Message from Chairman

Jeffrey Brown, MD

When I first arrived in Toledo, Ohio I had the good sense to attend Grand Rounds in Ann Arbor at The University of Michigan. This was when both Edgar Kahn and Richard Schneider, pioneers both in neurosurgery, were active attendees.

Their presence allowed for a fascinating breadth of knowledge and experience to be communicated in each session. In his autobiographical “Journal of a Neurosurgeon,” Dr. Kahn wrote of his training in the treatment of trigeminal neuralgia under Dr. Max Peet, the preeminent speedy practitioner of the subtemporal approach to the trigeminal ganglion. Dr. Peet “frequently divided the sensory root of the Gasserian ganglion ten minutes after making the skin incision.” More important than the surgical technique, Dr. Kahn wrote of the life lesson he acquired from Dr. Peet.

He wrote, “…the good surgeon is one… who makes a difficult operation look easy. I have often thought of what a great surgeon Joe DiMaggio might have made.” Dr. Kahn continues, “Speed in surgery is… a matter of knowing what one wants to do and then doing it…It is comparable to good art. Examine a line drawing by Picasso or Matisse and see the marvelous effect they achieve with so few lines.”

In my last message, I wrote of the sculptural art of ancient Greece and Italy and how the artists of that era were able to capture in marble the expressions of anguish that permeate the soul of one who is patient with his suffering. The word patient is after all derived from the Latin patientia, suffering, and, according to the OED, was probably first used in its modern connotation in English by Chaucer in the fourteenth century, “To us Surgeons aperteneth…to our patienz that we do no damage.” It is significant that the first usage of this now well used word is tied to our also well known first rule of surgery. It is also important that in the summary words of Dr. Kahn’s own story, he chose a chapter on his “Exposure to Art.”

In an era of managed care and outcome evaluation, where management consultants retain power over physician professionals, there is no box to check on the surgeon’s scorecard representing the artfulness he exudes while delivering his care. It is, of course, “care” that we are in the business of providing. Instead of evaluating the clarity of the lines that a Picasso paints, we review the minutes spent in the operating room and length of stay in the hospital. “Care” evaluation translates to bargraphs on a “patient satisfaction” survey. Great art and great care are, however, priceless.

Often we are as neurosurgeons at odds with that which will provide immediate satisfaction to our patients who are in chronic pain - more narcotics or another spine procedure. In past symposia the section has addressed the rational use of narcotics in chronic benign pain to address this central problem to our practice. This topic will be revisited during the breakfast seminar on “Neurosurgical Management of Intractable Pain” to be given during the upcoming AANS Annual Meeting in New Orleans. Other topics discussed in this seminar should include DREZ surgery, spinal stimulation and infusion techniques and neurostimulation for intractable ischemic chest pain.

Our section symposium at this meeting will be on the treatment of the cranial cephalgias. Practical Workshops are offered on Trigemi-
nal Neuralgia and Minimally Invasive Procedures for Spinal Pain Syndromes. This is a new workshop and will teach percutaneous techniques for the diagnosis and treatment in the spine. Such techniques include many that are more often performed by anesthesiologists: facet and root blocks, epidural injections and sympathetic blocks. Also to be discussed will be discography and intradiscal therapy. Another breakfast seminar offered will cover “Contemporary Percutaneous Techniques for Trigeminal Neuralgia.” In addition to the section symposium and scientific papers during the section meeting, there will be a paper of interest presented in the opening Plenary Session on the treatment of neuropathic facial pain by motor cortex stimulation.

On the Thursday and Friday April 22-23, 1999 preceding the AANS Annual Meeting the Section will sponsor our Satellite Symposium on Pain Management. Ken Follett and Sam Hassenbusch have once again organized this well-received and comprehensive program that will include both didactic and practical sessions. This year, as was done last year, a CD-ROM will be published after the symposium containing the audiotaped presentations and digitized slides of all formal didactic sessions.

A subspecialty fellowship training proposal has been forwarded by the Joint Section on Pain to both the Society of Neurological Surgeons and the Residency Review Committee for evaluation. These organizations will review it in parallel as organized neurosurgery moves closer towards accreditation of subspecialty fellowship programs in pain, pediatric, tumor and vascular neurosurgery. These proposals are available for review through NAVAON-CALL. Jaime Henderson has worked diligently to design our contribution to neurosurgery’s home on the internet. Also available is a proposed core curriculum for progressive education in neurosurgical pain management during residency training. Kim Burchiel and Ken Follett have developed these detailed proposals. The documents should help us to standardize the education of neurosurgeons in this field. I encourage discussion and further comment from each of you.

In April I will become a member of The Board of Directors of the AANS representing the interests of the Pain Section and the Northwest Quadrant of the CSNS. The AANS in the last three years has moved to integrate the voice of the Pain Section and all other sections into the strategic planning of the organization. The surgery and treatment of pain is integral to all other areas of neurosurgery. It remains our responsibility as neurosurgeons with special interest and expertise in this field to maintain our presence.

Jeffrey Brown, M.D.
Medical College of Ohio
Most neurosurgeons are keenly aware of the plight of a trigeminal neuralgia patient when they have reached that level of intractable pain and their quality of life is totally diminished. What you may not be aware of is that there is an organization dedicated to addressing the problems confronting these individuals who are afflicted with this excruciatingly painful disorder.

The Trigeminal Neuralgia Association (TNA) is a nonprofit, tax exempt organization founded in 1990 to provide support and encouragement to TN patients, to promote awareness of TN among the public and among the professional medical and dental communities, and to act as an advocate for TN research. Aided by a Medical Advisory Board of national composition and reputation, the Association’s numbers have swelled to over 9,000 patients. It offers its resources without charge via mailings and the Internet and recently held its second National Conference attended by physicians and patients from the U.S. and overseas. The Association also sponsors 41 support groups throughout the U.S. to provide encouragement and comfort to TN patients on a local and personal level. Two groups have formed in Canada and one is forming in the U.K.

