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# Triple Woven EndoBridge device strategy for recurrent basilar tip aneurysm: A case report

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Case Report

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## ABSTRACT

**Background:** Coil embolization and surgical clipping are among the treatment options for acutely ruptured cerebral aneurysms. However, wide-neck aneurysms may necessitate stent placement, introducing dual antiplatelet therapy risks during subarachnoid hemorrhage (SAH). The Woven EndoBridge (WEB) intrasaccular device provides a unique solution for wide-neck aneurysms that does not require dual antiplatelet therapy.

**Case Description:** This case report details a 56-year-old male with a recurrent basilar tip aneurysm, treated with three WEB devices. He presented with Hunt Hess grade 4 SAH and underwent initial embolization with a WEB  $9 \times 7.6$  mm. He made a significant recovery, but recurrence of the aneurysm base was observed after 6 months. He underwent embolization with a second WEB  $7 \times 5.6$  mm. A year later, follow-up angiography revealed a recurrence of the aneurysm base yet again, and he underwent embolization with a third WEB  $5 \times 3$  mm.

**Conclusion:** This case demonstrates the application of the WEB for a ruptured aneurysm, obviating the need for dual antiplatelet therapy and minimizing the risks of re-rupture and extraventricular drain complications. It also demonstrates the technical feasibility of deploying three WEB devices in the same aneurysm, providing a strategy for challenging aneurysm recurrence. The WEB offers a safe approach for intrasaccular flow disruption with satisfactory occlusion rates for recurrent aneurysms.

Keywords: Embolization, Ruptured aneurysm, Subarachnoid hemorrhage, Wide aneurysm, Woven EndoBridge

## INTRODUCTION

Coil embolization is among the treatment options for many acutely ruptured cerebral aneurysms.<sup>[3]</sup> It is important to note that surgical clipping can also be utilized for this indication and has certain advantages, particularly for accessible sites, such as the middle cerebral artery, and when decompression is warranted.<sup>[19]</sup> Other advantages of surgery include a slightly reduced re-bleed rate and robust securement which can allow the confident use of pressors for vasospasm.<sup>[3]</sup> However, other situations may lend themselves to endovascular approaches, particularly for aneurysms in the posterior circulation and patients with poor neurological status<sup>[6]</sup>. One study demonstrated enhanced functional outcomes and improved survival rates after coil embolization compared to clip ligation.<sup>[6]</sup> However, coil embolization can be challenging for wide-neck aneurysms, often requiring the placement of a stent in the parent artery. This poses some additional risk during the management of subarachnoid

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hemorrhage (SAH) given the need for dual antiplatelet therapy. The Woven EndoBridge (WEB) intrasaccular device offers unique advantages for the treatment of wide-neck ruptured aneurysms.<sup>[11,16]</sup>

The WEB is a nitinol-based electrothermal detachable device that functions as an intra-saccular flow diverter.<sup>[1,3,8,10,20]</sup> Food and Drug Administration (FDA)-approved for wideneck bifurcation intracranial aneurysms, the WEB disrupts blood flow at the aneurysm neck, promoting intrasaccular thrombosis without requiring intravascular implantation or prolonged dual antiplatelet therapy.<sup>[8,20]</sup> The WEB device can safely secure aneurysms of various sizes in both anterior and posterior circulation during acute SAH.<sup>[4,10]</sup> The endovascular treatment of wide-neck aneurysms with the WEB system has proven to be a dependable strategy for inducing flow disruption with satisfactory aneurysm occlusion rates.<sup>[8,17,23]</sup>

The WEB device has previously been utilized as a 1st-time treatment approach and for aneurysm recurrence following prior treatment. In prior studies, exploring the WEB device as a retreatment option after unsuccessful surgical clipping, WEB was demonstrated to be feasible without significant complications.<sup>[5,9,16,22]</sup> Indications for WEB embolization of recurrent aneurysms include recurrence after clipping, coil compaction, recurrence after coiling, and anatomical considerations conducive to WEB placement.<sup>[14]</sup> Despite the many advantages of WEB, a proportion of aneurysms following WEB implantation have required retreatment.<sup>[20]</sup> Retreating recurrent and residual aneurysms with the WEB device is both feasible and associated with a favorable occlusion rate, coupled with a low incidence of complications.<sup>[5,20]</sup> This case report demonstrates the use of three WEB devices over time to treat basilar tip aneurysm recurrence.

