

Transpedal Artery Access for Tibiopedal Lesions

Tools and techniques for achieving revascularization.

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Transpedal artery access to revascularize complex tibiopedal lesions in patients with critical limb ischemia (CLI) has gained momentum in recent years.¹ Transpedal access is vital in failed retrograde and antegrade femoral access for limb salvage.² Occasionally, morbidly obese patients with claudication due to femoropopliteal segment occlusions may require transpedal access for revascularization. This article discusses the role of transpedal access, the use of duplex ultrasound for access, and the role of 4-F pedal access kits.

BACKGROUND

CLI needs adequate revascularization to achieve a straight-line flow to the foot.³ Partial revascularization of iliac or femoropopliteal arteries alone is usually insufficient to heal advanced leg ulcers or gangrene. Antegrade and retrograde femoral access have a failure rate of 15% to 20% when crossing difficult tibiopedal occlusions.² Retrograde femoral artery access is an easy and commonly used method of access but has some disadvantages when crossing tibiopedal lesions.⁴ For example, few balloons and catheters are available for reaching distal tibiopedal lesions. Also, the crossing wire loses the ability to carry torque, which affects pushability, and there is an increased chance of vessel dissection and failure to revascularize. Antegrade femoral access may increase the ability to cross tibiopedal lesions due to the availability of catheters, wires, and adequate support for catheter crossing. However, antegrade femoral access requires operator experience (at least five cases to be proficient) because the risk of multiple punctures resulting in hematoma is high. Antegrade puncture may also cause difficulty in access management, especially in obese patients.

TECHNIQUE

Transpedal access also requires operator experience (at least 10 cases to be proficient), but the technique can have a short learning curve. Using duplex ultrasound can be helpful in achieving access. An alternative approach to transpedal access includes roadmapping or image overlay. However, this method can be difficult if the patient moves

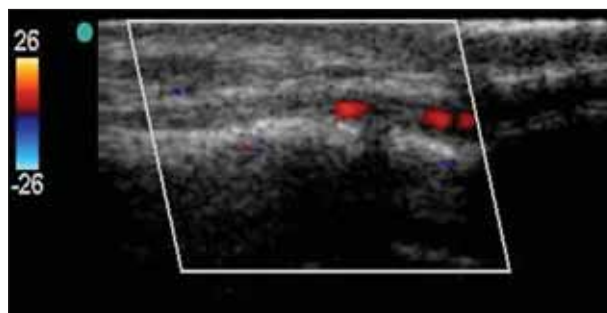


Figure 1. Ultrasound imaging of the dorsalis pedis artery.

or if there is table movement, and it also requires the use of additional contrast. This method requires operator expertise because the puncture must be made at a 90° angle to the flow. Exposure of fingers to radiation is also a concern here.

Duplex Ultrasound to Access the Pedal Artery

Using handheld duplex ultrasound can help locate the tibiopedal vessels. The pedal vessels are usually accessed under local anesthesia with a 4- or 5-F microaccess needle. Based on angiosome distribution, the most commonly accessed pedal arteries are the dorsalis pedis artery, followed by the posterior tibial artery and peroneal artery. However, the peroneal artery's course lies on the interosseous ligament, and manual pressure for hemostasis can prove cumbersome.

Operator familiarity with duplex ultrasound is important, but the learning curve can be short, especially for vascular interventionalists who are already familiar with the use of duplex ultrasound for femoral arterial and venous access. A handheld duplex ultrasound can provide an image of the dorsalis pedis artery in both short and long axis (Figure 1), the long axis view is the preferred approach. A novice to pedal artery access should seek assistance from ultrasound technicians to image and access the pedal artery. However, after success with a few cases, the operator should be able to use the duplex independently. An attempt must be made to achieve access with the first puncture to prevent spasm, and if the puncture is through and through, slow withdrawal of the needle will facilitate



Figure 2. A 4-F Micropuncture® needle (Cook Medical, Bloomington, IN) in the dorsalis pedis artery.

access with a Micropuncture® wire guide. The access wire should be advanced only to the occluded segment of the pedal artery to prevent vessel dissection. Dilator placement over the wire will facilitate placement of a sheath.

Cook Medical provides a 4-F pedal access kit with a sheath that has a side arm for injecting fluids and contrast (Figures 2 and 3). The dedicated Micropuncture® Pedal Access Set consists of a 21-gauge, 4-cm echogenic needle; a 7-cm Micropuncture® introducer engineered to increase control while gaining retrograde infrapopliteal access; and a 0.018-inch nitinol wire guide and hemostasis valve. This Check-Flo® hemostasis valve attaches directly to the Micropuncture introducer, allowing it to be used as an interventional introducer with a 2.9-F inner diameter.