Since its inception, the Association has seen as its organizational priority the dissemination to TN patients of credible information concerning available medical and surgical options. At the same time, the Association seeks to reduce the isolation of those affected by this disorder. These twofold objectives are achieved through a variety of means including:

- Telephone Access to the Association’s Staff and Volunteer Support Contacts
- Distribution of Informational Packages
- Newsletters
- The Association’s Internet Web site: http://neurosurgery.mgh.harvard.edu/tna/
- Local Support Group Meetings and mailings
- Biennial National Conferences for Physicians and Patients

Aided by its Medical Advisory Board TNA recently has undertaken the development of the first patient registry for TN patients and others with acute facial pain. A two page survey containing patient history concerning onset, medical and surgical treatments, outcome and patient satisfaction, as well as other personal characteristics, such as hereditary factors, was mailed to over 9,000 patients in TNAs database. The returns are being compiled by the University of Arkansas. Hopefully, data retrieved from the survey will provide a valuable insight into the nature of this disorder and treatment effectiveness.

In July of this year NIH in conjunction with TNA is planning to hold its first all-day scientific meeting on trigeminal neuralgia. Leaders in clinical research and clinical management will come together to share findings and develop priorities to address the present and future needs in the treatment of TN. Hopefully, this initial meeting will be the precursor of many more into the investigation of this perplexing and painful disorder.

If you have a keen interest in trigeminal neuralgia and are interested in knowing more about TNA, you may contact the national office at:

Trigeminal Neuralgia Association,  
P.O. Box 340, Barnegat Light, NJ 08006  
Telephone: 609-361-1014   Fax: 609-361-0982  
E-mail: tna@csionline.net

or feel free to contact one of your colleagues who is a member of the TNA Medical Advisory Board ((Affiliations (listed below)):

- Dr. Peter Jannetta, M.D., Chairman, University of Pittsburgh School of Medicine, Dept. of Neurological Surgery
- Dr. John F. Alksne, M.D., University of California, San Diego Medical Center
- Dr. Ronald I. Apfelbaum, M.D., University of Utah Medical Center (Neurosurgery)
- Dr. Ronald Brisman, M.D., Columbia Presbyterian Medical Center, Neurological Institute, New York
- Dr. Kim J. Burchiel, M.D., Oregon Health Sciences University (Neurosurgery)
- Dr. J. Kieth Campbell, M.D., Mayo Clinic-Rochester MN (Neurology)
- Dr. Kenneth F. Casey, M.D., Allegheny University of the Health Sciences, Philadelphia (Neurosurgery)
- Dr. R.A. de los Reyes, M.D., Beth Israel Medical Center-North Division (Neurosurgery)
- Dr. Steven B. Graff-Radford, D.D.S. The Pain Center, Cedars-Sinai Medical Center
- Dr. Stephen J. Haines, M.D., Medical University of South Carolina
- Dr. Yoshio Hosobuchi, M.D., Straub Clinic and Hospital, Honolulu (Neurosurgery)
- Dr. Edward R. Laws Jr., M.D., University of Virginia School of Medicine (Neurosurgery)
- Dr. Parker Mahan, D.D.S., Ph.D., University of Florida College of Dentistry, Facial Pain Center
- Dr. Albert L. Rhoton Jr., M.D., University of Florida College of Medicine, (Neurosurgery)
- Dr. John M. Tew Jr., M.D., University of Cincinnati Medical Center
- April H. Vallerand, Ph.D., R.N., University of Pennsylvania School of Nursing
- Dr. Charles B. Wilson, M.D., University of California San Francisco (Neurosurgery)
- Dr. Ronald F. Young, M.D., Northwest Hospital Gamma Knife Center, (Neurosurgery)
The decision to use ablative techniques to treat neuropathic pain is a complicated one. Certain painful conditions have been shown with excellent long-term studies to be well-treated using ablative techniques; others have not. The fact that the injury to the nervous system is the origin of a given painful condition should give any careful physician pause before offering a treatment that is designed to add new neurological injury. Nevertheless, certain guidelines can be used in making such a decision. These include the fact that all reasonable medical treatments have been tried, that non-destructive procedures have either been tried or are considered ineffective for the pain in question, and that methods (i.e. nerve blocks) which can temporarily test the effect of denervation have proven highly successful. Neurmodulatory techniques such as spinal cord or brain stimulation or neurochemical techniques such as intrathecal drug infusion systems offer the advantage of being reversible and non-destructive. Neuroablative techniques offer the advantage of possibly reducing or eliminating pain without a need for ongoing hardware maintenance and are typically less costly than neuroaugmentative approaches.

Neuroablative procedures that have been shown to be successful in treating neuropathic pain states include the following. Radiofrequency trigeminal rhizolysis (RFL) is an effective treatment for trigeminal neuralgia. Dorsal root entry lesions (DREZ) are effective in reducing or eliminating pain caused by brachial or lumbosacral plexus avulsion and for spinal cord injury pain at the edge of the neurologic deficit (so-called “end zone” pain). Percutaneous cordotomy is indicated in the treatment of unilateral extremity pain caused by malignant disease in patients with a short life expectancy. In each of these procedures, the outcome is as much determined by proper patient selection as by proper techniques in performing the procedure. For example, attempts to use RFL to treat patients who do not have typical trigeminal neuralgia are usually not successful and relatively frequently result in worsening of the patient’s complaints of pain. Likewise, use of the DREZ procedure for upper extremity painful conditions not caused by nerve root avulsion, or in spinal cord injury pain of the diffuse variety will usually not reduce and may actually increase pain.

