The Emergence of Pain Medicine

Kenneth A Follett, MD, PhD

Fundamental approaches to the treatment of chronic pain are changing. Historically, the treatment of pain has been based upon the concept of pain management, which involves the treatment of pain as a symptom of disease or injury. Over the past two decades, a growing understanding of pain as a biopsychosocial disorder has led to the emergence of the concept of pain medicine. There are key differences between pain management and pain medicine. Pain management is appropriate for some types of pain, such as acute pain, which generally serves the useful purpose of signaling tissue injury (“eudynia,” good pain). In contrast, many chronic pain states are characterized by intractable pain that serves no useful biological purpose (“maldynia,” bad pain). The chronic pain, itself, becomes the disease. Overwhelming scientific data support the concept of maldynia as a neurobiological disorder and support the need for a new approach to the treatment of such pain. “Pain medicine” is the evolving field that transcends treatment of pain as a symptom by seeking to understand the causes of maldynia, and develop and provide appropriate treatment strategies for this malady.

Neurosurgery and anesthesiology, and other medical specialties to a lesser extent (e.g., psychiatry, physical medicine and rehabilitation, neurology, internal medicine), have long histories in the practice of pain management. Some practitioners in these specialties provide excellent comprehensive care of chronic pain disorders but, for the most part, pain management physicians restrict the treatments they offer to those that reflect the bias of their parent specialties. Consequently, the typical chronic pain patient visits a succession of physicians and undergoes multiple isolated specific interventions as each physician provides only those treatments that are within the scope of his or her specialty. This approach is characterized by a lack of continuity of care and no coordination of care. Patients suffer as a result of this fragmented approach to pain treatment.

Comprehensive training of pain physicians in the broad scientific and medical issues relevant to the treatment of maldynia can lessen the fragmentation of care these patients are subject to. Unfortunately, none of the primary specialties of the American Board of Medical Specialties (ABMS) offers such comprehensive training. Each specialty emphasizes pain therapies that are associated with its discipline. The American Board of Pain Medicine (ABPM), founded over a decade ago, was organized by neurosurgeons and other specialists in the field of pain management to remedy this problem. The ABPM recently submitted an application to the Liaison Committee for Specialty Boards (LCSB) of the ABMS, seeking recognition as a new primary medical specialty. The application was denied (by divided vote) but the importance of the issues raised by the ABPM has captured the attention of the ABMS. In response to the application, the LCSB will convene meetings between the ABPM and representatives of relevant primary ABMS boards to discuss development of a specialty of Pain Medicine.

The development of a Pain Medicine specialty does not threaten neurosurgery or any other ABMS specialty that deals with pain disorders. To the contrary, a specialty of Pain Medicine can be a great asset. Pain Medicine is best conceptualized as a cognitive specialty rather than an interventional specialty such as neurosurgery or anesthesiology. Cognitive
AWARDS AND GRANTS

**William H Sweet Young Investigator Award**

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

Awardees:
- **2000** Alon Y Mogilner, MD
  "Functional Brain Imaging and Spinal Cord Stimulation: Localization of Cortical Activity with Magnetoencephalography (MEG)"
- **1999** No award given
- **1998** Ali R Rezai, MD
  "Deep Brain Stimulation for Intractable Neuropathic Pain: Contemporary Management and Outcome in 80 Patients"
- **1996** John G Piper, MD
  "Systematic Studies in Visceral Nociceptive Processing"
- **1995** Zelma H T Kiss, MD
- **1994** Richard K Simpson, Jr, MD, PhD
- **1993** Robert M Levy, MD, PhD
- **1992** Nayef L Al-Rodham, MD, PhD

**Ronald R Tasker Young Investigator Award**

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

Awardees:
- **2000** James W Leiphart, "Increased Spinal Cord Alpha2-Adrenergic Receptor Binding in a Rat Model of Neuropathic Pain."
- **1999** Nikki Maartens, "Motor Cortex Stimulation for Chronic Neuropathic Pain: Literature Review and Results from a Prospective Audit"
- **1998** Nicholas Theodore, "A Prospective Randomized Double Blind Controlled Trial to Evaluate the Efficacy of an Analgesic Epidural Paste Following Lumbar Decompression"
- **1997** Jan J Gouda, "Behavioral Evidence of Glycerol Induced Trigeminal Neuropathic Pain in Sprague-Dawley Rats"

**Ronald R Tasker Young Investigator Award 2000**

Dr. Leiphart received both his MD and PhD degrees from Northwestern University, where his laboratory mentor was Dr. Robert Levy. He is currently a resident in Neurological Surgery at UCLA.

**Increased Spinal Cord α-2-Adrenergic Receptor Binding in a Rat Model of Neuropathic Pain**

*James W Leiphart, MD, PhD, Cynthia Dills, BS, Robert M Levy, MD, PhD (Chicago, IL)*

**INTRODUCTION:** Previous studies have demonstrated that intrathecally administered tizanidine, an α-2-adrenergic agonist, produces neuropathic pain specific analgesia in the chronic constriction injury (CCI) rat model of neuropathic pain. Several receptors, including the μ-opioid receptor, are increased in CCI spinal cords. A similar increase in α-2-adrenergic receptors may underlie intrathecally administered tizanidine’s neuropathic pain analgesia specificity. This study was performed to test the hypothesis that there is an increase in superficial dorsal horn α-2-adrenergic receptors in the spinal cord of CCI rats.

