Transradial Arterial Approach for the Treatment of Bilateral Femoropopliteal Disease

Vinoy Prasad, MD, and Amr Mohsen, MD

An accompanying podcast with the authors is available using the QR code at the end of the article.

Lower extremity arterial disease is common, affecting more than 8 million adults in the United States, and is associated with significant morbidity and mortality.[1] Endovascular intervention of peripheral arterial disease is, in many cases, a safe and effective treatment option. Traditionally, the femoral arteries are the access sites for endovascular interventions of the lower extremities due to convention and experience, as well as limitations of equipment design. However, just as with coronary angiography, transradial access has emerged as a safe and effective alternative for transfemoral endovascular catheterizations and interventions, and the technology is catching up to the need. Here, we describe a case of peripheral angiography and bilateral femoropopliteal intervention performed entirely through transradial arterial access.

Case

A patient with hypertension, hyperlipidemia, diabetes mellitus, history of myocardial infarction and 3-vessel coronary artery bypass graft surgery in 2009, peripheral arterial disease, and bilateral lower extremity venous insufficiency presented with bilateral calf cramping that occurred consistently with exertion. The patient's functional capacity was severely affected by claudication, as they could only walk for less than 3 minutes before needing to stop.

Six months prior, the patient had bilateral superficial femoral artery (SFA) intravascular lithotripsy and balloon angioplasty, performed at an outside hospital through staged interventions via contralateral femoral arterial access. Per review of the records, drug-coated balloons were not used for the interventions.

The patient's symptoms improved for 3 months, then recurred. Arterial duplex showed bilateral elevated velocities (right proximal SFA velocity 313.75 cm/sec and left proximal SFA velocity of 393.5 cm/sec) with monophasic waveforms below the knee. Based on the patient's symptoms and ultrasound findings, they were scheduled for elective lower extremity angiography with possible intervention.

