Extreme Options After Failed Antegrade CLI Treatments

A step-by-step look at retrograde distal metatarsal (digital) artery puncture and direct puncture of occluded calcified tracts.

BY MARCO MANZI, MD, AND LUIS MARIANO PALENA, MD

Critical limb ischemia (CLI) occurs as a result of progressive obstructive atherosclerosis, most closely associated with tibial and pedal artery disease. Restoration of arterial blood flow can achieve relief of rest pain and improves wound healing, and revascularization is considered more and more the first-line treatment for CLI and foot salvage.[1]

According to recent literature, as well as the experience in our institution,[2] in cases where antegrade recanalization fails, the use of retrograde percutaneous revascularization and subintimal arterial flossing with antegrade-retrograde intervention are considered valuable options.[3,4] However, in some cases, the percutaneous access site at the pedal artery level is not available for puncture or percutaneous puncture is not feasible.[5]

We have developed a new strategy for retrograde percutaneous revascularization through percutaneous transmetatarsal artery access, which has proven to be a useful adjunct tool in selected cases in which antegrade recanalization fails or distal sites to perform retrograde recanalization are not available.[6] In this article, we illustrate the ideal application of the technique and our method for direct puncture of occluded, calcified tracts that can be used in cases of long occlusions in which all other options have failed or are not feasible.

RETROGRADE PERCUTANEOUS TRANSMETATARSAL ARTERY ACCESS

Step 1

The first step is to choose the target metatarsal branch to perform the access. In our experience, the first metatarsal artery provides the best option for retrograde percutaneous access. The best site to perform the access is at the dorsum of the foot, through the first dorsal metatarsal artery. Plantar access of the metatarsal artery is not the preferred route from a practical point of view. After obtaining access to the first metatarsal artery, it is usually possible to reach the pedal arch or loop and, across the loop, it is subsequently possible to recanalize the dorsalis pedis or lateral plantar artery.

Figure 1. Local injection of lidocaine 2% and vasodilator.

Figure 2. A 21-gauge needle oriented to the calcifications under fluoroscopic guidance.

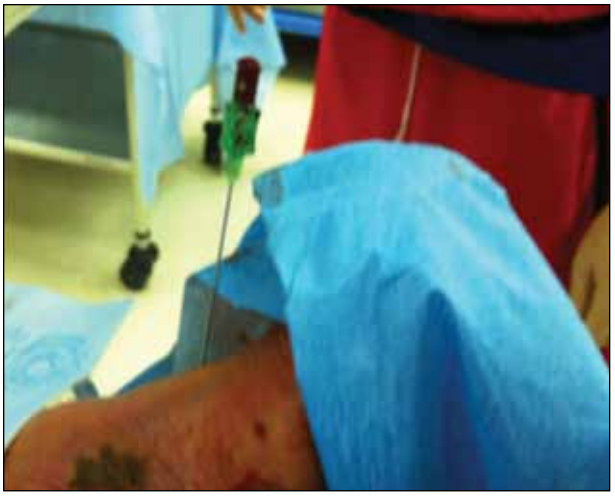


Figure 3. Blood in the cone of the needle.

Step 2

The second step is aimed at avoiding spasms that might compromise the puncture and wiring of small vessels. Pharmacologic support is mandatory. We use verapamil 5 mg/2 mL diluted to 10 mL with saline solution and inject 9 mL intra-arterially (which corresponds to a total dose of 4.5 mg), as distal as possible, close to the foot. Local anesthesia is performed on the dorsum of the foot, close to the target metatarsal branch. Along with lidocaine, 1 mL of the diluted verapamil is injected into the periarterial tissue as a support to avoid spasms. This pharmacologic support guarantees good preparation of the puncture site (Figure 1).

We perform the puncture with a 21-gauge needle under fluoroscopic guidance with contrast-medium injection at the maximum magnification to identify the calcifications of the target vessel (Figures 2 and 3). A roadmap is not used, as it is not useful for patients' movements; good magnification is enough when calcifications are presented.

