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## Challenging Endovascular Treatment of Ruptured Proximal Posterior Inferior Cerebellar Artery Aneurysm: A Case Report

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### ABSTRACT

**Introduction** Aneurysms of the posterior inferior cerebellar artery (PICA) are rare clinical entities with a lower risk of rupture than other intracranial locations. This makes managing PICA aneurysms challenging and important for neurointerventionists to understand. In this case report, we looked at a rare case of PICA aneurysm with post-coiling rebleeding. **Case:** We reported a 51-year-old female with complaints of dizziness and vomiting. The patient was found to be hypertensive and a neurologic assessment revealed neck stiffness and left hemiparesis. A computed tomography (CT) scan of the head indicated subarachnoid hemorrhage. CT angiography (CTA) showed an aneurysm at the right proximal PICA. Although endovascular coiling was performed, the patient rebleed one month later. Following the insertion of the second coil, successful embolization was achieved, and the patient showed clinical improvement. **Conclusion:** PICA aneurysms require careful endovascular management, considering the difficulty of access due to their anatomical location. An understanding of its proper management is of paramount importance to reducing mortality.

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## INTRODUCTION

The posterior inferior cerebellar artery (PICA) aneurysm is relatively rare, accounting for about 0.5–1% of all intracranial aneurysms, and it tends to be small. Subarachnoid hemorrhage (SAH), intraventricular hemorrhage, and acute hydrocephalus are the most frequent clinical manifestations of aneurysms originating in PICA, and they are found in more than 95% of cases. An estimated 9–12% of distal vertebral or PICA aneurysms manifest with symptoms of the brainstem and lower cranial nerve mass effect.<sup>1,2</sup>

Despite being uncommon, ruptured PICA aneurysms can be particularly challenging to manage due to the anatomical variation, both in its origin from the vertebral artery and its path through the cranial nerves. Endovascular coiling is recommended with satisfactory rates of aneurysmal occlusion.<sup>2</sup>

Recently, endovascular treatment of PICA aneurysms has shown promising results. Angiography showed that patients with proximal PICA aneurysms treated with coiling had occlusion in 97%. However, post-coiling rebleeding remains possible in 1%.<sup>1,2</sup>

We reported a case of right proximal PICA aneurysm which rebleeded one month post successful coiling in our institution and presented our strategy for treating it.

## CASE

A 51-year-old female with a history of uncontrolled hypertension came to our emergency department with the chief complaint of dizziness with vomiting 13 hours prior to admission. She also complained of hearing loss in her left ear and left-sided weakness. She denied diplopia, slurred speech, and paresthesia. A history of cardiovascular or cerebrovascular diseases was absent.

During physical examination, it was observed that the blood pressure was 194/71 mmHg. The neurological examination demonstrated that the patient was fully conscious, along with the presence of neck stiffness and mild left-sided hemiparesis (muscle strength 4). There was no cranial nerve palsy.

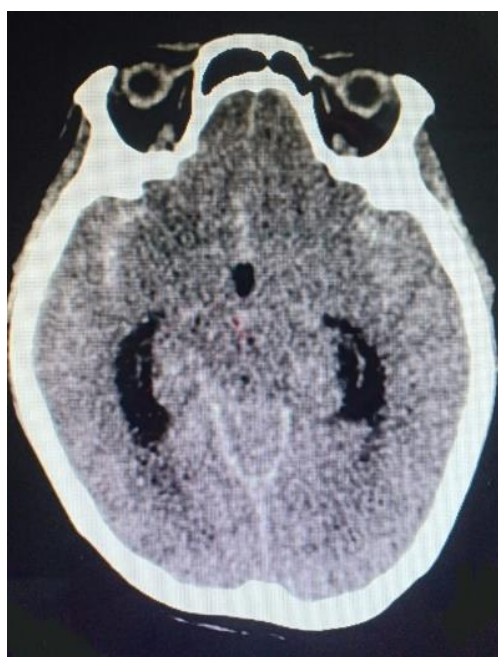


Figure 1. Head CT scan showed subarachnoid hemorrhage

Laboratory tests showed an elevated white blood cell count. The head CT scan (Figure 1) demonstrated subarachnoid hemorrhage in the basal cistern and bilateral cerebral hemispheres. 3D CT angiography showed a saccular aneurysm at the right proximal PICA branch with a dome diameter of 2.3 x 2.6 mm and a neck of 1.2 mm (Figure 2).

