

Parent Artery Occlusion for a Dissecting Posterior Cerebral Artery Aneurysm in the P4 Segment Presenting with Ischemic Stroke and Rapid Growth: A Case Report

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Abstract

A dissecting aneurysm in the P4 segment of the posterior cerebral artery (PCA) is extremely rare, and its treatment is sometimes challenging. Endovascular parent artery occlusion (PAO) was performed for an unruptured P4 segment dissecting PCA aneurysm presenting with ischemic stroke and rapid growth. A 70-year-old man was rushed to our emergency department due to a right-sided headache and a visual field defect. Head magnetic resonance imaging showed a right occipital lobe ischemic stroke, with right PCA occlusion and aneurysm formation in the P4 segment. The diagnosis was PCA dissection in the calcarine artery, and oral aspirin was started. Within a week, the dissecting aneurysm had enlarged progressively to 6.2 mm in diameter. Thus, PAO with coils was performed as a preventive measure against aneurysm rupture, assuming that complication risks were low because the tributary area of the dissecting PCA had already infarcted. A 6-Fr guiding sheath was introduced from the right brachial artery to the right vertebral artery, and a microcatheter/microguidewire was placed into the true lumen of the calcarine artery distal to the aneurysm. PAO with coils was performed, and the blood flow to the aneurysm was completely obliterated. After the treatment, the known infarction in the right occipital lobe was enlarged, but no new neurological symptoms developed. The patient was discharged independently on postoperative day 3. Treatment for a distal PCA dissecting aneurysm is challenging. PAO with coils is one of the reasonable choices, especially when a visual field defect has already developed.

Keywords: intracranial artery dissection, dissecting aneurysm, posterior cerebral artery, parent artery occlusion

Introduction

Aneurysms of the posterior cerebral artery (PCA) are relatively rare, accounting for about 0.7%-2.3% of all intracranial aneurysms.^{1,3)} Dissecting PCA aneurysms are also quite rare, and the most common locations are the P1 and P2 segments.^{4,5)} Dissection can occur between the intima and media and between the media and adventitia. Both

dissections may result in aneurysms of various shapes.^{5,6)} Treatment of dissecting PCA aneurysms is challenging because of the severe ischemic complication risks for posterior circulations. For ruptured cases, surgical or endovascular intervention is necessary to prevent rebleeding. Meanwhile, conservative therapy is acceptable for unruptured cases, although some unruptured cases safely treated with endovascular technique have been reported.^{4,9)} An ex-

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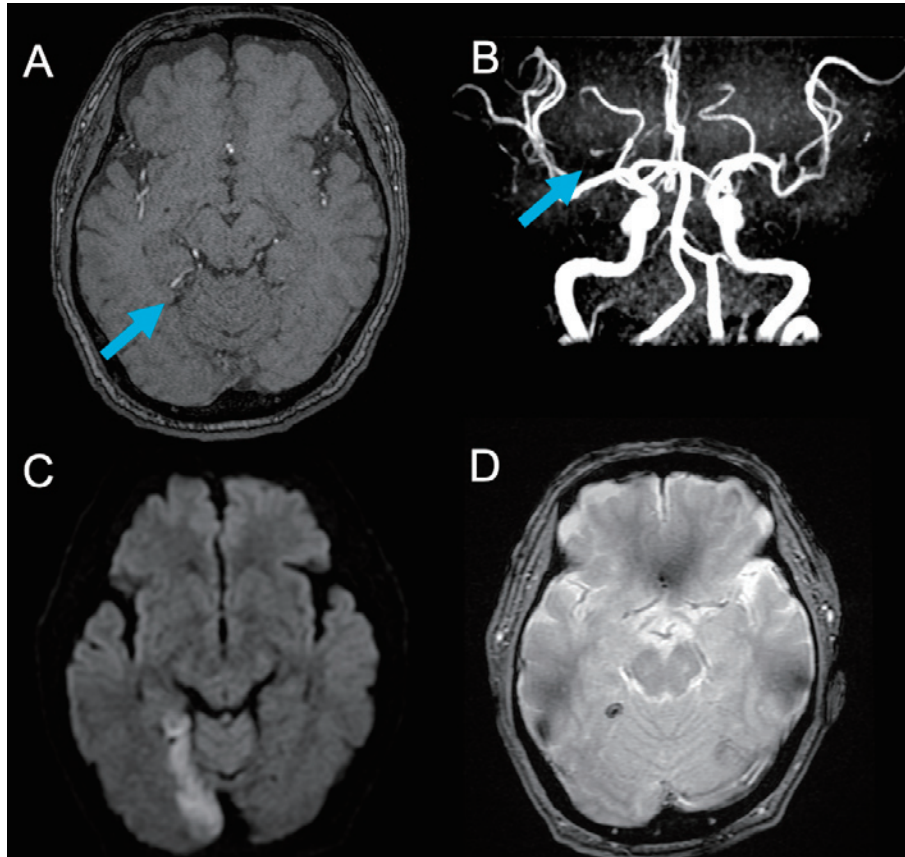


