Staged endovascular repair of an abdominal aortic aneurysm adjacent to a chronic high-flow iliocaval traumatic arteriovenous fistula

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ABSTRACT

Large-vessel chronic traumatic arteriovenous fistulas are a rare complication after trauma. Delayed presentation can consist of one or more features of high-output cardiac failure, pulsatile abdominal mass, bruit, limb ischemia, and venous congestion. We describe a patient with a complex iliocaval fistula secondary to a remote gunshot wound associated with a large 8.5-cm aortic aneurysm. Informed consent of the patient was obtained for publication of the case. (J Vasc Surg Cases and Innovative Techniques 2017;3:247-50.)

CASE REPORT

A 53-year-old man presented to our facility with sudden-onset abdominal pain of several hours' duration. Computed tomography angiography (CTA) demonstrated an 8.5-cm infrarenal abdominal aortic aneurysm (AAA) with retroperitoneal stranding concerning for impending rupture. In addition, a large traumatic arteriovenous fistula (tAVF) between the left common iliac artery (CIA) and the inferior vena cava or left common iliac vein with extensive arterial and venous collateralization (Fig 1) was observed. The patient's history was significant for an abdominal gunshot wound 35 years previously. Emergency surgery at that time consisted of a left external iliac artery ligation and a right to left femoral-femoral bypass. He additionally required a total colectomy, small bowel resection, and ileostomy creation. Gastrointestinal continuity was restored before the patient was lost to follow-up. Previous to his current presentation, the bypass occluded, resulting in nondisabling claudication. Given his hostile abdomen, an emergent endovascular repair was planned to repair both the symptomatic aneurysm and tAVF.

A high groin cutdown was performed to access the proximal right common femoral artery above the prior femoral anastomosis. A high-flow AVF was evident on angiography from the left CIA to the proximal iliac vein or vena cava. A pre-emptive attempt to embolize a large inferior mesenteric artery (IMA) was unsuccessful, given the dynamic motion of the aneurysm from the flow of the iliocaval fistula. Repeated attempts to cannulate the proximal left CIA (antegrade approach; no retrograde approach was possible because of prior external iliac artery ligation) resulted in recurrent dissection secondary to ostial disease and sac mobility. Given the inability to cannulate the tAVF from an antegrade arterial approach, we decided to address the combination of tAVF and AAA in two stages as we thought stabilization of the aneurysmal sac was the most pressing issue. Two Excluder devices (26 mm $\times$ 14.5 mm $\times$ 12 cm; Gore Medical, Flagstaff, Ariz) were used to create an aortouni-iliac configuration to the right side and deployed without evidence of type I or type III endoleak (Fig 2). The operation was terminated, and the patient was transferred to the intensive care unit. CTA in preparation for the secondary intervention demonstrated a significant IMA and lumbar type II endoleak filling the residual sac, with right internal iliac flow shunted to the left-sided AVF through pelvic collaterals.

On hospital day 3, the second-stage procedure was performed to repair the tAVF and type II endoleak (Fig 3). Percutaneous access of the right common femoral artery below the incision was obtained in the interventional suite. Angiography demonstrated the fistulous connection between the left CIA and inferior vena cava as well as a large type II endoleak from the IMA that was accessed through the superior mesenteric artery origin.

At this point, our attention turned to the tAVF. Using the left common femoral vein, selective catheterization of the left CIA was accomplished through the fistulous connection. With assistance from a sizing balloon, a 20-cm Amplatzer II vascular plug (St. Jude Medical, St. Paul, Minn) was chosen per the manufacturer's instructions and deployed with two-thirds protruding into the arterial lumen and the remainder in the venous system. Repeated angiography demonstrated trickle flow through the proximal IMA and the tAVF. Multiple Nester (Cook Medical, Bloomington, Ind) microcoils were deployed in the IMA between its origin and the left colic takeoff through our arterial access. The patient was prescribed low-dose aspirin and discharged home on hospital day 5.

The patient was lost to follow-up secondary to alcohol-related legal issues. However, contact was made 18 months after the procedure, when follow-up CTA demonstrated the absence of

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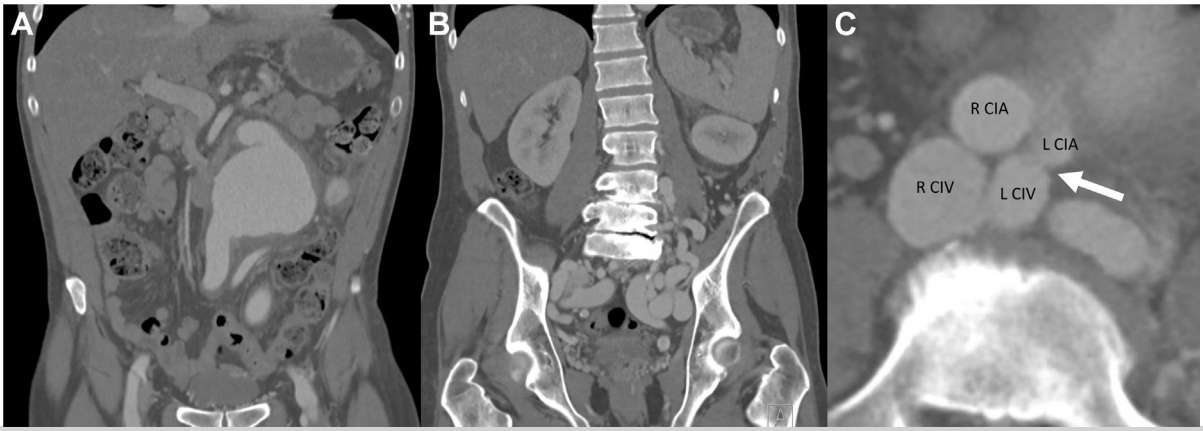

