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Surgical Neurology International

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SNI: Neurovascular

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Case Report

Usefulness of Y-shaped PulseRider-assisted coil embolization for basilar artery tip aneurysm with a misaligned axis: A case report

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Received: 27 May 2023
Accepted: 09 August 2023
Published: 25 August 2023

DOI
10.25259/SNI_449_2023

Quick Response Code:

ABSTRACT

Background: Endovascular treatment of wide-necked bifurcation aneurysms remains challenging. Although the advent of PulseRider and Web has expanded treatment options, aneurysms with a large deviation from the parent artery axis remains difficult to treat. We present the case of a wide-necked bifurcation aneurysm that was misaligned with the angle between the long axis of the parent artery and the aneurysm and was successfully treated with Y-shaped PulseRider-assisted coil embolization.

Case Description: A 64-year-old woman presented with an unruptured basilar tip aneurysm. Cerebral angiography showed a wide-necked aneurysm measuring 8.1 mm × 6.1 mm, neck 5.7 mm. The aneurysm was strongly tilted to the right and posterior relative to the basilar artery, and the bilateral posterior cerebral artery (PCA) and superior cerebellar artery (SCA) diverged from the aneurysm body. PulseRider-assisted coil embolization was performed. A Y-shaped PulseRider was selected to be placed in a hybrid fashion with the right arch in the aneurysm and the left arch in the branch. Adequate coil embolization with preservation of the bilateral PCA and SCA was possible, and cerebral angiography immediately after the treatment showed slight dome filling. Cerebral angiography 6 months after the procedure showed that the embolic status had improved to complete occlusion.

Conclusion: For wide-neck bifurcation aneurysms with a misaligned axis, a Y-shaped PulseRider used in a hybrid fashion, in which the leaflet on the side with the tilted axis is placed in the aneurysm, allows the PulseRider to be deployed more closely to the aneurysm, thereby enabling good coil embolization.

Keywords: Coil embolization, PulseRider, Wide-neck bifurcation aneurysm

INTRODUCTION

Endovascular treatment of intracranial wide-neck aneurysms is widely performed due to advances in devices.[2,7] However, the endovascular treatment of wide-necked bifurcation aneurysms remains challenging, even with advances in endovascular therapy, due to low occlusion rates and high complication rates.[3] Although the advent of PulseRider (Cerenovus, New Brunswick, NJ, United States (USA)) and Web (Microvention/Terumo, Aliso Viejo, California, USA) has expanded treatment options, aneurysms that are misaligned with the angle between the long axis

of the parent artery and the aneurysm are still considered difficult to treat.[4,11] We present a case of a wide-necked bifurcation aneurysm that was misaligned with the angle between the long axis of the parent artery; this aneurysm was successfully treated with Y-shaped PulseRider-assisted coil embolization.

CASE PRESENTATION

A 64-year-old woman with a head injury incidentally showed an unruptured basilar tip aneurysm on magnetic resonance angiography. Cerebral angiography showed a wide-necked aneurysm measuring 8.1 mm × 6.1 mm; neck, 5.7 mm, at the basilar artery (BA) tip. The aneurysm was strongly tilted to the right and posterior relative to the BA, and the bilateral posterior cerebral artery (PCA) and superior cerebellar artery (SCA) diverged from the aneurysm body [Figures 1a and b].

Because branch preservation with conventional stent-assisted coil embolization is difficult, we decided to perform PulseRider-assisted coil embolization. A Y-shaped PulseRider was selected to be placed in a hybrid fashion with the right arch in the aneurysm and the left arch in the branch. The patient received dual antiplatelet therapy with 100 mg aspirin and 75 mg clopidogrel 2 weeks before treatment. Under general anesthesia, an 8 Fr-long sheath was inserted into the right femoral artery. After inserting an 8 Fr Roadmaster (Goodman, Aichi, Japan) into the left subclavian artery, a 6-Fr Navien (Medtronic, Minneapolis, MN, USA) was inserted into the left distal vertebral artery as an intermediate catheter. A Headway27 (Terumo Corporation, Tokyo, Japan) was selected as the microcatheter in anticipation of torque transfer and support to the PulseRider, and the Headway was guided proximal to the BA tip aneurysm. Although somewhat difficult, a PulseRider (10Y/2.7-3.5, Cerenovus, New Brunswick, NJ, USA) was deployed in a hybrid fashion as planned [Figure 2a]. A Phenom 17 (Medtronic, Minneapolis, MN, USA) was placed in the aneurysm through a PulseRider leaflet. A 6 mm × 20 cm GALAXY (Cerenovus, New Brunswick, NJ, USA) was inserted into the aneurysm as a framing coil. The aneurysm neck was covered by the PulseRider, and the barrel view showed no deviation of the coil into the parent artery [Figure 2b]. Eight coils measuring 75 cm in length were added, and successful embolization was achieved. Cerebral angiography immediately after treatment showed slight dome filling [Figure 2c], and bilateral PCA and SCA blood flow was normal. No neurological symptoms were observed. The patient was discharged with a modified Rankin Scale score of 0. Cerebral angiography 6 months after the treatment showed that the embolic status had improved to complete occlusion [Figure 2d]. No delayed neurological symptoms were observed during the follow-up.

