

Editor's Access and Closure Challenge: How Would You Do It?

Endovascular Today's Guest Chief Medical Editor, Dr. John H. Rundback, presented four challenging PAD cases to a panel of interventional experts and asked them to answer a series of questions on their preferred methods for assessment, access, and treatment.



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CASE 1

EDITOR'S PRESENTATION

An 87-year-old man had a painful, slow-healing skin graft over an intertriginous ulcer between the first and second toes of the left foot for 2 months (Case 1A and 1B), as well as right thigh and right heel pain aggravated with walking. An angiogram obtained at another institution 2 months earlier (not available) showed a right common femoral artery (CFA) stenosis proximal to a patent

femoral-popliteal bypass and diffuse disease in the left superficial femoral artery (SFA).

Cardiovascular risk factors included hypertension and a 40-year, two-pack-per-day smoking habit (stopped in 1996). He had a history of coronary artery disease with a coronary artery bypass graft in 1996 and a right carotid endarterectomy. On examination, pulses were Dopplerable only in both feet.

Initial assessment consisted of bilateral lower extremity arterial duplex imaging (Case 1C–1L).

CASE 1: PREINTERVENTION



What additional testing is needed, if any, before intervention?

Dr. Fleming: I would proceed with computed tomography angiography (CTA) of the aorta with runoff. It would also be reasonable to proceed directly with a diagnostic aortogram and lower extremity angiogram. In my practice, if there is an abnormal common femoral waveform, abnormal common femoral pulse exam, or evidence of a potential access issue (previous common femoral bypass with CFA stenosis in this case), I proceed with CTA.

Dr. Chopra: I would obtain toe pressures and possibly skin perfusion pressure measurement with the SensiLase device (VasaMed) to get an accurate assessment of perfusion to each angiosome. If renal function is adequate, a good CTA or MRA could help map out the anatomy and help the operator plan the inter-

ventions in advance. This would help me choose the appropriate access for the interventions the patient may need. If a CTA or MRA cannot be obtained, one could proceed directly to an angiogram.

Dr. Bacharach: Consider MRI of the left foot to assess for osteomyelitis, which would influence treatment with longer-term antibiotics.

What are your expected angiographic findings?

Dr. Bacharach: In the right leg, focal stenosis of the right CFA with calcified lesion. In the left leg, I would expect to find severe disease in the SFA and popliteal segment.

Dr. Fleming: I would expect to see progression of the left SFA disease with at least a short-segment occlusion. I would also expect to see diffuse left iliac and CFA disease.

It should be noted that these are fabulous but extraordinarily difficult cases. They require significant forethought about approach and individual consideration for appropriate intervention.

—J. Michael Bacharach, MD

Dr. Chopra: It appears that the patient has bilateral multilevel disease. The right side possibly has an external iliac artery and/or CFA stenosis with high velocities in the CFA. The bypass appears patent but with monophasic flow, most likely from the proximal stenosis. The remainder of the vessels have monophasic flow. The anterior tibial artery possibly has a high-grade stenosis. In the left lower extremity, high velocities in the mid-SFA with dampened flow in the popliteal artery suggest critical calcified SFA stenosis/occlusions. The anterior tibial artery has biphasic flow with possible proximal critical stenosis, the peroneal artery has critical stenosis, and the posterior tibial most likely is occluded.

What access site would you use and why?

Dr. Chopra: Depending on the patient's height, the left SFA could be treated via the left radial access. If the left SFA cannot be accessed from the left radial access, at another time (or the same time, depending on patient condition and contrast load), I would achieve access through the popliteal artery or anterior tibial (pedal access), recanalize any chronic total occlusions (CTOs), perform orbital atherectomy as needed, and perform angioplasty and/or stenting as needed.

Dr. Fleming: Given the previous right common femoral-to-popliteal bypass and a stenosis in the right CFA above the take-off of the bypass, I would determine my access based on the findings of the CTA, with an anticipated left femoral access.

Dr. Bacharach: I would do initial diagnostic access via the wrist or brachial approach to avoid the right CFA and previous bypass.

What is your initial interventional strategy?

Dr. Chopra: The overall strategy would be to treat any inflow disease first, increase perfusion to the limb, and increase perfusion pressures to the lower extremity to promote healing of the wounds and continue simultaneous wound care. Depending on the patient's condition and resources available, I would try to treat as much as possible in one sitting and then stage the

procedure for a possible second or third intervention to achieve the desired results.

Dr. Bacharach: Depending on the initial diagnostic angiogram, the interventionist may be able to approach the left leg from the right CFA approach, up and over for intervention of the left SFA and popliteal segment. For the right CFA, depending on the degree of stenosis and calcification, surgical CFA endarterectomy may be preferential. Alternatively, a left CFA approach up and over for endovascular treatment could be considered if the lesion would be amenable to atherectomy or percutaneous transluminal angioplasty (PTA).

Dr. Fleming: The ultimate goal is to establish in-line flow to the left foot. A surgical/procedural plan will require more information.

EDITOR'S ASSESSMENT

Arterial imaging showed elevated peak systolic velocity (PSV) consistent with a calcified, hemodynamically significant stenosis of the right CFA (Case 1C) and the mid-distal left SFA (Case 1H and 1I). Waveforms distal to the lesions were monophasic (Case 1D–1G, 1J–1L).

EDITOR'S PROCEDURE

We believed that the arterial Doppler imaging provided sufficient anatomic detail to proceed with intervention. We accessed the right femoropopliteal bypass with ultrasound guidance, providing an ability to simultaneously treat the right CFA stenosis proximal to the bypass as well as the symptomatic contralateral left femoropopliteal disease via a single puncture (Case 1M, double arrow). A 5-F sheath was inserted. Initial angiography showed the right CFA stenosis (Case 1M, black arrow), which was treated with PTA alone with a satisfactory result (Case 1N and 1O).

