The use of an upper extremity hemodialysis access site for stenting of the superior mesenteric artery for chronic mesenteric ischemia

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ABSTRACT

We report the use of an upper extremity hemodialysis access site to facilitate endovascular treatment of the superior mesenteric artery in the setting of chronic mesenteric ischemia. A 64-year-old woman with end-stage renal disease on hemodialysis presented with worsening symptoms associated with chronic mesenteric ischemia. Her left upper extremity interposition graft within the fistula access site was selected to avoid a hostile aortoiliac system and in consideration of the potential benefits it provided over transfemoral, transbrachial, and transradial sites. The procedure was technically successful without complication. Hemodialysis access sites, such as the interposition graft within the fistula of this patient, are a potential route of upper extremity access for mesenteric interventions in patients with end-stage renal disease on hemodialysis. (J Vasc Surg Cases and Innovative Techniques 2019;5:406-9.)

Keywords: End-stage renal disease; Hemodialysis; Hemodialysis access site; Arteriovenous graft; Chronic mesenteric ischemia; Superior mesenteric artery stent

Endovascular treatment of chronic mesenteric ischemia has supplanted mesenteric bypass as the preferred therapeutic approach, given its lower morbidity and mortality and overall cost-effectiveness.[1-3] However, severe aortoiliac disease and acute angulation of the mesenteric arteries can make the transfemoral (standard) approach technically challenging. Upper extremity access may be preferable in these instances. The brachial artery is an access route that avoids a diseased aortoiliac system and that decreases the risk of mesenteric artery complications, such as perforation, dissection, and embolization.[4,5] However, the transbrachial approach is more likely to result in access-related complications, most notably neurapraxia.[5,6] The radial artery has also been used for treatment of chronic mesenteric ischemia, but the need for smaller diameter catheters and associated vasospasm, which can lead to thrombosis, are some limitations to this approach.[7]

CASE REPORT

A 64-year-old woman with end-stage renal disease on hemodialysis for 2 years and coronary artery disease status post stents presented with a 2-month history of postprandial pain associated with nausea, vomiting, and a 15-pound weight loss. Computed tomography angiography revealed heavily calcified and tortuous aortoiliac vasculature and an infrarenal aortic aneurysm containing significant mural thrombus (Fig 1). There was a moderate to severe stenosis of the celiac axis and a severe stenosis of the superior mesenteric artery (SMA). The inferior mesenteric artery was occluded. The decision was made to use the left upper extremity interposition graft within the fistula access site for endovascular treatment to avoid the hostile aortoiliac vasculature and because of the potential benefits over other access sites. The possibility of graft thrombosis was a consideration but was believed to be less morbid than the potential direct arterial puncture sites.

Informed consent was obtained from the patient for publication.

TECHNIQUE

The left brachiocephalic arteriovenous fistula with composite interposed graft was 4 months old. Before its creation, the patient was catheter dependent. The graft was punctured under direct ultrasound guidance toward the brachial artery using a 21-gauge needle just beyond the anastomosis site in a retrograde manner with respect to the flow within the access circuit (Fig 2). The puncture was made near the anastomosis with the brachial artery to minimize the torque on the graft and artery and was essentially a 90-degree puncture with respect to the artery but oblique with respect to the lateral wall of the graft. A 0.018-inch guidewire was advanced into the brachial artery under fluoroscopy guidance, and the needle was exchanged for a 5F coaxial sheath. A 0.035-inch guidewire was advanced into the artery, and the sheath was exchanged for a 5F short vascular sheath (Terumo, Somerset, NJ). Heparin 3000 units was immediately