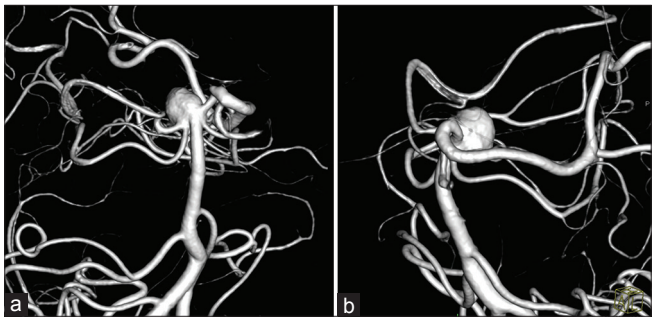

Figure 1: Cerebral angiography showing a wide-necked aneurysm measuring 8.1 mm × 6.1 mm; neck, 5.7 mm, at the BA tip. (a and b) The aneurysm is strongly tilted to the right and posterior relative to the BA, and the bilateral PCA and SCA diverge from the aneurysm body. BA: Basilar artery, PCA: Posterior cerebral artery, and SCA: Superior cerebellar artery.

DISCUSSION

Despite advances in endovascular treatment, coil embolization of wide-neck bifurcation aneurysms remains challenging.[12] These aneurysms have two important branches bifurcating near the aneurysmal neck, which must be protected

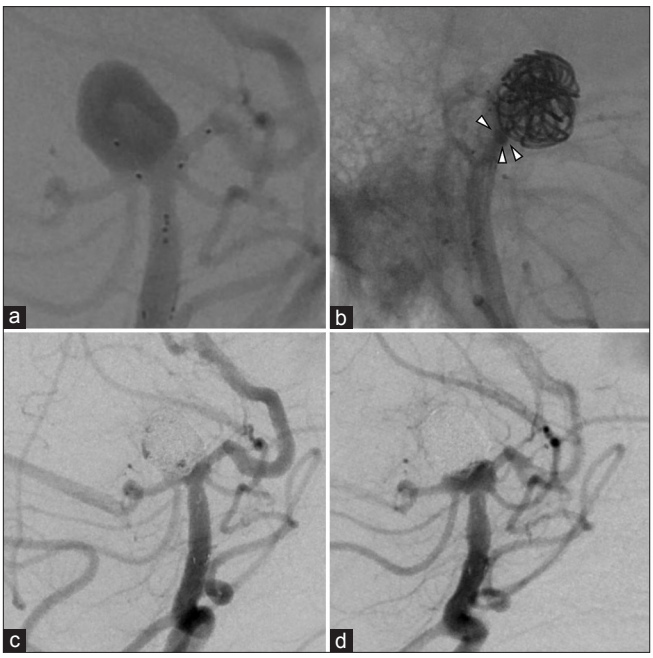

Figure 2: (a) A PulseRider (10Y/2.7–3.5) is deployed in a hybrid fashion with the right arch in the aneurysm and the left arch in the PCA as planned. (b) The aneurysm neck is covered by PulseRider, and the barrel view shows no deviation of the coil into the parent artery (arrowhead). (c) A cerebral angiography immediately after treatment showing slight dome filling, and bilateral PCA and SCA blood flow is normal. (d) A cerebral angiography 6 months after the treatment showing that the embolic status had improved to complete occlusion. PCA: Posterior cerebral artery and SCA: Superior cerebellar artery.

