The field of interventional pain management continues to change and expand at a rapid pace. In the absence of widespread interest among neurosurgeons, anesthesia pain specialists have largely been the driving force behind this expansion. Although there are many examples of collaboration and cooperation between neurosurgery and anesthesia pain management, two separate incidents have come to my attention within the past few months regarding credentialing of neurosurgeons to perform pain procedures. In both cases, anesthesiologists lobbied their hospital credentialing committees to try to prevent neurosurgeons from implanting spinal cord stimulators and intrathecal medication delivery systems, claiming that board certification in pain medicine was a necessary prerequisite. Consequently, the Executive Committee of the Section will meet in Philadelphia to discuss a position statement, which will state in no uncertain terms that neurosurgeons possess the neuroanatomical and physiological knowledge, as well as the technical skills, to perform a wide variety of interventions for pain, which extend far beyond those of which anesthesia pain specialists are capable. Neurosurgeons invented surgical pain management and will maintain a preeminent role for the foreseeable future. Educating hospital credentialing committees to these facts will allow us to protect our members from these attempts at restraint of trade.

The second half of this situation regards the issue of subspecialty certification in pain. At the present time, the only ABMS-recognized certification process for pain medicine belongs to anesthesia. Unfortunately, little has changed in this arena within the past 6 months. Your Section leadership continues to participate in the process of developing broader guidelines for board certification in pain.

The upcoming Congress of Neurological Surgeons meeting in Philadelphia will provide attendees with a several course offerings on varying aspects of pain management. “Minimally Invasive Procedures for Spinal Pain Syndromes”, an all-day practical course, will focus on percutaneous procedures for spinal pain. This course was previously given at the AANS in New Orleans and was very well received. Luncheon seminars on trigeminal neuralgia and the management of intractable pain will also be presented. The Pain Section Scientific Program will be held on Tuesday, September 24, beginning with the presentation of the Tasker Young Investigator Award and ending with a special symposium on the management of facial pain from 4:30-5:30. Speakers will include Kim Burchiel, John Gorecki, and Ali Rezai. Please join us for what promises to be a very informative and exciting session.

I am also pleased to announce that the Pain Section will be presenting a special symposium at the annual meeting of the Joint Section on Spine & Peripheral Nerves meeting in Tampa Bay on March 5, 2003. Dr. Ed Benzel and I will be co-chairing the symposium, which will focus on various options for the treatment of spinal pain, both from a reconstructive and a symptomatic standpoint. A case-based format will allow lively discussion and audience participation. This collaboration between the Pain Section and the Section on Spine & Peripheral Nerves marks the beginning of a closer affiliation between surgeons who approach the spine from numerous different perspectives. It is my sincere hope that this relationship will continue to grow with time.

cont. on Page 12...
Osteoporosis is a major public health problem that affects approximately 44 million Americans. The National Osteoporosis Foundation estimates that 10 million Americans have osteoporosis and an additional 34 million people are at risk because of low bone mass. Of the 1.5 million fragility fractures that occur each year in the United States, approximately 700,000 are vertebral fractures (N Engl J Med 314:1676-86). Vertebral compression fractures (VCFs) that present as clinically symptomatic events can be painful and even debilitating. Progressive deterioration of the spinal column actually can be seen in patients with osteoporosis, multiple myeloma or other intramedullary bone tumors.

Vertebral compression fractures can lead to serious consequences including impaired function, decreased quality of life, gastrointestinal disorders, pulmonary complications and mortality. To minimize pain and further morbidity, fracture treatment should stabilize the injury and restore spinal anatomy. Early diagnosis and treatment likely will optimize outcomes. The patient population is predominantly geriatric so special care may be required.

Kyphoplasty is a comprehensive method for treating painful vertebral compression fractures in the thoracic and lumbar regions. In brief, this minimally invasive procedure involves the following:

- Insertion of the KyphX® inflatable bone tamp (Kyphon, Sunnyvale, CA) into the fractured vertebra
- Inflation of the bone tamp to elevate the vertebral endplates and create a void in the vertebra
- Removal of the bone tamp
- Deposition of bone filler (e.g., polymethyl methacrylate) into the vertebra

The minimally invasive nature of kyphoplasty allows for shorter surgical time, anesthesia exposure, hospital stays and recovery time. The use of inflatable bone tamps gives the opportunity to restore the fractured vertebra and improve spinal alignment, which may be especially important for patients with multiple VCFs.

Relatively few major complications have been reported to date (7 in >10,000 procedures). Thorough physician training and the use of high-quality, surgical imaging can eliminate most of the problems, which include anterior cord syndrome, cord compression, epidural hematoma, radiculopathy, hypoxia/fever, unilateral neuropathy and ileus.

Between May 2000 and December 2001, 116 patients with painful VCFs had kyphoplasty under the care of the Tyler Neurosurgical Associates. In all, there were 124 procedures to treat 161 fractures. All patients previously had failed medical therapy. Thirty one patients were male, and 85 patients were female. The average patient age at the time of surgery was 77 years. Treated fractures were between T5 and L5 and were an average of 2.43 months old (range 2 days to 14 months, 119 fractures).

Pain was monitored on a visual analog scale where one is equivalent to no pain and ten represents severe pain. Preoperatively, the average pain score was 8.8 (119 procedures). After surgery, pain scores dropped to 2.7 (1 week post-surgery), 1.9 (3 months post-surgery), 1.5 (6 months post-surgery) and 1.4 (1 year post-surgery) (see Figure 1).

Patient function was assessed by ambulatory status. Patients who were bedridden or wheelchair bound were non-ambulatory, patients who used a cane or walker were categorized as assisted ambulation and patients who were able to move independently were considered fully ambulatory. As illustrated in Figure 2, the percentage of patients who were fully ambulatory increased with time after kyphoplasty. The number of patients responding to the survey is denoted on the bars of the graph.

Changes in vertebral height also were monitored. The estimated height of the fractured vertebra was determined by averaging the measurements of the closest normal vertebra above and below the fracture. Before surgery, the average anterior height measurement was 65% of the expected value, and the average midline height measurement was 60% of the expected value (Table 1). One month after kyphoplasty, both anterior and midline vertebral heights increased to 85% and 90% of the expected value, respectively. This change in percentage is significant (p<0.0001, paired samples t-tests, Table 2). After six months and one year, the average vertebral

Figure 1.