We advise the use of nitroglycerin, a small dose of heparin, and sometimes verapamil to prevent vessel spasm and clotting. A 0.014- to 0.035-inch wire can be advanced via this sheath. Additional support can be achieved with a 0.018-inch CXI™ support catheter (Cook Medical). This method will allow crossing of lesions and subsequent insertion of the wire into a sheath from femoral access or the snaring of the pedal wire from the top. Further delivery of balloons and stents can be performed via the femoral

approach. The pedal sheath and the catheters can be removed and manual pressure held (Figure 4).

Another option is the placement of 4-, 5-, or 6-F sheaths in patients with adequate-caliber pedal arteries. The dedicated Micropuncture® Pedal Access Set is available in 4- and 5-F outer diameters; physicians sometimes use 5- or 6-F sheaths (inner diameter) if the vessel is large enough. The 5- or 6-F sheath will allow delivery of balloons and stents to the lesion. Use of a large sheath will require sheath removal when the activated clotting time is within normal limits. Occasionally, use of a radial band in the foot to achieve hemostasis can be helpful. A large-caliber sheath may cause vessel occlusion.

Total Occlusion of the Tibiopetal Lesions

It can be helpful to use a 0.014-inch coronary wire after gaining pedal access. Total occlusion wires such as MiracleBros, Confianza (Asahi Intecc Co., Ltd., Nagoya, Japan), or Cook Medical wires are usually the first choice. In some cases, hydrophilic-coated wires such as the CholCE PT Extra Support (Boston Scientific Corporation, Natick, MA), Pilot 50 (Abbott Vascular, Santa Clara, CA), or Fielder XT (Asahi Intecc) can also be helpful. Some operators have described the use of a 0.035-inch Glidewire (Terumo Interventional Systems, Somerset, NJ) to cross tibiopedal occlusions from the pedal approach. Use of support catheters in a sheathless “bareback” fashion is useful in difficult cases. Here, a 0.018-inch CXI™ support catheter is placed inside a 0.035-inch catheter and is used in a telescoping fashion. Any 0.014- or 0.018-inch wires can be used. An alternative is to use a sheathless 0.014-inch balloon via pedal access over a 0.014-inch wire to cross the tibiopedal vessels. Balloon-angioplasty-supported wire advancement may be needed to minimize friction in these occlusions. The downside of this technique is that a larger-profile balloon will be withdrawn from the pedal vessels and may predispose to vessel trauma.



Figure 3. Dedicated Micropuncture® Pedal Access Set in the dorsalis pedis artery.



Figure 4. Successful hemostasis of the dorsalis pedis artery after manual compression.

Pedal Access for Popliteal and Distal Superficial Femoral Artery Occlusions

We have performed pedal access for crossing distal femoral and popliteal lesions in morbidly obese patients. In such patients, the body habitus may be a nidus for vascular access complications when femoral antegrade or retrograde approaches are used. The pedal approach and delivery of a 5-mm balloon via a 5-F sheath has facilitated plain old balloon angioplasty and successful recanalization of occluded femoropopliteal lesions.

Existing Clinical Data

We searched the literature on CLI, and a total of fewer than 400 cases of pedal artery access interventions have been published. No prospective randomized clinical trials comparing antegrade/retrograde femoral versus retrograde pedal access have been published. A registry studying retrograde pedal access and subsequent prospective clinical trials are anticipated. The technique continues to evolve, and the number of procedures performed is increasing.

The Evolving Role of Pedal Artery Access in the Management of CLI

Retrograde pedal artery access can increase the success of recanalization of occluded tibiopedal occlusions. Transpedal access is especially beneficial in patients who have had a failed retrograde or antegrade femoral attempt at recanalization of the occluded tibiopedal vessels. The interventionist needs to be familiar with this approach, which can be an important rescue procedure, to increase limb salvage rates. We believe familiarity with pedal access and lesion crossing will increase the number of procedures performed, and in the future, interventionists may adopt the pedal-first approach in conjunction with antegrade access. There is an increasing need for a dedicated pedal sheath to accommodate delivery of catheters, balloons, and stents, as well as a need for the development of dedicated short-length wires, balloons, and stents to use in the approach.

CONCLUSION

The use of transpedal access to achieve a high success rate for limb salvage is clearly an innovative technique.

Case selection, operator experience, and appropriate technique are essential for optimal clinical and procedural success. We hope a wide acceptance and adoption of this approach will improve clinical outcomes in CLI revascularization. ■

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