

Western Neurosurgical Society

52nd ANNUAL MEETING

Semiahmoo Resort & Spa
Blaine, Washington

SEPTEMBER 16-19, 2006

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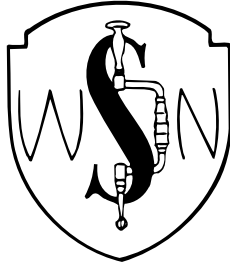
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Peter Sun	Martin Weiss	
Moustapha Abou-Samra	Randall Smith	Melvin Cheatham
August Turak	Bruce Sorensen	



Western Neurosurgical Society

52nd ANNUAL MEETING 2006 Learning Objectives

The purpose of this meeting is to provide an update in the basic and clinical sciences underlying neurosurgical practice through lectures, discussions, interactive sessions with neurological surgeons, neurologists, neuroradiologists, and other allied health personnel.

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

1. Review the current treatment of brain tumors to include radiosurgical and surgical options.
2. Discuss recent advances in the treatment of spinal disorders to include instrumentation.
3. Analyze the role of various treatment modalities in the management of vascular diseases affecting the nervous system.
4. Discuss surgical approaches to management of cervical spine disorders.



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2006 GUESTS

Anthony Avellino	Richard Ellenbogen
Edward F. Chang	Resident Award
Farrokh Farrokhi	Charles Nussbaum
Igor Fineman	Bill Caton
Kiarash Golshani	Resident Award
Theodore W. Hole	Moustapha Abou-Samra
K. Anthony Kim	Resident
John D. Loeser	Kim Burchiel
Sabareesh Natarajan	Resident
John B. Oldershaw	Paul Turner
Gosta Iwasiuk	Moustapha Abou-Samra
Richard Rapport	Charles Nussbaum
Nathan Selden	Kim Burchiel
Bob Shafa	Austin Colohan
Kia Shahlaie	Resident
Kiarash Shahlaie	Resident
Jim L. Story	Moustapha Abou-Samra
Augie Turak	Ablin Lecturer



Formal Banquet Entertainment

Throughout North America, the Timebenders have pleased clients that include Bill Gates, Francis Ford Coppola, United Airlines, The Boeing Group, University of Louisiana, the Royal Bank and Telus.

They have performed at Caesar's Palace in Las Vegas, Hawaii, Florida, San Francisco and countless fairs and expositions all across the continent. The Timebenders have truly earned the title of Canada's best retro show band.

Now in their 14th year on the North American music scene, their experience is evident in every performance. Their comic timing, sharp musical skills and zany choreography make it a perfect balance of total entertainment.

Audience participation is a key ingredient in the Timebenders' show. They are masters at getting the crowd excited and are often off the stage onto the dance floor or even have the audience up on the stage with them!

August Turak



Most people wait their whole lives to meet a man like Augie Turak. He's one of those one-in-a-million type of people that most of us only get to read about. At age nineteen, he found himself in a dilemma: he was in a good college, he was a bright and successful student, he had a promising future—and he was unsatisfied. He couldn't locate a meaning to life, a higher purpose. Of course, almost everyone “goes through a phase” like this around late adolescence, but most people never do anything about it. Lucky for the SKS, Augie Turak is not most people.

In 1973, Turak met a man who would change his life forever. His name was Richard Rose, and to the untrained eye, he was just a simple, West Virginia farmer. But Rose was much more. A voracious spiritual seeker since childhood, Rose had dedicated his life to finding God. He traveled the nation, looking for individuals, spiritual groups, and books that might have answers. At twenty-eight, in the late 1940s, he had an Enlightenment experience while meditating. His first impulse was to share his new knowledge with others, but in the conservative atmosphere of the era, he knew he would be taken for a madman, so he stayed quiet. When the spiritual movements of the 1960s and 1970s began, Rose saw that he finally had an opportunity to teach.

August Turak was one of his first—and best—students. For five years, Turak studied under Richard Rose. Did he realize at the time that his life would never be the same?

The determined, “take no prisoners” attitude Rose held towards spiritual seeking rubbed off on Turak, and it's the same attitude that has made him so successful in other arenas of his life. In 1978 Turak moved to Washington, DC, to work as the protégé of recently retired IBM Executive School Founder & Director, Lou Mobley (also author of the best-selling

book, *Beyond IBM*). Turak moved into Mobley's home, lived with his family, and spent every morning studying management and leadership, and every afternoon helping Mobley build his consulting business.

In 1981, Turak began working with a small, little known cable television programming venture known as MTV: Music Television. After helping MTV become *Fortune Magazine's* breakthrough product of the year in 1981, Turak became the National Director of Marketing for what was to become The Arts & Entertainment Network. Shortly thereafter, he took a position as Vice President of Marketing with Adelphia Communications, one of the largest cable television system operators in the U.S. Already seeing the ethical problems that would eventually lead to Adelphia's demise, Turak left Adelphia after only a year.

From 1985 to 1993, Turak worked in executive and consultant capacities at a number of cable and software companies, including Data Broadcasting Corporation (a subsidiary of Financial News), UPI, Bell Atlantic, Federal News Service, and Applied Control Systems. But all this time, he wanted to begin a group of seekers like those he had known while working with Rose. Spirituality had always been his primary passion—he defines himself as a spiritual man who happens to be good at business, rather than a businessman who happens to have an interest in the spiritual.

In 1985, Turak moved to Raleigh, NC, and in 1989, several students at North Carolina State University approached him after a lecture and asked him to teach on a regular basis. Thus the first chapter of the Self Knowledge Symposium was born, which has since expanded to the University of North Carolina and Duke University, as well as recently gaining federal non-profit foundation status.

In 1993, Turak founded Raleigh Group International, a software company that he ran until he and his partners sold the company to Mutek Solutions, Inc. in 2000. Turak stayed on as a President of Mutek until his retirement from the business world in 2002. But Turak's true love is the time he spends teaching university students involved in the Self Knowledge Symposium (SKS).

Ablin Lecture
August Turak

**WESTERN NEUROSURGICAL SOCIETY
52ST Annual Meeting**

**SCIENTIFIC PROGRAM
SESSION I
Sunday, September 17, 2006**

Moderators: Linda Liau, Austin Colohan

- 7:00-7:05 **Welcome, Moustapha Abou-Samra, President WNS**
- 7:05-7:20 1 **“Surgical Applications of 3T MRI”**
 Jonathan Curtis
- 7:20-7:25 Discussion
- 7:25-7:40 2 **“Neural Stem / Progenitor Cell Transplantation
for Stroke”**
 Gary Steinberg
- 7:40-7:45 Discussion
- 7:45-8:00 3 **“Complex Pediatric Cervical Spine Surgery Using
Smaller Non-Traditional Screw and Plates and
the Intraop CT”**
 Anthony Avellino
- 8:00-8:05 Discussion
- 8:05-8:20 4 **“Dose Optimization for CyberKnife Trigeminal
Rhizotomy”**
 John Adler
- 8:20-8:25 Discussion
- 8:25-8:40 5 **“Optimizing the Injured CNS: From Deep Brain
Stimulation to a Cortical Prosthesis”**
 Igor Fineman
- 8:40-8:45 Discussion
- 8:45-9:00 6 **“Peripheral Nerve Stimulation”**
 John Loeser
- 9:00-9:05 Discussion
- 9:05-9:20 7 **“SANSWired: A Tool for Learning and MOC”**
 Nathan Selden
- 9:20-9:25 Discussion
- 9:25-9:40 8 **“Occipitocervical Fixation with C2 Translaminar
Screws in Children”**
 Peter Sun
- 9:40-9:45 Discussion
- 9:45-10:15 Break – Visit Exhibits

SESSION II
Sunday, September 17, 2006

Moderators: Kim Burchiel, Jack Bonner

10:15-10:30 9 **“Management of Midline Tumors”**
James Ausman

10:30-10:35 Discussion

10:35-10:50 10 **“Neurons and Networks: The Discovery of the Synapse”**
Rick Rapport

