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University Movement Disorders Surgery Program offers patients a wide array of treatment options

Dr. Kondziolka
Co-Director, Center for Image-Guided Neurosurgery

by Douglas Kondziolka, MD

The Movement Disorder Surgery program at the University of Pittsburgh offers patients and their families a number of different surgical treatment options for their movement disorder. Movement disorders suitable for treatment include Parkinson's disease, Essential Tremor, Primary or Secondary Dystonia, tremor from Multiple Sclerosis or brain injury, and other movement disorders.

Procedures and Indications

1. Deep brain stimulation (DBS, thalamus): Thalamic DBS is performed for the treatment of one-sided tremor (right or left hand) from either Parkinson's disease or Essential tremor (intention tremor).

2. Deep brain stimulation (DBS, subthalamus): Subthalamic DBS is performed in patients with advanced and disabling Parkinson's disease. It can be performed either on one side or on both sides of the brain.

3. Deep brain stimulation (DBS, globus pallidus): Pallidal DBS is performed mainly for patients with dystonia but can also be performed for patients with Parkinson's Disease. Surgery is performed both in children and in adults.

4. Gamma Knife® radiosurgery: Gamma Knife® Radiosurgery is used to create a thalamotomy (lesion of the thalamus) for the management of tremor. The tremor can be from Essential Tremor, Parkinson's disease or Multiple Sclerosis. Gamma Knife® radiosurgery is mainly performed in patients who have medical risks that make open surgery hazardous or those with advanced age. It is also performed in patients who wish to avoid open procedures.

5. Radiofrequency lesioning (RF thalamotomy; RF pallidotomy): Stereotactic lesioning of deep brain targets has been performed for decades for the management of movement disorders. The most common procedure is a pallidotomy, used to treat advanced Parkinson's disease, and in particular, dyskinesia.

Drs. Michael Sharts (L) and Douglas Kondziolka (R) place a stimulating electrode into the subthalamic nucleus of a patient with Parkinson's Disease.

Deep Brain Stimulation

Deep brain stimulation (DBS) in adults is a two-stage procedure under both local and general anesthesia. DBS in children is usually performed under general anesthesia. In adults, the first stage begins with application of a stereotactic frame using sedation and local anesthesia. A stereotactic MRI scan is then performed to identify the deep brain target (this takes about 30 minutes). Coordinates are determined for the electrode and a safe trajectory down to the target is identified.

The patient is taken back to the operating room and placed comfortably on the operating room table. The patient is monitored by the anesthesia service. After the hair and stereotactic frame are prepared, a small scalp shave is performed. The skin is numbed with local anesthetic and a small incision is made.

A 14mm hole is made in the skull bone. The dura (covering of the brain) is opened and a tiny area of the brain is exposed. The probe is then passed down toward the deep brain structures.

In thalamic DBS, 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. One hopes to identify 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 to the skull opening. The wound is then closed.

(see *movement* on page 4)

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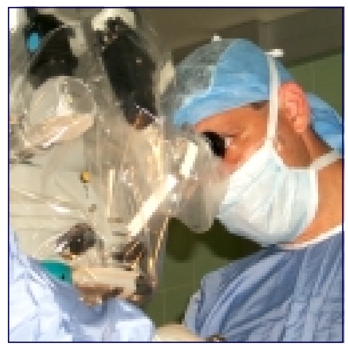
Spotlight: Graduating Resident

Dr. Melvin Field

As a third-year medical student at the University of Florida, Melvin Field, MD, found himself awestruck and inspired during his rotation in neurosurgery. "I knew at that point that nothing else would quench my intellectual and technical aspirations in medicine quite like neurosurgery," says Field. Nine years later Field's dream has become a reality as he joins James Burke, MD, and Alan Scarrow, MD, in graduating from the Department of Neurological Surgery's residency program.

"I realized the greatest advancements in medicine over the next fifty years will be centered around the nervous system," says Field, "and I wanted to be associated with a program that would lead that advancement." Field believed, at the University of Pittsburgh, he would be challenged by some of the most respected doctors in the field — both in the operating room and in the research arena.



