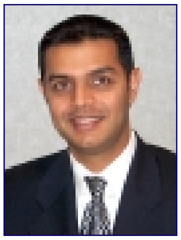
Volume 4, Number 2 **Spring 2003**

UNIVERSITY *of* PITTSBURGH neurosurgery news

Published by the University of Pittsburgh Department of Neurological Surgery ▾▾▾ www.neurosurgery.pitt.edu

Center for Cranial Base and Minimally Invasive Surgery pioneering treatment of tumors and vascular lesions



▲ *(From top to bottom)* ***Drs. Amin Kassam****,* ***Carl Snyderman*** ***Ricardo Carrau*** *and* ***Barry Hirsch****.*

The University of Pittsburgh Medical Center (UPMC) has played a pioneering role in the development of cranial base surgery over the past two decades.

The field has benefited significantly from tremendous advances in biotechnology and evolved considerably from the early experiences in the 1980s. This has led to the evolution of cranial base surgery to incorporate minimally invasive strategies with a focus on preserving neurological function and reducing morbidity.

The Center for Cranial Base and Minimally Invasive Surgery serves as a national and international resource for patients afflicted with tumors, vascular and congenital lesions affecting the skull base. This center, led by Drs. Amin Kassam and Carl Snyderman, with the collaboration of Drs. Ricardo Carrau and Barry Hirsch, relies upon the expertise of neurosurgeons, otolaryngologists, neuroradiologists, oral maxillofacial surgeons and plastic surgeons.

Participation of these specialists allows the center to provide a multimodality approach incorporating conventional and minimally invasive surgical strategies along with endovascular interventional approaches and gamma knife radiosurgery, all with the ultimate goal of restoring or preserving neurologic function.

The center is able to offer a comprehensive and individualized approach for the management of skull base conditions. The center continues to pursue innovative approaches in order to optimize outcome while minimizing complications.

A recent case exemplifies the collaborative effort ongoing at the center allowing for innovative solutions in dealing with complex problems.

A two-year-old girl presented with severe epistaxis leading to an angiogram. The angiogram confirmed a rare arteriovenous malformation occupying the entire ventral skull base and clivus. The AVM was located within the bone itself and likely represented an embryological failure of regression of the normal vascular plexus occupying this space with postnatal vascular expansion.

Traditional surgical access to this region for resection would require a craniofacial approach which in itself would be a formidable task in a two-year-old patient. The combined blood loss of the exposure and subsequent resection in such a young patient made this an impossibility. A decision was made to temporize with endovascular obliterations of the AVM. The patient underwent over a dozen such procedures over a two-year period. The aggressive endovascular therapy required led to a loss of vision in the right eye.

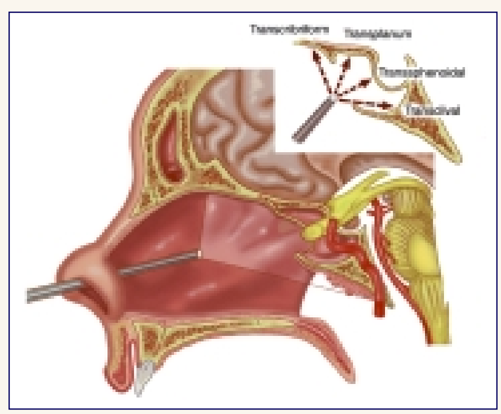
Center's multimodality management of a rare skull base AVM demonstrates ability to deal with complex problems.

At the age of four she presented with another more severe life-threatening bleed. A decision was made to consider surgical ablation of the malformation. A craniotomy and transorbital approach was undertaken to address the upper portion of the lesion.

The feeders incorporated the left ophthalmic artery that provided vascularization to the only seeing eye. The feeders also came from the vertebral arteries that were providing vascularization to the entire intracranial circulation as both carotid arteries had been previously sacrificed. This approach did not

(see ***multimodality*** on page 8)

The Expanded Endonasal Approach



This innovative approach has established the center as an internationally-recognized leader in the surgery of the cranial base with emphasis on patient outcomes. (See Story on Page 4.)

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The Three M's

Like much of modern medicine, neurosurgery entered a new era as the century changed. As we review recent advances in the field, we can discern that the foundations of modern neurosurgery are based on a three legged stool concept: multi-disciplinary, minimally invasive, and molecular.

Twenty-five years ago, outcomes in neurological surgery were based on patient survival. Now our patients expect to be better after surgery and postoperative mortality is a rare outcome. Instead, recovery leads to improvement in both the quantity and the quality of life.

