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Patient Care • Teaching • Research

# UPMC team clips aneurysm utilizing endonasal, completely endoscopic route

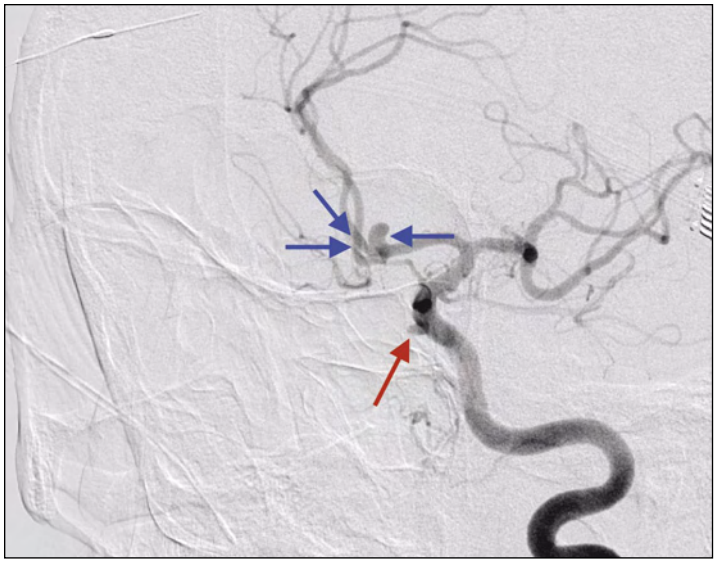
## *Case represents first reported clipping of unsecured aneurysm using this technique*

**by Arlan Mintz, MD**
*Assistant Professor of Neurological Surgery*

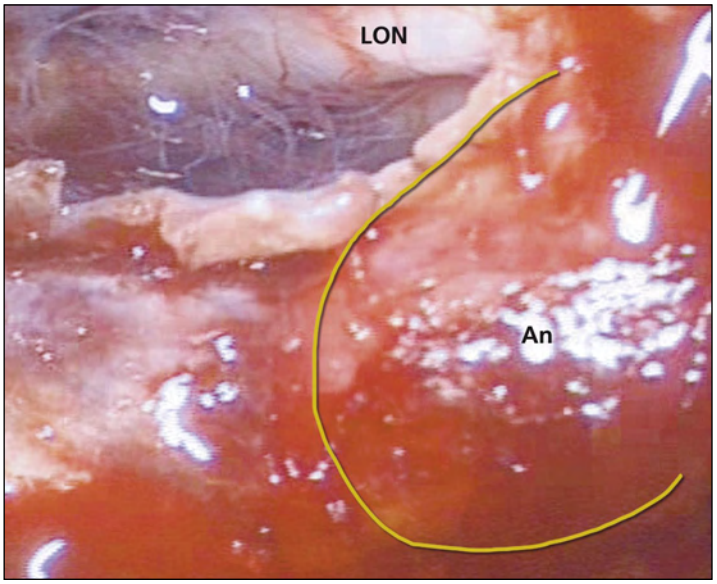
and **Paul Gardner, MD**
*Neurosurgery Resident*

The treatment of intracranial aneurysms has undergone a significant evolution in the past decade with the introduction and refinement of endovascular techniques. The surgical management of aneurysms is often reserved for those aneurysms having a complex geometry making endovascular techniques not ideal. Standard surgical approaches for these challenging aneurysms often involve employing skull base techniques. More recently, the exovascular and endoscopic team at UPMC have developed techniques to expose and clip aneurysms utilizing an endonasal and completely endoscopic route. The endoscopic method approach allows for direct access through the paranasal sinuses and skull base to certain aneurysms that are challenging to approach using traditional surgical corridors. This case represents the first reported clipping of an unsecured aneurysm using this technique.

The patient is a 56-year-old woman who presented with two anterior circulation aneurysms (left anterior communicating artery (ACoA) and left superior hypophyseal artery (SHA), both measuring about 5 mm. These aneurysms were unruptured and were discovered on a routine screening MRI performed due to a family history of cerebral aneurysms. A 4-vessel cerebral angiography was performed to better determine the anatomy of these aneurysms and to evaluate for potential endovascular coil embolization (*see image below*). After discussions with



**AP and oblique angiographic views following a left ICA injection showing left superior hypophyseal artery (red arrow) and left anterior communicating artery aneurysms (blue arrows).**




**Endoscopic view shows exposure of the aneurysm neck (*An*); *LON* (left optic nerve is seen in the supersellar area).**

the patient about risks of treatment as compared with observation of these aneurysms, the patient decided on treatment for both aneurysms. Given her relative youth, family history of aneurysms and the presence of multiple aneurysms, treatment was felt to be a reasonable option. Neither aneurysm was felt to be favorable for coil embolization, though the anterior communicating artery aneurysm could be potentially treated via stent-coiling if it were present in isolation or if the patient were not a surgical candidate.

