

# In-Stent Restenosis of the SFA

Two case studies using a retrograde approach with a combination of different devices to treat recurrent lower-extremity ischemia.

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An integral component of endovascular therapy for the treatment of lower-extremity ischemia certainly includes the implantation of self-expanding stents in the superficial femoral artery (SFA) for flow-limiting dissections and residual stenosis after angioplasty. This has been expanded to include the placement of nitinol stents from the origin of the SFA to the adductor canal (long-segment stenting). Unfortunately, there can be a significant arterial restenosis response to stent placement, resulting in reocclusion with intimal hyperplasia known as in-stent restenosis. The endovascular cor-

rection of these restenoses can be challenging due to the difficulty of recannulation through these regions of occlusion within the stented segment. The etiology of the difficulty with traversing through the regions of in-stent occlusion can be attributed to either stent fracture or the passage of the wire through the interstices of the stent rather than through the lumen. We present two cases of chronic total occlusion of the SFA due to in-stent restenosis. After failing to cross the occluded segment using an antegrade approach, retrograde access of the popliteal artery was performed, and the SFA was successfully recanalized.

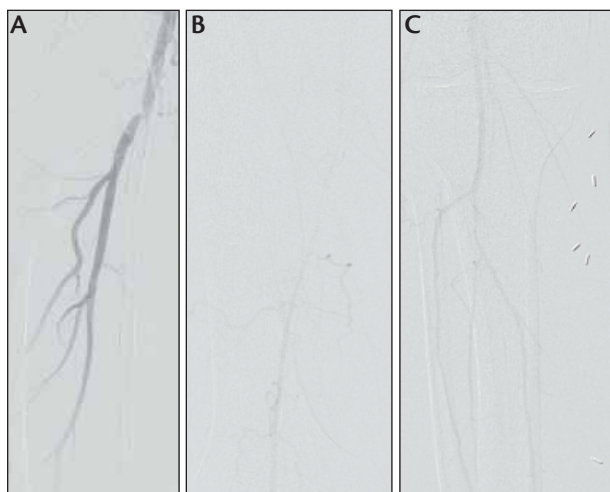


Figure 1. Preoperative angiogram. Occluded proximal SFA (A). Reconstitution of distal SFA (B). Three-vessel runoff (C).



Figure 2. Mid-SFA stents with multiple fractures. Dissection plane passes around stents at a point of fracture.



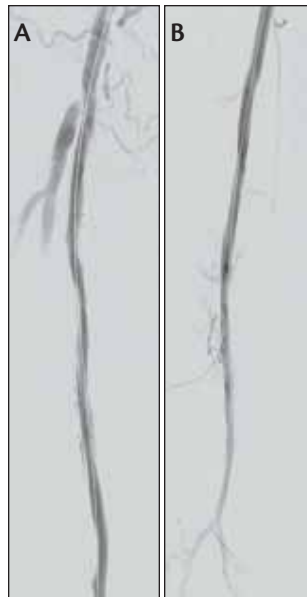
**Figure 3.** Snaring of wire introduced from popliteal puncture site.

## CASE 1

A 56-year-old man with coronary artery disease and diabetes presented with a 2-year history of right calf claudication at 1 block. He had undergone a right lower-extremity angioplasty and stenting at an outside institution 4 years before for similar symptoms. On physical examination, the patient had a strong right femoral pulse with no palpable pulses distally. The ankle-brachial index on the affected side was .60, and