Crossover angiography of the left leg (Case 1P) showed diffuse calcific left femoropopliteal stenosis, treated with orbital atherectomy (Case 1Q) using a 2-mm Crown device at low speed (Cardiovascular Systems, Inc.), followed by 5-mm long-segment percutaneous transluminal angioplasty (Case 1R, Admiral

balloon, Medtronic, Inc.), with an excellent final angiography result (Case 1S).

Upon removal of the sheath and attempted Angio-Seal hemostasis (St. Jude Medical), the patient developed a large and progressive right thigh hematoma, and puncture of the left CFA was performed for crossover angiography of the right femoropopliteal bypass, demonstrating active extravasation at the puncture site (Case 1T, arrow). After inserting a 7-F, crossover Raabe sheath (Cook Medical), hemostasis was successfully achieved by implanting a 6-mm nominal diameter Viabahn stent graft (Gore & Associates, Case 1U). The patient had no further complications and an excellent recovery.

PANEL'S COMMENTS

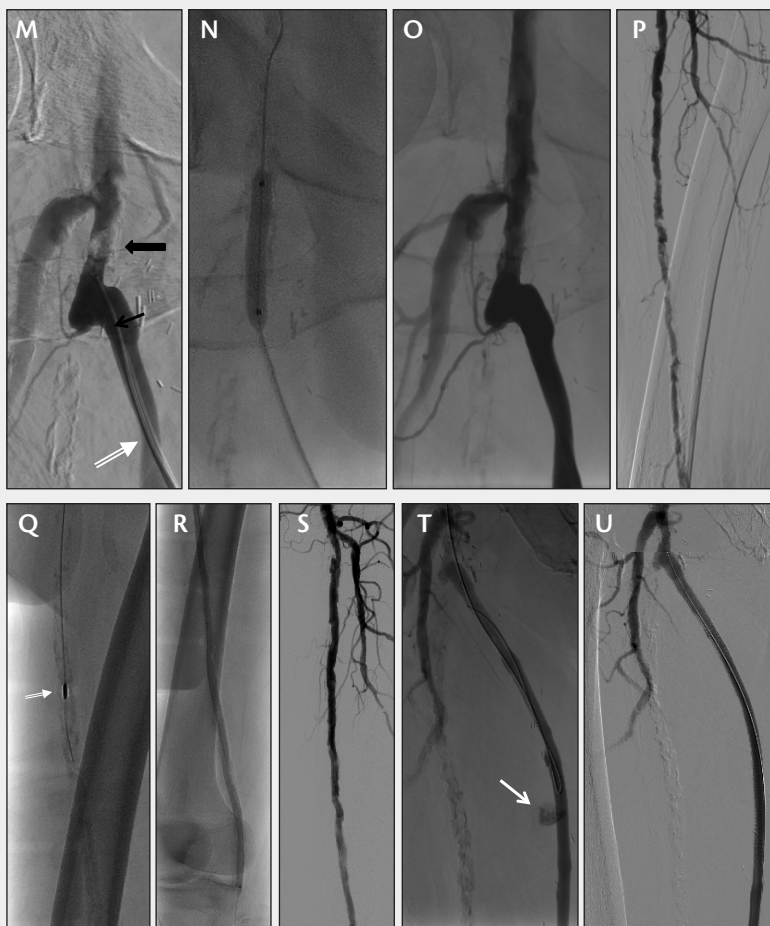
Dr. Bacharach: Careful access on the right using ultrasound guidance allowed for treatment of the right CFA stenosis. This was a thoughtful approach and allowed for treating both legs from a single access site. The use of orbital atherectomy for the diffusely calcified left femoropopliteal stenosis led to an improved luminal result.

The use of any closure device with this degree of calcification can be fraught with difficulty as demonstrated in this case, even with a very experienced operator. Using a Viabahn stent graft was preferable to sending the patient for an open operation given his age and comorbidities.

It should be noted that these are fabulous but extraordinarily difficult cases. They require significant forethought about approach and individual consideration for appropriate intervention. They require a diverse and rather expansive amount of endovascular devices, wires, atherectomy devices, and stents, which is not found in the typical low-volume vascular practice. Also, it is clear that the operator needs to be very skilled and experienced.

Dr. Fleming: This was an excellent result for a complex patient. Access site selection in patients with severe multilevel atherosclerotic disease is difficult.

