



Promising immunotherapy trial opens for childhood glioma treatment

Malignant astrocytomas are among the most common and deadly brain tumors of childhood. Most children with brainstem gliomas and partially resected malignant gliomas arising elsewhere within the brain die within several years of diagnosis, despite treatment. Low-grade gliomas can also prove treacherous; while most children with cerebellar and superficial cerebral lesions are cured with surgical tumor removal, lesions in deep sites, such as the hypothalamus and brainstem, rarely can be removed completely and carry high risks for recurrence and long-term side effects.

During the past decade, researchers at the University of Pittsburgh, led by Hideho Okada, MD, PhD, have gained significant preclinical and clinical experience with immunotherapy for adult gliomas. Recently published studies from UPMC show substantial similarities between pediatric and adult gliomas in their expression of glioma-associated antigens (GAAs). “Our clinical study and biological correlative analyses represent the first application of a multipeptide epitope vaccine-based strategy for the treatment of

children with gliomas,” says Ian Pollack, MD, the head of pediatric neurosurgery at Children’s Hospital of Pittsburgh of UPMC. “It will provide fundamental data for assessing safety, and clinical and immunological efficacy, of immunotherapeutic strategies in the pediatric brain tumor context.”

Dr. Pollack and pediatric oncologist Regina Jakacki, MD have worked with Dr. Okada to develop a GAA-based vaccine cocktail, combined with an immunoadjuvant (poly-ICLC) to further boost immune response. The trial includes children with newly diagnosed malignant brainstem gliomas, newly diagnosed subtotaly resected non-brainstem malignant gliomas, recurrent malignant gliomas and treatment-refractory low-grade gliomas. This study is a joint initiative of the Pediatric Neurosurgery and Neuro-Oncology Programs at Children’s Hospital of Pittsburgh of UPMC. Dr. Jakacki says, “Children with these tumors generally do not respond well, if at all, to standard chemotherapy. This treatment offers a unique new strategy to try to control tumor growth.”

Participants are treated with subcutaneous injections of GAA vaccines every three weeks for eight courses, and poly-ICLC is administered as a separate subcutaneous injection on the same day as each vaccination. Participants are evaluated for treatment-related side effects and treatment response by clinical and laboratory evaluations and MR imaging. Participants who demonstrate disease stabilization or regression without unacceptable toxicity can receive additional vaccinations. These studies take advantage of unique institutional resources provided by the University of Pittsburgh Cancer Institute Immunological Monitoring and Cellular Products Laboratory, which will evaluate various parameters of immune response in children treated on this study.

“This trial has developed based on the unique combination of clinical and translational researchers in Pittsburgh,” says Dr. Pollack. “In view of the poor prognosis of these tumors, this represents a promising new approach that has potentially less toxicity than conventional chemotherapy.”

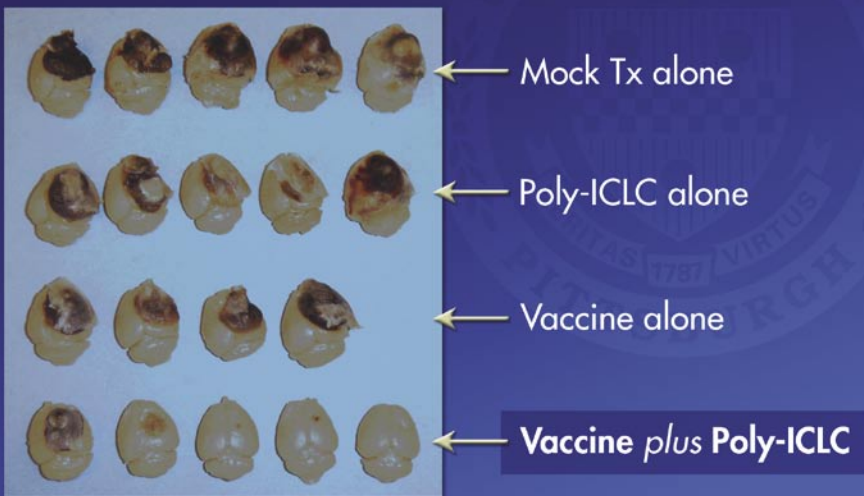
Patients from age three to 21 are currently being recruited for five distinct strata:

1. Newly diagnosed brainstem gliomas
2. Newly diagnosed non-brainstem malignant gliomas
3. Newly diagnosed malignant gliomas in patients who have received chemo-irradiation therapy
4. Recurrent malignant gliomas, and
5. Progressive recurrent low-grade gliomas.

“These tumors are notoriously very frustrating to treat because of their frequent resistance to standard chemotherapy,” says Dr. Jakacki. “If this treatment proves to be as promising as hoped, it could be incorporated into upfront treatments and potentially reduce the need for standard chemotherapy.”