During his residency, he participated in over 1,500 operative cases including numerous cutting edge neurosurgical procedures, such as Gamma Knife® stereotactic radiosurgery, minimally invasive endoscopic pituitary surgery and subthalamic deep brain stimulation for Parkinson's Disease. "Because of the many interests among the department's attending neurosurgeons," Field says, "I was able to learn and master these skills from nationally renowned experts."

"Mel Field has taken all this program has to offer and created a neurosurgical career based on innovation and minimally invasive treatment strategies," says Douglas Kondziolka, MD, vice chairman of education for the Department of Neurological Surgery.

Field's most rewarding work during his training at the University of Pittsburgh was related to the management of cerebral concussion in athletes. In collaboration with the University of Pittsburgh Medical Center's Sports Medicine Center, the University of Pittsburgh's Alzheimer Disease Research Center, UPMC's Center for Functional Imaging, and Carnegie Mellon University's Center for the Neural Basis of Cognition, Field created the country's first fMRI neurocognitive analysis group committed to the development of novel ways to evaluate athletes after cerebral concussion.

Through a five-year NIH-funded project grant to study sports-related concussion, Field utilized functional MRI and computerized neurocognitive testing to help link the observed signs and symptoms of sports-related concussion with the poorly understood physiological and anatomical abnormalities theorized to occur with concussion. Early data and results being generated from this project are already helping to identify objective measures to accurately diagnose, follow and treat sports-related concussion.

Field is returning to his home state of Florida where he plans to begin his career in neurological surgery at Florida Hospital Health System's Neuroscience Institute in Orlando. Besides focusing on minimally invasive cranial and spinal surgical alternatives to neurosurgical disease, he plans on developing a National Center for Sports-Related Craniospinal Injuries in collaboration with Florida Hospital, the University of Central Florida and the National Basketball Association's Orlando Magic. The purpose of the center is to aide athletes — from the professional ranks to the middle school level — in the prevention and management of cerebral concussion and spinal injury.

"Dr. Field will combine his expertise in neurological surgery with his love of sports to improve the neurological care of athletes," says Kondziolka, "I expect, within a short period of time, he will be a national leader in the field." ■

Trigeminal neuralgia: Overview and medical management

by Ajay Niranjan, MCh, L Dade Lunsford, MD, Douglas Kondziolka, MD

Trigeminal neuralgia (TN), also known as tic douloureux, is a pain syndrome recognizable by patient history alone. The condition is characterized by intermittent one-sided facial pain. The pain typically involves one side (>95%) of face (sensory distribution of trigeminal nerve (V), typically radiating to the maxillary (V2) or mandibular (V3) area). Physical examination findings are typically normal; although mild light touch or pin perception loss has been described in central area of the face. Significant sensory loss suggests that the pain syndrome is secondary to another process, and requires high-resolution neuroimaging to exclude other causes of facial pain.

The mechanism of pain production remains controversial. One theory suggests that peripheral injury or disease of the trigeminal nerve increases afferent firing in the nerve perhaps by ephaptic transmission between afferent unmyelinated axons and partially damaged myelinated axons; failure of central inhibitory mechanisms may also be involved. Blood vessel-nerve cross compression, aneurysms, chronic meningeal inflammation, tumors, or other lesions may irritate trigeminal nerve roots along the pons. Uncommonly, an area of demyelination, such as may occur with multiple sclerosis, may be the precipitant. In some cases, no vascular or other lesion is identified rendering the etiology unknown. Development of trigeminal neuralgia in a young person (<45 years) raises possibility of multiple sclerosis, which should be investigated. Thus, although TN typically is caused by a dysfunction in the peripheral nervous system (the roots or trigeminal nerve itself), a lesion within the central nervous system may rarely cause similar problems.

Medical Management

The goal of pharmacologic therapy is to reduce pain. Carbamazepine (Tegretol) is regarded as the most effective medical treatment. Additional agents that may benefit selected patients include phenytoin (Dilantin), baclofen, gabapentin (Neurontin), Trileptol and Klonazepin.