It is essential to use the correct radiological projections. The arterial plane must be at 90° to the orientation of the X-ray beam, and the needle must be aligned with the artery. We usually use a Micropuncture introducer set (Cook Medical, Bloomington, IN) (Figure 4), which is composed of one long 21-gauge needle, a dedicated Torq-Flex 0.018-inch guidewire, and a microsheath. The set is very useful to perform the access. In many cases in which the target vessel is smaller than usual (between 1 and 2 mm), we prefer to use a 0.014-inch guidewire (Hi-Torque Pilot 200, Abbott Vascular, Santa Clara, CA, or Approach Hydro ST, Cook Medical).

Figure 4. Dedicated microsheath (Micropuncture set, Cook Medical) deployment.

Step 3

After achieving access and sheath deployment in the metatarsal branch, a retrograde recanalization of the foot and tibial arteries is performed, usually using a 0.018-inch guidewire (V-18, Boston Scientific Corporation, Natick, MA) and a small support catheter (CXI, Cook Medical) as a support to the guidewire (Figure 5).

The purpose of this retrograde wiring is to reach the distal patent arterial segment where a 4-F Berenstein-type II catheter (Cordis Corporation, Bridgewater, NJ) was left after the failed antegrade attempt. The catheter is cannulated with the retrograde guidewire, and the wire is retrieved at the groin sheath level. Subsequently, the definitive dilatations are performed using the antegrade approach.

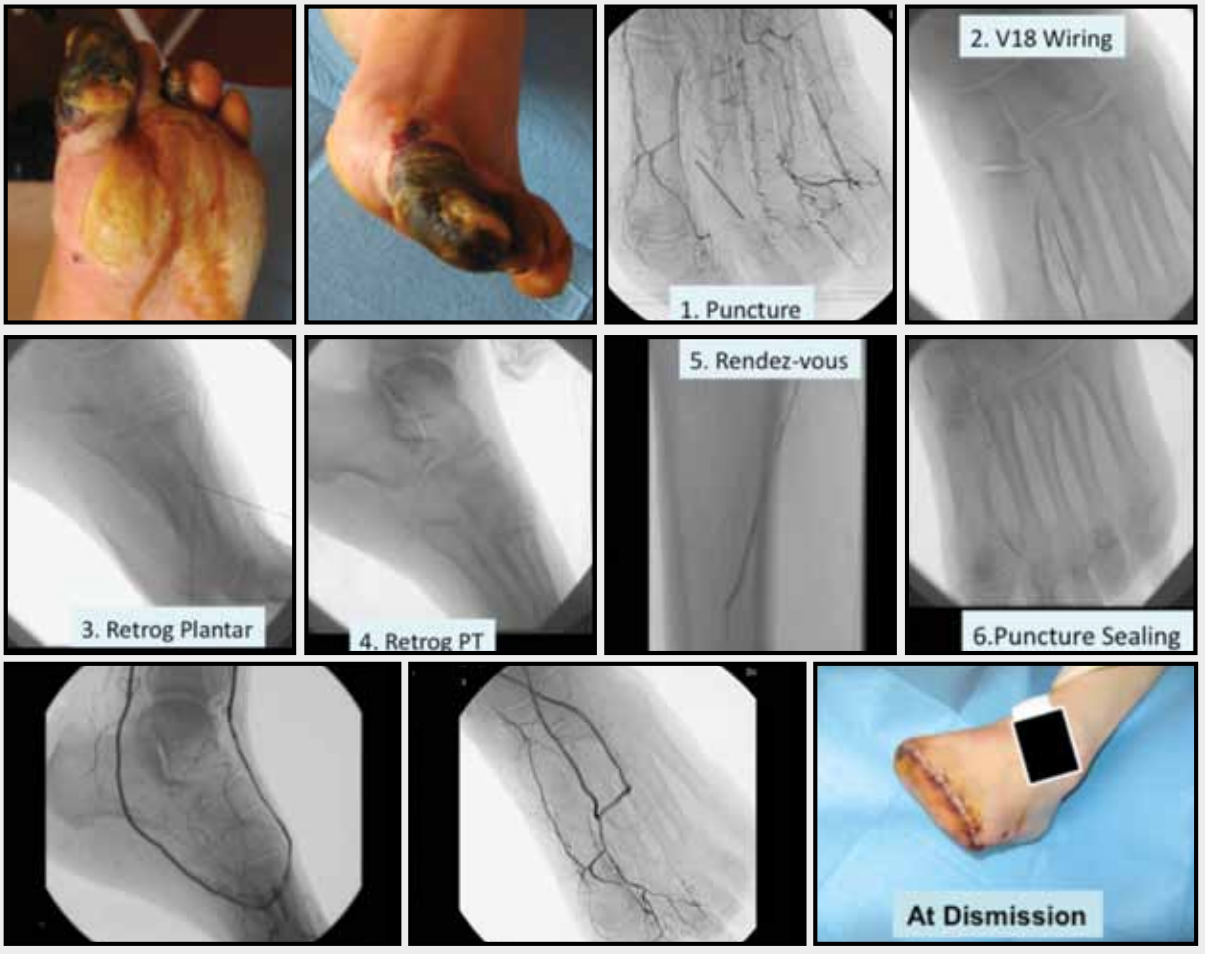
Figure 5. An 0.018-inch wire is inserted and directed through the pedal artery.