Fig. 1 (A, B) The magnetic resonance imaging performed on day 1 (admission day) shows that the proximal part of the right calcarine artery is stenotic, and the distal part is occluded with aneurysm formation (arrow) on the upper surface of the tentorium. (C) Diffusion-weighted image shows acute infarction in the territory of the calcarine artery in the right occipital lobe. (D) T2* gradient echo shows thrombosis in the aneurysm.

tremely rare case of an unruptured P4 segment dissecting PCA aneurysm, presenting with ischemic stroke, grew rapidly within several days after onset and was treated by endovascular parent artery occlusion (PAO). The treatment strategy is discussed along with a literature review.

Case Report

A 70-year-old man presenting with a sudden onset of a headache and a visual field defect was brought to our emergency department. These symptoms manifested abruptly the day before his admission. The pain was localized on the right side and persisted continuously. Initially, he observed these symptoms for a day but called for an ambulance as it persisted. He did not have any history of head trauma, and his past medical history included only essential hypertension. He did not have a history of smoking or drinking. His family history was not remarkable for cerebral aneurysm or connective tissue disease. He was alert and conscious. Neurological examination showed left upper quadrantanopia, but it was otherwise intact. Head magnetic resonance imaging (MRI) showed right occipital

lobe infarction and right PCA occlusion at the P4 segment (Fig. 1). He received a diagnosis of acute ischemic stroke with a suspected embolic mechanism. Despite conducting electrocardiogram telemetry monitoring, transthoracic echocardiogram, and laboratory tests, no suspicious findings for atrial fibrillation, blood streambloodstream infection, or vasculitis were revealed. Consequently, oral antiplatelet therapy with aspirin at a dose of 100 mg/day was initiated.

On day 4 after the onset, a follow-up head MRI showed that the affected vessel had enlargement just proximal to the occluded part, and computed tomography angiography on day 6 indicated further progression of the enlargement. Considering the morphological changes observed in the affected artery, similar findings as the “pearl and string sign” observed in the initial MRI, and the characteristics of his headache, we concluded that the diagnosis was an ischemic stroke resulting from spontaneous dissection and aneurysm formation in the calcarine artery.

Digital subtraction angiography (DSA) was performed on day 7. It showed fusiform aneurysm formation on the dissecting PCA, and its size had been rapidly growing to 5.7



Fig. 2 (A) Magnetic resonance angiography (MRA) taken on day 1 and (B) MRA taken on day 4 show enlargement of the dissecting aneurysm in the right calcarine artery. (C) Computed tomography angiography on day 6 shows that the aneurysm is further enlarged.

mm in the maximum diameter within a few days (Figs. 2 and 3A). No findings could indicate an intimal flap or double lumen. Upon consultation with the patient, internal trapping by endovascular coiling was chosen because of the considerable rupture risk and the expectation that PAO would not worsen the symptoms because the territory of this cortical branch had already been infarcted.

