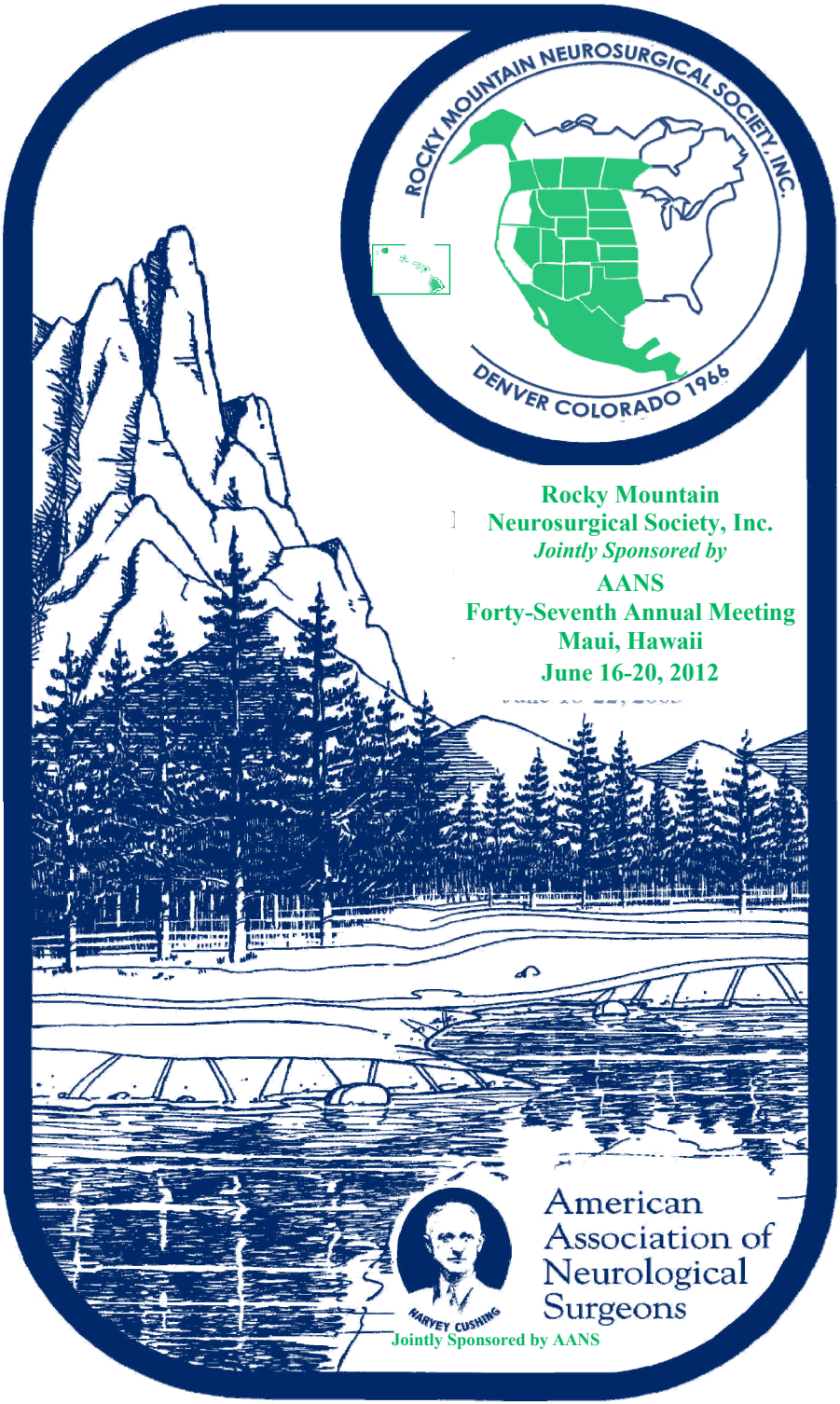
ROCKY MOUNTAIN NEUROSURGICAL SOCIETY, INC.
DENVER COLORADO 1966
Rocky Mountain
Neurosurgical Society, Inc.
Jointly Sponsored by
AANS
Forty-Seventh Annual Meeting
Maui, Hawaii
June 16-20, 2012
HARVEY CUSHING
American
Association of
Neurological
Surgeons
Jointly Sponsored by AANS

www.rmns.org

PROGRAM

THE FORTY-SEVENTH ANNUAL MEETING

Of

THE ROCKY MOUNTAIN NEUROSURGICAL SOCIETY, LLC

AANS

American Association of Neurological Surgeons

Jointly Sponsored by AANS

Honored Guests:

Charles L. Branch Jr., MD

Jeffrey N. Bruce, MD

June 16-20, 2012
The Fairmont Kea Lani
Maui, Hawaii

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 2011-2012

President:	Randy L. Jensen, MD, PhD
President Elect:	Stewart Levy, MD
Vice President:	Joseph Beshay, MD
Secretary:	Richard A. A. Day, MD
Treasurer:	Paul A. House, MD
Historian:	Albert H. Capanna, MD
Past President:	Michael Brown, MD
Member at Large:	John MacFarlane, MD

Committees 2011-2012

Program Committee:	Kelly Schmidt, MD
Local Arrangements:	Stewart Levy, MD
Membership Committee:	Randy L. Jensen, MD, PhD (2012) Mark Robinson, MD (2013) Paul Elliott, MD (2014)
Nominating Committee:	Joel D. MacDonald, MD (2012) Jonathan White, MD (2013) Michael Brown MD (2014)
CME Committee:	Brett Dietz, MD
Website Administrator:	Joel D. MacDonald, MD

MEETING AT A GLANCE

SATURDAY, JUNE 16, 2012

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 17, 2012

7:00 - 7:55 a.m.	Physician and Exhibitors Breakfast*
7:00 - 11:00 a.m.	Spouse and Children's Breakfast*
8:00 a.m. - 12:00 p.m.	**Scientific Session**
6:30 - 9:30 p.m.	Luau on Polo Beach Lawn

MONDAY, JUNE 18, 2012

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

TUESDAY, JUNE 19, 2012

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

WEDNESDAY, JUNE 20, 2012

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

***Breakfast -** *Kea Lani Buffet* (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 place winner will receive a $1500 travel stipend to attend the RMNS meeting.

Academy Cup

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

Firing Line

Present cases for discussion with our distinguished guest professors.

Raffle

This year we will hold a raffle for a *brand new* **iPad.** To enter the raffle you must submit your completed entry card by 12:00 Noon, Tuesday, June 19, 2012. Entry completion requires an exhibitor sign off from each booth.

Free Internet/Benefits: Enroll in the Fairmont Presidents Club at https://www.fairmont.com/fpc/

The Fairmont Kea Lani

4100 Wailea Alanui Drive
Maui, HI 96753
Tel. 808-875-4100

The 2012 Rocky Mountain Neurosurgical Society Meeting will be held from June 16th through June 20, 2012 at The Fairmont Kea Lani in Maui, Hawaii. This will be the first time the RMNS has taken its annual meeting to Hawaii and we are all very excited for a fun and unique experience. In Hawaiian, Kea Lani means "heavenly white," an appropriate description for this all suite and villa oceanfront luxury resort. Situated on 22 acres of tropical landscape, It features a full-service spa and salon, 24-hour fitness center, three swimming pools, a 140-foot waterslide, four restaurants, gourmet bakery and deli, a year-round children's program, and boutique shopping. Their signature gourmet restaurant Kō has just completed a fresh remodel. Golfers will be glad to know that the resort is adjacent to Wailea's three championship golf courses with an additional two nearby Makena courses. In addition to golf, recreational activities in the area include surfing, snorkeling with sea turtles, scuba diving, hiking through rainforests and to waterfalls, horseback riding, sea kayaking, deep sea fishing, windsurfing, and zip-lining. You and your family may decide to take a day to drive around the island and hike bamboo forests and visit various historic sites. Also, plan to visit Maui's Haleakala National Park, home of the world's largest dormant volcano. Rising 10,023 feet above sea level, it last erupted in 1790 A.D. The park also offers hiking, sightseeing, horse-back riding, downhill biking and unforgettable sunsets and sunrises. To top off your adventure, helicopter tours are readily available from several tour companies.

Social Highlights

Opening Reception at Royal Fountain Terrace - Saturday, June 16th, 2012
The Opening Reception will be held June 16th on the beautiful Royal Fountain Terrace at sunset. Look forward to our tradition of offering delicious fresh hors d'oeuvres and refreshments while you reconnect with your colleagues. All attendees including exhibitors are invited.

Hawaiian Luau on Polo Beach - Sunday, June 17th, 2012
In ancient Hawaii, men and woman ate their meals apart. Commoners and women of all ranks were also forbidden by the ancient Hawaiian religion to eat certain delicacies. This all changed in 1819, when King Kamehameha II abolished the traditional religious practices. A feast where the King ate with women was the symbolic act which ended the Hawaiian religious tabus, and the luau was born. This outdoor party on the beach features poke (fish appe□zer), poi (corn), kalua pig, lomi salmon, opihi (shellfish), haupia (coconut dessert), cocktails, beer, wine, and entertainment, such as Hawaiian music and hula dancing. All attendees including exhibitors are invited.*

Golf Tournament at Wailea Emerald Course - Monday, June 18th, 2012
You can experience the Wailea Golf Club, whose championship Gold, Emerald and Blue courses boast breathtaking ocean views from every hole and dozens of prestigious awards. Truly, the best golf in Hawaii. Take advantage of the club's wide array of services and amenities including an excellent pro shop, top-quality rental clubs and shoes, exceptional golf school, on-site restaurants, locker rooms and lounges. All attendees including exhibitors are invited to participate in this yearly contest. *

Tennis Tournament at Wailea Tennis Club -Tuesday, June 19th, 2012
The Wailea Tennis club is the largest resort tennis facility on Maui in Hawaii. Ranked for more than a decade as one of the country's 50 best resorts. All attendees including exhibitors are invited to participate in this yearly contest. *

Annual Banquet -Tuesday, June 19th, 2012
Enjoy dinner, dancing, with awards and prizes for outstanding categories in our Golf and Tennis tournaments. All attendees including exhibitors are invited.*

**Additional Fees Apply for all participants.*

LEARNING OBJECTIVES

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

Scientific Session I

1. Discuss the indications and growing use of novel direct coagulation factor inhibitors.
2. Recognize the need for development of management strategies regarding intracranial hemorrhage for patients treated with these novel medications.
3. Understand the characteristics of pediatric aneurysms and know how they differ from their adult counterparts.
4. Identify the commonly employed strategies in treating complex pediatric aneurysms that are not amenable to standard clipping and the reported success rates of those treatments.
5. Understand the advantages & disadvantages of clip-wrapping as a treatment strategy in complex pediatric aneurysms.
6. Understand the direction spinal surgery is going - what is current and what the future may be.
7. Identify currently accepted methods for treating type II odontoid fractures in elderly patients.
8. Make informed decisions regarding treatment of type II odontoid fractures based on consideration of factors which determine the most appropriate method.
9. Better understand the socioeconomic impact that an aging population will have on how we allocate neurosurgical resources.
10. Understand the literature on lumbar decompression surgery.
11. Understand the indications for spinal fusion in patients with lumbar instability
12. Review the results of a 20 year follow-up survey study on patients with lumbar decompression for stenosis
13. Discuss a novel hybrid approach to minimally invasive lumbar fusion.

Scientific Session II

1. Know the reported bone flap resorption rates after autologous cranioplasty in pediatric patients who underwent decompressive craniectomy for severe TBI.
2. Identify the risk factors that have been demonstrated to lead to increased rates of bone flap resorption.
3. Discuss the difference between electromagnetic neuronavigation and optical neuronavigation.
4. Describe the benefits of electromagnetic neuronavigation in pediatric patients and in difficult intracranial catheter placements.
5. Understand current treatment choices for low grade glioma.
6. Understand effect of genotype on outcome in low grade glioma.
7. Understand rationale for primary chemotherapy in low grade glioma.
8. Describe preoperative patient characteristics that can predict patient outcome with oligodendrogliomas.
9. Understand molecular markers that can be used to determine patient progression free survival and overall survival in patients with oligodendrogliomas.
10. Utilize IDH-1 and 1p19q gene mutation information for predicting behavior of oligodendroglioma tumors.
11. Describe the etiology and most common location of pneumocephalus associated with frontoethmoid osteomas.
12. Describe potential operative approaches for frontoethmoid osteomas with associated pneumocephalus.
13. Understand the relevant anatomy for safe and successful resection of sphenoorbital meningiomas.
14. Discuss surgical approaches to sphenoorbital meningiomas and discuss management of complications and recurrences.
15. Recognize common headache patterns that will respond to conservative management.
16. Understand guidelines for optimum chemotherapy in cancer.
17. Understand how these guidelines were developed.
18. Determine how patients with GBM are most effectively treated with advancing technology.
19. Describe the current and future clinical applications of convection enhanced delivery of chemotherapeutic agents for brain tumors.

