Early Supera stent fracture in the femoropopliteal artery

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Abstract

The Supera peripheral stent has been designed to resist stent fracture, which can develop from the torsion and compressive forces in the femoropopliteal artery. We report on a case of Supera peripheral stent fracture in the early period after the index procedure in a patient with femoropopliteal artery disease. An individualised approach, considering the lesion location, patient’s age and exercise capacity is important for the treatment of femoropopliteal artery disease.

Keywords: peripheral artery disease, popliteal artery occlusion, Supera interwoven nitinol stent, stent fracture

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The Supera peripheral artery stent (Abbott, CA, USA) has an interwoven nitinol design that allows it to mimic the natural movement of the anatomy and supports the vessel with minimal chronic outward force. Therefore, Supera stents can be effective when treating the dynamic environment of the superficial femoral artery and proximal popliteal artery. While observational data has supported its use, some complications have been reported.1-3 Here we present a case with a Supera peripheral stent fracture 12 days after stent implantation in the femoropopliteal artery.

Case report

A 73-year-old male patient visited our hospital complaining of right leg claudication (Fontaine stage IIb, Rutherford category 3) over three months. His past medical history and laboratory results were non-specific. Non-invasive studies of ankle–brachial index (ABI) and lower extremity computed tomography (CT) angiography showed right femoropopliteal artery total occlusion (Fig. 1).

The patient underwent percutaneous transluminal angiography (PTA) through the ipsilateral femoral artery (6 French, Ansel® sheath, Cook Medical, IN, USA) (Fig. 2A) using microcatheter support (CXI®, Cook Medical, IN, USA). A 0.014 wire (Command ES®, Abbott, CA, USA) was used for lesion crossing. As required by the Supera stent instructions for use, sequential predilatation of the femoropopliteal lesion was performed (Admiral Xtreme® 5 × 80 mm, Medtronic, MN, USA) and the Supera 5 × 80-mm stent was implanted. A final angiogram showed good patency of the right popliteal artery with no residual disease (Fig. 2B) and post-PTA ABI was 1.07.

However, 12 days later, he visited our hospital and complained of claudication again. ABI was 0.62 and lower extremity CT angiography showed stent fracture with right popliteal artery total occlusion (Fig. 3A). We performed secondary PTA. The angiogram showed stent fracture (type V),4 with a large amount of thrombus in the area of the Supera stent (Fig. 3B, C). Thrombus aspiration was done and a 0.035 wire (Terumo®, Terumo Medical Corporation, Tokyo, Japan) was passed through the back-up of the guiding catheter (Glide®, Terumo Medical Corporation, Tokyo, Japan). After popliteal filter deployment, balloon angioplasty (Admiral Xtreme® 5 × 60 mm, Medtronic, MN, USA) was performed and drug-coated balloon angioplasty (Lutonix® 5 × 120 mm, Bard, AZ, USA) was applied. The final angiogram showed good patency of the stent (Fig. 3D) and post-PTA ABI was 0.9.

Unfortunately, claudication developed again three days after repeated PTA. We transferred the patient to the vascular surgeons and bypass surgery between the superficial femoral artery and...
Fig. 2. Percutaneous transluminal angiography at the initial index procedure. A shows the initial angiogram with total occlusion of the right femoropopliteal artery (black arrows) and B depicts the well-positioned Supera stent (between black arrows) without residual stenosis.

Fig. 3. Supera stent fracture. There is a definite stent fracture observed on computed tomography (A, between white arrows) and fluoroscopy (B, between black arrows). The percutaneous transluminal angiography is performed (C, right popliteal artery is completely occluded and black arrow demonstrates a stent fracture) and successful revascularisation is shown (D).
popliteal artery was performed. ABI after the operation was 1.27 and the patient was discharged without complications.

Discussion

Femoropopliteal artery disease accounts for a significant proportion of endovascular interventions in patients suffering from disabling claudication or chronic limb ischaemia. The femoropopliteal artery descends along the hip and knee joints and passes through the muscular adductor canal of the thigh, which places the artery at increased biomechanical stress. Stents in the femoropopliteal lesion have historically been associated with increased rates of stent fracture. The cumulative incidence of stent fractures ranged from 2 to 65%, and stent fracture is associated with increased risk of in-stent restenosis and re-occlusion of the target vessel.

The self-expanding wire-interwoven nitinol stent (Supera stent) was designed to withstand the unique stressors along the course of the femoropopliteal artery. In the prospective, multicentre, non-randomised, single-arm trial (SUPERB trial), 264 patients with symptomatic peripheral artery disease undergoing endovascular treatment of de novo or restenosis lesions of the superficial femoral or proximal popliteal artery were enrolled. In this study, absence of stent fracture was observed by independent core laboratory analysis in the 243 stents evaluated at 12 months. In the final three-year outcomes of the SUPERB trial, only one stent fracture (0.6% event rate) was noted in a patient with restenosis who underwent multiple atherectomy procedures within the stent.

Since then, four cases of Supera peripheral stent fracture have been reported. All cases were detected three months after the Supera stent implantation and three cases were type V and one was type III. One case was treated with only balloon angioplasty and another with an additional Supera peripheral stent. Two cases were treated with bypass surgery.

The occurrence of stent fractures is not only determined by the stent architecture and length but also by the technique of implantation. In a post hoc analysis of the DURABILITY I study, stent elongation occurred during implantation in 90% of all fractured stents, which was associated with continuous strain exerted on the stent struts. Additionally the implantation of multiple overlapping stents may increase the axial stiffness of the stent segment. Vigorous exercise by the patient can adversely affect stent fracture.

Our Supera stent fracture case was detected 12 days after stent implantation. The exact fracture mechanism in our case could not be postulated; however, because of the premature time of fracture after implantation, we assumed that it might not be associated with a fatigue fracture, as seen in the above cases. We can assume that the most important risk factor for stent fracture is the lesion location in femoropopliteal arterial disease. Moreover, our patient was 73 years old but had a very active lifestyle. So, together with the lesion location, an individualised approach, considering the patient’s daily activity according to his age, is needed for better clinical outcomes.

Conclusion

Femoropopliteal artery stenting, especially the Supera stent, is a promising option for the treatment of claudication. However, the Supera stent is not fracture-proof. Careful observation after Supera peripheral stent implantation and an individualised approach for treatment of femoropopliteal artery disease, considering the lesion location, patient’s age and exercise capacity is warranted.

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References