During the next 20 years, additional advances will be based on the incorporation of the talents of many different physicians who are focused on common disease process.

Skull base surgery is a collaborative venture between neurological surgeons, otolaryngologists, and neuro-imaging. The talents of neuroendocrinology, plastic surgery, and interventional neurosurgeons and radiologists are often required. Image-guided neurosurgery, a field that incorporates surgical resection of brain tumors, stereotactic delivery techniques, and radiosurgical procedures such as Gamma Knife® and CyberKnife®, are dependent upon the input of neurological surgeons, radiation oncologists, radiologists, medical physicists and engineers. This combined talent integrates subtleties in neuro-imaging, neuro-anatomy, neurologic function, radiation biology, and precision. Robotics are a significant part of our new technologies, both with Gamma Knife® and CyberKnife® and even assist in microsurgical techniques. Bioengineers have to provide the support base for this combined effort.

Neuro-oncologic care requires the input of neurological surgeons, imaging specialists (who now incorporate magnetic resonance spectroscopy, tissue gene analysis, advanced PET imaging techniques, and blood flow measurements), medical neuro-oncologists with special expertise in advanced chemotherapeutic techniques, molecular biologists with expertise in tissue typing and genetic analysis, radiation oncologists, and neuropathologists. Each patient may receive the benefit of multiple treatments which have cumulative value. Our previous silo mentalities in the delivery of patient care have collapsed, all to the better for patients.

Minimally invasive surgery is the future of most surgical endeavors, and neurosurgery has been a prime mover in this development. We now remove deep seated brain tumors by endoscopic techniques through the base of the skull, or through small ports in the cranial vault when the tumor is intraventricular.

Better understanding of the molecular basis of much of neurological disease will enhance our ability to develop targeted molecular therapies. Examples include restorative neurosurgery for Parkinson's disease, perhaps in the future of Alzheimer's disease and other neuro-degenerative disorders. The need for expertise in these fields will be dramatic, as an estimated 35 to 40 million Americans will suffer from neurodegenerative disorders by the year 2030.

In order to be providers of molecular therapy, neurosurgeons must speak the language of the molecular biologists, and rely on the developmental efforts in the laboratories of molecular biologists. Currently, our faculty is involved in a unique tumor vaccine trial for patients with malignant brain tumors. Soon, we hope to get FDA clearance and an investigational device exemption for a newly created herpes simplex virus vector that potentiates the brain killing effect of certain chemotherapeutic agents and radiosurgically targeted tumor cells.

Neurosurgery has already passed the threshold of the current century. The new three legged stool is likely to provide the greatest benefit for a very large number of patients, requiring the multi-disciplinary talents of the most advanced neurosurgical practitioners and their partners. ■

Neuroendocrine outcomes following endoscopic resection of 64 macroadenomas

Endoscopic pituitary surgery: Does it make a difference?

by Amin Kassam, MD

Pituitary macroadenomas can generally be divided into non-functional tumors and functional tumors with consequent hypersecretion syndromes and endocrinopathies. Irrespective of the tumor's secretory activity, macroadenomas can create regional mass effect by virtue of their size. Mass effect exerted within the sella can lead to pituitary gland dysfunction while vertical extension into the suprasellar cistern can compress the optic apparatus.

Tumors can also extend horizontally with invasion into the cavernous sinus making complete resection less likely. While lateral extension into the cavernous sinus can make resection difficult and may not always be indicated, suprasellar components must be removed to relieve the optic chiasm compression. Outcome from surgical removal and likelihood of recurrence is directly proportional to the degree of resection. The impact of the degree of resection is especially important in the case of functional tumors since hypersecretion syndrome and endocrinopathy can persist when a small residual focus of tumor is left behind.

Traditional surgical approaches to pituitary tumors have relied on microseptal transphenoidal access to the sella. Larger tumors often required a craniotomy for optimal removal and decompression. The advent of the endoscopic endonasal approach has provided for superior visualization of both the sellar and suprasellar component of these tumors. This approach avoids anterior transeptal dissection associated with traditional approaches, thus, minimizing patient discomfort and postoperative pain. Furthermore, the endoscopic technique by virtue of angled lenses allows for inspection of all components of the regional anatomy and removal of tumor under direct visualization. Opening of the diaphragma sella is possible thus allowing for decompression of the optic apparatus under direct visualization.