Scientific Session III

1. Recognize that cellular therapies other than stem cells are under investigation for disc nucleus repair.
2. Discuss the molecular basis of chondrocyte immune privilege that permits allogeneic transplantation without immunologic rejection.
3. Identify the transcription factor regulating chondrocyte survival in an avascular environment, such as the disc space.
4. Recognize the differences in surgical approaches to metastatic and primary spine tumors.
5. Understand the different techniques for the surgical treatment of spine tumors.
6. Understand the available literature and evidence based approach to surgery for spine tumors.
7. Describe the reported survival rates for evacuation of traumatic acute subdural hematomas in the elderly.
8. Know what factors predispose elderly patients to good outcomes from traumatic acute subdural hematomas.
9. Discuss the use of intraoperative MRI for brain tumor surgery.
10. Understand the limitations of intraoperative MRI.
11. Describe the rationale and indications to use intraoperative MRI for brain tumor surgery.
12. Discuss the physical principles behind the ferromagnetic heat induction device.
13. Discuss potential applications of the ferromagnetic device to various surgical procedures.
14. Discuss similarities and differences between ferromagnetic and other technologies.
15. Understand the surgical anatomy of the anterior choroidal artery.
16. Understand the surgical techniques and nuances involved in microsurgical clipping of anterior choroidal artery aneurysms.
17. Review the potential complications, pitfalls and risks involved in surgery of the anterior choroidal artery, including anterior choroidal artery infarct.
18. Discuss the predicted trends of cranial and spine surgery over the next ten years.
19. Discuss the outcomes of elderly patients who undergo minimally invasive spine surgery.

Scientific Session IV

1. Discuss how to handle a multiple system trauma requiring surgeons of various specialties to operate simultaneously.
2. Understand the requirements for ACGME guided systems based practice and practice based learning.
3. Understand the importance of coding education in neurosurgery residency.
4. Understand one method of utilizing a coding education team to educate residents.
5. Discuss pertinent anatomy and surgical approaches to the pineal region.
6. Identify risks and possible complications of pineal region surgery.
7. Discuss junior and senior resident perceptions of neurocritical care training during residency training.
8. Discuss program director/chairman perceptions of neurocritical care education during current residency training.
9. Recognize what role neurocritical care education has in current and future neurosurgical residency programs.
10. Describe the pathologic features of choriocarcinoma.
11. Discuss the operative indications for choriocarcinoma intracranial metastases and the multidisciplinary approach necessary to best treat these lesions.
12. Understand the use of differential scanning calorimetry (DSC) for tumor diagnosis.
13. Discuss the utility of DSC for determining tissue grade and explain how it might be used for CSF diagnosis of brain tumors.

SCIENTIFIC PROGRAM - JUNE 17th – 20th

Rocky Mountain Neurosurgical Society

SUNDAY, JUNE 17, 2012

MODERATOR: Randy L. Jensen, MD, PhD

07:00-07:55	Breakfast
08:00-12:00	**SCIENTIFIC SESSION I**
08:00-08:10	**Introductory Remarks and Welcome** President Randy L. Jensen, MD, PhD
08:10-08:30	Walavan Sivakumar, MD; Sarah T. Garber, MD; **Paul A. House, MD**: "Recurrent, Delayed Intracranial Hemorrhage Associated With Edoxaban and DBS"
08:30-08:50	**Christian A. Bowers, MD**; William T. Couldwell, MD, PhD: "Efficacy of Clip-Wrapping in Treatment of Complex Pediatric Aneurysms"**
08:50-09:10	**Albert H. Capanna, MD**: "Microdiscectomy to Minimally Invasive"
09:10-09:30	**John B. Dietze, MD**: "Treatment Considerations for Type II Odontoid Fractures in the Elderly Population"
09:30-09:50	**Yasuaki Harasaki, MD**; Oszkar Szentirmai, MD; Samuel Nortman, MD; Glenn W. Kindt, MD: "How did our patients do with lumbar decompression without fusion? A retrospective survey review of the VA population"**
09:50-10:10	**Break**
10:10-11:10	**SPECIAL GUEST LECTURE:** **Charles L. Branch Jr., MD** "Minimally Invasive Lumbar Fusion: A Novel Hybrid Approach"

11:10-12:00 **SPECIAL GUEST PRESENTATION:***

Pauline Fiene

Marine Biologist

**No CME awarded*

NOTES

MONDAY, JUNE 18, 2012

MODERATOR:	Brett Dietze, MD
07:00-07:55	Breakfast
08:00-12:00	**SCIENTIFIC SESSION II**
08:00-08:20	**Christian A. Bowers, MD**; Jay Riva-Cambrin, MD; Marion L. Walker, MD: "Factors and Rates of Pediatric Bone Flap Resorption After Decompressive Craniectomy for Severe Traumatic Brain Injury"****
08:20-08:40	**Kelly Schmidt, MD**: "The Use of Noninvasive Electromagnetic Neuronavigation for Intracranial Catheter Placement"
08:40-09:00	**Edward B. Arenson, MD**: "Primary treatment of low grade glioma with multi-agent chemotherapy"
09:00-09:20	**Randy L. Jensen, MD, PhD**; Nan Hu, PhD: "Predicting outcomes of patients with oligodendrogliomas: Comparison of IDH-1, 1p19q, hypoxia biomarkers, and preoperative patient characteristics and imaging"
09:20-09:40	**Yasuaki Harasaki, MD**; Kelly J. Pettijohn; Allen Waziri, MD; Vijay Ravakrishnan, MD: "Frontoethmoid osteoma with pneumocephalus: Case report and consideration of options for surgical management"**
09:40-10:00	Oszkar Szentirmai, MD; **Kevin O. Lillehei, MD**: "10 Year Experience with Surgical Treatment of Spheno-Orbital Meningiomas at the University of Colorado"
10:00-10:20	**Break**
10:20-10:40	**Steven J. Wilk, DDS**: "New Perspectives in Diagnosis and Management of Postoperative Headache and Facial Pain"
10:40-11:00	**Edward B. Arenson, MD**: "Superior Survival in Glioblastoma with Multi-agent Chemotherapy"

11:00-12:00 **SPECIAL GUEST LECTURE:**

Jeffrey N. Bruce, MD

"Convection enhanced delivery of topotecan for malignant gliomas: Bench to bedside"

NOTES

TUESDAY, JUNE 19, 2012

MODERATOR:	Stewart Levy, MD
07:00-07:55	Breakfast
07:30-07:55	**ANNUAL BUSINESS MEETING FOR RMNS MEMBERS**
08:00-12:00	**SCIENTIFIC SESSION III**
08:00-08:20	Domagoj Coric, MD; Kenneth Pettine, MD; Andrew Sumich; Margaret O. Boltes; **Huston D. Adkisson, PhD**: "Prospective Study of Human Juvenile Chondrocytes for Treatment of Discogenic Back Pain Secondary to Lumbar Degenerative Disc Disease"
08:20-08:40	**Yevgeniy Khavkin, MD**: "Surgical Treatment of Spinal Tumors"
08:40-09:00	**Christian A. Bowers, MD**; Andrew T. Dailey, MD: "Improved Mortality Rates & Factors Predicting Good Outcomes in Elderly Patients Undergoing Craniotomy for Evacuation of Acute Subdural Hematomas"**
09:00-09:20	**Randy L. Jensen, MD, PhD**: "Planning, implementation, construction and preliminary use of a combination diagnostic and intraoperative magnetic resonance imaging system at the University of Utah"
09:20-09:40	**Joel D. MacDonald, MD**: "Clinical Experience with Ferromagnetic Dissection Tool"
09:40-10:00	**Daniel R. Klinger, MD**; Gordon Mao; Jonathan A. White, MD: "Microsurgical Treatment of Anterior Choroidal Artery Aneurysms: Lessons Learned"**
10:00-10:20	**Break**
10:20-10:40	**Kelly Schmidt, MD**: "The Future of Neurosurgery from the Hospital Perspective: Where Are We Headed?"
10:40-11:00	**Firing Line**

11:00-12:00 **SPECIAL GUEST LECTURE:**

Charles L. Branch Jr., MD

"Minimally Invasive Spine Surgery in the Aging Patient: Are the Benefits Real or Imagined?"

NOTES

WEDNESDAY, JUNE 20, 2012

MODERATOR: Kelly Schmidt, MD

07:00-07:55	Breakfast
08:00-12:00	**SCIENTIFIC SESSION IV**
08:00-08:20	**Albert H. Capanna, MD**: "Cranial Reimplantation after Machete Attack"
08:20-08:40	**Paul E. Kaloostian, MD**; Martina Stippler, MD: "A retrospective study of a novel coding education program in accordance with ACGME practice based learning and systems based practice: a new addition to modern neurosurgery residency training?"**
08:40-09:40	**SPECIAL GUEST LECTURE:** **Jeffrey N. Bruce, MD** "Exploring the seat of man's soul: Observations from pineal region surgery"
09:40-10:00	**Paul E. Kaloostian, MD**: "Neurocritical care training for the neurosurgery resident: Should it continue?"**
10:00-10:20	**Break**
10:20-10:40	**Charles V. Hatchette, MD**: "Intracranial Metastatic Choriocarcinoma"**
10:40-11:00	**Randy L. Jensen, MD, PhD**: "Differential Scanning Calorimetry of Cerebrospinal Fluid, Brain Tumor Cell Lines, and Patient Tumor Samples: Emphasis on correlation with tumor diagnosis and histology"

11:00-12:00 **SPECIAL GUEST PRESENTATION:***

Meagan Jones, PhD

Executive Director: Whale Trust

12:00 **Closing Remarks:** Randy L. Jensen, MD, PhD

12:05 **MEETING ADJOURN**

**No CME awarded*

*** Denotes consideration for Resident Award*

NOTES

Mark your calendars, the 48th Annual Meeting of the Rocky Mountain Neurosurgical Society, Inc. will be held in:

SUN VALLEY, ID

Sun Valley Resort

June 15 - 19, 2013

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.

Brain Lab
Codman
DePuy Spine
DJO Global
Globus Medical
Integra Neurosurgery
ISTO Technologies
KLS-Martin, L.P.
Leica Microsystems
Medtronic - Spine/ Biologics
Medtronic - Surgical Technologies
Medtronic - NT
Nuvasive
OsteoMed
Southwest Surgical
Stryker Craniomaxillofacial
Stryker Spine
Synthes CMF
Synthes Spine
TranS1, Inc.

*Visit each booth and qualify to win an **iPad!***

Disclosure Information

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

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

Name	Disclosure	Type of relationship
Paul House	Medtronic, Boston Scientific	Consultant
Huston D. Adkisson	ISTO Technologies, Inc.	Employee
Randy L. Jenson	Medronic, Pharmco Kinesis	Consultant

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

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

Joseph E. Beshay*	Christian A. Bowers	Meagan Jones
Richard A. A. Day*	Yasuaki Harasaki	Pauline Fiene
Michael Brown*	Charles L. Branch	Yevegiy Khavin
Albert H. Capanna*	Edward B. Arenson	
John B. Dietze*	Kevin O. Lillehei	
Stewart Levy*	Steven J. Wilk	
Joel D. MacDonald *	Jeffrey N. Bruce	
Jonathan A. White*	Daniel Klinger	
John MacFarlane*	Kelly Schmidt*	
Mark Robinson*,	Paul E. Kaloostian	
Paul Elliott*	Charles V. Hatchette	

* Educational content planner of this meeting

Accreditation/Continuing Medical Education

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

The AANS designates this live activity for a maximum of **13.0** *AMA PRA Category 1 Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

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The material presented at the 45th Annual Rocky Mountain Neurosurgical Society Meeting has been made available by the Rocky Mountain Neurosurgical Society and the AANS for educational purposes only. The material is not intended to represent the only, nor necessarily the best, method or procedure appropriate for the medical situations discussed, but rather it is intended to present an approach, view, statement, or opinion of the faculty, which may be helpful to others who face similar situations.

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

Neither the AANS nor the Annual Rocky Mountain Neurosurgical Society makes any statements, representations or warranties (whether written or oral) regarding the Food and Drug Administration (FDA) status of any product used or referred to in conjunction with any course, seminar or other presentation being made available as part of the 45th Annual Rocky Mountain Neurosurgical Society Meeting. Faculty members shall have sole responsibility to inform attendees of the FDA status of each product that is used in conjunction with any course, seminar or presentation and whether such use of the product is in compliance with FDA regulations.

Historical Notes

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

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

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

RMNS Constitution - Revised June 1999

Article I - Name
The organization shall be known as The Rocky Mountain Neurosurgical Society, Inc.

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

Article III - Membership
Section 1 - The membership of Society shall consist of five categories: ACTIVE, ASSOCIATE, SENIOR, INACTIVE, and HONORARY.
(A) ACTIVE MEMBERS shall consist of neurological surgeons who have been certified by the American or Mexican Board of Neurological Surgery, or Fellowship in the Royal College of Surgeons (Canada), and also members of allied fields who have been certified by their appropriate board in that allied specialty. Active members in allied fields shall not exceed twenty per cent (20%) of the total membership of the Society.

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

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

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

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

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

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

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

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

Article IV Founders Group - Executive Committee

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

Article V - Officers

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

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

pointed by the President.

