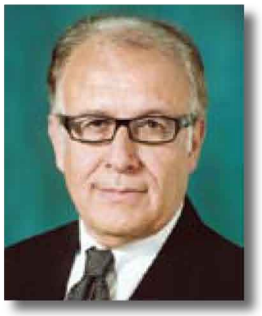
Successful Resection of Meningioma Encasing Multiple Major Cerebral Arteries



Asher Taban, MD
Medical Director, Neuroscience Institute

Case Summary
A 56-year-old white female patient presented with the sudden onset of dizziness and then subsequent loss of consciousness. Her evaluation at Northridge Hospital Emergency Department, including a CT scan of the brain, revealed a right orbital apex medial sphenoid wing tumor mass. A subsequent MRI of the brain, with and without contrast, disclosed an enhancing tumor mass at the region of the right orbital apex-medial sphenoid wing, measuring 2.9 cm in its maximum dimension, with encasement of the right carotid artery, proximal right middle cerebral and anterior cerebral arteries and probable involvement of the right optic nerve and optic chiasm.

Diagnosis
These findings were suggestive of a probable non-malignant tumor, such as meningioma. There was minimal bony reactive tissue at the tumor base. The patient had a previous history of breast cancer, which was treated five years prior to this admission, and there were no known metastases at that time. An MR angiogram of the brain was performed, which disclosed irregularity of the A1 portion of the right anterior cerebral artery. The patient's neurological examination was totally unremarkable.

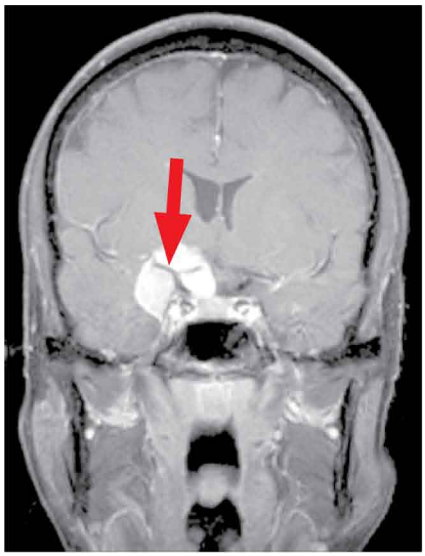
Procedure Performed
The patient was found to be a suitable candidate for surgical resection of the tumor with reservation of possible incomplete tumor resection. This was due to the complex encasement of multiple, extremely critical brain vessels, involvement of the right optic nerve and optic chiasm, and an inability to delineate these nerves by the thinnest MRI scanning of this region.

Generally, considering the location of the tumor and its very vital surrounding structures, a 100 percent successful surgical resection of this lesion seemed to be quite remote. However, an attempt for total excision was planned and implemented in May 2009.

The frameless stereotactic neuronavigation device and intraoperative microdoppler scan of the involved cranial vessels were utilized. After seven hours of very tedious and technically demanding surgery, I was able to achieve total microscopic resection of the tumor mass and preservation of all vital structures, including her internal carotid artery, proximal middle cerebral and anterior cerebral arteries and very small perforating branches, and complete preservation of the optic nerve and optic chiasm.

Outcome
Post-operatively, the patient was neurologically intact and was discharged 72 hours post-surgery. I strongly believe that this achievement (total tumor resection) could not have been successful years ago when devices such as neuronavigation equipment and micro ultrasound doppler scans for real-time intermittant monitoring of the blood flow of very small vessels were not available.

The patient's MRI scans of the brain, obtained in the first 24 hours post-surgery and exactly one year later in May 2010, revealed no residual enhancing mass. The patient's neurological examination remained totally stable and normal.



Left – *Coronal MRI Scan shows encasement of internal carotid artery, as well as middle and anterior cerebral arteries, by the tumor mass.*

Right – *Post-op image shows complete removal of the meningioma and preservation of all very vital structures.*

About Meningiomas

Meningiomas derive from arachnoid cell clusters, such as paccionian granulations. Between the years 1743 and 1896, 13 operations were performed for resection of this kind of tumor with nine deaths. These tumors were diagnosed during life only if the tumor presented with change of the skull overlying the tumor and it could be either palpated or inspected at the skull surface.

Makeup of the Meninges

The meninges consist of three distinct layers, the dura mater, the arachnoid and the pia mater. The latter two layers are lumped and called leptomeninges. The arachnoid consists of two populations of cells. One subgroup follows the dura closely and is formed by arachnoid barrier cells. The other subgroup consists of arachnoid trabecular cells and bridges the subarachnoid space to attach to the pia mater. There is no potential subdural space that exists, as the arachnoid barrier cells are attached to the inner most layer of the dura. The arachnoid is avascular, but the blood supply of the dura is of clinical importance because meningiomas often will parasitize the blood supply of the adjacent dura. The arachnoid villae are most numerous in the area of the superior sagittal sinus, cavernous sinus, tuberculum sella, lamina cribrosa and foramen magnum-torcula herophili. These tumors are attached to the dura and compress the underlying brain without invading it.

Characteristics of Meningiomas

A very high percentage of meningiomas are benign. However, if these tumors cause brain invasion or metastases, they will be called malignant meningiomas, even though microscopically malignant cells cannot be detected. The most common sites for metastases are liver, lung, pleura and lymph nodes. Some histological features are considered aggressive in the behavior of the meningiomas. These criteria include hypercellularity, loss of architecture, nuclear pleomorphism, increased mitotic index, focal necrosis and hypervascularity. Hyperostosis is a characteristic finding in meningiomas, especially in en Plaque meningiomas. In most cases, histological studies of hyperostotic bone reveals tumor cells in the diploic portion of the calverium. About 20 percent of meningiomas are found at the sphenoid ridge, such as in this patient, although the medial sphenoid ridge creates a much more challenging surgical pathology. The occurrence of meningiomas in the general population varies from 2.3 to 5.5 percent per 100,000.

Meningiomas constitute one to four percent of all childhood brain tumors under the age of 18 years old. They are extremely uncommon in infancy.

The DNA virus called IMV has been linked with the formation of intracranial meningiomas in six of seven human meningiomas after cell cultures post surgery, whereas such a culture for this virus was negative in six other brain tumors. There has been some suggestion of trauma as a cause of development of meningiomas, however the direct role of trauma in the development of these tumors is not proven. Patients who received irradiation of the scalp for treatment of tinea capitis (ringworm) had a higher rate of development of meningioma at the site of the radiation.

Features, such as the invasion of the dura or brain infiltration, hemangioblastic or similar tumors, mitosis and nuclear premorphism, plus focal necrosis, could all be indicative of an increased chance of tumor recurrence after surgical resection. The presence of hormonal receptors in meningiomas has promoted research into hormonal manipulation for treatment. Tamoxifen, an estrogen antagonist, was shown to stimulate meningioma cells in culture, perhaps because of a partial estrogen agronistic activity of Tamoxifen. Bromcriptine, a dopamine antagonist, significantly inhibits meningioma cells invitro.

Conclusion

In conclusion, despite significant progress in treatment of meningiomas by surgery and other modalities, recurrence of this tumor occur, which could create significant challenges, subsequent to successful initial treatments.

Asher Taban, MD
Medical Director, Neuroscience Institute
Neurosurgery
818-993-6063

How to Refer

- Physicians wishing to refer a patient to any of the Northridge Hospital Neuroscience Institute programs are encouraged to call **818-885-3504**.
- A referring physician is an active partner in the treatment process.
- You are kept informed of your patient's status and all patients are returned to you for further follow-up.
- The Northridge Hospital Neuroscience Institute physician team is available for consultation at any time.