CASE REPORT

Treatment of wide-necked basilar tip aneurysm not amenable to Y-stenting using the PulseRider device

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SUMMARY

Endovascular treatment of broad-necked bifurcation aneurysms remains challenging. Stent-assisted coiling has been successful but requires catheterization of the branches off the parent vessel. We present the case of a patient who failed primary and stent-assisted coiling of a large basilar tip aneurysm because the morphology of the aneurysm precluded successful distal catheterization of the posterior cerebral artery (PCA) branches. Using the PulseRider device, which does not require catheterization of bifurcation branches, we were able to treat the aneurysm successfully.

BACKGROUND

The array of endovascular techniques for the treatment of cerebral aneurysms is expanding at a rapid

rate. As a result of improvements in catheter and device technology as well as cumulative clinical experience, the vast majority of aneurysms are now able to be treated safely and effectively through endovascular treatments alone. Broad-necked bifurcation aneurysms, however, represent a subset for which coiling remains challenging. The morphology of these aneurysms prohibits the use of standard coiling techniques and may require multiple assistive stents and/or balloons. While these aneurysms have been successfully treated using scaffolding techniques such as 'Y' stenting, these approaches still require catheterization of the bifurcation branches.

In this report we present the case of a patient who failed multiple attempts at endovascular

Figure 1 Large basilar tip aneurysm with broad-based neck. (A) Incidentally discovered large basilar tip aneurysm with a broad neck that incorporated the origins of the posterior cerebral arteries (PCAs). The aneurysm had a maximal dimension of 13 mm with a 7 mm neck. (B) Post dual microcatheter coiling angiogram. (C) MR angiogram showed recanalization and sharp angulation of the PCA origins due to dysplasia at the aneurysm base. (D) Angiogram confirmed recanalization, with incorporation of both the superior cerebellar artery and PCA origins into the aneurysm neck.

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Figure 2 PulseRider stent-assisted coiling of basilar tip aneurysm. (A, B) Initial angiogram showed significant recurrence around the base of the aneurysm. The dysplastic base with incorporation of the bilateral posterior cerebral arteries (PCAs) and superior cerebellar arteries (SCAs) is seen. (C) PulseRider deployment into the neck of the aneurysm with protection of the PCA origins. (D, E) Following endovascular coiling showing tight coil packing and robust PCA flow with no residual contrast within the aneurysm dome.

treatment for a large basilar tip aneurysm, including dual microcatheter coiling, balloon-assisted coiling, and stent-assisted coiling, who was ultimately treated with a PulseRider stent device. The previous procedures had failed to achieve adequate coil packing density due to an inability to safely scaffold the posterior cerebral artery (PCA) branches. This case highlights the unique applicability of a stent design that does not require branch catheterization, without which this patient would not have undergone successful endovascular treatment.

CASE PRESENTATION

A 67-year-old woman with a history of hypertension, smoking, and carotid endarterectomy presented to our outpatient clinic for evaluation of an incidentally discovered large basilar tip aneurysm. The aneurysm measured approximately 13 mm in maximal dimension, with a large 7 mm neck. The origins of both PCAs and superior cerebellar arteries (SCAs) arose from the base of the aneurysm. After a discussion of the risks and benefits of treatment given the size and location of the aneurysm, the patient elected to proceed with endovascular treatment of the basilar tip aneurysm.

The aneurysm was successfully filled with coils using a dual microcatheter technique. Tight packing was achieved, though a residual neck was intentionally left to maintain patency of the PCAs (figure 1A, B). A follow-up diagnostic angiogram approximately 6 months later showed a small amount of recanalization into the broad neck of the aneurysm. One year after the procedure this recanalized portion was seen to have enlarged, so the patient was brought back for additional coiling. A dual microcatheter and balloon-assisted technique was used, and the aneurysm was successfully filled again with coils, with mild contrast penetration within the aneurysm neck on the final angiogram.

