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An entirely endovascular approach to the repair of an ascending aortic pseudoaneurysm

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Traditional surgical repair of an ascending aortic pseudoaneurysm requires sternotomy, cardiopulmonary bypass, and often hypothermic circulatory arrest. These procedures are complex, technically challenging, and associated with significant mortality.¹ The rapidly advancing technology of catheter-based interventions has rarely addressed diseases of the ascending aorta, because the proximity to the coronary and brachiocephalic arteries makes such interventions particularly challenging.²⁻⁴ Here we describe the use of a stent-graft to perform an entirely endovascular repair of a symptomatic ascending aortic pseudoaneurysm in a patient who was a poor candidate for open surgical intervention.

Clinical Summary

Review of patient data for this report was approved by the institutional review board at Baylor College of Medicine. Informed consent for the report was obtained from the patient. An 82-year-old woman had undergone emergency repair of an acute iatrogenic dissection localized to the ascending aorta 18 months previously. In her previous operation, primary aortic repair with obliteration of the false lumen and resuspension of the aortic valve had been accomplished by means of surgical adhesive, aortic plication with felt strips, and direct closure of the aortotomy. Concomitantly, the patient had undergone bypass of the left anterior descending coronary artery with the left internal thoracic artery. She subsequently

required placement of an automatic defibrillator-pacemaker and treatment for chronic congestive heart failure.

The patient was referred to our center after an evaluation for chest pain revealed an expanding ascending aortic pseudoaneurysm. Because of her poor physical condition and previous sternotomy, open repair was considered to be an extremely high-risk option. Treatment with an endovascular stent-graft as a novel alternative was discussed with the patient and her family.

A retroperitoneal incision was used to access the left external iliac artery. A 7F sheath was introduced into the right brachial artery. A pigtail marker catheter was used to measure the distance between the right coronary and innominate arteries (Figure 1, A). A guidewire was advanced to the ascending aorta from the left external iliac artery and exchanged for an extra-stiff Lunderquist wire (Cook Medical Inc, Bloomington, Ind). A 24F guiding sheath was inserted over the stiff wire. After angiographic confirmation, a 40 × 100-mm GORE TAG thoracic endograft (W. L. Gore & Associates, Inc, Flagstaff, Ariz) was deployed through the left external iliac artery. Completion angiography confirmed total exclusion of the pseudoaneurysm, with brisk antegrade flow into the right coronary and innominate arteries (Figure 1, B).

The patient's initial recovery was complicated by her deconditioned state; she did not have any neurologic deficits but required extensive physical therapy because of her generalized weakness. On postoperative day 15, she had an acute brainstem stroke and died. Autopsy confirmed that the stent-graft had not migrated and that the coronary ostia and brachiocephalic arteries were patent.

Discussion

Pseudoaneurysm is an increasingly recognized complication of ascending aortic replacement; a magnetic resonance imaging study found an incidence of 13%.⁵ These pseudoaneurysms have a poor prognosis because of the risks involved in complex reoperations in patients with multiple comorbidities. Endovascular approaches may provide a unique treatment opportunity for patients who have ascending aortic pseudoaneurysms but are not candidates for conventional open repair.

To be considered for treatment with an endovascular stent-graft, patients must have adequate landing zones to ensure proper

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Figure 1. Intraoperative aortography showing pseudoaneurysm arising from mid-ascending aorta (A) and complete exclusion of pseudoaneurysm after stent-graft deployment, with antegrade flow in brachiocephalic branches and both coronary arteries and transient valvular insufficiency caused by position of pigtail catheter (B).

circumferential seals and complete aneurysmal exclusion. Patients with ascending aortic disease often have inadequate landing zones and a substantial risk of flow obstruction of the coronary and

brachiocephalic arteries, so endovascular stent-grafts are not usually considered for these patients. To compensate for inadequate landing zones, hybrid approaches combining open surgical debranching of the supra-aortic trunks with endovascular stent-graft placement have been used successfully in high-risk cases. Alternative endovascular approaches to ascending aortic pseudoaneurysms have included temporary occlusion with a balloon catheter (before surgical repair)² and thrombosis through transcatheter intra-arterial thrombin injection.³ Komanapalli and colleagues⁴ successfully used an Amplatzer septal occluder device (AGA Medical Corporation, Golden Valley, Minn) to exclude an ascending aortic pseudoaneurysm in a poor surgical candidate.

In our patient, we were able to position the stent-graft by using the natural curve of the ascending aorta and successfully exclude the pseudoaneurysm without covering the coronary or innominate arteries. Although this necessitated positioning the floppy end of the extra-stiff guidewire against the aortic valve, the resulting intermittent aortic valvular insufficiency did not produce untoward hemodynamic effects. Regrettably, the patient did not recover from the aortic repair, even though a minimally invasive approach was used. Despite this unfortunate outcome, this report describes a novel approach to managing focal ascending aortic disease in high-risk patients and expands the potential indications for thoracic endografting.

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