Article VI - Duties of Officers

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

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

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

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

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

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

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

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

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

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

(E) Call special meetings when deemed necessary.

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

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

Article VII - The Constitution

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

RMNS By-Laws - Revised June 1999

Article I - Application and Election to Membership

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

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

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

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

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

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

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

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

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

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

1) censured, or

2) suspended for a definite time, or

3) expelled from the society.

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

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

Article II - Election of Officers

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

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

Article III - Initiation Fees and Dues

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

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

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

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

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

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

Article IV - Guests

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

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

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

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

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

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

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

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

Article X - Scientific Papers

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

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

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

Article XI - Amendments

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

Past Meetings of the Society

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

Past Presidents

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

Abstracts RMNS 2012:

Title: Recurrent, Delayed Intracranial Hemorrhage associated with Edoxaban and DBS

Authors: Walavan Sivakumar; Sarah T Garber; Paul A. House

Introduction: The previous mainstays of stroke prevention in nonvalvular atrial fibrillation (platelet function inhibition and vitamin K blockade) are being supplanted by direct coagulation factor inhibition. Edoxaban, a novel factor-Xa inhibitor, is currently in phase III clinical trials examining stroke and systemic embolization prevention compared to warfarin.

Methods: The authors report a case of a man who presented with delayed, recurrent intracranial hemorrhage months after successful deep brain stimulator placement for Parkinsonís disease while on edoxaban for atrial fibrillation.

Results: Delayed intracranial hemorrhage is extremely rare following deep brain stimulation. Only a single case of delayed hemorrhage has previously been reported despite approximately 80,000 systems implanted and no cases of recurrent hemorrhage have been described. It is therefore concerning that Edoxaban might carry significant risk of hemorrhage in this setting. The authors will discuss several new direct coagulation factor inhibitors and review the lack of clinical management strategies for caring for patients taking these new medications when intracranial surgery or trauma occur.

Conclusions: This case serves to highlight the limited information available regarding direct coagulation factor inhibitors and intracranial surgery.

Keywords: Anticoagulation, Intracranial Hemorrhage, Trauma

Objectives: 1- discuss the indications and growing use of novel direct coagulation factor inhibitors. 2- recognize the need for development of management strategies regarding intracranial hemorrhage for patients.

Title: Efficacy of Clip-Wrapping in Treatment of Complex Pediatric Aneurysms

Authors: Christian A. Bowers; William Couldwell

Introduction: Pediatric aneurysms (PAs) are a rare clinical entity distinct from their adult counterparts with respect to their typical location, aneurysm type, patient demographics, known predisposing risk factors, Hunt-Hess grade after rupture, clinical outcome, propensity to hemorrhage, rehemorrhage, and recur. A myriad of strategies have been employed to treat PAs, but although it has been used frequently in adults, the use of clip-wrapping in pediatric patients has only been reported once. We present a small series of pediatric patients that underwent clip-wrapping for treatment of their aneurysms and discuss this strategy as an effective means of treating unclippable pediatric aneurysms.

Methods: We performed a retrospective chart cohort review of pediatric aneurysm patients treated with clip-wrapping by a single surgeon over a 5-year period. Clinical presentation, surgical management, and clinical and radiological outcome of the patients were evaluated.

Results: Five patients were treated with clip-wrapping during the specified period. Three patients had traumatic pseudoaneurysms, with two subarachnoid hemorrhages from aneurysm rupture. One patient presented with mycotic pseudoaneurysm rupture causing a large intraparenchymal and subarachnoid hemorrhage. Another patient had a dissected complex saccular aneurysm with 4 perforating vessels arising from the dome. All patients with available follow-up had good clinical results, with Glasgow outcome scale scores of 5 at 6 months or 1 year. Post-operative neuroimaging demonstrated vessel patency after clip-wrapping with no recurrent hemorrhages or increase in aneurysm size during follow-up.

Conclusions: Clip-wrapping appears to be an effective yet very underutilized technique for treatment of complex pediatric aneurysms that are not amenable to conventional methods. A few previously reported cases demonstrate long-term success of clip-wrapping in pediatric patients with complex aneurysms and our experience doubles the previously reported cases while supporting clip-wrapping as an effective tool.

Keywords: Complex aneurysms; pediatric; clip-wrapping

Objectives: Understand the characteristics of pediatric aneurysms and know how they differ from their adult counterparts. Know the commonly employed strategies in treating complex pediatric aneurysms that are not amenable to standard clipping & the reported success rates of clip-wrapping. Understand the advantages & disadvantages of clip-wrapping aneurysms.

Title: Microdiscectomy to Minimally Invasive

Authors: Albert H. Capanna

Introduction: The advent of the operating microscope revolutionized neurosurgery totally reversing the inherent morbidity and mortality. Spinal surgery was slow to adopt the microscope and in fact went in the opposite direction with the coming of fellowship trained orthopedic surgeons. Macrosurgery with fusions of all kinds became the norm- even the 360 degree or anterior/posterior spinal fusions. Fusions have given way to "motion preservation" operations and now to the evolving "ìminimally invasive" spinal fusions. The origin of the microdiscectomy and the evolving direction of spinal surgery will be reviewed.

Methods: Reviewed results of prior surgeries and current morbidity and mortality data.

Results: Minimally invasive reduces morbidity and mortality.

Conclusions: Further evolution of minimally invasive techniques should optimize results while decreasing patient mortality and morbidity.

Keywords: Spine, Microsurgery, Minimally Invasive

Objectives: Learn the direction spinal surgery is going, what is current and what the future may be.

Title: Treatment Considerations For Type II Odontoid Fractures In The Elderly Population

Authors: John B Dietze

Introduction: Type II odontoid fractures are encountered very frequently among the elderly population. Though seldom associated with neurological deficits, these injuries can be quite disabling and their management can be problematic due to the numerous health challenges likely to be present.

Methods: A survey of recent literature was undertaken in order to identify currently accepted methods for management of type II odontoid fractures among the elderly. Consideration was given to both operative and non-operative treatment, as well as factors which determined which method was chosen. Outcomes for each were likewise considered.

Results: Operative treatments consist of trans-odontoid screw fixation, C1-C2 trans-articular fixation/arthrodesis and occipital-cervical fixation/ arthrodesis. Non-operative treatments include cervical collar immobilization and halothoracic bracing. Factors determining which method is chosen include patient anatomy, co-morbidities, and the level of comfort and experience of the treating surgeon.

Conclusions: As the general population continues to age, the frequency of these injuries will no doubt increase. With improvements in surgical and anesthesia technique, the viability of operative treatment in even the extremely aged is quite good. However in light of the looming changes in the healthcare system, and the socioeconomic impact of an aging population, the need for more cost-effective means of treating patients is obvious. While the rate of radiographic osseous healing of these fractures which are treated non-operatively is low, it appears that a fibrous union may well be adequate from a functional and quality of life standpoint.

Keywords: Odontoid Fracture, Halothoracic Brace, Fixation, Fibrous Union

Objectives: Identify currently accepted methods for treating type II odontoid fractures in elderly patients. Make informed treatment decisions based on considering factors which determine the most appropriate method. Better understand the socioeconomic impact that an aging population will have on how we allocate neurosurgical resources.

Title: How did our patients do with lumbar decompression without fusion? A retrospective survey review of the VA population.

Authors: Yasuaki Harasaki; Oscar Szentirmai; Glenn Kindt

Introduction: Lower back pain is one of the most common patient complaints in the United States. Some reports suggest that it may affect 80% of the adult population at some point in their lives. These patients constitute a major part of our neurosurgical practice at the Denver Veterans Administration Hospital. Most of these cases (>95% at 1 year) are initially managed with conservative therapy alone. This leaves a small percentage of patients who require surgical intervention. A portion of those that require surgery have lumbar stenosis. In response to the recently published guidelines and the national trend of increasing spinal fusions for lumbar stenosis, we venture to produce a follow-up study to our 1999 manuscript.

Methods: We hypothesize that good functional outcomes with low incidence of spinal instability can be achieved in treating lumbar stenosis with bilateral partial laminectomy without fusion, saving comorbidities for patients and health care dollars at the same time. We mailed an outcome survery to 400 patients (100/5 years block) whose surgery was performed between 1990 and 2010. The survey included the same questionnaire we used in our 1999 publication and the Oswestry Low Back Pain Disability Index. We anticipated at best a ~50% response rate.

Results: We received 158 survey responses (39.5% response rate). We suspect a significant portion of the non-responders have expired since surgery. We will present the results from the survey questionnaire, such as "Are you generally satisfied with your surgery?" with 141/158 (89%) responding "Yes" and 11% of responding "no". Despite this very high satisfaction with surgery overall, when prompted with more specific questions, such as "How is the pain down your legs since you had surgery?", the mean response was "Somewhat better". We will review the limitations of such long-term follow-up survey study and it's implications.

Conclusions: We reviewed our 20 year experience of lumbar decompressions with bilateral partial laminectomies for lumbar stenosis at the Denver Veterans Administration Hospital. We present the results of a survery study and the lack of evidence of spinal instability requiring fusion following bilateral partial laminectomies for decompression in patients with lumbar spinal stenosis.

Keywords: lumbar decompression, laminotomy, lumbar fusion, survey

Objectives: Understand the literature on lumbar decompression surgery understand the indications for spinal fusion in patients with lumbar instability review the results of a 20 year follow-up survey study on patients with lumbar decompression.

Title: Factors and Rates of Pediatric Bone Flap Resorption after Decompressive Craniectomy for Severe Traumatic Brain Injury

Authors: Christian A. Bowers; Jay Riva-Cambrin; Marion L Walker

Introduction: Decompressive craniectomy (DC) for pediatric traumatic brain injury (TBI) is commonly performed. Bone flap resorption (BFR) after autologous cranioplasty (AC) is morbid, requiring additional surgery. There is almost no documentation of pediatric BFR following TBI and there are no known risk factors.

Methods: We performed a retrospective chart cohort review for long-term survivors that underwent DC for severe TBI from 1996 to 2010. We looked at multiple variables: Age, sex, mechanism, GCS, Rotterdam score, comminuted skull fracture (SF), post-traumatic hydrocephalus (PTH), infection, permanent VPS, time to AC and/or BFR. We analyzed these variables using bivariate statistical fashion and a multivariate logistic regression model for significant variables.

Results: We found that 50.9% of our sample patients experienced BFR. The average sample age was 6.25 years. The mean time to AC was 2.06 months and the mean time for BFR was 9.52 months. Univariate comparisons were made between a number of baseline variables and outcome of BFR. Significant associations were observed with SF, infection, PTH, and a permanent VPS. Eighty-one percent (13/16) of patients with comminuted skull fractures, 80% requiring permanent VPS, 88.9% with post-operative infection, and 90% with hydrocephalus after AC had BFR. No other factors were significant. We then used multivariate analysis to develop a predictive model (logistic regression, forward, conditional). The variables entered were comminuted skull fractures, permanent VPS, and age <2.5. Comminuted skull fractures (O.R. 10.94, CI (1.19, 100.7), p=0.03), permanent VPS (O.R. 34.4, CI (2.56, 4626), p=0.007), and age < 2.5 years old (O.R. 36.1, CI (3.07, 474.5), p=0.005) were found to be significant risk factors for BFR.

Conclusions: After DC for pediatric TBI, a very large percentage [50.9%] of our AC patients experienced BFR. Factors associated with BFR in a multivariate model were patients with permanent VPS, comminuted skull fractures, and age <2.5. This is the largest series of pediatric BFR after craniectomy for TBI and the only one to find risk factors other than size associated with BFR.

Keywords: Craniectomy, TBI, Pediatrics, Cranioplasty

Objectives: Know the reported Bone Flap Resorption rates after autologous cranioplasty in pediatric patients who underwent decompressive craniectomy for severe TBI. Identify the risk factors that have been demonstrated to lead to increased rates of bone flap resorption. Summarize what the previous literature showed concerning pediatric bone flap resorption rates and explain how this new research provides information that can be used to help council patients and their families about autologous cranioplasty.

Title: The Use of Noninvasive Electromagnetic Neuronavigation for Intracranial Catheter Placement

Authors: Kelly Schmidt

Introduction: Optimal intracranial catheter placement for shunt or reservoir procedures can be immensely difficult in patients with complicated ventricular anatomy. CT and MRI-guided neuronavigation systems have improved our ability to place catheters in patients with complicated ventricular anatomy. However, standard optical systems have limitations with these procedures. Electromagnetic neuronavigation on the other hand, requires no rigid head fixation, allows the head to be moved freely in space during the procedure, and accurately tracks the tip of the catheter to allow optimal placement within the ventricle.

Methods: A retrospective chart review for a 25 month period identified patients who underwent intracranial catheter placement for any type of shunt or reservoir procedure. 88 patients were identified who underwent a total of 103 procedures. In addition to determining which patients required subsequent catheter revision, the preoperative imaging was evaluated and each procedure was divided into "routine" or "difficult" catheter placement. The difficult placement category included slit ventricles, dysmorphic ventricles, and loculated hydrocephalus. The ìroutineî placement category included normal to large-size ventricles or cysts without septations or loculations.