**METHODS:** CCI rats were compared to unoperated rats, with three rats in each group. In the CCI rats, four 4x0 chromic gut sutures were tied loosely around the sciatic nerve as described by Bennett and Xie (1988). One week after surgery, pain tests were performed to verify neuropathic pain. The rats were then perfused and L3-L6 spinal segments were cut and thaw mounted onto microscope slides. These slides were bathed in various concentrations of [3H]yohimbine with and without cold ligand, and exposed to film. The dorsal horn regions of the resulting autoradiographs were analyzed for maximum binding as a measure of receptor concentration using the Scatchard transformation.

**RESULTS:** The maximum binding was statistically significantly (p<0.01) greater for the CCI rats than the unoperated rats for both the affected and contralateral sides. CCI affected was 40.8 pmol/mm², CCI contralateral was 33.0 pmol/mm², unoperated right was 24.8 pmol/mm² and unoperated left was 23.2 pmol/mm².

**CONCLUSIONS:** These results demonstrate that there are increased spinal cord dorsal horn α-2-adrenergic receptors induced by the CCI model of neuropathic pain. These results are consistent with prior findings of changes in other receptor types in CCI rat spinal cords, and they may provide a mechanism for the neuropathic pain specificity of intrathecally administered tizanidine.
INTRODUCTION: Spinal cord stimulators (SCS) have become an accepted modality for the treatment of many chronic pain syndromes. Achieving adequate paresthesia coverage is often challenging. Once obtained, complications related to hardware insertion may necessitate repositioning or reinsertion of the implant which may preclude ever again obtaining proper paresthesia coverage. We present the management on ten cases where patients had compressive symptoms related to implanted plate electrodes in the dorsal epidural space.

METHODS: We retrospectively reviewed the charts on over 1500 patients with spinal cord stimulators implanted by the senior author from 1985-2000. Ten patients were identified with symptoms which were attributable to compression of the nervous elements. These charts and films were further analyzed. The patients symptoms were further classified as that of axial pain, radicular pain, and myelopathy.

RESULTS: Of the ten (nine women, and one man) implanted patients, four patients presented with myelopathy, four with radicular pain, and two with symptoms consistent with axial pain. All patients had their symptoms relieved by laminectomy without removal of the electrodes.

DISCUSSION: Chronic neural compression can occur as complications from the insertion of SCS. These symptoms may be difficult to identify in a population with chronic pain and pre-morbid pathology. Vigilance to these symptoms is paramount. We have now managed ten patients who had excellent paresthesia coverage and pain relief from their spinal cord stimulator and they did not wish to have their implants removed. With strategic laminectomies, we were able to relieve the patients compressive symptoms without having to explant the hardware.

CONCLUSION: Achieving paresthesia coverage and pain relief remains challenging. Compressive symptoms related to implanted SCS insertion do not necessarily require explantation of hardware.

A role of percutaneous radiofrequency neurotomy of posterior primary rami

INTRODUCTION: The purpose of this study is to prospectively evaluate the role of facetal denervation (radiofrequency neurotomy of medial branch of posterior primary rami) in selected patients with low back pain based on two temporary diagnostic blocks (saline and lidocaine) in double-blinded fashion.

METHODS: A total of 63 patients who met all inclusion criteria and responded to temporary block were included. Main inclusion criteria were axial and predominantly pseudoradicular pain exacerbated by extension and facetal irritation but not associated with clinical signs of motor, sensory deficits, sciatic compression, and radiographic findings suggestive of prominent disc or lesions of roots and cord.

RESULTS: These patients had more than 6 months of pain and failed to obtain substantial benefits from at least 4-6 weeks of intense physiotherapy. Eighteen patients who had previously undergone lumbar disc surgeries but had persistent low back pain were also included. Radiofrequency procedure was done under local anesthetics and performed according to side(s) of pain with modified technique. Minimal follow-up period was 24 months. Initial responders (>50% of pain relief) were 74.6 % (47/63). At 6 month, this was reduced to 60.3 % but 52.3 % were still responders at 2-year follow up. Variables found to be significantly related to outcome were positive sign of “4” (facetral irritation sign), prominent local tenderness, and bilaterality. Variables such as sex, age, and previous surgery showed no significant relationship to outcome. There were no major neurologic complications.

CONCLUSIONS: These results indicate that this procedure may play a role in management of patients with specific clinical syndrome, presumably chronic low back pain of mechanical origin from facet joints or surrounding structures. It is considered safe and repeatable. Similar results obtained in patients with previous disc surgery may also have a role in management of selected patients with failed back surgery syndrome.
The popularity of surgical sympathectomy for treatment of pain has decreased over the years. This reflects the improvement of medical management and the development of less invasive and nondestructive surgical techniques for treatment of sympathetic mediated pain, namely radiofrequency percutaneous sympathectomy and dorsal column stimulation. Most recently however, great interest has been raised on the endoscopic approach to the sympathetic nervous system. In 1994, a symposium dedicated to thoracic endoscopic sympathectomy summarized the main clinical issues and technical advances of this technique. The thoracic and the lumbar sympathetic ganglia can be readily visualized and severed or electrocoagulated through minimal incisions with the use of several endoscopic ports. The best surgery indicated depends upon the intensity and location of the pain.

The proper diagnosis of pain generated and maintained by the sympathetic nervous system is frequently difficult. An organized nomenclature for this pain phenomenon is necessary to allow for comparison of treatment results and define appropriated treatment for the various forms of pain related to the sympathetic system. For the neurosurgeon however, the term sympathetic mediated pain, introduced by Roberts in 1986, defines that surgery of the sympathetic nervous system may lead to important control of the patient’s chronic pain.

