ELSEVIER

Staged Open, Endovascular, and Hybrid Repair of Concomitant Mycotic Aneurysms

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Primary mycotic aneurysms of the aorta are a rare but life-threatening condition. A 59-year-old woman developed a back abscess secondary to an insect bite. A computed tomography scan revealed 3 concomitant mycotic aneurysms, including a rupture. Staged repair was undertaken: immediate open repair for contained rupture of a type IV thoracoabdominal aortic aneurysm, followed by endovascular repair of a descending thoracic aneurysm 3 weeks later and finally an aortic arch hybrid repair of a left subclavian artery aneurysm 16 months later. She remains well postoperatively. There is currently no consensus on the timing of repair or modality of treatment of mycotic aneurysms. Each patient should be treated individually based on aneurysm location, rupture, and comorbidities, as shown by this case.

Primary mycotic aneurysms of the aorta (MAAs) are a rare but life-threatening condition with an incidence ranging from 1.31%[1] to 3%.[2] Infected aneurysms of the aortic arch,[3] thoracic aorta,[4] and suprarenal abdominal aorta[5] are rare, with only sporadic case reports or small case series. The mortality rate is extremely high without surgical treatment, but reported hospital mortality can also be significant,[1] particularly because of severe medical comorbidities, the magnitude of surgery, and patient instability caused by systemic sepsis and, commonly, rupture.[6] We report a case of complex concomitant MAAs at the left subclavian artery origin, the descending thoracic aorta, and the suprarenal abdominal aorta, including a contained rupture, and outline the management strategy used.

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CASE REPORT

A 59-year-old woman developed a painful red swelling on her upper back after an insect bite. The abscess was drained and *Streptococcus pneumoniae* and Prevotella species of bacteria were found on culture. She had continued back pain, and a computed tomography (CT) scan performed 6 weeks later revealed multiple MAAs. She was treated with intravenous antibiotics, but repeat imaging revealed a rapid expansion of the aneurysms, including a contained rupture of the visceral segment aneurysm. There were no surgical treatment options available in her home country, and she was transferred to our regional vascular unit.

On admission, she was pyrexial with a white blood cell count of 9.0 $\times$ 10^9/L and a C-reactive protein level of 56 mg/L (normal range: <10 mg/L). A CT scan revealed 3 concomitant MAAs, including a 3-cm left subclavian artery aneurysm (Fig. 1), a 5-cm descending thoracic aneurysm (Fig. 1), and a contained rupture of a 12-cm Crawford type IV thoracoabdominal aortic aneurysm (TAAA; Fig. 2). The diagnosis of a MAA was based on the presence of all of the diagnostic features of a mycotic aneurysm: sepsis (i.e., fever and pain), positive blood culture, and the characteristic radiologic appearance of the aneurysm wall (i.e., irregular aortic wall, rapid growth rate, and saccular appearance).

The ruptured type IV TAAA was repaired the same day as her transfer to our unit. An open thoracolaparotomy was performed with medial visceral rotation and revascularization of the celiac axis, superior mesenteric artery, and left renal artery. A Dacron graft (DuPont, Kinston, NC) was used with a long beveled proximal anastomosis

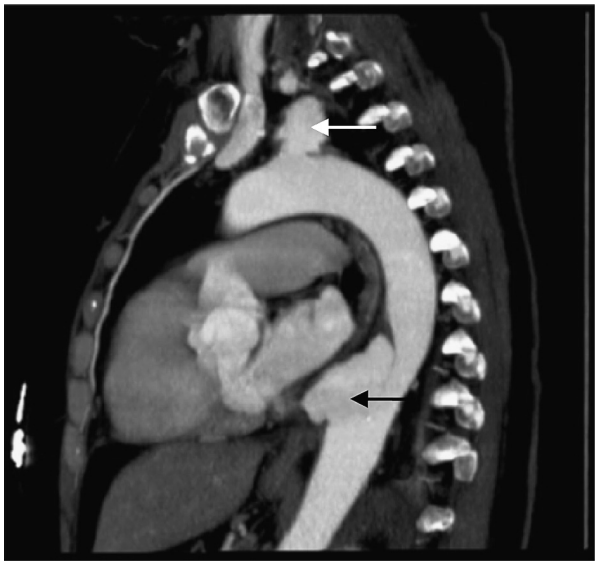

Fig. 1. Left subclavian (white *arrow*) and descending thoracic (black *arrow*) aneurysms.