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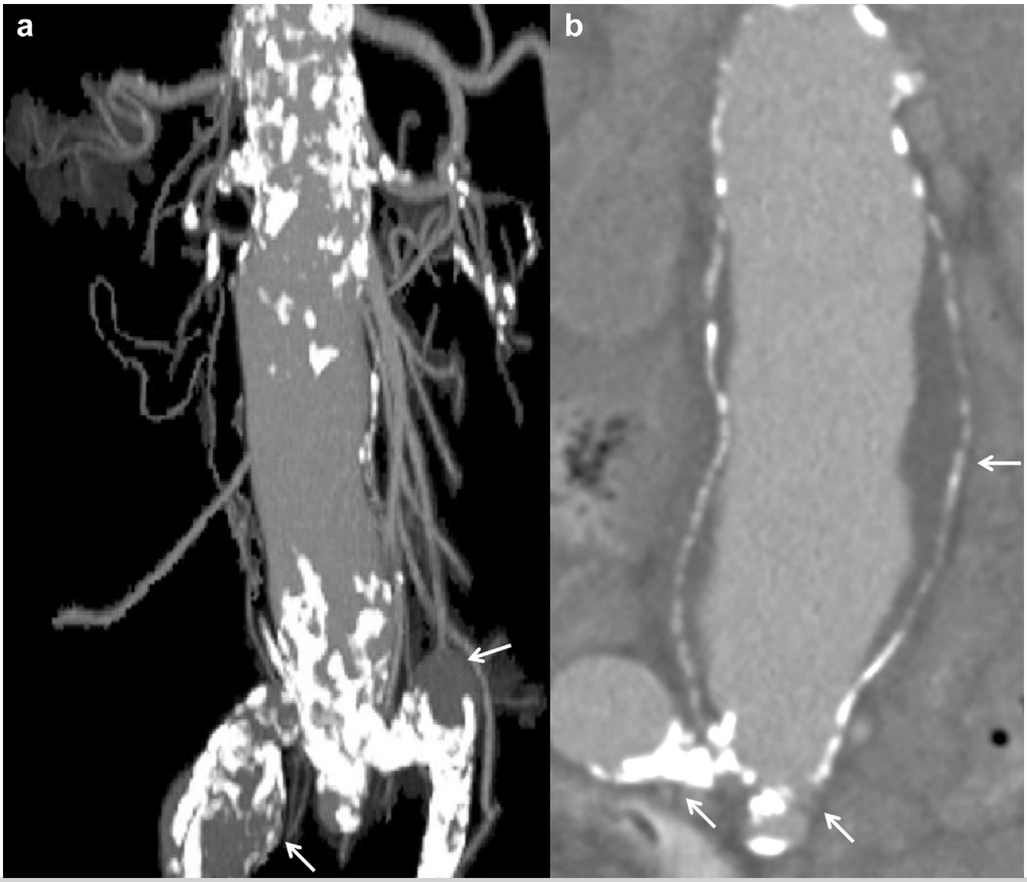

Fig 1. a, Computed tomography angiography three-dimensional reformatted image shows a heavily calcified, tortuous atherosclerotic aortoiliac system. Note the aneurysmal dilation of the bilateral common iliacs. **b,** Standard contrast-enhanced computed tomography coronal image shows extensive mural thrombus lining an infrarenal abdominal aortic aneurysm with tortuous origin of the common iliac arteries.

Fig 2. Ultrasound image of initial access of the arteriovenous fistula with composite interposed graft. The needle is traversing the anterior graft with the tip pointed toward the more caudal brachial artery.

administered intravenously to minimize thrombosis. Through the sheath, a 5F directional catheter (AngioDynamics, Latham, NY) was used to negotiate over a Glidewire (Terumo) into the abdominal aorta under fluoroscopy guidance, and the catheter was exchanged for a 5F flush catheter that was placed into the proximal abdominal aorta with digital subtraction arteriography performed in lateral projections. The aortogram demonstrated a moderate focal stenosis within the origin of the celiac axis and a moderate to severe focal stenosis at the ostium of the SMA. The SMA was favored for treatment, given it was more severely diseased, and revascularization provides a higher pressure head to the inferior mesenteric artery territory. Celiac revascularization was the second choice if SMA treatment was not technically feasible.

The sheath was upsized to a 6F vascular sheath that was connected to a normal saline arterial pressure drip to minimize thrombosis locally within the brachial artery. By use of a combination of various catheters and guidewires, the stenosis was ultimately crossed with a 4F directional Fubuki catheter (Asahi Intecc, Tustin, Calif), which was placed into the SMA with digital subtraction arteriography performed, demonstrating once again the moderate to severe focal stenosis with significant post-stenotic dilation (Fig 3, *a*). A hemodynamically