The pathophysiology of sympathetic mediated pain is poorly understood. Recent theories suggest ephaptic transmission between somatic afferents and sympathetic efferents at the level of the spinal cord, leading to the release of chemical mediators known to cause pain in inflammatory reactions, such as Substance P, prostaglandin and bradykinin. These substances would give the classical symptoms of vascular instability and temperature changes. Supporting this theory, the results of dorsal column stimulation in suppressing sympathetic mediated pain appear to occur due to stimulation-induced suppression of efferent sympathetic hyperactivity. Before surgical indication one must rule out other maintaining factors such as secondary gain, psychological problems, viral infections, neuropathic processes or peripheral nerve damage. Clearly, not all patients afflicted with this condition require sympathectomy. Early and frequent use of sympathetic blockade associated to physical therapy may carry the patient through a milder and self-limiting episode of causalgic pain. Other clinical measures of controlling pain must also be exhausted before the consideration of sympathectomy. Withholding surgery too long however, may decrease chances of complete pain relief afforded by a sympathectomy. Above all, the patients must have a reliable and objective response to a regional sympathetic block encompassing the affected extremity. Good pain relief with sympathetic nerve block confirms that the complex regional pain is sympathetically mediated.

There are several approaches for upper thoracic and lower cervical sympathectomy and less options for splanchnic and lumbar sympathectomy. The tansaxillary and posterior paravertebral approaches are advocated by few for exposure of the upper thoracic and lower cervical ganglia. The most acceptable open procedure is the modification of MacKay’s paravertebral approach described in 1955. Cloward described similar approach in 1957. This route has the advantage of bilateral exposure through a single incision. It provides a more direct exposure of the sympathetic ganglia and their rami communicantes. The retroperitoneal flank approach is predominantly used for lumbar chain, while the splanchnic chain is reached via lower thoracic paravertebral incision. This surgery involves rib removal and retraction of the pleura. These approaches are frequently too invasive for the patient’s symptoms at hand, therefore the minimally invasive procedures to the sympathetic ganglia are becoming prevalent. The splanchnic procedure is mostly indicated for very debilitated patients with cancer pain, currently being treated mostly medically or with phenol injection of the splanchnic chain. Similar to thoracoscopic sympathectomy, modern minimally invasive endoscopic techniques are being applied to lumbar sympathectomy reducing the surgical morbidity, hospital stay, and speed return to activity due to small surgical incisions and reduced tissue injury. A limited number of published reports with small series suggest similar results as open procedures, however reduced morbidity and hospitalization are the major differences.
Epidural Infusion vs. Intrathecal Morphine Injection in the Selection of Patients for Chronic Opioid Therapy

Valerie C. Anderson, PhD, Kim Burchiel, MD, Beverly Cooke, RN
(Portland, OR)

INTRODUCTION: We showed recently that intrathecal opioids delivered via implanted infusion system can reduce pain and improve function long-term among patients with severe nonmalignant pain. However, patient selection remains a critical problem and the optimal method of screening patients prior to implantation of permanent infusion system is undefined. We report here on the first prospective, randomized comparison of epidural infusion vs. intrathecal injection screening of patients for chronic opioid therapy.

METHODS: Participants were randomized (1:1) to continuous epidural infusion or 1mg intrathecal morphine injection screening. Standardized measures of pain (VAS, McGill Pain Questionnaire) and function (Sickness Impact Profile, Profile of Mood States) were assessed at baseline and after 3 and 6 months of chronic therapy. Pharmacological and device-related complications were monitored throughout study. Procedural costs were collected from hospital billing records.

RESULTS: Subjects (N=23) had a mean age of 56±12 yrs. 65% were diagnosed with FBSS. At baseline, groups were matched with respect to age, pain intensity and prior surgeries for pain. Overall, the number of hospital days and total costs of screening were significantly less in the injection group (P<0.001). There were no significant between-group differences in VAS pain, McGill, SIP or POMS scores after 3 months of intrathecal opioid infusion. No serious complications were experienced during screening by patients in either group. Pharmacological complications were mild in both groups, but were more common after injection; however, after 3 months of chronic infusion, the frequency of pharmacological complications was indistinguishable between groups. Procedural difficulties were more common among the injection group.

DISCUSSION/CONCLUSION: Intrathecal injection appears to be as safe and more cost-effective than continuous epidural infusion for selection of patients for chronic opioid therapy. Both methods are equally likely to identify patients whose pain is responsive to chronic intrathecal opioid.

Sphenopalatine and maxillary nerve block and denervation for face pain

J Brett Gentry, MD, Samuel J Hassenbusch, MD PhD, Cheryl Keenan, APN (Houston, TX)

INTRODUCTION: Face pain involving the orbit, lateral nose, cheek, and teeth is a complex problem for neurosurgeons. Depending on the exact location of the pain, sphenopalatine ganglion or maxillary nerve block and denervation can be an effective means of treatment.

Unfortunately, this technique is not widely used or known by neurosurgeons. The purpose of this paper is to review the technique and our experience at MD Anderson hospital.

METHODS: The medical records of 5 patients that underwent sphenopatine ganglion or maxillary nerve block and denervation at MD Anderson between 1996-2000 were reviewed. All patients are presently being followed at 4 to 48 months. The technique for block and denervation involves placing a needle below the midpoint of the zygoma through the coronoid notch. The needle is inserted until it reaches the pterygopalatine fossa. Stimulation of the maxillary nerve will produce paresthesias in the cheek and/upper lip. Stimulation of the sphenopalatine ganglion will produce paresthesias in the nose. Once the correct anatomic area is identified, block or radiofrequency is performed.

