PROGRAM

THE FORTY-NINTH ANNUAL MEETING

OF

THE ROCKY MOUNTAIN NEUROSURGICAL SOCIETY, LLC

American Association of Neurological Surgeons

Jointly Sponsored by AANS

Honored Guests:

Dr. Sean Grady MD
Dr. James T. Rutka, MD, PhD
June 14-18, 2014

Westin Bear Mountain Resort

Victoria, BC

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 2013-2014

President: Paul Elliott, MD
President Elect: Paul House, MD
Vice President: Andrew Daily, MD
Secretary: Brett Dietze, MD
Treasurer: Kelly Schmidt, MD
Historian: Albert H. Capanna, MD
Past President: Stewart Levy, MD
Member at Large: Michael Seiff, MD

Committees 2013-2014

Scientific Program Committee: Brad Duhon, MD
Local Arrangements: Lee Krauth, MD
Membership Committee: Michael Brown MD (2014)
Randy Jensen MD, PhD (2015)
Stewart Levy MD (2016)
Nominating Committee: Randy L. Jensen, MD, PhD
Stewart Levy, MD
Paul House, MD
CME Committee: Kris Smith MD
Website Administrator: Joel D. MacDonald, MD
### MEETING AT A GLANCE

**SATURDAY, JUNE 14, 2014**
- 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 15, 2014**
- 7:00 - 7:55 a.m. Physician Breakfast
- 7:00 - 11:00 a.m. Spouse and Children's Breakfast
- 8:00 a.m. - 12:00 p.m. Scientific Session: Trauma
- 1:00 pm - ? Ziplining / Whale Watching

**MONDAY, JUNE 16, 2014**
- 7:00 - 7:55 a.m. Physician Breakfast
- 7:00 - 11:00 a.m. Spouse and Children's Breakfast
- 8:00 a.m. - 12:00 p.m. Scientific Session: Neoplasia
- 12:30 – 6:00 p.m. Golf Tournament / Whale Watching
- 7:00 - 10:00 p.m. President's Dinner (executive board and guest speakers)

**TUESDAY, JUNE 17, 2014**
- 7:00 - 7:55 a.m. Physician 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: Spine
- 12:30 - 4:00 p.m. Tennis Tournament / Whale Watching
- 6:30 - 10:00 p.m. Annual Award Banquet and Dance
- 5:30 - 9:00 p.m. Kids’ Party

**WEDNESDAY, JUNE 18, 2014**
- 7:00-7:55 a.m. Physician Breakfast
- 7:00-11:00 a.m. Spouse and Children’s Breakfast
- 8:00 a.m.-12:00 p.m. Scientific Session: Vascular/Functional
- 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 17, 2014. Entry completion requires an exhibitor sign off from each booth.
The Westin Bear Mountain Golf Resort & Spa, Victoria
1999 Country Club Way
Victoria, British Columbia V9B 6R3
Tel. (250) 391-7160

The 2014 Rocky Mountain Neurosurgical Society Meeting will be held from June 14th through June 18 at Westin Bear Mountain Resort and Spa, Victoria, British Columbia. Dr. Lee Krauth is serving as the local arrangements chairperson, and is putting together an exciting array of activities for members, guests, and their families at this pristine iconic Mountain Resort.

Located in a sub-Mediterranean zone, Victoria, British Columbia boasts the mildest climate in Canada. Victoria receives an average of 2,183 hours of sunshine per year. The average monthly temperature for June 67°F.

Just a few miles west of The Westin Bear Mountain Golf Resort & Spa, Victoria is Goldstream Provincial Park, home to Mount Finlayson, one of the most popular hiking destinations near Victoria. The trail going up is rugged and at times steep, but immensely rewarding thanks to the beautiful native trees and flowing Goldstream River. At the top of the 656-foot peak, you’ll enjoy panoramic views, including the resort and city of Victoria, as well as the Strait of Juan de Fuca and the Olympic Mountains in the distance.

A short drive to downtown Victoria offers a myriad of activities. From museums and castles to whale-watching and kayaking, wine and beer tours, gardens and zoos, Victoria’s attractions invite visitors into a world of history, entertainment, and color. The capital city of British Columbia, Victoria is located on the southern tip of Vancouver Island off Canada’s Pacific coast. The city has a population of about 80,017, while the metropolitan area of Greater Victoria, has a population of 344,615, making it the 15th most populous Canadian urban region.

Named after Queen Victoria of the United Kingdom and, at the time, British North America, Victoria is one of the oldest cities in the Pacific Northwest, with British settlement beginning in 1843. The city has retained a large number of its historic buildings, in particular its two most famous landmarks, the British Columbia Parliament Buildings (finished in 1897 and home of the Legislative Assembly of British Columbia) and the Empress hotel (opened in 1908). The city’s Chinatown is the second oldest in North America after San Francisco’s. The region’s Coast Salish First Nations peoples established communities in the area long before non-native settlement, possibly several thousand years earlier, which had large populations at the time of European exploration. Victoria, like many Vancouver Island communities, continues to have a sizable First Nations presence, composed of peoples from all over Vancouver Island and beyond.

Social Highlights - All attendees, including exhibitors, are invited to our social program*.  
Breakfast Daily at Masters Lounge - 7:00 – 11:00 AM  
Opening Reception - Saturday, June 14, 2014  
Ziplining - Sunday, June 15, 2014 (Shuttle Service Provided)  
Whale Watching - Daily afternoons throughout meeting (Shuttle Service Provided)  
Golf Tournament - Monday, June 16th, 2014  
Tennis Tournament - Tuesday, June 17th, 2014  
Annual Banquet - Tuesday, June 17th, 2014

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. Discuss surgical techniques for cranial and spinal disorders.
3. Identify some principles of post-operative pain management.
4. Explain various practice guidelines.
SCIENTIFIC PROGRAM - JUNE 15th – 18th
Rocky Mountain Neurosurgical Society

SUNDAY, JUNE 15, 2014

MODERATOR: Paul Elliott, MD

07:00-07:55 Breakfast

08:00-12:00 SCIENTIFIC SESSION I: SpineSkull Base

08:00-08:10 Introductory Remarks and Welcome
President Paul Elliott, MD

08:10-08:30** Joel MacDonald and Christian Bowers, MD
Surgical Treatment of Vestibular Schwannomas at the University of Utah: Does Elderly Status Predict Worse Outcomes?

08:30-08:50** Marcus Mazur, MD
Craniocervical Instability from Transcondylar Approaches to Skull Base

08:50-09:10 Paul House, MD
An Automated Technique for Identifying Induced Afterdischarges During Invasive EEG Mapping

09:10-09:30 Peter Witt, MD, PhD
Spinal Endoscopy: Techniques and Outcomes

09:30-9:50 Kris Smith, MD
Gamma Knife for GBM: Why a Focal Treatment for a Diffuse Disease?

9:50-10:20 Break
Michael Brown, MD

10:50-11:10** Wally Sivakumar, MD
*IV Acetaminophen for Post-operative Supratentorial Craniotomy Pain-A Prospective, Randomized, Double-Blinded Placebo-Controlled Trial*

11:10-12:00 SPECIAL GUEST LECTURE:
James Rutka, MD, PhD
*Neurosurgical Oncology: What We Should Know*

NOON ADJOURN

NOTES
### MODERATOR: Kris Smith, MD

**07:00-07:55**  
Breakfast

**08:00-12:00**  
**SCIENTIFIC SESSION II:**  
**Tumor**

**08:00-08:20**  
Arianne Boylan, MD  
*Cervical Arthroplasty: An Update on Devices and Outcomes*

**08:20-08:40**  
David Newell, MD  
*Therapeutic Neurosonology: Something New in Neurosurgery*

**08:40-09:00**  
Randy Jensen, MD PhD  
*Intraoperative Magnetic Resonance Imaging in Neuro-Oncology*

**09:00-09:20**  
Steven Carr, MD  
*Outcome for Patients with Cushing's Disease with No Adenoma Found at Surgery: Surgical Strategy, Pathological Findings, and Remission Rate*

**09:20-09:40**  
Kris Smith, MD  
*Subtemporal Approach for Mesial Temporal Lobe Tumors*

**09:40-10:00**  
Break

**10:00-10:20**  
Robert Rostomilley, MD  
*Making it Personal-Theory, Reality, and Implementation of Precision Medicine for Brain Tumors*
10:20-11:00  SPECIAL GUEST LECTURE:  
M. Sean Grady, MD  
Concussion: Overhyped or the Tobacco of Our Time?

