Below the Knee Intervention Using Multidisciplinary Methods Including an Antegrade, Retrograde Approach Without the Use of a Sheath but With a Plaque Excision Device

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Below the knee (BTK) interventions are increasing in patients with rest pain or critical limb ischemia, and these interventions are frequently successful in facilitating limb salvage. New intervention techniques and devices allow successful recanalization of occluded BTK arteries. Here, we report a case of successful recanalization of BTK arteries using multidisciplinary methods, including an antegrade approach and retrograde approach without the use of a sheath, but with simple balloon angioplasty, and plaque excision using Silverhawk atherectomy device. (**Korean Circ J 2012;42:125-128**)

KEY WORDS: Peripheral arterial disease; Ischemia; Angioplasty; Atherectomy.

Introduction

Peripheral artery disease of the lower extremities usually presents with claudication or critical limb ischemia (CLI). Below the knee (BTK) intervention can be performed for limb salvage and as treatment for patients with rest pain, non-healing ulcers, and to prevent possible limb loss.¹⁾ Peripheral percutaneous transluminal angioplasty (PTA) is a method of treating CLI with outcomes similar to those of bypass surgery.^{2,3)}

Many possible intervention strategies for the treatment of CLI with BTK lesions must be considered: an antegrade approach via the contralateral femoral artery, antegrade approach via the ipsilateral

femoral artery, retrograde approach via the pedal artery, balloon angioplasty, stent deployment, or atherectomy. Antegrade recanalization is the most common method of chronic total occlusion recanalization; however, retrograde recanalization is a necessary alternative in some cases.

Here, we report a case of successful recanalization of a BTK artery using multidisciplinary methods; an antegrade approach, a retrograde approach without using a sheath, but with simple balloon angioplasty, and plaque excision.

Case

A 61-year-old male was admitted to our hospital due to rest pain and a cold sensation in the left lower leg. He had a medical history of hypertension, diabetes, and smoking. The patient complained of a two-month history of severe pain in the left lower leg at rest. On physical examination, the left femoral artery pulse was strong, but the left popliteal artery pulse was weak and the left dorsalis pedis artery pulse was not palpable. The left ankle-brachial index (ABI) was 0.44. Computed tomography of the lower extremities and angiography revealed a diffuse, significant arterial stenosis in the proximal to mid portion of the left superficial femoral artery (SFA), total occlusion of the left popliteal artery, and total occlusion of the left tibio-peroneal trunk to the proximal portion of the three distal run-off

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vessels (Fig. 1).

The right common femoral artery was punctured and a 6 Fr Balkin sheath (Cook, Bloomington, IN, USA) was moved into the left exter-

Fig. 1. Computed tomography and angioplasty of the lower extremities. A: computed tomography with contrast revealed diffuse significant arterial stenosis in the left proximal to mid superficial femoral artery, total occlusion in the left distal SFA, diffuse arterial stenosis in the left popliteal artery, and total occlusion of the left tibioperoneal trunk. B, C, and D: angiography revealed a patent left proximal SFA with total occlusion of the left distal SFA to the popliteal artery with a poor distal run-off vessel. SFA: superficial femoral artery.

nal iliac artery. An attempt to pass the wire to the distal occlusion site was unsuccessful. Since the posterior tibial artery distal to the occlusion site was disease-free and normal in caliber, a retrograde approach was performed as an alternative to the antegrade approach. After successful wire passage using BMW wire (balanced middle weight, Abbott, IN, USA) via the posterior tibial artery, we extracted the wire via the right femoral sheath using a snare (10 mm, pfm Produkte für die Medizin AG) (Fig. 2). A 3×100 mm Savvy balloon (Cordis, Europa, Mexico) was then used instead of a sheath. The 3×100 mm Savvy balloon (Cordis, Europa, Mexico) was removed from the posterior tibial artery and balloon angioplasty was performed for the posterior tibial and peroneal arteries via a contralateral antegrade approach using the same balloon (figure not shown). A plaque was also extracted using a Silverhawk (ev3 Inc., Plymouth, MN, USA) plaque excision device (Fig. 3).

Final angiography demonstrated a well-visualized posterior tibial artery and a peroneal artery without residual stenosis (Fig. 4). During 6 months of follow-up, the patient had no claudication or pain at rest, and the left ABI improved from 0.44 to 0.99.

Discussion

Below the knee intervention lied in the realm of "forbidden territory" for catheter treatments until recently. The availability of multiple interventional devices and techniques can offer patients treatment options in diseased arterial territories that have traditionally not been amenable to treatment (especially BTK arteries), particularly in tibial and pedal interventions.

Yet, these techniques have been practiced infrequently due to technical complexity, the high potential for serious complications likely to result in amputation or compromise of a subsequent surgical bypass, and poor success rates.

This patient underwent complex interventions, including atherectomy and PTA without a sheath performed through a retrograde approach, with good results. The major advantage of the retrograde approach is the ability to perform complex interventions in a de-

Fig. 2. Wire passage via the posterior tibial artery. A: the left pedal artery was punctured using an 18 gauge Seldinger needle and the wire was advanced successfully. B: after advancing the wire up to the tibioperoneal trunk, a 3×100 mm Savvy balloon was placed, without ballooning, as a sheath substitute. C and D: after successfully crossing the wire, we pulled the wire via a right femoral sheath using a snare (10 mm, pfm Produkte für die Medizin AG).

Fig. 3. Percutaneous transluminal angioplasty and plaque excision. A: we performed PTA in the left popliteal artery using a 3×100 mm Savvy balloon at 6–10 atm. B: plaque excision using the Silverhawk device.

Fig. 4. Final angiography demonstrated a good distal flow without residual stenosis.

creased procedure time compared with the combined retrograde-antegrade technique. Additionally, this approach avoids cutdown access, which may increase procedure time and the potential for infection. The mechanism by which retrograde revascularization is more successful than the antegrade revascularization has not yet been elucidated. For coronary arteries, in which a high success rate

with retrograde revascularization has also been documented, it has been proposed that the distal portion of an occlusion might consist of less fibrotic or calcified tissue, allowing easier passage of the guidewire into the occlusion.⁴⁾ The major limitation of this technique is the sheath size that can be used. A sheathless technique for percutaneous balloon catheter insertion was recently developed to reduce the effective catheter diameter. Fusaro et al.⁵⁾ described a sheathless approach in which a 0.018-inch guidewire is introduced through the puncture needle followed by an over-the-wire balloon, thus abandoning the introduction of a sheath. The potential vascular complications related to balloon therapy include acute lower limb ischemia requiring direct arterial intervention (thromboembolism, direct arterial repair, and femorofemoral bypass), peripheral arterial perforation, dissection, fasciotomy, and limb amputation, among others. The technique described in the current case could reduce these complications.

Additionally, we have used a Silverhawk plaque excision device. This device removes the plaque by directional cutting atherectomy that is mechanically and manually operated. The Silverhawk device effectively debulks chronic total obstructions and high-grade stenoses containing fibrotic plaques. The Silverhawk catheter is a modification of earlier atherectomy devices. Prior catheters had integrated balloons and had a greater profile. New generation devices enable improved luminal gain without the resultant barotrauma associated with balloon angioplasty and stent placement. Its low-profile monorail design facilitates traversal of long-length lesions and repetitive plaque excision.⁶⁾

In summary, this intervention performed using atherectomy and percutaneous balloon angioplasty without a sheath via the retrograde approach can be extremely useful for revascularization of the popliteal and below-the-knee vessels, especially in cases where antegrade access is not feasible.

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