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Case Report

Primary coiling of a wide-neck unruptured aneurysm in the trifurcation of the P2 segment of the posterior cerebral artery: A case report ☆,☆☆

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ABSTRACT

Intracranial aneurysms are now treatable with coils, stents, and flow diverters in recent years. For saccular aneurysms with broad necks and short domes, stent-assisted coiling has become a common technique, but over time, the complications—both intraprocedural and in a delayed fashion—occur more frequently than coiling alone. Nonstent or balloon-assisted coiling results in lower aneurysm recanalization, lower aneurysm rupture or re-rupture, or lower aneurysm retreatment. This paper illustrates a successful coiling of wide-neck unruptured aneurysm in the trifurcation of the left P2 posterior cerebral artery done without the assistance of stents or balloons.

Introduction

Brain aneurysm, an abnormal dilatation of cerebral vessels' anterior wall, is a condition that is estimated to be found in 2.8% of the population. Although aneurysm rupture occurs only in 0.25% of all aneurysms, it can result in stroke or even death [1]. One of the treatment options of brain aneurysm is endovascular treatment which includes coiling. For wide-neck aneurysm, defined as aneurysm neck diameter of 4 mm or greater or dome-to-neck ratio of less than 2, the coiling procedure can be done with the assistance of a balloon or stent to prevent the protrusion of the coil into the parent artery [2]. Balloon- and stent-assisted coiling, unfortunately, are not without any complications, as they may cause thrombus formation and thromboembolic events. In this manuscript, we describe a patient with a wide-neck unruptured aneurysm in the trifurcation of the P2 segment treated with coiling using 3D coils and without assistance of stents or balloons.

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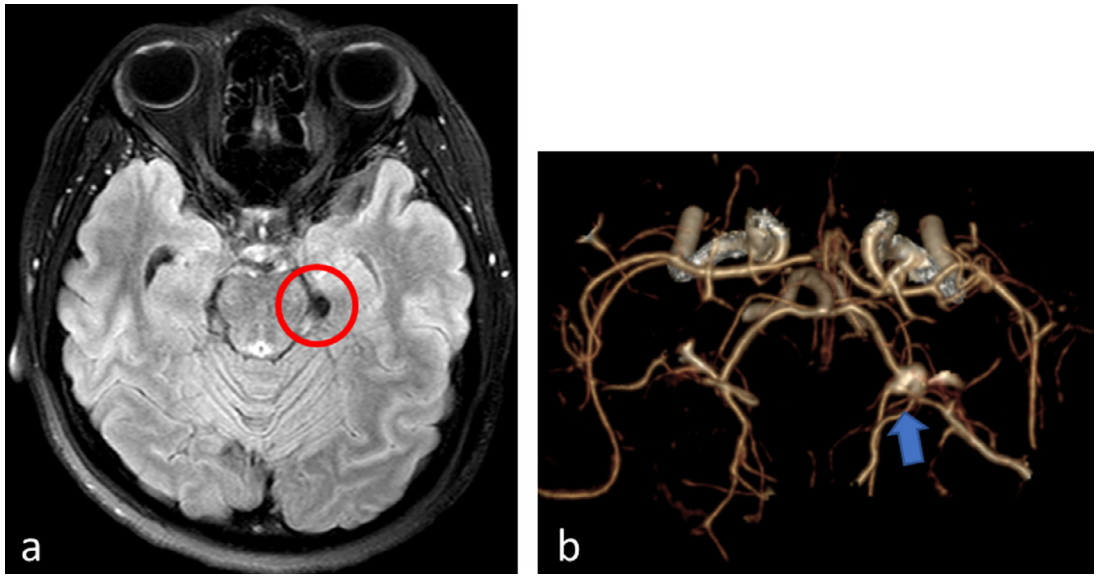

Fig. 1 – (A) The patient's FLAIR sequence of brain MRI. A saccular flow void is visualized at the left paracistern (red circle); (B) an aneurysm is visualized by CTA at the trifurcation of the left P2 posterior cerebral artery, located at a similar site as the brain MRI (blue arrow).

Case report

A 28-year-old woman presented with persistent chronic headaches and auditory hallucinations. No hemiparesis was reported. Her laboratory results were normal. The patient had no history of subarachnoid hemorrhage, neurological deficits, hypertension, diabetes mellitus, head trauma, or drug abuse. Her brain MRI showed an incidental finding of an aneurysm in the left posterior circulation (Fig. 1A). From the contrast-enhanced CT angiography, the aneurysm had saccular shape and was in the trifurcation of the left P2 posterior cerebral artery (Fig. 1B).

