Endovascular Management of Severe Aortoiliac Occlusive Disease

BY RICHARD PIN, MD, RPVI

A prerequisite to successful lower extremity revascularization is the establishment of sufficient arterial inflow at the aortoiliac level. Isolated aortoiliac occlusive lesions can cause thigh and buttock claudication. Combined with infrainguinal disease, symptoms may progress to critical limb ischemia and potential limb loss. Short occlusions or stenoses without occlusion may be effectively treated with percutaneous intervention. Endovascular treatment for these types of aortoiliac lesions have generated durable results with > 90% patency rates at 3 years and > 70% patency rates at 10 years. However, as aortoiliac occlusions become longer and more complex, the challenges and potential risks of endovascular intervention can evolve beyond those of the infrainguinal territory. Similarly, open surgical management of the aortoiliac segment generally requires a greater degree of invasiveness and attendant potential morbidity than procedures involving the common femoral artery and below.

Abdominal exposure and aortic clamping are usually necessary to bypass or perform endarterectomy in occluded vascular segments. Many patients with peripheral arterial disease may in fact be unsuitable candidates for this type of major operation, and these patients may even pose high risk for less-invasive, extra-anatomical bypass. Claudicating patients who possess this severe degree of medical disarray may simply choose to walk less or not at all. However, similarly ill patients with critical limb ischemia must rely on endovascular treatment as their only option for limb salvage.

When dealing with complex aortoiliac lesions, a single algorithm for technical success does not exist. The difficult occlusions that arise in this vascular territory tend to be more calcified and solid than those occurring infrain-

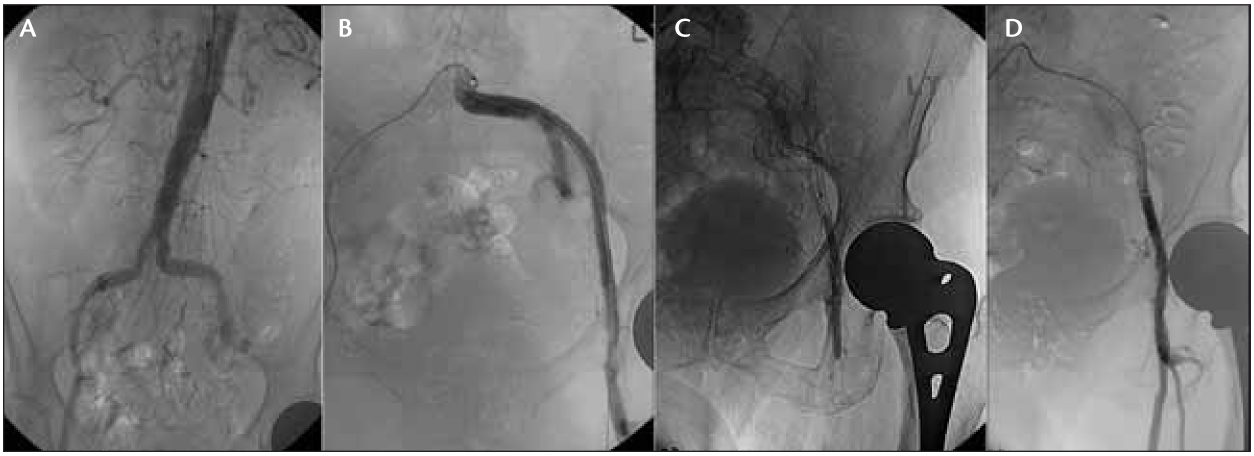

Figure 1. An angiogram shows an occluded left external iliac artery and stenotic common femoral artery (A). The occlusion could not be crossed from a contralateral femoral approach. The diseased ipsilateral femoral artery was accessed, and a 0.035-inch wire was brought into the aorta, crossing the external iliac occlusion and allowing for placement of a balloon-expandable stent (B). The left femoral sheath was then removed, and the puncture site was closed with a Mynx closure device (AccessClosure, Inc., Mountain View, CA). Angioplasty was performed in the left common femoral artery with a 6-mm balloon that was directed from the right femoral system (C). A completion angiogram showed minimal residual stenosis in the common femoral artery (D).

guinally. Crossing aortoiliac occlusions within the confines of the arterial lumen is often not possible, and a subintimal approach may be the only route of passage. Once in that dissection plane, there is the additional task of reentering the true lumen, and this process presents another challenge. In addressing these difficult lesions, having the potential for multiple vascular access points allows for great flexibility in treatment and, in some cases, may be necessary for technical success. The proximity and direct line of a lesion to an ipsilateral femoral puncture allows for a tremendous amount of pushability to traverse long-segment occlusions. Conversely, this added force can also lead to inadvertent vessel perforation, which in the aortoiliac segment can be immediately life-threatening. Even in cases of aortoiliac disease involving the common femoral arteries, ipsilateral common femoral access can still be used, and intervention of the common femoral artery itself can be performed from a brachial or contralateral femoral approach after closure device placement (Figure 1).

