Retrograde Recanalization of an Occluded Popliteal Artery

A case study and discussion on the successful recanalization of an occluded popliteal artery via the dorsalis pedis artery.

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Occlusive lower extremity arterial disease is a common finding in patients with critical limb ischemia (CLI). Antegrade recanalization of occluded infrainguinal arteries can often be performed successfully using subintimal angioplasty with hydrophilic wires or other techniques. However, when antegrade recanalization fails, other approaches to endovascular recanalization should be explored. One of these approaches is retrograde recanalization of the occluded vessel through a dorsalis pedis access. In this case report, we describe successful retrograde recanalization of an occluded popliteal artery in a patient with CLI after failure of the antegrade approach.

CASE REPORT

A 48-year-old male with a history of coronary artery disease (with previous coronary bypass surgery), end-stage renal disease (on hemodialysis), and paroxysmal atrial fibrillation (on warfarin therapy), presented to his primary care physician with right foot pain at rest and a nonhealing ulcer. The ankle brachial index was 0.42 in the right leg and 0.7 in the left. The patient was referred to our institution for lower extremities angiography and possible revascularization.

Antegrade Revascularization Attempt

Informed consent was obtained from the patient. Digital

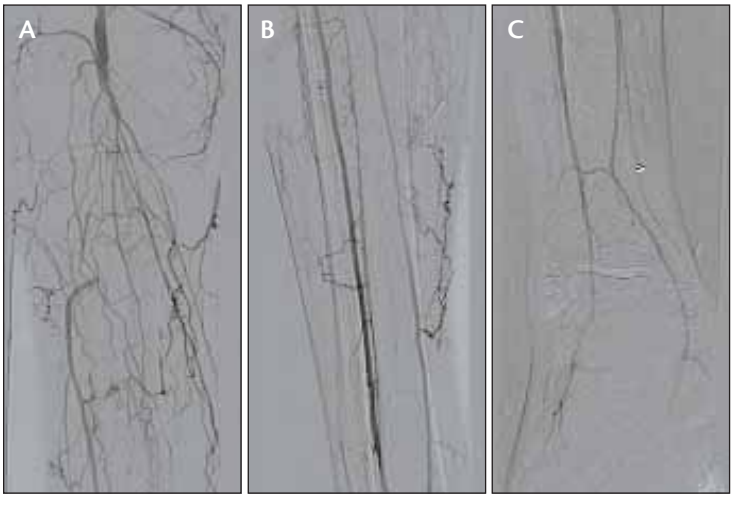

Figure 1. Preprocedural angiography demonstrating right popliteal artery occlusion extending into the tibioperoneal trunk and the proximal segments of the infrapopliteal vessels (A). The anterior tibial and posterior tibial arteries filling below the trifurcation via collaterals (B). The distal anterior tibial artery providing collaterals to the posterior tibial artery (C).

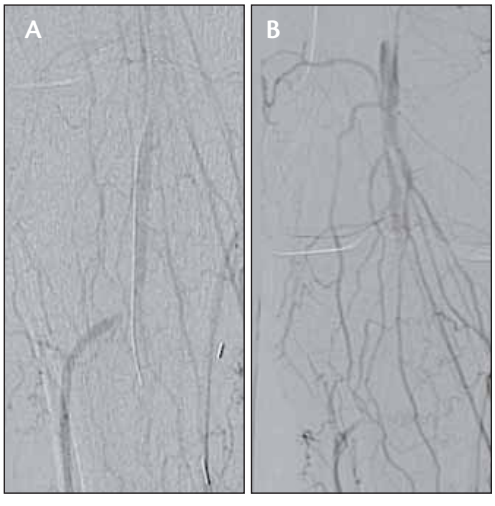

Figure 2. Unsuccessful attempt to re-enter into the distal true lumen of the anterior tibial artery (A). Postprocedural angiography demonstrating the popliteal artery occlusion (B).

subtraction angiography of the right lower extremity was performed using a contralateral approach after securing access in the left common femoral artery using a 5-F, 10-cm sheath (Terumo Interventional Systems, Somerset, NJ). Right lower extremity angiography demonstrated patent common, internal, and external iliac arteries, patent superficial and profunda femoral arteries, and an occluded popliteal artery extending to the tibioperoneal trunk and involving all three infrapopliteal vessels (Figure 1A and 1B). The anterior tibial artery was visualized distal to the occlusion via geniculars collaterals (Figure 1B) with slow-flow two-vessel runoff supplying the pedal arch (Figure 1C). An attempt to recanalize the occluded right popliteal artery was made via a crossover access from the contralateral (left) femoral artery using a 6-F, 65-cm Pinnacle Destination sheath (Terumo). Several attempts using multiple Terumo Glidewires and different support catheters were used to traverse the occlusion failed due to the inability to re-enter into the distal true lumen of the popliteal artery (Figure 2A and 2B).

