Case Reports

Management of a Mycotic Thoracoabdominal Aortic Aneurysm Involving the Celiac Artery

Ahmet Dolapoglu, MD
Kim I. de la Cruz, MD
Joseph S. Coselli, MD

Key words: *Aneurysm, infected/diagnosis/microbiology/surgery/therapy; aortic aneurysm, abdominal/diagnosis/microbiology/surgery; streptococcal infections/diagnosis/surgery/therapy; treatment outcome; vascular surgical procedures*

From: *Department of Cardiovascular Surgery (Drs. Coselli, de la Cruz, and Dolapoglu), Texas Heart Institute; Department of Cardiovascular and Thoracic Surgery (Drs. Coselli, de la Cruz, and Dolapoglu), CHI St. Luke's Health–Baylor St. Luke's Medical Center; and Division of Cardiothoracic Surgery, Michael E. DeBakey Department of Surgery (Drs. Coselli and de la Cruz), Baylor College of Medicine; Houston, Texas 77030*

Dr. Coselli serves as principal investigator for clinical trials conducted by Medtronic, Inc., W.L. Gore & Associates, and Cook Medical, Inc. He spoke at a meeting sponsored by Medtronic, serves on an advisory board for W.L. Gore, and consults with and receives royalties from Vascutek Ltd., a Terumo company.

Address for reprints: *Kim I. de la Cruz, MD, Division of Cardiothoracic Surgery, Michael E. DeBakey Department of Surgery, Baylor College of Medicine, 6770 Bertner Ave., C-330, Houston, TX 77030*

E-mail: *kimdlc@bcm.edu*

A mycotic aneurysm that also involves the visceral arteries is a life-threatening condition. Surgical management typically consists of débridement and in situ repair with a Dacron graft and reimplantation of the involved visceral branches. We report a rare case of a mycotic saccular thoracoabdominal aortic aneurysm involving the celiac artery, with Streptococcus pneumoniae *as the responsible organism. Successful repair of the aneurysm and concomitant revascularization of the celiac artery were achieved.* ***(Tex Heart Inst J 2016;43(6):528-30)***

A mycotic aortic aneurysm (AA) is a rare and dangerous condition that is associated with substantial morbidity and mortality rates. It is defined as an aortic aneurysm with one or more of the following clinical signs: fever, elevated white blood cell count, positive blood or aneurysmal wall cultures, or purulent operative findings. Of all aortic aneurysms, 0.8% to 3.4% are mycotic.[1] Those mycotic AAs that involve visceral arteries can result in disastrous sequelae, such as gangrene of the intestine. Here we present an account of the successful treatment of a mycotic thoracoabdominal aortic aneurysm (TAAA) that was accompanied by celiac artery occlusion.

Case Report

In May 2015, a 60-year-old woman presented with a 2-month history of back pain, which was associated with postprandial nausea and unintended weight loss. Before her admission, her gastric symptoms had led her to undergo esophagogastroduodenoscopy and colonoscopy, the results of which were specific for gastritis, hemorrhoids, and anal fissure. She had a history of hypertension and fibromyalgia and was taking nitrofurantoin for a recent urinary tract infection.

Computed tomographic (CT) scans revealed a saccular aneurysm of the thoracoabdominal aorta, together with occlusion of the celiac artery and reconstitution via multiple small collateral arteries (Figs. 1 and 2). Her laboratory values were notable for leukocytosis (white blood cell count, 17 $\times 10^3$/mL) and a platelet count of 778,000/mm^3. Her blood and urine cultures on admission were negative.

