ASK THE EXPERTS

Mycotic Thoracic Aortic Aneurysms: Is Endovascular Repair Definitive or Simply a Bridge Therapy?

A discussion of how to approach mycotic thoracic aortic aneurysms based on patient risk factors and comorbidities, source of infection, and type of organism.

With Konstantinos P. Donas, MD; Drosos Kotelis, MD; Audra A. Duncan, MD, FACS, FRCSC; Gregory A. Magee, MD, MSc, FACS; and Vincent L. Rowe, MD, FACS

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Treatment of mycotic aneurysms may lead to the development of aortoesophageal fistulas (AEFs). AEFs occur at an incidence of approximately 1.5% to 2% after thoracic endovascular aortic repair (TEVAR), mostly for ruptured thoracic aneurysms, and have been associated with the presence of mediastinal hematoma at the time of TEVAR. Mycotic thoracic aneurysms can also develop as a result of hematogenic infection after TEVAR. Nowadays, primary mycotic aneurysms (eg, syphilitic aneurysms) are extremely rare.

An analysis of a multicenter European registry (17 centers) with a total case load of 2,387 TEVAR procedures identified 36 patients with a post-TEVAR AEF.[1] These patients were divided into four groups depending on the treatment approach they received. In the first group, patients were treated conservatively, and the 1-year mortality reached 100%. A second group of patients received esophageal stenting only and had a 17% survival rate after 1 year. In a third group, patients underwent esophagectomy without aortic replacement, and the survival rate was 43% at 1 year. The fourth group underwent both esophagectomy and aortic replacement with stent graft explantation, resulting in a slightly higher 1-year survival rate of 46%.

In hemodynamically unstable patients (eg, those with hematemesis), we advocate "redo" TEVAR as a bridging procedure to stabilize the patient. In our opinion, definitive treatment is radical surgery for fit patients and is ideally performed in high-volume centers in a multistaged fashion.[2,3] In cases of AEF, first the involved segment of the esophagus should be widely resected, usually through a right-sided thoracotomy. Next, through a left-sided thoracotomy, the infected aortic segment and stent grafts inside should be completely removed. Reconstruction of the resected thoracic aorta can be performed by a tube graft self-made from a bovine pericardial patch. Extracorporeal circulation for distal aortic perfusion is commonly established by femoral artery and femoral vein cannulation. Again, in cases of AEF, a third operation is necessary. Once the patient has recovered, esophageal reconstruction can be achieved by gastric pull-up through a retrosternal route.

In our opinion, endovascular therapy is a bridge to definitive therapy for mycotic thoracic aortic aneurysms. Depending on the clinical status and the surgical fitness of the patient, a major repair in a multistaged fashion will lead to a total treatment. For patients at high risk or unfit for open repair, endovascular therapy can represent a therapeutic option; however, no robust conclusions can be drawn from the existing literature.

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3. Gombert A, Grommes J, Schick G, et al. Sarcoidosis-associated aortoesophageal fistula-multistage interdisciplinary surgical therapy for a rare and life-threatening condition. Ann Vasc Surg. 2017;39:287.e15-287.e20. doi: 10.1016/j.avsg.2016.06.034

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Although only a small percentage of aneurysms (2%-3%) are considered mycotic or have a primary infection,[1] patients who develop mycotic aneurysms often have multiple comorbidities and complex anatomy. These factors, in addition to the rarity of cases, make decision-making difficult. Data available in the literature are often case series or large descriptive studies with mixed patient groups (ie, infrarenal and thoracic mycotic aneurysms combined), making conclusions difficult to interpret. Higher-level data are available to assess the management of infected grafts and endografts, and extrapolating outcome data from these patients may be valid in determining how to manage thoracic mycotic aneurysms.