<table>
<thead>
<tr>
<th>Time</th>
<th>Pain Score</th>
<th>Preop.</th>
<th>1Wk.</th>
<th>3 Mo.</th>
<th>6 Mo.</th>
<th>1Yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>119</td>
<td>113</td>
<td>98</td>
<td>79</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>1=no pain</td>
<td>10 = severe pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.79</td>
<td>2.58</td>
<td>1.87</td>
<td>1.40</td>
<td>1.35</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2.

<table>
<thead>
<tr>
<th>Time</th>
<th>Fully Ambulatory</th>
<th>Assisted Ambulation</th>
<th>Non-Ambulatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preop.</td>
<td>107</td>
<td>106</td>
<td>99</td>
</tr>
<tr>
<td>34</td>
<td>35</td>
<td>32</td>
<td>23</td>
</tr>
<tr>
<td>80%</td>
<td>85%</td>
<td>63%</td>
<td>49%</td>
</tr>
<tr>
<td>1Wk.</td>
<td>106</td>
<td>99</td>
<td>75</td>
</tr>
<tr>
<td>34</td>
<td>38</td>
<td>67</td>
<td>46</td>
</tr>
<tr>
<td>80%</td>
<td>85%</td>
<td>67%</td>
<td>49%</td>
</tr>
</tbody>
</table>
William H. Sweet Young Investigator Award - 2002

This $1,000 award sponsored by Medtronic, Inc. is given for the best presentation by an investigator within 5 years of completion of residency training at the AANS Annual Meeting.

2002 - Ashwini Sharan, “MRI and Spinal Cord Stimulation: An Experimental Safety Study”

Dr. Ashwini Sharan was born in Patna, a small city in the Northeast of India. He immigrated to the United States when he was an infant in 1971. He then grew up in New York and New Jersey in an environment surrounded by multicultural immigrants. In 1995, he completed his B.A.-M.D. from Boston University and UMDNJ - Newark, N.J. in an accelerated medical program. He initially began neurosurgical training at the University of Connecticut and completed the majority of his training at Thomas Jefferson University, PA. Since then he has decided to complete a fellowship in spine neurosurgery and functional neurosurgery both at The Cleveland Clinic Foundation in Cleveland, OH. Following the completion of his training, he plans on pursuing a career in academic neurosurgery with research interests focusing on movement, functional imaging, pain, and neural prosthesis.

MRI and Spinal Cord Stimulation: An Experimental Safety Study

Ashwini D. Sharan, M.D., Ali R. Rezai, M.D., Jorge A. Gonzalez-Martinez, M.D., Daniel Finelli, M.D., John A Nyenhuis, Ph.D., Jean Takac, Ph.D., Paul Rugieri, M.D., Gregory A. Hrdlicka, B.S.E.E., M.B.A., Paul Stypulkowski, Ph.D. and Frank G. Shellock, Ph.D.

Introduction: Patients with chronic axial pain benefit from spinal cord stimulation (SCS). It often becomes necessary to obtain MRI examinations in these patients. The current study was conducted in order to assess MR related heating and safety with SCS.

Methods: Cervical and thoracic configurations were evaluated using single and bilateral quadripolar leads, laminectomy SCS leads, and percutaneous leads connected to an impulse generator. In vivo testing was performed using a 1.5-Tesla/64 MHz MR system and a gel-filled phantom designed to approximate the head and upper torso of a human. MR imaging was conducted using the transmit body and receive head RF coils. Varying levels of RF energy were applied with the coils. A fluoroptic thermometry system was used to record temperatures.

Results: MR imaging was conducted in order to simulate worst case scenarios. Using plate electrodes, temperature changes ranged from 0.6 to 5°C measured at the electrode contacts. Using unilateral or bilateral quadripolar electrodes, the temperature changes ranged from 0.3 to 3°C. Finally, using bilateral quadripolar electrodes temperature changes ranged from 3 to 4.5°C. Additionally using the head t/r coil with cervical positioned leads, an SAR <= 0.12 and a Resume™ electrode, an SAR <=0.24 and a dual Quad, (Resume™ and Quad™, Medtronic, Inc., Minneapolis, Minn.) produced less than 2°C temperature rise. The use of a body t/r coil produced more variability and an asymmetry with respect to heating. Placement of the impulse generator in the abdomen versus the back does not appear to significantly impact the heating.

Conclusions: These findings indicate that excessive heating occurs under certain conditions, while others produce relatively minor, physiologically inconsequential temperature increases. These observations are restricted to the tested spinal cord stimulation systems in the scenarios mentioned above. Using certain SCS configurations, the head t/r coil, and the SAR recommendations noted above while maintaining heating at less than 2°C, patient may obtain an MR image safely.

Figures: On the left shows in vitro experimental setup of dual cervical placed quadripolar electrode connected to a left sided pulse generator in a phantom. The black wires are fiber optic probes placed to measure temperature rises. In between the quadripolar electrodes is a reference electrode. Note that in this scenario, the SAR is 0.24 W/Kg and the temperature rise is 0.6°C when using a head coil.

Previous William H. Sweet Young Investigator Awardees

2001 - Dragan F. Dimitrov
Human Adult Cortical Plasticity: Lidocaine Anesthesia Generates Effects Similar to Limb Amputation

2000 - Alon Y. Mogilner
Functional Brain Imaging and Spinal Cord Stimulation: Localization of Cortical Activity with Magnetoencephalography (MEG)

1999 - No award given

1998 - Ali R. Rezai
Deep Brain Stimulation for Intractable Neuropathic Pain: Contemporary Management and Outcome in 80 Patients

1996 - John G. Piper
Systematic Studies in Visceral Nociceptive Processing
Endoscope-assisted Microvascular Decompression for Trigeminal Neuralgia

Charles Teo, (Sydney, Australia), Peter Nakaji, (San Diego, CA), Ralph J. Mobbs, (Sydney, Australia) and Gaye Sink, (Little Rock, AR)

Introduction: The aim of this study was to document the utility of endoscopy in the surgical management of trigeminal neuralgia by microvascular decompression. Many large series describing the management of trigeminal neuralgia by retrosigmoid microvascular decompression (MVD) report an initial failure rate of 2-8%. The proliferation of MRI has virtually eliminated patients with multiple sclerosis or other nonvascular causes of trigeminal neuralgia (e.g. tumor). Therefore, most failures are now due to failure to find a vessel compressing the trigeminal nerve at the root entry zone. We hypothesized that better visualization of the fifth cranial nerve would reduce the number of negative explorations, increase the number of successful microvascular decompressions, and ultimately improve the procedure’s success rate in both the short and long-term.