Retrograde Revascularization

Vascular surgery consultation was obtained; however, the patient was declined for surgery due to limited surgical bypass options. Informed consent was obtained for a retrograde approach via the right dorsalis pedis artery.

Antegrade right common femoral access was obtained, and a 6-F, 25-cm-long Pinnacle sheath (Terumo) was inserted. Digital subtraction angiography of the right lower extremity, including an image of the distal anterior tibial and dorsalis pedis artery, was performed and stored using the mapping technique. Using the angiographic map and Doppler ultrasound guidance, the right dorsalis pedis artery was accessed using a micropuncture needle set, a 4-F Pinnacle Introducer sheath (Terumo) was placed, and retrograde right anterior tibial artery angiography was performed (Figure 3A). After administration of intravenous unfractionated heparin, (3,000 units), a 260-cm .014-inch Asahi Confianza Pro guidewire (Abbott Vascular, Santa Clara, CA) was placed in a Transit exchange catheter (Cordis Corporation, Warren, NJ) and both were introduced through the 4-F Introducer to the right anterior tibial artery (Figure 3B). The totally occluded anterior tibial artery, tibioperoneal trunk, and popliteal artery were traversed using the Asahi Confianza guidewire (Figure 3B and 3C). An Amplatz Goose Neck 4-mm microsnare (ev3 Inc., Plymouth, MN) was then introduced from the antegrade femoral access to snare the Asahi Confianza Pro guidewire in the superficial femoral artery (Figure 3D). The guidewire was then exteriorized from the right common femoral artery access (Figure 3E). A .014-inch Quick-Cross catheter (Spectranetics Corporation, Colorado Springs, CO) was introduced from the right common femoral access site over the soft end of the Asahi Confianza guidewire and positioned at the midsection of the anterior tibial artery. The Asahi Confianza guidewire was then exchanged for a .014-inch Asahi Grand Slam wire (Abbott Vascular) (Figure 3F). The right dorsalis pedis artery sheath introducer was then removed and manual pressure applied at the puncture site. Repeat angiography demonstrated complete hemostasis without any intimal disruption at the puncture site.

Percutaneous transluminal angioplasty was then performed in a traditional fashion using the antegrade approach via the right common femoral artery access. Balloon dilatation of the anterior tibial and tibioperoneal

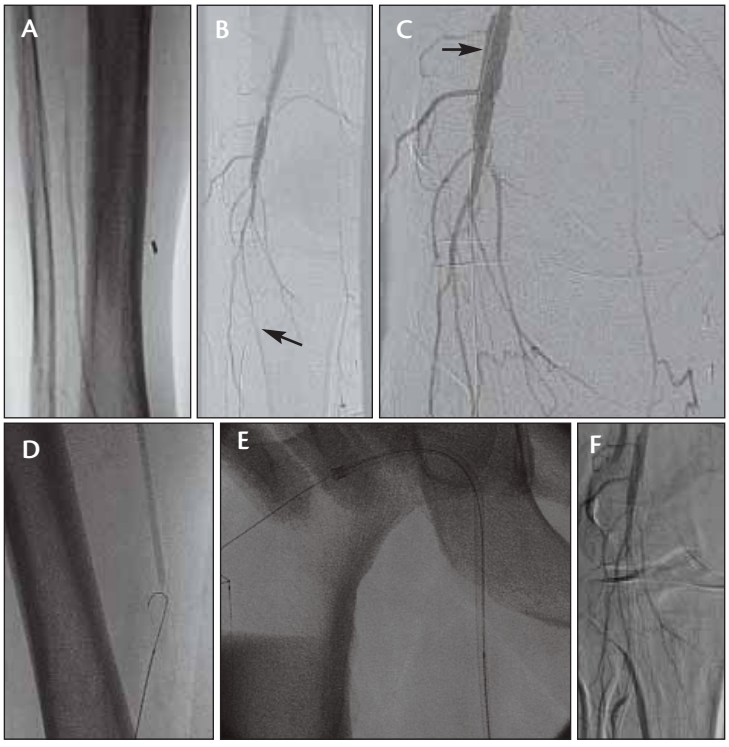

Figure 3. Preprocedural angiography of the anterior tibial artery via 4-F sheath introducer in the dorsalis pedis artery (A). The popliteal artery occlusion was traversed from below via the anterior tibial artery using a .014-inch Asahi Confianza Pro guidewire (Abbott Vascular) in a Transit exchange catheter (Cordis Corporation) (small black arrow) (B, C). The .014-inch guidewire in the superficial femoral artery is snared with an Amplatz Goose Neck 4-mm microsnare through the antegrade femoral sheath (D). The guidewire is exteriorized through the antegrade femoral sheath (E). A .014-inch Asahi Grand Slam guidewire is positioned in the anterior tibial artery through the antegrade approach (F).