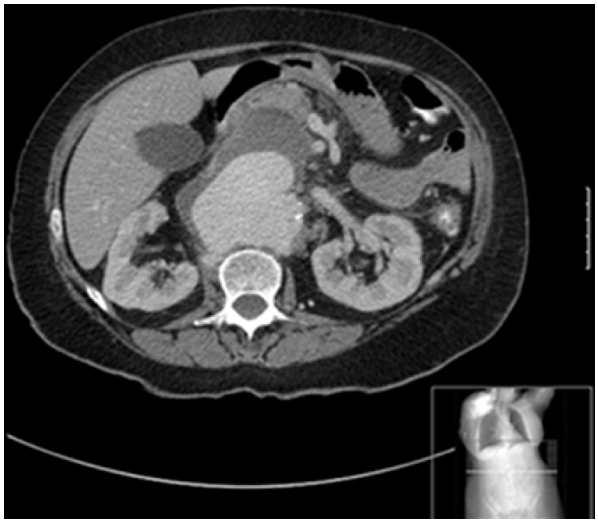

Fig. 2. Ruptured visceral segment aneurysm.

to incorporate the 3 vessels, with the distal anastomosis at the confluence of the aortoiliac bifurcation. The graft was soaked in rifampicin (600 mg, diluted with 10 mg water for injection) for 30 min before implantation. The right renal artery could not be salvaged because it was intimately involved in the aneurysm rupture. Three weeks later, the patient underwent the second stage of her treatment to exclude the descending thoracic aneurysm. A Valiant (Medtronic, Minneapolis, MN) thoracic stent was deployed from the mid-descending thoracic aorta to above the celiac axis.

Sixteen months later, the third stage of the repair was undertaken, when an aortic arch hybrid repair of the left subclavian aneurysm was performed. The aneurysm arose directing from the aortic arch and did not involve the origin of the vertebral artery. The proposed proximal landing zone of the stent involved coverage of the origins of the left carotid and subclavian arteries. Patency of the left vertebral artery was required to reduce the risk of spinal cord ischemia because of the extensive thoracic coverage by the stent grafts. Additional adjuncts to prevent spinal cord ischemia included cerebrospinal fluid drainage to maintain a pressure of <10 mm Hg and elevation of the mean arterial pressure to >80 mm Hg. A right to left carotid–carotid Dacron crossover graft (DuPont) was tunneled retropharyngeally, and a left carotid–subclavian bypass was performed. The left subclavian artery was then ligated proximal to the origin of the left vertebral artery. The thoracic stent graft was landed, covering the origin of the left carotid and subclavian arteries and excluding the aneurysm (Fig. 3).

The patient made a rapid recovery, and follow-up CT scan surveillance at 3 years revealed successful exclusion of the aneurysms and satisfactory graft flow with no endoleaks or stent migration (Fig. 4). The right kidney is atrophic, but there has been no deterioration of her renal function. She remains well postoperatively, and given the stable appearance of the aorta, additional imaging will be performed in 2 years. She underwent a 6-week course of intravenous ceftriaxone (cephalosporin) and teicoplanin (glycopeptide) after the initial procedure, and will remain on lifelong oral rifampicin and doxycycline (tetracycline), which was subsequently changed to trimethoprim because of nausea and patient intolerance. She has not experienced any septic complications or evidence of prosthesis infection.

Discussion

This case posed a complex problem because of the presence of multiple MAAs, including a rupture. A potential option to treat the ruptured type IV aneurysm was a hybrid repair with visceral revascularization and endovascular stenting to exclude the thoracic and visceral aneurysms simultaneously. However, a transperitoneal approach to the aorta to debranch the viscera bore the risk of converting the contained rupture to a free rupture, and we had to treat the rupture immediately. Treating the intact concomitant aneurysms simultaneously would have significantly increased the magnitude of intervention and the potential for complications in a compromised patient. It would also have increased the risk of spinal cord ischemia caused by the extensive thoracic and thoracoabdominal aortic coverage, without allowing time for the development of collaterals. We also wanted to treat the patient aggressively with intravenous antibiotics before the implantation of stent grafts. A staged approach was therefore used.

Salmonella and *Staphylococcus aureus* are the most common pathogens involved,[7] but other organisms, such as Klebsiella,[6] Streptococcus, and Prevotella species[8] (as in this case) have also been evident on culture. Preoperative antibiotics should be prescribed where possible and as soon as a mycotic aneurysm is suspected. The duration