Winter 2009 • Volume 10, Number 1
UNIVERSITY of PITTSBURGH
neurosurgery news
Published by the University of Pittsburgh Department of Neurological Surgery • www.neurosurgery.pitt.edu
Patient Care • Teaching • Research

Minimally invasive portals 'expand' surgical innovation in spine trauma surgery

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Director, CNS Injury Program

UPMC Presbyterian remains among the top Level 1 trauma centers in the country, providing state-of-the-art care to nearly 4,500 trauma patients annually. Approximately 10% of these patients sustain fractures to their spinal column, many of which produce severe neurological deficits resulting in protracted hospitalizations and disability. The goal of modern medical practice is to treat these patients in a fashion that minimizes further neurological deterioration and gets them back on their feet and back into society as quickly as possible. This often requires decompression of neural structures followed by reconstruction and stabilization of the spinal column.

Until recently, spine trauma stabilization has required extensive—and frequently multiple—surgical procedures that carry significant drawbacks over and above the injury itself. Patients are often rendered non-ambulatory for extended periods of time in the early stages of their recovery. Prolonged immobilization has been linked to poorer patient outcomes with an increased risk of medical complications (such as pneumonia and blood clots), narcotics reliance, and psychological ramifications of societal estrangement.

In an effort to minimize these potential complications and maximize positive patient outcomes, we have adopted numerous minimally invasive surgical (MIS) strategies to provide safe and early spinal realignment and stabilization, enabling rapid mobilization and neurological rehabilitation.

The latest surgical innovation employed to accomplish this goal involves the expansion of a MIS lateral access retractor to reach the lateral spinal column without disrupting the bony or ligamentous integrity of the uninjured structures. A recent case demonstrates the suitability of this approach for severe thoraco-lumbar spinal injuries: a 17-year-old involved in a motor vehicle collision remained neurologically intact despite an L1 burst fracture with severe spinal canal compromise at the level of the conus medullaris. Pre-operative imaging clearly revealed spinal compression, fracture and deformity with critical impingement of the traversing neural elements (Fig. 1).

The patient underwent a minimally invasive lateral access decompression of the spinal canal and placement of an expandable intervertebral cage filled with autologous bone graft (Fig. 2). We successfully achieved vertebral height restoration and normal alignment of the spinal column with construct embedded materials to encourage a bony fusion. A titanium plate was additionally placed to provide supplemental stabilization during the fusion process. The patient was ambulating the following morning and was discharged home three days later, neurologically intact, and aesthetically delighted at four-week follow-up (Fig. 3).

Traditional approaches often require extensive multi-level fusion constructs that lock numerous segments of the spine in a fixed position, reducing flexibility of the spine at those sites. This contemporary MIS approach focuses intervention solely to the injured level, leaving the patient with near full range of motion and mobility.

This same approach can additionally be used to treat trauma patients in the non-acute setting. We are seeing more and more referrals of patients months—even years—out from their injury with delayed or progressive post-traumatic spinal deterioration or deformity. Extrapolation of the same technical nuances employed in the illustration above are being performed to address these trauma-induced aberrations with excellent results.

Neurosurgeons at UPMC will continue to push the surgical envelope in treating patients with spinal trauma; performing safer procedures through smaller portals, minimizing destruction and maximizing function and mobility. Minimally invasive cage placement and stabilization is simply the latest adjunct in our surgical arsenal to achieving this goal. •

Figure 1: Sagittal pre (a) and post-operative (b) imaging demonstrates successful spinal canal decompression, realignment, and stabilization following minimally invasive lateral access surgical cage placement and fusion.

Figure 2: Intra-operative placement of expandable titanium cage through two-inch lateral flank incision.

Figure 3: Patient at four-week follow-up: minimum scar, maximum cosmesis.

CHAIRMAN'S LETTER

Prevention important part of department focus

This issue of *Neurosurgery News* highlights many interesting surgical procedures, but the effort we are most proud of is our department's focus on injury prevention and healthy lifestyle which are illustrated by the articles on the Center for Injury Research and Control (CIRCL) and the review of Joe Maroon's book *The Longevity Factor*.

As neurosurgeons we tend to concentrate on a daily basis on the management of anatomic perturbations whether mechanical, cellular, neuronal or hemodynamic. As physicians, however, our greatest contributions to health care are in the realm of disease prevention. If trauma and injury are appropriately viewed as societal diseases, then the efforts by CIRCL will pay off through increased quality of life and overall decrease in societal expenditure both acutely and chronically as support for the disabled is reduced.

