Treating Complex Femoropopliteal Lesions

A case presentation showing how modern endovascular tools can facilitate optimal treatment.

BY TAKAO OHKI, MD, PHD

Endovascular therapy is increasingly being used for treating peripheral artery disease (PAD). Its less-invasive nature, as well as its improved durability, have contributed to this increased utilization. Among several concerns related to endovascular therapy are the risk of stent fracture and subsequent restenosis and the risk of burning the surgical bridge. This case highlights the value of modern endovascular tools that not only make intervention possible but may also make it safer and more durable.

CASE PRESENTATION

An 88-year-old woman (who was a mother of a prominent vascular surgeon) was referred to us for the treatment of right leg PAD resulting in severe claudication and occasional rest pain (especially at night). Her maximum walking distance was 50 meters (60 yards), and her quality of life was severely impaired due to this condition. She had a number of medical comorbid conditions, including coronary artery disease, diabetes mellitus, hypertension, and mild renal insufficiency, but none were severe enough to preclude interventional therapy.

Her surgical history was notable for right superficial femoral artery (SFA)/popliteal artery angioplasty that was performed 3 years prior to presentation. This intervention only lasted several weeks according to the patient's symptoms. Her ankle-brachial index was 0.4 on the right and 0.95 on the left. She had 2+ femoral artery pulses bilaterally but only had palpable pulses in the popliteal and dorsalis pedis artery on the left. She was treated with cilostazol (50 mg twice a day) for 2 months; however, her symptoms were not alleviated.

After discussing the various treatment options, including surgical bypass, we decided to proceed with interventional therapy. Clopidogrel (75 mg daily) was added to the regimen while continuing the cilostazol.

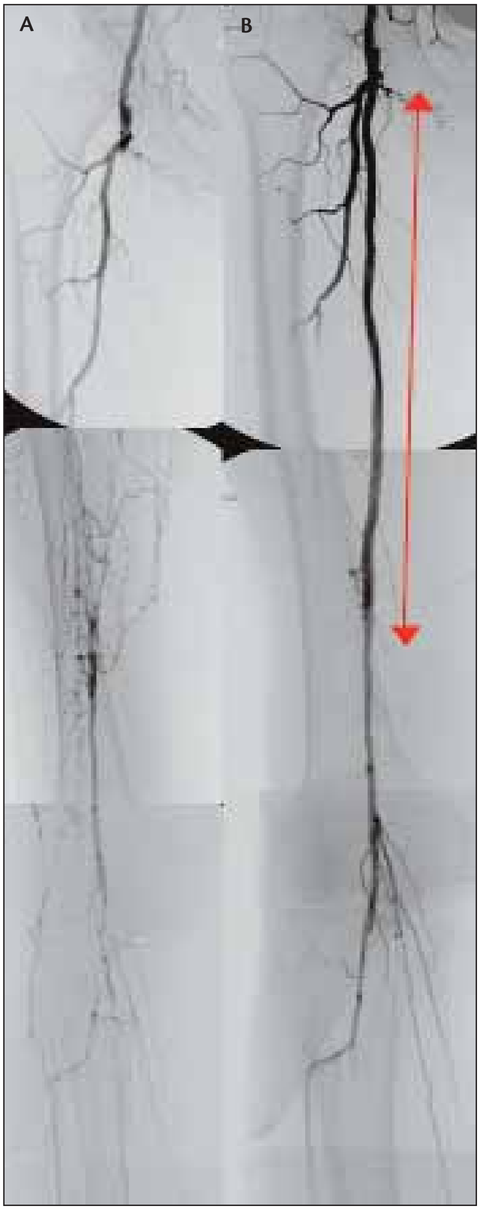

Figure 1. A preinterventional angiogram shows long occlusion of the right SFA from the orifice with popliteal artery reconstitution. Also, occlusion of the popliteal artery is seen (A). Imaging after SFA stenting with the Protégé EverFlex stent (6-mm X 150-mm; ev3, Inc., Plymouth, MN) and SilverHawk LS (FoxHollow Technologies, Redwood City, CA) atherectomy of the popliteal artery (arrows). Note that stenting is limited to the minimum length. Also, the genicular vessels are well-preserved (B).

Figure 2. The Frontrunner XP (Cordis Corporation, a Johnson & Johnson company, Miami, FL) accomplishes controlled revascularization by using the microdissector and the Micro Guide catheter (Cordis) (M).

