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Endoscopic Occipital Transtentorial Approach for Supracerebellar Lesions

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Abstract

The occipital transtentorial approach (OTA), which is often applied for superior cerebellar lesions, has an inevitable risk of homonymous hemianopsia due to the retraction of the occipital lobe. The endoscopic approach provides increased visibility of the surgical field due to the wide-angled panoramic view and is minimally invasive in approaching deep brain lesions compared to the conventional microscopic approach. However, little is known regarding endoscopic OTA for the removal of cerebellar lesions. We experienced a case of a hemangioblastoma in the paramedian superior surface of the cerebellum that was successfully treated with endoscopic OTA combined with gravity retraction while avoiding postoperative visual dysfunction.

A 48-year-old woman was diagnosed with a hemangioblastoma in the superior surface of the cerebellum. She underwent tumor removal with endoscopic OTA combined with gravity retraction of the occipital lobe instead of using brain retractors. The narrower space was sufficient for surgical manipulation with a panoramic view obtained by endoscopy. The simultaneous observation of the lesion with both an endoscope and a microscope revealed the superiority of infratentorial visualization with an endoscope. Gross total removal was achieved with no postoperative complications, including visual dysfunction.

Endoscopic OTA may reduce the risk of postoperative visual dysfunction because of its minimally invasive nature, which is enhanced when combined with gravity retraction. Additionally, the panoramic view of the endoscope allows favorable visualization of an infratentorial lesion, which is otherwise hidden partly by the tentorium. The use of endoscopy is compatible with OTA, and endoscopic OTA could be an option for superior cerebellar lesions for avoiding visual dysfunction.

Keywords: occipital transtentorial approach, endoscopy, supracerebellar lesion, hemangioblastoma, visual dysfunction

Introduction

The occipital transtentorial approach (OTA) is an established microscopic procedure for lesions in the posterior incisural space, such as a pineal lesion, and is often used for superior cerebellar lesions. OTA has an inevitable risk of homonymous hemianopsia caused by the retraction of the occipital lobe.[1-5] Early and long-term postoperative visual field loss has been reported to occur in 19%-100% and 17% of the patients, respectively.[6-9] To prevent visual dysfunction, several strategies have been tried. One of these is gravity retraction of the occipital lobe combined with cerebrospinal fluid (CSF) drainage from the lateral ventricle or lumbar drain.[5,10,11] Approaching under the occipitotemporal junction[12] and retracting the inferior surface of the occipital lobe[13] have also been reported to be advantageous in avoiding visual dysfunction. However, these strategies are not applicable to a cerebellar lesion because of the difference in the axis of approach to the lesion.

The endoscopic approach provides increased visibility of the surgical field due to its wide-angled panoramic view.[14,15] Endoscopy also allows minimally invasive and keyhole craniotomies for approaching deep brain lesions. Endoscopy is now being applied to various types of transcra-

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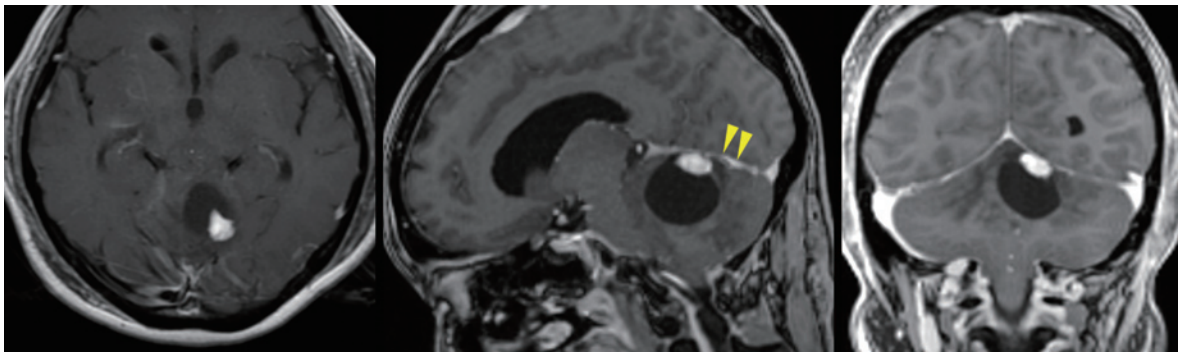

