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CASE REPORT

# Flanking the fenestration: circumferential limb-to-limb stent-assisted coiling of a basilar artery fenestration aneurysm

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## ABSTRACT

A man aged 61 years with a history of a ruptured basilar fenestration aneurysm underwent unassisted coiling in 1997 and repeat intervention for a recurrence at the aneurysm mouth in 2011. At repeat intervention, the decision was made to intentionally leave some filling at the base to preserve the parent vessels. Stent-assisted coil embolization, although technically feasible, was not pursued given the relative risks of the procedure. In 2017, the patient returned for repeat surveillance and further coil compaction was found at the aneurysm base. With the advent of more compliant woven stents deliverable through 0.017 microcatheters, stent-assisted coiling was possible. This case demonstrates hereto unseen agility afforded by novel low-profile stents allowing a circumferential approach to a basilar artery fenestration aneurysm and resultant limb-to-limb stent-assisted coiling. Techniques described here may be extended to more common anatomic variants that require stent-assisted coiling.

## BACKGROUND

Fenestrations represent a well-known anatomical variant of undetermined significance in the cerebral vasculature.[1 2] Their structure introduces novel branch points to vessels with otherwise laminar flow.[1] This configuration provides the opportunity for aneurysm development and rupture. Behind the anterior communicating artery, the second most common location of fenestrations is the basilar artery.[1 3 4] Aneurysms in this location can represent a challenge for microsurgical approaches.[5] Consequently, endovascular management has become the preferred intervention.[3 5] Stent-assisted coiling emerged as an effective therapeutic option as devices and techniques have advanced.[3] The rigidity and size of past stent deployment systems limited the effectiveness of stent-assisted coiling in this location, often leading to incomplete neck coverage.[5 6] With the advent of more compliant woven stents, novel approaches to treatment of branch point aneurysms are possible. Here, we present a successful limb-to-limb stent deployment across the neck of a basilar artery aneurysm after a circumferential approach, resulting in successful coil embolization.

## CASE PRESENTATION

A man aged 61 years with a history of a ruptured basilar fenestration aneurysm and successful coiling in 1997 developed a left sixth cranial nerve palsy concurrent with an aneurysm base recurrence identified on routine surveillance in 2011. Additional coil embolization was performed with some filling intentionally left at the base to preserve parent vessels. Stent-assisted coil embolization, although technically feasible, was not pursued given relative risks of the procedure. In 2017, further coil compaction and recurrence was found during surveillance at the aneurysm base, measuring 7 mm x 5 mm with a 7 mm neck (figure 1).

## TREATMENT

To achieve proximal support, a 0.071 Benchmark guide catheter (Penumbra, Alameda, California, USA) was positioned in the distal cervical segment of the right vertebral artery. Further support came from a 130 cm 4.4 French DAC catheter (Stryker neurovascular, Kalamazoo, Michigan, USA) positioned in the V4 segment of the right vertebral artery. Through this, a straight SL-10 microcatheter was advanced over a Synchro 2 Standard microwire (Stryker neurovascular). The microcatheter was advanced over the wire into the left fenestration limb and, in a counterclockwise manner, around the lesion to ultimately cross the fenestration mouth, landing the tip of the catheter back in the left limb (figure 2). The intermediate catheter was advanced over the microcatheter into the left limb of the fenestration to increase support in preparation for stent deployment. A 2.5 mm x 23 mm low-profile visualized intraluminal stent (LVIS) Jr. (MicroVention, Tustin, California, USA) was then deployed from the left limb to the right limb to cover the aneurysm neck (figure 3). The microcatheter was then gently withdrawn into the right vertebral artery, and readvanced over the wire through the tines of the stent to enter the aneurysm base. Coil embolization was performed with 10 target detachable coils (Stryker neurovascular) (figure 4).

## OUTCOME AND FOLLOW-UP

The patient tolerated the procedure well, was awakened from anesthesia without complication, and discharged the following day with no change in his neurological status.

## DISCUSSION

Fenestrations have been reported in varying proportions of the population. Basilar artery fenestrations

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**Figure 1** Digital subtraction angiography in lateral oblique (LAO) Waters working projection demonstrates recurrence of previously coiled ruptured basilar fenestration aneurysm.

(fsBA) are the most common on DSA, seen in 0.6%–1.7% of studies, roughly 50% of all fenestrations reported.[1 3 7] Incomplete fusion of the primitive longitudinal neural vessels leads to fsBA development, most commonly seen at the vertebrobasilar junction (VBJ).[2] The resulting structure introduces excessive pressure and turbulence to the local system. The coupling of high flow in the VBJ and divergent flow dynamics of fenestrations potentiates aneurysm development.[2]

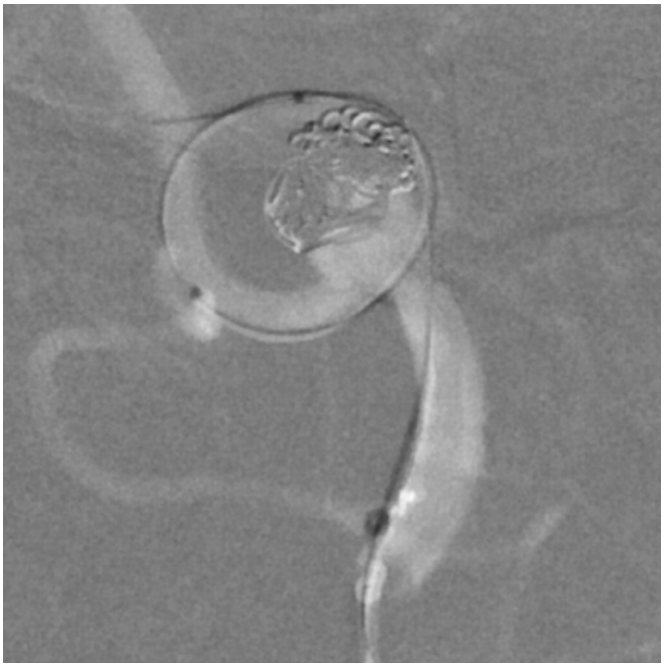

**Figure 2** Stored roadmap projection in LAO Waters working projection demonstrates intermediate catheter positioned in the right V4 segment and microcatheter advanced over microwire into the left fenestration limb, back down the right limb of the fenestration, and back into the left limb.

