Creative Access Techniques for CTOs

New technology and unconventional approaches help to maximize success in difficult cases.

BY CHARLES F. BOTTI, JR, MD, AND GARY M. ANSEL, MD

By its very nature, advanced peripheral vascular disease is often highly complex with long chronic total occlusions (CTOs) being the norm rather than the exception. Although high degrees of success in crossing and reconstructing these segments can usually be attained by experienced operators using commonly available tools, a frustrating segment of patients remain in whom the stakes are high (ie, limb loss) but on whom the standard techniques and tools fail.

Traditionally, the most commonly approached total occlusions have been the iliac and subclavian. The use of hydrophilic wires via a luminal or subintimal approach, and the availability of access on both sides of the lesion lead to successful recanalization of the vast majority of cases without much difficulty. More challenging, however, are the cases involving CTOs of the common femoral, superficial femoral, popliteal, and tibial vessels in which success rates may decrease significantly. It is in these vascular beds that a creative approach may prove most useful—especially in high-risk patients who have few other options. These approaches may include antegrade or retrograde access in the femoral, popliteal, tibial or even pedal arteries, direct puncture of bypass grafts, and the use of new CTO tools.

INITIAL APPROACH TO THE CTO

There is little doubt that the total occlusion is the source of the vast majority of morbidity in interventional vascular practice. When approaching the CTO, it is important that all options, from medical therapy to open surgery, be given due consideration. In those CTOs requiring treatment, most can and should be treated with endovascular techniques. The next question then concerns ideal approach. Before the advent of preprocedural planning studies via MRA or CT, the access point for the diagnostic angiogram defined the initial attempt at treating the occlusion; however, this site often leaves the interventionist at a disadvantage when initially approaching the CTO. Common iliac occlusions with no proximal stump, for example, may

Figure 1. This CTO of the superficial femoral artery could not be crossed via the antegrade approach (A). The Outback catheter (Cordis Corporation, a Johnson & Johnson Company, Miami, FL) is used to re-enter the true lumen (B) and complete the intervention (C).

be difficult to cross in an antegrade fashion from the contralateral groin. Similarly, a flush occlusion of the subclavian or brachiocephalic arteries may not be best approached from the arch.

Preplanning studies, however, will often allow for a more strategically favorable access point because consideration need not be given to completing a full diagnostic angiogram.

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In cases in which the lesion cannot be crossed luminally, a subintimal plane can be created with or without the use of a luminal re-entry catheter (Outback[1,2] or Frontrunner catheters, Cordis Corporation; Pioneer, Medtronic Inc., Minneapolis, MN) to re-enter vessel beyond the occlusion. In addition to the obvious use in the superficial femoral artery, we have also used these devices to re-enter the aorta at the level of the aortic bifurcation for noncrossable ostial iliac lesions. When placed in the subintimal plane beyond the point of native vessel reconstitution, the Outback (radiographically guided) and Pioneer (IVUS-guided) catheters similarly utilize a curved hollow nitinol needle to re-enter the true lumen. A coronary guidewire can then be passed, and routine intervention can be performed (Figure 1).

SECONDARY ACCESS IN THE APPROACH TO CTOs

The principal of attacking a CTO from the other direction is well-known in iliac and subclavian occlusions in which large vessels on both sides of the occlusion may be readily accessed by standard cath lab techniques. CTOs in the superficial femoral artery can also be readily approached by utilizing the popliteal artery for a retrograde attempt. It is often remarkable how easily a wire will cross in the opposite direction after protracted failure on the initial approach. This "lobster trap" phenomenon likely results from eccentric plaque oriented more favorably for crossing in one direction than the other.

Most peripheral interventionists have performed such retrograde popliteal access for occlusions in the superficial femoral artery that could not be crossed with an antegrade approach. Although luminal re-entry catheters may decrease the need for popliteal access, a similar approach can be applied to occlusions involving or below the popliteal artery, via tibial access. We have previously published an article regarding a series of six patients in limb salvage situations in which a CTO of the dominant tibial vessel could not be crossed from the popliteal downward.[3] In these patients, percutaneous access was obtained in either the dorsalis pedis or posterior tibial artery under fluoroscopic guidance with a 4-F micropuncture kit (Cook Incorporated, Bloomington, IN). This kit contains a 21-gauge entry needle and a straight, .018-inch wire.

Using direct fluoroscopic and angiographic guidance from previously existing access, the distal vessel is percutaneously accessed, and the guidewire is advanced. To avoid missing the vessel due to depth perception error, it is easiest to align the image intensifier along the desired needle path and then approach the vessel with the needle headed directly down into the vessel, parallel to the beam. It is best to use brief fluoroscopy to align the needle, but then advance the needle off fluoroscopy to minimize radiation exposure. The small, 2-F inner component of the staged dilator can then be placed over the wire, allowing angiographic confirmation of intervascular place-