The patient then underwent a DSA diagnostic examination in a conscious state for measurement and mapping of the aneurysm. An introducer sheath was inserted for the access to the carotid artery. With the help of a guidewire, a vertebral catheter was placed in the internal carotid artery. DSA results showed a wide-neck saccular type aneurysm in the trifurcation of the P2 segment of the left posterior cerebral artery, which branches into the medial inferior temporal artery, posterior inferior temporal artery, and distal branches of P2 posterior cerebral artery (Fig. 2).

The endovascular coiling procedure was performed under general anesthesia. An angiography catheter was placed in the left vertebral artery, then rotational angiography with 3-dimensional (3D) image reconstruction using Innova 3100 (GE Healthcare, Innova 3100, BUC France) was conducted to establish the aneurysm location and configuration, which eventually determines the procedure plans for the working position. The depth, height, and width of the aneurysm were measured by the 3D reconstructed angiographic images. The diameters of the distal P2 segment and proximal P3 segment of the left posterior artery were approximately 1.6 mm and 1.4 mm, respectively. The aneurysm neck diameter was 4.4 mm, while its dome width and height were approximately 5.1 mm and 5.3 mm, respectively. The dome-to-neck ratio was 1.15 and its aspect ratio was 1.20 (Fig. 3). Based on these measurements, it was found that the dome diameter was greater than the neck diameter. Therefore, 3D coiling was possible without the assistance of stents or balloons.

A 6 Fr Fargomax guiding catheter (Balt, France) was placed in the basilar artery and a 1.7 Fr Excelsior SL-10 microcatheter (Stryker, United States), with a Microvention Traxcess 14 EX guidewire (Terumo, Japan) was placed in the left posterior cerebral artery. Coiling was done using 3D Optima Coil System Complex-10 Supersoft 5 mm × 8 cm (Balt, France), 3D ev3 Axium Prime 4 mm × 8 cm (Medtronic, US), 3D Optima Coil System Complex-10 Supersoft 4 mm × 6 cm (Balt, France), Optima Coil System Helical-10 Supersoft 4 mm × 6 cm (Balt, France), and Microvention HydroSoft Helical-10 3 mm × 6 cm (Terumo, Japan) respectively (Fig. 4). After every coiling, a DSA was performed to ensure there was no protrusion into the parent artery. The placement of fully packed coils in the aneurysm sac without any protrusion was shown in the final DSA (Fig. 5). The procedure was successful and did not cause any complications. After the procedure, aspirin (80 mg) and clopidogrel (75 mg) were given orally for 6 months, followed by lifetime aspirin (80 mg).

Discussion

Optimal management of unruptured aneurysms remains controversial. However, aneurysms' dimensions smaller than 10 mm are excellent candidates for coiling [2]. The coils will alter the blood flow pattern, which then lead to thrombosis. The decision for coiling is based on aneurysm morphology, aneurysm parent vessel relationship, patient preference, and

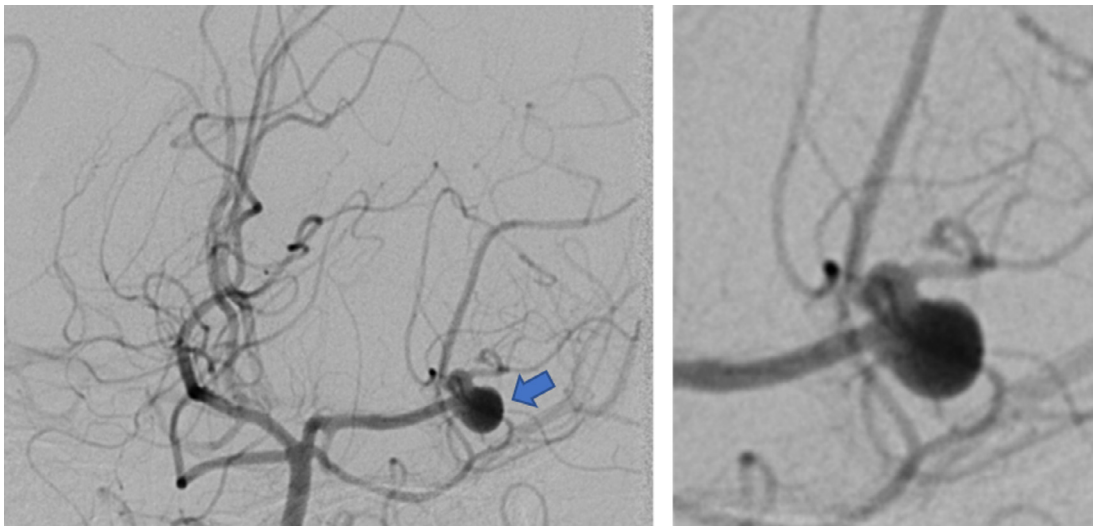

Fig. 2 – The same aneurysm, located in the trifurcation of the left P2 posterior cerebral artery, as shown by DSA.

