Case Report & Case Series

Endonasal endoscopic approach for a giant cavernous sinus meningioma that extended to the middle cranial fossa with preoperative embolization

Ryota Tamura a,⁎, Masahiro Toda a, Maya Kohno a, Hiroyuki Ozawa b, Toshiki Tomita b, Takenori Akiyama a, Kaoru Ogawa b, Kazunari Yoshida a

a Department of Neurosurgery, Keio University Hospital, 35 Shinanomachi, Shinjuku-ku, Tokyo 160-8582, Japan
b Department of Otorhinolaryngology, Keio University Hospital, 35 Shinanomachi, Shinjuku-ku, Tokyo 160-8582, Japan

A B S T R A C T

Background: Transcranial surgery is considered more appropriate than an endonasal endoscopic approach (EEA) for a large cavernous sinus meningioma with lateral extension.

Case presentation: A 6-cm-diameter hypervascular meningioma around cavernous sinus invaded the orbital apex and infratemporal fossa. 80% of the tumor was removed without too much blood loss via endoscopic endonasal transpterygoidal-infratemporal approach. Preoperative embolization from some feeding arteries was done, and 80% of the tumor staining disappeared.

Discussion: Tumor removal rates for giant meningioma are worse with EEA than with the transcranial approach because of various anatomical limitations and blood control. Recently, EEA has become more widely used with approaches such as the transpterygoidal approach. The operation can be done safely with preoperative embolization because the operative view is clear without bleeding.

Conclusion: Preoperative embolization for a large hypervascular tumor makes EEA more effective. A giant meningioma can be removed by EEA if the anatomical limitations can be identified and approached safely and effectively.

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1. Introduction

The endoscopic endonasal approach (EEA) has advantages, such as the favorable cosmetic results, the avoidance of brain retraction, and early bilateral optic nerve decompression. The rate of postoperative cerebrospinal fluid (CSF) leaks has been improved with the use of vascularized pedicled flaps [1]. Recently, EEA has been considered suitable for midline tumors. Today, we can approach a broad area of the skull base by EEA, and the indications for EEA have gradually increased. For example, cavernous sinus meningioma is not usually treated by craniotomy because of its associated neurological complications. On the other hand, it can sometimes be treated by EEA. Generally, a large meningioma is considered appropriate for open surgery because it is difficult to accurately devascularize feeding arteries by the endoscopic approach. However, preoperative embolization can overcome that weakness [2].

In the present case, a giant meningioma located in the middle cranial fossa was removed after preoperative embolization. The limitations of EEA and the advantages of preoperative embolization are reviewed.

2. Case report

2.1. Onset

A 66-year-old Asian woman was referred to our hospital with right visual acuity disturbance. A giant meningioma around the cavernous sinus was found and removed via craniotomy 24 years earlier. A diagnosis of meningothelial meningioma was made. After the operation, gamma knife radiation was applied to the remaining tumor. Magnetic resonance imaging (MRI) showed tumor regrowth 24 years after the first operation. Her right eye was already blind, and she had a sensory disturbance of the middle and lower face, implying V2 and V3 involvement.

2.2. Preoperative radiological and angiographic findings

MRI showed the right remaining solid parasellar tumor, 6 cm in diameter, that invaded the orbital apex, sphenoid sinus, maxillary sinus, and infratemporal fossa (Fig. 1A,B). Gadolinium (Gd)-enhanced MRI showed strong enhancement. Angiography showed the feeding arteries mainly from the right middle meningeal artery (MMA), accessory meningeal artery (AMA), sphenopalatine artery (SPA), and ascending pharyngeal artery (APA) (Fig. 1C). Right internal carotid artery was
occulted at the previous operation. There was no anastomosis between external and internal carotid artery. It was thought to be difficult to coagulate all of the feeding arteries during EEA. Therefore, preoperative embolization was performed on the day before the operation. The right MMA, AMA, the pharyngeal branch of the APA, and the SPA were embolized using a coil and Embosphere (®, 300–500 μm), and 80% of tumor staining disappeared (Fig. 1F).

2.3. Operation

Tumor removal was done via an endoscopic endonasal transpterygoidal-infratemporal approach. Subtotal removal (80%) was achieved. Preoperative embolization of IMA was effective, thus only minor bleeding was identified during tumor removal (Fig. 2A). Most of the tumor in the infratemporal fossa and middle cranial fossa and around the orbit was removed, except for the lower site of the infratemporal fossa and the lateral site of the orbit. During the operation, the infraorbital nerve and the maxillary nerve were identified. The foramen rotundum could not be identified because of tumor invasion. A small amount of tumor was deliberately left behind (Fig. 2E) because the patient had a past history of subarachnoid hemorrhage and a ventriculoperitoneal shunt had been inserted earlier, and liquorrea had to be prevented. The C5 portion of the internal carotid artery and the right abducens nerve were identified at the clivus, but both had already been cut at the previous operation. The navigation system identified the cavity after tumor resection. The upper and lower parts of the clivus, the left carotid canal, and the lateral side of the foramen rotundum could be approached by EEA (Fig. 3A–D). Reconstruction of

