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### Disclosures

Nduka Amankolor, MD, is a consultant for Oncorus, Inc.

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## What Do Patient Satisfaction Scores Mean in Spine Surgery?

by D. Kojo Hamilton, MD



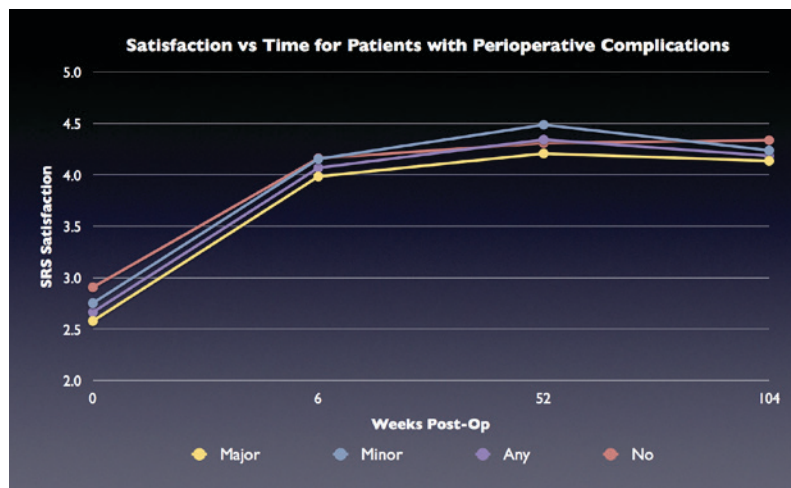
Currently, many patients seeking care for their spinal disorders have questions regarding the expertise of a spine surgeon found online, and they believe that the noted scores or “approval” ratings are indicative of better-than-average outcomes.

This has prompted a review of the methodologies used in acquiring these “satisfaction” scores and careful study of their utility in medical decision-making.

Patient-centered care has encouraged and promoted the use of patient-reported outcomes (or PROs). In fact, the move toward a less paternalistic approach to medicine continues to be advocated by the Institute of Medicine, which recommends that quality care be responsive to patient values, needs, and partialities. Most of the data derived from accessing patient preferences are embedded in pooled medical economic data and not directly focused on the individual patient. It is only recently that physicians who care for patients with spinal disorders have begun to appreciate the vast gap that exists between satisfaction scores (from PROs) and the safety and efficacy of the treatment administered during spine surgery.

Unfortunately, both patients and physicians continue to erroneously use medical economic measures in researching “best informed” treatment options. The available evidence is often limited to the utility of using patient satisfaction scores to assess improvement in clinical outcomes, particularly in spine surgery. Nevertheless, several health agencies continue to partner with Medicare and Medicaid to evaluate and direct reimbursement to hospitals. Of great concern is the mounting evidence of an association between certain patient demographics and comorbid health and social characteristics that lead to lower patient

*(Continued on Page 6)*



Based on study scoring, patients are considered highly satisfied with a score of 4/5 on the SRS-22r scale that was used. Even with complications, no matter how severe, satisfaction is the same after six weeks.

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## Editor's Message

# Communicating the Advancements of Neurological Surgery



At this fall's annual meeting of the Congress of Neurological Surgeons in Boston, the University of Pittsburgh Department of Neurological Surgery was once again well represented. Our faculty, residents, and medical students had the opportunity to share with fellow neurosurgeons from across the country — and around the globe — the pioneering research performed by members of our department. In addition, members of our department served as faculty for a wide variety of courses, sharing their expertise regarding new techniques and technologies, many of which were developed in Pittsburgh.

Presentations at national and international meetings to our neurosurgical peers is an important form of scientific communication for our faculty and a key part of our academic mission. However, the department continues to develop many different vehicles to inform the medical community about ways in which we are advancing the field of neurological surgery.

This newsletter attempts to capture the exemplary work performed here while offering CME credits to our readers.

In addition, our department maintains an in-depth website — for patients, researchers, and physicians alike — featuring background information, bios, and videos covering many aspects of neurosurgical care and treatments offered here at UPMC. Our Facebook page and YouTube channel are additional vehicles, further advancing our message of neurosurgical advancements. All these communication tools serve our ultimate goal of providing the finest medical care to patients in need.