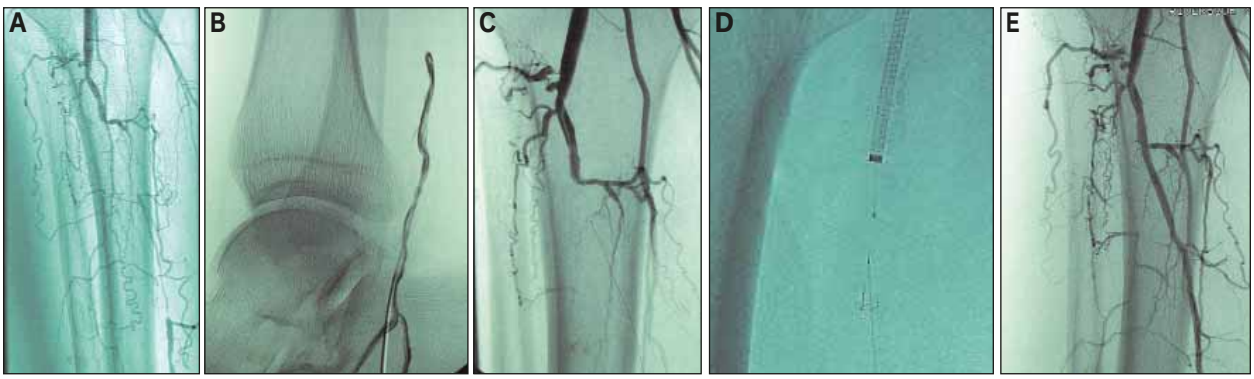

Figure 2. Pedal access to the uncrossable posterior tibial artery (A). Percutaneous access in the posterior tibial artery (B) is used to cross easily retrograde (C). The wire is snared in the superficial femoral artery (D), and the intervention is completed (E).

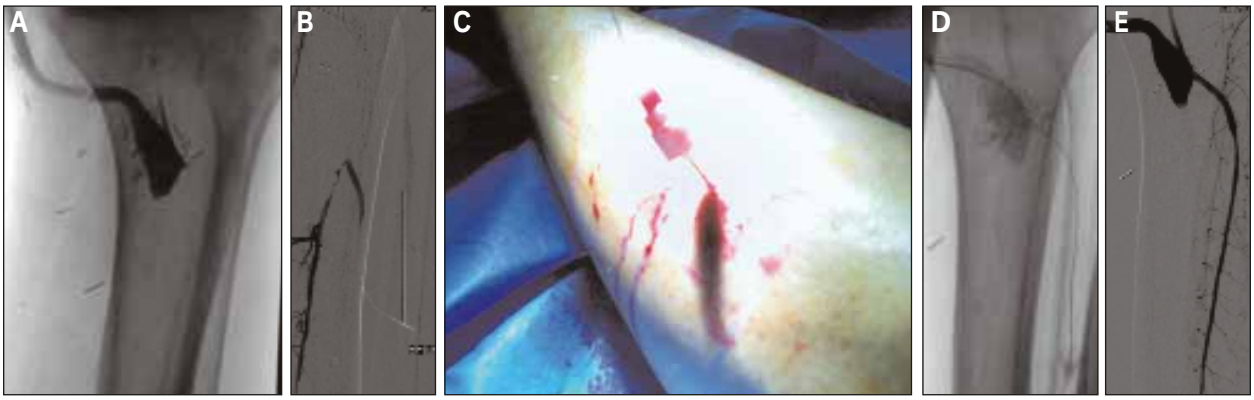

Figure 3. Below-the-knee bypass with uncrossable anterior tibial artery (A). Micropuncture access is gained in the mid-vessel (B, C). The lesion crossed via the retrograde approach (D), and the wire is snared and exteriorized to allow completion from femoral access (E).

ment and subsequent passage of a longer wire for the retrograde approach to the CTO. Our usual choice is an .018-inch angled glidewire (Boston Scientific Corporation, Natick, MA).

After the CTO is successfully crossed, the wire can be snared and externalized via the femoral access. A balloon or exchange catheter is then advanced over the wire and back through the CTO, and the intervention is completed (Figure 2). The percutaneous tibial access point can then be closed with digital pressure.

Our six-patient cohort all had procedural success, and five of six had complete wound healing at 2 months and were stable at 6-month follow-up. The sixth patient had progressive ischemic cardiomyopathy.

Recently, in a patient with an occluded anterior tibial artery arising from a patulous distal below-the-knee femoral popliteal anastomosis, antegrade access into the dominant anterior tibial artery from the graft could not be gained despite a prolonged attempt from the antegrade femoral approach. Unfortunately, neither the dorsalis pedis nor the posterior tibial artery was satisfactory for an attempt at retrograde pedal access; however, the anterior tibial artery in the mid-calf was a good size. Therefore, the anterolateral extensor surface of the lower leg, lateral to the tibia, was prepared, and a direct puncture of the anterior tibial artery was fairly easily performed utilizing the method described previously. The occlusion was easily crossed, the wire was snared and externalized, and the intervention was completed in a standard fashion from the femoral access (Figure 3). The 2-F dilator was removed, and hemostasis was obtained via luminal compression at the arteriotomy site with a 2.5-mm balloon for 3 minutes. The puncture successfully sealed, and the patient's ulcer was healing well at 2 months.

SUMMARY

CTOs comprise a large and increasing part of the target lesion population in the typical busy vascular practice. Traditional techniques with hydrophilic guidewires, as well as the use of new luminal re-entry devices yield success in the vast majority of cases.

In refractory cases, approaching the CTO from the other direction is often successful and well-known in larger vessels. This technique can also be used fairly easily in infrainguinal vessels via popliteal, pedal, or mid-tibial access, especially when the price of failure is amputation. ■

Charles F. Botti, Jr, MD, is an interventional cardiologist with MidOhio Cardiology and Vascular Consultants, MidWest Research Foundation, Riverside Methodist Hospital in Columbus, Ohio. He has disclosed that he holds no financial interest in any of the products or manufacturers mentioned herein. Dr. Botti may be reached at (614) 262-6772; cbotti@mocvc.com.

Gary M. Ansel, MD, is Clinical Director for Peripheral Vascular Intervention, MidOhio Cardiology and Vascular Consultants, MidWest Research Foundation, Riverside Methodist Hospital, Columbus, Ohio. He has disclosed that he is a paid consultant for Cordis Endovascular and Medtronic. Dr. Ansel may be reached at (614) 262-6772; gansel@mocvc.com.

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