At UPMC Presbyterian, the endoscopic approach, when combined with image guidance neuronavigation technology has obviated the need for craniotomy even in exceptionally large tumors. This approach allows for less traumatic access into the cavernous sinus for further tumor removal. The availability of Gamma Knife® radiosurgery particularly for functional tumors invading the cavernous sinus has made such cavernous sinus exploration less necessary.

In this review, we examined our experience with the endoscopic endonasal approach used for the resection of pituitary macroadenomas. A retrospective review of 64 macroadenomas was undertaken. This consisted of review of the pre and postoperative MRI images and measurements of the tumor in three dimensions for volumetric analysis by a neuroradiologist. Optic nerve function was assessed in terms of visual fields, visual acuity and color saturation. Tumors were divided into functional and non-functional categories.

There were approximately twice as many patients with non-functioning tumors (n=46) as there were with functioning tumors (n=18). The most common presenting features were visual compromise (64%), pituitary hypersecretion syndromes (37.5%) and pituitary insufficiency (31%). Patients with endocrinopathy presented at an earlier age (41.2 years-old. ± 13.1 years) than did those without non-functioning tumors (59.9 years-old ± 10.9 years). This is not surprising as the former developed symptoms from excessive hormone secretion, rather than, the insidious onset of visual compromise, which is easier to accommodate to.

Degree of Resection

Thirty patients had adequate imaging available. Endocrine active tumors presented at a smaller size (median = 4.5ml) than non-functional tumors (9.15ml). The degree of resection is more complete in the case of functional tumors. This can be explained by two facts: (1) there is a greater need to be aggressive with functional tumors in order to resolve the endocrinopathy, whereas for non-functional tumors the primary goal is adequate optic decompression; (2) non-functioning tumors are generally larger at presentation often with lateral extension into the cavernous sinus, removal of which may not be indicated if adequate optic decompression has already been achieved. (*See table 1*).

		Functioning N = 9	Non-Functioning N = 21
Pre-Operative Size (ml)	Mean ± SD	17.9 ± 35.4	11.8 ± 11.4
	Median	4.5	9.15
	(Min, Max)	(0.2, 110.9)	(0.95, 52.2)
Post-Operative Size (ml)	Mean ± SD	1.2 ± 1.9	1.1 ± 1.5
	Median	0.24	0.53
	(Min, Max)	(0, 4.8)	(0, 4.9)
Degree of Resection (%)	Mean ± SD	92.3 ± 7.7	88.2 ± 17.5
	Median	95.6	93.6
	(Min, Max)	(75.4, 100)	(22.5, 100)

Table 1. Outcome (volumetric analysis). Thirty patients had adequate imaging data to allow for volumetric analysis.

Visual Function

Visual function was assessed by considering pre and postoperative visual fields, acuity and color saturation. Preoperative visual function was categorized as normal or impaired. Postoperative function was categorized as improved, stable or deteriorated. Forty-seven of the 64 patients had adequate data for review. Overall 35/47 patients (74%) presented with impaired visual function of which 31(89%) recovered visual function. The four patients with impaired visual function that did not improve maintained their preoperative status. All four of these patients had longstanding compromise associated with optic atrophy. No patient experienced a deterioration in visual function following surgery. There were five patients that presented with opthalmopalegia (4 with III nerve palsy, 1 with VI nerve palsy). All five patients recovered completely.

*(see **review** on page 6)*

The Expanded Endonasal Approach to the Ventral Skull Base

A new paradigm in the surgical management of tumors compressing the optic chiasm

by Amin Kassam, MD and Carl Snyderman, MD

Lesions affecting the olfactory groove, planum sphenoidale, and the tuberculum sella causing compression of the chiasm have traditionally been approached via a variety of transcranial approaches. These approaches have the potential for significant morbidity related to brain and neural tissue retraction. This is particularly true in the case of ventral pathology causing chiasmatic compression from the subchiasmatic cistern. The optic nerve and chiasm are encountered first when coming from a transcranial approach. Access to the pre and postchiasmatic cistern needs to be gained and even then the nerve may need to be manipulated in order to get to the tumor on the underside. This is more of an issue when one considers that a significant portion of the vascular supply to the chiasm comes from the ventral surface via subchiasmatic perforators. In the presence of mass effect these vessels can be very difficult to visualize and preserve. Furthermore, the vascular supply to the tumor comes from the ethmoidal feeders running along the skull base and supplying the undersurface of the ventral dura. These can be more difficult to reach via transcranial approaches.

