Shaping a vascular graft for total aortic arch replacement

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Aortic arch replacement extended to the ascending and/or descending thoracic aorta with a single vascular graft may cause kinking of the prosthesis. We propose an artifact to obtain a curved prosthesis from a straight one for total aortic arch replacement without the risk of kinking.

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Introduction

Total arch replacement may be necessary for chronic aneurysm of the arch or acute dissection. Although in many artists' illustrations of total arch replacement a vascular prosthesis perfectly reproduces the anatomical shape of the aorta[1-4], it is not infrequent to observe the kinking of the graft in the operating room. In these cases transkinking pressure gradients and postkinking turbulences have been demonstrated[5]. We propose a way to overcome this problem obtaining a true curved graft for replacement of the aortic arch, ascending and descending thoracic aorta with a single graft without the risk of kinking.

Case report

A 66-year-old man with a huge saccular atherosclerotic arch aneurysm associated with aneurysmal dilation of the ascending and descending aorta underwent aortic arch replacement extended to the ascending and descending thoracic aorta. The operation was performed on circulatory arrest and antegrade cerebral perfusion by the axillary artery as previously described[6]. During the cooling time a 28 Hemashield (Boston Scientific Medi-tech, Wayne, NJ, USA) straight graft was selected; in the middle part of the prosthesis three wedges of the wall were excised and the cut edges were sutured together as shown in figure 1. After circulatory arrest and aneurysm resection the prosthesis was invaginated, pushed into the descending thoracic aorta as described for the elephant-trunk technique[7] and anastomosed 1 cm distally to the left subclavian artery with a 3-0 polypropylene suture. The mark on the prosthesis wall was the reference for the spatial orientation of the graft according to the aortic arch axis. The graft was pulled out and the brachiocephalic vessels were anastomosed in block as an island to the prosthesis. After removal of air and debris, the graft was clamped and systemic circulation was restored. Proximal anastomosis was performed during re-warming time. At the end of the operation the prosthetic graft looked like a normal aorta without any kinking in spite of its length. The postoperative course was uneventful. Forty months after the operation the patient is going well. The patient refused to undergo computed tomographic scan examination and he could not perform magnetic resonance imaging because of previous pacemaker implantation.

Discussion

Today aortic arch replacement is frequently performed to treat chronic aneurysms of the aortic arch or acute dissections when the intimal tear involves the arch. Misfeld et al.[5], in an elegant experimental work, showed that when conventional straight or thermally fixed curved grafts were pressurized and used for total arch replacement double kinking folds in the lesser curve developed; the authors could demonstrate transkinking pressure gradient and postkinking turbulences bearing the risk of thrombus formation and

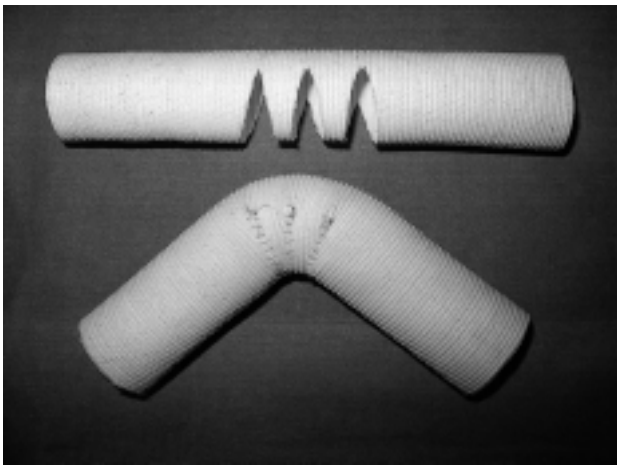

Figure 1. *Technique to construct a curved prosthesis from a straight one.*

proposed a novel curved vascular prosthesis for aortic arch replacement. To overcome this problem Svensson[8] suggests the graft to be transacted at 45° and the proximal end rotated through 180° to 270° and the two pieces joined together. Although we treated only one case, we believe that with the proposed method it is easy to tailor a curved graft that perfectly mimics the anatomy and physiology of a normal aortic arch. The inversion of the curved graft for elephant trunk construction could be easily obtained; in this case the mark on the graft wall allows the optimal spatial orientation of the graft according to the aortic arch axis. The technique is inexpensive, easy to perform and is not time-consuming because it can be done during the cooling time.

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