We chose to perform an open Crawford extent III TAAA repair, with reimplantation of the celiac axis using a prefabricated single-branched graft. Cerebrospinal fluid was drained preoperatively to protect the spinal cord. With the patient under endotracheal general anesthesia, a left thoracoabdominal incision was made through the 8th intercostal space. The left lung was collapsed with a double-lumen endotracheal tube. We divided the diaphragm and exposed the aneurysm (Fig. 3A). After administering heparin, we cross-clamped the mid-descending thoracic aorta. The aneurysm was opened, and the intraluminal thrombus was evacuated. We widely débrided the opened aortic wall, the appearance of which was consistent with infection. After soaking an 18-mm Dacron graft in rifampin (our standard choice of antibiotic when treating mycotic aneurysms), we anastomosed the graft to the affected segment of the aorta in an end-to-end fashion, with the distal anastomosis performed just proximal to the origins of the superior mesenteric artery. After endarterectomy, we sutured (also end-to-end) an 8-mm prefabricated side branch to the celiac artery (Fig. 3B).

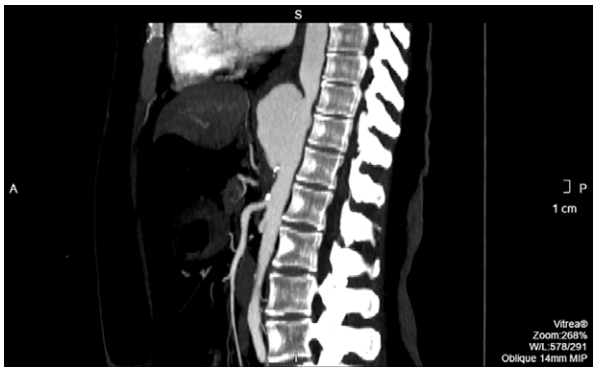


Fig. 1 *Preoperative computed tomographic scan (lateral view) shows the saccular aneurysm originating from the thoracoabdominal aorta (necessitating extent III repair). The aneurysm extends to the occluded celiac artery.*

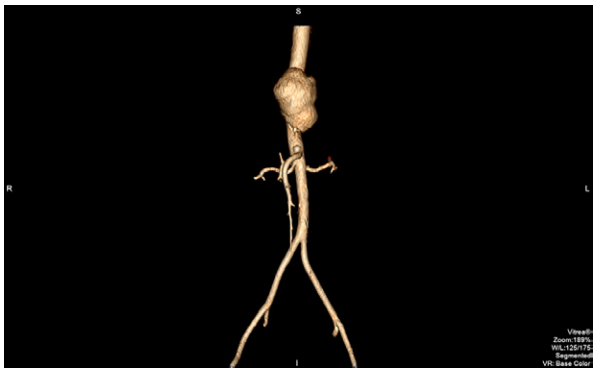
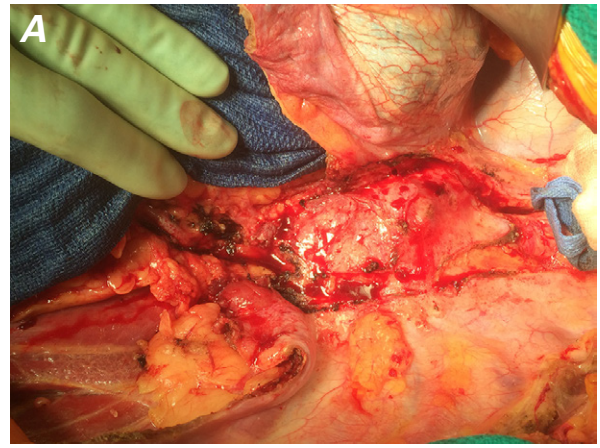


Fig. 2 *Computed tomographic scan (3-dimensional reconstruction) shows the distinctive shape of the saccular aneurysm, which incorporates the celiac axis in its distal aspect.*