With the advances of the endoscopic approach in combination with advances in image guidance and endoscopic instrumentation we have gained a unique experience in accessing these lesions transphenoidally via an expanded endonasal transplanum approach. This approach allows direct access to the ventral skull base and early devascularization of the dura, which along with elective ethmoidal artery ligation provides excellent hemostasis (*see figure 1*). With this approach the optic nerve is identified early and the tumor is dissected away from the undersurface obviating any manipulation of the nerve or chiasm. Furthermore, the approach allows for direct visualization of the subchiasmatic perforators, which can be easily preserved preventing ischemia.

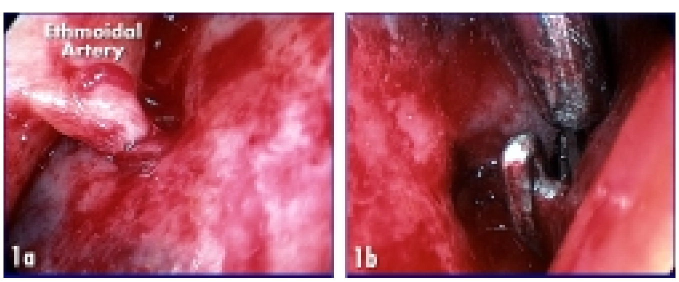


Figure 1: (1a) Ethmoidal artery endoscopically exposed; (1b) Clip ligation of the ethmoidal artery to devascularize a tuberculum meningioma.

This approach relies heavily on image guidance, as the margin of error is only a few millimiters. The approach involves an endoscopic transphenoidal transethmoidal exposure of the undersurface of the planum sphenoidale. Drilling using a high-speed diamond drill between the medial clinoid and optic strut is undertaken to remove the planum sphenoidale creating a 1/2 inch opening in the dura into the prechiasmatic cistern. Once this is completed the dura is identified and coagulated. This portion of the procedure is heavily reliant on image guidance to identify the optic nerves, carotid arteries, optico-carotid recess, and the tumor. The goal is to navigate between these structures and land directly on the undersurface of the tumor via a 1/2 inch opening in the planum sphenoidale (*see figure 2*). This opening provides direct access to the tumor, which is then removed using sharp microdissection under endoscopic visualization. Progressive tumor removal and dissection allows for the creation of planes with complete control of the anterior and posterior constituents of the Circle of Willis, the pituitary stalk, the optic chiasm and nerves. Access to the hypothalamus can even be gained through this exposure.

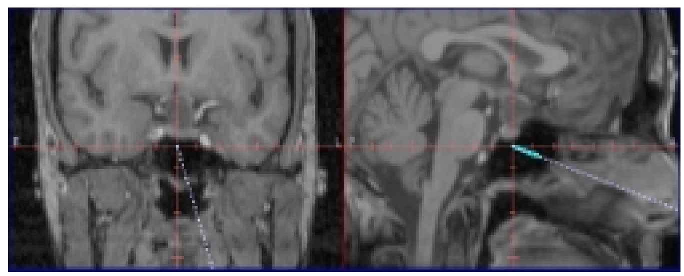


Figure 2: Image-guided localization (Stryker-Leibinger)

A young woman presented during the first trimester with profound visual loss and a suprasellar mass. We were concerned about a prolonged anesthetic in this patient during the first trimester and opted for an endonasal approach in order to minimize surgical time. The total procedure was under 2.5 hours with a complete resection. The image on the right in *figure 2* above represents the image guide scan using the Stryker-Leibinger system. Note the excellent accuracy that allows us to identify the planum just above the level of the pituitary and staying between the carotid arteries.

Once the initial sphenoidotomy is complete and the posterior ethmoidectomy is performed access to the planum is achieved. Using the image guided system the key bony landmarks are identified, specifically the optico-carotid recess and the medial clinoids. The planum sphenoidale is identified and an opening made exposing the space directly under the tumor and between the optic nerves and carotid arteries. (*This is seen in figure 3, next page*.)

Once the bony exposure is completed the dura is coagulated and then opened. The tumor dissection is initiated and debulked (*figure 4, next page*) Once the tumor is debulked and dissected away the subchiasmatic perforators can be visualized and preserved (*figure 5, next page*) The tumor is dissected away from the membrane of Liliquist and freed from its adherence to the basilar artery. *Figure* 6

Figure 3: Initial transplanum exposure between optic nerves.

