



The role of transbasal approach for anterior skull base tumors with acute visual impairment

Koji Fujita, MD, PhD; Junya Fukai, MD, PhD; Hiroki Nishibayashi, MD, PhD; Naoyuki Nakao, MD, PhD



Department of Neurological Surgery, School of Medicine, Wakayama Medical University, Wakayama, Japan

Abstract

The anterior skull base tumors invading the optic canal (OC) occasionally result in acute visual impairment. We treated 5 cases for these kinds of tumors with acute visual impairment, extending into OCs. To rescue the visual function, as early as possible, we employed the transbasal approach for the tumor resection around the optic nerve in all cases. Accordingly, 4 out of 5 patients showed marked visual recovery without complications. The transbasal approach was efficacious in removing the tumors around the OCs and orbits, as well as paranasal sinus, nasal cavity, clivus and parapharyngeal space. However via this approach, there were the blind areas in inferolateral orbit and the lateral maxillary sinus. Hence for 3 cases, the lateral approach like infratemporal fossa approach or Dolenc approach was additionally given. In this fashion, gross total removal was achieved in 3 out of 5 patients. The transbasal approach can be a feasible technique to rescue the visual function for the anterior skull base tumors extending into OCs with acute visual impairment.

Introduction

The tumors located in the anterior skull base and craniofacial structures invading the optic canal (OC) occasionally lead to acute visual impairment from optic nerve compression. To rescue the visual function we chose the transbasal approach for the tumor removal around the optic nerve. We review our treatment experience for the anterior skull base tumors invading OCs with acute visual impairment, and discuss surgical approaches and patient outcomes.

Materials and Methods

We surgically treated 5 patients (Ewing PNET, atypical meningioma, adenoid cystic carcinoma, schwannoma and chordoma) presenting with acute visual impairment, accompanying with large extension into OCs and orbits. As early as possible, to rescue the visual performance the transbasal approach was performed for tumor resection in all cases.

[Operative techniques] (Fig.1)

The basic techniques were the bicoronal incision, bifrontal craniotomy, removal of the supraorbital bar, and drilling of the anterior midline skull base^{1,2}. The osteotomized cribriform plate was retracted along with the dura to preserve olfaction and prevent a CSF leak³. The affected OCs were routinely skeletonized. Neuronavigation system was introduced to confirm anatomical landmarks and tumor location during surgical procedure.

[Illustrative case] Case 1(Fig.2)

A 25-year-old man presented with progressive visual loss in his right eye and was referred to our institution. The tumor occupied the right orbit and paranasal sinus with intracranial growth. His visual acuity deteriorated rapidly, and he became blind in the right eye. Emergent tumor removal was performed via the transbasal approach. The tumor was resected totally. The patient showed nearly complete restoration of the visual function. A diagnosis of Ewing sarcoma/PNET was confirmed histopathologically.

Results (Table)

The transbasal approach was effective in removing the tumors around the OCs and orbits, as well as sphenoid and ethmoid sinus, nasal cavity, clivus and parapharyngeal space. With early treatment in this fashion, 4 out of 5 patients showed remarkable improvement of visual function without complications.

Subsequently, for 3 cases the lateral approach like infratemporal fossa approach or Dolenc approach was additionally required for the radical tumor resection in inferolateral areas in the orbit and the lateral aspects of maxillary sinus (Fig.3). Finally, gross total removal was achieved in 3 out of 5 patients.