As leaders in the field of neurosurgical care in the 21st century, we will continue to utilize a variety of communication platforms to transmit scientific information for the advancement of neurosurgical care.

*Peter C. Gerszten, MD, MPH, FACS*

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### Chief Residents

Gurpreet S. Gandhoke, MD  
Philip Lee, MD, PhD  
David Panczykowski, MD  
Gregory Weiner, MD  
Georgios Zenonos, MD

## Contact Us

### Department of Neurological Surgery

UPMC Presbyterian  
Suite B-400  
200 Lothrop St.  
Pittsburgh, PA 15213  
412-647-3685

**Editor:** Peter C. Gerszten, MD, MPH, FACS

**Website:** [neurosurgery.pitt.edu](http://neurosurgery.pitt.edu)

**Email:** [neuroinfo@upmc.edu](mailto:neuroinfo@upmc.edu)

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# Building a World-Class Brain Tumor Bank at UPMC

by **Aparna Rao, PhD, and Nduka Amankolor, MD**

Malignant gliomas remain a perplexing clinical problem with no cure. The discovery of effective therapies for these devastating brain tumors will invariably depend on a deep understanding of the molecular and cellular characteristics of tumor cells, immune cells, and other components of the glioma tumor microenvironment.

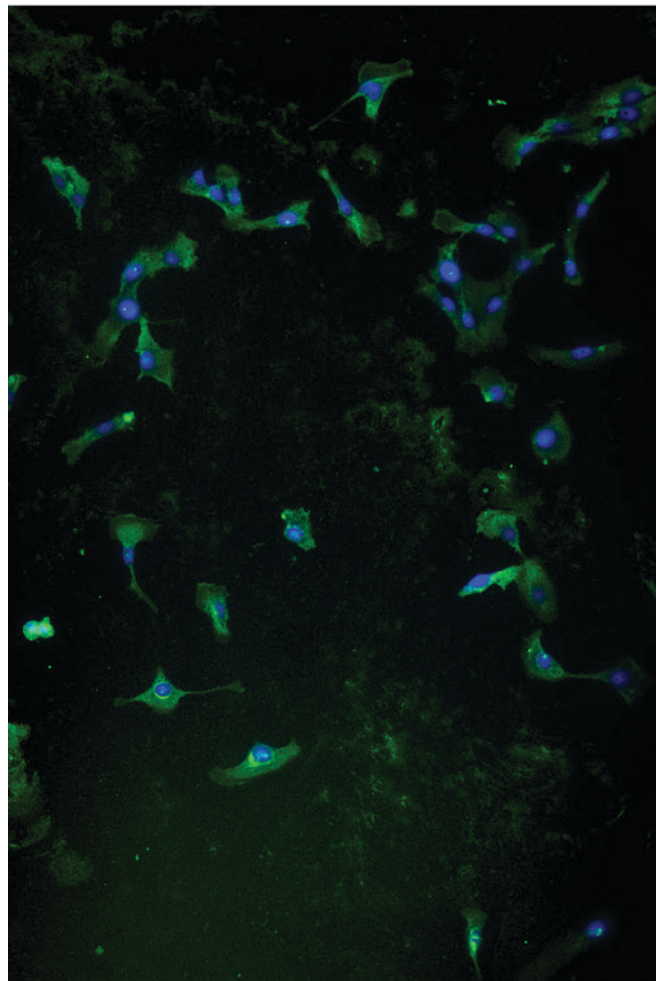
Much of the progress in our understanding of the genetic properties of gliomas has resulted from the conscientious collection of tumor tissue by neurosurgeons. For instance, the National Cancer Institute sponsored the Cancer Genome Atlas (TCGA), which defined the genetic landscape of multiple human cancers, collected over 700 tissue samples from more than 15 institutions en route to defining the main genetic alterations that characterize gliomas. These findings have spawned the discovery of multiple targeted therapies for the treatment of human malignancies, including glioma.

A significant shortcoming of TCGA was that it solely focused on characterization of cancer cells, while failing to catalogue the properties of the immune cells that combat these tumors. We now know that understanding the properties of immune cells within the tumor — the immune tumor microenvironment — is a necessary step in the design of effective immune-directed therapies for gliomas.