Surgical Management

Prior to considering surgery, all patients should have a MRI, with close attention being paid to the posterior fossa. Imaging is performed to rule out other causes of compression of the trigeminal nerve such as mass lesions, large ectatic vessels, or other vascular malformations. The surgical options for TN include peripheral nerve blocks or ablation, gasserian ganglion and retrogasserian ablative (needle) procedures, craniotomy followed by microvascular decompression (MVD), and stereotactic radiosurgery (Gamma Knife®). Percutaneous transovale needle techniques include radiofrequency trigeminal electrocoagulation, glycerol rhizotomy, and balloon microcompression. Microvascular decompression (MVD) is often preferred for younger patients with typical trigeminal neuralgia. High initial success rates (>90%) have led to the widespread use of this procedure. This procedure provides treatment of the cause of TN in many patients. Percutaneous techniques are advocated for elderly patients, patients with multiple sclerosis, patients with recurrent pain after MVD, and patients with impaired hearing on the other side, however some authors recommend needle techniques as first surgical treatment for many patients. It is generally agreed that MVD provides the longest duration of pain relief while preserving facial sensation. In experienced hands, MVD can be performed with low morbidity and mortality. Most authors offer MVD to young patients with TN.

The Faces of Trigeminal Neuralgia

Sex: Male-to-female ratio is 2:3.

Age: The average age of pain onset in TN typically is sixth decade of life, but it may occur at any age. Symptomatic or secondary TN tends to occur in younger patients.

Nature of pain: Pain is stabbing or electric shock like sensation and is typically quite severe. Pain is brief (few seconds to one to two minutes) and paroxysmal, but it may occur in volleys of multiple attacks. Pain may occur several times a day; patients typically experience no pain between episodes.

Distribution of pain: Pain is one-sided (unilateral, rarely bilateral). One or more branches of the trigeminal nerve (usually lower or midface) are involved.

Trigger points: Various triggers may commonly precipitate a pain attack. Light touch or vibration is the most evocative. Activities such as shaving, face washing, or chewing often trigger an episode. Over years, periods of remission are less and less and severity of pain increases.

Course: The disease course is usually one of clusters of attacks that wax and wane in frequency. Some patients report that their exacerbations commonly occur in fall and spring.

Causes: Some patients' conditions are unknown, but compression of the trigeminal root entry zone by blood vessels (especially branches of the superior cerebellar arteries or venous channels) or tumors may cause pain.

Imaging Studies: Patients with characteristic history and normal neurologic examination may be treated without further workup. An MRI scan with and without contrast is essential to rule out the presence of a tumor, arteriovenous malformation, or multiple sclerosis all of which can cause trigeminal neuralgia in a small number of patients. In addition, basal skull condition including maxillary sinusitis may mimic symptoms of TN.

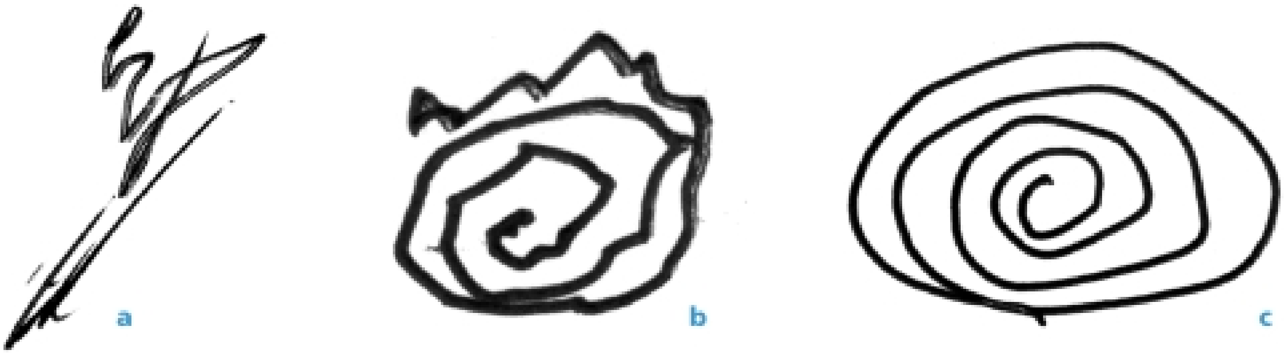
Trigeminal Neuralgia Radiosurgery

Radiosurgery is performed by delivering a high dose of ionizing radiation in a single treatment session using multiple beams precisely focused at the target inside the brain (photo on page 6). Several

(See **trigeminal neuralgia** on page 6)

University program provides proven treatment for

Movement Disorders



The above three spiral diagrams are drawings by a 39-year-old male high school teacher undergoing left thalamic deep brain stimulation for right hand essential tremor. Image A is drawn with the right hand with the stimulator off; image B is drawn with the untreated left hand; image C is drawn with the right hand with the stimulator on.

