2. Boston Scientific. Consultant and Educator. No Royalties and not relevant.

Complex Spine talk.

Brad Duhon, MD

Abstract:

A case-based review of complex spinal trauma and degenerative cases will be presented. Audience input and feedback will be engaged.

Keywords:

1. Complex Spine
2. Management
3. Discussion

Objectives:

1. Discuss management of complex spine patients
2. Discuss Novel treatment solutions for spine pathologies
3. Identify complications and management of spinal disorder treatment

Michael Finn, MD

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3D Printing in Spine Surgery: From Pre-Operative Planning to Patient Specific Implants

Introduction:

3D printing was developed in the 1980s and has enjoyed a rapid boost in capabilities over the last decade. Everything from auto parts to patient specific implants are currently being 3D printed. As the technology improves, it's utilization in neurosurgery, and spine surgery specifically will likely increase. We describe the current state of the art of 3D printing for spine specific applications culminating in the development of a custom patient specific implant.

Methods:

A history of 3D printing is provided with an eye towards utilization in surgery. A case report is provided in which 3D printing was utilized to create a patient specific implant in the case of a failed lumbo-sacral fusion after en bloc sacrectomy. The process of device design and creation are described.

Results:

The custom device was successfully implanted. The patient experienced immediate pain relief in the short term, likely secondary to the robust immediate stability of the implant. The patient is currently beginning to ambulate 6 months post-operatively.

Conclusions:

3D printing has developed to point where the creation of custom spinal implants is feasible. Greater experience is necessary to determine the ultimate role of it utilization in spine surgery.

Abstract Title: Early Experience with 3-D Stereo EEG electrodes for Seizure Focus Localization in Non-temporal, Non-lesional medically refractory Epilepsy.

Kris A. Smith, MD, Barrow Neurological Institute, Phoenix, Arizona

Several recently developed technologies are now available for use in patients with medically refractory epilepsy. Stereoelectroencephalography (SEEG) has made 3-dimensional seizure onset localization a less invasive and more precise option for the surgical work-up. Advances in software and computer power have allowed more precise co-registration of MEG data, which is important for patients with normal MRIs. All patients who were implanted with SEEG electrodes with the new software merged with MEG over the last 2 years are reported with early seizure outcome results. Learning points from implantation strategies and potential pitfalls and nuances of this recording strategy are discussed.

Learning Objectives:

1. Indicate recent advances in technology which allow for minimally invasive approaches for epilepsy surgery to be applicable to more patients than in the past.

2. Associate case presentations and outcome studies to understand the minimal-access surgical philosophy, demonstrating the potential to improve patient outcomes and decrease morbidity.

3. Describe new concept of SEEG based mapping and temporal-spatial epileptic zone origination modeling, correlated to MEG data, to more precisely localize an epileptic focus.

Key Words: Epilepsy, MEG, SEEG

TITLE: Avoiding Burnout and Finding Purpose in Neurosurgical Practice

AUTHORS: John B Dietze

STUDY DESIGN: Survey

INTRODUCTION:
There are few occupations that are as stressful as the practice of neurological surgery. If not managed effectively, the emotional and psychological toll can be devastating.

METHODS:
Burnout is defined as "as a drawback related to life-management difficulty combined with a state of vital exhaustion" (ICD-10 Version:2010). Symptoms include fatigue, cynicism, disconnectedness, anger problems, and guilt. The challenges associated with the practice of neurosurgery create an environment where the risk of burnout is high.

RESULTS:
The burnout rate among neurosurgeons is over 56% according to a 2012 survey of AANS members. Factors contributing to burnout include long work hours, strained interpersonal relationships due to the former, and liability concerns to name only a few. There is therefore a need to be intentional in adopting strategies which minimize exposure to this risk factors whenever possible.

CONCLUSIONS:
A failure to appropriately manage stress not only adversely affects the quality of life for the provider and those with whom he is in relationship but also his patients. As such, maintenance of emotional and psychological health is of utmost importance toward the goal of providing the best possible care.