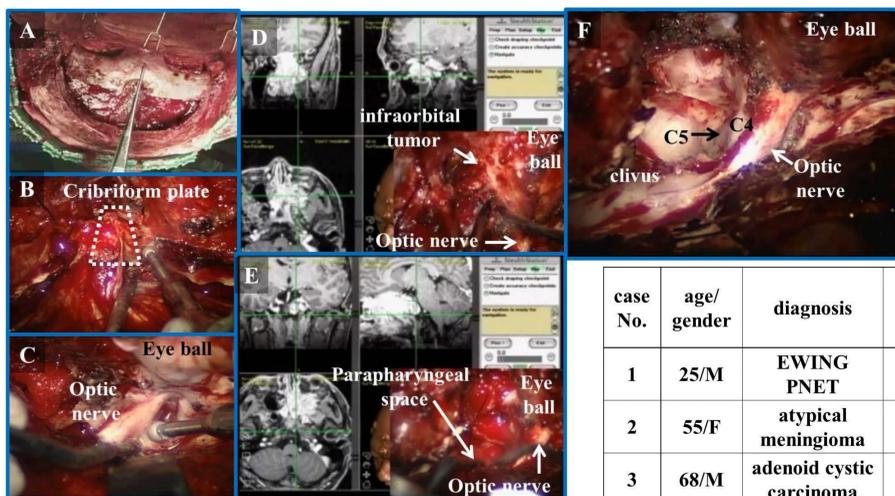


Fig.1 Intraoperative photographs of the transbasal approach
A. Removal of the supraorbital bar
B. Osteotomy of the cribriform plate
C. Skeletonization of the optic nerve
D. Removal of the infraorbital tumor with neuronavigation system
E. Removal of the tumor located in parapharyngeal space with neuronavigation system
F. Final view after the tumor removal

case No.	age/gender	diagnosis	the affected eye with acute visual dysfunction	visual acuity on the affected side before→after surgery	additional surgery (approach)	removal rate	complications	additional treatment
1	25/M	EWING PNET	right	blind → 0.6	-	GTR	-	chemo. SRT
2	55/F	atypical meningioma	right	0.02 → 0.3 (0.03) (1.2)	①Infratemporal fossa	GTR	-	IMRT
3	68/M	adenoid cystic carcinoma	right	0.4 → 0.6 (1.2) (1.2)	①Dolenc	STR	-	SRS
4	74/F	neurinoma	right	0.15 → 0.9 (nc)	-	GTR	-	SRS
5	71/F	chordoma	left	0.03 → 0.03 (nc)	①Infratemporal fossa ②Dolenc	STR	-	-

Table The summary of the cases with transbasal approach for anterior skull base tumors with acute visual impairment () ; corrected visual acuity, nc; non corrigent, GTR; gross total removal, STR; subtotal removal, chemo.; chemotherapy, SRT; stereotactic radiotherapy, IMRT; intensity modulated radiation therapy, SRS; stereotactic radiosurgery

