

Two Stick or Not Two Stick: Acute Thrombosis of Femoral-Femoral Bypass Graft Resulting in Critical Limb Ischemia

Revascularization in a patient with inflow disease of a left-to-right femoral-femoral bypass utilizing multiple access locations.

BY JOHN A. PHILLIPS, MD

Acute critical limb ischemia (ACLI) often presents with more distal arterial occlusion from plaque rupture (“leg attack”) versus a thromboembolic process, typically from a cardiac source (eg, atrial fibrillation). Vascular interventional specialists try to differentiate between inflow ACLI and outflow ACLI when planning a treatment strategy. In general, inflow ACLI typically involves the aortoiliac vessels and common femoral artery (CFA), whereas outflow ACLI involves the superficial femoral artery (SFA) and more distal vessels, including the tibial vessels and plantar loop.

Inflow disease that leads to ACLI can present as acute occlusion of an iliac artery from an embolic source in a peripheral arterial disease (PAD)–“naïve” patient. However, in patients with known PAD and previous inflow disease, it often stems from the acute compromise of a collateral pathway. For example, occlusion of the profunda artery in a patient with a pre-existing SFA occlusion and severe outflow obstruction can lead to ACLI. If one can recanalize the more proximal occlusion, even if that only improves distal collateral flow, relief from ACLI can be achieved.

CASE REPORT

A 59-year-old woman with a past medical history of diabetes mellitus, hypertension, tobacco use,

and extensive PAD was transferred to our facility with acute onset of right lower extremity discomfort, parathesia, and decreased range of motion for approximately 12 hours. The patient reported worsening claudication over the past several days and had an acute change in symptoms that prompted her to seek medical attention at her local emergency department.

Vascular examination of the right lower extremity revealed a faintly palpable femoral pulse, with absent pulse and Doppler signal of the popliteal, doralis pedis, and posterior tibial arteries. The leg from the mid-thigh distally was cool to the touch, with decreased sensation and range of motion. She was determined to have category IIb ACLI. The patient was not known to our institution and had, by history, extensive, severe PAD with multiple procedures—both surgical and endovascular.

Often, at tertiary care centers that receive patients from outside facilities, the luxury of understanding the patient’s past medical and surgical history is just that: a luxury. This void can be readily apparent when dealing with ACLI in a patient with a history of PAD. When one carries the general diagnosis of PAD, this covers a broad spectrum of the disease state, including relatively simple SFA disease to complex revascularizations that involve both surgical and endovascular techniques to multiple segments of the vascular tree.

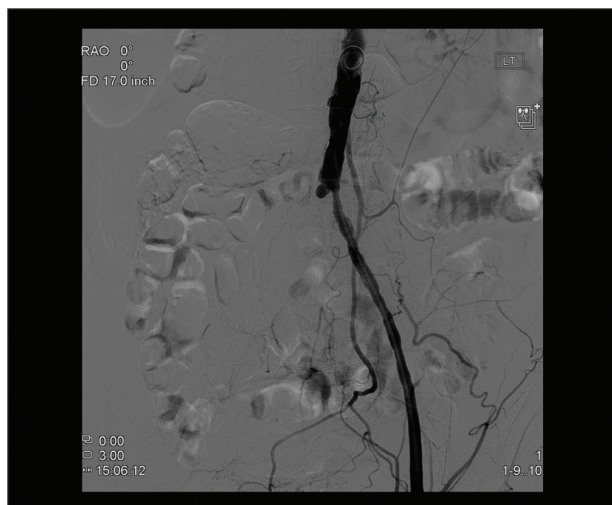


Figure 1. Initial angiogram showing proximal right common iliac artery occlusion and stenosis of the left proximal common iliac artery (the only inflow vessel to the bilateral lower extremities) with very minimal proximal collaterals to the right lower extremity.

