

Woven Endobridge Device for Ruptured Aneurysm Within Middle Cerebral Artery Bifurcation

Technical Note

Humberto Montaña-Tello¹, Fabiola Eunice Serrano-Arias¹, Diego López-Mena¹, Jorge Luis Balderrama-Bañares¹ and Héctor Alfredo Montenegro-Rosales¹

¹ Neurology and Neurosurgery National Institute “Manuel Velasco Suarez”, Endovascular Department

Reception date of the manuscript: 31/Mayo/2022

Acceptance date of the manuscript: 21/Junio/2022

Publication date: 09/Julio/2022

DOI: 10.5281/zenodo.6814159

Abstract—Woven Endobridge Device for Ruptured Aneurysm Within Middle Cerebral Artery Bifurcation: Technical Note

Introduction: Intracranial aneurysms represent an abnormal dilatation on the arterial wall of the cerebral vessels. There is a controversy about the best treatment for ruptured aneurysms located at the middle cerebral artery bifurcation. **Case Report:** 63-year-old male, presented with left facial paralysis and ipsilateral paresthesia associated with right palpebral ptosis. CT Angiography revealed bleeding in the subarachnoid space, Fisher grade I and the presence of a ruptured, wide neck saccular aneurysm in right middle cerebral artery. Given the size and shape of this wide neck aneurysm (5 mm neck dimension, 7.4 mm height/neck aspect ratio and dome/neck ratio of 7.43mm.) added to its location, we considered the usage of Woven Endobridge device for endovascular embolization. The device was suitable because of its preferred wide-neck indication (4mm). **Conclusions.** Mexico’s experience with intracranial WEB device remains scarce, therefore, pointing out different therapeutic options but neurosurgical clipping highly benefits patients in our country.

Ictus 2022;3(2):e09072203011

Keywords—Aneurysm, WEB, Subarachnoid Hemorrhage

Resumen—Dispositivo WEB (Woven Endobridge) Para Aneurisma Roto de La Bifurcación de La Arteria Cerebral Media: Nota Técnica

Introducción: Los aneurismas intracraneales representan una dilatación anormal en la pared arterial de los vasos cerebrales. Existe una controversia sobre el mejor tratamiento para los aneurismas rotos ubicados en la bifurcación de la arteria cerebral media. **Reporte de Caso:** Hombre de 63 años que presentó parálisis facial izquierda y parestesia ipsilateral asociada a ptosis palpebral derecha. La angiografía por TC reveló sangrado en el espacio subaracnoideo, grado I de Fisher y la presencia de un aneurisma saccular de cuello ancho roto en la arteria cerebral media derecha. Dado el tamaño y la forma de este aneurisma de cuello ancho (dimensión del cuello de 5 mm, radio de aspecto de cuello / altura de 7,4 mm y radio de cúpula / cuello de 7,43 mm.) agregado a su ubicación, consideramos el uso del dispositivo Woven Endobridge (WEB) para la embolización endovascular. El dispositivo era adecuado debido a su indicación preferida de cuello ancho (4 mm). **Conclusiones:** La experiencia de México con el dispositivo intracraneal WEB sigue siendo escasa, por lo tanto, señalando diferentes opciones terapéuticas pero el recorte neuroquirúrgico beneficia altamente a los pacientes en nuestro país.

Ictus 2022;3(2):e09072203011

Palabras clave—Aneurisma, WEB, Hemorragia Subaracnoidea

INTRODUCTION

Intracranial aneurysms (IA) represent an abnormal enlargement of the arterial wall of the cerebral vessels.¹ This structural malformation can be developed out of a straight vessel segment or within a bifurcation point. Mexico's surgical approach of aneurysms has changed dramatically within the last years. Currently more cases can be treated through an endovascular approach with a minimum intervention and full functional recovery within a shorter period.