## **CASE PRESENTATION**

### Presentation

A 56-year-old male patient with a past medical history of hypertension and medication noncompliance presented with the worst headache of his life after being found on the ground at work. He was urgently referred for neuroendovascular treatment for a ruptured cerebral aneurysm. Initial noncontrast head computed tomography (CT) revealed a SAH and CT angiography [Figure 1] of the head showed an aneurysm at the basilar tip. His clinical presentation was consistent with a Hunt Hess grade of 4 and imaging with a modified Fisher scale of 4. He was admitted to the neurosurgical service for further management. The patient was intubated and given hypertonic saline as he had a Glasgow Coma Scale (GCS) 8 and a dilated right pupil. An extraventricular drain and arterial line were placed. The patient underwent an unsecured SAH protocol with systolic blood pressure (SBP) maintained <140, seizure prophylaxis with levetiracetam, and vasospasm prevention with nimodipine.

The patient was taken urgently for digital subtraction angiography, which confirmed the presence of a basilar tip aneurysm measuring  $8.9 \times 9.1$  mm and an incidental  $4.6 \times 5.8$  mm left superior hypophyseal aneurysm. A decision was made to treat the basilar tip aneurysm, deemed the likely source of SAH, with a WEB device. He was taken to the operating/interventional room for placement of a WEB Single-Layer Sphere (SLS)  $9 \times 7.6$  mm. Follow-up angiography [Figure 2] showed persistent but slowed filling within the WEB device. The patient was returned to the intensive care unit (ICU) for management of the SAH. He transitioned to a secured protocol. Blood pressure was allowed to autoregulate, and serial cerebral vasculature velocities were monitored by transcranial Doppler as well as neurologic examinations. He required intra-arterial treatment with verapamil for vasospasm on days 5, 6, 7, and 9.

His ICU course was also complicated by tachycardia, likely due to alcohol withdrawal and aspiration pneumonia, for which he received appropriate treatment. He was extubated following WEB embolization. He later required reintubation on day 6 for an increasing oxygen requirement, excess secretions, and airway protection. He subsequently underwent a tracheostomy, which was later downsized, and he was eventually decannulated. Due to challenges in weaning the extraventricular drain, a shunt was placed. He was discharged to inpatient rehabilitation on day 89. He was oriented to self, able to follow commands, and had symmetrical movements in all extremities against gravity. The patient had a significant recovery and returned for followup 6 months later. His neurologic examination was intact. There was evidence of interval compaction of the WEB with >50% recanalization measuring approximately  $6.5 \times 5.9$  mm in greatest dimensions. The 4.6  $\times$  5.8 mm left superior hypophyseal aneurysm was stable in size and shape. After a discussion with the patient about treatment options, including a second WEB versus stent-assisted coiling, a decision was made to proceed with a second embolization with WEB SLS 7  $\times$  5.6 [Figure 3]. Final angiography revealed good placement within the residual base and contrast stasis within the second WEB. The patient was discharged home the following day.

At 1-year follow-up, the patient's neurologic examination remained intact, and he was otherwise well. As the patient was stable, he underwent treatment of the incidental  $4.6 \times 5.8$  mm left superior hypophyseal aneurysm with a Pipeline flow diverter. This procedure was uncomplicated, but diagnostic angiography of the posterior circulation showed that there was again a recurrence of the basilar tip aneurysm. The patient was discharged home the following day, with a plan to continue dual antiplatelet therapy for 6 months and re-evaluate both aneurysms at that time.

At follow-up after another 6 months, the patient expressed a wish to discontinue dual antiplatelet therapy, given easy



**Figure 1:** (a and b) Initial computed tomography (CT) of the head at the time of admission, showing subarachnoid hemorrhage. (*c*) CT angiography of the head showing concern for a basilar tip aneurysm.



**Figure 2:** (a and b) Digital subtraction angiography pre-treatment. (c and d) High-resolution angiography post-WEB SLS  $9 \times 7.6$  mm embolization, showing good WEB placement within the aneurysm, good lateral device compression, and reduced filling of the aneurysm with contrast stagnation.

bleeding and bruising. On angiography, there was minimal residual filling of the left superior hypophyseal artery aneurysm with no evidence of in-stent stenosis or migration. However, there was a persistent recurrence of the basilar tip aneurysm, with residual filling measuring  $4.9 \times 3.3$  mm. There was again consideration of different treatment approaches, including stent-assisted coil embolization. However, the residual filling had a size and shape amenable to the straightforward placement of a third WEB. In addition to the patient's desire to discontinue dual antiplatelet therapy, another perceived benefit of this approach was avoiding stent placement in the basilar artery. The patient was treated with a third WEB, this time Single-Layer (SL)  $5 \times 3$  [Figure 4].



**Figure 3:** (a and b) Digital subtraction angiography pre-treatment. (c and d) High-resolution angiography post-WEB SLS  $7 \times 5.6$  mm embolization, showing good WEB placement within the aneurysm residual, good lateral device compression, and reduced filling of the aneurysm residual with contrast stagnation.

