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WEB-assisted microwire navigation for the treatment of complex wide-neck intracranial aneurysms: technical note

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Abstract

Background: Unfavorable aneurysm anatomy can make microwire navigation challenging, increasing the risk of complications. We present our experience of WEB-assisted microcatheterization in complex aneurysms.

Clinical Presentation: Flow diversion was performed for three wide-neck large/giant intracranial aneurysms. A WEB was placed inside the sac, blocking the aneurysm neck and providing a contact surface to redirect the microwire across the aneurysm.

Conclusion: WEB-assisted microcatheterization appears an alternative strategy for the treatment of complex aneurysms.

Key Words: WEB; intracranial aneurysms; microcatheterization, endovascular treatment; wide-neck aneurysms

Introduction

Large and giant intracranial aneurysms are still challenging lesions to treat by both surgical and endovascular approaches[2]. The presence of a wide-neck or unfavorable configuration of the branches can make microwire and microcatheter navigations difficult, increasing the time of the intervention and the risk of intraprocedural complications[11]. Shaping of the microcatheter, guidewire or both may help the access to the artery or the aneurysm sac [6-8]. In addition, the use of a support balloon to facilitate guidewire engagement and navigation of the vessel, and to assist with microcatheterization has been described for the treatment of complex aneurysms[5], dural[17] and cerebral arteriovenous malformations[9]. Flow disruption with the WEB device (Sequent Medical, Aliso Viejo, CA) is an innovative technique for the endovascular treatment of wide-neck bifurcation aneurysms. The WEB is an intrasaccular, spherically shaped, self-expanding, braided device with a dense mesh constructed from a large number of extremely fine nitinol wires[1]. This construct disrupts blood flow at the level of aneurysm neck, promoting intrasaccular thrombosis[3, 10, 13-15]. Recently, the possibility to extend the indications of WEB devices for the treatment of distally located or more complex aneurysms has been highlighted[12]. We propose the use of a WEB placed inside the sac to cross the aneurysm neck with the microwire, blocking alternative routes and allowing an easy changing of the direction, with the aim to facilitate the catheterization of the target vessel.

Illustrative Technical case report (Figure 1)

A 68-year-old woman was admitted to our hospital with a WFNS grade 4 subarachnoid hemorrhage. The angio-CT revealed a giant aneurysm of the posterior wall of the right internal carotid artery (ICA). With the patient under general anesthesia, a digital subtraction angiography (DSA) was performed confirming a 28mm x 26mm aneurysm incorporating the right Pcom artery. Giving the presence of a fetal type of the Pcom artery originating from the aneurysm, the strategy was to perform a partial coiling of the sac, avoiding the occlusion of the Pcom, together with the deployment of a flow-diverter. Access to the aneurysm was obtained in a triaxial fashion. Through a long femoral sheath, a 6F guiding catheter was advanced into the carotid artery. Vessel and aneurysm features were analyzed via biplane and 3D rotational angiography. Under roadmap guidance, several attempts to advance a microwire across the aneurysm neck failed due to microwire prolapse into the aneurysm. Many types of microwires were unsuccessfully used to cross the aneurysm neck. A balloon-assisted microwire navigation was tried inflating a compliant 7 x 7 Hyperform balloon (ev3, Irvine, CA, USA) at the aneurysm neck. However, given the dimension of the aneurysm neck, the balloon was not able to redirect the microwire. Accordingly, a WEB SL 9 x 7 was navigated through a VIA .027 microcatheter and then it was opened into the aneurysm sac. The WEB was then gently pulled back until the aneurysm neck: with the contact surface of the WEB, the trajectory of the microwire (Asahi Chikai black .014) was efficiently redirected, crossing the aneurysm neck and allowing the catheterization of the M1. The WEB was then delivered into the sac, and a second microcatheter was placed into the aneurysm for coiling. Subsequently, a PED 45 x 25 was deployed through a .027 microcatheter covering the neck. Before stent deployment, an intravenous bolus of abciximab (0.125 mg/kg) was administered. The aneurysm was then successfully coiled, avoiding the origin of the fetal Pcom artery. No intra/periprocedural treatment-related complications were encountered.

Discussion

Navigation of the microwire and the microcatheter is essential in endovascular treatments of intracranial aneurysms. However, in some instances, the presence of a very wide-neck aneurysm, an acute angle between the target and the parent artery, or an unfavorable projection of the lesion can make catheter navigation across the aneurysm neck quite difficult. The struggling microcatheter navigation, with multiple attempts and excessive wire exchanges, increases the risk of distal wire perforation[9]. Different techniques have been described to facilitate microwire navigation in difficult anatomical situations. Balloon-assisted super selective microcatheterization has been reported in cases of very recurrent feeders of AVMs [9] and DAVFs [17]: a compliant balloon inflated in the parent artery after the origin of the feeder provided support for the navigation of the microwire, facilitating the catheterization of the target vessel. Cekirge et al[4] reported the "balloon-assisted endovascular neck bypass technique" for difficult very large/giant aneurysms. In this technique, a guidewire is gently pushed inside the aneurysm, making a loop inside the sac to reach the outflow of the aneurysm and then the target artery. A HyperForm balloon is advanced over the wire into the artery: inflating the balloon to stabilize the system, the loop is straightened by gently pulling the balloon catheter, reaching the access of the target vessel.

