Temporizing endovascular repair of a ruptured mycotic abdominal aortic aneurysm

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Ruptured mycotic abdominal aortic aneurysms (MAAAs) present a significant treatment challenge requiring emergency attention to control hemorrhage and hemodynamic compromise, surgical evacuation of the nidus of infection, and restoration of flow to compromised organs. We present a rare case of a MAAA with a contained rupture into the inferior vena cava in the setting of phlegmasia alba dolens of the bilateral lower extremities, sepsis, and significant hemodynamic compromise. A staged, hybrid approach with temporizing endovascular aneurysm repair, followed by extra-anatomic bypass and surgical resection of the MAAA, was performed. (J Vasc Surg Cases 2015;1:20-3.)

Ruptured mycotic abdominal aortic aneurysms (MAAAs) present a significant treatment challenge requiring emergency attention to control hemorrhage and hemodynamic compromise, surgical evacuation of the nidus of infection, and restoration of flow to compromised organs. We present a rare case of an MAAA with a contained rupture into the inferior vena cava (IVC) in the setting of phlegmasia alba dolens of the bilateral lower extremities (LEs), sepsis, and significant hemodynamic compromise. Consent to publish this case report was formally obtained from the patient.

CASE REPORT

A 25-year-old man with a history of intravenous drug abuse presented with fevers, back pain, abdominal pain, and significant bilateral LE swelling. The initial workup revealed sinus tachycardia (140 beats/min), extensive, bilateral ileofemoral and femoropopliteal acute-on-chronic deep vein thrombosis (confirmed by venous duplex imaging), leukocytosis (64,000/mm^3), and methicillin-resistant *Staphylococcus aureus* (MRSA) bacteremia. Tenderness to palpation was noted in the epigastrium in addition to a locally palpable thrill, as well as anasarca and phlegmasia alba dolens of the bilateral LEs.

Computed tomography angiography confirmed an infrarenal MAAA with spontaneous decompression via erosion into the IVC resulting in a giant aortocaval fistula (Fig 1, *A*). Diminished distal arterial flow and cavernous transformation of the ileofemoral venous network were also noted (Fig 1, *B*). Noninvasive studies confirmed symmetrically diminished ankle-brachial indexes of 0.7 bilaterally, with dampened aortoiliac pulse-volume recordings. No evidence of active vegetation was seen on echocardiography.

Given the significant acute cardiopulmonary overload in the setting of sepsis, with significant arterialization of an extensively thrombosed venous system, a decision was made to temporize the patient with endovascular aneurysm repair (EVAR) to promptly correct the cardiopulmonary overload by eliminating the arteriovenous shunt and for control of the nidus of infection. Once the patient was medically resuscitated and his hemodynamic status optimized, formal resection of the MAAA, preceded by extra-anatomic bypass, was performed.

Technical details. The procedure was performed in the hybrid operating suite ≤24 hours after initial presentation. To halt further sac erosion and degeneration and to treat the significant arterialization of the venous system, temporizing EVAR was performed through bilateral femoral cutdowns to facilitate insertion of a Gore C3 modular bifurcated endograft (W. L. Gore and Associates, Flagstaff, Ariz), which was strategically placed 2.5 cm distal to the lowest renal artery in anticipation of impending explant (Fig 2). Given significant shunting of arterial blood centrally into the venous system, causing poor filling of the LE arterial tree bilaterally, this patient was not a candidate for percutaneous EVAR.

An ascending ileofemoral venogram was performed at the completion of EVAR showed significant caval compression by the aneurysm sac, with multiple significant draining venous collaterals. There was acute-on-chronic ileofemoral thrombosis refractory to catheter-directed mechanical thrombectomy and open thrombectomy via common femoral venotomy and Esmarch compression.

