Endovascular repair of a mycotic thoracic aortic aneurysm in a patient with aortic coarctation

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This report describes the management of a 28-year-old female patient who presented with septicemia and mediastinal mass-effect secondary to a proximal mycotic aneurysm of the descending aorta. The patient had an infected bicuspid aortic valve, aortic coarctation, and a left vertebral artery arising directly from the aortic arch. Evidence of disseminated embolization affecting her posterior cerebral circulation, the left axillary, and the superior mesenteric arteries was noted. The patient had a considerably small aorta. An urgent thoracic endovascular aortic repair was performed successfully with a chimney stent to the left vertebral artery. The report discusses the planning and technique used in managing this complex case. (J Vasc Surg Cases 2015;1:154-6.)

Bicuspid aortic valve (BAV) is the commonest congenital cardiac anomaly. It affects between 1% and 2% of the population.[1] Up to 5% of individuals with BAV will also have aortic coarctation (AC).[2] Infective endocarditis (IE) is a serious complication of BAV. IE will develop at some stage in up to 30% of patients with BAV, with IE often being the first presentation of BAV. Men, young adults, and those with regurgitant BAV are at an increased risk of developing IE.[1,3] Septic embolization is a known complication of IE occurring in up to 50% of cases. However, for these emboli to cause mycotic aneurysm formation is uncommon.[4] *Streptococcus* species are responsible for >50% of IE, with the oral variety responsible for nearly 24% of cases.[5]

In this report, we present the management of what we believe to be the first case of a thoracic endovascular aortic repair (TEVAR) in a patient with AC and a mycotic thoracic aortic aneurysm (MAA). The patient gave full consent for publishing her case.

CASE REPORT

A 28-year-old woman with BAV presented with septicemia in the form of emaciation, hypotension, tachycardia, tachypnea, dyspnea, hypothermia, thrombocythemia, and leukocytosis. Her erythrocyte sedimentation rate and C-reactive protein concentration were elevated. She also had progressive dysphagia and expressive dysphasia with coordination impairment due to a posterior circulation stroke. Computed tomography angiography showed a saccular multiloccular aneurysm arising from the medial side of the thoracic aorta immediately distal to an AC (Fig 1).

The aneurysm caused considerable narrowing to the esophagus and complete occlusion of the left main bronchus leading to a total collapse of the left lung. The aneurysm was deemed mycotic based on the clinical assessment and radiologic images. The patient also had a left vertebral artery (LVA) arising directly from the aortic arch. In addition, she had an occluded left axillary artery and occluded superior mesenteric artery. Transthoracic echocardiography demonstrated a moderate aortic regurgitation and pericardial effusion.

Results of blood cultures taken before antibiotics were administered were positive for *Streptococcus salivarius*. The patient had two major and two minor modified Duke's criteria for IE.[6] Antibiotic therapy with intravenous meropenem was initiated and was maintained throughout her hospital stay of 8 weeks. Results of repeated blood cultures during this period were negative.

The TEVAR suitability assessment found the patient had a number of challenging features. She had an angulated proximal neck, which was short on the inner curvature. The maximum neck diameter was 15 mm at the origin of the left common carotid artery. The distal landing zone was an adequate length but had a maximum diameter of only 14.5 mm. The common femoral and external iliac arteries were too small, in keeping with her AC history.

With these factors in mind, the choice of a TEVAR device was challenging. We initially considered using the iliac limb of an infrarenal device, which would have offered a better size match. However, we excluded this option because these stents are not designed to withstand the radial and longitudinal forces seen in the aortic arch and could readily collapse if subjected to such pressures. Instead, we opted for a TEVAR-specific device even when this meant oversizing beyond the recommended range. Accordingly, the patient underwent an urgent TEVAR using a size 21 C-TAG device (W. L. Gore and Associates, Flagstaff, Ariz) crossing the origin of the left subclavian artery (LSA). A 5-mm ×22-mm Advanta (Atrium Medical Corp, Hudson, NH) chimney stent was placed in the LVA.

Access was achieved via extraperitoneal exposure of the right common iliac artery and percutaneous right brachial artery puncture. Although the contralateral antegrade access to the LVA

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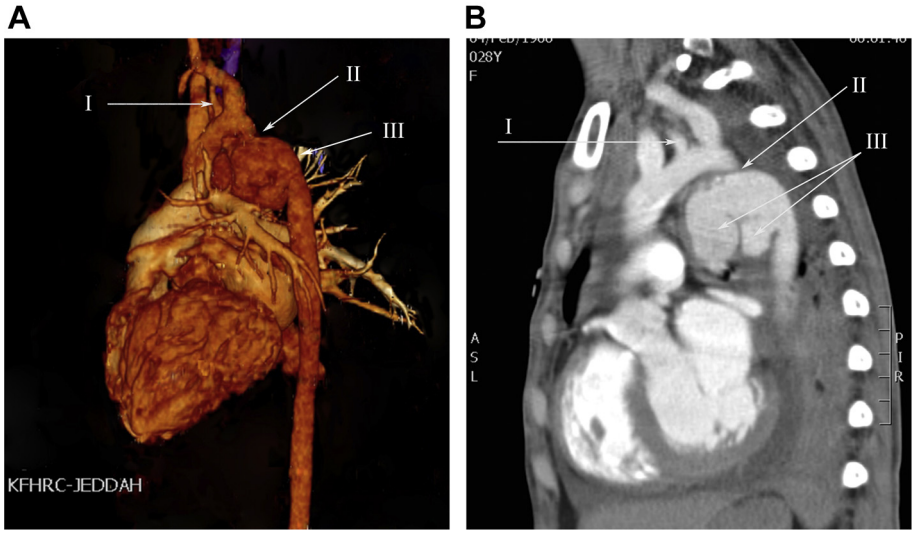