Fig. 1 Preoperative T1-weighted gadolinium-enhanced image of the mass lesion surrounded by a cyst. The draining vessel is present at the tentorial surface of the cerebellum (arrowhead).

nial surgeries. Endoscopic transcranial surgery for tuberculum sellae meningiomas has been shown to offer favorable postoperative visual outcomes.[16]

However, there are few reports on endoscopic OTA, which has been mostly used for pineal lesions.[17-20] Kawauchi et al. reported the efficacy of the combined use of a microscope and an endoscope to remove supracerebellar hemangioblastomas.[21] In these reports, the panoramic view and minimal invasiveness have been emphasized as the advantages. There is only one report regarding endoscopic OTA for a cerebellar lesion,[22] where its feasibility was mainly shown using a computed tomography (CT) angiogram and cadaveric heads.

Herein, we present a case of a hemangioblastoma in the paramedian superior surface of the cerebellum, which was successfully treated with endoscopic OTA combined with gravity retraction while avoiding postoperative visual dysfunction.

Case Report

A 48-year-old woman developed gradually worsening dizziness and headache and visited a doctor. Medical examination revealed an approximately 1.3 cm × 1.2 cm × 0.8 cm sized mass with a surrounding cyst and noncommunicating hydrocephalus, and she was referred to our department. The acute hydrocephalus deteriorated, causing disturbance in consciousness. Therefore, endoscopic third ventriculostomy (ETV) was performed before tumor removal. An Ommaya reservoir was also placed in the tract of ETV for CSF drainage and was used for tumor removal later. Subsequently, the hydrocephalus improved, but the perifocal edema gradually increased, suppressing the brain stem. Further examination revealed a strong enhancement in the tumor mass with the tumor drainer attached to its tentorial side (Fig. 1). Tumor removal was performed under general anesthesia 4 days after ETV.

Surgical procedure

The patient was placed in a prone position. A zigzag skin incision and 4.0 cm × 3.0 cm craniotomy were performed for exposing the dura mater on the superior sagittal sinus and left cerebral convexity. The site of craniotomy was defined so that the surgical trajectory was directly perpendicular to the tentorium according to the navigation system. The head was fixed in a neutral position at first and then rotated approximately 10 degrees after bone flap removal to facilitate gravity retraction. The Ommaya reservoir was punctured and left open during surgery to relieve the excessive pressure on the occipital lobe by draining the CSF. The dura mater was incised, and the endoscope was set up fixed to UniARM (Mitaka, Tokyo, Japan) for starting the endoscopic procedure. The tentorium on the lesion was incised toward the tentorial incisura. The endoscope (diameter 4 mm, 0 degrees) was placed in the upper side of the surgical field, and the lower side was utilized for manipulation by both hands. A straight scope allows an adequate view for manipulation throughout the surgery. An oblique scope (diameter 4 mm, 30 degrees) was used only for checking the surrounding structures. The occipital lobe was gradually retracted by gravity and intermittent mild compression by using tools for manipulation. After the tentorial incision, the tumor and the superior surface of the cerebellum were exposed. The tumor drainer was also exposed in front of the tumor (Fig. 2). The tumor was dissected from the surrounding cerebellum with the drainer preserved. Numerous microfeeding vessels were repeatedly coagulated and cut at the level of the cerebellar surface. The placement of the endoscope was changed to the lower side of the surgical field, and the upper side was utilized for manipulation when dissecting the upper side of the lesion. Changing the angle of the tip of the surgical instruments according to the situation was useful in avoiding interference with the endoscope. The drainer was cut at the end, and the enhanced mass lesion was resected in one piece. Before cutting the drainer, a microscope was introduced to check the blood flow to the tumor using indocyanine green. The tumor, drainer, and surrounding structures were well visualized by the endoscope, and only the tumor was visualized by the microscope because of the