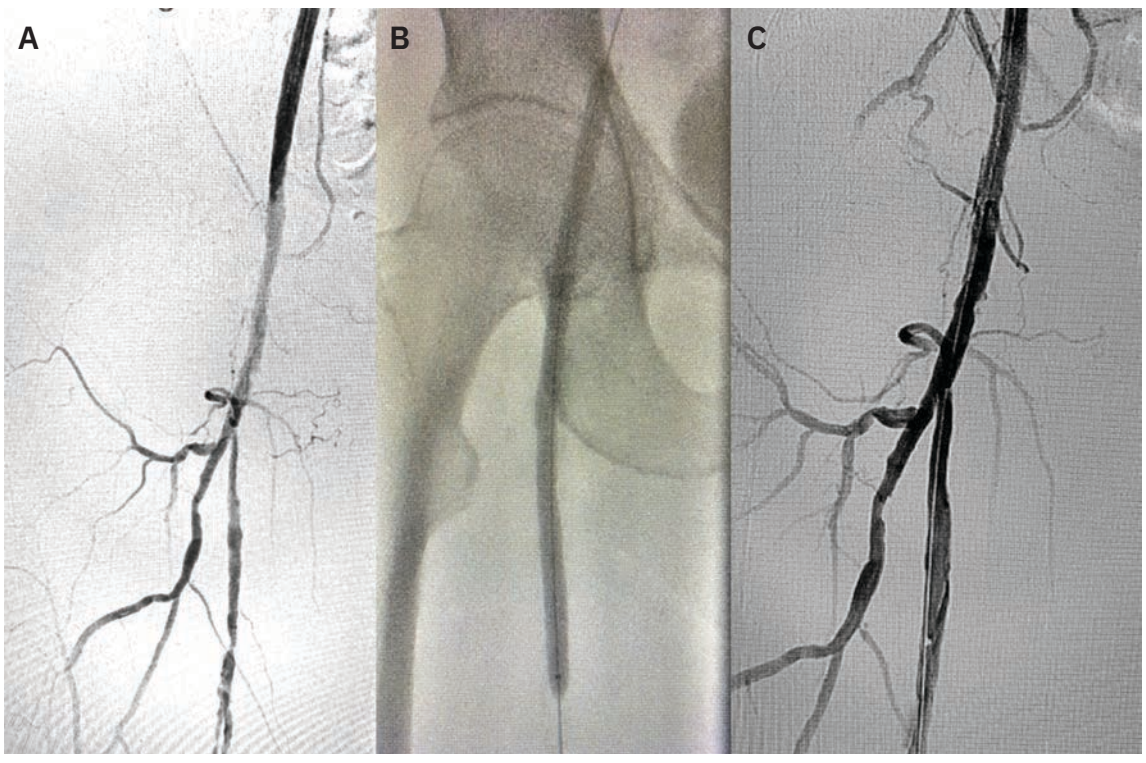


Figure 1. Angiography and intervention of the right superficial femoral artery (SFA). (A) Severe disease from proximal to mid SFA. (B) Percutaneous transluminal angioplasty (PTA) and drug-coated balloon (DCB) inflation in the right SFA. (C) Post-intervention angiogram demonstrating no significant residual stenosis or flow-limiting dissection.

Access was obtained in the right radial artery with ultrasound guidance, and a 6 French (Fr) Glidesheath Slender (Terumo Interventional Systems) was placed. A standard radial cocktail was administered. Over an .035-inch J-wire, a 4 Fr 150 cm Glidecath Multicurve (Terumo Interventional Systems) with side holes was advanced into the distal abdominal aorta. Iliac angiography was performed. A 400 cm angled .035-inch Glidewire (Terumo Interventional Systems) was then used over the Glidecath to selectively cannulate the right popliteal and external iliac arteries for infrapopliteal and femoral arterial angiography, respectively, followed by the left popliteal and external iliac arteries. Digital subtraction images demonstrated severe proximal to mid SFA disease in the right leg with 3-vessel runoff (Figure 1A), and severe disease of the left leg up to the mid SFA, with 3-vessel runoff. (Figure 2A). Pressure gradients were measured on pullback from the popliteal artery to the common femoral arteries, confirming hemodynamic significance of the lesions. At this time, we proceeded with transradial endovascular intervention of the bilateral femoropopliteal arteries.

The Glidecath was removed. Heparin was administered to therapeutic activated clotting time (ACT). Over the .035-inch Glidewire, the Glidesheath Slender was removed and replaced with a 6 Fr 119 cm R2P Destination Slender Guiding Sheath (Terumo Interventional Systems), which was advanced to the level of the left common external iliac artery. An .018-inch 335 cm ViperWire (CSI) was taken to the infrapopliteal arteries. The entire left SFA into the moderately diseased proximal left popliteal artery was ballooned with a 5 mm x 200 mm Metacross balloon (Terumo Interventional Systems), followed by drug-coated balloon (DCB) angioplasty in the proximal to mid SFA with a 6 mm x 150 mm IN.PACT 018 DCB (Medtronic) (Figure 2B). The IN.PACT 018 DCB has only recently become available in the U.S. in a 200 cm shaft length on an .018-inch platform, facilitating femoropopliteal treatment from the transradial approach. Following left leg intervention, the .018-inch wire was removed, and the sheath was pulled back over the .035-inch Glidewire, and then advanced over the dilator into the right external iliac artery. The proximal to mid right SFA was similarly treated with a 5 mm x 200 mm Metacross balloon, followed by DCB with a 6 mm x 150 mm IN.PACT 018 (Figure 1B). Final angiograms of both legs showed no significant residual stenosis or flow-limiting dissections (Figures 1C and 2C), with 2+ distal pulses.

Follow-Up

Several weeks after the endovascular interventions, the patient's claudication significantly improved to the point that they were able to walk without leg pain. However, the patient now developed typical exertional angina. They were admitted, and underwent coronary and graft angiography,