(from page 1)

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.

In subthalamic DBS, the procedure is similar. However, once the skull opening has been created safely, a microelectrode (very small metal wire) is inserted into the brain toward the thalamus and subthalamic region. A neurophysiologist participates in the identification of specific brain cells in these regions. The purpose is to map out the area to optimize placement of the electrode. Often the room will be dark during this time period. The patient will be kept comfortable during this time as the brain is evaluated.

The time for microelectrode recording can take several hours. Once the appropriate area is identified, test stimulation is performed in order to check that the electrode is in a safe location that will not disturb brain function. When the safe area is identified, the electrode will be left in place and clipped to the skull bone-fastening device. If both sides of the brain are to be operated on at the same setting, a second incision will be made on the other side and the procedure repeated. This will again take several hours.

Subthalamic DBS is a longer operation. For most patients, the first stage of the operation (placing electrodes into the brain) will all be performed in one day. The patient will be observed overnight in the hospital. The scalp incisions will be closed and the patient will return to the hospital 3-7 days later for the second stage of the procedure. At the second stage, performed under a general anesthetic, the cables and batteries will be inserted into the neck and chest area. Once the device is inserted, the patient will return to the neurology clinic. The stimulators will be turned on by the neurologist and his team several weeks later.

For globus pallidus DBS, the procedure is similar to that described above with several exceptions. In dystonia patients, the electrodes are placed into the brain using MRI stereotactic guidance, and then checked using stimulation. This makes for a shorter procedure. For most patients, both electrode insertion (under local anesthesia) and cable and pulse generator placement (under general anesthesia) is performed on the same day.

Potential complications in Deep Brain Stimulation

We are only beginning to understand the brain and its functions and pathways. At the same time, our understanding of the causes of complex Parkinson's disease, tremor and dystonia is somewhat simplistic. It is not surprising therefore that despite many good outcomes that can be achieved with deep brain stimulation surgery, there are many side effects that can be identified. Some of these side effects are related to placement of the electrode into the brain, some are side effects related to the hardware and it's components, and some are due to stimulation of the brain.

Side effects related to placement of the device:

These include complications from local or general anesthesia, application of the stereotactic frame (scalp infection), exposure of the skull and brain surface (bleeding of the scalp or bleeding on the surface of the brain), and stroke (bleeding within the brain itself, 1% risk of significant bleeding within the deep brain from placing the electrode). This can cause stroke or death. If life threatening, the patient would need urgent brain surgery to stop the bleeding and save the patient's life. This is often the most serious complication of open brain surgery.

• **Wound Infection:** This can occur from cutting the skin and exposing the brain or other tissues. The risk of infection 3-5%. Patients are placed on antibiotics at the time of surgery to try to minimize this. If an infection occurs, part or all of the system will have to be removed and then replaced several months later. The patient will remain on a standard course of antibiotics until the infection is completely treated.

• **Complications from hardware and its components.** Hardware-related problems seem to occur in 10-15% of patients. These include fracture or breakage of the DBS wire or cable and need for subsequent replacement.

• **Battery failure.** On average the batteries last 3-5 years, but will require replacement over time. Most patients will turn off their system at night in order to extend the life of the battery.

• **Erosion of the plastic cable or device through the skin.** If the patient is quite thin and the amount of soft tissue under the skin is limited, the system could exert pressure on the skin and erode through. If this is the case, the skin would have to be revised and the system removed.

• **Migration of the wire.** The plastic cap that anchors the DBS wire to the skull can break. This could lead to movement of the wire either deeper into the brain or further out of the brain. We use what we believe is the best anchoring device available for our patients. This complication should be uncommon.