Paraclinoidal aneurysms, including the SHA , are known to have a relatively high risk of optic injury during surgery, related to anterior clinoidectomy and optic nerve manipulation. This aneurysm had a typical projection for SHA aneurysms, that is, medial or inferomedial which would require a fair amount of optic manipulation. This same projection, extending into the sella, makes it accessible via an anterior, endonasal approach which would avoid contact with the optic apparatus. After careful consideration of the SHA aneurysm anatomy and a thorough discussion about risks, it was decided that the superior hypophyseal artery aneurysm would be treated via an anterior, endonasal approach. The anterior communicating artery aneurysm would also be clipped during the same anesthetic. It would be evaluated for clipping via the endonasal approach following the SHA aneurysm clipping, but plans were made for a standard pterional clipping.

### Operative Technique/Intervention

The patient was placed supine on the operating table with radiolucent Mayfield head holder fixation. Her head was turned approximately 15 degrees to her right for a left pterional craniotomy and the image-guided CT angiography was registered. Her midface

*(see **UPMC team** on page 4)*

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# United we stand, divided we fall

Kentucky's motto, "United we stand, divided we fall" holds true for nations, states, and families. In the current medical environment, however, it also holds true for the successful implementation and execution of 21st Century neurosurgical care.

Neurosurgery as a field and neurosurgeons as practitioners have for a long time been looked upon by hospitals, other physicians and the public as entities that are separate from more mainstream medical institutions. In the past the phrase "you don't have to be a brain surgeon ..." seems to have gone hand in hand with "you don't have to be a rocket scientist ..." when differentiating between a person's capability of performing difficult and simple physical or mental tasks. Popular and characteristic perceptions of neurosurgeons as loners, eccentrics, intellects, and dexterity savants has only served to at times isolate us as a specialty from those with whom we could most benefit from interacting with: other specialists, engineers, corporate MBAs, and hospital administrators. Current trends in the medical and healthcare environment along with the need for newer ways to approach neurologic disease requires that we dispense with the older perceptions and embrace relationships with our medical, surgical and business colleagues so as to make the necessary advances required of 21st Century neurosurgical practice.

At our own institution the need for and benefits of cooperation and interaction between medical subspecialties, hospital administrators, and industry has been born out by almost every aspect of our current neurosurgical departmental practice. Advances in skull base surgery have now provided us with the means to resect large skull base tumors, pituitary adenomas, craniopharyngiomas and vascular abnormalities trans-nasally and endoscopically that only five years ago would have required open procedures. These newer advances will potentially reduce surgical morbidity/mortality while at the same time improve upon disease control. They have, however, only come about through extensive cooperation between neurosurgeons, ortolaryngologists, neuro-ophthalmologists, endocrinologists, industrial partners, and hospital administrators who have all put aside individual aspirations and desires to work together as a team sharing responsibility and accolades for advancements in care. New approaches to spinal disorders have been marked by extensive collaborations between neuro- and orthopedic surgeons, general surgeons, materials and biomedical engineers, radiation oncologists, and neurophysiologists to permit the successful development of both invasive and minimally intrusive techniques for management of intrinsic and extrinsic spinal disorders. Management of cranial and cervical vascular disease has benefited extensively from interactions between exovascular and endovascular neurosurgeons, stroke and endovascularly trained neurologists, invasive cardiologists, and engineers. Radiosurgical approaches have especially flourished due to close cooperation between radiation oncologists and neurosurgeons to assure safe, accurate, and effective management of a variety of disorders that include neoplasms, vascular malformations, functional disorders, and pain syndromes.

The above demonstrates the growing interactions between medical subspecialties and business partners that have permitted tremendous advancement in neurosurgical care over the past few years. Management of more complex diseases coupled with the public's desire for improved outcomes and improved quality of life necessitates closer collaborations so as to meld expertise from a variety of fields towards a common endpoint. Gone are the days of a single practitioner or specialty having the ability to tackle a complex malady in the most effective manner. We look forward to continued collaborations between ourselves and others in the medical field so as to continually advance neurosurgical care in a direction that maximizes outcomes and minimizes negative quality of life impact. •

**Amin Kassam, MD**
*Interim Chairman*
*Department of Neurological Surgery*

UNIVERSITY of PITTSBURGH neurosurgery news

# UPMC Endovascular Neurosurgeons Using Onyx® Liquid Embolic System

**by Anand V. Germanwala, M.D.**
*Clinical Instructor of Neurosurgery*

and **Nirav A. Vora, M.D.**
*Neurology Stroke Fellow*

A bio-compatible liquid polymer that precipitates and solidifies upon contact with blood, forming a soft and spongy embolus is now being used routinely by UPMC neurosurgeons in the management of many arteriovenous malformations.

Onyx®, a liquid embolic system created by Micro Therapeutics, Inc. of Plymouth, MN, and approved for use by the FDA in July of 2005, contains ethylene-vinyl copolymer (EVOH), dimethyl sulfoxide solvent (DMSO), and micronized tantalum powder which provides radioopacity.

