Improving Quality of Life

The legs, the heart, and sex: What is the connection? An iliac artery case report.

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A 56-year-old man with progressive angina and a recent coronary angiogram that was obtained out of state presented to our office for a second opinion regarding coronary artery bypass grafting (CABG). The cardiac catheterization, performed through a radial approach, showed severe three-vessel disease and an ulcerative, complex 70% to 80% left main coronary artery stenosis. Additionally, the patient stated that his previous cardiologist "had trouble with the cath through both groins," necessitating the radial approach. Further history revealed the patient also had severe (<20 ft) bilateral hip and leg claudication, and his leg symptoms had been attributed to several previous back surgeries. The patient also reported impotence for 5 years, which he readily stated caused his recent divorce and bankruptcy filing. The patient had undergone bilateral greater sapheneous vein stripping a decade earlier.

A physical examination revealed bilateral absence of femoral and infrainguinal pulses, with bilateral ankle-brachial indices (ABIs) of 0.25. The patient had 2+ bilateral brachial pulses. An immediate 64-channel abdominal CTA with runoff was obtained in our outpatient office. CTA revealed that both iliac arteries and the right hypogastric artery were totally occluded, with a 99% left hypogastric or internal iliac artery stenosis (Figure 1A). Interestingly, the aorta and both common femoral arteries (CFAs) were free of significant disease. The CTA demonstrated that both CFAs were dominantly perfused from large inferior epigastric artery collaterals, which received flow directly from the superior epigastric artery continuation of the internal mammary arteries (IMAs). This collateral pathway occurs through the small anastomotic channels at the level of the distal sternum just proximal to the site where the IMA is ligated and used as the conduit of choice during CABG (Figures 1A-C).

Acute limb ischemia, limb loss, and an increased mortality rate have been reported in the immediate post-CABG period when the IMA was used for coronary revascularization in patients with unrecognized severe aortic or iliac artery disease.[1-4] This vital collateral pathway in aortoiliac occlusive disease has historically been referred to as *Winslow's pathway*.[5] When considering the importance of patent IMA grafts to the overall long-term survival in this 56-year-old patient, and the increased risk of inducing acute limb ischemia during CABG, a recommendation for percutaneous bilateral iliofemoral revascularization staged prior to CABG with bilateral IMAs as conduits was immediately rendered. The patient was started on clopidogrel (75 mg twice a day), and all cardiac medications were maximized.

PROCEDURE

Three days later, both arms and groins were prepared in a sterile manner, and diagnostic 5-F angiography via a left brachial artery approach beautifully confirmed the CTA finding (Figure 1D). The brachial artery was chosen because previous failed CFA approaches during recent cardiac catheterizations likely may have caused dissection tracts, and the lack of any femoral pulse increased the risk of primarily attempting this revascularization procedure through a traditional CFA approach. Intravenous bivalirudin was used as the anticoagulation foundation (0.75-mg/kg bolus with 1.75-mg/kg infusion). We have had excellent results using the current longer- and lower-profile devices from a brachial artery approach, which can be