While focus on prevention is not "sexy" it does provide us with the greatest fiscal efficiency and "bang for the buck" and as such will remain an important department focus for years to come. •

Amin Kassam, MD
Professor and Chairman
Department of Neurological Surgery
Director
Minimally Invasive endoNeurosurgery Center (MINC)

for ***more*** *information*
on the **University of Pittsburgh Department of Neurological Surgery,**
visit our **website** at
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CIRCL	(412) 802-6500	Neurotrauma	(412) 647-1025
Clinical Neurophysiology	(412) 647-3450	Neurosurgical Oncology	(412) 647-8312
CyberKnife (*spine*)	(412) 647-1700	Pediatric Neurosurgery	(412) 692-5090
CyberKnife (*cranial*)	(412) 647-8312	Referrals (General)	(412) 647-3685
Community Neurosurgery	(412) 647-3685	Residency Program	(412) 647-6777
Donations	(412) 647-7781	Speakers Bureau	(412) 647-3685
Endovascular	(412) 647-7768	Spine	(412) 802-8199
Gamma Knife	(412) 647-7744	Synergy	(412) 647-9786
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		Website	(412) 647-7931

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Editor: Douglas Kondziolka, MD • **Production Editor:** Paul Stanick
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Newsletter .pdf archive is available on our website at **www.neurosurgery.pitt.edu/news/neuronews**

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Proven effective in Parkinson's, Essential Tremor and Dystonia treatment

Deep Brain Stimulation playing key role in functional recovery

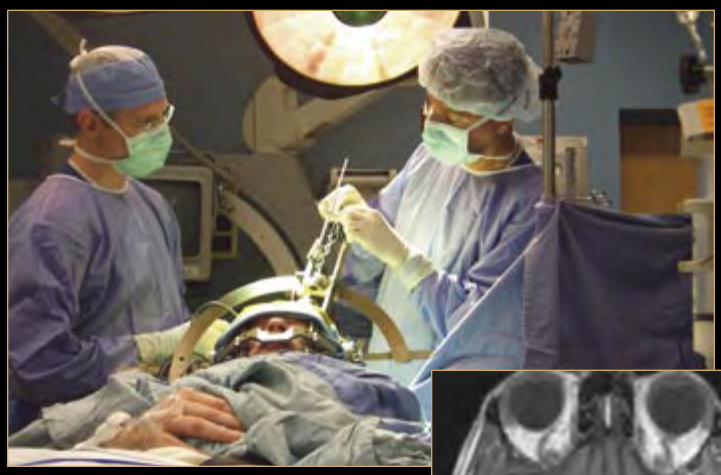
Douglas Kondziolka, MD
Director, UPMC Center for Brain Repair
Peter J. Jannetta Professor of Neurological Surgery

Deep Brain Stimulation (DBS) is used in adults and children for movement disorders such as Parkinson's Disease, Essential Tremor and Dystonia. On a research basis, it is also being evaluated in major depression.

DBS was first approved by the United States Food & Drug Administration (FDA) in 1997 for use in tremor and in 2002 for the general symptoms of Parkinson's Disease. It is used at our facility in adults and children with dystonia under an FDA Human Device Exemption (HDE). While research studies in medically refractory depression and obsessive-compulsive disorder are in progress, other studies have evaluated DBS for epilepsy, cluster headache, and selected pain syndromes. It is clear that there is a great need for improved therapies for patients with behavioral disorders. We are also conducting clinical trials on the value of cortical stimulation and vagal nerve stimulation for major depression

In thalamic deep brain stimulation used for tremor, the DBS electrode is placed down into the thalamus and testing is begun. Electrical impulses are sent from the tip of the electrode into the thalamus. The surgeon confirms a brain location where the tremor can be stopped effectively. At the same time, the surgical team monitors for any side effects of stimulation (persistent numbness of the face, mouth, hand or leg, heaviness or weakness of the limb, change in speech). If good results are obtained, the electrode is left in place and anchored to a plastic clip that has been attached at the burr hole. The wound is then closed.

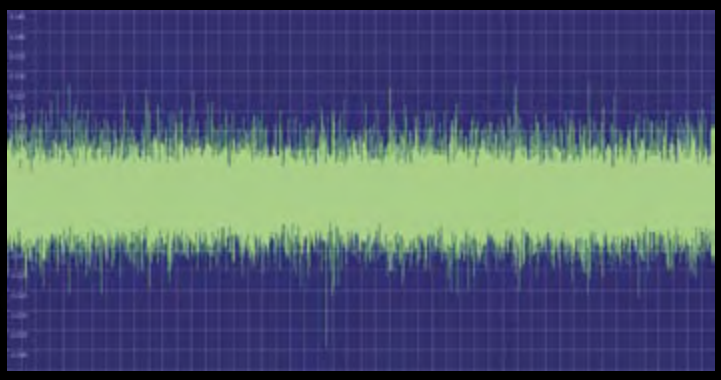
In stage two of the operation, the patient is given a general anesthetic and put to sleep. The side of the head, neck and upper chest is prepared and draped. A small incision is made below the collarbone to allow creation of a small pouch underneath the skin that will hold the stimulator pulse generator (battery). A small incision is made behind the ear and a cable passed from the chest incision up to the head (all under the skin). This cable is then attached to the electrode coming out of the brain using a small plastic cover. The entire system remains underneath the skin. Generally, the chest incision is closed with an invisible stitch that does not need to be removed. The scalp stitches (in the front and behind the ear) are closed with nylon.



