



Ruptured intrameatal anterior inferior cerebellar artery aneurysm associated with obstructed internal auditory artery in a patient with sudden hearing loss and vertigo

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Abstract

Background Intrameatal aneurysms arising from the meatal loop of the anterior inferior cerebellar artery (AICA) are extremely rare.

Case presentation We report a 60-year-old man presenting with severe vertigo and sudden left hearing loss associated with subarachnoid hemorrhage caused by rupture of a saccular aneurysm arising from the meatal loop of the AICA, which was entirely buried in the meatus. Intraoperatively, we identified the occluded internal auditory artery arising from the meatal loop of the AICA, where the aneurysm originated, and performed neck clipping.

Conclusion These findings suggest that internal auditory artery occlusion is a potential cause of loss of auditory and vestibular functions.

Keywords Anterior inferior cerebellar artery · Meatus · Subarachnoid hemorrhage · Tinnitus · Hearing loss · Vertigo

Background

Intrameatal aneurysms arising from the meatal loop of the anterior inferior cerebellar artery (AICA) are an extremely rare entity [1, 3–5, 7, 10, 12, 15]. Rupture of the aneurysms in this location is known to be associated with acute auditory and vestibular dysfunctions [1, 3–5, 7, 10, 12, 15], although the mechanism remains unclear. Occlusion of the internal auditory artery (IAA) may be a potential cause of the loss of auditory and vestibular functions. However, there are no reports with clear intraoperative findings in the IAA. Herein, we present a case of a ruptured, partially thrombosed intrameatal AICA aneurysm with sudden loss of auditory and vestibular functions, in which occlusion of the IAA was surgically confirmed.

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Case presentation

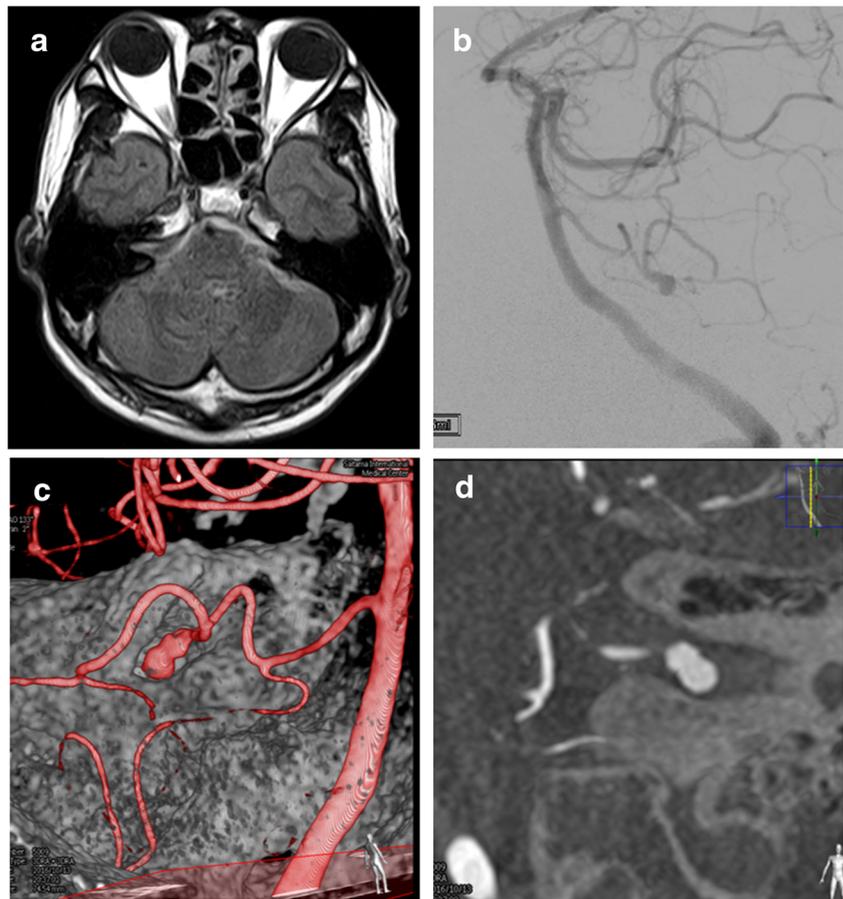
History and examination

A 60-year-old man, who had suffered from vertigo for 4 weeks, presented with sudden left hearing loss and vomiting. Neurological examination on admission revealed left hearing loss, mild upper and lower limb ataxia on the left side, and horizontal nystagmus toward the right side. Facial nerve palsy was not observed. Preoperative pure-tone average was not evaluated as the patient was mildly sedated and laid on the bed in the intensive care unit just after admission and while waiting for surgery. Magnetic resonance imaging (MRI) showed a thin subarachnoid hemorrhage localized to the prepontine and ambient cisterns (Fig. 1a). Digital subtraction angiography showed a saccular aneurysm (diameter of 6.0 mm) on the apex of the meatal loop of the left AICA (Fig. 1b, c). The aneurysm was entirely buried in the meatus (Fig. 1c, d).

