Concomitant paravisceral and thoracic mycotic aortic aneurysms in a cirrhotic patient

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ABSTRACT

In the present case report, we have described concomitant, rapidly expanding, abdominal and thoracic mycotic aortic pseudoaneurysms in a patient who had originally presented for right arm superficial thrombophlebitis and a right-hand abscess in the presence of methicillin sensitive *Staphylococcus aureus* bacteremia. Within 12 days, the patient had developed a rapidly expanding paravisceral mycotic abdominal aortic pseudoaneurysm that required open surgical repair. After the initial operation, she developed a thoracic mycotic aortic aneurysm that ultimately required open surgical repair. Her postoperative course after the initial operation was complicated by decompensated hepatitis C cirrhosis that required convalescence before repair of the thoracic aneurysm. Follow-up data were available for ≤10 months after the initial operation. (J Vasc Surg Cases Innov Tech 2021;7:496-501.)

Keywords: Endovascular aneurysm repair; Mycotic abdominal aortic aneurysm; Mycotic aortic aneurysm; Open in situ reconstruction; Thoracic mycotic aortic aneurysm

Mycotic aortic aneurysms (MAAs) comprise 0.6% to 4.5% of aortic aneurysms, with concomitant thoracic MAAs (TMAAs) and abdominal MAAs (MAAAs) comprising only 1.5% of these cases.[1] The complexity of MAAs presents a challenge for surgeons and represents a highly mortal condition.[2-4] Surgical intervention is critical, but no consensus has been reached regarding the preferred operative therapy owing to the diverse pathology.[3] The ultimate intervention depends on the clinical scenario and anatomic location of the MAA. Open in situ reconstruction (OISR) with native aorta resection and/or periaortic debridement has become the accepted surgical approach for TMAAs and MAAAs.[2,3,5] Additionally, endovascular repair has recently emerged as a promising therapy.[1,6,7] We present the case of a patient with a rapidly progressing paravisceral MAAA and concomitant TMAA in the presence of methicillin-sensitive *Staphylococcus aureus* (MSSA) bacteremia and Child's class B cirrhosis requiring separate open repairs. The patient's mother provided written informed consent for the report of her daughter's case details and imaging studies.

CASE REPORT

A 57-year-old woman was transferred to our institution because of concerns for a right hand abscess and cephalic vein suppurative thrombophlebitis. The pertinent initial laboratory test results, history details, and imaging results are presented in the Table. The blood cultures were confirmed positive for MSSA. Broad-spectrum antibiotics were initiated and ultimately tailored to cefazolin. Despite debridement of the hand abscess and aggressive antibiotic therapy, her blood cultures remained positive with no identifiable nidus. On hospital day 12, the patient developed severe abdominal pain. The computed tomography angiogram (CTA) revealed a periaortic abscess extending into the left psoas muscle with a rapidly expanding paravisceral mycotic thoracoabdominal aneurysm with a contained rupture (Fig 1, *A*). The patient was taken to the operating room urgently for open repair owing to concern for an impending free rupture.

Retroperitoneal exposure revealed necrotic tissue surrounding a contained rupture of the aortic wall with significant periaortic inflammation. The aorta was clamped at the supraceliac position and bilateral common iliac arteries. The necrotic tissue and native aorta were excised in their entirety, and a rifampin-soaked Dacron tube graft was sutured into place with left renal artery reimplantation and right renal artery bypass. Additional debridement, irrigation, circumferential omental flap coverage, and closure were performed the next day.

The broad-spectrum antibiotics were maintained and, ultimately, transitioned to rifampin and nafcillin. The postoperative complications included persistent hypertension, decompensated cirrhosis, large volume ascites, hepatorenal syndrome, hypokalemia, and malnutrition. A postoperative CTA revealed a developing mycotic aneurysm of the transverse aortic arch that expanded from 1.6 to 3.2 cm during the course of 8 weeks. The patient required nutritional and medical optimization before repair of the thoracic aneurysm (Fig 2, *A*). Because of concern for impending rupture of the TMAA, the patient

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Table. Patient demographics, comorbidities, and operative variables

