CASE REPORT

The Transfrontal Approach Using Nasal Endoscopy to Treat Anterior Skull Base Carcinomas

Naoyuki Kohno, M.D.,¹ Satoshi Kitahara, M.D.,² Etuyo Tamura, M.D.,²
Tetuya Tanabe, M.D.,² and Yoshihiro Ohno, M.D.²

ABSTRACT

We used a simple subcranial procedure that employed nasal endoscopy to resect two anterior skull base tumors. The solid geometry of the deep frontal sinus must be known to determine the appropriateness of this technique. Since 1999 two patients underwent this technique and have exhibited no signs of local or distant disease for 36 months and 32 months, respectively. This approach minimizes visible scarring, provides a wide exposure of the roof of the anterior ethmoid, and reduces the risks of excessive bleeding and neurogenic complications. The patients recovered rapidly so the treatment was cost-effective and the patients achieved an early return to work. We conclude that the transfrontal approach for anterior skull base tumors can be simple and effective. Further studies of this minimally invasive maneuver for high-risk patients are warranted.

KEYWORDS: Transfrontal approach, nasal endoscopy, anterior skull base tumor

Malignant tumors invading the anterior skull base are often resected through a craniofacial procedure.^{1,2} Craniofacial resections are lengthy operations and demand highly skilled surgeons. The subcranial approach for resecting anterior skull base tumors was developed by Raveh et al.³ This approach is less aggressive than a craniofacial procedure but requires an extensive osteotomy. Schramm et al.⁴ reported using a less time-consuming ap-

proach through a small frontal craniotomy (low anterior burr hole approach) to access anterior skull base tumors. This approach also requires facial resection with retraction of the frontal lobe.

The transfrontal approach using endoscopy is not only effective for treating small anterior skull base tumors but also offers patients a rapid return to full activity. We used this procedure to treat two high-risk cancer patients.

Skull Base, volume 12, number 2, 2002. Address for correspondence and reprint requests: Naoyuki Kohno, M.D., Dept. Otorhinolaryngology, Kyorin University, School of Medicine, 6-20-2 Shinkawa, Mitaka-shi, Tokyo, Japan. E-mail: sukohno@kyorin-u.ac.jp. Dept. ¹Otorhinolaryngology, Kyorin University, School of Medicine, 6-20-2 Shinkawa, Mitaka-shi, Tokyo, Japan; ²Otolaryngology, National Defense Medical College, 3-2 Tokorozawa, Saitama, Japan. Copyright © 2002 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA. Tel: +1(212) 584-4662. 1531-5010,p;2002,12,02,097,102,ftx,en;sbs00277x.

MATERIAL AND METHODS

Patients

Patients who had a tumor in the anterior skull base and also a well-pneumatized frontal sinus were included in this study.

The patients were evaluated using computerized tomography (CT), magnetic resonance imaging (MRI), or both. The size of the frontal sinus and the extent of the lesion in the adjacent structures were defined. Detailed information regarding the solid geometry of the deep frontal sinus (more than about 1.5 cm) is needed to pursue this technique. Tumors with an intracranial extension that deeply invades the posterior ethmoid and orbit were excluded as inappropriate candidates for this approach.

Surgical Technique

The solid geometry of the deep frontal sinus determines the appropriateness of the transfrontal approaches (Fig. 1). A midline skin incision through

Figure 1 The solid geometry of the deep frontal sinus (more than about 1.5 cm) determines the appropriateness of this technique.

Figure 2 The anterior portion of the frontal and nasal bones can be osteotomized to obtain a view of the anterior skull base. With a nasal endoscopy, the extent of the tumor involved with adjacent structures can be confirmed from a posteroinferior perspective.

the nasion was used to expose the anterior wall of frontal sinus. The shape of the frontal sinus was outlined on preoperative plain radiographs. The bony incision was performed with a chisel. The anterior parts of the frontal and nasal bones were osteotomized and removed temporarily to optimize the exposure and visibility for the radical resection of the tumor. This method provides satisfactory visualization of the anterior skull base and nasal cavity.

A 30-degree nasal endoscope placed posteroinferiorly through the nasal cavity was used to determine the extent of the tumor in adjacent structures (Fig. 2). The posterior edge of the tumor was resected using cutting forceps manipulated endoscopically. The tumor, uncinate process, anterior ethmoid sinus, and superior and middle turbinates were removed anteriorly with the cutting forceps (Fig. 3). For this procedure, the illumination from the light guide over the mucous membrane helps the surgeon navigate the transfrontal resection. After the tumor was removed completely, normal tissue was left on

Figure 3 The tumor together with the superior and middle turbinates can be removed through the anterior surgical view. The illumination of the mucous membrane from the light guide through the nasal endoscope provides good visualization for the transfrontal resection.

each side and hemostasis was secured with bipolar cauterization. The skull bones were replaced and fixed with fibrin glue.