Since 2012, the Department of Neurological Surgery at UPMC has developed a world-class glioma tumor bank providing tumor specimens that include tumor cells, immune cells, and peripheral blood, along with annotated clinical information on patients with gliomas. The tumor bank provides researchers with high-quality, patient-derived biospecimens across all glioma grades. Depending upon the size and quality of the specimen received, tissues are processed for a variety of purposes. These include snap-freezing for genetic and proteomic studies, paraformaldehyde fixation for histology studies, deriving cell lines for a variety of biological and therapeutic assays, and isolation of tumor-infiltrating and peripheral blood immune cells for immunophenotyping studies. Clinical data from each patient are logged into a secure computer database. Tissue received by the tumor bank is catalogued and referenced by a unique numbering system in order to maintain patients' confidentiality.

To date, this fully annotated tumor bank consists of more than 150 snap-frozen and paraformaldehyde-fixed samples, 20 patient-derived cell lines, and 50 patient blood samples. The tumor collection consists of all types of gliomas that span the different stages of progression, making it a one-of-a-kind facility.

The repository has developed into a crucial and necessary resource to support both pre-clinical and translational neuro-oncology research. The availability of a vast variety of patient-derived specimens has spurred several collaborative studies both within and outside the University of Pittsburgh and has led to several critical discoveries. For further information related to the Glioma Tumor Bank, please email: [amankolornm@upmc.edu](mailto:amankolornm@upmc.edu).



**Figure 1:** Human astrocytes stained with an astrocyte marker (GFAP, shown in green) and a nuclear counterstain (DAPI, shown in blue). 20X magnification.

# A Creative, Reconstructive Endovascular Approach to Challenging, Symptomatic Carotid Dissections

by Benjamin Zussman, MD, Bradley Gross, MD, and Brian Jankowitz, MD

A carotid dissection is a tear in the lining of the carotid artery that can occur spontaneously or as a result of trauma. At the dissection site, a clot can form and then embolize to the brain to occlude an artery and cause a stroke. The dissection can also result in stenosis or even occlusion of the carotid artery itself, potentially leading to a stroke. Most often, dissections are managed with antiplatelet agents or anticoagulation. Patients that sustain a stroke despite optimal medical management are considered for more definitive endovascular therapy.

At UPMC, reconstructive endovascular approaches are always entertained, instead of empiric, deconstructive endovascular approaches. The latter refers to vessel sacrifice as a means to prevent embolization. We prefer reconstructive treatment in the

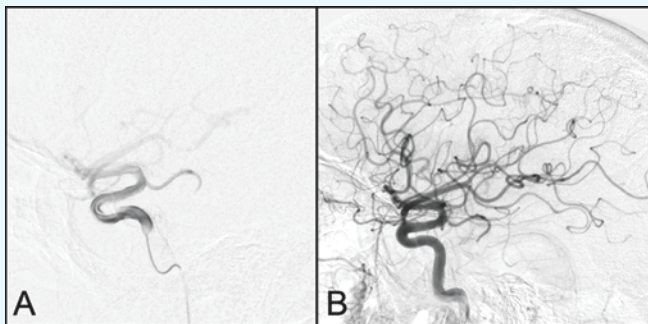
form of stent placement to preserve the parent vessel and restore normal flow. However, typical carotid stents are quite rigid and challenging to navigate through tortuous carotid arteries.

When an internal carotid artery dissection is associated with an acute intracranial occlusion, the large vessel occlusion is referred to as a “tandem” occlusion, and this situation presents a unique technical challenge for endovascular intervention. It is important to prioritize emergent endovascular treatment because these patients have been shown to respond poorly to systemic anticoagulation or thrombolytic therapies such as tissue plasminogen activator (tPA) alone.