Placement of a thoracic endograft is often a relatively simple procedure, provided the aneurysm is remote from main aortic branches and iliac access is adequate. Therefore, using a stent graft to treat a mycotic aortic aneurysm is tempting. Based on available data, the risk of reinfection after endovascular treatment remains relatively high (approximately 20%), yet optimal treatment with antibiotics may not affect the course of reinfection.[2]

Because of the risk of reinfection, endovascular treatment is best used in patients who would not tolerate open repair. Often, age, comorbidities, and type of organism(s) may inform this decision. For example, a young patient or the presence of *Salmonella* infection is best treated with open repair primarily. However, if the patient is extremely ill, an endovascular graft could be used as a bridge to definitive repair. Once an endograft is in place, a secondary open procedure may be significantly more challenging and may require more extensive exposure, circulatory arrest or left atriofemoral bypass, and graft tissue coverage with omentum or serratus anterior flaps. These technical challenges should be considered first when deciding whether a graft should be placed as a bridge, because the follow-up procedure may be prohibitive. Interval surveillance, use of antibiotics, and timing of the definitive procedure should be considered at the onset before placement of an endovascular stent graft if a secondary procedure is planned. The optimal time between endovascular and the definitive procedure depends on patient factors but is typically 2 to 6 months.

Several groups of patients are best treated solely with endovascular treatment for mycotic thoracic aneurysms. These include patients with prohibitive pulmonary function, advanced age (> 80 years), severe frailty, or significant cardiac or renal disease. In these patients, endovascular repair with lifelong antibiotics and a discussion regarding the limits of endovascular repair is indicated. Patients with unresolved hemoptysis after endovascular mycotic aneurysm repair may have ongoing infection. In many cases, these patients are unsuitable for open repair due to pulmonary comorbidities and may need broad-spectrum antibiotics or palliative care.

In summary, high-risk patients with correctable risk factors can be considered for endovascular treatment as a bridge to therapy as long as the secondary procedure is planned from the onset and antibiotics are used in the intervening time. Although the risk of reinfection is high, using endovascular stent grafts as the definitive procedure to treat mycotic thoracic aneurysms may be the only option in high-risk chronically ill patients.

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As endovascular therapy has greatly surpassed open repair of thoracic and abdominal aortic aneurysms, it is not surprising that an endovascular-first approach is increasingly being used either as a temporizing measure or for initial definitive management of mycotic aortic aneurysms. Although placing a prosthetic endograft into an infected field may seem to contradict fundamental surgical dogma, the advantages of less physiologic stress, reduced blood loss, no aortic cross-clamping, and potential for reduced organ ischemia makes the endovascular approach attractive. The benefits are further exemplified in patients presenting with hemodynamic instability, sepsis, or rupture and in those considered to be poor surgical candidates.

Recent studies by Sörelius et al have shown that in Sweden a large proportion of mycotic aortic aneurysms are treated with endovascular repair, with reported short- and long-term survival rates that are surprisingly similar to open repair.[1,2] These unforeseen results may be due to the early morbidity and mortality of open repair for mycotic aortic aneurysms.[3]

We believe it is too simplistic to think that all mycotic aortic aneurysms can be definitively treated with endovascular repair. Logistic challenges present within the current literature include heterogeneous groups of patients with variable microbiologic confirmation of infections in the aneurysm, comparison of patients with a known continued source for infection (fistula) with those who have no known source, lack of accounting for the size of mycotic aneurysm, and poor long-term follow-up. Other confounding issues include a lack of an adequate control (open) arm, a bias toward endovascular repair, and adequate statistical comparison by anatomic location or organism.

In our center, we found that bacteriology is the biggest predictor of overall survival after endovascular repair of aortic infections. Methicillin-resistant *Staphylococcus aureus* (MRSA) has become the predominant cause of mycotic aneurysms in our institution, and patients who underwent endovascular repair for MRSA-positive aortic infections had very poor 1- and 5-year survival compared to patients with other pathogens (1 year, 20% vs 71%; 5 years, 0% vs 44%; $P = .0009$).[4] This finding was so dramatic that we have subsequently changed our practice and consider endovascular repair as an ineffective treatment for MRSA-positive aortic infection. If these patients are not candidates to undergo definitive open reconstruction, endovascular repair should be considered purely a temporizing intervention to bridge the patient until a more definitive open repair could be tolerated. In patients who are reasonable candidates for open repair, open reconstruction and not endovascular options should be considered, especially if there are concerning features (pathogen/MRSA, lack of sufficient seal zone, need for incorporation of branch vessels/left subclavian artery/celiac artery). ■

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