Reconstruction of “unreconstructable” critical limb ischemia with hybrid techniques

John R. Power, BA, Christine Chung, MD, Paul S. Lajos, MD, Peter L. Faries, MD, Michael L. Marin, MD, and **Rami O. Tadros, MD,** *New York, NY*

This case describes the surgical repair of critical limb ischemia in a patient with diffuse multilevel peripheral arterial disease. It demonstrates the value of patient-specific approaches that employ hybrid endovascular and open surgical techniques to reconstruct blood flow in patients who are not ideal candidates for traditional revascularization. We detail a technique that combines endarterectomy, femoropopliteal bypass, angioplasty, and stenting. This case suggests that innovative hybrid approaches can be used to achieve limb salvage in some patients with multilevel peripheral vascular disease who would otherwise undergo primary amputation. (J Vasc Surg Cases 2016;2:10-3.)

As the global population ages and prevalence of cardiovascular disease rises, critical limb ischemia (CLI) is anticipated to be a growing problem.[1] A cause of high morbidity, CLI can result in major amputation should revascularization prove impossible. Fortunately, modern vascular surgeons have at their disposal a bevy of endovascular techniques that have revolutionized the treatment of peripheral arterial disease.[2,3] Correctly applied, these endovascular techniques can facilitate revascularization with lower morbidity and mortality than in open procedures.[4] However, isolated surgical or endovascular treatments are suboptimal for a small subset of patients who are not candidates. Hybridizing surgical and percutaneous procedures may offer improved options for limb salvage.

This case describes the application of open and endovascular techniques to revascularize the right lower extremity (RLE) of a patient with CLI. Initially, an outside institution had recommended that the patient undergo a primary amputation. After a second opinion, a hybrid approach aimed at limb salvage was performed. After revascularization, the patient needed only a partial hallux amputation instead of a major amputation. The patient described in this case report has consented to publication of this manuscript.

From the Division of Vascular Surgery, Department of Surgery, The Icahn School of Medicine at Mount Sinai.

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Correspondence: Rami O. Tadros, MD, Division of Vascular Surgery, Department of Surgery, The Icahn School of Medicine at Mount Sinai, 1425 Madison Ave, 4th Fl, New York, NY 10029 (e-mail: rami.tadros@mountsinai.org).

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CASE REPORT

A 55-year-old woman with a history of sarcoidosis, hypertension, hyperlipidemia, and a 40-pack-year smoking history presented with right first toe gangrene and 1 month of progressive RLE rest pain. Examination demonstrated a weak right femoral pulse with absent popliteal, dorsalis pedis, and posterior tibial (PT) pulses. RLE ankle-brachial index was measured to be 0.74, but pulse volume recording suggested severely decreased perfusion at the metatarsal level. Evaluation of the right foot revealed interdigital ulceration between the first and second toes and a first toe ulcer with early distal gangrene. RLE angiography revealed severe multilevel peripheral arterial occlusive disease (Fig 1). A flush chronic total occlusion extending the entire length of the superficial femoral artery prevented a percutaneous attempt at revascularization. Reconstitution of the popliteal artery below the knee was seen, although it was diffusely stenosed along its length. Furthermore, there was a chronic total occlusion of the entire anterior tibial artery, the peroneal artery below the midcalf, and the PT artery from the distal calf to the ankle joint with collateralization of the plantar arc. Vein mapping revealed that the saphenous and upper extremity veins were inadequate for use as a bypass conduit. Whereas pedal bypass with a distal vein patch or arteriovenous fistula was considered, it was deemed unlikely to succeed, given the distal location of the outflow and the lack of autogenous conduit. Furthermore, the patient was very thin, and tissue cover was a concern because of increased risk for complications such as wound breakdown and surgical site infection, especially in the setting of prosthetic conduit.

Surgical technique. Femoral and above-knee popliteal cutdowns were performed. The popliteal artery was directly accessed and a 5F vascular sheath was placed. The popliteal artery and tibioperoneal trunk stenoses were traversed. A Quick-Cross catheter (Spectranetics, Colorado Springs, Colo) and Whisper guidewire (Abbott, Chicago, Ill) were used to cross the peroneal and PT occlusions. This allowed angioplasty of the peroneal artery and PT artery with 2.5-mm balloons over a 0.014-inch ASAHI Grand Slam guidewire (Abbott). An intraoperative angiogram showed patent vessels with improved outflow to the foot. Next, an exchange was made for a 7F sheath over a Bentson guidewire. Then, a 6- × 80-mm ringed Propaten (Gore, Newark, Del)