Complications related to DBS stimulation:

Deep brain stimulation can cause both positive and negative effects to the brain. This is due to the fact that many critical brain functions are located within a very small distance of each other. In some patients stimulation could improve walking, but cause side effects related to arm or leg function. Some side effects could include numbness of the face, arm hand or leg, stiffness or weakness of the limb, double vision, closure of the eyelids, change in mood, thinking problems, facial weakness, dizziness, light headedness, or imbalance. The stimulator can usually be adjusted to treat these effects. In some patients, stimulation benefits occur together with some side effects.

In patients who undergo surgery on both sides of the brain at the same operation, surgeons have noted that some may develop confusion. In such patients, this confused state has lasted anywhere from a few days to several weeks. It is usually temporary.

If you have DBS surgery performed, you have to inform your dentist or surgeon when you need dental work or surgery. You must also inform any physician who may want to order an MRI scan on your brain or body.

Benefits of Deep Brain Stimulation

It is hoped that deep brain stimulation will lead to significant benefit of your movement disorder. This could include reduction of tremor to allow you or your family member to use their hand or leg efficiently, or reduction in head tremor.

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 it may take many hours of physician or physician extender programming to optimize the stimulation parameters. Every patient is different. The neurology team will work with you to tune the stimulator to the parameters that may give you the most benefit. At the same time they may adjust your medication. 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.

Gamma Knife® Radiosurgery

Gamma Knife® surgery is used at the University of Pittsburgh for the treatment of intractable tremor in elderly patients, those who have concomitant medical problems, or those who do not wish other open approaches. The effects of radiosurgery are usually not immediate. The gamma knife is used to create a focal brain lesion to stop the abnormal function of brain cells in a specific brain location. Radiation effects take time and most patients will note improvement over 1-4 months. However, we have seen patients who have had tremor improvement within several days. The effects will build for up to close to six months.

We generally use a standard amount of very focused radiation (130-140 Gy) and target a 4mm region in the brain. The targeting is completely based upon information from an MRI scan. Since we do not place an electrode into the brain, we cannot electrically map out the area prior to lesioning it. On the other hand, our mapping based upon imaging is similar to that used in patients who undergo stimulation as well as radiosurgery.

The overall success rate is approximately 80%, (the percentage of patients who have a major improvement in their tremor). The goal of the procedure is not complete elimination of the tremor, but rather, a reduction in tremor to allow improved movement and function. One of the advantages to Gamma Knife® surgery is that no hardware is placed into your body and that nothing needs to be turned on or off to achieve an effect as with a stimulator. On the other hand, unlike a stimulator, the lesioning effect is permanent. This procedure can be performed in patients on blood thinners.

The main complications of radiosurgery include radiation-induced effects to surrounding structures that could disrupt function. These include a 5% risk for numbness of the hand, mouth or leg, weakness of the limb, slurred speech, or trouble with vision (looking off to one side). Generally, these problems would occur 4-12 months after the procedure and in most patients would be temporary. In some patients where radiation-induced brain swelling is identified, you may be treated with a short course of steroid medicine to treat the edema. We recommend that an MRI scan be performed four and 12 months after the procedure to check the appearance of the brain. ■

Trigeminal neuralgia: Overview and medical management

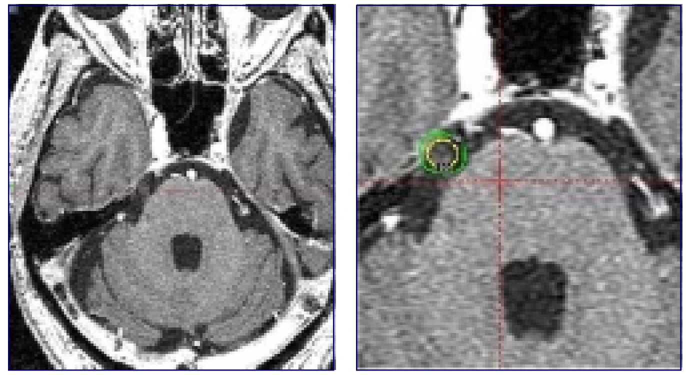
(continued from page 3)

