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Case Report

Usefulness of posterior transpetrosal approach for the large solid cerebellopontine angle hemangioblastoma fed from multiple blood supplies: A technical case report

Kosuke Miyahara, Tomu Okada, Shin Tanino, Yasuhiro Uriu, Yusuke Tanaka, Koji Suzuki, Noriaki Sekiguchi, Naoyuki Noda, Teruo Ichikawa, Kazuhiko Fujitsu

Department of Neurosurgery, National Hospital Organization Yokohama Medical Center, Yokohama, Kanagawa, Japan.

E-mail: *Kosuke Miyahara - kosukemiyahara@outlook.jp; Tomu Okada - t0mu0kada@yahoo.co.jp; Shin Tanino - shintanino@hotmail.com; Yasuhiro Uriu - uriu23@kme.biglobe.ne.jp; Yusuke Tanaka - y.t.0524@gmail.com; Koji Suzuki - 123456777koji@gmail.com; Noriaki Sekiguchi - d06sm054@yahoo.co.jp; Naoyuki Noda - aoyuki0506@yahoo.co.jp; Teruo Ichikawa - ichi-aya@jeans.ocn.ne.jp; Kazuhiko Fujitsu - fujitsu1944102@yahoo.co.jp

***Corresponding author:**
Kosuke Miyahara,
Department of Neurosurgery,
National Hospital Organization
Yokohama Medical Center,
Yokohama, Kanagawa, Japan.

kosukemiyahara@outlook.jp

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ABSTRACT

Background: Extra-axial cerebellopontine angle (CPA) hemangioblastomas are rare clinical entity and surgical treatment is challenging due to the anatomical difficulties and multi-directional blood supplies. On the other hand, the risk of endovascular treatment for this disease has also been reported. Herein, we successfully applied a posterior transpetrosal approach to remove a large solid CPA hemangioblastoma without preoperative feeder embolization.

Case Description: A 65-year-old man presented with a complaint of diplopia during downward gaze. Magnetic resonance imaging revealed a solid tumor with homogeneous enhancement measuring about 35 mm at the left CPA, and the tumor compressed a left trochlear nerve. Cerebral angiography disclosed tumor-staining fed by both left superior cerebellar and left tentorial arteries. After the operation, the patient's trochlear nerve palsy improved dramatically.

Conclusion: This approach offers more optimal surgical working angle to the anteromedial part compared to the lateral suboccipital approach. In addition, the devascularization from the cerebellar parenchyma can be performed more reliably than the anterior transpetrosal approach. After all, this approach can be particularly useful when vascular-rich tumors receive blood supplies from multiple directions.

Keywords: Cerebellopontine angle, Hemangioblastoma, Transpetrosal approach

INTRODUCTION

Hemangioblastomas are typically intra-axial and highly vascular tumors occurring in the posterior fossa.[11,19] A cerebellar hemangioblastoma is found in 44–72% of patients with von Hippel-Lindau (VHL) disease.[2] Extra-axial hemangioblastomas are rarely described in the literature, particularly those originating from the cerebellopontine angle (CPA).[1,2,5,7-9,11,12,14,16-18,21] Surgical results are worse for solid type than for cystic one in this location.[3,6,10] In particular, large solid CPA hemangioblastomas represent a surgical challenge because of their arteriovenous malformation-like hypervascularity, the multi-directional blood supply, the exploration of wide

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operative field, and the circumferential dissection.[5,13,14,16] Herein, we emphasize our experience with the practical use of a posterior transpetrosal approach (PTPA) to surgically resect a large solid CPA hemangioblastoma without preoperative embolization.

CLINICAL PRESENTATION

Preoperative course

A 65-year-old man presented with a complaint of diplopia during downward gaze. He was diagnosed with left trochlear nerve palsy at admission. He had no family history of VHL disease. Magnetic resonance (MR) imaging showed a well-enhancing solid mass (maximum diameter of 35 mm) in the left CPA extending superiorly to the tentorial notch [Figures 1a and b]. Cerebral angiogram revealed tumor staining fed by left superior cerebellar and left tentorial arteries [Figures 1c and d]. Preoperative diagnosis was of an extra-axial CPA hemangioblastoma. It was considered to be fixed to the tentorium and richly vascularized; therefore, resection through the retrosigmoid approach was considered technically difficult. We decided to choose a PTPA in this case without preoperative embolization.

