Clinical Case Report

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Surgical treatment of a posterior inferior cerebellar artery aneurysm via transcranial neuroendoscopic approach

A case report

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Abstract

Rationale: Posterior inferior cerebellar artery (PICA) aneurysms are rare and heterogeneous in both location and morphology, and the management of proximal PICA aneurysms is challenging. In 2011, Joaquim reported a successfully treated VA-PICA ruptured aneurysm using a pure endoscopic endonasal transclival approach for the first time. However, the patient suffered CSF rhinorrhea and underwent an additional operation to repair the CSF leak. In this case report, we describe the treatment of proximal PICA aneurysm by transcranial neuroendoscopic approach.

Patient concerns: A 68-year-old woman presented with a sudden onset of severe headache followed by loss of consciousness and computed tomography of the head showed a mild SAH, located predominantly in the posterior fossa. Clinical signs and symptoms included headache and a positive meningeal irritation sign; no other neurological symptoms were found.

Diagnosis: A 3-dimensional CT angiography revealed the diagnosis as left VA-PICA junction aneurysm.

Interventions: After a medical treatment, the patient regained consciousness and the aneurysm was treated by pure neuroendoscopy via a modified far-lateral surgical approach.

Outcomes: The patient recovered well after the procedure, and the post-operation image view shows a proper placement of the clip, obliteration of the aneurysm, and the parental artery was unobstructed.

Lessons: To our best knowledge, this is the first reported case of treating aneurysm by neuroendoscopic transcranial approach and the second reported case treated by endoscopy. In the present report, we propose that ruptured VA-PICA junction aneurysms could be treated by a pure transcranial neuroendoscopic approach. The advantages of this approach included no risk of CSF rhinorrhea compared with the endoscopic endonasal transclival approach.

Abbreviations: CT = computed tomography, DSA = digital subtraction angiography, PCA = posterior cerebral artery, PICA = posterior inferior cerebellar artery, VA = vertebral artery.

Keywords: aneurysms, posterior inferior cerebellar artery (PICA), transcranial neuroendoscopic approach

1. Introduction

Posterior inferior cerebellar artery (PICA) aneurysms are heterogeneous in both location and morphology and are rare; PICA aneurysms account for approximately 0.5% to 3% of all intracerebral aneurysms.[1–3] Although aneurysms can occur anywhere from the VA-PICA junction to the distal cortical branches of the PICA, most of them occur in the proximal segment of the PICA, especially at the VA-PICA junction. The management of these PICA aneurysms is challenging due to their proximity to the lower cranial nerve, high risk of rebleeding, and the presence of critical perforators supplying the medulla; these aneurysms are usually treated by both microsurgical treatments and endovascular treatments (EVT).[1,4–7]

Recently, with the improvement and application of minimally invasive techniques, a variety of vascular lesions have been treated via endoscopic procedures.[8,9] However, it is still very difficult to treat aneurysms, especially posterior circulation ruptured aneurysms. To date, only 1 patient has been reported with a proximal PICA ruptured aneurysm that was successfully clipped via an extended endoscopic endonasal transclival approach.[4] Here, we report a case of a VA-PICA junction ruptured aneurysm that was successfully clipped using a pure endoscopy via a far-lateral surgical approach. To our knowledge, this is the first case worldwide treated by a pure transcranial neuroendoscopic approach, and it is also the second case treated by endoscopy.

