Rescue Retrieval of a Fully Deployed Low-Profile Intracranial Stent After Acute Occlusion

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The use of self-expandable stents for endovascular treatment of intracranial aneurysms has increased over time. Different types of stent malpositioning, such as stent migration, distortion, incomplete opening, and apposition, can occur as a complication of the stent deployment procedure. In this report, we present a successful retrieval of a low-profile stent after full deployment in a dissecting posterior-inferior cerebellar artery because of incomplete apposition and subsequent acute occlusion of the stent.

The use of self-expandable stents for endovascular treatment of intracranial aneurysms has increased over time. For the treatment of wide-necked aneurysms, self-expandable intracranial stents can be deployed into the parent arteries to prevent coil protrusion, termed the *stent-assisted coiling technique*, or they can be used as flow-diverting devices as a stent monotherapy without coiling.[1–4]

All but one type of self-expandable intracranial stent (Solitaire, Covidien, Plymouth, Minnesota, USA) are not retrievable after full deployment. Here, we report the successful retrieval of a fully deployed low-profile intracranial stent after its acute occlusion in a patient with a dissecting posterior-inferior cerebellar artery (PICA) aneurysm.

CASE REPORT

A 32-year-old male patient presented with severe headache and sudden weakness in his right arm and leg. His initial neurologic examination revealed right hemiparesis (grade 3/5). Cranial magnetic resonance and magnetic resonance angiography examinations demonstrated a saccular aneurysm in the left PICA. Subarachnoid hemorrhage was excluded by a negative noncontrast-enhanced cranial computed tomography and lumbar puncture. Cerebral digital subtraction angiography (DSA) was performed to evaluate the PICA aneurysm. Cerebral DSA revealed an 8 × 4 mm—sized, wide-necked dissecting saccular aneurysm located in the lateral medullar segment of the left PICA (**Figure 1**). The diameter of the medullary segment of the PICA was 1.6 mm. His hemiparesis regressed completely within 48 hours following admission. The possible treatment options were discussed with the patient. Stent monotherapy using a low-profile intracranial stent was chosen.

Procedure

Dual antiplatelet therapy with 300 mg/day aspirin and 75 mg/day clopidogrel was initiated 5 days before the procedure. The proper responses to aspirin and clopidogrel were confirmed immediately before the procedure. The procedure was performed under general anesthesia. Systemic anticoagulation therapy was initiated immediately after insertion of a femoral introducer with a bolus dose of 5000 IU of heparin. A 6-Fr guiding catheter was placed into the V2 segment of the left vertebral artery. Two mg nimodipine (Nimotop, Bayer AG, Leverkusen, Germany) diluted in 150 mL saline were infused via the 6-Fr guiding catheter to prevent vasospasm. The posterior medullary segment of the left PICA was catheterized with a Headway 17 microcatheter (MicroVention, Tustin, California, USA) using a soft-tip Transend guidewire (Stryker, Fremont, California, USA) (**Figure 2**). A low-profile Leo baby stent (2.0 × 25 mm) (Balt, Montmorency, France) was deployed into the left PICA extending from the lateral medullary segment to the orifice of the PICA. The control DSA performed immediately after stent deployment showed stagnated filling of the aneurysm and incomplete opening and apposition of the stent in a very short segment (see **Figure 2**). An attempt of distal catheterization over the delivery wire failed. The control DSA images obtained 15 minutes after stent deployment revealed millimetric in-stent filling defects in the segment with incomplete apposition of the stent and stagnated flow in the PICA distal to the stent. Catheterization with a balloon microcatheter to perform in-stent balloon angioplasty was attempted. However, the maneuvers to catheterize this segment of the stent failed. The control DSA images that were obtained during the

Key words
- Aneurysms
- Low-profile
- Retrieval
- Stents

Abbreviations and Acronyms
DSA: Digital subtraction angiography
PICA: Posterior-inferior cerebellar artery