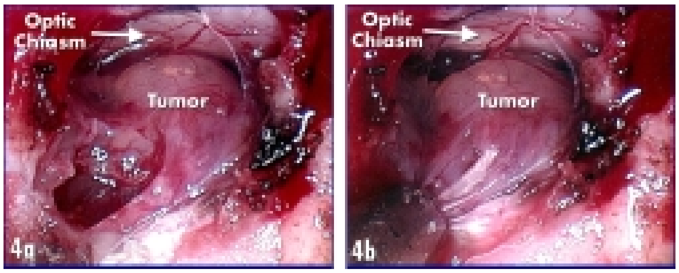
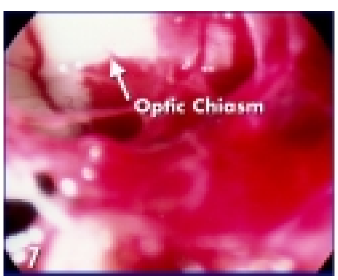


Figure 4: (4a) Initial internal debulking of the tumor; (4b) Following debulking the tumor dissected away from the chiasm

Figure 5: Subchiasmatic perforators (P); Figure 6: Basilar artery dissection showing posterier cerebral and superior cerebral arteries.



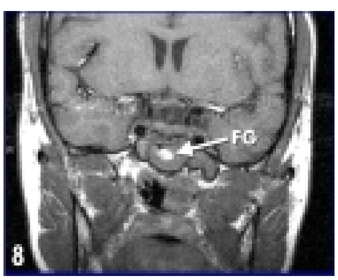


Figure 7 (Left): Post-removal view of the chiasm; Figure 8 (Right): Postoperative MRI with fat graph (FG).

shows the basilar artery (BA) bifurcation and the posterior cerebral (PCA) and superior cerebral (SCA) arteries bilaterally with the third nerve in between, as seen from the nose via an endoscopic transplanum approach.

Following removal of the tumor the decompressed chiasm can be visualized with perforators preserved (*figure 7*). Postoperative MRI confirm complete removal (*figure 8*). Note the decompression of the optic chiasm and the fat packing within the sphenoid sinus.

This approach can be used to address lateral extension into the cavernous sinus when indicated. The figures below demonstrate a right transcavernous sinus approach in a patient with an invasive pituitary macroadenoma. The patient developed blindness in the right eye following previous transcranial surgery at another institution. The tumor continued to grow leading to impending visual loss in the remaining eye. Complete decompression of the left optic nerve was undertaken with recovery. Aggressive cytoreductive surgery was pursued with removal of the tumor in the right cavernous sinus in order to reduce the tumor burden for adjuvant therapy.

Dissection along the lateral compartment of the cavernous sinus reveals the third nerve and the meningohypophyseal artery (*figure 9, below*).

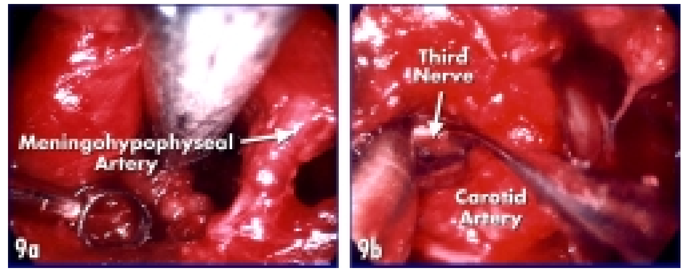


Figure 9: (a) Right lateral cavernous dissection; (b) The probe is on the third nerve lateral to the carotid artery.

The transplanum approach can be utilized for very large tumors. A 40-year-old male presented with anosmia and a large olfactory groove meningioma.

The patient underwent resection using an expanded endonasal approach with image guidance. Complete removal was achieved including dissection of the component adherent to the anterior cerebral artery. This was accomplished without the need for a craniotomy and the skull base was repaired through the nose without complication.

Figure 10 shows pre- and post-op images depicting a complete resection of the tumor. Notice the anterior cerebral arteries have been left intact. Since this approach avoids a craniotomy and brain retraction there is no disturbance of the brain parenchyma.