The principals of lesion making are similar for all procedures that involve radiofrequency techniques. These techniques typically require a combination of anatomical and physiological guidance prior to making a lesion. Anatomical landmarks may be based on direct vision as in the DREZ procedure or radiographic images such as with trigeminal RFL where skull–base fluoroscopic images are used. Physiological guidance is best obtained from the patient during the procedure using the nerve stimulator function of the radiofrequency generator. The amount of current required to produce a physiological effect, typically a report of paresthesias, as well as the location of that effect are important parameters. The specific guidelines for a given procedure are usually explained in the literature describing that procedure with modifications based on the surgeon’s experience.

Neuroablative techniques with relatively high reported success rates, but which are performed by relatively few surgeons include cingulotomy, mesencephalotomy and nucleus caudalis DREZ. Cingulotomy has been reported to reduce painful conditions of both malignant and non-malignant origin. It requires a stereotaxic approach and has a very low complication rate. The same procedure has been used to treat psychiatric conditions such as obsessive-compulsive disorder. Mesencephalotomy also requires stereotactic guidance but has a higher rate of new neurological injury to nearby brainstem structures. The nucleus caudalis DREZ procedure has been used for a variety of conditions.
facial pain conditions including refractory trigeminal neuralgia, and other neuropathic facial pains. It requires direct exposure of the caudal brainstem and should probably be performed only by surgeons with extensive experience in this area.

A few other neuroablative procedures deserve mention. Radiofrequency rhizolysis of thoracic nerves can be used to treat neuropathic pains caused by injury to the nerves originating from thoracic roots. These include intercostal neuralgia, post-thoracotomy or post-nephrectomy pain, and injury to abdominal cutaneous nerves. In such cases, patients should receive excellent pain relief by paraspinal nerve blocks before a permanently destructive procedure is performed. A similar procedure can be successful in treating nerve injury pain following inguinal hernia repair. In such cases, patients should receive near-total pain relief from a T-12 paraspinal block. This can be followed with a T-12 paraspinal rhizolysis. In each of these procedures, it is recommended that the patient be awake for a portion of the procedure so that physiologic feedback can be obtained before performing the rhizolysis.

These and other neuroablative procedures in the treatment of neuropathic pain should be performed only after a thorough review of the patient’s pain history including a psychological profile, after all reasonable medications have been tried, and after consideration of non-destructive techniques. Patients should be warned that, occasionally, pain will be worsened by these techniques. In properly selected cases, neuroablative techniques will give highly rewarding pain relief without a need for maintenance of pumps or stimulators.
Abstracts

Selected Abstracts from the 48th Annual Meeting of the Congress of Neurological Surgeons

October 3-8, 1998

**Trial of Analgesic Epidural Paste in Lumbar Decompressive Surgery**

Nicholas Theodore, MD  
R. John Hurlbert, MD, PhD*  
Volker K.H. Sonntag, MD  
Phoenix, AZ  
*Calgary

Recently, there have been significant advances in the management of chronic pain syndromes. Little attention, however, has been paid to the treatment of postoperative pain. While usually only temporary, postoperative pain is a source of great concern to patients undergoing any type of surgical procedure. Significant pain after surgery can prolong hospital stays and delay patients from returning to work.

Recently, an analgesic epidural paste (AEP) was developed to treat postoperative pain after lumbar decompressive surgery, (1). Consisting of a base of microfibrillar collagen with epidural morphine, methylprednisolone, and aminocaproic acid, AEP is applied directly to the dura after surgery. Although initial results were promising, the compound was not tested in a rigorous fashion.

Consequently, a prospective, randomized, double-blind trial was undertaken at the Barrow Neurological Institute with secondary analysis at the University of Calgary. Sixty patients undergoing first-time lumbar decompressive surgery were stratified by procedure (laminectomy, n=30; discectomy, n=30) and randomized into either the active (AEP) or placebo group. All surgeries were performed by a single surgeon and postoperative pain medication, as needed, was standardized for all patients. Patients were evaluated preoperatively and monitored for 3 months after surgery with the final follow-up scheduled at 1 year.

Physician-derived outcome measures included a detailed neurological examination. Patient-derived outcomes consisted of the Pain Rating Index PRI(R), the Number Words Chosen (NWC), and the measure of Present Pain Intensity (PPI) on the McGill Pain Questionnaire (MPQ), the Aberdeen Back Pain Index (ABPI), and the SF-36. Hospital-derived outcomes included vital signs, length of stay, amount of pain medication used, and complications.

Preoperatively, both groups were similar with respect to demographic characteristics, neurological status, and level of pain. There were no difference in length of stay between groups. The incidence of urinary retention in the AEP group did not increase compared to the placebo group. There were no instances of respiratory depression in either group. Two AEP patients did have superficial wound infections, which were managed on an outpatient basis with oral antibiotics.

Reports of pain on the McGill PRI(R) (p=0.022) and NWC (p=0.035) indices were significantly lower for the AEP group for 6 weeks after surgery compared to those of the placebo group, as were reports on the McGill PPI (p=0.005) index for 3 weeks after surgery. Compared to the placebo group, the AEP group’s perception of general health as reported on the SF-36 survey was significantly enhanced (p=0.015), and the effect persisted for 6 weeks after surgery. The AEP group showed a trend toward reporting more improvement on the ABPI than the placebo group, but statistical significance was not reached.