RESULTS: Greater than 50% pain relief was obtained in all patients except one. One patient received a block only. Three patients required 2 denervation procedures. One patient required 6 denervation procedures. There were no major complications. The most common adverse effect was numbness of the cheek or upper lip.

DISCUSSION/CONCLUSION: Sphenopatine ganglion and maxillary nerve blocks and denervations can be an effective means for treating a specific subset of patients with face pain. Sphenopatine ganglion block or denervation can be used for pain that is involving the inferior orbit or lateral nose. Maxillary nerve block or denervation is more effective for pain involving the cheek, upper lip or teeth. Patient selection is very important for good results to be obtained.

Somatotopic arrangement of human postgasserian fibers in trigeminal neuralgia. A computerized analysis using the multielectrode technique

Eduardo A Karol, MD, Marcelo Larramendy MSc, Mariano Socolovsky MD, Jose Leston, MD and Ariel Szvalb, MD (Buenos Aires, Argentina)

INTRODUCTION: In an attempt to minimize residual current morbidity after thermocoagulation in trigeminal neuralgia a multielectrode technique was described. Out of 331 thermocoagulations for trigeminal neuralgia performed since 1974, the present report describes the somatotopic organization of postgasserian fibers found using such technique in the last 128 consecutive procedures.

METHODS: An outer needle is introduced into the inner third of the oval foramen avoiding blind and suboptimal positions. The multielectrode is then introduced so its four successive 2.9mm caps protrude at the tip of the outer needle. All verbal and motor responses after electrical stimulation at each of the caps from 0.05V at 5 (and 75)Hz are recorded in one to 6 tracks on each procedure. Whenever possible, verbal responses were codified within thirty three possible responses corresponding to various subsegments of the three trigeminal divisions. All responses at or behind the first cap, at, in front or behind the second and third caps and at or in front of the fourth cap were recorded. Only responses elicited under 0.5V were considered for inclusion in the somatotopic map (or the performance of lesions). The smallest safest target can then be chosen knowing the segment of division located in front and behind. Lesions could never exceed the size of the chosen target.

RESULTS: The somatotopic arrangement of postgasserian fibers is described using a computerised protocol for thermo-coagulation in trigeminal neuralgia, to analyze statistically the

continued on page 11
2001 AANS/CNS Section on Pain Interventional Therapies in Neurosurgical Pain Management Workshop 19-20 April, 2001 Toronto, Ontario, Canada

Thursday, April 19, 8:00 AM - 5:30 PM AUGMENTATIVE TECHNIQUES
- Psychological Considerations in Chronic Pain Treatment
- Spinal Cord Stimulation: Patient Selection and Outcomes
- Spinal Cord Stimulation: Implant Technique
- Motor Cortex Stimulation
- Occipital Nerve Stimulation
- Break
- Intraspinal Drug Infusion: Patient Selection and Outcomes
- Intraspinal Drug Infusion: Trializing and Implant Technique
- Intraspinal Drug Infusion: Neuraxial Analgesics and Polyanalgesia
- Disability and Impairment Assessment in the Pain Patient
- Lunch
- Orientation/assignment to hands-on sessions
- Augmentative Therapies Hands-On Rotations: including implantation techniques for spinal cord stimulation systems and intraspinal drug infusion systems, intracranial stimulation techniques, and peripheral nerve stimulation.
- Panel discussion and wrap-up

Friday, April 20, 8:00 AM - 5:30 PM ABLATIVE TECHNIQUES
- Coding and Reimbursement for Pain Procedures
- Percutaneous Spinal Procedures
- Intradiscal Electrothermal Therapy (IDET) and Epiduroscopy
- Spinal Ablative I: Cordotomy and Myelotomy
- Spinal Ablative II: DREZ and Brainstem Procedures
- Facet Denervation
- Endoscopic and Open Sympathectomy
- Break
- Radiosurgery for Trigeminal Neuralgia
- Trigeminal Neuralgia I: Percutaneous Techniques
- Trigeminal Neuralgia II: Posterior Fossa Techniques
- Persistent Pain after Neurosurgical Procedures: What to do?
- Lunch
- Orientation/assignment to hands-on sessions
- Ablative Therapies Hands-On Rotations: including techniques for treatment of trigeminal neuralgia, peripheral ablative techniques, radiosurgery, and spinal and intracranial ablative techniques.
- Panel discussion and wrap-up
- New Topics of Special Interest to Neurosurgeons
- Motor cortex stimulation
- Occipital nerve stimulation
- Radiosurgery for Trigeminal Neuralgia
- Epiduroscopy
- Intradiscal Electrothermal Therapy (IDET)

Celebrate the 70th Anniversary of the AANS at the 69th AANS Annual Meeting
21-26 April, 2001 Toronto, Ontario, Canada
“Leading Neurosurgery Through Science, Education, Innovation”

PRACTICAL CLINICS
033 Sunday April 22, 1:00 PM - 5:00 PM
Trigeminal Neuralgia
Director: Jeffrey Alan Brown, Samuel Hassenbusch
Faculty: Harry Von Lovern, Jeffrey Keller, G Robert Nugent, Bruce Pollock, Peter J Jannetta

BREAKFAST SEMINARS
122 Monday April 23, 7:30 AM - 9:30 AM
Advances in the Treatment of Trigeminal Neuralgia
Moderator: Peter J Jannetta

