Long Tibial CTO and No Pedal Arch: CTOP Classification Helps Guide Treatment Approach

Srini Tummala, MD

Srini Tummala, MD, Limb Preservation; Chief Vascular Interventional Services, Department of Vascular & Interventional Radiology, University of Miami Health System & Clinics, University of Miami Miller School of Medicine, Miami, FL

A 79-year-old man with critical limb ischemia (CLI) presented to my outpatient vascular clinic with a several-month history of severe left foot rest pain, non-healing ulcers, and gangrene. He was evaluated by a local vascular surgeon who recommended amputation, so the patient came to see me for a second opinion. His past medical history was significant for severe peripheral arterial disease (PAD) with CLI, hypertension, and hyperlipidemia. Although he had been seen by a vascular specialist in the past, he never had an angiogram or bypass surgery. Although he had a two-pack-per-day (for 20 years) smoking history, he quit several years prior to presenting to my clinic.

His labs were normal (CBC, BMP, PT/PTT/INR), and his medications included losartan, amlodipine, furosemide, atorvastatin, omeprazole, gabapentin, clopidogrel, and baby aspirin.

Upon examination, we found that the patient had dependent rubor, elevation pallor, and chronic ischemic changes (loss of hair, shiny skin, thickened nails). He had non-healing ulcers involving toes 1, 2, 3, and 5 with associated gangrene. His left lower extremity was cool to palpation but was sensory and motor intact. Bilateral common femoral artery pulses and popliteal artery pulses were 2+ palpable. He had a barely audible dorsalis pedis artery and no Doppler pulse in the left posterior tibial artery (Figure 1).

Non-invasive arterial study showed abnormal left ankle brachial index (ABI) of 0.81, dampened left metatarsal waveform, and flat-line toe photoplethysmographics (PPGs) compatible with severe left tibial-peroneal artery occlusive disease and severe small vessel disease in the foot (Figure 2).

The patient was taken to the angiography suite the next day and antegrade left common femoral access (CFA) was obtained with placement of a 6 French (Fr) Terumo sheath to allow direct in-line access, increased pushability, and ability to treat the pedal loop. Antegrade access was chosen as the patient had normal 2+ palpable common femoral artery pulses and no evidence of in-flow disease. Intra-procedure the patient was given IV heparin to maintain an activated clotting time (ACT) of 250 seconds and intra-arterial nitroglycerin as needed for spasm.

Continued on page 15

Figure 1. On exam, the patient had clear signs of critical limb ischemia.