When a heavily diseased ipsilateral femoral artery makes puncture exceedingly difficult, primary brachial access provides an antegrade position for initial angiography to delineate the extent of aortoiliac disease and to guide secondary femoral access if necessary. A brachial approach also permits long sheath placement to the level of occlusion, allowing for engagement of lesions at the aortic bifurcation and origin of the common iliac artery, which may not be reasonably treated from a contralateral femoral approach. Small brachial vessel diameter can limit placement of larger sheath sizes, however, and care must be taken to avoid the adjacent median nerve during initial puncture. Likewise, after sheath placement, adequate intraoperative anticoagulation must be promptly initiated and maintained to prevent thrombus formation and the possibility of upper extremity limb ischemia. In cases of long complete occlusions necessitating entry into a dissection plane, methods of reentering the true lumen can be accomplished in the iliac segment or the aorta while respecting the consequences of vessel perforation (Figure 2).

The subsequent cases detail some of my recent experience with difficult TASC II D aortoiliac lesions. These are circumstances in which open surgical intervention would have been the preferred treatment choice had the patients been acceptable surgical candidates. These patients presented with critical limb ischemia primarily due to severe aortoiliac occlusions, with a secondary component of infrainguinal disease. These are medically ill patients in which endovascular therapy was their only option for limb salvage. Through combined brachial and femoral access, sufficient arterial inflow was reestablished, providing symptomatic relief without further infrainguinal intervention.

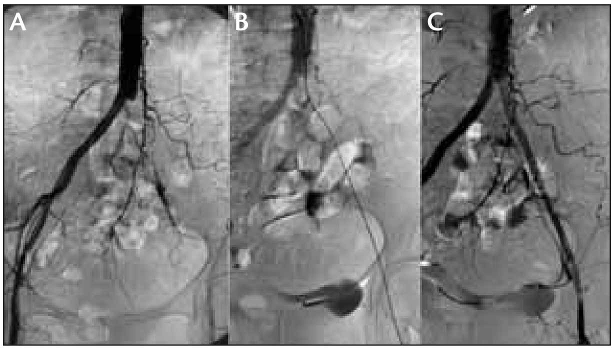

Figure 2. Aortography was performed and showed an occluded left iliac system (A). The left common femoral artery was accessed angiographically, and a dissection plane was entered in the external iliac artery using an angled Glide catheter and straight stiff Glidewire (Terumo Interventional Systems, Somerset, NJ) (B). The true lumen was reentered at the aortic bifurcation, with subsequent angioplasty and stenting of the left iliac system (C).

CASE 1

The patient was an 83-year-old woman who resided in an extended care facility and had a history of severe rest pain and ulceration over the dorsum of her right foot. She was diagnosed with congestive heart failure and worsening chronic obstructive pulmonary disease requiring a brief period of intubation 2 months before angiography.

At presentation, she had no palpable femoral pulses, and duplex evaluation demonstrated monophasic waveforms bilaterally with poor tibial flow in the right leg. Initially, access was gained through a left brachial approach. Aortography showed an occluded right iliac system with reconstitution of a diseased common femoral artery (Figure 3A). After multiple attempts through a brachial approach, it was not possible to gain wire access into the right iliac system. Access to the right femoral artery was achieved, and a 0.035-inch catheter and straight stiff hydrophilic wire were brought into the right common iliac artery with considerable difficulty, entering into a dissection plane. This wire and catheter combination would not cross into the aortic bifurcation, and we exchanged for a weighted 0.014-inch wire and a 0.014-inch Quick-Cross catheter (Spectranetics Corporation, Colorado Springs, CO), which navigated into the dissected aortic plane (Figure 3B).

After graduated balloon angioplasty of the right external and common iliac arteries from 1.5 to 4 mm, we were able to bring an Outback catheter (Cordis Corporation,

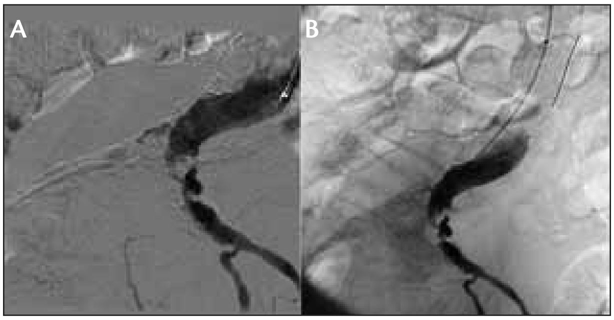

Figure 3. Angiogram demonstrating an occluded right iliac system (A). 0.014-inch wire access obtained into dissected aortic plane from the right common femoral artery (B).

