Resection of Giant Olfactory Groove Meningioma with Extradural Devascularization

Chih-Peng Wei, M.D.,¹ Alexander D. Wang, M.D., Ph.D.,¹ and Ming-Dar Tsai, M.D.¹

ABSTRACT

A 55-year-old male patient presented with a giant olfactory groove meningioma supplied by both ophthalmic arteries. The tumor was debulked through a bifrontal craniotomy, but the surgery was discontinued because of extensive blood loss. During a second operation, the dura of the frontal base was dissected extradurally before the tumor was removed. The meningeal blood supply was occluded with bipolar coagulation of the epidural meningeal vessels around the crista galli. The highly vascular tumor then was totally removed with considerably less blood loss. The patient's postoperative course was uneventful. Because the ophthalmic artery cannot be embolized preoperatively, the direct extradural approach to the skull base to devascularize the blood supply around the olfactory groove may reduce blood loss and facilitate resection.

KEYWORDS: Giant olfactory groove meningioma, ophthalmic artery, orbitofrontal craniotomy, extradural devascularization

Among skull base meningiomas, olfactory groove meningiomas are relatively easy to access. Most surgeons, like Ojemann and Swann¹ and Symon², favor a bifrontal craniotomy. Al-Mefty³ added an orbital osteotomy to gain generous access to the anterior cranial fossa. The pterional approach

was recommended by Hassler and Zentner.⁴ From Cushing and Eisenhardt⁵ to Samii and Ammirati,⁶ the surgical mortality rate has decreased from 19 to 0%. Occasionally, an olfactory groove meningioma is giant and highly vascular, and surgery becomes difficult. We report such an experience.

Skull Base, volume 12, number 1, 2002. Address for correspondence and reprint requests: Chih-Peng Wei, M.D., Department of Neurosurgery, Shin Kong WHS Memorial Hospital, No. 95, Wen Chang Road, Shih Lin District, Taipei, Taiwan, R.O.C. E-mail: nsfrank@hotmail.com. ¹Department of Neurosurgery, Shin Kong WHS Memorial Hospital, Taipei, Taiwan. Copyright © 2002 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA. Tel: +1(212) 584-4662. 1531-5010,p;2002,12,01,027,032, ftx,en;sbs00249x.

CASE REPORT

A 55-year-old male patient experienced progressive dementia, behavioral changes, and urinary incontinence for 1 year. On examination, a frontal lobe syndrome was obvious. The left nostril was anosmic, but the sense of smell was preserved on the right.

Computed tomography (CT) showed the enhanced mass overriding the frontal base near the crista galli. The preponderance of tumor was on the left (Fig. 1). Bilateral angiographic injections of the internal carotid artery showed a frontal tumor stain supplied by ophthalmic arteries via ethmoidal branches (Fig. 2).

The tumor was approached through a bifrontal craniotomy. The superior sagittal sinus was ligated and divided, and the falx was sectioned. Only a small portion of the tumor was removed before the operation had to be stopped because of massive blood loss (about 2000 ml). A decompressive craniectomy with dural augmentation was performed to treat marked swelling of the brain. After surgery, the patient was comatose for 3 days. Postoperative CT (Fig. 3) showed the residual meningioma and bulging craniectomy.

During a second operation, the bifrontal craniotomy was made as low as possible without removal of the orbital rim. The blood supply to the tumor from the dural vessels around the crista galli was occluded first by using subfrontal-epidural dissection. Although epidural bleeding was brisk, it

was controlled fairly easily with bipolar coagulation. The tumor then was completely resected (Fig. 3), and total blood loss was less than 500 mL. The meningioma arose from the left olfactory groove. The right olfactory nerve was preserved. The patient fully recovered within 2 weeks, and his sense of smell was preserved.

DISCUSSION

Since Cushing⁷ reported olfactory groove meningiomas and their removal, many different surgical approaches have been used. With his first patient, Cushing attempted an extradural frontobasal approach to devascularize the tumor, which he then debulked. The tumor was dissected from the surrounding brain after local pressure was reduced. Cushing failed because a deep vessel was injured, and the patient died. Consequently, Cushing later exposed these tumors more extensively through a polar frontal lobectomy and obtained good results.^{4,5} Early devascularization and debulking to facilitate dissection of a tumor capsule should apply to all intracranial tumor surgery if possible. We believe the originality of Cushing's first procedure should be reappraised.