Procedural outcome. Immediately after EVAR, hemodynamic stability was achieved, with resolution of tachycardia. Phlegmasia improved significantly over the subsequent 3 days, and leukocytosis resolved over a 6-day span. Once results
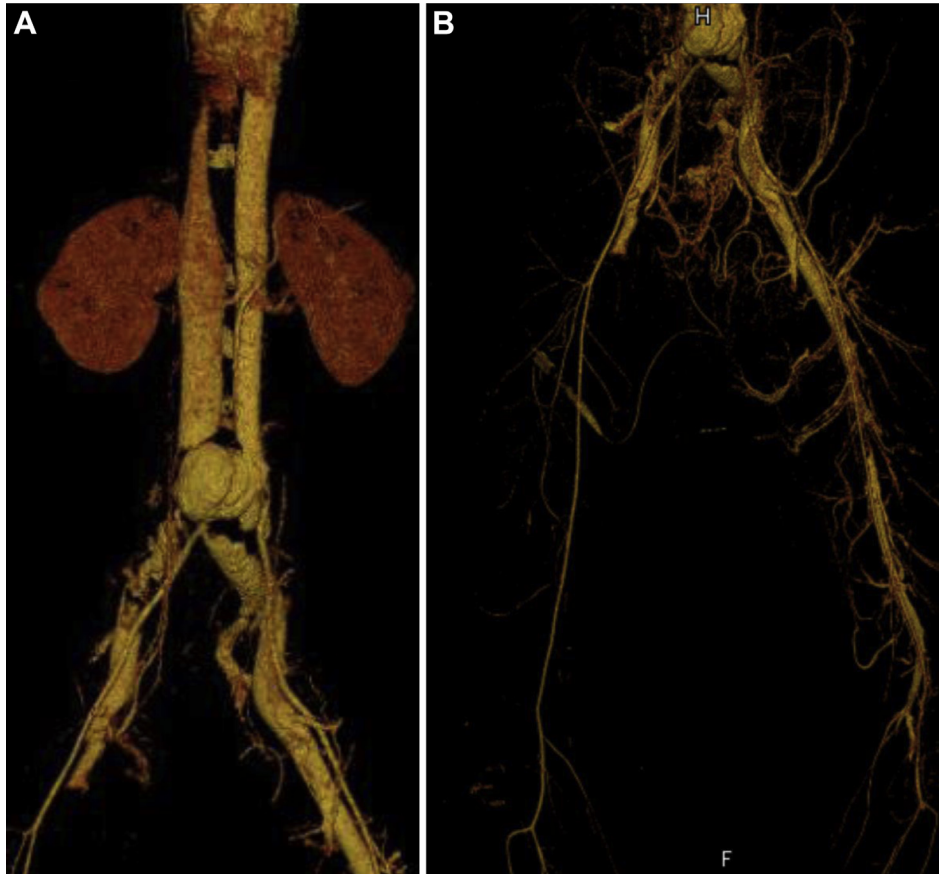
Fig 1. A, Ruptured saccular mycotic abdominal aortic aneurysm (MAAA) with a giant aortocaval fistula. **B,** Note the iliocaval thromboses bilaterally and the significantly diminished distal arterial flow on run-off.

of blood cultures were negative and the patient had remained afebrile for 1 week, bilateral axillary unifemoral bypass grafts were placed to help facilitate transperitoneal endograft explant, with ligation of the aortic stump and the IVC (Fig 3). The explant was performed 24 hours after the extra-anatomic bypass.

The patient tolerated the procedure well, without any complications, recovered in the intensive care unit for 4 days, and was discharged home on postoperative day 10 with normal ankle-brachial indices. He was given 6 weeks of vancomycin administered through a peripherally inserted central catheter. He was seen in follow-up at 1 and 3 months postoperatively and has had a smooth recovery, with no complications.

DISCUSSION

MAAAs generally originate from bacterial or fungal infection of the arterial vessel walls. By definition, a true mycotic aneurysm develops as a result of septic emboli, most commonly from a cardiac origin.[1] Septic emboli becoming lodged in the arterial wall and generating a local infection as well as septic emboli becoming lodged within the vasa vasorum and generating a necrotic process from within the arterial wall are possible.[2] Infectious arteritis, however, refers to a nonembolic phenomenon wherein

secondary infection of an atherosclerotic plaque or any other native arterial pathology or secondary contamination from adjacent organs takes place.[1,3] Regardless of the mode of infection, treatment traditionally involves open surgical debridement of all nonviable tissues with extra-anatomic bypass or in situ repair in certain instances.[4]

Overall, surgical repair has been associated with 11% to 40% in-hospital mortality rate, regardless of the method of repair.[4,5] Assessing whether in situ repair offers any survival advantage compared with extra-anatomic bypass is difficult because there may be confounding variables such as the virulence of the causative organism. Surgical repair does remain the gold standard for treatment, however, despite recent reports and reviews suggesting improved short-term outcomes by mainly palliative endovascular approaches.[6-10]

Fistula formation in the setting of aortic degeneration is rare, appearing in 0.2% to 6% of ruptured aortic aneurysms.[11] Aortoesophageal, aortobronchial, aortocaval, and aortoenteric fistulas have been reported, especially in the presence of infected aneurysms.[12] However, treatment approaches remain variable and mortality remains extremely high.[13,14] Untreated aortocaval fistulas, as in our patient, generally progress to death from congestive

Fig 2. Successful elimination of the aortocaval fistula by deployment of a modular bifurcated endograft positioned purposefully 2.5 cm distal to the lowest renal artery. Immediate normalization of heart rate was noted after endograft deployment was completed.

heart failure. Arterialization of the venous system exacerbates pre-existing venous hypertension and can lead to limb loss, particularly in the setting of extensive bilateral acute-on-chronic deep vein thrombosis with phlegmasia alba dolens, as was the case in our patient.

