Endovascular retrieval of an elongated Supera stent

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ABSTRACT

Stenting is used to achieve artery patency, and the Supera stent, a self-expanding interwoven nitinol stent, has produced good clinical outcomes. A 70-year-old woman with peripheral artery disease had experienced intermittent claudication (Fontaine stage IIb). Endovascular treatment was performed for a chronic total occlusion TransAtlantic InterSociety Consensus class II type B lesion. A Supera stent (Abbott Vascular, Santa Clara, CA) was used. However, it had become severely elongated to the proximal end in the superficial femoral artery and was removed using a balloon inserted from the side and trapped to the guide sheath with the distal end of the stent outside the sheath. After this bailout, an alternate stent could be placed through an antegrade approach to the contralateral common femoral artery. (J Vasc Surg Cases Innov Tech 2022;8:484-7.)

Keywords: Calcification; Chronic total occlusion; Elongation; Endovascular removal; Peripheral artery disease; Supera stent

The femoropopliteal artery is a challenging anatomic location for endovascular treatment of peripheral artery disease (PAD) because of repetitive flexion. The Supera stent (Abbott Vascular, Santa Clara, CA), a self-expanding interwoven nitinol stent, was developed to provide superior resistance to fracture and kinking and better radial force and flexibility compared with those of conventional laser-cut stents.[1] It has shown high patency rates at 6, 12, and 36 months after implantation and has been approved in the United States for treating complex lesions in the superficial femoral artery (SFA) and proximal popliteal artery (POPA), including calcification and chronic obstruction.[2-5] In the present report, we have described a case of severe elongation of a Supera stent in heavily calcified femoropopliteal lesions associated with PAD during stenting that required endovascular removal. The patient provided written informed consent for the report of her case details and imaging studies.

CASE REPORT

A 70-year-old woman had presented to our department because of intermittent claudication with a claudication distance of 20 m, classified as Fontaine stage IIb.[6] The patient's medical history included diabetes mellitus, stage 3 chronic kidney disease, and coronary artery bypass grafting (from the left internal mammary artery to the left anterior descending artery, from the superficial saphenous vein to the right coronary artery, and from the free right internal mammary artery to the left circumflex coronary artery) 1 year before to treat effort angina. The right femoral and popliteal pulses of the patient were palpable on physical examination. The dorsalis and posterior tibial arteries were not palpable; however, the toes were not cyanotic. The right and left ankle brachial index was 0.65 and 0.89, respectively. Non–contrast-enhanced magnetic resonance angiography, performed because of the patient's chronic kidney disease, showed total occlusion of the right mid-SFA and severe stenosis of the left distal SFA (Fig 1, *A* and *B*). We diagnosed PAD.

Endovascular treatment was performed for a chronic total occlusion (CTO) TransAtlantic InterSociety Consensus class II type B lesion from the middle of the SFA to the proximal end of the POPA.[7] A Parent Plus 60-cm 6F guide catheter (Medikit, Tokyo, Japan) was inserted into the right common femoral artery (CFA) through an antegrade approach. We successfully crossed the CTO lesion in the right SFA using a combination of a Naveed 4, Hard 15, 0.014-in. guidewire (Terumo Corp, Tokyo, Japan) and a Prominent Advance NEO2 150-cm microcatheter (Tokai Medical Products, Aichi, Japan). The microcatheter could not cross into the CTO lesion because of heavy calcification. The calcified CTO lesion was crossed using a Crosser system (Bard Peripheral Vascular, Tempe, AZ) and then gradually dilated to 20 atm using a 4.0 × 40-mm AngioSculpt scoring balloon catheter (AngioScore, Fremont, CA) and then to 30 atm with a 5.0 × 100-mm SHIDEN HP balloon catheter (Kaneka Medix, Osaka, Japan; Fig 2, *A*). Intravascular ultrasound revealed a 100-mm-long severe concentric calcification (Fig 2, *B*), and the lesion was well dilated with balloon catheters, which had caused a minor dissection of the lesion (Fig 2, *C*). A 6.0 × 100-mm Supera stent (Abbott Vascular) was deployed in the SFA from the POPA (Fig 2, *D*).

