Neuroendoport\textsuperscript{SM} surgery facilitates removal of hard-to-reach brain tumors

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Primary brain tissue tumors afflict approximately 20,000 Americans per year, and well over 100,000 per year suffer from metastases of other cancers to the brain. These tumors can cause death, disability, and neurological dysfunction. Multi-modal therapy for such tumors includes surgical removal, chemotherapy, and radiation. However, for most of these tumors, surgical removal is the most expedient way to facilitate neurological recovery.

Surgical removal of any brain tumor is a challenging enterprise, as the neurosurgeon must minimize manipulation and/or trauma to the surrounding functional brain as much as possible, while maximizing removal of the abnormal tissue itself. Modern techniques such as image-guidance, neurophysiological monitoring, and even awake craniotomy all have demonstrated benefit, but the trauma suffered by brain tissue as a result of the trans-cortical channel taken into the tumor remains problematic.

In addition, brain tumors can exert significant regional pressure upon the normal tissue surrounding them. Standard opening of the lining of the brain can induce brain herniation and significant cortical injury in this setting. In addition, standard dissection instruments through the white matter can induce significant neural trauma just to expose a tumor. The deeper a tumor is located, the more dissection is required in order to facilitate visualization using the funneling cone of light of an operating microscope.

(Fig. 1) The top panel demonstrates the cannulation process, with the port being placed through the cerebral cortex (brain needle already removed). Following removal of the dilator device, the port is left in place, and an endoscope is brought into the port for visualization. The neuroendoport\textsuperscript{SM} (bottom panel) is an 11.5 mm diameter clear plastic tube, which ranges in length from 4.5-8.5 cm. The tube is deployed over a standard brain biopsy needle and a bullet-shaped dilator.

(Fig. 2) Two surgical trajectories to the subcortical metastasis showed in A have been simulated. C represents an endoport approach, and D a “microport” approach. D trajectory is predefined as approx. twice as large as C, due to the intrinsic characteristics of the endoscope vs microscope as visualization systems. Note the increased tract (TR) damage, along with voxel (VX) damage and estimated volume of white matter lost. White matter damage is proportional, but not directly proportional, to the size of the port. Density of white matter at a particular point is the modifying factor, so the deeper you go toward the central core of the hemisphere the more damage you create. However, even in “Gyral” subcortical lesions, the endoport approach theoretically minimizes invasiveness to the white matter of the brain.

In an attempt to address these limitations of conventional brain tumor surgery, University of Pittsburgh neurological surgery department chair Amin Kassam, MD, developed a technique of removing brain tumors through an 11.5 mm endoscopic port, known as the neuroendoport\textsuperscript{SM}. The technique was pioneered after modification of multiple prior methods for brain tumor surgery, including stereotactic brain tumor removal as described by Patrick Kelly, MD—noted expert in computer-assisted stereotactic neurosurgery and former chairman of neurosurgery at New York University’s Langone Medical Center—and stereotactic endoscopic intraventricular tumor removal as developed by Drs. Kassam and L. Dade Lunsford, MD, former chairman of neurological surgery at the University of Pittsburgh.

Special features of the neuroendoport include its clear edges, which facilitate visualization of surrounding white matter, the use of a 4 mm rod-lens endoscope for visualization, and the ability to dynamically manipulate the port, facilitating resection of lesions much larger than the port itself. As demonstrated in Figure 1, the neuroendoport is roughly the diameter of two pencils, and it is deployed over a standard stereotactic biopsy needle following brain expansion over the needle by a bullet-shaped dilator.

(See Endoport on back page)
Eleven years ago, expanded endoscopic endonasal approaches (EEAs) were developed at UPMC by Amin Kassam, Carl Snyderman and Ricardo Carrau. It was innovative work that was progressively presented to the entire world. These surgeons expanded the application of the endoscopic endonasal technique that was being used for pituitary surgery in a few centers around the world to now treat many other skull base pathologies. As this new paradigm in skull base surgery was created, it brought multiple doubts and questions that were not fully answered at that time. Various famous neurosurgeons, head and neck surgeons and otolaryngologists strongly questioned the method during its inception. As with any shift in scientific paradigms, it did not occur in a straightforward or smooth manner.