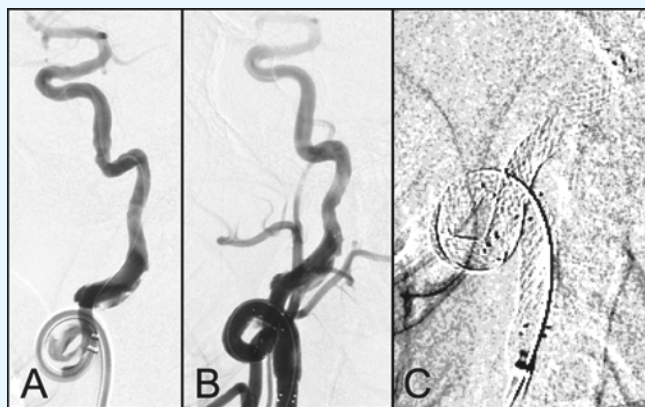
The goals of intervention are to perform a thrombectomy for the intracranial occlusion and to restore patency of the dissected extracranial internal carotid artery through a reconstructive approach. We recently reviewed our institutional experience treating patients with tandem intracranial occlusions and internal carotid artery dissections and focused specifically on patients with challenging, anomalous, curving loops and anatomical coils in the internal carotid artery.

We first cross the extracranial dissection and work distally to perform our intracranial thrombectomy (Figure 1). Then, once the intracranial vessels are reopened, we focus on reconstructing the dissected internal carotid artery. When the internal carotid artery anatomy is simple and the vessel is relatively linear, angioplasty and stenting are often straightforward. However, when the carotid anatomy is tortuous or looping, more creative approaches are needed because conventional carotid artery stents are not flexible enough to accommodate this variant anatomy.

In recent cases, we successfully used self-expanding peripheral stents with an overlapping or telescoping stenting technique in this setting (Figure 2). This approach entailed the usage of a modern, creative supportive guide and intermediate catheter system along with the extrapolative usage of more flexible, biliary (peripheral) stents. In our described cases, a manual aspiration thrombectomy achieved good intracranial reperfusion, and complete endovascular reconstruction of the dissected extracranial loops was performed in all patients. Our patients had improved pre-to-post intervention NIH Stroke Scale scores and good clinical outcomes on long-term follow up. We concluded that although technically challenging, stent remodeling across circular, 360-degree loops of the dissected internal carotid artery is feasible with the use of flexible, self-expanding stents and advanced catheter support systems. As carotid dissections with tandem intracranial lesions are increasingly managed with emergent endovascular treatment, this technique may prove useful when variant anatomy is encountered.



**Figure 1:** Example patient: A) Right internal carotid artery angiographic run prior to mechanical thrombectomy demonstrates right supraclinoid and middle cerebral artery thrombus. B) Right internal carotid artery run following thrombectomy demonstrates significant radiographic recanalization.



**Figure 2:** Example patient: A) Left cervical internal carotid artery angiographic run prior to revascularization demonstrates a 360-degree coil anomaly associated with dissection. B) Left internal carotid artery run following stent deployment and revascularization. C) Magnified view of the telescoping stent construct.

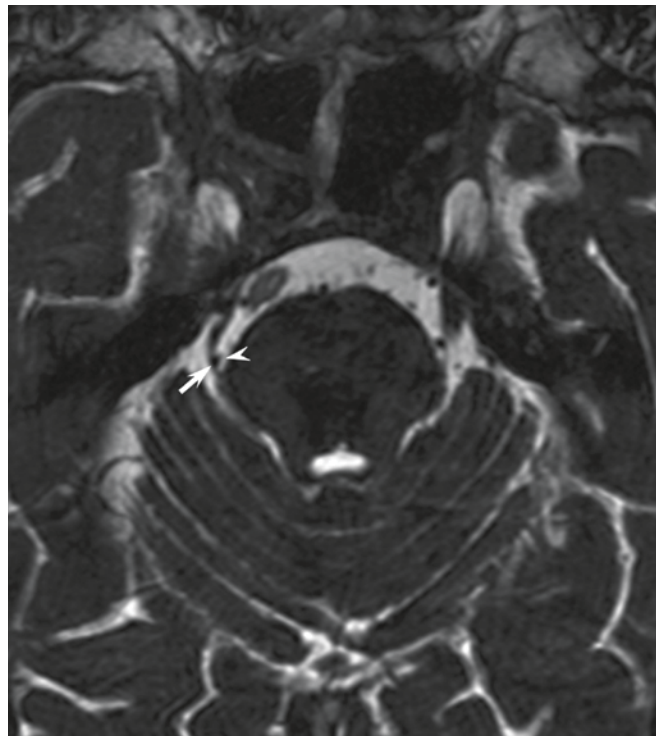
# Treating Orofacial Pain

by Raymond F. Sekula, Jr., MD, MBA, FACS, Kathleen Deeley, BS, MPH, and Alex Vieira, DDS, MS, PhD