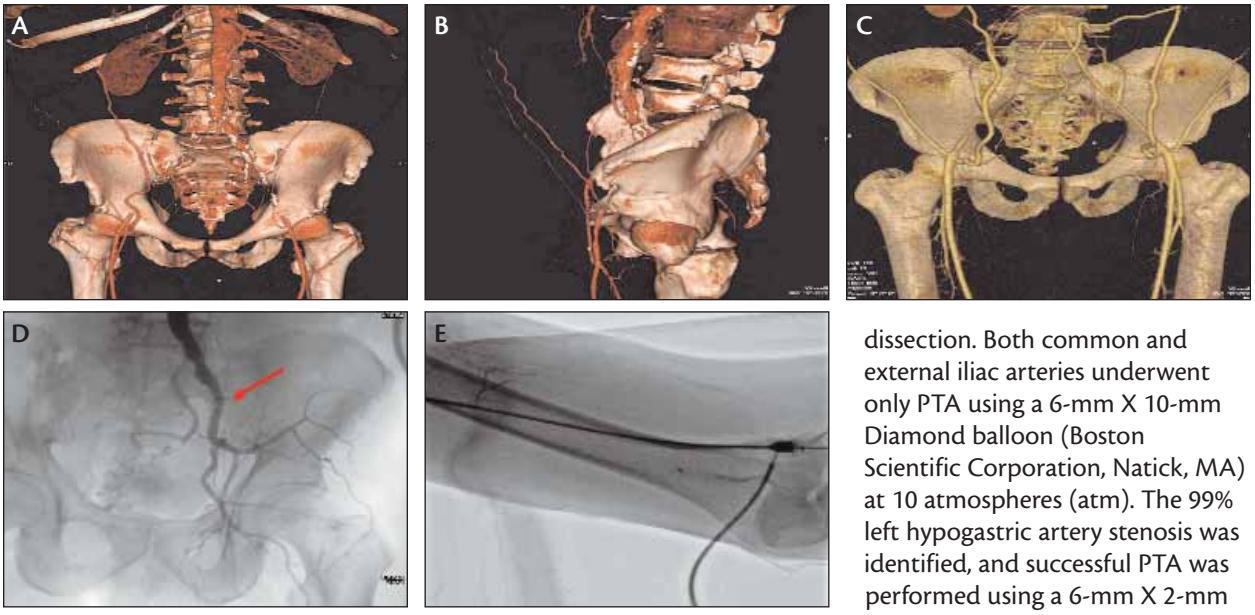

Figure 1. CTA of patient demonstrating bilateral iliac chronic total occlusions, total right hypogastric occlusion, severe left hypogastric disease, and both CFAs collateralized by the inferior epigastric arteries (A). Lateral CTA demonstrating the inferior epigastric arteries in this case (B). A classic example of inferior epigastric arteries completing Winslow's pathway (C). Angiography in this case correlating with the CTA results (note the arrow indicating the severe hypogastric artery stenosis) (D). Left brachial artery retrograde injection demonstrating complete 5-F sheath obstruction of flow to the forearm (E).

very valuable in a variety of clinical scenarios involving patients who have limited femoral access. The left brachial artery is preferred over the right because the access route is more direct, shorter, and does not cross the brachiocephalic vessels, which theoretically lessens the risk for cerebral emboli. An immediate retrograde brachial artery angiogram with runoff to the hand is recommended to assess brachial artery size, to identify immediately the obstructive potential of the initial 5-F sheath, and for postprocedural comparison to rule out thrombosis or emboli. This information will allow planning during the case regarding upsizing the sheath to 6 F to 7 F, if clinically necessary. The 5-F sheath was occlusive in this case, therefore allowing PTA but precluding iliac stenting because no <6-F–compatible iliac stents exist (Figure 1E).

The left IMA injection demonstrated the large inferior epigastric artery collateral filling the CFA above the level of the head of the left femur, demonstrating Winslow's pathway (Figures 2A-E). Both iliac artery occlusions were sequentially crossed from the left brachial artery approach using standard 0.35-mm Glidewire (Terumo Medical Corporation, Somerset, NJ) technique and the distal wire entered the CFAs without dissection. Both common and external iliac arteries underwent only PTA using a 6-mm X 10-mm Diamond balloon (Boston Scientific Corporation, Natick, MA) at 10 atmospheres (atm). The 99% left hypogastric artery stenosis was identified, and successful PTA was performed using a 6-mm X 2-mm Diamond balloon at 10 atm (Figure 3A, B). Angiography revealed adequate flow to both CFAs, with an anticipated small dissection. The left hypogastric PTA results were excellent and without dissection. Both CFAs were then easily "stuck" under direct angiographic vision using a standard Seldinger technique facilitated by visualizing the wire and a small injection of contrast from above. A 6-F Pinnacle Destination sheath (Terumo Medical Corporation) was placed in the right CFA, and a 7-F sheath was placed in the left CFA. A larger sheath was planned for the left side to accommodate the delivery of a Symphony self-expanding nitinol stent (Boston Scientific Corporation) to cover the ostium of the left hypogastric artery. The interstices of the Symphony stent are extremely wide and allowed us to avoid complex hypogastric T-stenting and reduced the risk of "jailing off" the hypogastric artery.