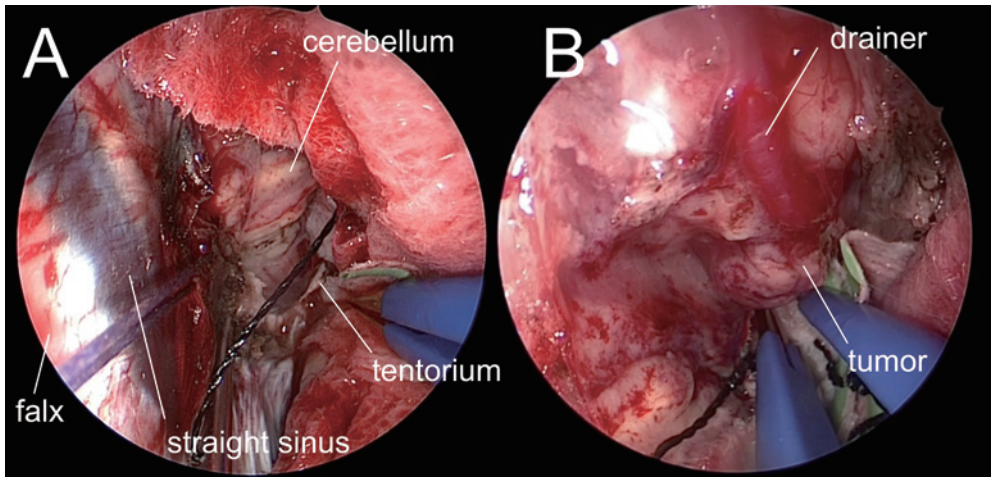

Fig. 2 Endoscopic image during the surgical procedure (diameter 4 mm, 0 degrees). The paramedian tentorium was dissected (A), and the tumor and draining vein were exposed (B).

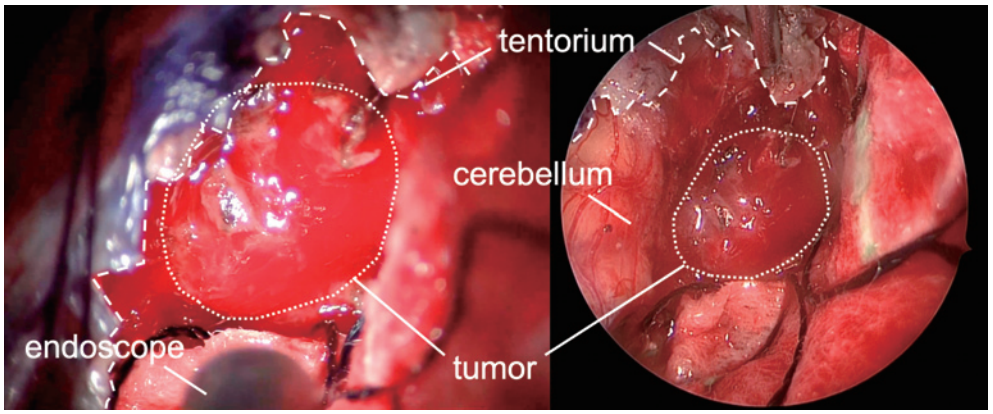

Fig. 3 Simultaneous operative view of the microscope (left) and endoscope (right) showing superior visualization of the subtentorial space by the endoscope.

tentorium in front of the other structures (Fig. 3). The CSF drained from the Ommaya reservoir amounted to only 3 mL throughout the entire procedure.

The patient recovered from the consciousness disturbance immediately after surgery and had no visual dysfunction. The tumor was diagnosed as a hemangioblastoma, and magnetic resonance imaging showed gross total removal of the lesion.