Wolfe et al[16] presented a technique in which a Hyperform balloon is inflated inside large/giant aneurysms and used as a contact surface to "bounce" another remodeling balloon across the aneurysm neck. However, in this technique over inflation should imperative avoided to prevent aneurysm rupture or vessel dissection.

In our study we reported the application and the feasibility of the WEB-assisted microwire navigation across the aneurysm neck. In this technique, a WEB was opened inside the aneurysm sac and gently pulled back at the neck: the WEB provided a contact surface to redirect the microwire across the neck, avoiding the prolapse of the microwire inside the lesion. Comparing with the inflation of the balloon inside the aneurysm, the WEB-assisted catheterization may be, in general, a safer strategy. However, the choose of the correct size of the WEB is crucial to adequately cover the aneurysm neck, whereas, during the use of the balloon, his inflation must be accurately balanced. This technique was successfully used to bypass very wide-neck aneurysms (Figure 1), or for the treatment of lesions with unfavorable parent vessel-neck angle. In figure 2 and figure 3, immediately after the curve of the carotid siphon, the large neck of the ophthalmic artery aneurysm presented a critical angle with the parent artery, making quite tough the bypass of the aneurysm neck with the microwire. The opening of a WEB device inside the sac and close to the aneurysm neck, provided an effective and safe support that allowed the redirection of the microwire into the target vessel. In patient number 1, the WEB was deployed inside the aneurysm, whereas in cases numbers 2 and 3 the WEB was retrieved. The last two cases were large aneurysms (approximately 10mm), and it is likely that the deployment of the WEB may influence the cage structure of the coils. Contrariwise, the first case was a giant aneurysm, and the impact of the WEB was considered negligible for the disposition of the coils.

Finally, it is important to point out that, despite the feasibility of this strategy, WEB remains an expansive device that increases the cost of the procedure.

Conclusions

The use of a WEB device to assist the microwire navigation appears an alternative strategy to gain the access of the target vessel in cases of complex anatomical vessel/aneurysm configuration.

Disclosure of interest: The authors declare that they have no competing interest.

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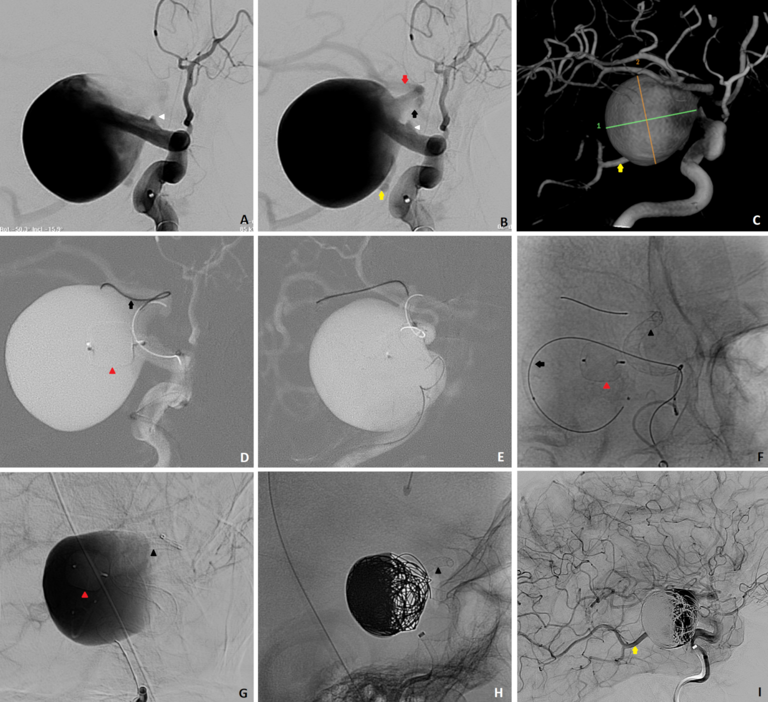
Figure Legend

Figure 1. A 68-year-old woman with a ruptured giant right Pcom artery aneurysm (A). White arrow-head depicting a possible small dissection on the posterior wall of the ICA, close to the origin of the aneurysm. An oblique view showing the wide-neck aneurysm with a fetal variant of the Pcom artery arising from the sac (yellow arrow). The red arrow and the black arrow indicate the right M1 and the right A1, respectively (B). 3D reconstruction of the aneurysm (C). A WEB SL 9 x 7 (red arrow-head) was opened into the sac and placed at the aneurysm neck, allowing support surface to redirect the microwire (black arrow-head) (D). Successful catheterization of the right MCA (E). A second microcatheter was placed inside the aneurysm (black arrow) and a PED 45 x 25 was deployed (black

arrow-head) covering the neck. The WEB was released into the sac (red arrow-head) (F). Flow stagnation inside the aneurysm (G) that was partially coiled (H) with the aim to avoid the occlusion of the fetal Pcom artery (yellow arrow) (I).

