How-to-do-it

A novel approach to reconstructing the distal aortic arch

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Abstract

Repair of the aortic arch remains one of the greatest challenges in cardiac surgery. This difficulty is compounded by associated descending or thoracoabdominal pathology. Options include single stage repair, two stage procedures and the ingenious elephant trunk operation where a distal trunk is left for reconnection at a subsequent operation or completion by endovascular stenting. We present a technique involving the use of horizontal interrupted buttressed sutures. This allows the distal suture line to be safely placed more distally than is generally the case, achieves reliable haemostasis and may avoid the need for a second stage procedure in some cases. © 2002 Elsevier Science B.V. All rights reserved.

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1. Introduction

Repair of arch and descending thoracic aneurysms represents a major surgical undertaking. One approach has been the use of a single stage repair, with either a clamshell incision or a combined sternotomy and thoracotomy [1], but this is a major procedure with attendant risks. If approached as a two-stage procedure, the second stage can be hazardous because of adhesions to nearby vital structures, such as the left recurrent laryngeal nerve, left pulmonary artery and oesophagus. An alternative approach, the elephant trunk procedure and its variants [2–4] transfers the second stage anastomotic line away from vital structures. Furthermore, it also opens the opportunity of completing the second stage by endovascular techniques [5]. Nevertheless, some problems remain with the elephant trunk procedure. Firstly, although visibility is improved using the Crawford modification, it remains an awkward continuous anastomosis in the deepest and least accessible part of the chest. Bleeding from this suture line can be extremely difficult to control once the graft is pressurised. Secondly, the redundant elephant trunk may result in complications in the intervening period such as haemolysis, distal embolisation and paraplegia. Finally, as the anastomosis is usually performed in an inclusion fashion, vital structures such as the recurrent nerve are still at risk of being included in a deep stitch.

We describe a technique, which facilitates the distal anastomosis and avoids some of the pitfalls of the elephant trunk, while preserving its advantages. This technique has been used (by the senior author G.M.) in the last five patients requiring total arch reconstruction, with excellent results.

2. Methods

The patients were placed on cardiopulmonary bypass through a median sternotomy. Venous return was achieved with a two-stage venous cannula to the right atrium. Arterial cannulation was either to the ascending aorta or peripherally via femoral or right axillary arteries as appropriate. Cooling was continued to 20 °C and the head packed in ice. The field was flooded with CO₂. Blood cardioplegia was delivered via antegrade and retrograde routes. Upon reaching target temperature, the patient was placed in steep Trendelenburg position, cardiopulmonary bypass discontinued and the aorta opened. Antegrade cerebral perfusion was initiated via 14F retrograde catheters (DLP) into each of the three brachiocephalic vessels. Flow rates of 1–1.5 l/min were used to achieve a radial artery pressure of 40–60 mmHg. (Deep hypothermia was also used as it is not always possible to perform safe antegrade perfusion, e.g. when atheromatous head vessels are encountered, and once the arch is open it is too late to switch to a solely hypothermic approach.) A 30 cc Foley catheter was also introduced into the upper descending aorta. This allowed distal body antegrade perfusion either directly into the Foley catheter or via the femoral cannula if the latter was already inserted.

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The aorta was transected distally and a row of horizontal mattress sutures (Ethibond Excell, Johnson and Johnson) was placed evenly around the circumference of the proximal descending aorta, 3–4 cm beyond the left subclavian artery (LSCA) (Fig. 1). Traction on sequentially placed sutures provides excellent visibility even in deep chests and small arches and allows placement of the suture line well away from the LSCA. If access to the more distal descending thoracic aorta is needed, traction on the indwelling Foley will allow easy reach down to junction of the upper and middle thirds of the descending thoracic aorta. The mattress sutures are then passed through the perimeter of a Dacron graft. This can be to the free end of a graft, or if an ‘elephant trunk’ (ET) is required, to a ‘collar’ on the body of the graft (Fig. 2) a few centimetres from the free end. In the latter, it is not necessary to intussuscept the main graft into the elephant trunk, as visibility is excellent and there is no need to retrieve the main graft from within the ET subsequently.

The subsequent reconstruction of the arch vessels is done routinely, although if access to the distal side of the left subclavian artery is difficult, the interrupted horizontal mattress technique can be used to advantage again.

3. Discussion

We believe that the interrupted mattress technique described here has a number of advantages over the continuous techniques. All the sutures are placed in both the distal aorta and the Dacron graft precisely with good vision at all times, thus allowing for a reliably watertight anastomosis. The Teflon pledgets enhance the intrinsic strength of the native aorta in cases of acute dissection or severe medial necrosis and as they are placed under direct vision in the transected aorta, damage to nearby structures can be prevented. Furthermore the distal anastomosis can be constructed at a site on the descending aorta, well distal to the left subclavian artery. This also helps to avoid inadvertent inclusion of adjacent vital structures. In cases where the aneurysm extends a short distance into the descending aorta, it may be possible to extend the resection to include this area, thus avoiding a second procedure. By placing the distal suture line more distally than is possible with continuous techniques, it may be feasible to place an endovascular stent at a subsequent occasion even when an elephant trunk has not been left. Because the distal suture line is well distal to the left subclavian artery, there is more room to construct the distal part of the arch vessel reconstruction.

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References