

# Management of a thoracic endograft infection through an ascending to descending extra-anatomic aortic bypass and endograft explantation

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A 52-year-old man presented 33 months after thoracic aortic endovascular repair with hemoptysis and was found to have an aortobronchial fistula secondary to a mycotic aneurysm. The endograft infection was managed in a two-stage fashion. During the initial stage, the patient underwent an ascending-to-descending thoracic aortic bypass. Neither cardiopulmonary bypass, hypothermic circulatory arrest, nor aortic cross-clamping were used. During the same hospitalization, the patient underwent successful endograft explantation through a left thoracotomy. Imaging at 6 months demonstrated no anastomotic concerns and resolution of residual pulmonary inflammation. Thoracic aortic endograft infections necessitating endograft removal can potentially be successfully and safely managed without the need for cardiopulmonary bypass, hypothermic circulatory arrest, or interruption of aortic blood flow. (*J Vasc Surg* 2010;51:207-9.)

Endograft-related infections after thoracic endovascular aortic repair (TEVAR) are rarely reported but are a devastating complication of aortic disease management. Definitive treatment necessitates revascularization, open surgical endograft explantation, and débridement of infected tissue within the surgical field. This represents a failure of the intended minimally invasive approach of TEVAR and places the patient at increased risk of morbidity and death from an urgent or emergency open surgical intervention.

As endovascular interventions become more commonly applied to thoracic aortic pathology, secondary endograft infections will undoubtedly be encountered at institutions in which these procedures are performed. The application of less invasive surgical approaches that minimize the operative risk to patients who require endograft explantation in this setting would be beneficial.

## CASE REPORT

A 52-year-old man was referred to our institution with a history of recurrent hemoptysis. His medical history was significant for a prior left thoracotomy and anterior spinal fusion of T7-T9 for a vertebral compression fracture sustained as a complication of multiple myeloma. Evaluation at the referring institution had revealed a pseudoaneurysm in the descending thoracic aorta at the

level of the patient's spinal hardware. Cross-sectional imaging showed no evidence of periaortic inflammation, and the pseudoaneurysm was assessed to have most likely been an iatrogenic complication of the patient's spinal surgery.

The patient underwent TEVAR and received a 26-mm × 10-cm Gore TAG endograft (W. L. Gore and Associates Inc, Flagstaff, Ariz). The procedure was technically successful, and the patient was discharged home on postoperative day 1. At the 1-year follow-up, the patient reported no recurrence of hemoptysis, and computed tomographic angiography (CTA) demonstrated successful exclusion of the pseudoaneurysm. The patient did not return for further follow-up.

The patient presented again with hemoptysis 33 months after TEVAR and reported a 6-month history of treatment at a local hospital for recurrent pseudomonas infections. CTA at that time demonstrated resolution of the original pseudoaneurysm, pulmonary infiltrates in the left lower lobe, and periaortic inflammation with proximal and distal aortic aneurysmal formation around the endograft (Fig 1). Blood and bronchial lavage cultures were positive for *Pseudomonas aeruginosa*. Intravenous (IV) antibiotics and strict blood pressure control were initiated, and the hemoptysis resolved.

The patient was assessed to be high risk for conventional repair with anatomic interposition graft reconstruction given his previous thoracotomy and the active infection with adjacent lung inflammation. To minimize the invasiveness of the surgical treatment and avoid uncontrollable hemorrhage during operative exposure, a two-stage approach was used.

In the first stage, the patient underwent an ascending-to-descending thoracic aortic bypass through a median sternotomy. The pericardium was opened longitudinally, exposing the ascending aorta. The diaphragm was divided near the midline, and the distal descending thoracic aorta was dissected circumferentially. Systemic heparinization was administered, and a side-biting clamp was placed on the aorta at the level of the hiatus. A 16-mm Dacron graft (Hemashield, Meadox Medicals Inc, Oakland, NJ) was anastomosed in an end-to-side fashion to the distal thoracic aorta and tunneled into the mediastinum through the diaphragm just lateral to the pericardium. The proximal anastomosis was fashioned in an

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**Fig 1.** Computed tomography angiography of the chest demonstrates periaortic inflammation and aneurysmal dilatation around the endograft.

end-to-side fashion to the right lateral aspect of the ascending aorta (Fig 2). Neither cardiopulmonary bypass, hypothermic circulatory arrest, nor complete aortic cross-clamping were used during the procedure.

During the same hospitalization, the second stage of the intervention was performed. The patient was placed in a lateral decubitus position with external rotation of his hips to allow for access to the left groin. Open access to the left femoral artery was obtained with placement of a 20F sheath. To ensure vascular control during exposure and dissection through the chest, two endografts were deployed with proximal and distal overlap of the original endoprosthesis (28- × 10-mm and 26- × 10-mm Gore TAG components, respectively).