Results: 103 procedures for intracranial catheter placement were performed. 67 (65%) were placed without any type of neuronavigation. The remaining 36 (35%) were placed with neuronavigation ñ 29 (81%) with noninvasive electromagnetic neuronavigation using the Medtronic Stealth Axiem system, the remaining 7 (19%)with standard optical neuronavigation using Medtronic Stealth or BrainLab. During the study period, there was no difference in the rate of proximal catheter revision between the two groups ñ 2 patients (.03%) in the non-navigated group and 1 patient (.03%)in the navigated group required a catheter revision. However, 69% of the navigated procedures were considered to be ìdifficultî placements compared to only .07% of the non-navigated patients.

Conclusions: Noninvasive electromagnetic neuronavigation provides benefits over standard optical neuronavigation and freehand technique for intracranial catheter placement in complicated ventricular anatomy. Use of the Medtronic Stealth Axiem system adds minimal time and cost to the surgical procedure and does not increase the risk to the patient. Optimal catheter placement can prevent postoperative catheter-related complications. Noninvasive electromagnetic neuronavigation should be considered for use in any patient, regardless of their ventricular anatomy.

Keywords: Electromagnetic, Neuronavigation, Ventricular catheter, Shunt, Reservoir.

Objectives: Discuss the difference between electromagnetic neuronavigation and optical neuronavigation. Describe the benefits of electromagnetic neuronavigation in pediatric patients and in difficult intracranial catheter placements.

Title: Primary Treatment of Low Grade Glioma with Multi-agent Chemotherpy

Authors: Edward B Arenson

Introduction: Between 1995 and 2012 we treated 64 patients with low grade gliomas (LGG). Median follow-up is 79 months, mean 75 months, and range 14-196. There were 17 astrocytomas, 32 oligodendrogliomas (ODG), and 15 mixed tumors. Of 37 patients whose tumors were tested for 1p19q co-deletion, 23 were positive. 52 patients were treated with primary chemotherapy, and 12 received no post-surgical treatment. We report the results of this large group of patients with LGG treated by a single investigator with primary chemotherapy.

Methods: Based on the fact that cancer is seldom, if ever, curable with single agent chemotherapy, we chose to create a hybrid regimen (mPCV) which combines temozolomide (TMZ) the current standard, with PCV (minus procarbazine) the excessively toxic regimen first shown to be effective in LGG.

Results: 52 patients were treated with primary chemotherapy. This regimen was well tolerated; there were no treatment related deaths and 1 patient was hospitalized with shingles. The mean number of monthly courses of mPCV was 12, (range 1-20). Of 632 monthly courses, there were 73 episodes (12%) OF grades III/IV leukopenia and 40 episodes (6%) of grades III/IV thrombocytopenia. Of 52 patients treated, 16 have relapsed. One progressed at 31 months with GBM and died. The next earliest death occurred at 49 months and the latest at 132. All whose tumors recurred as GBM (9) died. The other 7 have responded to salvage therapy including radiotherapy (RT). Overall survival is 84% and relapse-free survival is 70%. Analysis of survival as a function of tumor type indicates that only 1 of 9 deaths occurred among 23 patients who tested positive for 1p19q co-deletion. Objective response to treatment does not appear to predict outcome.

Conclusions: Follow-up is too brief to predict median survival. Nevertheless, we can conclude that primary chemotherapy appears to be rational and produces results which compare favorably with primary radiotherapy (RT). Further, this approach preserves RT for relapses and, by avoiding RT, offers a better quality of life for survivors.

Keywords: glioma, chemotherapy, oligdendroglioma, survival

Objectives: 1. understand current treatment choices for low grade glioma 2. understand effect of genotype on outcome 3. understand rationale for primary chemotherapy

Title: Predicting outcomes of patient with oligodendrogliomas: Comparison of IDH-1, 1p19q, hypoxia biomarkers, and preoperative patient characteristics and imaging.

Authors: Randy L. Jensen; Nan Hu

Introduction: We examine whether traditional tumor measures such as MIB-1 proliferation index (PI), microvascular density (MVD index),1p19q chromosomal codeletion or the emerging biomarker isocitrate dehydrogenase isoform 1 (IDH-1) and molecular markers of hypoxia including hypoxia-inducible factor-1α (HIF-1α) and its downstream targets vascular endothelial growth factor (VEGF), glucose transporter-1 (GLUT-1), and carbonic anhydrase-IX (CA-IX) , and the UCSF preoperative grading system are able to predict progression-free (PFS) and overall (OS) survival of oligodendroglioma.

Methods: We prospectively collected tissue samples and followed outcomes of 50 patients with oligodendrogliomas and 32 with anaplastic oligodendrogliomas (AO). We retrospectively analyzed preoperative imaging and clinical data based on the UCSF scoring system (good prognostic indicators: Karnofsky Performance Scale (KPS) score>80, age<50 years, tumor diameter<4 cm, noneloquent tumor location) and correlated this with immunohistochemical markers, 1p19q chromosomal status, and compared both with patient PFS and OS.

Results: Mean follow-up was 88 months. 1p19q codeletion was associated with a better overall survival for both oligodendrogliomas (p=0.011) and AO (p=0.077). IDH-1 mutation was associated with better OS for both oligodendrogliomas (p=0.033) and AOs (p=0.050). 1p19q codeletion also predicted higher PFS for both oligodendrogliomas (p=0.049) and AOs (p=0.045). IDH-1 mutation was also associated with increased PFS for both oligodendrogliomas (p=0.062) and AOs (p=0.021). Higher MIB-1 correlated with worse OS in oligodendrogliomas (p=0.015) and higher GLUT-1 expression is associated with worse PFS in AO (p=0.019). We also evaluated the performance of the these markers using C-statistics and found UCSF and both IDH-1 and 1p/19q deletion status accurate in predicting both OS and PFS events. GLUT-1 appears to be as good as the UCSF score in predicting PFS.

Conclusions: 1p19q deletion and IDH-1 mutation are the most accurate predictor of patient outcome for oligodendrogliomas. The UCSF score, MIB-1 and GLUT-1 are also useful. The small sample size of patients and the retrospective nature of this study is major limitations of our report. Further studies are warranted to validate our interesting results in larger patient populations.

Keywords: anaplastic, isocitrate, hypoxia, chromosomal, outcome

Objectives: 1. Describe preoperative patient characteristics that can predict patient outcome with oligodendrogliomas 2. Understand molecular markers that can may be used to determine patient progression free survival and overall survival in patients with oligodendrogliomas 3. Utilize IDH-1 and 1p19q gene mutation information for predicting behavior of oligodendrogliomas.

Title: Frontoethmoid osteoma with pneumocephalus: Case report and consideration of options for surgical management

Authors: Yasuaki Harasaki; Kelly J. Pettijohn; Allen Waziri; Vijay Ramakrishnan

Introduction: Pneumocephalus has been reported as an exceedingly rare complication of frontoethmoid osteomas. The overarching surgical strategy for affected patients remains undefined.

Methods: We describe the case of a 61 year old female who presented with frontal sinus osteoma accompanied by profound intraparenchymal pneumocephalus and associated neurological deficit, treated through a minimally-invasive combined surgical strategy involving image-guided burr hole decompression of the pneumocephalus followed by transnasal endoscopic removal of the tumor. Using this approach, the patient rapidly recovered full neurological function. We review the details of our management strategy in the context of previously reported cases.

Results: Although there have been suggestions in existing literature of the rarity of intraparenchymal pneumocephalus associated with frontoethmoid osteomas, review of existing literature reveals that pneumocephalus is most commonly reported as intraprenchymal in these cases. We advocate aggressive management strategy of these lesions through a minimally invasive combined craniofacial approach.

Conclusions: Pneumocephalus when associated with frontoethmoid osteomas are most commonly reported to be intraparenchymal. A combined craniofacial operative approach is minimally invasive while providing excellent surgical access to these lesions. Urgent surgical management is critical due to potential of acute neurologic decompsensation.

Keywords: osteoma, pneumocephalus

Objectives: - describe the etiology of pneumocephalus associated with frontoethmoid osteomas - describe the most common location of pneumocephalus associated with frontoethmoid osteomas reported in literature - describe potential operative approaches for frontoethmoid.

Title: 10 year Experience with Surgical Treatment of Spheno-Orbital Meningiomas at the University of Colorado

Authors: Kevin O Lillehei; Oscar Szentirmai

Introduction: Spheno-orbital meningiomas are an unusual subset of skull base meningiomas associated with hyperostosis of the spheno-orbital region, with frequent invasion into the cavernous sinus, optic canal and superior orbital fissure. Patients present with characteristic symptoms of proptosis, visual impairment and ocular paresis. Surgery is often challenging, requiring orbital decompression, sphenoid bone resection, optic nerve decompression and skull base reconstruction. Recurrence rates are associated with extent of resection and tumor histology.

Methods: We reviewed our last 10 year surgical experience at the University of Colorado and identified 25 patients with spheno-orbital meningiomas. Fronto-temporal craniotomy was performed in all patients with an extradural resection of the hyperostotic skull base, extradural lateral orbital decompression and an extradural opening of the optic canal (as indicated). This was followed by an intradural tumor resection. Cranial reconstruction was performed in all cases without the need for specific orbital reconstruction.

Results: 80% of patients were female and 20% male, consistent with prior reports. Our median follow-up was 3 years. Ability to obtain a complete resection was limited by the extent of orbital, superior orbital fissure, and cavernous sinus invasion. In all cases, the spheno-orbital hyperostosis was found secondary to tumor invasion. The CT and MRI features of this unusual tumor will be presented along with the spectrum of pathologic findings. Extent of resection, need for post-operative adjuvant radiation therapy and recurrence rate will also be presented. An analysis of the literature will be presented, highlighting the difference between these tumors and anterior clinoid or planum sphenoidale meningiomas, particularly with respect to optic canal invasion. Intra-operative video recordings will be shown with a discussion of the importance of collaborating with an oculo-plastics surgeon for successful resection of the intra-orbital extension of these tumors.

Conclusions: Spheno-orbital meningiomas are an unusual and challenging subset of tumors requiring both an intra-dural and extra-dural approach. The ability to obtain a gross total resection is dependent on the extent of tumor invasion. We advocate an aggressive skull base resection and in this presentation analyze our outcomes in a series of 25 patients.

Keywords: sphenoorbital meningioma, proptosis, sphenoid wing, optic nerve

Objectives: ...understand the relevant anatomy for safe and successful resection of sphenoorbital meningiomas, be able to discuss surgical approaches, understand the literature and discuss management of complications and recurrences.

Title: New perspectives in diagnosis and management of post operative headache and facial pain

Authors: Steven J Wilk

Introduction: Pre and post operative headache and facial pain can often originate and be perpetuated in the masticatory system. From intubation through discharge, a residual headache can often be managed with appropriate therapies. Dr. Wilk will discuss common causes of these pain entities often overlooked, and discuss management using interventional injections, medication, and oral device therapy.

Methods: Masticatory muscles such as the temporal, massetter, and lateral pterygoid muscles are often injured during surgical procedures. The TMJ apparatus can also be hyper-extended during a difficult intubation. The results of these necessary procedures is often post operative headache, facial, and jaw pain. Symptomatic patients were evaluated in a private clinic following professional referral. Using imaging and anesthetic blockade, a diagnosis and subsequent treatment plan was formulated. Treatment consisted of interventional injections with corticosteroids, onabotulinumtoxin A, and other medicament's. Oral device therapy was also used to manage patients with movement disorders such as sleep bruxism.

Results: Once the source of headache and facial pain were identified, the patients were treated with an appropriate combination of injections, medications, and oral device therapy.

Conclusions: Post operative headache, facial pain, TM and sleep disorders are frequently seen. Management of neuromuscular pain can be helpful for many patients.

Keywords: Headache, post operative, temporalis, TMD

Objectives: Participants should be able to recognize common headache patterns that will respond to conservative management.

Title: Superior Survival in Glioblastoma with Multi-agent Chemotherapy

Authors: Edward B Arenson

Introduction: The use of multi-agent chemotherapy to treat glioblastoma (GBM) is based on the fact that single agent therapy seldom, if ever, cures cancer. We report a retrospective review of 74 patients treated by investigator choice between July, 2003 and January 2010 using a modified multi-drug chemotherapy regimen.

Methods: In a previous report (J.Neuro.Oncol.,May 2005,) we presented encouraging results of 37 patients with newly diagnosed GBM treated with BCNU, irinotecan and temozolomide (BITE). Subsequently, we modified BITE to reduce toxicity (mBITE). Patients received daily temozolomide (TMZ) and weekly CPT-11 during radiotherapy (RT) and monthly cycles of TMZ, CPT-11 and paclitaxel alternating with TMZ and BCNU after RT. Patients were treated consecutively save 8 who either elected standard TMZ alone or no post-surgical treatment.