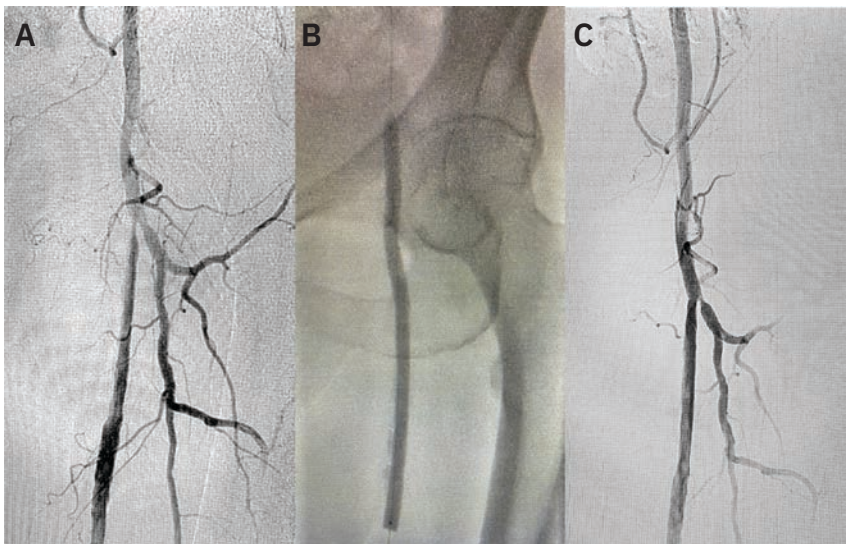


Figure 2. Angiography and intervention of the left SFA. (A) Severe diffuse disease in the left SFA. (B) PTA and DCB of the left SFA. (C) Post-intervention angiogram demonstrating no significant residual stenosis or flow-limiting dissection.

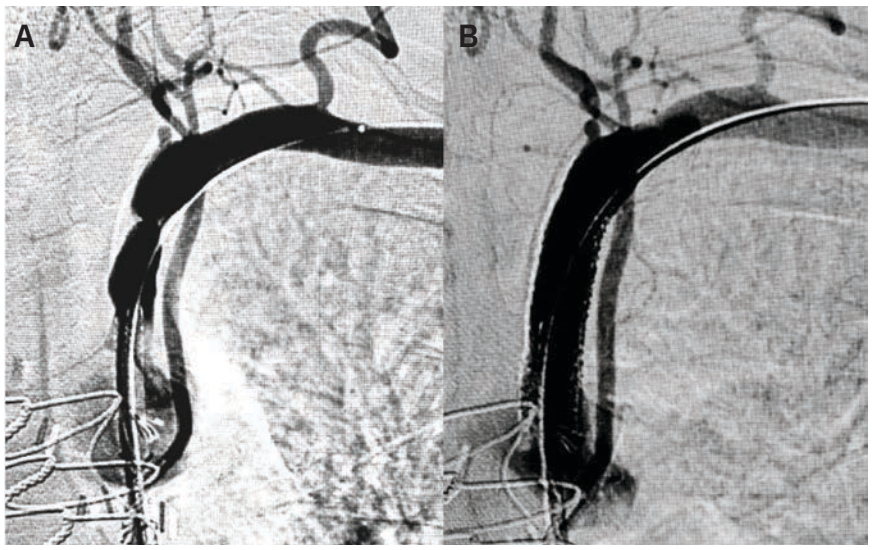


Figure 3. Angiography and intervention of the left subclavian artery. (A) 80% stenosis of the left subclavian artery proximal to the LIMA to LAD, with a 90 mmHg pullback gradient. (B) No residual stenosis or gradient after stenting. *LIMA to LAD, left internal mammary artery to left anterior descending coronary artery*

demonstrating an 80% stenosis of the proximal left subclavian artery with >90 mmHg pressure gradient on pullback, resulting in coronary steal of blood flow from the left internal mammary artery (LIMA) graft to the left anterior descending (LAD) coronary artery (Figure 3A). As this was not the site of prior access (the endovascular interventions were performed through right radial approach), it was believed to be a chronic stenosis with anginal symptoms now unmasked after improvement in claudication and exertional capacity. The lesion was stented with an 8 mm x 37 mm Express LD (Medtronic) bare-metal stent (Figure 3B), with complete resolution of angina on follow-up.

Discussion

In randomized clinical trials, paclitaxel-based drug-coated balloons (DCB) have shown consistent long-term efficacy over balloon angioplasty and lower target vessel revascularization in the treatment of femoropopliteal disease.[2,3] Five-year follow-up from the real-world IN.PACT Global study showed 70% freedom from reintervention with no mortality signal, demonstrating both safety and efficacy in long-term follow-up.[4]

Traditionally, endovascular intervention of lower extremity PAD involves femoral arterial access, followed by an "up-and-over" approach to treat the contralateral leg. There are obvious limitations to this approach, however, including bleeding and vascular complications associated with femoral access, as well as the need for staged interventions in the not-so-uncommon scenario of bilateral lower extremity peripheral arterial disease needing treatment. As such, the patient is exposed to double the risk from two separate procedures, as well as the inconvenience and discomfort from groin access.

