# Below-the-Knee CTO Crossing Strategies

Insights on process and procedure.

**WITH LUIS MARIANO PALENA, MD, AND MARIANNE BRODMANN, MD**

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Patients with diabetic chronic limb-threatening ischemia (CLTI) usually present with multilevel and multivessel artery disease. The prevalence of chronic total occlusions (CTOs) over stenosis, arterial wall calcifications, and involvement of the distal foot arteries or small arteries make this population a challenge for an endovascular approach. Still, endovascular-first strategies have been growing in acceptance, with multiple approaches available for below-the-knee (BTK) vessels.

My preferred method is an ipsilateral femoral approach. After treating stenosis in the iliac arteries, I perform antegrade access under ultrasound guidance in the common femoral artery and deploy a 6-F sheath (11 cm). Through this sheath, I perform diagnostic angiography to confirm the previous results of the Doppler ultrasound, and with the support of a 4-F Berenstein II catheter, I begin revascularization.

My preferred approach to treat BTK arteries remains antegrade access. In at least 80% of our cases, we are able to engage and successfully cross the CTOs in the tibial arteries, followed by reentry in the foot vessels. The crossing technique can be endoluminal, which is preferred for short lesions or heavily calcified arteries, or subintimal, which is better for long CTOs or those with no heavy calcifications, but I usually use a mix of both techniques. In most cases, an 0.018-inch guidewire is my first choice because it allows me to go the endoluminal route and shift to subintimal if needed.

The retrograde techniques—percutaneous retrograde access or a transcollateral approach such as a pedal-plantar loop—are backup options and are usually used when the reentry fails. My preferred backup option is retrograde access because of the high success rate and to avoid crossing the foot arch unnecessarily. This method is performed under ultrasound or fluoroscopy guidance using a 21-gauge needle. Retrograde access in the foot arteries can be achieved via this option. An 0.018-inch guidewire is preferred as a first approach to increase the support, and retrograde crossing is then performed with a retrograde support catheter. Typically, the final therapy is delivered using an antegrade approach.

I consider it very important to have a backup approach in all cases, as well as a plan regarding when to shift from one approach to the other. There are no rules about when it is time to switch to plan B, but practically speaking, I consider 10 minutes enough time to change the plan. After 10 minutes of trying to engage and cross a BTK CTO, a guidewire escalation is usually performed; after 5 minutes more, I usually change for a retrograde access.

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Endovascular treatment of BTK disease, specifically in patients with diabetes mellitus, end-stage renal failure, and elderly patients, has become more of a focus because we recognize that a good outflow is important for long-term patency and success. CTOs are highly prevalent in patients with CLTI, and endovascular therapy has become the preferred treatment option given that these patients are not ideal candidates for surgery.

There are many treatment approaches for BTK/CLTI/CTO patients (contralateral, retrograde, loop technique via the pedal arch), and each is a good option in the hands of experienced physicians. My preferred approach is the ipsilateral femoral approach, and as I have gained experience, I have become familiar with devices that have improved strength and maximum pushability for successful BTK treatment.

To start, I achieve antegrade access via the common femoral artery by deploying a 6-F, 45-cm sheath using ultrasound guidance as far as possible. If there is inflow disease, I obtain diagnostic angiograms, treat the inflow lesions, and then progress the sheath to the infrapopliteal area. The next step is diagnostic angiography of the BTK arteries, including the pedal arteries, using a minimum of two different views.

I begin revascularization of the BTK arteries using a 4-F support catheter and a 0.018-inch guidewire; in most cases, the CTOs in the tibial arteries can be successfully crossed, followed by reentry in the foot vessels. As Dr. Palena notes, the crossing technique can be endoluminal or subintimal, but it's not uncommon to use both during a case.

Regarding backup options, I prefer percutaneous retrograde access over a transcollateral approach because of its high success rate. I avoid crossing the foot arch because it may lead to complications such as vasospasm or thrombosis. When I perform retrograde access, it is usually under fluoroscopy with a 21-gauge needle.

The most important issue related to BTK CTO procedures is having the flexibility to easily switch between one approach to another and having a backup plan. Sticking to an unsuccessful approach too long risks injury to the BTK arteries, promoting an unsuccessful result and making future attempts impossible. Knowing when to stop with the first revascularization attempt and switching to another option is the key to a successful procedure, which for me is a maximum of 10 minutes. This is a learning curve everybody has to go through. ■