10:50-10:55 Discussion

10:55-11:10 11 **“Image Guided Spinal Stereotactic Radiosurgery”**
Antonio DeSalles

11:10-11:15 Discussion

11:15-11:25 Introduction of Ablin Lecturer
Moustapha Abou-Samra

11:25-11:55 **ABLIN LECTURE**

“Spirituality and the Neurosurgeon”
August Turak

11:55 Scientific Session Adjournment

SCIENTIFIC PROGRAM SESSION III
Monday, September 18, 2006

Moderators: John Adler, Phil Carter

- 8:00-8:15 12 **“Sylvian Fissure AVMs”**
Michael Lawton
- 8:15-8:20 Discussion
- 8:20-8:35 13 **“Eloquence and Cortical AVMs: Experience with Functional Mapping using MRI, Optical Imaging, and Cortical Stimulation”**
Neil Martin
- 8:35-8:40 Discussion
- 8:40-8:55 14 **“Quantitative Comparison of Simple and Complex Finger Movements after Ventralis Intermedius DBS for Essential Tremor”**
Kim Burchiel
- 8:55-9:00 Discussion
- 9:00-9:15 15 **“DBS: Past, Present and Future”**
Peter Nora
- 9:15-9:20 Discussion
- 9:20-9:35 16 **“Modulation of Regional Temperature and Pain in Patients with Complex Pain Syndromes by Cutaneous Application of Light”**
Robert Florin
- 9:35-9:40 Discussion
-
- 9:40-9:55 17 RESIDENT AWARD - BASIC SCIENCE
“Role of Endothelin A and B Receptors in Maintenance of Cerebrovascular Tone”
Kiarash Golshani, OHSU
-
- 9:55-10:00 Discussion
- 10:00-10:30 Break – Visit Exhibits

SCIENTIFIC PROGRAM SESSION IV
Monday, September 18, 2006

Moderator: Jeff Rush

10:30-10:45 18 **RESIDENT AWARD - CLINICAL SCIENCE**

“Long-Term Outcomes after Surgery for Endocrine-Inactive Pituitary Adenomas”
Edward Chang, UCSF

10:45-10:50 Discussion

10:50-11:00 Introduction of Cloward Award Winner
Moustapha Abou-Samra

11:00-11:30 **CLOWARD AWARD**

“A Historical Walk Through Pituitary Surgery”
Martin H. Weiss

11:30-11:40 Introduction of President

11:40-12:10 **PRESIDENTIAL ADDRESS**

**“A Neurosurgeon’s Personal Perspective
Freedom-Privilege-Obligation”**
Moustapha Abou-Samra

12:10 Scientific Session Adjournment

SCIENTIFIC PROGRAM SESSION V
Tuesday, September 19, 2006

Moderator: Moustapha Abou-Samra

7:00-9:00 **Mini-Symposium**

Neurosurgeon-Physician-Human Being / A Well Rounded Neurosurgeon

Physician Heal Thyself

Bruce Sorensen, M.D.

Humanitarian Experience / Writing

Melvin L. Cheatham, M.D.

Ranching and Wood Working Experience

Randall W. Smith, M.D.

Educating a Well Rounded & Ethical Neurosurgeon

Martin H. Weiss, M.D.

Panel Discussion 20 minutes

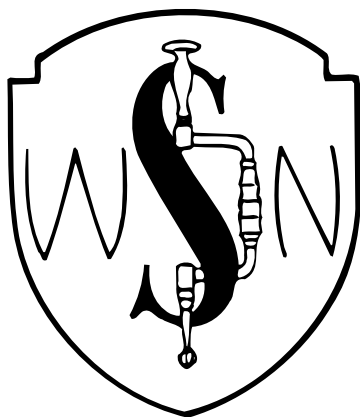
9:00-9:30 Break – Visit Exhibits

SCIENTIFIC PROGRAM SESSION VI
Tuesday, September 19, 2006

Moderators: Linda Liao, Austin Colohan

- 9:30-9:45 19 **“Enhanced Bone Formation with Use of Instrumentation Implanted with Calcium and Phosphate Ions”**
Edmund Frank
- 9:45-9:50 Discussion
- 10:50-10:05 20 **“Amyloid Transporter Expression is Altered by Aging at the BBB and Choroid Plexus in a Reciprocal Fashion”**
Gerald Silverberg
- 10:05-10:10 Discussion
- 10:10-10:25 21 **“Device for Intervertebral Assisted Motion (DIAM) for Posterior Dynamic Stabilization**
K. Anthony Kim
- 10:25-10:30 Discussion
- 10:30-10:45 22 **“Postoperative Cortisol as a Predictor of Adrenal Function Following Pituitary Tumor Surgery”**
Marc Mayberg
- 10:45-10:50 Discussion
- 10:50-11:05 23 **“Role of N-type Voltage-Gated Calcium Channels in TBI”**
Kia Shahlaie
- 11:05-11:10 Discussion
- 11:10-11:25 24 **“Embolization of AVMs and ONYX: Preliminary Experience”**
Sabareesh Natarajan
- 11:25-11:30 Discussion
- 11:30 Meeting Adjournment

See you in Hawaii 2007



ABSTRACTS

ABSTRACTS

1. **SURGICAL APPLICATIONS OF 3T MRI**

Jonathan Curtis, MD, Velez Dennis, MD, David Newell, MD,
Marc Mayberg, MD, Seattle, WA

Objective and rationale: The use of functional MRI (fMRI) to localize eloquent cortex has become common practice in recent years. Although intra-operative cortical mapping and stimulation have high correlation with fMRI, some interpretation is still required before applying results to the surgical patient. We sought to further investigate the impact of functional MRI for surgical planning and patient outcome using a 3T Magnet and contemporary speech paradigms.

Methodology: 10 patients with a variety of surgical lesions located in the sub cortical white matter in or adjacent to speech or motor centers were imaged. High-resolution axial T1 Gadolinium images with functional mapping were obtained with a 3T Magnet. Standard protocols including rapid finger and toe tapping for motor mapping, and 3 separate paradigms for speech localization were applied. Surgical Planning using 3D rendered functional MRIs and Stealth Neuronavigation was used in each case for resection.

Results: All patients underwent successful resections with no episodes of permanent neurological deficit. While motor strip and frontal speech localization is effective, more complete representation of speech pathways remains difficult with current fMRI protocols.

Conclusion: 3T 3-Dimensional fMRI appears to effectively localize and display eloquent cortex in a way that assists with safe surgical planning and execution. This is likely to be helpful in reducing surgical morbidity and may reduce the need for awake craniotomies.

2. **NEURAL STEM/PROGENITOR CELL TRANSPLANTATION FOR STROKE**

Gary K. Steinberg, MD, PhD, Tonya M. Bliss, PhD,
Raphael Guzman, MD, Marcell Daadi, PhD, Jason Liauw, BS,
Nobuko Uchida, PhD, Irving L. Weissman, MD,
Michael Moseley, PhD, Ben Barres, MD, PhD,
Douglas Kondviolka, MD, Theo Palmer, PhD, Stanford, CA

Currently there is no treatment for restoring neurological function after stroke. Stem/progenitor cell transplantation offers a potential new

therapy for stroke patients. We studied the use of human fetal neural stem cells (hNSCs), human post-mitotic neuronal progenitor (hNT) cells, and rodent neural stem cells in experimental ischemic rodent models. hNSCs transplanted to ischemic rat cortex survive robustly, migrate in a targeted fashion to the stroke and differentiate primarily into immature neurons (49% β -tubulin +). The dependence of targeted migration on the chemokine receptor CXCR4 was evaluated using neural progenitors from CXCR4 KO mice. hNSCs improved neurological function when transplanted into the ischemic NOD-*scid* mouse striatum. hNT neurons transplanted into the ischemic rat cortex survive, extend processes and differentiate into neurons, but do not improve behavior. Grafts of rat medial ganglionic eminence neural precursors into ischemic rat striatum differentiate into neurons, express synaptic markers and improve motor behavioral deficits. Mouse neuronal progenitor cells enhance synapse formation when co-cultured with retinal ganglion cells, due to thrombospondin expression. Superparamagnetic iron oxide labeling allowed in vivo tracking of the hNSCs in stroke models.