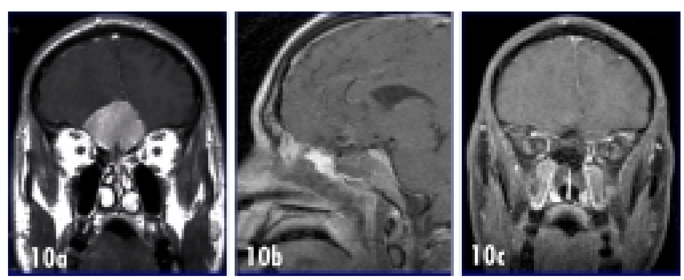


Figure 10: (a) Pre-op coronal view; (b) Post-op saggital view; (c) Post-op coronal view.

This preliminary experience has shown the feasibility of removing large and complex ventral lesions from the subchiasmatic space using an expanded endonasal approach with image guidance. The approach is minimally invasive and does not require a craniotomy. The transplanum dissection provides for complete control of critical neurovascular structures. Hemostasis does not seem to be prohibitive as even transcavernous dissections are feasible. This approach we believe is not only minimally invasive but is a more anatomic approach to preserve the critical vascularity of the chiasm and avoids brain retraction and manipulation. ■

A review: Does endoscopic pituitary surgery make a difference?

(from page 3)

	Functioning (13)	Non-Functioning (34)
Pre-op Normal → Post-op Normal	7	5
Pre-op Impair → Post-op Improved	5	26
Pre-op Impair → Post-op Stable	1	3
Pre-op Impair → Post-op Deteriorated	0	0

Table 2: Visual outcomes.

Neuroendocrine Outcomes

Each hormonal axis was examined individually to assess anterior pituitary gland function. Within the non-functioning group two patients did not have adequate data for review. Of the remaining 44 patients, three (6.8%) developed a new anterior gland insufficiency (one adrenal, one adrenal and thyroid, and one panhypopituitarism). The Functional group was expanded in this analysis to include an additional five hormonally active microadenomas along with the eighteen macroadenomas. Two patients (8.6%) with functional tumors developed a new anterior gland hormonal axis dysfunction (one thyroid and the other thyroid and adrenal) while 12% of the entire group recovered pituitary function following surgery likely from relief of mass effect.

The incidence of Diabetes Insipidus in the entire series including the giant and invasive tumors was 7% transient and 5% permanent. All cases of endoncrinopathy and hypersecretion were resolved with either endoscopic surgery alone or the addition of radiosurgery for the cavernous component.

		Functioning (23) Micro (5) Macro (18)	Non-functioning (46)	Totals (69)
Missing data			2/46 (4%)	2/69 (3%)
Unchanged	Normal	8 (35%)	10/44 (23%)	18/67 (27%)
	Hypopit.	8 (35%)	24/44 (55%)	32/67 (48%)
Improved		2 (9%)	6/44 (14%)	8/67 (12%)
Deteriorated*		2 (7%)	3/44 (7%)	8/67 (12%)

** new anterior gland pituitary dysfunction*

Table 3: Neuroendocrine outcomes.

Aggressive decompression and resection of pituitary macroadenomas is an important goal. The endoscopic approach enables radical resection of these tumors with direct visualization of the optic apparatus and confirmation of decompression. Eighty-nine percent of patients enjoyed a recovery of visual function while the rest remained stable. The degree of resection is even more paramount in the case of functional tumors as the indication for surgery is not only optic decompression but also resolution of endocrinopathy. All cases of endocrinopathy were resolved even with cavernous sinus extension when adjuvant Gamma Knife radiosurgery was added to the treatment.

We suggest that the endonasal endoscopic approach is a safe and effective means of removal of even very large tumors with 95.6% and 93.6% median volume reduction for functional and non-functional tumors respectively. This is done without the need for craniotomy even in the case of very large and invasive tumors. Not only is this minimally invasive approach more effective, but it is also better tolerated by patients in comparison to the more traditional approaches.

Case Illustration

In the case of 50 year-old male with an invasive prolactinoma (*figure 1*), despite six months of dopamine agonist therapy the patient continued to have profoundly elevated and climbing prolactin levels. While the initial bromocriptine therapy resulted in some improvement of visual function, persistent severe deficits were noted.