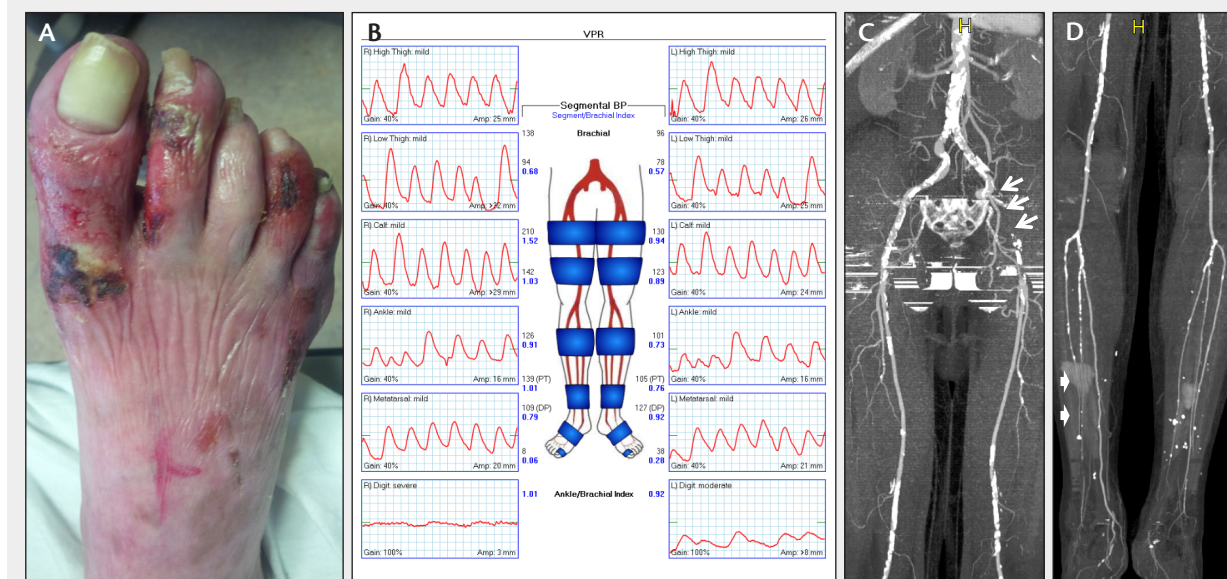
CASE 1: POSTINTERVENTION



Until longer-platform devices (stents and atherectomy devices) are widely available, intervention of these lesions is not possible from a radial or brachial access site. Another option for this case would be that of a staged approach with the left SFA being approached by an antegrade left femoral puncture or a right common femoral puncture above the common femoral stenosis. The right common femoral stenosis could then be treated in a subsequent setting via a retrograde left common femoral puncture or surgical endarterectomy.

Dr. Chopra: The vein femoral-popliteal bypass grafts do not have thick arteries, and therefore closure does not work too well. I would have treated the right CFA lesion via a left CFA contralateral approach or via a left radial artery approach (we are increasingly using this approach for the CFA). It often is better to stage the procedure to avoid complications.

CASE 2: PREINTERVENTION



CASE 2

EDITOR'S PRESENTATION

A 70-year-old man presented with ischemic rest pain and a calcaneal ulcer on the left foot, and cellulitis and forefoot ischemia with a MRSA wound on the right foot. The patient had a 40-year smoking history and recently exacerbated chronic obstructive pulmonary disease. There was no history of diabetes, hypertension, or dyslipidemia.

On examination, extensive superficial ulceration was noted on all of the toes on the right with mottling (Case 2A). The left foot was erythematous and swollen with decreased capillary refill (not shown).

Noninvasive arterial flow studies (Case 2B) and CTA (Case 2C and 2D) showed a left external iliac artery (EIA) occlusion (Case 2C, arrows) and severe stenosis in the anterior tibial artery angiosome supplying the region of the right foot ischemia (Case 2C, arrowheads).

How would you approach this to provide endovascular therapy to both legs in a single sitting?

Dr. Bacharach: It would be difficult to revascularize this patient in a single sitting. A staged procedure would likely be preferable.

Dr. Chopra: I would achieve left CFA access and recanalize the left iliac CTO, and then go over the bifurcation and treat the right SFA and infrapopliteal disease.

Dr. Fleming: Left femoral access could be used to recanalize the left EIA followed by up-and-over access to treat the right lower extremity.

Would you consider staging the procedure, and why? What would be your endovascular approach in that case?

Dr. Chopra: I would stage the procedure only if there were a limitation on the amount of contrast I could use, or if the iliac revascularization were complicated, difficult, and time consuming. If I had to stage the procedure, I would first fix the inflow on the left side and ensure adequate perfusion to the left leg. If the inflow to the right side is adequate and the common femoral access is feasible, I would have the choice to go via a right CFA antegrade approach and treat the right infrapopliteal artery occlusive disease.

Dr. Fleming: With critical ischemia of both lower extremities, if at all feasible, I try to avoid staging. If staging is necessary, close clinical follow-up of the wounds is required, as is a short interval between stages. Also, if a staged procedure is required, I will treat the most significantly affected limb first.

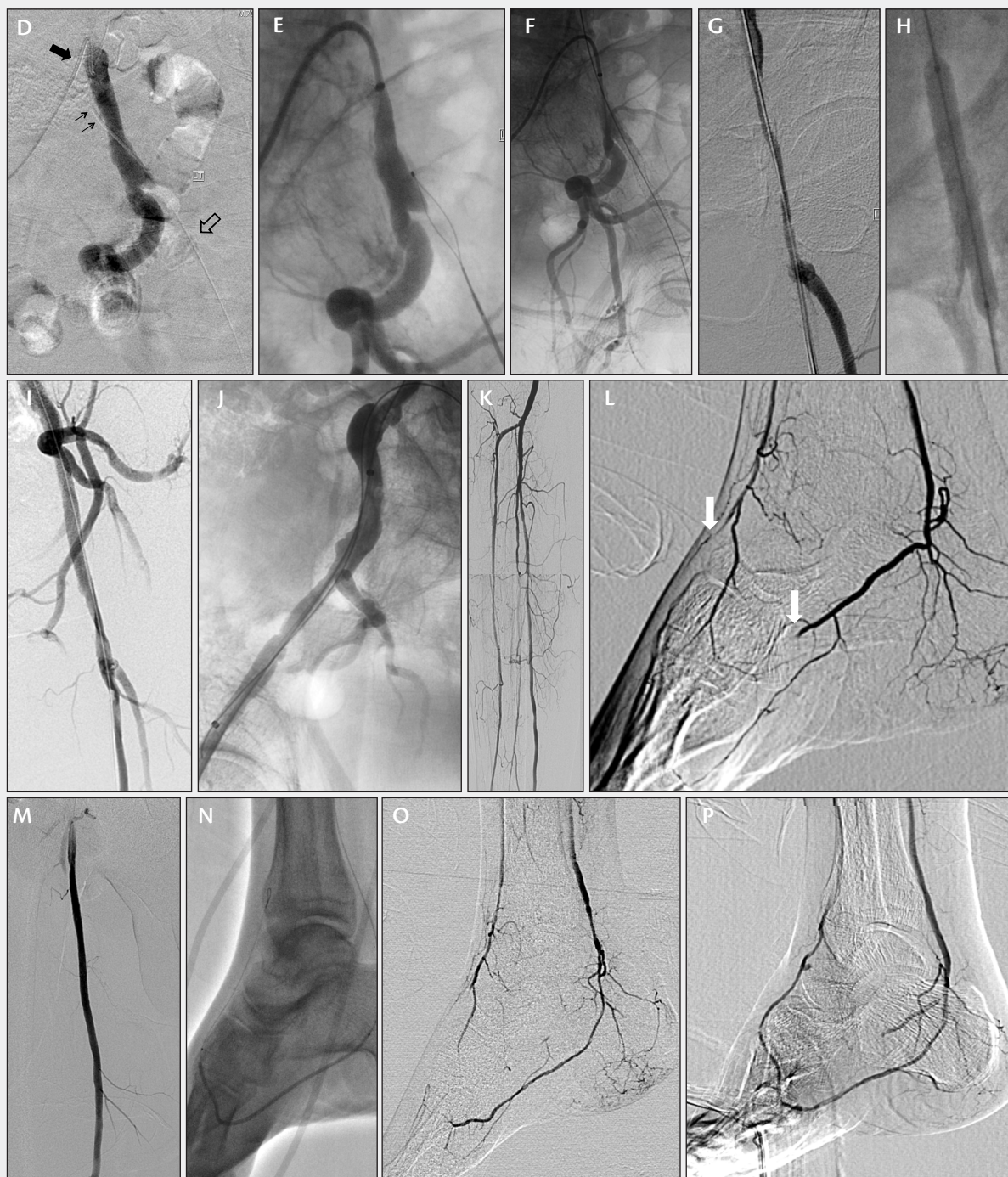
Dr. Bacharach: I would initially stage the procedure with first attempting to revascularize the left iliac segment with access from the contralateral side (right CFA). If successful, I would then use left CFA access up and over in an attempt to get in-line flow into the right foot.