Results: Patients were treated for variable periods of time depending on response and tolerance. All patients experienced at least one episode of grade III/IV hematologic toxicity and 24 patients had grade III/IV G.I. toxicity. There were 16 serious infections and 1 death unrelated to GBM (pneumonia). With a median follow-up of 39 months, median survival was 19 months. By Kaplan-Meier analysis, survival is predicted to be 83% 1 year, 48% 2 year, 37% 3 year, 28% 4 year, and 19% 5 year. A subgroup (24%) of good risk patients defined by high grade resection, age <60 and KPS >70 had median survival of 36 months and 55% predicted 5 year survival. By Chi square analysis, these results are superior to those reported for TMZ alone by Stupp et al, (The Lancet Oncology, May 2009). There is a conspicuous shift in the survival curve at 20 months which seems to predict superior outcome for those patients (approximately 50%) who reach this point without relapse.

Conclusions: We conclude that multi-agent chemotherapy is tolerable and superior in efficacy to single agent TMZ in a single institution. It appears that about half the patients derive the most benefit and may be identifiable at diagnosis using gene expression analysis, (L. Liau, personal communication).

Keywords: glioblastoma, multi-agent chemotherapy, survival, prognosis

Objectives: !. understand guidelines for optimum chemotherapy in cancer 2. understand how these guidelines were developed 3. determine how patients with GBM are most effectively treated with advancing technology

Title: Prospective Study of Human Juvenile Chondrocytes for Treatment of Discogenic Back Pain Secondary to Lumbar Degenerative Disc Disease

Authors: Domagoj Coric; Kenneth Pettine; Andrew Sumich; Margaret O. Boltes; Huston D. Adkisson

Introduction: Mechanical lower back pain (LBP) is difficult to diagnose and treat, and the vast majority of patients with LBP respond to nonsurgical management. The purpose of this ongoing, phase I, prospective, single-arm study was to evaluate the safety and initial efficacy of a cellular therapy for patients with lumbar mechanical LBP due to degenerative disc disease (DDD).

Methods: Fifteen patients with clinically diagnosed LBP recalcitrant to at least 6 months of nonsurgical management were enrolled. MRI confirmed single-level DDD at L3-S1 and discography confirmed annular integrity. Each patient received a single percutaneous treatment of human juvenile chondrocytes blended with fibrin carrier. Baseline Oswestry Disability Index (ODI), Numerical Rating Scale (NRS) for pain, SF-36 and neurological exams were compared at Months 1, 3, 6 and 12 post-op. Adverse events were monitored continually to evaluate safety of the cellular therapy and percutaneous delivery procedure.

Results: Mean patient age was 40 years (range 19-47). Treatment levels were L3/4=2, L4/5=1, L5-S1/12; Pfirrmann grade III=12; grade IV=3. Mean injection volume and mean peak injection pressure was 1.3mL (10 million cells per mL) and 87.6 psi, respectively. Injection time ranged from 5-33 seconds. Fourteen of 15 patients (93%) have completed minimum 1yr follow-up. Mean ODI (baseline=53.33; 12 months=20.21; p=<0.0001), NRS (baseline=5.73; 12 months=3.07; p=0.0019) and SF-36 (Physical Component) scores (baseline=35.45; 12 months=46.84; p=0.0003) improved significantly from baseline. There were no disc infections, neurological events felt to represent clinical deterioration, immunological response to treatment or serious unexpected adverse events. Three patients (20%) underwent TDR by 12 month due to persistent LBP.

Conclusions: This is a report of the safety and preliminary clinical efficacy of juvenile chondrocytes for the treatment of lumbar DDD with mechanical LBP. Clinical results at 12 months are encouraging with statistically significant improvements in both pain and function (ODI, NRS and SF-36). A prospective, randomized, double-blinded, placebo-controlled study is under design with enrollment targeted for Q42012.

Keywords: Discogenic back pain, nucleus repair, chondrocytes, degenerative disc disease

Objectives: 1. Recognize that cellular therapies other than stem cells are under investigation for disc nucleus repair. 2. Discuss the molecular basis of chondrocyte immune privilege that permits allogeneic transplantation without immunologic rejection. 3. Identify the transcription factor regulating chondrocyte survival in an avascular environment, such as the disc space.

Title: Surgical Treatment of Spinal Tumors

Authors: Yevgeniy Khavkin

Introduction: Neurosurgeons should be familiar with the principles of surgical treatment of spinal tumors. Even though not all neurosurgeons perform complex spine procedures, knowing the literature and available surgical and non surgical approaches to the treatment of spinal tumor, helps provide better care for our patients.

Methods: Review of literature and case reports

Results: Surgical treatment can be effective in improving quality of life in patients with metastatic spine lesions and extend survival in the patients with primary spine tumors.

Conclusions: Surgery should be considered for the treatment metastatic and primary spine tumors.

Keywords: Spine, Tumors, Surgery, Sacrectomy

Objectives: 1. Recognize the difference in surgical approaches to the metastatic and primary spine tumors 2. Learn about different techniques for the surgical treatment of spine tumors 3. Familiarize yourself with available literature and evidence based approach to the surgery for spine tumors.

Title: Improved Mortality Rates & Factors Predicting Good Outcomes in Elderly Patients Undergoing Craniotomy for Evacuation of Acute Subdural Hematomas

Authors: Christian A. Bowers; Andrew Dailey

Introduction: Acute subdural hematomas (ASDH) have been reported to carry mortality rates of 80% in patients older than 55 years of age with functional survival rates quoted as low as 9% in patients older than 65 years. We hypothesized that our outcomes were better than what has been reported.

Methods: The authors retrospectively reviewed the cases of all elderly patients (>65 years old) with acute subdural hematoma (ASDH) treated with craniotomy at the University of Utah between 2000-2010. Patients were located using the OpCoder database and their demographic information, including clinical presentation of pre-operative Glascow Coma Score (GCS) and Glasgow Outcome Scale (GOS) at time of discharge were recorded and analyzed.

Results: Thirty-eight patients with an average age of 76.8 years old underwent craniotomy for ASDH. 66.7% of patients without bilaterally fixed pupils upon presentation survived to hospital discharge. Among the survivors, 13 (59.1%) were GOS-4/5, while the other 8 survivors (40.9%) were GOS-3. Univariate comparisons were made with outcome of alive or dead at discharge. Significant associations were observed with GCS=3 (p=.006), and pupils (p=.013). We then developed a predictive model. The variables entered were anticoagulation (Yes/No), pupils, GCS, age, Rotterdam. The only factor that predicted alive or dead at discharge was GCS, specifically GCS of 3. We repeated the analysis with the outcome : goodgos (GOS 4 or 5). In the univariate analysis, pupils (p=.01) and GOS (p=.035) were the only significant associations with goodgos. With the new analysis, the only variable that entered the model was pupils.

Conclusions: A patient with bilaterally reactive pupils had a 1:1 (50%) chance of obtaining goodgos but this increased to 2:1 (66.7%) if the patient had a preoperative GCS of 13-15. If one or both pupils were non-reactive, then there were no patients achieving goodgos.

Keywords: Acute subdural, Elderly, TBI, mortality rates

Objectives: 1) Describe the reported survival rates for evacuation of traumatic acute subdural hematomas in the elderly 2) Know what factors predispose to good outcomes 3) Educate other physicians with respect to prognosis for elderly patients with traumatic acute subdural hematomas based on presenting GCS and the presence or absence of papillary abnormalities.

Title: Planning, implementation, construction and preliminary use of a combination diagnostic and intraoperative magnetic resonance imaging system at the University of Utah.

Authors: Randy L. Jensen

Introduction: We have recently begun using an intraoperative magnetic resonance imaging (IMRI) system at the Huntsman Cancer Institute (HCI) at the University of Utah. A second, IMRI system with both intraoperative and interventional angiographic capability is currently under construction. This report describes the critical decisions, planning, construction, and use of this system.

Methods: We have now used the HCI system for over 25 cases. We have prospectively collected patient information including demographics, surgical procedure including the use of awake cortical mapping and navigation systems. Complications and pitfalls were recorded.

Results: These cases were all tumor cases, mostly for low-grade gliomas. Only one case had technical difficulties requiring the procedure to be done without intraoperative MRI. Intraoperative MRI fusion and navigation was seamless. There were no complications but there was one potential near miss with operating table equipment that was recognized before any difficulties occurred. We will discuss the rationale of using this technology and patient selection.

Conclusions: Intraoperative MRI is safe and relatively easy to do. The clinical utility and impact on patient outcome is yet to be proven. We discuss patient selection and future applications of this technology.

Keywords: Intraoperative MRI, navigation, IMRIS

Objectives: 1. Discuss the use of intraoperative MRI for brain tumor surgery 2. Understand the limitations of intraoperative MRI 3. Describe the rationale and indications for intraoperative MRI.

Title: Clinical Experience with Ferromagnetic Dissection Tool

Authors: Joel D. MacDonald

Introduction: The ability to cut and coagulate during soft tissue dissection are essential to virtually all surgical procedures. There are a variety of energy based technologies available for this purpose. We have evaluated a novel device that uses ferromagnetic (FM) heat induction to incise and coagulate simultaneously without passing current through the patient.

Methods: Surgical cases at 2 institutions since the introduction of the FM device a year ago.THe device has been used in procedures ranging from spine to functional neurosurgery. Procedural details were examined for the utility of the FM device.

Results: A series of cranial and spinal procedures were identified. Case examples will be demonstrated.

Conclusions: The FM device has demonstrated utility in a range of clinical applications.

Keywords: Ferromagnetic, Dissection

Objectives: Participants will be able to discuss the physical principles behind the ferromagnetic heat induction device. Participants will be able to discuss potential applications of the FM device to various surgical procedures. Participants will be able to discuss similarities and differences between FM and other technologies.

Title: Microsurgical Treatment of Anterior Choroidal Artery Aneurysms: Lessons Learned

Authors: Daniel R Klinger; Gordon Mao; Jonathan A. White

Introduction: Anterior choroidal artery (AChoA) aneurysms represent 2-5% of all intracranial aneurysms. They are supraclinoid lesions often in close proximity to the posterior communicating artery and the carotid bifurcation, and traditionally their treatment has consisted of microsurgical clipping. Despite advancements in endovascular treatment modalities, it remains important and essential to analyze and understand the complexities of microsurgical treatment.

Methods: A retrospective search of a prospectively-maintained patient database from 1990 through 2010 identified patients who underwent microsurgical treatment of AChoA aneurysms. Data collected included patient age and gender, presenting symptoms, aneurysm size and anatomy, presence and location of other aneurysms, surgical complications and patient outcomes.

Results: 79 patients underwent treatment for anterior choroidal artery aneurysms. A total of ten cases were excluded from the evaluation for reasons that included surgical wrapping without clipping (6), insufficient chart data (3) and incorrect documentation of aneurysm location (1): leaving 69 cases involving 67 patients. 57% of patients suffered aneurysmal subarachnoid hemorrhage (SAH): 30% with ruptured AChoA aneurysms and 27% from rupture of another intracranial aneurysm. The rate of transient surgical complication was 17%, and the rate of of permanent neurological complication was 13%, with AChoA infarct the most common complication at 7.2%. There was a significantly higher rate of AChoA infarct in cases of AChoA aneurysm rupture (24% v. 2.1%, p = 0.009). 84% of patients sustained a good outcome (GOS ≥ 4) at 6 months and 83% at 1 year.

Conclusions: The microsurgical treatment of AChoA aneurysms carries significant surgical risk (30%) and a high risk of AChoA infarct (7.2%) that increases significantly in cases of AChoA rupture (24% rate of AChoA infarct). Despite these concerns, the majority of treated patients have the potential for a good functional outcome after surgical intervention.

Keywords: anterior choroidal artery, aneurysm, subarachnoid hemorrhage, microsurgery

Objectives: - Understand the surgical anatomy of the anterior choroidal artery. - Understand the surgical techniques and nuances involved in microsurgical clipping of anterior choroidal artery aneurysms. - Review the potential complications, pitfalls and risks involved in surgery of the anterior choroidal artery, including anterior choroidal artery infarct.

Title: The Future of Neurosurgery from the Hopital Perspective: Where are We Headed?

Authors: Kelly Schmidt

Introduction: From a hospital perspective, neurosurgical volume is continuously changing. Particularly with development of new and improved technology, a focus on more minimally invasive procedures, and a steady foray into fields that now have a procedural component performed by some neurosurgeons (neurology, radiology, and oncology). Given steadily declining reimbursement, it is in a hospitalís best interest to try to predict the future trends of neurosurgical procedures so as to prepare for major changes that could affect their bottom line. These trends should also be of interest to individual neurosurgeons.

Methods: Data from an independent research group employed by a hospital corporation was reviewed. The research group predicts trends by taking a disease-based look at current utilization of diagnostics and surgical care and integrating that data with the expected driving economic forces, epidemiology, and emerging clinical innovations and technology. The data produced includes a population based forecast as well as the research groupís predicted forecast of the national trends for cranial and spinal surgery over the next ten years.

Results: Areas within neurosurgery that will see the greatest technological advances in the next ten years are predicted to have the largest growth in terms of procedure volume. Specifically this includes tumor surgery and radiosurgery, endovascular procedures, and deep brain stimulation. Spine surgery, as an area of neurosurgery that is being closely scrutinized by insurance companies, is predicted to have the smallest growth in terms of procedure volume as well as a distinct shift towards outpatient care.