A decision was made to undertake surgical debulking with the goal of cytoreductive surgery (complete decompression of the optic apparatus and removal of the suprasellar portion). Removal of the intrasellar content and the component that has eroded the upper and middle third of the clivus was achieved (*figures 2,3*). The patient did not have pre-operative ophthalmoplegia, and therefore, an upfront decision was made to leave the tumor within the cavernous sinus to be treated with postoperative Gamma Knife radiosurgery. With this combination therapy, the patient completely recovered the preoperative visual loss and retained normal pituitary function

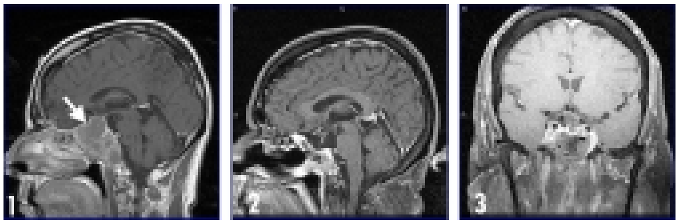


Figure 1. Preop image of an invasive prolactinoma that has failed medical management. Note the significant suprasellar extension with complete distortion and profound compression of the optic apparatus. Erosion of adjacent bony structures is visible. Anteriorly the planum sphenoidale has been destroyed. Posteriorly the upper and middle third of the clivus have been eroded with the tumor encroaching on the basilar artery with a rim of dura intervening. Figure 2 and 3. Postoperative image of the same case. Note the complete removal of the vertical extent of the tumor. The suprasellar portion and anterior portion eroding the planum has been completely resected. The optic apparatus and infundibulum can now be seen. The posterior portion eroding the clivus has been removed and normal CSF space in the prepontine cistern has returned. There is some postoperative packing in the sphenoid sinus that was used to achieve hemostasis that can be seen. On the coronal image note the relatively small residual component left within the cavernous sinus representing the lateral extension of the tumor. Postoperatively the patient retained preoperative level of normal pituitary function while the prolactin level normalized and a complete recovery of visual function was achieved. ■

Gene Therapy of Malignant Gliomas Protocol

Dr. Hideho Okada, MD, PhD, is conducting a phase I study to evaluate the safety, and secondarily, the clinical and immunological activity in subjects with malignant gliomas of a vaccine consisting of interferon-γ stimulated dendritic cells (DCs) loaded with tumor cell lysate and interleukin-4 (IL-4) expressing fibroblasts. DCs are the potent antigen presenting cells (APC) that are likely to compose an essential element for initiating an anti-tumor immune response. In this study, Dr. Okada will test the activity of IFN-γ stimulated DCs for induction of systemic immune responses against autologous glioma cells in conjunction with delivery of IL-4 at the vaccine site.

Hypothesis and specific aims of this study are:

1. To assess the local and systemic toxicity associated with this form of vaccine.
2. To assess the ability of DC vaccines to induce systemic T cell immune responses against a patient's autologous glioma cells.
3. To evaluate the ability of this form of vaccine to induce a humoral immune response to glioma-specific antigens.
4. To obtain a preliminary assessment of clinical activity of this form of vaccine.

For more information, please contact Dr. Okada at (412) 623-1111.

Recent Grant Awards

• "Gene Expression in Brain Tumor Angiogenesis," **Dr. Kevin A. Walter,** Neurosurgery Research and Education Foundation (NREF) ($40,000). The goal of the research is to use Serial Analysis of Gene Expression (SAGE) technology to map the transcriptome of CNS microvascular endothelial cells.

Award

• **Dr. Joseph T. King, Jr.** was awarded the 2003 Volker Sonntag Award from the Joint Section on Disorders of the Spine and Peripheral Nerves of the AANS/CNS for $30,000 for his study "Thoracic and Lumbar Compression Fracture Treatment with Kyphoplasty and Vertebroplasty (TALCOM)."

Maroon Joins Mylan Board

Mylan Laboratories Inc. recently named **Dr. Joseph C. Maroon**, department vice chairman and Dennis and Rose Heindl Scholar in Neurosciences, to its board of directors. Mylan is a nationally-known, Pittsburgh-based pharmaceutical company developing, manufacturing and marketing generic and proprietary prescription products.

"Dr. Maroon has been recognized both nationally and internationally as one of the world's preeminent neurosurgeons," stated Robert J. Coury, vice chairman and CEO of Mylan Laboratories Inc. Coury further stated, "Neuroscience has long been an area of focus for Mylan, and as such, the addition of Dr. Maroon to the board of directors will bring tremendous value to Mylan, its employees and shareholders."

news & NOTES

Promotions

• **Drs. P. David Adelson** and **John J. Moossy** were promoted to professor at the University of Pittsburgh.

• **Yue-Fang Chang, PhD** was named research associate.

Announcements

• **Dr. L. Dade Lunsford** served as visiting professor and Balfour Lecturer at Archbold Hospital, Thomasville, GA.

