

# COMBINED TRANSPETROSAL AND FRONTO-ORBITO-ZYGOMATIC APPROACH TO A GIANT SKULL BASED MENINGIOMA: A CASE REPORT

Takahiro Eguchi, M.D., Norihiko Tamaki, M.D., Hiromitsu Kurata, M.D., Tatsuya Nagashima, M.D., Atsushi Fujita, M.D., Mitsugu Nakamura, M.D., and Yoshie Hara, M.D.

*Department of Neurosurgery, Kobe University School of Medicine, Kobe, Japan*

Eguchi T, Tamaki N, Kurata H, Nagashima T, Fujita A, Nakamura M, Hara Y. Combined transpetrosal and fronto-orbito-zygomatic approach to a giant skull-based meningioma: a case report. *Surg Neurol* 1998;50:272-6.

## BACKGROUND

Recently, various surgical approaches to skull base lesions have been developed. Skillful use of the combination of two standard approaches make possible the removal of large brain lesions, which conventionally had been considered inoperative. In this study, we present a case of a giant meningioma located in the cerebellopontine angle and middle cranial fossa. A near total resection was achieved using a combined transpetrosal and fronto-orbito-zygomatic approach.

## CASE REPORT

A 15-year-old boy presented with a meningioma that caused a left hearing loss, dysarthria, and cerebellar ataxia. Preoperative magnetic resonance imaging revealed a giant meningioma located in the right cerebellopontine angle, middle fossa, and cavernous sinus. The patient underwent a near total resection of the tumor through a combined transpetrosal and fronto-orbito-zygomatic approach. He experienced a marked improvement postoperatively and entered high school the following year.

## CONCLUSIONS

An approach from several angles was necessary for the giant skull based tumor presented here. A combination approach was selected for obtaining a wide operative field with minimal brain compression during resection of neoplasm. According to the individual features of each case, selection of the operative approach, decisions regarding the extent of excision, and postoperative treatment regimens should be adequately planned in the preoperative period. © 1998 by Elsevier Science Inc.

## KEY WORDS

*Fronto-orbito-zygomatic approach, transpetrosal approach, skull base surgery, meningioma.*

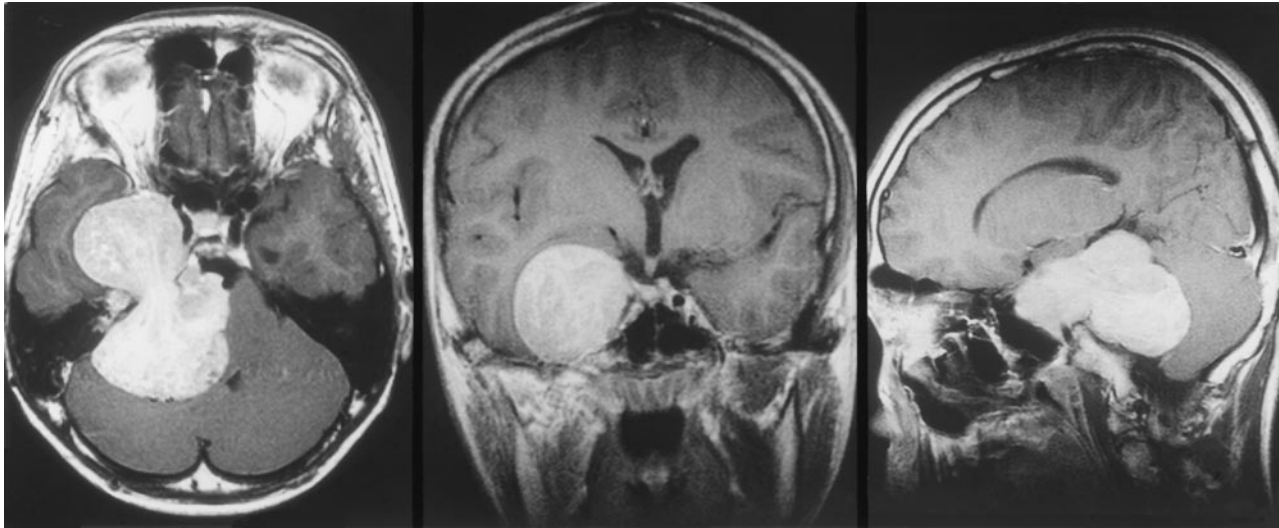
In recent years, various surgical approaches have been developed for lesions of the skull base, and surgical treatment has become possible for lesions that conventionally have been considered inoperative. The usefulness of these approaches has been described. We report a case of a giant meningioma located in the cerebellopontine angle and middle cranial fossa that enlarged, extending into the cavernous sinus. A near total resection was achieved using a combined transpetrosal and fronto-orbito-zygomatic approach.