INTERVENTIONAL THERAPY

A left femoral puncture was made, and the right common iliac artery was cannulated selectively using an Omni-Flush catheter (AngioDynamics, Queensbury, NY) and a Glidewire (Radifocus, Terumo Medical Corporation, Somerset, NJ). Selective angiography of the right leg showed near flush occlusion of the right SFA and occlusion of the right popliteal artery (Figure 1A). The lengths of the occlusion in the SFA and the popliteal arteries were 28 cm and 7 cm, respectively. A decision was made to proceed with endovascular therapy.

The Glidewire was selectively cannulated into the right deep femoral artery, and the Omni-Flush catheter was then introduced. The Radifocus guidewire was exchanged for an Amplatz super-stiff guidewire (Cook Incorporated, Bloomington, IN). The catheter, along with the 5-F femoral sheath, was removed and a 7-F Guidesheath (Pinnacle, Terumo Medical Corporation) was introduced into the right common femoral artery from the left femoral artery. Due to the Pinnacle's smooth transition at the tip (between the inner dilator and the sheath) and its flexibility, insertion of the sheath over the aortic bifurcation was performed easily and smoothly.

Because the lesion was long, and attempts at revascularization utilizing standard guidewire have been suboptimal in our hands, we decided to proceed with the Frontrunner XP recanalization tool. With the subintimal technique, the site where the guidewire reaccesses the true lumen distally is often much more distal than where the vessel reconstitutes.[1] In other words, the site of re-entry often takes place at a much more distal location than is needed. The nubbin at the takeoff of the right SFA was cannulated selectively with the Glidewire, and the 4.5-F Micro Guide Catheter was introduced over this guidewire. The Glidewire was removed, and the Frontrunner catheter was introduced.

The Frontrunner catheter enables controlled crossing of chronic total occlusions (CTOs). It uses blunt microdissection to create a channel through the occlusion to facilitate wire placement (Figure 2). The Frontrunner features a crossing profile of .039 inch, with actuating jaws that open to 2.3 mm. The previously placed Micro Guide Catheter provides pushability and support to the Frontrunner XP catheter. The nubbin of the right SFA occlusion, which is typically difficult to penetrate, was easily broken by opening and closing the blunt microdissector (Figure 3). In addition, the Frontrunner catheter was often rotated to provide additional dissection capability. The Frontrunner catheter was able to re-enter the true lumen at exactly the point where the popliteal artery reconstituted (Figure 3C). Serial PTA resulted in multiple

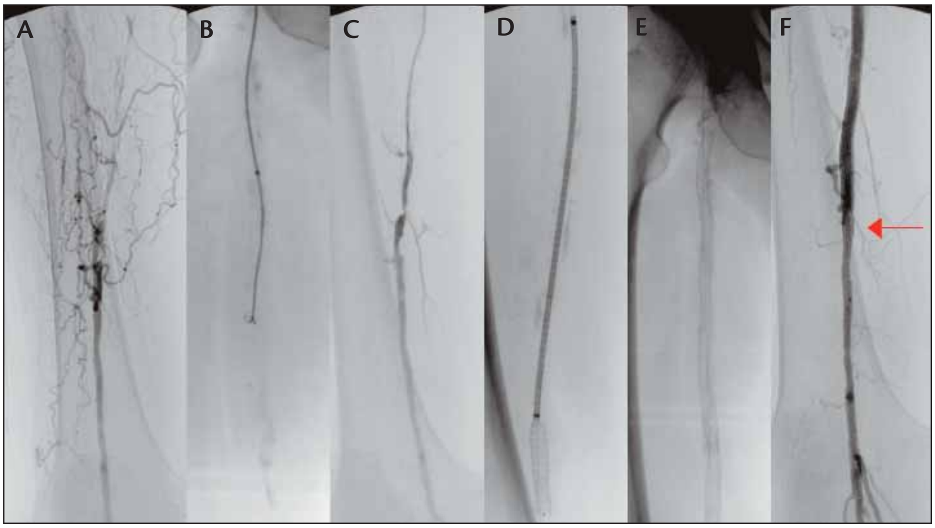

Figure 3. A preinterventional angiogram of the distal SFA/popliteal artery shows popliteal artery reconstitution (A). The Frontrunner catheter and the Micro Guide catheter were successfully used to cross the long lesion (B). Recanalization of the popliteal artery was performed successfully with the Frontrunner device at the desired location (most proximal part of the runoff vessel) (C). Despite the lesion being 28 cm long, stenting was performed with only two (6-mm X 150-mm) Protégé EverFlex stents. The distal end of the stent is shown with the red arrow (D-F).

flow-limiting dissections, and a decision was made to stent the SFA. The lesion length that needed to be stented was measured with the guidewire pullback method; the lesion length was 28 cm. Because it is beneficial to reduce the number of stents to prevent stent fracture, the Protégé EverFlex stent (6-mm X 150-mm) was chosen.[2] Two Protégé EverFlex stents with 2-cm overlap were sufficient to cover this long lesion (Figure 3).