The stent was severely elongated to just very proximal in the SFA to ~200% of its original length due to the lesion. Although the delivery system was pushed excessively, the proximal

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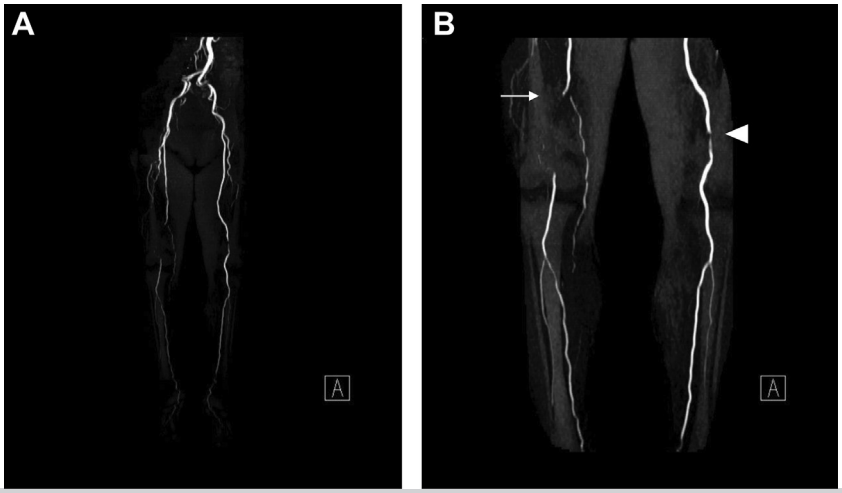

Fig 1. Magnetic resonance angiography before intervention. **A** and **B**, Total occlusion of the right mid-superficial femoral artery (SFA; *arrow*) and severe stenosis of the left-distal SFA (*arrowhead*).