Would you use a closure device after therapy? If so, which device and why?

Dr. Fleming: In my practice, I prefer to use a closure device. My algorithm is simple. If the CFA does not

have significant atherosclerosis of the anterior wall and the lumen is > 5 mm, I will use a Proglide Perclose (Abbott Vascular). If there is significant atherosclerosis or calcification of the anterior wall of the femoral artery

CASE 2: POSTINTERVENTION



or the lumen is 5 mm or smaller, I use Exoseal (Cordis Corporation) (please note this is a precaution under the instructions for use, which I would advise reading prior to use). As with many closure devices, if the steps to deployment are suspect (the lack of a short loss of pulsatile blood flow in the back bleed indicator, then the return of pulsatile bleeding followed by the indicator changing), then I avoid deployment and proceed with manual pressure.

Dr. Bacharach: Given the extensive calcification, I would avoid a closure device in this patient.

Dr. Chopra: For the left CFA access, I would use a suture-mediated device such as Perclose, if possible and feasible. I like to do this because it allows for possible early reinterventions, and I do not leave behind any material inside the artery.

EDITOR'S ASSESSMENT

CTA showed dense, diffuse calcific atherosclerosis with a left EIA occlusion and bilateral single-vessel posterior tibial artery runoff to the right and dominant peroneal runoff on the left (Case 2C). Bilateral anterior tibial arteries appeared to taper distally, and the left posterior tibial artery was occluded in the distal calf (Case 2D). Calcification limited the interpretation of the ankle-brachial index (ABI), although the right DP ABI (0.79) and left PT ABI (0.76) were mildly impaired. PVR waveforms to the ankle appeared sufficient, but toe-brachial index (TBI) was markedly reduced (0.06 on the right and 0.28 on the left) suggesting distal tibial and pedal loop disease (Case 2A). Based upon these findings, our initial strategy was transfemoral revascularization of the left iliac to improve inflow and reduce left lower extremity symptoms, with simultaneous crossover intervention of the right anterior tibial angiosome and/or pedal loop.

EDITOR'S PROCEDURE

Other than for the treatment of aortoiliac bifurcation disease, we generally don't attempt therapy of both limbs at the same time, due to higher patient and operator exposure to radiation, increased procedure time, concern about contrast loads, and a lack of current economic viability. However, for patients with multifocal "in-line" lesions amenable to intervention via the utilized access strategies, approaches vary. For claudicants, we prefer to treat inflow (iliac or femoropopliteal) disease first, and defer tibial intervention; in contradistinction, for critical limb ischemia patients, it is important to revascularize all diseased segments and

restore the best possible flow to the foot.

Access was achieved via the right CFA (black arrowhead) and left CFA (open arrowhead), with insertion of a Sos II catheter on the right (AngioDynamics), and a 4-F Kumpe catheter on the left (Cook Medical) (Case 2D). Note that the Kumpe catheter spontaneously entered the subintimal space (small arrows).

After inserting a snare via the left femoral approach (Case 2E), through-and-through access was achieved, and the left EIA was stented with a 7- X 80-mm LifeStent (Bard) (Case 2F). There was no initial flow due to a severe stenosis of the distal left EIA and CFA (Case 2G), which was treated with PTA and stenting (Figure 2H) with restored unobstructed iliac flow (Case 2I).

After intervention on the left leg, a 7-F Raabe sheath (Cook Medical) was advanced over the aortic bifurcation (Case 2J) for tibial imaging (Case 2K), showing distal plantar occlusive disease (white arrows, Case 2L). This was treated a week later via an antegrade right femoral approach (Case 2M) with pedal loop angioplasty (Figure 2N) with partial restoration of the pedal arch (Case 2O and 2P).

