DOI: 10.5137/1019-5149.JTN.21334-17.2
Received: 02.08.2017 / Accepted: 06.12.2017
Published Online: 29.01.2018

Case Report

Intentional Herniation Technique with the Neuroform EZ Stent System for Preservation of Aneurysmal Neck Branch: A Case Report

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ABSTRACT

Endovascular treatment of bifurcation aneurysms is difficult and complicated because arterial branches may arise from the aneurysmal neck. We treat these cases with complex techniques such as Y or T stenting. In this report, we deployed one Neuroform EZ stent using the intentional herniation technique for the preservation of arterial branches. A 78-year-old female presented with two unruptured aneurysms. One was an 8 mm aneurysm located at the bifurcation of the internal carotid artery and the posterior communicating artery (PcomA). The other was an 11 mm aneurysm located at the cavernous segment of the internal carotid artery. A 4.5×20 mm Neuroform EZ stent was placed across the aneurysm neck. The delivery wire and microcatheter were pushed during deployment, similar to braided stents. High resolution cone beam computed tomography (CT) after stenting revealed the stent strut to be vertically aligned near the aneurysmal sac, and the PcomA orifice was preserved. We performed coil embolization easily and achieved acceptable obliteration. Our intentional herniation technique may be useful in some cases. Open cell stents have some advantages depending on the method of deployment.

KEYWORDS: Neuroform EZ stent, High resolution cone beam CT, Stent assisted coil embolization

INTRODUCTION

The endovascular treatment of wide-neck aneurysms which are located at vessel bifurcations is very complicated and requires the use of a variety of devices in order to obliterate such aneurysms. The Neuroform EZ stent system (Stryker, Kalamazoo, MI) has a unique open strut design which facilitates stent delivery, positioning, and deployment. However, published reports state that the clinical outcomes, and complications associated with coil embolization, using the Neuroform EZ stent are acceptable (1,7). In this study, we report a case of a bifurcation aneurysm which had a wide neck and a branch originating from the aneurysm's sac. We treated this case with a Neuroform EZ stent using our intentional herniation technique, thus preserving the internal carotid artery (ICA) and the orifice of the posterior communicating artery (PcomA).

CASE REPORT

A 78-year-old female was diagnosed by magnetic resonance imaging (MRI) as having two left ICA aneurysms (Figure 1). Diagnosis was subsequently confirmed by digital subtraction angiography (DSA). One aneurysm was located at the bifurcation of the PcomA while the other was located at the cavernous portion (Figure 2A, B). The ICA-PcomA aneurysm was irregularly-shaped and 5.16-8.30 mm in size. The cavernous aneurysm was regular-shaped and 9-11.21 mm in size. We attempted to treat both aneurysms during the same procedure.

Cone Beam Computed Tomography (CT) Protocol

High-resolution cone beam CT was performed using a flat panel detector biplane angiographic system with commercially-available software (Xpert; Philips Healthcare, Amsterdam,

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The Netherlands) using the following parameters: 20 second acquisition, 120° total angle, 1024 matrix in projections, 6°/s, and 30 frames/s, for a total of 600 frames. Reconstructive images were created using a commercial work station (Xtravision; Philips Healthcare, Amsterdam, The Netherlands).

Procedure

Under local anesthesia, an 8 Fr. Fubuki guiding catheter (Asahi Intec, Tokyo, Japan) was navigated to the left ICA. The vessel structure was then checked an Excelsior XT-27 micro-catheter (Stryker, Kalamazoo, MI, USA) navigated into the left ICA with a headway 17 micro-catheter (Terumo, Tokyo, Japan) inserted into the ICA-PcomA aneurysm. Both procedures were accomplished with a Chikai 0.014 inch guidewire (Asahi Intecc, Aichi, Japan).

Next, we used our novel technique to deploy a 4.5 x 20 mm Neuroform EZ close to the neck of the aneurysm, intensively pushing the delivery wire and the XT-27 micro-catheter (Figure 3A). After stenting, we used cone beam CT to confirm that the stent had been deployed in an appropriate manner. The stent`s greater curvature struts were arranged vertically and herniated into the aneurysm sac, thus maintaining the space of the PcomA orifice (Figure 3B). Following confirmation, we used Target coils (Stryker, Kalamazoo, MI, USA) to perform a coiling procedure. During the procedure, some coils were inadvertently placed outside of the aneurysm sac; despite this, the patient had no symptoms, including headache or nausea. Coiling was thus continued and achieved an acceptable level of obliteration (Figure 3C).