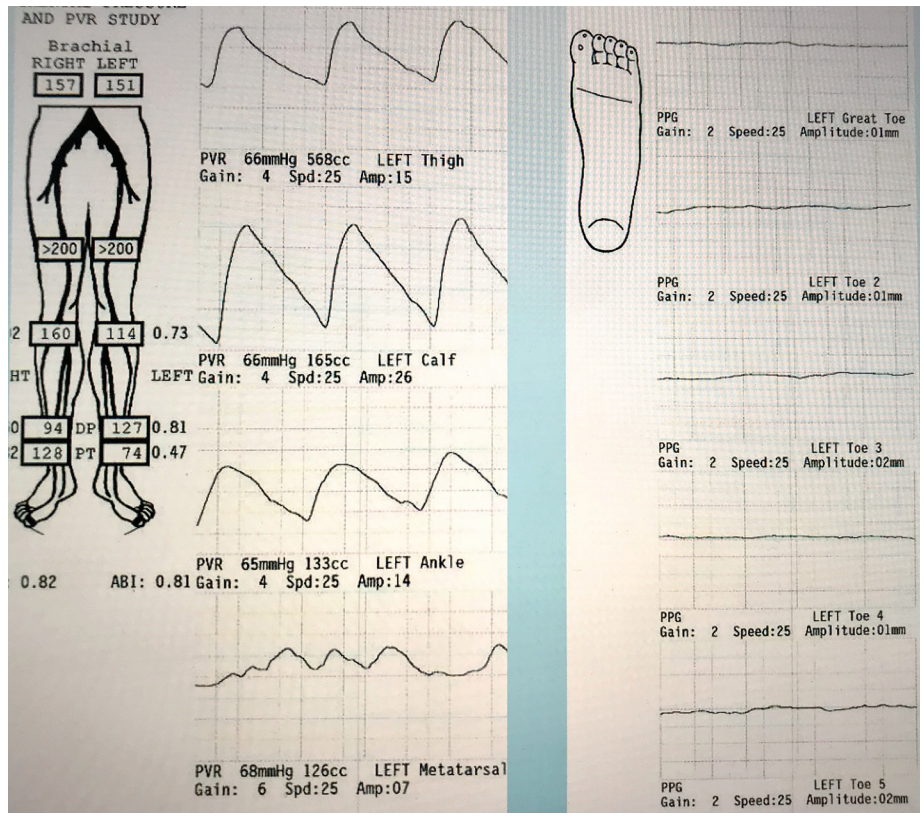


Figure 2. Non-invasive imaging shows left tibial-peroneal artery occlusive disease and severe small vessel disease in the foot.

Figure 3. Patent left SFA/popliteal artery segment.

"I believe the CTOP classification is a needed and important system to consider when approaching CLI patients with CTOs."

Figure 4. Type 1 or 2 left anterior tibial artery CTO based on CTOP classification as described by Saab et al.[1]