For patients that undergo subthalamic deep brain stimulation, it is important to know that the goal of the procedure is to improve the condition in the "off" medication state. Many patients with Parkinson's disease have both "on" and "off" medication states. The "on" state is when the medications appear to be working and when the patient is more loose and nimble. The "off" state is when the patient is slower and stiffer. Deep brain stimulation does not usually improve the "on" state (the patients best condition), but hopes to improve the patient when they are in their worst state. It also hopes to improve dyskinetic movement abnormalities.

It is important to know that there will be many hours of physician or assistant programming to optimize the stimulation parameters. Every patient is different. Our team works with each patient to program the stimulator to the parameters that provide the most benefit. At the same time a medication adjustment may be required. The stimulators can be programmed in many different ways (the voltage, the frequency with which the stimulus is delivered to the brain, the length of each stimulus, and the shape of the stimulus and region that it influences the brain cells) and each patient may be different.

We do not as yet have a clear understanding of the mechanism of action of DBS. It may acting to inhibit overactive neurons, or to excite inhibited axons. We continue to obtain both neurophysiologic and anatomic data to correlate with clinical outcomes. Research studies in limbic neuromodulation for major depression are also planned. More to come on that topic in the next few months. •



Images at top of page and to right show placement of stimulator in patient. Image directly above is intraoperative subthalamic nucleus microelectrode recording.

EMG monitoring reduces injury, complications in Expanded Endonasal procedure

Parthasarathy D. Thirumala, MD
Clinical Asst. Professor of Neurological Surgery

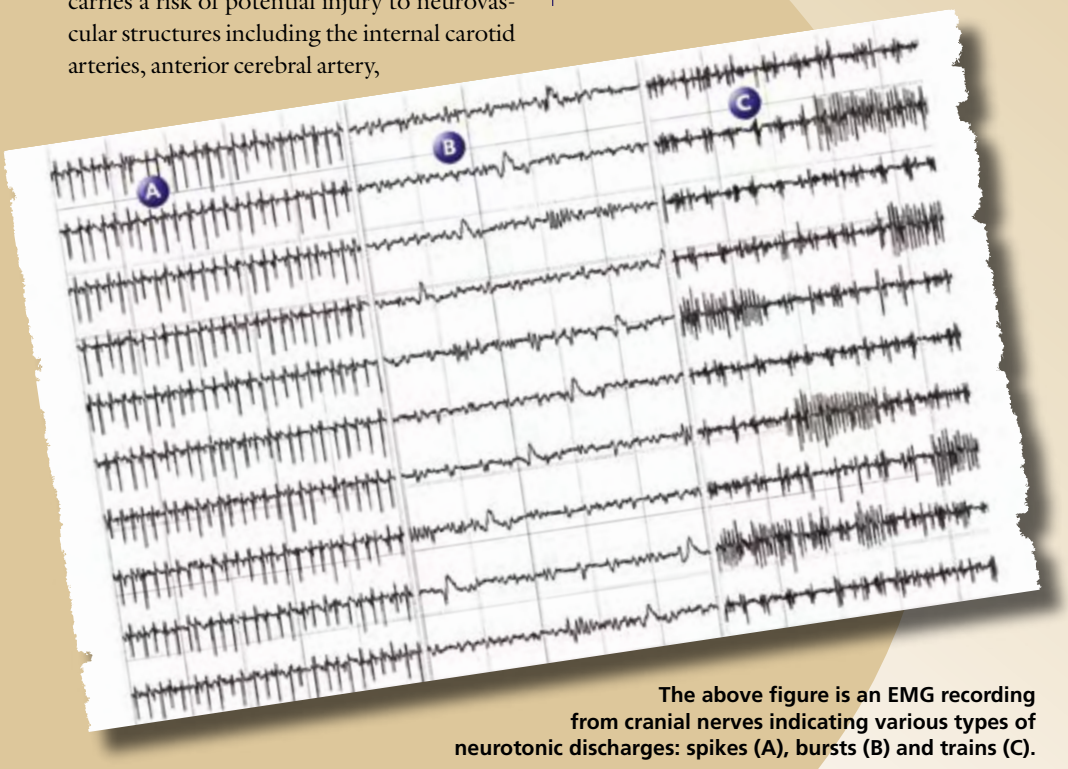
The earliest report of cranial nerve (CN) monitoring was described observing twitches in the facial muscles during posterior fossa surgery more than 110 years ago. There has been significant progress in our understanding of neurophysiology of the cranial nerves in response to electrical stimulation. Injury to the lower CN (V, VII, IX-XII) can result in devastating post operative complications including hoarseness of voice, swallowing problems, and taste and speech difficulties. Intraoperative CN monitoring can provide immediate feedback on the location of the nerve in relation to a mass lesion or tumor, map the course of the nerve along a tumor, and provide prognostic information on the anatomical and functional integrity of a nerve.