Subarachnoid hemorrhage (SH) caused by a ruptured aneurysm located at the middle cerebral artery (MCA) bifurcation represents a challenge. Work position makes it hard to stabilize coil in the aneurysm sac and there is a significant risk of coil protrusion.² Notwithstanding flow diversion technology is controversial for covering one or several branches of the bifurcation given the risk of occlusion and potential risk of incomplete coverage of the aneurysm neck since two flow diverters cannot be placed in the bifurcation.³ In this light, experience was disappointing, with a relatively high morbidity rate (22%) and a relatively low rate of complete aneurysm occlusion (62%).⁴

The Woven EndoBridge device (WEB) was designed specifically for the treatment of wide neck bifurcation aneurysm, which comprises 26–36% of all intracranial aneurysms.⁵ It has been used in Europe since 2011.⁶ In Mexico, usage of the WEB device had been recently approved by Federal Commission for the Protection against Sanitary Risks (COFEPRIS by its acronym in Spanish) as of 2019 and represents an acute therapeutic option for subarachnoid hemorrhage.

CASE REPORT

A 63-year-old male, with history of four-year evolution Type 2 Diabetes Mellitus treated with metformin and an estimated count of 5 cigarettes daily for the last 40 years, arrived to the emergency department with left facial paralysis and ipsilateral paresthesia associated with right palpebral ptosis. Computed Tomography (CT) Angiography revealed subarachnoid hemorrhage due to a ruptured saccular bilobed wide neck aneurysm in the right MCA, Fisher grade I (Figure 1A). Digital Subtraction Angiography (DSA), found a 5 mm neck, 7.4 mm height and width dome radio of 7.43mm aneurysm (Figure 1B).

Therapeutic intervention performed is started under general anesthesia. Under subtraction fluoroscopy, C1 segment of internal carotid artery was administered with 200 micrograms of nimodipine within 10 cm³ saline solution due to vasospasm that eventually allowed cannulization. Microcatheter VIA 27 is introduced at lesion level where WEB 9 x 4 mm device is appropriately affronted to aneurismatic primary lobe walls and displayed. Subsequently microcatheter was ca-

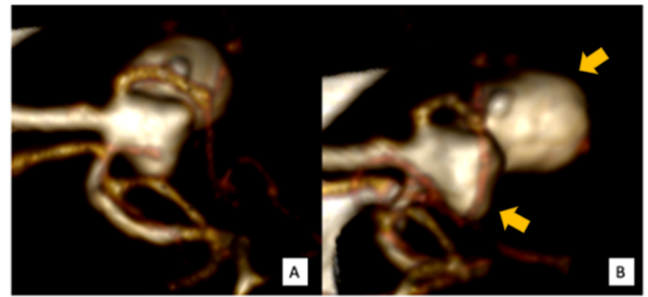


Figure 1: Angiotomography three-dimension reconstruction for a bilobed middle cerebral artery bifurcation aneurysm at a lateral (A) and oblique (B) plane view. Arrows indicate aneurysm primary and secondary lobe, lower right and upper right corner respectively.

refully removed and a control contrast injection view confirmed complete retained contrast material inside the device. (Figure. 2).

Based in Rankin Modified Scale, patient has current score of 0, following a fully functional recovery. Successful occlusion within this case was confirmed with a Flat-Panel Computed Tomography (CONEBEAM-CT) at three-month follow up, the aneurysm was classified as a Raymond-Roy modified score (RRms) A.⁷ (Figure 3)

DISCUSSION

Main purpose for present manuscript is to represent the change of paradigm for acute subarachnoid hemorrhage approach in Mexico. In this light, understanding the endovascular interventional treatment as an alternative in comparison with open surgical clipping can be a safer option for elderly patients who may benefit from a shorter hospital stay. A 2018 Systematic Review and Meta-Analysis compared endovascular coiling versus neurosurgical clipping for intracranial aneurysms considering no significant difference in 1-year medical costs, however, the length of stay of endovascular coiling was much shorter than neurosurgical clipping and decreased over time.⁸

Considering a patient with current bleeding and SH context, the WEB device offers a safe and effective treatment option for broad-based intracranial aneurysms without the need for dual antiplatelet therapy.⁹ Great advantage for its usage in acute occlusion in comparison with stent assisted coiling and flow diverter stent. Embolization of bilobed aneurysm with a WEB device represents a safe option despite its rupture, compared to stent plus coiling within an acute SH: A systematic review and meta-analysis using a 565 cohort of cases demonstrated that subarachnoid hemorrhage does not imply a worse prognosis with a WEB usage; ruptured aneurysm had similar rates of perioperative morbidity (2% [0–26%]) compared to patients with unruptured aneurysm (2% [0%–6%]) although no statistical significance was found.¹⁰