Radial access has become the predominant approach for coronary intervention due to its lower risk, patient comfort, and the ability to discharge patients home sooner after the procedure. The lessons learned from transradial coronary angiography and interventions are now being appreciated in the endovascular realm, with the advantages of reduced risk for complications and the ability to treat disease in both legs simultaneously without the need to bring the patient back for a separate procedure.[5] The technology has advanced to support transradial endovascular interventions, with the introduction of radial-to-peripheral sheaths, wires and catheters greater than 300 cm in length, and treatment devices (balloons, DCBs, stents, and orbital atherectomy) supporting radial-to-peripheral interventions.[6]

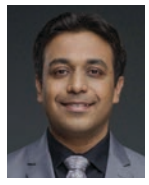
This case highlights the technique and the equipment needed to treat femoropopliteal disease from a transradial approach. Using the recently FDA-approved .018-inch 200 cm shaft length IN.PACT 018 DCB, we were able to provide contemporary endovascular treatment to a patient with lifestyle-limiting claudication and severe bilateral femoropopliteal disease in a single setting. We expect improved patient safety and comfort with continued adoption of a transradial approach to endovascular intervention. ■

References

1. Criqui MH, Matsushita K, Aboyans V, et al; American Heart Association Council on Epidemiology and Prevention; Council on Arteriosclerosis, Thrombosis and Vascular Biology; Council on Cardiovascular Radiology and Intervention; Council on Lifestyle and Cardiometabolic Health; Council on Peripheral Vascular Disease; and Stroke Council. Lower Extremity Peripheral Artery Disease: Contemporary Epidemiology, Management Gaps, and Future Directions: a Scientific Statement from the American Heart Association. *Circulation.* 2021 Aug 31; 144(9): e171-e191.
2. Schneider PA, Laird JR, Tepe G, et al; IN.PACT SFA Trial Investigators. Treatment effect of drug-coated balloons is durable to 3 years in the femoropopliteal arteries: long-term results of the IN.PACT SFA randomized trial. *Circ Cardiovasc Interv.* 2018 Jan; 11(1): e005891.
3. Krishnan P, Faries P, Niazi K, et al. Stellarex drug-coated balloon for treatment of femoropopliteal disease: twelve-month outcomes from the randomized ILLUMENATE pivotal and pharmacokinetic studies. *Circulation*. 2017 Sep 19; 136(12): 1102-1113.
4. Zeller T, Brodmann M, Ansel GM, et al. Paclitaxel-coated balloons for femoropopliteal peripheral arterial disease: final five-year results of the IN.PACT Global Study. *EuroIntervention*. 2022 Dec 2; 18(11): e940-e948.
5. Hanna EB, Ababneh BA, Amin AN. Endovascular therapy of the superficial femoral artery via a stand-alone transradial access: a single-center experience. *Vasc Endovascular Surg.* 2018 Feb; 52(2): 107-114.
6. Lodha A, Giannopoulos S, Sumar R, et al. Transradial endovascular intervention: results from the Radial accEss for nAvigation to Your CHosen Lesion for Peripheral Vascular Intervention (REACH PVI) study. *Cardiovasc Revasc Med*. 2022 Mar; 36: 115-120.

THE OPERATORS DISCUSS:

Use the QR code to find the article online and an accompanying podcast with authors Drs. Vinoy Prasad and Amr Mohsen.



Vinoy S. Prasad, MD, FACC, FSCAI, Director of Interventional Cardiology; Amr M. Mohsen, MD, FACC, FSCAI, FSVM
Loma Linda University International Heart Institute, Loma Linda University Medical Center, Loma Linda, California

Disclosures: Dr. Prasad and Dr. Mohsen report no conflicts of interest regarding the content herein.

The authors can be contacted via Lisa Aubry at LAubry@llu.edu.