For more information or to discuss any potentially eligible patients, please contact Regina Jakacki, MD (412-692-7056 or regina.jakacki@chp.edu) or Ian F. Pollack, MD, (412-692-5090 or pollackif@upmc.edu). •

Poly-ICLC enhances the effect of vaccines in mouse brain tumors



Mice in first three rows received mock treatment alone, poly-ICLC alone and peptide-vaccines alone. (Dark nodules are tumors) Mice in bottom row received both peptide-vaccines and poly-ICLC. Four of five mice appear almost tumor-free.

PEDIATRIC NEUROSURGERY

Adapting approaches for pre-eminent pediatric care

This issue of *University of Pittsburgh Neurosurgery News* highlights a number of innovative developments in pediatric neurosurgery. In some cases, these represent a translation of technologies and approaches from adult neurosurgery into the pediatric arena.

For example, the use of novel immunotherapy approaches for challenging childhood brain tumors builds upon a longstanding institutional focus in adult neuro-oncology on vaccine-based therapies, as well as basic laboratory studies at our center that supported the rationale for applying similar approaches to pediatric gliomas.

Likewise, the application of endoscopic surgical approaches to the management of childhood intraparenchymal tumors, as well as lesions of the cranial base, has been facilitated by the extensive experience gained with these methodologies in adults.

However, as highlighted by the article on pediatric vascular disease, it is important to recognize that children are not simply little adults, and manifest a distinct spectrum of neurological problems that in some instances require distinct approaches to care. Although these age-related differences can pose challenges, they can also provide opportunities. In particular, the plasticity of the

developing brain provides a potential advantage for recovery from surgical interventions in childhood, as compared to adulthood. This factor has provided a strong impetus for the adoption of aggressive intervention in appropriately selected patients with intractable epilepsy as a way to improve both seizure outcome and quality of life.

A fundamental element that ties together all of the above areas is the necessity for multidisciplinary involvement in order to provide optimal therapeutic decision-making. Most of the major subspecialty areas within pediatric neurosurgery (e.g., neuro-oncology, epilepsy, craniofacial, spinal dysraphism, vascular) require the involvement of skilled members of collaborating subspecialties.

As one of the nation's pre-eminent children's hospitals, the Children's Hospital of Pittsburgh has the full gamut of pediatric subspecialists in areas such as neuro-oncology, neurology, plastic surgery, radiology, and other key disciplines, which help to support our mission of being a leading center in North America for treatment, teaching, and research in pediatric neurosurgery. •



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CyberKnife (<i>cranial</i>).....	(412) 647-7614	Referrals (General).....	(412) 647-3685
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New philosophy of early, aggressive pediatric epilepsy surgery takes hold

by Mandeep Tamber, MD

Over the last several years, pediatric epilepsy surgery has undergone a paradigm shift. The concept that many children with medically intractable epilepsy can be relieved by surgery, and that such surgeries are no longer “last resort” procedures, is a relatively new one. A new philosophy of early and aggressive epilepsy surgery has taken hold, as evidence accumulates in support of the notion that such surgery can be performed safely and effectively in infants and young children, and as the detrimental effects of recurrent seizures (and the antiepileptic drugs designed to control them) on the developing brain continue to be highlighted.

Another key factor in the push towards early surgical intervention in children afflicted with intractable epilepsy is the desire to make full use of the plasticity of the developing brain, so as to optimize the transfer of function following surgery done in eloquent areas of the brain.

Aggressive epilepsy surgery is predicated upon accurate presurgical identification of the epileptogenic zone, the area necessary and sufficient for the generation of electroclinical seizures. Advances in neuroimaging have allowed for delineation of the epileptogenic zone in patients in whom it would otherwise be impossible to define.

Advanced MR imaging modalities allow for the detection of subtle lesions in cases previously considered non-lesional. Surgery relies greatly on structural brain imaging, which has the ability to detect malformations of cortical development and other epileptogenic lesions. Not surprisingly, detecting a lesion on MRI affects surgical prognosis favorably. New structural studies like diffusion tensor imaging (DTI), and higher resolution techniques such as higher field strengths (>1.5 T), and more notably, phased-array coils, appear to greatly enhance the sensitivity of this test.

When MRI is concordant with non-invasive EEG recordings, surgery (lesionectomy) can be performed without necessitating further workup. However, when MRI is discordant with EEG studies, fails to detect a lesion, or reveals certain abnormalities like cortical dysplasias, further workup may be needed with functional imaging, and possibly intracranial EEG recordings, to better delineate the surgical borders of the epileptogenic

zone. Use of these supplementary diagnostic modalities may identify additional patients that would not otherwise be considered traditional (i.e. harboring a lesion) surgical candidates.

Magnetoencephalography (MEG) is a promising functional imaging modality that is increasingly used in clinical practice. MEG delineates the irritative zone by detecting magnetic fields produced by interictal epileptiform activity. MEG appears to be better than surface EEG for the detection of sources that are tangential to the convexity, such as those emanating from the insular cortex.