Discussion

It might be suggested that the endoscopic approach reduces the risk of postoperative visual dysfunction due to its minimally invasive nature, which is enhanced when combined with gravity retraction of the occipital lobe. Additionally, the panoramic view of the endoscope allows favorable visualization of infratentorial lesions, which are otherwise hidden partly by the tentorium.

The retraction of the occipital lobe, which is indispensable in OTA, is associated with the risk of homonymous hemianopsia.[1-5] To avoid this risk, several strategies have been attempted. The prolonged retraction of the occipital lobe may be a causative factor.[11,23,24] Therefore, gravity retraction of the occipital lobe has been reported to reduce the risk,[10,11] where the patient's head is mostly fixed laterally to drain the CSF (25-60 mL), thus maximizing the effect of gravity retraction. In the current case, the tentorium was incised with little retraction of the occipital lobe, assisted by the endoscope and its panoramic view. The occipital lobe was gradually retracted to some extent through the entire procedure. The extent of retraction was relatively mild (Fig. 4). The total amount of CSF drainage from the Ommaya reservoir was only 3 mL. It may be because little retraction was necessary during tentorial incision and subsequent manipulation. Therefore, the subarachnoid space itself might have drained the CSF. External drainage of CSF such as by lumbar drainage and tapping of the lateral ventricle might not have been necessary if hydro-

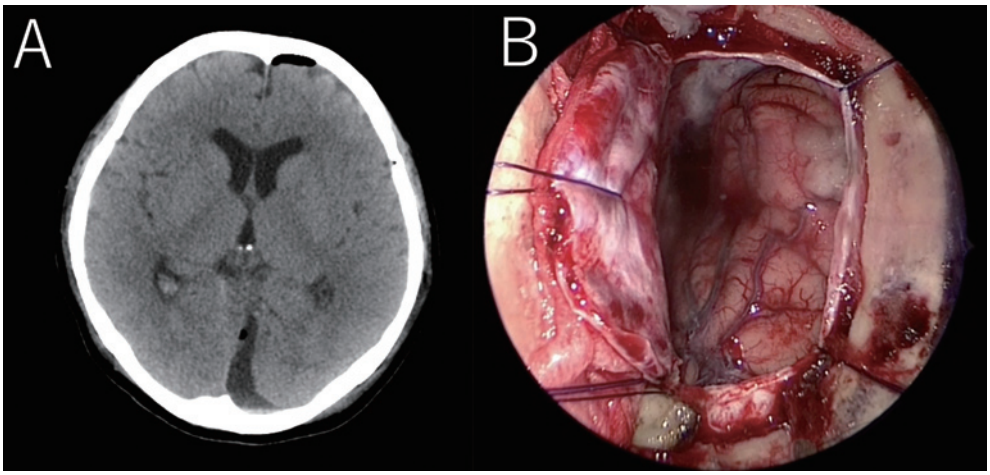

Fig. 4 (A) Postoperative computed tomography (CT) image and (B) postprocedural endoscopic image showing mild retraction of the occipital lobe.

cephalus was not present. A favorable view and sufficient working space for surgical manipulation were obtained with this approach, showing its feasibility. The feasibility of endoscopic OTA for the anterosuperior cerebellum has been reported in a study of CT angiogram of cadaveric heads.[22] The relatively small craniotomy required in the current case shows the minimally invasive nature of the endoscopic transcranial approach, as reported earlier.[25] For avoiding postoperative visual dysfunction, the supracerebellar infratentorial (SCIT) approach could also be applicable in the current case. However, the manipulation of the lesion would be more difficult and would cause more damage to the cerebellum because of a narrower working space and the position of the cerebellum in the surgical trajectory. For a hemangioblastoma, OTA is also advantageous in controlling the feeder and drainer. Indeed, OTA has been previously recommended for a median or paramedian hemangioblastoma.[26]