Expanded Endonasal Approach (EEA) is a novel minimally invasive technique developed at UPMC that involves use of endoscope and complex neuronavigational systems with neurosurgery and otolaryngology working together during all phases of surgery. Using the principles of expanded endonasal approach we are able to access the entire ventral skull base, from the crista galli and up to and through the odontoid. Although minimally invasive, the EEA still carries a risk of potential injury to neurovascular structures including the internal carotid arteries, anterior cerebral artery, extraocular and lower cranial nerves. We believe that EMG monitoring during the EEA can decrease the incidence of devastating postoperative neurological deficits.

Nerve monitoring and predictors of nerve injury

Cranial nerve function can be monitored using spontaneous (SEMG) and or triggered (TEMG) electromyography. Neurotonic discharges (figure below) are SEMG activity precipitated by mechanical stimulation of the motor axon. They are a sensitive indicator of nerve irritation and give immediate information regarding nerve location. Neurotonic discharges are classified as spikes, bursts and trains based on length of activity, amplitude and frequency of the discharges. Complete transaction of the nerve has been associated with no neurotonic discharges during SEMG recordings.

Triggered EMG can be elicited by constant current or voltage stimulation of the nerve to produce a compound muscle action potential. When stimulated at low current threshold the responses have a definite latency and intersubject variable amplitude. The amplitude of the response indicate the percentage of functional axons in the nerve between stimulating and recording site. A decrease in amplitude ratio from proximal and distal stimulation or an increase in threshold of current stimulation has been a predictor of cranial nerve injury.



The above figure is an EMG recording from cranial nerves indicating various types of neurotonic discharges: spikes (A), bursts (B) and trains (C).

Intraoperative monitoring technique

The motor component of the glossopharyngeal nerve was monitored by placing two electrodes after endotracheal intubation in the soft palate. The recurrent laryngeal component of the vagus nerve was monitored by placing two electrodes in the cricothyroid muscles below the thyroid cartilage. Monitoring spinal accessory nerve and hypoglossal nerve were done using two electrodes in the trapezius, and tongue muscles respectively. No detectable EMG activity was considered to be normal at baseline in each case. All instances of EMG activity, regardless of type, were immediately reported to the surgeon.

UPMC experience

In one review of research at our institution, SEMG monitoring during EEA was helpful in identifying lower cranial nerves and preventing postoperative neurological deficits. Eighty seven patients were reviewed who had at least one lower cranial nerve EMG monitoring. Our database includes the largest subset of motor cranial nerve monitoring 24% (n=21) of the patients. SEMG activity occurred in 9.5% (n=2) with no ensuing postoperative neurological deficits. Monitoring cranial nerves VII, IX and XI identified SEMG activity in 22% (n=11), 25% (n=12), 4.1% (n=1) without any postoperative neurological deficits. Monitoring cranial nerves X, and XII had EMG activity in 17% (n=9), 18% (n=9) without any postoperative neurological deficits. There were two postoperative motor deficits supplied by cranial nerve X, XII without any EMG activity. The sensitivity and specificity for identification of lower cranial nerves or an impending iatrogenic neurological injury was 93.9%, and 100% respectively. In comparison to traditional skull base surgery there was a lower number of EEA cases with cranial nerve SEMG activity and more importantly very minimal devastating postoperative neurological deficits.

Intraoperative neurophysiological monitoring with cranial nerve EMGs during EEA will provide important information to prevent and reduce impending injury to cranial nerves. We advocate a comprehensive approach to neurophysiological monitoring during EEAs including somatosensory evoked potentials, SEMG and TEMG of the CN II-XII, and brain stem auditory evoked potentials depending on the location of the neural structures at risk.