Babu et al.⁸ presented the unilateral supraorbital approach to facilitate access to the floor of the

Figure 1 Axial (left) and coronal (right) computed tomographic scans showing a giant enhanced tumor overriding the crista galli. Most of the tumor is on the left.

Figure 2 The bilateral internal carotid artery angiograms showing the tumor stain fed by the prominent ophthalmic arteries. The middle image was produced by overlapping the bilateral carotid angiograms in the anteroposterior direction.

anterior cranial fossa and to ease the interruption of a tumor's blood supply. During the initial stage, our patient's tumor was exceedingly vascular. Bleeding diminished markedly once the ethmoidal arteries from the base were cauterized and sectioned at the cribriform plate. The advantages of this approach were preservation of the function of the frontal lobe and contralateral olfactory nerve. Our experience suggests that the extradural approach might be used to devascularize such tumors in the initial stage.

The key arguments for pterional approach as presented by Hassler and Zentner⁴ focused on devascularization. The hyperostotic tumor nidus in the region of the planum sphenoidale was coagulated

and drilled so that the tumor was largely devascularized. Hassler and Zentner⁴ described devascularization as the second surgical step instead of the first. During the first step, the posterior part of the tumor was removed to expose and decompress the optic chiasm, optic nerves, internal carotid artery, and anterior cerebral arteries. Although Hassler and colleagues experienced no troublesome bleeding even in their later larger series,⁹ we could not cope with the excessive bleeding that would have been associated with using the pterional approach in our patient.

Bricolo's¹⁰ insistence on the superiority of the pterional approach reflected early detection of the important landmark of the optic nerves and rapid and safe devascularization of the tumor by

Figure 3 (Left) Computed tomographic (CT) scan showing the large residual tumor and the bulging decompressive craniectomy after the first operation. (Right) CT scan showing the bed of resected tumor after the second operation.

coagulating and resecting the basal dural attachment along with the perforating vessels that supplied the tumor. Al-Mefty's¹¹ experience, however, seems to be shared by most neurosurgeons, including our group. The tumor capsule attached to the optic nerves and the suprasellar vessels were best dissected after the tumor was devascularized and debulked significantly. It was more troublesome to try to free these attachments while the tumor was still vascular and bulky.

We understand that the site and area of dural attachment and the size of the tumor might account for the effectiveness of devascularization. When the attachment is wide or buried beneath a giant tumor, as in this case, the resection could be difficult from either the frontal or pterional approaches intradurally. The extradural approach as Cushing first described and followed by Derome and Guiot¹² could block the blood supply around the crista galli before the dura was opened for the attack on the tumor.

The main blood supplies to these tumors usually are from the ophthalmic arteries and branches of the ethmoidal arteries (Fig. 4). Because the ophthalmic artery cannot be embolized

preoperatively, the extradural approach via a frontal or frontorbital craniotomy seems to be a feasible approach for devascularizing the ethmoidal blood supply before a tumor is resected.

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Figure 4 Illustration showing the anterior and posterior ethmoidal arteries fed by the ophthalmic artery from the internal carotid artery.

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Commentary

The authors discovered one of the central tenets of contemporary cranial base surgery in a difficult way. One reason underlying current management strategies is to avoid such excessive blood loss in basal meningioma surgery. The concept is to make these lesions akin to convexity meningiomas, where the blood supply is exposed as an initial step in the operation. The blood supply then can be handled effectively and safely early in the procedure to make tumor resection less hazardous.

In large olfactory meningiomas, the important point is to attack the tumor at the base—whether intradurally or extradurally is not so important. I have performed both, and the result is the same. The blood supply is interrupted, and tumor resection is much easier. Blood loss is minimal, even without preoperative embolization. In my experience, preoperative embolization is unnecessary and only increases the patient's risk of morbidity.

The goal in such cases is a Simpson grade 1 removal of the tumor. Resection is possible through either a unilateral or bilateral approach. The old-fashioned technique of exposing a tumor and diving in to debulk it with no thought to the blood supply should now be of only historical significance. In this era of more sophisticated cranial base surgery, no patients should be subjected to that type of approach.

J. Diaz Day, M.D.¹