Variable	Details
Admission data and patient demographics	
Age	57 years
Gender	Female
Medical history	Hepatitis C cirrhosis (Childs class B); hypertension; depression; mediastinitis secondary to previous PICC line infection 2 years earlier
Pertinent admission laboratory test results	WBC count, 22 $\times$ 10^9/L; LA, 3.2 mmol/L; Cr, 2.1 mg/dL; blood cultures positive for MSSA
Social history	20 Pack-year smoking history; occasional alcohol use; history of intravenous drug abuse
Surgical history	Partial sternotomy and left clavicular head resection secondary to PICC line infection (2017); resection or replacement of infected right knee arthroplasty (2016)
Admission imaging studies	CT scan at OSH showing nonocclusive thrombus of right cephalic vein and fluid collection in dorsum of right hand concerning for abscess; CTA showing hepatic cirrhosis with portal vein hypertension, fluid collection surrounding left subclavian vein and aortic arch, severe luminal narrowing of distal abdominal aorta secondary to significant atherosclerotic disease with no apparent ectatic change; TEE with no concern found for vegetative endocarditis as a source for bacteremia; normal EF
First stage (abdominal)	
Hospital day performed	12
Preoperative MELD score	16
Preoperative APRI	0.3
Patient position	Right lateral decubitus
Procedural details	Retroperitoneal exposure of thoracoabdominal aorta with extensive debridement of aortic tissue; aortic replacement with rifampin-soaked Dacron graft; right renal artery bypass with Dacron; reimplantation of left renal artery; proximal anastomosis just inferior to celiac trunk; ABTHERA application with washout and closure on POD 1
Operative time	266 Minutes
Supraceliac clamp time	23 Minutes
EBL	4.3 mL
Intraoperative transfusions	5 U of RBCs, 2 U of FFP, 1 U of PLT, 4 L of Isolyte
Postoperative APRI	0.5
Postoperative MELD score	23
Preoperative echocardiography	EF >55%; no vegetations
Second stage (thoracic component)	
Time from first stage	62 Days (hospital day 74)
Preoperative MELD score	13
Preoperative APRI	0.3
Procedural details	Total aortic arch replacement and debridement with rifampin-soaked Dacron arch graft; cardiopulmonary bypass required
Operative time	240 minutes
EBL	535 mL
Intraoperative transfusions	3 U of pRBCs, 2 U of FFP, 2 U of PLT
CPB time	102 Minutes
Aortic cross-clamp time	45 Minutes
Postoperative details	
Overall length of stay	83 Days (POD 70 from index procedure)
Echocardiography	40%-45% EF during follow-up
Initial discharge	Discharged to inpatient rehabilitation

(Continued on next page)

Table. Continued.

Variable	Details
Readmission 1	Postdischarge day 16: readmitted for sternal wound infection requiring sternectomy, pectoral flap coverage, and NPWT
Second discharge	Discharged home with home healthcare and physical therapy
Readmission 2	8 Months after initial discharge, she was readmitted for atrial fibrillation requiring ablation and initiation of anticoagulation
Follow-up duration	10 months
Final postoperative imaging	CTA of chest, abdomen, and pelvis at 8 months demonstrated stable appearance of aortic repair
Miscellaneous details	
Consultations	Cardiothoracic surgery, wound care, infectious disease, hepatology, plastic surgery, pain management, palliative care
Aspirin	Yes
Statin	Yes
Anticoagulation	Apixaban (Eliquis; after atrial fibrillation diagnosis)
Considerations for other approaches	
Palliative approach	Discussed goals of care with the patient, who wished to pursue aggressive management and continued to optimize her health, working with all consultants and physical therapy
BEVAR/FEVAR	Because of the virulence of the organism identified and the patient deemed not prohibitively at high risk for open repair by a team of experts, we elected not to pursue fenestrated repair for fear of failure of the graft owing to infection-related complications

APRI, Alanine aminotransferase/platelet ratio index; *BEVAR,* branched endovascular aneurysm repair; *CPB,* cardiopulmonary bypass; *CT,* computed tomography; *CTA,* computed tomography angiography; *EBL,* estimated blood loss; *EF,* ejection fraction; *FEVAR,* fenestrated endovascular aneurysm repair; *FFP,* fresh frozen plasma; *LA,* lactic acid; *MELD,* model for end-stage liver disease; *MSSA,* methicillin-sensitive *Staphylococcus aureus*; *NPWT,* negative pressure wound therapy; *OSH,* outside hospital; *PICC,* peripherally inserted central catheter; *PLT,* platelets; *POD,* postoperative day; *pRBCs,* packed red blood cells; *RBCs,* red blood cells; *TEE,* transesophageal echocardiography; *WBC,* white blood cell.

underwent total aortic arch replacement with a rifampin-soaked arch graft (Fig 2, *A*). The intraoperative tissue cultures were positive for MSSA. The postoperative complications and follow-up data are also presented in the Table. Late follow-up data revealed negative blood cultures and a stable appearance of the aortic repairs on a CTA (Figs 1 and 2, *B*). However, she died at 10 months postoperatively of an unknown cause.