Technological advances in Axial Lumbar Interbody Fusion system (Axial LIF™) now allow for two-level minimally invasive fusion at both L4-5; L5-S1 levels

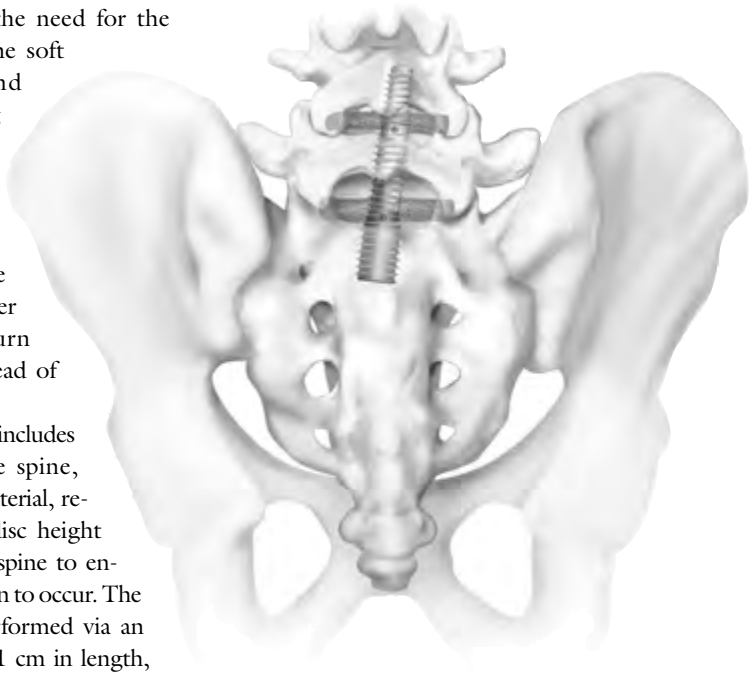
Peter C. Gerszten, MD, MPH, FACS
Associate Professor of Neurological Surgery

Christopher Bonfield, MD
PGY-2 Resident

For patients requiring an interbody fusion operation at both the L4-5 and L5-S1 levels (where the lumbar spine meets the sacrum), surgery can be a major undertaking, associated with risks as well as patient discomfort. Such techniques usually involve an incision in the abdomen or the back that allows for the placement of rigid devices within the disc space to prevent motion. Such surgeries may last for several hours and are associated with risks of vascular and nerve root injury. Patients usually recover in the hospital for several days.

The Axial Lumbar Interbody Fusion System (Axial LIF™) is a minimally invasive approach that was first developed to allow for the L5-S1 disc space alone to be accessed and fused while avoiding the need for a painful incision. This technique has been used by members of the Department of Neurological Surgery at the University of Pittsburgh Medical Center since 2005. Previously, the Axial LIF system was limited to surgery at the L5-S1 disc space alone. However, a new advancement in the technology now allows for a fusion to be performed at both the L4-5 and L5-S1 levels through the same minimally invasive approach.

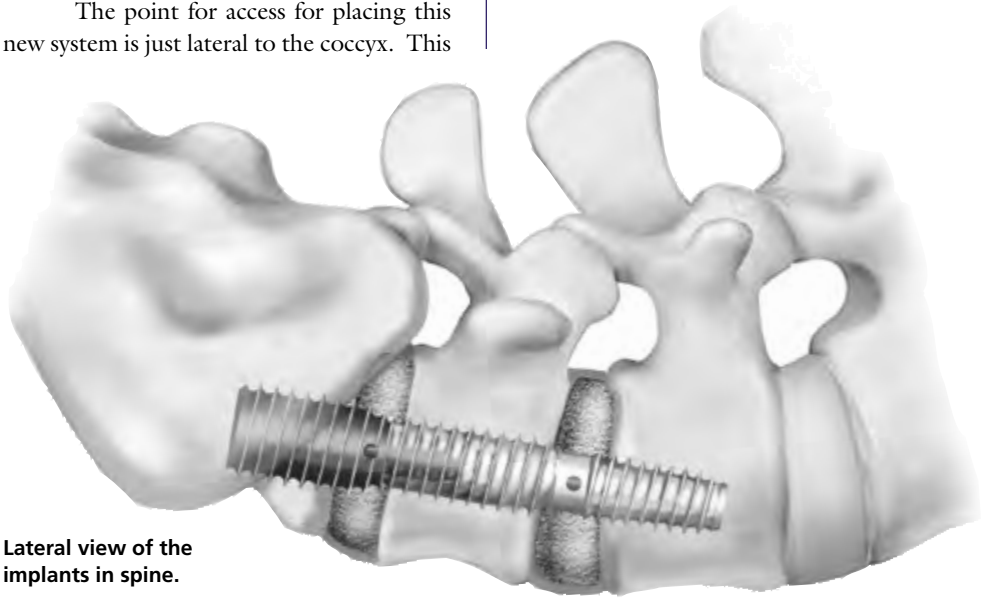
The point for access for placing this new system is just lateral to the coccyx. This point of access alleviates the need for the surgeon to cut through the soft tissue such as muscle and ligaments, thus lessening patient pain and the likelihood of complications. This minimally invasive approach allows patients to be discharged from the hospital usually the day after surgery. Patients can return to work within weeks instead of months.



