Stenting of the ascending aorta: a stent too far?

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Abstract

A 45-year old woman with then unknown Loeys-Dietz syndrome (LDS) presented in 2007 with aneurysms involving the entire thoraco-abdominal aorta, but sparing the aortic root and valve. She underwent debranching of the aortic arch, followed by stenting of entire distal ascending aorta, arch and descending aorta. Two years later, a diagnosis of LDS was established. Five years later, she re-presented with severe aortic regurgitation in a dilated aortic root, requiring aortic root replacement. We present the challenges involved in performing aortic root replacement in the presence of stents within the ascending aorta.

Keywords: Ascending aortic aneurysm • Stenting • Root replacement

INTRODUCTION

Stenting of the descending thoracic aorta has almost become the standard of care in managing aneurysms and dissections, due to lower early morbidity and mortality [1]. Hybrid procedures bring together aortic stenting of thoracic aortic aneurysms and aortic-root replacement and debranching of the head and neck arteries, with good results [2].

We report a case where the entire thoracic aneurysmal aorta, sparing the aortic root, was stented following debranching of the brachiocephalic, left carotid and left subclavian (BCS) arteries, 6 years ago, when the pathology and genetics of Loeys-Dietz syndrome (LDS) had just been described [3], and clinicians had an incomplete understanding of the clinical pathology of this syndrome. The patient re-presented with symptomatic severe aortic regurgitation in a dilated aortic root, requiring aortic valve and root replacement.

CASE

A 45-year old lady underwent complete stenting of an ascending aortic arch and descending aortic aneurysm shortly after aortic debranching in April 2007. Debranching of the BCS arteries was performed using four end-to-end anastomoses after adding two additional limbs to an inverted trouser graft. This was in turn anastomosed proximally to the ascending aorta. The arch stent had been placed immediately distal to this anastomosis. Diagnosis of LDS was established in September 2009 by our genetics testing laboratory.

She re-presented in February 2012 with severe aortic valvular regurgitation in a dilated aortic root with the annulus lying only 4.5 cm from the proximal lip of the debranching anastomosis (Fig. 1). Redo cardiac surgery, and aortic valve and root replacement became necessary.

PROCEDURE

Redo sternotomy (April 2012) was uneventful. There were dense adhesions around the aorta, debranching graft and aortic root, which were divided. An 8-mm Vascutek (Terumo-Vascutek, Renfrewshire, Scotland) graft was anastomosed to the aortic arch, which was divided. An 8-mm Vascutek graft was anastomosed proximal to the stent waist of the debranching complex, into which a 24-F arterial cannula was inserted. The right femoral artery was cannulated in similar fashion, providing a dual-inflow arterial return. A standard cannula was inserted into the right atrium and cardiopulmonary bypass (CPB) commenced. Systemic cooling was performed and, at 20°C, the circulation to the debranching graft was maintained at 1.5 l/min, while the circulation to the femoral limb was stopped briefly. The ascending aorta was transected proximal to the stent and the debranching conduit, which was now clamped proximal to the cannulation site (Fig. 2). A 20-F Foley catheter was introduced into the stented aorta and balloon inflated with 30 ml of saline to occlude the lumen of the stented aorta. In this way the heart and aortic root were separated from the two separate head and upper limb, and trunk and lower limb circulations. The circulation was recommenced at 3.5 l/min feeding into both the arterial cannulae, in the debranching conduit, and into the femoral artery. The heart was arrested using St Thomas cardioplegic solution (Terumo UK, Egham, Surrey) admixed with cold blood, administered directly into the coronary ostia and repeated at 20-min intervals. The aortic root was replaced using a composite valve graft with a 25-mm mechanical prosthesis and 28-mm Dacron graft (St Jude Medical, Inc., St Paul, MN, USA) using pledged 2-0 polyester horizontal mattress sutures. The coronary ostia were re-implanted into the valved conduit using continuous 5-0
The patient was rewarmed and weaned from CPB without difficulty. A mobile prosthesis was present and therefore easy to suture. The portion of the anastomosis where the proximal part of the debranching suture on the inside, which was used to complete the anterior side of the anastomosis. Surgical knots were excluded by a continuous 4-0 polypropylene. The conduit was anastomosed to the stented segment of the ascending aorta (Fig. 2); this was the difficult portion of the anastomosis. The surgical knots were excluded by a continuous 4-0 polypropylene suture on the inside, which was used to complete the anterior portion of the anastomosis where the proximal part of the debranching prosthesis was present and therefore easy to suture. The patient was rewarmed and weaned from CPB without difficulty. The total duration of CPB was 200 min and the cardiac ischaemic time was 85 min. She made a complete recovery, with no complications and was discharged home on the ninth postoperative day.