Operation

The patient underwent retrosigmoid craniotomy on the day after onset, with intraoperative monitoring using facial nerve stimulation and auditory brainstem response (ABR). The left vestibular/facial nerve complex and the segment of the AICA

Fig. 1 Preoperative radiological findings. **a** Fluid-attenuated inversion recovery magnetic resonance (FLAIR-MR) imaging showing a subarachnoid hemorrhage mainly distributed at the prepontine cistern and left cerebellopontine angle. **b** Lateral view of a digitally subtracted left vertebral angiogram showing an aneurysm arising from the meatal loop of the anterior inferior cerebellar artery (AICA). **c** Three-dimensional reconstruction image of rotation angiography showing a saccular aneurysm, which is buried in the meatus, arising from the tip of the meatal loop of the AICA. **d** Coronal image of cone beam computed tomography (CT) showing the relationship between the fundus of the meatus and the aneurysm



proximal and distal to the aneurysm were exposed. The posterior wall of the meatus was drilled off and the dura was incised. An aneurysm was found protruding toward the fundus, with splitting of the superior and inferior vestibular nerves (Fig. 2a). The meatal loop of the AICA was exposed through the nerves (Fig. 2b). The dome of the aneurysm was partially thrombosed (Fig. 2c), which was then incised and the thrombosis totally resected with temporary trapping of the parent artery. The IAA originating from the meatal loop of the AICA just next to the proximal neck of the aneurysm was found to be collapsed and thrombosed (Fig. 2d). The aneurysmal neck was clipped using a titanium clip (Fig. 2e). Intraoperative indocyanine green video angiography showed good filling of the meatal loop of the AICA (Fig. 2f). No reproductive waves of the ABR to left ear stimulation were identified throughout the surgery.

Postoperative course

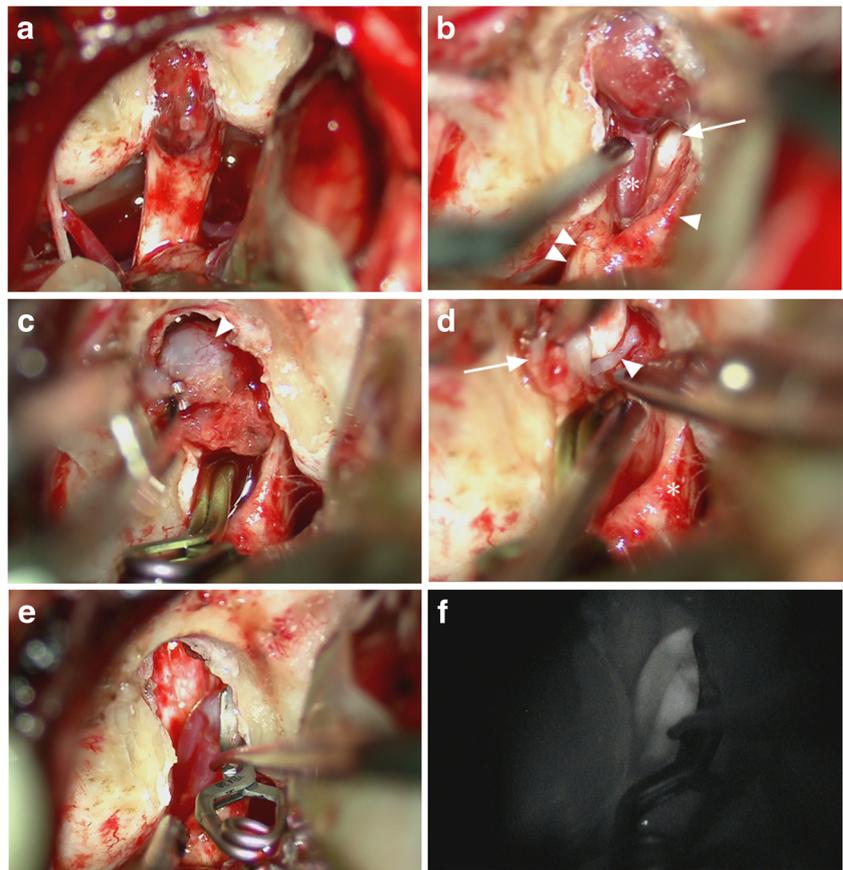
Postoperatively, the patient recovered well except for persistent hearing loss. Horizontal nystagmus completely disappeared within a few days after surgery. Vertigo and limb ataxia also improved and disappeared within

1 week after surgery. Postoperative vertebral angiography showed complete obliteration of the aneurysm (Fig. 3a). MRI showed no ischemic lesion of the AICA territory (Fig. 3b). Postoperative pure-tone audiometry revealed left deafness (Fig. 4). At 16 months after surgery, the patient was well, although his auditory dysfunction had not recovered.