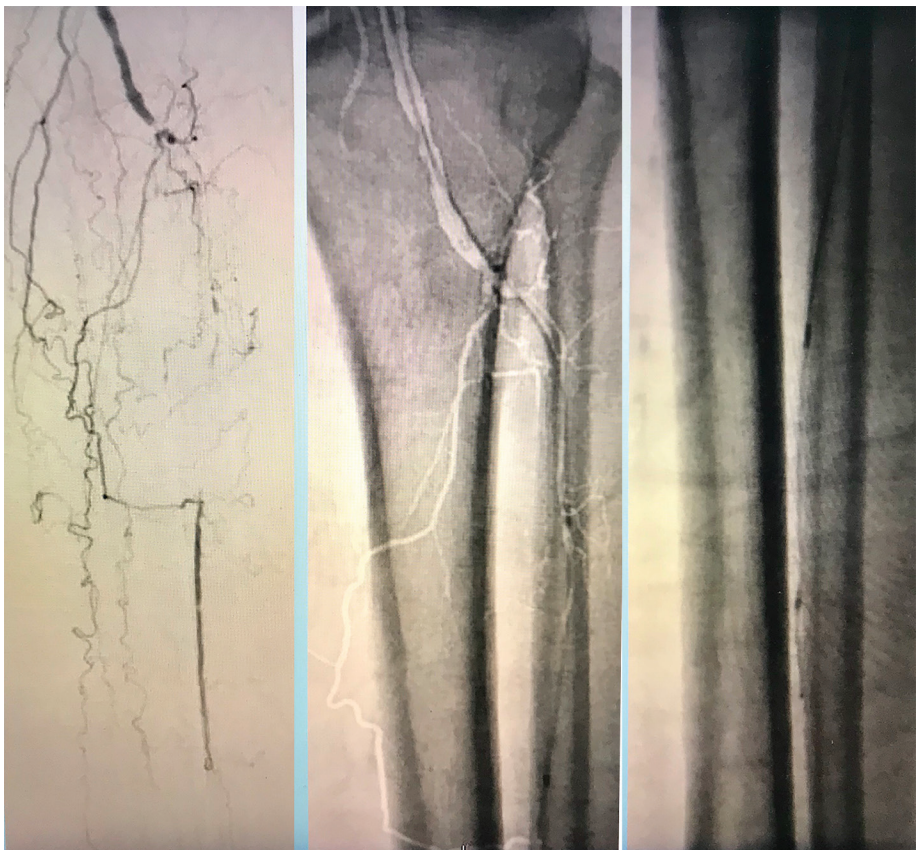
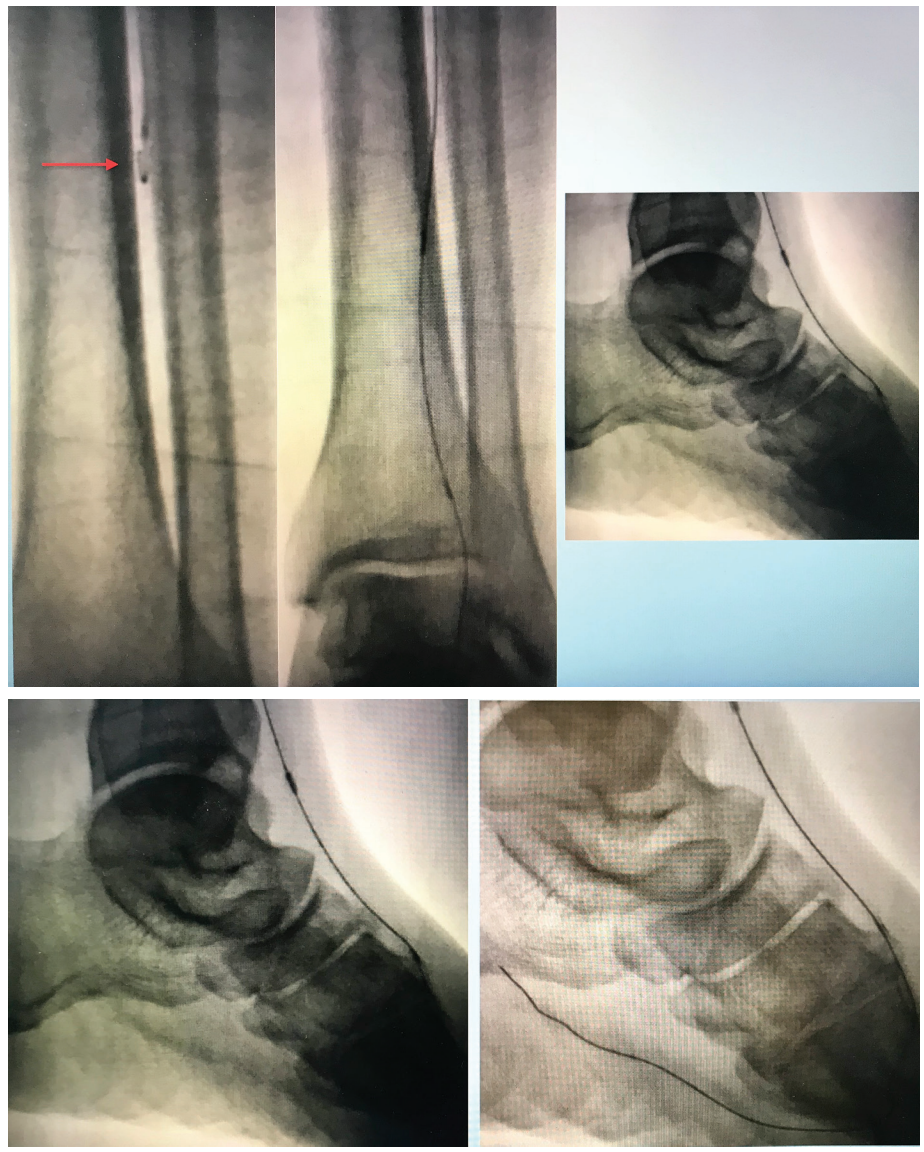


Figure 5. Successful crossing of the left anterior artery CTO proximal cap to the mid lower leg.

Figure 8. Prolonged angioplasty (3-minute inflation time) of the left anterior tibial artery and dorsalis pedis artery.



Figures 6 and 7. Bentson guidewire began to form a loop and could not be advanced further. As a result, a V18 guidewire was then used to advance through the remainder of the left anterior tibial artery and dorsalis pedis artery CTO into the pedal loop.