This study demonstrates that application of an AEP at the time of lumbar decompressive surgery can positively affect patients’ perceptions of pain, can decrease the amount of narcotics they use postoperatively, and can enhance patients’ perceptions of their general health for as long as 6 weeks after surgery. After a 1-year follow-up, no long-term complications have been related to the use of this compound.

Reference


**This article has been accepted for publication in The Journal of Neurosurgery: Spine, April 1999**
The Effect of Timing of Local Anesthetic Administration on Functional Outcome in Lumbar Discectomy Patients - A Prospective Randomized Controlled Trial

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James Embry, CRNA, PhD
Patricia Finestone, RN

Richmond, VA

Introduction: Although lumbar discectomy is highly effective in resolving pain in the vast majority of patients, there still remains a rather frustrating group of postoperative failed back patients. An exaggerated response to pain may play a role in this group. This exaggerated response may have a physiologic basis. Studies in animals have shown that prolonged and substantial cutaneous receptive field changes in dorsal horn neurons can be produced by brief inputs from peripheral unmyelinated afferent fibers in decerebrate spinal rats. This tissue injury results in an increased sensitivity to stimuli post-injury (1). This and other works has suggested that surgical trauma may lead to long term changes within the central nervous system which results in an increased sensitivity to pain in the surgical area (2,3,5). Woolf and Wall (6) have shown that this sensitization can be prevented by neural blockade with local anesthetic when administered prior to the injury. This has lead to the hypothesis that pre-incisional local anesthetic (preemptive analgesia) may be more effective than post-procedural local anesthetic in preventing long-term pain amplification in lumbar discectomy patients. To test this hypothesis, we performed a prospective randomized controlled trial to examine the effect of pre-incisional versus post-procedural Marcaine in 42 lumbar discectomy patient’s postoperative pain and function.

Methods: All patients who were scheduled to undergo a first time lumbar discectomy within the Department of Neurosurgery at The Virginia Commonwealth University/The Medical College of Virginia were identified and were offered the opportunity to participate in the study. Patients were excluded if they had risk factors for administration of bupivacaine or epinephrine. The patients gave informed consent in accordance with the Institutional Review Board of the Medical College of Virginia. On the day of surgery, the operating room nurse made up 2 syringes, one containing 1-200,000 epinephrine and the other containing 1-200,000 epinephrine and 0.5% bupivacaine. The order of administration of these two syringes was randomized. The first syringe was administered immediately after the prep and at least 3 minutes prior to the incision. The second syringe was injected at wound closure. Twenty cc’s were infiltrated on the side of the dissection, attempting to fully infiltrate the skin, paraspinal muscles and periosteum. If the patient was to undergo bilateral discectomy or discectomy at another level, an additional 20cc’s was infiltrated in a similar fashion at that site. Both the pre-incisional and the postprocedural infiltrations were done in a similar fashion.

We chose outcome measures which identified patients who may be considered “failed back” patients. The three main outcome measures of the study were narcotic usage, continued pain at 6 weeks, and lack of improvement in function on the Prolo scale at 3 months. (Table 1) (4).

Table 1: Baseline Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Preop Bupivacaine</th>
<th>Postop Bupivacaine</th>
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<tbody>
<tr>
<td>N</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>Age</td>
<td>41.9 (20-75)</td>
<td>43.7 (21-73)</td>
</tr>
<tr>
<td>% Female</td>
<td>60%</td>
<td>58.3%</td>
</tr>
<tr>
<td># Smokers</td>
<td>65%</td>
<td>50%</td>
</tr>
<tr>
<td>Pain Durn&gt; 1 yr</td>
<td>10%</td>
<td>25%</td>
</tr>
<tr>
<td>SecondaryGain</td>
<td>35%</td>
<td>37.5%</td>
</tr>
<tr>
<td>Preop VAS -S</td>
<td>3.3 (.4-7.2)</td>
<td>3.8 (.4-10)</td>
</tr>
<tr>
<td>Preop VAS -A</td>
<td>4.0 (.4-10)</td>
<td>5.1 (.4-10)</td>
</tr>
<tr>
<td>Preop Prolo-Ec3</td>
<td>75%</td>
<td>41.7%</td>
</tr>
<tr>
<td>Preop Prolo-Fc3</td>
<td>90%</td>
<td>91.6%</td>
</tr>
<tr>
<td>Preop Narcotics</td>
<td></td>
<td></td>
</tr>
<tr>
<td># Patients</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Av Morph Equiv.</td>
<td>82.2 (6.8-189)</td>
<td>25.6 (2.8-47.3)</td>
</tr>
</tbody>
</table>

The narcotic outcome measure equalled the total milligrams of morphine equivalents consumed by the patient during the first 6 weeks after the surgery. In addition, we analyzed the narcotics used while in the hospital immediately postoperatively excluding the discharge medications. The preoperative and 6 week postoperative Visual Analog Pain Scale (VAS) scores were used to define the number of patients whose pain did not improve with surgery. A VAS failure consisted of a postoperative score greater than 0 and a postoperative minus preoperative score which was greater than or equal to 0. The preoperative and 3 month Prolo scores were used to identify the number of patients who did not see an improvement in their level of function at home or at work. A Prolo failure was considered a postoperative score of less than 5 with a postoperative minus preoperative score less than or equal to 0.

The baseline characteristics of age, sex, smoking history, pain duration greater than 1 year, the presence of secondary gain, pre-op VAS and Prolo Scores, the preoperative use of narcotics and their amount were then subjected to step-wise linear regression to assess if any of these factors predicted outcome.

Results: Forty-four patients were randomized. Twenty patients were in group A and received the bupivacaine prior to the incision. Twenty-four patients were randomized to receive the bupivacaine at the end of the procedure. The forty-two

continued on page 8
patients had one level, one sided discectomies and received 20cc’s of 0.5% bupivacaine, and two patients received a total of 40cc’s. The baseline characteristics of the two patient populations are listed in Table 2.