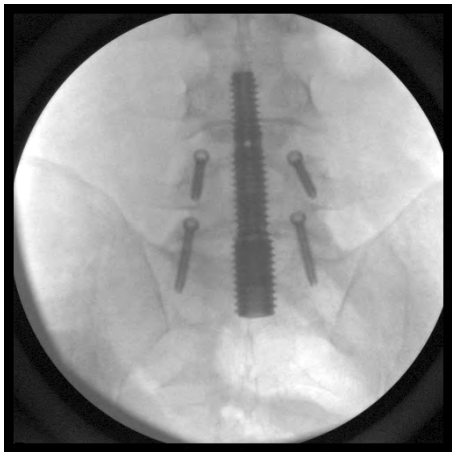
The Axial LIF system includes devices used to access the spine, remove the diseased disc material, re-establish normal disc height and stabilize the spine to enable lumbar fusion to occur. The procedure is performed via an incision of only 1 cm in length, with complete preservation of all native paraspinal soft tissues structures including the disc annulus. The spine is further stabilized by the percutaneous placement of bilateral facet screws that can be placed through a needle incision.

Implants.

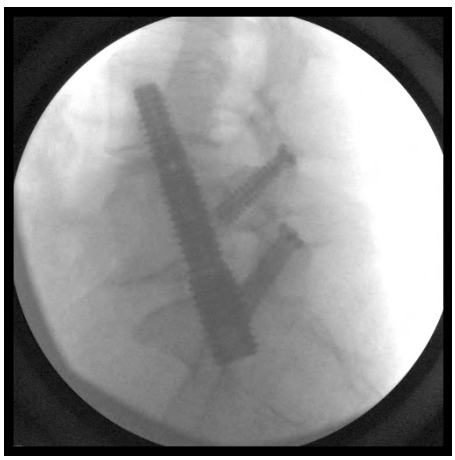
So far, experience with the new two-level Axial LIF system with patients at the University of Pittsburgh has been very positive. The patients have been extremely pleased with the results and surprised at how little post-operative pain they have experienced. •



Lateral view of the implants in spine.



Anterior posterior xray of the final construct.



Lateral xray of the final construct.

CIRCL one of premier injury research, training centers in nation

The Center for Injury Research and Control (CIRCL) is one of the premier injury research and training centers in the United States. The mission of CIRCL is to understand injuries and reduce their occurrence, severity and consequences through development of multi-disciplinary research and educational and training activities.

From its initial founding in 1992, CIRCL has addressed the spectrum of injury with foundational, developmental, primary prevention, translational acute care and rehabilitation research as well as training and outreach. CIRCL is one of only 13 centers in the United States to receive official designation as an Injury Control Research Center (ICRC) by the Centers for Disease Control and Prevention (CDC). Anthony Fabio, MPH, PhD, is the center's director and Patrick Kochanek, MD, is associate director.

To fulfill its mission CIRCL has been organized into three cores: the Administrative Core, the Research Core and the Training and Outreach Core. The Administrative Core oversees and manages the Grant and Project Administration, the Data Analysis and Management Division (DAMD), the Seed Projects and the Annual Research Awards. The Research Core carries out research and consists of three divisions: the Public Health Division, the Acute Care Division and the Rehabilitation and Disability Division. The Research Core has been organized to cover the full spectrum of injury, from primary prevention, to acute care, to rehabilitation. The Training and Outreach Core develops and implements education and training for students and health professionals as well as outreach to the community.

CIRCL is a truly multidisciplinary integrated network with collaborators from the departments of Physical Medicine and Rehabilitation, Pediatrics, Critical Care and Epidemiology as well as other institutions including Carnegie Mellon University. Currently CIRCL conducts injury research with a focus on traumatic brain injury (TBI) and youth violence. Several CIRCL projects focus on using biomarkers as prognostic and diagnostic tools for TBI.

In a project looking at improving the diagnosis of inflicted head trauma in infants, Drs. Kochanek and Rachel Berger have shown that biomarkers and a clinical decision rule can be used to help physicians recognize possible brain injury in infants in emergency rooms. Missed diagnosis contributes significantly to the morbidity and mortality from this type of injury which is the leading cause of severe TBI in children less than two years of age. This work has led us much closer to being able to properly identify TBI in infants and young children and thereby improve diagnosis of inflicted TBI.