213 Tuesday April 24, 7:30 AM - 9:30 AM
Sympathectomy for Pain and Hyperhidrosis
Moderator: Deborah L Benzil
Panelists: Cheuk-Wah Wong, V Vanaclocha, Harold A Wilkinson

405 Thursday April 26, 7:30 AM - 9:30 AM
Neurosurgical Management of Intractable Pain
Moderator: Kim J Burchiel
Panelists: Nicholas M Barbaro, Ronald R Tasker, Allan H Friedman, Donlin M Long, Zelma H T’Kiss

AANS/CNS SECTION ON PAIN; SESSION
Tuesday April 24, 3:00 PM - 5:45 PM
Symposium 3:00 PM - 4:00 PM Rational use of Opioids for Chronic Pain
Moderator: Kenneth A Follett
Panelists: Jaimie M Henderson, Phil L Gildenberg, William H. Sweet
Young Investigator Award, 4:00 PM - 4:15 PM
Human Adult Cortical Plasticity: Lidocaine Anesthesia Generates Effects Similar to Limb Amputation
Awardee: Dragan F Dimitrov, presented by Kenneth A Follett
Scientific Session, 4:15 PM - 5:45 PM
Moderators: Kenneth A Follett, Jaimie M Henderson

SCIENTIFIC SESSION VII/VIII
768 Wednesday April 25, 9:45 AM - 11:15 AM
Pain Reduction and Improvement in Functional Mobility by the use of percutaneous PMMA Vertebroplasty for the Treatment of Vertebral Compression Fractures: Retrospective Report of 925 cases: John S Sarzier, Avery J Evans, Mary Jensen
Discussant: Richard D Fessler

773 Wednesday April 25, 9:45 AM - 11:15 AM
Subcutaneous Neurostimulation for Intractable C2 Mediated Headaches: Richard L Weiner, Kenneth M Alo, Kenneth L Reed, Michelle L Fuller
Discussant: Kim J Burchiel

PAIN POSTER VIEWING SESSION
Wednesday April 25, 2:15 PM - 2:45 PM
In a prospective trial, a sequential series of patients with trigeminal neuralgia (typical and atypical), underwent T2 and 3D-TOF MRI imaging (MRA source images) to determine the rate at which neurovascular compression (NVC) of the trigeminal nerve could be detected by preoperative imaging. MRI studies were evaluated by a neuroradiologist without knowledge of either the nature or the side of the patient’s pain. Twenty-two patients had MRI imaging, and eighteen patients had a retromastoid craniectomy for microsurgical exploration of the region of the trigeminal nerve. Of the four patients who did not have surgery, two had positive MRI indication of NVC, but remain on medical management; one had MS, and no NVC on MRI; one showed no NVC, but later proved to have a neurotropic nasopharyngeal tumor of the mandibular nerve root. Of the remaining 18 patients that had surgery, 13 had both positive NVC on MRI, and a confirmed arterial cross-compression at the time of surgery; three had both positive NVC on MRI, and a confirmed venous cross-compression at the time of surgery (true positive rate = 89%); one had negative NVC on MRI, and a confirmed venous cross-compression at the time of surgery (false negative rate = 6%); one had negative NVC on MRI, and an equivocal venous cross-compression at the time of surgery (true negative rate = 6%). This preliminary study demonstrates that trigeminal NVC may be reliably imaged in patients with trigeminal neuralgia, and may play an important role in patient selection and surgical decision making in patients with trigeminal neuralgia.

**Management of Trigeminal Neuralgia: predictors of outcome for microvascular decompression**

**Elizabeth C Tyler-Kabara, MD, PhD, Amin B Kassam, MD, Michael Horowitz, MD, Louisa Urgo, PA-C, Costas Hadjipanayis, MD, Howard Yonas, MD, Peter Jannetta, MD (Pittsburgh, PA)**

**SIGNIFICANCE:** Microvascular decompression (MVD) is a safe and effective treatment of trigeminal neuralgia (TN) refractory to medical management. We have previously reported an efficacy rate of 75% at one-year following MVD. We postulated that certain patient characteristics would determine likelihood of response to MVD.

**METHODS:** We randomly selected 100 patients from the 1864 patients that have undergone MVD for typical TN. Thirty were locked into a validation set and the remaining seventy were used to determine the predictive factors. Using a focussed consensus group a questionnaire of predictors was developed with weighted elements. A univariate and multivariate analysis was undertaken to examine the predictive power of each element and impact on recurrence. Functional outcomes were determined apriori as follows: excellent (no pain off medications), good (significant relief of pain requiring low dose medication), and poor (no pain control still on medications). Once individual predictors were assessed they were then validated by applying them to the locked data set.

**RESULTS:** In the analysis group 81.4% had complete relief while 18.6% had partial relief following MVD with a 38.5% incidence of recurrence. Within the validation group 86.7% had complete relief and 13.3% had partial relief. The recurrence rate was 33.3%. When examining the individual characteristics within the Typical TN group there was no significant effect of preoperative deficits, side, sex, age, and previous procedures (MVD, glycerol rhizotomy, and radiofrequency). Furthermore associated symptoms of bilateral TN, glossopharyngeal neuralgia and tinnitus did not impact on outcome.

**CONCLUSIONS:** If a patient is identified as having typical TN they enjoy an excellent result with MVD in 81% of cases. There are no patient characteristics that proved to be predictive of outcome within the typical TN group. We are now in the process of comparing the typical TN against atypical TN to determine differences in prognosticators.