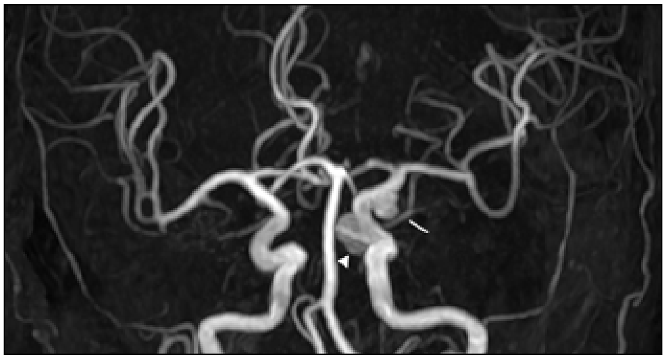

Figure 1: Magnetic resonance angiography showing two internal cerebral aneurysms; one located at the bifurcation of the PcomA (arrow) and the other located at the cavernous segment (arrow head).

Using the same procedure, the cavernous aneurysm was coiled with a balloon catheter and was completely obliterated (Figure 4A, B).

Post-procedural Course

Following the procedure, the patient did not exhibit any additional symptoms and was discharged after only 5 days. Post-procedural MRI showed no positive findings on diffusion-weighted images (DWI).

Follow-up

The patient was administered with dual antiplatelet medicines for 6 months. Follow-up DSA was performed 6 months after the intervention which showed that both aneurysms had been acceptably obliterated and that there was no clot formation in the proximity of the coils and stent. The PcomA remained patent (Figure 5A, B) and the patient continues to be administered a single antiplatelet medicine.

■ DISCUSSION

The endovascular treatment of bifurcation aneurysms remains complicated and often requires the use of adjunctive techniques and the deployment of balloon catheters or stents. However, the use of additional devices increases

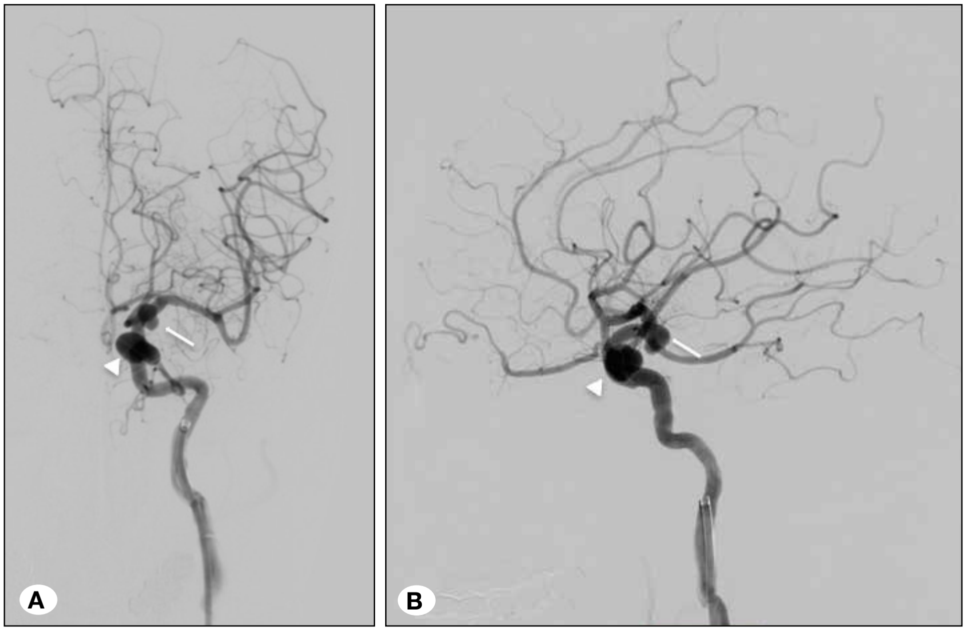

Figure 2: Initial DSA showing two aneurysms of the left ICA; one located at the bifurcation of the PcomA (arrow) and the other located at the cavernous segment (arrow head). **A)** AP view. **B)** lateral view.