reports have documented the efficacy of Gamma Knife® stereotactic radiosurgery for TN. Because radiosurgery is the least invasive procedure for TN, it is a good treatment option for patients with co-morbidities, high-risk medical illness, or pain refractory to prior surgical procedures. Between December 1992 and January 2003, a total of 507 radiosurgical procedures for TN were performed at the University of Pittsburgh Medical Center. Our report summarizes the long-term outcome in 220 patients who had undergone Gamma Knife® radiosurgery for idiopathic, longstanding pain refractory to medical therapy. One hundred and thirty-five patients (61.4%) had prior surgeries including microvascular decompression, glycerol rhizotomy, radiofrequency rhizotomy, balloon compression, peripheral neurectomy, or ethanol injections. Eighty-six patients (39.1%) had one, 39 (17.7%) had two, and ten (4.5%) had three or more prior operations. For the other 85 patients, radiosurgery was the first surgical procedure. A maximum dose of 70 to 80 Gy was used.

The outcome of pain relief was categorized into four results (excellent, good, fair, and poor). Complete pain relief without the use of any analgesic medication was defined as an excellent outcome. Complete pain relief with still requiring some medication was defined as a good outcome. Partial pain relief (>50% relief) was defined as a fair outcome. No or less than 50% pain relief was defined as a poor outcome. Most patients responded to radiosurgery within six months (median, two months). At the initial follow-up within six months after radiosurgery, complete pain relief without medication (excellent) was obtained in 105 patients (47.7%), and excellent and good outcomes were obtained in 139 patients (63.2%). Greater than 50% pain relief (excellent, good, and fair) was obtained in 181 patients (82.3%).

Complications after Radiosurgery

The main complication after radiosurgery was new facial sensory symptoms caused by partial trigeminal nerve injury. Seventeen patients (7.7%) in our series developed increased facial paresthesia and/or facial numbness that lasted longer than 6 months.



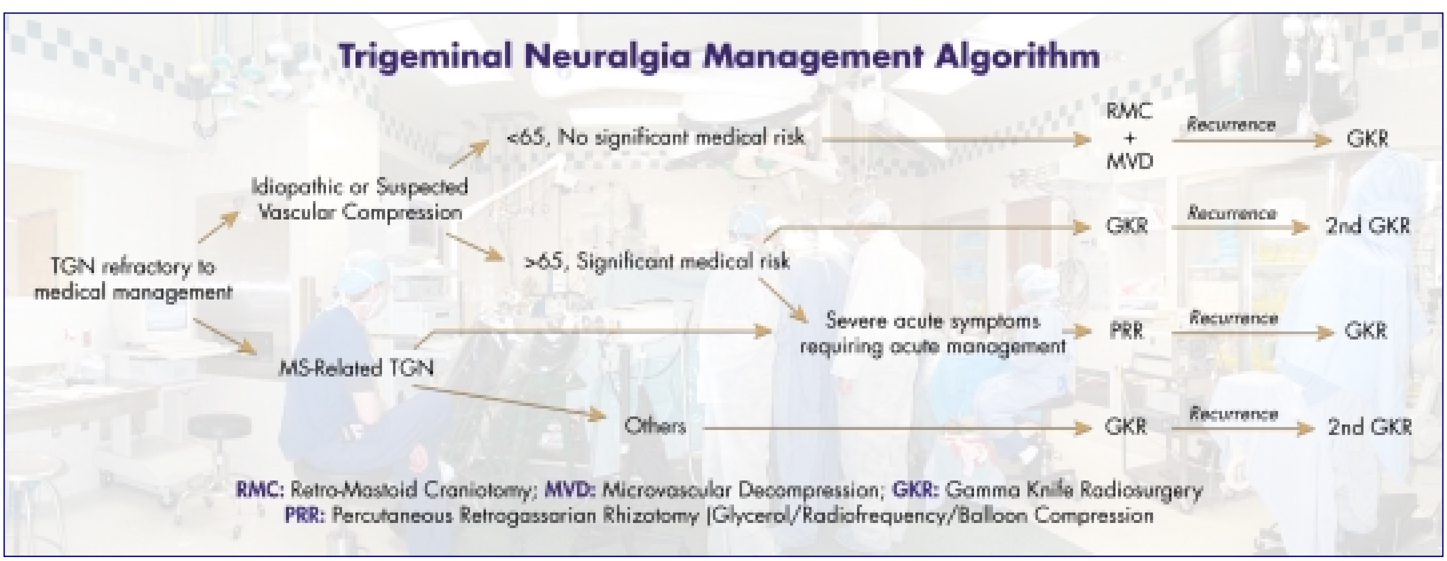
Left: MR scan of a patient with right-sided trigeminal neuralgia. Right: Gamma Knife® radiosurgery dose plan showing 50% isodose line on the right trigeminal nerve (central dose of 80Gy).

