



Adjustment of Malpositioned Woven EndoBridge Device Using Gooseneck Snare: Complication Management Technique

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The Woven EndoBridge (WEB) is an intrasaccular flow-disrupting device for the treatment of wide-necked saccular cerebral aneurysms. As with any neuroendovascular device, complications in the form of malpositioning and migration must be managed quickly and safely. Few studies have reported complication management techniques in instances of dislocated or migrated WEB devices. We retrospectively describe a case of a malpositioned WEB device that was successfully adjusted with the use of a gooseneck snare. Multiple other intra-procedural bailout strategies for management of WEB malposition and migration were considered, and are herein discussed. Operators should be aware of the causes of WEB malposition and a variety of bailout strategies.

Key Words: Cerebral aneurysm; Subarachnoid hemorrhage; Device malposition; Device retrieval; Woven endobridge; Gooseneck snare

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INTRODUCTION

Intrasaccular flow disruption is quickly becoming an effective and widespread treatment modality for wide-necked saccular cerebral aneurysms. The Woven EndoBridge (WEB; MicroVention, Tustin, CA, USA) is a novel device that has been shown to have excellent safety and efficacy for the treatment of such lesions. As with any neuroendovascular device, complications in the form of malpositioning and migration must be managed quickly and safely in order to avoid morbidity and mortality. We describe a case of a malpositioned WEB device that was successfully adjusted with the use of a gooseneck snare. We offer technical

pearls of this maneuver and also review additional intra-procedural bailout strategies for management of WEB malposition and migration.

MATERIALS AND METHODS

We retrospectively describe a case of a malpositioned WEB device that was successfully adjusted with the use of a gooseneck snare.

RESULTS

An early elderly patient with a history of smoking visited to the emergency room

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with acute onset of severe headache and neck pain for 1 day. A computed tomography (CT) of the brain demonstrated subarachnoid hemorrhage centered in the right suprasellar and crural cisterns. A CT angiogram and subsequent emergent diagnostic cerebral angiogram (DSA) confirmed a multi-lobulated 8-mm aneurysm arising from the communicating segment of the right internal carotid artery (ICA; Fig. 1A). Through a 6-Fr guide sheath in the cervical ICA, a 5-Fr Sofia EX intermediate catheter (MicroVention) was positioned in the petrous segment. A Via 27 Microcatheter (MicroVention) was tracked into the aneurysm and a WEB SL embolization device, 9 mm×4 mm, was deployed with excellent dome and neck coverage (Fig. 1B) and detached without incident. During recovery of the delivery wire, the microcatheter advanced in an anterograde fashion and bumped the proximal aspect of the WEB to an inwardly-concave morphology,

thus uncovering a significant portion of the neck (Fig. 1C). Multiple strategies were considered as described below. Ultimately, a 4 mm Amplatz Gooseneck Microsnare (Medtronic, Minneapolis, MN, USA) was used to capture the proximal WEB marker, and gentle retraction was applied to restore the neutral position of the WEB (Supplementary Video 1, Fig. 1D). Follow-up DSA showed restoration of aneurysmal neck coverage (Fig. 1E, F). The patient was started on 81 mg of daily aspirin. She had an uneventful remaining hospitalization and was discharged on hospital day 15. This research received Institutional Review Board approval, as well as patient consent.