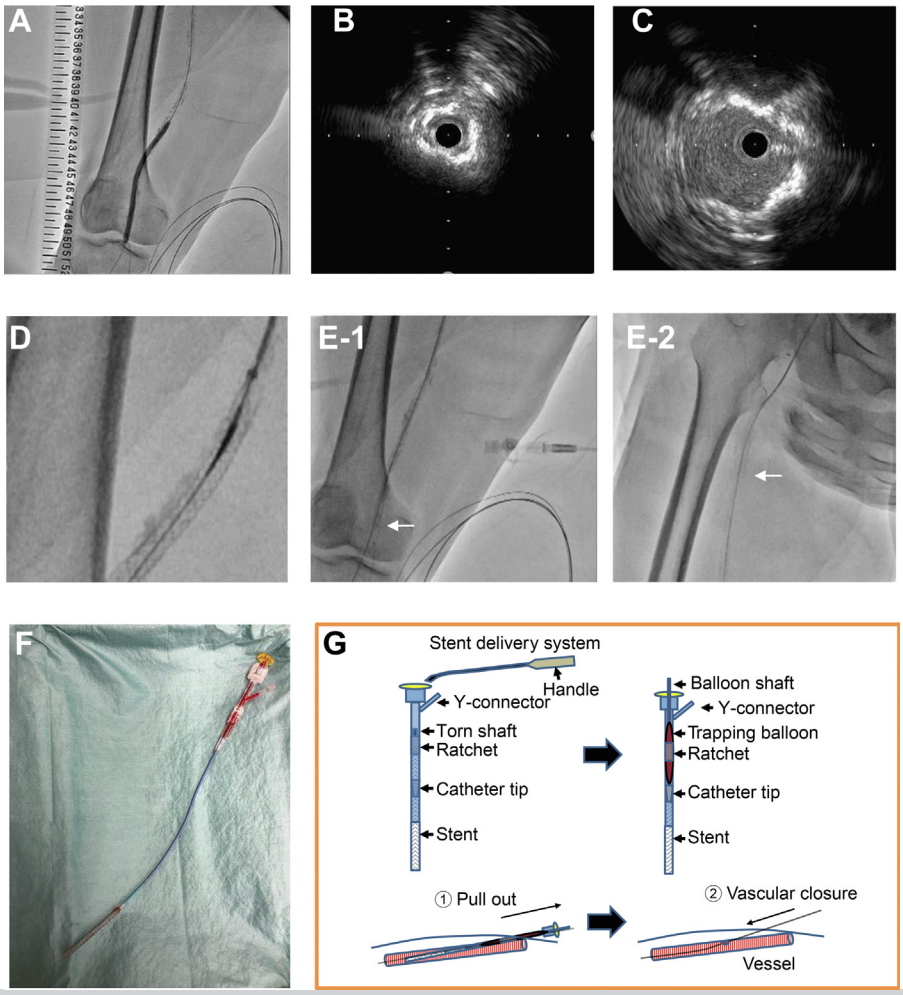

Fig 2. Stent elongation in a highly calcified femoral artery (after dilation). **A,** After the wire was passed through, preexpansion was performed using a SHIDEN HP balloon (Kaneka Medix). **B,** Intravascular ultrasound showing severe calcification. **C,** Intravascular ultrasound showing relatively sufficient preparation for stenting. **D,** The Supera stent was deployed halfway into the femoropopliteal lesion. **E1** and **E2**, The stent had become severely elongated and was trapped with a balloon and slowly withdrawn while focusing on the stent's distal edge (*arrows*). The guidewire was left inside. The vascular closure system was used to close the puncture site. **F,** Image of the removal system. **G,** Diagram depicting the endovascular bailout method for removing the elongated Supera stent.

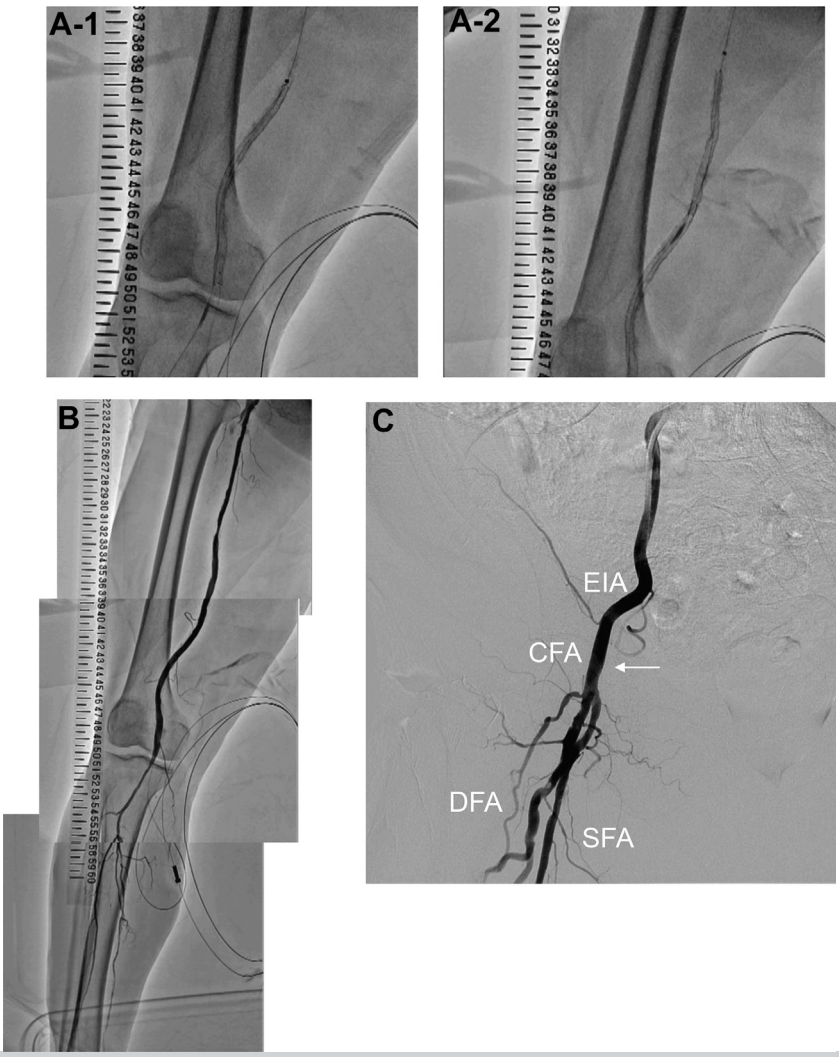

Fig 3. Contrast-enhanced image of lesion and puncture site after endovascular treatment. **A,** Two Eluvia stents were deployed at the culprit lesion. **B,** Final angiogram showing good flow. **C,** Digital subtraction angiogram revealing no damage to the vessel. The *arrow* indicates the puncture site. *DFA,* Deep femoral artery; *EIA,* external iliac artery; *SFA,* superficial femoral artery.