Functional imaging modalities such as positron emission tomography (PET) and single photon emission computed tomography (SPECT) are also increasingly being used to delineate the epileptogenic zone. FDG-PET is being used in nonlesional neocortical epilepsy for general localization and for guiding intracranial electrode placement. Ictal SPECT may offer important localizing information when the MRI is non-contributory, especially if pathologies such as focal cortical dysplasia are suspected. Even with a lesion on MRI, ictal SPECT might be vital for surgical planning in instances where the EEG is nonlocalizing. Ictal SPECT can also be compared to interictal SPECT (subtraction SPECT), possibly identifying additional patients for whom epilepsy surgery may be a therapeutic option.

Intracranial EEG monitoring is most often used to determine the localization of

extratemporal seizure foci, a common scenario in pediatric epilepsy patients. Subdural electrodes (grids and strips) are being used for intracranial monitoring in children and infants, even those less than one-year of age. Stereotactically placed depth electrodes are also used with acceptable low morbidity, and allow recordings of electrical activity at the depth of convolutions and other areas of interest (e.g. hippocampus).

Frequently in pediatric patients, the results of the surgical epilepsy workup may localize the epileptogenic zone to functionally eloquent cortex. Whereas traditionally children with seizure foci located in eloquent brain were not considered appropriate surgical candidates, or received “palliative” procedures (such as multiple subpial transactions) alone, our understanding of the effects of neural plasticity has resulted in major resective procedures, such as hemispherectomies and peri-rolandic resections, being undertaken in young children, who appear to tolerate these procedures without major functional deficit (see figure 1 below).

Issues regarding functional plasticity, the effects of surgery on brain development, the diversity of the pediatric epilepsy syndromes, and pre- and post-surgery psychosocial factors require expertise unique to the pediatric patient. Therefore, the evaluation of a patient for possible epilepsy surgery has to be a careful process performed in a dedicated pediatric epilepsy center such as the one at Children’s Hospital of Pittsburgh. •

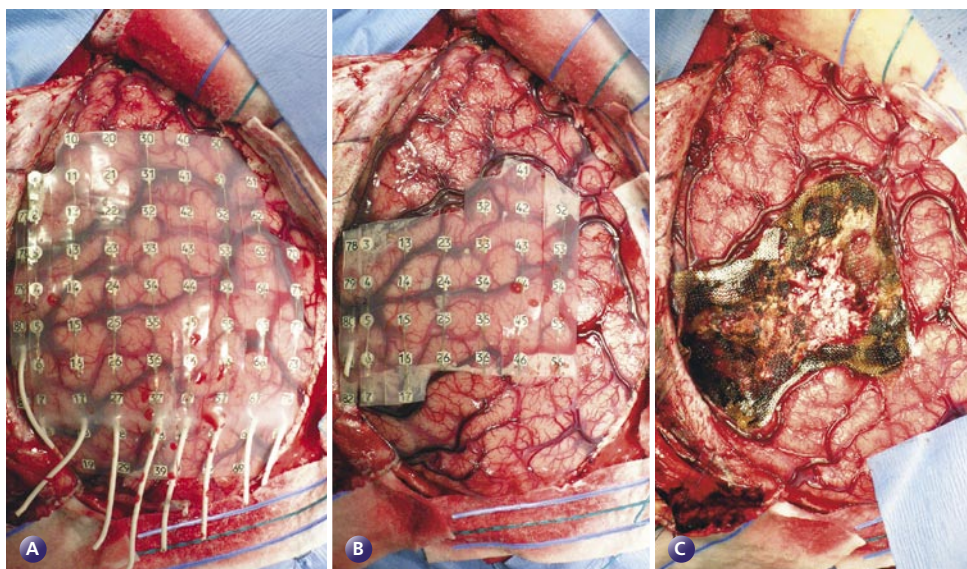


Figure 1. Intraoperative view of a large right hemispheric subdural grid placed in a four-year-old child in status epilepticus (A). Post-implantation recordings demonstrated that the epileptogenic zone was located in the peri-rolandic area (B). Following resection of the peri-rolandic cortex, the child is seizure-free, with a left hemiparesis that is expected to improve (C).

NeuroendoportSM surgery implemented with success at Children's Hospital

by Johnathan A. Eng, MD
Ian Pollack, MD

Pediatric brain tumors are the most common solid tumors of childhood, and the second most common malignancy overall among children. Most such tumors respond favorably to surgical resection, but in selected cases, the tumor location itself can be a barrier to removal. Critical neural and vascular structures surrounding the mass lesion can make approaching and removing the tumor unfeasible. In such cases, therapeutic options are limited.