A phase II randomized study of hNT cells was completed in 18 patients with fixed motor deficits due to basal ganglia stroke occurring 1-6 years previously. Patients were randomized to receive 5 or 10 million transplanted cells followed by stroke rehabilitation (n=7/group) or as controls (rehabilitation only, n=4). There were no cell-related adverse serologic or imaging defined effects. Improvement was noted in some of the transplanted patients and in some this translated into improved activities of daily living, with certain secondary outcomes statistically improved (Action Research Arm Test, Stroke Impact Scale and Everyday Memory Score). However, there was no significant benefit in motor function on the primary outcome measure (ESS motor score). Further preclinical studies of neural stem/progenitor cell transplantation for stroke should be pursued to help plan future clinical trials.

3. COMPLEX PEDIATRIC CERVICAL SPINE SURGERY USING SMALLER NON-TRADITIONAL SCREWS AND PLATES AND THE INTRAOPERATIVE CT SCANNER

Anthony M. Avellino, MD, Sohail K. Mirza, MD, Seattle, WA

Introduction: The treatment of craniocervical instability in children is often challenging due to their small spine bones and their complex anatomy. The authors discuss their surgical experience in the treatment of nine children (≤ 14 years) with craniocervical spine instability using the

intraoperative CT scanner and smaller non-traditional titanium screws and plates.

Methods: All craniocervical fusion procedures were performed with intraoperative fluoroscopic imaging and electrophysiological monitoring. Non-traditional spine hardware included smaller screw sizes (i.e., 2.4 mm and 2.7 mm) from the Synthes orthopedic hand/foot set and mandibular plates. Eight of the nine surgical procedures were performed with the intraoperative CT scanner (Philips Tomoscan M), which was used after the screws were placed to confirm adequate position.

Results: The mean age was 7 years (range: 2-14 years). Five children underwent a posterior C1/C2 transarticular screw fusion, two had an occiput-C3 fusion, one had an occiput-C4 fusion, and one had an anterior C2/C3 fusion. Follow-up ranged from 1 to 23 months (mean 10 months). Eight of the nine children that were followed for at least three months had successful fusion. Of the 16 C1/C2 transarticular screws that were placed, six were 2.4 mm, two were 2.7 mm, four were 3.5 mm, and four were 4.0 mm. One 2.4 mm screw was noted to be broken at four weeks postoperatively, but was left in place and the child went on to successfully fuse. The intraoperative CT scanner was invaluable in that it enabled us to reposition three of the C1/C2 transarticular screws so that adequate placement was achieved.

Conclusions: Successful craniocervical fusion procedures were achieved using smaller non-traditional titanium screws and plates. The intraoperative CT scanner was a helpful adjunct to confirm and readjust the trajectory of the screws prior to extubation, which potentially decreases overall treatment costs and reduces complications.

4. Dose Optimization for CyberKnife Trigeminal Rhizotomy

Michael Lim MD and John Adler MD, Stanford University

Introduction: Among patients with idiopathic trigeminal neuralgia, non-isocentric CyberKnife lesioning of the trigeminal nerve is highly efficacious but has been associated with high rates of facial numbness. A dose de-escalation study was conducted to determine if more optimal rhizotomy parameters might result in less facial numbness without lessening radiosurgical efficacy.

Methods A retrospective study of 64 patients treated at Stanford University Medical Center for idiopathic TN between 2002 and 2005 was

performed. Patients were divided into 2 groups based on Dmin using 60 Gy as the dividing line. Pain control (Boulder-Stanford (BS) scale of 1=excellent, 2=moderate, 3=minimal), rate of response and occurrence of hypesthesia were evaluated. Dmax was similarly analyzed using 76 Gy as the point of division.

Results: 41 patients were treated with a Dmin greater than 60 Gy. After a mean follow-up of 23.6 months, 38/41 patients (93%) experienced excellent or moderate initial pain relief, with an average BS score of 1.25. However, 35/41 (85%) developed some ipsilateral facial numbness, which in twenty-six patients (68%) was graded as moderate or severe, and qualified as anesthesia dolorosa in 2 cases. In contrast, 23 patients received a Dmin of 60 Gy or less. After a mean follow-up of 10.6 months, 21/23 (91%) patients in this later group experienced excellent or moderate pain relief with an average BS score of 1.35. 8/23 (35%) of patients reported some numbness and 5/23 (22%) complained of moderate or severe numbness. No patient in the lower Dmin cohort complained of anesthesia dolorosa. Although mean T-test demonstrated no difference in efficacy between the two Dmin ($P=0.63$), there was a significant difference in the rate of facial numbness ($P=0.0004$).

After a mean follow-up of 22.7 months, 32/36 patients (89%) treated with a Dmax >76 Gy had excellent or moderate pain relief and an average BS score of 1.33. However, 31/36 (86%) of this group experienced facial numbness, which was graded as moderate or severe in 23 (74%). Among the 28 patients treated with a Dmax <76 Gy, 25/28 (89%) experienced excellent or moderate pain relief and an average BS score of 1.46. Meanwhile, among these patients who a mean follow-up of 14.3 months, 13/28 (46%) reported some numbness, but with no cases of anesthesia dolorosa. Although T-test demonstrated no difference in efficacy between the two different Dmax ($P=0.56$), there was a significant difference with respect to facial numbness $P=0.009$.

5. OPTIMIZING THE INJURED CNS: FROM DEEP BRAIN STIMULATION TO A CORTICAL PROSTHESIS

Igor Fineman, MD, Glendale, CA

Advances in imaging and computer technologies are making it possible for neurosurgeons to begin changing the paradigm of their approach to CNS disease from working to prevent further damage and doing the least harm possible in the process, to augmenting the injured CNS and optimizing the patients' ability to function in their environment. This talk will summarize our recent experience with deep brain stimulation and

review the progress and challenges encountered in our work to develop a parietal cortical prosthesis.

6. PERIPHERAL NERVE STIMULATION

John D. Loeser, MD, Chong Lee, MD, Seattle, WA

Pain relief from stimulation of a peripheral nerve was a direct result of the Melzack-Wall Gate Hypothesis and was first implemented by Sweet and Wepsic in 1967 and reported in the 2nd edition of White and Sweet's classic text in 1969. By 1974, these authors have 50 patients with peripheral nerve stimulators in their experience. Since then, peripheral nerve stimulation has not developed as rapidly as spinal cord stimulation. Case series are sparse, and controlled studies are non-existent. This, I believe, is mainly because of the lack of appropriate electrodes to interface with a peripheral nerve. I report here on a series of 18 patients who were treated with a unique helical quadripolar electrode. Over half of these patients have had good or excellent pain relief. Thanks to FDA rules and the lack of commercial interest in developing this technology, this project is not further evolving. The lessons learned from the use of this electrode will be discussed.

7. SANSWired: A TOOL FOR LEARNING AND MAINTENANCE OF CERTIFICATION

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on behalf of the Congress of Neurological Surgery (CNS)

Introduction: Self-assessment tools have long been used in surgical education and are now required for maintenance of certification (MOC) by the American Board of Neurological Surgery (ABNS). Simultaneously, the ACGME and the ABNS have required both residents and surgeons to participate in learning about non-clinical core competencies, including ethics, compliance, safety and evidence-based medicine.

Methods: For many years, the Congress of Neurological Surgeons (CNS) has published the Self Assessment in Neurological Surgery (SANS) learning tool. Early editions of SANS were produced in printed format or CD-ROM and were jointly sponsored by the CNS and the AANS. The latest edition, *SANSWired*, enables users to both subscribe and access content via the internet, track global and topical performance, and receive continuing medical education (CME) credits

online. Materials relevant to the non-clinical core competencies are now included. Each SANS question is associated with instant performance feedback, an expert critique, and hyperlinked references for further immediate learning. *SANSWired* also incorporates multimedia elements.

