ASK THE EXPERTS

What Is Your Top Tip on How to Safely and Efficiently Cross a Lower Extremity CTO?

Experts discuss their access approaches to and techniques for crossing chronic total occlusions.

WITH JOHN A. PHILLIPS, MD; SAHER SABRI, MD, FSIR; RAMON L. VARCOE, MBBS, MS, FRACS, PHD; SABINE STEINER, MD; AND OSAMU IIDA, MD

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In my opinion, crossing long tibial chronic total occlusions (CTOs) in patients with critical limb ischemia (CLI) can be one of if not the most challenging procedure performed by endovascular interventionalists. CTOs in this patient population require a different skill set and a level of patience that is unparalleled to other peripheral interventions. Reconstructing tibial CTOs that are often > 30 cm long with no defined ostium can take several hours. Therefore, my one tip centers around this quandary and is not that of a specific wire, catheter, or device, but more of an ethos or procedural philosophy.

We all are familiar with Einstein's quote regarding insanity, which is particularly germane when treating difficult CTOs. The longer the case goes without any progress, the quicker the fog of doubt seeps into your mind, and the sooner you abort the procedure, ultimately resulting in failure. My one tip is simple: If what you are doing isn't working, try something else—another wire, catheter, or access point. Set a timer in your head, give yourself 2 minutes with your current plan of attack, and if that is getting you nowhere, switch tactics. The more time you waste, the less successful you will be. Oftentimes, I will even have my staff set a timer for me, and when the 2 minutes are up, we move on. The more often I practice this approach, the more frequently I am successful when tackling any complex CTO.

I believe that most, if not all, CTOs can be crossed, regardless of location. Serious, immediately life-threatening complications are rare during these cases; thus, we have little to lose when attempting these interventions for CLI. Our patients are the sickest of the sick, with extremely high mortality rates even with a successful intervention. So, have a plan, be nimble, and quickly change your approach when you stall.

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Crossing CTOs requires knowledge of the extent of disease and plaque morphology. Appropriate planning with preprocedural imaging, especially for iliac and femoropoliteal segments, is valuable in deciding the access site and methods to cross the CTO. If the lesion cannot be crossed from one direction (eg, antegrade) due to the morphology of the plaque and the proximal cap, retrograde recanalization should be attempted because the distal cap may have more favorable morphology.

For iliac disease, ipsilateral femoral access is ideal for crossing iliac CTOs (retrograde crossing). If unsuccessful, contralateral femoral access (or upper extremity access) is usually successful due to more favorable proximal cap morphology. If neither is successful, subintimal crossing with reentry devices improves technical success. Close attention should be given to reentering the true lumen in the aorta as close as possible to the aortic bifurcation.

For femoropopliteal disease, antegrade crossing is usually attempted initially. For long CTOs, subintimal recanalization is an appropriate option. If the patient has a patent popliteal artery, every attempt should be made to reenter the true lumen as proximal as possible in the popliteal artery to preserve the option of a bypass to the popliteal artery if needed in the future.

If the CTO involves the below-knee popliteal artery and extends into the origins of the tibial vessels, these occlusions are difficult to cross in an antegrade fashion. One should have a low threshold for performing retrograde recanalization through pedal artery puncture in such cases. This technique is also used in long-segment tibial artery CTOs. When connecting retrograde with antegrade access, the wires from both accesses have to be in the same plane (either both luminal or both subintimal). Various advanced techniques can be used to connect the antegrade and retrograde wires, including use of reentry devices and balloon disruption of the intimal flap. I rarely use pedal access as the only site for access and prefer to keep the pedal access no larger than 3 F. The intervention is performed through antegrade access once the retrograde wire is externalized. This provides more options to intervene on the below-the-ankle arteries if needed.

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Crossing CTOs is all about support. Support provides pushability and the ability to effectively and responsively torque the guidewire. The approach begins with choice of access. Where the vascular lesion, anatomy, and patient body habitus allow, I prefer to access the ipsilateral common femoral artery in an antegrade direction and use a long sheath to get close to the lesion. This maximizes both push and torque. A supportive guidewire such as a V-18 ControlWire (Boston Scientific Corporation) or a Hi-Torque Command 18 (Abbott Vascular) is used coaxially within an angled support catheter to find and engage the CTO microchannels wherever possible. This will help to facilitate a transluminal CTO crossing path, which simplifies reentry into the reconstituted lumen. Finally, I have a low threshold for converting to a retrograde crossing technique (bidirectional), as I find this more efficient than persisting with time-consuming attempts from an antegrade approach.

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I prefer an ipsilateral antegrade approach for CTO crossing, unless I am treating very obese patients or proximal/ostial superficial femoral artery disease. An ipsilateral antegrade approach helps shorten the distance from the access site to the CTO with enhanced pushability and much better torqueability with the wire and catheter. However, antegrade recanalization of peripheral CTOs is typically associated with a high failure rate, which was subsequently linked to an increased risk of major amputations in clinical studies. Therefore, I believe knowledge of the retrograde approach with the puncture of tibioperoneal arteries is the most important tool for safe and efficient treatment of lower extremity CTOs.

I try to gain access close to the CTO cap for the same reasons as previously mentioned. For femoropopliteal occlusions, I prefer to puncture the proximal anterior tibial artery, because due to its larger caliber, it can usually accommodate a 4-F sheath if needed. Another reason to perform retrograde access is heavy vessel calcification where it is sometimes impossible to cross the lesion with a balloon from an antegrade approach. In these cases, balloon passage can often be accomplished using a pull-through wire. We know from our own large series of more than 550 endovascular interventions with retrograde tibioperoneal access for CTO crossing, that acute and long-term complications at the distal puncture site are extremely rare.

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Vessel diameter, lesion length, and calcification severity are factors that largely impact the difficulty of recanalization for treating CTO lesions. Improving the technical success of recanalization begins with a careful assessment of the CTO lesion using preoperative angiography to confirm: (1) the CTO stump shape, (2) the degree of the collateral circulation, and (3) the puncture site in cases using a two-way bidirectional approach.

If the CTO distal stump shape is reverse tapered, do not hesitate to use a retrograde approach as the first-line option, because this decision may shorten procedural time as well as potentially reduce the complication rate. The two-way bidirectional approach with a distal puncture is the safest, most effective, and routine method for achieving a successful CTO recanalization.

In long CTO lesions, recanalization can be attempted using a knuckle wire from both sides, followed by either controlled antegrade and retrograde subintimal tracking (CART) or reverse CART at the closest portion to each wire. For short or intermediate CTOs, careful penetration of the center portion of the lesion using a 0.014-inch wire is strongly recommended. Although the 0.018-inch, 12-gauge tip load Treasure 12 guidewire (Asahi Intecc USA, Inc.) has been initially used for CTO recanalization, I have found the 0.014-inch, 3-gauge tip load Gladius guidewire (Asahi Intecc USA, Inc.) to be the most effective for penetrating the microchannel in the CTO. The Gladius guidewire is especially useful for a single-directional approach for CTO lesions and is my primary choice. ■