These pioneers (all of whom were experienced with traditional skull base surgery) were immediately convinced of the superiority of the technique to treat many diseases. There were fewer major complications, less morbidity and mortality with these procedures when compared to the standard surgical approaches. By using the natural corridors of the sinuses, our surgeons were able to remove large tumors of the skull base with an ‘inside-out approach,’ not touching or retracting the brain. To them, the results were clearly superior; however, as they went all over the world to show these advantages they encountered incredible resistance.

This predictable response from many centers of skull base surgery evolved. From denial and initial shock it progressed to aggressive reactions and critical response. As in other specialties, endoscopic techniques in skull base surgery represent progress. Since then, more than 300 patients underwent EEAs at UPMC in less than a year.

We recently reviewed our data on the first 800 patients and the results are unquestionable. In summary, the incidence of complications in these patients was: 18.6% CSF leak (decreased to 5.4% after the advent of the nasoseptal mucosal flap), 1.9% infectious complication, 0.9% vascular injury, 1.8% neural injury, 1.9% delayed neurological deficit, 0.5% permanent visual loss, and 2.9% incidence of systemic complications. This yields an overall permanent morbidity of 1.8% and mortality of 0.9%. We believe these rates to be favorable when compared to conventional approaches. Further, they should be further improved with experience and the continuous use of vascularized reconstruction techniques, which diminishes the CSF leak and consequently all of the secondary associated morbidities such as infection and systemic complication.

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Innovations in minimally invasive endoneurosurgery training, presurgical planning

by Juan C. Fernandez-Miranda, MD
Clinical Instructor

The recent introduction of the endoscope in skull base surgery (expanded endonasal approach) and intraparenchymal surgery (neuroendoplasty) pioneered by University of Pittsburgh neurosurgery chairman Amin Kassam, MD, is creating a paradigm shift perhaps equivalent to the introduction of the neurosurgical operating microscope into those fields more than four decades ago.

The explosion of microsurgery during that time period was fostered not only by the development of microsurgical techniques, as championed by M. Gazi Yasargil, MD, and others, but also by thorough definition of microsurgical neuroanatomy, by pioneers such as Albert Rhoton, Jr, MD. Historically, proficiency in microsurgical techniques has been acquired through diligent practice on both ex vivo human and in vivo animal subjects. Following the acquisition of appropriate manual skill sets in the laboratory setting, as well as a thorough understanding of the relevant anatomy, neurosurgeons-in-training are gradually able to apply their newly learned techniques in the operating room.

At the UPMC endomicroneuroanatomy laboratory directed by Daniel Prevedello, MD, training for endonasal endoscopic and neuroendopanopto surgery is performed based on the time-tested model that has worked so well for microneurosurgery. This lab is committed to training, research, and education in endo and microsurgical neuronatomy and techniques fully supporting the 360° surgical concept highlighted in this newsletter by Paul Gardner, MD, co-director of UPMC’s Center for Skull Base Surgery.

With the outstanding work of several research fellows, the support of Copeland Foundation and the assistance of Wendy Fellows, PhD, we have completed several anatomical studies that are bringing new light to such complex topics as the endoscopic anatomy of the abducens nerve, the endoscopic anatomy of the superior hypophyseal artery, the anatomic classification of the transclival approaches, and the lateral expansion of the inferior transclival approach. We have also developed an innovative method for 3D reconstruction and digital projection of endoscopic and microscopic anatomical images that has been used to illustrate the complex 3D anatomy of the brain, ventricles, and skull base to students, residents, fellows, and fully trained specialists from many different countries. A unique collection of 3D anatomical (and intraoperative) pictures has been created to illustrate the modular concept of the expanded endonasal approach and the intricate anatomy and radiology of the white matter tracts.

In addition, we have developed a novel animal model for training of endoscopic techniques at the millimeter level. As defined by Dr. Kassam, the principles of endoneurosurgical dissection, specifically tumor debulking, extracapsular sharp dissection, and countertraction using gentle suction are identical to those of microsurgical dissection. All these surgical maneuvers can be specifically trained with the animal model developed in our laboratory, which allows for simulation of both endonasal and neuroendopanopto surgical procedures at variable levels of complexity.