Results: In two years since the publication of *SANSWired*, over 1000 neurosurgeons have subscribed (including residents from over 40 training programs) and more than 100 have received CME certificates. *SANSWired* is now required of all neurosurgeons by the ABNS for MOC. Future modules of *SANSWired* will include pediatrics and spine, corresponding to specialized MOC cognitive examinations offered by the ABNS in these areas, as well as a module relevant to the core competencies.

Conclusions: *SANSWired* is a useful component of lifelong learning in neurosurgery, including self-assessment, written and oral boards preparation, and MOC.

8. OCCIPITOCERVICAL FIXATION WITH C2 TRANSLAMINAR SCREWS IN CHILDREN

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Background: Rigid occipitocervical (O-C) instrumentation has resulted in a high fusion rate and reduced the need for postoperative Halo immobilization in children with craniovertebral instability. Screw fixation at the C2 part of the construct has been described with C1-2 transarticular screws and C2 pedicle screws. However, children with smaller bones may have unsuitable anatomy for both these methods. Recently a novel C2 translaminar screw fixation has been described which does not require screw placement near the transverse foramen and utilizes the relatively large C2 spinous process as screw entry site.

Aim: The authors present O-C fusion with C2 translaminar screws in 7 pediatric patients

Methods: 7 patients ranging from 5 to 16 years of age underwent O-C fusion with translaminar screws at C2. 4 patients were felt to have unsuitable anatomy for C1-2 transarticular screws. 2 patients were treated for instability from Down syndrome, 1 from Morquio's, 2 from trauma, 1 from dysoptic os and 1 from basilar invagination. All patients had autologous hip bone graft; 1 patient received BMP for fusion adjunct. The 2 Down syndrome patients were immobilized postoperatively with

a Halo and the other patients in a hard collar. All patients fused with a mean follow-up of 27 months. One patient died of unknown cause 7 months after surgery. 1 patient developed an adjacent level kyphosis.

Conclusion: C2 translaminar screw fixation is an effective alternative to other methods of C2 screw fixation in children requiring 0-C instrumentation.

9. MANAGEMENT OF MIDLINE TUMORS

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Midline tumors involve the third ventricle, hypothalamus, pineal region, and brain stem. These tumors are difficult to approach surgically, to remove, and to treat with radiation or chemotherapy without damaging the densely neuronally packed adjacent structures. We will report on the treatment of over 200 midline lesions by various surgical methods with or without radiosurgery.

In the third ventricle and hypothalamus, the common lesions are colloid cysts, which can be treated by microsurgical approaches, transcortically or transcallosally, or endoscopically; hypothalamic hamartomas which we prefer to treat radiosurgically; and gliomas. Craniopharyngeomas, which cannot be totally excised, can be treated by multiple strategies including radiosurgery. Pineal region tumors can be approached endoscopically for biopsy and if a pineocytoma, can be treated radiosurgically. One third are benign and can be removed surgically either by the supracerebellar route or by the 3/4 prone operated side down trans-tentorial approach. Malignant lesions can be treated radiosurgically.

Brain stem lesions consist of brain stem tumors and cavernomas. These lesions require brainstem monitoring, including auditory evoked potentials, lemniscal tract monitoring, motor evoked potentials and direct stimulation to locate the facial nucleus. Special very narrow suction and long instruments are used to remove these lesions. Exquisite presurgical planning and knowledge of the brainstem nuclei and fiber tracts is key to success in removing these lesions. According to Briccolo, brain stem tumors can be exophytic, intrinsic focal or diffuse. 2/3 are benign and 50% are gliomas. A majority of pontine tumors are malignant as are the diffuse tumors anywhere in the brain stem.

Examples of the surgical approaches, some created by our neurosurgeons specifically for these lesions will be presented and a discussion of the therapies beyond surgery will be given. Midline brain lesions, which were difficult to treat in the past, can be successfully managed with modern surgical and other strategies, including brain stem tumors.

10. NEURONS AND NETWORKS: THE DISCOVERY OF THE SYNAPSE

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For centuries, the puzzle of how nerves might communicate belonged to quiet philosophical speculation. By about 1830, after more serviceable microscopes reached the benches of European laboratories, the debate grew much louder. Is the entire nervous system connected directly, anatomists wondered, or are there individual units that talk to each other?

Two investigators, the hot Spaniard Ramon y Cajal and the cool Italian Camillo Golgi, struggled first against scientific barriers, and ultimately against each other to discover what brain cells looked like and how they managed to communicate. Both did their most important work as young men in laboratories set up on their kitchen tables, and both made profound discoveries that led to their jointly winning the 1906 Nobel Prize. Yet one of them found his way into the microscopic forest of individual cells, while the other died convinced that the nervous system is a network physically connecting every brain cell to its neighbor.

From the understanding of Parkinson's disease to enabling the development of neurosurgery, from Eric Kandel's remarkable studies defining the biological basis of memory to the treatment of depression, modern neuroscience is ever indebted to the man who correctly interpreted the anatomy of the neuron.

11. IMAGE-GUIDED SPINAL STEREOTACTIC RADIOSURGERY

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Introduction: The adoption of spinal radiosurgery has been slow because of the difficulty in topographical targeting. Advances in infrared tracking and image fusion technology permit accurate localization of a spinal cord

and column targets. We examined whether LINAC-based spinal SRS is effective and with durable results for metastatic and benign lesions.

Materials and Methods: Thirty-six patients with 52 lesions were treated at UCLA with single fraction spinal radiosurgery from January 2002 to March 2006. Twenty patients were males and 16 were females. Mean age was 52.7 ± 18 years. There were 32 metastases, 19 benign lesions and 1 primary chordoma. The mean peripheral radiation dose was 12.1 ± 1.6 Gy prescribed to the 90% isodose line. The mean tumor volume was 20.7 ± 36.0 ml. Intensity modulation and shaped-beam techniques were used for planning. The mean follow-up period was 11.5 ± 7.7 months. Benign tumors had a mean follow-up of 13 ± 8 months. Radiosurgery was with the Image-guided Novalis Body system

Results: No complications were noted. There was 61% of symptomatic improvement, 18% started asymptomatic and remained so, 7% remained with their initial symptoms. 15% deteriorated due to tumor progression. Imaging showed 17% had improvement, 67% stable and 17% failure. Of the benign lesions, 45% had symptomatic improvement, 27% had no symptoms prior to treatment and remained asymptomatic, and 27% had stable symptoms. Imaging follow-up revealed 75% had stability, while 25% demonstrated regression. No patients treated for benign lesions had symptomatic or imaging progression of their lesions.

Conclusions: The necessity of a fixed frame historically limited radiosurgery to intracranial lesions. Image guided systems has resulted in improved physical targeting, enabling spinal single-fraction radiosurgery. LINAC-based radiosurgery is effective and low-risk alternative for spinal lesions, especially for benign pathologies.

12. SYLVIAN FISSURE ARTERIOVENOUS MALFORMATIONS: RESULTS WITH MICROSURGICAL MANAGEMENT

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Objective: AVMs in the Sylvian fissure are typically deep below the cortical surface, surrounded by eloquent brain, fed by arteries that also supply distal territories, and drained by veins that lie over the nidus. These features and others make them challenging to resect. A consecutive, single-surgeon experience was reviewed retrospectively to evaluate results with microsurgical management.

Methods: Twenty-seven patients with Sylvian fissure AVMs were identified from a series of 295 AVM patients treated by the author over an 8 year period. According to the Sugita classification, AVMs were pure Sylvian (N=5, 18%), lateral (N=4, 15%), medial (N=7, 26%), and deep (N=11, 41%).