<table>
<thead>
<tr>
<th>Economic Status</th>
<th>Preop Bupivacaine</th>
<th>Postop Bupivacaine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete invalid</td>
<td>50.8 (sd 33.8)</td>
<td>47.7 (sd 45.3)</td>
</tr>
<tr>
<td>E2: No gainful occupation including ability to do housework or continue retirement activities</td>
<td>105.7 (sd 169.3)</td>
<td>77.7 (sd 81.5)</td>
</tr>
<tr>
<td>Able to work but not at previous occupation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working at previous occupation part-time or limited status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Able to work at previous occupation with no restrictions of any kind</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Functional Status</th>
<th>Preop Bupivacaine</th>
<th>Postop Bupivacaine</th>
</tr>
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<tbody>
<tr>
<td>Total</td>
<td>3 (15%)</td>
<td>7 (29%) (p=.26)</td>
</tr>
<tr>
<td>Sensory</td>
<td>4 (20%)</td>
<td>4 (16.7%)</td>
</tr>
<tr>
<td>Affective</td>
<td>4 (20%)</td>
<td>4 (16.7%)</td>
</tr>
<tr>
<td>Economic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F1: Total incapacity (or worse than before operation)</td>
<td>5 (25%)</td>
<td>9 (37.5%) (p=.37)</td>
</tr>
<tr>
<td>F2: Mild to moderate level of lower back pain and/or sciatica (or pain same as before operation) but able to perform all daily tasks of living</td>
<td></td>
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</tr>
<tr>
<td>F3: Low level of pain and able to perform all activities except sports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F4: No pain, but patient has had one or more recurrences of lower back pain or sciatica</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F5: Complete recovery, no recurrent episodes of lower back pain, able to perform all previous sports activities</td>
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The two groups had some dissimilarities at baseline. The difference in preoperative narcotics was predominately due to one patient in the preoperative bupivacaine group who had very high consumption of narcotics preoperatively. There was a difference in the economic scores with a larger number of patients in the preoperative bupivacaine group not working at the time of surgery, however, a greater number of patients in the postoperative bupivacaine group had pain for more than a year. A linear regression analysis revealed that none of these baseline characteristics predicted outcome. The results of the main outcome measure analyses are shown in Table 3. The narcotic usage, both in the hospital and for the total postoperative period was not significantly different between the two groups. The higher total usage in the preoperative bupivacaine group was due to one patient.

The number of VAS failures at 6 weeks were also not significantly different in the two groups. The patients who failed to demonstrate improved function at 3 months were considered Prolo failures. The rate of economic Prolo failures was nearly twice as high in the patients who did not receive preemptive analgesia. The functional scale showed a difference in the same direction, however, neither of these differences were statistically significant.

**Discussion:** In summary, 44 virgin lumbar discectomy patients were given preoperative bupivacaine. The only difference in the treatment of these two groups was whether the bupivacaine was administered prior to the procedure in a preemptive analgesic fashion or administered after the procedure was completed. The number of “failed backs” in the two groups were compared. We did not see a difference in the number of VAS scores. We did detect a difference in the patients improvement in function in both their work and home activities at 3 months, with patients who were given preemptive analgesic experiencing one half the failure rate of the other group, however, this was not statistically significant. We did not identify any baseline characteristics which predicted outcome.

**References:**
The Use of Laboratory Autonomic Function Tests in Evaluating the Results of Spinal Cord Stimulation (SCS) in Reflex Sympathetic Dystrophy

Ricardo Segal, MD
Michael Giuliani, MD
Brett Stacey, MD
Margaret-Beth Ott, BA

Pittsburg, PA

Objective: A prospective study of 40 CRPS patients referred to a neurosurgeon for management and treatment of chronic pain after failing non-interventional multidisciplinary treatment at a Pain Clinic was conducted in order to validate the role of autonomic function tests (AFT) in the diagnosis of CRPS and to determine the effectiveness of spinal cord stimulation (SCS).

Methods: Diagnoses of CRPS type I and II were made/confirmed using the Putative Diagnostic Criteria for Reflex Sympathetic Dystrophy as proposed by Wilson. AFT obtained included Resting Sweat Output (RSO), Quantitative Sudomotor Axon Reflex Test (QSART), and Thermography.

Clinical Signs/Symptoms
- Burning pain
- Hyperpathia/allodynia
- Temperature/color changes
- Edema
- Hair/nail growth

Laboratory Results
- QSART /Thermography
- Bone X-ray studies
- Three phase bone scan
- Response to sympathetic blocks

A score of 6 or more was diagnosed as “probably RSD” (55%), 3-5 as “possible RSD” (17.5%), and less than three as “unlikely RSD” (15%). The remaining 12.5% either refused testing or results are pending. Once a diagnoses of CRPS was confirmed, the diagnosis was further classified into CRPS-I (reflex sympathetic dystrophy) and CRPS-II (causalgia) according to whether a nerve injury was documented or not. Using this criteria, we found that 72% qualified as CRPS-I and 28% as CRPS-II.

Upper extremities were affected in 60% of the cases and lower extremities in 40%. Of the 24 subjects whose upper extremities were affected, 19 were affected in a single extremity, 2 bilaterally, and 2 were migratory (right to left and left to bilateral lowers). Sixteen patients reported origin of symptoms in the lower extremities in which 12 were affected in a single extremity, 1 bilaterally, and 3 were migratory although only subjective symptoms were recorded in one case.

The etiology of CRPS was divided into three categories: iatrogenic, work-related trauma, and miscellaneous.

