Hybrid Treatment of Thoracoabdominal Aortic Aneurysms With the Use of a New Prosthesis

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We report the case of a 72-year-old woman with thoracoabdominal aortic aneurysm who underwent hybrid surgical and endovascular procedure. First, debranching of the aortic arch and implantation of a new multi-branched prosthesis with transdiaphragmatic celiac artery and superior mesenteric artery revascularization was performed. Two weeks later the procedure was successfully completed with aneurysmal exclusion by deployment of multiple stent grafts. The postoperative course was uneventful. A two-staged surgical and endovascular approach with the use of a new prosthesis reduces the risk of endoluminal graft endoleak and may constitute an attractive alternative to conventional surgery in management of high-risk thoracoabdominal aortic aneurysms.


Surgical repair of thoracoabdominal aortic aneurysms is still a complex and high-risk procedure that often causes multiple postoperative organ dysfunction.

Although endovascular stent-grafting provides an attractive alternative, it can be used when the ascending aorta and visceral vessels are involved in aneurysmal dilatation.

A two-stage approach by first performing a conventional ascending aorta replacement and debranching of the epi-aortic and visceral vessels has shown promise with reduction of postoperative complications [1–3]. We propose an effective two-stage strategy in management of this complex disease using a new multi-branch vascular prosthesis, followed by endovascular stent grafting of the aneurysm.

We report the case of a 72-year-old woman referred to us for treatment of a thoracoabdominal aortic aneurysm. The patient presented with progressive shortness of breath and a past medical history relevant for chronic obstructive bronchopneumopathy and moderate renal dysfunction. A computed tomographic scan revealed a 70 mm diameter thoracoabdominal aortic aneurysms extending from the left subclavian artery to the origin of the renal arteries and an ascending aortic aneurysm of 50 mm in diameter.

Considering the high risk of standard surgical repair, a combined approach was planned. After approval by Città di Lecce Hospital's Ethical Committee, with informed consent of the patient, the first stage operation was performed in October 2006. A sternotomy with a small left laterocervical incision was performed, and epi-aortic vessels were extensively dissected. An incision was then extended for 6 cm toward the umbilical line to expose the celiac trunk and superior mesenteric artery through the lesser gastric curvature. At this stage, a full-heparin dose was administered. After cannulation of the innominate trunk and right atrium in normothermic extracorporeal circulation and warm hematic cardiopulmonary arrest, the aneurysmal ascending aorta was replaced up to the origin of the innominate trunk with a new Dacron prosthesis (Vascutek Terumo, Renfrewshire, Scotland) constructed with a standard cylindrical graft (26 mm) with a trifurcated graft of different sizes (10, 10, and 8 mm) and another side branch of 10 mm coming off the main body of the prosthesis (Fig 1). After the aortic
Fig 1. The new Dacron prosthesis (Vascutek Terumo, Renfrewshire, Scotland).

cross clamp was released, two branches of the trifurcated arm were connected in end-to-end fashion, respectively, to the innominate trunk (10 mm) and the left carotid artery (8 mm) previously detached from the aortic arch. The patient was then weaned off extracorporeal circulation and the side branch of the main graft (used as arterial inflow after the ascending aorta replacement) was connected to the left subclavian artery. At this stage the last branch of the trifurcated graft (10 mm), placed along the right atrium, was tunnelled through the right diaphragm in the retro-epiploic space and was anastomosed in an end-to-end fashion to the celiac trunk and to the superior mesenteric artery by interposition of a 6-mm graft (Fig 2). The first stage postoperative course was uneventful. After 2 weeks, using spinal fluid drainage to minimize the risk of paraplegia, the second stage endovascular procedure was performed through a left femoral access by deployment of three Endolift stent-grafts (Endomed Inc, Phoenix, AZ) from the ascending aorta up to the suprarenal aorta. The postoperative course was uneventful, and at 5 months follow-up the patient is doing well with no evidence of clinical problems related to the procedure.

Comment

Treatment of aortic aneurysmal disease involving the thoracic and abdominal aorta still represents a challenge for the surgeon [4]. Elephant trunk, clamshell, as well as the extensive thoraco-phrenico-laparotomy approach are still high-risk procedures carrying a mortality rate of 18% to 25% [5]. Despite the increasing success obtained with an endovascular approach, complete endovascular treatment of a thoracoabdominal aneurysm is still under development. Some authors have used multi-branched or fenestrated endovascular grafts to preserve visceral perfusion during repair of thoracoabdominal aortic aneurysms [6]. Nevertheless, their experience is limited and these endovascular devices are still troublesome to manage. Few cases of combined surgical and endovascular treatment have been recently reported with a different approach for visceral vessel revascularization [7]. The aim of our original prosthesis is to perform a single-stage debranching of the entire thoracic and suprarenal abdominal aorta involved by aneurysmal dilatation using a sternotomy approach extended to the upper abdomen. Furthermore, with this technique, mesenteric revascularization with a preconstructed prosthetic graft through a limited upper laparotomy can be accomplished without cross clamping the aorta, thus minimizing risk of visceral and renal ischemia. Moreover, the use of a Dacron graft (Vascutek Terumo) as “landing zone” in the ascending aorta seems to be crucial to optimize the sealing of the endovascular stent graft, minimizing the risk of a type I endoleak that still represents the major adverse complication of the endovascular procedure [8].

We believe that the use of this new prosthesis in treatment of aneurysmal dilatation of the thoracic and suprarenal aorta can considerably reduce morbidity and mortality associated with a standard surgical approach. With this technique, in fact, first-stage operation permits an extensive de-branching of the entire thoracic and suprarenal aorta with limited cardiopulmonary bypass and aortic cross-clamp time, whereas the presence of a Dacron graft in the ascending aorta with a radio-opaque marker just distal to the origin of the trifurcated arm facilitates the subsequent endovascular procedure. Obviously a long multi-component stent-graft is required to exclude the entire aortic aneurysm. In the case presented, three Endolift stent grafts (Endomed Inc) were used with generous overlapping

Fig 2. Postoperative angiogram. (a) Branch to innominate trunk. (b) Branch to left carotid artery. (c) Branch to left subclavian artery. (d) Branch to celiac trunk and superior mesenteric artery.
to minimize the risk of migration, and the endoleak was induced by aneurysmal configuration.

In conclusion, a two-staged combined surgical and endovascular approach with the use of a new multi-branched prosthesis may be effectively and safely used in management of high-risk extensive thoracic and suprarenal abdominal aortic aneurysm.

References