KEYWORDS: Coping Mechanism, Stress, Burnout

OBJECTIVES: Be able to understand what burnout is and how to prevent it.
Identify strategies to cope with stressful situations.
Define relationship between good emotional health and good patient care

Notes

TITLE: Cannabis, Reversible Cerebrovascular Syndrom, and Cerebral Hemorrhage

AUTHORS: Theodore C Larson

STUDY DESIGN: Retrospective chart review

INTRODUCTION:

If cannabis causes reversible cerebral vasoconstriction syndrome,
and reversible cerebral vasoconstriction syndrome causes cerebral hemorrhage,
then, cannabis should cause cerebral hemorrhage. Although described in RCVS publications, the association between the three entities has not been emphasized.

METHODS:

Chart review of patients with intracranial hemorrhage, documented marijuana use, and catheter cerebral angiography was completed. Patients with a history of other illicit drug use and those with hemorrhagic conversion of ischemic infarction were excluded.

RESULTS:

Six patients met the inclusion criteria. All patients presented with HA, typically severe. Three patients had SAH, three had IPH, and 2 had PRES. RCVS was diagnosed on catheter cerebral angiography in all patients. Angiography findings sometimes were subtle, especially early after ICH. CTA was ineffective to diagnose RCVS. Three patients had seizures. One patient underwent brain biopsy that was negative.

CONCLUSIONS:

Because of the increased prevalence of cannabis use, patients who present with ICH should undergo diagnostic catheter cerebral angiography to determine if RCVS is the underlying etiology and determine appropriate management. Given that a non-trivial percentage of the population tests positive for cannabinoids, the incidence of RCVS caused by cannabis is likely low.

KEYWORDS: Cannabis, RCVS, Cerebral Hemorrhage

OBJECTIVES:

1. Recognize cannabis has been reported to cause RCVS.
2. State RCVS can present as ischemic or hemorrhage cerebral insults.
3. Distinguish catheter cerebral angiography is necessary to diagnose RCVS.

TITLE: Non-compressive intrathecal pain pump catheter granuloma with signal change in spinal cord and neurologic deficit.

AUTHORS: Joseph G Sramek

STUDY DESIGN: Case report

INTRODUCTION:

58 year old female with a history of multiple lumbar fusions in the past and chronic pain with an intrathecal drug pump delivering a combination of morphine and bupivacaine developed acute onset of left leg weakness and numbness.

METHODS:

patient was seen and evaluated. With a thorough history and neurologic exam and review of appropriate imaging modalities, a differential diagnosis was determined. As the patients symptoms had been stable for several months prior to neurosurgical consultation, the patients pain pump dosing was gradually tapered under direction of patients pain specialist. As her symptoms failed to improve, surgical exploration was performed. Patient has been followed for several months postoperatively and follow up imaging obtained.

RESULTS:

Preoperative MRI reveals increased T2 signal in the thoracic cord at the T10 level and enhancement around the tip of the catheter which appears to be non compressive. intraoperatively, a granulomatous reaction was found around the tip of the catheter with adherence to the dorsal aspect of the spinal cord and tethering to the dura. The granuloma was separated off the cord and the tip of the catheter was transected. Pathology consistent with granuloma. In short term follow up, patients symptoms are stable and MRI shows resolution of increased T2 signal at the T10 level.

CONCLUSIONS:

Catheter tip granulomas are a rare entity that can occur with intrathecal drug delivery. Typically neurologic deficits can occur from compression. This is an unusual case in which the granuloma did not appear compressive and imaging changes and neurologic deficits may be related to an inflammatory response or to a tethering phenomenon.

KEYWORDS: Intrathecal catheter, granuloma

OBJECTIVES: 1.Identify consideration of catheter tip granuloma in a patient with an intrathecal drug pump and development of new neurologic deficit.

2. Recognize potential risk factors in development of catheter tip granulomas.

3. Employ management strategies for intrathecal catheter granuloma

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Mark your calendars, the 53rd Annual Meeting
of the
Rocky Mountain Neurosurgical Society, Inc.
will be held in:

BANFF, ALBERTA
FAIRMONT BANFF SPRINGS
JUNE 16 –20TH, 2018

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