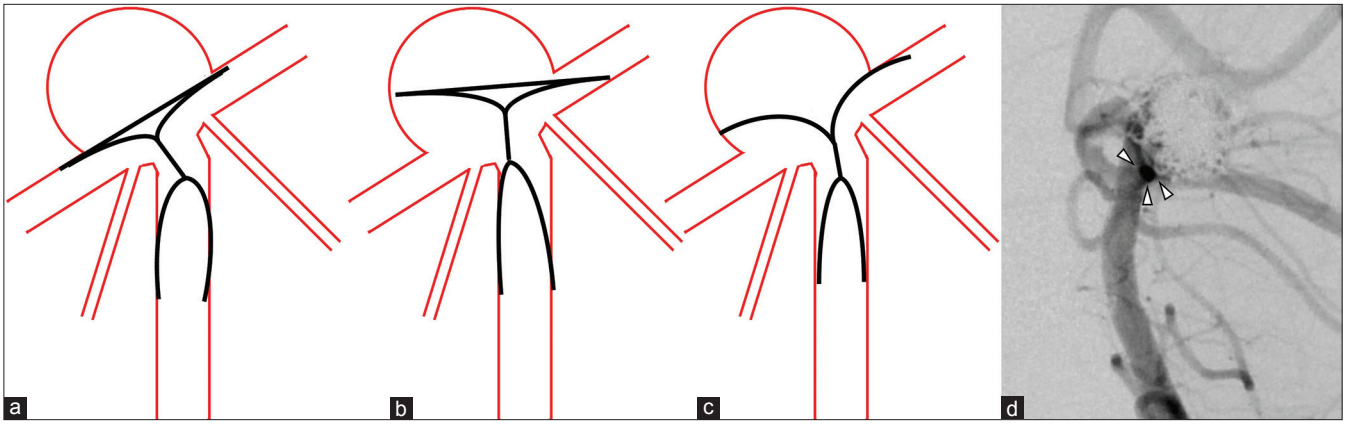

Figure 3: (a) When the aneurysm is displaced to the left or right in relation to the axis of the parent artery, it is ideal to place the PulseRider in the extra-aneurysm position. (b) However, this is often difficult, and hybrid placement should also be considered. (c) The Y-shaped PulseRider can adhere more closely to the neck than the T-shaped PulseRider. (d) Cerebral angiography immediately after treatment shows no coil deviation in the parent artery in the barrel view (arrowhead).

during embolization. Simple and single-stent-assisted coil embolization may result in inadequate embolization of the aneurysm, and branch preservation may be difficult. The Y-stent technique is advantageous because coil embolization can be performed while preserving multiple parent blood vessels. However, stent deformity or deviation in the stent-overlapping region may increase the risk of thrombotic complications.[5] A horizontal stent is also an option for BA tip aneurysms, which provided that the posterior communicating artery is well developed.[1] However, this method has limited options for retreatment in case of recurrence after treatment. Based on the above, we considered the possibility of incomplete treatment and the risk of postoperative thrombosis if conventional treatment was used and planned PulseRider-assisted coil embolization in this case.

The efficacy and safety of the PulseRider in intracranial wide-neck aneurysms have been demonstrated in a meta-analysis.[8] Spiotta *et al*. reported that aneurysms in which the axis of the parent artery is misaligned with that of the aneurysm are challenging.[11] Spiotta *et al*.[11] reported that when the aneurysm is displaced to the left or right in relation to the axis of the parent artery, it is ideal to place the PulseRider in the extra-aneurysm position [Figure 3a]; however, this is often difficult, and hybrid placement should also be considered [Figure 3b]. In this case, the Y-shaped PulseRider was selected based on the idea that it can adhere more closely to the neck than the T-shaped PulseRider [Figure 3c]. Because the aneurysm was tilted to the right relative to the parent artery, a hybrid implantation was performed with the right arch placed in the aneurysm and the left arch in the PCA. Similarly, Spiotta *et al*.[11] reported PulseRider-assisted coil embolization when an aneurysm was displaced anteriorly and posteriorly relative to the parent artery. They stated that in such cases, the neck of the aneurysm is located obliquely along the saddle of the PulseRider, but if proper framing is chosen, the branching vessel will be protected.[11] In this case, the neck was oblique to the saddle, but there was no deviation of the coil into the parent artery in the barrel view due to the neck-bridge effect [Figure 3d].

There are few reports on the long-term efficacy of PulseRider-assisted coil embolization. In a report comparing the results of a Y-stent technique and PulseRider-assisted coil embolization, there was no difference in adequate occlusions immediately after treatment, but cerebral angiography 6 months later reported significantly less complete occlusion with PulseRider and significantly more worsening of the embolic conditions with PulseRider.[6] In contrast, in the Adjunctive Neurovascular Support of Wide-Neck Aneurysm Embolization and Reconstruction trial, adequate occlusion progressed from 79% immediately after treatment to 90% after 1 year of treatment, without recurrences during the same period.[10] A single-center case series after PulseRider-assisted coil embolization reported an increase in complete occlusion from 12.5% to 75% over 2 years with no recurrence or complications.[9] In this case, cerebral angiography performed 6 months after the procedure showed an improvement in the embolic state. Hybrid implantation of the leaflet on the side with the tilted axis into the aneurysm allows the PulseRider to be placed closer to the aneurysm neck, which may lead to strong contact between deployed coils and the leaflet of the PulseRider. Consequently, this treatment method may contribute to an improved embolization state and reduced postoperative recurrence.

CONCLUSION

Here, we described a case of coil embolization using a Y-shaped PulseRider with good results for a BA tip aneurysm misaligned along the axis with the parent artery. By placing the leaflet with a tilted axis into the aneurysm, the PulseRider can be placed closer to the aneurysm, which is expected

to provide effective embolization and reduce the risk of recurrence.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The author(s) confirms that there was no use of Artificial Intelligence (AI)-Assisted Technology for assisting in the writing or editing of the manuscript and no images were manipulated using the AI.

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How to cite this article: Shibuya K, Hasegawa H, Suzuki T, Fujiwara H, Shibuma S, Shida K, *et al.* Usefulness of Y-shaped PulseRider-assisted coil embolization for basilar artery tip aneurysm with a misaligned axis: A case report. Surg Neurol Int 2023;14:300.