Based on the history provided by the patient, and previous incisions noted on exam (multiple, bilateral groin scars), we suspected that she had previous endovascular stent placement to the right common and external iliac arteries with subsequent occlusion, resulting in a left-to-right femoral-femoral bypass. The patient also reported previous endovascular stent placement in the bilateral SFA, with occlusion and subsequent femoral-to-above-knee popliteal artery bypass grafting, most recently a right femoral-popliteal bypass 3 months before presentation.

Access Planning (or Lack Thereof)

A successful endovascular intervention ultimately commences with successful arterial access. Access during any procedure can be a challenge, becoming more magnified during ACLI when thrombolytic therapy may be utilized, which can lead to increased bleeding complications from the vascular access site. This, juxtaposed with incomplete knowledge of the patient's underlying anatomy, creates further challenges, particularly if multiple access sites are needed to complete the procedure, which was the case in this situation. Ideally, the use of noninvasive testing (eg, arterial duplex ultrasound or imaging with CT or magnetic resonance angiography) can better define patient anatomy, specifically with respect to bypass graft location and patency.

Given the acuity of the presentation, we elected

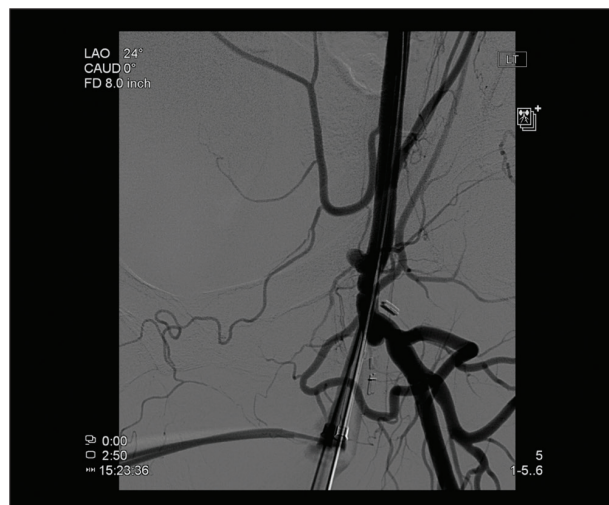


Figure 2. Acutely occluded cap of left-to-right femoral-femoral bypass. Note proximity to access in femoral artery.

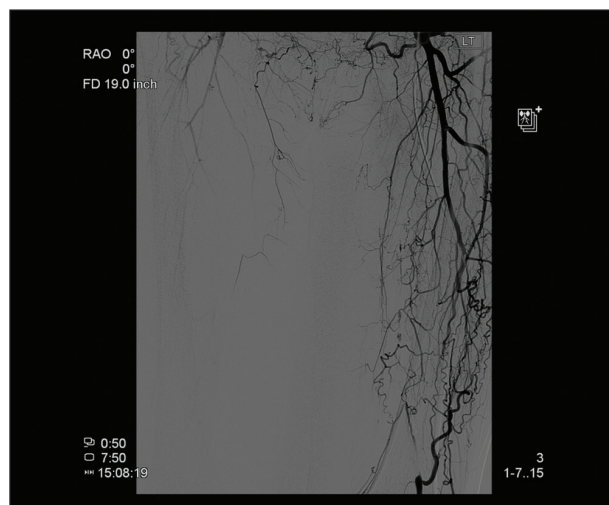


Figure 3. Runoff into the thigh with essentially no flow to the lower extremity, including an occluded native SFA and recent femoral-popliteal bypass.

to proceed directly to emergent angiography with ultrasound-guided access of the left CFA using a 4-F Micropuncture introducer system (Cook Medical) and a 5-F Pinnacle Destination sheath (Terumo Interventional Systems) inserted into the artery. The initial runoff images are shown in Figures 1 through 3.

