Three-year Follow-up of Fenestrated Thoracoabdominal Stent Graft Bridging an Endovascular Thoracic Stent Graft and a Surgical Abdominal Aortic Graft

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ABSTRACT

This case report describes repair of a type I endoleak at the distal landing zone of a thoracic aortic stent graft by endovascular placement of a thoracoabdominal fenestrated stent graft (Cook, Brisbane, Australia). The fenestrated stent graft was interposed between a previous abdominal aortic aneurysm (AAA) Gelsoft tube graft (Sulzer Vascutek Ltd, Inchinnan, United Kingdom) and two overlapping Zenith thoracic endografts (Cook Inc, Bloomington, Indiana). Placement was made more complex because the distal thoracic endograft had rotated into a horizontal position. At 3-year clinical and computed tomography (CT) follow-up, continued clinical and radiologic success was shown with no further intervention required.

ABBREVIATIONS

AAA = abdominal aortic aneurysm, EVAR = endovascular aneurysm repair, SCI = spinal cord ischemia, SMA = superior mesenteric artery, TAAA = thoracoabdominal aortic aneurysm, TEVAR = thoracic endovascular aneurysm repair

The first case of endovascular aneurysm repair (EVAR), which is a less invasive alternative to open surgical repair, was described in 1991 by Parodi et al (1). Since then, EVAR has become a widely accepted technique for treating abdominal aortic aneurysm (AAA) because it is associated with less blood loss, a reduction in perioperative mortality and morbidity, and shorter inpatient stays than the surgical alternative (2). Complications still occur, however, and most of these manifest as endoleaks (3) with blood flow in the aneurysm sac peripheral to the stent graft. Up to 27% of patients treated with EVAR for AAA have an endoleak (4), although these do not always require treatment (5). Another problem with EVAR is the requirement for a suitable proximal segment of normal aorta to serve as a sealing zone for the stent graft. One solution has been the introduction of customized fenestrated grafts to incorporate the visceral branches of the aorta. The fenestrations are lined up with the vessel origins and sealed with placement of covered stents. Fenestrated EVAR in AAA is gaining popularity in larger centers and shows promising results (6–8). Its use in a thoracoabdominal aortic aneurysm (TAAA) was first reported in 2001 by Chuter et al (9) in a type III TAAA. Since then, the largest series includes 73 patients with type I, II, III, and IV TAAA (10). All devices used in this series were Zenith stent grafts (Cook, Inc, Bloomington, Indiana). This series reported a 14% major complication rate, a technical success rate of 93%, a 30-day mortality of 5.5% and a 1-year survival of 81%.

We present a case of the use of a fenestrated stent graft to treat an endoleak from a thoracic aortic stent complicated by further aneurysm dilation of the thoracoabdominal aorta and of distal thoracic stent graft rotation into a horizontal position. Further technical complexity was added by the presence of an uncovered portion of the stent protruding into the lumen of the distal graft. The patient had previously undergone surgical repair of a ruptured AAA.

CASE REPORT

Our institution does not have an institutional review board. The authors have read and abided by the principles of the Declaration of Helsinki.

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Open Abdominal Aortic Aneurysm Repair

A 62-year-old male ex-smoker presented in 2003 to the emergency department with a blood pressure of 95/60 mm Hg, pulse of 135 beats/min, and abdominal pain. He had a past history of myocardial infarction and had been treated with coronary artery bypass graft surgery 15 years previously. Since then, he had experienced further myocardial infarctions and had coronary artery stents placed. Comorbidities included angina and chronic obstructive pulmonary disease. A computed tomography (CT) scan (Philips Brilliance 16-slice, Best, The Netherlands) at that time showed a 9-cm infrarenal AAA with no identifiable neck. There was also a 6-cm aneurysm of the descending thoracic aorta and a mildly dilated aortic arch with some mural thickening and atheroma. The ascending aorta was normal. At operation, the AAA was elongated with an edematous wall and showed signs of rupture. The AAA was treated with open repair using a Gelsoft knitted 18 mm × 12.5 cm infrarenal tube graft (Sulzer Vascutek Ltd, Inchinnan, United Kingdom). The graft was sutured onto the aorta at the level of both renal arteries incorporating the orifices of the renal arteries into the proximal anastomosis. The inferior anastomosis was made to the bifurcation of the aorta into the common iliac arteries. Recovery was uncomplicated.

Endovascular Thoracoabdominal Aortic Aneurysm Repair

The thoracoabdominal aortic aneurysm (TAAA) was treated endovascularly 6 months later with two overlapping Zenith endografts and a short proximal extension (Cook Inc, Bloomington, Indiana). The stents were placed via a right femoral cutdown from just distal to the origin of the left common carotid artery to the celiac trunk. The fabric of the graft was placed to within 1–2 mm of the celiac trunk. A C2 catheter (Johnson & Johnson, Miami Lakes, Florida) was placed in the celiac origin from below as a marker (**Fig 1**). A bare metal stent (the "crown of thorns") projected below the celiac trunk. The proximal graft was 30 mm in diameter throughout its length and 227 mm in length. The distal graft had a 30-mm proximal diameter and a 36-mm distal diameter and was 219 mm in length. An endoleak was noted after deployment of the proximal graft, and this was covered by a 32-mm diameter 80-mm body extension graft. No evidence of endoleak was present after deployment.

Recovery after the procedure was uneventful, and a follow-up CT scan 4 months later showed stable appearances of the stent grafts and aneurysm sac. The patient did not have any left arm claudication. A CT scan 18 months after the procedure showed that the distal landing zone had dilated from 30 mm to 47 mm resulting in loss of a seal just proximal to the celiac trunk and reperfusion of the aneurysm. In addition, the distal end of the stent had moved away from the original landing zone and was now horizontal (**Fig 2**). Symptomatically, the patient had developed at this time claudication and pain in his left leg. He had also experienced further angina attacks, inpatient stays for acute coronary syndrome, and exacerbations of chronic obstructive pulmonary disease requiring antibiotics and oral steroids and was American Society of Anesthesiologists grade III.

Figure 1. Postprocedural (thoracoabdominal aortic aneurysm) angiogram after insertion of thoracic stents. The distal end of the stent can be seen above the celiac trunk, and there is a good seal with no evidence of endoleak.

Fenestrated Thoracoabdominal Stent Graft

After discussions among the patient, vascular surgeons, vascular radiologists, and cardiothoracic surgeons, the patient was listed for endovascular fenestrated stent graft repair of the endoleak and interposition of the fenestrated graft between the previously placed thoracic stents and the abdominal surgical graft. Arterial phase CT (Philips Brilliance 16-slice) images from the ascending aorta to the common femoral arteries were obtained. The CT scan parameters were a CT pitch of 0.938, slice thickness of 1 mm, and a reconstruction interval of 1 mm. The matrix was 512 × 512. Ultravist 300 (Bayer Schering Pharma AG, Berlin, Germany), 100 mL, was injected at 3 mL/s. Vessel diameters, angulations, ostial diameter of the visceral vessels, relative distance of the visceral branches to a fixed landmark, and angular orientation of the visceral vessels were required for stent graft planning, which was undertaken by Cook (Brisbane, Australia). The diameter of the stent graft was 38 mm throughout its length. The total length of the stent graft was 230 mm, the celiac fenestration was 126 mm from the proximal edge of the stent graft, the superior mesenteric artery (SMA) fenestration was 142 mm from the proximal edge, and the left renal fenestration was 162 mm from the proximal edge. The right kidney was small (6.9 cm in length) with a small renal artery, and a decision was made to sacrifice this kidney. The procedure was performed under general anesthesia in a dedicated angiography suite.