• **Dr. Daniel Wecht** has been named chief, division of neurosurgery at UPMC McKeesport Hospital.

• **Donald Crammond, PhD**, was recently board certified in intraoperative neurophysiological monitoring by the American Board of Neurophysiologic Monitoring.

• **Dr. Kevin Walter** was appointed Congress of Neurological Surgeons delegate to the Council of State Neurosurgical Societies.

• **Dr. Douglas Kondziolka**, president of the American Society for Stereotactic and Functional Radiosurgery, will preside over the organization's next meeting scheduled for May 18-21 at the Plaza Hotel in New York.

Welcome and Transition

Karen Chervenick, financial administrator; **Melissa DeGore**, grants manager; **Carla Costello**, medical records assistant; **Anne Erny**, physician assistant; **John Spangler**, secretary to Dr. Ghassan Bejjani; **Jane Demore**; nurse for Dr. Bejjani. **Melissa Persinger**, former secretary to Dr. Bejjani, is now handling the same duties for Dr. Douglas Kondziolka; **Arlene Jones, RN**, and **Kathleen Brunetti** long-time nurse and administrative secretary, respectively, for Dr. Peter Sheptak are also handling similar duties for Drs. Kevin Walter and Peter Gerszten.

Congratulations

New baby girl (Grace Ann, February 2) to resident **Dr. Mel Field** and wife Aileen; new baby boy (Joseph Patrick, February 7) to resident **Dr. Christopher Koebbe** and wife Shannon; new baby girl (Kaylee Rose, March 11) to **Darius Carlins** and wife Tammy.

Upcoming Events

• May 7: Visiting Professor Lecture Series. **Dr. Peter Carmel**, chairman of the department of neurological surgery at the University of Medicine and Dentistry of New Jersey (UMDNJ). Duquesne Club, 6:00 p.m. For reservations, call (412) 647-0990.

• September 22-24: **Gamma Knife® Radiosurgery Training for Nurses**. Training course directed at nurses and other allied health care personnel providing clinical care for patients undergoing Gamma Knife radiosurgery. Contact Charlene Baker at (412) 647-7744 for more information.

Newsletter Questions and Comments

Direct comments or questions regarding our newsletter, to Paul Stanick at (412) 647-7931, or submit them on our website at www.neurosurgery.pitt.edu/contact/newsletter/question.html.

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Volume 4, Number 2 **Spring 2003**

Center's multimodality approach helps solve complex AVM problem

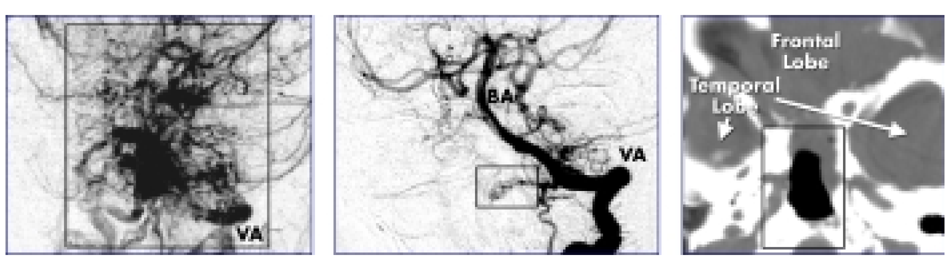
(from page 1)

provide for access to the entire clivus. A craniofacial approach was considered but felt to be problematic because of the associated deformities and the blood loss that would be required.

Therefore, an expanded transnasal endoscopic approach was designed using image guidance. Using this approach, progressive endoscopic access to the sinuses and the entire ventral skull base from anterior base through the optic canals down to C1 was established.

Using only endoscopic techniques the ventral skull base and clivus were removed along with incorporated AVM. Given the limited circulating blood volume in a four-year-old patient, this was done in three stages a week apart to allow for hemodynamic recovery in between. Arteriograms were done in between to allow for image-guided retargeting.

A small portion of the lesion intimate with each vertebral artery was left behind, to not threaten the only supply to the intracranial circulation. This portion had been pretreated with gamma knife radiosurgery and was felt to be small enough for likely regression. The patient is now eight months following the procedures and has remained free from any further episodes of severe epistaxis and is returning to normal life. ■



(left) AVM of skull base fed by vertebral arteries; (middle) residual AVM following combined therapy; (right) post-op axial CT scan; area within box represents region of clivus removed.