A classic balloon-expandable kissing stent technique was then performed at the iliac bifurcation using 8-mm X 39-mm Express LD stents (Boston Scientific Corporation) via the bilateral CFA approach at 12 atm (Figure 3C). Bilateral external iliac stenting was accomplished using a 10-mm X 79-mm self-expanding nitinol Sentinol stent (Boston Scientific Corporation) on the right iliac artery at 10 atm, and a 10-mm X 40-mm Symphony stent on the left iliac artery at 12 atm (Figure 3D). Completion angiography revealed excellent bilateral iliofemoral and left hypogastric artery flows with <10% residual stenosis (Figure 3E). The bivalirudin drip was stopped.

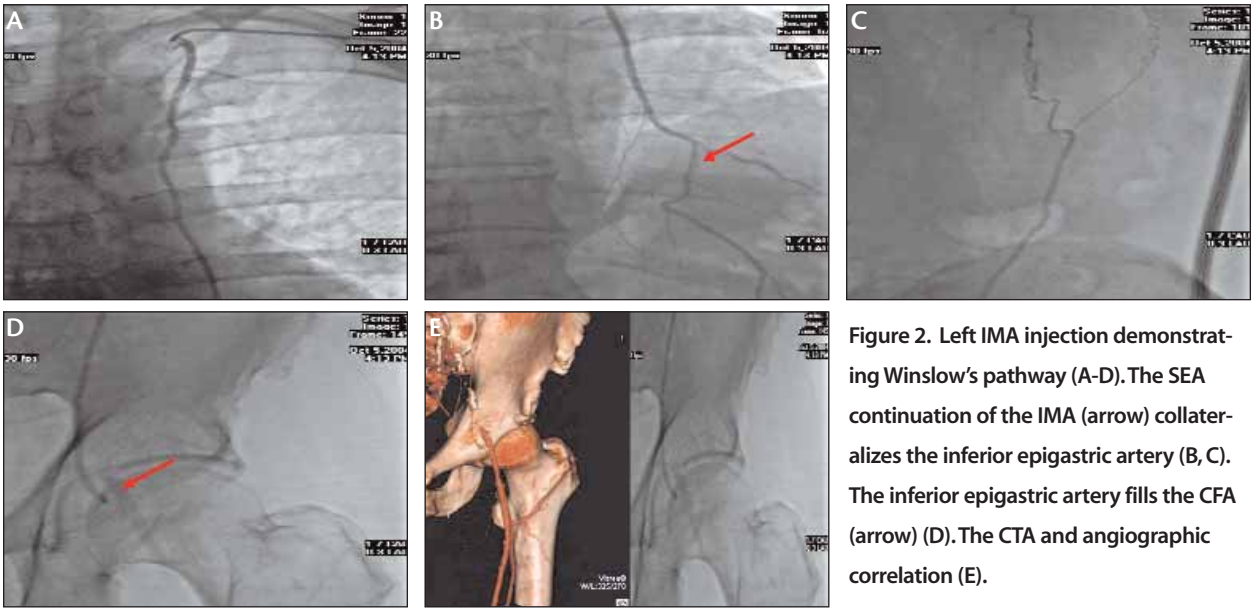

Figure 2. Left IMA injection demonstrating Winslow's pathway (A-D). The SEA continuation of the IMA (arrow) collateralizes the inferior epigastric artery (B, C). The inferior epigastric artery fills the CFA (arrow) (D). The CTA and angiographic correlation (E).

The 5-F procedural sheath was immediately removed from the left brachial artery, and the novel 56 Boomerang 18-gauge wire system and disc (Cardiva Medical, Inc., Mountain View, CA) were deployed. A 2+ left radial pulse immediately returned; 90 minutes later, the Boomerang System was removed, and 10 minutes of light manual compression was applied. Similarly, the 610 Boomerang wire system was deployed immediately in both CFAs in the catheterization lab, and both CFA sheaths were removed, returning unobstructive flow to both lower extremities. Both CFA Boomerangs were similarly removed at approximately 90 minutes. The patient developed no complications and had bilateral palpable 2+ CFA pulses when discharged the next morning. A 75-mg dose of clopidogrel once a day was continued for 1 week and then stopped for 5 days, preparing for CABG when the patient developed breakthrough angina. The patient underwent uneventful triple-vessel CABG using both IMAs and the right radial artery as conduits. Administration of clodiprogel was restarted 24 hours after CABG.