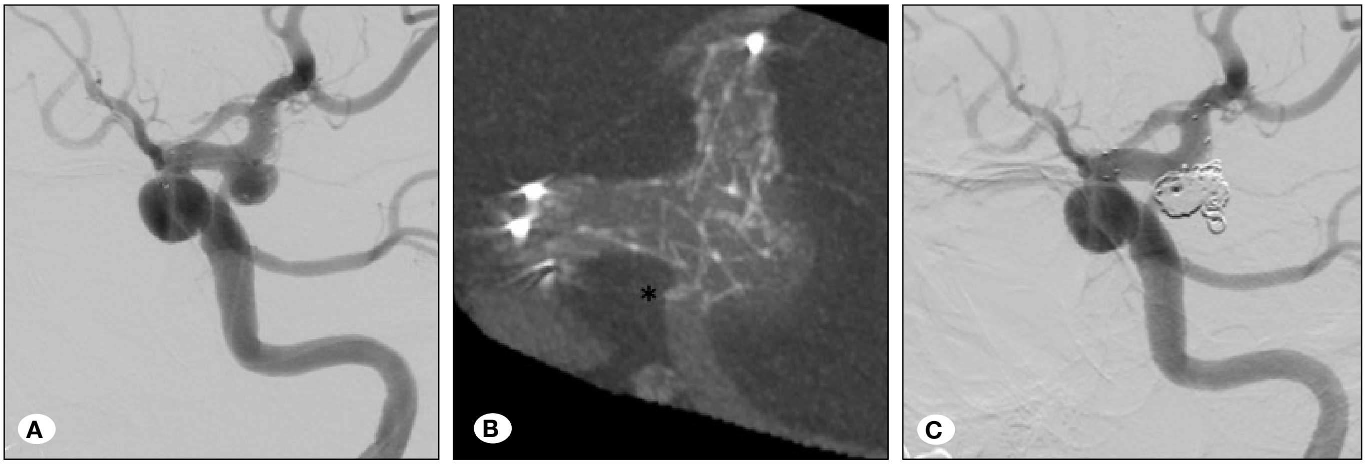

Figure 3: A) Conventional angiogram following the deployment of the Neuroform stent. **B)** High-resolution cone beam CT image showing the stent struts covering the orifice of the PcomA (asterisk) and herniating into the aneurysmal sac. **C)** Final angiogram showing coil embolization of the PcomA aneurysm.

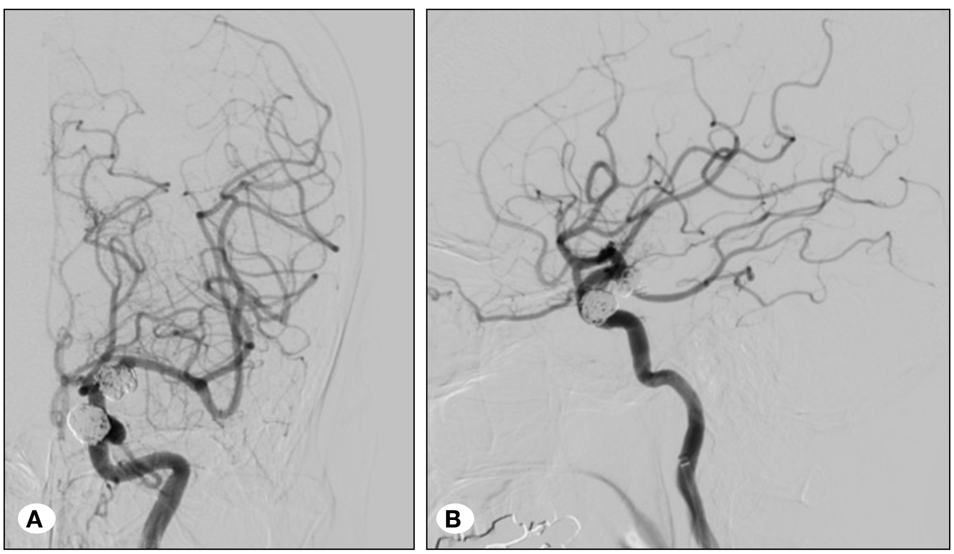

Figure 4: Final DSA showing the obliteration of the two aneurysms. **A)** AP view. **B)** Lateral view.