Surgical procedure

After administering general anesthesia, we inserted a lumbar cerebrospinal fluid drain to minimize brain retraction. In the lateral park-bench position, the patient's head was turned 30° inferiorly from the vertical plane. A horseshoe-shaped skin incision and temporo-suboccipital craniotomy were made with a splitting mastoidectomy [Figure 2a]. Extradural posterior petrosectomy was carried out, and the dura mater of the presigmoid space was exposed. Subsequently, linear incision of the supra and infra-tentorial dura mater was performed, and the superior petrosal sinus was ligated and transected. The incision of the tentorium toward the free edge revealed a reddish extra-axial tumor between the cerebellum and the tentorium [Figure 2b]. The tumor was detached from the tentorium while carefully coagulating the extra-axial feeding arteries. After confirming the presence of displaced trochlear nerve in the deep part [Figure 2c], the feeding arteries from the cerebellar parenchyma were coagulated [Figure 2d] and the tumor was completely removed as a mass [Figure 2e].

Postoperative course

The postoperative course was uneventful and the pathology was confirmed as hemangioblastoma. He was discharged without any new complication, and his left trochlear nerve palsy improved after a few months. Postoperative MR imaging confirmed total excision of the tumor [Figures 3a and b] and no signs of recurrence for 8 years.

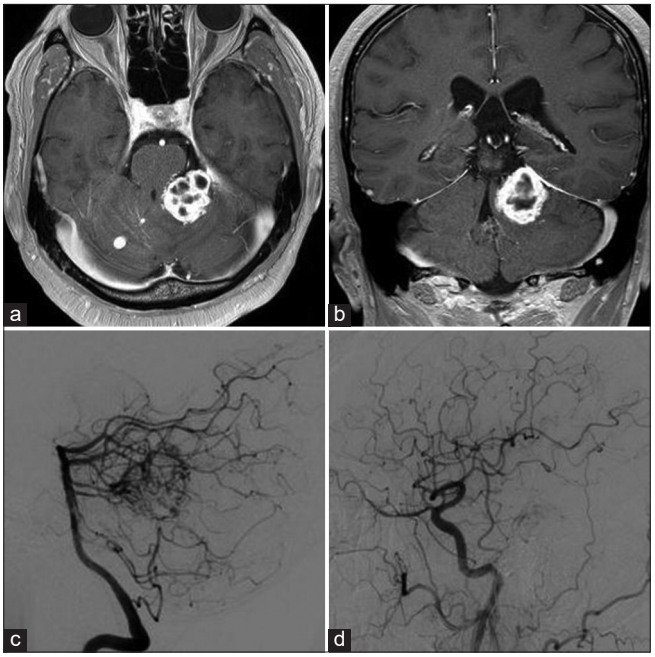

Figure 1: Preoperative magnetic resonance axial (a) and coronal (b) T1-weighted gadolinium images showing a 35 mm homogeneously enhancing solid mass in the left cerebellopontine angle. Left vertebral angiogram lateral view showing the vascular tumor fed by the left superior cerebellar artery (c) and left common carotid angiogram lateral view also showing the vascular tumor fed by the left tentorial artery (d).

DISCUSSION

Except for the cases originating from cranial nerves, 15 cases (including the present case) of CPA hemangioblastoma have been reported with MR findings [Table 1].[1,2,5,7-9,11,12,14,16-18,21] The patient's ages ranged from 12 to 70 years (mean 48.2 years), with a male: female ratio of 6:9, and no patients had VHL. The tumor type was classified as solid in six cases, solid/cystic in six, and cystic in three. The surgical strategy for CPA hemangioblastoma is completely different from that of acoustic neuroma and meningioma, so we should pay more attention to differentiation by preoperative imaging. Preoperative angiography gives us the most useful information for accurate diagnosis. Cystic hemangioblastomas can be resected as a mass using a lateral suboccipital approach. However, to perform *en bloc* resection of solid tumors, advanced surgical skills are needed, as in the surgical treatment of arteriovenous malformation. Preoperative embolization for small hemangioblastoma is effective in reducing intraoperative bleeding.[4,15,20,22,23] Polyvinyl alcohol (PVA) particles have been previously widely used as an embolic material. However, since the vascular bed is well developed in hemangioblastomas, the use of PVA is associated with an increased risk of intratumoral hemorrhage and subarachnoid hemorrhage due to venous obstruction

Table 1: Characteristics of patients with cerebellopontine angle hemangioblastoma.