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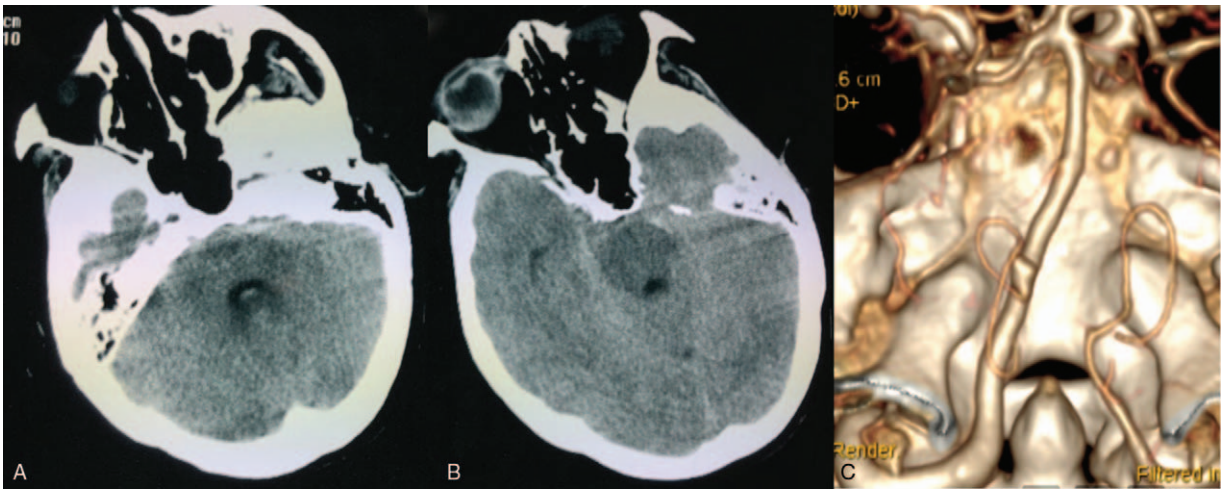

Figure 1. Pre-operation image of the patient. A–B: Pre-operative CT scan showed a mild SAH, located predominantly in the posterior fossa. C: Pre-operative CTA scan showed a saccular aneurysm at the origin of the left PICA. CT = computed tomography, PICA = posterior inferior cerebellar artery.

2. Clinical presentation

A 68-year-old woman presented with a sudden onset of severe headache followed by loss of consciousness. Soon after ictus, she was transferred by ambulance to the emergency department in a county-level hospital. Computed tomography (CT) of the head showed a mild SAH, located predominantly in the posterior fossa (Fig. 1A, B). Subsequent 3-dimensional CT angiography revealed a saccular aneurysm at the origin of the left PICA (Fig. 1C). After a medical treatment, she regained consciousness and was then transferred to our hospital 2 days later. Clinical signs and symptoms included headache and a positive meningeal irritation sign; no other neurological symptoms were found. After extensive discussion with the patient's family, she and her family chose a craniotomy to treat the aneurysm 2 days after admission.

After general anesthesia, she underwent a smaller far-lateral surgical procedure to treat the aneurysm. After opening the dura mater, a rigid endoscope (Aesculap, Germany) was introduced to the operation field, and then, the arachnoid membrane was sharply dissected to expose the left VA and the medulla. After exposing the left VA, the cranial root of PICA, the caudal root of PICA, and lower cranial nerve were identified, and then, a saccular aneurysm was recognized at the origin of the PICA (Fig. 2A–H). After carefully exposing the neck of the aneurysm, a mini titanium aneurysm clip was placed at the neck of the aneurysm (Fig. 2A–H). Then, the body of the aneurysm was