## CASE REPORT

This 15-year-old boy presented with a gradual onset of a right hearing loss, dysarthria, and dizziness over a 1-year period. These symptoms progressed, and he visited a local hospital. Computed tomography (CT) and magnetic resonance imaging (MRI) revealed abnormalities. Subsequently, the patient was referred to our hospital and was admitted on February 1, 1994. Neurologic findings on admission included a sensory loss of the 1st and 2nd divisions of the right trigeminal nerve, a right facial palsy, right-sided hearing loss, mild dysphagia, a decrease in the right pharyngeal reflex, a right hypoglossal palsy, a right Bruns' nystagmus, and right-sided cerebellar ataxic symptoms. CT of the brain revealed a large (7.5 × 6 × 6 cm) lesion that extended from the right cerebellopontine angle into the right middle cranial fossa. Calcification was seen within

Address reprint requests to: Takahiro Eguchi, M.D., Department of Neurosurgery, Kobe University School of Medicine, 7-5-1, Kusunoki-cho, Chuo-ku, Kobe, Japan 650.

Received January 13, 1996; accepted June 10, 1996.

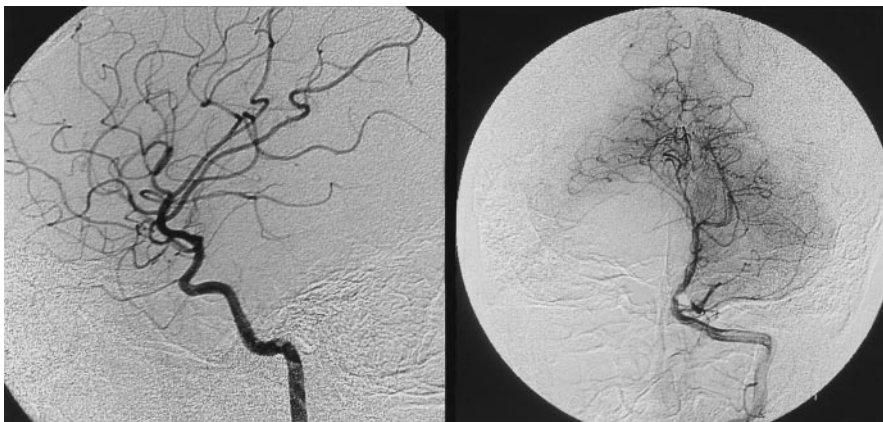


**1** Preoperative Gd-DTPA MRI, showing a homogeneously enhancing giant tumor extending from the intra-cavernous sinus to the foramen magnum.

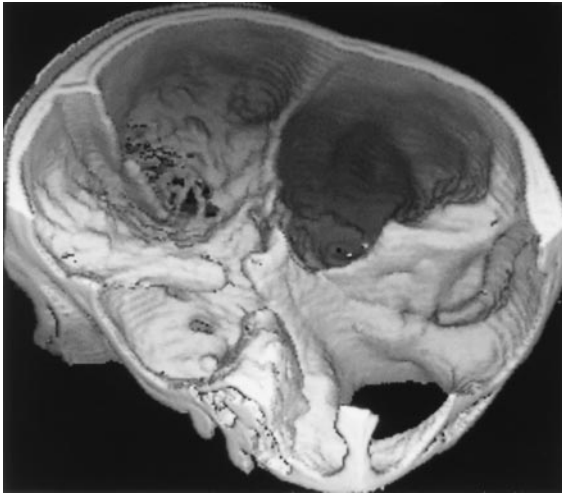
the lesion that was enhanced homogeneously with contrast media. MRI showed the lesion to be of low signal on T<sub>1</sub>-weighted images and of mixed signal on T<sub>2</sub>-weighted images, and enhancing with gadolinium administration. The tumor extended into the right cavernous sinus, encasing the internal carotid artery. It extended inferiorly into the vicinity of the foramen magnum (Figure 1). Cerebral angiography demonstrated compression of the blood vessels surrounding the tumor and the right internal carotid artery in its cavernous sinus course. A slight tumor stain and feeding vessels to the lesion were seen (Figure 2). Three-dimensional CT showed erosion of the right petrosal apex and the anterior and posterior clinoids (Figure 3).