11:00-11:20  Kevin Lillehei, MD  
*Experience with the Anterior Endoscopic Skull Approach for the Treatment of Cranio- pharyngiomas*

11:20-11:40  Fauzan Hashimi, MD  
*Prognostic Implications of Histological Clear Cells in High Grade Intracranial Ependymal Tumors: A Retrospective Analysis from a Tertiary Care Hospital in Pakistan*

11:40  ADJOURN

*NOTES*
**TUESDAY, JUNE 17, 2014**

**MODERATOR:** Randy Jensen, MD, PhD

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>07:00-07:55</td>
<td>Breakfast</td>
</tr>
<tr>
<td>07:30-07:55</td>
<td><strong>ANNUAL BUSINESS MEETING FOR RMNS MEMBERS</strong></td>
</tr>
<tr>
<td>08:00-12:00</td>
<td><strong>SCIENTIFIC SESSION III: Spine</strong></td>
</tr>
<tr>
<td>08:00-08:20</td>
<td>Brad Duhon, MD&lt;br&gt;<em>Interim Analysis of Prospective Clinical Trial for Minimally-Invasive SI Joint Fusion</em></td>
</tr>
<tr>
<td>08:20-08:40</td>
<td>Michael Finn, MD&lt;br&gt;<em>Deformity Surgery at an Academic Institution</em></td>
</tr>
<tr>
<td>08:40-09:00</td>
<td>Michael Finn, MD&lt;br&gt;<em>Medical Marijuana Use Characteristics in the Spinal Surgery Patient</em></td>
</tr>
<tr>
<td>09:00-09:20</td>
<td>Randy Jensen, MD PhD&lt;br&gt;<em>Brain Biopsy: Tumor vs Non-Neoplastic with the &quot;New Pathology&quot;</em></td>
</tr>
<tr>
<td>09:20-09:40</td>
<td>Kelly Schmidt, MD&lt;br&gt;<em>Concussion: The Current Landscape and Return to Play Guidelines</em></td>
</tr>
<tr>
<td>09:40-10:00</td>
<td>Break</td>
</tr>
<tr>
<td>10:00-10:40</td>
<td><strong>SPECIAL GUEST LECTURE:</strong>&lt;br&gt;James Rutka, MD, PhD&lt;br&gt;<em>Neurosurgery Leadership: Lessons Learned</em></td>
</tr>
<tr>
<td>10:40-11:20</td>
<td><strong>SPECIAL GUEST LECTURE:</strong>&lt;br&gt;M. Sean Grady, MD&lt;br&gt;<em>One Neurosurgery</em></td>
</tr>
</tbody>
</table>
11:20-12:00* John Adams  
*No CME awarded

History of Vancouver Island and Surrounds  
Families and Vendors Welcome

NOON ADJOURN

NOTES
### WEDNESDAY, JUNE 18, 2014

**MODERATOR:** Joel Macdonald, MD

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>07:00-07:55</td>
<td>Breakfast</td>
</tr>
<tr>
<td>08:00-12:00</td>
<td><strong>SCIENTIFIC SESSION IV:</strong> Vascular/Tumor</td>
</tr>
</tbody>
</table>
| 08:00-08:20 | Randy Jensen, MD, PhD  
*Implementation of Milestones Program at the University of Utah Neurosurgical Residency Program* |
| 08:20-08:40 | Fauzan Hashmi, MD  
*Gliosarcoma: Case Series from a Tertiary Care Hospital in Pakistan* |
| 08:40-09:15 | SPECIAL GUEST LECTURE:  
M. Sean Grady, MD  
*The Evolution of Skull Base Neurosurgery* |
| 09:15-09:45 | Paul Elliott, MD  
*Controversies in Neurosurgery* |
| 09:45-10:00 | Break                                                                   |
| 10:00-10:20 | Mandy Binning, MD  
*Outcomes of Aneurysms Treated Exclusively by Comprehensive Vascular Neurosurgeons* |
| 10:20-10:40 | Mandy Binning, MD  
*Benefits of Vascular Neurosurgeons Taking an Active Role in All Vascular Conditions of the Brain and Spine* |
| 10:40-11:00 | Randy Jensen, MD, PhD  
*RNA Interference Targeting HIF-1a via a Novel Multifunctional Surfactant Attenuates Glioma Growth in an Intracranial Mouse Model* |
11:00-11:20  Fauzan Hashmi, MD
Clear Cell Ependymoma: Rare Variant First Time to be Reported by Tertiary Care Center in Pakistan

11:20  Closing Remarks: Paul Elliott, MD

11:30  MEETING ADJOURN

** Denotes consideration for Resident Award

NOTES
Mark your calendars, the 50th Annual Meeting of the Rocky Mountain Neurosurgical Society, Inc. will be held in:

COLORADO SPRINGS, COLORADO
THE BRAODMOOR RESORT
JUNE 13-17, 2015

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.

Amendia
Arbor Pharmaceuticals
CBSI
Codman
Cyberonics
DePuy Synthes Spine
DJO GLOBAL
Globus Medical
IMRIS Inc.
Integra
K2M Inc
LDR Spine
Leica Microsystems
Medtronic
Mountain States Medical/Biomet Spine
SI-Bone
Southwest Surgical, LLC/Zeiss
Spineology
Stryker Spine
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.

<table>
<thead>
<tr>
<th>Name</th>
<th>Disclosure</th>
<th>Type of relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brad Duhon, MD*</td>
<td>SI-Bone, Inc</td>
<td>Consultant</td>
</tr>
</tbody>
</table>

*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:

Paul House, MD*
John B. Dietze, MD*
Steven Carr, MD
Kris Smith, MD *
Kevin Lillehei, MD
Mandy Binning, MD
Kelly Schmidt, MD *
M. Sean Grady, MD
Benjamin Boudreaux, 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 13.0 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

**Joint Providership 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 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 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**
**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 and 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 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 personal 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. 7. Reports of Special Committees.
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 at 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