Materials and Methods: The charts of all patients who underwent MVD from Jan 1994 to July 2000 by the senior author (CT) were reviewed and where necessary patients were contacted by telephone.

Patients were categorized into four groups.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Patient experience result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>no pain, no medication, no persisting side effects from surgery</td>
</tr>
<tr>
<td>Good</td>
<td>no pain, minor (non-disabling) complications from surgery</td>
</tr>
<tr>
<td>Fair</td>
<td>excellent control of pain with medication</td>
</tr>
<tr>
<td>Poor</td>
<td>either persistent neuralgia, or no pain but with persistent debilitating side effects</td>
</tr>
</tbody>
</table>

Surgical Technique: Patients were placed in the lateral decubitus or supine position with the head tilted away as far as their individual neck mobility permitted. Under general endotracheal anesthesia, a small 1 to 2 cm retrosigmoid craniectomy was made just inferior to the transverse-sigmoid junction. The dura was opened and reflected against the sinus. Using standard microneurosurgical techniques the trigeminal nerve was identified by gently retracting the cerebellum, releasing cerebrospinal fluid from the basal cisterns and lysing arachnoidal bands. After exploring the nerve as thoroughly as possible with the microscope, a 30-degree rigid endoscope was then placed into the cerebellopontine angle to further ease the surgeon’s view. If the vessel could be seen clearly with the microscope then the endoscope was only used to assess the competency of decompression at the completion of the procedure. If the compressing vessel was seen better or only with the endoscope, MVD was performed under endoscopic control. Microvascular decompression was achieved by using a small Dacron patch placed securely between the root entry zone of the nerve and the offending vessel. Closure was by standard techniques.

Results: Sixty-eight patients with trigeminal neuralgia were managed by surgical exploration using a standard microscopic retrosigmoid approach. One patient did not have an endoscope-assisted operation because of technical problems with the endoscope. This patient had a traditional MVD and had an excellent result. The 67 other patients underwent traditional microscope-assisted microvascular decompressions followed by endoscopic inspection and, where necessary, endoscope-assisted decompression. The 67 patients’ ages ranged from 34 to 76 years with a mean of 56 years. There were 30 males and 37 females. The duration of symptoms ranged from 18 months to 9 years, with a mean duration of 3.1 years.

All patients had a positive exploration. A single vessel was implicated as the source of the compression in all cases, and in all cases the offending vessel was an artery. In 22 patients (33%), endoscopy revealed arterial compression that was poorly seen or not at all seen with the microscope. In 6 cases (9%), the vessel compressing the trigeminal nerve was found after no convincing vessel was found with the microscope alone. In 16 cases (24%), decompressions that were initially considered adequate using the microscope were subsequently found to be inadequate under endoscopic inspection. In each of these cases, the operation was altered in order to take advantage of the superior visualization provided by the endoscope. Technically adequate decompressions were subsequently performed under endoscopic guidance in all 22 patients.

Follow-up ranged from 9 months to 6 years with a mean follow-up of 29 months. All 67 patients had complete relief of trigeminal pain off medication at time of follow-up. An excellent outcome was obtained in 58 patients (87%) and a good outcome was obtained in 9 patients (13%). Complications included transient dysesthesias in the distribution of the trigeminal nerve in seven patients, transient hearing loss in one patient, and permanent hearing loss in one patient. The dysesthesias in the majority of patients who complained of it were present at the 6-week follow-up visit but all had resolved by the 3-month follow-up visit. There were no instances of infection, cerebellar dysfunction, cerebrospinal fluid leak, or any perioperative deaths. This equates to an overall complication rate of 13%.

Discussion: The two major deterrents to the selection of MVD for the treatment of trigeminal neuralgia are the inherent risks of a posterior fossa craniectomy and the fear of a negative exploration. Only direct inspection of the nerve root entry zone will establish whether compression is present. The current gold standard is exploration with an operating microscope. However, the microscopic view is limited to the line of sight between the craniectomy and the lateral surface.
Objective: There is limited available research measuring the cost-effectiveness of Spinal Cord Stimulation (SCS) when compared with Chronic Pain Therapy (CPT). The purpose of this study was to tabulate the actual costs in Canadian dollars for a consecutive series of patients treated within SCS in a constant health care delivery environment and to compare the costs with those for a control group treated in the same controlled environment.

Methods: We present a consecutive series of 104 patients with failed back syndrome. Within this group, 60 patients underwent SCS electrode implantation, whereas 44 patients were designated as controls. We monitored these patients for a 5-year period and tabulated the actual costs incurred in diagnostic imaging, professional fees paid to physicians, implantation (including the costs for hardware), nursing visits for maintenance of the stimulators, physiotherapy, chiropractic, massage therapy, and hospitalization for treatment of breakthrough pain (Figure 1). From these data, the cumulative costs for each group were calculated for a 5-year period. An analysis of the Oswestry questionnaire was also done to evaluate the effect of treatment on quality of life.

Results: The actual cumulative mean cost for SCS therapy over a five year period was $29,123 per patient as compared to $38,029 for CPT (Table 1). The cost of treatment for the SCS group is greater than those of the CPT group in the first two and a half years (Figure 2). After this period, the cost of managing patients with SCS was less than for CPT and remained so during the remainder of the follow up period. In addition, 15% of SCS patients were able to return to employment due to superior pain control and lower drug intake. No patients in the control group were able to return to employment of any kind.

Conclusions: SCS is cost-effective in the long-term, despite the initial high costs of the implantable devices.

Table 1. Actual and Cumulative Costs in ($ Canadian)

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual SCS($)</th>
<th>ACTUAL CPT($)</th>
<th>Cumulative SCS($)</th>
<th>Cumulative CPT($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18028</td>
<td>8865</td>
<td>18013</td>
<td>8865</td>
</tr>
<tr>
<td>2</td>
<td>1092</td>
<td>7291</td>
<td>19120</td>
<td>16156</td>
</tr>
<tr>
<td>3</td>
<td>1092</td>
<td>7291</td>
<td>20212</td>
<td>23447</td>
</tr>
<tr>
<td>4</td>
<td>7819</td>
<td>7291</td>
<td>28013</td>
<td>38738</td>
</tr>
<tr>
<td>5</td>
<td>1092</td>
<td>7291</td>
<td>29123</td>
<td>38029</td>
</tr>
<tr>
<td>Total</td>
<td>29123</td>
<td>38029</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Average: 5825 7606

Figure 2. Cost Comparison at Five Years
Annual AANS Meeting, Chicago 2002

Loss of IB4-Immunoreactive Neurons After Spinal Nerve Root Ligation in the Rat
Laurie L. Ackerman, M.D., Ryan L. Holdsworth, Laila T. Queral, B.S. and Donna L. Hammond, Ph.D. Neurosurgery, University of Iowa Hospital & Clinic, Iowa.