Orofacial pain is estimated to affect more than one quarter of adults, and while most cases are odontogenic in nature, a subset of orofacial pain patients suffer from trigeminal neuralgia (TN). TN corresponds to a clinical manifestation of paroxysmal attacks of sudden, unilateral, and lancinating facial pain with characteristic triggers (e.g. light touch, cold air), lasting a few seconds to a few minutes, and more often involving the mandibular and maxillary branches of the trigeminal nerve. TN is one of the most painful neuropathic pain syndromes known. Unfortunately, we are sometimes lacking in consistently effective therapeutic interventions. Consequently, despite its relatively low prevalence, this disorder is associated with a disproportionately high burden on society in terms of associated health care costs, impaired productivity, and reduction in quality of life.

Over the past century, our understanding of this disorder has evolved slowly. In the 1920s, Walter Dandy, MD, a pioneering neurosurgeon, described vascular compression of the trigeminal nerve as a cause of TN. In the 1970s, our own Peter Jannetta, MD, and Joseph Maroon, MD, worked with colleagues at the University of Pittsburgh Department of Neurological Surgery to develop and refine a surgical procedure called microvascular decompression (MVD) to alleviate vascular compression of the trigeminal nerve. The result was miraculous and life-changing... for some patients. In the 1980s, our own L. Dade Lunsford, MD, introduced a radiosurgical, minimally invasive treatment — the Gamma Knife® (see related article on Page 8) — for TN to our region of the country. Again, the result was life-changing...for some patients. Today, our center utilizes the most sophisticated imaging, developed by UPMC neurosurgeon Raymond F. Sekula, Jr., MD, and colleagues Char Branstetter, MD, and Marion Hughes, MD, of the UPMC Department of Radiology, to better select patients for MVD or other surgical procedures to treat TN. Still, vascular compression as the etiopathogenesis of TN occurs in just half of patients with the disorder, strongly suggesting that other mechanisms almost certainly contribute to the development of TN. Although several studies have clarified some physiopathological mechanisms underlying TN, the molecular basis remains vague.

And so, the biggest challenge that we face daily in our clinics is the ability to provide relief from facial pain for the hundreds of patients that we evaluate each year. Annually, more than 8,000 patients undergo surgery for TN in the United States, with estimated costs exceeding \$100 million. While these treatments result in excellent outcomes for some patients, as many as half of all affected patients experience little or no pain relief. Fortunately, DNA may provide an answer to this problem.



**Figure 1:** Axial SSFP image demonstrates the right superior cerebellar artery (white arrowhead) deforming the medial margin of the right trigeminal nerve (white arrow). Note the deviation of the trigeminal nerve in this patient with right-sided trigeminal neuralgia.

At the University of Pittsburgh, the Department of Neurological Surgery has partnered with the School of Dental Medicine's Orofacial Pain Registry and Sample Repository (OPRSR), under the direction of Director of Clinical Research, Alex Vieira, DDS, PhD. Since January 2016, our team has collected more than 300 samples from Dr. Sekula's patients with facial pain. Our hypothesis is that patients that do not respond to various therapies, including medications and surgical treatments, have genetic variations that explain this. Given that very little is known about the distribution of relevant genetic variants in our patients who respond to therapy versus the non-responders, this genetic repository of DNA from patients with various types of facial pain has the potential to transform how we currently manage our orofacial pain patients. As we have in the past, clinicians and researchers across various departments of UPMC and the University of Pittsburgh continue to lead the way in advancing our understanding of this most debilitating disorder and providing the very best care to those suffering with TN.

## What Do Patient Satisfaction Scores Mean in Spine Surgery? *(Continued from Page 1)*

satisfaction scores. These variables include depression, psychological distress, financial stress, poor pain coping strategies, somatization, and poor health behaviors. In trying to understand what patient satisfaction scores mean for spine surgery, we identified the following four pertinent questions.

### Do satisfaction scores from PROs correlate with the level of clinical improvement or decline following spine surgery?

