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Entrapment of Embolic Protection Device within Peripheral Stent: "Troubleshooting When Novelty Fails"

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Abstract

The use of embolic protection devices (EPD) in peripheral vascular procedures with higher risk of distal embolic shower has gained wider acceptance with evidence mounting in favor of its use. We report our unique experience on the circumstances leading to and management of entrapment of an EPD within peripheral stent during management of a patient with critical limb ischemia.

Keywords
- filter entrapment
- retrieval
- embolic protection devices

Introduction

The use of embolic protection devices (EPD) in peripheral vascular procedures with higher risk of distal embolic shower has gained wider acceptance with evidence mounting in favor of its use.[1] We report our unique experience on the circumstances leading to entrapment of an EPD within a peripheral stent and its management, during treatment of a patient with critical limb ischemia.

Clinical Presentation and Management

A 59-year-old male, a chronic smoker and alcoholic with hypertension, presented with blackish discoloration of right fourth and fifth toes associated with rest pain for 2 months. On examination, he had cold right lower leg and foot with loss of hair in lower leg. Right popliteal and pedal arteries showed monophasic low resistance "parvus-et-tardus" waveform on duplex ultrasonography. He had a prothrombotic risk with elevated homocysteine levels and CHADS VASc score of 3. Computed tomography angiography (CTA) showed hypodense intraluminal thrombus with peripheral intimal calcifications causing segmental occlusion of the distal superficial femoral artery (►**Fig. 1**). Based on imaging features, possible underlying pathophysiological mechanisms include rupture of chronic atherosclerotic plaque and thrombus formation or embolus trapped at the level of a prior plaque. The patient was started on dual pathway regime with aspirin and rivaroxaban. During revascularization, in view of easy passage of 0.035" Terumo guidewire across the occlusion, a Spider FX distal EPD of size 4mm was deployed across the lesion. Occluded segment was revascularized using 5mm angioplasty balloon and stented with a 5mm x150mm iVolution bare metal stent. Thrombolysis or thrombectomy was not considered due to the chronic presentation. Fish scaling of stent was seen in mid-segment that remained despite angioplasty. This segment corresponded to the location of the intimal calcification seen on CTA. All three infrapopliteal vessels showed improved flow.

The fish scaled stent segments prevented the passage of the recapture sheath and only partial recapture of EPD was feasible. The filter got entangled within the projecting stent struts. Furthermore, attempt at removal of this partially recaptured assembly caused reversible telescoping of stent thwarting

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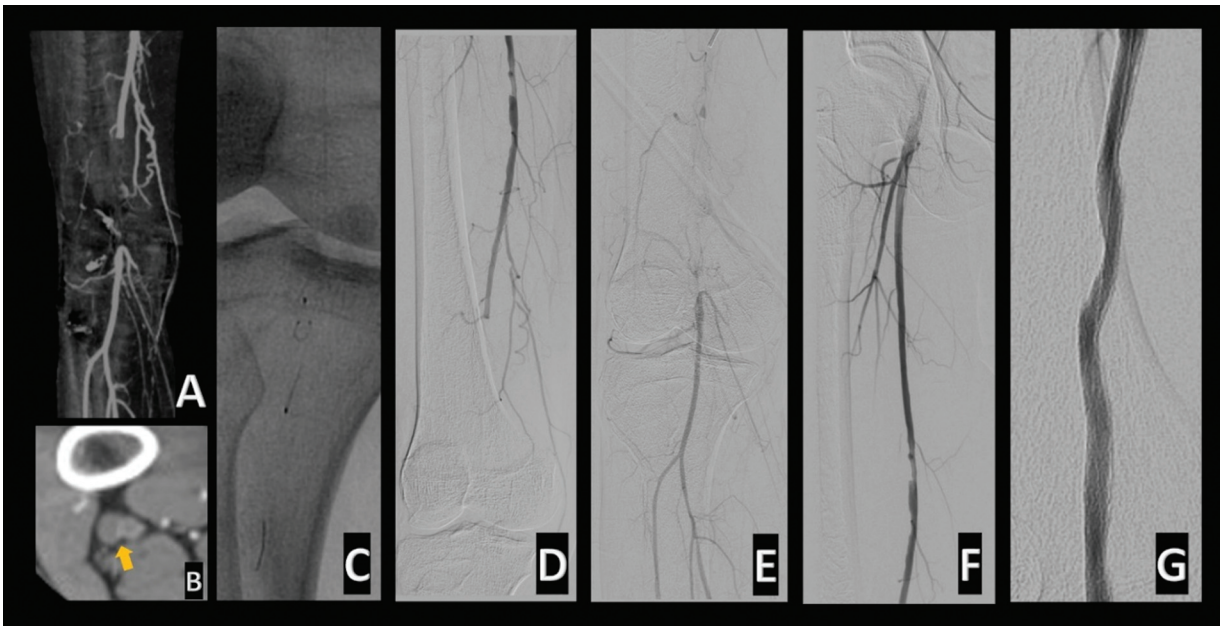