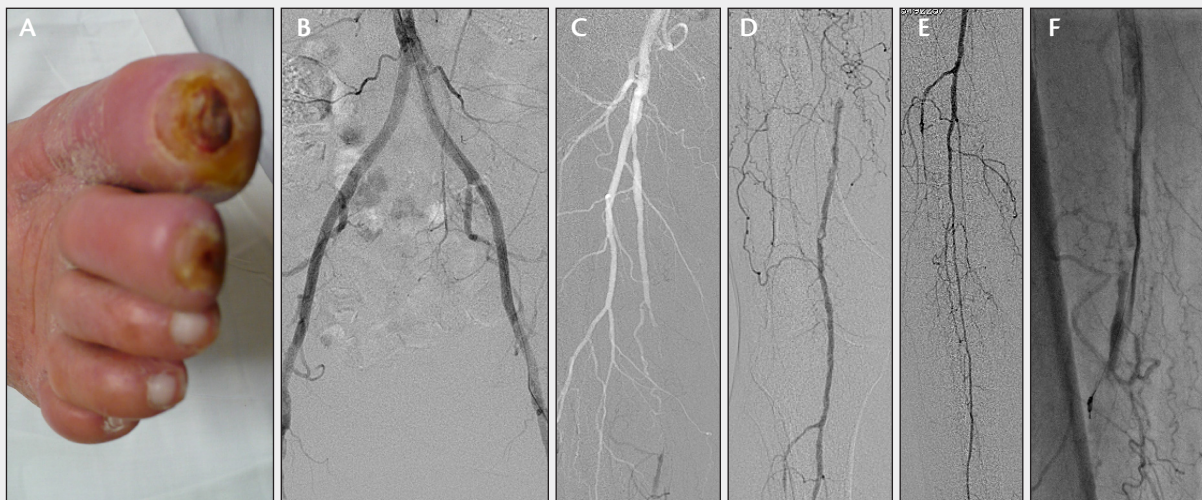
PANEL'S COMMENTS

Dr. Chopra: I agree wholeheartedly with the approach and would have used the same or a similar strategy.

Dr. Fleming: Nicely done! This case is a great example of some of the difficulties that can be encountered when recanalizing an EIA. Re-entry into the true lumen and preservation of the hypogastric artery are two priorities of the case (both successfully achieved here). In many cases, bilateral femoral access or femoral and brachial access is required. In cases where the wire remains subintimal above the takeoff of the hypogastric artery, contralateral femoral or brachial access can be used to try to enter the lesion from above, at, or below the take-off of the hypogastric artery. If all else fails, re-entry catheters will aid in re-entry.

Dr. Bacharach: I believe there is consensus about revascularization of the left iliac to improve flow and improve left lower extremity symptoms. The decision to do crossover intervention at the right anterior tibial at the same time worked out well in this patient. Clearly, there are numerous variables from the patient's standpoint and the operator to do this type of case in one setting rather than in a staged procedure. With this experienced operator, a very nice result was achieved in both lower extremities.

CASE 3: PREINTERVENTION



CASE 3

EDITOR'S PRESENTATION

A 70-year-old woman with a known history of peripheral arterial disease and prior history of claudication presented with a right nonhealing foot and toe ulcer (Case 3A). She had a skin graft on the left second toe in November, which was healing slowly. She also noticed paresthesia in the right foot and a cold feeling in her feet bilaterally.

Cardiovascular risk factors were hypertension, uncontrolled insulin-dependent diabetes mellitus, and hyperlipidemia. She did not smoke. She took Plavix, aspirin 81 mg, insulin, metformin, pentoxifylline, simvastatin, amlodipine and benazepril, lorazepam, and antibiotics for her foot infection.

She had 1+ femoral pulses bilaterally. On the left, both pedal pulses were Dopplerable only. On the right, only the posterior tibial pulse was Dopplerable. There was evidence of dry skin, excoriation, and xerosis on both toes. There was an ulcer on the second and third toes of the right foot.

ABIs were obtained and measured 0.5 on the right in the posterior tibial distribution and 0.6 on the left, also in the posterior tibial distribution.

In this case, we initially attempted right SFA intervention via a left CFA approach (Case 3B–3F) but failed due to an angiographic dead end and inability to reenter the patent popliteal lumen. The procedure was stopped with the plan to repeat intervention at another time via a different route. To avoid burning bridges for subsequent procedures, no closure device was used for hemostasis.

What is your next choice of access and why?

Dr. Fleming: At this point, I would access the distal SFA/proximal popliteal. This can be easily performed with the patient supine via fluoroscopic guidance. I access the proximal popliteal with a 21-gauge spinal needle inserted in the medial distal thigh at approximately the patellar level. Once access is achieved, I insert a V-18 wire (Boston Scientific Corporation) and a 0.018-inch, 90-cm Quick-Cross catheter (Spectranetics) as a sheathless technique. The Leipzig group has written a great article on this technique, which has significantly improved my success at treating difficult SFA lesions.

