Retrieval of distorted pipeline embolic device using snare-loop

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Abstract

Background—Flow-diverter stents are increasingly being used in the endovascular treatment of intracranial aneurysms. Because of this increased usage, the occurrence of stent malpositioning, intra-arterial distortion, or migration will likely increase as well.

Methods—We describe the conformational twisting and deformity of a pipeline embolic device (PED) stent (Covidien, EV3) within the carotid artery during stent placement, with the subsequent immediate removal of the stent by using an endovascular snare-loop to successfully remove the device.

Results—The PED can be successfully removed using a snare-loop device when indicated. In this case, following removal of the initial PED, the aneurysms can be successfully treated with the placement of a second PED.

Conclusion—It is critical to have a contingency plan for the removal of malpositioned or otherwise deformed stents that could potentially represent significant sources of iatrogenic stroke.

Key words
Pipeline embolic device; retrieval; snare loop; Intracranial; aneurysm

Introduction

The use of endovascular devices to treat cerebrovascular diseases has increased dramatically in the past several years, and along with this expanded use of endovascular devices, there is also the distinct possibility that one of these devices will remain in an unintended location, requiring removal. Some of the more common devices to become misplaced include catheter fragments, guidewires, stents, dislodged embolic coils, and sheath fragments [1]. These events can precipitate serious complications, including vessel thrombus, vessel rupture with brain hemorrhage, endothelial damage during retrieval, or dislodging of embolic material with subsequent stroke.

Flow-diverter stents have become integral devices in the effective treatment of vascular abnormalities in the central nervous system, particularly the pipeline embolization device (PED, EV3/Covidien; Plymouth, MN). In this case report, we describe the twisting and subsequent deformity of a pipeline stent during placement in the supra-clinoid carotid artery for treatment of an aneurysm, requiring immediate extraction of the device. To our knowledge, this case involving a pipeline stent with significant distortion and subsequent retrieval has not been previously described in the literature, and this is the first of its kind. We further describe the subsequent treatment and recovery involved in this patient.

Case report

A 38-year-old man with no medical or surgical history experienced a sudden onset of headache after sneezing. Computed tomography scan of the head at an outside hospital revealed a small basilar cistern hemorrhage, and the patient was transferred to our facility for a higher level of care. He remained wide awake, alert, and fully oriented, with no apparent deficits, but did endorse headache, nausea, and some photophobia. Cerebral angiogram was performed, and demonstrated two dissecting blister aneurysms on the left supraclinoidal seg-
ment of the carotid artery. Treatment options were discussed with the patient, and he subsequently elected for endovascular treatment of his aneurysms.

Following diagnostic arteriogram, the patient was loaded with heparin (100 units/kg to maintain activated clotting time 250–300 s), and the left carotid artery was successfully accessed using a 6F Neuron Max guide catheter (Penumbra; Alameda, CA), followed by a Excelsior XT-27 delivery catheter (Stryker; Kalamazoo, MI) positioned into place over a Terumo Double-Angle 0.016-in. guidewire (Terumo, Somerset, NJ). At this point, a 5 × 18 mm PED was then deployed across the area of the dissected aneurysms and down through the distal carotid siphon. After being fully deployed however, it became evident that the proximal portion of the PED within the carotid siphon failed to expand fully (Figure 1), and although it did not appear to significantly inhibit flow within the carotid artery, the decision was made immediately to remove the device, as access through the PED could not be achieved.

A 4 mm Amplatz Goose-Neck microsnare-loop device (Covidien/EV3; Plymouth, MN) was then introduced via the Neuro Renegade Microcatheter, and was looped around the proximal end of the deformed PED, allowing it to be snared and pulled to the microcatheter and subsequently removed. There was no attempt to try to snare the PED distally. This PED had severe deformity upon examination, once removed (Figure 2). A second PED (5 × 14 mm) was then deployed successfully, completely covering the area of the aneurysms. Balloon angiography was performed on the proximal segment of the PED to ensure full expansion to the arterial walls. The patient recovered uneventfully in the ICU, with no apparent deficits. A magnetic resonance imaging was performed and did show several small punctate regions of diffusion restriction in the distal MCA distribution, though with no evidence of any hemorrhage or thrombosis near the supraclinoid carotid artery.

Discussion

Having a contingency plan to retrieve a foreign body device is critical to minimizing complications. Snare-loops have been employed successfully in the past, as have balloon catheters, curved catheters, and stone baskets. In a recent comprehensive review of all reported cases of retrieval of malpositioned endovascular devices, it was found that endovascular methods of retrieval predominated (94% of cases), with very high rates of success [2]. Combined open/endovascular methods of retrieval have also proven successful, with a lower, though significant percentage of overall cases of unsuccessful retrieval.

With an ever-increasing usage, flow-diverter stents also have problems common to other stents as well as their own unique set of problematic issues including difficulty with deployment, accordion effect, and stent twisting during deployment. Furthermore, the inherent design of flow-diverter stents is to provide a more dense matrix of stent wires to provide sufficient diversion of blood flow to at least partially occlude or divert flow away from intracranial aneurysms or other vascular malformations. Given the increased density of these stent walls compared with most currently available open-cell or closed cell stents, it is possible that severe in-stent

Figure 1. (A) Oblique view of the distorted PED within the left carotid artery, arrowhead indicating the proximal end. (B) Angiography of the left carotid artery showing that despite the stenotic proximal segment of the PED (arrowheads), there is still distal blood flow to the carotid artery. (C) Three-dimensional reconstruction of the distorted stent.
deformity after deployment (as in this case) may present a more significant physical barrier to blood-flow through the deformity than less densely packed stents would. Here, we have shown that a previously used method for the removal of other stents can also be successful in the case of a pipeline stent. It is likely that the showering of microemboli that occurred in this case occurred during the removal of the stent with the snare, as in our experience it is exceedingly rare to have any areas of diffusion restriction after uneventful placement of a PED.

It is important to note that even after retrieval of the stent, we proceeded with successful placement of a second pipeline stent over the original area intended to be

Figure 2. (A) Snare-loop device being deployed to successfully capture the proximal end of the PED (arrowheads). (B) Removal of the stent into the catheter placed proximally to the PED. (C) Three-dimensional reconstruction of the final placement of another PED covering the area of the aneurysms (arrows). (D) Once outside of the catheter, the stent could be seen to be clearly deformed.
covered by the stent. This served two purposes: first, to continue with the planned therapeutic treatment of the supra-clinoid aneurysm, and secondly, to cover the area of the artery where the deformed previous stent had been dragged across the endoluminal wall. In the latter purpose, this was a prophylactic measure to prevent the formation of any thrombi as well as to prevent any possible arterial dissection from the trauma of retrieving the stent.

Conclusions
Flow-diverting stents are fundamentally different from previous generations of stents, specifically designed to alter blood flow with their more dense array of stent wires, and may behave differently than more open stents if they have stenotic or deformed regions, as in this case. Despite these differences, we have shown that removal of the device is possible, with minimal collateral damage or neurologic injury.

References