TEACHING POINTS

Collaboration Is Key

This case illustrates several very important teaching points. First, it demonstrates the importance of the awareness that cardiovascular disease does exist from head to toe, and everything in between. Second, the cardiologist and surgeons must not only closely work together on each patient, but they should eliminate any tunnel vision and consider the entire cardiovascular system to obtain optimal outcomes. Winslow's pathway and analogous chronic peripheral collateral systems are not uncommon and are likely to become more commonplace with our rapidly increasing elderly patient population. Kim et al have recently reported 15 patients with this collateral pathway in aortoiliac disease.[4] This case also underscores the importance of doing a good basic history and physical examination and that cardiologists, cardiothoracic, and vascular surgeons alike must not only understand PAD, but each specialty should develop catheter skills to treat this very prevalent disease.

Diagnostic CTA in Peripheral Arterial Disease

This case also demonstrates why multichannel CTA has totally revolutionized our approach to both the diagnostic and treatment planning in peripheral arterial disease.[6] It is highly likely that had this patient not undergone CTA, a CABG would have been performed with the use of one or both IMAs, rendering one or both limbs acutely ischemic in the immediate post-CABG period with a significant increase in mortality and possibly morbidity. The angiographic correlations between CTA and traditional angiography are excellent, and the benefits of CTA in peripheral arterial disease have been described.[6] It must be re-emphasized that this very complex patient with very limited vascular access presented in our outpatient office and, within 60 minutes, not only was a second opinion made, but multichannel CTA enabled the diagnosis of a new aspect of the disease process. CTA facilitated a completely different treatment plan with the potential for overall improvement in this patient's outcome.