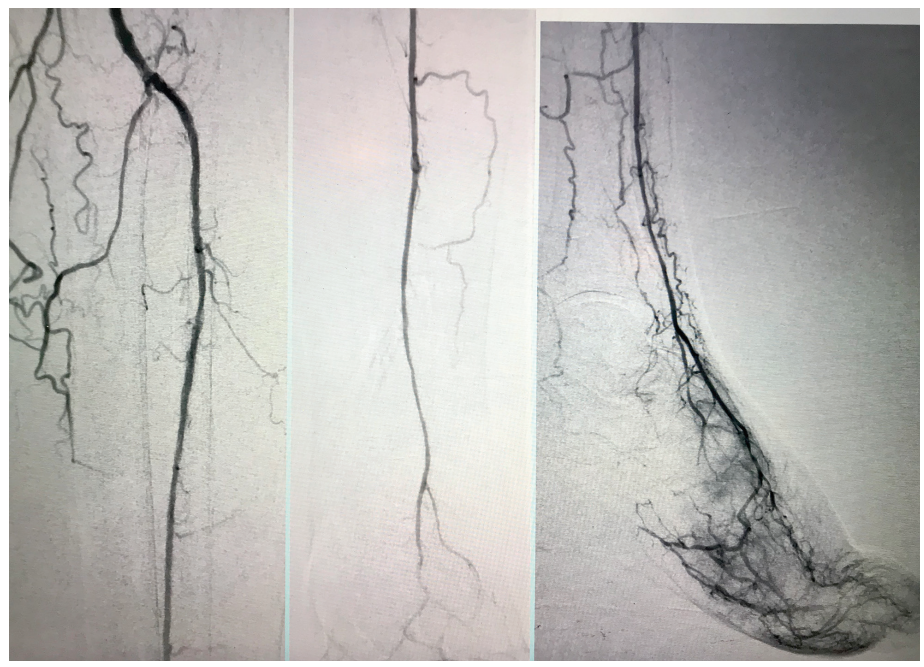


Figure 9. In-line flow re-established to the foot, pedal arch, and toes with a palpable dorsalis pedis artery and excellent angiographic blush of the tissues in the foot.

TUMMALA *from page 4*

His left leg angiogram showed a patent left superficial femoral artery (SFA)/popliteal artery segment (Figure 3).

The left anterior tibial artery was occluded at its origin with a type 1 or 2 chronic total occlusion (CTO) based on the CTOP classification.[1]

There was reconstitution of an isolated distal anterior tibial artery, possibly with a thin dorsalis pedis artery, that was occluded near the ankle joint. There was no significant pedal loop despite delayed imaging (Figure 4).

Given the proximal cap morphology, it was elected to proceed with antegrade crossing. A .035-inch CXI Support catheter (Cook Medical) with a Bentson Wire Guide (Cook Medical) was advanced through the left anterior tibial artery CTO with success to the mid lower leg (Figure 5). At this point, the Bentson guidewire began to form a loop and could not be advanced further. As a result, the Bentson guidewire was exchanged for a V18 guidewire (Boston Scientific), which was successfully advanced into the distal left anterior tibial artery and subsequently into the dorsalis pedis artery and around the pedal loop (Figures 6 and 7). If I was unable to cross from an antegrade approach, then pedal access would have been performed.

Since the tibial arteries were not heavily calcified, we elected to go straight to balloon angioplasty without atherectomy in this case.

Prolonged angioplasty (3-minute inflation time) was performed throughout the left anterior tibial artery and dorsalis pedis artery with a combination of balloon sizes on a .018-inch platform Ultraverse (Bard) 3.5 mm proximal and 3 mm mid and distal left anterior tibial artery, and 2.5 mm dorsalis pedis artery (Figure 8).

Continued on page 16

MICHAEL *from page 6*

external iliac arteries was confirmed, and vessel measurements were made.