Final angiography revealed good device placement with contrast stagnation within the WEB. He was transitioned to aspirin monotherapy. Overall, the patient remained intact and clinically well status post the third WEB embolization. He complained of only mild lightheadedness and mild right arm tremor, which has been stable since the initial SAH, for which he is seeing outpatient Neurology.

#### DISCUSSION

This case report demonstrates the use of WEB embolization for a ruptured aneurysm and the use of three WEB devices in the same basilar tip aneurysm in the setting of recurrence over time. Aneurysms with a history of prior rupture are recognized for their propensity to exhibit elevated rates of recurrence and need for subsequent treatment.<sup>[7]</sup> Although surgical clipping may be utilized to treat ruptured aneurysms, patients with aneurysms involving the posterior circulation or those with poor neurological status may benefit from alternative treatment options, such as endovascular approaches.<sup>[6]</sup> Stent-assisted coiling is another treatment option for wideneck basilar tip aneurysms. Indeed, Nejadhamzeeigilani *et al.* demonstrated acceptable outcomes using this approach. However, stent-assisted coiling poses risks of thromboembolic complications, possibly more so if a stent is placed in the basilar artery, requires prolonged dual antiplatelet therapy, may increase the risk of bleeding, and carries a risk of recurrence due to technical challenges.<sup>[18]</sup>

As introduced, WEB offers many advantages for ruptured wide-neck aneurysms since it does not necessitate antiplatelet agents due to its intrasaccular placement.<sup>[4]</sup> The patient presented in this case was able to avoid dual antiplatelet therapy in the acute setting, which could have increased his risk of aneurysm re-rupture or complications related to his extraventricular drain. While the most common complication associated with WEB treatment is a thromboembolic event within the periprocedural period,<sup>[21]</sup> none occurred in the presented case. Collectively, WEB has demonstrated satisfactory occlusion rates for wide-neck intracranial aneurysms.<sup>[2]</sup>

Overall, studies have shown an 87% success rate in treating recurrent aneurysms with the WEB alone.<sup>[3]</sup> A multicenter study demonstrated that adequate occlusion rates using WEB were 86% at the mid-term and 94% at the long-term follow-up.<sup>[15]</sup> While some neck remnants can be seen after WEB implantation, only 11% of aneurysms had mid-to-long-term recurrence.<sup>[15]</sup> A systematic review demonstrated that approximately 10.7% of all aneurysms treated with WEB will recur and undergo retreatment.<sup>[20]</sup> Retreatment following basilar aneurysms was 34.1% in one study.<sup>[20]</sup> Furthermore, evidence supports that WEB is effective and safe for retreating wide-neck aneurysms, as the majority of retreated cases had favorable outcomes.<sup>[20]</sup>

Treatment of recurrent basilar tip aneurysms endovascularly can be challenging due to the aneurysm morphology and proximity and configuration of nearby anatomy.<sup>[12]</sup> Aneurysms located in the posterior circulation involving the vertebrobasilar system constitute 12% of intracranial aneurysm cases,<sup>[13]</sup> although another study found that basilar tip aneurysms may be even more common (30%).<sup>[2]</sup> In addition, basilar tip aneurysms have a high rate of recurrence after treatment.<sup>[20]</sup> Since basilar tip aneurysms rank among the most predisposed to rupture within the category of posterior circulation aneurysms, aggressive treatment is warranted.<sup>[13]</sup> WEB was approved for wide-neck aneurysms



**Figure 4:** (a and b) Digital subtraction angiography pre-treatment. (c and d) High-resolution angiography post-WEB SL  $5 \times 3$  mm embolization, showing good WEB placement within the aneurysm residual, good lateral device compression, and reduced filling of the aneurysm residual with contrast stagnation.

of the basilar tip by the FDA in 2018 due to its safety ad efficacy profile.<sup>[15]</sup>

### CONCLUSION

We present a case study of a patient with a complex clinical course, highlighting the challenges in managing ruptured cerebral aneurysms and recurrent basilar tip aneurysms. This case demonstrates the application of the WEB device for treating a ruptured aneurysm, eliminating the need for dual antiplatelet therapy. In addition, this approach may reduce the risks of re-rupture and extraventricular drain complications. While we do not advocate for the routine use of multiple WEB devices in the same aneurysm, this unique case showcases an example in which it may have provided the safest option by avoiding stent placement in the basilar artery, consistent with patient preferences to discontinue dual antiplatelet therapy, and supports the technical feasibility of this approach, providing another strategy for addressing challenging aneurysm recurrences. The WEB device offers a safe approach for intrasaccular flow disruption, minimizing risks while yielding satisfactory occlusion rates for recurrent aneurysms.

**Ethical approval:** The research/study was approved by the Institutional Review Boards at the University of New England College of Osteopathic Medicine (0923-05, dated September 28,

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