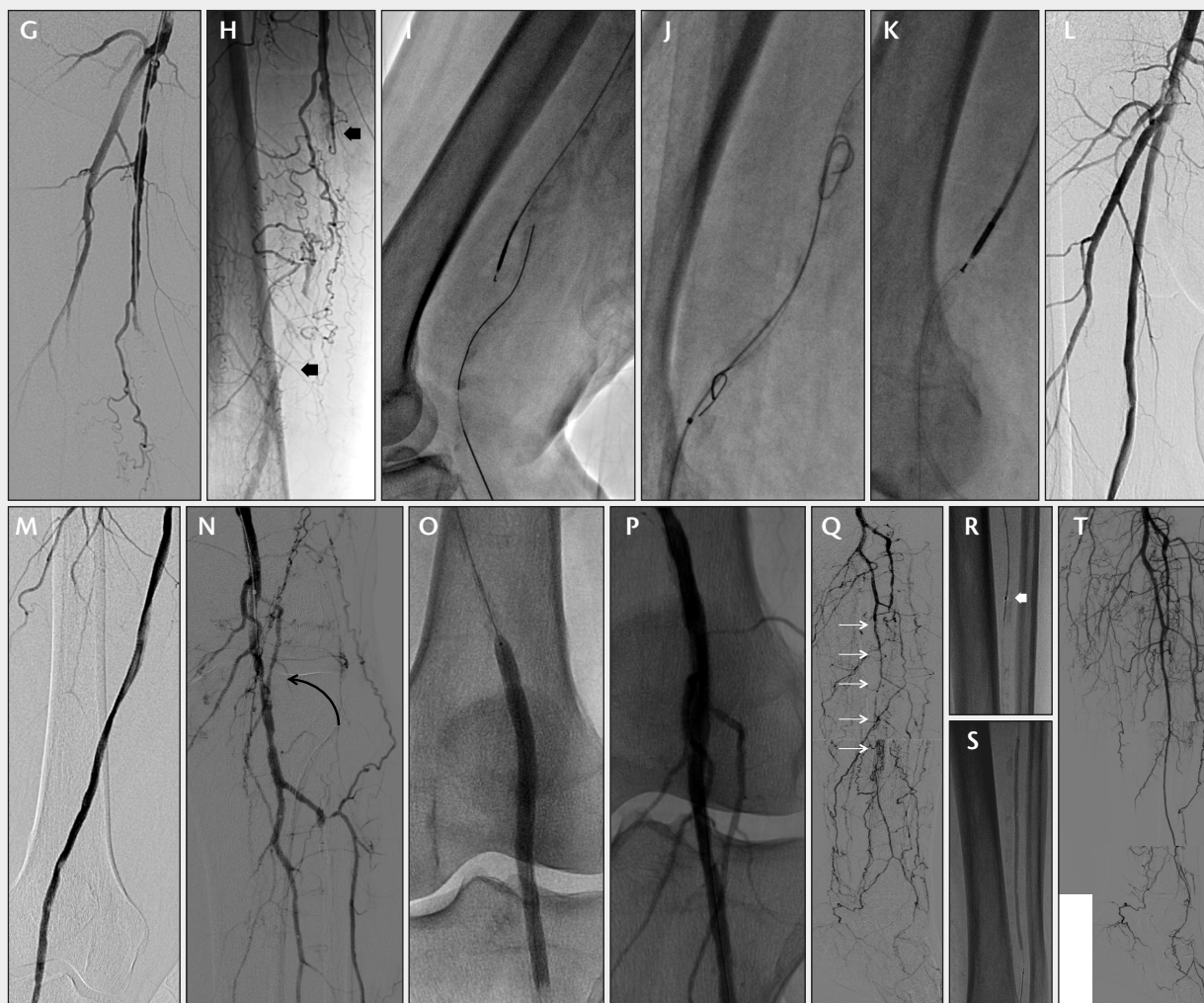
Dr. Bacharach: It would be reasonable to consider antegrade access on the right, which may provide mechanical advantage. I would consider a re-entry device for intraluminal access at the popliteal artery. Micropuncture access at the distal SFA proximal popliteal using a long needle may allow for retrograde recanalization.

Dr. Chopra: I am not sure why the patient has 1+ femoral pulses. The aortogram did not show much iliac disease. I would check the aorta to make sure there was no stenosis higher. Because attempts at recanalization of the SFA from above had failed, I would consider access via the popliteal artery and, if necessary, the left CFA for combined antegrade and retrograde access. It might be easy to recanalize the CTO from below.

What is your interventional device plan?

Dr. Fleming: Given an SFA occlusion of the mid-SFA, a proximal SFA stenosis, and a mid above-knee popliteal

CASE 3: POSTINTERVENTION



stenosis, I would treat the SFA stenosis and occlusion with a stent. With small-caliber SFAs in women, I prefer a Zilver PTX (Cook Medical). In a larger-caliber SFA, I use Viabahn stent grafts or Zilver PTX. For a short, above-knee popliteal stenosis, a drug-coated balloon would be my first-line treatment, with a bare-metal stent for bailout.

Dr. Chopra: I would start with ultrasound-guided access of the right popliteal artery and recanalize the CTO with whatever device is available and good in the operator's hands. I initially use a Glidewire and Glidecath (Terumo) combination. If this is unsuccessful, I use the Outback (Cordis Corporation) and the Ocelot (Avinger) if needed. Once I have crossed the CTO and I get a wire into the true lumen distally, I would perform orbital atherectomy, then perform angioplasty of the SFA. I would then stent with a Viabahn in the proximal

portion and Supera in the mid and distal SFA, especially where there is extensive calcification.

Would you consider bypass surgery instead of repeat endovascular therapy, and what would determine this?

Dr. Bacharach: Yes, I would consider surgical bypass. The decision would depend on the patient's overall clinical status and whether she could undergo surgery safely. The patient has poor runoff, so I would favor autologous vein, so vein availability would be an important consideration.

Dr. Fleming: In my practice, iliac and SFA disease is treated with an endovascular-first approach if feasible. With this approach, I take care to not burn a bridge/target site for an open bypass. With adequate vein cali-

ber and length, open surgical bypass has much better patency rates and is my preference. In patients without adequate vein for a bypass conduit, I prefer endovascular interventions.

Dr. Chopra: Not at this time. Surgery only if endovascular options fail.

EDITOR'S ASSESSMENT

Vein mapping was performed to determine if the patient would be a good candidate for bypass and to help determine the aggressiveness with which additional endovascular therapy should be pursued. Both greater saphenous veins were insufficient for single-vein conduits.

EDITOR'S PROCEDURE

We elected to repeat an attempt at endovascular therapy approximately 1 month later using a CART (combined antegrade and retrograde transluminal) approach, which we refer to as a *rendezvous procedure*. Antegrade right CFA access was again obtained (Case 3G), once more showing the calcified distal SFA CTO (Case 3H, between arrowheads). After dilating the antegrade subintimal tract, an Outback catheter was advanced into the distal SFA, and retrograde access of the popliteal artery was achieved using roadmap guidance and frog-leg positioning with the patient remaining supine (Case 3I).