Fig 1. A, Preoperative computed tomography angiography (CTA) demonstrated a large 8.5-cm infrarenal abdominal aortic aneurysm (AAA) concerning for impending rupture and signs of a left-sided iliocaval traumatic arteriovenous fistula (tAVF). **B,** There was significant collateralization in the retroperitoneum, making an open operation prohibitively risky. **C,** Fistulous connection is observed between the left common iliac artery (*CIA*) and the proximal right common iliac vein (*CIV*) or distal vena cava (*arrow*).

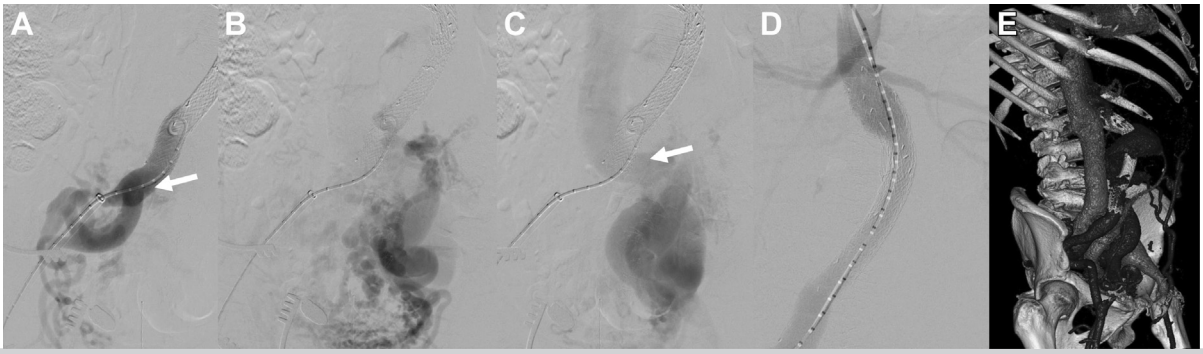

Fig 2. A-C, During the index procedure, injection of the right common iliac artery (CIA; *arrow*) demonstrated flow through pelvic collaterals to the left CIA. An anomalous connection was discovered from the left CIA to the inferior vena cava (*arrow*). **D,** An aortouni-iliac Gore Excluder was deployed to temporize the abdominal aortic aneurysm (AAA), with an excellent angiographic result. **E,** Three-dimensional reconstruction of the postoperative result.

the tAVF, right to left flow of the hypogastrics without signs of venous leak, and residual sac shrinkage to 5.7 cm (Fig 4). Venous-phase images were concerning for a complete occlusion of his left common iliac vein. In the interim, the patient developed increased varicosities to his left lower extremity and some mild scrotal pain but denied edema, erythema, or ulceration. His left ankle-brachial index of 0.73 was not sufficient to warrant further revascularization.

DISCUSSION

AVFs bypass capillary beds, leading to flow of arterialized blood directly into low-resistance venous channels.[1] In the context of aortic disease, spontaneous high-flow AVFs can occur from aneurysmal erosion into the vena cava.[2] AVFs secondary to missed trauma can be more insidious in development and produce dramatic changes over time of flows exceeding 15 to 20 L/min, causing vessel dilation, congestion of collateral vessels, and aneurysmal progression of involved arterial and venous tributaries.[3] In either case, the late development of congestive heart failure is associated with a markedly dilated cardiomyopathy. Simple fistulas, if recognized early, can be repaired through an open approach with minimal risk; endovascular stent coverage is also an alternative if suitable anatomy exists that avoids compromising critical branch vessels.[4]

There is a dearth of knowledge in the endovascular era regarding outcomes after treatment of large-vessel tAVFs. A review of pertinent literature demonstrated that all publications in the last decade were in the form of small case series and case reports. Antoniou et al[5] reviewed endovascular repair of major abdominal tAVFs in these case reports (21 papers, 22 patients) and reported excellent results. Technical success was 96% (22/23), with no perioperative deaths. The most common complication was type II endoleak, which was present in 22% (5/23) of patients. Whereas endovascular repair has been historically encouraged with stable patients,

