A modified valve-sparing aortic root replacement technique for acute type A aortic dissection: the patch neointima technique

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Abstract

We describe a modified valve-sparing aortic root replacement technique for acute type A aortic dissection. After the normal root geometry was restored by removing blood and clots in the proximal false lumen and the valve insufficiency was corrected by simple re-suspension of the aortic commissures, three teardrop-shaped patches were sutured inside the sinuses as neointima and then in situ coronary buttons were connected to the small holes created in the corresponding patches. Our initial application showed that this modified valve-sparing aortic root replacement technique is an easy and effective way to restore the geometry of the aortic root and avoid bleeding during surgery for acute type A dissection.

Keywords: Dissection • Valve-sparing • Great vessels

INTRODUCTION

Although several established techniques have been used [1–4], valve-sparing root replacement is still a difficult and risky procedure for acute type A aortic dissection. By performing time-consuming steps, the surgeon needs to rebuild a complex three-dimensional root structure when even a slightly misplaced stitch may jeopardize the result. Moreover, intractable haemorrhage frequently arises from deep and long suture lines. With the intention of making valve-sparing aortic root replacement a much easier and safer procedure for acute type A aortic dissection, we developed an alternative technique: the patch neointima technique.

TECHNIQUE

All procedures were performed by a standard median sternotomy and cardiopulmonary bypass. A probe for transoesophageal echocardiographic monitoring was routinely placed.

Once the patient was in cardiopulmonary bypass, core cooling was initiated. The ascending aorta was clamped at 30°C. The aorta just above the aortic valve commissures was transected, and an external dissection of the aortic root was made. Only valves without gross structural defect, aortic valve insufficiency as a result of commissural detachment and an acute root ectasia due to the false lumen distended by perfusion pressure were selected for the patch neointima technique. After removing blood and clots in the proximal false lumen and resuspension of the detached aortic commissures using 4–0 polypropylene sutures with Teflon pledgets placed on both the inner and outer sides of the root, a repaired root with correct root geometry and a competent valve was obtained (Fig. 1A). Depending on the visual judgement of the repaired root, three teardrop-shaped patches (Polyester surgical patch, Chest Medical Technological Co, Shanghai, China) compatible with the sizes and shapes of the corresponding sinuses were trimmed exactly. Then each patch was inserted within the corresponding sinus and fixed to the annulus using several mattress sutures. Those mattress fixation sutures were placed within the root and passed through the annulus underneath the valve (from ventricular to aortic side) (Fig. 1B). A small hole was created in the patch inside the coronary sinus and the in situ coronary orifice with the surrounding sinus wall was anastomosed to the hole with a 5–0 polypropylene running suture (if the surrounding sinus wall was not involved by the dissection) or with several horizontal mattress sutures placed circumferentially from inside to outside the sinus wall (when the surrounding sinus wall was involved by the dissection) (Fig. 1C). Then a selected Dacron tube was anastomosed with a 4–0 polypropylene running suture to the reconstructed aortic root with incorporation of the distal margin of the implanted patches.

When core cooling to a 22°C rectal temperature was achieved, a systemic circulatory arrest was induced. After we cross-clamped the left common carotid artery and innominate artery, selective cerebral perfusion via the right axillary artery cannula was established at a rate of ~10 to 15 ml kg⁻¹ min⁻¹. Distal aortic reconstruction and distal aortoprosthesis anastomosis were performed.

RESULTS

Between January 2009 and December 2010, 73 consecutive patients (57 male, 16 female; median age 48.23 ± 9.95 years;
range 25–80 years) with acute Stanford type A aortic dissection underwent valve-sparing aortic root replacement with the patch neointima technique. The cardiopulmonary bypass time was 115–160 min (mean 131.44 ± 8.49 min); aortic cross-clamp time was 75–99 min (mean 85.48 ± 4.12 min); and selective cerebral perfusion was 24–45 min (mean 31.07 ± 4.32 min). Three in-hospital deaths occurred in this group. Postoperative cerebral complications were observed in nine patients (cerebral infarction in one patient and global temporary neurological dysfunction in eight) and acute renal failure occurred in seven patients (five requiring dialysis). The grade of the aortic incompetence in survivors is shown in Table 1.

**DISCUSSION**

In our technique, we did not resect any sinuses of Valsalva but sutured teardrop-shaped patches to the inside of the sinuses. Several advantages of our technique were shown in this study. Leaving all sinuses of Valsalva in place facilitated the determination of the proper size and shape of the patches. Furthermore, although a certain increase in external diameter is frequently found in acute type A aortic dissections, most aortic roots have normal pre-existing structures. In these situations, root dimensions can be expected to return to normal after removing blood and clots in the proximal false lumen. Consequently, the normal root geometry can be easily maintained by suturing teardrop-shaped patches to the inside of the sinuses, which may be crucial for the favourable function of the preserved valve [5]. In addition, in both Yacoub’s remodelling technique and Urbanski’s patch technique, the long suture line between the aortic

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**Table 1:** Aortic incompetence in survivors (no. of patients)

<table>
<thead>
<tr>
<th></th>
<th>Aortic insufficiency</th>
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<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Before surgery</td>
<td>3</td>
</tr>
<tr>
<td>Before discharge</td>
<td>48</td>
</tr>
<tr>
<td>Three months after surgery</td>
<td>43</td>
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**Figure 1:** Schematic diagram of the operation. (A) After removing blood and clots in the proximal false lumen and resuspension of the detached aortic commissures using 4–0 polypropylene sutures with Teflon pledgets placed on both the inner and outer sides of the root, a repaired root with correct root geometry and competent valve occurred. (B and D) Three teardrop-shaped patches compatible with the sizes and shapes of the corresponding sinuses were inserted within the corresponding sinus and fixed to the annulus using several mattress sutures. Those mattress fixation sutures were placed within the root and passed through the annulus underneath the valve (from ventricular to aortic side). (C) A small hole was created in the patch inside the coronary sinus and the in situ coronary orifice with the surrounding sinus wall was anastomosed to the hole with a 5–0 polypropylene running suture (left coronary, the surrounding sinus wall was not involved by the dissection) or with several horizontal mattress sutures placed circumferentially from inside to outside the sinus wall (right coronary, the surrounding sinus wall was involved by the dissection). LCO: left coronary ostium; RCO: right coronary ostium.
renament and the Dacron tube or patch is in the deep surgical field. Once bleeding occurs after the anastomoses, haemostasis in this deep field is difficult. In our technique, the patch fixation sutures were placed within the aortic root and the proximal aortic anastomosis was performed just above the aortic valve commissures, which provided a better surgical view and subsequent easier haemostasis. Some surgeons have also confirmed that partial aortic root reinforcement with the patch inside the sinus can effectively overcome bleeding [6].

In conclusion, patch neointima is a feasible technique. By using this technique, valve-sparing root replacement may become easier and safer for selected patients with acute type A aortic dissection.

Conflict of interest: none declared.

REFERENCES