S. No.	Author	Age/ sex	Size (mm)	Symptoms	Solid or cystic	Feeder	Embolization	Approach	Outcome
1.	Dow *et al.* (2002)[5]	62/F	15	Headache, ataxia	Solid/ cystic	?	None	Transcochlear + far lateral approach	Facial palsy, hearing loss
2.		64/F	20	Hearing disturbance, ataxia	Solid	PICA, AICA	PVA	Transcochlear approach	Facial palsy, hearing loss
3.	Kamitani *et al.* (2004)[7]	37/F	35	Headache, ataxia, hoarseness, dysphasia	Solid	PICA, AICA	None	Radiosurgery + retrosigmoid	Good recovery
4.	Amano *et al.* (2009)[1]	49/M	?	Hearing disturbance	Cystic	PICA, AICA	None	Retrosigmoid	Good recovery
5.	Bush *et al.* (2010)[2]	48/F	38	Tinnitus, hearing loss	Cystic	?	?	Translabyrinthine approach	Hearing loss
6.	Moon *et al.* (2014)[13]	31/M	?	Hearing disturbance	Solid	SCA, AICA	NBCA	Transcondylar fossa approach	Good recovery
7.	Nair *et al.* (2014)[16]	12/F	50	Facial palsy, hearing disturbance, ataxia	Solid/ cystic	AICA	Histacryl	Retrosigmoid	Facial palsy worsened, gag reflex
8.	Laviv *et al.* (2016)[9]	59/F	25	Headache	Solid/ cystic	SCA, tentorial artery	Onyx	Retrosigmoid	Good recovery
9.	Meena *et al.* (2016)[12]	45/F	?	Facial palsy, hearing disturbance, ataxia	Solid	PICA, ascending pharyngeal artery	Yes (material unknown)	Retrosigmoid	Good recovery
10.	Persad *et al.* (2017)[18]	42/M	?	Vertigo, diplopia	Cystic	?	None	Retrosigmoid	Good recovery
11.	Staudt *et al.* (2018)[21]	45/F	42	Headache, ataxia, vertigo, diplopia, nystagmus	Solid/ cystic	SCA, ICA	PVA	Retrosigmoid; piecemeal (+SRS)	Trochlear nerve palsy
12.	Mooney *et al.* (2019)[14]	70/F	?	Facial palsy, hearing disturbance, ataxia	Solid/ cystic	AICA, ascending pharyngeal artery	None	Posterior petrosal transotic	Facial palsy, abducens nerve palsy
13.	Lan *et al.* (2020)[8]	31/M	50	Hearing disturbance	Solid/ cystic	?	None	Retrosigmoid	Good recovery
14.	Neto *et al.* (2020)[17]	63/M	27	Facial palsy, ataxia	Solid	?	None	Retrosigmoid	Facial palsy worsened
15.	Present case (2023)	65/M	35	Diplopia	Solid	SCA, tentorial artery	None	Presigmoid posterior transpetrosal approach	Good recovery

AICA: Anterior inferior cerebellar artery, F: Female, ICA: Internal carotid artery, M: Male, MMA: Middle meningeal artery, NBCA: N-butyl-2-cyanoacrylate, PICA: Posterior inferior cerebellar artery, PVA: Polyvinyl alcohol, SCA: Superior cerebellar artery, SRS: Stereotactic radiosurgery, ?: Unlisted

after the embolization procedure.[4,20] Although N-butyl-2-cyanoacrylate has been recently used,[15] partial embolization does not reduce operative complication or morbidity.[22] Only one reported case was found describing both dural and pial blood supplies in CPA hemangioblastoma,[9] especially large CPA hemangioblastomas are difficult to remove because of limit access through a lateral suboccipital approach. To control the blood supply from the multiple direction of the