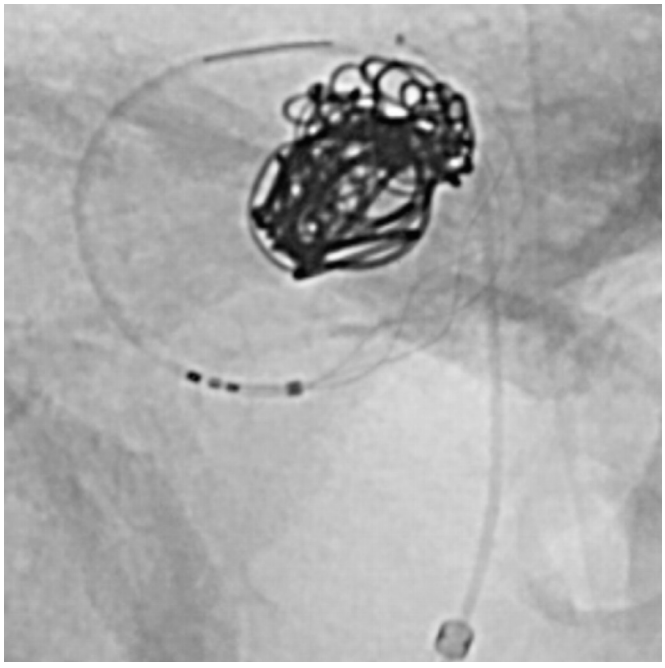

**Figure 3** Fluoroscopic image in LAO Waters working projection demonstrates deployment of stent across the aneurysm neck.

It has been reported that 70%[1] of aneurysms at the VBJ are associated with fenestrations (fsBA-AN), representing 0.011%–0.36% of intracranial aneurysms overall.[1 7] Operative treatment of such lesions requires an excessively morbid approach,[3 5] and high perioperative complication rates have been reported.[8] The density of perforating vessels, proximity of lower cranial nerves, anatomical complexity of the fenestration, and sequelae of retraction injury on the brainstem have led to endovascular intervention becoming the favoured management technique.[3 7]

fsBA-ANs pose a particular challenge for stenting, perforators may arise from both fenestration arms[3] and sacrifice of the non-dominate arm is a concern.[5] The waffle cone, kissing Y stents, double barrel technique, and flow diversion techniques have been attempted with varying success.[9–14] To address concerns of inadequate coverage and thrombogenic burden, new devices such as the woven endobridge (WEB) (Sequent Medical, Aliso Viejo, California, USA), PulseRider (Pulsar Vascular, San Jose, California, USA) and pCONus (Phenox, Bochum, Germany) have been designed for complex junctional aneurysms with promising results.[6] However, patient selection is important as these devices can require rigid deployment systems and wide-necked aneurysms with a low dome-to-neck ratio may not be able to support device positioning.[15] Our current

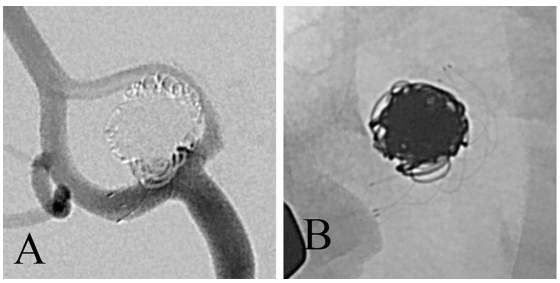


**Figure 4** (A) Digital subtraction angiography and (B) fluoroscopic image in LAO Waters working projection following embolization demonstrates coil packing in the base of the aneurysm and widely patent stent.

case highlights the benefit of new low-profile, compliant stents like the LVIS Jr (MicroVention, Aliso Viejo, California, USA) for novel approaches to complex and wide-necked aneurysms. This technique in combination with other novel neck-bridging approaches further bolsters the neurointerventionalist's armamentarium for posterior circulation lesions.

These woven devices have increased compliance and higher metal surface area than traditional open and closed cell stents.[6] Most importantly, they can be delivered through a 0.017 in microcatheter. A recent case study of 85 patients by Grossberg *et al*[16] using the LVIS Jr stent demonstrated near or complete occlusion in 73% of patients initially poststenting and 85% of patients at 6 months. These findings mirror other studies and suggest higher initial and 6-month occlusion rates than conventional stenting at 45% and 61%, respectively.[17] The fenestration configuration in combination with the discussed LVIS Jr stent attributes enabled a single stent implant to preserve both fenestration limbs with complete ostial coverage. Despite the rarity of this anatomic arrangement, the advantages of lower-profile stents may be realized in other more commonly encountered situations where stent assistance is needed. This has been seen with the barrel technique in lesions such as middle cerebral artery bifurcation aneurysms.[18] It is the expectation of the neurointerventional community that the variety of conventional and flow-diverting stents deliverable via 0.017 catheters to expand in the years to come.

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