Results: The anatomical relationships between arteries, veins, and nidus differ between the 4 Sugita types, requiring critical modifications of surgical technique. For example, medial Sylvian AVMs have lenticulostriate supply whereas lateral Sylvian AVMs have anterior choroidal artery supply, which must be carefully dissected along the deep border. There was no surgical mortality in this experience; 4 patients had transient deterioration (15%) and 1 patient was permanently worse (4%). Good outcomes (modified Rankin Scale scores 0 – 2) were observed in 24 patients (89%).

Conclusions: Sylvian AVMs are a diverse group of lesions, each with unique characteristics that influence microsurgical technique. Despite their eloquent location and formidable challenges, results with microsurgical resection are excellent, making this the preferred treatment option for low-grade AVMs.

13. ELOQUENCE AND CORTICAL ARTERIOVENOUS MALFORMATIONS: EXPERIENCE WITH FUNCTIONAL MAPPING USING FMRI, OPTICAL IMAGING, AND CORTICAL STIMULATION

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The proximity of cortical arteriovenous malformations to critically functional (eloquent) cortical regions has been demonstrated to be a major determinant of neurological outcome after surgery. Cortical functional mapping with fMRI has become generally available. This paper will review our results with functional mapping in 50 patients with cortical vascular lesions. We will compare the results with fMRI to those with intraoperative optical imaging and cortical stimulation. We will correlate the neurological outcome of surgery with the degree of eloquence of AVM-involved cortex. We will also review the effect of vascular malformations on displacement and reorganization of cortical activity for language and motor function.

14. QUANTITATIVE COMPARISON OF SIMPLE AND COMPLEX FINGER MOVEMENTS AFTER VENTRALIS INTERMEDIUS DEEP BRAIN STIMULATION AND THALAMOTOMY FOR ESSENTIAL TREMOR

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Objective: To compare the effects of ventralis intermedius (Vim) deep brain stimulation (DBS) and Vim thalamotomy (TH) on contralateral and ipsilateral finger movements in patients with essential tremor (ET).

Background: Analysis of key strike sequences during finger tapping provides sensitive measures of fine motor control. We hypothesized that TH and DBS differentially affect fine finger movements due to varying effects of lesion and stimulation on the cerebellothalamocortical loop.

Methods: 10 subjects (66 ± 9 yrs; 6 female) with upper extremity action/postural tremor (median Tremor Severity Rating 3) and symptoms inadequately controlled by medications were randomized (1:1) to unilateral Vim TH or Vim DBS. Tremor, neurological function, and disability were assessed pre-operatively and at 1, 3 and 6 months after surgery using clinical and performance-based tasks. Finger movements were assessed on the ipsilateral and contralateral hands using three 30-second tapping tasks of increasing complexity (*SS*, 1 key w/index finger; *Trill*, 2 adjacent keys w/index and middle fingers; *Scale*, 4 adjacent keys w/4 fingers) played on an electronic keyboard with MIDI computer interface. Subjects were instructed to tap as quickly and regularly as possible while maintaining accuracy. Key strike velocity and sequence, note duration, and tapping frequency were analyzed. Timing errors were defined as intervals of key strike duration or inter-keystrike interval that fell more than $1.5 \times$ [interquartile range] from the first or third quartile. Accuracy errors were determined by comparison of key strike sequence with the correct sequence template, with key presses not following the template counted as errors.

Results: All clinical and patient-rated scales of function or disability were improved 6 months after TH or DBS surgery ($P_{\text{rank sum}} > 0.5$). Timing and accuracy errors were differentially affected on the ipsilateral and contralateral hand. Contralateral timing errors were improved after 6

months in both groups, but only in the simplest, SS, task where changes in timing errors (Δ_t) = -62 and -65%, TH and DBS, respectively; Prank sum = 0.4. In the more complex tasks, contralateral timing errors were again decreased by TH (Δ_t = -26, -62%; *Trill* and *Scale*, respectively), but increased by DBS (Δ_t = +174, +39%; *Trill* and *Scale*, respectively). Between group differences were significant at the 0.1 level only in the 4-finger *Scale* task. A comparable effect of TH and DBS on the accuracy of contralateral tapping was also observed. Six months after surgery, accuracy errors were reduced in both groups (Δ_a = -45, -50%, TH and DBS, respectively), but only in the simple *Trill* task. In the more complex 4-finger *Scale* task, accuracy errors were reduced by 65% in the TH group, but only 8% among DBS subjects (between group differences were not statistically significant). In the ipsilateral hand, there was no change in tremor ratings. Postoperative timing errors were also not significantly different between DBS and TH. However, accuracy improved ipsilaterally after DBS in the trill and scale task, but deteriorated after TH ($p=0.05$).

Conclusion: Clinical and functional scales show few differences after TH or DBS surgery among patients with ET. Although subject numbers are small, the present data suggest that there may be differential effects of Vim TH and DBS on the contralateral hand, especially on the rhythmicity and accuracy of complex finger movements essential to dextrous manipulation. Furthermore, although there appears to be no effect of DBS or TH on ipsilateral tremor, ipsilateral accuracy of complex movements appears to improve after DBS, and deteriorate significantly after thalamotomy.

15. DEEP BRAIN STIMULATION: PAST, PRESENT, AND FUTURE

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Over the last 10 years there has been an increasing volume of Deep Brain Stimulation (DBS) procedures performed in the United States. As indications for DBS are evolving, it is important to evaluate our successes and failures in treating the primary indications of Parkinson's Disease, Essential Tremor, and Dystonia. The financial and social impacts of DBS will also be presented. Finally, development of DBS 'Centers of Excellence' will be discussed in relation to the future of neuromodulation.

16. MODULATION OF REGIONAL TEMPERATURE AND PAIN IN PATIENTS WITH COMPLEX REGIONAL PAIN SYNDROME BY CUTANEOUS APPLICATION OF LIGHT

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Introduction: Complex Regional Pain Syndrome (CRPS) manifests a variety of symptoms, chief among which are severe pain and temperature changes in a distal extremity.

Objective: To determine if the cutaneous application of light (CAL) to patients with CRPS can induce changes in the regional skin temperature of the affected limb. A second objective was to determine if CAL can reduce the patient's pain.

Methods: Twelve adult patients with chronic CRPS of 2 to 25 years duration and ten normal controls were treated with CAL. Modulated low intensity light in the visible spectrum was applied to specific skin sites for measured periods of time during a series of visits. To measure outcomes, regional skin temperatures of the affected extremities were recorded during the CAL sessions from infrared thermograms. Changes in pain intensity were measured from pre- and post treatment numeric pain scores.

Results: Following CAL, the average skin temperature change in the affected limbs was 5.0°C (range +11.2°C to -6.9°C) relative to the pre-treatment temperature. In the controls, the average change was 1.4°C (range 0.2 to 4.0°C). All 12 cases showed a 2°C change in temperature at least twice during the course of their CAL sessions. In the same period, 83% reported a reduction in their baseline pain intensity of more than 45%.

Conclusion: This study demonstrates that administration of light to specific sites on the skin of CRPS patients can induce significant changes in skin temperature of the affected limbs. It also demonstrates that significant reduction in the intensity of pain in CRPS may occur following CAL.

17. ROLE OF THE ENDOTHELIN A AND B RECEPTORS IN MAINTENANCE OF CEREBROVASCULAR TONE

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Introduction: In an attempt to characterize the role of endothelin receptor subtypes in the regulation of cerebrovascular tone, we describe the immunohistochemistry and videomicroscopy of isolated male Sprague-Dawley rat, middle cerebral artery penetrating cerebral arterioles (IPA).