Repeat radiosurgery

Patients who experience recurrent pain during the long-term follow-up despite initial pain relief after radiosurgery can be treated with second radiosurgery procedure. The target is placed anterior to the first target so that the radiosurgical volumes at second procedure overlaps with the first one by 50%. We advocate less radiation dose (50 to 60 Gy) for second procedure, because we believe that a higher combined dose would lead to a higher risk of new facial sensory symptoms.

Indications for Radiosurgery

The lack of mortality and the low risk of facial sensory disturbance, even after a repeat procedure, argue for the use of primary or secondary radiosurgery in this setting. Repeat radiosurgery remains an acceptable treatment option for patients who have failed other therapeutic alternatives. ■



University Honors Pollack with Installation as Walter Dandy Professor

The University of Pittsburgh honored Ian Pollack, MD, with installation as Walter Dandy Professor May 22 in a ceremony in the Fricks Fine Arts Auditorium. Dr. Pollack marked the honor, formerly presented by university provost and senior vice chancellor James V. Maher, by delivering a lecture on novel strategies in brain tumor research and treatment.

Dr. Pollack's primary research interests focus on identifying and evaluating innovative strategies for treating malignant brain tumors, improving the treatment of children with brain tumors, and optimizing the management of childhood craniofacial disorders. He currently chairs the Brain Tumor Strategy Group of the Children's Cancer Group, is institutional principal investigator in the Pediatric Brain Tumor Consortium (PBTC), and chair of the Drug Delivery Committee of the PBTC. Dr. Pollack is also co-director of the University of Pittsburgh Brain Tumor Center.

Resident Graduation Dinner

A special graduation dinner was held June 27 at the Fox Chapel Golf Club honoring **James Burke, MD, Mel Field, MD**, and **Alan Scarrow, MD**, for their successful completion of the seven-year neurosurgery residency program at the University of Pittsburgh.

Dr. Burke is headed to Allegheny Brain and Spine Surgeons in Altoona, PA; Dr. Field to Orlando Neurosurgery in Florida; and Dr. Scarrow to St. John's Neurosurgical Associates in Springfield, MO.

Media

• **Thomas J. Songer, PhD**, researcher for the Center for Injury Research and Control (CIRCL), was quoted in a number of media outlets regarding his study on thunderstorm-related deaths. Outlets providing coverage included the *New York Times*, *National Post* (Canada), *Pittsburgh Post-Gazette*, *Pittsburgh Tribune-Review*, Reuters, KDKA, KQV, WQED, WPXI-TV, WTAE-TV, WBBH-TV (Fort Myers, FL) and CHML (Canada). Dr. Songer was also mentioned in a May 4 *New York Times* article on "Why Men Die Young."

• **Melvin Field, MD**, was quoted by the *Pittsburgh Tribune-Review* and *Toronto Globe and Mail* regarding his published study in the May 19 issue of the *Journal of Pediatrics* indicating age may play a key role in recovery following sports-related concussions. He was also interviewed on WDUQ. (See story on page 8.)

Grants & Awards

• **Costas G. Hadjipanayis, MD**, received a two-year NIH T32 National Research Service Award to study "Radiosensitivity Enhancement of Human Glioblastoma By A Herpes Simplex Virus Vector" with Nina Schor, MD, PhD, (Pediatrics) and Neal DeLuca, MD, (Molecular Genetics & Biochemistry).

• **Dr. Hideho Okada, MD, PhD**, received a four-year grant from the James S. McConnell Foundation for his proposal "Identification and Characterization of Glioma-CTL Epitopes." The McDonnell grant is a prestigious award among brain tumor scientists. Dr. Okada's proposal was one of five of 140 accepted.