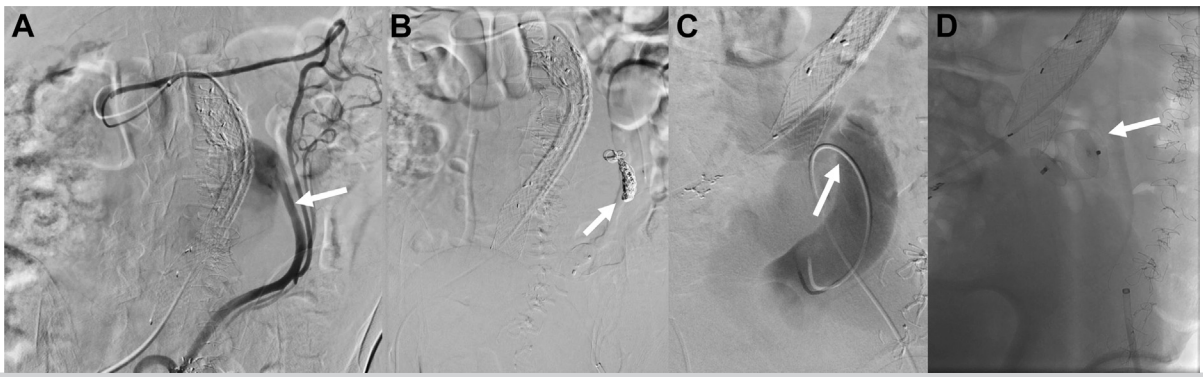

Fig 3. A, Through the superior mesenteric artery, an inferior mesenteric artery (IMA; *arrow*) angiogram was obtained to visualize the large type II endoleak. **B,** Several microcoils (*arrow*) were deployed between the IMA origin and the left colic takeoff to thrombose the endoleak source. **C,** Through the left common femoral vein, the fistulous track (*arrow*) was identified. **D,** An Amplatzer II vascular plug was deployed to close the traumatic arteriovenous fistula (tAVF; *arrow*).

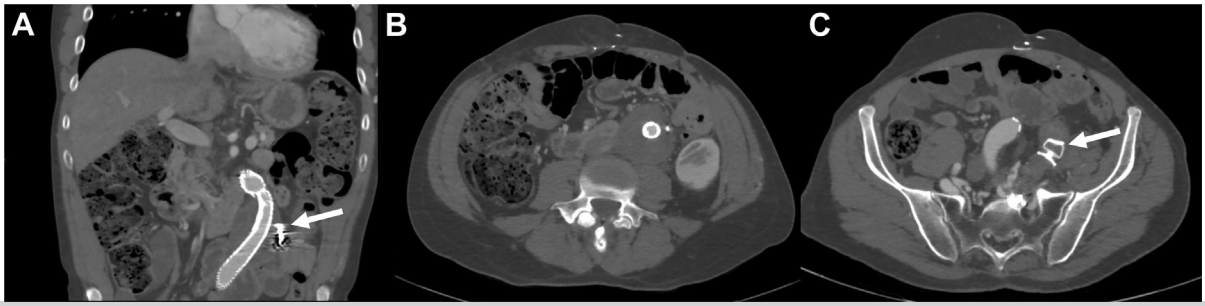

Fig 4. A, Computed tomography angiography (CTA) at 18-month follow-up demonstrated stable position of the endograft and microcoils (*arrow*). **B,** The previously identified type II endoleak was not observed. **C,** The Amplatzer device (*arrow*) was in good position, with no further evidence of traumatic arteriovenous fistula (tAVF).

reports of successful emergent intervention, even in the setting of multiorgan failure, have been published.[6] However, the interventionalist should be wary of a possible loss of sympathetic tone during sudden occlusion of the fistula by the stent, termed the Nicoladoni-Branham sign. This loss of tone may be severe enough to cause cardiac arrest after device deployment.[7]

Perhaps the most robust study came from Brewster et al[8] when they reported their 30-year experience. In this series, 20 combined aortocaval and iliocaval AVFs were treated by open surgical repair. Fourteen fistulas were secondary to aneurysmal erosion, four were secondary to iatrogenic trauma (spinal surgery), and two were from gunshot injury. Not surprisingly, back pain was the most common presenting symptom. Intraoperative blood loss was nearly 6 L, and average cardiac output decreased from 12.2 to 5.4 L/min postoperatively. Two patients died in the perioperative phase, signaling the danger of open repair in this setting.

Given the degree of venous congestion in the setting of a high-outflow tAVF and symptomatic AAA, we believe this patient would not have survived an open operative approach. The preadmission computed tomography scan was concerning for impending rupture; therefore, the goal of the index operation was to temporize the situation and to prevent a catastrophic event, knowing we had to return to fix the fistula and endoleak. After stabilization, we obtained high-quality imaging and electively returned to the operating room to finish the repair.

CONCLUSIONS

We describe the successful staged endovascular treatment of an AAA in danger of rupture in the setting of a massive, chronic tAVF and hostile abdomen. In this patient, acceptable results have been observed at 18-month follow-up with minimal associated morbidity.

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