Presurgical Fiber Mapping Techniques in Neuroendopanopto Surgery

Neuroendopanopto surgery represents the ultimate innovation in minimally invasive brain surgery. Its profound value is based on its minimal invasiveness to the most complex human structure: the white matter of the brain. The white matter is perfectly organized in recognizable fascicles or bundles of fibers that interconnect cortical and subcortical regions. As conceived by Dr. Kassam, neuroendopanopto surgery has the potential and ambition to become a true parafascicular approach to brain lesions. The vertiginous development of MRI techniques that allow for visualization of the structure of the white matter is a crucial phenomenon. From the original diffusion tensor imaging technique we are evolving to more sophisticated and precise fiber mapping techniques, as diffusion spectrum imaging and multi-shell imaging. The utilization of functional MRI to select functional ROIs (regions of interest) provides a new horizon for white fiber mapping techniques, where fiber tracts are not just structural but also functional aggregations of fibers.

At this moment, we are starting to apply these novel MRI techniques of fiber mapping for the presurgical planning of neuroendopanopto cases. Using the words of Johnathan Engh, MD—chief of the department of neurological surgery’s endopanopto surgery program—“cannulography” is the next step in neuroendopanopto development. The selection of the cannulation point and trajectory that follows the less invasive parafascicular approach to a particular brain lesion based on presurgical tractographic studies is an achievable goal. The collaborative efforts and expertise of Walter Schneider, PhD—professor of psychology at the University of Pittsburgh—and his computational team as well as Fernando Boada, MD—professor of radiology at the University of Pittsburgh—and his radiological team are critical for the success of this endeavor.

All these efforts should culminate with the development of the neurosurgical planning station, where neurosurgeons with the assistance of radiological and computational experts investigate, compare, and discuss the different entry points and trajectories (“cannulography”) suitable for removing a brain lesion using the neuroendopanopto approach. The surgical plan would then be transferred to the image guidance system for intraoperative parafascicular neuronavigation. Our ultimate goal is to improve functional outcomes in brain surgery, the same goal envisioned by the birth of the expanded endonasal approach over a decade ago.

(Left) Partial tractographic reconstruction of the right hemisphere using a combination of anatomical and functional ROIs. The superior longitudinal fasciculus is formed by several segments: lateral (yellow), medial (green), and arcuate (red). The medial segment is related to the posterior parietal cortex (green), and the arcuate to the dorsolateral prefrontal cortex (red). The pyramidal tract arises from the motor cortex (blue) and descends toward the cerebral peduncle.
Neuroangiography plays vital role in diagnosis, treatment of skull base tumors

by Brian Jankowitz, MD
PGY-6 Resident

Management of patients with cranial base tumors requires an interdisciplinary approach. We utilize an experienced team of neurosurgeons, otolaryngologist, ophthalmologists, physiatrists, endocrinologists, critical care specialists, and endovascular surgeons to help diagnose, treat, and care for our patients. While angiography has long assisted in the diagnosis and surgical planning of tumors involving the skull base, recent advances in microcatheters/guidewires, imaging resolution, and embolization materials have made the utilization of neuroangiography increasingly safe and effective.

Our Siemens bi-planar neuroangiography suite has an eight-panel, flat screen display which allows sub-millimeter resolution. The ability to view vascular anatomy in two dimensions simultaneously has drastically improved our ability to study blood vessels and understand their three-dimensional relationship.

Technology continues to drive the development of microcatheters. Strong yet supple catheters with an outer diameter of only 0.51 mm allow maneuverability into distal microvasculature never thought possible.

New developments in vascular occlusive agents have greatly expanded the utility of preoperative embolization. In general, there is an inverse relationship between the physical size of the embolic agent and the degree of end-organ devascularization.

Fibered platinum coils or larger particles often cause proximal occlusion of the vessel, allowing a modest decrease in tissue perfusion to promote hemostasis. Liquid embolic agents such as N-butyl cyanoacrylate (NBCA), Onyx (ev3, Irvine, CA), and ethanol along with smaller sized particles can cause permanent microvascular devascularization with resultant ischemic necrosis to soften the tumor and facilitate resection.

In general, we have phased out the use of older generation polyvinyl alcohol (PVA) particles and solely employ Embospheres (Biosphere Medical, Rockland, MA). They have a more uniform particle diameter that allows improved control and more distal occlusion. NBCA and concentrated ethanol were the mainstay of treatment for penetration into distal microvasculature, however their low viscosity can allow erratic distal embolization. We have transitioned to the use of Onyx, a copolymer of ethylene vinyl alcohol dissolved in dimethyl sulfoxide opacified with tantalum powder. The increased viscosity, slower polymerization times, and cohesiveness allow for safer, more controlled injections.