Figure 4. Preinterventional angiography of the popliteal artery shows below-the-knee popliteal artery reconstitution. Occlusion length was 7 cm (A). The Frontrunner catheter and the Micro Guide catheter were successfully used to cross the long lesion (B). Recanalization of the popliteal artery was performed successfully with the Frontrunner device at the desired location (C). Angiogram obtained after Frontrunner recanalization (D). The SilverHawk device was used to recanalize the lesion (E). Completion angiography. Note preservation of all the collateral genicular vessels (F).

The Micro Guide Catheter was reintroduced into the popliteal artery through the stented SFA. Angiography revealed complete occlusion of the popliteal artery, with reconstitution of the most distal popliteal artery (Figure 4). The Frontrunner catheter was introduced into the Micro Guide Catheter, and utilizing the same technique described previously, the occluded popliteal artery was rencanalized. Again, the Frontrunner was able to re-enter the true lumen at the location where the popliteal artery reconstituted (Figure 4). Because the popliteal artery is not an ideal lesion to stent (no stent zone), we decided to use the SilverHawk LS device (Figure 4). The SilverHawk catheter traversed the lesion smoothly, and atherectomy was performed without any difficulty. Four passes resulted in an excellent outcome without any evidence of dissection.

Completion angiography revealed excellent flow, with no signs of contrast extravasation or distal embolization (Figure 1 and 4). Of note is the fact that the genicular collaterals that arose from the occluded end of the popliteal artery (Figure 4) were all preserved because of the Frontrunner catheter (which avoids subintimal dissection) and SilverHawk atherectomy (because of the absence of PTA and stenting). The patient tolerated the procedure very well and was discharged home the next day. Claudication as well as mild rest pain resolved completely.

DISCUSSION

One of the concerns regarding endovascular therapy of PAD is related to the risk of making the future surgical option more complex (or burning the surgical bridge) and the risk of making the patient's condition worse than before (Table 1). For example, if one stents the entire above-the-knee popliteal artery, an, if the stent thromboses in the future, the patient may require a below-the-knee popliteal bypass as opposed to an above-the-knee bypass. Obviously, an above-the-knee bypass is much more advantageous for the patient because the patency rate is 15 to 20 points better compared with the patency

TABLE 1. TAKE HOME MESSAGES OF THIS CASE

Concerns Related to Endovascular Therapy of PAD	Solutions
May make the future surgery more complex (convert above-the-knee femoropopliteal bypass to below-the-knee femoropopliteal bypass)	Use of Frontrunner to re-enter true lumen at the desired location
Stent fracture	-Use of longer stents (150 mm) to reduce the number of stents -Use atherectomy to avoid stenting (especially in the no-stent zone) -Use of Frontrunner to re-enter true lumen at minimal distance
Preservation of collateral branches	-Avoid subintimal dissection by using the Frontrunner

rates for below-the-knee bypass. The risk of stenting more distally than needed is minimized with the use of the Frontrunner catheter, as highlighted in this case. As far as the latter is concerned, preserving as many collateral vessels as possible is one important thing to keep in mind during endovascular procedures. As shown in this case, all of the important genicular collaterals were preserved due to the use of the Frontrunner catheter (by avoiding subintimal dissection) and the use of the atherectomy device (by avoiding stenting).

In terms of stent fracture, it is well known that stent fracture correlates with recurrent stenosis. Furthermore, it is well known that the number of stents correlates with the incidence of stent fracture.[2-4] Thus, it is important to reduce the number of stents by using as long a stent as possible. In this regard, because the Protégé EverFlex stent comes in lengths up to 150 mm, one is able to reduce the number of stents as much as possible. In the case shown in this article, although the lesion length was 28 cm, we were able to limit the number of stents to two. Had we used any other self-expanding stent, the minimum number of stents would have been three or more.

SUMMARY

This case demonstrates that optimal endovascular therapy is made possible by using a number of modern endovascular tools. In order to provide patients with the best possible treatment, it is important that interventionists familiarize themselves with all of the tools available. ■

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