Step 4

The wire is then passed beyond the puncture site. The microsheath is retrieved, and a balloon is inflated to achieve hemostasis. We usually choose a 0.014-inch, 1.5- X 20-mm, over-the-wire balloon, which is inflated at 4 to 5 atm for 4 minutes. In our experience, this is enough to obtain good hemostasis without complications.

RETROGRADE PERCUTANEOUS TRANSMETATARSAL ARTERY ACCESS ILLUSTRATION

A 56-year-old patient with diabetes, hypertension, CLI, transcutaneous oxygen tension of 3 mm Hg, and gangrene I, II, and III toes scheduled for below-the-knee amputation after two endovascular recanalization failures.



DIRECT PUNCTURE OF OCCLUDED CALCIFIED TRACTS

Recently, we have used a new technique—direct puncture of occluded calcified tracts—in patients who have severely calcified vessels and are not candidates for antegrade or retrograde techniques. The puncture is possible under fluoroscopic guidance. After puncture, no blood will appear in the 21-gauge needle, given the fact that an occluded vessel segment has been punctured. The 0.018-inch wire is then inserted in the thrombosed true lumen or in the subintimal space. In our experience, it is more difficult to pass balloons in the true lumen in cases during which we cannot dilate the chronic total occlusion after successfully crossing it.