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Year</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td>Colorado Springs, CO</td>
<td>1991</td>
<td>Jackson Hole, WY</td>
</tr>
<tr>
<td>1967</td>
<td>Tucson, AZ</td>
<td>1992</td>
<td>Sedona, AZ</td>
</tr>
<tr>
<td>1968</td>
<td>Banff, AB</td>
<td>1993</td>
<td>Bigfork, MT</td>
</tr>
<tr>
<td>1969</td>
<td>McAllen, TX</td>
<td>1994</td>
<td>Snowmass, CO</td>
</tr>
<tr>
<td>1970</td>
<td>Sun Valley, ID</td>
<td>1995</td>
<td>Sun Valley, ID</td>
</tr>
<tr>
<td>1971</td>
<td>Colorado Springs, CO</td>
<td>1996</td>
<td>Telluride, CO</td>
</tr>
<tr>
<td>1972</td>
<td>Guadalajara, Mexico</td>
<td>1997</td>
<td>Jasper Park Lodge, AB</td>
</tr>
<tr>
<td>1973</td>
<td>Scottsdale, AZ</td>
<td>1998</td>
<td>Vail, CO</td>
</tr>
<tr>
<td>1974</td>
<td>Victoria, BC</td>
<td>1999</td>
<td>Coeur D'Alene, ID</td>
</tr>
<tr>
<td>1975</td>
<td>Cozumel-Merida, Mexico</td>
<td>2000</td>
<td>Alyeska, AK</td>
</tr>
<tr>
<td>1976</td>
<td>Las Vegas, NV</td>
<td>2001</td>
<td>Steamboat Springs, CO</td>
</tr>
<tr>
<td>1977</td>
<td>Lake Tahoe, NV</td>
<td>2002</td>
<td>Santa Ana Pueblo, NM</td>
</tr>
<tr>
<td>1978</td>
<td>Colorado Springs, CO</td>
<td>2003</td>
<td>Big Sky, MT</td>
</tr>
<tr>
<td>1979</td>
<td>Jackson Hole, WY</td>
<td>2004</td>
<td>Squaw Creek, CA</td>
</tr>
<tr>
<td>1980</td>
<td>Park City, UT</td>
<td>2005</td>
<td>Whistler, BC</td>
</tr>
<tr>
<td>1981</td>
<td>Durango, CO</td>
<td>2006</td>
<td>Sedona, AZ</td>
</tr>
<tr>
<td>1982</td>
<td>Big Sky, MO</td>
<td>2007</td>
<td>Jackson Hole, WY</td>
</tr>
<tr>
<td>1983</td>
<td>Mescalero, NM</td>
<td>2008</td>
<td>Park City, UT</td>
</tr>
<tr>
<td>1984</td>
<td>Colorado Springs, CO</td>
<td>2009</td>
<td>Girdwood, AK</td>
</tr>
<tr>
<td>1985</td>
<td>Banff, AB</td>
<td>2010</td>
<td>Telluride, CO</td>
</tr>
<tr>
<td>1986</td>
<td>Keystone, CO</td>
<td>2011</td>
<td>Taos, NM</td>
</tr>
<tr>
<td>1987</td>
<td>Deer Valley, UT</td>
<td>2012</td>
<td>Maui, HI</td>
</tr>
<tr>
<td>1988</td>
<td>Lake Tahoe, NV</td>
<td>2013</td>
<td>Sun Valley, ID</td>
</tr>
<tr>
<td>1989</td>
<td>Durango, CO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>Vail, CO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>President</td>
<td>Location</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>----------------------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td>1966</td>
<td>Homer G. McClintock</td>
<td>Denver, CO</td>
<td></td>
</tr>
<tr>
<td>1967</td>
<td>Charles Elkins</td>
<td>Tucson, AZ</td>
<td></td>
</tr>
<tr>
<td>1968</td>
<td>William McKinney</td>
<td>Ft. Worth, TX</td>
<td></td>
</tr>
<tr>
<td>1969</td>
<td>Chester Powell</td>
<td>Salt Lake City, UT</td>
<td></td>
</tr>
<tr>
<td>1970</td>
<td>Thomas K. Craigmile</td>
<td>Denver, CO</td>
<td></td>
</tr>
<tr>
<td>1971</td>
<td>Alexander C. Johnson</td>
<td>Great Falls, MT</td>
<td></td>
</tr>
<tr>
<td>1972</td>
<td>Joseph W. Robertson</td>
<td>Houston, TX</td>
<td></td>
</tr>
<tr>
<td>1973</td>
<td>Robert G. Fisher</td>
<td>Oklahoma City, OK</td>
<td></td>
</tr>
<tr>
<td>1974</td>
<td>Michael Pollay</td>
<td>Albuquerque, NM</td>
<td></td>
</tr>
<tr>
<td>1975</td>
<td>Robert L. Imler, Jr.</td>
<td>Tulsa, OK</td>
<td></td>
</tr>
<tr>
<td>1976</td>
<td>Javier Verdua</td>
<td>Mexico City, Mexico</td>
<td></td>
</tr>
<tr>
<td>1977</td>
<td>George T. Hoffman</td>
<td>Phoenix, AZ</td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>Michael McNally</td>
<td>Colorado Springs, CO</td>
<td></td>
</tr>
<tr>
<td>1979</td>
<td>Richard Moel</td>
<td>Houston, TX</td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>R. Barton Carl</td>
<td>Oklahoma City, OK</td>
<td></td>
</tr>
<tr>
<td>1981</td>
<td>Ralph J. Kaplan</td>
<td>Oklahoma City, OK</td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td>Paul Turner</td>
<td>Roswell, NM</td>
<td></td>
</tr>
<tr>
<td>1983</td>
<td>Charles Clough</td>
<td>Kansas City, MO</td>
<td></td>
</tr>
<tr>
<td>1984</td>
<td>Robert Partain, III</td>
<td>San Antonio, TX</td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>Ronald D. Clark</td>
<td>Greeley, CO</td>
<td></td>
</tr>
<tr>
<td>1986</td>
<td>Richard F. Tenney</td>
<td>Tulsa, OK</td>
<td></td>
</tr>
<tr>
<td>1987</td>
<td>Robert S. Hood</td>
<td>Salt Lake City, UT</td>
<td></td>
</tr>
<tr>
<td>1988</td>
<td>Henry Fieger</td>
<td>Denver, CO</td>
<td></td>
</tr>
<tr>
<td>1989</td>
<td>Franco Erculei</td>
<td>Las Vegas, NV</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>Harry B. Tate</td>
<td>Oklahoma City, OK</td>
<td></td>
</tr>
<tr>
<td>1991</td>
<td>David Fell</td>
<td>Tulsa, OK</td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>Wayne Paullus</td>
<td>Amarillo, TX</td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td>Kenyon Kugler</td>
<td>Tulsa, OK</td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td>Volker Sonntag</td>
<td>Phoenix, AZ</td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>Lee Krauth</td>
<td>Denver, CO</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>Robert Morelli</td>
<td>Reno, NV</td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td>Larry Tice</td>
<td>Grand Junction, CO</td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>Ronald Apfelbaum</td>
<td>Salt Lake City, UT</td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>Charles Fullenwider</td>
<td>Muskogee, OK</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>Kevin Lillihei</td>
<td>Denver, CO</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>Howard Morgan</td>
<td>Dallas, TX</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>Al Capanna</td>
<td>Las Vegas, NV</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>Vance MacDonald</td>
<td>Las Vegas, NV</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>Richard Schmidt</td>
<td>Salt Lake City, UT</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>John McVicker</td>
<td>Englewood, CO</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>Mary Kay Gumerlock</td>
<td>Oklahoma City, OK</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>Robert Beatty</td>
<td>Kansas City, KS</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>Joel MacDonald</td>
<td>Salt Lake City, UT</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Jonathan White</td>
<td>Dallas, TX</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>Michael Brown</td>
<td>Colorado Springs, CO</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>Randy Jensen</td>
<td>Salt Lake City, UT</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>Stewart Levy</td>
<td>Denver, CO</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>Paul Elliott</td>
<td>Denver, CO</td>
<td></td>
</tr>
</tbody>
</table>
Abstracts RMNS 2014:

Title: Surgical Treatment of Vestibular Schwannomas at the University of Utah: Does Elderly Status Predict Worse Outcomes?

Authors: Christian Bowers, Joel MacDonald

Introduction: Vestibular schwannomas are commonly encountered in neurosurgery and despite an abundance of publications, reports on outcomes in elderly patients (>65 y/o) are uncommon.

Methods: We performed a retrospective chart cohort review for all adult patients that underwent treatment for vestibular schwannoma at the University of Utah from 2000 to 2012. We looked at the following variables: Age, elderly status (>65 years old), sex, BMI, smoking-status, Charlson Comorbidity Index (CCI) score, preoperative symptoms, and post-operative outcomes and complications.

Results: There were a total of 246 patients that underwent surgery for VS from 2000-2012. The average sample age was 49.3, 52.4% were males, and the average BMI was 29.5. The average extra-meatal tumor size in the axial plane was 16.7 mm. The patient population was relatively healthy as 78.8% had CCI of ≤1. The most common surgical approach was TransLab (56.9%), while 25.2% were middle fossa, and 17.9% were retrosigmoid. There were significant post-operative improvements with respect to tinnitus, headaches, facial numbness, and dizziness. CSF leaks requiring lumbar drainage and reoperation were uncommon, 4.9% and 2.8%, respectively. Facial nerve outcomes showed that 10% of patients had severe facial nerve impairment (HB 4-6) and 4.5% had mild impairment (HB3).

We found no significant difference in complication rates between elderly patients (13.0% vs 13.5%). We also found that increased BMI was not associated with increased CSF leak rates in any group of patients.

Conclusions: Preliminary results from a large (250 patients) single-center retrospective study showed that complication rates and overall outcome were similar regardless of patient age, BMI, CCI score, and elderly status. Therefore, our study does not support discouraging surgical treatment in patients with advanced age, increased BMI, or a high CCI score. Complication rates were < 15%, with the vast majority consisting of transient CSF leaks that resolved with temporary CSF diversion.

Keywords: Vestibular Schwannomas, Elderly, Complication Rates, CSF leaks.

Objectives:

1. Discuss the relationship between patient age and surgical outcome in treatment of vestibular schwannomas.
2. Know the relationship between increasing age, increasing BMI, smoking status, CCI score and outcomes with surgical treatment of vestibular schwannomas.
3. Know the complication rates associated with each approach with surgical treatment of vestibular schwannomas.
**Title:** Craniocervical Instability from Transcondylar Approaches to the Skull Base

**Authors:** Marcus Mazur, William Couldwell, Andrew Dailey

**Introduction:** During transcondylar approaches to the skull base, the hypoglossal canal (HC) is used to guide the extent of occipital condyle (OC) resection. The consensus is that drilling to the wall of the HC requires 33% OC resection, entering the HC requires 50% resection, and further drilling may cause craniocervical instability. We conducted a biomechanical cadaveric study and retrospective review of patients who underwent a far lateral transcondylar surgical approach to determine the mechanism of craniocervical instability that occurs in this population.