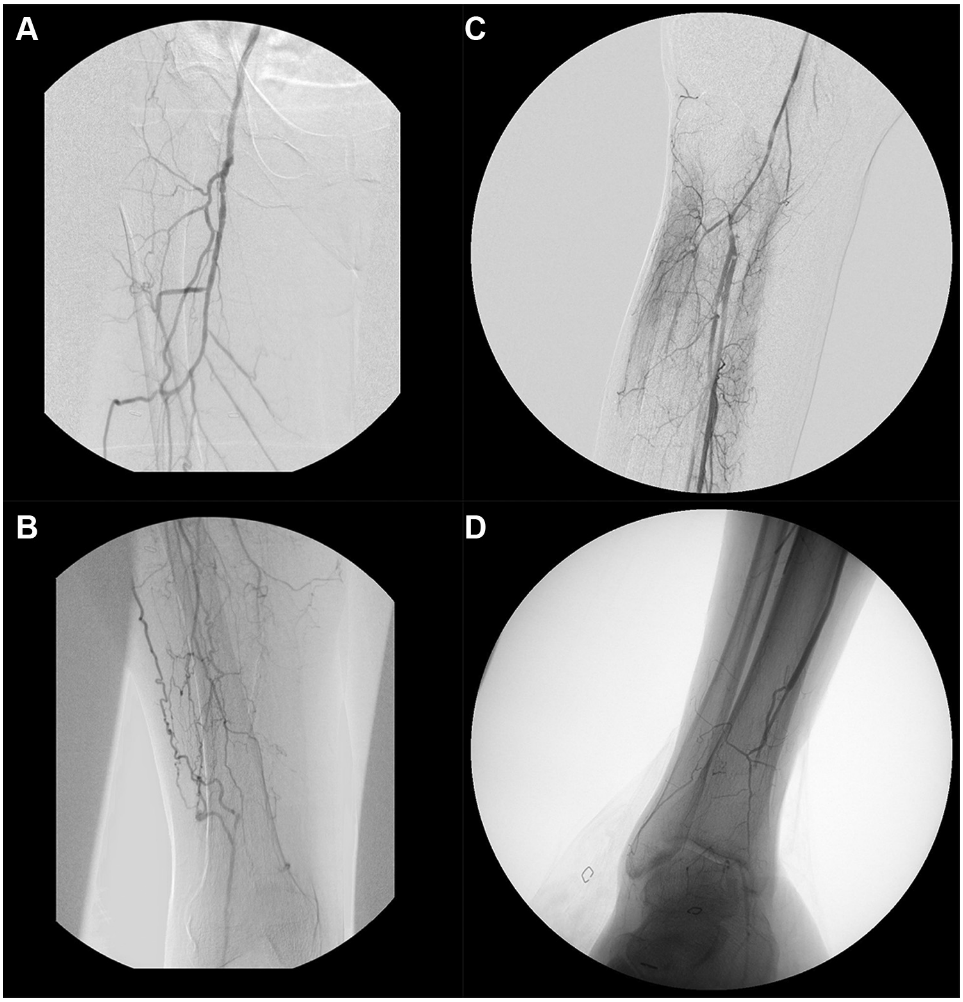

Fig 1. Preoperative right lower extremity (RLE) angiograms. **A,** Groin; **B,** Femur; **C,** Knee; **D,** Ankle.

polytetrafluoroethylene (PTFE) graft was tunneled from the femoral to the popliteal incision using a Kelly-Wick tunneler (Bard, Murray Hill, NJ). An 11F sheath was connected to the proximal end of the graft and secured with several 0 silk ties. Through this, a 7- × 10-cm Viabahn stent graft (Gore) was positioned through the bypass graft and placed outside the diffusely diseased popliteal artery (Fig 2).

The 0.035-inch wire in the popliteal artery was back-loaded into the Viabahn, and the Viabahn was advanced through the popliteal artery such that it was both in the popliteal artery and partially within the tunneled PTFE graft. This stent graft was deployed and angioplastied throughout to 6 mm. Several interrupted 6-0 Prolene sutures were then used to secure the PTFE graft to the popliteal artery. Care was taken to avoid puncture of the Viabahn as the PTFE coat is thin, making hemostasis difficult. Next, femoral endarterectomy was performed with patch angioplasty. The proximal graft was then sewn in a standard fashion to the patch. Completion angiography demonstrated excellent inflow with inline flow to the popliteal artery with a patent PTFE graft-popliteal Viabahn stent graft.

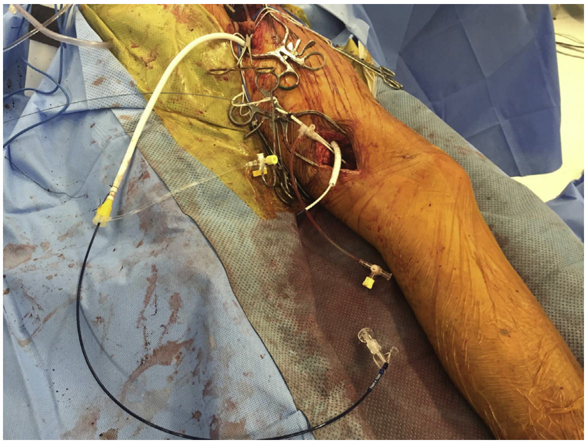

Fig 2. This representative image from a similar case illustrates the technique of loading a Viabahn stent graft through a tunneled polytetrafluoroethylene (PTFE) bypass conduit.