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Case Report

Sofia Catheter as a Valuable Tool to Rescue Embolic Protection Device with Difficult Retrieval in an Elderly Carotid Artery Stenting

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SUMMARY

Embolic protection device (EPD) is a well-described adjunct in carotid artery stenting for its benefit of reducing perioperative stroke, but EPD retrieval is sometimes challenging, especially in elderly patients. We described a 73-year-old patient of EPD retrieval difficulty with falling of the guide catheter into hostile aortic arch during the right carotid open-cell stent placement under filter device. In this case, type III arch, tortuosity distal to stenosis and calcified plaque resulted in angulated path, made filter wire entrapped in stent struts, and pulled back guide catheter into aortic arch. A 6-French Sofia intermediate catheter was performed to bail the operator out and retrieve the EPD which was unsuccessfully resolved by all the other methods. The Sofia intermediate catheter is a valuable and final tool to resolve an EPD retrieval difficulty, especially when the filter wire is trapped in the stent and the guide catheter loses an access to carotid artery in elderly patients.

1. Introduction

Embolic protection device (EPD) is a well-described adjunct in carotid artery stenting (CAS) for its benefit of reducing perioperative stroke, but the use of EPD is not free of complications.[1,2] EPD retrieval is the last step of CAS, and retrieval failure equals treatment failure. The irretrievable EPD needed to be surgically removed or left in the vessel, which usually added iatrogenic complications.[3] However, significant advances in the devices design and neuroendovascular technique had provided more effective treatments for EPD retrieval difficulty.[4] Here, we reported an elderly case of EPD retrieval difficulty with falling of the guide catheter into hostile aortic arch during the right carotid open-cell stent placement under a filter device. In this patient, a 6-French Soft torqueable catheter Optimized For Intracranial Access (Sofia) intermediate catheter was performed to bail the operator out and retrieve the EPD.

2. Case report

A 73-year-old female with hypertension, hyperlipidemia and coronary heart disease presented to our hospital because of repeated activity-related dizziness and two syncope episodes. Physical examination showed the vascular murmurs in bilateral carotid artery and left supraclavicular fossa, and a weak pulse in left radial artery. The left brachial blood pressure was 141/74 mmHg, and right brachial blood pressure was 170/81 mmHg. No abnormality was found in nervous system examination. The ultrasound showed bilateral carotid bifurcation stenoses and complete reversal blood flow in left vertebral artery throughout the cardiac cycle, suggesting left subclavian artery steal. The magnetic resonance imaging (MRI) scan showed some cerebral lacunar infarctions in the bilateral frontal subcortical areas but she had no corresponding cerebrovascular ischemic events. The digital subtraction angiography (DSA) confirmed 90% stenosis with calcified plaque in the right carotid artery bifurcation, 50% stenosis in the left carotid artery bifurcation, and near occlusion with calcified plaque in the left subclavian artery (Figure 1). The stenting for right carotid artery stenosis was firstly considered because the stenotic rate was more than 70% and there was corresponding silent cerebral infarctions. However, the repeated dizziness and syncope might result from bilateral internal carotid artery or left subclavian artery stenoses. Since the patient had no left upper extremity ischemia or claudication, the left subclavian artery stenosis would be treated only when the symptoms still existed after the right carotid artery stenting.

Under local anesthesia, an 8-French Cordis Envoy guide catheter was unsuccessfully advanced into the right common carotid artery (CAA) by a Terumo glide wire because of type III arch and mild stenosis in innominate artery (Figure 1). A 5-French Cordis Tempo MP A1 catheter was employed to assist in advancing 8-French guide catheter into CAA by a coaxial technique. A sized 6.0 mm ev3 filter EPD was navigated through the right carotid stenosis by Boston PT2 microwire, and positioned in the distal C1 segment of internal carotid artery (ICA). The stenosis was successively dilated with 3 × 20 mm and 5 mm × 20 mm Clearstream LitePAC balloons. A 9 × 30 mm ev3 Protege Rx self-expandable stent was then deployed with a 20% residual stenosis (Figure 2). However, with multiple attempts, such as trying both end of retrieval sheath, adjusting the top direction of guide catheter, externally compressing carotid artery, and rotating the patient's head to the contralateral side, we could not success-