DISCUSSION

Wide-necked cerebral aneurysms comprise 26–36% of all

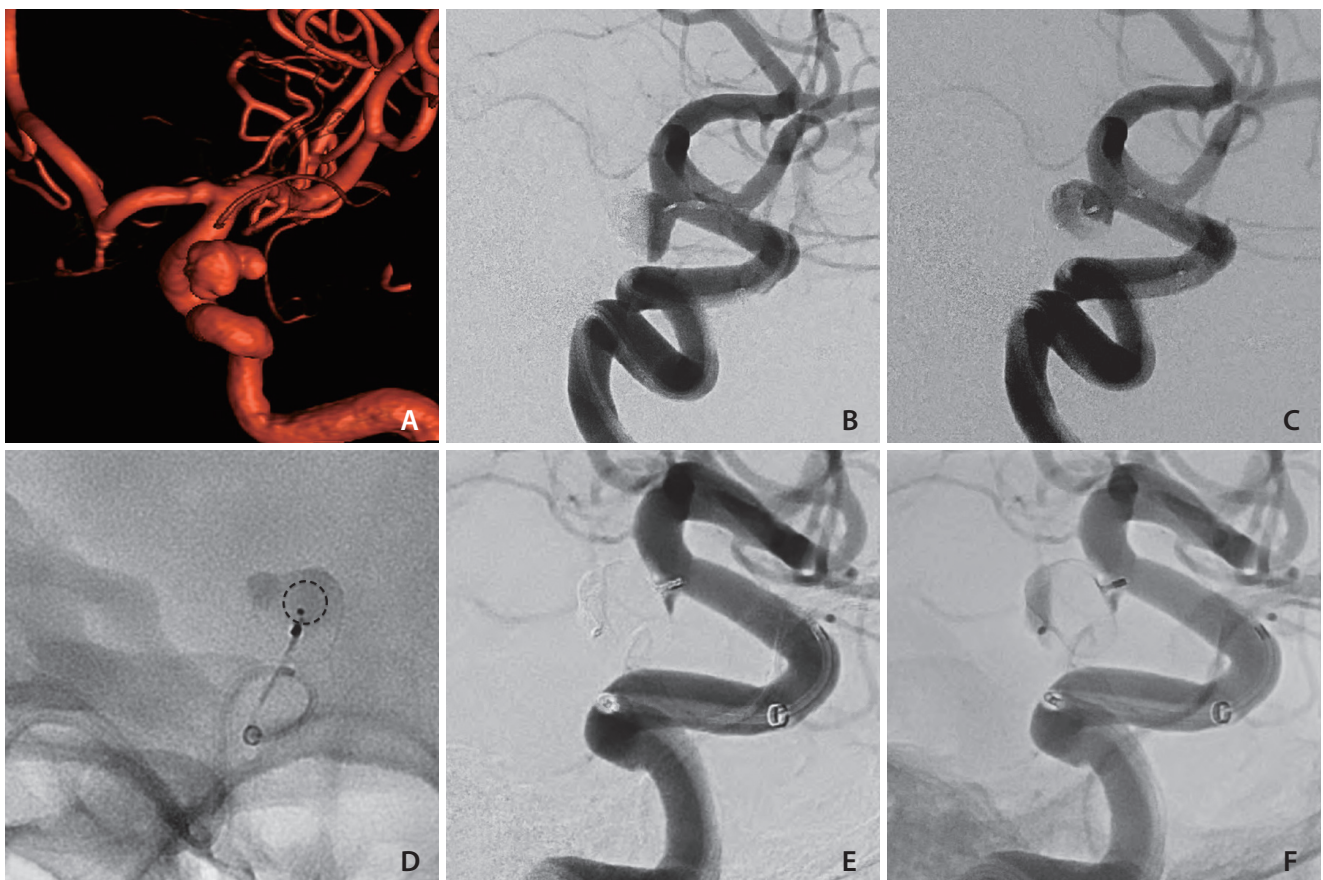


Fig. 1. (A) Digital subtraction angiogram (DSA) volume-rendered 3D reconstruction showing multilobulated communicating segment internal carotid artery aneurysm. (B) Immediate DSA after Woven EndoBridge (WEB) deployment and detachment showing aneurysm occlusion. (C) DSA after delivery wire retrieval showing inward-concavity of malpositioned WEB with uncovering of significant portion of aneurysm neck. (D) Fluoroscopic still image of obliquated “down-the-barrel” view of the WEB, which greatly facilitated gooseneck snare (exemplified by dotted line) capture of the proximal marker. (E) Subtracted DSA and (F) unsubtracted image showing restoration of neutral morphology of WEB and improved aneurysm occlusion.

intracranial aneurysms and remain challenging lesions in the neurointervention field. Traditional endovascular treatment may mandate the use of adjunctive techniques such as temporary ballooning or stenting. These maneuvers can be technically demanding, time intensive, and have been shown to have higher complication rates than primary coil embolization.¹ Introduced in 2011, the WEB device is an intrasaccular implant that induces thrombosis, as well as providing 55% to 100% metal surface-area coverage at the aneurysm neck.² The safety of the WEB has been studied, as data from WEB-IT, WEBCAST, WEBCAST2, and the French Observatory Studies have shown a combined overall morbidity rate of 2%, without any deaths.²⁻⁵ Previous studies have also demonstrated a high technical success rate, with a 98.7% technical success rate in the WEB-IT study.

In our case, the decision to use a WEB over other forms of embolization was based on our belief that the WEB would require less procedural time along with promising results from recent literature examining the WEB in acutely ruptured cases and sidewall and communicating segment ICA aneurysms (note however, the time gained with a single WEB device was likely conceded due to the eventual time that retrieval mandated, which was obviously unintentional and unknown prior to treatment).⁶⁻⁹ Goertz et al.⁷ showed complete occlusion in 76.5% of ICA sidewall aneurysms treated with WEB, without procedure-related morbidity or mortality, while Aguiar et al.⁸ showed a high safety profile for WEB devices when used in off-label indications such as posterior communicating artery aneurysms. While primary coil embolization, balloon-assisted coil embolization, and open surgical clipping were also considered as reasonable treatment options, we felt that WEB embolization was, at a minimum, not inferior to those techniques. Indeed, Kabbasch et al.¹⁰ showed that the WEB provides similar aneurysm occlusion rates to that of stent-assisted coil embolization.