Given the high morbidity and mortality associated with traditional open repair of a ruptured MAAA with secondary aortocaval fistula in the setting of sepsis and LE compromise, we proceeded with a temporizing procedure to promptly optimize the patient's hemodynamic status and control the source of infection. This allowed time for a temporary recovery and medical optimization before formal surgical excision and extra-anatomic bypass, particularly in the setting of MRSA bacteremia.

Immediate resolution of tachycardia was noted upon deployment of the endograft, which was positioned purposefully 2.5 cm below the level of the renal arteries to facilitate future explant. Significant improvement in LE arterial flow and leukocytosis was also noted over the course of a week postoperatively. Once leukocytosis and

bacteremia had resolved, we proceeded with formal repair of the MAAA via extra-anatomic bypass and explant of the endograft and wide debridement of the MAAA and surgical repair of the aortocaval fistula. Given presence of MRSA, in situ repair via antibiotic soaked grafts was avoided. Furthermore, autogenous venous reconstruction was precluded by the extent of chronic deep vein thrombosis in the bilateral LEs.

CONCLUSIONS

Proceeding directly to an extra-anatomic bypass and surgical resection of a ruptured MAAA in the setting of sepsis and cardiopulmonary overload from significant venous arterialization would have proven unnecessarily morbid and possibly lethal. Indeed, perioperative mortality rates approaching 35% have been reported in the setting of ruptured abdominal aortic aneurysms with secondary aortocaval fistulas.[14] Minimally invasive endovascular techniques are readily available and serve as an invaluable temporizing adjunct in such situations.
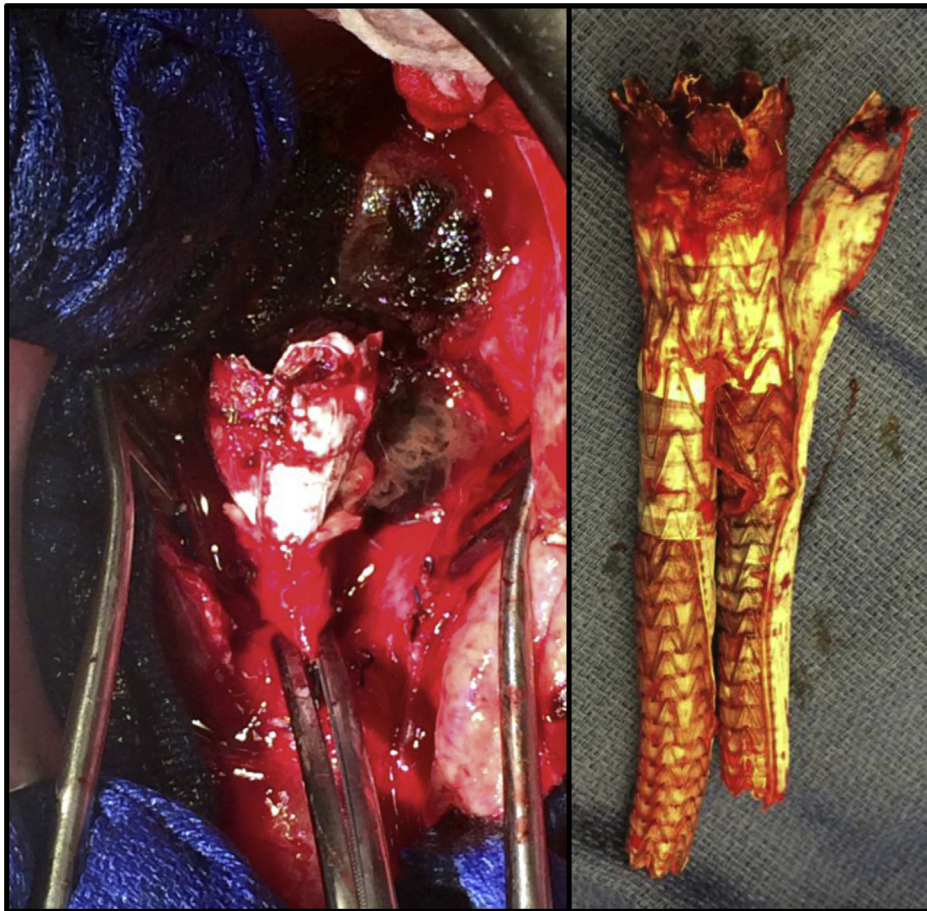
Fig 3. Explant of the temporizing **(right)** endograft at the time of **(left)** open repair of the mycotic aneurysm.

Adherence to tried and true surgical principles, however, remains of primary importance for ultimate patient survival and recovery.

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