For AVM treatment, Onyx delivery is a multistep procedure, first requiring adequate placement of a microcatheter into the AVM's arterial feeders. Once the microcatheter is properly positioned, it is flushed and filled with DMSO, a solvent that will not precipitate the Onyx upon contact

Next, the copolymer containing suspended tantalum powder is drawn into 1cc syringes and slowly injected into the microcatheter. Once this compound contacts an aqueous solution (blood), its precipitation begins.

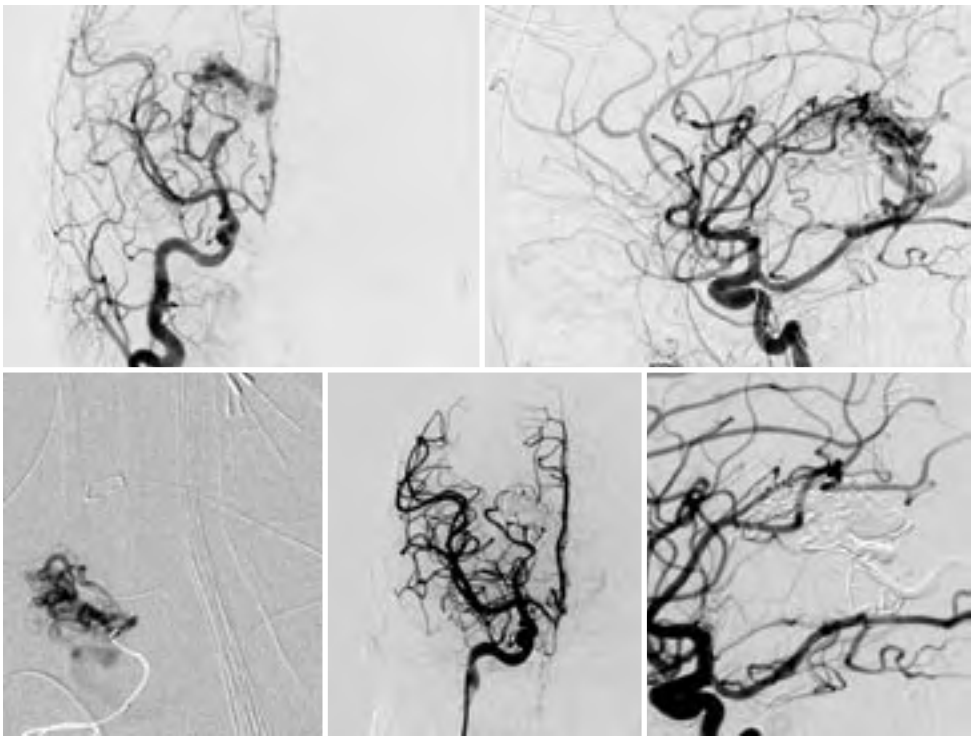
A slow (over minutes) deliberate injection allows the Onyx to be delivered in a cohesive and controlled manner, infiltrating the AVM distally. Given its radioopacity, its deliverance can be visualized with real time imaging using fluoroscopy.

After delivery of the Onyx material, the liquid quickly transforms into a solid polymer cast, thereby sealing off the vessels in the AVM from blood flow and reducing the risk of rupture.

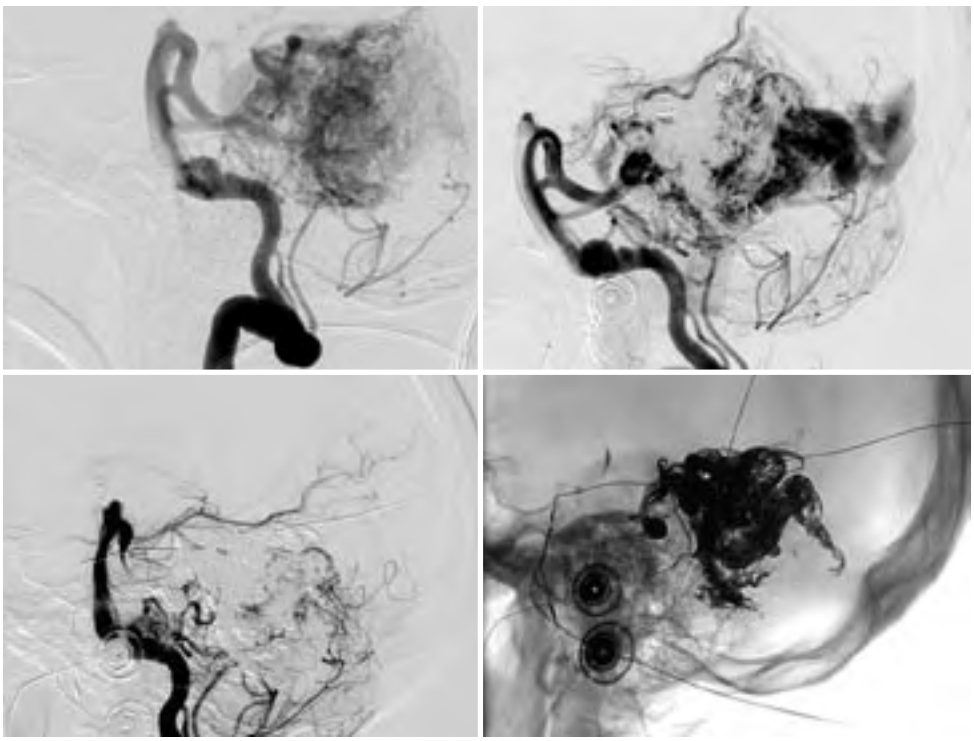
Complications of this relatively new technique, although low, can include transient and permanent neurological deficits, subarachnoid hemorrhage, microcatheters glued to the injection site, failure of complete lesion obliteration, and massive reflux of Onyx into the afferent artery peduncle.