Methods: IPA vessels were cannulated, pressurized, and perfused. Experiments were conducted on vessels that attained spontaneous tone and dilated in response to an acidic buffer. Dose responses [D-R] to endothelin (ET-1) antagonists were obtained with: (1) ET_A receptor antagonist BQ123, (2) ET_B antagonist BQ788, (3) ET_{B1} antagonist RES701-1, (4) endothelin converting enzyme (ECE) inhibitor, phosphoramidon (PHO), and (5) endothelial nitric oxide synthase (E-NOS) inhibitor, L-NAME. Intraluminal and extraluminal ET-1 [D-R] were obtained and repeated with co-administration of: (1) BQ123, (2) RES701-1, (3) PHO, (4) L-NAME, and (5) following endothelial light dye injury. To further elucidate the role of the ET_B receptor, a second trial was conducted using the ET_B agonist IRL1620.

Results: Immunohistochemistry revealed localization of: ET_A receptors to vascular smooth muscle (VSM), ET_B receptors to both endothelium and VSM, and ECE (faint stain) co-localized to endothelium. Extraluminal ET-1 caused a greater degree of maximal constriction than intraluminal ET-1 (77% vs. 27%). Co-administration of BQ123 and endothelial light dye injury significantly attenuated ET-1 constriction shifting the [D-R] curve to the right. Co-administration of L-NAME, PHO and BQ788 caused a significant left-shift in extraluminal ET-1 [D-R]. Extraluminal administration of IRL1620 had no effect except for a moderate constriction (23%) at 10⁻⁶ M. Intraluminal IRL1620 caused a biphasic dilation (5-10%) and constriction (5%), most pronounced at 10⁻⁸ M. The dilation response was attenuated by L-NAME, BQ788, RES701-1 and PHO. The constriction response was slightly enhanced by RES701-1 and L-NAME.

Conclusion: Our data suggests that ET_A receptor subtypes are largely localized to VSM and activation causes vessel constriction. The ET_B receptor exists both on endothelial cells and VSM. The endothelial

ETB1 subtype mediates vasodilation via activation of E-NOS. There was no evidence of ET_{B2} mediated constriction. Antagonism of the ET_B receptor, E-NOS and ECE potentiates ET-1-induced constriction and attenuates IRL 1620-induced dilation. Thus ET_B-induced production of NO attenuates ET-1-induced constriction and ECE may serve to amplify the role of the ET_{B1} receptor.

18. LONG-TERM OUTCOMES AFTER SURGERY FOR ENDOCRINE-INACTIVE PITUITARY ADENOMAS: RECURRENCE RATE, MORTALITY, AND THE ROLE OF RADIATION THERAPY

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Objective: To determine the long-term outcomes following surgery for EIAs, and to identify patient subgroups that may benefit from postoperative radiotherapy.

Design, Setting, and Patients: Retrospective review of a cohort of 663 patients at a single academic institution who underwent surgery between 1975 and 1995 for treatment of EIAs.

Main Outcome Measures: Disease progression after surgery, defined by clinical and/or radiographic criteria, and all-cause mortality.

Results: Over a median follow-up of 7.4 years, 64 (9.7%) recurrences occurred after treatment, with an overall median time to recurrence of 5.6 years. The overall 5-, 10-, 15- and 20-year recurrence-free probabilities were 0.96, 0.87, 0.81, and 0.74, respectively. Multivariate Cox proportional hazard regression analysis identified three variables that were associated with increased recurrence: cavernous sinus invasion (hazard ratio [HR], 4.0, 95% confidence interval [CI], 2.3-7.0; P<0.001), subtotal resection (HR, 2.9 95% CI 1.6-5.5; P<0.001), and no radiotherapy (HR, 3.8; 95% CI 2.4-6.6; P<0.001). Using time-to-event estimates to adjust for differences in follow-up between groups, subtotal resection without radiotherapy was found to be associated with higher rate of recurrence compared to subtotal resection with radiotherapy (log rank test, P<0.001). No difference was found between gross total resections (with and without radiotherapy) and subtotal resection with radiotherapy. Mortality did not differ between extent of resection or presence of radiotherapy, and when compared with the national population.

Conclusions: Cavernous sinus invasion is an important prognostic variable for initial extent of resection and long-term control of EIAs. Radiotherapy plays an important role in long-term tumor control for patients that have a subtotal resection, but does not affect outcome for patients that undergo gross total resection. Patients that undergo surgery for EIAs do not demonstrate increased mortality.

19. ENHANCED BONE FORMATION WITH THE USE OF INSTRUMENTATION IMPLANTED WITH CALCIUM AND PHOSPHATE IONS

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Introduction: Implants utilized in spinal surgery must form a bond between the implant and the bone. This bond can be mechanical, bioactive or both. Bioactive implant surface coatings containing calcium and phosphate have been used to provide a more integrative and interactive surface bonding. Unfortunately, application of these coating may lead to implant weakening or coating delamination resulting in failure. Submerged electro-spark deposition can remodel the surface of metals so that ions can be directly integrated into the surface, overcoming the limitations of surface coatings. We have made preliminary investigations of the utility of electro-spark deposition of calcium and phosphorus on modified reconstruction plates in the rabbit radial defect model.

Methods: Two groups of 8 rabbits were studied. In the control group, Ti-6AL-4V titanium cranial 4-hole reconstruction plates (Synthes, Inc.) were used to span a 5 mm radial defect. In the experimental group, the reconstruction plates were treated with electro-spark deposition of calcium and phosphorus. The ion concentrations used were based on prior work studying cultured osteoblasts. After a 4 week in life duration, radiomorphometry and histomorphometry analysis was performed to assess defect healing.

Results: Percent radiopacity, as measured by radiomorphometry, was $68.9 \pm 4.9\%$ in the control group and $85.0 \pm 7.3\%$ in the treated group. In addition, the percent of new bone growth filling the 5 mm radial defect as measured by histomorphometry was $46.2 \pm 6.8\%$ for the control group and $65.1 \pm 9.1\%$ in the treated group. Both outcome measures were significant at the $p < 0.001$ level.

Conclusions: These results demonstrate that electro-spark deposition of calcium and phosphorus into the surfaces of surgical implants will likely have a significant effect on bone healing. The radial defects healed faster and more completely when the implants were treated. Future studies will evaluate the utility of electro-spark deposition modified implants for interbody fusion.

20. AMYLOID TRANSPORTER EXPRESSION IS ALTERED BY AGING AT THE BLOOD- BRAIN BARRIER AND CHOROID PLEXUS IN A RECIPROCAL FASHION

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Introduction: Aging is the single greatest risk factor for Alzheimer's disease (AD). The prevailing theory of AD pathogenesis implicates the accumulation of amyloid beta-peptides (A β) in the brain interstitial fluid (ISF) due to impaired clearance. In young adult mice about 85-90% of A β produced in the brain is transported across the BBB, the remainder exiting via the bulk flow of CSF and across the choroid plexus (CP) epithelium. The endothelial transporter for A β out of the ISF is the low-density lipoprotein receptor related protein -1 (LRP-1). Transport of A β from the plasma back into the ISF is via the BBB receptor for advanced glycation end-products (RAGE). Normally these receptors maintain ISF A β within narrow limits. We assessed LRP-1 and RAGE expression in cerebral microvessels and CP as a function of aging in the Brown Norway/Fisher (BN/F) rat.

Methods: BN/F rats at 3, 10-12, 30 and 36 mos. were used for immunohistochemistry (IHC), RT-PCR and Western blotting (WB). The whole brain, isolated cerebral microvessels and CP tissue were analyzed. Cerebral microvessels were prepared as previously described.

Results: At 3 mos. LRP-1 expression was robust by IHC, RT-PCR and WB in the cerebral microvessels and, to a lesser degree, in CP. RAGE was not detected on cerebral microvessels but was seen on CP. Aging led to a decreased expression of microvessel LRP-1 by 10 mos. and an increase in RAGE, beginning at 12 mos. with a further increase at 30 mos, based on IHC, RT-PCR and WB. By contrast, CP epithelium showed an increase in LRP-1 expression and a decrease in RAGE expression with aging.