Introduction: Following sciatic nerve transection or spinal root ligation, the numbers of neurons in the dorsal root ganglion (DRG) decrease in a time-dependent manner. We examined whether tight ligation of the L5 and L6 spinal roots results in the loss of DRG neurons that stain for IB4, a selective marker of small diameter nonpeptidergic A-delta and C primary afferent neurons implicated in pain transmission.

Methods: The L5 and L6 spinal nerve roots of Sprague-Dawley rats were ligated under halothane anesthesia. Seven, 14 or 28 days later, operated and sham-operated rats were tested with von Frey filaments to assess tactile alldynia. Representative rats from each time point were anesthetized, perfused with fixative, and the ipsilateral and contralateral L4 and L5 DRG removed for visualization of IB4-immunoreactive neurons using indirect fluorescence methods.

Results: All operated rats exhibited tactile alldynia on the operated side whereas sham animals displayed little alldynia. Sham-operated rats exhibited robust staining for IB4 in all DRG at all time points. In contrast, IB4 staining for the ipsilateral L5 DRG was greatly reduced as early as 7 days and persisted through 14 days after ligation. At 28 days, IB4 staining was virtually absent in the ipsilateral L5 DRG. IB4 staining of the contralateral L5 or either L4 DRG was unaffected.

Conclusions: The loss of IB4-immunoreactive neurons in the DRG and the occurrence of tactile alldynia were temporally concordant. These results suggest that injury to and subsequent loss of this class of primary afferent neuron may contribute to the development and maintenance of neuropathic pain.

Efficacy and Durability of Microvascular Decompression for Glossopharyngeal Neuralgia
Peter M. Grossi, B.A., John H. Sampson, M.D., Ph.D., Neurosurgery, Duke University Medical Center, Durham, NC; Katsuyuki Asaoka, M.D. and Takanori Fukushina, M.D., Carolina Neuroscience Institute, Raleigh, NC.

Introduction: Microvascular decompression (MVD) has been reported to be an effective treatment for glossopharyngeal neuralgia (GPN). This study reports 48 cases of GPN treated with MVD between 1984 - 1991 in an attempt to evaluate the efficacy and durability of treatment.

Methods: All 48 patients presented with medically-irretratable paroxysmal pain in the sensory distribution of the glossopharyngeal nerve. Operative reports and direct patient contact were analyzed with respect to demographics, presentation, outcomes, and anatomical etiology. Additionally, direct personal long-term follow up (>10 years) for all variables was available for 31 of the 48 patients (65%).

Results: The patient population was 63% female with a mean age of 56 years at time of presentation (range = 29–82). The majority of patients presented with left-sided symptoms (73%, 35/48). The PICA, the most common offending vessel, was involved in 83% of cases (40/48). Forty-five of 48 patients (94%) experienced complete, immediate relief of pain following MVD. There was no surgical mortality. Thirty-five percent of patients (17/48) experienced some postoperative cranial nerve deficits including dysphagia (17%, 8/48), hoarseness (15%, 7/48), and facial palsy (2%, 1/48); however, symptoms only persisted in 15% (7/48). Of the 31 patients for which long-term follow up was available, all patients who experienced relief of symptoms continued to be free from pain at least ten years later.

Discussion: Surgical treatment of GPN has historically relied on destruction of a portion of the glossopharyngeal and vagus nerves. With recent advances in microsurgery, MVD has been reported to be effective for GPN; however, the efficacy, durability, and complication risk of MVD have been questioned. We are presenting the largest series to date of patients treated with MVD for GPN including complete long-term follow-up.

Conclusions: Microvascular decompression is a safe and efficacious treatment for glossopharyngeal neuralgia and this benefit appears to be durable.

Linear Accelerator Radiosurgery for the Treatment of Trigeminal Neuralgia
Zachary A. Smith, B.A., Leonardo Frighetto, M.D., Antonio A. F. De Salles, M.D., Ph.D., Timothy D. Solberg, Ph.D., Robert E. Wallace, Ph.D., Cynthia Cabatan-Aswang, N.P., Michael Sekh, M.D. and Judith M. Ford, M.D. (Los Angeles, CA)

The authors sought to assess the efficacy and complications of linear accelerator (LINAC) radiosurgery for trigeminal neuralgia. Between August 1995 and February 2001, 60 patients were treated with a dedicated LINAC for radiosurgery. The median patient age was 66.1 years (range 45–88 years). Forty-two patients had essential trigeminal neuralgia (70%), 11 patients had secondary facial pain (18.3%), and seven patients had atypical features (11.7%). Twenty-nine patients (48.3%) had previously undergone other surgical procedures. Doses varied between 70 and 100 Gy (mean 83.7 Gy), with the last 35 (58.3%) patients treated at 90 Gy. Treatment was focused at the trigeminal nerve root entry zone. Follow up was conducted by a third party, independent of each patient’s care. At last follow up (mean 17 months, range 2–70 months) 37 (88.1%) of the 42 patients with essential trigeminal neuralgia had sustained significant pain relief (good plus excellent results). Twenty-three patients (54.7%) were pain free without need of medication (excellent outcome), 14 patients (33.3%) had a 50% to 90% reduction in pain with or without medication usage (good outcome), and five (9.5%) had either minor improvement or no relief. Of 11 patients with secondary facial pain, significant relief was achieved in six patients (54.5%). Poorer results were found in patients with atypical pain. Fifteen (25%) of the 60 patients developed new numbness...
Calendar of Events

17-22 August 2002 - 10th World Congress on Pain
Location: San Diego, CA
WWW: www.iasp-pain.org/02congopen.html
e-mail: iaspexec@juno.com

21-26 September 2002 - Annual Meeting of the CNS
Location: Philadelphia, PA
WWW: www.neurosurgery.org/cns/meetings/2002/

14-17 November 2002 - 4th National Conference
Trigeminal Neuralgia Association
Location: San Diego, CA
Host: University of California, San Diego
Dr. John F. Alksne
WWW: www.tna-support.org

18-23 February 2003 - 19th Annual Meeting
American Academy of Pain Medicine
Location: The Fairmont, New Orleans, LA
WWW: www.painmed.org/
e-mail: aapm@amcetec.com

26 April - 1 May, 2003 - Annual Meeting of the AANS
Location: San Diego, Calif.
WWW: www.neurosurgery.org/aans/meetings/2003
Phone: 1.800.566.AANS (2267) or 847.378.0500
e-mail: abstracts@neurosurgery.org
abstract submission deadline September 13, 2002

Trigeminal Neuralgia Association - NEW ADDRESS!
Trigeminal Neuralgia Association
2801 S.W. Archer Road, Suite C
Gainsville, Florida 32608
Phone: 352-376-9955
Fax: 352-376-8688

Letters to the Editor

One of the main purposes of Pain News is to promote communication among section members. Your questions, comments and insights increase the value of the section for all. Please send your input to Kim J. Burchiel, M.D., editor, Pain News at burchiek@ohsu.edu or by fax to (503) 494-7161.