Interventional Procedure

It was surmised that the CLI resulted from occlusion of the femoral-femoral bypass with pre-existing right native SFA and femoral-popliteal bypass occlusions. The interventional plan included utilizing direct access

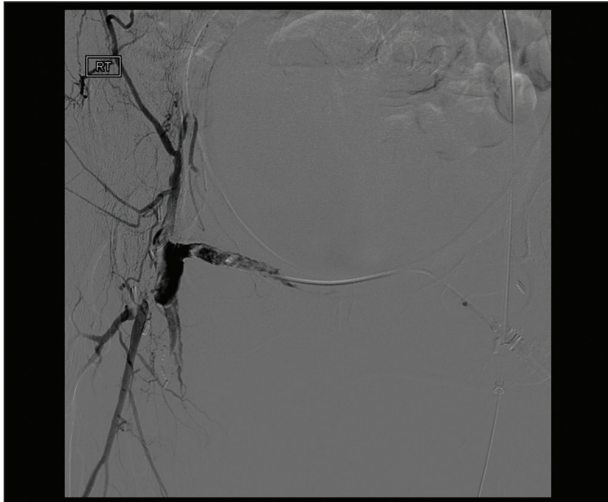


Figure 4. Initial angiogram of distal anastomosis with extensive thrombus within the graft and stricture in the profunda artery.

into the femoral-femoral bypass with two separate sheaths at opposite sides (proximal left-sided portion and distal right-sided portion) under ultrasound guidance. We planned on using mechanical thrombectomy in the entire femoral-femoral graft and potentially both anastomotic sites. This would prove to be impossible with access on only one side of the graft.

The patient was given 6,000 units of intra-arterial heparin for a goal activated clotting time of > 250 seconds; she had already received her home-dose aspirin and clopidogrel before presenting to the catheterization suite. The proximal left-sided portion of the graft was accessed first. We considered whether the initial access sheath in the left CFA could be withdrawn from its original position and then directed into the origin of the graft, but this was not attempted. It was believed that there was not enough purchase in the CFA to accomplish this, and we did not want to lose arterial access. In addition, balloon angioplasty and stent placement were planned in the left common iliac artery to optimize inflow, for which the initial access sheath would be needed. Under ultrasound guidance, a 6-F Pinnacle sheath (Terumo Interventional Systems) was inserted into the left side of the femoral-femoral graft. Figure 4 shows the initial image, with extensive thrombus in the graft and the anastomosis site, as well as high-grade stenosis in the profunda artery (the only vessel supplying the lower extremity).

Using a 0.035-inch stiff angled Glidewire (Terumo Interventional Systems), we were able to wire into the

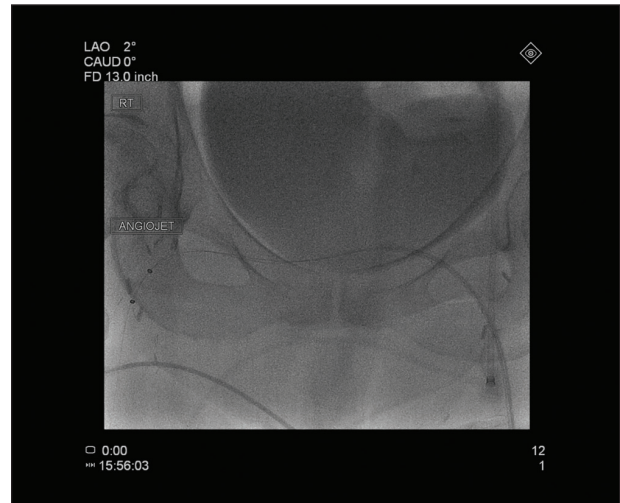


Figure 5. Use of the AngioJet device to extract thrombus.

