Indications and Limitations of the Endoscopic Endonasal Approach for Anterior Cranial Base Meningiomas

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Key words
- Endonasal endoscopic skull base surgery
- Expanded endoscopic approaches
- Meningioma
- Neuroendoscopy
- Skull base

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■ OBJECTIVE: **To describe the decision-making and the surgical strategy in the resection of anterior skullbase meningiomas.**

■ METHODS: **Details of the microsurgical and endoscopic approach to anterior skullbase meningiomas are presented.**

■ RESULTS: **Small and midsize olfactory groove, planum sphenoidale, and tuberculum sellae meningiomas can be removed via an endonasal endoscopic approach, an alternative option to the transcranial microsurgical approach. The choice of approach depends on tumor size and location, involvement of important neurovascular structures, and, most importantly, the surgeon's preference and experience. In my opinion, in most meningiomas, the endonasal approach has no advantage compared with the transcranial approach. Disadvantages of the endonasal approach are the discomfort after surgery and the prolonged recovery phase because of the nasal morbidity, which requires intensive nasal care. Compared with the eyebrow approach, the trauma to the nasal cavity, paranasal sinuses, and skull base is greater, and the risk of cerebrospinal fluid leak is higher.**

■ CONCLUSION: **For most skull base meningiomas, I usually prefer the endoscope-assisted microsurgical transcranial approach which combines the advantages of the operating microscope with the advantages of the endoscope. The endonasal approach is beneficial for small tumors located below or behind the chiasm.**

INTRODUCTION

The introduction of the endoscope into endonasal skull base surgery has widened the spectrum of indications tremendously. In general, there is consensus that the endonasal approach is the preferred approach for extradural lesions and pituitary surgery. However, there is still a debate about the best approach for intradural lesions, such as suprasellar craniopharyngiomas, epidermoids, skull base meningiomas, and other tumors.

Meningiomas of the anterior cranial base can be challenging lesions. They may spread extensively along the frontal skull base and often involve optic nerves and the anterior cerebral artery complex (9, 10). Transcranial microsurgical resection has been standard in the resection of meningiomas for >30 years. The results have improved dramatically because of refinement of the microsurgical technique, availability of high-resolution magnetic resonance imaging, and application of intraoperative monitoring. However, via transcranial approaches, frontal skull base meningiomas or parts of the lesion may be hidden under the optic apparatus and require a certain degree of optic nerve manipulation, which may result in visual field deficits or decrease of visual acuity. The additional use of endoscopes with various angles of view is sometimes advantageous in transcranial approaches to improve the visualization of these lesions without the need for retraction (11, 12). Another approach to avoid retraction of neurovascular structures is an endonasal endoscopic approach to frontal skull base meningiomas. Several articles have been published describing the approach and results (3, 5, 8).

GENERAL SURGICAL TECHNIQUE

The patient is positioned supine with the body elevated 30 degrees to reduce the venous cranial pressure. After administration of decongestant nasal drops, the head is fixed in the Mayfield clamp with tilting to the left and rotation to the right to allow a convenient position for the surgeon who stands on the right side of the patient looking cranially. The nasal cavity and the periumbilical region are disinfected (although the nasal cavity remains contaminated anyway). Both nasal cavities are inspected using a 4-mm 0-degree rigid rod-lens endoscope, which is assembled in the Thumfart suction-irrigation device (Karl Storz GmbH & Co. KG, Tuttlingen, Germany). Even with significant mucosal hemorrhage, good visualization is maintained with this handpiece, and removing the scope from the nose for cleaning can be avoided. The inferior, middle, and superior turbinates and the choanae are visualized. The inferior and middle turbinates are displaced laterally to obtain more space. In extended approaches, 1 (usually the right) middle turbinate is taken frequently but not always to get additional space. The sphenoethmoid recess with the ostium of the sphenoid sinus is identified bilaterally. Sometimes the ostium cannot be found.