Fig 1. A, Preoperative volume-rendered reconstruction and **(B)** computed tomography angiography show (*I*) left vertebral artery (LVA), (*II*) aortic coarctation (AC), and (*III*) complex mycotic aortic aneurysm (MAA).

involved more arch manipulation and increased the risk of an intraoperative stroke, this was the only available access route and the only feasible revascularization option in this patient. The AC was balloon dilated from within the stent graft. The aneurysm sac was excluded completely on completion angiography and at 3 months postprocedure (Fig 2).

After TEVAR, the left lung expanded fully, and the patient's dysphagia resolved. Her body mass index increased from 12.9 kg/m^2 on admission to 17.8 kg/m^2 at 4 weeks post-TEVAR.

The patient underwent an uneventful aortic valve replacement surgery 6 weeks after the MAA repair. She made a considerable neurologic improvement and was discharged home on a 6-month course of oral azithromycin, life-long full anticoagulation, sepsis screening (white cell count, C-reactive protein) every 4 months, outpatient follow-up every 6 months, and transthoracic echocardiography and yearly computed tomography imaging.

DISCUSSION

MAAs are a challenging clinical entity. Patients with this condition often present as an emergency with poor general health due to the associated sepsis. Although the MAA diagnosis is often straightforward, the choice of open or endovascular surgical intervention is usually determined case-by-case. Owing to the rarity of this condition, all the available evidence for MAA management comes from case series. By nature, these tend to reflect the management preferences of a single surgeon or center and their conclusions cannot therefore be generalized. A number of relatively large such series showed open surgery provided reasonably good long-term outcomes.[7,8] In the meantime, TEVAR experience continues to build up, with some recent reports showing equally good results.[9,10] However, TEVAR does not allow the removal of infected tissues, and concern remains regarding the infection-free durability of such a repair.[11]

Fig 2. Volume-rendered postoperative computed tomography angiography shows complete isolation of the mycotic aneurysm sac.

The patient in this report required two major interventions, namely, aortic valve replacement and MAA repair. With an American Society of Anesthesiology Physical Status Classification score of 4, open MAA repair was ruled out. We were still left with the difficult choice of inserting a considerably oversized stent graft in an aortic segment that was both aneurysmal and constricted and with a hostile aneurysm neck. This task required a device with good conformability.

The Gore C-TAG appeared to be a suitable candidate, particularly because it can be oversized by up to 33%.

Covering the origin of the LSA was necessary to obtain an adequate proximal seal on the inner curvature. Although we would routinely revascularize the LSA,[12] we decided against doing so in this particular patient because the ipsilateral axillary artery was occluded and the origin of the LVA was from the aortic arch directly. We therefore opted to revascularize the LVA only. The main concern of covering the LSA in this patient was the interruption of blood supply to the well-developed left internal mammary artery. However, we assumed that dilating the AC would compensate for this. By opting not to revascularize the LSA, we took the risk of having a type II endoleak from this vessel. This risk did not outweigh the benefit of no intervention. Had a type II endoleak developed from the LSA, this would have been potentially amenable to Onyx (ev3 Endovascular Inc, Plymouth, Minn) or coil embolization via direct puncture or surgical ligation if necessary.

Although some centers continue to offer open surgery for AC in adults with good results,[13] balloon angioplasty is now an established treatment method for AC in this age group. The combination of balloon angioplasty and stenting improves the durability of pressure gradient reduction compared with angioplasty alone.[14,15] In our patient, we decided against prestenting angioplasty of the AC because the risk of aortic rupture was high. Instead, we performed within-stent angioplasty.

The chimney technique is a useful tool for maintaining visceral or arch vessel perfusion during endovascular aortic stenting. The method is technically demanding but lends itself to emergency situations where rapid endovascular intervention is required. This technique has a proven high short-term success.[16] Intermediate-term and long-term data regarding its durability are now coming through, with some centers reporting good results.[17]

Graft collapse is a recognized complication of thoracic aortic endograft oversizing. The risk is particularly high when low radial force devices are used. The Gore TAG was one such device for which relatively high collapse rates had been reported.[18] Graft collapse tends to occur ≤30 days from the insertion of grafts that are oversized by >23%.[19] Although we used the smallest available size, the C-TAG device we used was still oversized by 40%. However, the C-TAG device has a superior radial force and radial fit compared with its predecessor and has performed well to date in this particular patient.

CONCLUSIONS

A number of endovascular techniques were used to manage this complex and rare presentation of a thoracic MAA in a patient with AC and aberrant arch anatomy. Although long-term device durability and infection-free survival in this patient remain to be seen, she has at least survived the acute phase of her disease. We are not planning to offer this patient open surgery at this stage. However, she has now recovered sufficiently to be considered for such an intervention should it become necessary in the future.

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