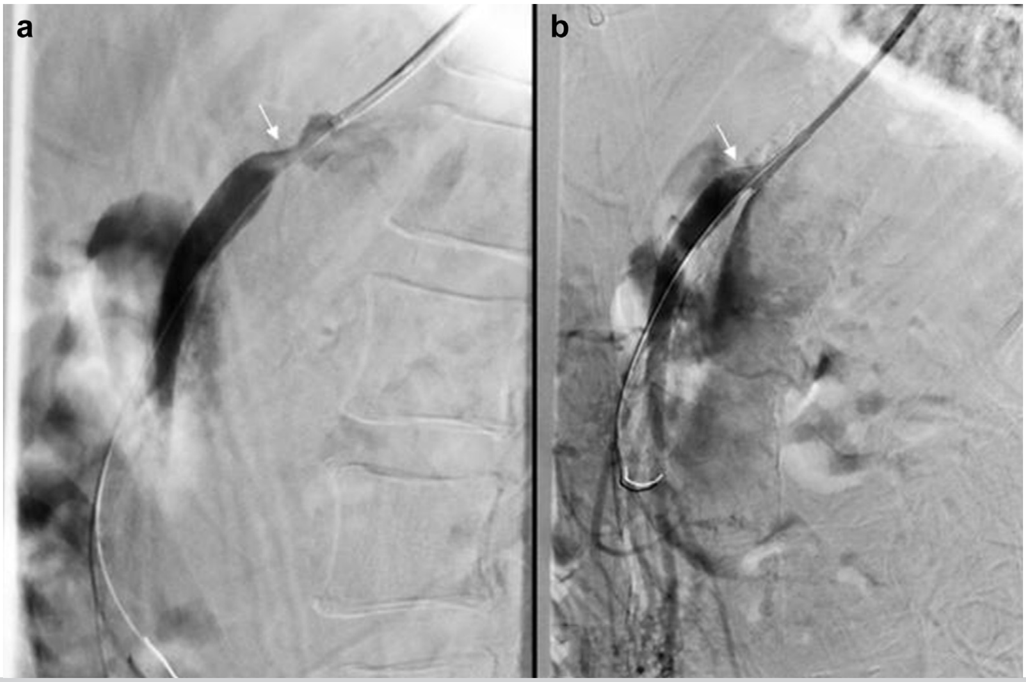

Fig 3. Digital subtraction arteriography in the lateral projection showing the ostial superior mesenteric artery (SMA) stenosis before **(a)** and after **(b)** treatment.

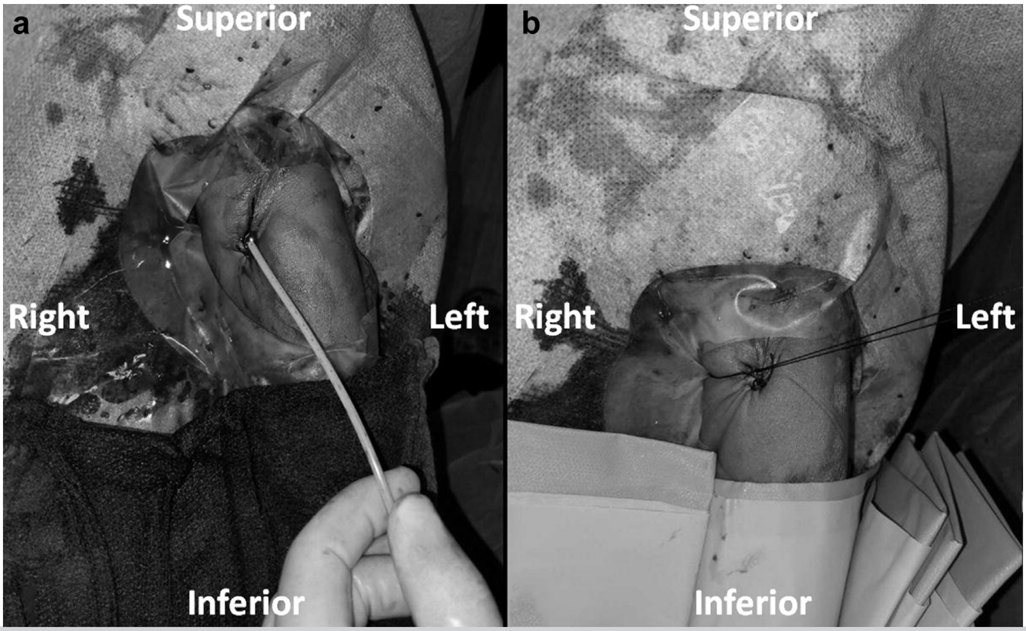

Fig 4. a, Access through arteriovenous graft with vascular sheath in place. **b,** Placement of purse-string sutures after removal of the sheath at the end of the procedure.