Favorable visualization of the infratentorial lesion was obtained after tentorial incision by an endoscope compared to a microscope (Fig. 3). An endoscope can visualize the space wider than the tentorial incision, whereas a microscope cannot. The tentorial incision is often limited by the tentorial sinus. Consequently, the endoscopic approach is especially advantageous in such cases. The tentorial incision was just on the tumor, which was necessary for manipulation, but was sufficient for observing the surrounding structures and tumor drainer as well as the tumor itself. Understanding the vascular structures related to the tumor is especially crucial for safe resection of hemangioblastomas.[27]

The disadvantages of using an endoscope instead of a microscope include interference with surgical instruments and a two-dimensional view. For avoiding interference with the instruments, we separated the surgical field for the endoscope and instruments as mentioned above. However, when the endoscope is put close to the lesion for magnification, the instruments can easily interfere with the endoscope. The choice of surgical instruments is therefore important to minimize such inconvenience. Manipulation under a two-dimensional view can be improved if the surgeon gets familiar with it. Three-dimensional endoscopy may be able to solve this problem. In any case, an endoscope has an absolute advantage in the visualization of the blind spot over a microscope.

This report describes only one successful case of endoscopic OTA. Therefore, further investigation is needed for elucidating the optimal use of endoscopy. However, the use of an endoscope could be compatible with OTA, and endoscopic OTA could be an option for a superior cerebellar lesion to avoid visual dysfunction.

In conclusion, the use of an endoscope in OTA for cerebellar lesions may be minimally invasive to the occipital lobe, minimizing the risk of postoperative visual dysfunction. The panoramic view of the endoscope allows favorable visualization of the infratentorial space, which is advantageous for safe and effective resection of the lesion.

Informed Consent

The consent from all participants was obtained.

Conflicts of Interest Disclosure

All authors have no conflicts of interest. All authors are members of the JNS and have registered online self-reported COI Disclosure Statement Forms through the website for JNS members.