Endoscopic port surgery (EPS) using the NeuroendoportSM for minimally invasive brain tumor removal has been implemented with success for selected brain tumors at UPMC. Over 100 adult patients have been successfully treated using this technique. EPS facilitates minimization of brain trauma associated with dissection into deep brain tumors. In addition, the endoscopic visualization provided by the port helps to delineate critical structures in hard-to-reach areas of the brain parenchyma (see figure 1 at left).

In July 2009, EPS was attempted at Children's Hospital of Pittsburgh for the first time. A 14-year-old boy presented with gait instability and dyscoordination, and was noted to have a deep-seated lesion of the left superior cerebellar peduncle. Due to the difficult location of the tumor and the patient's relatively stable neurologic status, the plan of observation was implemented with serial MRI scans to assess for tumor progression. Over a period of 18 months, the tumor grew in size, with increasing mass effect against the midbrain. Therefore a decision was made to resect the tumor. Because of concerns regarding brain retraction with a lesion so close to the brainstem, EPS was used to facilitate resection of the tumor.

The port was deployed into the tumor through the lateral cerebellar hemisphere using frameless image-guidance. Piecemeal resection was completed without complication. Postoperative MRI scans demonstrated a complete resection of the lesion, which was diagnosed as a pilocytic astrocytoma (see figure 2). The patient developed transient post-operative worsening of his gait, which resolved in less than a week. Today, his neurological exam is normal.

While EPS is not necessarily the procedure of choice for all pediatric brain tumors, it offers an intriguing option for patients with hard-to-reach tumors. EPS is a welcome addition to one of the most diverse pediatric brain tumor programs in the country. Continued implementation of the technology is planned at Children's Hospital of Pittsburgh. •

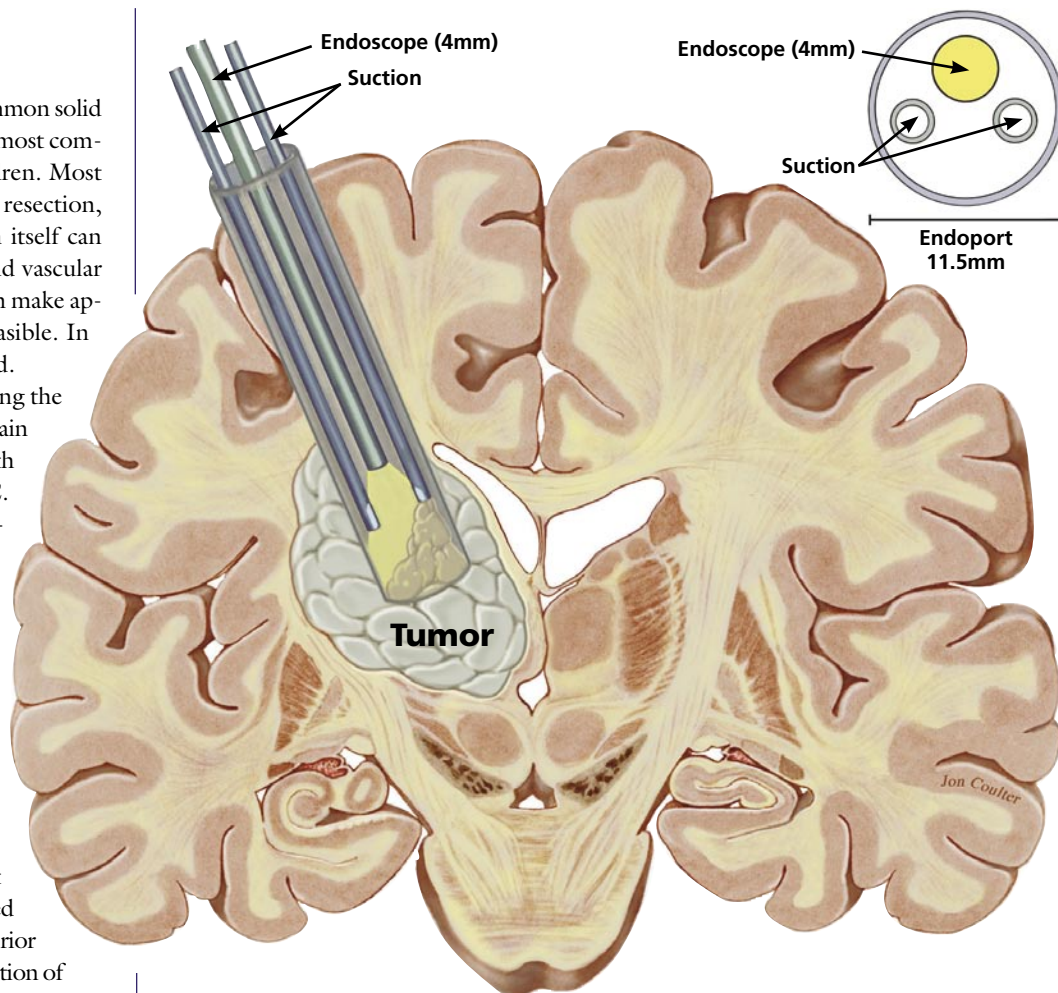


Figure 1: Schematic of the neuroendoportSM deployed into a deep-seated tumor of the thalamus, with the light from the endoscope and two suction devices aspirating the tumor through the port. The image at top right corner demonstrates an axial view of the 11.5 mm endoport, with an endoscope and two suction devices.