The left chest was entered through the fifth and eighth interspaces. Proximal control of the aorta just distal to the left subclavian artery and distal control of the distal descending aorta was obtained. The proximal and distal ends of the thoracic aorta were ligated with a 45-mm vascular stapler, and the staple lines were reinforced with suture ligation. The lung was dissected off the aorta, and a wedge resection of the lingual and a portion of the left lower lobe was performed. The aorta was opened longitudinally, and the three indwelling endografts were removed. Results of intraoperative cultures of the infected aortic tissue were positive for *Pseudomonas*.

The patient had an uncomplicated recovery from this procedure and was discharged home on postoperative day 8 on a 6-week course of IV gentamicin and ceftazidime. In follow-up at 6 months, he was asymptomatic off antibiotics, and CTA revealed patency of the ascending-to-descending aortic bypass and resolution of the pulmonary inflammation (Fig 3). Eighteen months after endograft explantation, the patient has continued to do well.

## DISCUSSION

An incidence of endograft infection after endovascular abdominal aortic aneurysm repair of 0.16% to 0.43% has been reported.<sup>1,2</sup> The incidence of thoracic endograft infection after TEVAR is largely undefined at this time. The most widely accepted approach for the treatment of infected abdominal aortic grafts and endografts is complete



**Fig 2.** Intraoperative photograph shows completion of the ascending-to-descending thoracic aortic bypass.



**Fig 3.** A three-dimensional reconstruction of computed tomography images obtained 6 months after thoracic endograft explantation demonstrates patency of the ascending-to-descending aortic bypass.

removal of the graft or endoprosthesis, local débridement of infected tissue, and extra-anatomic bypass through a noninfected surgical field.<sup>3</sup>

For thoracic aortic graft and endograft infections, anatomic limitations often necessitate in situ vascular reconstruction within the infected field.<sup>4</sup> A direct surgical approach to the thoracic aorta may be compromised by the adjacent inflammatory response to lung parenchyma and surrounding structures. Obtaining adequate exposure with conventional proximal and distal vascular control may place the patient at risk for life-threatening hemorrhage. Hemorrhage from lung parenchyma and surgical dissection would also be exacerbated, and often extensive, by the use of hypothermic arrest in this setting. Furthermore, anatomic reconstruction in this setting places the new prosthe-

sis at risk for graft infection, which may lead to late infectious complications.<sup>4</sup> This approach may also necessitate cardiopulmonary bypass, hypothermic arrest, and aortic cross-clamping, which confers significant physiologic stress; the avoidance of which was the intent of the initial endovascular procedure.

Several authors have described the use of the ascending aorta as a source of inflow for extra-anatomic bypass of descending thoracic aortic lesions.<sup>5-16</sup> Descriptions of distal aortic revascularization sites have included the descending thoracic aorta,<sup>11,12,15,16</sup> the supraceliac abdominal aorta,<sup>5-7,13</sup> and the infrarenal abdominal aorta.<sup>7,10,14</sup> Although most of these extra-anatomic ascending-to-distal aortic bypass procedures have been for the treatment of aortic coarctation,<sup>5,10-13,15,16</sup> other reported applications have included atherosclerotic aneurysms,<sup>7</sup> infected aneurysms,<sup>4,7</sup> and infected prosthetic grafts.<sup>6</sup> Some authors have used cardiopulmonary bypass during the construction of these bypasses for the treatment of coarctation to ensure adequate perfusion during partial clamping of the aorta.<sup>11,12</sup> In the absence of a stenotic aortic lesion and the use of partial aortic occlusion, cardiopulmonary would be unnecessary.

A major benefit of this extra-anatomic surgical approach is that it provides a highly durable bypass that supplies adequate distal blood flow to the mesentery and lower extremities. McKeller et al<sup>12</sup> reported their single-institution series of 50 patients who underwent ascending-descending aortic bypass for coarctation. No graft occlusion or pseudoaneurysm formation was reported through a mean follow-up of 33 months, with 74% of grafts undergoing imaging evaluation.

Another useful adjunct in our surgical approach was the deployment of additional thoracic endografts proximally and distally to the original endoprosthesis to protect the patient from hemorrhage during the long second stage of the procedure. We did not exclude the patient's mycotic aneurysm at the time of presentation because the hemoptysis resolved and we wanted to avoid aggravation of the infected vascular territory. The use of additional thoracic endograft components to stabilize the patient or facilitate vascular control should be considered in anatomically acceptable candidates.

## CONCLUSION

Extra-anatomic ascending-to-descending thoracic aortic bypass for the treatment of infected thoracic endografts offers a durable form of vascular reconstruction that avoids the placement of a prosthesis within the contaminated field

and facilitates endograft explantation without the use of cardiopulmonary bypass or interruption of aortic blood flow. This approach may be especially beneficial in patients who have associated lung pathology or who have undergone prior thoracotomy.

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