DISCUSSION

Aortic arch aneurysms are dangerous threatening life (5-year mortality: 80%) through rupture, dissection and embolic stroke, and merit treatment. Open surgical replacement carries a 10–20% mortality and 10–20% risk of stroke/paraplegia [4], comparing poorly to the 30-day outcomes of intra-aortic stenting [1]. To permit transluminal covered stent replacement of the diseased aortic arch, the BCS arteries need to be relocated (‘debranched’) to the non-aneurysmal ascending aorta, which is a simpler surgical procedure than open arch replacement [5]. Our case describes a young woman with initial extensive aortic aneurysm formation but a spared aortic root. She underwent aortic debranching in 2007. She re-presented 5 years later with severe aortic regurgitation in a dilated aortic root. A better understanding of LDS only described the previous year [3] would have discouraged us from stenting the ascending aorta and arch without replacing the aortic root. With the low proximal anastomosis of debranched arch vessels there was very restricted access to the aortic root (4.5 cm between the annulus and the proximal lip of the debranching anastomosis). However, in patients unfit to undergo open repair, stenting of aortic dissections and aneurysms in the entire aorta, including the ascending segment, along with debranching of BCS arteries may be the procedure of choice.

Our case represents the unique problems that may be encountered after a hybrid procedure, and highlights drawbacks of this approach for patients with LDS. These patients have a very high incidence of multiple aneurysms involving several vessels and branching points. If there is a possibility of these patients presenting in the future with aortic or any cardiac pathology requiring clamping of the ascending aorta and administration of cardioplegia, this hybrid technique is unsuitable and must not be done, as demonstrated by our case. Our patient initially presented with aneurysms involving the ascending aorta, arch and descending aorta, but sparing the aortic root in the absence of aortic regurgitation. Therefore, during the initial hybrid procedure, there was no indication to intervene on the aortic root. But given the high incidence of aortic pathology in patients with LDS, we should have anticipated this occurrence in the future. Anticipation of this problem may have prompted us to deal with the initial pathology differently. We could have then replaced the ascending aorta with a branched graft, performed the debranching of the BCS arteries and then, as a hybrid procedure, stented the descending aortic aneurysm. The Dacron graft would be much easier to clamp during future cardiac surgery.

Faced with this unusual situation, we were forced to replace the aortic root in the presence of stents in the ascending aorta, which precluded clamping this structure. Therefore, we adopted an innovative strategy of isolating the aortic root by cannulating the graft and femoral arteries, and inflating a Foley catheter in the ascending aorta to stop back-bleeding. This enabled us to isolate the aortic root completely to be able to replace it by conventional techniques. There remained the problem distal with the anastomosis of the graft to the stented ascending aorta, for which we developed a unique suturing technique of inserting the graft into the stented ascending aorta (Fig. 2), followed by exclusion of the surgical knots by a running 4-0 polypropylene suture.

In conclusion, all patients and particularly those with LDS require anticipation of future aortic and cardiac pathology. With this in mind, hybrid stenting of the ascending aorta must not be performed unless they are deemed unfit for open surgery.

Conflict of interest: none declared.
REFERENCES