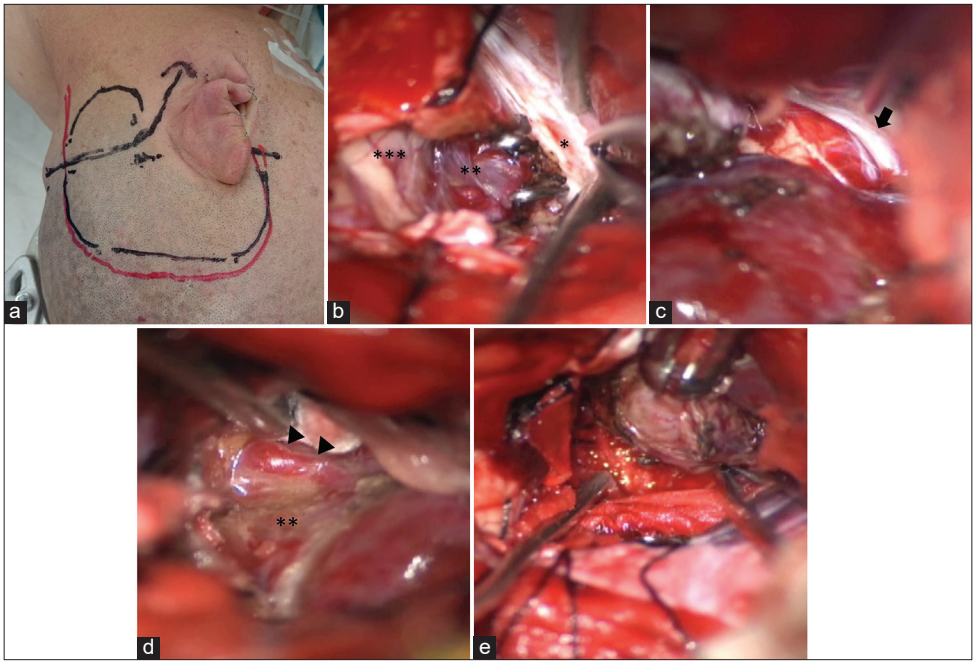

Figure 2: (a) Photograph demonstrating the scalp incision and craniotomy range. (b) The incision of the tentorium (asterisk) toward the free edge revealed a reddish extra-axial tumor (double asterisk) between the cerebellum (triple asterisk) and the tentorium. After confirming the presence of displaced trochlear nerve (arrow) in the deep part (c), the tumor (double asterisk) was detached while the feeding arteries from the cerebellar parenchyma (arrowheads) were coagulated (d), and the tumor was completely removed as a mass (e).

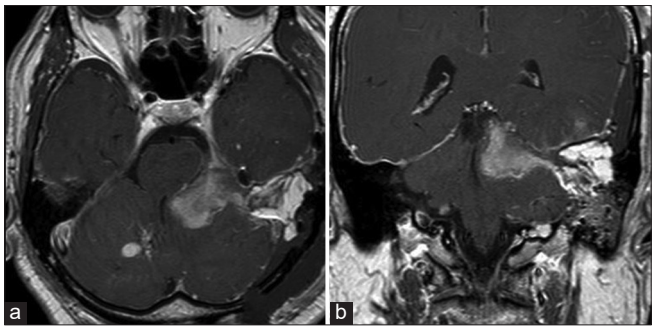

Figure 3: Postoperative axial (a) and coronal (b) T1-weighted gadolinium images confirming total excision of the tumor.

tumor, we think that skull base surgery should be used to achieve safe excision of large solid CPA hemangioblastomas. Studies have reported on transcochlear approach and a transotic approach, but these procedures are associated with an increased risk of hearing loss.[5,14] A PTPA can reach the anterior surface of the brainstem and cerebellum by drilling the posterior surface of the pyramidal bone and offer optimal surgical working angle to detach from cranial nerves and brainstem in the anteromedial part and devascularize from the cerebellar parenchyma in the posterior part without producing hearing impairment. After all, this advantage can be particularly useful when vascular-rich tumors receive blood supply from multiple directions. The use of this approach has been able to meet the challenges unlikely to be met with a lateral suboccipital approach.

CONCLUSION

Surgical strategies for CPA hemangioblastomas should be determined while considering several parameters, such as tumor's size, location, solid or cystic forms, and the number of feeders. In particular, the treatment of large solid type is difficult because of multiple feeders entering the tumor from various directions, for which a preoperative feeder embolization or a skull base approach is needed. Our report indicates the usefulness of a PTPA for large solid CPA hemangioblastomas.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

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