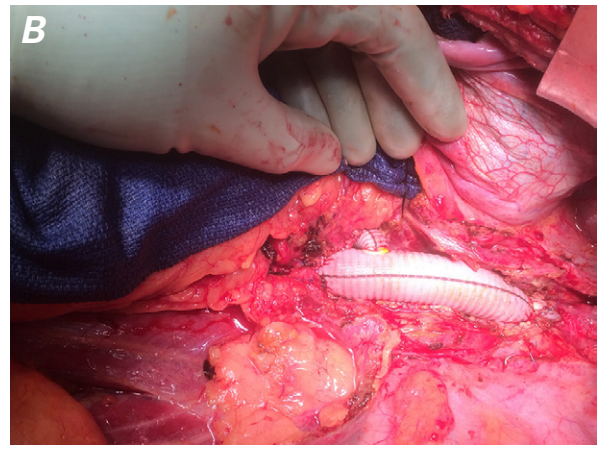


Fig. 3 *Intraoperative photographs show **A**) the exposed mycotic aneurysm and **B**) the Dacron graft in situ, with a distal aspect of the prefabricated side branch anastomosed end-to-end to the celiac artery.*

Distal pulses were positive after the procedure. Empiric therapy with vancomycin and ertapenem was begun. After an intraoperative culture was positive for *Streptococcus pneumoniae*, our infectious disease department evaluated the patient and changed her antibiotic agent to intravenous levofloxacin, which shortly thereafter was changed to oral levofloxacin. Aerobic, anaerobic, fungal, and tuberculous (QuantiFERON®-TB Gold) cultures were all negative. The postoperative course was uneventful. The patient was discharged from the hospital 9 days after repair, with directions to continue a 6-week course of antibiotic therapy. To prevent recurrent infection, she remained under the care of her local infectious disease specialist. More than 17 months after repair, this patient was well and free of such infection.

Discussion

Mycotic aortic aneurysm is a rare but life-threatening condition with a prevalence of 1.8% among all patients with TAAA.[2] Whereas the intact aortic wall is highly resistant to infection, congenital defects and intimal diseases (such as atherosclerosis) can render the aortic wall susceptible. Mycotic aneurysms are most often caused by gram-negative bacilli, gram-positive cocci, *Candida* species, *Bacteroides fragilis*, mycobacteria, and clostridia. The most common causes of aortic infection are urinary tract infection, gastrointestinal infection, salmonellosis, respiratory infection, cellulitis, osteomyelitis, wound infection, dental extraction, and intravenous line sepsis.[3] Although the preoperative blood and urine cultures were negative in the current case, the patient's recent urinary tract infection or her prior gastrointestinal exploration might have been the source of the infection and resulting aneurysm.

Mycotic aneurysm must be ruled out in patients with fever, abdominal or back pain, and a pulsatile abdominal mass. Leukocytosis and an elevated erythrocyte sedimentation rate are often present, but these are nonspecific findings, and blood cultures might be negative. In the present case, the results of a culture of an intraoperative specimen were positive for *S. pneumoniae*, although the patient's blood and urine cultures had been negative upon admission.

The CT results in the present case revealed a saccular aneurysm (highly suggestive of infection), rather than the more common fusiform aneurysm. Other such CT findings include a rapidly growing or newly developed aneurysm, air in the aortic wall, contrast leakage, and a soft tissue mass surrounding the aorta.

Mycotic aneurysm is a fulminant condition that can cause serious sequelae, such as visceral artery occlusion, aortic fistula, and aortic rupture. Gastrointestinal symptoms or renal failure can occur if the aneurysm involves the visceral and renal arteries; such involvement is associated with an increased risk of morbidity and death. We speculate that occlusion of the celiac artery could have caused our patient's symptoms of unintended weight loss and postprandial nausea, because this artery provides circulation to the stomach, to the superior half of the duodenum, and to other organs.

Because of the potential for life-threatening sequelae, all infected aneurysms should be treated immediately. The conventional treatment for mycotic AA is surgical resection, extensive débridement, and revascularization, followed by the administration of an appropriate antibiotic. For revascularization, either in situ graft reconstruction or extra-anatomic bypass with aortic extirpation can be performed. Although in situ graft reconstruction can increase the risk of graft infection, previous studies have shown that extra-anatomic bypass is associated with a higher incidence of late vascular sequelae that include rupture of the residual aortic stumps, which renders TAAA reconstruction technically challenging.[4] In patients with visceral or renal arterial occlusive lesions, reimplantation or endarterectomy is recommended for reducing the risk of ischemic sequelae after repair.

