CASE REPORT

Retrograde pedal access with a 20-gauge intravenous cannula after failed antegrade recanalization of a tibialis anterior artery in a diabetic patient: a case report

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Retrograde tibiopedal approach is being used frequently in below-the-knee vascular interventions. In patients with diabetic foot pathology, complex anatomy often requires a retrograde technique when the distal vascular anatomy and puncture site is suitable. The dorsalis pedis and posterior tibial arteries can be punctured because of their relatively superficial position. We report a retrograde puncturing technique in patients with chronic total occlusions. After failed antegrade recanalization, puncturing and cannulation of a tiny dorsalis pedis artery with a narrow bore [20-gauge (0.8 mm)] intravenous cannula is described.

Keywords: *intravenous cannula; retrograde access; diabetic foot; critical limb ischemia*

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Patients with peripheral arterial disease (PAD) of the lower extremities present with claudication or critical limb ischemia (CLI). PAD is usually accompanied with foot ulcers and/or gangrene. Improvement in arterial circulation of the diabetic foot may be necessary in certain clinical case scenarios for adequate healing of the diabetic foot ulcerations and/or amputation sites. Bypass surgery is the gold standard with high patency rates and wound healing, especially in diabetic patients, whereas below-the-knee angioplasty is recommended as an alternative method (1, 2). The advent of minimally invasive endovascular therapy has offered comparable results in appropriately selected patients. Target vessel and lesion access and crossing are some of the most significant obstacles faced when treating patients with PAD. Novel techniques and anatomy-specific technologies are providing new pathways via alternate access sites. Retrograde tibiopedal access is progressively being used for patients in whom other access efforts have failed or are simply impossible because of their vascular disease (3, 4).

This case report describes one of the five cases in which an intravenous (IV) cannula was used to access the dorsalis pedis artery retrogradely, which also was used in tibialis posterior artery puncture with satisfactory procedural outcome.

Case report

An 80-year-old man was admitted to our hospital due to rest pain below the right knee and ulcerations in his

right first and second toes. His past medical history was significant for diabetes mellitus and smoking. On physical examination, the patient had palpable pulses at the femoral and popliteal levels. The right dorsalis pedis and tibialis posterior artery pulses were not palpable. Patent right common and superficial femoral arteries and popliteal artery was demonstrated by duplex ultrasound. Absence of Doppler signals in infrapopliteal arteries was reported. Because of these findings, a decision was made to perform peripheral angiogram and angioplasty procedures simultaneously. The right superficial femoral artery was punctured antegradely and a 6 French sheath introducer (Medtronic, Minneapolis, MN, USA) was inserted. Lower limb diagnostic angiograms were then obtained. Baseline angiography revealed non-significant lesions in the superficial femoral and popliteal arteries and total occlusion of the distal segment of the popliteal artery along with the proximal portions of the three distal run-off vessels while demonstrating distal flow in the dorsalis pedis artery from collaterals (Fig. 1).

The target vessel for recanalization was the anterior tibial artery because of the location of the patient's diabetic foot ulcer. A bolus of 10,000 IU intravenous heparin and a 600-mg loading dose of clopidogrel were administered immediately after the decision was taken for revascularization. A 6 French guiding catheter (Judkins JR3.5, Medtronic, Minneapolis, MN, USA) was used to select the origin of the tibialis anterior artery.

Fig. 1. Angiography showing total occlusion of the three vessels with distal flow in dorsalis pedis artery from collaterals.

A 0.014-inch hydrophilic guidewire (Fielder, Asahi Intecc, Aichi, Japan) inside a microcatheter (Finecross, Terumo Corp. Tokyo, Japan) was used to cross the lesion. Numerous attempts to pass the wire to the distal occlusion site were unsuccessful.

A retrograde access was then decided as an alternative to the antegrade approach because the dorsalis pedis artery distal to the occlusion site was observable. The dorsalis pedis artery was punctured at the dorsum of the foot with a 20-gauge IV cannula (cannula-over-needle device with internal diameter of 0.8 mm and length of 32 mm) under fluoroscopic guidance (Fig. 2a). A weak pulsatile arterial blood flow from the needle was then visualized. Next, a 0.014-inch hydrophilic guidewire was inserted into the cannula and advanced through the lumen retrogradely (Fig. 2b). The IV cannula was then removed and replaced with a 1.5 × 15 mm over-the-wire (OTW) balloon (NC Sprinter, Medtronic, Minneapolis, MN, USA) afterwards.

At that time, we were able to enter into the guiding catheter with the guidewire following successful guidewire passage via the tibialis anterior artery (Fig. 3). The OTW balloon was advanced into the guiding catheter. The guidewire was replaced with a 330-cm-long 0.014-inch

Fig. 2. Intravenous cannula at the dorsum of the foot (a) and guidewire inside the dorsalis pedis artery (b).

exchange guidewire (RG3, Asahi Intecc, Aichi, Japan) for externalization. The guidewire was extracted via the right femoral sheath. The artery was predilated with a 2.0 × 20 mm monorail balloon (Invader PTCA balloon, Alvimedica, Assen, The Netherlands). A 2.5 × 200 mm drug eluting balloon (Legflow, Cardionovum, Bonn, Germany) was inflated for 3 min at the lesion site. The choice of balloon was at the operator's discretion. Final angiography demonstrated that antegrade flow was restored with well-visualized anterior tibial and dorsalis pedis arteries (Fig. 4a and b). Subsequently, successful hemostasis of the access site was exclusively obtained with manual compression. Wound healing has been perceived at the patient's first follow-up after 1 month.

Fig. 3. Entrance of the guidewire into the guiding catheter.

Discussion

Below-the-knee angioplasty may present as an alternate method of addressing CLI (2). Revascularization intends to prevent amputation, improve quality of life, and prolong survival. Nevertheless, vascular recanalization may be very challenging because it is often necessary to deal with very long occlusions and chronic total lesions. Numerous interventional devices and techniques are readily available and accessible. Retrograde tibiopedal access could be successful and offer an alternative technique when antegrade approaches fail. In a recent study, pedal access was attempted after the antegrade route was deemed unsuccessful (4). Pedal access via anterior tibial, posterior tibial, or peroneal approach was successful in most of the patients. Generally, a 4 French sheath introducer was utilized in tibiopedal access. The researchers reported no access failures in vessels with a diameter >1.5 mm. However, tibiopedal access may be restricted by potential difficulties. Small-diameter vessels are often significantly calcified and are prone to spasm and dissection. Access near the ankle may cause significant difficulty in sheath passage because of the sharp angulation.

Fig. 4. (a) and (b) Final angiogram.

In cases with short, calcified, and small distal target vessels, the authors believe that IV cannula which is compatible with 0.014-inch guidewire may be attempted as a practicable approach. When compared to 4 French pedal access kit (Cook Medical, Bloomington, IN, USA),

IV cannula is shorter (70 mm vs. 32 mm), easily accessible, and economical.

Conclusion

Retrograde puncture of small distal lower extremity arteries through a 20-gauge short IV cannula may be a simple, useful option to a relatively longer sheath introducer. In addition, there are several limitations to this case report including and not limited to the short-term follow-up without any further follow-up studies such as duplex imaging, angiogram, or toe pressures to demonstrate the successful outcome of this technique. Additional studies with a greater patient population and long-term patient outcomes are necessary in the future.

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