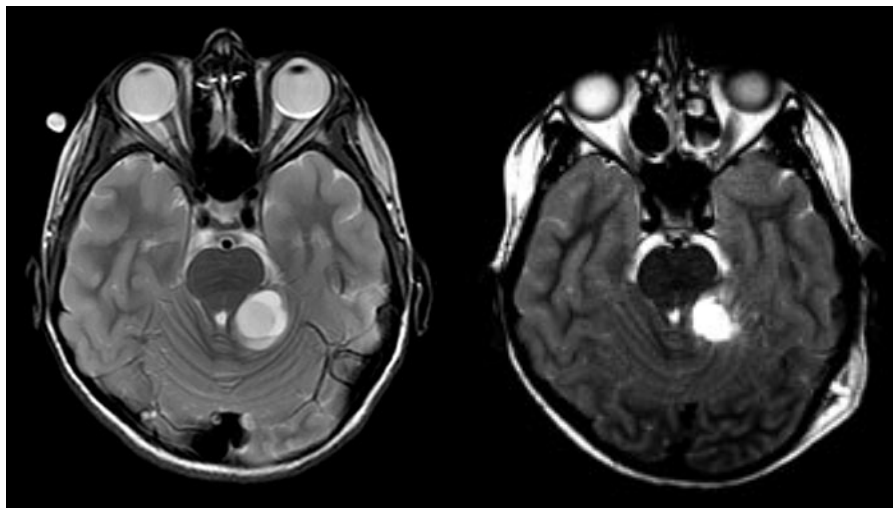


Figure 2: Pre and post-operative MRI scans on a 14-year-old pediatric patient who underwent EPS for resection of a deep-seated brain tumor. (Left, preop), axial image demonstrates a mass within the superior cerebellar peduncle causing regional mass effect on the dorsolateral midbrain. (Right, postop), image demonstrates gross total tumor resection.

Pediatric vascular disease: 'Not just little adults'

by Stephanie Greene, MD

A previously healthy six-year-old girl walked into her parents' bedroom one morning, complaining of tingling in her right forehead. She then collapsed into her mother's arms, where she lost consciousness and had a generalized tonic-clonic seizure.

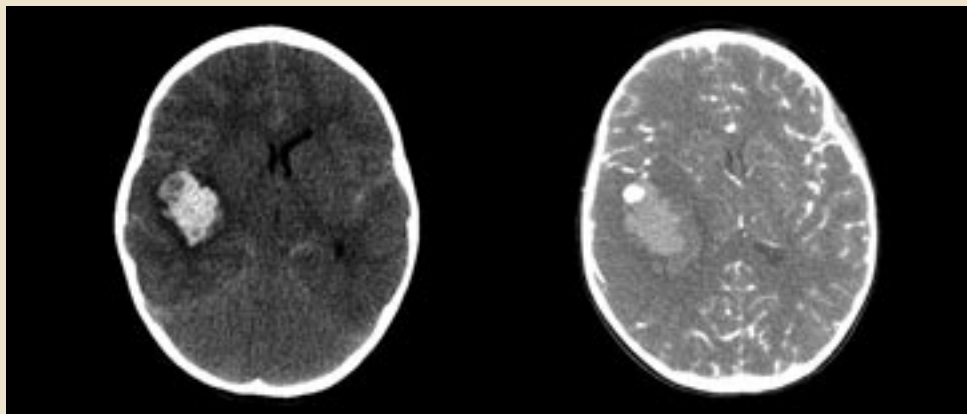
She was rushed to Children's Hospital of Pittsburgh by ambulance, where a stat head CT and CT-angiogram revealed a middle cerebral artery (MCA) aneurysm adjacent to a large right frontotemporal hematoma. She was taken emergently to the operating room with a dilated pupil. She underwent evacuation of the hematoma and trapping of a large distal MCA aneurysm. Daily transcranial Doppler examinations and an angiogram allowed for the rapid diagnosis and tailored treatment of her severe vasospasm, which resolved without sequelae after aggressive management with hypervolemia, hemodilution, and hypertension for two weeks.

Three months later, her only residual deficits include trace weakness in her left hand musculature and a mild visual field deficit. The multiple teams of specialists available at Children's Hospital of Pittsburgh, including emergency medicine, anesthesia, critical care medicine, neurology, interventional radiology, neurophysiology, and neurosurgery, ensured that this child received the complex care she required.

Aneurysms in children are rare, and occur in only an estimated one to three children per million.