Embolization facilitates tumor resection by limiting blood loss which can improve visualization and avoid the morbidity of blood transfusion. In addition, ischemic necrosis of the lesion can soften the tissue, enable cleaner dissection planes, and soften the fibrous tethering to vital neural structures. The most common vessels to consider for embolization include the ascending pharyngeal artery, internal maxillary artery, and internal carotid artery.

Arteries which display a vascular blush or have sizable feeding arteries may be candidates for embolization.

A typical sequence of events would entail diagnosis of a skull base lesion by MRI or CT. MRA, contrast enhancement, or large flow voids on T2 weighted imaging may predict hypervascular lesions. CTA is also helpful in determining the vascularity of a lesion based on the size and density of enhancing vessels. Digital subtraction angiography (DSA) is often the only study that can determine the extent or presence of arterial inflow to a lesion. DSA can define the location of feeding vessels for preoperative planning, the extent of flow in the specific vessels, and even provide valuable information regarding venous drainage. This information can guide the skin incision, craniotomy, and location of dissection. If the internal carotid artery (ICA) is in close proximity to the lesion and arterial sacrifice is a consideration, then balloon test occlusion (BTO) can predict the risk of stroke with > 90% sensitivity and specificity if the vessel requires emergent or planned occlusion.

Typical vascular lesions found in the cranial base that are candidates for preoperative angiography include dural arteriovenous fistulas, meningiomas, parangangiomas, juvenile nasopharyngeal angiofibromas (JNA), metastasis (most commonly renal, melanoma, lung, choriocarcinoma, thyroid), primary carcinoma, hemangiomas, fibrosarcomas, hemangiopericytomas, hemangioblastomas, and esthesioneuroblastomas.

Figure 1 A-F illustrate the case of a 14 year old boy with recurrent nose bleeds and left proptosis. An MRI revealed an invasive, highly vascular lesion filling the ethmoid, maxillary, and sphenoid sinuses with invasion into the left orbit consistent with a JNA; a histologically benign fibrovascular tumor with the potential for locally aggressive behavior. DSA revealed an extensive vascular blush from the bilateral external carotid arteries. Although both internal carotid arteries (ICA) were enveloped by the lesion, the circumferential enclosure of the left ICA prompted a BTO, which the patient passed. We subsequently embolized the bilateral internal maxillary arteries with a combination of Embospheres and fibered platinum coils. This allowed a safe, staged resection of the lesion without morbidity or significant blood loss.
Endoscopic endonasal approaches (EEAs) have been developed over the past decade to address many of the pathologies of the ventral skull base. They can also be used to access Meckel’s cave, the cavernous sinus, the clivus and even the second vertebrae odontoid process. Work at the University of Pittsburgh Medical Center has expanded these approaches to its limits. Emerging outcome studies show decreased morbidity with these procedures for many tumors, especially since the development of the nasal septal mucosal flap for reconstruction and prevention of postoperative CSF (cerebrospinal fluid) leak.

However, EEA is not a panacea for skull base disease. It merely offers a low morbidity anterior corridor. The success of the EEA comes from appropriate tailored indication. The majority of traditional skull base surgical morbidity is due to retraction or manipulation of neurovascular structures. By choosing surgical corridors that avoid such manipulation of (i.e. not ‘crossing’) cranial nerves or cranial vasculature, maximal tumor resection can be performed with minimal morbidity. Therefore, if a tumor (for example a chordoma) has a central skull base origin, thereby displacing the neurovascular structures peripherally and to the back, it should be approached from a midline trajectory from the front to allow maximal access to the tumor in a safe manner. An EEA provides this for many skull base tumors.

However, there are many tumors for which an anterior approach is not appropriate, based on this philosophy. For example, acoustic neuromas inevitably displace the cranial nerves (especially the facial) anteriorly. So, while the petrous bone and IAC can be accessed endonasally, addressing this pathology via an anterior approach would require working over and around the extraordinarily sensitive facial nerve.