Illustrative Case

An 80-year-old man suffered persistent nasal bleeding from a mass lesion in the anterior ethmoid. The tumor was suspected to have invaded or attached itself to the dura and adjacent areas (Fig. 4). Myocardial disease precluded aggressive and time-consuming surgery. The solid geometry of the deep frontal sinus determines the appropriateness of the transfrontal approaches. The patient underwent the transfrontal approach for en bloc tumor resection in January 1999 (Fig. 5). The tumor appeared to have been completely removed along with normal tissue on each side. Analysis of the excised tissue revealed an adenocarcinoma. The patient was discharged 10 days after surgery and had no recurrence 2 years later (Fig. 6).

Figure 4 Preoperative coronal MRI showing the tumor in the anterior ethmoid region.

RESULTS

Since 1999 two patients have undergone this technique and have shown no signs of local or distant disease 36 months and 32 months later, respectively (Table 1).

DISCUSSION

This approach provided wide exposure of the roof of the ethmoid, thereby reducing the risk of excessive bleeding and neurogenic complications. Although the ipsilateral olfactory nerve was resected in our patients, contralateral olfactory filaments could be preserved during unilateral tumor resection. Anosmia was observed in neither patient. This procedure avoided an intracranial operation and frontal lobe retraction and accelerated immediate postoperative recovery.

The cost of this subcranial approach in Japan was calculated as \$2,000 compared to the \$9,000

Figure 5 Intraoperative view of the frontal sinus (F) and roof of the ethmoid (E) through the resection cavity.

Figure 6 Coronal MRI obtained 2 years after the operation shows no signs of recurrent tumor.

required for craniofacial resection. This cost excludes the savings associated with the need for less postoperative nursing care.

This approach also minimizes visible facial scarring. Our patients were satisfied with their cosmetic appearance.

Customarily, anterior skull base tumors are removed through a craniofacial resection. This approach provides a good surgical view and avoids intracranial complications due to the operation. However, this intracranial approach is aggressive and requires a lengthy operation. Complications related to craniofacial resection have ranged from 15 to 26%.⁵ In contrast, our patients developed no major

complications, including no postoperative cerebrospinal fluid leakage or epidural infection.

Nasal endoscopy clearly defined the posterosuperior margin of the tumor and allowed it to be resected while leaving an adequate margin, especially along the posterior edge of the tumor. Yuen et al.⁶ reported endoscopic cranionasal resection using a bicoronal scalp flap. This maneuver avoids a facial scar, but a frontal craniotomy is required.

Our procedure fulfills most of the requirements of anterior skull base surgery. The procedure is simple enough to be easily taught and undertaken. The duration of surgery is 3 hours or less. In addition, patients can care for themselves postoper-

Table 1 Patient Data

Case	Age	Gender	Diagnosis	Length of Follow-up	Results	Complications
1	80	M	Adenocarcinoma	36 months	AWD	None
2	69	F	Olfactory neuroblastoma	32 months	AWD	None

AWD, alive without disease.

atively. Because the procedure causes no intracranial damage, postoperative recovery is accelerated and the total length of hospitalization is shortened. Consequently, this approach may play an important role in the treatment of some high-risk patients.

Large tumors that extensively involve the posterior ethmoid may be a contraindication for this technique, while small tumors limited to the anterior roof of the nasal cavity and ethmoid sinus are appropriate cases for this approach.

In our two patients, the transfrontal approach was associated with acceptable levels of early and late complications, considerable financial savings with minimal social disruption, and highly satisfactory postoperative cosmetics. These advantages may make the transfrontal approach a useful option for patients with tumors at the base of the anterior skull.

EDITORS' NOTE

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Commentary

Kohno et al. have described a simple transfrontal approach for small anterior skull base tumors using transnasal endoscopy. This uncomplicated approach achieved good results and, in these two patients, was successful. We are concerned that this approach may not provide adequate margins with resection, making it a less than optimal operation. We believe that this procedure has a limited indication in extremely small tumors, but it may be a worthwhile alternative to a craniofacial resection.

Anil Nanda, M.D., F.A.C.S.¹
Ajay Jawahar, M.D.¹