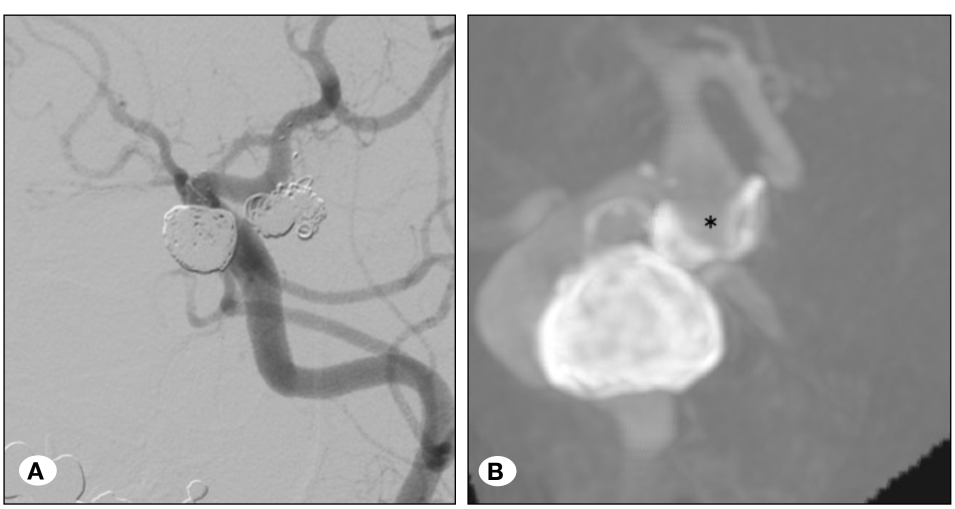

Figure 5: Follow-up DSA at 6th months showing occlusion of the two aneurysms and the patent PcomA. **A)** Conventional DSA at working angle. **B)** Cone beam CT showing the PcomA orifice being kept away from the coils (asterisk).

the risk of ischemic complications. In some difficult cases, Y-configuration stents may be used; however, the procedural complication rate of this device is relatively high at 11.1% (4).

In a previous study, Darflinger et al. used a silicon simulator to describe the barrel technique using an low-profile visualized intraluminal support (LVIS Jr.) stent (Terumo, Tokyo, Japan) (3), but noted the limitations of laser-cut nitinol stents with regards to their maximum diameter. However, Neuroform EZ stents are open-cell stents, and due to their unique design, there is increased room for the stent struts and an increased cell opening to prolapse into the aneurysm orifice (2). Because of the limitations of the LVIS Jr stent's maximum diameter (4.5 mm compared to 5 mm in the Neuroform EZ stent), we would not have been able to adequately cover the orifice of the PcomA using the standard technique with the LVIS Jr stent. Using our novel technique, it was possible to adapt the diameter of the Neuroform EZ stent to 5.9 mm in our patient; this indicates that this type of stent could be successfully adapted for larger vessels if required.

The barrel stent (Medtronic Minneapolis, MN, USA) has been reported to be effective in the treatment of wide-necked bifurcation aneurysms (8). This is a laser-cut closed-cell stent which has a unique design with a bulged center section for the aneurysm neck to support coiling. However, it is not currently approved for use in Japan. Other new devices have appeared on the market, and designed to support coiling, but have not yet been approved in Japan. These include pCONus (Phenox, Bochum, Germany) and Pulse rider (Pulsar Vascular, San Jose, California, USA) (5,9). However, these devices are not suitable for curved vessels.

This technique had some limitations which need to be considered. Firstly, the Neuroform EZ stent was not visible using conventional fluoroscopy. Consequently, we were not able to confirm its correct positioning and form during deployment without high resolution cone beam CT examination. Secondly, this technique requires a pushing maneuver which means that the stents had to be deployed very carefully. Thirdly, this technique is useful for coiling in the greater curvature of the artery because the struts fit the vessel wall and protect against coil migration. However, in the lesser curvature, there was a visible gap between the vessel wall and the stent strut (6). Finally, the long-term results of this particular technique remain unclear and require further investigation.

■ CONCLUSION

Complex bifurcation aneurysms can be successfully treated in an endovascular manner using the Neuroform EZ stent and our intentional herniation technique. For each case, the application of our technique allows the number of stents and devices to be reduced and therefore helps to avoid thrombotic complications.

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