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fully pass the EPD retrieval system through the middle segment of the stent. 5-French MP A1 catheter also failed to pass through the stent. The repeated angiography showed that the filter wire was close to the stent wall (Figure 2). A 3 × 20 mm over-the-wire balloon was used to dilate the middle segment of the stent. The filter wire was successfully detached from the stent but 8-French guide catheter was pulled back to the aortic arch due to the excessive stretching stress. Attempts of moving 8-French guide catheter forward had a risk of pulling back the EPD. Therefore, using the coaxial technique of 8-French guide catheter, 6-French MicroVention Terumo Sofia intermediate catheter and 4-French MP A1 catheter over the filter wire, 8-French guide catheter was positioned in innominate artery, and 6-French Sofia catheter carefully was advanced to the carotid stent lumen, and then 4-French MP A1 catheter was withdrawn. The 6-French Sofia catheter floated following the blood flow without close to the stent. At last, with the help of Sofia catheter, the retrieval sheath smoothly passed through the stent and successfully captured the EPD (Figure 3).

3. Discussion

EPD retrieval sometimes was challenging, especially in the setting of calcified plaque, type III arch and carotid tortuosity, which were common in elderly patients.[5] The retrieval difficulty would prolong the procedure and increase the possibility of vasospam and intracranial complications.[3] For the open-cell stent, retrieval difficulty tends to appear in-stent, because the struts of the open-cell stent protrude into the stent and hamper inserting or advancing the retrieval device, especially in the presence of calcified plaques or vessel tortuosity.[2] In addition, the filter wire could be easily trapped deep into the stent struts in the open-cell stent.[6]

Some strategies have been described to rescue the EPD retrieval difficulty, including external carotid compression, turning the head to the contralateral side or swallowing, advancing the guide catheter close to or into the stent, and using a catheter with a curved tip.[2–4,7] However, none of these techniques worked in this case for following reasons: first, manual carotid compression is useful for closed-cell stent, but not for open-cell stent. Second, type III arch, mild stenosis in the ostium of innominate artery, calcified plaque and vessel tortuosity of right carotid stenosis resulted in an angulated path for the catheter and wire system in this elderly patient.[4] Thus in summary, the filter wire was more likely to be trapped in the stent struts and the curved tip of diagnostic catheters could not detach the filter wire from the stent struts.

A balloon catheter or over-the-wire balloon postdilation have been reported to pull the filter wire out of the stent struts.[6,8] Although the different sizes of balloons were used in these reports, a small over-the-wire balloon was chosen to perform postdilation in this case, because we mainly took advantage of the sharp tip of balloon to detach the filter wire from the stent struts but not to further dilate the stent. Unfortunately, although the balloon passed through the stent after postdilation, the attempt of advancing the guide catheter made it falling into the aortic arch because of more stretching force resulting from the angulated path. In this situation, EPD would be pulled back at any time to snag the stent margin or lumen due to insufficient support. Therefore, the guide catheter was set in innominate artery, and a 6-French Sofia intermediate catheter was advanced to the stent lumen and assisted in EPD retrieval. We adopted this strategy for the following reasons. First, the 6-French Sofia catheter is the second generation of the Sofia Distal Access Catheter, which is designed with a hybrid design of braid and coil for neurovascular access during diagnostic or therapeutic interventions.

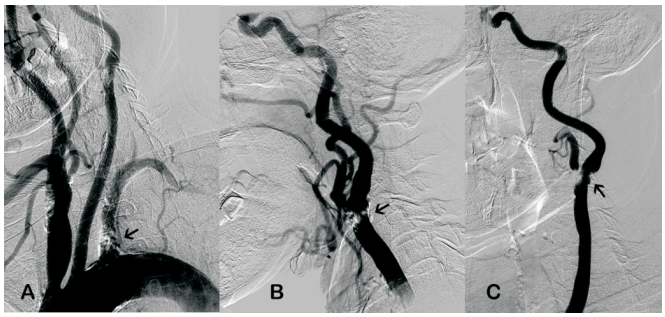

Figure 1. Pre-operational angiography. A showed type III aortic arch and near occlusion in left subclavian artery (arrow). B showed 90% stenosis with calcified plaque in right carotid artery (arrow) and distal tortuosity. C showed 50% stenosis in left carotid artery (arrow).