On day 11, endovascular coiling was performed under general anesthesia. The aneurysm size increased (6.2 mm), exceeding that on day 7 (Fig. 3A-C). A guiding sheath (FUBUKI Dilator Kit: 6-Fr 90-cm Asahi Intecc, Aichi, Japan) was introduced from the right brachial artery to the right vertebral artery, the dominant side of the vertebral arteries, because catheter placement was difficult through the femoral artery to the right vertebral artery. A microguidewire (Synchro SELECT Standard: 0.014" 215 cm, Stryker, Kalamazoo, MI, USA) was introduced to the true distal lumen of the calcarine artery across the dissecting aneurysm. A microcatheter (GREACH: 1.7 Fr 157 cm, Tokai Medical Products, Aichi, Japan) was placed into the true lumen of the calcarine artery distal to the aneurysm (Fig. 3D). The distal part and the proximal part of the calcarine artery were 0.7 mm and 1.4 mm in diameter, respectively, and the dissecting aneurysm had a depth of 6.2 mm, a width of 5.1 mm, and a height of 4.2 mm. PAO and aneurysm trapping were performed with 12 detachable coils. The flow in the aneurysm and the calcarine artery was completely obliterated (Fig. 3E). No collateral flow into the calcarine artery territory was observed in the late arterial phase (Fig. 3F, G).

After treatment, the patient showed no deterioration in his visual field defect and no other neurological deficit. A head MRI taken posttreatment showed obliteration of the calcarine artery and dissecting aneurysm. The known infarction in the right occipital lobe was enlarged, but no infarction in other vessel territories emerged (Fig. 4). The patient was discharged on postoperative day 3, and aspirin therapy was discontinued. DSA performed six months after the treatment showed no recurrence of the PCA dissecting aneurysm.

Discussion

Several studies have reported that the most common location of dissecting PCA aneurysms is the P2 segment, and almost all reported dissecting PCA aneurysms were proximal to or at the P2-P3 junction.^{3-6,9)} The proximal PCA and the tentorial incisura free edge have an intimate relationship. Trauma or stress on the arterial wall of the PCA along the tentorial edge may have developed dissecting PCA aneurysms.^{5,6)}

The current case involves a P4 segment fusiform aneurysm presenting with an ischemic stroke. The P4 segment usually refers to the two terminal branches of PCA: the parieto-occipital and calcarine arteries. A PCA dissecting aneurysm in P4 is rare, possibly because the P4 segment has little mobility in the cerebral sulcus. Using the search terms "posterior cerebral artery dissecting aneurysm," "posterior cerebral artery dissection," or "P4 aneurysm" in PubMed, only a few cases of fusiform/dissecting aneurysm in P4 have been found to be reported in the English literature.^{3,10)} In the present case, the vessel lumen constricted immediately after the PCA bifurcation into the parieto-occipital and calcarine arteries and before the calcarine artery enters the calcarine sulcus, where the calcarine artery runs close to the upper surface of the tentorium (Fig. 1). A traumatic mechanism between the calcarine artery and the tentorium may have caused the dissection.

Treatment options for ruptured dissecting aneurysms include neck clipping or trapping with or without bypass as surgical treatment, including aneurysm sac coiling, PAO with coils, proximal occlusion resulting in flow reversal, or flow diversion as endovascular therapy. With endovascular device and technique developments, many cases are treated through endovascular therapy. In several case series, PAO with coils was commonly employed to treat dissecting PCA aneurysms, with relatively good outcomes.^{4-6,9,11,12)} However, a review of 20 studies by Kocaeli et al. reported that 22% of therapeutic PCA occlusions were associated with permanent neurological deficits, and new neurological symptoms developed least often after PAO at