As a result, it is critical for any skull base team to be facile with any and all approaches and corridors. Many tumors, such as petroclival meningiomas, completely envelope the critical neurovascular structures at the base of the skull and require multiple different approaches to achieve adequate, safe debulking and decompression.

A Case Study:

A 17-year-old girl presents with headaches. MRI shows a large, peripherally enhancing, dumbbell-shaped tumor based in Meckel’s cave (fig 1). The tumor was believed to be a trigeminal schwannoma. The large, anterior portion of the tumor was resected via an EEA up to the retrogasserian portion of the trigeminal nerve (fig 2). Pathology confirmed the diagnosis of schwannoma. The second, posterior portion was resected via a retromastoid craniectomy (fig 3). She was left with some numbness in the maxillary and mandibular divisions of the Vth nerve. She also had mild diplopia which resolved.

This case illustrates an approach to a skull base tumor using two separate corridors, each designed to limit neurovascular manipulation. By avoiding a lateral approach, the only brain retraction needed for resection is cerebellar. Though not a primary goal of skull base surgery, this approach is also cosmetically appealing, as the only external incision is a retromastoid one (behind the ear), well hidden behind the hairline.

In conclusion, EEAs have provided an entirely new option for addressing skull base tumors. As these approaches become more accepted, care must be taken to apply them appropriately as one management tool, to be used selectively as part of an overall management strategy that includes multidisciplinary care by otolaryngologists, head-neck surgeons, neurosurgeons, ophthalmologists and radiation oncologists.
Brainstem auditory evoked potentials (BAEP) decreases postoperative neurological deficits during EEA

Parthasarathy D. Thirumala, MD
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Brainstem auditory evoked potentials (BAEPs) have been used to monitor the integrity of cranial nerve VIII during skull base surgery. Specifically the role of BAEPs has been reported to preserve hearing in acoustic neuroma resection and microvascular decompression of cranial nerves V and VII. The integrity of brainstem structures including the midbrain, pons, and medulla to changes in cerebral blood flow can also be monitored by BAEPs.

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. We believe that BAEP monitoring during the EEA can decrease the incidence of postoperative neurological deficit.

Value of BAEPs

The waveform generators of the BAEP include cranial nerve VIII, medulla, pons, and midbrain, which receive their blood supply from the vertebral and basilar arteries. Changes in the latency and amplitude of the BAEP waveform can be due to compression of the cranial nerve VIII, direct mechanical damage from dissection, thermal injury from cautery, and ischemia or infarction due to a compromise of blood supply. Alteration in surgical procedures based on these changes can help decrease post operative hearing loss during microvascular decompression of cranial nerve V, VII, and acoustic neuroma surgery.

The EEA, though minimally invasive, still carries a risk of potential injury to neurovascular structures especially in tumors located near the clivus. We know that adequate blood flow is essential for viable neuronal cells in the brainstem to generate BAEP responses. Research in animals subjected to varying bilateral vertebral artery occlusion have shown that changes in the amplitude of BAEPs are reversible when flow is quickly reestablished. Animal studies have also shown that change or loss of neurophysiological responses is a precursor of ion pump failure. Hence reliable warning signs for changes in BAEPs can warn the surgeon of impending ischemia/infarction to the brain stem. Appropriate action to quickly readjust the surgical procedure can prevent devastating neurological complications.

Intraoperative monitoring technique:

To date we have recorded BAEPs and Somatosensory evoked potentials (SSEP) simultaneously from the upper and lower limbs continuously during approximately 137 EEA procedures including exposure and closing. BAEP and SSEP recordings were obtained from the scalp and cervical region using subdermal needle electrodes. A reduction in amplitude of wave V of more than 50%, and/or increases in latency of more than 10% from baseline, was considered significant, and the surgeon was informed.

UPMC Experience:

Research at our institution showed significant reversible prolongation of the latency and/or amplitude of wave V was seen in 2.9% (n=4) of the patients. These changes in BAEP responses had multiple etiologies include decrease in the mean arterial pressure, significant blood loss (see image above). In the patients who had BAEP changes, one patient had changes in BAEPs and Somatosensory evoked potentials (SSEP). There were no post operative neurological deficits in either of the above patients. There were significant reversible changes in SSEP exclusively in 5.7% (n=7) with no change in BAEP responses. The reversible changes had multiple etiologies including decrease in mean arterial pressure, significant blood loss. There were no post operative neurological deficits. Appropriate surgical interventions were performed in response to above BAEP, SSEP changes in the patients. All patients who displayed changes in BAEPs had vascular tumors in the region of the brain stem. The changes in BAEPs with no changes in SSEPs and vice versa show the selective nature of ischemia in the brainstem. These results clearly demonstrate the need for multimodality monitoring of the brainstem with both SSEP and BAEP.