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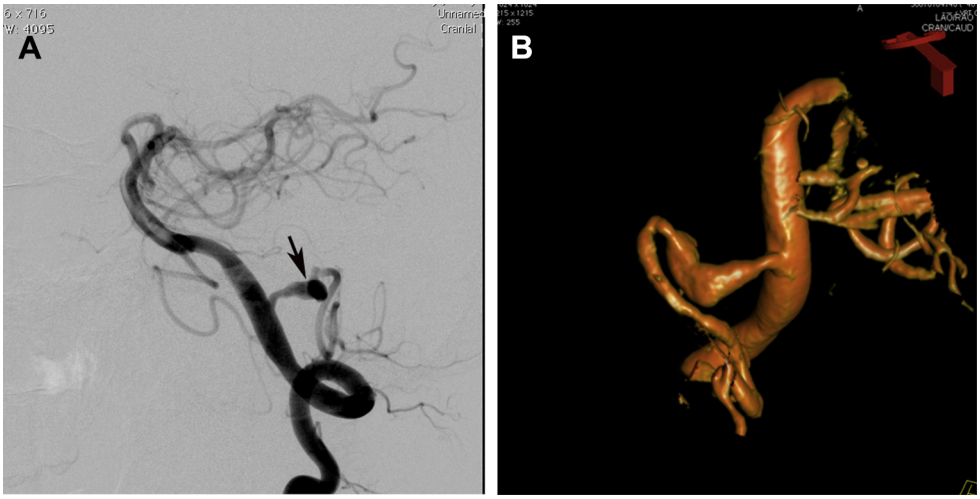

Figure 1. Digital subtraction angiography (DSA) and virtual volume rendering (VRT) angiography images obtained during the initial admission procedure. (**A**) DSA image in the lateral oblique projection shows an 8 × 4 mm wide-necked aneurysm (*arrow*) located in the medullar segment of the left posterior-inferior cerebellar artery (PICA). (**B**) VRT image demonstrates the wide-necked aneurysm in the PICA. The segment of the PICA just distal to the neck of the aneurysm has a tortuous course.

attempts of distal catheterization showed progression of the stagnated in-stent flow and, eventually, complete occlusion of the stent (see **Figure 2**). Furthermore, there was no collateral flow to the distal PICA territory. At this time, the decision was made to remove the occluded stent to restore blood flow through the PICA. With the help of a Transend guidewire, an SL-10 microcatheter (Stryker, Fremont, California, USA) was passed through the proximal struts of the stent to catheterize the basilar artery. A 4-mm Amplatz Gooseneck microsnare loop device (Covidien, Plymouth, Minnesota, USA) was introduced to the basilar artery via its 2.3-Fr microcatheter. The tip of the SL-10 microcatheter was captured by the loop of the microsnare. Next, the SL-10 and microsnare were pulled back together to retrieve the stent from the PICA. The stent, together with the SL-microcatheter and microsnare, were pulled down into the guiding catheter. Then the entire system and the guiding catheter were pulled back and removed (**Figure 3**). A control DSA showed complete restoration of blood flow through the PICA and in the sac of the aneurysm (**Figure 4**). The procedure was completed at that point, and the patient awoke and had no deficits. Stent-assisted coiling using a shorter low-profile stent was planned but had not been performed before the submission of this paper.

DISCUSSION

Parent artery occlusion, stent-assisted coiling, and flow diversion with stenting are the possible endovascular treatment options in a case of dissecting PICA aneurysm. In our case, because the aneurysm was located in the medullary segment of PICA, parent artery occlusion would cause severe neurologic deficits. Therefore stent-assisted coiling and flow diversion were the possible treatment options. When we considered the small diameter of the PICA (1.6 mm), we performed a flow diversion stent monotherapy by using a low-profile stent. And we preferred a low-profile Leo baby stent, which has a relatively high-flow diversion capacity.[5]

Incomplete stent opening and apposition is a rare technical complication that can develop during the deployment of a self-expandable stent. Incomplete stent apposition can lead to hemodynamic changes triggering in-stent thrombus formation and even total occlusion of the stent. In such situations, pushing and pulling manipulations of the stent delivery microcatheter inside the stent can achieve complete stent opening and apposition in most cases. Rarely, in-stent balloon angioplasty or telescopic implantation of a second stent may be required to achieve full opening and complete apposition of the stent.

In our case, the parent artery had a complex anatomy, which made stent deployment challenging. The parent artery had a stenotic segment just distal to the neck of the aneurysm. Moreover, the stenotic segment of the parent artery was tortuous with steep curves and acute angles. The Leo baby stent did not fully open in this segment, probably due to a compressing effect of the tortuous anatomy of the segment.[6] This technical complication eventually led to complete occlusion of the stent and PICA in our case.

The medulla has a rich perforator blood supply from the medullary segments of the PICA. In our patient, occlusion of those perforators would have inevitably caused a medullar infarct.[7] Furthermore, the lack of a distal collateral blood supply would have resulted in a cerebellar infarct. Thus as a bailout treatment option, we decided to retrieve the stent to restore the blood flow through the PICA.

Retrieval of embolized or lost coronary stents has been described previously[8]; however, in the literature, there are few case reports of the intracranial stent retrieval.[9–11] Mitchell et al. reported the