In an attempt to answer this question, UPMC scoliosis spine surgeons in the Department of Neurological Surgery partnered with 11 high-volume centers across the country to analyze prospectively gathered data on adult patients undergoing thoracolumbar spine surgery for scoliosis and kyphoscoliosis. The surgeons at all centers were board-certified with an average of 15 years of experience, post training. We evaluated patients' satisfaction with regard to overall treatment experience and inquired if the patient would have undergone similar treatment again based on their experience. Multiple disease-specific and non-specific patient reported outcomes were used to report outcomes concerning satisfaction as well as Health-Related Quality of Life (HRQOL) scores related to improvement in function, back pain, etc. We also captured and correlated satisfaction with objective standard radiographic measurements for successful realignment and neural decompression. Finally, we assessed how major and minor complications affected the patients' satisfaction scores.

Two years after surgery, our results from more than 250 patients showed that patients had very high satisfaction rates (76%) with respect to the outcomes of their surgery and irrespective of the degree of complications or optimum radiographic alignment.

Importantly, there was only a weak correlation between post-operative back pain and patient satisfaction. Furthermore, patient satisfaction after surgery was not strongly correlated with HRQOLs or disability.

A recent study using the Quality Outcomes Database (QOD) found that preoperative diagnosis was predictive of patient satisfaction following spine surgery. However, in that study from a heterogeneous population, patient satisfaction with surgical experience was lower for more complicated procedures. In a more homogenous yet procedurally complex population of scoliosis patients, we reported a high satisfaction rate and yet no strong correlation with outcomes.

### Do we have tools to successfully analyze patient satisfaction data?

Currently, the answer to this question is "no." Patient satisfaction data is referred to as "proxy data"— i.e., the fact that a patient is satisfied implies that the procedure was safe and efficacious. Even in disease-specific PROs, granularity is never achieved as to the exact measure of patient satisfaction. Questions remain regarding which aspects of the patient experience should or should not be included in satisfaction data. Our validated and widely used PROs currently lack detailed satisfaction questions even though many medical and medical economic decisions are made based upon results.

### Are there universally accepted measures to facilitate appropriate comparisons with regard to disease-specific PROs?

Again, the short answer is "no." Often, surgical treatments score better than medical treatments in terms of patient satisfaction. Newer surgical procedures, despite similar long-term efficacy and safety, continue to be associated with higher rates of patient satisfaction than older procedures. Early (<1 year) patient satisfaction results for newer minimally invasive spine surgery for scoliosis scores higher compared to traditional open procedures, but subsequent follow-up demonstrates that patient satisfaction scores even out in the long term.

### What is the best way to utilize patient satisfaction scores?

The best way to utilize patient satisfaction scores is by being as specific as possible. Such specificity begins with continuous and careful evaluation of de-identified patient comments, as opposed to numeric scores. Then, we must continue to rely upon safety and efficacy data. Though expensive and much more difficult to collect for the evaluation of a chosen surgical treatment, such data is likely far more valid than a patient's satisfaction with their caregivers. Third, we are attempting to uncouple the multiple aspects of a patient's experience with their team of health care providers. At our center, providers, together with their support staff, are collectively rated based upon outpatient visits. We collect and review comments not captured in numeric scores about patient experience and satisfaction. These de-identified surveys are the very best for quality improvement of patient experience and recognizing excellent providers versus being used as a proxy analysis of the true safety and efficacy of spine surgical treatments.

## Stroke Survivor Uses Art in Support Group to Help Others Cope, Recover

by Emily Guerriero, PA-C

Art: the expression of self. The outward interpretation of one's innermost thoughts and feelings. Some find beauty, some find sadness or anger, and others find joy or hope. For Alessandra Crivelli, hope was the motivation that led her to major in art therapy at Robert Morris University. At the age of 17, Crivelli suffered a hemorrhagic stroke secondary to a ruptured arteriovenous malformation (AVM). An AVM is an abnormal collection of blood vessels wherein arterial blood flows directly into draining veins without normal interposed capillary beds. Under the care of Brian Jankowitz, MD, assistant professor of Neurological Surgery at the University of Pittsburgh, Crivelli underwent multiple surgical interventions, including both endovascular and open surgery, to treat the AVM and associated aneurysmal disease. Today, she still struggles with coordination and memory issues. She has had to adapt and learn to use her non-dominant hand to write and paint. She continued to pursue her degree at Robert Morris after a medically necessary hiatus while she participated in therapy.