landing zone was expected to be within the guiding sheath. Next, we decided to remove the stent with the guiding sheath and attempted to retrieve the Supera stent system by storing the deployed stent in a Parent Plus 60-cm 6F guide catheter. The delivery system was pulled to cover the entire stent with the sheath while it was connected to the delivery system. When the stent delivery system had been half retrieved into the sheath, resistance was observed, and the distal shaft of the system tore off. A balloon was used to trap the stent and a part of the torn shaft in the sheath for retrieval as one unit. At this point, the wire and stent remained in the body, and the torn delivery shaft, delivery catheter tip, and proximal end of the stent remained in the sheath. We hypothesized that, unlike other laser nitinol stents, the Supera stent was a single interwoven coil stent and that when the distal stent was fixed, it could be extended longitudinally and retrieved in a few wire-like strands without tearing. A 6F, 90-cm Destination guiding sheath (Terumo Corp) was inserted via a contralateral antegrade CFA approach to prepare for hemostasis with balloon compression during bailout of extensive vascular injury after system removal. Next, a 2.5 × 100-mm conventional balloon (SABER balloon; Cordis Corp, Hialeah, FL) was inserted into the Parent Plus guiding sheath but not on the guidewire to trap the stent system to the guiding sheath. We successfully pulled the whole system out, with the distal end of the stent outside the sheath without any resistance (Fig 2, *E*; Supplementary Video), leaving the guidewire in place (Fig 2, *F* and *G*). The puncture site was closed using the Perclose ProGlide suture-mediated closure system (Abbott Vascular). A Vassallo floppy wire (Cardinal Health, Inc, Tokyo, Japan) was inserted to cross the lesion through the Destination guiding sheath. Two overlapping Eluvia paclitaxel-eluting vascular stents (6.0 × 120 mm and

70 × 80 mm; Boston Scientific, Marlborough, MA) were successfully placed (Fig 3, *A*). Although slight stenosis (50%) remained in the proximal part of the stent, the proximal and distal pressures in the lesion differed by <5 mm Hg (Fig 3, *B*). The patient had no vascular complications (Fig 3, *C*) and was almost completely free of symptoms the day after treatment.

After the intervention, the right ankle brachial index of the patient had improved to 0.89. The patient was discharged and was free from symptoms on postinterventional day 2. Follow-up angiography 12 months later confirmed good patency and flow in the stents, with no late lumen loss.

DISCUSSION

To the best of our knowledge, bailout methods for elongated Supera stents have not been reported previously. The degree of lesion calcification in our patient was severe according to two scoring systems.[8,9] Although the lesion was prepared optimally, >30% residual stenosis remained before stent delivery. Therefore, the Supera stent was used to manage the calcified plaque. Despite a sufficient delivery system, the combination of suboptimal lesion preparation and the use of an oversized stent was the probable cause of stent elongation during stent deployment in the heavily calcified lesions. The lesion must be dilated to a predilatation balloon/stent ratio of ≥1:1. Moreover, the stent diameters are chosen to match the reference vessel luminal diameter in a 1:1 ratio to achieve nominal deployment.[10] When the stent is severely elongated, the primary patency will decreases.[10,11] Unlike other laser nitinol stents, the Supera stent is a single interwoven coil stent and can be recovered without tearing when it must be removed because of, for example, severe elongation. Removing the elongated stent with the guide sheath, combined with the use of vessel closure, seemed the most reliable method of removing the stent without damaging the vessel puncture site. Moreover, stent replacement was possible in one session using a contralateral antegrade CFA approach. As previously investigated and described, our patient had had multiple high-risk factors for restenosis, such as a history of diabetes mellitus, the presence of a CTO lesion, and a long lesion length, as previously investigated and described.[12] Therefore, we decided that deploying an Eluvia stent (Boston Scientific Corp), a paclitaxel-eluting vascular stent, was an appropriate alternative to overcome the restenosis and circumvent the occurrence of complications.[13,14]

CONCLUSIONS

The Supera stent can become elongated in the presence of heavy calcification of vessels in association with PAD. However, owing to its unique design, removing the Supera stent with a guide sheath is a possible, reliable, and simple endovascular bailout method that can be used without causing damage to the stent or vessel wall. Furthermore, an alternate stent can be placed immediately after bailout through an antegrade approach to the contralateral CFA.

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