The tumor was resected by a combined fronto-orbito-zygomatic and transpetrosal approach on March 14, 1994. The patient was placed in the supine position with his head rotated 90 degrees to

the left. A skin incision was made, as shown in Figure 4. The superior and lateral walls of the orbit were removed, and the zygomatic arch was mobilized and turned inferiorly with the temporal muscle flap attached. The mastoid process and petrosal bone on the lateral side of the internal acoustic foramen were removed (Figure 4). The anterior clinoid was drilled down in order to expose the optic canal. In the middle cranial fossa, the foramen spinosum was identified, and the middle meningeal artery was coagulated and cut, which then allowed dissection of the dura of the middle cranial fossa. After the right great petrosal nerve had been confirmed and sacrificed with preservation of the geniculate ganglion, fenestration of Glasscock's triangle was performed giving exposure of the right internal carotid artery. A temporary clip applied to the right internal carotid had been confirmed securing the proximal blood flow. A longitudinal inci-



**2** Preoperative angiography. Carotid angiogram (*left*) showing stenosis and distortion of the internal carotid artery (C5 portion), and vertebral angiogram (*right*) showing the compression by the tumor.



**3** Preoperative 3D-CT, showing the mass effect of the tumor.

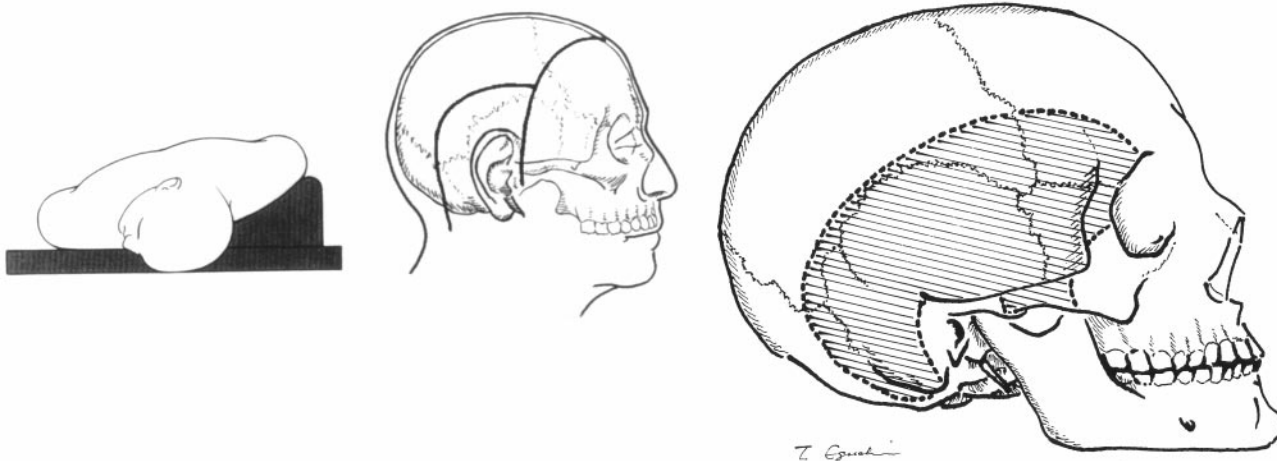
sion was made in the dura of the middle cranial fossa, and the presence of tumor in the cavernous sinus was confirmed. When the lateral wall of the cavernous sinus was incised, milk-white tumor substance surrounded by a thin capsule was seen. The tumor was soft, elastic, and moderately hemorrhagic. A posterior incision of the dura allowed exposure of most of the lateral surface of the tumor. This wide exposure of the tumor was accomplished with minimal compression of the brain. Tumor in the middle cranial fossa and the cavernous sinus was removed piecemeal. Much of the tumor was calcified and was excised using an ultrasonic knife. Following excision of tumor on the lateral side of the right middle cranial fossa, tumor in the right cerebellopontine angle was removed. After the tentorium had been incised up to its free edge for

maximum exposure of the operative field, the infratentorial portion of the tumor was resected. After total resection of the tumor in the cerebellopontine angle, tumor tissue extending into the cavernous sinus and around the internal carotid artery was excised. The tumor encasing the internal carotid artery was hard and strongly adherent to the vessel. The internal carotid artery wall was noted to be fragile and tumor infiltration of the wall was seen. This allowed for only a subtotal removal of the tumor in this area. A small piece of abdominal fat was inserted and the dura was closed using a temporal fascia graft.