In the United States, Onyx is being used in the endovascular treatment of arteriovenous malformations and in Europe for the management of AVMs and cerebral aneurysms.

Two typical cases of the use of Onyx are described at right. •



**Case 1:** **A 12 year-old boy presented with acute headache and left hemiparesis. Workup reveals a right thalamic AVM with intraparenchymal and intraventricular hemorrhage. Embolization was carried out using Onyx. (*top*) Preoperative ap/lat R CCA angiogram demonstrating AVM; (*bottom left*) beginning injection of Onyx; (*bottom middle/right*) postoperative ap/lat R CCA angiogram after Onyx obliteration of AVM.**



**Case 2:** **A 55 year-old woman presented with headache. Angiogram demonstrates a large, complex posterior fossa AVM (unruptured). Patient was taken to the interventional suite for a two-stage embolization using Onyx. Small residual AVM treated with stereotactic radiosurgery. Lateral views: (*top left*), preembolization; (*top right*) post embolization stage 1; (*bottom right*) post embolization stage 2; (*bottom right*) lateral skull xray, demonstrating radioopaque Onyx.**

# UPMC team exposes, clips aneurysm utilizing endonasal, completely endoscopic route

*(continued from page 1)*

was also prepped as well as her abdomen for fat grafting. A sheath was placed in the right femoral artery and the site prepped for intraoperative angiography. A left pterional craniotomy was completed without dural opening and then covered with sterile drapes. This was performed in preparation for the anterior communicating artery aneurysm clipping as well as a precaution prior to the endonasal aneurysm clipping.

Next, a separate instrument set was opened for the endonasal portion of the case, in order to separate the "clean" craniotomy from the "clean-contaminated" endonasal approach. A standard, expanded endonasal opening was completed, including a right middle turbinectomy. A vascularized nasal septal flap, which would be utilized for the closure, was prepared and tucked into the nasopharynx. The sphenoid sinus was opened widely, exposing the paraclival internal carotid artery (ICA), sella and planum sphenoidale. Proximal control was obtained by exposing the paraclival ICA via a vidian canal approach. Temporary clip access to the proximal ICA was confirmed. A transplanum exposure of the paraclinoid carotid in the optico-carotid cistern provided distal control.

Final localization and exposure of the superior hypophyseal artery aneurysm was completed by opening the sellar dura above and below its neck. Venous bleeding from the intercavernous sinuses was controlled with bipolar electrocautery and microfibrillar collagen packing applied on a cottonoid "sandwich." The dura overlying the dome of the aneurysm was not removed. A curved titanium aneurysm clip was applied with a pistol-grip clip applier across the neck of the aneurysm and the overlying dura (*see images at right*). Intraoperative angiography confirmed obliteration of the aneurysm. A second clip was placed adjacent (distal) to the first to ensure adequate closing pressure.

