

What are your tips and tricks for crossing long CTOs that start in the SFA and reconstitute in the distal tibial arteries in patients with ischemic ulcers?



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Most cases of long occlusions of the superficial femoral artery (SFA) can be recanalized using either an intraluminal crossing technique or the subintimal technique. Actually, most cases end up using partial intraluminal and partial subintimal passages. The problem with all of these kinds of lesions is re-entering the true lumen at a point where the artery is patent again and not to extend the dissection too far distally. Typically, re-entry devices are used to make a controlled re-entry at a pre-established level. Due to the bulky nature of the re-entry devices, they cannot be used in the smaller tibial vessels.

To achieve re-entry in the tibial vessels, I typically downsize a Glidewire device (Terumo Interventional Systems, Inc., Somerset, NJ) from 0.035 to 0.032 inch because the lesser stiffness of the guidewire tip will allow for formation of a loop with a smaller radius, which provides easier re-entry. When re-entry is needed very distally, I choose an even smaller guidewire size (0.014 or 0.018 inch) with a Glidewire-like tip. In those cases, I will support the guidewire with a support catheter (QuickCross, Spectranetics Corporation, Colorado Springs, CO; CXI, Cook Medical, Bloomington, IN; or similar).

When these measures fail, I resort to retrograde recanalization from a distal access site. In those cases, proximal re-entry is usually not an issue, and after proximal wire pick-up, the procedure can be completed from above. In cases

when it is not possible to create a connection between the antegrade and retrograde channel, balloon dilatation at the level where the guidewires meet may crack the intima, thus establishing a connection between the two lumina.



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Diabetic patients with ischemic foot ulcers (Rutherford class 5–6; University of Texas Wound Classifications 2C, 3C, 2D, and 3D) could often (27%) present with multilevel disease involving SFA, popliteal tract, and below-the-knee (BTK) vessels. Treating a long occlusion of the SFA, starting at its origin and extending to the popliteal artery and trifurcation with rehabilitation of a single BTK artery in the distal tract, is usually a challenging situation.

It could be very difficult to identify and reconstitute the trifurcation, as there could be a mild risk of distal embolization in the only patent vessel, and the duration of the procedure could be very long, with an exponential rise in the risk of potential complications.

A treatment strategy should therefore be planned after evaluating the following:

- Grade of calcifications;
- The risk of compromising collateral refilling distal to the occlusion;
- Presence or absence of a landing zone, possibly related to the wounded area.

If there is calcification present, antegrade ultrasound-guided access of the common femoral artery and an intra-

luminal attempt with loaded tip wires (0.018 inch) directly supported by a balloon or dedicated catheters should be considered first. I try to alternate the use of loaded wires with navigation wires, especially when tortuosities and curves are present. Devices for crossing chronic total occlusions (CTOs) can also sometimes help.

When crossing failures occur, shifting to a subintimal technique could be considered, being mindful of the collaterals refilling the distal zone. Dissection should not extend beyond the vessel reconstitution by collaterals, and a few prudent attempts to achieve re-entry into the true lumen should be performed with a 4-F Berenstein type 2 catheter (Cordis Corporation, Bridgewater, NJ).

A re-entry device could be useful in the popliteal area, but not for BTK vessels. The landing zone could be difficult to re-enter, and dissection must be stopped before the collateral level. If I am still in the subintimal space after a reasonable number of attempts with the tip of different properly shaped wires, a retrograde approach should be considered. This way, we have the ability to select the artery related to the wound in order to achieve a direct, straight inline flow when two or three BTK distal vessels are still patent.

In my experience, it is better to consider a retrograde approach immediately after the first re-enter failure rather than engaging in prolonged attempts; these procedures are time and energy consuming for us and the patients! The retrograde approach through the distal tract of the anterior tibial artery is usually the easiest, whereas a posterior tibial distal puncture, especially around the malleolar area, could be a little more difficult. With a retrograde distal peroneal puncture, it is not possible to perform manual compression in case of failure, and compartment syndrome is always possible, which can cause severe complications.

Hemostasis is achieved in the peroneal artery with antegrade inflation of a low-pressure balloon. If there is an absence of calcifications, my first choice is a direct subintimal dissection performed with a 0.018-inch stiff wire supported again by a 4-F Berenstein catheter.



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As always, you have to be specifically trained in doing these kinds of procedures. First, you must start with relatively simple cases, and once you have mastered those, you can

proceed to the more difficult ones. Second, it is very important to be closely familiar with all of the devices you are using, especially in knowing the specific quirks of the guidewires and catheters. Third, you should have a good portfolio of devices on hand, so that if one does not work, you can quickly switch to another one. You also need a lot of patience to continue trying different techniques until you are successful. It is crucial that you are able to realize when the first device is not going to be successful and switch to another one, so that you do not continue pursuing the wrong approach.



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Long CTOs starting in the SFA and reconstituting in a distal tibial vessel may be the most challenging endovascular intervention scenario. Successful recanalization of these long CTOs can be deeply satisfying and essential to ulcer healing in CLI patients. In terms of my approach to these challenging lesions, I largely rely on some of the fundamental wire and catheter techniques. I typically approach all of my endovascular cases with contralateral femoral access. I use a 6-F Ansel sheath (Cook Medical), which I will sometimes bury in the origin of the SFA to help facilitate "pushability" of my crossing catheters.

Although there is a plethora of crossing devices, catheters, and wires that have specific application for crossing CTOs, I find that the most reliable approach is with a combination of the Glidewire and a catheter. Specifically, for the SFA segment, I will use a 0.035-inch, hydrophilic, angled Glidewire supported by a 0.035-inch QuickCross catheter. A stiff 0.035-inch wire can be used for added support in lesions with bulky calcification.

Within the proximal SFA, I form a small J-tip, which I then use to facilitate wire propagation through the CTO. The wire is advanced and followed closely with the QuickCross support catheter while maintaining a short, tight J-tip. I will generally continue this approach to the level of the below-the-knee popliteal, at which point, I transition to a 0.014-inch system. I employ a similar technique for the below-the-knee popliteal segment to the reconstituted vessel.

One of the greatest challenges here is in getting some directionality to the target tibial vessel. A directional catheter, such as the angled CXI or Glide catheter (Terumo Interventional Systems, Inc.), can help to direct the wire to

the tibial target. Once I think that I am oriented toward the target, I use a 0.014-inch Pilot wire (Abbott Vascular, Santa Clara, CA) with a 0.14-inch QuickCross for support. The two techniques I employ here are with a J-tip technique or as a "piggyback" with the pilot wire exposed 1 to 2 mm and followed with close support of the QuickCross catheter. In this latter piggyback technique, the wire and catheter are advanced simultaneously. In cases of dense calcification or with particularly troublesome lesions, I may also employ a heavier 0.014-inch wire, such as an 18- or 25-g Approach CTO wire (Cook Medical).

However, when the antegrade approach fails to succeed, as it often does for these long CTOs, it is important to have an alternative approach. In these CLI patients, in whom an antegrade approach has failed and there are no bypass options, I feel very comfortable employing retrograde access techniques via the target tibial vessel. In my approach to retrograde tibial access, I exclusively use a 0.014-inch platform. I start with a 0.14-inch micropuncture needle and wire using fluoroscopic guidance. Once I have wire access, I advance the microsheath dilator only as initial catheter support. I will then use a 0.014-inch Pilot wire and 0.014-inch QuickCross catheter as support, employing some of the same techniques I previously described. I like to keep the size of the retrograde tibial access as small as possible and avoid using sheaths.

Of course, when all else fails, there is nothing better than a good old-fashioned bypass to get the blood flowing. ■

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