In the iatrogenic category, 9 cases resulted from surgical procedures, one experienced pain following venipuncture, and one suffered a lacerated left hand in an industrial accident. Subjects categorized in the work-related trauma classification revealed employment in the manual/construction, health/personal care giver, administrative, and service genres. Finally, the miscellaneous category was comprised of 3 motor vehicle accidents, 5 non-work related traumas, angina pectoris, cerebral palsy, cervical spondylotic radiculopathy, and cervical spondylotic myelopathy.

The racial and gender composition of the CRPS cohort was compared to the racial and gender composition of the entire patient population referred to the neurosurgery clinic of the neurosurgery author (RS) during the time of the study.

Results: Resting sweat output is unreliable because patients may have anhidrosis or hypohidrosis requiring a high gain. Quantitative Sudomotor Axon Reflex Test (QSART) response morphology was variable: 13% were poor, 22% were prolonged “hung up”, 47 were normal, and 19% were not available. Output was abnormal in 53%. One hundred percent (100%) of the thermographic studies were abnormal/revealing asymmetry meaning the asymptomatic limb was colder (74%) or warmer (26%). The ratio of colder to warmer was 4:1. Patterns of autonomic function testing abnormalities revealed 54% positive thermography and QSART, 42% positive thermography negative QSART, 1% negative thermography positive QSART. There were no reported cases of negative QSART and thermography.

Ten out of 15 patients succeeded a three-day SCS trial and underwent implantation of an Itrel® Generator. A Resume® lead was placed in four cervical and one lumbar cases, and a Pisces-Quadripolar® lead in two cervical and four lumbar •

continued on page 10
A laser targeting system for fluoroscopically guided procedures was developed and used to provide accurate surface point of entry and angle of approach to spine landmarks (figure 1). The system identifies a path of radiation from the x-ray source to the image intensifier, positions a laser beam on that line and provides a target symbol visible on the video monitor. After fluoroscopic cross-hair target localization, radiation is turned off, and the laser beam guides needle placement to the target. Highly accurate needle placement is easily performed, while ionizing radiation, and patient discomfort and procedure time are reduced. The early experience with facet blocks and RF rhizotomy using this technique is reported.

The contribution to back pain from the spine lumbar facets has been studied for many years (Goldthwait, Putti, Williams, Ghormley). Ghormley described the facet syndrome in 1933 relating facet arthropathy to low back pain and leg pain.

Partial denervation of the facet joints was described by Rees in 1971 using a stiletto-like knife. Because of problems with hematoma formation, Shealy introduced percutaneous RF thermocoagulation as an alternative.

For carefully selected patients, percutaneous radiofrequency rhizotomy is an effective means of treating mechanical low back syndrome (MLBS). Outcome studies of the effectiveness of this treatment have shown consistency. Comparing outcome, patients were divided into three groups: 1: virgin back; 2: previously operated (unfused); 3: previously operated (fused) Table 1.

Anatomy: Facet innervation is principally derived from the medial branch of the posterior ramus that arises just distal to the dorsal root ganglion at each spinal level.

The main fibers of the medial branch pass around the facet capsule, over the transverse process to the inferior aspect of the facet joint. At this point the nerve divides, proximally it enters the facet capsule, distally it descends to innervate the superior aspect of the next inferior facet. Intermingled with these fibers are small fibers that come from other spinal levels, even from the contralateral facet. Because of the complex neuroanastamoses it is unlikely that the facet can be totally denervated with percutaneous rhizotomy.

Facet Rhizotomy Technique: The junction of the transverse process and the pedicle are targeted using fluoroscopy and the DRTS. X-ray radiation is turned off and the laser beam is used to guide a RF needle through the soft tissues to the transverse process. The needle tip is then “walked” in a cephalad direction until it just slips over the edge of the transverse process-pedicle interface. The radiofrequency generator is then connected to the needle. With stimulation, needle placement in proximity to the facet nerve fibers will result in reproduction of the patient’s local back pain. If the RF needle is adjacent to the nerve root, radicular symptoms will result. After satisfactory needle placement, a thermal lesion is made with the radiofrequency generator.

Results: Four patients underwent RF rhizotomy from L3-S1
(32 facets) for mechanical low back pain syndrome. All obtained good relief of pain. The DRTS system was useful and accurate in the localization of RF targets and guiding RF needle placement.

<table>
<thead>
<tr>
<th>Group</th>
<th>Shealy</th>
<th>Burton</th>
<th>McCulluch</th>
<th>Lora</th>
<th>Oudenhoven</th>
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</thead>
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<tr>
<td>1</td>
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<td>67</td>
<td>62</td>
<td>61</td>
<td>68</td>
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<td>3</td>
<td>29</td>
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</tr>
</tbody>
</table>

#patients 380 126 82 119 801

References:

A. X-ray of facet targeting
B. X-ray of facet targeting with RF aligned with laser
C. Oblique x-ray of facet targeting with RF positioned


Radiosurgical Treatment of Trigeminal Neuralgia with the Leksell Gamma Knife: Promising Early Results

J. Adair Prall, MD
Mary Sherman, RN
Corrine Cloughen, RN
Joseph Henderson, PhD

Denver, CO

Introduction: Recently, reports have emerged suggesting acceptable treatment results for patients with trigeminal neuralgia (TN) using the Leksell Gamma Knife (LGK), [1,2]. Success rates appear to approach those of percutaneous rhizotomy and microvascular decompression series. In light of the favorable outcomes reported in these series, we examined the results at our own center. Determinations of outcomes were made both with scales used in other LGK series and with those traditionally employed. Attempts were also made to identify subgroups with superior outcomes.