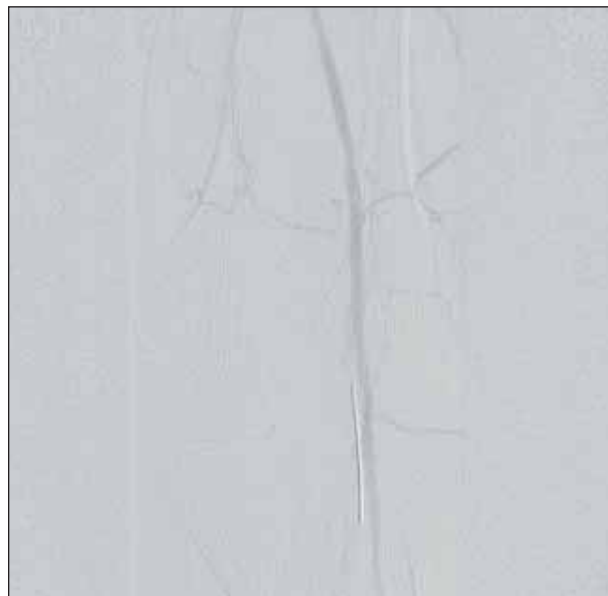
**Figure 5.** Occluded proximal SFA.



**Figure 4.** Completion angiogram. Proximal SFA (A). Distal SFA/popliteal (B).

duplex ultrasound showed a stented SFA with occlusion of the proximal and midportions. Angiogram of the right lower extremity demonstrated total occlusion of the proximal SFA and stenosis of the proximal profunda femoral artery. The previously placed SFA stent was shown to extend proximally into the distal common femoral artery, jailing the profunda origin (Figure 1A). The stents extended into the below-knee popliteal, with reconstitution within the stents at the above-knee

popliteal artery (Figure 1B) and three-vessel runoff distally (Figure 1C). A 7-F contralateral Balkin sheath (Cook Medical, Bloomington, IN) was placed, and the proximal half of the SFA was successfully recanalized. At this point, all further attempts resulted in the wire passing outside of the previous SFA stents due to multiple areas of fracture (Figure 2).



**Figure 6.** Position of the micropuncture needle using angiography to localize the popliteal artery.

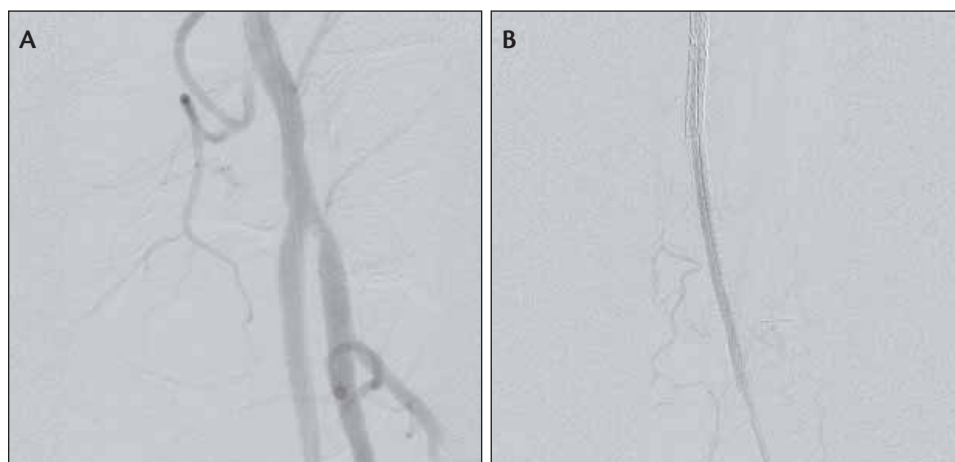


Figure 7. Completion angiogram. Proximal SFA (A). Distal SFA (B).

sheath in place, and the patient was placed in the prone position. The right popliteal region was then prepared, and a micropuncture needle was used to access the popliteal artery through the interstices of the below-knee popliteal stent under fluoroscopic guidance. A .014-inch wire was then passed proximally into the above-knee popliteal through the micropuncture catheter. Using the .014-inch wire and a bareback .014-inch Quick-Cross catheter (Spectranetics, Colorado Springs, CO), the occluded SFA was successfully recanalized past the area of stent fracture and proximally into the external iliac artery. A 10-mm Amplatz Goose Neck Snare (ev3, Plymouth, MN) introduced from the Balkin sheath was used to capture the .014-inch wire and bring it out through the left groin (Figure 3). A .018-inch Quick-Cross catheter passing from the left groin was passed over the wire into the popliteal artery, and the .014-inch wire was then removed from the right popliteal artery. Pressure was held over the popliteal puncture site until hemostasis was obtained.