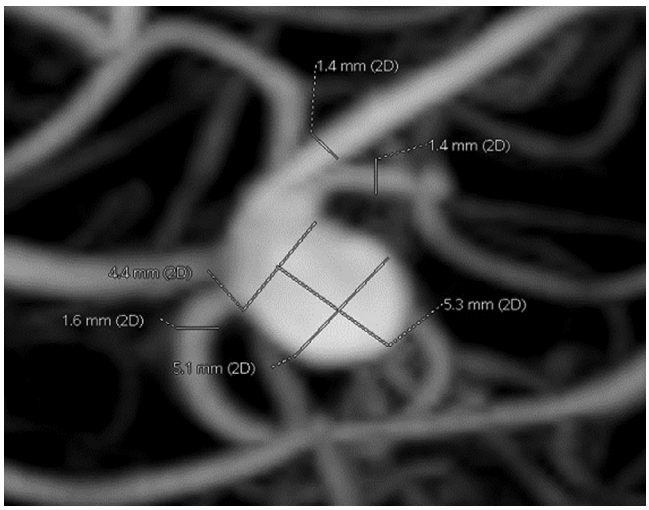

Fig. 3 – The measurement of the aneurysm's dimensions was done using a 3D image reconstruction of the DSA.

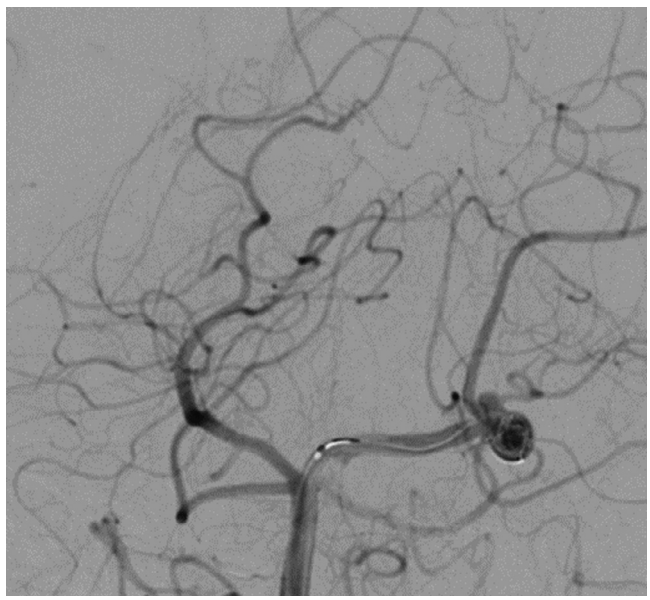

Fig. 4 – The insertion of coils into the aneurysm. The tip of the microcatheter is positioned in the aneurysm sac at the trifurcation of the left P2 posterior cerebral artery during the insertion of coils.

patient's comorbidities. Wide-neck aneurysms can be coiled with or without the assistance of balloons [3].

In this patient, an aneurysm in the left posterior circulation was incidentally found on brain MRI. Therefore, a CT angiography (CTA) examination was performed to determine the location of the aneurysm. CTA is one of the modalities that can be used for the diagnosis as well as the screening of unruptured aneurysms. The sensitivity ranges from 53% (95% confidence interval [CI], 44%-62%) for 2 mm aneurysms up to 95% (95% CI, 92%-97%) for 7 mm aneurysms, while the overall specificity is around 98.9% (95% CI, 91.5%-99.99%) [4]. This patient was treated because the persistent headaches impaired her quality of life.

A study by Papadopoulos et al. [5] explained potential difficulties during the procedure in relation to aneurysm morphology, such as size and the location of the aneurysms. The usage of stents promotes neointimal growth, leading to progressive aneurysm occlusion. In this case, the coiling was done by adjusting the shape of the aneurysm from 3D image reconstruction. After the procedure, the coil did not obstruct the parent artery.