Announcements

• **Peter Gerszten, MPH, MD** , participated in Oncology Grand Rounds at Sinai Hospital of Baltimore on April 8.

• **P. David Adelson, MD**, was named vice chairman for research at the Department of Neurological Surgery. Dr. Adelson was also named director of the Walter Copeland Neurosurgical Research Laboratory.

• **C. Edward Dixon, PhD**, president of the National Neurotrauma Society, will preside over that organization's 21st annual symposium scheduled for November 6-7 at the Grand Casino Hotel in Biloxi, MS.

• **Dr. Ghassan Beijjani, MD,** was recently elected president of the World Association of Lebanese Neurosurgeons.

• **Dr. L. Dade Lunsford, MD**, served as keynote speaker at the American Association of Stereotactic and Functional Neurosurgeons meeting May 21 at the Plaza Hotel in New York City. Dr. Lunsford also served as the keynote speaker at the International Stereotactic Radiosurgery Society Congress in Kyoto, Japan, June 23.

Promotions

• **Matt El-Kadi, MD, PhD**, was promoted to clinical associate professor.

• **C. Edward Dixon, PhD**, was promoted to associate professor with tenure.

Congratulations

• **Desiree Playso,** financial analyst, graduated cum laude from Robert Morris University with a bachelor of business administration degree, specializing in accounting.

• **Louise Foreman**, secretary to Amin Kassam, MD, and Michael Horowitz, MD, graduated with a bachelor of science degree in psychology/business from the University of Pittsburgh.

• **Allison Toomey**, patient information coordinator, graduated from Carlow College with a master of science in professional leadership, concentration in training and development.

• Marriage for **Ajay Niranjan, MBBS, MS, MCh**, to Ranjana Katiyar on May 2.

• New baby girl (Athena, June 6) to **Costas G. Hadjipanayis, MD** and wife Lorraine.

Welcome

Ira Goldstein, MD, visiting instructor, will be working with William Welch, MD, in the Spine Services Division; **Thomas Steineke, MD**, visiting instructor, will be working in Pediatric Neurosurgery; **Danielle Kausler**, research assistant for C. Edward Dixon, PhD; **Hemant Sarin, MD**, PGY-4 resident; **Martina Stippler, MD**, PGY-2 resident; **Devin Amin, MD**, PGY-1 intern; **Brian Jankowitz, MD**, PGY-1 intern; **Ricky Madhok, MD**, PGY-1 intern. ■

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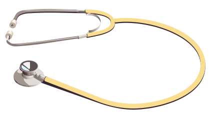

Patient Referrals
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Study finds age may play key role in sports-related concussion recovery

Does age play a role in how long it takes for an athlete to recover from concussion? In the first published study to examine age as a factor, University of Pittsburgh Medical Center sports concussion researchers found that high school athletes showed prolonged memory dysfunction requiring longer recovery compared to college athletes.

The study's results, published in the May 19 issue of the *Journal of Pediatrics*, supports more conservative management and comprehensive assessment of the concussed high school athlete and may have serious implications for return-to-play guidelines and decisions involving high school athletes.

In the study, post-concussion neuropsychological recovery of high school athletes was compared to that of college athletes at 24 hours, three days, five days and seven days post-injury. In tests of neurocognitive function and self-reported symptoms, high school athletes performed significantly worse than age-matched control subjects at seven days post-injury.

Concussed college athletes, despite sustaining more severe injuries, displayed commensurate performance with age-matched control subjects by day three post-injury. Specifically, following mild concussion, high school athletes showed significant memory impairment at day seven; conversely, college athletes revealed significant memory deficits only within the first 24 hours post-injury.

"Our finding that high school athletes did not recover from concussion as quickly as college athletes is a cause for concern because the largest majority of at-risk athletes are at the high school level or below," said principal investigator Melvin Field, MD, chief resident in the department of neurological surgery at UPMC. "Furthermore, existing return-to-play guidelines assume a standard use for all age groups and levels of play, from school-age to professional. Our study is the first to suggest that there may be differing vulnerabilities to concussion at different ages and that current guidelines may not be appropriate for all age groups," said Dr. Field.

(For more information on this and other studies, visit the University of Pittsburgh Department of Neurological Surgery website at www.neurosurgery.pitt.edu.) ■