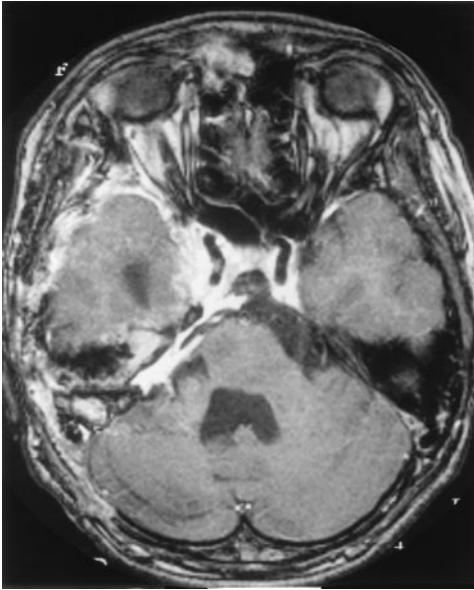
Resolution of the right facial palsy, right hearing disorder, dysphagia, and right hypoglossal palsy was seen postoperatively. The right trigeminal nerve palsy and right-sided ataxic symptoms were unchanged. A mild right abducens paralysis and a left facial palsy appeared transiently, but resolved within 2 months. A postoperative MRI demonstrated a near total excision of tumor. Tumor remained in the right cavernous sinus where it had been strongly adherent (Figure 5). This residual tumor was treated by local linac irradiation at 60 Gy. The patient was discharged, fully independent, from the hospital without support on September 2, 1994. The patient entered high school the following year.

## DISCUSSION

Skull base lesions are difficult to access and various approaches to this area have been described. In 1982, Jane et al. [8] reported a supraorbital approach. Since that time, investigators have employed several approaches through the anterior



**4** Operative position (*left*), skin incision (*center*), and craniotomy (*right*) are shown.



**5** Postoperative Gd-DTPA MRI, showing a near total removal of the tumor.

skull base for lesions of the cavernous sinus and vascular lesions at the cerebral base [6,7,13]. Fujitsu et al. [3] and Al-Mefty et al. [2] have described a zygomatic approach that allows access to the middle skull base. The fronto-orbito-zygomatic approach has been used as an approach combining several advantages. Approaches through the posterior and middle skull bases by excision of the petrosal bone have also been described for lesions of the cerebellopontine angle and brainstem [1,5,9,12]. These approaches have the advantage of giving the surgeon a wide operative field and minimizing brain compression.

An approach from several angles was necessary for the giant skull based tumor presented here. A combination of the fronto-orbito-zygomatic and the transpetrosal approaches was selected for optimal tumor resection in this case. The combined use of these approaches gives the surgeon a wide operative field including good visualization of the cavernous sinus, the ventral side of the brainstem, and the vicinity of the foramen magnum. This wide operative field was obtained with minimal brain compression, combining aspects of the separate approaches.

In this patient, preoperative cerebral angiography revealed an irregular internal carotid artery lumen in the right cavernous sinus, suggestive of tumor infiltration into the internal carotid artery. Internal carotid artery bypass surgery was considered to be necessary for a total resection of the tumor. A preoperative internal carotid artery occlu-

sion test was negative; however, there are reports that have shown that the reliability of this test is questionable [11]. In this case, we resected as much tumor as possible while preserving the integrity of the internal carotid artery. The bulk of the tumor was able to be removed, however, some residual tumor remained. The internal carotid artery may slowly occlude as a result of tumor infiltration. A total tumor resection after the development of collateral circulation may be possible in the future.

The beneficial use of local irradiation [4] and gamma-knife [10] in treating residual tumor after excision of a meningioma has been reported. Goldsmith et al. [4] applied radiotherapy to the site of residual tumor after subtotal resection of meningiomas and reported tumor control rate that exceeded 90% during a 10-year follow-up period. On the basis of these reports, this patient was given local irradiation at 60 Gy. In skull base surgery, careful attention must be given to the patient's outcome, particularly the patient's quality of life. According to the individual features of each case, selection of the operative approach, decisions regarding the extent of excision, and postoperative treatment regimens should be adequately planned in the preoperative period.

## CONCLUSION

We presented a patient with a giant meningioma that extended into the cerebellopontine angle and middle cranial fossa and invaded the cavernous sinus, which was resected by a combined fronto-orbito-zygomatic and transpetrosal approach. A multiangle approach is necessary for such a large skull based tumor. A wide operative field can be obtained with minimal brain compression by combining the advantages of these two approaches.