Aneurysm shape varies depending on their size and location. Cylindrical, spherical or ovoid shaped cases are the most suitable candidates for WEB treatment. In spite of the former, multilobular morphology as the represented in this

Contact data: Héctor Alfredo Montenegro-Rosales, Av. Insurgentes Sur 3877, La Fama, Tlalpan, 14269 ciudad de México, CDMX., Phone number: +52 (55) 4381 8095, dr.montenegrorx@gmail.com

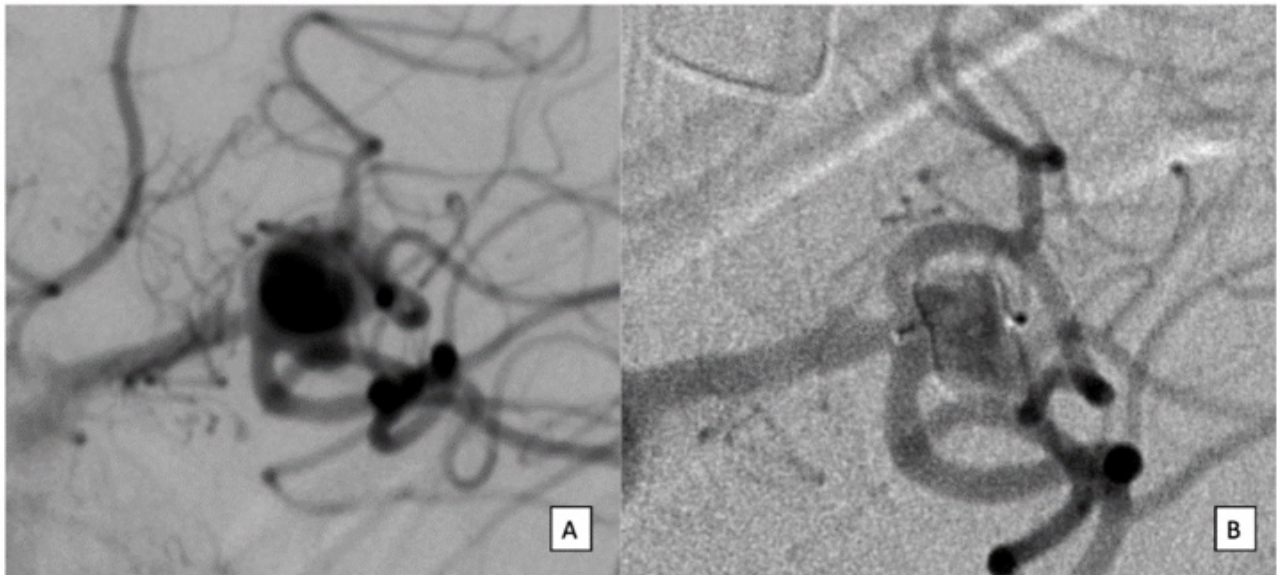


Figura 2: Diagnostic and therapeutical views. (A) Angiography demonstrating the blood inflow mechanism through bilobed aneurysm structure. (B) Therapeutic approach with Woven EndoBridge (WEB) device. Occlusion of second aneurysmatic lobe, adjacent vessels remain intact.

case can also be treated with the WEB device by sizing it to the primary lobe.¹¹ Saccular shaped, basilar apex, middle cerebral artery, internal carotid artery terminus, or anterior communicating artery complex aneurysms are some of the indications for the use of WEB device.^{11,12} In fact, device is fittable and flexible due to its nitinol/platinum wires. Presentations include: Single Layer as the one used for this case (Figure 4), double layer and single layer sphere.¹² Endovascular complications are classified as ischemic (e.g., thrombo-embolic, spasm during treatment) and hemorrhagic (e.g., aneurysm rupture).¹³ In the other hand, neurosurgical clipping may include a hemorrhagic event, brain swelling (edema), infarction, hypotension, and cardiac arrhythmias.¹⁴



Figura 3: Successful Occlusion Follow up. Flat-Panel Computed Tomography performed at the three-month follow-up. Radiopaque WEB device showed complete occlusion of secondary lobe. Adjacent vessels remain permeable.

As of date, Mexico's public healthcare system does cover the WEB device in some tertiary centers, however, its use has yet to be generalized.