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**Trigeminal Neuralgia Association has moved to**

http://www.tna-support.org/
A Prospective, Randomized Controlled Investigation of Pain Control Options following Lumbar Microscopic Diskectomy

Phillip A Tibbs, M.D., Jimmi Hatton, PharmD, Christie Sparkman-Johnson, RN, Tina Brooks, RN, Robin Boxer, PharmD (Lexington, KY)

Lumbar microscopic diskectomy (LMD) patients at the University of Kentucky Chandler Medical Center receive patient-controlled analgesia (PCA) for pain control postoperatively. The purpose of this study was to compare PCA to an alternative pain regimen (APR) using intraoperative bupivacaine and postoperative ketorolac (scheduled every 6h) with supplemental acetaminophen/oxycodone as needed. The hypothesis was that no difference would be observed in pain control, length of stay (LOS), or adverse effects (AE). During the clinic visit, 19 patients (12M/7F) were prospectively randomized to PCA and 15 (10M/5F) to APR. Pain scale scores were recorded every 4h and overall pain satisfaction was determined at discharge. Monitoring included sedation status, vital signs, nausea, vomiting, constipation, itching, headache, time to unassisted ambulation, urination, and oral intake. There was no difference in age or weight between the groups. No differences were observed in pain scores or sedation status at any time. Both groups rated pain control good to very good. Time to ambulation, urination and oral intake was 4.2, 8.0 and 8.2h for PCA patients compared to 3.6, 5.9 and 5.4h for the APR group. Fourteen PCA patients required medications for nausea, itching and headache versus five APR patients (p<0.05). Heart rate was consistently higher (81 vs. 69 bpm p<0.05) in PCA patients. LOS was longer (20.5h vs 15h p<0.05) in the PCA group. Preliminary cost estimates were lower in the APR group (4.5K vs. 5.2K PCA). The APR was as effective as PCA in LMD patients with fewer AE, and decreased time to ambulation, urination, oral intake, LOS and hospital costs (see figure).

Efficacy of an Analgesic Epidural Paste Following Lumbar Decompressive Surgery: Long-Term Follow-Up of a Prospective Randomized Double-Blind Controlled Trial

Aaron S Dumont, MD, (Charlottesville, VA), Nicholas Theodore, MD, Volker K H Sonntag, MD (Phoenix, AZ) and R John Hurlbert, MD, PhD (Calgary, Alberta, Canada)

INTRODUCTION: We have previously demonstrated the conclusive efficacy of a single-dose epidural analgesic "paste" in the control of postoperative pain in patients undergoing lumbar decompressive surgery followed for up to 3 months postoperatively. Subsequently, we have analyzed our long-term (1-year) follow-up data to quantitatively evaluate any potential long-term effects of paste treatment.

METHODS/RESULTS: Sixty patients undergoing routine elective lumbar decompressive surgery were randomized to receive either active or placebo paste. Patients were followed as inpatients and outpatients for 12 months post surgery. Comparability between groups was ensured, and pain control was evaluated with multiple measures. Patients receiving active paste demonstrated significantly lower pain scores and better general health perception (as measured with the Short Form 36) for up to 6 weeks postoperatively. There were no significant differences between groups in these outcome measures at 6 months and 1-year follow-up. Additionally, inpatient and outpatient oral narcotic consumption was lower in the active paste treatment group, compared to placebo paste group, for up to 6 weeks following surgery. No significant differences in narcotic consumption were ascertained at 6 months and 1-year follow-up.

CONCLUSIONS: The application of an epidural analgesic paste during lumbar decompressive surgery significantly enhances pain control, reduces oral narcotic consumption and improves overall health perception for up to 6 weeks postoperatively. No significant differences were demonstrated between the treatment groups in these outcome measures at 6 months and 1-year follow-up. Hence, the application of an epidural analgesic paste imparts significant benefit for up to 6 weeks following surgery without harmful long-term sequelae. Implementation of this efficacious and safe pain management strategy may evolve into a new standard of care in patients undergoing lumbar disectomy or laminectomy.

Is outpatient trial for spinal cord stimulation more cost-effective than inpatient trial?

Frank P Hsu, MD PhD, Farhad Limonadi, MD, Zvi Israel, MD, Kim Burchiel, MD (Portland, OR)

Cost-effectiveness is an important issue in conducting spinal cord stimulation implant trials. For outpatient trials, percutaneous electrode is placed as an outpatient procedure and the patient is discharged to home on the same day of surgery for the adjustment of stimulation parameters. The candidate returns one week later to be assessed if implantation or removal of the generator is indicated. For the inpatient trials, the patient is admitted to the hospital after the placement of electrode and the efficacy is determined for the next two days. If implantation is decided then it is performed within the same hospitalization before the patient is discharged. While it may seem that outpatient trial is more cost-effective since the hospitalization charges are avoided in the process, factor such as increased rate of infection negatively impact on the cost-effectiveness of conducting outpatient trials. We performed a retrospective review of the experience at Oregon Health Sciences University between the time period of 1988 and 1999. Spinal cord stimulation was conducted on an inpatient and outpatient basis from 1988 to 1994 and from 1994 to 1999, respectively. While there is almost no infection in the inpatient trial group (n=92) the infection rate for the outpatient trial group is 6.2% (n=113), which is consistent with the literature. The impact of an infection on a successfully tried implant is tremendous since the loss from the cost of the hardware is more significant compared to the hospitalization costs saved in the outpatient trials. Our retrospective data support our hypothesis that inpatient trials for the spinal cord
Long-term Effectiveness of Continuous Intrathecal Opioid Treatment in Alleviating Malignant and Chronic Benign Pain

Evan Hermanson, BS, Lyal G Leibrock, MD, Daniel J Tomes, MD, William E Thorell, MD (Omaha, NE)

INTRODUCTION: Intrathecal opioid administration is an effective alternative for treatment of chronic pain. For long-term chronic pain control, a permanent pump is implanted to deliver intrathecal opioids in a continuous fashion.