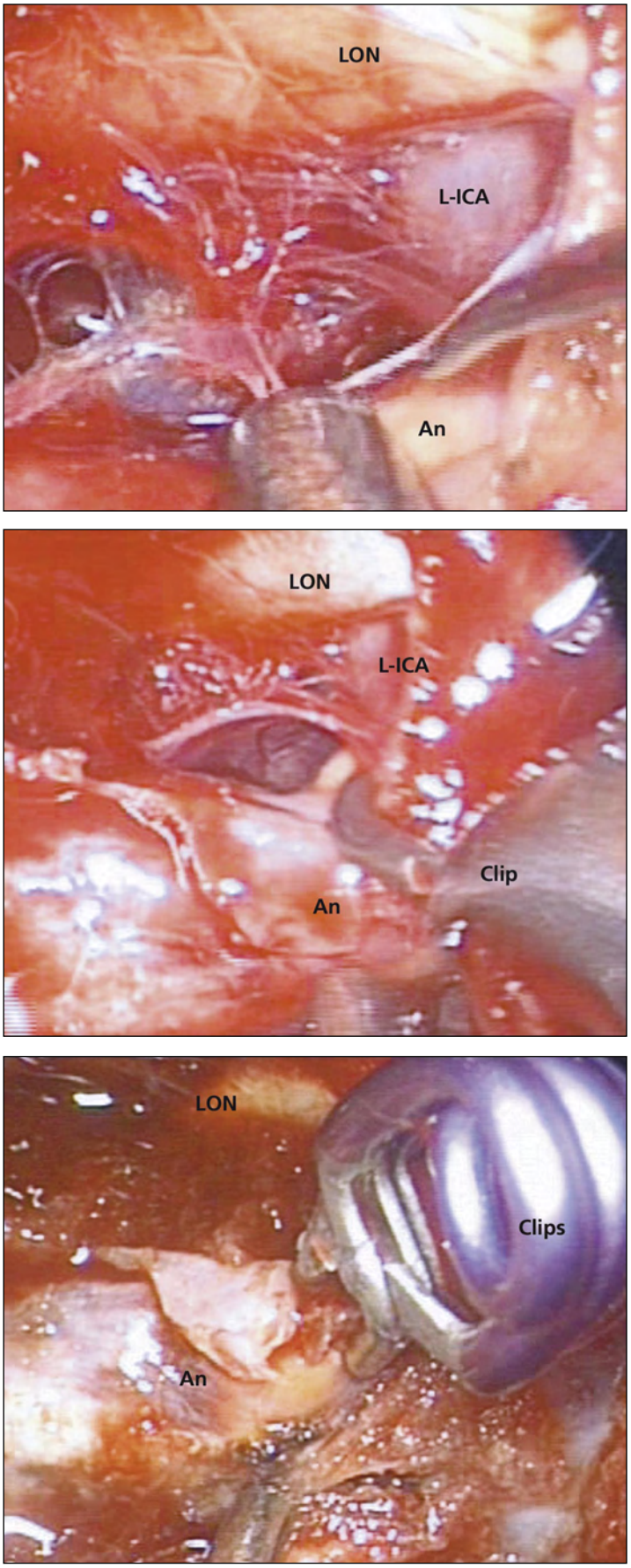
The anterior cerebral arteries were explored via the same endonasal exposure (transplanum), but the anatomy of this aneurysm was not believed to be favorable for endonasal clipping due to its superior and posterior orientation. The dural defect was closed by placing an intradural "inlay" duragen graft. The space in the sphenoid sinus around the aneurysm clip was filled in with fat graft. Finally, the vascularized nasal septal flap was laid over this fat graft without pressure on the clip and secured with tissue glue and a foley balloon buttress.

After the endonasal portion of the procedure was completed, the "clean" craniotomy instrument trays were reopened and a fresh drape placed over the head, face and body. The left pterional skin flap was turned down and a standard trans-sylvian approach was performed for clipping of the anterior communicating artery aneurysm.

The patient tolerated the procedure well. She has had no postoperative infectious complications and no CSF leak. She did have post-operative confusion that resolved by discharge. Postoperative CT confirms clip placement and a small, callosal infarct potentially related to a small perforator occlusion as a result of the anterior communicating artery aneurysm clipping.

## Conclusions

This is the first report of an endoscopic endonasal clipping of an unsecured aneurysm. This represents a very unusual circumstance of an aneurysm with favorable anatomy for an endonasal approach performed by a surgical team with significant experience with both neurovascular and endoscopic endonasal surgery. •




**(*top*) Dissecting neck of the aneurysm; (*middle*) clipping the aneurysm through the nose; (*bottom*) aneurysm already clipped. *An*: aneurysm; *L-ICA*: left internal carotid artery; *LON*: left optic nerve.**

# Dedicated spine research laboratory established at University of Pittsburgh

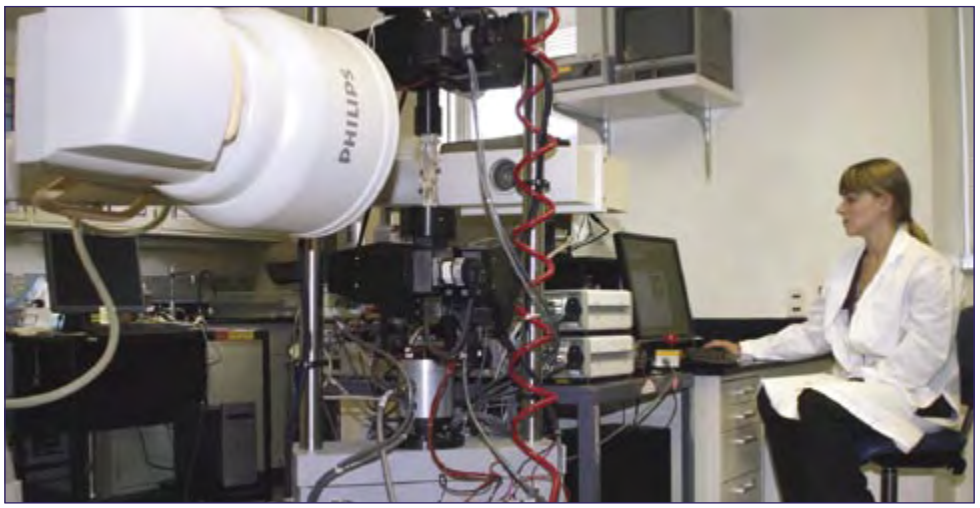
**by Boyle C. Cheng, PhD**
*Co-director*
*Welch Neurosurgical Research Laboratory*

The University of Pittsburgh Department of Neurological Surgery has a long-standing reputation of excellence in research, clinical care and education. In order to continue the advancement of research in spinal biomechanics, spinal cord injury and spine radiosurgery, a dedicated spine research laboratory—the Welch Neurosurgical Research Laboratory—has been established at the University of Pittsburgh.