References

1) Qi S, Fan J, Zhang XA, Zhang H, Qiu B, Fang L: Radical resection

of nongerminomatous pineal region tumors via the occipital transtentorial approach based on arachnoidal consideration: experience on a series of 143 patients. *Acta Neurochir (Wien)* 156: 2253-2262, 2014
2) Sonabend AM, Bowden S, Bruce JN: Microsurgical resection of pineal region tumors. *J Neurooncol* 130: 351-366, 2016
3) Little KM, Friedman AH, Fukushima T: Surgical approaches to pineal region tumors. *J Neurooncol* 54: 287-299, 2001
4) Hart MG, Santarius T, Kirollos RW: How I do it—pineal surgery: supracerebellar infratentorial versus occipital transtentorial. *Acta Neurochir (Wien)* 155: 463-467, 2013
5) Bassiouni H, Hunold A, Asgari S, Stolke D: Tentorial meningiomas: clinical results in 81 patients treated microsurgically. *Neurosurgery* 55: 108-116, 2004
6) Ausman JI, Malik GM, Dujovny M, Mann R: Three-quarter prone approach to the pineal-tentorial region. *Surg Neurol* 29: 298-306, 1988
7) Bruce JN, Stein BM: Surgical management of pineal region tumors. *Acta Neurochir (Wien)* 134: 130-135, 1995
8) Kurokawa Y, Uede T, Hashi K: Operative approach to mediosuperior cerebellar tumors: occipital interhemispheric transtentorial approach. *Surg Neurol* 51: 421-425, 1999
9) Nazzaro JM, Shults WT, Neuwelt EA: Neuro-ophthalmological function of patients with pineal region tumors approached transtentorially in the semisitting position. *J Neurosurg* 76: 746-751, 1992
10) Lopez-Gonzalez MA, Jaeger A, Kaplan B, et al.: Retractorless interhemispheric transtentorial approach for large lesions in the posterior incisural space. *Surg Neurol Int* 10: 130, 2019
11) Chi JH, Lawton M: Posterior interhemispheric approach: surgical technique, application to vascular lesions, and benefits of gravity retraction. *Neurosurgery* 59: ONS-41, 2006
12) Moshel YA, Parker EC, Kelly PJ: Occipital transtentorial approach to the precentral cerebellar fissure and posterior incisural space. *Neurosurgery* 65: 554-564, 2009
13) Matsuo S, Baydin S, Güngör A, et al.: Prevention of postoperative visual field defect after the occipital transtentorial approach: anatomical study. *J Neurosurg* 129: 188-197, 2018
14) Zaidi HA, Elhadi AM, Lei T, Preul MC, Little AS, Nakaji P: Minimally invasive endoscopic supracerebellar-infratentorial surgery of the pineal region: anatomical comparison of four variant approaches. *World Neurosurg* 84: 257-266, 2015
15) Ferrer E, Santamarta D, Garcia-Fructuoso G, Caral L, Rumia J: Neuroendoscopic management of pineal region tumours. *Acta Neurochir (Wien)* 139: 12-20, 1997
16) Marx S, Clemens S, Schroeder HW: The value of endoscope assistance during transcranial surgery for tuberculum sellae meningiomas. *J Neurosurg* 128: 32-39, 2018
17) Tanikawa M, Yamada H, Sakata T, et al.: Exclusive endoscopic occipital transtentorial approach for pineal region tumors. *World Neurosurg* 131: 167-173, 2019
18) Tanikawa M, Yamada H, Kitamura T, Sakata T, Mase M: endoscopic occipital transtentorial approach for pineal region tumor. *Oper Neurosurg (Hagerstown)* 14: 206-207, 2018
19) Liu JK: Endoscopic-assisted interhemispheric parieto-occipital transtentorial approach for microsurgical resection of a pineal region tumor: operative video and technical nuances. *Neurosurg Focus* 2016 Jan;40 Video Suppl 1:2016.1.FocusVid.15450
20) Ding Y, Sun L, Hu Y, et al.: Combined microscopic and endoscopic surgery for pineal region meningiomas using the occipital-parietal transtentorial approach. *Front Oncol* 12: 828361, 2022
21) Kawauchi D, Higuchi Y, Ikegami S, et al.: Unilateral occipital transtentorial approach with multimodal assistance for resection of large supracerebellar hemangioblastomas: preliminary experience of 2 cases. *World Neurosurg* 129: e733-e740, 2019
22) Tanikawa M, Sakata T, Yamada H, et al.: Endoscopic high occipital interhemispheric transtentorial approach for lesions in the anterosuperior cerebellum, upper fourth ventricle, and upper dorsal brain stem. *World Neurosurg* 159: e260-e266, 2022
23) Liyong S, Bao Y, Liang J, Li M, Ren J: Posterior interhemispheric transtentorial approach for resection of a meningioma at the posteromedial tentorial incisura. *Neurosurg Focus* 2016 Jan;40 Video Suppl 1:2016.1.FocusVid.15428
24) Nanda A, Patra DP, Savardekar A, et al.: Tentorial meningiomas: reappraisal of surgical approaches and their outcomes. *World Neurosurg* 110: e177-e196, 2018
25) Shahrestani S, Ravi V, Strickland B, Rutkowski M, Zada G: Pure endoscopic supracerebellar infratentorial approach to the pineal region: a case series. *World Neurosurg* 137: e603-e609, 2020
26) Watanabe T, Suematsu Y, Saito K, et al.: Selection of surgical approach for cerebellar hemangioblastomas based on venous drainage patterns. *Neurosurg Rev* 44: 3567-3579, 2021
27) Wan JQ, Cui H, Wang Y: Surgical management of large solid hemangioblastomas of the posterior fossa. *J Clin Neurosci* 18: 39-42, 2011

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