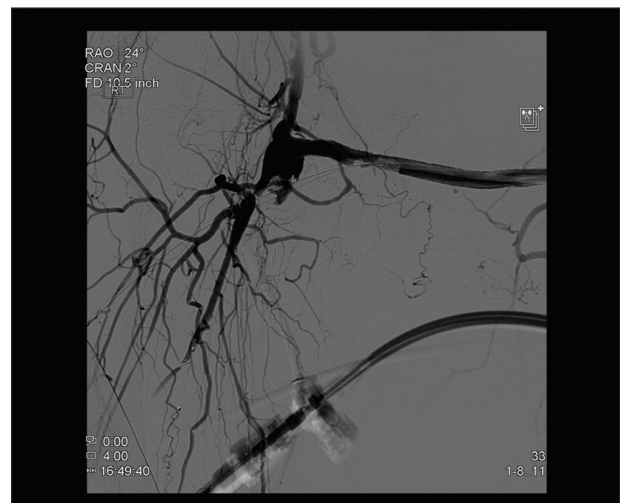


Figure 6. Angiogram after PowerPulse mechanical thrombectomy.

profunda artery and exchange for a 4-mm SpiderFX embolic protection device (Covidien) using a 0.035-inch CXI angled support catheter (Cook Medical) in an attempt to limit distal embolization during mechanical thrombectomy, as this was the only vessel supplying the right lower extremity.

The AngioJet rheolytic mechanical thrombectomy catheter with PowerPulse spray (Boston Scientific Corporation) was then advanced into the bypass graft. An initial thrombectomy run was performed, and tenecteplase (TNK) (10 mg/500 mL) was pulsed into the thrombosed graft and anastomotic site in the CFA, with a dwell time of 15 minutes. Five mg of TNK was used. Figures 5 and 6 show the AngioJet

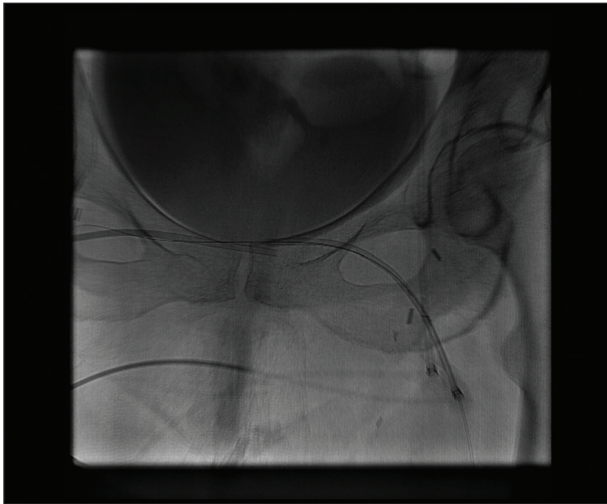


Figure 7. Three separate sheaths in place. The tips of the two sheaths in the femoral-femoral meet at the midline of the graft.

and angiogram after the initial run. Note the stenosis in the profunda and thrombus (filling defect) in the SpiderFX embolic device.

Knowing that there was going to be a significant amount of thrombus proximal to the access site on the left side of the graft (which was confirmed on angiography), access was achieved via ultrasound guidance in the right side of the graft, and another 6-F Pinnacle sheath was successfully placed. Figure 7 shows all three access sites.

The same technique was used to wire the graft from left to right; however, we elected to place the distal wire in a cephalad direction (in the external iliac artery) as opposed to caudal because of the position of the sheath in the left CFA and general lack of wire purchase.

The angled Glidewire was exchanged for a stiff 0.014-inch X 300-cm Grandslam wire (Abbott Vascular) over the CXI catheter, and mechanical thrombectomy with PowerPulse thrombolytic infusion with TNK was performed as previously described. Figure 8 confirms that the majority of the thrombus was removed, although there was still some remaining. A 5-mm balloon was inflated to nominal pressure to help macerate the clot, and mechanical thrombectomy was performed again, eliminating the residual thrombus (Figure 9). Attention was then directed toward the stenosis in the right profunda artery, and a 5- X 20-mm AngioSculpt balloon (Spectranetics Corporation) was inflated to nominal pressure for 3 minutes with an excellent angiographic result (Figures 10 and 11).