The lab—established with the support of Zimmer Spine—is under the direction of myself and founder William C. Welch, MD, director of the UPMC Spine Services Division and chief of neurosurgery at UPMC Presbyterian.

The ability to deliver high quality neurosurgical spine care comprises excellence in clinical care and innovation in basic science research. Science demands high quality, progressive, unique research with translational applications. Society requires ethical, timely treatment of patients. Successful growth in the neurosciences will require that the needs of clinical and scientific applications be met through the development and utilization of translational programmatic research. The study of spinal biomechanics is a prime example of a translational research program.

Spinal biomechanics includes the study of the kinematic response of functional spinal units in response to externally applied forces and moments. This science attempts to reproduce physiologic loading found naturally in the human spine. Manipulations such as flexion extension bending and axial torsion are applied to spine analogs and the effects are quantified in engineering terms. Such results are then clinically qualified in order to establish translational significance. This research is a well accepted means to evaluate spinal implants prior to clinical use. State of the art treatments require sound biomechanical testing and proof prior to their clinical implementation. The Food and Drug Administration requires safety and efficacy studies, which biomechanical testing can potentially partially satisfy, prior to receiving clearance for clinical use or evaluation of all commercialized devices. Furthermore, it allows engineers to evaluate implant systems in order to validate proof of concepts and improve design for new implant technologies.




**Lab assistant Jessica Spehar performs a lateral bend test using the Bose Spine Test machine.**

The lab has recently designed—and staff is in the midst of validating—a six axis spine test frame with automated follower load capability. In addition, submillimeter optical tracking and fluoroscopy will be integrated into the biomechanical test protocols. Built in collaboration with the Bose Corporation, the automated follower load machine will provide state of the art testing and physiologic like loading to test specimen. Bose has been listed as one of the world's 50 most recognized brand names and received numerous other accolades for the design and development of their sound systems. The spine tester with automated follower load capabilities follows in this tradition. Other capabilities within the lab include development of spinal cord injury models based on the electroforce motor platform indenter. Again, Bose technology provides new methods for scientific study. The magnetic coil technology provides a truly frictionless means for creating precision damage models. Also vertebral strength assessment through compression tests, and imaging changes attributed to senescence are active areas of research.

Additionally, efforts will focus on education involving research projects designed for many levels of backgrounds and interests. Currently, undergraduate level, residency and foreign research scholars have research projects underway with the laboratory.

The requirements of these diverse research interests have also encompassed a number of departments including the McGowan Center for Regenerative Medicine, the Department of Rehabilitation Medicine, the Department of Orthopedic Surgery and the Carnegie Mellon University Bone Biology Laboratory. These collaborative efforts allow us to undertake the extremely challenging animal and cadaveric studies that have become a necessity for FDA approval, while providing educational and research project support for many of the major disciplines at the University of Pittsburgh.

Perhaps most importantly, appropriate and well-defined biomechanical studies add to an expanding body of academic literature and a greater understanding of this basic science. Direct translational research is accomplished through this testing with an eye toward the development of materials and instruments with clinical applications. •

**Tariq E. Awad, MD, and lab co-director director William C. Welch, MD, examine a lumbar spine specimen as the Bose Spine Tester performs flexion/extension testing.**

# Brain Trauma Research Center receives $6.3 million renewal grant from NIH

*(continued from back page)*

"The awarding of the BTRC to the group at the University of Pittsburgh is recognition of the great talent and focus of our research group. Interdisciplinary studies of neuron death and cognitive loss after brain injury, and new studies of the relationship between brain trauma and Alzheimer's disease, are directed toward improving therapy for people with brain injury. Through such research, care will be improved, which is the ultimate goal of this talented group," said Steven DeKosky, MD, professor and chair of the Department of Neurology and director of the Alzheimer's Disease Research Center (ADRC) at the University of Pittsburgh.

The BTRC is one of only three NIH-designated head injury centers in the United States. It is closely allied with the Center for Injury Research and Control, Safar Center for Resuscitation Research, Epidemiology Data Center, Benedum Pediatric Trauma Program, Alzheimer's Disease Research Center, Traumatic Brain Injury Clinical Trials Network of the National Institute for Medical Rehabilitation Research of the NIH, all of the University of Pittsburgh, and the Pittsburgh NMR Center for Biomedical Research at Carnegie Mellon University.