Conclusions: As neurosurgeons, the predicted trends for neurosurgical procedure volume over the next ten years could have potential impact on patient care, our individual practices, and our relationship with hospitals.

Keywords: Neurosurgery Economics, Utilization, Future Trends

Objectives: Discuss the predicted trends of cranial and spine surgery over the next ten years.

Title: Cranial Reimplantation after Machete Attack

Authors: Albert H. Capanna

Introduction: The patient suffered an assault with a machete with fifteen blows to the head and neck and cutting the fingers off both hands and fracturing the ulna. Multiple cranial comminuted compound skull fractures with cerebellum exuding and the neck opening to the cervical spine. Combined simultaneous emergency procedures of craniectomy, reconstruction of the neck with implantation of the skull and re-implantation of the fingers. The treatment of this complex patient will be reviewed.

Methods: Case study of simultaneous surgery at a Level I Trauma Center.

Results: Combined surgeries in the prone and then supine positions by multiple surgeons allowed salvage of this patient.

Conclusions: The patient had a good result with the multiple specialty trauma team operating emergently.

Keywords: Trauma, Cranial Reimplantation, Machete

Objectives: How to handle a multiple trauma by surgeons of various specialties operating spontaneously.

Title: A retrospective study of a novel coding education program in accordance with ACGME practice based learning and systems based practice: a new addition to modern neurosurgery residency training?

Authors: Paul E Kaloostian; Martina Stippler

Introduction: The Accreditation Council for Graduate Medical Education (ACGME) and American Association of Medical Colleges (AAMC) have implemented the 6 core competencies into resident training. Current neurosurgery resident training does not include a standardized coding educational program which results in lack of resident coding skills after residency and significant loss of reimbursement for the institution. Our aim was to blindly analyze one residentís operative dictations before and after instituting a standardized monthly coding course for 12 months within a neurosurgery residency.

Methods: Sixty operative notes were randomly obtained: thirty operative notes before instituting the coding course and thirty notes after completion. Our neurosurgery coder graded the operative notes in a standardized blind fashion. Points were assigned to every coding mistake noted. All operative notes were from one resident. Results were then tallied in a blind fashion by two physicians within neurosurgery.

Results: The average number of mistakes in the operative notes before and after were 31 and 19.5, respectively (Figure 1). There was a statistically significant improvement ($p<0.05$) in resident coding practices during this time.

Conclusions: The utilization of our neurosurgery faculty and coder in teaching the monthly educational coding courses, along with resident involvement in coding education, has shown to be a successful method of not only improving resident coding practices but also a method of satisfying ACGME required systems based practice and practice based learning strategies in residency education. Including this in the current neurosurgery residency program is recommended.

Keywords: systems based practice, practice based learning, residency, neurosurgery

Objectives: 1.Understand requirements for ACGME guided systems based practice and practice based learning 2. Understand the importance of coding education in neurosurgery residency 3. Understand one method of utilizing coding education team to educate residents.

Title: Neurocritical care training for the neurosurgery resident: should it continue?

Authors: Paul E Kaloostian; Howard Yonas

Introduction: The majority of current neurosurgery training programs do not emphasize neurocritical care (NCC) for many reasons, such as the intensely busy neurosurgical service requirements and the presence of NCC intensivists. The Leapfrog group, established in 2000 in response to a variety of preventable medical errors, has begun to lead patient care in the neurosurgical intensive care units around the country. Our aim was to determine what current neurosurgery residents in different levels of residency and program directors/ chairman thoughts were on NCC education in neurosurgical resident training.

Methods: Surveys were sent out electronically to all residency programs. 39 responses from junior residents, 36 responses from senior/chief residents, and 8 responses from program directors/chairman were obtained.

Results: Results shown in Figure 1 and 2. No statistical difference between the majority responses of the different level residents, and between program directors/chairman and combined resident responses.

Conclusions: Clearly, neurosurgery residents of all levels and program directors/chairman value NCC education and see a valuable role for this knowledge in their future. Most residents however do not want to spend an additional year of fellowship training to become certified neurointensivists. The majority of residents and program directors/chairman surveyed agree not to spend a year solely dedicated to NCC. A variety of procedures such as intracranial monitoring devices, arterial lines, intubations, and central lines are clearly valued by neurosurgery residents as procedures they want to do. Perhaps a shift in current standard neurosurgery resident training to include a focused 3-6 month rotation on the ICU service working as a team with the hospitalists may be an optimal educational experience.

Keywords: neurocritical care, resident, training, neurointensivists

Objectives: Determine junior and senior resident perceptions of Neurocritical care training during residency training Determine program director/chairman perceptions of Neurocritical care education during current residency training Determine what role neurocritical care education has in current and future neurosurgical residency programs .

Title: Intracranial Metastatic Choriocarcinoma

Authors: Charles V Hatchette

Introduction: We report the case of a woman who presented with headache and lethargy and was found to have hydrocephalus and a large right cerebellar enhancing lesion with associated mass effect. She was treated with a ventriculostomy and steroids. Upon workup her beta-HCG was elevated and choriocarcinoma was suspected, and empiric chemotherapy was started. She was subsequently taken for surgical resection of the lesion due to its extensive mass effect. She tolerated this procedure well, and the ventriculostomy was removed without the need for shunt placement. The successful treatment of this patient involved the multidisciplinary effort of neurosurgery, hematology oncology, and obstetrics and gynecology.

Methods: This is a retrospective chart review

Results: After being treated with a combination of chemotherapy and surgical resection, the patient made a good functional recovery

Conclusions: Choriocarcinoma intracranial metastasis is a rare and potentially challenging problem that requires surgical resection in some cases, and is best treated with a multidisciplinary approach.

Keywords: Choriocarcinoma, Metastasis

Objectives: Describe the pathologic features of choriocarcinoma, state the operative indications for choriocarcinoma intracranial metastasis, explain the multidisciplinary approach necessary to best treat these lesions

Title: Differential Scanning Calorimetry of Cerebrospinal Fluid, Brain Tumor Cells Lines, and Patient Tumor Samples: Emphasis on correlation with tumor diagnosis and histology

Authors: Randy L. Jensen

Introduction: Thermal stability signatures of complex molecule interaction in biological fluids can be measured using a new approach called differential scanning calorimetry (DSC). The thermal stability of plasma proteome has been described previously as a method of producing a disease-specific ìsignature,î termed thermogram, in several neoplastic and autoimmune diseases. We describe the preliminary use of DSC performed on cerebrospinal fluid (CSF) brain tumor cell cultures and human brain tumor tissue samples to create unique thermograms for correlation with histological tumor classification.

Methods: Samples of CSF from nine patients with confirmed GBM were evaluated using DSC, and the thermogram signatures evaluated. These thermograms were compared with thermograms of CSF taken from patients with non-neoplastic conditions such as head trauma, hydrocephalus, or CSF leak. Further analysis was also performed on CSF from patients who had non-GBM neoplastic conditions such as carcinomatosis meningitis or central nervous system lymphoma or leukemia. With these established techniques we then used the same technique to examine cell lines (3 GBM and 2 meningioma) and brain tumor tissue samples (10 GBM, 5 oligodendrogliomas, 5 low grade astrocytomas, and 10 meningiomas) with confirmed histological diagnosis.

Results: The DSC thermograms of CSF of the patients with GBM were significantly different when compared with other neoplastic and nonneoplastic cases. The melting temperature of the major transition was shifted by 5∞C, which makes it easily distinguishable from control cases. DSC profiles of glioma and meningioma cell lines are distinctly different. Brain tumor sample analysis correlates with the cell line work with distinct GBM, oligodendroglioma, low-grade astrocytoma, and meningioma signatures

Conclusions: Our results are very preliminary, but it appears that the DSC of CSF has potential utility in diagnostics and monitoring disease progression in GBM patients. DSC of processed tumor samples seems to display unique ìsignaturesî for different brain tumor histological

Keywords: diagnosis, calorimetry, signatures, tumor profiles

Objectives: 1. Understand the use of DSC for tumor diagnosis 2. Discuss the utility of DSC for determining tissue grade 3. Explain how DSC might be used for CSF diagnosis of brain tumors.

Rocky Mountain Neurosurgery Society Roster:

Active

Alvis, J. Michael
2412 Palmer Cir
Norman, OK 73069-6301
O: (405) 321-6347
E: mike@alvis-md.net
Spouse:

Arnold, Paul
3901 Rainbow Blvd.
Kansas Ctiy, KS 66160
O: (913) 588-7587
E: parnold@kumc.edu
Spouse: Celia

Baldwin, Nevan
3601 21st Street
Lubbock, TX 79410
O: (806) 785-6775
E: nevan3@cox.net
Spouse:

Barnett, Samuel
5323 Harry Hines Blvd
Dallas, TX 75390-8855
O: (214) 648-0211
E: samuel.barnett@gmail.com
Spouse:

Barranco, F.
Dept. of Neurosurgery 2910 N. 3rd Ave.
Phoenix, AZ 85013-4434
O: (602) 406-4760
E: david.barranco@bnaneuro.net
Spouse: Jessica

Beatty, Robert
12200 W 106th St, Ste 400
Overland Park, KS 66215
O: (913) 299-9507
E: rmbeattymd@gmail.com
Spouse: Shelley

Beer, Steven
1950 Bluegrass Circle, Suite 170
Cheyenne , WY 82009-7323
O: (307) 778-2860
E: drsbeer@yahoo.com
Spouse:

Beshay, Joseph
5323 Harry Hines Blvd.
Dallas, Tx. 75390-8855
O: (214) 648-7912
E: joseph.beshay@utsouthwestern.edu
Spouse:

Brega, Kerry
12631 E. 17th Ave., C307
Aurora, CO 80045
O: (303) 724-2305
E: kerry.brega@ucdenver.edu
Spouse:

Brinton, W. Robert
1050 East South Temple
Salt Lake City, UT 84102
O: (801) 350-4636
E: None Listed
Spouse:

Brown, Michael
175 South Union Blvd Ste 310
Colorado Springs, CO 80910
O: (719) 473-3272
E: mbrownmd@aol.com
Spouse: Connie

Capanna, Albert
716 South Sixth Street
Las Vegas, NV 89101
O: (702) 382-1960
E: acapanna@aol.com
Spouse: Dawn

Christiano, Joseph
4753 East Camp Lowell Drive
Tucson, AR 85712
O: (520) 881-8400
E: jachristiano@msn.com
Spouse:

Clough, John
6500 W. 183rd St.
Stilwell, Kansas 66085
O: (913) 681-8603
E: fivestarcattle@hotmail.com
Spouse: Michelle

Clyde, Brent
3401 South U. S. HWY 89
Bountiful, UT 84010
O: (801) 295-2438
E: ebrainmd@aol.com
Spouse:

Coester, Hans
1313 Riverside Avenue
Ft. Collins, CO 80524
O: (303) 493-1292
E: ntimmons@brain-spine.com
Spouse:

Couldwell, William
175 N Medical Drive East Building 550
Salt Lake City, UT 84132
O: (801) 581-6908
E: william.couldwell@hsc.utah.edu
Spouse: Marie

Covington, Christopher
6802 S. Olympia Ave, Suite 300
Tulsa, OK 74132
O: (918) 749-0762
E: robbi@osbi.net
Spouse: Gina

Cravens, George
1319 Summit Ave. #200
Fort Worth , TX 76112
O: (817) 336-0551
E: krego@cnopa.com
Spouse: Tracey

Crutchfield, J. Stuart
722 Clinic Drive
Tyler, TX 75701
O: (903) 531-9901
E: jscmd@suddenlink.net
Spouse: Kay

Day, Richard A. A.
2835 Fort Missoula Road, Suite 202
Missoula, MT 59804-7423
O: (406) 544-0558
E: raadmd@aol.com
Spouse:

Detwiler, Paul
700 Olympic Plaza, Suite 850
Tyler, TX 75701-1951
O: (903) 595-2441
E: pdetwiler@suddenlink.net
Spouse: Alex

Dickman, Curtis
2910 N. 3rd Ave.
Phoenix, AZ 85013
O: (602) 406-3932
E: cdickman@earthlink.net
Spouse: Celeste

Dietze, J. Brett
1002 Texas Blvd., Suite 406
Texarkana, TX 75501
O: (903) 794-4196
E: jbdietze@mac.com
Spouse: Jennifer

Dorman, John
400 N Garfield St Ste 200
Midland, TX 79701-5908
O: (432) 687-2350
E:
Spouse:

Duhon, Brad
1814 Roseland Blvd Suite 200
Tyler, TX 75701
O:
E: bradd@gordonspine.com
Spouse:

Ebeling, John
634 S.W. Mulvane Suite 202
Topeka, KS 66606-1678
O: (785) 232-3555
E: None Listed
Spouse: Andrea

Elliott, J. Paul
499 East Hampden Avenue Suite 220
Englewood, CO 80113
O: (303) 788-4000
E: pelliott@cbsi.md
Spouse: Jennifer