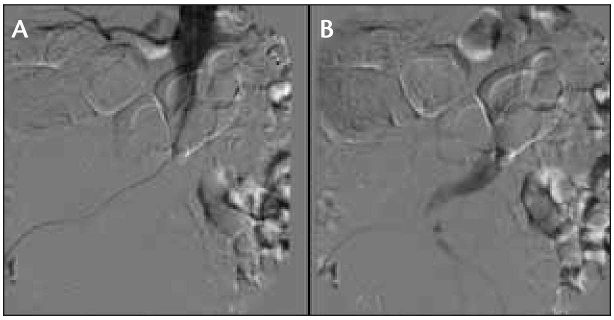

Figure 4. Angiogram from the femoral catheter demonstrating reentry into the true aortic lumen (A). The right iliac system remains completely occluded (B).

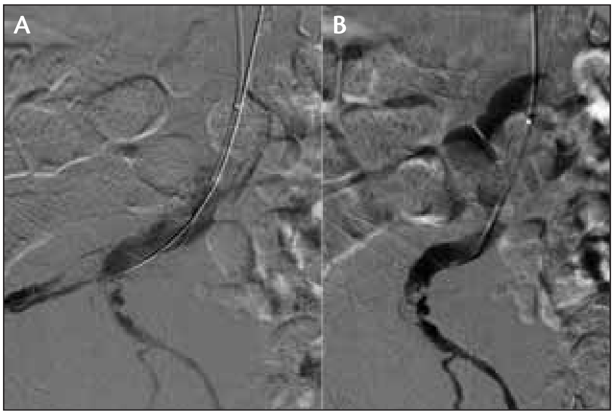

Figure 5. Angiogram via right femoral sheath demonstrating filling of left iliac system (A). Despite stent placement in the right common iliac artery, flow remains absent in the right iliac system (B).

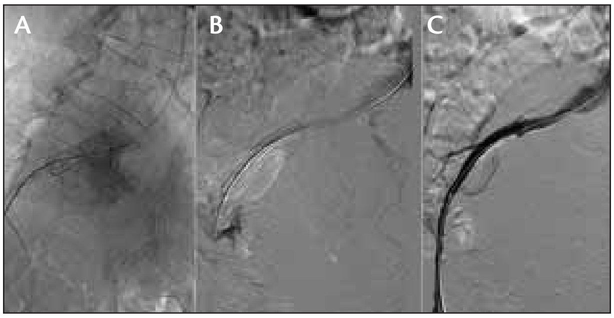

Figure 6. Brachial sheath advanced into the right iliac system by snaring femoral wire to gain access (A). After further stenting of the common and external iliac arteries, patency is achieved (B, C).

Bridgewater, NJ) into the aorta and obtain true lumen access in the distal infrarenal abdominal aorta (Figure 4A). The right iliac system remained occluded, as seen on angiography from the brachial sheath (Figure 4B).

However, angiography through the right femoral sheath showed filling of the left common iliac artery, again suggesting true lumen access within the distal infrarenal aorta (Figure 5A). Stenting of the right common iliac artery (via our femoral sheath) was achieved using a 6- X 18-mm balloon-expandable Express LD stent (Boston Scientific Corporation, Natick, MA). However, angiography through our brachial sheath showed persistent occlusion of the right common iliac artery (Figure 5B).

The femoral wire was then snared from the brachial sheath and used to guide the sheath into the right iliac stent, allowing entry into the right iliac system from our brachial access point (Figure 6A). The external iliac artery was stented with a 6- X 57-mm Express LD balloon-expandable stent and the common iliac artery with a second 6- X 18-mm Express LD balloon-expandable stent. Angiography showed inline flow from our brachial sheath into the right common femoral artery (Figure 6B and C). The brachial and right femoral sheath arterial pressures were equivalent. The remainder of the right leg runoff showed small but patent profunda and superficial femoral arteries with two-vessel runoff through the anterior tibial and peroneal arteries. The patient had a palpable dorsal pedis pulse at the end of the procedure. Rest pain improved within 24 hours, and ulcerations improved at 1-month follow-up.

CASE 2

A 70-year-old man presented with complaints of severe numbness and rest pain in his left leg and mild numbness in the right leg. He had a history of bilateral carotid occlusions and right subclavian artery occlusion. Computed tomographic angiography showed cerebral circulation primarily supplied by a left vertebral artery, which itself had a 60% proximal stenosis. Physical examination demonstrated no palpable femoral pulses. His ankle-brachial indexes were 0.47 on the right and 0.31 on the left. Severe carotid artery disease precluded him from

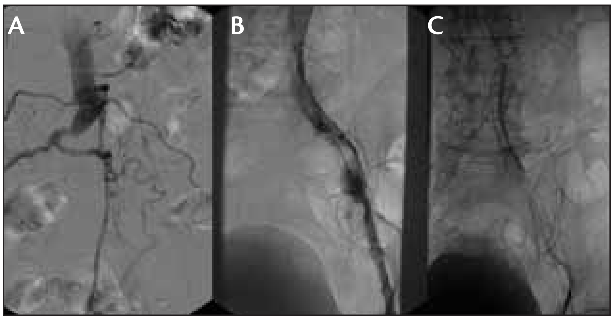

Figure 7. Occluded distal aorta and iliac vessels (A). Ipsilateral femoral access with catheter placement in the false aortic lumen (B). Angioplasty of the false lumen channel with a 3-mm balloon from the common iliac artery into the aorta (C).