METHODS: To assess long-term (>2 years) effectiveness of continuous intrathecal opioid administration, the study reviewed the chart history of 59 patients who, between 1989 and 1998, underwent permanent pain pump implantation. Standardized follow-up with phone interviews were used to collect outcome data.

RESULTS: Twenty-two of the study patients (37%) were able to be contacted. The remaining patients were either unable to be located (22 patients) or known to be deceased (15 patients) from causes unrelated to pump implantation. Time from pump implantation to interview averaged 4.5 years (range 2.2-7.3 years). Of the patients contacted, 4 individuals had undergone elective pain pump removal despite receiving adequate pain relief with its use. The remaining 18 patients were using the pump at the time of the interview for control of either malignant (1 patient) or chronic benign (17 patients) pain. The average patient age was 64 years old (range 42-84 years). Sixteen of the patients contacted (89%) considered the opioid pump effective at relieving their pain, with the average relief being 60%. Fourteen of the patients contacted (78%) required supplemental oral pain medications for breakthrough pain control. Complications of pump implantation included pump malfunction (2 patients), programming error resulting in overdose (2 patients), constipation related to the intrathecal opioid (2 patients), and pump pocket seroma (1 patient). Six patients suffered intrathecal catheter complications, including catheter fractures (5 patients) and catheter dislodgement (1 patient). Nine patients reported battery failure occurring in the study period, with average battery life lasting 52 months (range 42-61 months).

CONCLUSION: The study suggests long-term continuous intrathecal opioid administration may effectively control chronic pain.
**Oral Posters**

**Annual 50th CNS Meeting, 2000**

**Long-term Outcome Analysis of Dorsal Column Spinal Cord Stimulators**

John Hain, BS, Lyal G. Leibrock, MD, William E. Thorell, MD, Daniel J. Tomes, MD (Omaha, NE)

**INTRODUCTION:** Dorsal column spinal stimulators (DCSS) have long been employed to treat chronic pain. A paucity of literature describes the long-term (>5 years) outcome of patients treated with DCSS.

**METHODS:** A retrospective review of patients who underwent DCSS implantation between 1989 and 1999 provided demographic and clinical data. A standardized phone interview was conducted to gather outcome data.

**RESULTS:** Sixty-four patients had undergone DCSS implantation during the study period. No infections occurred in the study group. Thirty patients (47%) were contacted and interviewed. The mean time from stimulator implantation until phone interview was 7.7 years. Twenty-one continued to use the DCSS units, sixteen of whom stated they would undergo the procedure again. Pain relief ranged from 0-10% relief to 90-100% relief. One half of the patients noted greater than 60% long-term pain control. Complications of device implantation included the need for electrode repositioning (8 patients), further spine surgery (10 patients, including either laminectomy, foraminotomy, diskectomy, and/or fusion), and DCSS removal per patients’ requests (4 patients). Six patients are currently employed; four full-time. Of the 24 not currently employed, 10 are retired, 1 is disabled from lung disease, and 4 choose not to work.

**CONCLUSIONS:** The study suggests DCSS may be an effective alternative in the treatment of long-term chronic, debilitating pain.

**Adjunctive Use of Rigid Endoscopy During Posterior Fossa Surgery for Cranial Neuropathies**

Harel Deutsch, MD, Wesley King, MD, Phillip Wackym, MD (New York, NY), Dennis Poe, MD (Boston, MA), John Shiau, MD, Chandranath Sen (New York, NY)

**OBJECTIVE:** The objective of this study was to determine the utility and safety of incorporating the rigid endoscope for posterior fossa surgery for cranial neuropathies.

**METHODS:** Twenty-one patients underwent craniotomies for non-neoplastic processes involving the fifth, seventh, and eighth cranial nerves. Five patients with trigeminal neuralgia and two patients with hemifacial spasm underwent microvascular decompression. Thirteen patients underwent unilateral vestibular nerve neurectomy for Meniere’s disease. One patient with geniculate neuralgia underwent section of the SCA as an alternative drug.

**RESULTS:** The rigid endoscope allowed for improved definition of the anatomical neurovascular relationships without the need for significant retraction of the cerebellum or brainstem. In addition, identification of the cleavage plane between the cochlear and vestibular nerves entering the internal auditory canal in three patients could not be made with the microscope or 0 degree endoscope; however, identification was possible in all patients with the 30 or 70 degree endoscope. There were no complications related to the endoscope.

**CONCLUSIONS:** The rigid endoscope can be used safely during posterior fossa surgery for cranial neuropathies and it allows for improved visualization of the cranial nerves, nerve cleavage planes, and vascular anatomy. Additionally, the endoscope allowed for smaller craniotomies, reduced brain retraction, and a decreased incidence of cerebrospinal fluid leakage.

**Intrathecal Opioids: Reasons for changing from morphine therapy**

Zvi Israel, MBBS, Larisa Jeffreys, RN, Kim J. Burchiel, MD, (Portland, OR)

**INTRODUCTION:** It is now more than ten years since continuous intrathecal opioid therapy for intractable chronic and cancer pain was introduced. Most clinicians still begin such therapy with morphine sulfate even though in a significant number of patients morphine proves to be inadequate, inappropriate, or problematic. We retrospectively reviewed the reasons for changing intrathecal therapy from morphine to an alternative drug.