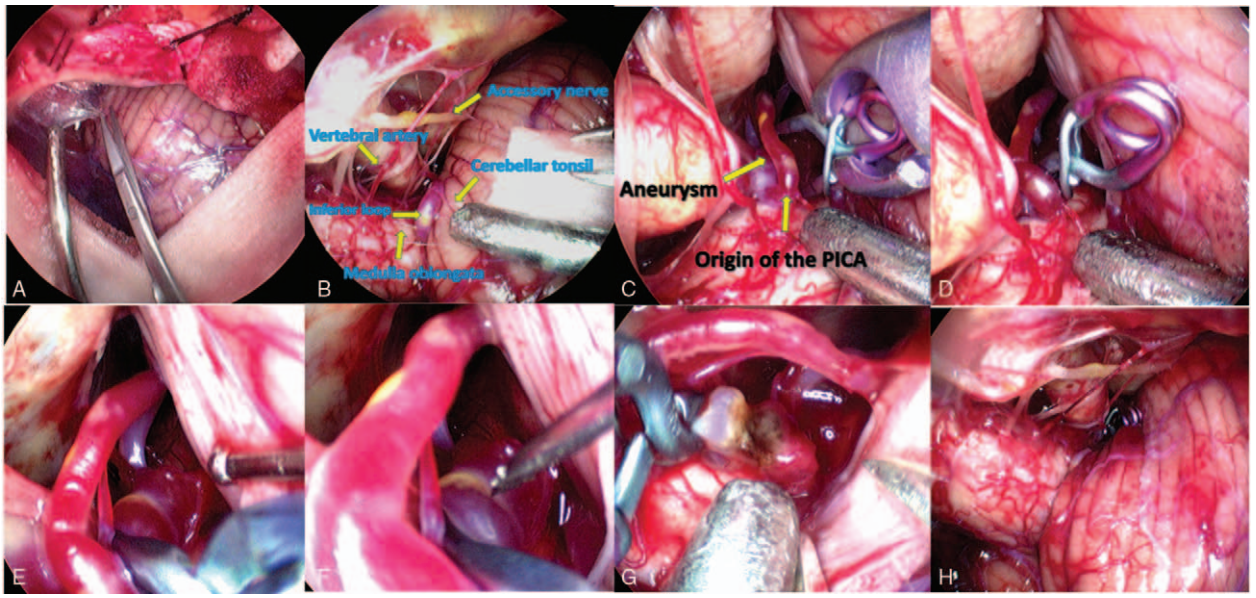

Figure 2. Operation view of the patient. A: The arachnoid membrane was sharply dissected under neuroendoscopy. B: After lifting the cerebellum, the left VA, accessory nerve, medulla, cerebellar tonsil and inferior loop of the PICA were exposed. C: The aneurysm was recognized at the origin of the PICA. D: After carefully exposing the neck of the aneurysm, a mini titanium aneurysm clip was placed at the neck of the aneurysm. E–G: Then, the body of aneurysm was checked carefully and punctured by a needle to verify completed clipping. H: Structures in the lateral perimedullary cistern were carefully checked after the aneurysm was clipped. CT = computed tomography, PICA = posterior inferior cerebellar artery.

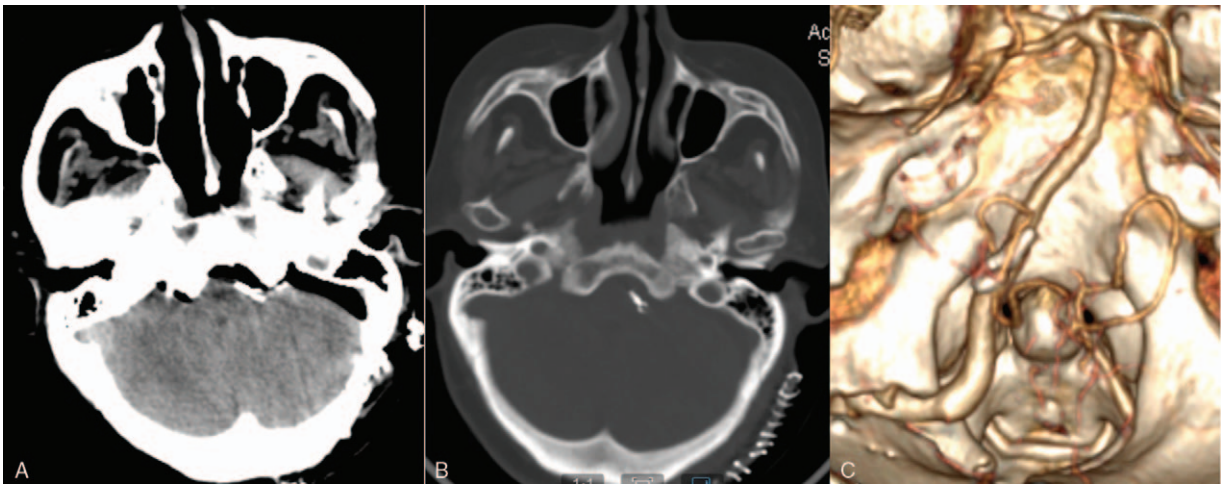

Figure 3. Post-operation image of the patient. A, B: Post-operation CT scan showing the clip of the aneurysm was at a proper placement; C: Post-operation CTA scan showed the parental artery was unobstructed. CT = computed tomography.

punctured to verify that the clipping was complete. After carefully checking the structures in the lateral perimedullary cistern under neuroendoscopy, the dura was closed, the bone flap was replaced, and the incision was sutured.