In the United States, traumatic brain injury is the most common cause of death, disability and mental impairment in people between the ages of 1 and 45 years and affects an estimated two million people each year. Because trauma disproportionately affects younger individuals, it accounts for more years of potential life lost than cancer and cardiovascular disease combined.

Each year, 50,000 people suffer severe brain injuries and require long-term care at a cost of more than $20 billion, according to the NINDS. Motor vehicle accidents are the most common cause of such injuries.

**C. Edward Dixon, PhD**

The Department of Neurological Surgery at the University of Pittsburgh was started more than 60 years ago with a strong commitment to patient care, education and research. Today, the department is the largest neurosurgical academic provider in the United States performing more than 6,500 procedures annually.

More information on this project and others underway at the Brain Trauma Research Center can be obtained by visiting their website at www.neurosurgery.pitt.edu/trauma. •

## Residents dispatch attendees 17-8 in grudge match softball game

**The Department of Neurological Surgery residents (*top*) easily defeated the department attendees 17-8 in a spirited softball game September 17. The play of the day was a catch made by resident Stephen Pirris who will be giving up his neurosurgical career for a tryout with the Pittsburgh Pirates. Congratulations to all the participants (*bottom*).**

## Recent donations to the department

*(all donations 'Up to $1,000')*

**Gamma Knife**
Betty J. Mecca

**General Neurosurgery**
Robert A. Alness

**Lars Leksell Chair**
Robert T. Cashion

**Neurotransplantation Research**
Henry A. Senf

**Neurosurgery Faculty**
Corpus Christi Parish (*Dixon*)
Barbara Anne Dively (*Dixon*)
Martha H. McLaurin (*Kassam*)
Jeffrey G. Mitchell (*Dixon*)

**Otolaryngology Research**
United Way of Allegheny County

**Welch Biomechanics Lab**
George P. Parker

## Kondziolka Elected Congress President

Department vice-chair of education and co-director of the Center for Image-Guided Neurosurgery, **Douglas Kondziolka, MD**, has been elected to serve as president of the Congress of Neurological Surgeons (CNS) beginning with their annual meeting in October. CNS is a leading international neurosurgical organization with a mission to promote public welfare through the advancement of neurosurgery, through a commitment to excellence in education, and by dedication to research and scientific knowledge.

Dr. Kondziolka has served on the executive committee of the CNS in numerous roles over the past nine years including chair of the fellowships and publications committees, scientific program chair, annual meeting chair, treasurer, and strategic planning committee.

## CIRCL Co-Sponsors Colloquium

The University of Pittsburgh's Center for Injury Research and Control (CIRCL), along with the Centers for Disease Control (CDC) sponsored a colloquium on the macro-level relationship between the economy and violence July 20 in Atlanta GA. The purpose of the colloquium was to, 1) review the state of knowledge in the area, 2) discuss current limitations, 3) assess the most appropriate measures and methods, and 4) develop future directions for research. The colloquium was organized by **Anthony Fabio, RD, MPH, PhD**.


## Books

• Tri-State Neurosurgical Associates director **Joseph Maroon, MD**, and clinical instructor **Jeff Bost**, have authored a book, *Fish Oil: The Natural Anti-Inflammatory*. The book focuses on the many benefits of fish oil supplements scientifically documented in over 900 clinical studies in treating such conditions as arthritis, spine pain, heart and vascular disease, depression and even very promising research on Alzheimer's and Parkinson's Diseases. The book explains the basic process of inflammation and the factors that cause inflammation to be a chronic condition. The book is published by Basic Health Publications.

• **Katrina S. Firlik, MD**, a 2002 graduate of the University of Pittsburgh neurosurgery residency program, has authored a book, *Another Day in the Frontal Lobe* that takes an inside look at the neurosurgery profession. Dr. Firlik is now a private practitioner in Greenwich, CT, and a clinical assistant professor at Yale University School of Medicine. Her book is published by Random House.

## In the News

• **Amin Kassam, MD**, was mentioned and interviewed in local Pittsburgh media for his role in the medical treatment of former Pittsburgh mayor Bob O'Connor. Dr. Kassam performed a shunt procedure on O'Connor to help channel excess fluid from his brain during the mayor's recent battle with primary central nervous system T-cell lymphoma.

• **Peter Gerszten, MD**, was featured in the September 2006 issue of *Hem/Onc today* magazine regarding his study indicating that stereotactic radiosurgery safely and effectively treats spine metastases secondary to lung cancer.

• **Douglas Kondziolka, MD**, was quoted in the July 20 edition of the *Baltimore Sun* in an article discussing the national debate over stem cell research.

• **P. David Adelson, MD**, was interviewed by KDKA-TV (Pittsburgh), WPXI-TV (Pittsburgh), and the *Pittsburgh Tribune Review* regarding football-related injuries in young athletes.

## Prominent Lectures

• **Dr. Gerszten** was an invited guest lecturer at the National Neurological Institute of Italy, in Milan, Italy on September 18.