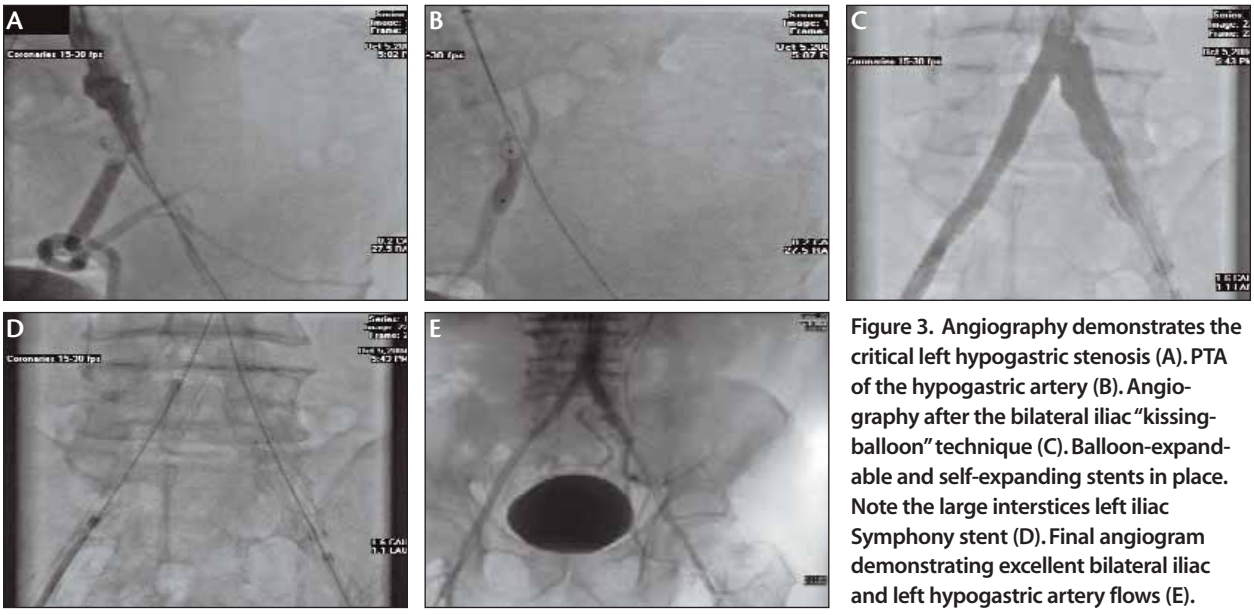

Figure 3. Angiography demonstrates the critical left hypogastric stenosis (A). PTA of the hypogastric artery (B). Angiography after the bilateral iliac "kissing-balloon" technique (C). Balloon-expandable and self-expanding stents in place. Note the large interstices left iliac Symphony stent (D). Final angiogram demonstrating excellent bilateral iliac and left hypogastric artery flows (E).

Alternative Vascular Access

This case also illustrates the importance of using alternative vascular access sites in percutaneous iliofemoral revascularization and the postprocedural left brachial artery access and CFA site management with both the novel 56 and the 610 Boomerang Wire System. In patients with limited CFA access, we have found that creative utilization of the brachial artery facilitates percutaneous revascularization in a variety of iliac, CFA, profunda and proximal-to-mid SFA cases. Familiarization with this approach is recommended. In many patients, 6-F brachial artery sheaths can be used, allowing stent delivery from one or both brachial arteries and enabling complete bilateral iliac and proximal femoral artery PTA/stenting. An advantage of the Boomerang Wire System is that it allows immediate removal of the obstructive procedural sheath with reinstitution of distal flow, which likely decreases both the higher bleeding and thrombotic complications associated with "brachial sticks" and peripheral interventions in general.[7-9] These complications are lessened by the immediate removal of the sheath, allowing reinstitution of distal flow to the hand or feet and by decreasing the manual compression time (8 to 10 minutes) required with the Boomerang as opposed to traditional manual compression time of >30 minutes or more especially after a 5-F to 7-F sheath has been in place in the brachial artery.

LIMITATIONS

One potential criticism of this case may be that because the known restenosis rates after iliac chronic total occlusion PTA/stenting are higher than in iliac stenosis, this patient would be at higher risk for future acute limb ischemia, especially because his main lower-extremity collaterals were the IMAs. Our decision to recommend iliac revascularization before CABG was based on the fact that this patient was a poor PTCA candidate, had no venous conduits, and needed bilateral IMAs during CABG. It is our experience that with a close, noninvasive, iliofemoral surveillance program (including CTA), iliac restenosis can be diagnosed early, and secondary reintervention would be possible using a CFA approach, resulting in good long-term results.

Another potential criticism of this case is the use of bivalirudin in this complex iliac chronic total occlusion case relative to an increased hemorrhagic risk to the patient because both brachial artery access and iliac chronic total occlusions are known to be at higher risk for bleeding complications. The lack of an immediate reversal agent with bivalirudin, analogous to the role of protamine in heparin reversal, has been cited in these types of cases as too risky for the anticoagulation with bivalirudin. The limitations of heparin are well known, and bivalirudin was chosen for anticoagulation to decrease the potential thrombotic complications in both the hands and feet (in this case with obstructive sheaths). Bivalirudin provides a more optimal anticoagulation environment and, furthermore, it has been shown to decrease the hemorrhagic complications in complex PCI and peripheral interventions.[9-12] We have found the short half-life of bivalirudin (T 1/2 = 22 minutes) to be particularly advantageous when used with the Boomerang wire, allowing much shorter disc dwell

times and resulting in overall facilitated vascular access management from reduced manual compression times to earlier ambulation times, with significantly fewer complications as compared to previously published peripheral vascular interventional results.[8,9,11]

CONCLUSION AND FOLLOW-UP

Four weeks after CABG and 6 weeks after bilateral iliofemoral and left hypogastric revascularization, the patient and his new girlfriend both presented back to the office and reported satisfactory resolution of the patient's impotence. The patient had no chest pain, which clinically confirmed patency of the IMA grafts, and he had bilateral 2+ CFA and pedal pulses with bilateral ABIs of 1.0, which clinically confirmed patency of the iliofemoral vessels. ■

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