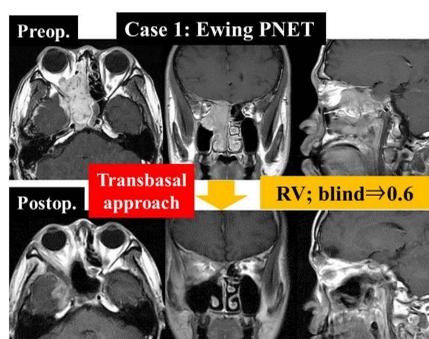


Fig.2 Pre- and postoperative MRI on Case 1

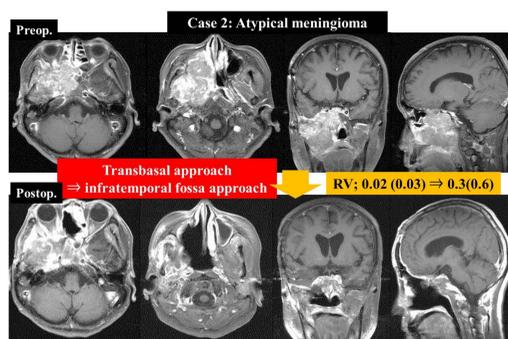


Fig.3 Pre- and postoperative MRI on Case 2

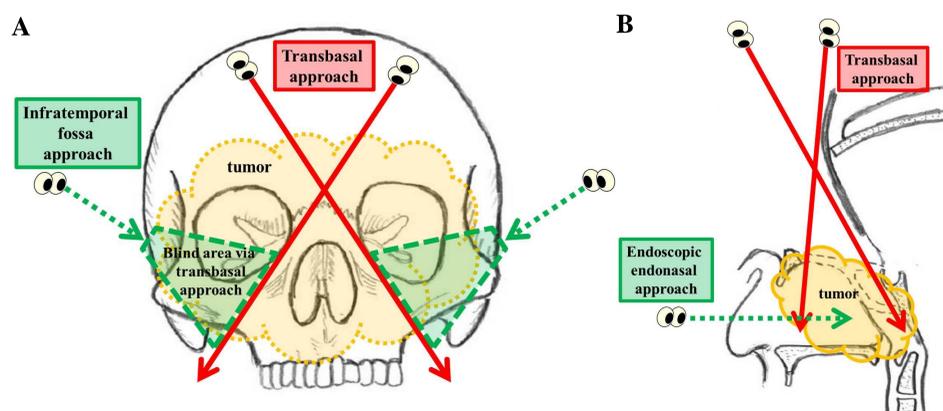


Fig.4 Surgical strategy for anterior skull base tumors

Discussion

The transbasal approach was originally described as a method of attacking extensive lesions of the anterior skull base². This approach is suitable for radical resection of frontal base, paranasal sinus, clival and nasopharyngeal tumors. The area between the pituitary gland and the retropharyngeal space, including the clivus and C1 anterior arch can be reached with this technique^{1,2} (Fig.4B).

In addition, with this approach the OCs and orbits can be also accessible. A better view inferior to each orbit from a contralateral viewing trajectory, towards the maxillary sinus, is afforded by this technique (Fig.4A). In our series, with early tumor resection around the OCs and orbits with this approach, 4 out of 5 patients had marked recovery of visual function. Thus, transbasal approach can be a feasible technique to rescue the visual function for the anterior skull base lesions extending into OCs and orbits.

While via transbasal approach, there were the blind areas in inferolateral orbit and the lateral maxillary sinus (Fig.4A). Hence, our 3 cases additionally underwent the lateral approach like infratemporal fossa approach⁴ or Dolenc approach for these kinds of tumors.

Moreover, endoscopic endonasal approach has received a great attention as an efficacious means to visualize the anterior skull base lesions. The use of the endoscope inserted through the nostril can avoid scalp and facial incisions for anterior skull base and craniofacial lesions (Fig.4B). Therefore, transbasal approach can be combined with a lateral approach or an endoscopic endonasal approach for the anterior skull base tumor extending into the inferolateral orbit and the lateral maxillary sinus.

Conclusions

The tumor resection via transbasal approach can be a safe and effective treatment to rescue the visual function for the skull base and craniofacial tumors extending into OCs and orbits presenting with acute visual impairment.

Contact

Koji Fujita
Department of Neurological Surgery, School of Medicine,
Wakayama Medical University, Wakayama, Japan
Email: kfujita@wakayama-med.ac.jp
Website: <http://www.wakayama-med.ac.jp/med/neurosurgery/>
Phone: +81-73-441-0609

References

- Chandler JP et al. Advances in surgical management of malignancies of the cranial base: the extended transbasal approach. J Neurooncol 73:145-153, 2005
- Derome PJ: The transbasal approach to tumors invading the base of the skull, in Schmidek HH, Sweet WH (eds): Operative Neurosurgical Techniques. Indications, Methods, and Results. Boston: Grune & Stratton, Vol 1, pp 357-379, 1982
- Spetzler RF et al. : Preservation of olfaction in anterior craniofacial approaches. J Neurosurg 79:48-52, 1993
- Nakao N et al.: Surgical treatment and outcome of skull base meningiomas with extracranial extensions. Clin Neurol Neurosurg 112:40-46, 2010