As with the increased implementation of any neurointerventional device, complications will inevitably arise in the form of device malpositioning and migration, and bailout strategies are imperative to avoid morbidity and mortality. In our case, inadvertent advancement of a microcatheter during recovery of a delivery wire ultimately caused an inwardly-concave displacement of the WEB device. A possible explanation for this includes excessive built-up loading pressure on the microcatheter during the recovery, which caused it to launch forward. Thus, operators can anticipate this complication and ensure that excess microcatheter

load is reduced prior to the recovery step. The significance of the seemingly small amount of force required to deform the WEB device remains unknown. Although the WEBCAST study showed a retreatment rate of 11.4%, this value has come under recent controversy.^{11,12} Our case highlights the relatively small amount of force required to deform the WEB device, and it is possible that this may indirectly contribute to the necessity of future retreatments for recurrent aneurysmal neck filling. Other intra-procedural device-related complications of WEB treatment of ruptured aneurysms have been reported at approximately 8–10%, and can include aneurysm perforation, device protrusion into the parent vessel requiring further intervention, dislodgement, and/or distal migration and thromboembolic events.

Few studies have reported complication management techniques in instances of dislocated or migrated WEB devices. König et al.¹³ described a dislocated and migrated WEB device during treatment of an unruptured right carotid terminus aneurysm. After successful detachment, the WEB device migrated into the middle cerebral artery and was retrieved using an Alligator retrieval device. John et al.¹⁴ describe a case of a dislocated WEB device during treatment of an unruptured middle cerebral artery bifurcation aneurysm. After attempting to recapture the device after incomplete detachment, the WEB inadvertently detached and herniated into the parent vessel. The authors then used a microcatheter to successfully push the device back into the aneurysm.¹⁴ Other techniques have been reported for rescue maneuvers of malpositioned and migrated WEB devices in porcine models, such as the use of stent-retrievers, aspiration catheters, and rescue devices.^{15,16}

In our case, several intra-procedural bailout interventions were considered, although many were precluded given our patient's subarachnoid hemorrhage. Our case is unique, as it is the first reported WEB bailout strategy for an acutely ruptured aneurysm. We considered a conservative approach of leaving the malpositioned WEB; however, we were not confident the aneurysm was adequately secured and feared re-rupture. Coil embolization of the remnant was considered; however, we did not want to risk added pressure towards the WEB's interface with the dome of the aneurysm. We also wanted to avoid placing a flow-diverting stent given the need for dual antiplatelet therapy. We decided against a direct aspiration first pass technique (ADAPT)-removal/repositioning with a thrombectomy aspiration catheter (which has been described in animal models).¹⁵ We feared crossing

the neck with such a large catheter, as well as exacerbating the inward-concavity of malpositioning. Furthermore, the reports of ADAPT-retrieval of WEB devices were done in porcine models where the device was positioned perpendicular to the parent artery, a situation very different than ours. Because of these reasons, the decision was made to reposition the WEB with a Gooseneck snare device. Initially, several attempts to snare the WEB proximal marker were unsuccessful while using the same fluoroscopic working projections during WEB deployment. The frontal view was then obliquated in order to obtain a “down-the-barrel” view of the WEB, and roadmap imaging was turned off in order to enhance resolution of the marker. These imaging maneuvers were vital in facilitating the successful snaring of the WEB, and are the major technical pearls of this report. Once the proximal marker was snared and trapped with the delivery microcatheter, the WEB device was gently retracted until a neutral position was re-obtained. Operators should be aware of the risks of thromboembolism and aneurysm rupture using such a maneuver and appraise those risks compared to alternate management modalities, such as conservative watching and other retrieval methods as discussed above.

CONCLUSION

With the growing experience and more frequent use of WEB devices, neurointerventionists should be increasingly aware of possible bailout techniques in cases of device migration or dislocation. We describe a case of a malpositioned WEB device during embolization of a ruptured aneurysm that was successfully adjusted with the use of a gooseneck snare.

SUPPLEMENTARY MATERIALS

Supplementary video related to this article can be found online at <https://doi.org/10.5469/neuroint.2021.00318>.

Fund

None.

Ethics Statement

This study was approved by the Institutional Review Board. The board waived the need for patient consent given the retrospective nature of the study. Since the consent for pub-

lication was not available for the patients mentioned in the figures and the result section, patient’s information was anonymized by removing the sex and specific age.

Conflicts of Interest

The authors have no conflicts to disclose.

Author Contributions

Concept and design: KA. Analysis and interpretation: KA, FA, DS, JS, and AD. Data collection: KA. Writing the article: KA. Critical revision of the article: KA, FA, DS, JS, and AD. Final approval of the article: FA, DS, JS, and AD.

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