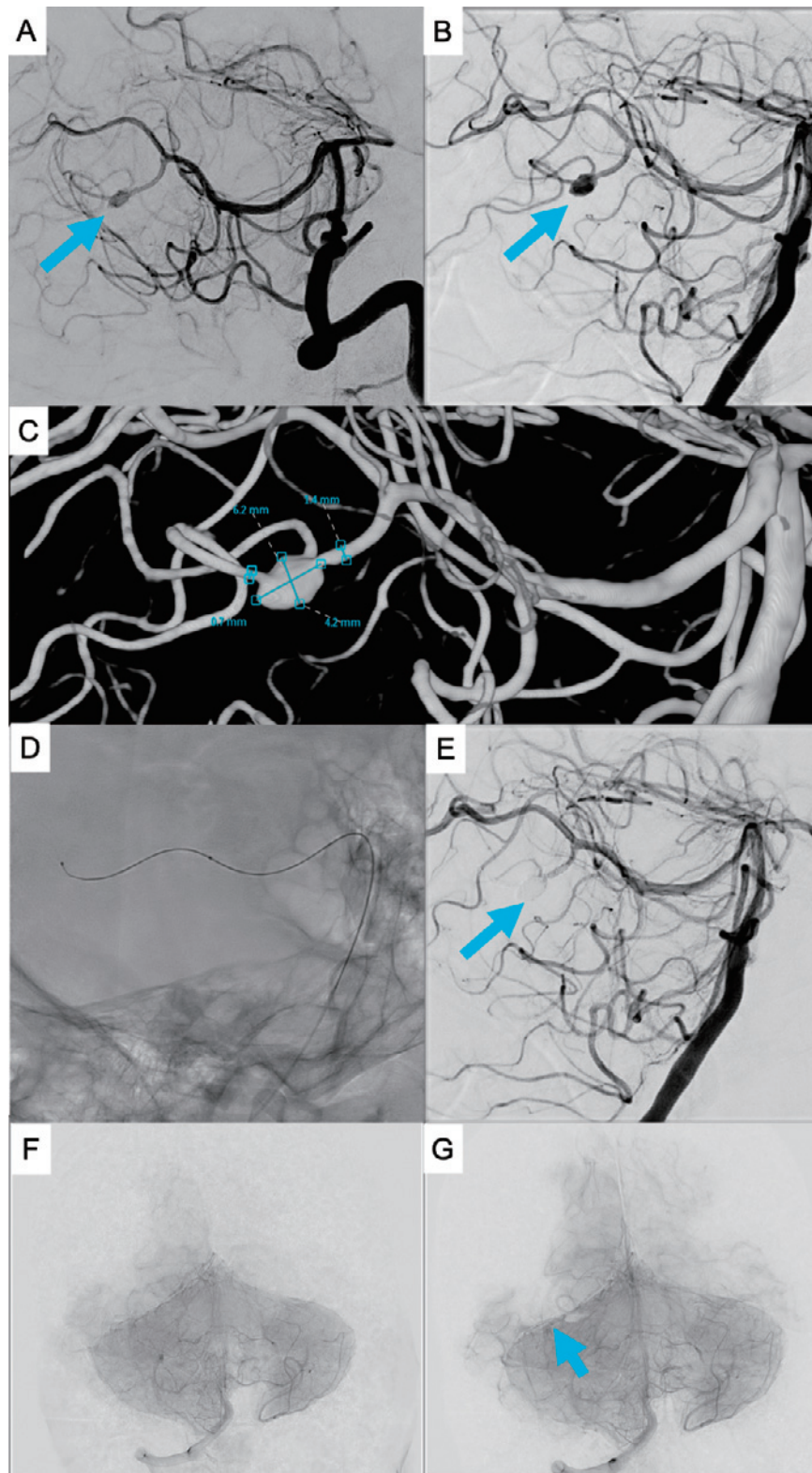


Fig. 3 (A) Digital subtraction angiography performed on day 7 shows a fusiform aneurysm in the right calcarine artery. (B) On day 11, when internal trapping is performed, the aneurysm becomes slightly enlarged. (C) Its depth, width, and height are 6.2 mm, 5.1 mm, and 4.2 mm, respectively. (D) A microcatheter is placed into the true distal lumen in the calcarine artery, and parent artery occlusion (PAO) with detachable coils is performed. (E) The flow into the aneurysm has disappeared with the preservation of the branch just proximal to the aneurysm. (F) Preoperative right vertebral artery (VA) angiography and (G) postoperative right VA angiography show no collateral flow in the territory of the right calcarine artery in the late arterial phase after PAO.