**Methods:** Ten cadaveric specimens (Oc-C2) underwent biomechanical testing. Each specimen was tested in the intact state and then after a far lateral surgical approach in which OC was drilled until the HC was entered. Data was collected on motion and stiffness. Volumetric analysis using thin-cut CT was performed to quantify the OC resection.

The medical record and postoperative imaging of patients who underwent a transcondylar resection between 2001 and 2013 were reviewed for any radiographic evidence of craniocervical instability or if an occipitocervical fusion operation was performed.

**Results:** Bone removal during OC resection ranged from 15-66%. Resected specimens had less stiffness and increased motion in flexion-extension (-5% stiffness, p=0.052; +5% motion, p=0.024), lateral bending (-13%, p=0.021, +9%, p=0.063), and axial rotation (-17%, p=0.012; 19%, p=0.007) relative to their intact states. Extent of OC resection correlated with increase in motion in flexion-extension (Pearson’s r=0.84; p=0.002) and lateral bending (r=0.72; p=0.018), and change in stiffness in flexion-extension (r=-0.63; p=0.050) and lateral bending (r=-0.68; p=0.030).

Review of the electronic medical record resulted in 64 patients who underwent a transcondylar operation. OC resection remained posterior to the HC in 92%, drilling extended into or beyond the HC in 8%. Four patients developed craniocervical instability (6%), 2 of whom had instability suspected preoperatively and in 2 unexpected catastrophic instability occurred.
Conclusions: Due to anatomic variation, transcondylar approaches require varying degrees of OC resection. In most cases, drilling to the HC requires less than one-third of the OC to be removed and the risk of developing instability is minor. However, in some cases drilling to the HC may weaken the OC significantly and catastrophic failure at the craniocervical may occur. Clinically, these patients may present with pathological fractures at the anterior foramen magnum. Patients who undergo OC resection into or anterior to the HC should be followed closely for instability.

Keywords: Occipital condyle, skull base, craniocervical junction

Objectives:
1. Describe how craniocervical instability occurs after a transcondylar surgical approach
2. Identify the mechanism of failure at the craniocervical junction
3. Describe patients who may be more prone to instability after a transcondylar approach
Title: Spinal Endoscopy: Technique, Pitfalls and Outcomes

Authors: Jens-Peter Witt

Introduction: Full-endoscopic lumbar discectomy is presented as an complementary treatment option to lumbar microdiscectomy. We review our results of this technique, discuss complications and look into the future of full-endoscopic spine surgery.

Methods: VAS, readmissions and neurological deficits were examined and compared with the available literature on lumbar microdiscectomy

Results: Results are comparable with those of lumbar microdiscectomy. Early recurrence of lumbar disc herniations are noted in this set of patients

Conclusions: Full-endoscopic lumbar discectomy is a safe and efficient technique to treat lumbar herniated discs. Technical advances have improved visualization of the pathology, the neuroforamen and the epidural space. Minimal Invasive Fusion technology is evolving and in combination with direct endoscopic visualization presents alternatives to existing techniques.

Keywords: Endoscopy, Spine, Disc Herniation, Lumbar Spinal Fusion

Objectives:

1. Full-endoscopic lumbar discectomy is a safe and efficient technique to treat lumbar herniated discs.
2. Technical advances have improved visualization of the pathology, the neuroforamen and the epidural space.
3. Minimal Invasive Fusion technology is evolving and in combination with direct endoscopic visualization presents alternatives to existing techniques.
Title: Perforating Artery Aneurysm of The Recurrent Artery Of Heubner

Authors: Benjamin Boudreaux, Robert Funk, Babu Welch

Introduction: Perforating artery aneurysms (PAA) are a rare cause of aneurysmal subarachnoid hemorrhage. They have been previously reported to arise from lenticulostriate, anterior choroidal, thalamostriate and distal basilar arteries1. PAAs often present in association with hypertension, arteriovenous malformations, infection, tumor, moya moya disease, or recent history of trauma.

Methods: We report the case of a ruptured, perforating artery aneurysm of the recurrent artery of Heubner (RAH).

Results: A 75 year old man with uncontrolled diabetes and hypertension was transferred to our medical center with subarachnoid hemorrhage within the suprachiasmatic cistern. Digital subtraction angiography identified a fusiform aneurysm of the recurrent artery of Heubner (RAH). Surgical treatment included trapping of the aneurysm via an ipsilateral pterional craniotomy.

Conclusions: While aneurysms of the RAH are rare, they can be grouped with aneurysms that arise from other small perforating arteries. The natural history of ruptured PAAs is poorly defined making treatment decisions difficult.

Keywords: Recurrent Artery of Heubner, Perforating artery, Aneurysm

Objectives:
1. Presentation of rarely occurring cerebral aneurysm
2. Treatment options for perforating artery aneurysm
3. Discussion of pertinent vascular anatomy
Title: Intravenous Acetaminophen for Postoperative Supratentorial Craniotomy Pain – A Prospective, Randomized, Double-Blinded, Placebo-Controlled Trial

Authors: Walavan Sivakumar, Paul A. House, Jay Riva-Cambrin, Robert Hoesch, Craig Kilburg, Safdar Ansari, Julie Martinez, Nancy Duncan

Introduction: Optimizing patient comfort after craniotomy is often difficult as the use of narcotic medications can impair the clinical evaluation of brain function. Numerous studies have shown that patients in the neurocritical care (NCC) unit experience inadequate pain control. Additionally, craniotomy is associated with postoperative nausea and vomiting, which delays the use of oral medications. Very few nonnarcotic intravenous (IV) medications are available. The recently approved IV formulation of acetaminophen might serve as a safe, potent non-opioid adjunct to narcotic medication that may improve the care of these patients. No prospective, randomized studies on the clinical effectiveness of IV APAP in post-craniotomy patients have been performed.

Methods: This is a prospective, randomized, double-blinded, placebo-controlled trial enrolling 210 patients. We will review study design criteria explored to help determine if use of this drug is truly beneficial in post-craniotomy patients. Opportunities and challenges of various study designs will be discussed. The ultimate initiation and early results will be discussed.

Adults undergoing elective, supratentorial craniotomies are randomized into one of two groups: 1) 1000mg/100mL IV acetaminophen every 8 hours with the standard-pain protocol or 2) 100mL 0.9% normal saline with the standard-pain protocol. Primary outcome measures are narcotic consumption in morphine equivalents at 24 and 48-hours after surgery. Secondary outcome measures will include visual analog pain scores, time to ambulation, transfer from the NCC, to independent state, and discharge from the hospital.

Results: At the last interim analysis, 75 patients have been enrolled in the study. An independent statistician performed an early interim analysis. Early results will be reviewed.

Conclusions: We are performing a prospective, randomized, double-blinded, placebo-controlled trial with a successful recruitment process. We anticipate that the study will be completed in mid-2015.

Keywords: Craniotomy, Pain, Acetaminophen, Trial

Objectives:

1. Understand that post-craniotomy pain control is a difficult challenge for neurosurgeons.
2. Understand the importance of utilizing prospective randomized studies in neurosurgery when possible.
Title: Cervical Arthroplasty: An Update on Devices and Outcomes

Authors: Arianne Boylan, MD   Michael Finn, MD

Introduction: Cervical arthroplasty devices are approved for the treatment of cervical radiculopathy and myelopathy secondary to degenerative disc disease. There is an evolving body of literature examining the biomechanics and clinical outcomes of these devices as well as their potential to decrease the incidence of adjacent level disease. This presentation will review the rationale behind, indications for and outcomes of cervical arthroplasty.

Methods: Clinical articles about cervical disc arthroplasty published in English through April 2014 were identified on PubMed.gov. Papers which presented cervical disc arthroplasty results were reviewed specifically for type of disc, length of follow-up, quality of life outcome scores, complications, and long-term preserved range of motion.

Results: Recent reports from randomized trials of the commercially available devices demonstrate significant improvements or trends toward improvements in quality of life outcome scores at six months and one year, relative to patients undergoing cervical fusion. There does not appear to be a significant difference in operative time, length of hospital stay, or perioperative complications between the arthroplasty and fusion groups. Meta-analysis of prospective randomized studies reveals no statistical difference in rates of adjacent segment degeneration at two and five years postop, however some reports do indicate a lower number of total reoperations in patients undergoing arthroplasty. In biomechanical models, cervical arthroplasty has been demonstrated to maintain segmental and global spinal range of motion similar to the native spine. However, imaging has demonstrated a potential trend towards reduced range of motion arthroplasty constructs after two years. Treatment of two-level disease has recently been FDA approved with the Mobi-C device with superior results to fusion at two years. A Hybrid technique, utilizing fusion and arthroplasty at alternate levels, has been also described with promising results.