Discussion

The AICA around the meatus gives rise to the IAA, which enters the internal auditory canal and supplies the facial and vestibulocochlear nerves and vestibulocochlear labyrinth [11]. Therefore, preservation of the IAA is important to preserve facial nerve and auditory functions in surgery for intrameatal AICA aneurysms, as well as for the acoustic tumor [9]. However, the IAA is rarely observed intraoperatively [5–7, 13, 14] as it is usually hidden by the aneurysm fully buried in the meatus [5], and to our knowledge, there are no reports of clear intraoperative findings in the IAA. Herein, we describe an extremely rare case in which the occluded IAA arose from the meatal loop of the intrameatal AICA where the aneurysm originated.

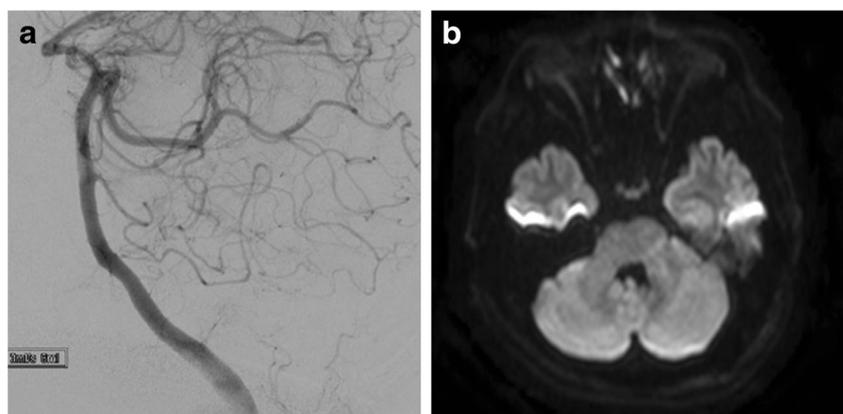
Fig. 2 Intraoperative findings. **a** An aneurysm with blood clots is exposed after unroofing of the posterior wall of the meatus. **b** After removal of the clots, the distal part of the meatal loop of the AICA (asterisk), facial nerve (arrow), superior vestibular nerve (arrowhead), and inferior vestibular nerve (arrowheads) can be seen. **c** A partially thrombosed aneurysm dome (arrowhead) was pulled from the fundus under temporary occlusion of the proximal and distal AICA by a titanium clip. **d** The collapsed internal auditory artery (arrowhead) can be seen after resection of the thrombosed dome. The arrow indicates the stump of the aneurysmal dome after resection of the majority of the dome. The asterisk shows the superior vestibular nerve. **e** A clip was applied to form the aneurysmal neck arising from the meatal loop. **f** Indocyanine green video angiography showing good filling of the meatal loop of the AICA



A wide surgical field is required to identify the IAA in a narrow intrameatal space through the nerve bundles, AICA, and aneurysmal dome. In the present case, a high jugular bulb or pneumatization of the posterior wall of the meatus was not observed. Thus, the posterior wall of the meatus was safely and widely removed. Further, we temporarily trapped the AICA, and the dome of the aneurysm was incised and resected to remove the intraaneurysmal thrombosis, which resulted in successful identification of the IAA without blood flow before neck clipping.

Ruptured intrameatal aneurysms frequently cause acute auditory and vestibular dysfunctions [1, 3–5, 7, 8, 10, 12, 15]. The proposed mechanisms include nerve compression by an intrameatal hematoma and insufficient blood flow of the IAA. In the present case, the aneurysm was partially thrombosed, which supports the notion that rupture of the aneurysm activates thrombus formation, leading to obstruction of the parent artery [2]. Audiometry of our patient was not evaluated before surgery. Thus, intraoperative monitoring using ABR was very important to assess the degree of preoperative hearing loss.

Fig. 3 Postoperative radiological findings. **a** Lateral view of a postoperative digitally subtracted left vertebral angiogram showing complete obliteration of the aneurysm. **b** Diffusion-weighted magnetic resonance imaging (DW-MRI) showing no ischemic lesion of the AICA territory



