Extended aortic root replacement with pulmonary autograft

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Abstract

The surgical relief of complex multilevel left ventricular outflow tract obstruction remains a challenging surgical problem. We present a new operation which combines the concepts of aortoventriculoplasty, extended aortic root replacement and the use of a pulmonary autograft. Fourteen patients underwent this operation: nine patients after previous attempts to relieve diffuse subvalvular stenosis and five patients who presented excessive gradients over an outgrown aortic valve prosthesis. All patients except one survived the operation. One patient developed complete heart block after a septal infarction. One patient remained in congestive heart failure and died suddenly after 17 months. All other patients are in NYHA class I after a mean follow-up of 20 ± 12 months. All patients showed excellent function of the autograft and homograft valve at follow-up.

This operation might present a more durable or even a definitive solution in the management of these complex left ventricular outflow tract obstructions.

The surgical relief of complex multilevel left ventricular outflow tract obstruction (LVOTO) remains a challenging problem. Several aggressive surgical procedures have been developed to treat these lesions. Aortoventriculoplasty (AVP) introduced by Konno (9), and aortic root replacement proposed by Ross (6, 16) are certainly more satisfactory than the placement of a left ventricular apico-aortic conduit (1, 4).

Clarke and associates combined the concepts of the AVP and the use of allografts in an operation described as the extended aortic root replacement (EARR) (13).

Convinced by the superiority of the pulmonary autograft in aortic position (7, 11, 15), we therefore combined the concept of the EARR and the use of a pulmonary autograft. This chapter describes our experience of this operation in 14 patients.

Patients and methods

Fourteen patients underwent an EARR: nine after several attempts of resection of a severe tunnel subvalvular aortic stenosis and five patients because of increasing gradients over an outgrown aortic valve prosthesis (Table 1). The ages at operation
Table 1. Patient material

<table>
<thead>
<tr>
<th></th>
<th>Redo SUBV-AS</th>
<th>Redo AVR</th>
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<tbody>
<tr>
<td>Patients (n)</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Ages (years)</td>
<td>2.5–26</td>
<td>17–28</td>
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<tr>
<td>Interval previous surgery (years)</td>
<td>2–15</td>
<td>8–18</td>
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<tr>
<td>Mean preop gradient LVOT (mmHg)</td>
<td>112</td>
<td>80</td>
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<tr>
<td>Patients with CHF (n)</td>
<td>2</td>
<td>1</td>
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ranged from 2.5 to 26 years. The mean preoperative gradient was 112 mmHg in the subvalvular stenosis group and 80 mmHg in the group operated for an outgrown aortic prosthesis. Three patients presented signs of congestive heart failure preoperatively.

Operative technique

Cardiopulmonary bypass is instituted using one aortic and one right atrial canula. The patient is cooled to 25 °C. The ascending aorta and the main pulmonary artery (PA) are separated down to the orifice of the left coronary artery. After aortic cross-clamping the aorta is transected 1 cm distal to the aortic commissures. Multidose crystalloid cardioplegia is delivered through two coronary canulas until a septal temperature of 10 °C is reached. Topical cooling with sludged ice is added to avoid myocardial rewarming.

After confirmation of the diagnosis the aortic valve is removed and the LVOTO is sized with Hegar obturators. The two coronary ostia are excised from the aorta with a generous button of 2–3 mm of aortic wall. The coronary arteries are only mobilised to allow proper excision of the buttons. The proximal aorta is then excised, leaving the annulus in place.

The pulmonary artery is transected at the bifurcation with a slight oblique cut into the left pulmonary artery. The main PA is posteriorly completely separated from the left main coronary artery which is probed to allow proper visualisation. The right ventricular infundibulum is incised transversely 5–6 mm from the pulmonary valve anulus. The excision of the pulmonary root is completed by respecting this distance except in the area of the left anterior descending coronary artery and its first septal branch where the transection is kept close to the pulmonary annulus.

After resection of eventual residual subvalvular tissue the interventricular septum is incised starting at the commissure between the right and left aortic cusp. The septal incision is continued into the infundibular septum as far to the left as possible to avoid the conduction mechanism. The length of the incision depends on the severity of the LVOTO and the size of the native pulmonary valve annulus, which is always much larger than the hypoplastic aortic annulus. Sometimes an aberrant left ventricular tendon inserting in the interventricular septum is recognized (two patients). This tendon should be resected as it might be partially responsible for recurrence of the subvalvular stenosis (8). The margins of the septal incision are bevelled on the left ventricular side to further widen the LV outflow tract.