Fig. 1 Coronal (**A**) and axial (**B**) reformatted images of computed tomography angiography showing hypodense filling defect within distal superficial femoral artery at level of adductor hiatus causing occlusion with eccentric intimal calcifications (yellow arrow) seen on corresponding axial images suggestive of an acute or chronic pathology. Fluoroscopy and digital subtraction angiography images showing deployment of the Spider FX embolic protection device distal to occlusion (**C**), occluded segment prior to and following angioplasty with residual intimal flaps (**D–F**) and fish scaling of the open cell design stent likely owing to inadequate vessel preparation **G**).

removal in the proximal direction. Therefore, distal pedal access was achieved using 4Fr slender sheath (Terumo, Japan, Terumo Corp., Somerset, NJ, USA) under ultrasound guidance via posterior tibial artery and the filter was removed using a gooseneck snare from distal end (►**Fig. 2**). The conical shape of the filter facilitated disentanglement from stent and easy removal from distal access. Postprocedure duplex ultrasound showed biphasic high resistance waveform within pedal arteries. Immediate postoperative period was uneventful with reduction in rest pain. The gangrenous fourth and fifth toe underwent amputation. Complete healing of the amputation stump was achieved in 2 months. The patient improved symptomatically on follow-up visits at 3 and 6 months with no rest pain, ulcer or gangrenous changes.

Discussion

Evidence in favor of the use of EPDs in peripheral interventions has increased in today's era of vessel preparation and debulking atherectomy procedures. Data from DEFINITIVE Ca++ trial[2] and DEEP-EMBOLI registry[3] reiterate the safety and efficacy of EPDs in peripheral vasculature. Since EPDs have been extensively used in carotid revascularization, the management of complications associated with their use has also been well described in them. Techniques aimed at retrieval of entangled filters range from changing the position of the neck to novel techniques.[4] Passage of recapture sheath across the stent is

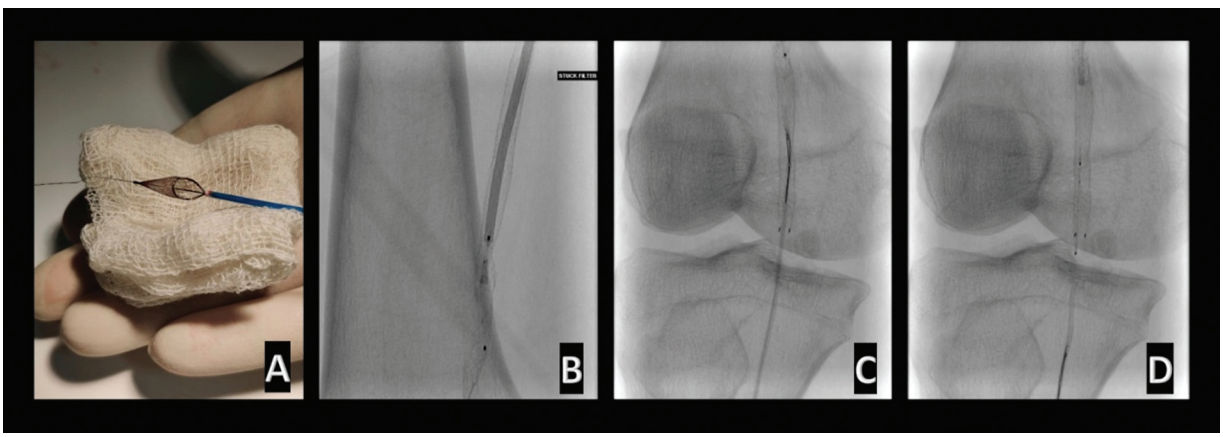

Fig. 2 Clinical photograph of the Spider FX embolic protection device (**A**). Fluoroscopic images showing entanglement of filter within stent with reversible distortion of stent morphology on traction (**B**). Retrograde snaring of filter not only facilitated filter removal but also reversed the traction on stent (**C** and **D**).

crucial for the successful complete filter recapture. Since distal access in the carotid and coronary anatomy is anatomically challenged, techniques hitherto described favor proximal approach. The "balloon-bridge" technique describes the use of a balloon catheter to dilate the segment proximal to filter entanglement. This dilatation not only allows easier antegrade passage of recapture sheath but also allows sideways movement of the filter within the stent. It is of prime importance to understand the design of EPDs. Devices including Spider FX and Filterwire have the filter eccentric to guidewire, while Angioguard and Accunet have central wire with concentric filter. The "olive-tipped" technique is an improvisation on the partial recapture technique where a small rent is created within recapture sheath tip to widen the ostium that facilitates easier recapture and lesser traction on the deployed stent.[5] Our experience introduces a new technique of filter retrieval, hitherto not reported that may be employed in all peripheral interventional cases where filter entrapment is suspected. Antegrade flow may prevent the dislodgement of any captured emboli during retrieval. However, the EPD may be full of emboli and could get dislodged. In addition, snaring and retrieval need to be careful since it can cause trauma to pedal vessels if they are very small in caliber.

Conclusion

To conclude, retrograde pedal retrieval can be attempted in case of stuck EPD. This, however, should be considered as an option rather than upfront resort.

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Conflict of Interest
None declared.

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