Figure 2. A 65-year-old woman with a large unruptured left ophthalmic artery aneurysm (A). Another mirror contralateral ophthalmic artery aneurysm has been coiled in another treatment session (black arrow-head). Oblique view showing the broad-based aneurysm and the origin of the ophthalmic artery (white arrow-head) (B). 3D angiograms depicting the angle between the carotid siphon and the aneurysm neck (C and D). Due to the large neck and the unfavorable vessel-aneurysm angle, a .014 microwire was navigated (white arrow) by using the contact surface of a WEB SL 8 x 5 (red head-arrow) opened inside the aneurysm and close to the neck (red head-arrow) (E and F). The WEB-assisted technique allowed the progression of the microwire into the right MCA (red arrow) (G and H). VasoCT showing the correct vessel wall apposition of a PED 45 x 14 (yellow arrow), and the coiling of the sac (I).

Figure 3. A 63-year-old woman with a large and irregular ophthalmic artery aneurysm discovered due to visual symptoms. Frontal view (A), and oblique view (B) depicting the angle between the aneurysm neck and the carotid siphon, as well as the steep angle of the MCA (red arrow-head). The aforementioned technique was performed with a WEB SL 7 x 5 (black arrow-head), allowing the navigation of the microwire into the MCA (D, E, and F). A PED 42.5 x 14 was navigated into the target vessel (red arrow) (G). Deployment of a PED (red arrow) and coiling of the aneurysm through a .021 microcatheter (yellow arrow-head) (H and I).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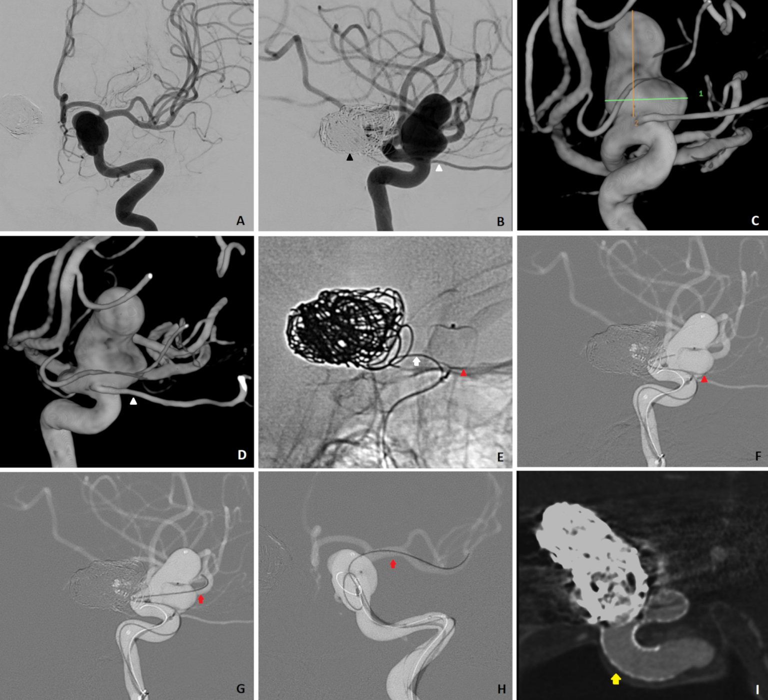
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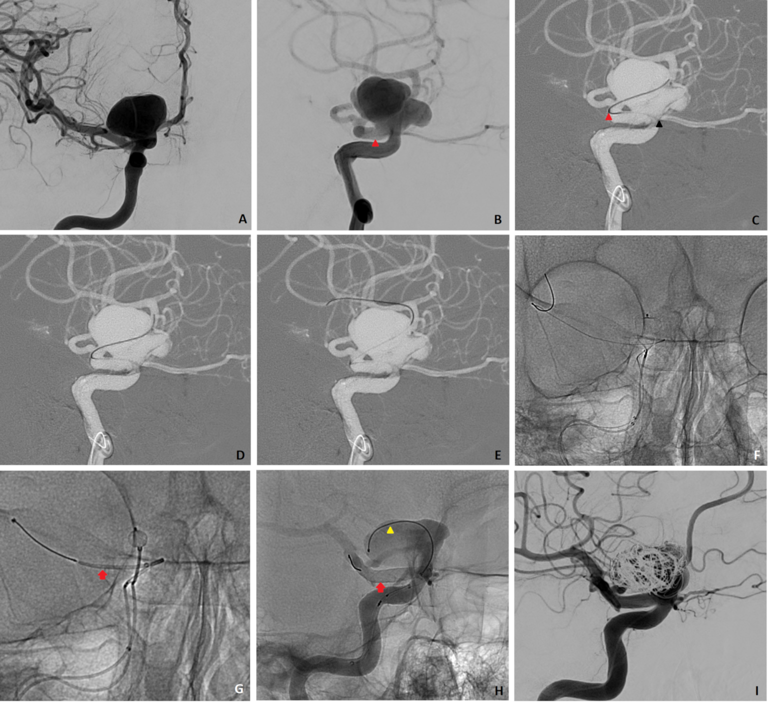
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