Case Report: An Unusual Combined Retrograde and Antegrade Transpedal Subintimal Recanalization of the Infrainguinal Arteries

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ABSTRACT

Retrograde or combined retrograde and antegrade recanalization should be considered when antegrade recanalization has failed in selected patients with critical limb ischemia (CLI). Retrograde recanalization is typically attempted through a patent segment of the popliteal artery or an infrapopliteal artery. The challenge arises, however, when there are no patent popliteal or infrapopliteal arteries suitable for retrograde access.

ABBREVIATIONS

CLI = critical limb ischemia, $TcPo_2$ = transcutaneous oxygen tension

We present a case of a 66-year-old male patient who presented with a nonhealing ulcer of the dorsum of the left foot and complete occlusion of the superficial femoral, popliteal, and infrapopliteal arteries. Antegrade recanalization was attempted but was unsuccessful. Combined retrograde and antegrade subintimal recanalization was established through an occluded dorsalis pedis artery, leading to reestablishment of vascular flow in the femoral, popliteal, and infrapopliteal arteries and complete healing of the foot ulcer.

Patients with critical limb ischemia (CLI) have a bleak prognosis, with a combined 1-year mortality and amputation rate that exceeds 50% (1,2). These patients frequently have extensive arterial disease both above and below the knee (1). Although surgical revascularization for lower extremity arterial disease in patients with CLI can offer a durable result, endovascular revascularization has been preferred over distal arterial bypass surgery as the initial arterial revascularization procedure in these patients because of comparable clinical success rates and lower complication rates (3,4).

Retrograde or combined retrograde and antegrade recanalization (combined approach) should be considered when the antegrade access has failed (5,6). Retrograde recanalization is typically attempted through a patent segment of a chosen artery, usually involving the popliteal, the tibial, or the dorsalis pedis artery. The challenge arises when there are no patent popliteal or infrapopliteal arteries suitable for retrograde access. Herein, we describe a novel technique for retrograde recanalization of the infrainguinal vessels, even when no patent arteries can be identified at or below the level of the knee joint.

CASE REPORT

The institutional review board approved the presentation of this case report.

A 66-year-old man with diabetes, ischemic cardiomyopathy, right hemiplegia, and a history of previously treated hypopharyngeal carcinoma presented with a 3-month history of a nonhealing ulcer of the dorsum of the left foot; it was associated with 1 month of left foot pain at rest.

A physical examination revealed an absence of palpable pulses at the posterior tibial and dorsalis pedis arteries. Transcutaneous oxygen tension ($TcPo_2$) measured at the dorsum of the left second toe, which exhibited the ulcer, was 0 mm Hg.

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Figure 1. **(a–c)** Left lower limb angiography revealed occlusion of the left superficial femoral artery and popliteal artery occlusion extending into all arteries below the knee, with reconstitution of the distal two-thirds of the peroneal artery (white arrows on **b**).

Computed tomography (CT) angiography of the lower limbs showed a calcified stenosis of the left common femoral artery, extending into the profunda femoris artery, and complete occlusion of the superficial femoral, popliteal, and infrapopliteal arteries. Poor distal runoff was identified in the distal two thirds of the peroneal artery. The patient declined surgical bypass options. Endarterectomy with patch angioplasty of the left common femoral and profunda femoris arteries was performed, with no significant improvement of his clinical condition. The patient was then referred to the vascular interventional unit for lower extremity angiography and revascularization.

After informed consent was obtained from the patient, digital subtraction angiography of his left lower extremity was performed through a contralateral approach using a 6F, 40-cm Flexor Check-Flo sheath (Cook Medical, Bloomington, IN). There were no flow-limiting stenoses of the common, internal, or external iliac arteries or of the patent common femoral and profunda femoris arteries. There was complete occlusion of the superficial femoral and popliteal arteries, extending into the anterior tibial artery and the tibioperoneal trunk. The posterior tibial artery, the proximal one third of the peroneal artery, and the dorsalis pedis artery were totally occluded. Poor flow, through collaterals, was noted in the distal two thirds of the peroneal artery, with one-vessel runoff supplying the plantar arch (**Fig 1a–c**).

Antegrade recanalization was attempted but was unsuccessful after administration of a bolus of heparin (5,000 IU). We decided to proceed with a retrograde approach through the left dorsalis pedis artery.

After identification of the occluded left dorsalis pedis artery by Doppler ultrasound (US), a noncalcified segment was chosen (**Fig 2**) and accessed using a micropuncture needle set (Cook Medical). A 4F, 10-cm sheath (Radiofocus, Terumo, Tokyo, Japan) was introduced into the vessel. A 300-cm, 0.014-inch Approach CTO-25 guide wire (Cook Medical) was placed in a 4F, 100-cm straight Glide catheter (Terumo), and both were inserted through the 4F introducer to the left anterior tibial artery (**Fig 3**). A gentle retrograde negotiation was carried out, with successful formation of a subintimal dissection and wire loop as the wire was advanced cephalad through the subintimal space. The totally occluded anterior tibial, popliteal, and superficial femoral arteries were recanalized subintimally until the common femoral artery was reached, where the true lumen was easily reentered. A 15-mm Amplatz GooseNeck Snare Kit (Covidien, Dublin, Ireland) was then introduced from the contralateral femoral access to snare the 0.014-inch guide wire in the left common femoral artery. The guide wire's soft end was then retrieved from the right common femoral artery access. A vertebral curve 4F, 100-cm catheter (Terumo) was introduced from the right common femoral