In 2011, a UPMC Presbyterian neurosurgical nurse and I started the first Aneurysm and AVM Support Group in western PA, hosted by UPMC. The group is geared toward providing open communication between aneurysm and AVM survivors and their caretakers, friends, and loved ones. Our goal is to provide hope to those newly diagnosed and offer myriad strategies to cope with the cognitive, physical, and emotional aspects of recovery, which is an ongoing process. Several of our participants suffered an aneurysm rupture more than five years ago and benefit from

the educational sessions and guest speakers we incorporate in our monthly meetings.

Crivelli used her love of art and her compassion for others as inspiration for her college thesis project titled "All in One Stroke: The Regrowth of Life," which was completed in the spring of 2017. The concept stemmed from her initial stroke and the intense physical, occupational, and speech therapy she required to learn to walk, talk, and feed herself again. "Regrowth of life" and the tulip she chose to represent it describe how she views her journey. During one of our support group meetings, she arranged an art therapy session. Each survivor in attendance was provided a canvas with a sketched tulip to paint any way they wanted. Soft music played in the background as participants sat side by side filling their canvases with color. It was amazing to witness the compassionate, encouraging, and thoughtful nature of these once-strangers, now like family, all because of a medical event that changed their lives forever. These canvases are currently proudly displayed at the Carnegie Museum of Art in Oakland.

Earlier this year, we hosted the 4th Annual Aneurysm Awareness 5K, which raised over \$25,000 for the Brain Aneurysm Foundation. All are encouraged and invited to join us at the 5K next summer.

WTAE-TV recently interviewed Crivelli and Dr. Jankowitz in a piece that aired Sept. 21. Our support group meetings are held on the third Wednesday of each month from February through November. For more information, email [guerrieroer@upmc.edu](mailto:guerrieroer@upmc.edu).

Alessandra Crivelli (third from right) with fellow AVM/aneurysm survivors and their artwork from the Aneurysm and AVM Support Group.



## Lunsford to Receive Prestigious Award



L. Dade Lunsford, MD, Lars Leksell Distinguished Professor at the University of Pittsburgh and director of the UPMC Center for Image-Guided Neurosurgery, was named the 2017 recipient of the

prestigious Herbert Olivecrona Award by the Karolinska Institute in Stockholm, Sweden.

The annual award is bestowed each year on an international neurosurgeon in recognition of their significant research contributions in the field of neurosurgery. It is presented in honor of Herbert Olivecrona, MD, credited as being the father of modern neurosurgery in Sweden. He was a professor of neurosurgery at Karolinska Institute from 1935 to 1960 and died in 1980.

Dr. Lunsford, an internationally recognized authority on stereotactic radiosurgery

techniques, served as the American Association of Neurological Surgery Van Wagenen Fellow from 1980-1981 and studied at the Karolinska Institute under the direction of Lars Leksell and Erik-Olof Backlund. He was responsible for bringing the Gamma Knife® to UPMC in 1987, the first center in the United States to offer this state-of-the-art, minimally invasive form of brain surgery. He also created the first neurosurgical operating room with a dedicated CT scanner for deep brain surgery in 1982.

The installation of the Leksell Gamma Knife revolutionized neurosurgical care, drastically reducing hospital stays while significantly improving patient care. The technology represents one of the most advanced means available to help patients with brain tumors, arteriovenous malformations (AVMs), and pain or movement disorders. More than 14,700 patients have undergone Gamma Knife stereotactic radiosurgery under the direction

of Dr. Lunsford and his team at UPMC since the device's installation.

In addition, Dr. Lunsford has established the Center for Image-Guided Neurosurgery as a major international training site for radiosurgery and minimally invasive neurosurgery. Over the past 20 years, more than 2,200 neurosurgeons, neurotologists, radiation oncologists, medical physicists, and nurses have trained at this center. The courses offered here are among the highest-rated post-graduate courses offered at the University of Pittsburgh.

As recipient of the award, Dr. Lunsford will receive the Olivecrona Medal and deliver the Olivecrona Lecture at the Olivecrona Symposium held at the Karolinska University Hospital in Stockholm on Dec. 1, 2017.

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