Conclusions: Adjacent segment cervical disease is likely multifactorial and longer term outcomes data will be needed to definitively determine the superiority of arthroplasty over fusion. Cervical arthroplasty does appear to be associated with a lower incidence of need for reoperation in both single and two level disease.

Keywords: Cervical spine, Fusion, Arthroplasty, Prestige ST, ProDisc-C, BRYAN Cervical Disc, Mobi-C Disc

Objectives:

1. To review evidence for adjacent level cervical disc disease and potential benefits of arthroplasty versus fusion.

2. To review the functional and pain score outcomes for both arthroplasty and fusion to assess patient satisfaction.

3. To critically review the current arthroplasty models and understand the benefits, contraindications, and limitations of each model.
Title: Intraoperative Magnetic Resonance Imaging in Neuro-Oncology

Authors: Randy Jensen

Introduction: Intraoperative magnetic resonance imaging (IMRI) is increasingly becoming available for neurosurgical practice. We describe the use of two IMRI systems in our hospital system for neuro oncological procedures.

Methods: Over 120 brain tumor patients have been treated at the University of Utah on two different systems. One, a 1.5 Tesla Siemens MR in a two room, diagnostic and operating room, configuration is located in our cancer hospital and has been available for the longest period of time. The other a 3.0 Tesla system in a three room, angio suite, diagnostic, operating room, configuration is a newer system.

Results: We describe the cases treated in our IMRI suites with emphasis on advantages and pitfalls of intraoperative imaging. Special situations including awake craniotomy and intraoperative electrophysiology are discussed. Particular emphasis is placed on difficulties of imaging non-enhancing lesions.

Conclusions: Intraoperative MR imaging has many potential benefits. It is however not without a steep learning curve and need for committed staff and faculty to make these benefits outweigh disadvantages of longer and more complicated operating room experiences.

Keywords: intraoperative, imaging

Objectives:
1. Understand the potential for intraoperative magnetic resonance imaging (IMRI)
2. Discuss the disadvantages and pitfalls of IMRI
3. Develop ideas on how to incorporate IMRI for better treatment of patients with brain tumors
Title: Outcome For Patients with Cushing’s Disease With No Adenoma Found At Surgery: Surgical Strategy, Pathologic Findings And Remission Rate

Authors: Steven Carr, Kevin Lillehei

Introduction: The data presented here reports the pathologic findings and rate of remission of Cushing’s disease by using a transsphenoidal two-thirds gland resection when no adenoma is found at surgery.

Methods: A total of 23 patients diagnosed with hypercortisolism from a pituitary source were found by retrospective chart review that underwent two-thirds gland resection between 1989 – 2011. A single surgeon performed all surgeries with consistent surgical strategy and technique.

Results: Of the 23 total patients who had no gross or histological confirmation of tumor at the time of surgery, 9 ultimately had positive histopathology on final pathology. 6 patients (26%) were found to have a corticotroph cell adenoma – all of whom were in remission at last follow-up. 3 patients were found to have ACTH cell hyperplasia (13%) – 2 of whom were in remission at last follow-up. Of the 14 patients with negative histopathology, 9 were in remission at last follow-up (64%). The remaining 5 patients (22%) had persistent hypercortisolism, of which one is suspected to harbor a cavernous sinus adenoma, one was later found to have NSCLC secreting excess ACTH, one had an ACTH-secreting lung carcinoid tumor discovered years after transsphenoidal surgery, and 2 remained with an undiagnosed source. Follow-up was between 1 month - 23 years, median of 24.5 months. Nine patients had adrenal deficiency at last follow-up (39%), and 4 patients had hypopituitarism (17%).

Conclusions: Of the patients where no tumor was found at surgery and in whom a two-thirds gland resection was performed, 9 ultimately had diagnostic pituitary pathology (6 adenoma with 100% remission rate, 3 hyperplasia with 66% remission rate). Of the patients with negative pathology, 9 have remained in remission. In the 5 patients without remission, 2 ultimately were found to have a responsible lung lesion (NSCLC, carcinoid), 1 has a suspected cavernous sinus adenoma and one has yet an unknown etiology for hypercortisolism.

Keywords: Pituitary, Cushing, Negative Histology

Objectives:
1. Understand surgical strategy for Cushing microadenoma
2. Know outcomes following trans-sphenoidal resection
3. Focus work-up and diagnose ACTH hypersecretion source
**Title**: Clinical and Radiographic Characteristics of A Spontaneous Third Ventriculostomy Confirmed By Endoscopic Evaluation

**Authors**: Benjamin Boudreaux, Robert Funk, Dale Swift

**Introduction**: Spontaneous third ventriculostomy (STV) is a rarely reported phenomenon resulting from chronic, obstructive hydrocephalus. Recent reports suggest that MRI with phase-contrast cine or high spatial-resolution T2 sequences is the study of choice for evaluation and diagnosis of a suspected STV.

**Methods**: We report the case of a 23 year old woman with obstructive hydrocephalus resulting from a tectal mass. She experienced spontaneous resolution of chronic headaches with concurrent reduction in her ventricular size. A STV was confirmed with neuroendoscopy.

**Results**: Previous case reports and case series suggest STV can be confirmed by non-invasive imaging. However, there is a risk of untreated hydrocephalus in patients treated presumptively on non-invasive imaging studies. Artifact from a pulsatile basilar artery or distortion of normal third ventricular anatomy may result in false positive studies. In addition, flow voids have been described in patients with treatment failure after surgically performed ETV.

**Conclusions**: When a STV is suspected, the initial diagnostic workup should include MRI with phase contrast or high spatial resolution T2 sequences for identification of the fistulous tract. Positive studies should be investigated with serial imaging or a confirmatory study to reduce the risk of untreated hydrocephalus.

**Keywords**: Hydrocephalus, Neuroendoscopy, Spontaneous Ventriculostomy

**Objectives**:

1. Describe the clinical presentation and imaging characteristics of spontaneous third ventriculostomy
2. Understand the limitations of non-invasive imaging studies in the management of STV
3. Describe the management of patients with suspected STV to prevent untreated hydrocephalus
Title: Prognostic Implications of Histological Clear Cells in High Grade Intracranial Ependymal Tumors: A Retrospective Analysis from a Tertiary Care Hospital in Pakistan.

Authors: Fauzan Hashmi, Muhammad Bari, Arsalan Ahmed, Saad Khan

Introduction: Clear Cell variant in Ependymal tumors is rare. We aim to compare the features, clinical outcomes of Clear Cell variant with the Classic pathology of high grade intracranial Ependymal tumors in Pakistan.

Methods: A retrospective cohort study conducted at the Department of Neurosurgery, Aga Khan University. The medical record files from 2003 – 2013 were reviewed, MRI/ C.T scans and Histopathological slides of WHO grade III Ependymal tumors were re-viewed. Patients lost to follow-up were contacted on phone. Analysis was done on SPSS 20.

Results: There were 10 cases of clear cell variant and 23 cases of classic Anaplastic Ependymoma.

The median age of Clear Cell variant was 52 years (range 24 years-72 years), whereas of Anaplastic Ependymoma was 37 years (range 3 months to 65 years). Symptoms included Headache 66% in CCE and 63% in AE, Seizures 30% in CCE and 22% in AE, and raised ICP in 30% in CCE and 54% of AE. CCE was Supratentorial in 70% cases, intracranial Anaplastic Ependymoma was supratentorial in 58% of cases. Gross Total Resection was achieved in 55% cases in CCE and 26% cases in AE. Sub-total resection was done in 45% cases in CCE and 65% in AE. Radiotherapy was given in 60% patients in CCE and in 50% in AE. Recurrence was there in 80% cases of CCE and 55% in AE. Re-peat Surgery was done in 30% cases of CCE and 34% cases of AE. Median Progression free survival was 8 months (range 3-28 months), and Overall survival was 10 months (range 3-41 months) in CCE. Median Progression free survival was 4 months (range 0.5-53 months), and Overall survival was 14 months (range 1.5-36 months) in AE.

Conclusions: The median Progression free survival was better in Clear Cell variant than Anaplastic Ependymoma. This could be explained by a higher Gross total resection in CCE, whereas the median Overall survival was worse in Clear Cell variant group.