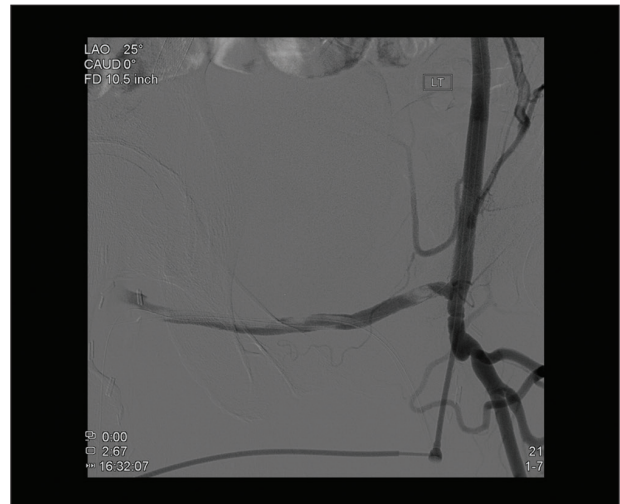


Figure 8. Angiogram after first-pass mechanical thrombectomy, with residual thrombus.



Figure 9. Angiogram after maceration with a balloon and second-pass mechanical thrombectomy.

At this point during the procedure, the patient began to report improved sensation and range of motion, with diminished pain in the right lower extremity extending into the foot. We had now restored flow to the femoral-femoral bypass, as well as to the profunda artery, which is the only inflow to the right lower extremity, thus relieving the CLI and ultimately resulting in the improvement of symptoms. The patient no longer had acute ischemia to the leg, thereby achieving our desired clinical outcome. Finally, we focused on the inflow stenosis in the left common iliac artery, which was addressed with an 8- X 27-mm



Figure 10. A scoring balloon.



Figure 11. An angiogram after angioplasty.



Figure 12. Final angiogram after scoring balloon use and mechanical thrombectomy.

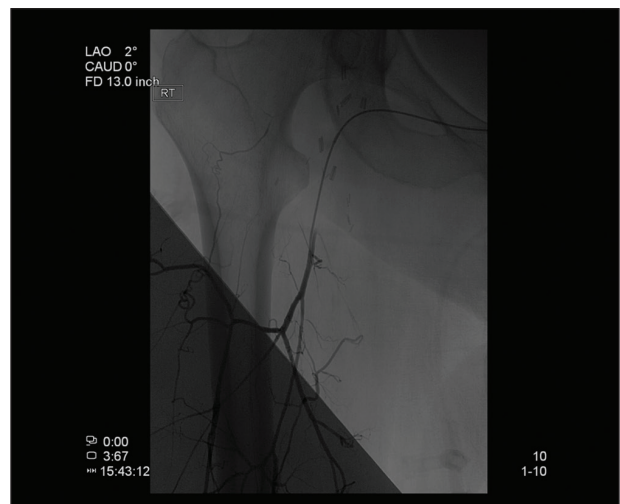


Figure 13. Final angiogram of the distal profunda artery, demonstrating patency.

balloon-expandable stent, and final angiographic images were obtained (Figures 12 and 13). The two access sites in the bypass graft were closed using the Mynx 6/7-F closure device (Cardinal Health) without any bleeding complications. The patient had a Doppler signal to the right dorsalis pedis and posterior tibial artery at the end of the procedure and was discharged home 48 hours later. The patient was seen a month later as an outpatient, ambulating free of rest pain without symptoms.

CONCLUSION

Treating inflow ACLI with endovascular techniques is complex, which often requires unique plans and

methodology. One initial hurdle can be determining appropriate access site location, which may be particularly challenging in patients with complex pre-existing PAD and bypass grafting. The treating vascular interventionist needs to have an open mind to unique access locations and think “outside the artery” when bypass grafts are involved in ACLI. ■

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