We chose to treat from the tibial access since we could not complete therapy delivery from the arm given the length challenge. In addition, we wished to deliver all therapy from the same access point to better guarantee control of the vessels. A 2.0 Rotablator burr (Boston Scientific) (Figure 3) was used to perform retrograde rotational atherectomy from the popliteal artery to the CFA followed by balloon angioplasty. Stenting was then required and performed via tibial access after upgrading to a 5/6 Fr Slender sheath (Terumo). In order to avoid creating potential dissection planes and better ensure true lumen angioplasty, all therapy was delivered via the tibial access. Using our IVUS measurements, an 8 mm x 59 mm Omnilink (Abbott) balloon-expandable stent was placed in the left external iliac artery and deployed to high pressure, followed by an 8 mm x 100 mm self-expanding Innova stent (Boston Scientific) from the external iliac artery to the distal CFA. Another 8 mm x 100 mm self-expanding stent was deployed from the left CFA into the left SFA followed by two 7 mm x 150 mm self-expanding Innova stents to treat the body of the SFA. We finished with a 6 mm x 120 mm Supera stent (Abbott) to the popliteal artery that had been pretreated with a 6 mm x 120mm IN.PACT drug-coated balloon (Medtronic) (Figure 4).

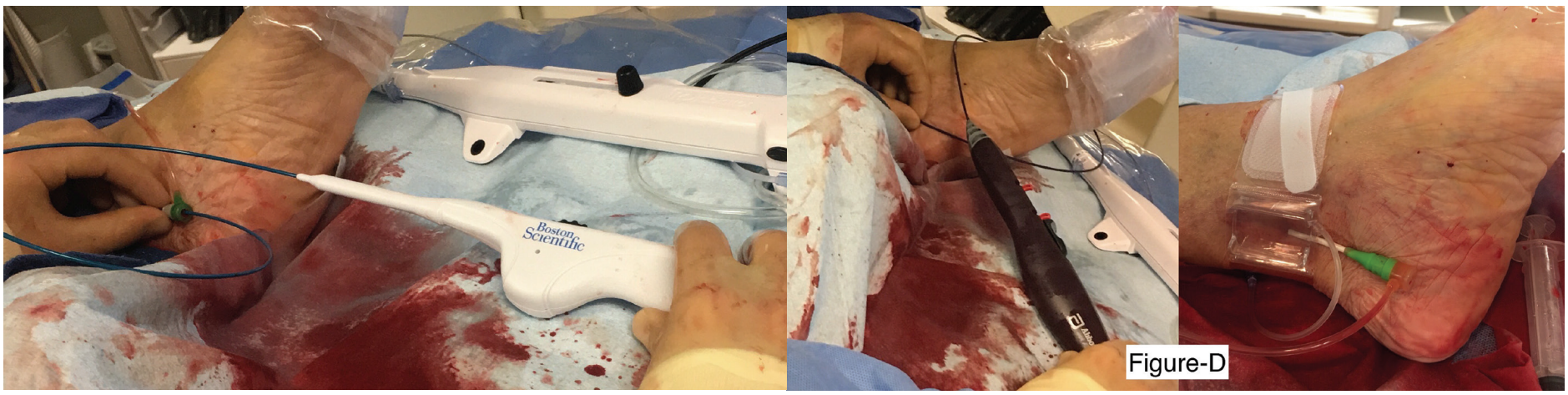


Figure 4. Stent deployment via 6/7 slender sheath in posterior tibial access and radial band used briefly for patent hemostasis.

TUMMALA *from page 6*

Final angiography showed in-line flow to the foot, pedal arch, and toes. There was a palpable dorsalis pedis artery (Figure 9).

The patient was discharged the same day as the procedure.

At the 1-month follow-up clinic appointment, the patient's dependent rubor, elevation pallor, and ischemic changes had improved and/or resolved. His toe ulcerations were healing (Figure 10).

Non-invasive arterial study at one month confirmed improved blood flow to the foot and toes with normal left ABI, left metatarsal waveform, and toe PPGs (Figure 11).