DISCUSSION

MAAs are rare in clinical practice and in the literature. The surgical treatment of patients with multifocal MAAs is important to highlight, because these patients can require additional operations with resulting increased mortality. Most MAAAs will affect the infrarenal aorta (51%) but have shown a greater propensity to affect the paravisceral aorta (13%-20%) or suprarenal segment (15%) compared with degenerative atherosclerotic aneurysms.[3,4,8-10]

Staphylococcus aureus (50%-60%) and nontyphoidal *Salmonella* (30%-40%) are the most commonly isolated microorganisms.[3,10-12] Infection results in rapid aortic weakening, leading to a high risk of rupture in MAAs, with an incidence of 50% to 85%.[3,4] The use of the blood cultures is critical to optimize antibiotic therapy. Specifically, *S. aureus* is known to be quite virulent and is associated with a poor prognosis if isolated from patients with MAAs.[3,13-15] Although some have advocated for extra-anatomic bypass (EAB) in severely infected fields, specific operative guidelines based on microorganism data have not been established. However, ~50% of MAAs will have negative culture results, and waiting for the culture results can delay care.[3]

Historically, EAB with aortic resection was the preferred surgical treatment of MAAAs. OISR and extensive tissue debridement with rifampin-soaked Dacron, cryopreserved allograft or femoral vein reconstruction (neo-aortoiliac system [NAIS]) have all been reported.[6,12,16-18] These additional options for OISR using biologic conduits such as cryopreserved allografts or xenografts have an estimated 5-year survival of 71% that is slightly superior to prosthetic OISR (60%-67%).[1,6,12,18] Some investigators have preferred in-line reconstruction with omental coverage owing to the adaptability of the procedure, superior primary patency, and lower incidence of major complications compared with EAB.[2,3,5,19,20] However, a recent retrospective study revealed similar long-term survival and infection-free survival between OISR and EAB in the repair of aortoenteric fistulas.[21] The NAIS and cryopreserved allografts have demonstrated increased resistance to reinfection; however, their use has been associated with longer operative times and a greater physiologic insult.[12,18,19] Cryopreserved allografts might

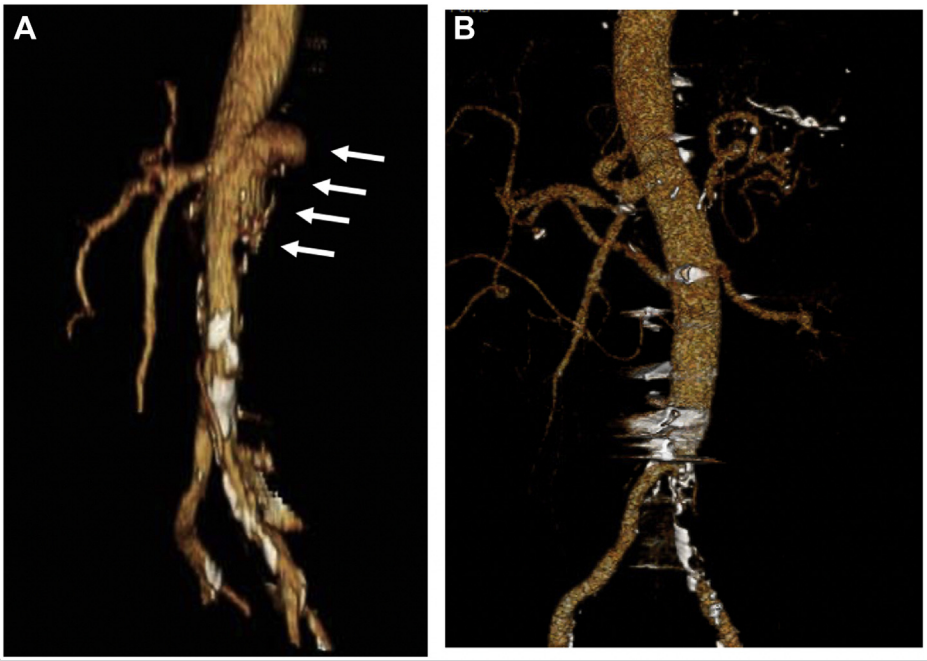

Fig 1. Radiographic images of abdominal mycotic aortic aneurysm (MAA). **A,** Three-dimensional reconstruction demonstrating a paravisceral abdominal MAA (MAAA; *arrows*) with a pseudoaneurysm just above the left renal artery. **B,** Postoperative three-dimensional reconstruction allowing for visualization of proximal and distal anastomoses and visualization of the left renal artery reimplantation and bypass graft from the right renal artery.