Keywords: Clear Cell Ependymoma, Anaplastic Ependymoma, Gross Total Resection

Objectives:

1. Know about the differences in clinical presentation of Clear cell ependymoma v/s anaplastic ependymoma
2. Know about the differences in radiological and histopathological presentation of Clear cell ependymoma v/s anaplastic ependymoma
3. Outcomes of clear cell v/s anaplastic ependyma tumors in Pakistan.
Title: Experience with the Anterior Endoscopic Skull Approach for the Treatment of Craniopharyngiomas

Authors: Kevin Lillehei

Introduction: Craniopharyngiomas (CP) are rare benign tumors derived from cell remnants of Rathke's pouch along the line from the nasopharynx to the diencephalon. In the United States CPs are felt to account for about 2.5-3% of all primary brain tumors. The incidence is approx. 1.1 to 1.3 cases per million population. Typically, the peak age for occurrence is bimodal occurring in the 5-9 year old age group and the 50-74 year old age group. CPs occur as either one or two histologic subtypes. The first is papillary, also known as squamous-papillary, and the second is adamantinomatous. Adamantinomatous CPs are the only type seen in children and comprise about 50-86% of the tumor sub-type in adults. Papillary CPs occurs in approximately 14-50% of adults and are rarely seen before the age of 20.

Methods: Author’s surgical experience.

Results: Typically surgery has consisted of the craniotomy, either the classic pterional craniotomy or the orbitozygomatic approach but more recently more minimally invasive approaches are being used such as the supraorbital keyhole approach and now the trans-nasal endoscopic anterior skull base approach. In this presentation I will discuss our current experience with the anterior endoscopic skull base approach and argue that it is the approach of choice in the initial treatment of the majority of these lesions. I will end by giving a short discussion on new molecular therapies for these lesions which may further revolutionize our current management strategy.

Conclusions: Typically surgery has consisted of the craniotomy, either the classic pterional craniotomy or the orbitozygomatic approach but more recently more minimally invasive approaches are being used such as the supraorbital keyhole approach and now the trans-nasal endoscopic anterior skull base approach. In this presentation I will discuss our current experience with the anterior endoscopic skull base approach and argue that it is the approach of choice in the initial treatment of the majority of these lesions. I will end by giving a short discussion on new molecular therapies for these lesions which may further revolutionize our current management strategy.

Keywords: craniopharyngioma, endoscopic surgery, skull base

Objectives:

1. Knowledge of treatment for craniopharyngiomas
2. How histologic subtypes of craniopharyngiomas influences treatment
3. New information on the molecular biology of craniopharyngiomas and how it will influence therapy
Title: Concussion: Overhyped or the Tobacco of Our Time?

Authors: M. Sean Grady

Introduction: The lecture will review current research on concussion using both preclinical models and human correlates.

Methods: basic science techniques including animal models of concussion, tissue culture.
Imaging and neuropathological analysis of human TBI

Results: White matter tracts are preferentially affected by mild TBI. Those consequences set up a chain of reactions that can persist for years. The long term consequences bear similarity to pathological processes seen in Alzheimer's disease.

Conclusions: Concussion and its long term effects results from damage to white matter tracts

Keywords: Concussion

Objectives:
1. Understand the latest pre-clinical research in concussion
2. Demonstrate potential consequences of repetitive TBI
3. Identify methods of reducing risk
Title: Interim Analysis of Prospective Clinical Trial for Minimally-Invasive SI Joint Fusion

Authors: Brad Duhon

Introduction: Sacroiliac (SI) joint pain is an often-overlooked cause of low back pain. SI joint arthrodesis has been reported to relieve pain and improve quality of life in patients suffering from degeneration or disruption of the SI joint who have failed non-surgical treatments. We report herein early results of a multicenter prospective single-arm cohort of patients with SI joint degeneration or disruption who underwent minimally invasive fusion using the iFuse Implant System.

Methods: The safety cohort includes 32 subjects with chronic SI joint pain who met study eligibility criteria and underwent minimally invasive SI joint fusion with the iFuse Implant System between August 2012 and April 2014. Subjects underwent structured assessments preoperatively and at 1, 3, and 6 months postoperatively, including SI joint and back pain visual analog scale (VAS), Oswestry Disability Index (ODI), Short Form-36 (SF-36), and EQ-5D. Patient satisfaction with their surgery was assessed at 6 months. The effectiveness cohort includes the 94 subjects who have had 6-month follow-up to date.

Results: Mean subject age was 51 years (n=94, safety cohort) and 66% of patients were women.

Subjects were highly debilitated at baseline (mean VAS pain score 76, mean ODI score 55). Three implants were used in 80% of patients; two patients underwent staged bilateral implants. 23 adverse events occurred within 1 month of surgery and 29 additional events occurred between 30 days and latest follow-up. Six adverse events were severe but none were device-related. Complete six-month postoperative follow-up was available in 26 subjects. At 6 months, mean (±SD) SI joint pain improved from a baseline score of 76 (±16.2) to 26.5 (±18.6, an improvement of 51 points, p<.0001), mean ODI improved from 55.3 (±10.7) to 37.4 (±17.0, an improvement of 17.4 points, p<.0001) and SF-36 PCS improved from 30.7 (±4.3) to 37.0 (±10.7, an improvement of 56.7 points, p=0.003). 90% of subjects who were ambulatory at baseline had regained full ambulation by month 6; median time to full ambulation was 30 days. Satisfaction with the procedure was high at 88%.

Conclusions: Minimally invasive SI joint fusion using the iFuse Implant System is safe. Mid-term follow-up indicates a high rate of improvement in pain and function with high rates of patient satisfaction.

Keywords: Sacroiliac, SI, Fusion

Objectives:

1. Identify prevalence of SI Joint pain among patients with “low back pain.”
2. Identify that prior lumbar fusion is a risk factor for SI Joint degeneration.
3. Results of minimally-invasive SI Joint fusion with the iFuse device.
Title: Medical Marijuana Use Characteristics in the Spinal Surgery Patient

Authors: Michael Finn

Introduction: The use of marijuana for medical purposes was legalized in the state of Colorado in 2000 and there are currently over 115,000 patients registered to receive marijuana from over 800 dispensaries. Over 94% of marijuana recommendations are issued for the treatment of pain. There has been a paucity of research examining the use of marijuana for pain control and there have been no studies examining marijuana use in the spine surgery patient. We seek to describe patterns of marijuana usage in patients presenting to a tertiary spine center in the state of Colorado.

Methods: After IRB approval, all adult patients presenting for evaluation at the University of Colorado Spine Center were asked to participate. Informed consent was obtained in all participating patients and a brief survey was administered. Responses were stored in a secured, de-identified file.

Results: One hundred eighty four patients agreed to participate while 16 declined enrollment. Of the 184 participants, 35 patients (19.0%) admitted to marijuana use: four patients reported taking marijuana recreationally, while 31 reported using marijuana only for medical purposes. Marijuana users were younger than non-users (44 vs 54, p<0.05), but had similar educational and employment characteristics. Rates of use were higher in Hispanic patients (28.6%) than White or African-American patients (18.4% and 12.5% respectively), although this difference did not reach statistical significance. Of patients who did admit to marijuana use, 45.5% had a prescription and 73% of these had that prescription primarily for back pain. Eighty three percent of users also take other pain medications, especially narcotic pain medications. Eight nine percent of users felt that marijuana “moderately” or “greatly” relieved their pain. Users typically used marijuana less than 1-2 times a day. Fourteen endorsed negative side effects, including depressed mood 5.7%, difficulty concentrating 20%, memory problems 8.6%, weight gain 25.7%, and paranoia 11.4%. However, only 43% (6 of 14) of these patients felt the side effects were significant. Users trended towards reporting higher VAS and ODI scores.

Conclusions: Marijuana use is frequent in the spine patient population. While marijuana users tend to be younger than non-users, other demographic factors surveyed were comparable. Most patients using marijuana report significant alleviation of painful symptoms with tolerable side effects. More research is needed to ascertain whether marijuana use is truly efficacious in this population and to determine whether it may have any effect on surgical results.