Using a loop snare placed through a catheter from the popliteal approach (not shown), the Outback catheter was used to achieve antegrade luminal re-entry (Case 3J), allowing a wire to be passed beyond the popliteal sheath (Case 3K). After angioplasty and stenting, unobstructed flow was restored in the femoropopliteal segment with single-vessel peroneal runoff (Figure 3L and 3M).

Approximately 2 weeks after treatment of the right leg, left lower extremity intervention was undertaken via an antegrade left femoral approach, with angioplasty of a short-segment popliteal stenosis (curved arrow) (Case 3N–3P), and simultaneous 1.5-mm Crown orbital

atherectomy (white arrowhead) and PTA of a peroneal occlusion (arrows) (Case 3Q–3S). Completion angiography showed restored straight-line peroneal flow to the foot (Case 3T).

PANEL'S COMMENTS

Dr. Fleming: Combined antegrade and retrograde access is extremely helpful in successfully treating CTOs of the SFA. I highly recommend reading Andrej Schmidt et al, *Retrograde recanalization technique for use after failed antegrade angioplasty in chronic femoral artery occlusions* (J Endovasc Ther. 2012;19:23-29). There are several key points in this kind of access to minimize complications. The first is that I perform the access to the popliteal or distal SFA via a sheathless approach with a 0.018-inch Quick-Cross catheter and a V-18 wire. CTO wires such as the Victory (Boston Scientific Corporation) 0.018-inch diameter, 30-gauge tip wire can also be helpful in crossing the lesion. When the Quick-Cross is removed, perform prolonged PTA (2 minutes) at the access site and manual pressure or BP cuff (subsystolic pressure, 40–60 mm Hg). Get a limited angiogram to confirm successful hemostasis with a BP cuff and to confirm the cuff has not resulted in occlusive pressure.

Dr. Bacharach: It is important to note that vein mapping was performed and that the patient was considered for surgical bypass. The presence of insufficient vein is a very reasonable indication to reattempt endovascular therapy. This case nicely demonstrates the advantage of using combined antegrade and retrograde approaches to obtain intraluminal position and successful revascularization. These types of cases require excellent imaging, multiple endovascular tools, and an experienced operator.

Dr. Chopra: I would have used the same approach for this case.

CASE 4

EDITOR'S PRESENTATION

A 68-year-old man presented with progressive bilateral claudication (approximately 100 yards). Cardiovascular risk factors included hypertension, dyslipidemia, coronary artery disease, previous left cerebrovascular accident, previous CABG, and aortic valve replacement.

He took amlodipine, labetalol, aspirin 81 mg, celecoxib, folate, ranolazine, valsartan, warfarin, and niacin.

In August 2010, the patient underwent angioplasty of a calcified right CFA stenosis, angioplasty, and Supera stent placement (Abbott Vascular) for a calcified distal femoral lesion, and kissing-balloon angioplasty for an exophytic calcified right tibial trifurcation lesion (Case 4A–4D) with three-vessel runoff.

At the time of right lower extremity intervention, angiography of the left leg was obtained (Case 4E–EF). Left leg Doppler tracings and segmental pressures were also performed (Case 4G).

Would you treat these tibial lesions or try medical therapy?

Dr. Bacharach: In the absence of tissue loss or rest pain, I would initially try conservative therapy with a walking program and aggressive risk-factor modification.

Dr. Chopra: Yes, I would treat them. Medical therapy would not help this patient as much as restoring flow and good perfusion to the lower limb.

Dr. Fleming: I would recommend a walking trial as well as maximum medical therapy (antiplatelet, statin, and aggressive BP control).

What endovascular approach(es) would you use to treat this patient?

Dr. Fleming: In my practice, I reserve tibial interventions for patients with critical limb ischemia or failing previous open or endovascular procedures. Unfortunately, the devices we have available today have not proved to have adequate short-term patency. With an intervention, the intimal hyperplasia/restenosis may convert the patient from claudication to critical limb ischemia.

If I were treating this lesion for critical ischemia, I would start with contralateral femoral access and a 6-F (70 cm) Cook Raabe sheath. I would attempt to cross from above. If unsuccessful, I would move to pedal access with a V-18 wire and 0.018-inch Quick Cross catheter (sheathless). With buddy wires (one into the anterior tibial and one in the posterior tibial), a kissing balloon technique can then be performed. For the popliteal stenosis, I would use a drug-coated balloon.

Dr. Chopra: I would either obtain access from above or from below via the pedal access. I would then perform

orbital atherectomy to modify the compliance of the vessel and then perform a low-pressure angioplasty.

I would avoid stenting because the patency rates are low. The patient is merely a claudicant at this time.

What are the anatomically unique challenges in this case?

Dr. Bacharach: The challenges of this case include rather diffuse calcification and distal location with segmental occlusion rather than stenosis. Limited stent availability for bailout is also a limitation.

Dr. Fleming: One of the anatomical challenges of this case is an occlusion at a bifurcation. In addition, the proximal anterior tibial artery is not well suited for bailout stent placement, as the interosseous membrane often crushes or compresses stents in this location. Also, the use of atherectomy presents the challenges of maintaining wire access in both the posterior tibial and anterior tibial artery (buddy wire technique), as a buddy wire can get entangled or sheared off.