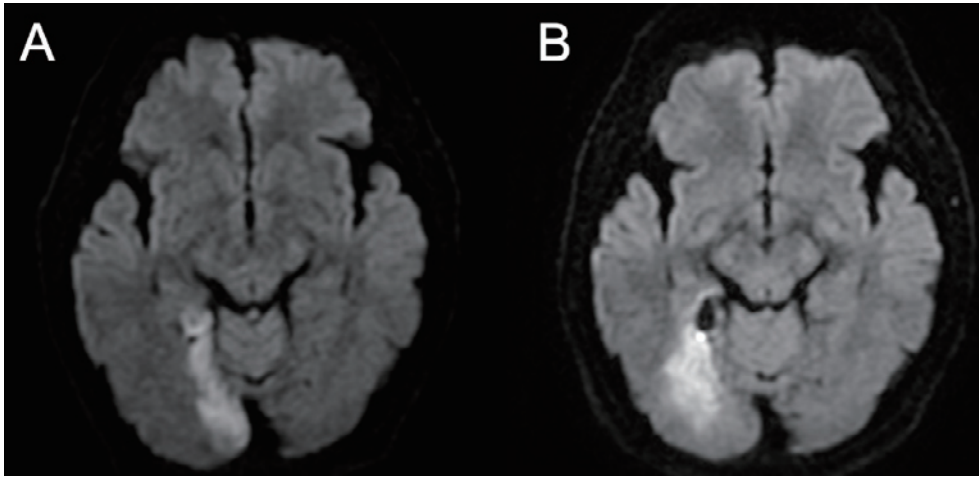


Fig. 4 (A) Diffusion-weighted image (DWI) taken before treatment on day 1 and (B) DWI after treatment on day 12 shows enlargement of the right occipital lobe infarction in the tributary area of the right calcarine artery. The aneurysm already embolized with coils shows low signal intensity.

the P2 and P3 segments and most often after PAO at the P1-2 junction and P4 segment.^{5,13} To reduce the risk of ischemic complications, Park et al. reported the efficacy of balloon test occlusion (BTO). In their case series, 60% of the patients who underwent PAO without BTO developed PCA territory infarctions, whereas 20% of the patients who received PAO after passing the BTO experienced PCA territory infarctions.⁶ For unruptured dissecting aneurysms, conservative management is acceptable^{5,7,8} since most dissections heal spontaneously within 3-6 months with medical treatment, and dissecting aneurysms are usually stable.¹⁴ Conversely, large or growing aneurysms are typically treated. The optimal timing for intervention remains unclear, but careful observation is crucial, considering the past reports of dissecting aneurysms exhibiting growth over several months to even a year.^{3,5,6,12,15}

In our case, PAO with coils was performed because the aneurysm grew rapidly, and the right occipital lobe had already infarcted, presenting with a visual field defect. The outcome was acceptable considering that the aneurysm was completely occluded, and no new neurological symptoms developed, despite the infarction enlarged after PAO. Reconstructive strategies, including trapping with bypass, stent-assisted coiling, and flow diversion, are challenging for P4 dissecting aneurysms due to their unfamiliar location for direct surgery and small parent vessel diameter (0.7-1.4 mm in the present case) for stenting. Chang et al. reported a high complication rate (53%) with the occipital artery-to-PCA bypass procedure to treat distal PCA aneurysms and concluded that bypass should be reserved for patients who are not in poor condition, without a preoperative visual field defect, and who do not pass BTO.¹⁶ Stent-assisted coiling using low-profile stents might be feasible. Kim et al. reported the safety and efficacy of stent-assisted coiling for cases with small parent arteries.¹⁷ How-

ever, applying their results to the present case requires caution because the median parent artery diameter was 1.78 mm, and the smallest diameter was 1.15 mm in their series, which is much larger than the distal diameter of the parent artery in the present case (0.7 mm). In addition, they excluded dissecting aneurysms. Stent placement into the dissected aneurysmal segment has a greater risk of perforation and rupture than conventional microcatheter/microguidewire navigation.⁵ Thus, reconstructive techniques' benefits and potential risks must be evaluated for each case.

Conclusion

Endovascular PAO could be a treatment option for distal PCA dissecting aneurysms, especially when a visual field defect has already developed. Reconstructive techniques to preserve the parent artery should be performed with deliberate consideration of the benefits and risks of potential complications.

Informed Consent

The consent from the participant was obtained.

Conflicts of Interest Disclosure

The authors declare no conflicts of interest.

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