Many characteristics make them distinct from those seen in adults. They are more common in boys, and are more often large (>1 cm) or giant (>2.5 cm). Pediatric aneurysms occur in different locations in children than in adults, being more often seen in the posterior circulation, at the carotid bifurcation, and in the middle cerebral artery distribution. They are more likely to be distal on the anterior or middle cerebral arteries, while adult aneurysms classically occur at branch points.

Acquired risk factors for aneurysm formation identified in adults are largely absent in children, leaving congenital factors to play a correspondingly larger role. Pediatric aneurysms can be seen in association with systemic diseases such as coarctation of the aorta, Marfan and Ehler-Danlos syndromes, sickle cell anemia and thalassemia, and polycystic kidney disease. While traumatic and



(Left) CT scan showing intraparenchymal hemorrhage; (Right) CT-angiogram showing MCA aneurysm adjacent to hematoma.

mycotic (infectious) aneurysms occur, the majority are idiopathic.

Most aneurysms in children, as in adults, present with subarachnoid hemorrhage. Those in specific locations, such as middle or anterior cerebral artery aneurysms, may rupture into the adjacent parenchyma and produce hematomas. The propensity toward larger aneurysms leads a number of these patients to present with symptoms referable to a mass lesion.

The general workup and management of these patients are similar to that of adults. Aneurysms in children often require complex and creative treatment for obliteration, with less than 30% treated with a single clip. Post-operative issues of hydrocephalus and vasospasm, both related to the degree of subarachnoid hemorrhage, are managed expectantly. In children, vasospasm is less likely to lead to clinical symptomatology and radiographic stroke, perhaps because of the robust collateral circulation.

In contrast to adult patients, the majority of acute hemorrhages in children are not due to aneurysms. Other causes of intracranial hemorrhage and stroke, including arteriovenous malformations (AVMs) and Moyamoya syndrome, must be considered.

Arteriovenous malformations are treated with a combination of therapies, including surgery, endovascular treatment, and gamma knife radiosurgery, to most effectively treat the malformation with the least risk to the patient. As the lifetime risk of rupture of AVMs is 4% per year, most AVMs diagnosed in childhood require treatment. Arteriovenous malformations most commonly present with intraparenchymal or intraventricular hemorrhage, diagnosed by head CT after the

sudden onset of a severe headache.

A four-vessel angiogram is obtained prior to any intervention if the patient is clinically stable. A hematoma may be partially evacuated as a life-saving maneuver, to allow for an angiogram to be performed prior to an elective AVM resection. AVM resection is ideally delayed four to six weeks after a hemorrhage, when brain relaxation has occurred and the surrounding hematoma has liquefied. Endovascular intervention is often used as an adjunct, to lower the hemorrhage risk of surgery or to decrease the size of the nidus prior to radiosurgery. Recent advances in this area are allowing for primary endovascular treatment of select AVMs. Radiosurgery is used for small or deep AVMs, or for a small residual nidus after surgical hematoma evacuation, and produces obliteration over several years' time.

Moyamoya syndrome is a progressive narrowing of the distal internal carotid arteries and proximal anterior and middle cerebral arteries, producing a decrease in cerebral blood flow. Ischemic attacks precipitated by hyperventilation can produce infarction. Less common presentations include seizure and headache. Adults usually present with intraventricular hemorrhage. The incidence of this disease is increased in children of Asian descent, and those with Down syndrome, a hypercoagulable state, or a history of cranial irradiation.

Moyamoya syndrome involves the compensatory dilation of the normal leptomeningeal arteries and the later development of external carotid transdural anastomoses to provide collateral flow to the ischemic brain. Cerebral revascularization is the treatment of choice, by direct or indirect bypass. Direct

(See *Pediatric* on page 7)

Management of pediatric craniopharyngiomas complex and varied

by Douglas Kondziolka, MD

Craniopharyngiomas, although histologically benign, represent one of the most challenging tumors in both children and adults. Because of their intimate association with critical visual pathways, memory regions, and the hypothalamic-pituitary axis, the tumor or its management can be disabling. Some tumors are small and others can be very large. The tumor can be solid, partially solid or cystic, or predominantly cystic. For solid tumors with significant mass effect, microsurgical resection or endoscopic-based resection remain important options.

Should residual or recurrent tumor be identified, then either stereotactic radiosurgery or, in some situations, radiotherapy are appropriate. In patients with predominantly cystic tumors, then stereotactic drainage of the cyst or stereotactic intracavitary irradiation with colloidal radioactive phosphorus (P32) remain important choices. At the University of Pittsburgh, all of these tools and approaches are used either alone or in combination in the management of children with craniopharyngiomas.

For patients with cysts, even if large, stereotactic placement of a small cannula followed by aspiration of a 1 ml of fluid and then instillation of the colloidal phosphorus suspension, is performed through a single twist drill hole. The patient leaves the hospital the next day. The half-life of the phosphorus is 14 days, and the isotope typically exerts its effect over 70 days.