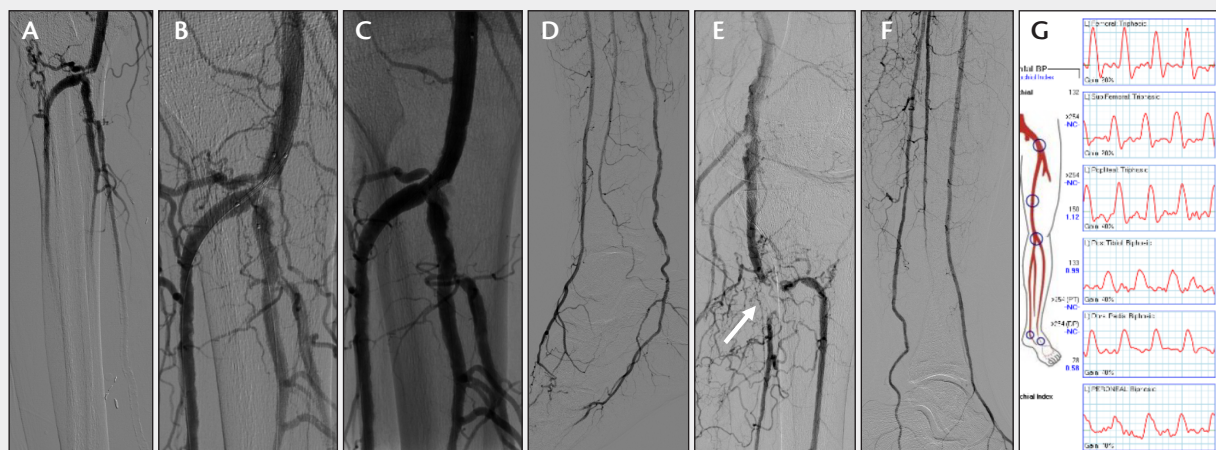
Dr. Chopra: The calcified bifurcation lesions with irregular plaque are the main challenge here.

What are your preferred tools and techniques for bifurcation lesions?

Dr. Fleming: My preference for bifurcation lesions is achieving buddy wire access and angioplasty via a kissing technique or sequential angioplasty of the vessels.

Dr. Chopra: The preferred approach is to place two wires, one in each lumen. Given the amount of calcification, it is important to make sure the vessel is compliant and does not dissect during angioplasty. I would accom-

CASE 4: PREINTERVENTION



CASE 4: POSTINTERVENTION



plish this with orbital atherectomy (I would use the 1.25-mm Micro Crown [Cardiovascular Systems, Inc.]) on each of the two vessels. Then I would dilate them together with two balloons showed in the images above to avoid occlusion of one of the two lumens.

Dr. Bacharach: The approach could be antegrade via left CFA or right CFA up and over. A 7-F sheath would allow enough room for a two-wire system to be used to protect both branches if successfully crossed. Newer hydrophilic CTO wires and support catheters such as the CXI have made crossing these lesions more successful.

EDITOR'S ASSESSMENT

Diagnostic angiography of the left lower extremity shows a similar mirror-image occlusion of the distal popliteal artery and origins of the anterior tibial artery and tibioperoneal trunk, with a cranially directed origin of an aberrantly proximal anterior tibial arch (Case 4E–4F, arrow). There is unob-

structed distal runoff. Noninvasive flow studies showed tibial calcification and a reduced toe-brachial index at rest (Case 4G).

Because the patient had progressive symptoms despite several years of antiplatelet therapy and exercise, it was believed that intervention was warranted at this time. In addition, there was a questionable history of previous heart failure precluding the use of cilostazol.

EDITOR'S PROCEDURE

Angiography at the time of intervention again shows the tibial trifurcation occlusion with preserved pedal runoff (Case 4H and 4I). Based upon the upward angulation of the anterior tibial origin, an initial dorsalis pedis puncture was used for planned primary intervention (Case 4J), with the goal of placing two wires: the first into the tibioperoneal trunk and a second into the femoropopliteal segment. However, because lesion recanalization was difficult, it was decided to perform an antegrade left femoral puncture for simultaneous

COVER STORY

antegrade and retrograde angiography and further treatment planning (Case 4K).

From the pedal access, it was possible to advance a 2.5-F CXI catheter (Cook Medical) and a 0.014-inch Glidewire Advantage (Terumo) into the tibioperoneal trunk (Case 4L). Subsequently, the antegrade femoral access was used to cross the distal popliteal lesion and pass a 0.014-inch Command ES wire (Abbott Vascular) into the peroneal artery (Case 4M), showing the complex nature of the lesion and sharp cranial angulation of the anterior tibial origin (small arrows). Due to dense calcification at the lesion, a low-profile 2-mm balloon (Amphirion Deep, Medtronic, Inc.) was needed for predilation (Case 4N, open arrow).

Following kissing-balloon 3-mm PTA from both the DP and femoral accesses, there was restored patency with residual stenosis in the distal popliteal artery and anterior tibial artery origins (Case 4O, curved arrows), which was treated with kissing 3-mm nominal diameter Resolute drug-eluting stents (Medtronic, Inc.) with resolution of significant narrowing (Case 4P). After removal of the pedal sheath, there was spasm in the dorsalis pedis artery (Case 4Q, arrow), although pulses were normal the next day, and the patient had complete resolution of symptoms.

PANEL'S COMMENTS

Dr. Fleming: Once again, a very nice result of a very complex lesion. As mentioned in my previous comment, the proximal anterior tibial artery can be problematic for stents, although in this case, I believe the stent is likely not across the interosseous membrane. With regard to the choice of a drug-eluting coronary stent, that is my preference when placing a stent in the tibial arteries for residual stenosis or dissection.

Dr. Chopra: I agree with this strategy and would have employed a similar approach.

Dr. Bacharach: Progressive symptoms despite adequate medical therapy and exercise are very reasonable indications to attempt endovascular revascularization. This case, again, nicely demonstrates the advantages of both antegrade and retrograde approaches. An important component was the decision to use a dual-wire technique to protect access into the peroneal and anterior tibial arteries. With the degree of calcification, it is not surprising that balloon angioplasty alone did not provide an adequate luminal diameter. The use of coronary stents in this location, while acceptable, highlights the need for industry to develop stents that are more specifically designed for tibial revascularization. ■