Materials and Methods: The LGK unit at the Rocky Mountain Gamma Knife Center (RMGKC) has been in operation since 1993. During that period, over 600 patients have been treated radiosurgically for different indications. Of these, fifty-two were treated for trigeminal neuralgia. No patients treated for this indication were excluded from review. Eight different neurosurgeons were involved in these treatments. A review of the epidemiology, treatment parameters and outcomes of this series of patients was performed. Outcomes were assessed by telephone interview in most cases, in order to obtain current data. Interviews were performed by RMGKC nursing staff, following a template of questions. Outcome grading was performed in a manner similar to that of other LGK series, rating patients as complete success (no pain, off medications), partial success (incomplete pain relief and/or decreased requirement for medication) and failure (no pain

continued on page 12
relief, no decrease in medication requirement). Patients were also graded by more traditional means, in terms of success (no pain, with or without medication) or failure (any persistent pain). Attempts were always made to wean medications after resolution of pain following treatment, but not all patients have completed their medication wean at the time of this review.

All patients underwent single shot treatments using a 4 millimeter collimator. Maximum treatment doses ranged from 30 Gray (associated tumor) to 90 Gray, the latter having been prescribed in most recent patients. Except in three cases with associated tumors, all patients were treated targeting the root entry zone of the trigeminal nerve on the affected side. The 50th percentile isodose contour included a thin rim of the lateral pons in most cases. Steroids and perioperative adjustments in medications were not routinely performed. Anticonvulsant medications were routinely weaned several weeks after complete resolution of symptoms.

Statistical analyses were performed using chi-square testing and Fisher's exact test. Statistical significance was defined by a P value less than or equal to 0.05.

Results: The results of the first fifty-two consecutive cases of TN treated at this center were reviewed. Fifteen of these were male, 15 had prior surgical treatments, and 2 had prior LGK treatments. Fifty had classic TN pain, 6 had multiple sclerosis, and 3 had associated tumors. The mean age of the entire group was 64 years, with 16 cases of V1 pain, 44 cases of V2 pain, 26 cases of V3 pain and 31 cases with multiple distributions affected. Twenty-eight patients had pain on the right, twenty-four on the left. A maximum dose of 90 Gy was prescribed in 5 patients, 80 Gy in 20 patients, 70 Gy in 16 patients and 30, 40 and 50 Gy in three others (one tumor and two repeat LGK treatments). Maximum doses at repeat procedures were prescribed in order to give cumulative doses not to exceed 120 Gy.

Follow-up could be obtained on only 44/52 (84%) patients. Of the eight patients without follow-up, six (11%) had deceased of unrelated causes, leaving only two (4%) who could not be located. The mean length of follow-up was 9.0 months (range 1-39 months). Outcomes graded by the two methods described in the Methods section are shown in Figure 1. Both immediate and most recent patients and to compare their outcome with those treated by more traditional outcome scales. Future reviews of LGK results must support detractors of the LGK's effectiveness, resulting in a lower success rate than more established methods (i.e., percutaneous techniques, microvascular decompression).

However, among those in the current series without prior treatment who had at least six months of follow-up, 87% had complete resolution, rivaling or surpassing results from MVD series, [3]. Long term results could compare favorably with those of both MVD or rhizotomy series, depending on recurrence rates using the LGK. These recurrence rates are currently unknown but hover around 10% in the short term in this and other published series, [1,2]. Escalating radiation dose did not appear to improve outcome, nor did it increase complications. Differences in outcome among varying maximum doses may be hidden by the small size of this series, however. Higher maximum doses seem likely to further injure the nerve, but there may be a trade-off point where complications begin to appear with greater frequency. We have not reached that point at 90 Gy, in our experience. Changes must be made slowly, though, so that any delayed complications will be noted prior to dose escalation.

Both the small number of patients and the relatively short follow-up in this series hinder the significance of its findings; however, these results are promising even when graded with traditional outcome scales. Future reviews of LGK results must adhere to the standards of outcome grading used in series of other types of surgical therapy for TN (i.e., stricter success/failure grading), in order for LGK to be taken seriously as a first-line therapy for this condition. Longer follow-up will be necessary in order to better establish the rate of recurrence in LGK-treated patients and to compare their outcome with those treated by more established methods.
Immediate results are compared to those at most recent follow-up; the two grading schemes resemble that found in other LGK series (complete/partial/failure) and that used in most other reviews of rhizotomy and MVD (success/failure).

References:

Refractory pain involving the head and neck is often unresponsive to medical or conventional surgical regimens when prior ablative procedures have failed. During a three-year period, 20 patients with severe refractory head and neck pain had caudalis DREZs with or without cervical extension. All had prior ablative procedures including; peripheral or central nerve sectioning, percutaneous procedures, or DREZs. Primary etiologies included; 7 patients with refractory trigeminal neuralgia, 4 with atypical headaches or facial pain, 3 with post traumatic closed head injuries, 3 that had undergone prior oral or sinus surgeries, 2 with multiple sclerosis, and 1 that had cancer related pain. At the time of discharge, satisfactory pain relief was present in all patients. At 3 months following surgery, 17 (85%) had good to excellent results and 3 had recurrent pain. At one year following surgery, 13 patients could be evaluated, 7 (69%) still considered their relief as good to excellent. Transient postoperative ataxia was present in 12/20 patients (60%), but was largely resolved at 1 month. In 3/13 (23%) patients, however, a degree of ataxia was still present at one year. Two patients had transient diplopia, 2 had increased corneal anesthesia. No surgical or post surgical mortality was noted. The extension of facial pain into the head and neck or recurrence of head or neck pain after the initial ablative surgery was a poor prognostic indicator for the DREZ. A prior DREZ did not preclude a satisfactory result as long as intraoperative evoked potential localization was possible and ablation of aberrant input obtained. For many patients with refractory head and neck pain, this procedure appears to be successful. Adequate prior training and intraoperative monitoring experience are crucial for success.