CONCLUSION

Without a doubt, educate future generations about benefits of endovascular treatment will make it a more accessible option within the next decades. Mexico's experience with intracranial WEB device remains scarce. Despite its cost, effectiveness of this device can highly improve patient's outcome without the need of antiaggregant medication and decreasing the hospital stay, so its use could become generalized.

SOURCES OF FINANCING

Authors declare that no source of economic financing for the execution of the present writing was provided nor decision to submit it to *ictus*, Journal of the Mexican Stroke Association.

DECLARATION OF CONFLICTS OF INTEREST

All authors declare no potential conflicts of interest, including any financial, personal or other relationship with any person or organization that might have an influence, or that might be regarded as having an influence on the scientific articles submitted to *ictus*, Journal of the Mexican Stroke Association.

RIGHT TO PRIVACY AND INFORMED CONSENT

The authors have obtained the informed consent of the patients and/or subjects referred to in the article. This document is in the possession of the corresponding author

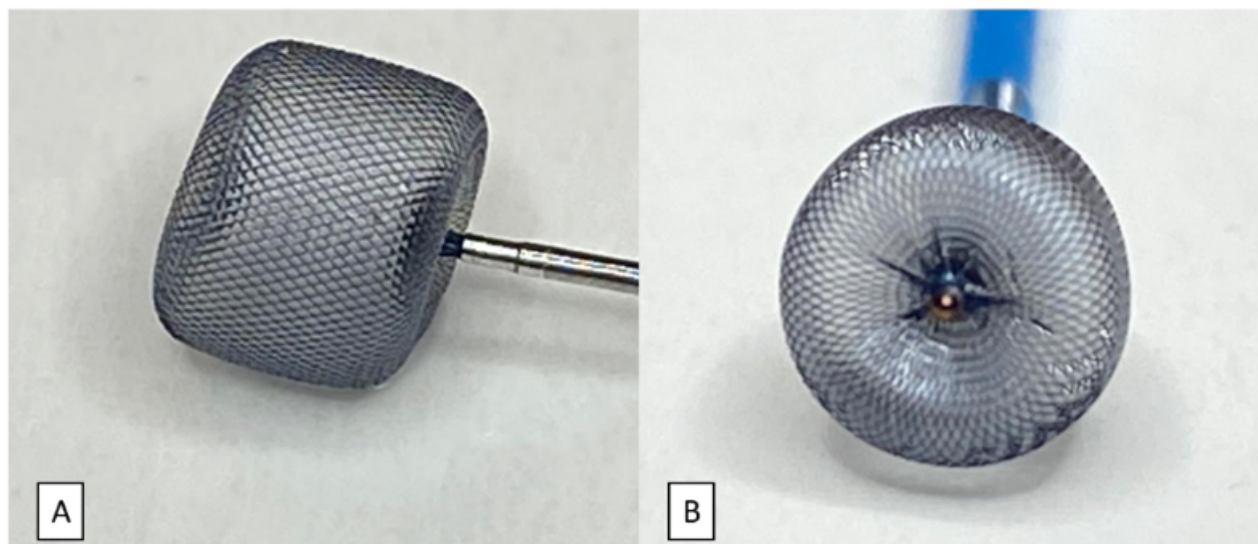


Figura 4: Single Layer Woven EndoBridge (WEB) device displayed at a Lateral (A) and Anterior (B) presentation.

PROTECTION OF PEOPLE AND ANIMALS

The authors state that no experiments have been conducted on humans or animals for this research.