The post-operative course was uneventful, and the patient was discharged 2 weeks after surgery. The post-operation image view shows a proper placement of the clip, obliteration of the aneurysm, and the parental artery was unobstructed (Fig. 3 A–C) The patient was follow-up to 3 months and recovered well after the procedure.

Written informed consent was obtained from the patient's family for publication of this case report and the accompanying images. All procedures were approved by the ethics committee of Renmin Hospital of Wuhan University.

3. Discussion

The PICA has a complex, tortuous and variable course throughout the brainstem and cerebellum and has 5 segments that are divided based on their relationships with lower cranial nerves (LCNs), the medulla and the cerebellum. The P1 (anterior medullary) and P2 (lateral medullary) segments were defined as proximal PICA, which existed with brainstem perforators. The P3 (tonsillo-medullary), P4 (telovelo-tonsillar), and P5 (cortical segment) segments were classified as distal PICA.[10] Aneurysms originating from the origin and proximal segment of the PICA were the most common and the most difficult to treat.

Management of PICA aneurysms included EVT and direct microsurgical clipping; many factors should be considered when determining the optimal treatment.[7] Usually, EVT showed better outcomes and was thus more common for older patients, patients with poor Hunt and Hess scores, and patients who had aneurysms with a good dome-to-neck ratio. However, even after EVT, these lesions still have complications, including recanalization and regrowth. Chalouhi et al reported recurrence in 21.2% of cases, and 18.2% of cases required re-treatment in patients with selectively coiled proximal aneurysms.[11] Moreover, approximately 19% of cases resulted in procedural rupture, and 8.6% of cases resulted in combined mortality.[12] Furthermore, for aneurysms with a broad neck or those that were variable and incorporated into the PICA, it was difficult to perform EVT. Even with the advent of compliant balloon and self-expanding stents technology, EVT would never be able to offer a decompressive effect, including hematoma removal or cerebrospinal fluid drainage.[7] Thus, in cases of massive IVH or hydrocephalus, microsurgery was suggested, and other factors to determine the appropriate microsurgery included better Hunt and Hess scores and young age. However, microsurgical approaches are uniquely difficult due to the complex neurovascular anatomy of aneurysms and their close proximity to the brainstem and lower cranial nerves; lower cranial nerve palsies may occur in 20% to 60% of patients.[7] For more complex fusiform-shaped aneurysms, multiple aneurysms, and severely tortuous vessels in cases of PICA, OA - PICA bypass should also be prepared.

Hence, it is often challenging to treat PICA aneurysms by both EVT and microsurgical treatments. It has been suggested that the traditional modality is insufficient, and multimodal approaches have been reported in the literature.[7] In recent years, endoscopic skull base surgery has undergone rapid advancement, moving from pituitary surgery to more complex midline intradural tumors to treat vascular lesions.[8,9]

In 2011, Joaquim[4] reported a successfully treated VA-PICA ruptured aneurysm using a pure endoscopic endonasal transclival approach for the first time. This patient underwent endoscopic endonasal clipping of the aneurysm by the 3 senior authors, and she was discharged 8 days after surgery. However, 7 days later, the patient was readmitted to the emergency department with a CSF rhinorrhea, and the repair of a CSF leak was performed via an endoscopic endonasal approach. On the 12th day after the operation, a CT scan demonstrated a nonobstructive hydrocephalus, and a ventriculoperitoneal shunting was performed without complications. The patient was discharged 1 month after reoperation without any neurological issues.

However, since 2011, no other VA-PICA junction ruptured aneurysm has been reported to be treated by endoscopy. The case we reported in this study is the second case treated by endoscopy, and it is also the first case treated by a pure endoscopic transcranial approach in the world. The success of this case suggests that ruptured VA-PICA junction aneurysm could be

treated by a pure endoscopic transcranial approach, and seems to have advantage of no risk of CSF rhinorrhea compared with endonasal approach. However the operation procedure is difficult and adept microsurgical skill is needed.

Author contributions

Conceptualization: Qiang Cai.
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Formal analysis: Qiang Cai.
Writing – original draft: Qiang Cai.
Writing – review & editing: Qiang Cai.

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