Fig. 1. A) Preoperative Gd-enhanced axial MRI shows the remaining right solid parasellar tumor of 6 cm in diameter invading the orbital apex, sphenoid sinus, maxillary sinus, and nasal cavity. B) Preoperative Gd-enhanced coronal MRI shows tumor invasion to the infratemporal fossa. C) Angiography shows the feeding arteries from the right middle meningeal artery, accessory meningeal artery, ascending pharyngeal artery, and internal maxillary artery. D,E) Postoperative Gd-enhanced axial MRI shows a small amount of residual tumor located outside the right orbit and infratemporal fossa. F) Tumor stain has mostly disappeared after coil and embosphere embolization.

Fig. 2. A) The tumor is soft and greyish. Bleeding from the tumor is controlled because the feeding arteries were embolized on the day before surgery. B) Most of the tumor is removed, but a thin layer has remained. The sella turcica, bilateral orbit, clivus, and infratemporal fossa are identified. (blue dot: floor of the sella turcica, yellow dot: carotid prominence, green dot: floor of the sphenoid sinus.)
the middle cranial fossa was done using a left pedicled nasoseptal flap. Total blood loss was less than 300 ml without blood transfusion, and surgical time was seven hours.

2.4. Postoperative course

CT performed one day postoperatively showed a small amount of residual tumor (Fig. 1D,F). The patient’s postoperative course was uneventful. The patient was discharged from our hospital 13 days postoperatively with no new neurological sequelae.

3. Discussion

Generally, transcranial surgery is considered more appropriate for large cavernous sinus meningiomas with lateral extension, invasion to the optic canal, and vascular encasement that needs delicate technique [1,2]. However, recently, delicate procedures for neural and vascular structures can be performed via EEA. Thus, the use of EEA has spread, except for tumors larger than 4 cm and edematous tumors [1]. EEA is better especially for midline tumors. In addition, the advantages of EEA include a better cosmetic result, avoidance of brain retraction, early devascularization including the anterior and posterior ethmoidal arteries, and early bilateral optic nerve decompression [2]. However, areas that can be approached by EEA are continuing to spread. For example, there are approaches to reach the anterior, lateral and inferior sites as described below. Some anatomical limitations of these approaches have been identified. The floor of the frontal sinus is the anterior limitation of the transfrontal approach. The upper cervical spine is the inferior limitations of the transsphenoidal approach. The transpterygoidal approach can access the infratemporal fossa and the foramen rotundum [3]. There are some limitations mentioned above, but tumor removal rates, visual outcomes, and endocrinological outcomes are equivalent to those of the transcranial approach. Thus, EEA tends to overcome its weaknesses.

In this case, all anatomical limitations of EEA were identified during surgery. If the tumor invades larger areas, a combined or staged approach is thought to be necessary.

It is often difficult to control intraoperative bleeding for meningiomas. Currently, preoperative embolization is often done for hypervascular tumors. Preoperative embolization decreases blood loss, shortens surgical time, and improves the rate of removal. Tumor removal can be done safely, because the operative view is clear without bleeding [4,5].

On the other hand, embolization of the feeding arteries from the external carotid artery for tumors that mainly feed from the internal carotid artery may affect hemodynamic status, which increases the risk of surgical removal. Embolization has some complications, such as skin and oral mucosal ulcers, trigeminal and facial nerve palsies, and trismus, caused by internal maxillary artery occlusion [4,5].

Recently, craniotomy has sometimes been combined with preoperative embolization. However, no reports have discussed the advantages of preoperative embolization for endoscopic tumor removal.

Certainly, EEA can devascularize the feeding arteries, such as the anterior and posterior ethmoidal arteries on the frontal cranial base. In addition, it can devascularize numerous feeding arteries from the lateral side such as APA and MMA and the pial supply from the internal carotid artery at an early stage. Preoperative endovascular procedure can make embolization of these arteries. EEA often needs internal decompression of the tumor. Therefore, intratumoral embolization is important so that EEA can be done safely.

Thus, preoperative embolization is more effective for EEA. If intraoperative bleeding is controlled by preoperative embolization, we can approach any anatomical limitations with a clear working view. Hypervascular tumors larger than 4 cm can be removed safely by EEA with preoperative embolization.

4. Conclusion

Preoperative embolization for hypervascular large tumors makes EEA more effective. Tumors larger than 4 cm can be removed by EEA if any anatomical limitations can be identified.

Patient consent

The patient has consented to the submission of the case report for submission to the journal.

Conflict of interest

All authors certify that they have NO affiliations with any financial interest in this manuscript.

References