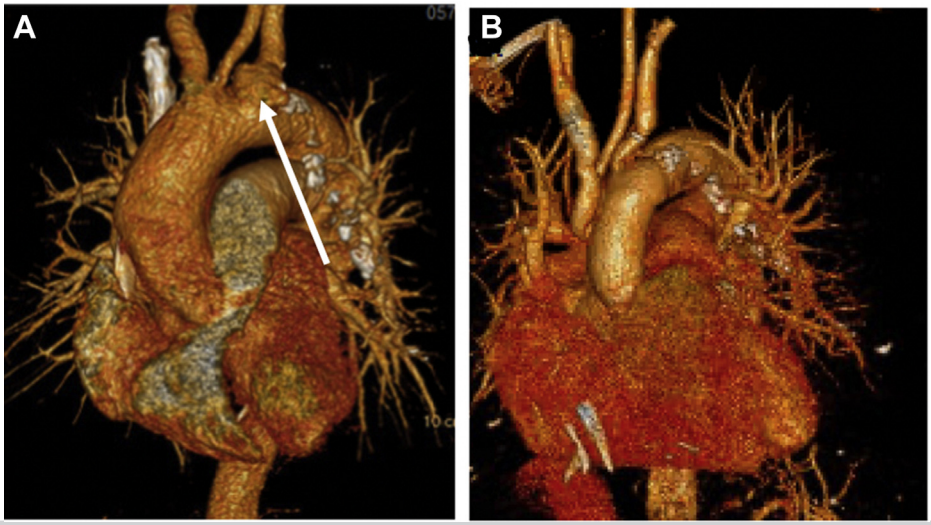

Fig 2. Pre- and postoperative imaging studies of thoracic mycotic aortic aneurysm (TMAA). **A,** Three-dimensional reconstruction demonstrating rapidly expanding TMAA before repair. **B,** Three-dimensional reconstruction after repair and total arch replacement.

not be readily available and using either cryopreserved allografts or a NAIS reconstruction could be limited by a size mismatch or an inadequate length to reach the distal target.[19]

Deploying a prosthesis in an infected field without extensive debridement remains a major concern in using endovascular aneurysm repair (EVAR) as definitive management for MAAs. Thus, OISR has remained the preferred therapy, with EVAR reserved as a temporizing measure for hemodynamically unstable patients and those who are not candidates for open surgery.[3,22-25] Recently, EVAR has achieved recognition as a potential definitive therapy for MAAs with superior perioperative survival (91%-99% vs 81%-89%) and comparable 5-year survival (58% vs 60%) compared with OISR.[1,6] However, for paravisceral MAAs, the incidence of infection-related complications such as sepsis, graft infection or failure, recurrence, and aortoenteric fistulas with EVAR has

been shown to be as high as 33% vs 20% with OISR.[6] Rifampin-soaked endografts have also been used to improve the durability of EVAR.[24,26]

Aortic arch TMAAs are exceedingly rare in clinical practice and in the literature. The options for the repair of TMAAs include OISR with prosthetic or cryopreserved grafts, thoracic endovascular aneurysm repair (TEVAR; fenestrated/branched), and hybrid repair.[7,27] Depending on the aneurysm location, arch debranching might be necessary for complete resection of the affected segments.[27] Hsu and Lin[27] reported 65% survival at 1 year for a cohort of 25 patients with TMAAs who had undergone OISR, with significant favor for those with involvement of only the descending aorta. Sörelius et al[7] demonstrated a 5-year survival of 71% for patients undergoing TEVAR. In their study, only 11% of the patients had had TMAAs affecting the aortic arch.[7] In general, the incidence of infection-related complications after TEVAR and OISR has been comparable (16% vs 18%), with an associated mortality after TEVAR of 66%.[7,27] Biologic grafts for TMAAs have also been used for infected thoracic endografts, with a 5-year survival of 64%.[16]

Delays in operative intervention for patients with MAAs have been associated with poor outcomes and increased aneurysm-related mortality.[14,28] Some investigators have delayed operative or endovascular intervention to observe for a response to antibiotic therapy in the absence of concerning signs or symptoms.[13,14] Our case demonstrated both approaches in that urgent intervention was performed in the wake of contained rupture in stage 1 with delay before the second stage for medical and antimicrobial optimization. Imaging findings indicating the presence of rapid expansion, a contained rupture, or pseudoaneurysm formation should prompt more urgent intervention.[13,28]

CONCLUSIONS

The details from the present case have highlighted the challenges of MAAs in the setting of synchronous infections in multiple anatomic locations. A high index of suspicion and an early diagnosis is imperative for these patients, with prompt surgical management, including aggressive debridement of the infected aorta and surrounding tissues, wound cultures, and organism-directed antibiotic therapy. Patient comorbidities and the possibility of concomitant MAAs should be factored into the operative decision-making.

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