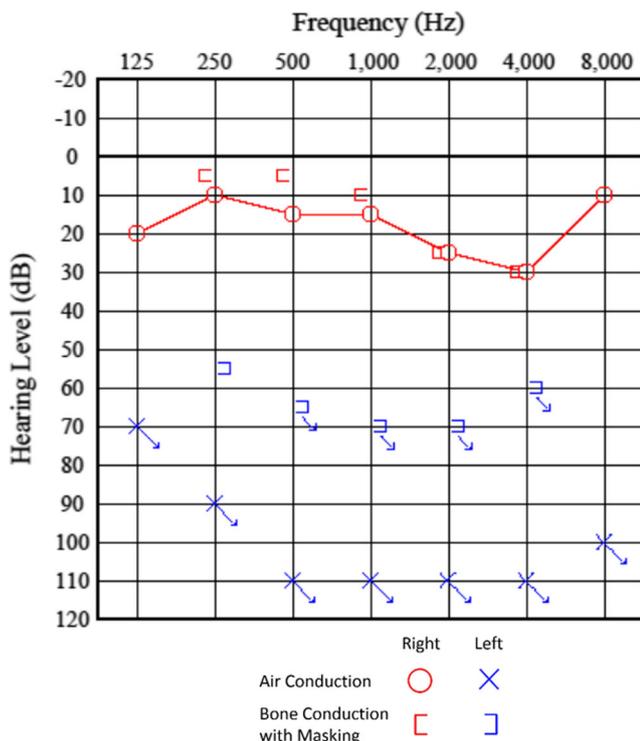


Fig. 4 Pure-tone audiometry of the patient. Audiogram showed scale out on the left

After starting the monitoring, no reproducible wave of the ABR was identified even before intradural manipulation, suggesting that left auditory function was severely impaired before surgery. Postoperative pure-tone audiogram reinforced the intraoperative ABR findings. These results are consistent with the preoperative severe hearing loss, which may have been caused by the occlusion of the IAA. Further studies are required to demonstrate the mechanism of this fairly rare condition associated with a ruptured aneurysm in this location.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from the participant included in the study.

References

1. Castaigne P, Pertuiset B, Cambier J, Brunet P (1967) Aneurysm of the internal auditory artery revealed by re-current facial paralysis. Radical cure. *Presse Med* 75: 2493–2496
2. Edner G, Forster DM, Steiner L, Bergvall U (1978) Spontaneous healing of intracranial aneurysms after subarachnoid hemorrhage. Case report *J Neurosurg* 48:450–454
3. Fukuya T, Kishikawa T, Ikeda J, Kudo S, Kuwano H, Matsumoto S, Fujii K (1987) Aneurysms of the peripheral portion of the anterior inferior cerebellar artery; report of two cases. *Neuroradiology* 29: 493–496
4. Hori T, Hirakawa K, Ishijima B, Manaka S, Fukushima T (1971) Aneurysm in the internal auditory meatus. Case report. *J Neurosurg* 35:605–609
5. Inoue Y, Matsumoto Y, Ohmiya N, Matsuoka T, Takeda S, Ohkawara S (1987) A case of ruptured internal auditory meatus aneurysm. *Surg Cereb Stroke* 15:280–284
6. Kim HC, Chang IB, Lee HK, Song JH (2015) Ruptured total intrameatal anterior inferior cerebellar artery aneurysm. *J Korean Neurosurg Soc* 58:141–143
7. Kiya K, Uozumi T, Emoto K, Matsuoka T (1989) Anterior inferior cerebellar artery aneurysm at the internal auditory meatus—case report. *Neurol Med Chir (Tokyo)* 29:592–595
8. Lee SJ, Koh JS, Ryu CW, Lee SH (2012) Ruptured intrameatal aneurysm of the anterior inferior cerebellar artery accompanying an arteriovenous malformation: a case report. *Cerebellum* 11:808–812
9. Morawski K, Telischi FF, Merchant F, Namyslowski G, Lisowska G, Lonsbury-Martin BL (2003) Preventing internal auditory artery vasospasm using topical papaverine: an animal study. *Otol Neurotol* 24:918–926
10. Okumura Y, Sakaki T, Hirabayashi H, Shimomura T (1999) Intrameatal aneurysm successfully treated by meatal loop trapping—case report. *Neurol Med Chir (Tokyo)* 39:161–164
11. Rhoton AL Jr (2003) Operative techniques and instrumentation for neurosurgery. *Neurosurgery* 53:907–934 discussion 934
12. Spallone A, De Santis S, Giuffrè R (1995) Peripheral aneurysms of the anterior inferior cerebellar artery. Case report and review of literature. *Br J Neurosurg* 9:537–541
13. Tokumitsu N, Sako K, Shirai W, Aizawa S (2004) Anterior inferior cerebellar artery aneurysm at internal auditory meatus: report of 2 cases. *Surg Cereb Stroke* 32:61–65
14. Yamakawa H, Hattori T, Tanigawara T, Sahashi Y, Ohkuma A (2004) Intracanalicular aneurysm at the meatal loop of the distal anterior inferior cerebellar artery: a case report and review of the literature. *Surg Neurol* 61:82–88 discussion 88
15. Zager EL, Shaver EG, Hurst RW, Flamm ES (2002) Distal anterior inferior cerebellar artery aneurysms. Report of four cases. *J Neurosurg* 97:692–696