Although endovascular treatment is another option for myotic AA patients who are poor candidates for open surgery or who have acute aortic rupture,[5] such repair is not yet approved for TAAAs, and open repair is generally favored in cases of infection. Furthermore, in this case, the aneurysm involved the occluded celiac axis, which necessitated open reimplantation with a side branch. Therefore, we decided to use open surgical treatment, instead of an endovascular technique.

After surgical or endovascular intervention, long-term antibiotic prophylaxis against the identified organism is often recommended to prevent recurrent graft infection. Our current practice is to prescribe 6 weeks of intravenous antibiotic therapy followed by lifelong oral antibiotic therapy.

A few cases of mycotic AA associated with visceral artery occlusion have been reported.[6-8] However, to our knowledge, this is the first report of an infected aneurysm that involved only the celiac artery.

In our case, the patient had a mycotic aneurysm along with celiac artery occlusion. We performed in situ graft reconstruction to reduce the risk of late, graft-related sequelae, and we reimplanted the celiac artery to lower the risk of acute gastrointestinal ischemia, which is highly lethal should it occur.

Careful long-term monitoring is important in the treatment of these patients. Clinical signs of recurrent infection, such as fever and abdominal or back pain, should prompt further aggressive investigations. Blood cultures, white blood cell count, erythrocyte sedimentation rate, and C-reactive protein tests are important adjuncts to support the clinical impression, thereby guiding the duration of the antibiotic treatment. We also recommend CT scanning for monitoring annually and when symptoms arise.

In conclusion, in patients with fever, abdominal or back pain, and pulsatile abdominal mass, mycotic AA must be considered a possible cause. Emergency surgical resection and revascularization comprise the principal treatment plan, along with reimplantation of any involved visceral arteries. After surgical treatment, patients need to be evaluated for an appropriate long-term antibiotic regimen consistent with the surgical specimen and blood culture results, to prevent recurrent graft infection.

Acknowledgment

The authors thank Stephen N. Palmer, PhD, ELS, for editorial support.

References

1. Chan P, Tsai CW, Huang JJ, Chuang YC, Hung JS. Salmonellosis and mycotic aneurysm of the aorta. A report of 10 cases. J Infect 1995;30(2):129-33.
2. Svensson LG, Crawford ES. Aortic dissection and aortic aneurysm surgery: clinical observations, experimental investigations, and statistical analyses. Part I. Curr Probl Surg 1992;29(11):817-911.
3. Katz SG, Andros G, Kohl RD. Salmonella infections of the abdominal aorta. Surg Gynecol Obstet 1992;175(2):102-6.
4. Hagendoorn J, de Vries JP, Moll FL. Primary infected, ruptured abdominal aortic aneurysms: what we learned in 10 years. Vasc Endovascular Surg 2010;44(4):294-7.
5. Heneghan RE, Singh N, Starnes BW. Successful emergent endovascular repair of a ruptured mycotic thoracic aortic aneurysm. Ann Vasc Surg 2015;29(4):843.e1-6.
6. Atnip RG. Mycotic aneurysms of the suprarenal abdominal aorta: prolonged survival after in situ aortic and visceral reconstruction. J Vasc Surg 1989;10(6):635-41.
7. Gupta AK, Bandyk DF, Johnson BL. In situ repair of mycotic abdominal aortic aneurysms with rifampin-bonded gelatin-impregnated Dacron grafts: a preliminary case report. J Vasc Surg 1996;24(3):472-6.
8. Itatani K, Miyata T, Komiyama T, Shigematsu K, Nagawa H. An ex-situ arterial reconstruction for the treatment of an infected suprarenal abdominal aortic aneurysm involving visceral vessels. Ann Vasc Surg 2007;21(3):380-3.