Engles, Charles
4120 West Memorial Road Suite 208
Oklahoma City, OK 73120-9322
O: (405) 755-3540
E: engles@qns.com
Spouse: Clara

Fell, David
6767 South Yale Ave
Tulsa, OK 74136
O: (918) 492-7587
E: dafellmd@gmail.com
Spouse: Anne Therese

Fullenwider, Charles
333 South 38th, Suite F
Muskogee, OK 74401
O: (918) 682-8087
E: CBFullenwider@hotmail.com
Spouse: Susan

Gardon, Mark
2845 Greenbrier Road Suite 330
Green Bay, WI 54155
O: (920) 288-8350
E: None Listed
Spouse: Margaret

Goodman, Stuart
2900 12th Avenue North Suite 340 West
Billings, MT 59101
O: (406) 238-2500
E: sgoodman@billingsclinic.org
Spouse: Shawna

Greenwald, Brent
3200 Channing Way Suite A106
Idaho Falls, ID 83404-7546
O: (208) 535-4800
E: brentgreenwald@aol.com
Spouse:

Gross, Naina
1000 N. Lincoln Blvd. Suite 400
Oklahoma City, OK 73104
O: (405) 271-4912
E:
Spouse:

Gumerlock, MaryKay
1000 North Lincoln Suite 400
Oklahoma City, OK 73104
O: (405) 271-4912
E: mkgumerlock@ouhsc.edu
Spouse:

Hamilton, Allan
P. O. Box 245070
Tucson, AZ 85724
O: (602) 626-6793
E: allan@surgery.arizona.edu
Spouse: Jane

Heiden, James
2496 N.W. 141st Place
Portland, OR 97229
O: (503) 531-0818
E: jimsuzie@msn.com
Spouse: Sue

Hellbusch, Leslie
8005 Farnam Drive Suite 305
Omaha, NE 68114
O:
E: lhellbusch@msn.com
Spouse: Joan

Hood, Robert
24 South 1100 East Suite 302
Salt Lake City, UT 84102
O: (801) 531-7806
E: royalwulff1943@hotmail.com
Spouse: Kim

House, Paul
175 North Medical Drive East Rm # 5229
Salt Lake City, UT 84132
O: (801) 581-6908
E: paul.house@hsc.utah.edu
Spouse: Melissa

Jensen, Randy
175 N. Medical Drive East 5th Floor CNC
Salt Lake City, UT 84132
O: (801) 581-6908
E: randy.jensen@hsc.utah.edu
Spouse: Liz

Jimenez, Omar
Two West 42nd Street Suite 2550
Scottsbluff, NE 69361
O: (308) 630-1947
E:
Spouse:

Kaplan, Stuart
3061 South Maryland Pkwy Suite 200
Las Vegas, Nevada, 89109
O: (702) 737-7195
E: stuartkaplan@hotmail.com
Spouse:

Keep, Marcus
Neurosurgery MSC 105610 1
Alburquerque, NM 87131
O: (505) 272-3401
E: mkeep@salud.unm.edu
Spouse:

Kopitnik, Thomas
6600 East 2nd Street
Casper, WY 82609
O: (307) 266-4000
E: tom@cwnsurgery.com
Spouse: Catherine Lynn

Krauth, Lee
501 Airport Road
Rifle, CO 81650
O: (970) 625-1100
E: leekrauth@gmail.com
Spouse: Mary

Lamond, Roderick
1601 East 19th Avenue Suite 4400
Denver, CO 80218
O: (303) 861-2266
E: None Listed
Spouse:

Ledlie, Jon
700 Olympic Plaza Ste 850
Tyler, TX 75701
O: (903) 595-5382
E: jledlie@tylerneuro.com
Spouse: Andi

Levitt, Jodie
82 South 1100 East #303
Salt Lake City, UT 84102
O: (801) 363-2473
E: jkl4brainz@yahoo.com
Spouse:

Levy, Stewart
4101 W. Conejos Place #225
Denver, CO 80204
O: (303) 595-6765
E: stewartlevy@centura.org
Spouse: Rhoda

Lillehei, Kevin
12631 E. 17th Ave., C307
Aurora, CO 80045
O: (303) 724-3389
E: kevin.lillehei@ucdenver.edu
Spouse:

Little, Andrew
2910 N. Third Ave
Phoenix, AZ 85013
O:
E: Andrew.Little@bnaneuro.net
Spouse: Susan

MacDonald, Joel
175 No. Medical Drive East, Rm 5229
Salt Lake City, UT 84132
O: (801) 581-6908
E: vasospaz@aol.com
Spouse:

Macfarlane, John
5171 S. Cottonwood Street Suite 950
Murray, UT 84107
O: (801) 507-9555
E: nrosrgn@yahoo.com
Spouse: Michelle

Madden, Christopher
5323 Harry Hines Blvd. UT
Dallas, TX 75390-8855
O: (214) 648-7905

Spouse:

Manwaring, Kim
1919 East Thomas Road
Phoenix, AZ 85016
O: (602) 546-0455
E: kmanwaring@phoenixchildrens.com
Spouse: Cindi

Marciano, Frederick
7301 East 2nd Street Suite 106
Scottsdale, AZ 85251
O: (480) 524-8004
E: frederick.marciano@bnaneuro.net
Spouse:

McDougall, Cameron
2910 N. Third Ave.
Phoenix, AZ 85013
O: (602) 406-3964
E: cameron.mcdougall@bnaneuro.net
Spouse:

McVicker, John
1725 East Boulder Street 104
Colorado Springs, CO 80909
O: (888) 894-8681
E: mcv@earthlink.net
Spouse: Debra K.

Morgan, Jr., Howard
5323 Harry Hines Blvd.
Dallas , TX 75390-8855
O: (214) 648-7895
E: howard.morgan@utsouthwestern.edu
Spouse: Theodora (Teddy)

Morrill, Kevin
5323 Harry Hines Blvd. CS7.524
Dallas, TX 75390-8855
O: (214) 648-8791
E: kevin.morrill@utsouthwestern.edu
Spouse: Laura Klesse, M.D., Ph.D.

Moss, S. David
1919 E. Thomas Rd.
Phoenix, AZ 85016-7710
O: (602) 239-4880
E: dmoss@phoenixchildrens.com
Spouse: Wendy

Penka, Christopher
4403 Harrison Blvd Ste 1815,
Ogden, UT 84403
O: (801) 387-6520
E: nucleusdentatum@aol.com
Spouse: Soledad

Rao, Ganesh
P. O. Box 301402
Houston, TX 77230
O:
E: grao@mdanderson.com
Spouse:

Reichman, Mark
5171 S Cottonwood Street Suite 950
Murray, UT 84107
O: (801) 507-9555
E: mreichman@sisna.com
Spouse: Dondi

Renfro, Mark
700 Olympic Plaza Cir Ste 850
Tyler, TX 75701-1955
O: (903) 595-2441
E:
Spouse:

Reynolds, W. Emery
4120 West Memorial Road Suite 208
Oklahoma City, OK 73120-9322
O: (405) 755-3540
E: wersjrber@aol.com
Spouse:

Robinson, Mark
4101 West Conejos Place Suite 225
Denver, Colorado, 80204
O: (303) 595-6765
E: markrobinson@centura.org
Spouse: Lisa

Samson, Duke
5323 Harry Hines Blvd
Dallas, TX 75390-8855
O: (214) 648-4551
E: duke.samson@utsouthwestern.edu
Spouse:

Schmidt, Kelly
3006 S. Maryland Pkwy, Suite 765
Las Vegas, NV 89109
O: (702) 480-3868
E: kellyschmidtmd@yahoo.com
Spouse:

Schmidt, Meic
30 North 1900 East Suite 3B-409
Salt Lake City, UT 84132
O: (801) 581-6908
E: meic.schmidt@hsc.utah.edu
Spouse: Wendy

Schmidt, Richard
175 N. Medical Drive East Suite 3B-409
Salt Lake City, UT 84132
O: (801) 581-6908
E: rhs@suzy.med.utah.edu
Spouse: Nancy

Schwartz, Richard
1220 E 3900 S. Ste 4E
Salt Lake City, UT 84124
O: (801) 537-5322
E: rsfg1@attbi.com
Spouse: Faith Gartrell

Seiff, Michael
3061 South Maryland Parkway Suite 200
Las Vegas, NM 89102
O: (702) 737-1948
E: drseiff@aol.com
Spouse:

Shedden, Peter
9200 New Trails Dr Ste 100
The Woodlands, TX 77381-5257
O: (281) 364-9509
E:
Spouse: Megan

Shetter, Andrew
2910 North Third Avenue
Phoenix, AZ 85013
O: (602) 406-3469
E: andrew.shetter@bnaneuro.net
Spouse:

Sincoff, Eric
1055 Bowles Ave. Ste. 200
Fenton, MO 63026-0000
O: (405) 271-4912
E: eric-sincoff@ouhsc.edu
Spouse:

Smith, Kris
2910 N Third Ave.
Phoenix, AZ 85013
O: (602) 406-7750
E: kris.smith@bnaneuro.net
Spouse: Tracy

Snell, Brian
4120 West Memorial Road Suite 300
Oklahoma, OK 73120
O: (405) 748-3300
E: brian.snell@cox.net
Spouse:

Sorini, Peter
700 West Gold Street
Butte, MT 59701
O: (406) 782-6391
E: sorinipm@aol.com
Spouse:

Sramek, Joseph
1233 East 2nd Street
Casper, WY 82601
O: (307) 266-2222
E:
Spouse:

Stratemeier, Phillip
2224 N. W. 50th, Suite 276 West
Oklahoma City, OK 73112-8046
O: (405) 858-2350
E: phstrat@att.net
Spouse: Sylvia

Tice, Larry
775 26 Rd
Grand Junction, CO 85106
O: (970) 241-7261
E: ltice92046@aol.com
Spouse: Sharon

Tippets, Richard
5171 S. Cottonwood Street Suite 950
Murray, UT 84107
O: (801) 507-9555
E: None Listed
Spouse: Kristi

Tomecek, Frank
6802 S. Olympia Suite 300
Tulsa, OK 74132
O: (918) 749-0762
E: doctomecek@aol.com
Spouse: Anne

Turner, Donn
1313 Riverside
Fort Collins, CO 80524
O:
E: dmkt1@comcast.net
Spouse:

Turner, Paul
73 Via Entrada
Sandia Park, NM 87947
O: (505) 272-3401
E: pturner@salud.unm.edu
Spouse: Annette

Valadka, Alex
1400 North IH35,Suite 300
Austin, TX 78701
O: (512) 324-8300
E: avaladka@gmail.com
Spouse: Patty

Walker, Marion
100 North Medical Drive
Salt Lake City, UT 84103
O: (801) 588-3400
E: marion.walker@hsc.utah.edu
Spouse: Sue Ann

Welch, Babu
5323 Harry Hines Blvd.
Dallas, TX 75390-0001
O: +1 (214) 648-8779
E:
Spouse:

White, Jonathan
5323 Harry Hines Blvd
Dallas, TX 75390-8855
O: (214) 648-7912
E: Jonathan.White@utsouthwestern.edu
Spouse:

White, William
2910 North Third Avenue
Phoenix, AZ 85013
O: (602) 406-3466
E: william.white@bnaneuro.net
Spouse: Nancy

Willingham, Irene
3600 Gaston Avenue #1158
Dallas, TX 75246
O: (214) 363-6812
E: iwillingham@att.net
Spouse: Dr. Lance Terada

Wirt, Timothy
1313 Riverside
Ft. Collins, CO 80524
O: (303) 493-1292
E: taximommy@aol.com
Spouse: Candyce

Zabramski, Joseph
2910 North 3rd Avenue
Phoenix, AZ 85013
O: (602) 406-3465
E: jmz@bnaneuro.net
Spouse: Verna

Associate

Barry, Christopher
238 No. Midwest Blvd.
Midwest, OK 73110
O: (405) 813-2600
E: cbarry@pol.net
Spouse:

Roberts, Warren
90 Health Park Drive Suite 320
Louisville, Colorado, 80027
O: (303) 661-4316
E: warrenroberts@centura.org
Spouse:

Senior

Acosta, D
811 W I-20, Suite 132
Arlington, TX 76017
O: (817) 265-2456
E: dracosta@arlingtonneurosurgical.com
Spouse:

Bolles, Gene
P. O. Box 20530
Boulder , CO 80308
O: (303) 447-8642
E: genebolles@hotmail.com
Spouse: Judith

Angel, Jorge
3722 Piping Rock
Houston, TX 77027
O:
E: jangelmd55@aol.com
Spouse:

Calica, Arnold
4139 East Sandy Mountain Road
Paradise Valley, AZ 85253
O:
E: Calica@fastq.com
Spouse: Diana

Apfelbaum, Ronald
1311 Tomahawk Dr.
Salt Lake City, UT 84103
O: (801) 581-6908
E: Ronald.Apfelbaum@hsc.utah.edu
Spouse:

Carl, R. Barton
14601 Wilson Road
Edmond, OK 73013
O:
E: rbc1020@cox.net
Spouse:

Barrash, J. Martin
5959 West Loops, #470
Bellaire, TX 77401
O: (713) 797-9775
E:
Spouse:

Cheek, William
3009 Robinhood
Houston, TX 77005
O:
E: None Listed
Spouse:

Clark, Ronald
1512 Waterfront Drive
Windsor, CO 80550
O:
E: rclark1032@comcast.net
Spouse:

Crue, Jr., Benjamin
108 Ponderosa Park Drive
Durango, CO 81301
O:
E: None Listed
Spouse:

Danielson, III, Guy
P. O. Box 8000
Tyler, TX 75711
O: (903) 595-8077
E: guyotis@neurocare.org
Spouse:

Daspit, C. Phillip
222 W. Thomas, Suite 114
Phoenix, AZ 85013
O: (602) 279-5444
E: pdaspit@chw.edu
Spouse:

Dawson, Jr., W. N.
130 Southridge Drive
Reno, NV 89509
O: (775) 329-7281
E: billgailnv@aol.com
Spouse:

Donaldson, Ronald
700 Olympic Circle Dr. Ste. 850
Tyler , TX 75701
O: (903) 595-2441
E: jbdietze@mac.com
Spouse:

Fieger, Jr., Henry
1904 Kearney Street
Denver, CO 80220-1549
O: (303) 377-7818
E: fieger@rubyranch.com
Spouse:

Garland, Lloyd
2108 Topeka Avenue
Lubbock, TX 79407
O: (806) 792-3232
E: garland@hub.ofthe.net
Spouse:

Gary, Jr., Henry
554 W Broadway ST#1
Missoula, MT 59802-4008
O: (406) 728-6520
E: None Listed
Spouse:

Garza-Mercado, Roman
Aleutianas 396 Col Vista Hermosa
Monterrey MEXICO, MX 64620
O:
E: rogarza@ccr.dsi.uanl.mx
Spouse:

Gogela, Louis
1500 South 48th Street #511
Lincoln, NE 68506
O:
E: None Listed
Spouse:

Gomez-Mendez, Francisco
Suite B1
San Luis Potosi, SLP, MEXICO, MX
O: (524) 813-3359
E: None Listed
Spouse:

Gordy, PhilLip
3601 Carmel Dr.
Casper, WY 820604-4949
O:
E: None Listed
Spouse:

Harrington, Timothy
2217 E. Ranco Drive
Phoenix, AZ 85016
O: (602) 955-1746
E: None Listed
Spouse:

Helme, William
71 Terrace Villa Drive
Centerville, OH 45459
O:
E: None Listed
Spouse:

Hered, John
818 N Emporia, #200
Wichita, KS 67214
O:
E: jhered@mac.com
Spouse:

Hubbard, Richard
1325 Pennsylvania Avenue, Suite 890
Ft. Worth, TX 76104
O:
E: None Listed
Spouse:

Kaplan, Ralph
1433 Stagecoach Rd
Albuquerque, NM 87123
O: (505) 842-8400
E: None Listed
Spouse:

Kilgore, Bassett
2721 Rosedale Avenue
Dallas, TX 75205-1528
O: (214) 365-9687
E: b.b.kilgore@worldnet.att.net
Spouse:

Kindt, Glenn
12631 E 17th Ave, C307
Aurora, CO 80045
O: (303) 724-2300
E: glenn.kindt@ucdenver.edu
Spouse: Charlotte

Klebanoff, Robert
1711 Camino La Canada
Santa FE, NM 87501-2326
O:
E: None Listed
Spouse:

Kubala, Mark
2965 Harrison Street #111
Beaumont, TX 77702-1148
O: (409) 898-7800
E: None Listed
Spouse:

Kugler, Kenyon
1919 South Wheeling Avenue
Tulsa, OK , 74104
O:
E: cnskugler@aol.com
Spouse:

Lewin, Richard
2030 N Chettro Trail
St George, UT 84770-5345
O:
E: rjl@sginet.com
Spouse:

Lisle, Jr., A.C.
4120 West Memorial Rd. #300
Oklahoma City, OK 73120
O: (405) 748-3300
E: nss@neurosurg.org
Spouse:

Litvak, John
3830 West 17th Avenue
Denver, CO 80204
O: (303) 825-0288
E: jlitvak2@inr.net
Spouse:

MacDonald, Vance
3675 Pama Lane
Las Vegas, NV 89120
O:
E: Vancem8572@aol.com
Spouse:

McClintock, Homer
4200 E. 9th Ave. , Box C307
Denver , CO 80262
O:
E: None Listed
Spouse: Shirley

McNally, Michael
3150 Sheiks Place
Colorado Springs, CO 80904
O:
E: mcnal2@msn.com
Spouse:

Moiel, Richard
3656 Ella Lee Lane
Houston, TX 77027
O:
E: None Listed
Spouse:

Mora, Federico
1809 Avenida Alturas NE
Albuquerque, NM 87110
O: (505) 255-3617
E: Locomora1@aol.com
Spouse:

Paullus, Jr., Wayne
11 Medical Drive
Amarillo, TX 79106
O: (806) 353-6400
E: waynepaullus@sbcglobal.net
Spouse: Debby

Pollay, Michael
14205 West Via Tercero
Sun City West, AZ 85375-2279
O:
E: None Listed
Spouse:

Pressley, Richard
P. O. Box 2055
Advance, NC 27006-2055
O:
E: None Listed
Spouse:

Presti, Mathew
3116 Paseo Road
Colorado Springs, CO 80909-1048
O:
E: None Listed
Spouse:

Price, William
2505 Teckla
Amarillo , TX 79106
O: (806) 355-8296
E: None Listed
Spouse:

Rich, Charles
5171 So. Cottonwood Street, Suite 950
Murray, Ut 84107
O: (801) 507-9555
E:
Spouse:

Rich, Jr., J.
2811 Wilshire Blvd. Ste. 840
Santa Monica, CA 90403-0000
O:
E: None Listed
Spouse:

Rosenauer, Adolf
2150 Willow Treet Lane
Reno, NV 89509-8209
O:
E: None Listed
Spouse:

Saxton, Robert
105 Old Hewitt Rd. #100
Waco, TX 76712-6558
O:
E: None Listed
Spouse:

Shaddock, Samuel
13205 Glad Acres Drive
Dallas, TX 75234-5202
O:
E: s.shaddock@tx.rr.com
Spouse:

Sharkey, Paul
3601 W. FM 2693
New Waverly, TX 77358-5672
O:
E: None Listed
Spouse:

Simpson, Charles
8230 Walnut Hill Lane #220
Dallas, TX 75231
O: (214) 369-7596
E: None Listed
Spouse:

Slade, Harry
3 Hillandale Road
Waco, TX 76710
O:
E: hsladedr@hot.rr.com
Spouse:

Sonntag, Volker
2910 North Third Avenue
Phoenix, AZ 85013
O: (602) 406-3458
E: None listed
Spouse: Lynne

Stough, Daniel
14100 Parkway Commons Drive, Suite 201
Oklahoma City, OK 73134-6015
O: (405) 945-4720
E: drstough@neuroscienceokc.com
Spouse:

Tate, Harry
Rt. 1 box 44
Fairfax, Oklahoma, 74637
O:
E: None Listed
Spouse:

Tenney, Robert
10550 Quivira Road Suite 230
Overland Park, KS 66215
O:
E: None Listed
Spouse:

Van Hook, Cloyd
4131 Lakeview Drive
Ogden, UT 84403-3217
O:
E: vanhook@webpipe.net
Spouse:

Vander Ark, Gary
701 East Hampden Ave. Ste 510
Englewood, CO 80110
O: (303) 788-4000
E: None Listed
Spouse:

Wheeler, Joe
1650 Rosedale, Suite 305
Ft. Worth , TX 76104
O: (817) 335-3966
E: wheelerNS1@aol.com
Spouse:

Williams, Jr., Phillip
P.O. Box 25562
Dallas, TX 75225-1562
O: (214) 369-3333
E: phil3737@aol.com

Spouse:

Williams, Robert
P.O. Box 1458 302 S. Haggin Avenue
Red Lodge, MT 59068
O: (406) 446-3750
E: None Listed
Spouse:

Yorke Jr., Craig
634 SW Mulvane #202
Topeka, KS 66606
O: (785) 232-8683
E: napayae@inlandnet.net
Spouse:

Zahniser, John
12101 Alderwood Road
Mendocino, CA 95460
O:
E: None Listed
Spouse:

Honorary

Barrows, Howard
Springfield, IL 62708

Caspar, Wolfhard

Cohen, Alan
300 Longwood Ave
Boston, MA 02115-5724
O: (617) 355-1484

Ferguson, Gary
London , 5339 N6A 5A5

Fukushima, Takanori
Raliegh, NC 27609

Hopkins, L.
100 High Street, Suite 84
Buffalo, NY 14203
O: (716) 887-5200

Jannetta, Peter
420 E North Ave
Pittsburgh, PA 15212-4746
O: (412) 359-4810

Kurze, Theodore
Newport Beach, CA 92663-3806

Laws, Edward
15 Francis Street PBB3
Boston, MA 02115
O: (617) 732-6600

Long, Don
600 N. Wolfe St. Carnegie 466
Baltimore, MD 21287-0001
O: (410) 614-3536

Ojemann, Robert
Boston, MA 2114

Oldfield, Edward
PO Box 800212 Hospital Dr. CDW Room 3530
Charlottesville, VA 22908-0212
O: (434) 982-0059

Papadopoulos, Stephen
2910 N 3rd Ave
Phoenix, AZ 85013-4434
O: (602) 406-3181

Parkinson, Dwight
Winnipeg Manitobe, OT R3E OW3

Post, Kalmon
1 Gustave L Levy Pl #1136
New York, NY 10029-6500
O: (212) 241-0933

Sekhar, Laligam
Univ. of Washington MC/Box 359924
Harborview Med. Ctr. 325 9th Ave.
Seattle, WA 98104
O: (206) 744-9330

Sexton, Daniel
Durham, NC 27710

Stein, Bennet
Bernardsville, NJ 7924

Todd, Edwin
Pasadena, CA 91103

Yasargil, Gazi
4301 West Markham Street Suite 783
Little Rock, AR 72205

Deceased

Baggenstos, Pius
Butte, MT 59701

Bernell, William
Fort Worth, TX

Boyd, Harry
Denver, CO 80209

Brackett, Charles
Kansas City, KS 66103

Caram, Pedro
Houston, TX

Carpenter, Richard
Edmond, OK

Carter, Phillip
Tucson, AZ 85704-7802

Clark, Gale
Walnut Creek, CA

Clark, W.
Dallas, TX

Craigmile, Thomas
Denver, CO

Detwiler, Karl
Tulsa, OK 74136

Dotter, Richard

Drake, Charles
London, ON

Dunn, Jack
TX

Earnest, Carl
Oklahoma City, OK

Elkins, Charles
Tucson, AZ

Erculei, Franco
Las Vegas, NV 89138-1585

Farris, Robert
Austin, TX

Finlayson, Alister
Omaha, NB

Freed, Charles
Denver, CO

French, Lyle

Galloway, Dan
Oklahoma City, OK

Green, John
Denver, CO

Griffin, John
Denver, CO

Haar, Floyd
New York, NY

Heilbrun, M. Peter
Stanford, CA 24305-5327

Hoffman, George
Phoenix, AZ

Imler, Robert.
Tulsa, OK

Johnson, Alexander
Great Falls, MT

Jones, J.
Baytown, TX

Jones, William
San Angelo, TX

Kalmon, Edmond
Oklahoma City, OK

Kaufmann, Edmundo
El Paso, TX

Keller, Ted
Denver, CO

Kopaniky, Dennis
Houston, TX

Laurent, John
Houston, TX

Lipscomb, William
Tucson, AZ

McKinney, William
Ft. Worth, TX

Miller, Leroy

Morelli, Robert
Reno, NV

Nash, George
Tucson, AZ

Nash, Tom
Dallas, TX

Partain, III, Robert
San Antonio, TX 78229

Piskun, Walter
Amarillo, TX 79119

Powell, Chester
Salt Lake City, UT

Reilly, Gerald
Pueblo, CO

Rhinehart, Don
Oklahoma City, OK

Robertson, Joseph
Houston, TX

Robertson, Robert
Houston, TX

Sanders, Morris
Dallas, TX

Schoolman, Arnold
Shawnee Mission, KS

Speakman, Thomas
Edmonton, AB

Starr, Harry
Beaumont, TX

Stoops, William
Salt Lake City, UT

Stowell, Averill
Tulsa, OK

Swengel, Richard
Denver, CO

Tozer, Richard
Topeka, KS

Van Dyk, Henry

Verbrugghen, Adrien
La Jolla, CA

Weiford, Edward
Shawhee Mission, KS

Wilkins, Harry
Oklahoma City, OK

Williamson, William
Kansas City, KS

Woods, Robert
Topeka, KS

Wray, David
Houston, TX

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Mark your calendars, the 48th Annual Meeting
of the
Rocky Mountain Neurosurgical Society, Inc. will be held in:

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