• **Dr. Kassam** was the keynote speaker at the Symposium on Minimally Invasive Neurosurgery in Montreal, Canada, June 12; a guest speaker at the Cirugia Endoscopica Transnasal De La Base Del Craneo in Madrid, Spain, June 16; a visiting professor at the University of Calgary, September 8; and a guest speaker at the Sally Letson Symposium, University of Ottawa, September 14-15.

• **Dr. Kondziolka** was a special lecturer of the Brazilian Congress of Neurosurgery, September 15-18 in Florianopolis, Brazil speaking on acoustic neuromas, movement disorders and neurotransplantation. He was also a guest lecturer at the International Neuro-Oncology Symposium, August 25 in Memphis TN.

## Visiting Scholar

• **Costas Hadjipanayis, MD, PhD**, spent over a month this past summer at the University of California, San Francisco studying 'Awake Craniotomy and Cortical Mapping Techniques' with Mitch Berger, MD.

## Welcome

• **Mary Jo Tutchko**, executive assistant to Dr. Kassam; **Matthew Kratski**, office manager, pediatric neurosurgery; **Gayle L. Gibson**, secretary to Matthew Wetzel, MD; **Jessica Spehar**, Welch Neurosurgical Lab research assistant; **Jennifer Hasse**, grants administrative assistant; **Robin Lampenfeld**, physician assistant.

• Special welcome to **Daniel Prevedello, MD**, who joins the faculty as a clinical instructor from the University of Virginia.

## Personal Congratulations

• Baby boy (Oscar David, August 23) to **David Okonkwo, MD, PhD** and wife Quirine; **Geri Guman** was married to Herbert Parris on August 26; **Maryann Ruperto** was married to Eric Hilburg on July 8.

## Upcoming Events

• November 13-17: **Principles and Practice of Gamma Knife Radiosurgery.** For neurosurgeons, radiation oncologists and medical physicists interested in Gamma Knife radiosurgery certification. This course will also be offered January 8-12. Call (412) 647-7744 for more information.

• December 6: **2nd Annual Stuart Rowe Society Lectureship/Research Day**. Day-long series of lectures intended to showcase research activities in the field of neurological surgery and provide a forum for discussion. M. Sean Grady, MD, Charles Harrison Frazier Professor and Chairman of the University of Pennsylvania Health System Department of Neurosurgery will be the honored guest lecturer. Call (412) 647-0990 for more information.

• January 18-20: **Minimally Invasive Endoscopic Surgery of the Cranial Base and Pituitary Fossa Course**. Presentation of minimally invasive techniques for endoscopic surgery of the cranial base and pituitary fossa. Call (412) 647-6358 for more information. •

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neurosurgery news

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# Brain Trauma Research Center receives $6.3 million renewal grant from NIH

**by Gloria Kreps**
*UPMC News Bureau*

The University of Pittsburgh Brain Trauma Research Center (BTRC) has been awarded a $6.3 million grant from the National Institute of Neurological Disorders and Stroke (NINDS) of the National Institutes of Health (NIH) to continue groundbreaking research into the effects on the brain following head injury. Researchers will look at the factors that often contribute to poor outcomes and investigate new treatments that may lead to better recovery for patients at all levels of brain injury. The five-year grant is an extension to the BTRC, an NIH Center of Excellence originally established at the Department of Neurological Surgery in 1991.

"Traumatic brain injury is a huge public health problem for which there is no cure," said Edward Dixon, PhD, professor of neurological surgery, anesthesiology, neurobiology, and physical medicine and rehabilitation, and director of the BTRC. "Since there are so few treatments for brain trauma, our special focus is to translate our research into practical, clinical approaches that can ultimately help the brain-injured patients who are on the road to recovery."

"This grant truly distinguishes us as one of the leading centers in the world in brain trauma research and treatment. This focused and concerted effort lays the foundation for better understanding of trauma to the central nervous system, enabling us to develop treatment strategies that will make a difference," said Amin Kassam, MD, associate professor and interim chair of the Department of Neurological Surgery.

Since establishment of the BTRC in 1991, which is designated as a NIH Center of Excellence, researchers have made groundbreaking contributions to the understanding of how head trauma damages the brain, and the progression of that damage during the first few hours and days following injury. BTRC-led research has resulted in more than 150 peer-reviewed publications in leading scientific journals. In a 1997 issue of the *New England Journal of Medicine*, BTRC investigators reported that moderate cooling of the brain was effective in improving outcomes following severe brain trauma, which has led to additional clinical testing by University of Pittsburgh neurosurgery investigators.

The continuing BTRC research projects include a comprehensive study of the links between Alzheimer's disease and brain trauma; investigations of the mechanisms of nerve cell death and dysfunction; an investigation of learning and memory disruption after injury, which may shed light on post-traumatic amnesia and offer strategies to prevent or treat it; and a two-year neurocognitive follow-up study of severely brain-injured patients who received aggressive treatment.

*(see **Trauma** on page 6)*