Commentary

I would like to respond to the abstract included in the Spring 2002 Pain News published by the AANS/CNS Section on Pain “Al-Banyon A, Mantle R, Benoit BG: Long Term Inflation Time of 20 minutes Increases Remission Time in Percutaneous Balloon Rhizolysis for Trigeminal Neuralgia.”

In this abstract the authors conclude “Long term balloon inflation times of 20 minutes significantly improve the duration of remission in cases of trigeminal neuralgia, but also increases the duration of postoperative facial numbness, which is usually well tolerated.” Whereas the lancinating elements of trigeminal neuralgia respond to trigeminal nerve destruction, the neuropathic pain that is generated is not “usually well tolerated.” Recurrence rate is an inadequate measure of successful treatment of trigeminal neuralgia pain. An abstract that advocates compression times that are likely to lead to dense hypesthesia bears a responsibility for accurately reporting the effect of the nerve destruction that has ensued. Unfortunately, this abstract lacks this vital element and, as such, is misleading. The focus of the statistical evaluation used in the abstract is on the relation between duration of balloon compression and generation of numbness. Previous literature confirms authors’ finding that longer compression is more likely to be associated with postoperative hypesthesia. This does not justify their conclusion that more is better in this case.

Jeffrey A. Brown, M.D.
Professor of Neurological Surgery
Wayne State University School of Medicine

Pain Section
Young Investigator Fellowship Award 2003

Eligibility: Applicants must be M.D.s who have been accepted into, or who are currently in, approved residency training programs in neurological surgery in North America.

Description: The Fellowship is offered as a two-year commitment, totaling $70,000 or a one-year grant of $40,000.

Supports: Advanced Research in Pain.

Sponsor: Neurosurgery Research and Education and Foundation (NREF) and Medtronic, Inc.

Submit applications to: NREF, 5550 Meadowbrook Drive, Rolling Meadows, IL 60008

Deadline: November 15, 2002

Abstract: Functional neurosurgery is surgery designed to change the function of the nervous system. It might involve modification of functioning pathways to interrupt conduction of pain sensation or interruption of malfunctioning pathways to abolish abnormal movements or other symptoms. Some stereotactic surgery is functional in nature, but stereotactic techniques can be used for other purposes as well.

Recently, the neurosurgical community has witnessed a renaissance in the use of therapeutic brain stimulation for the treatment of movement disorders and other emerging areas. This technique, considered today as one of the most technologically advanced in the neurosurgical armamentarium, has its roots in over 100 years of diagnostic human brain stimulation and fifty years of neurosurgical experience with therapeutic stimulation of the human brain.

Improvements in stimulation equipment, advances in imaging and computer-assisted navigation devices, breakthroughs in anatomic and physiologic brain mapping, and the realization of the limitations of medical therapies have all contributed to the renaissance of brain stimulation techniques.

We discuss the multifaceted history of therapeutic human brain stimulation in the movement disorders arena, the current clinical results, as well as the future scope of this rapidly evolving field.

History of Therapeutic Human Brain Stimulation

The first report of direct stimulation of the human brain was by Roberts Bartholow1 of Cincinnati, Ohio in 1874. Bartholow inserted insulated needle electrodes through the exposed dura and brain of a 30-year-old woman with a scalp defect secondary to an erosive basal cell carcinoma. Electrical stimulation was catastrophic producing a variety of effects, including contractions of the contralateral extremities, unpleasant sensory experiences, and, with increasing amounts of current, focal and then generalized seizures.

Stereotactic neurosurgery, introduced by Spiegel and Wycis1 in 1947 offered a less invasive alternative to open neurosurgical ablative procedures for the treatment movement disorders. It soon became evident that this technology was well-suited for the placement of stimulating electrodes into the brain with decreased risk to the patient as compared with open procedures.

The first systematic use of chronic deep brain stimulation for the treatment of movement disorders is attributed to Bechtereva and colleagues in Russia in 19674. The Russian group reported successful therapeutic effects, lasting for up to three years, in patients with Parkinson's disease, Wilson's disease, and torsion dystonia, although detailed outcome measures and complications were not provided.

The modern era of deep brain stimulation for movement disorders began in 1987, when Alim-Louis Benabid (in Grenoble, France)5 began the systematic use of chronically implanted Thalamic electrodes for long-term tremor control in patients with Parkinsonian and essential tremor. Benabid appears to have been the first to recognize the importance of high frequency stimulation (130 Hz or greater) for a consistent beneficial effect.

Technique of Brain Stimulation

The basic technique for deep brain stimulation is the precisely targeting of basal ganglia nuclei and thalamic nuclei involved in the physiopathology of the movement disorder. The fundamental algorithm of functional stereotactic localization involves, in some form or another, anatomic localization of the initial target followed by physiologic verification.

Anatomical Targeting

Anatomical targeting is performed using stereotactic coordinates from fixed structures in the brain, such as the anterior and the posterior commissure. In addition, stereotactic atlases, in which cadaver brains were sliced and oriented with respect to landmarks such as the anterior and posterior commissures6,7,8 allow for target localization in stereotactic coordinates.

The introduction of computerized tomography (CT) and Magnetic Resonance Imaging (MRI) into the stereotactic field provided neurosurgeons with additional flexibility in target selection. Image fusion algorithms, which combine the anatomic detail of MRI with the low spatial distortion of CT, are currently in use, allowing the correction of the inherited MRI distortion and, as consequence, a better precision in targeting9.

Physiologic Verification

Because of the frequent discrepancies between anatomical and physiological localization, a number of physiologic verification methods exist: microelectrode recording (MER), semimicroelectrode recording, and macrostimulation. While microelectrode recording can distinguish single cell activity10, the semimicroelectrode reflects the activity of a larger population of cells.