Tumor cyst regression can be rapid in some patients leading to prompt improvement in vision or other symptoms. If significant visual deficits persist, then aspiration of the cyst two weeks later can be performed to drain the fluid and make the cyst smaller while waiting for the phosphorus to work. Overall, the chance for cyst control with this

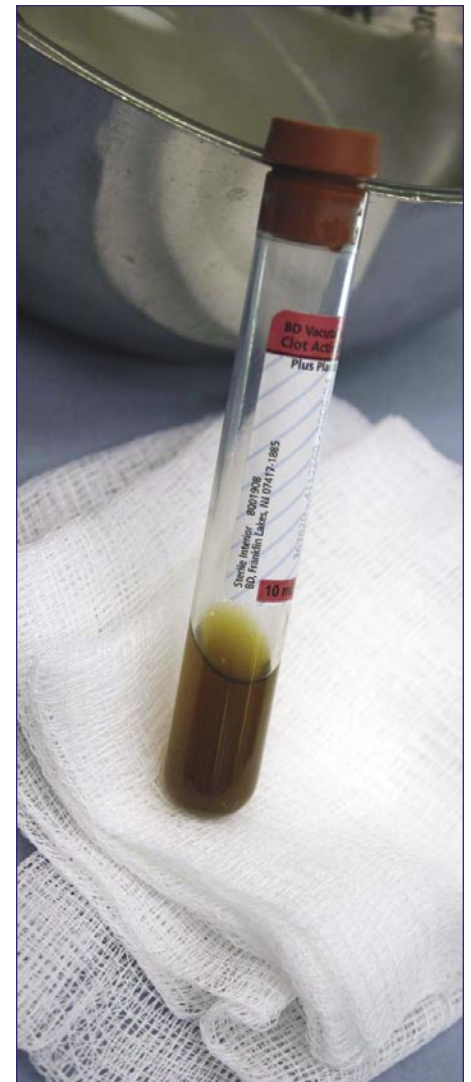


approach is approximately 90%. In some patients, other cysts may develop or the tumor may be polycystic initially, which may require additional surgery.

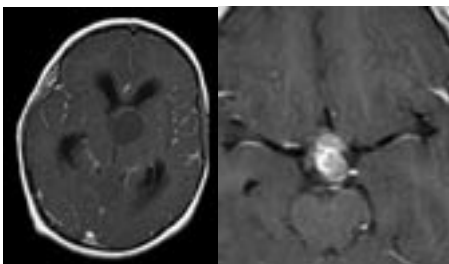
For smaller residual solid or cystic tumors, Gamma Knife radiosurgery remains an important option. Performed either under general anesthesia or intravenous sedation, depending on age, the tumor target is identified with high-resolution imaging and then powerfully irradiated with a steep dose fall-off toward surrounding critical structures. This approach has been successful in the majority of patients. As with all patients with craniopharyngiomas, long-term follow-up is necessary.

All management strategies are used in an attempt to improve or prevent worsening of visual deficits and to avoid endocrinopathy, damage to cognitive pathways or regional vascular structures. In patients following attempted total surgical resection, pituitary insufficiency is common both of the anterior and posterior pituitary axes. Following intracavitary irradiation or radiosurgery, these deficits are uncommon, and children usually develop to larger stature and without the concomitant need for multiple hormonal replacement.

The management of children with craniopharyngiomas is complex and requires a center with access to all surgical and radiotherapeutic tools. Careful use of these approaches provides the patient and their family with the best options for tumor control, improvement in preexisting symptoms, and avoidance of new problems. •



(Top), Stereotactic injection of colloidal phosphorus; (bottom) Craniopharyngioma cyst fluid after aspiration.



P32 instillation (left) and three years later (right) showing collapsed tumor. Child is now at full height with normal mentation.

news & NOTES

Stuart Rowe Lectureship Day Set For December 9

The fifth annual Stuart Rowe Society Research & Lectureship Day, showcasing research activities in the field of neurological surgery, has been set for Wednesday, December 9. **Edward H. Oldfield, MD**, Crutchfield Professor of Neurosurgery and Professor of Internal Medicine at the University of Virginia, will be serving as the day's honored guest. Dr. Oldfield will present a talk on Cushing's Disease and will also preside over the day's research talks. For more information, please call (412) 647-0990. A schedule of the day's events is available on our website at neurosurgery.pitt.edu.

In the News

- **Ian Pollack, MD**, chief of pediatric neurosurgery at Children's Hospital of Pittsburgh, was featured on the WTAE-TV (Pittsburgh) *Evening News*, July 22, discussing endoscopic port surgery, a revolutionary new procedure for removing brain tumors. (See related article on page 4.)