## REFERENCES

1. Al-Mefty O, Fox JL, Smith RR. Petrosal approach for petroclival meningiomas. *Neurosurgery* 1988;22:510-16.
2. Al-Mefty O, Anand VK. Zygomatic approach to skull-base lesions. *J Neurosurg* 1990;73:668-73.
3. Fujitsu K, Kuwabara T. Zygomatic approach for lesions in the interpeduncular cistern. *J Neurosurg* 1985;62:340-43.
4. Goldsmith BJ, Wara WM, Wilson CB, Larson DA. Postoperative irradiation for subtotally resected meningiomas. *J Neurosurg* 1994;80:195-201.
5. Hakuba A, Nishimura S, Inoue Y. Transpetrosal-transtentorial approach and its application in the therapy of retrochiasmatic craniopharyngiomas. *Surg Neurol* 1985;24:405-15.
6. Hakuba A, Liu S, Nishimura S. The orbitozygomatic

- infratemporal approach: a new surgical technique. *Surg Neurol* 1986;26:271-76.
7. Ikeda K, Yamashita J, Hashimoto M, Futami K. Orbitozygomatic temporopolar approach for a high basilar tip aneurysm associated with a short intracranial internal carotid artery: a new surgical approach. *Neurosurgery* 1991;28:105-10.
  8. Jane JA, Park TS, Pobereskin LH, Winn HR, Butler AB. The supraorbital approach: technical note. *Neurosurgery* 1982;11:537-42.
  9. Kawase T, Toya S, Shiobara R, Mine T. Transpetrosal approach for aneurysms of the lower basilar artery. *J Neurosurg* 1985;63:857-61.
  10. Lunsford LD. Contemporary management of meningiomas: radiation therapy as an adjuvant and radiosurgery as an alternative to surgical removal? *J Neurosurg* 1994;80:187-90.
  11. Origitano TC, Al-Mefty O, Leonetti JP, DeMonte F, Reichman OH. Vascular considerations and complications in cranial base surgery. *Neurosurgery* 1994;35:351-63.
  12. Sekhar LN, Jannetta PJ, Burkhardt LE, Janosky JE. Meningiomas involving the clivus: a six-year experience with 41 patients. *Neurosurgery* 1990;27:764-81.
  13. Sumith RR, Al-Mefty O, Middleton TH. An orbitocranial approach to complex aneurysms of the anterior circulation. *Neurosurgery* 1980;24:385-91.

---

#### COMMENTARY

I don't have any doubt that the combination of the two techniques gave a very nice exposure for this large tumor, and undoubtedly that was necessary. However, I have a few problems with it. I would not argue with leaving the carotid-involved tumor in place, although we don't see the postoperative MR to see just how much tumor was left. In a 15-year-old, however, I would be a little uncomfortable about the irradiation. A postoperative MR might convince me, although it could be that masterful inactivity waiting for recurrence with an occlusion of the carotid might be the best course of action. Then a radical resection of tumor and carotid could be carried out.

The technique the authors used was certainly highly successful in terms of minimal postoperative findings, but this only represents a variation on a theme that everyone is interested in and accomplishing in their own way.

**John A. Jane, M.D., Ph.D.**  
*Department of Neurosurgery*  
*University of Virginia*  
*Charlottesville, Virginia*

Skull base approaches in children are becoming much more utilized as the advantages have become more obvious with time. Initially, skull base surgery was felt to be reserved almost exclusively for the adult population; however, many of the lesions seen in childhood lend themselves well to skull base techniques. In particular, the orbito-zygomatic approach has afforded excellent exposure of lesions of the middle cranial fossa, the suprasellar area, and the anterior upper brainstem. Approaches to those areas using this particular skull base approach have resulted in significantly decreased retraction and decreased morbidity. I now consider it the approach of choice for most craniopharyngiomas and for lesions of the upper pons and midbrain.

The transpetrosal or parapetrosal approach to the anterior brainstem is also valuable for lesions in this area, including lesions within the substance of the brainstem.

I congratulate the authors on a wise choice for their surgical approach and for the excellent outcome in this patient with a significantly large meningioma.

**Marion L. Walker, M.D., F.A.C.S., F.A.A.P.**  
*Division of Pediatric Neurosurgery*  
*University of Utah*  
*Salt Lake City, Utah*