Occipital Artery-Anterior Inferior Cerebellar Artery Bypass With Microsurgical Trapping for Exclusively Intra-meatal Anterior Inferior Cerebellar Artery Aneurysm Manifesting as Subarachnoid Hemorrhage

—Case Report—

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Abstract

A 77-year-old woman presented with an extremely rare exclusively intra-meatal anterior inferior cerebellar artery (AICA) aneurysm manifesting as subarachnoid hemorrhage. The aneurysm was located at a non-branching site of its meatal loop, deeply inside the internal auditory canal. The ipsilateral posterior inferior cerebellar artery was hypoplastic and the affected AICA supplied a wide vascular territory in the right cerebellum. The patient underwent microsurgical trapping of the distal AICA aneurysm in the acute stage. Collateral back flow to the parent artery was poor, so right occipital artery (OA)-AICA anastomosis was performed prior to aneurysm trapping. The postoperative course was uneventful, and magnetic resonance imaging after surgery did not demonstrate any ischemic change. Postoperative angiography showed complete disappearance of the AICA aneurysm and the apparently patent OA-AICA bypass. She did not suffer neurological deficit except for right incomplete hearing disturbance, and postoperative single photon emission computed tomography demonstrated absence of hemodynamic compromise in the cerebellum. OA-AICA anastomosis with aneurysm trapping could be the optimal surgical management of the AICA aneurysm located exclusively inside the internal auditory canal, especially if the parent artery supplies a wide vascular territory.

Key words: anterior inferior cerebellar artery aneurysm, subarachnoid hemorrhage, extracranial-intracranial bypass, occipital artery, occipital artery-anterior inferior cerebellar artery bypass

Introduction

Distal anterior inferior cerebellar artery (AICA) aneurysm is very rare, accounting for only 0.1% of all intracranial aneurysms,6,18) and intra-meatal AICA aneurysm is even more rare, with only 16 reported cases.2–5,7–10,12,16,17,19–21) Female prevalence (female/male = 15/1) is remarkable, with mean patient age of 53 years. Most patients (15/16) developed subarachnoid hemorrhage (SAH) at the onset,2–4,7–10,12,16,17,19–21) and only one presented with hearing disturbance due to the mass effect of the aneurysm.5) The pathological nature of intra-meatal aneurysm is unclear. Most cases were saccular aneurysm at non-branching sites of AICA, whereas one patient had mycotic aneurysm mimicking intracanalicular acoustic neuroma.3) Surgical management of distal AICA aneurysm includes microsurgical neck clipping and meatal loop trapping, but the optimal management procedure has not yet been determined, especially if the affected AICA supplies a wide vascular territory and the aneurysm is located deeply inside the internal auditory canal.

We treated a 77-year-old woman with ruptured distal AICA aneurysm at a non-branching site of the meatal loop, located exclusively inside the internal auditory canal. Although the parent artery supplied a wide vascular territory of the right cerebellum, the patient was successfully treated by occipital artery (OA)-distal AICA anastomosis with microsurgical trapping of the aneurysm.

Case Report

A 77-year-old woman suffered sudden onset of occipitalgia and consciousness disturbance, and was admitted to our hospital. She was semi-comatose on admission, and
computed tomography (CT) found SAH in the basal cistern and extending to the right cerebello-pontine cistern (Fig. 1A). Emergency digital subtraction angiography demonstrated a saccular aneurysm at a non-branching site of the meatal loop of the right AICA (Fig. 1B–D), which was located exclusively in the dilated internal auditory canal (Fig. 1C). Right vertebral angiography demonstrated that the right posterior inferior cerebellar artery (PICA) was hypoplastic, and the affected right AICA supplied a wide vascular territory in the right cerebellum (Fig. 1D). Right external carotid angiography demonstrated that the right posterior inferior cerebellar artery (PICA) was hypoplastic, and the affected right AICA supplied a wide vascular territory in the right cerebellum (Fig. 1D). Right external carotid angiography demonstrated that the right OA was well visualized. Because of the wide vascular territory supplied by the right AICA as well as the inaccessible location of the broad-necked aneurysm at the distal AICA, we attempted microsurgical trapping of the aneurysm with extracranial-intracranial (EC-IC) bypass during the acute stage.

Surgery was performed in the prone position under general anesthesia via right lateral suboccipital osteoplastic craniotomy one day after the onset of SAH. The foramen magnum was widely opened, and the lateral aspect of the petrous bone was thoroughly drilled out to minimize retraction of the cerebellum. After dural incision, subarachnoid clot and bloody cerebrospinal fluid were
aspirated, and the right vestibular nerve/facial nerve complex, the right AICA, and both afferent and efferent arteries of the aneurysm were explored (Fig. 2A). The right internal auditory canal was apparently dilated (Fig. 2A), probably due to the presence of the AICA aneurysm. The blood clot was tight and thick around the internal auditory canal, indicating that the intra-meatal AICA aneurysm caused the SAH. Since the aneurysm was located exclusively inside the internal auditory canal, behind the vestibular nerve/facial nerve complex, direct neck clipping of the AICA aneurysm was abandoned. Temporary occlusion of the parent artery suggested poor collateral back flow to the peripheral arteries in the right cerebellar hemisphere, so OA-distal AICA anastomosis was performed with temporary occlusion time of 28 minutes (Fig. 2B, C). After completion of the OA-AICA anastomosis, the AICA aneurysm was trapped at the internal auditory canal using titanium clips (Fig. 2D). Doppler ultrasonography indicated favorable revascularization through the OA-AICA bypass.