Due to the potential risks of surgery, simple

coiling technique was the chosen modality using a single microcatheter for treating the aneurysm. We used a 6F guiding catheter and placed the guiding catheter tip at the left VA. We used Echelon™ microcatheter and Avigo™ hydrophilic guidewire, embolized with Optima™ complex supersoft in size 2 mm x 8 cm.



Figure 2. (A) Lateral-view of cerebral Digital Subtraction Angiography (DSA) showing a PICA aneurysm at its origin, with a diameter of 2.3 x 2.6 mm, a neck of 1.2 mm, and dome-to-neck ratio of 1.9; (B) Reconstructed 3D view of the aneurysm; (C) Lateral view of the aneurysm post-coiling, showing some remnant of the neck.

The patient came to our hospital one month after coil embolization with a severe headache and vomiting. We conducted a CT scan and found that rebleeding had occurred, prompting us to recoil the aneurysm (Figure 3). We used the same procedure to perform the embolization. The aneurysm was larger and the coils inserted last month no longer occluded the neck. We recoiled with a standard Optima™ complex supersoft with a size of 5 mm x 17 cm and a helix of 4 mm x 8 cm without any remaining neck and filling 95% of the sac. Coil embolization of the ruptured PICA aneurysm was performed successfully. The patient showed clinical improvement after a few days.

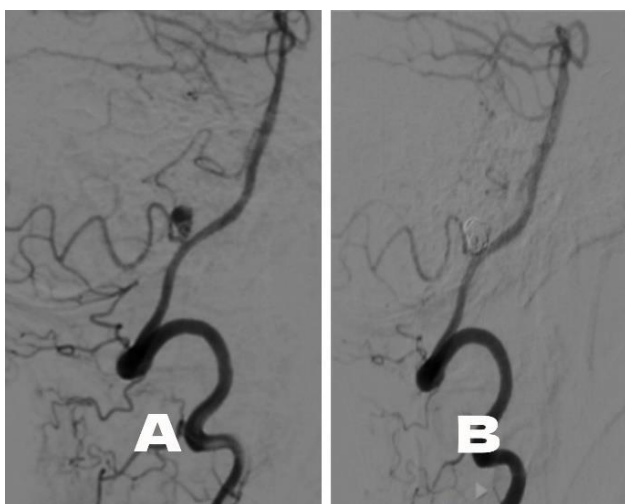


Figure 3. (A) Lateral view DSA showing the aneurysm was larger than previously, with a size 3.84 mm x 7.70 mm. (B) Aneurysm following recoiling.

## DISCUSSION

The PICA is the largest branch of the vertebral artery, emerging superior to the foramen magnum in more than 80% of the population and having the most intricate vascular trajectory compared to other cerebellar arteries. It is often distinguished into several segments based on its anatomy relative to the medulla oblongata and the cerebellum: anterior, lateral, posterior medullary, supra-tonsillar, as well as perforating branches.<sup>3</sup>

As seen in our patients, at least four out of five (>80%) PICA aneurysms develop around the PICA's origin in the vertebral artery. The mean age at onset is 46.1 years and male predominantly. Subarachnoid hemorrhage is the most prevalent disorder caused by VA and PICA aneurysms ruptured. It manifests as severe abrupt-onset headache, primarily in the occipital to neck region. Loss of consciousness, vertigo, and dizziness are commonly concomitant symptoms following the headache. In this case, the patient's initial symptom was dizziness.<sup>4</sup>

Several factors, such as the size, location, number, and shape of an aneurysm, along with the patient's age, have been known as attributing factors for the aneurysm rupture. The ratio of the maximum diameter of the aneurysm's dome to the average diameter of its parental vessel, also known as a size ratio, above 3.12 is a highly predictor for the aneurysm less-than-5-mm to rupture. Location in the posterior circulation, the presence of multiple aneurysms, the presence of a daughter sac, irregular shape, multilobulated morphology, a dome-neck ratio of  $\geq$

1.3, and younger age have also been demonstrated to contribute to aneurysmal rupture.<sup>1,5</sup> The aneurysm in our patient was in the posterior circulation, small (less than 5 mm), and had a dome-to-neck ratio of 1.9, making it prone to rupture.