Macrostimulation, stimulation through a relatively large diameter electrode (on the order of 1 mm in diameter) at the target, is used in all DBS cases prior to final implantation of the electrode. Prior to permanent implantation of the DBS electrode, macrostimulation allows the physician to assess for both the therapeutic effects of stimulation (reduction of tremor, rigidity, or pain), as well as for possible untoward effects (i.e. paresthesias, motor contractions, ocular deviation). As the stimulation parameters used during this testing phase are usually similar to those which will be used for chronic stimulation, macrostimulation should approximate the effects of chronic therapy.

Most common targets:

Thalamic Stimulation for Parkinson's disease

The Ventrolateral (VL) nucleus of the thalamus had been targeted since the early 1950's as a lesioning target11. While
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Active Members: Members shall be physicians who are members of The American Association of Neurological Surgeons and who are actively interested in the management of pain problems. Active members have the right to vote and hold office and shall pay dues.

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An application, in Adobe Acrobat format, for membership in the Joint Section on Pain can be located at www.neurosurgery.org/pain/Painapp.PDF and on page 15 of this issue.

We encourage you to forward this application to colleagues with interests in pain management.

The goals of the Section are to assure the highest quality of medical care for the management of patients with pain problems and to assure an appropriate socioeconomic and political climate conducive to the effective and efficient delivery of medical care to patients with pain problems.
both the thalamus and globus pallidus were used as targets during the 1950’s, by the late 1950’s, most stereotactic neurosurgeons gravitated to the thalamic target, specifically the Vim nucleus, lesions of which dramatically improved tremor. Thalamotomy thus became the primary surgical target for Parkinson’s disease and for tremor of other etiologies, with excellent long-term tremor suppression, but with little effect on other Parkinsonian symptoms, nor on the progression of Parkinson’s disease. The mechanism of action of Vim DBS, is thus thought to be similar to that of thalamotomy, which, in turn, is thought to reflect the interruption of a cerebellar-thalamic-motor cortical circuit or of a spino-thalamo-cortico-spinal circuit.

**Globus Pallidus (GPi) Stimulation for Parkinson’s Disease**

In 1992, Laitinen et. al. reported the beneficial effects of posteroverentral pallidotomy, performed by Leksell throughout the 1950’s, in alleviating Parkinsonian tremor as well as other symptoms including bradykinesia, rigidity, and drug-induced dyskinesias. For those neurosurgeons already convinced of the efficacy of thalamic brain stimulation for tremor control, the GPi became the obvious next target for chronic stimulation to treat the above symptoms. In 1992, Siegfried began chronic stimulation of the Globus Pallidus internus in Parkinsonian patients with severe bradykinesia, on-off fluctuations, and speech and gait disturbance. As with Benabid’s first reported case of Vim stimulation, the initial indication for pallidal DBS was the avoidance of the side effects of bilateral pallidotomy, the most serious of which are cognitive and speech disturbances. GPi stimulation is currently used by a number of centers for the treatment of refractory Parkinson’s disease, with beneficial effects on tremor, rigidity, bradykinesia, and dyskinesias similar to that of pallidotomy.

**Subthalamic Nucleus (STN) Stimulation for PD**

In 1993 Benabid implanted a stimulating electrode in the STN of a 51 year patient with severely disabling akinetorrigid PD with severe on-off fluctuations. Chronic high-frequency stimulation at 130 Hz resulted in alleviation of contralateral akinesia without inducing any dyskinesias. Since that time, the STN is increasingly becoming the preferred target for chronic electrical stimulation in PD at most centers, effective in treating akinesia, drug-induced dyskinesias, rigidity and tremor. The anti-dyskinetic effect of STN stimulation is believed to be secondary to a reduction in levodopa requirements following surgery, rather than a direct anti-dyskinetic effect of stimulation as seen with GPi DBS. However, some are reporting a direct anti-dyskinetic effect of STN stimulation.

**The Future**

It is safe to say that continued advances in the field will arise from work performed concurrently on a number of fronts:

1. **Improved understanding of mechanisms**: Expanding our understanding of these mechanisms will require a multifaceted approach, consisting of:
   - **Laboratory investigation**: Major advances in our understanding of Parkinson’s disease pathophysiology have come from the MPTP primate model. Similar advances in understanding of other disease states are essential to clearly defining and expanding the therapeutic scope of these techniques. **Human studies**: **Intraoperative Studies** The functional neurosurgical operating room must continue to be viewed as our primary locus of information acquisition. Unfortunately, the practical limitations of extensive microelectrode recording, including increased risk to the patient as well the financial considerations of increased operating room time, will continue to limit the amount that can be learned in the OR. **Non-Invasive Studies** As new studies surface describing the effects of brain stimulation on CNS activation patterns, current hypotheses as to the mechanisms of DBS activity may need to be revised.

2. **Technological Improvements**: The technology in use today in the clinical setting is, in effect, at least a decade old. It is likely, therefore, that future improvements, much like the ones of the past decade, will first find their way to the clinical arena in countries outside the United States. Improvements in electrode and pulse generator design, combinations of stimulation and infusion devices, improved programming algorithms, “smart” pattern-recognition devices which can modulate their stimulation based on physiological input, and advances in battery technology will undoubtedly be a boon to the field. With today’s explosion of the internet and communications technology, it is not unlikely that in the near future, patients with implantable stimulators will have their devices analyzed and adjusted via the internet or satellite.

3. **Change in societal attitudes**: It is perhaps the nature of our field that some neurosurgical procedures will always be met with skepticism and distrust. Despite this, as we enter the information era, it is imperative to educate both the medical community and the lay public of the new therapeutic possibilities offered by neuroaugmentative procedures.

**References:**


cont. on Page 12...
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**Peripheral Nerve Stimulators for Pain Control**
Tiel, Robert L.

The Surgical Treatment of Entrapment Neuropathies of the Lower Extremity
Gildenberg, Philip L.

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Boockvar, John A.; Zager, Eric L.

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of the nerve, whereas compression may occur anywhere around the circumference of the nerve or anywhere along its length. All areas of the nerve are easily accessible with the endoscope. In our series, 100% of patients were found to have arterial compression at or near the root entry zone. Thirty-four percent of patients would have had negative explorations and/or inadequate decompressions if it were not for the use of the endoscope. More vigorous retraction would probably allow some of the vessels to be seen; however, it was in part to avoid such retraction that inspired the senior author (CT) to apply the endoscope to this operation.