REFERENCIAS

- [1] Toth G, Cerejo R. Intracranial aneurysms: Review of current science and management. *Vasc Med* [Internet]. 2018;23(3):276–88. Disponible en: <http://dx.doi.org/10.1177/1358863X18754693>
- [2] Pierot L, Spelle L, Cognard C, Szikora I. Wide neck bifurcation aneurysms: what is the optimal endovascular treatment? *J Neurointerv Surg* [Internet]. 2021 [citado el 27 de abril de 2022];13(5):e9. Disponible en: <https://jn.is.bmj.com/content/13/5/e9>
- [3] Procedural complications of endovascular treatment in patients with aneurysmal subarachnoid haemorrhage treated at a single centre. Alanen M, Pyysalo L, Jalava I, et al. *Acta Neurochir*. 2018;160:551–557. [PubMed] [Google Scholar]
- [4] Caroff J, Neki H, Mihalec C, D'Argento F, Abdel Khalek H, Ikka L, et al. Flow-diverter stents for the treatment of saccular middle cerebral artery bifurcation aneurysms. *AJNR Am J Neuroradiol* [Internet]. 2016;37(2):279–84. Disponible en: <http://dx.doi.org/10.3174/ajnr.A4540>
- [5] De Leacy RA, Fargen KM, Mascitelli JR, et al. Wide-neck bifurcation aneurysms of the middle cerebral artery and basilar apex treated by endovascular techniques: a multicentre, core lab adjudicated study evaluating safety and durability of occlusion (BRANCH). *J Neurointerv Surg* 2019;11:31–6.
- [6] Muskens IS, Senders JT, Dasenbrock HH, et al. The Woven Endobridge device for treatment of intracranial aneurysms: a systematic review. *World Neurosurg* 2017;98:809–17.
- [7] Arthur AS, Molyneux A, Coon AL, Saatci I, Szikora I, Baltacioglu F, et al. The safety and effectiveness of the Woven EndoBridge (WEB) system for the treatment of wide-necked bifurcation aneurysms: final 12-month results of the pivotal WEB Intracranial Therapy (WEB-IT) Study. *J Neurointerv Surg* [Internet]. 2019 [citado el 24 de marzo de 2022];11(9):924–30. Disponible en: <https://jn.is.bmj.com/content/11/9/924>
- [8] Karhunen V, Bakker MK, Ruigrok YM, Gill D, Larson SC. Modifiable risk factors for intracranial aneurysm and aneurysmal subarachnoid hemorrhage: A Mendelian randomization study. *J Am Heart Assoc* [Internet]. 2021;10(22):e022277. Disponible en: <https://www.diva-portal.org/smash/get/diva2:1617103/FULLTEXT01.pdf>
- [9] Saavedra CR, Rangel CC, Pichardo Uribe OA, Benavides OC, Orijel AP. Reconstrucción endovascular de aneurisma intracraneal mediante dispositivo divisor de flujo Pipeline® Reporte de 2 casos y revisión de la literatura. *Rev Fac Med UNAM* [Internet]. 2019 [citado el 24 de marzo de 2022];62(3):20–6. Disponible en: <https://www.medigraphic.com/cgi-bin/new/resumen.cgi?IDARTICULO=86939>
- [10] Zhang X, Tang H, Huang Q, Hong B, Xu Y, Liu J. Total hospital costs and length of stay of endovascular coiling versus neurosurgical clipping for unruptured intracranial aneurysms: Systematic review and meta-analysis. *World Neurosurg* [Internet]. 2018;115:393–9. Disponible en: <http://dx.doi.org/10.1016/j.wneu.2018.04.028>
- [11] Popielski J, Berlis A, Weber W, Fischer S. Two-center experience in the endovascular treatment of ruptured and unruptured intracranial aneurysms using the WEB device: A retrospective analysis. *AJNR Am J Neuroradiol* [Internet]. 2018;39(1):111–7. Disponible en: <http://dx.doi.org/10.3174/ajnr.a5413>
- [12] Asnafi S, Rouchaud A, Pierot L, Brinjikji W, Murad MH, Kallmes DF. Efficacy and safety of the Woven EndoBridge (WEB) device for the treatment of intracranial aneurysms: A systematic review and meta-analysis. *AJNR Am J Neuroradiol* [Internet]. 2016;37(12):2287–92. Disponible en: <http://dx.doi.org/10.3174/ajnr.A4900>
- [13] Pierot L, Cognard C, Anxionnat R, Ricolfi F, CLARITY Investigators. Endovascular treatment of ruptured intracranial aneurysms: factors affecting midterm quality anatomic results: analysis in a prospective, multicenter series of patients (CLARITY). *AJNR Am J Neu-*



roradiol [Internet]. 2012;33(8):1475–80. Disponible en:
<http://dx.doi.org/10.3174/ajnr.A3003>

- [14] Goyal N, Hoit D, DiNitto J, Elijovich L, Fiorella D, Pierot L, et al. How to WEB: a practical review of methodology for the use of the Woven EndoBridge. *J Neurointerv Surg* [Internet]. 2020 [citado el 25 de marzo de 2022];12(5):512–20. Disponible en: <https://jn.is.bmj.com/content/12/5/512>