Conclusions: Aging causes a decrease in the expression of LRP-1, the transporter of A β out of the brain across the BBB, and an increase in RAGE expression consistent with a decreased ability to clear A β from the brain ISF; whereas the opposite is seen in the CP. Here there is an increase in LRP-1 expression and a decrease in RAGE expression, suggesting a pathway for enhanced transport of A β out of the CSF.

21. DEVICE FOR INTERVERTEBRAL ASSISTED MOTION (DIAM) FOR POSTERIOR DYNAMIC STABILIZATION: 18 MONTHS CLINICAL AND SAGITTAL BALANCE OUTCOME COMPARED WITH CONTROL

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Introduction: We compared 18 months outcomes of patients post-lumbar surgery with DIAM versus patients who underwent lumbar surgery alone.

Methods: 74 patients underwent simple lumbar surgery (laminectomy and/or microdiscectomy) in a 51 month period. Of these, 35 patients underwent concomitant surgical placement of DIAM inter-spinous process spacer (42 DIAMs total). Preoperative MR or upright radiographic imaging, pain scores, and clinical assessment were postoperatively followed to mean 18 months (range 6 – 51 mo). Patients who underwent no inter-spinous process spacer (Group C) were compared with patients who underwent placement of DIAM (Group D).

Results: In Group D, no statistically significant differences were noted in anterior or posterior disk height when comparing preoperative to postoperative patients and when comparing with Group C. A kyphosis of < 2 degrees was noted when comparing Group D (0.51 +/- 0.1 degrees) to Group C (2.4 +/- 0.48 degrees) postoperative images. No statistically significant differences in VAS pain or MacNab outcomes for radiculopathy or low back pain were noted at mean 18 months follow-up between Group C and D. Complications in Group D included 3 intra-operative spinous process fractures, 1 infection, and 1 case of markedly increased disk degeneration and facet disease at 2 year followup.

Conclusion: Following simple lumbar surgery, the placement of a DIAM inter-spinous process spacer does not alter disk height and alters sagittal alignment minimally at mean 18 months follow-up. No difference in VAS or MacNab outcome was noted between DIAM and non-DIAM group particularly in the use of DIAM to alleviate low back pain.



22. POSTOPERATIVE DAY #1 CORTISOL AS A PREDICTOR OF ADRENAL FUNCTION FOLLOWING PITUITARY TUMOR SURGERY IN PATIENTS WITHOUT PERIOPERATIVE STEROID ADMINISTRATION



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ACTH deficiency following pituitary surgery may lead to significant morbidity. Minimally invasive endonasal approaches to the pituitary now enable discharge of patients on the first postoperative day. However, studies to date do not adequately address the accuracy of early serum postoperative cortisol values in predicting ultimate function of the hypothalamo-pituitary-adrenal (HPA) axis. In addition, the routine practice of perioperative steroid administration in patients with normal pre-operative pituitary function is of uncertain value, and may distort the post-operative assessment of HPA function.

We did a retrospective chart review of 137 adult patients who underwent pituitary tumor surgery by a single neurosurgeon at the Cleveland Clinic between January 2002 and October 2003. Patients with Cushing disease or pituitary apoplexy were excluded. We identified 49 patients with available fasting morning cortisol on postop day (POD) # 1 followed by Cortrosyn Stimulation Test (CST) 4-6 weeks later. Patients with normal preoperative HPA axis were not given any glucocorticoids perioperatively and had their am cortisol measured on POD #1. Patients were started on Hydrocortisone 15-20 mg/day if cortisol on POD #1 was < 15 μg/dL until returning for the subsequent CST.

The median age of patients was 51 (Range 17-87). The pituitary tumors were mostly macroadenoma (44/49) and nonfunctional (31/49). A normal response in the CST was defined as cortisol value < 18.5 μg/dL at either 30 or 60 minutes after 25 mg Cortrosyn. In patients who passed CST (n=41), the median (range) cortisol level on POD # 1 was 33.7 (6.8-74.4), and was 19.8 (6.2-28.5) in those who failed

CST (n=8) . Using a POD#1 cutoff value of 15  ["http://www.marathonmultimedia.com/graphics/alphabet/mu.jpg"](http://www.marathonmultimedia.com/graphics/alphabet/mu.jpg)  g/dL, we were able to correctly predict a normal CST response in 77% of patients based on POD#1 morning cortisol. In addition, 3 patients with POD#1 cortisol values above cut off who failed CST were subsequently shown to have normal HPA axis by Metyrapone test. Using the combined criteria (normal CST or Metyrapone), the positive prediction value for POD#1 cortisol testing was 81%. None of the patients without glucocorticoid coverage in the perioperative period had any significant adverse event. Of note, there was also a significant apparent reduction in the incidence of post-operative transient diabetes insipidus in patients who did not receive peri-operative glucocorticoids.

Conclusion: In patients without preoperative hypopituitarism, our current approach of eliminating perioperative cortisol replacement and not administering post-operative glucocorticoids in patients with POD #1 cortisol ≥ 15  ["http://www.marathonmultimedia.com/graphics/alphabet/mu.jpg"](http://www.marathonmultimedia.com/graphics/alphabet/mu.jpg)  g/dL appears to be safe and effective. In the current retrospective analysis, this protocol caused no untoward effects and avoided unnecessary glucocorticoid therapy in the large majority of patients. A potential additional benefit of reducing the incidence of postoperative transient diabetes insipidus is currently being investigated.

23. ROLE OF N-TYPE VOLTAGE-GATED CALCIUM CHANNELS IN TRAUMATIC BRAIN INJURY

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J. Paul Muizelar, MD, PhD, Robert F. Berman, PhD,
Sacramento, CA

Over 1.5 million people suffer traumatic brain injury (TBI) in the United States each year. An important consequence of TBI is neuronal cytosolic calcium accumulation, which activates various intracellular pathways resulting in cell death. N-type voltage-gated calcium channels (VGCCs) may play a critical role in this process, although they have not been extensively studied on the cellular level previously. Using an *in vitro* model of TBI, we characterized the role of N-type VGCCs in mediating the effects of mechanical and hypoxic injury, and further explored the neuroprotective potential of selective channel blockade.

Neuronal-glia cortical cell cultures were generated from rat pups to yield morphologically complex, histologically mature neurons. Intracellular

calcium levels were measured using fura-2, cell culture media was sampled by microdialysis, and hypoxia was induced by exposure to elevated incubator CO₂ (EIC) levels. The selective N-type VGCC blocker SNX-185 was used to study the effects of channel blockade on stretch injury- and EIC-induced calcium rise, injury-induced glutamate release, maintenance of elevated cytosolic calcium levels, and resultant cell survival.

Exposure to EIC resulted in acidosis, hypoxia and increased peak neuronal calcium levels with resultant cell loss. Administration of SNX-185 prior to or immediately after stretch injury completely prevented intracellular calcium elevation, blocked injury-induced glutamate release, and was neuroprotective. Delayed treatment with SNX-185 significantly improved calcium recovery dynamics but did not affect neuronal survival. However, delayed treatment of stretch-injured neurons exposed to 24 hours of EIC was robustly neuroprotective.

N-type VGCCs are critically involved in both mediating acute calcium elevation as well as maintaining elevated calcium levels after injury, due, in part, to prevention of glutamate release following insult. SNX-185 may be a powerful neuroprotective therapy when delivered prior to TBI, or in a delayed fashion due to its beneficial effects on prolonged or secondary insults from superimposed ischemia and/or hypoxia.

24. EMBOLIZATION OF ARTERIOVENOUS MALFORMATIONS WITH ONYX: PRELIMINARY EXPERIENCE

Sabareesh K. Natarajan, Laligam N. Sekhar, Brian Kot,
Gavin W. Britz, Basavaraj Ghodke, Seattle, WA

Objective: To report our experience in treatment of arteriovenous malformations (AVMs) using a new liquid embolic agent, Onyx (Micro Therapeutics, Inc., Irvine, CA) and surgical resection or radiosurgery.