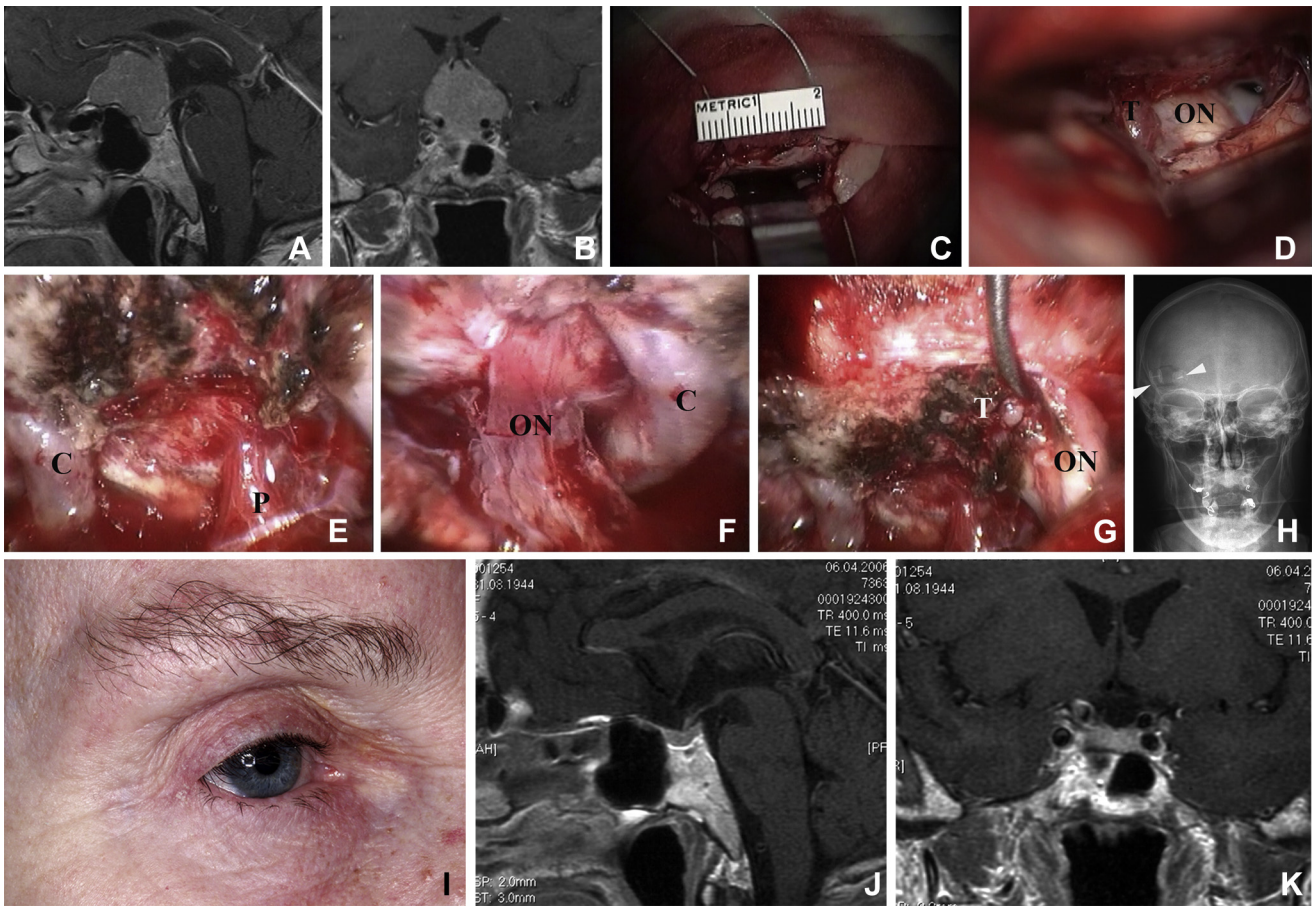

Figure 1. Endoscope-assisted microsurgical resection of a tuberculum sellae meningioma in a 61-year-old woman who presented with visual field deficit and visual loss. T1-weighted contrast-enhanced sagittal (**A**) and coronal (**B**) magnetic resonance imaging scans show a tuberculum sellae meningioma. (**C**) Supraorbital approach via eyebrow incision. (**D**) Right optic nerve (ON) lateral to the tumor (T). (**E**) Endoscopic inspection with a 30-degree endoscope revealed the left internal carotid artery (C) and the pituitary stalk (P), which could not be visualized with the microscope. (**F**) The left optic nerve (ON) is displaced laterally to the carotid artery (C) and extremely thinned out by the tumor. (**G**) Identification of tumor (T) under the right optic nerve (ON). (**H**) Postoperative x-ray shows the size of the craniotomy (*arrowheads*) and fixation of the bone flap with 2 CranioFix (B. Braun Melsungen AG, Melsungen, Germany) clamps. (**I**) Photograph taken 4 months after surgery shows an excellent cosmetic result. T1-weighted contrast-enhanced sagittal (**J**) and coronal (**K**) magnetic resonance imaging scans performed 5 years after surgery show no tumor remnant or recurrence.

Usually, a nasoseptal flap is raised on the side where it is done more easily (i.e., wide nasal cavity, no bony septum spur). If no nasoseptal flap is taken, the mucosa in front of the sphenoid sinus is coagulated using a monopolar suction. In most cases, a wide sphenoidotomy is performed using a high-speed drill and Kerrison punches. Depending on the tumor location and size, the extent of ethmoidectomy, resection of the nasal septum and superior turbinates, and drilling of the frontal skull base vary. After exposing the tumor base, the dura mater with supplying feeders is coagulated. Depending on the tumor consistency, the lesion is debulked with the aid of bipolar diathermy, ultrasonic aspirator, and scissors. The arachnoid plane is identified, and the tumor is dissected from the surrounding structures maintaining the arachnoid plane. Sharp dissection is preferred if the tumor is adherent to neurovascular structures. After tumor removal, meticulous hemostasis is achieved. Smaller skull base defects can be closed with periumbilical fat and fibrin glue. Larger defects should be closed with fat, nasoseptal flap, and fibrin glue. If a flap is used, the nose is packed with tamponades for 3 days to keep the flap in place. If the arachnoid is open, a lumbar drain is placed for 5 days.

INDICATIONS AND LIMITATIONS

The decision whether to perform a transcranial or endonasal approach depends on several factors. The following paragraphs reflect the personal opinion of the author in decision making.

Olfactory Groove Meningiomas

An important factor in olfactory groove meningiomas is the state of olfaction. Especially in smaller tumors, patients frequently have a good sense of smell. In my opinion, intact olfaction is an important factor in quality of life for enjoying food and wine and sometimes even