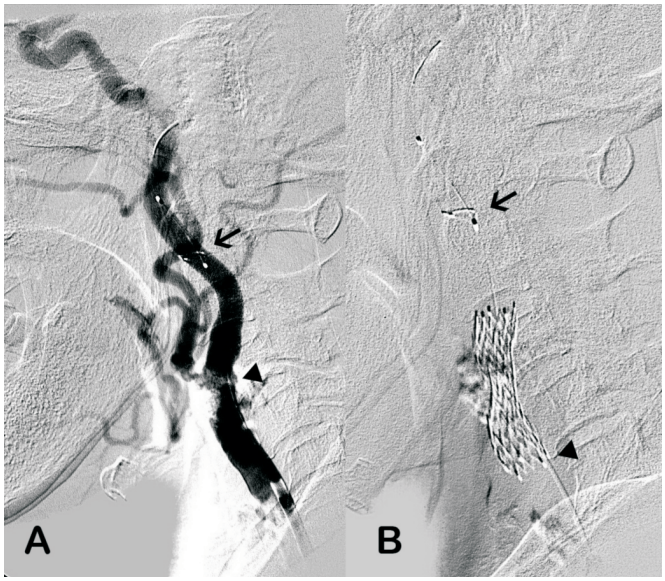

Figure 2. Endovascular procedures. A showed that embolic protection device (EPD) was successfully placed distally to stenosis (arrow), and the balloons were used to dilate stenosis (triangle). B showed that a 9 × 30 mm self-expandable stent was deployed over stenosis and the filter wire was close to the wall of stent (triangle), causing EPD retrieval difficulty (arrow).

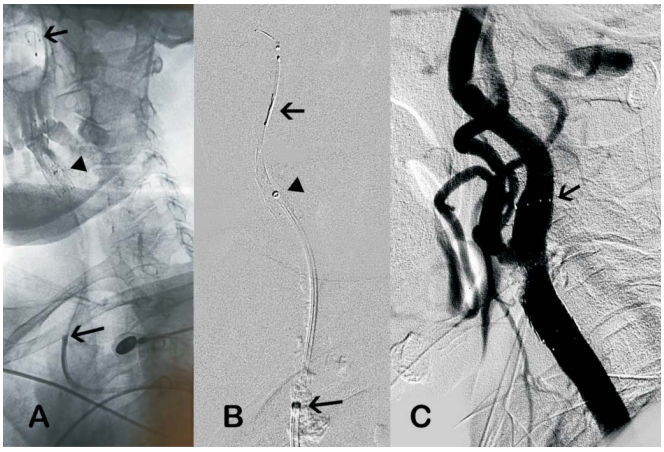

Figure 3. Salvaging trapped embolic protection device (EPD). A showed that 8-French guide catheter was positioned in innominate artery (long arrow), and 6-French Sofia intermediate catheter was advanced to stent lumen over filter wire (triangle). The filter device was distal to stent (short arrow). B showed that 6-French Sofia catheter floated in stent lumen (triangle), and retrieval sheath passed through stent to capture EPD (short arrow). 8-French catheter stably persisted in innominate artery (long arrow). C showed a 20% residual stenosis and stent end (arrow).

It possesses the characteristics of softness and flexibility to navigate through tortuous vessels such as aortic arch, CCA, and ICA siphon, even without guide wire or microcatheter support (named as the "SNAKE" technique). Second, a stable distal access catheter also provides a platform for manipulating the filter retriever device.[9] Moreover, the soft distal shaft of Sofia catheter can ensure its top end to float with the blood flow and not to contract with the vessel wall and stent. Kuhn previously reported that the 5-French Sofia intermediate access catheter was used to capture a hard-to-retrieve EPD in a case of carotid closed-cell stenting.[7] However, our case firstly showed that the Sofia catheter also rescued the EPD retrieval difficulty with the herniation of supportive guide catheter into the hostile aortic arch in the carotid open-cell stenting. In addition, if the EPD retrieval difficulty was anticipated in advance, we could also exchange a simple microwire with the EPD to perform the stenting after angioplasty. This method is helpful to avoid this problem.

4. Conclusion

The Sofia intermediate catheters are originally designed to enable interventionists to obtain adequate distal access to intracranial lesions.[9,10] This case demonstrates that it is also a valuable tool to rescue an EPD retrieval difficulty, especially when the filter wire is trapped in the stent and the guide catheter loses an access to carotid artery in elderly patients.

Conflict of interest

No potential conflict of interest is reported by the authors.

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