The overall complication rate of 13% experienced in this study is similar to that reported in the literature in other large series of non-endoscope-assisted MVDs. Importantly, the addition of endoscopy did not increase the rate of infection or cause other cranial nerve damage. A number of technical issues related to the use of the endoscope have been raised. One of the concerns most frequently cited is the fact that the view the endoscope provides is two-dimensional. Certainly one traverses a steep learning curve in the process of attaining the visuomotor skills necessary to work comfortably using the video image. While disorienting for the novice endoscopist, this theoretical limitation seldom presents much difficulty for most surgeons once they become familiar with it.

A second debate exists over whether more or less access is needed to use the endoscope. One of the eventual goals of the use of the endoscope is to reduce the cerebellar retraction needed to expose the full subarachnoid extent of the nerve, and thereby to avoid complications associated with retraction, such as hearing loss, cerebellar swelling, and cerebellar infarction. In the “endoscope-assisted” surgical role, the instruments are introduced around the endoscope, so adequate exposure is required to place the endoscope and work. It is debatable whether less retraction is required when using the endoscope to perform microvascular decompression versus in the usual no-retractor microscopic technique. At a minimum, the endoscopic technique is compatible with the smallest of cranietomies. In our experience, it contributes to a smaller opening and less retraction.

We recognize that this series is small compared to the large number of cases that have been performed microscopically, and acknowledge that the follow-up is still short. It is too early to conclude what effect the addition of endoscopy will have on long-term clinical outcomes. However, in our preliminary experience, endoscopy has been a valuable adjunct both in cases where an adequate decompression was believed to have been performed and in cases where no compression was found with microscopy alone. It should be considered as a useful adjunct in all cases in which no clear vessel is identified with a microscopic exploration, and equally should be strongly considered in all other cases to exclude sources of compression, which might otherwise be missed.

following the procedure. No other significant complications were found. Pain relief was experienced on average at 2.7 months (range 0–12). Magnetic resonance imaging at follow up demonstrated enhancement of the trigeminal nerve or nerve root in eight (33%) of 24 patients.

Linear accelerator radiosurgery is a precise and effective treatment for trigeminal neuralgia. Patients were treated expeditiously with significant pain relief and few operative complications.

**Linear Accelerator Radiosurgery Using 90 Gy for Trigeminal Neuralgia**


The purpose of this retrospective case series is to evaluate treatment of trigeminal neuralgia with 90 Gy delivered by a Novalis dedicated linear accelerator (LINAC). Twenty-five patients with essential trigeminal neuralgia underwent treatment with the dedicated LINAC from March 1999 to March 2001.

All patients were treated using a 5-mm collimator to a dose of 90 Gy at the 100% isodose line in one fraction. Treatment isodose was directed to the root of the trigeminal nerve adjacent to the pons. Patient follow up (2–27 months) was completed in the neurological outpatient clinic and by phone with patients. All patients obtained good to excellent pain relief with treatment. Nineteen (76%) of 25 patients achieved excellent pain relief (pain free without need of medication). Six patients (24%) achieved good pain relief with 50 to 90% reduction of pain with or without medication. The mean time to relief was 2.5 months. Seven (28%) patients relapsed 4 to 13 months posttreatment. Additionally, eight patients (32%) developed numbness, but no patient developed painful numbness or facial weakness.

Linear accelerator–based stereotactic radiosurgery using the Novalis system with a 5- mm collimator to deliver 90 Gy at the 100% isodose line is a safe and effective method for the treatment of trigeminal neuralgia.
Chronic Low-Back Pain Following Surgery for Central Lumbar Disc Herniation: Comparison of Two Surgical Methods

Foad Elahi (Tehran, Iran)

Introduction: Lumbar disc surgery is one of the most common procedures in neurosurgery. Yet regardless of the technique used, open disc surgery is associated with a number of complications, (a rate of 1.6-15%). The object of this study was to evaluate two surgical methods used in our department over the last decade. Evaluation was based on the complication rates of each method with a focus on the remaining post surgical low back pain. Other objectives were: 1) lumbar discectomy or neucleotomy as the mediator of radicular pain relief; 2) minimum complication rate; 3) minimum surgical time and hospital stay.

There is a plethora of articles in various orthopedic and neurosurgical journals which rely on more than twenty different surgical and non-surgical approaches which fulfil the above mentioned criteria/objectives. Many of which, site a remaining low back pain rate post surgery. If one looks at the epidemiological and social aspects, chronic low back pain patients present a major problem. It was not one of our objectives to elucidate the question of remaining or initiation of low back pain following a successful surgery due to psychological factors.

Material and Methods: Our indication for surgery in patients with lumbar spinal disc herniation was primarily based on the progression of clinical symptoms and unresponsiveness to conservative treatment, as well as the radiological detection of disc herniation with compressive abnormalities located anterior to the spinal theca sac or nerve roots. The most important indication for surgery was “pain” which was unresponsive to conventional treatment strategies. In a double-blind parallel-group cohort study, 400 patients with centrally herniated lumbar disc at the L4–5 level (diagnosed by MR imaging and/or CT myelography) were divided into two groups (200 in each group). All patients were candidates for surgery; the indication for surgery was neurological deficit, occurrence and/or progression, and unresponsiveness to conventional treatment. The most common indication for surgery was unresponsiveness to medical treatment. Half of the patients underwent interlaminar approach and L4–5 discectomy and half underwent bilateral microsurgical discectomy. The study period was between 1987 and April 2000. Pain analysis were made in accordance with the visual and numerical pain analogue scale: need for analgesic medication; discontinuation of medication; pain free ambulation; daily physical activities. We compared low back pain, radicular pain and neurological deficits both preoperatively and post operatively as well as surgical complications and length of hospital stay for each group.

Results: Group A, is conventional surgery and group B microsurgical. The percentages of patients with remaining low-back pain during the 1st month, 3 months, and 6 months after surgery was significantly and dramatically different between the two groups.