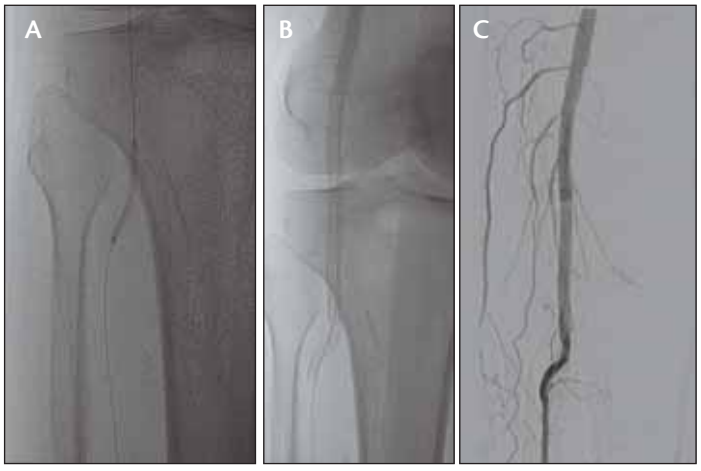

Figure 4. Balloon angioplasty of the popliteal and anterior tibial arteries using a Voyager Rx (2.5- X 30-mm) balloon catheter (A). Self-expandable nitinol stents deployed in the popliteal and anterior tibial arteries; Xpert 4- X 40-mm stent in the proximal segment of the anterior tibial artery and Xceed 6- X 100-mm stent in the popliteal artery (B). Postprocedural angiography after successful stenting of the popliteal and anterior tibial arteries (C).

trunk was performed with a 2.5- X 30-mm Voyager Rx balloon catheter (Abbott Vascular) and of the popliteal artery with a 4- X 30-mm Voyager Rx balloon catheter with suboptimal result (Figure 4A). A 4- X 40-mm Xpert stent (Abbott Vascular) was then implanted in the tibioperoneal trunk, and a 6- X 100-mm Xceed stent was implanted in the popliteal artery and postdilated with a 5- X 100-mm Agiltrac balloon catheter (Abbott Vascular) (Figure 4B). Final angiography demonstrated an excellent result with significant improvement in the flow to the pedal arch (Figure 4C).

Postprocedure ankle-brachial index increased from 0.42 to 0.95. The patient was discharged at day 2 after the intervention and remains well at 6 months.

DISCUSSION

Although surgical revascularization for lower extremity arterial disease in patients with CLI can offer a durable result in appropriately selected patients, it is associated with significantly higher rates of morbidity compared to endovascular approaches.[1,2] Importantly, endovascular intervention preserves the option of surgery in case of procedural failure.[3]

Endovascular recanalization of chronically occluded lower extremity vessels should always be attempted using an antegrade approach first (contralateral or ipsilateral). A retrograde approach using the dorsalis pedis access should only be attempted in patients who failed a concerted effort at antegrade recanalization and who have limited surgical options. Retrograde recanalization of occluded infrainguinal vessels have been reported using different techniques such as dorsalis pedis access using a surgical cutdown[4] or a combined antegrade and retrograde flossing technique.[5] More recently, the outcome of using a retrograde ipsilateral approach was comparable to the more conventional use of a contralateral or an antegrade ipsilateral approach.[6]

Although the retrograde approach can be applied successfully in patients with limited traditional revascularization options, it is a technically demanding endeavor. Securing access to the dorsalis pedis artery can be challenging, and it may require both angiographic and Doppler guidance. Traversing the totally occluded vessel and re-entry into the true lumen can also be very challenging using .014-inch guidewires.

In summary, retrograde recanalization of chronically occluded infrainguinal vessels through a dorsalis pedis access is a feasible and useful approach in well-selected patients with CLI who failed the antegrade approach and are at high risk for surgery. ■

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1. Adam DJ, Beard JD, Cleveland T, et al. The BASIL trial participants. Bypass versus angioplasty in severe ischaemia of the leg (BASIL), multicentre, randomized controlled trial. Lancet. 2005;366:1925-1934.
2. Hobbs SD, Yapanis M, Burns PJ, et al. Perioperative myocardial injury in patients undergoing surgery for critical limb ischemia. Eur J Vasc Endovasc Surg. 2005;29:301-304.
3. Lipsitz EC, Veith FJ, Ohki T. The value of subintimal angioplasty in the management of critical limb ischemia: failure is not always associated with a rethreatened limb. J Cardiovasc Surg. 2004;45:231-237.
4. Iyer SS, Dorros G, Zaitoun R, et al. Retrograde recanalization of an occluded posterior tibial artery by using a posterior tibial cutdown: two case reports. Cathet Cardiovasc Diagn. 1990;20:251-254.
5. Spinosa DJ, Leung DA, Harthun NL, et al. Simultaneous antegrade and retrograde access for subintimal recanalisation of peripheral arterial occlusion. J Vasc Interv Radiol. 2003;14:1449-1454.
6. Botti CF, Ansel GM, Silver MJ, Barker BJ, South SJ. Percutaneous retrograde tibial access in limb salvage. J Endovasc Ther 2003;10:614-618.