The patient did well after the procedure. On subsequent MR angiography 6 months after this second embolization, the

aneurysm was seen to have recanalized once again. After a detailed discussion of the risks and benefits of additional therapy, it was decided to start the patient on full dose aspirin and clopidogrel and to plan for Y-stenting and repeat coil embolization. On the initial diagnostic runs we found that the incorporation of the origins of the PCAs into the dysplastic base of the aneurysm had resulted in a sharp 90° angulation. In addition, both PCAs had sharp turns in their proximal portions that would not allow distal passage of the microcatheter (figure 1C, D). As such, it was felt that stent-assisted coiling of this aneurysm was not possible, as stenting these vessels carried a high risk of arterial or perforator injury from the resultant straightening of the PCA and PCA/basilar junctions.

Six months after this third embolization attempt the aneurysm had increased in size to 1.9 cm in maximal dimension, with a neck of approximately 1.1 cm. As a result, the patient was offered enrollment in a clinical study for treatment with the Pulsar Vascular PulseRider device and subsequent coil embolization.¹ This approach offered a key advantage to traditional stent-assisted coiling in that the branch vessels (PCAs in this case) did not need to be catheterized to deploy the stent. The T-shape of the stent allows for deployment in the parent artery while providing protection against coil herniation into both the parent vessel as well as the branches.

TREATMENT

The patient was brought back for a fourth embolization. The PulseRider 2.7–3.5 mm 10 T device was deployed across the neck of the aneurysm from the basilar artery, with the wings of the device protecting the origins of the P1 segments. The body of the device protected the distal basilar artery and allowed for tight coiling of the posterior portion of the aneurysm, which had been problematic on the prior attempts. Extensive coiling could be performed as there was no difficulty with herniation

into the branches or parent artery. On the final angiogram there was near complete occlusion of the aneurysm with sluggish contrast filling the coil mass. Tight packing at the base of the aneurysm had been achieved (figure 2). The PCAs and SCAs were widely patent.

OUTCOME AND FOLLOW-UP

Several days after the procedure the patient developed symptoms of double vision, gait instability, and worsened urinary incontinence. Neurological examination showed intact eye movements and coordination and strength testing was normal. An MRI was performed which showed no evidence of any diffusion-weighted imaging (DWI) changes, but showed mass effect on the midbrain, upper pons, and cerebral peduncles with perilesional edema. This finding was thought to be secondary to tight coil packing resulting in irritation of the surrounding tissues. The patient was treated with oral steroids, resulting in improvement in her symptoms.

DISCUSSION

As endovascular treatments for intracranial aneurysms become the standard treatments for the majority of aneurysms, a subset of aneurysms with broad necks at bifurcations remain challenging.² Stent-assisted approaches, including Y-stenting, have had success, but have also been associated with periprocedural and delayed complications.^{3–4} Other approaches, such as ‘waffle cone’ stenting, in which devices are used outside their intended purpose may be equally challenging. Our first approach was with dual microcatheter coiling, a technique that has been shown to be significantly safer than stent-assisted coiling for unruptured wide-necked aneurysms.⁵ After witnessing aneurysm

recanalization, we then moved to balloon and stent-assisted approaches. These techniques, however, require favorable anatomy that allows for distal catheterization of bifurcation branches. In the case of our patient, the origins of the PCAs had been incorporated into the dysplastic aneurysmal neck and, as such, arose at very steep angles and then had secondary sharp turns in the proximal portions that prevented safe stenting. The PulseRider device offers an alternative means for stent-assisted coiling that allows for tight coil packing without the need to catheterize the branch vessels.^{6–7} Long-term follow-up will be necessary to evaluate the durability of the treatment as well as the risk for thrombotic complications.

Contributors SAS was responsible for substantial contributions to the conception and design of the work, drafting and critically revising it and its final approval. ST was responsible for the conception of the work, revising the article, and for its final approval. NP, AI, GD, and DF were responsible for revising the article and for its final approval. All authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Competing interests NP, AI, and ST serve as local site investigators for the PulseRider HDE clinical trial. ST has served as a paid consultant to Pulsar Vascular and owns equity in the company.

Patient consent Obtained.

Ethics approval Ethics approval was obtained from the Institutional Review Board of Long Beach Memorial Hospital.

Provenance and peer review Not commissioned; externally peer reviewed.

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Learning points

- Endovascular treatment of broad-necked bifurcation aneurysms remains challenging.
- Stent-assisted coiling has been successful but requires catheterization of the branches off the parent vessel.
- We present the case of a patient who failed primary and stent-assisted coiling in whom we were able to achieve tight coil packing with the help of the PulseRider device.

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