In another project, Drs. Fabio and Amy Wagner have been studying the impact of neuroendocrine hormones after TBI. They have begun to identify unique state of the art modeling approaches, including trajectory analysis, to identify acute trajectory patterns of hormones. This work could lead to the establishment of comprehensive biomarker modeling algorithms for diagnosis, prognosis and management.

CIRCL is also on the leading edge of examining how societal effects interact with individuals to influence youth violence. In the *American Journal of Epidemiology*, Dr. Fabio and colleagues provided evidence that the youth violence epidemic of the late 1980's and early 1990's was due in part to specific social factors and not due the make-up of the generation growing up during that time. Earlier work by others theorized that individuals are solely responsible for the actions and society plays only a small role, suggesting that the rise of violence was due to factors specific to individuals. However, Dr. Fabio's work shows that individuals are not destined for a life of violence and that community based interventions can be effective.

Beyond research, CIRCL faculty and staff are involved in academic training, acute care training, research mentorship, and community outreach. Specifically, CIRCL faculty teach several injury related courses at the Graduate School of Public Health as well as mentor graduate and medical students. One of CIRCL's primary community outreach programs, in collaboration with Children's Hospital of Pittsburgh, is ThinkFirst for Kids (TFFK). TFFK is a brain and spinal cord injury prevention program directed towards children in grades K-3.

Additionally, CIRCL provides epidemiological and statistical services through the DAMD. To stimulate injury research and to foster collaborative interdisciplinary research in the field, CIRCL's Annual Research Awards Program awards one junior faculty grant for $10,000 and one student grant for $5,000 each year. To learn more about CIRCL, the DAMD, or the Annual Research Awards Program please visit CIRCL's website at www.neurosurgery.pitt.edu/circl. •

Community outreach is a main thrust of CIRCL. In the ThinkFirst for Kids and Safe Kids Programs, safety issues are promoted through neighborhood 'bike rodeos' and through education programs in elementary schools. In collaboration with Children's Hospital of Pittsburgh these programs distribute helmets and raffle bikes.

Madhok Wins Best Presentation Award at Rowe Day

PGY-6 resident **Ricky Madhok, MD**, received the best presentation award at the fourth annual Department of Neurological Surgery Stuart Rowe Society Lectureship held on December 10.

Madhok's presentation "The Biomechanical Characteristics of the Occipital Cervical Junction—Evaluation after Clivectomy, Condylectomy and Odontoidectomy" was one of eight research lectures presented by department residents during the day honoring Stuart Niles Rowe, the department's first chairman and an early advocate of broad neurosurgical training.

The award was chosen and presented by the lectureship's honored guest, **Patrick J. Kelly, MD**, noted expert in computer-assisted stereotactic neurosurgery and former chairman of neurosurgery at New York University's Langone Medical Center.

In addition to the resident lectures, the day featured 3D anatomy presentations by department fellows and a lecture on the stereotactic removal of brain tumors by Dr. Kelly. Dr. Kelly also presented a lecture on "The Resection of Gliomas and the Myth of Sisyphus" later in the evening at the Fox Chapel Golf Club.

New Department Appointments

• **Anthony Fabio, MPH, PhD**, was named director of the Center of Injury Research and Control (CIRCL) at the University of Pittsburgh in November.

• **C. Edward Dixon, PhD**, was appointed vice chairman of research for the Department of Neurological Surgery in December.

New Research Grants

• "Peptide vaccine-based immunotherapy for pediatric low-grade gliomas." **Ian Pollack, MD, Hideho Okada, MD**, Regina Jakacki, MD, Brain Tumor Society, $309,170.

• "Detecting Brain Injury Biomarkers in Exhaled Breath Condensates." **Martina Stippler, MD**, Pittsburgh Foundation, $10,000.

Prominent Lectures

• **Amin Kassam, MD**, provided the keynote address at the Congress of the Brazilian Neurosurgery Society in Iguassu Falls, Brazil, September 16 and at the Annual Meeting of the Japanese Society for Neuroendoscopy in Tokyo, Japan, November 21.

He was also a guest lecturer at the Annual Conference of Skull Base Surgery Society of India in Mumbai, India, October 10; the KNC Conference in Yamanashi, Japan, November 23; and the Annual Pennsylvania Neurological Society Conference in Pittsburgh, PA, October 4.

In addition, Dr. Kassam taught a course in "Cadaveric Dissection and Live Surgery" at Tata Memorial Hospital in Mumbai, India, October 9-10 and a course in "Cadaver Dissection" at the Annual Meeting of the Japanese Society for Neuroendoscopy in Tokyo, Japan, November 22.

• **L. Dade Lunsford, MD**, lectured and served on the faculty of The World Federation of Neurosurgery course in Bratislava, Sovakia, November 21-23, and the Slovakian Neurosurgery Annual Meeting, November 24.

