Introduction

Atherosclerosis of the noncardiac vessels is defined as peripheral artery disease (PAD). PAD affects 12% to 14% of the general population, and its prevalence increases with age, affecting up to 20% of patients over the age of 75 years. The lower-extremity vessels are affected more commonly than the upper-extremity vessels. The worldwide prevalence of lower-extremity PAD is between 3% and 12%. In Europe and North America, an estimated 27 million individuals are affected, and approximately 413,000 inpatient admissions annually are attributed to PAD.1

The risk factors for PAD are similar to those for coronary artery disease and cerebrovascular disease, but diabetes and cigarette smoking have a particularly strong association with PAD. Previous studies have shown that PAD is associated with a significantly elevated risk of cardiovascular disease morbidity and mortality.3-5

PAD of the lower limbs usually presents with claudication or critical limb ischemia (CLI). If a patient has coexisting diabetes or end-stage renal disease, PAD is often accompanied with foot ulcers and/or gangrene and is a major leading indication for lower-limb amputation. Revascularization of tibial arteries is often required to relieve ischemia and prevent progression to gangrene. This can be employed via antegrade angioplasty.

However, a recent study has highlighted the failure in about 20% of most complex cases where the antegrade approach was employed for revascularization.6 For cases that have failed the antegrade approach, a new method called angioplasty by retrograde approach through the dorsalis pedis artery or posterior tibial artery can be tried. The overall success rate of the procedure has been 86.3%, according to a recent study.7

Patient Background/Case Description

A 59-year-old woman presented to the hospital with claudication and chronic leg pain with exertion for the past 12 years.

She had already undergone multiple angioplasty involving stent placement in the right external iliac artery, two stents in the right superficial femoral artery (SFA), and one in the left SFA.

The patient has multiple comorbidities, including hypertension, diabetes mellitus type 2, dyslipidemia, and severe PAD. She also has cirrhosis of the liver stage 4, which is stable.

Physical examination was unremarkable with exceptions of tenderness to palpation over the anterior left thigh without any signs of hematoma or retroperitoneal bleed. Diminished pulses were found in the right dorsalis pedis, right posterior tibia, left dorsalis, and left posterior tibia, with normal femoral pulses bilaterally.

Formerly, the patient had undergone an anterograde right aortoiliac and right SFA angiogram and angioplasty through left groin access followed by multiple balloon dilatations of the right common and external iliac artery. An attempt had also been made to cross SFA at the ostium, but it failed due to chronic obstruction. This anterograde approach did not prove to be promising, and the patient soon returned with the persistence of symptoms.

The patient was then considered for retrograde intervention from below the knee through the dorsalis pedis artery.
Procedure Overview/Devices Used

The patient was taken to the cardiac catheterization lab and prepped and draped in the usual sterile manner. Right anterior tibial access was achieved with ultrasound guidance and using a Terumo® 4-Fr Pinnacle® Precision Sheath via the dorsalis pedis artery using the percutaneous route. The tibial vessel was visualized, a micropuncture needle was used to gain access, and a 4-Fr sheath was introduced and flushed. A total of 200 mcg of nitroglycerine, along with 2cc of lidocaine and 2000 units of heparin, were given. The vitals of the patient were stable at that time.

Using the sheath, approximately 10 ml of contrast was thrice injected into the right anterior tibial artery. Then a 0.75 mg/kg Angiomax® (bivalirudin) bolus was given via the peripheral intravenous (IV) route, and a NaviCross® 4-Fr × 135-cm diameter catheter was advanced over the Glidewire Advantage™ 260 cm. The patient’s vitals remained stable.

A 1.75-mg/kg/h Angiomax® drip was given IV and while using a NaviCross® 4-Fr × 135 cm, the right popliteal artery was injected with 5 ml of contrast.

The Glidewire Advantage™ was removed and replaced by 300-cm Runthrough™ NS. Again, the patient’s vitals were stable.

An attempt was made to cross the total occlusion. NaviCross® was removed over wire. A Submarine 0.018-in balloon 4-Fr × 40-mm × 130-cm was inserted over a Runthrough™ NS 0.014-in × 300-cm via the dorsalis pedis and inflated to 7 atm for 60 s in the right popliteal artery. The patient’s vitals were stable, and the balloon was removed.

Angiogram was then performed, which revealed a diseased proximal right anterior tibial vessel, a severely diseased tibioperoneal trunk with dissection, and creation of a false lumen followed by total occlusion of popliteal vessels just below a previously placed stent. The peroneal vessel was also involved 70% to 80%; however, the posterior tibial vessel was intact.

The 4-Fr sheath was removed over wire, and the intervention was performed using a 4-mm × 60-mm self-expanding stent deployed in the tibioperoneal trunk and the distal popliteal vessel without a sheath. Balloon dilatation was then performed to cover the dissection and to manage the severe tibioperoneal disease and stenosis.

The peroneal vessel was wired from the anterior tibial vessel, and balloon dilatation of the peroneal vessel was performed using a 2.5 balloon; the residual was less than 10%, so no stent was deployed.

The procedure gave a good result and was well tolerated by the patient. The patient was instructed to go home and continue aspirin and Plavix® (clopidogrel). By intervention with this approach, we saved the patient from bypass surgery in the right leg.
Sheathless Delivery of a Peripheral Self-Expanding Stent Into the Distal Popliteal Artery via Dorsalis Pedis Access
Muhammad Akram Khan. MD, FACC, FSCAI; Kashif Waqiee Ahmed. M.B., B.S.; Taliya Rizvi

Discussion

PAD involving the lower limb leads to CLI, which commonly involves multiple complex lesions or blockages that may impair or obstruct distal arterial perfusion and lead to limb amputation, morbidity, or even mortality without successful intervention. Recanalization of lower limb arteries is normally performed by the antegrade approach, but sometimes it is impossible to overcome certain occlusions, especially those below the knee, using this technique.

All the interventions performed earlier for this patient, whether antegrade or retrograde, employed the delivery of a stent using a minimum of 6-Fr sheath. However, unlike the rest of the procedures, this intervention involved the successful sheathless delivery of a peripheral self-expanding stent into distal popliteal artery via dorsalis pedis access.

The advantages and success rates of the pedal access approach for intervention and recanalization of below-the-knee arteries for treatment of CLI overweighs that of the antegrade approach and can be a good alternative to bypass surgery of vessels below the knee in cases who have failed conventional antegrade approach.

Key Takeaways

The retrograde approach is safe and well tolerated for the endovascular treatment of complex popliteal and/or tibioperoneal occlusions in patients with hybrid vessels or in those who have failed to respond to the antegrade approach.

This new technique known as transtibial intervention via pedal access is a promising alternative to invasive bypass surgery of the lower limb for those with CLI.

References


Disclosures

The authors declare that they have no competing interests.

Acknowledgements

The authors thank Dr. Akram Khan for his valuable recommendations and the patient for cooperation and consent for publishing the data.