Congratulations

- **Douglas Kondziolka, MD**, was named senior CNS delegate to the World Federation of Neurosurgical Societies.
- **Donald J. Crammond, PhD**, was elected chairman of the American Board of Neurophysiologic Monitoring.
- **Peter C. Gerszten, MD, MPH**, has been invited to serve as an associate editor for the journal *Neurosurgery*.
- **Joseph C. Maroon, MD**, finished fourth in his age group in the Muncie (IN) Endurathon Half-Ironman Triathlon on July 11. The race is the longest running half ironman, consisting of a 1.2-mile swim, 56-mile bike ride and 13.1-mile run.
- **Tracey Shockey** received her CPC (Certified Professional Coder) certification.

New Research Projects

- "Large Scale Natural Experiment of Community Economic Development: Effects on Violence Patterns." **Anthony Fabio, MPH, PhD**, Center for Disease & Control, \$990,000.

Promotions

- **Parthasarathy D. Thirumala, MD**, was named co-director of the Center for Clinical Neurophysiology.
- **Ava Puccio, RN, PhD**, was named visiting research associates.

Welcome

- **Erin Paschel**, physician assistant; **Rashelle Maderitz**, physician assistant (Greensburg); **Laura Petrikovic**, physician assistant (Mercy); **Erika Stout**, physician assistant (Mercy); **Robin Ungar**, physician assistant (Mercy); **Laura Petrikovic**, physician assistant (Mercy); **Jamie Kirchner**, medical secretary (Mercy); **Gina Sciulli**, patient information coordinator for Drs. J. William Bookwalter, III, and Dave Atteberry.
- **Mandeep Tamber, MD**, assistant professor of neurological surgery, Children's Hospital of Pittsburgh; **Donald N. Krieger, PhD**, visiting research associate; **Tara Nikonow**, research assistant for Drs. Adam Kanter and David Okonkwo.

Personal Congratulations

- **Amanda Walker** and husband Matthew, had a baby boy (Greyson Matthew) on September 17.

Upcoming Events

- November 9-13: **Principles and Practice of Gamma Knife Radiosurgery**. Training course for neurosurgeons, radiation oncologists and medical physicists interested in Gamma Knife radiosurgery certification. (412) 881-0602.
- December 2-5: **Endoscopic Endonasal Surgery of the Cranial Base and Pituitary Fossa Course**. Presentation of minimally invasive techniques for endoscopic surgery of the cranial base and pituitary fossa. Features live surgical demonstration, didactic lectures and hands-on cadaver dissection. (412) 647-6358. •

Pediatric vascular disease

(continued from page 5)

bypass (usually superficial temporal artery to middle cerebral artery, or STA-MCA) is feasible only in older children, due to the caliber of their vessels. This provides an immediate increase in cerebral blood flow. Indirect bypass, via pial or encephalodural synangiosis, requires formation of collateral vasculature from the superficial temporal artery, with a gradual improvement in symptoms over the first year following surgery. Regardless of the surgical procedure, these patients are maintained on low-dose aspirin for life.

Vascular disease in children is distinct from that in adults on many levels. The pathophysiology differs, in that acquired or environmental factors play much less of a role. The clinical presentation differs, with children much more likely to present in extremis. The treatment differs, with pediatric treatment being tailored to the unusual congenital anomalies of the vasculature and the small size of the vessels. •

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- Up to \$1,000:

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FALL 2009 • VOLUME 10, NUMBER 4

Pediatric division moves into new Children's Hospital state-of-the art complex

The Department of Neurological Surgery's pediatric division recently moved into Children's Hospital of Pittsburgh's new \$625 million facility in the Lawrenceville section of Pittsburgh.

The new complex—featuring a 296-bed hospital and four other buildings, including the Rangos Research Center—is a technologically advanced campus and one of the first pediatric hospitals in the nation built from the ground up. It features an environmentally sustainable design, innovations to improve patient safety, and a quiet, comfortable atmosphere built to enhance the healing process for patients and their families.

"In addition to providing a visually stunning, patient- and family-friendly physical structure, the new hospital incorporates state-of-the-art intraoperative capabilities in terms of monitoring, and minimally invasive surgical capabilities for the whole gamut of pediatric neurosurgery," said Ian F. Pollack, MD, chief of pediatric neurosurgery.

"Patients and parents particularly like the fact that virtually all rooms, both in the ICUs and on the neurosurgical floor, are private, with comfortable spaces for families, beautiful views of the city, and inviting open spaces on the wards. It's always hard when a child needs to be in the hospital. Little things can go a long way in making the experience less scary."

Dr. Pollack also points out the benefits of the on-site research center. "The new hospital incorporates an integrated research laboratory facility, the Rangos Research Center, which is physically connected to the main hospital and the Faculty Pavilion," he said. "The laboratory itself is an outstanding facility, and the contiguity with the hospital allows me to interact more closely and regularly with the researchers in my lab."

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