The Effect of Medial Thalamus Stimulation on Spinal Cord Dorsal Horn Neuron Responses to Noxious Visceral Stimulation in Rats

Kenneth A Follett, MD, PhD
SW Yang, MD
Iowa City, IA

We have shown that neurons in Nucleus Sumedius (Sm) of the medial thalamus respond to noxious visceral stimulation. We now hypothesize that Sm may have a role in descending modulation of visceral nociception. In this study, we evaluated the effect of Sm activation on visceral nociceptive activity at the spinal level.

In halothane-anesthetized rats, responses of spinal dorsal horn neurons (L6-S1) to noxious visceral stimulation (colorectal balloon distension, CRD) were characterized using standard extracellular microelectrode recording techniques. The effect of focal electrical stimulation of Sm on these responses was elevated. Forty-seven neurons were isolated. Thirty-six responded to CRD. Twenty-five had excitatory and 11 had inhibitory responses. Neurons showed graded responses to graded CRD pressures (20-100mmHg). Responses to noxious (pinch, heat) and innocuous (brush, tap) cutaneous stimuli were studied in 28 CRD-responsive and 10 CRD-nonresponsive neurons. Thirty-four of these neurons (89%) had cutaneous receptive fields, generally small and ipsilateral. Sixty-eight percent of these neurons responded to both noxious and innocuous stimuli, 29% were nociceptive-specific and 3% responded only to innocuous stimuli. Stimulation of Sm (100Hz, 100ms pulse width, 100-300 microA) produced statistically significant (p<0.05, ANOVA) intensity-dependent attenuation of CRD responses of most neurons (7/9 of CRD-excited and 3/4 of CRD-inhibited) tested. Sm stimulation had no effect on spontaneous activity.

These data indicate that Sm may be involved in descending inhibitory modulation of visceral nociception at the spinal level. This “stimulation-produced analgesia” may be mediated via relays in ventrolateral orbital cortex and/or periqueductal gray.
AANS/CNS Section on Pain Satellite Workshop
Interventional Therapies in Neurosurgical Pain Management
8:00 AM-6:00 PM
Thursday-Friday, 22-23 April 1999,

This workshop will include both didactic and hands on sessions and will be of interest to neurosurgeons wishing to become more familiar with the various neurosurgical pain procedures and provide more service to multidisciplinary pain management groups. This is a unique workshop designed to facilitate comprehensive and intensive learning of interventional therapies for pain management. It will cover both augmentative and ablative therapies at spinal, trigeminal, intracranial and peripheral nerve levels. The faculty is composed of 20 leading U.S. pain management neurosurgeons, as well as faculty representation by a pain physiatrist and a pain anesthesiologist. There will be a special emphasis on the close interaction between the faculty and workshop participants. (A preliminary agenda is available at http://www.aans.org/)

Contemporary Management of Trigeminal Neuralgia.
Monday 26 April 1999, Breakfast Seminar 106
707. Epidural Motor Cortex Stimulation for Neuropathic Facial Pain: Interim Analysis and Results From Treatment of 13 Patients in a Multicenter Prospective Trial Monday 26 April 1999, Plenary Session I

Neurosurgical Management of Intractable Pain
Tuesday 27 April 1999, Breakfast Seminar 209

AANS/CNS Section on Pain
2:45 PM–5:30 PM
Tuesday 27 April 1999

This session will serve as a forum for the presentation of topics on the neurosurgical management of pain.
Special Symposium 2:45 PM–4:00 PM
The Surgical Management of Cephalgias
Scientific Session 4:00 PM–5:30 PM

Educational Seminar Topics of Interest to Primary Care Physicians
1:00 PM–3:30 PM
Wednesday 28 April 1999
Lead Topic Low Back Pain
Second Topic Chronic Pain
Final Topic Stroke Prevention and Treatment
Application for Membership
AANS/CNS Section on Pain

I. Biographical

Name: ____________________________________________________________________________________________

Birth Place: _______________________________________ Birth Date:____________________________________

Citizenship _______________________________________

Home Address: ____________________________________ Office Address: ________________________________
_________________________________________________ _____________________________________________

Fax: __________________ Phone: ____________________ Fax: __________________  Phone: ________________

II. Category of Membership Requested:

☐ Active      ☐ Associate      ☐ Corresponding

III. Education

Premedical collegiate education (institutions/dates) _______________________________________________________

Final degree (institutions/dates) _______________________________________________________________________

Medical education (institutions/dates) __________________________________________________________________

Final degree (institutions/dates) _______________________________________________________________________

Internship or equivalent (institutions/dates) ______________________________________________________________

Residency or other graduate training (institutions/dates) ____________________________________________________

Residency training institution ____________________________________________________________

Completion (or expected completion) Date ______________________________________________________________

IV. Membership, Certification and Practice

Are you now certified by the American Board of Neurological Surgery?  ☐ Yes/Year ______  ☐ No

Are you certified in neurosurgery by another examining board?  ☐ Yes/Year ______  ☐ No

Are you a member of:

☐ American Medical Association

☐ Local or regional medical society Name: ________________________________________________________________

☐ State or provincial medical society Name: ______________________________________________________________

☐ American Association of Neurological Surgeons

☐ Congress of Neurological Surgeons

☐ American Academy of Pain

☐ International Association for the Study of Pain

☐ American Pain Society

Medical Licensure State _______________________________ Dates ________________________________

Signature____________________________________________ Date _________________________________

Please return completed application to:
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Membership Department
22 South Washington Street
Park Ridge, IL  60068
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