Keywords: marijuana, spine, pain

Objectives:
1. Understand marijuana usage patterns in spine care patients
2. Understand incidence of co-utilization between marijuana and narcotics
3. Understand demographics of medical marijuana in Colorado University setting
Title: Brain Biopsy: Tumor vs Non-Neoplastic with the "New Pathology"

Authors: Randy Jensen

Introduction: Neurosurgeons are asked to biopsy lesions in the brain that appear to be neoplastic but later turn out to be non-neoplastic. In fact there are many pitfalls when performing brain biopsies. We discuss the use of modern neuropathological and imaging techniques to distinguish tumor from their non-neoplastic mimics.

Methods: Discussion of imaging and neuropathological techniques associated with brain biopsy.

Results: Molecular diagnostic markers and preoperative imaging markers are available to help determine the need for as well assist with pathological diagnosis. The emerging role of mutated isocitrate dihydrogenase-1 detection on pathological specimens and its associated oncometabolite 2-hydroxyglutarate detection by magnetic resonance spectroscopy are discussed.

Conclusions: Pathological and preoperative imaging diagnostic procedures are emerging to help distinguish tumor from nonneoplastic brain lesions.

Keywords: molecular diagnostics, isocitratedihydrogenase-1

Objectives:

1. Discuss the use of 2-HG MR Spectroscopy
2. Review the use of IDH-1 mutation as a tumor biomarker
3. Outline tumor biomarkers available to distinguish tumor from non-neoplastic lesions.
Title: Concussion: The Current Landscape and Return to Play Guidelines

Authors: Kelly Schmidt

Introduction: The rate of concussions and mild traumatic brain injuries in the United States continues to increase. It is estimated that between 2-4 million concussions occur per year. Given many concussions go unreported, this number is likely much higher.

Methods: Over the past few years, head injury research and prominent media focus on concussion in both professional and youth sports has dramatically changed the management of these injuries. Grading systems have fallen out of favor in exchange for a set of more uniformly accepted guidelines regarding return to play. Additionally, there is increasing attention being paid to community education and concussion prevention.

Results: Concussion will be defined and the demographics of those most at risk for these injuries will be discussed. The process of establishing a concussion plan as well as the specifics of recommended return to play guidelines will be described.

Conclusions: As neurosurgeons we are not only involved in the evaluation and treatment of concussion injuries, we have a responsibility to provide community education and assist in prevention when possible.

Keywords: Concussion, Head trauma, Guidelines

Objectives:

1. Describe the patients at most risk for concussion.
2. Discuss current recommendations for return to play after a concussion.
3. Discuss the role of the neurosurgeon in concussion treatment and community education.
Title: One Neurosurgery

Authors: M. Sean Grady

Introduction: There are two major neurosurgical societies in North America. For a variety of reasons, the continuation of these two societies may be very difficult in the years to come. The One Neurosurgery Advocacy Committee recommends consolidation of these two societies into one representative organization.

Methods: surveys of neurosurgeons and industry

Results: >90% of over 2000 neurosurgeons recommend consolidation. Over 50 industry partners also recommend consolidation.

Conclusions: The neurosurgery community needs to determine mechanisms to indicate to the leadership of the AANS and CNS of their concerns about having two very duplicative organizations.

Keywords:

Objectives:

1. Contact leaders of the AANS and CNS
2. Determine actions they can take as individuals
3. Better inform themselves of the cost of two national societies
**Title:** Implementation of Milestones Program at the University of Utah Neurosurgical Residency Program

**Authors:** Randy Jensen

**Introduction:** We describe the process of implementing the Milestones residency reporting system in our residency program. This system is designed for residency programs to use in semi-annual review of resident performance and reporting to the ACGME. The milestones include the skills, attitudes, and other attributes for each of the ACGME competencies as part of the Next Accreditation System to determine whether residents are progressing overall as they move from novice to “expert” corresponding to levels 1-5.

**Methods:** We report the practical application of this system with emphasis on lessons learned as we have first implemented this program. Actual de-identified resident data is reviewed including the evaluations produced from our Clinical Competency Committee as well as faculty and staff evaluations.

**Results:** Complexities of the program and attempts to simplify the overall process are described. Potential weaknesses are described and attempts to overcome these challenges are outlined.

**Conclusions:** This program is the ACGME designated method for resident evaluation. It is not a perfect system but with proper adaption to each program can provide a framework to adequately document resident progression and mastery of necessary skills and knowledge to become a competent neurological surgeon.

**Keywords:** education, matrix, competency, evaluation

**Objectives:**

1. Understand the application of milestones residency program for neurosurgery
2. Describe the potential flaws in this new reporting system
3. Discuss competency based learning objectives.
Title: Gliosarcoma: Case Series from a Tertiary Care Hospital in Pakistan

Authors: Hashmi Fauzan, Muhammed Bari, Arsalan Ahmed, Saad Khan

Introduction: Gliosarcoma is a rare CNS neoplasm with a few cases reported from Pakistan.

Objectives: We aim to see the features and outcomes of this rare entity in Pakistan

Methods: A retrospective case-series conducted at the Department of Neurosurgery, Aga Khan University. The medical record files of surgically treated patients with Gliosarcoma from 2003 – 2012 were reviewed, MRI/C.T scans and Histopathological slides were reviewed. Patients lost to follow-up were contacted. Analysis was done on SPSS 20.

Results: A total of 7 cases of Gliosarcoma were found. The median age was 52 years with a male: female of 5:2. The symptoms included Headache 71%, hemiparesis 43%, dysphasia, forgetfulness and dysphagia 29% patients. KPS was >70 in 4 and <70 in 3 patients.

Five patients had tumor in Temporal lobe. MRI showed hypointense signals in 2, iso-intense in 2 and hypo-iso-intense signals in 2 cases on T1-weighted images and hyperintense in 5 cases on T2-weighted images. Solid tumor was seen in 5 patients, features of necrosis was seen in 4, hemorrhage in 3 cases. Mass effect was seen in 3 cases. Contrast enhancement was seen in 6 cases.

Gross-total resection was done in 3, Sub-total resection in 2 cases and biopsy in 2 cases. Recurrence was found in 6 patients. Repeat surgery was done in 3 patients, 6 underwent chemo+radiotherapy. Six patients died of the disease.

The median Progression Free Survival was 2 months (range 1-6 months), median Overall survival was 6 months (3-13 months).

Conclusions: Gliosarcoma is a significantly aggressive tumor in Pakistan.

Keywords: Karnofsky performance score (KPS), Gross total resection, Subtotal resection

Objectives:
1. Know about the clinical presentation of Gliosarcoma
2. Know about the differences in radiological and histopathological features of Gliosarcoma
3. Outcomes of Gliosarcoma in Pakistan.
Title: The Evolution of Skull Base Neurosurgery

Authors: M. Sean Grady

Introduction: Skull base surgery has evolved from maximally invasive procedures which involve resection/dissection of facial skeleton structures to a much less invasive approach using endoscopic techniques augmented by radio surgery. Future technical advancements may include the use of surgical robots.

Methods: Review of latest methods of surgical approaches to the anterior skull base using endoscopy.

Incorporation of the endoscope to augment posterior fossa microscopic procedures.

Potential use of robots (da Vinci system).

Results: new technology can augment present microsurgical techniques to minimize trauma and improve resections of skull base tumors.

Conclusions: skull base surgery continues to evolve as new technology is introduced into the clinical environment.

Keywords: skull base tumors, endoscopy, robotics

Objectives:

1. Understand the value of the endoscope
2. Determine ways this technology can be incorporated into clinical practice
3. Identify technical skills needed to utilize these devices
Title: Outcomes of Aneurysms Treated Exclusively by Comprehensive Vascular Neurosurgeons

Authors: Mandy Binning, Erol Veznedaroglu, Kenneth Liebman, Hakma Zakaria, Paster Jared

Introduction: Many centers employ separate operators to perform open microsurgical aneurysm clipping and endovascular coil embolization of cerebral aneurysms. Concern over the training of comprehensive (open and endovascularly trained) neurosurgeons has arisen regarding their technical abilities to achieve good outcomes with both modalities. We reviewed the aneurysm data at our institution where all patients are treated exclusively by comprehensive neurosurgeons to evaluate treatment trends and outcomes for the two treatment modalities.

Methods: This is a retrospective review of patients who underwent both open and endovascular treatment of ruptured and unruptured aneurysms at our institution. Patient demographics and characteristics as well as aneurysm characteristics and treatment modality and outcomes were reviewed.