While there are many options for tibial interventions, I typically prefer to use a 45 cm 6 Fr Pinnacle Destination Guiding Sheath (Terumo) with tip placed in the popliteal artery at the knee joint, as this allows easy access to the tibial arteries, excellent visualization of below-the-knee arteries and collaterals during angiography, and increased support for CTO crossing and pedal loop reconstruction, if needed. I believe the CTOP classification is a needed and important system to consider when approaching CLI patients with CTOs.

Guidewire selection is another topic that has been written about extensively. The concept of limiting usage to a few guidewires that you understand as well as guidewire size escalation (.014 to .018 to .035 inch, etc.) are important. For tibial interventions, I typically use a V18, Hi-Torque Command 18 (Abbott), or Regalia (Asahi) guidewire to start. While there are clearly many options, the key for each interventionalist is finding a system that works for them. ■

REFERENCES

1. Saab F, Jaff MR, Diaz-Sandoval LJ, et al. Chronic total occlusion crossing approach based on plaque cap morphology: the CTOP classification. *J Endovasc Ther.* 2018: 1526602818759333. [Epub ahead of print]

Disclosure: Dr. Tummala reports that he is a consultant for BD Peripheral Vascular.

Dr. Tummala can be contacted at DrSriniTummala@gmail.com or by phone at (310) 633-1974.

Please follow #CLIfighters and #stopthechop on Twitter and add to the discussion of relevant CLI treatment issues and strategies.

Figure 10. One-month follow up appointment confirmed improved ischemic changes and toe ulcerations.

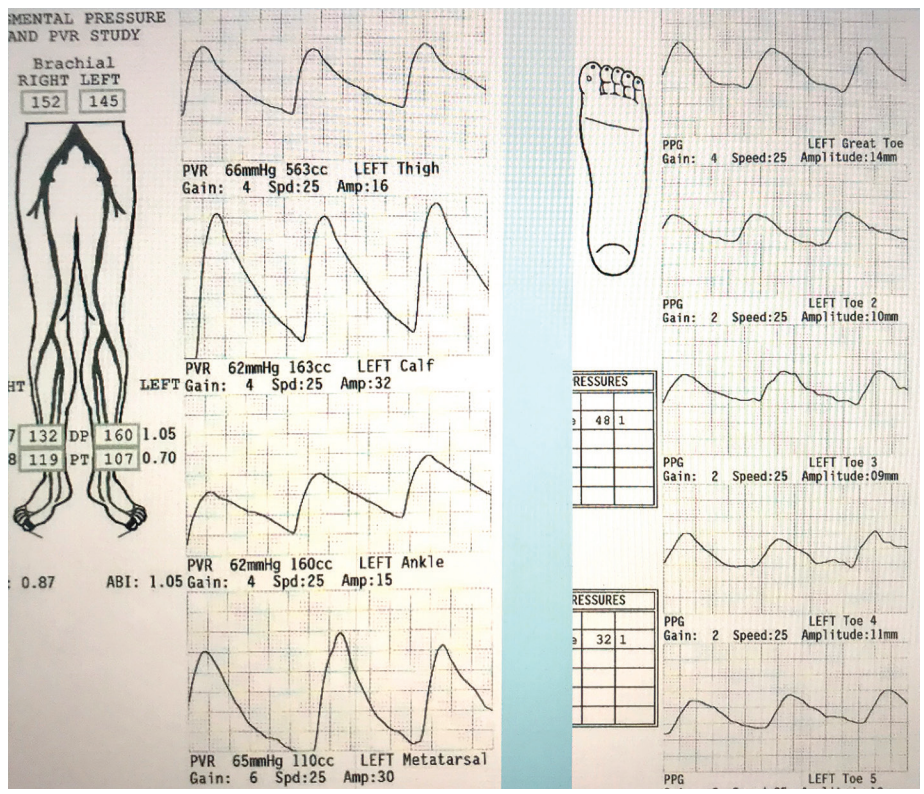


Figure 11. One-month non-invasive arterial study confirmed physiologically improved blood flow to the foot and toes.