The postoperative course was uneventful. The patient did not show neurological deficit except for right incomplete hearing disturbance. Postoperative diffusion-weighted magnetic resonance (MR) imaging did not detect any ischemic changes (Fig. 3A), and MR angiography demonstrated an apparently patent OA-AICA bypass. N-isopropyl-p-[123I]iodoamphetamine single-photon emission computed tomography after surgery indicated absence of hemodynamic compromise in the entire cerebrum and cerebellum including the right cerebellar hemisphere (Fig. 3B). She did not develop symptomatic vasospasm, and was transferred to a local hospital one month after the onset of SAH. Postoperative right vertebral angiography showed complete disappearance of AICA aneurysm (Fig. 3C), and right external carotid angiography demonstrated an apparently patent OA-AICA bypass (Fig. 3D).

**Discussion**

In the present case, OA-AICA anastomosis with aneurysm trapping was performed to treat the distal AICA aneurysm located exclusively inside the internal auditory canal. Intra-meatal AICA aneurysms are extremely rare, with only 16 previous cases.1–4,6–10,12,13,17,19,23,24,26–28 Ten of these 16 patients were treated by microsurgical neck clipping1–4,6–10,13,17,19,23,24,26–28 by opening the meatus with extensive nerve dissection, 5 patients underwent meatal loop trapping without bypass,2–4,6,7,10,12,13,17,19,23,24,26–28 and one patient with unruptured aneurysm was managed by microsurgical packing of the internal auditory canal.5 None of the 5 patients treated by simple meatal loop trapping developed cerebellar infarction, probably due to the favorable collateral blood supplies from dominant PICA and superior cerebellar artery. In fact, the size of the infarction area after AICA occlusion is inversely related to the sizes of the PICA and superior cerebellar artery.14 In our case, the aneurysm was located deeply inside the internal auditory canal at the ventral side of the VII/VIII cranial nerve complex, and the affected AICA supplied a wide vascular territory of the right cerebellum because the ipsilateral PICA was hypoplastic. Furthermore, temporary trapping of the aneurysm resulted in marked decrease in blood flow at the distal AICA as indicated by Doppler ultrasonography, suggesting poor collateral blood flow into the vascular territory of AICA. Based on these findings, we attempted OA-AICA anastomosis prior to microsurgical trapping of the intra-meatal AICA aneurysm without causing major neurological symptoms. We did not exclude the choice of simple meatal loop trapping if the ipsilateral PICA was not hypoplastic. Nevertheless, we recommend OA-distal AICA anastomosis because this procedure may also ameliorate the risk of cerebral infarction during the period of vasospasm in patients with SAH.

Meatal loop trapping with OA-AICA anastomosis may affect small branches originating from the meatal segment of the AICA, such as the internal auditory artery, recurrent perforating artery, and subarcuate artery.13,15 In most cases, the internal auditory artery originates from the pre-meatal segment (77%), but may also originate from the meatal loop (21%) and post-meatal segment (2%).13 Thus we do not rule out the possibility that postoperative incomplete hearing disturbance was due to occlusion of the internal auditory artery, though this deficit could also result from primary brain damage caused by the SAH or from the intraoperative retraction of vestibular nerve. Occlusion of the recurrent perforating artery, which may also originate from the meatal loop, although more rarely than from the pre-meatal segment,13 could result in brain stem infarction. In our case, we did not recognize recurrent perforating artery during the surgery, and the patient did not develop brain stem infarction. None of the 5 previous patients undergoing meatal loop trapping developed brain stem infarction.2,3,7,12,13 The subarcuate artery rarely originates from the meatal segment of the AICA (4%), but occlusion could result in VII/VIII cranial nerve palsy.13 Taken together, meatal loop trapping is considered to carry acceptable risks despite the substantial risk of hearing disturbance caused by ischemia.

A subset of complex cerebral aneurysms with aberrant anatomy or fusiform/dolichoectatic morphology may require revascularization procedures as a part of the strategy for occluding the aneurysm and/or parent artery.13 EC-IC bypass using the superficial temporal artery, OA, or arterial/vein graft is a powerful additional procedure that allows favorable occlusion of such complex cerebral aneurysms without causing ischemic complications.11,13,15 OA-AICA anastomosis is another revascularization procedure suitable for ischemic cerebrovascular disease of the posterior circulation,13 but OA-distal AICA bypass with microsurgical trapping of the intra-meatal aneurysm has not previously been reported. In the present case, the diameter of the peripheral branch of the affected AICA was as large as 1.0 mm at the lateral surface of the cerebellar hemisphere, consistent with its wide vascular territory, and thorough drilling of the lateral aspect of the petrous bone and foramen magnum, together with aspiration of the cerebrospinal fluid and use of hyperosmolar agent, provided favorable working space for the OA-distal AICA anastomosis with minimum retraction of the cerebellum. These preparations allowed us to perform...
the OA-distal AICA anastomosis using standard micro-forceps. Thus, we recommend this procedure for surgically inaccessible AICA aneurysm if the parent artery supplies a wide vascular territory. In contrast, microsurgical neck clipping or aneurysm excision with end-to-end anastomosis is the first choice for distal PICA aneurysms and surgically accessible distal AICA aneurysms.

References


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