The aneurysm in this case is treated using 3D coils as they have superiority over helical coils regarding homogenous aneurysm filling because of their conformability. 3D coils are stiffer than helical coils because of their configuration, but they can decrease the recanalization rate of embolized

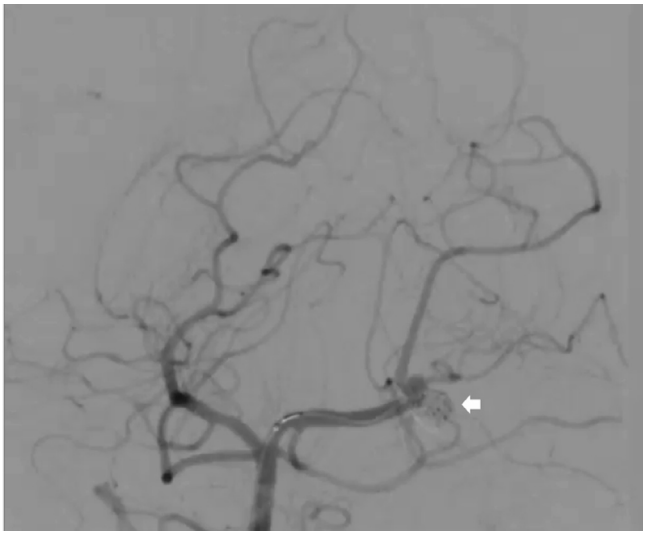

Fig. 5 – Final DSA after 5 coils were packed into the aneurysm. There is no blood flow into the aneurysm as well as protrusion of coils into the parent artery (white arrow).

aneurysms, shown by follow-up imaging after 6 months as reported by Lubicz et al. [6].

Several posterior cerebral aneurysm cases have also been reported [7–9]. In these cases, the aneurysms were treated with a number of modalities, including embolization, coiling, as well as the use of stents and flow diverters. Cases treated with these modalities show favorable outcomes, both clinically and radiologically. However, several complications may arise from the use of the aforementioned modalities to treat posterior cerebral aneurysms, which included stroke and intracranial hemorrhage. To date, no articles were found regarding the use of coiling without stents or balloons to treat posterior cerebral aneurysms.

Primary coiling may pose several complications during or after the procedure. The rate of procedure-related complications ranges from 1% to 19%, with the most common complication being thromboembolic events. Thromboembolic events may occur because of the metal surface of the stents. Several studies, which compared stent-assisted coiling (SAC), coiling alone, and balloon-assisted coiling (BAC), showed similar periprocedural complications. Long-term complications of coiling, such as in-stent stenosis and recanalization after SAC, remain a controversy as reports show a variable rate of complications, with in-stent stenosis ranging from 1.2% to 5.3% and recanalization ranging from 10% to 13.9% [10].

In a meta-analysis study, complications due to SAC and coiling alone were thromboembolism, transient ischemic attack, aneurysm rupture, coil protrusion, coil fracture, and migration of the coil. This study found no significant difference in the occurrence of complications between stent-assisted and coiling alone (17.6% and 15.9%, respectively) [11]. Wang et al compared the outcomes and complications between traditional coiling, SAC, and BAC. Aneurysms treated with stents have better clinical outcomes than traditionally coiled or BAC groups, but no significant differences were found in the rates of complications [12].

Dual antiplatelet therapy using a combination of 80 mg aspirin and 75 mg clopidogrel was given for 6 months after the procedure, followed by a lifelong single antiplatelet. However, evidence regarding the use of antiplatelet for the prevention of thromboembolic events in the coiling procedure of unruptured aneurysms is still limited and there are currently no guidelines that strongly recommend antiplatelet therapy for coiling of unruptured aneurysms [13–16].

In this case report, the aneurysm was successfully treated by coiling without the assistance of stents or balloons. Coiling itself is still possible if the width of the dome was wider than the neck of the aneurysm as it prevents protrusion of the coil into the parent artery.

Conclusion

Primary coiling of a wide-neck unruptured aneurysm in the trifurcation of the P2 segment of the posterior cerebral artery has been successfully performed. There were no complications reported during and after the procedure. From this case, 3-dimensional coiling without stents or balloons is still possible if the width of the dome of the aneurysm is greater than its neck. This coiling technique may be used as a treatment method for complex aneurysms in the P2 posterior cerebral artery.

Author declaration

Intellectual property

We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, with respect to intellectual property. In so doing we confirm that we have followed the regulations of our institutions concerning intellectual property.

Research ethics

Written consent to publish potentially identifying information, such as details or the case and photographs, was obtained from the patient(s) or their legal guardian(s).

Authorship

All listed authors meet the ICMJE criteria. We attest that all authors contributed significantly to the creation of this manuscript, each having fulfilled criteria as established by the ICMJE.

One or more listed authors do(es) not meet the ICMJE criteria.

We believe these individuals should be listed as authors because:

We confirm that the manuscript has been read and approved by all named authors.

We confirm that the order of authors listed in the manuscript has been approved by all named authors.

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Patient consent

The authors have obtained consent from the patient for their data, including their medical history and imaging studies, to be published in this case report.

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