After a wire was placed into the below-knee popliteal from above, plaque excision using a SilverHawk LS device (FoxHollow Technologies, Redwood City, CA) was performed on the areas proximal and distal to the SFA stent fractures. Through the area of multiple stent fractures, a 6-mm X 150-mm Protégé EverFlex (ev3) self-expanding nitinol stent was deployed, and the entire stented area was then treated using a 6-mm X 80-mm cryoplasty balloon (Boston Scientific Corporation, Natick, MA) starting at the below-knee popliteal and extending proximally to the distal common femoral artery. This was performed in an attempt to prevent further intimal hyperplasia within the stent segments. Completion angiograms showed

good flow through the SFA and three-vessel runoff into the foot (Figure 4). At the end of the procedure, the foot was warm, and popliteal and dorsalis pedis pulses were palpable.

The patient tolerated the procedure well and was discharged 1 day after the procedure on clopidogrel for 1 month. At 2-month follow-up, he reported that he was able to

walk up to 10 blocks without pain. The patient had palpable popliteal and pedal pulses, and noninvasive vascular studies showed an improvement in his ankle-brachial index, from .60 to .98.

## CASE 2

A 79-year-old woman presented with claudication with pain at less than 1 block distance and development of a nonhealing ulcer of the distal left first toe. The patient had undergone angioplasty and stenting of bilateral SFAs and proximal popliteal arteries for claudication 1 year before. Her medical history was significant for diabetes, coronary artery disease, and hypertension. On physical examination, only femoral pulses were palpable in her lower extremities, and duplex ultrasound was consistent with a complete occlusion of the SFA starting near the origin and extending to the distal SFA.

After arterial access of the contralateral common femoral artery, occlusion of the SFA was confirmed on angiogram (Figure 5). An 8-F Raabe sheath (Cook Medical) was positioned with its tip in the common femoral artery. Multiple techniques used to recanalize the occluded SFA, including laser atherectomy, Frontrunner and Outback (Cordis Corporation, a Johnson & Johnson company, Miami, FL) re-entry, were unsuccessful. At this point, the sheath was secured and covered with a sterile dressing. The patient was then placed in the prone position. The popliteal artery was accessed with a micropuncture needle using a combination of angiography and intraoperative ultrasound to localize the artery (Figure 6). After the micropuncture sheath was placed in the artery, a .014-inch wire was then passed

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retrograde into the occluded SFA. The wire passed easily up to the mid-SFA but could not pass through an area of stent fracture in the proximal SFA. Finally, after confirming the wire position using multiple orthogonal views, a .9-mm laser was used to pass through the area of occlusion, allowing the wire to pass through the fractured stent, traversing the remaining segment of occluded SFA, and passing into the common femoral artery.

A tri-lobed EN Snare (InterV, Gainesville, FL) was then passed through the Raabe sheath into the common femoral artery. The .014-inch wire was introduced through the popliteal artery, captured with a snare, and brought out through the femoral sheath. A .018-inch Quick-Cross catheter was passed through the Raabe sheath over the wire and advanced until it was positioned at the level of the popliteal sheath. The wire was then removed from the popliteal sheath, and a new wire was passed through the Quick-Cross catheter in the Raabe sheath. A combination of laser atherectomy and balloon angioplasty was used to treat the in-stent restenosis of the SFA. Stents were placed in areas of significant recoil and areas of prior stent fracture. There was brisk flow throughout the SFA with no evidence of distal embolization (Figure 7). A dorsalis pedis pulse was easily palpable at the end of the procedure.

The patient was placed on clopidogrel for 1 month. Six weeks after the procedure, she had improvement of her symptoms with near complete resolution of the left foot ulcer.

## CONCLUSION

These two cases illustrate endovascular, low-morbidity alternatives for treating in-stent restenosis without conversion to open surgical bypass. These options do not negate the future option of surgical revascularization and should be considered in appropriate patients with in-stent restenosis. ■

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