We believe intraoperative neurophysiological monitoring with BAEPs during EEA will provide important information to prevent and reduce impending catastrophic neurovascular injury. We advocate a comprehensive approach to neurophysiological monitoring during EEs including somatosensory evoked potentials, spontaneous and triggered electromyography of the cranial nerves II-XII, brain stem auditory evoked potentials, and electroencephalogram depending on the location of the neural structures at risk.
Pittsburgh Post-Gazette

**Pediatric Neurosurgery Moves Into New CHP Complex**

In May of 2009, the Department of Neurological Surgery’s Pediatric Neurosurgery division moved into Children’s Hospital of Pittsburgh’s new state-of-the-art complex located in the Lawrenceville section of Pittsburgh. The 10-acre, 1.5 million square foot campus is located on the site of the old St. Francis Hospital.

Pediatric Neurosurgery’s referral and contact phone number will remain the same at (412) 692-5090. Their new mailing address is 45th & Penn Avenue, Pittsburgh, PA 15201.

More info on the new facility can be found on the Children’s Hospital website at www.chp.edu.

**New Research Projects**

- “Biological Effects of Ionizing Radiation on Brain Tumor and Normal Brain Cells in Vitro and In Vivo Impact of Dose Rate.” PI: Glenn T. Gobbel, DVM, PhD. Elekta Instrument, AB, $29,884.
- “Scaffold/Neural Stem Cells-Based Tissue Engineering in a Traumatic Brain Injury.” PI: Jun Chen, Co-I: C. Edward Dixon, PhD, Hong Qu Yan, MD, PhD. $75,757, U.S. Army.

**Prominent Lectures**

- Peter Gerszten, MD, was a visiting professor in the departments of neurosurgery and radiation oncology at East Carolina University School of Medicine in Greensburg, NC, January 16-17.
- Amin Kassam, MD, served as a member of the International Faculty at the 5th Biennial Milano Masterclass held March 27-29 in Milan, Italy, presenting multiple lectures and a keynote lecture.
- Dr. Kassam also served as a member of the advisory board for the 9th Congress of the European Skull Base Society held in Rotterdam, The Netherlands, April 15-18. He moderated several panels and presented multiple lectures. In addition, Dr. Kassam was one of the directors of the post-congress course entitled “Hands-On Course on Endoscopic Endonasal Skull Base Surgery” held April 18-19.
- Joseph C. Maroon, MD, was the honored guest of the Neurological Society of the Chinese Medical Association and the Chinese Academy of Engineering for Medicine and Health, March 11-19.

**In the News**

- Anthony Fabio, MPH, PhD, was quoted in the February 15 edition of the Pittsburgh Post-Gazette commenting on research studying the connection between segregation and violent crime.
- Dr. Kassam and Johnathan Engh, MD, were featured in a February 19 Pittsburgh Tribune-Review article discussing their endoport, ‘surgery-through-a-straw’ technique that allows for removal of deep-seated tumors using a long, narrow tube.
- Dr. Kassam, Daniel Prevedello, MD, and Paul Gardner, MD, were featured in a February 12 Pittsburgh Tribune-Review article discussing the surgical care of Acharya Yashovijaysuri, a guru of Jainism who traveled to Pittsburgh to have a brain tumor removed using the Expanded Endonasal Approach procedure pioneered here.
- Dr. Maroon, and Matt El-Kadi, MD, PhD, were the subject of the lead cover story in the February issue of The Point North magazine, a local health magazine serving the northern suburban communities of Pittsburgh. The article focused on the two neurosurgeons’ 25 years of service in the Pittsburgh area.
- Dr. Maroon was also mentioned in a March 9 Seattle Times article for his role in the herniated disc surgery of Olympic and WBNA Seattle Storm star Swin Cash. He was also featured in the Pittsburgh Tribune-Review’s ‘Spotlight’ section on March 3.