Results: Preliminarily, data from 276 treated aneurysms was captured. One-hundred and fifteen (42%) of aneurysms were unruptured. Of the ruptured aneurysms, 11%, 20%, 13%, 10% and 4% were Hunt and Hess grade 1-5 respectively. In all comers, 79% of aneurysms were treated by coiling and 21% by clipping. In unruptured aneurysms, 29% were clipped and 71% coiled, while in ruptured aneurysms, 15% were clipped and 85% were treated endovascularly. At discharge, 86% of all patients were independent (mRS 0-2). In hospital mortality rate was 6.8%.

Conclusions: Our preliminary data shows that patients treated at our institution have lower than expected rates of morbidity and mortality regardless of treatment type. This may be as a result of lack of treatment bias when individualizing treatment to the patient.

Keywords: Endovascular Aneurysm Clip Ligation Outcome

Objectives:

1. To understand the treatment options for ruptured intracranial aneurysms.

2. To understand the treatment options for unruptured intracranial aneurysms.

3. To understand the benefits of each modality.
Title: Benefits of Vascular Neurosurgeons Taking an Active Role in All Vascular Conditions of the Brain and Spine

Authors: Mandy Binning

Introduction: Prior to 2009, Capital Health Regional Medical Center (CHRMC) was a community hospital, Level 2 trauma center, served by independent neurosurgeons that provided coverage. The landscape changed dramatically, when the hospital hired 2 comprehensive vascular (open and endovascularly trained) neurosurgeons from a major academic center to build a neurosciences program. By taking control of all transfers for neurological emergencies, closing the neurological intensive care units, and adhering to stringent quality measures, in 5 years a growing neuroscience institute has been built.

Methods: The landscape changed dramatically, when the hospital hired 2 comprehensive vascular (open and endovascularly trained) neurosurgeons from a major academic center to build a neurosciences program. By taking control of all transfers for neurological emergencies, closing the neurological intensive care units, and adhering to stringent quality measures, in 5 years a growing neuroscience institute has been built.

Results: The institute now employs 7 neurosurgeons (4 comprehensive vascular, 1 tumor, 1 spine, 1 functional/general), 2 vascular fellows annually, and 16 neurologists covering all neurological subspecialties including autism and pain. The institute is now a Joint Commission Certified Comprehensive Stroke Center, and with vascular neurosurgery taking an active role in developing a dedicated neurological emergency department (ED) and pre-hospital stroke alert protocols, measures of efficiency of care, such as door-to-needle time for IV-tPA have been reduced by 59% since 2009. Due to the fact that the institute has become a known center of excellence for the community and EMTs, the emergency department has seen a dramatic rise in stroke alerts from 391 in 2009 to over 1,000 in 2013. In addition to expanding volume within our own ED, the neurosurgeons at CHRMC are responsible for answering a direct hotline number that is used by over 90 hospitals, primarily in NJ and PA. As a result of our neurosurgeons serving as the first-line for transfers for all neurological emergencies, surrounding ED’s receive real-time feedback for acute management of the patient, while we instantaneously set up the transfer. This model has resulted in a 350% rise in admissions for neurological emergencies, a greater than 200% increase in neurosurgical operative cases since 2009.

Conclusions: The comprehensive vascular neurosurgeon fills many roles within a hospital system. He is able to serve as the neurosurgeon, interventionalist, stroke neurologist, and intensivist and provide the most comprehensive care to patients with neurovascular pathology. As the volume of stroke cases increases within the hospital system, the number of admissions for all
neurological emergencies also rises, increasing the volume of patients for other neurosurgeons and neurologists within the practice. This occurs for multiple reasons, first, other pathologies of the brain can present with symptoms that mimic stroke (seizure, tumor, cervical radiculopathy, etc.) and secondly, healthcare systems want to send their patients to the place where they know patients will simply get the best care, so they begin sending all patients with neurological symptoms as a result.

**Keywords:** vascular, endovascular

**Objectives:**

1. Identify ways to improve efficiency in evaluating and treating patients with neurological emergencies
2. Understand how a pre-hospital notification system is important in identifying acute neurological emergencies
3. Understand the roles that a comprehensive (open and endovascular) vascular neurosurgeon can play on the team that benefits all of the other subspecialties in neurology and neurosurgery
Introduction: High-grade gliomas are the most common form of adult brain cancer, and patients have a dismal survival rate despite aggressive therapeutic measures. Intratumoral hypoxia is thought to be a main contributor to tumorigenesis and angiogenesis of these tumors. Since Hif-1α the major mediator of hypoxia-regulated cellular control, inhibition of this transcription factor could reduce glioblastoma growth.

Methods: Using an orthotopic mouse model with U87-LucNeo cells, we utilized RNA interference to knock down HIF-1α in vivo. The siRNA was packaged using a novel multifunctional surfactant, EHCO, a nucleic acid carrier that facilitates cellular uptake and intracellular release of siRNA. Stereotactic injection was used to deliver siRNA locally through a guide set screw system and delivery/uptake was verified by imaging of fluorescently labeled siRNA. Osmotic pumps were used for extended siRNA delivery to model the commonly used human intracranial drug delivery technique convection-enhanced delivery (CED).

Results: Mice receiving daily siRNA injections targeting HIF-1α had a 79% lower tumor volume after 50 days of treatment when compared with controls. The HIF-1 transcriptional targets VEGF, GLUT-1, c-MET, and CA-IX and markers for cell growth (MIB-1) and vascularity (MVD) were also significantly lower. Altering the carrier EHCO by adding polyethylene glycol significantly increased the efficacy of drug delivery and subsequent survival of the treated mice.

Conclusions: Treating glioblastoma with siRNA targeting HIF-1α in vivo can significantly reduce tumor growth and increase survival in an intracranial mouse model. With further study this might be extended for use in human patients with malignant gliomas.

Keywords: hypoxia, hypoxia inducible factor, brain tumor

Objectives:
1. Understand the role of Hypoxia inducible factor-1a in human glioma growth and angiogenesis
2. Discuss the strategy of inhibiting HIF-1 for treatment of human gliomas
3. Describe the use of siRNA and multifunctional carriers for the treatment of brain tumors

Title: RNA Interference Targeting HIF-1a via a Novel Multifunctional Surfactant Attenuates Glioma Growth in an Intracranial Mouse Model

Authors: Randy Jensen, David Gillespie
Title: Clear Cell Ependymoma: Rare Variant First Time to be Reported by Tertiary Care Center in Pakistan

Authors: Hashmi Fauzan, Muhammad Bari, Arsalan Ahmed, Saad Khan

Introduction: Clear Cell Ependymoma has never been reported from Pakistan. We aim to see the features and outcomes of this rare entity in Pakistan.

Methods: A retrospective case-series conducted at the Department of Neurosurgery, Aga Khan University. The medical record files of patients with Clear Cell Ependymoma from 2003 – 2012 were reviewed, MRI/C.T scans and Histopathological slides were reviewed. Patients lost to follow-up were contacted on telephone. Analysis was done on SPSS 20.

Results: Nine cases of CCE were found. The median age was 47 years. The symptoms included Headache 66.6%, seizures, hemiparesis, raised ICP 33.3% patients.

Seven patients had supra-tentorial and 2 had infra-tentorial tumor. MRI showed hypo-intense signals on T1 and hyper-intense signals on T2 weighted images. Contrast enhancement was found in 7 patients (77.8%).

Histopathology: Clear cells were found frequently in 5 cases. Immunohistochemistry showed GFAP and EMA positivity in all cases. Ki-67 showed high proliferative index in 5 patients.

WHO class was II in 1 patient and III in 8 patients.

Gross total resection was done in 5 (55.5%), Subtotal Resection in 4 patients (44.4%). 5 patients underwent radiotherapy, 3 patients underwent Radiotherapy + chemotherapy, post-surgery.

Recurrence was there in 7 patients. Repeat surgery was done in 3 patients.

Six patients died of the disease. Median Progression free survival was 8 months (range 5-28 months), the median overall survival was 15 months (range 6-52 months).

Conclusions: CCE is a significantly aggressive tumor in Pakistan with prognosis worse than other parts of the world.

Keywords: Clear Cell Ependymoma, Gross total resection, Sub-total resection, Overall survival

Objectives:
1. Know about the clinical presentation of Clear cell ependymoma
2. Know about the radiological and histopathological features of Clear cell ependymoma
3. Outcomes of clear cell ependyma in Pakistan
Notes
Mark your calendars, the 50th Annual Meeting of the Rocky Mountain Neurosurgical Society, Inc. will be held in:

COLORADO SPRINGS
COLORADO
THE BROADMOOR RESORT
JUNE 13-17, 2015

© Copyright 2014 Rocky Mountain Neurosurgical Society, Inc. All rights reserved.