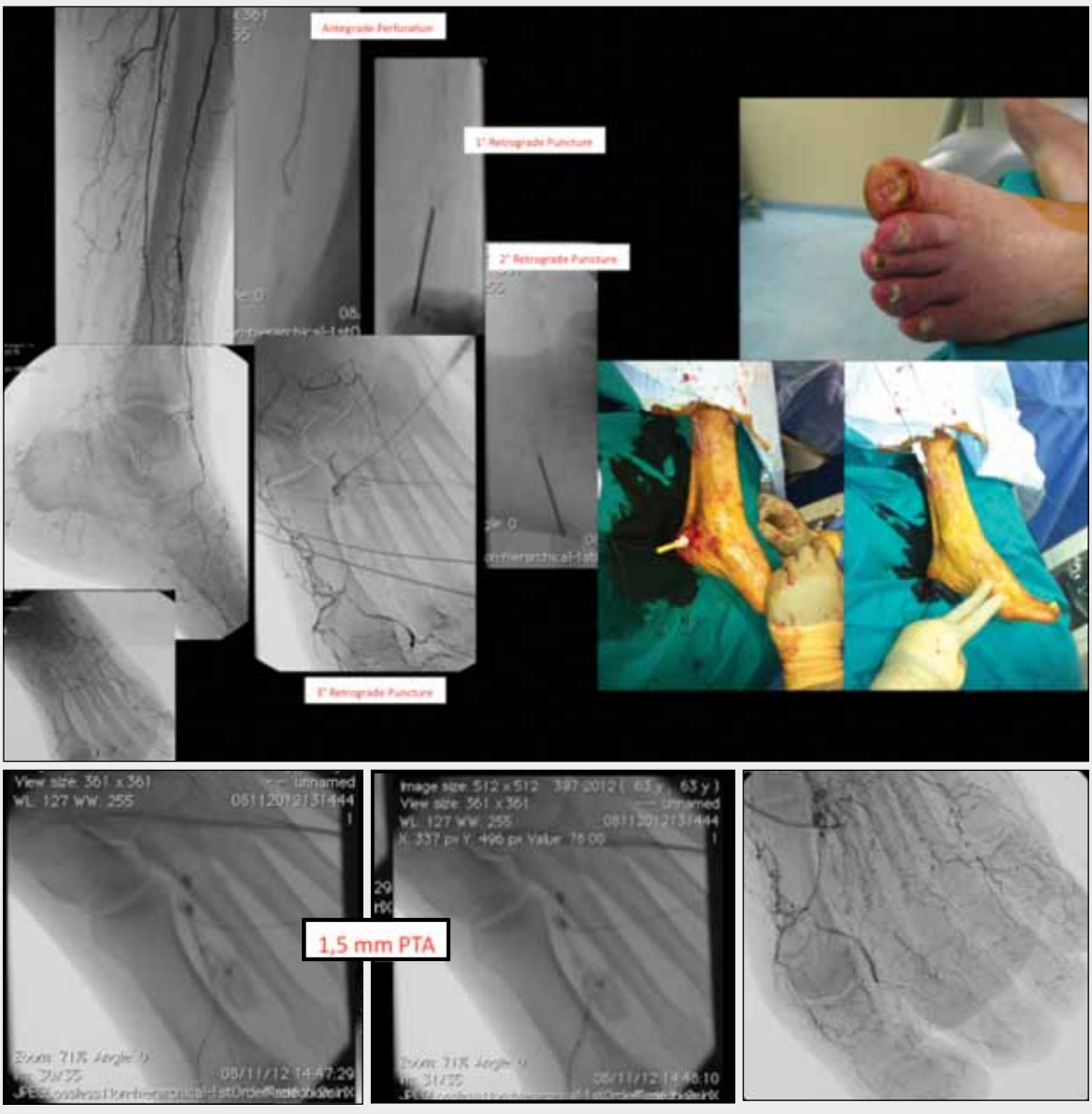
The goal is to shorten the length of the chronic total occlusions to cross, performing a retrograde puncture directly in the middle portion of the occluded tract. With the use of intraluminal or subintimal techniques, it is often possible to achieve a rendezvous with an antegrade 4-F Berenstein-type II catheter and then to proceed with the procedure in an antegrade fashion. Multiple retrograde and antegrade punctures are often required, and unexpectedly good outcomes can be achieved.

We have used this technique in only 10 patients, with a 60% success rate and no complications at all in cases of failure to date.

SUMMARY

In our experience, these two new technical strategies of retrograde percutaneous transmetatarsal artery access and direct puncture of occluded calcified tracts are feasible and safe. These strategies are reserved for extremely challenging

DIRECT PUNCTURE OF OCCLUDED, CALCIFIED TRACTS ILLUSTRATION



cases in which surgical revascularization is either contraindicated or not feasible, when endovascular treatment via antegrade access fails, and retrograde access in the pedal arteries is not possible. ■

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