**Congratulations**

- Dr. Maroon was inducted into the Western Pennsylvania Sports Hall of Fame, May 2. Dr. Maroon—a renown health and fitness expert and experienced triathlete—has been the team neurosurgeon for the Pittsburgh Steelers since 1977 and has done extensive research and teaching in the area of concussions and other head injuries in athletes.
- The UPMC Mercy stroke program received the American Stroke Association’s Get With The Guidelines stroke Silver Performance Achievement Award in February. The award recognizes commitment and success in implementing a higher standard of stroke care by ensuring that stroke patients receive treatment according to nationally accepted standards and recommendations. Kathleen Seiler, RN, BSN, is the hospital’s stroke program coordinator.
- Hank Weiss, MPH, PhD, was awarded the prestigious Alex Kelter Vision Award from the State Injury Prevention Directors Association (STIPDA) at the association’s annual conference in Washington, DC on February 25. Dr. Weiss also gave a keynote presentation at the conference.
- Matthew Maserati, MD, received the Mayfield Award for Clinical Research from the AANS/CNS Section on Disorders of the Spine and Peripheral Nerves in March. Dr. Maserati’s research, entitled “Occipital Condyle Fractures: Clinical Decision Rule and Surgical Management,” was mentored by David Okonkwo, MD, PhD and Rich Spiro, MD.
- In March, Karen Hlavac, administrative assistant to Joseph Maroon, MD, celebrated 25 years working with Dr. Maroon.
- Juan Fernandez-Miranda MD, was awarded the ESBS Fellowship Award from the European Skull Base Society at the group’s annual meeting in Rotterdam, Netherlands, April 15-18.

**Personal Congratulations**

- Erin Sauber-Schatz, PhD, MPH, and her husband Richard, had a baby boy (Bruce Owen) on March 4; Ed Shaffer, and wife Gina, had a baby boy (Dominic Jacob) on March 13.

**Welcome**

Jane Dervin, medical records clerk, UPMC Mercy.

**Upcoming Events**

- July 6-10: Principles and Practice of Gamma Knife Radiosurgery. Call (412) 881-0602 for more information.
As an example, figures 2 and 3 illustrate the case of a 54-year-old woman who presented with lethargy, speech disorder, and visual loss. Despite high-dose steroids and anti-convulsants, her mental status remained poor, and an MRI scan demonstrated a 4.5 cm enhancing lesion with significant mass effect on the overlying brain. By cannulating the lesion through a small dural opening, the trauma to the overlying cortex was minimized. Through the port, the atrium of the lateral ventricle was visualized, and the deepest part of the tumor was removed first. Then, the regional pressure from the tumor was used to allow the tumor to deliver itself into the port. The port was dynamically manipulated to facilitate resection of the tumor using standard microsurgical techniques in an air medium. Post-op MRI demonstrated near-total removal of the tumor, which was diagnosed histopathologically as a glioblastoma.

Although the patient’s tumor turned out to be a malignancy, she awakened from anesthesia relaxed and with markedly improved speech function, joking with nurses in the PACU and ambulating without assistance later that evening. She had minimal headache, and a scar extending approximately 1.5 inches. She was discharged from the hospital two days later. Although the neuroendoport technique did not cure her tumor, it facilitated a fast neurological recovery and subsequent administration of adjuvant therapy for her continuing care.

Surgeons at UPMC believe that the neuroendoport facilitates removal of deep brain lesions with remarkable visualization of critical structures and minimal trauma to surrounding brain. The technique is applicable for brain tumors, both intraparenchymal and intraventricular, as well as intracerebral hemorrhages and other mass lesions of the brain. With further innovation in white matter mapping and deployment instrumentation for the endoscopic port, we hope to establish truly parafascicular corridors into the lesions that we remove from the brain, dilating white matter fascicles without transaction, thus maximizing neuronal preservation and neurological function without sacrificing degree of tumor resection. 

(Fig. 3) Pre-operative (top image) and post-operative (bottom image) axial T1-weighted contrast-enhanced MRI scans demonstrate near total resection of the tumor (yellow arrow), minimal tissue trauma from the port (red arrow), and ventricular relaxation from removal of the tumor and lowering of intracranial pressure (blue arrow).