significant pressure gradient was measured. Given the significant post-stenotic dilation, a relatively large stent and delivery system were necessary. A TAD II guidewire (Abbott Vascular, Santa Clara, Calif) was placed into the SMA, and the catheter and long sheath were exchanged for a 7F long vascular sheath. Through the sheath, an 8- × 17-mm Express LD balloon-expandable stent (Boston Scientific, Marlborough, Mass) was successfully deployed across the ostial stenosis of the SMA without incident. Post-treatment images demonstrated an improved caliber and flow through the treated segment and no immediate complication (Fig 3, *b*).

Fistulography before removal of the devices showed patent flow within the hemodialysis circuit without evidence of thrombosis. The catheters and sheath were promptly removed, and hemostasis was achieved with purse-string sutures, which provided immediate hemostasis (Fig 4). The site was used for hemodialysis on postprocedure day 1, and the purse-string sutures were removed after that session of hemodialysis. Diet was advanced to a full renal diet, and the patient experienced no postprandial pain, nausea, or vomiting. The patient was discharged home on postprocedure day 2 and prescribed 325 mg of aspirin daily, 75 mg of clopidogrel, and 10 mg of rosuvastatin.

The patient remained symptom free at the 5-month follow-up visit. Difficulty in cannulation of the hemodialysis access site was reported at the 3-month visit, for which 7-mm balloon angioplasty was preformed to treat an unrelated stenosis. No issues with the hemodialysis access were reported at the 5-month visit.

DISCUSSION

The use of an upper extremity arteriovenous graft for cardiac interventions has been previously described. Ko et al[8] performed 24 interventional coronary procedures in 17 patients through an arteriovenous graft approach with no reported complications. Our report is unique in that the hemodialysis access site was used for a mesenteric endovascular intervention.

There are many advantages to use of a hemodialysis access site for aortic interventions. Hemostasis is easy to achieve, even in patients receiving anticoagulation, as the superficial hemodialysis access site allows placement of purse-string sutures. The superficial nature of this patient's graft also permitted some motion of the graft, which made the access geometry more favorable to accommodate the devices. The technical difficulties and risks encountered through the transfemoral approach in patients with diseased aortoiliac vasculature are avoided. We favored this as a safer upper extremity access than other sites because there is little risk of the type of complications encountered with direct brachial artery or radial artery punctures, such as hematoma, dissection, neurapraxia, and vasospasm. The threat of compartment syndrome is eliminated as well, as any bleeding will be predominantly external to the extremity, provided the most superficial component of the access is punctured. There is no significant learning curve to this approach, in contradistinction to transradial access. There is evidence suggesting reduced success in treatment of visceral disease through the radial artery; when technical difficulties were encountered in the large series published by Posham et al,[9] alternative access was required to facilitate definitive treatment.

There are limitations to this approach. Thrombosis of the graft may occur during or after the procedure. This could be managed with thrombectomy to restore patency and to salvage the access. The morbidity of any graft or fistula site thrombosis should be less than that of thrombosis occurring in the native brachial and radial arteries as these sites could potentially place the extremity at risk from ischemia.[10] Thrombosis of a hemodialysis access site is not associated with ischemic sequelae in general if it occurs at a site beyond the arterial inflow, which is where our puncture site in this patient was. Whereas radial thrombosis should be less morbid, given the ulnar artery collateral supply, thrombosis can limit return access, and mesenteric interventions may not be optimal from the radial approach as outlined before. The radial approach would have been unlikely to accommodate the 7F sheath that was needed to complete our procedure. In a patient with limited access for hemodialysis, the risk of using this approach may be prohibitive. These considerations have to be weighed on a case-by-case basis.

CONCLUSIONS

Our case supports the notion that hemodialysis access can serve as a potential upper extremity route for mesenteric or aortic interventions in patients with end-stage renal disease on hemodialysis.

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