**METHODS:** The records of all patients with an intrathecal drug delivery device managed between 1997-1999 were reviewed. Patient demographics were recorded. The reasons for switching intrathecal medication were recorded.

**RESULTS:** Over this two-year time period, we followed 154 patients with pumps implanted for the management of intractable pain. Sixty-six patients (42%) were changed from morphine to hydromorphone. Poor pain control was the most frequent reason, in 29 patients (44%), followed by nausea and vomiting in 15 patients (23%). Extremity edema was the reason in 12 patients (18%) and in seven of these 12, switching to hydromorphone alleviated the edema. Other reasons for discontinuing morphine were a frequent need to refill the pump, rash or itching, urinary retention or hesitancy and others.

**CONCLUSION:** Although intrathecal morphine remains efficacious for intractable pain in a majority of patients, a significant minority need to be switched to an alternative drug. There are no clear patient criteria that allow selection of a particular drug for a specific patient at the outset. Lower
extremity edema with morphine is previously unreported and appears to resolve in most patients when changing to hydromorphone. Possible explanations for this phenomenon are suggested. Further studies are needed to increase our understanding of how to optimize intrathecal drug therapy for the individual.

**Oxygen free radicals in the genesis of chronic pain**

Yukio Ikeda, MD, Kiyoshi Matsumoto, MD, Kenji Dohi, MD, Youtchi Umaizumi, MD, Hiroyuki Jinnho, MD (Tokyo, Japan)

Nonsteroidal antiinflammatory drugs (NSAIDs), used widely to manage chronic pain, are known to inhibit cyclooxygenase (COX). Sumatriptan is useful in the treatment of migraine. Recent reports have suggested that low levels of platelet superoxide dismutase and high levels of plasma lipid peroxidation were found in patients with migraine, suggesting that oxygen free radicals can be involved in the genesis of chronic pain. The present study was performed to investigate the ability of three NSAIDs (indomethacin, etodolac, loxoprofen) and sumatriptan to scavenge superoxide and hydroxyl radicals. Measurement of superoxide and hydroxyl radical scavenging activities of these drugs was performed by electron spin resonance (ESR) spectrometry using 5,5-dimethyl-1-pyrroline-1-oxide (DMPO) as a spin trap. Electron spin resonance study demonstrated that formation of superoxide -DMPO spin adduct was completely inhibited by indomethacin 3 mM and loxoprofen 3 mM. Etodolac; COX-2 inhibitor, and sumatriptan; anti-migraine drug, strongly inhibited formation of superoxide -DMPO spin adduct in a dose-dependent manner. Indomethacin 10 mM and sumatriptan 10 mM strongly inhibited formation of hydroxyl radical-DMPO spin adduct. These results indicate that NSAIDs and sumatriptan have direct free radical scavenging activities, suggesting that free radicals may be in part involved in the genesis of chronic pain and free radical scavengers might provide a new insight into the treatment of chronic pain.

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**CONCLUSIONS:** These data suggest that use of intraoperative frameless stereotaxy provides surgeons with accurate information that helps to guide the operative approach and precisely tailor the trajectory and depth of the electrode. It also appears to reduce patient discomfort and operative time, and potentially increases the safety and efficacy of the procedure.

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**Discussion and Conclusions:**

And interventional specialties tend to promote each other. For example, consider the symbiotic relationships between neurology (cognitive) and neurosurgery (interventional) or medical cardiology (cognitive) and interventional cardiology. Pain medicine physicians, by coordinating specific and timely treatment of maldynia, can facilitate an increase in the number of referrals, and improve the appropriateness of referrals, to neurosurgeons and other specialists for specific pain management interventions.

We are entering an era of heightened awareness about pain. The medical and research communities, state and federal regulators, payors, and the lay public are becoming more knowledgeable about pain, its causes, and the need for treatment. In 2000, the United States Congress passed H.R. 3244, signed into law by President Clinton, establishing the Decade of Pain Control and Research effective January 1, 2001. This resolution, which was enacted in large part as a result of the efforts of AANS member Philipp Lippe and his counterparts in the Pain Care Coalition, is only the second Congressionally declared medical decade (after the Decade of the Brain in the 1990’s). The Department of Veterans Affairs medical system has enacted a “Pain as the 5th Vital Sign” initiative. JCAHO has established recommendations for the assessment and treatment of pain. Programs promoting pain education, treatment, and research are being developed by numerous pain organizations, including the American Academy of Pain Medicine, the American Board of Pain Medicine, the American Pain Society, the International Association for the Study of Pain, and the American Pain Foundation (see pg. 9 for web links). Neurosurgeons have held numerous leadership positions in these and other pain organizations and have been integral to the success that these organizations have achieved.

Neurosurgery will be one of the specialties that will reap the benefits of heightened awareness about pain. We, as individuals and as an organization, should not be passive recipients of these benefits but should continue to work with pain organizations to sculpt the future of pain medicine. The emergence of pain medicine, and the changes in the field of pain management that will accompany its emergence, will proceed with or without the participation and influence of neurosurgeons. It is in the best interests of the field of pain medicine, the patients we serve, ourselves, and organized neurosurgery that we remain players rather than spectators as the field of pain medicine moves forward.

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Kenneth A. Follett MD, PhD

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**DISCUSSION AND CONCLUSIONS:**

Selective small lesions performed with a precise knowledge of the threshold and respective arrangement of each trigeminal subsegment within a known physiological map are shown to be useful to minimize unnecessary morbidity from percutaneous thermocoagulation in trigeminal neuralgia.
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