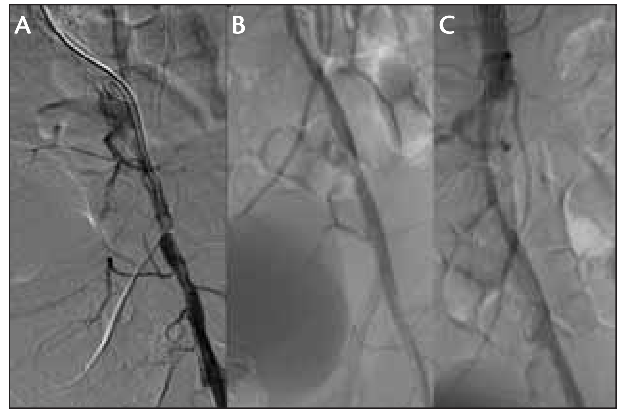

Figure 8. Brachial J-wire snared (A). The common and external iliac arteries were stented (B). Angiogram showing the stent extended into the distal aorta to maintain patency (C).

direct aortoiliac reconstruction, and subclavian and vertebral artery disease made him a suboptimal candidate for extra-anatomic axillary bypass.

The left brachial artery was accessed with a 4-F sheath, and initial angiography showed an occluded infrarenal aorta approximately 2 to 3 cm above the bifurcation. Common femoral arteries reconstituted bilaterally, with a large sacral collateral supplying the right femoral system. The bilateral profunda and superficial femoral arteries were mildly diseased. There was three-vessel runoff on the right and two-vessel runoff on the left through diseased peroneal and anterior tibial vessels. An attempt to engage the aortic occlusion was made, but advancement proved unsuccessful despite sheath placement in the distal aorta.

The left common femoral artery was punctured to introduce a 6-F sheath. From this ipsilateral position, a dissection plane was entered in the aorta above the level of occlusion. Despite multiple attempts, wire access into the true lumen could not be attained with a reentry catheter device. We elected to angioplasty a channel in the false lumen with a 3-mm balloon from the common iliac artery into the aorta (Figure 7). This maneuver allowed for a stiff hydrophilic wire from our brachial sheath to be advanced into the left common iliac artery, which previously had proved unsuccessful. Within the left iliac system, we were able to cross into the false lumen from our brachial approach, providing wire access into the false lumen from both brachial and femoral access sites.

A snare was directed into the femoral access to capture a brachial J wire, bringing the distal J through our femoral sheath (Figure 8A). We now had a 260-cm J wire extending between our 4-F brachial sheath and 6-F femoral sheath. Angioplasty of the left iliac system into the aorta was performed using a 5-mm balloon, primarily to create a reasonable plane to pass a stent. After angioplasty, there remained no flow in the left iliac system. The common and external iliac arteries were stented with 7- X 57-mm Express LD balloon-expandable stents (Figure 8B). To maintain patency at the distal aorta, the common iliac artery stent required extension into the aorta with an overlapping 7- X 25-mm stent (Figure 8C). At 2-month follow-up, the patient had resolution of his left leg rest pain and mild persistent numbness in his right leg. His ankle-brachial indexes were 0.54 on the right and 0.9 on the left.

CONCLUSION

The spectrum of aortoiliac occlusive disease ranges from short, simple stenoses to long, complete occlusions, with treatment options that vary accordingly from minimally invasive endovascular procedures to major open surgical intervention. Compared to the infrainguinal territory, the risk associated with percutaneous and open revascularization of the aorta and iliac vessels are heightened given the hazards of vessel rupture endovascularly and the morbidity associated with transperitoneal or retroperitoneal exposure surgically. Nonetheless, establishing adequate arterial inflow is essential for any procedure directed at improving blood flow to the lower extremities. When medical comorbidities make surgical intervention prohibitive in patients with critical limb ischemia and aortoiliac occlusive disease, a complex endovascular approach may be the only possibility for limb salvage. ■

Richard Pin, MD, RPVI, is a Vascular Surgeon at Grant Medical Center in Columbus, Ohio. He has disclosed that he holds no financial interest in any product or manufacturer mentioned herein. Dr. Pin may be reached at (614) 566-9035; rpin2@ohiohealth.com.