Methods: Between August 2005 and April 2006, 20 patients (7 men and 13 women) were treated by embolization with Onyx. Subsequently 16 patients underwent surgery, 2 patients are awaiting surgery and 2 patients had gamma knife radiotherapy. The results are compared with 11 AVMs treated with NBCA and surgical resection from January 2005 to July 2005.

Results: Onyx Embolization: The patients' average age was 30 years, with 50% of patients presenting with hemorrhage. The average Spetzler-

Martin grade on presentation was 3 (Grade 1=3, Grade 2=7, Grade 3=5, Grade 4=3, Grade 5=2.). 20 AVMs were embolized in 39 staged sessions. The average AVM size before embolization was 3.7 cm in largest diameter (Range: 1.7-7.6cm). Two patients had procedural complications (One had a microcatheter stuck to the vessel and another had a perforation of the vessel proximal to the site of embolization with hemorrhage. These were resolved with surgery). One patient developed hemiparesis after embolization through the anterior choroidal artery. Sixteen patients underwent surgery with 15 patients having complete removal of the AVM postoperatively. One patient had a remnant which was removed by a second operation. Postoperatively, two patients developed transient hemiparesis; one patient had normal pressure perfusion breakthrough. One patient died two weeks after surgery due to the initial insult of intracerebral hemorrhage. The average pre-embolization GCS was 13. The average postoperative GOS at discharge and 3 months were 3.75 and 4 respectively. NBCA Embolization: The average Spetzler-Martin grade on presentation was 2.2 (Grade 1=5, Grade 2=1, Grade 3=2, Grade 4=3, Grade 5=0.). 11 AVMs were embolized in 15 staged sessions. The average AVM size before embolization 2.5cm in largest diameter (Range: 1-4cm).

Conclusion: The advantages of Onyx embolization are slower solidification with greater penetration of the AVM nidus, including portions (more medial or apical) which are difficult for surgical excision. Fewer pedicles need embolization and much larger AVMs could be treated more safely with Onyx and Surgery. There is a lower risk of premature venous occlusion. Complications related to embolization were minimal. Although firm and rubbery, the material did not adversely impact on surgical resection.

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W. Ben Blackett	1985, 1986, 1987
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Randall W. Smith	1997, 1998, 1999
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Hector E. James	2003

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John C. Oakley*	1996-1999
John P. Slater	1999-2002
John T. Bonner	2002-2005

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Linda M. Liau, UCLA **	1997
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SooHo Choi, USC	1999
Michael Y. Wang, USC	2000
Odette Harris, Stanford	2001
Raymond Tien, OHSU	2002
Michael Sandquist, OHSU	2003
Iman Feiz-Erfan, Phoenix	2004
Johnathan Carlson, OHSU	2005
Mathew Hunt, OHSU*	2005

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PAST MEETINGS OF THE SOCIETY

1. Biltmore Hotel, Santa Barbara, CA Nov 25-26, 1955
2. Timberline Lodge, OR Dec 9-11, 1956
3. Holiday Hotel, Reno, NV Sept 29-Oct 1, 1957
4. Del Monte Lodge, Pebble Beach, CA Oct 19-22, 1958
5. La Valencia Hotel, La Jolla, CA Sept 27-30, 1959
6. Del Monte Lodge, Pebble Beach, CA Oct 23-26, 1960
7. Bayshore Inn, Vancouver, BC Oct 29-Nov 1, 1961
8. Camelback Inn, Phoenix, AZ Oct 28-31, 1962
9. El Mirador Hotel, Palm Springs, CA Oct 20-23, 1963
10. Fairmont Hotel, San Francisco, CA Oct 18-21, 1964
11. Olympic Hotel, Seattle, WA Oct 3-6, 1965
12. Hotel Utah, Salt Lake City, UT Nov 6-9, 1966
13. Kona Kai Club, San Diego, CA Oct 15-18, 1967
14. Mauna Kea Beach Hotel, Kamuela, HI Nov 16-19, 1968
15. Del Monte Lodge, Pebble Beach, CA Oct 15-18, 1969
16. Bayshore Inn, Vancouver, BC Oct 4-7, 1970
17. The Broadmoor, Colorado Springs, CO Oct 31 -Nov 3, 1971
18. The Skyline Country Club, Tucson, AZ Oct 29-Nov 1, 1972
19. Airport Marina Hotel, Albuquerque, NM Sept 16-19, 1973
20. Santa Barbara Biltmore Hotel, CA Oct 27-30, 1974
21. Mauna Kea Beach Hotel, Kamuela, HI Sept 28-Oct 1, 1975
22. Harrah's Hotel, Reno, NV Sept 26-29, 1976
23. La Costa Resort Hotel, Carlsbad, CA Sept 18-21, 1977
24. The Lodge, Pebble Beach, CA Oct 8-11, 1978
25. Camelback, Inn, Scottsdale, AZ Sept 23-26, 1979

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26. Mauna Kea Beach Hotel, Kamuela, HI	Sept 21-24, 1980
27. The Empress Hotel, Victoria, BC	Sept 20-23, 1981
28. Jackson Lake Lodge, Jackson Hole, WY	Sept 12-15, 1982
29. Hotel del Coronado, Coronado, CA	Oct 2-5, 1983
30. The Broadmoor, Colorado Springs, CO	Sept 9-12, 1984
31. Silverado Country Club & Resort, Napa, CA	Sept 22-25, 1985
32. Maui Intercontinental, Wailea, Maui, HI	Sept 28-Oct 1, 1986
33. Banff Springs Hotel, Banff, AB	Sept 6-9, 1987
34. The Ritz-Carlton, Laguna Niguel, CA	Sept 11-14, 1988
35. The Lodge, Sun Valley, ID	Sept 10-13, 1989
36. Mauna Lani Bay Hotel, Kawaihae, HI	Sept 9-12, 1990
37. The Pointe, Phoenix, AZ	Sept 22-25, 1991
38. The Whistler, Whistler, BC	Sept 20-23, 1992
39. Mauna Lani Bay Hotel, Kawaihae, HI	Sept 19-22, 1993
40. Le Meridien Hotel, San Diego, CA	Sept 18-21, 1994
41. Salishan Lodge, Gleneden Beach, OR	Sept. 9-12, 1995
42. Manele Bay, Island of Lanai, HI	Sept 14-17, 1996
43. Ojai Valley Inn, Ojai, CA	Sept 20-23, 1997
44. Silverado Resort, Napa, CA	Sept 12-15, 1998
45. Coeur d'Alene Resort, Coeur d'Alene, ID	Sept 18-21, 1999
46. Mauna Lani Bay Hotel, Hawaii, HI	Sept 9-11, 2000
47. Ocean Pointe Resort, Victoria B.C., Canada	Sept 15-18, 2001 (Cancelled)
48. Delta Victoria Resort, B.C. Canada	Oct 12-15, 2002
49. Hapuna Beach Prince Hotel, Kamuela, HI	Sept 20-24, 2003
50. Rancho Bernardo Inn, San Diego, CA	Sept 11-14, 2004
51. Squaw Creek Resort, Lake Tahoe, California	Sept. 17-20, 2005

FUTURE MEETINGS

Mauna Lani Resort, Hawaii, HI	Sept 8-11, 2007
Captin Cook Hotel, Anchorage, AK	August 16-19, 2008

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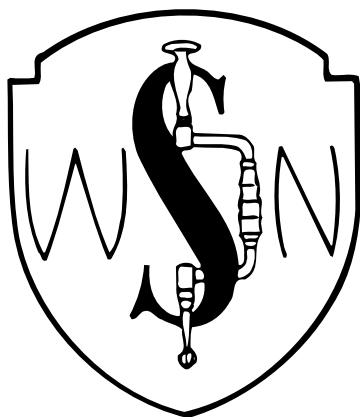
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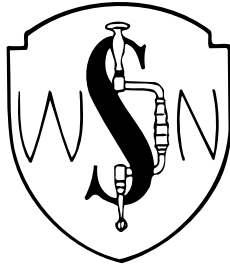
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