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Age</td>
<td>38.41yrs</td>
<td>38.54yrs</td>
</tr>
<tr>
<td>Mean Hospital Stay</td>
<td>11.68hrs</td>
<td>9.68hrs</td>
</tr>
<tr>
<td>Neural deficits pre- surgery</td>
<td>83.5%</td>
<td>72.4%</td>
</tr>
<tr>
<td>Neural deficits post- surgery</td>
<td>1.2%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Low Back Pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pre- surgery</td>
<td>34.5%</td>
<td>39%</td>
</tr>
<tr>
<td>post- surgery (1 month)</td>
<td>15%</td>
<td>9%</td>
</tr>
<tr>
<td>post- surgery (3 months)</td>
<td>3.5%</td>
<td>2%</td>
</tr>
<tr>
<td>post- surgery (6 months)</td>
<td>1%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Surgery Induced Low Back Pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 month follow-up</td>
<td>30%</td>
<td>14.3%</td>
</tr>
<tr>
<td>3 months follow-up</td>
<td>7%</td>
<td>1.6%</td>
</tr>
<tr>
<td>6 months follow-up</td>
<td>6%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Radicular Pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pre- surgery</td>
<td>88%</td>
<td>94.2%</td>
</tr>
<tr>
<td>post- surgery (1 month)</td>
<td>8.5%</td>
<td>13%</td>
</tr>
<tr>
<td>post- surgery (6 months)</td>
<td>1.5%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Straight leg rising test (slrt)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pre- surgery</td>
<td>68%</td>
<td>75.5%</td>
</tr>
<tr>
<td>3 months follow-up</td>
<td>9.5%</td>
<td>8%</td>
</tr>
<tr>
<td>6 months follow-up</td>
<td>1.5%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Complication Rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.8%</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

Group A: interlaminar conventional L4-L5 discectomy
Group B: microsurgical discectomy

Complications of surgery were mainly dural tearing and roots violation. There was one wound infection, and subsequent wound dehiscent and 4 patients with low-grade fever and slightly increasing in erythrocyte sedimentation (esr) without obvious stigmata of infection, Group B complications were less than that of Group A. We found nearly 2% chronic post surgical pain (cpsp) for both groups, nevertheless it was not our study aim to declare cpsp, and our study is deficient at this area.

Conclusions: Based on the results of long-term study, we find that early microsurgical discectomy is superior in providing postoperative and long-term pain relief compared with conservative management.

In some patients, postsurgical pain persists long after the natural healing processes should have been completed. Chronic post surgical pain (cpsp) after disc surgery is in general a neglected area of study: for many relatively common neurosurgical procedure the literature is sparse and for many others the problem appears to have been ignored altogether.

We propose the following criteria for cpsp diagnosis
1) pain developed after surgery
Balloon kyphoplasty: Is pain ... (cont. from Page 2 ...)

height measurements changed slightly but were not significantly different from the average obtained one month after surgery (Tables 1-2).

### Table 1

<table>
<thead>
<tr>
<th></th>
<th>Anterior Height %</th>
<th>Midline Height %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative</td>
<td>65</td>
<td>60</td>
</tr>
<tr>
<td>1 mo. postop</td>
<td>85</td>
<td>90</td>
</tr>
<tr>
<td>6 mo. postop</td>
<td>81</td>
<td>87</td>
</tr>
<tr>
<td>1 yr. postop</td>
<td>81</td>
<td>86</td>
</tr>
</tbody>
</table>

### Table 2

<table>
<thead>
<tr>
<th></th>
<th>Change in %</th>
<th>P-value</th>
<th>Change in %</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Anterior</td>
<td>Midline</td>
<td>Anterior</td>
<td>Midline</td>
</tr>
<tr>
<td>Preop vs. 1 mo. postop</td>
<td>22.0</td>
<td>&lt;0.0001</td>
<td>30.9</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>1 mo postop vs. 6 mo. postop</td>
<td>0.1</td>
<td>0.967</td>
<td>2.6</td>
<td>0.127</td>
</tr>
<tr>
<td>1 mo postop vs. 1 yr. postop</td>
<td>-1.5</td>
<td>0.459</td>
<td>-0.8</td>
<td>0.740</td>
</tr>
</tbody>
</table>

Selected Posters (cont. from Page 13 ...)


**The Nucleus Caudalis Dorsal Root Entry Zone Operation. Technical Update and New Electrodes for Nucleus Caudalis and Nucleus Solitarius Lesioning**

*Amr O. El-Naggar, M.D., F.A.C.S. (Somerset, KY) and Blaine S. Nasbeld, Jr., M.D. (Durham, NC)*

**Introduction:** The nucleus caudalis dorsal root entry zone (DREZ) operation has its established role in the treatment of intractable craniofacial pain. We now introduce five different electrodes and new lesion parameters that significantly reduce the incidence of complications including ataxia and dysthetic pain as well as the incidence of pain recurrence. Vulnerable structures surrounding the nucleus caudalis including the spinocerebellar tracts, the pyramid, decussation, the sensory decussation, the cuneate fasciculus, as well as the nucleus ambiguous and the restiform body are therefore spared.

**Methods:** The new electrodes take into account the size of the nucleus at each location, the thickness of the overlying trigeminal tract, the axis of the nucleus, its inclination to the vertical plane. Each electrode has its specific active tip, insulation length, and angle of inclination. An exact description of where each electrode should be placed in reference to the obex, the C-2 dorsal rootlets, and fibers of the 11th cranial nerve is outlined.

**Results:** Use of these electrodes yielded excellent and good results in 14 (87.5%) of 16 patients, fair and poor results in two patients (12.5%), and no recurrence (0%) in the entire group of 16 consecutive patients with intractable facial pain syndromes and intractable headache. Transient ataxia was demonstrated in eight cases, but its duration was no more than 3 days. No patient had any persistent complications.

**Conclusion:** The introduction of the new electrodes has significantly reduced the complication rate and incidence of recurrence of intractable craniofacial pain syndromes after nucleus caudalis DREZ surgery.

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❑❑❑❑❑ International

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(A) Are you now certified by the American Board of Neurological Surgery?  ❑ Yes    ❑ No

(B) Are you a member of

1. The American Medical Association?  ❑ Yes    ❑ No

2. A Local or Regional Medical Society?  ❑ Yes    ❑ No

3. A State or Provincial Medical Society?
   Name: ________________________________________________________________  ❑ Yes    ❑ No

4. American Association of Neurological Surgeons?  ❑ Yes    ❑ No

5. Congress of Neurological Surgeons?  ❑ Yes    ❑ No

6. The American Academy of Pain Medicine?  ❑ Yes    ❑ No

7. International Association for the Study of Pain?  ❑ Yes    ❑ No

8. American Pain Society?  ❑ Yes    ❑ No

_____________________________________________ _____________________________________
Signature of Applicant Date

Please return completed application with your membership fee of $50 to:
AANS/CNS Section on Pain
Department 77-7550
Chicago, IL  60678-7550