The management of PICA aneurysms presents significant challenges. Various surgical techniques, such as proximal or parental artery occlusion, trapping procedures, and clip reconstruction, can be utilized where direct clip application is not feasible. Meanwhile, endovascular treatments that can be used include parental artery coil occlusion, placement of stents, and a combination of both.<sup>6,7</sup>

Due to its deep location and proximity to the lower brain stem and cranial nerves, PICA aneurysm presents unique surgical difficulties during neck clipping. In fact, a variety of post-surgical complications have been reported, including hoarseness, dysphagia, aspiration pneumonia, diplopia, and lateral medullary syndrome. A review of 52 patients with PICA aneurysms presenting with SAH who underwent direct surgery revealed a mortality rate of 50%, with only one in four (25%) patients achieving a satisfactory recovery. As a result, the surgical management of PICA aneurysms carries a high risk, regardless of whether the patient has ischemia or SAH.<sup>8,9</sup>

Endovascular therapy of PICA aneurysms has resulted in more favorable outcome because of the lower risk in injuring neighboring lower cranial nerves as well as the PICA perforating branches. Coil embolization is still the preferred treatment option for narrow-necked saccular aneurysms. Even if recurrences have been reported, a flow diverter is also an alternative method. This is perhaps due to the nature of PICA as an end vessel, which lacks collaterals that may allow the aneurysm's proximal parts to remain patent. Endovascular occlusion of the parental vessel has also been successful, especially in fusiform and distal aneurysms, because sacrificing the parental artery rarely causes neurological sequelae.<sup>10,11</sup>

In the International Subarachnoid Trial (ISAT), over 2,000 patients with subarachnoid hemorrhage from various nations were randomized to either surgical clipping or endovascular coiling. The follow-up showed that 250 out of 1,063 (23.5%) and 326 out of 1055 (30.9%) patients had an outcome of death or dependency after endovascular and surgical procedure, respectively. This represents an absolute risk reduction of 7.4% for those treated by endovascular procedures, or 74 patients for every 1,000 treated, avoiding death or dependence after one year.<sup>12</sup>

In our case, the patient came again to our center due to rebleeding. Given that the placement of the coil was unsuccessful and left a neck remnant, we assumed that the cause was inadequate packing density during the first endovascular treatment. This is not unusual;

several studies indicate that neck remnants are common after coiling, occurring in 20–60% of cases, and their presence increases rupture risk.<sup>13–16</sup> This, combined with the patient's untreated hypertension, resulted in the aneurysm regrowing.<sup>17–19</sup> The regrown aneurysm, on the other hand, was larger in dimensions than the one we initially encountered, allowing us to easily insert the microwire and successfully execute recoiling.

Rebleeding of ruptured aneurysms post-coiling is rare, occurring in around 3% of cases, but has been widely reported to be prevented by endovascular coiling. Within one year of treatment, 35 (3.3%) rebleeds post-coiling were reported in ISAT. Following the initial procedure and/or within 30 days after the procedure, 15 (1.5%) of the patients whose coils were placed in the aneurysms experienced rebleeding. Seven of them had incomplete occlusion, three had complete occlusion, and five had thromboembolic complications that required thrombolysis.<sup>12</sup>

The Cerebral Aneurysm Rerupture After Treatment (CARAT) study, which followed up 1001 patients for an average of four years, reported 19 cases of post-coiling rebleeding. The median period between treatment and rebleeding was three days, and in 58% of cases, rebleeding led to death. The study found a strong association between the degree of aneurysmal occlusion post-coiling and the risk of rebleeding, as well as a higher risk of rebleeding after endovascular coiling than surgical clipping. However, following adjustment, no significant difference in rebleeding risk was found.<sup>20</sup>

## CONCLUSION

This is a rare case of post-coiling rebleeding PICA aneurysm. Several factors need to be considered in the management of PICA aneurysms, such as adequate packing density and hypertension management to prevent the risk of regrowing and rebleeding.

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## Conflict of Interest

The authors have no conflicts of interest to disclose.

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## Author Contributions

BTP, RGK, and BR were involved in the study concept and design. BR, PRW, and KTG were



involved in the literature review as well as the writing of the manuscript. All authors contributed to the revision of the manuscript and approved of the submitted manuscript.

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