• **Peter Gerszten, MD**, was a guest lecturer at Case Western Reserve University School of Medicine in Cleveland, OH, November 7 and at the Cancer Centre of the University of Calgary in Calgary, Canada, December 4.

• **Dr. Pollack** was a visiting professor at Louisiana State University (Shreveport, LA), December 3-4.

In the News

• **Joseph Maroon, MD,** was featured on the KDKA TV-2 (Pittsburgh) *Evening News*, December 4, discussing his recent Hawaiian Ironman Triathlon World Championship experience and how a good diet and exercise program can help a person lead a busy, complicated and satisfying lifestyle.

Dr. Maroon was also featured in numerous articles across the country for his book, *The Longevity Factor*, (see back page) released in December that examines certain natural substances in food that can potentially lead to a healthier and longer life.

Additionally, Dr. Maroon was mentioned in various media outlets across the country in December for his role in the care of Pittsburgh Steeler quarterback Ben Roethlisberger following his concussion December 28. Many of the articles also focused on the ImPACT concussion program at the University of Pittsburgh.

Congratulations

• **Erin Sauber-Schatz, MPH, PhD**, has been accepted into the Centers for Disease Control and Prevention's Epidemic Intelligence Service, a unique two-year post graduate program of service and on-the-job training for health professionals interested in the practice of epidemiology. Additionally, Erin successfully defended her dissertation titled "The Role of Injury in Nervous System Birth Defects and Birth Trauma During the Perinatal Period" and graduated with a PhD in epidemiology from the University of Pittsburgh's Graduate School of Public Health in December.

• **Johnathan Engh, MD**, was awarded the CNS Basic/Translational Young Investigator Research Fellowship at the Congress of Neurological Surgeons meeting in September. Dr. Engh also received the Clinical Educator of the Year Award from the University of Pittsburgh School of Medicine in October

• **Marianna Hegedus** graduated summa cum laude from the University of Pittsburgh with a bachelor of arts degree in health services. She also earned certificates in "Community Health Assessments" and "Managing Health Services Programs and Projects," was inducted into the Alpha Sigma Lambda Honor Society and received the Anne M. Levenson and Osher Foundation scholarships.

Welcome

Melissa Sroka, medical secretary for Drs. Lunsford and Douglas Kondziolka; **Daniel Premkumar, PhD**, visiting research assistant professor; **Juan Fernandez-Miranda, MD**, clinical instructor; **Dana Balanti**, patient information coordinator; **Adrianne Mullins**, administrative assistant to Drs. Engh, Gerszten and Adam Kanter; **Juliana Kovac**, nurse for Drs. Kassam, Engh, Paul Gardner and Daniel Prevedello.

Calendar Change

The 4th World Congress for Endoscopic Surgery of the Brain, Skull Base and Spine has been rescheduled for April 28-30, 2010.

2008 Annual Report Available

The Department of Neurological Surgery's 2008 annual report is now available in pdf format on the department's website at www.neurosurgery.pitt.edu. •

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WINTER 2009 • VOLUME 10, NUMBER 1

Maroon book examines natural elements in food that can promote a healthier life

Joseph Maroon, MD, Heindl Scholar in Neuroscience at the University of Pittsburgh and noted health and sports medicine expert, has authored a book that examines how the natural substances found in certain foods such as red wine and green tea can lead to a healthier and longer life.

The Longevity Factor: How Resveratrol and Red Wine Activate Genes for a Longer and Healthier Life is "a groundbreaking examination of new scientific research that holds the secret to weight loss, increased strength, endurance, memory, and a healthier, longer life," according to publisher Atria Books, a division of Simon & Shuster, Inc.

"In *The Longevity Factor*, noted neuroscientist and surgeon Joseph Maroon, MD, offers the definitive look at recent scientific breakthroughs identifying a group of natural substances—including the much-publicized molecule resveratrol—that can actually activate a specific set of genes in humans that promote a longer, healthier life. These substances, which make red wine, dark chocolate, and green tea good for us, appear to stave off a wide array of age-related diseases and keep us feeling young and vital.

"Resveratrol is the centerpiece of headline-making research being conducted at the Harvard Medical School and elsewhere. Only recently, however, have scientists discovered how to isolate resveratrol and concentrate it into an affordable and safe supplement. Already, more than 200 supplements featuring resveratrol have flooded the market, and there are countless more on the way. But which ones work best? What is a consumer to look for on the label? Since resveratrol is a natural substance, can you get enough of it through diet alone, or should you combine diet with a supplement? And what lies on the horizon from the pharmaceutical industry? All those questions and many more are answered in this immensely informative and practical book." •