Proposal for bail-out procedures - Valves

Valve-sparing aortic root replacement with repair of leaflet prolapse after Ross operation

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Abstract

The need for reoperation remains a principal limitation of the Ross procedure and most commonly includes replacement of the neo-aortic valve. Valve-preserving aortic root replacement has recently evolved into an increasingly accepted treatment modality for patients with neo-aortic valve regurgitation. Leaflet prolapse, however, may be present, making composite replacement the most frequent choice. Alternatively, valve preservation may be combined with correction of leaflet prolapse. We describe the use of a valve-sparing procedure with correction of leaflet prolapse in a patient with progressive dilatation of the pulmonary autograft and severe regurgitation of the neo-aortic valve.

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1. Introduction

Replacement of the aortic root with a pulmonary autograft (Ross procedure) provides a viable valve with excellent hemodynamic function, without anticoagulant therapy. However, the need for reoperation remains the principal limitation of this procedure. Dilatation of the autograft with or without regurgitation of the neo-aortic valve is a common indication for reoperation. Most of the reoperations have involved replacement of the aortic root with a composite graft containing a mechanical or bioprosthetic valve, or an aortic root allograft, in this particular case with leaflet prolapse [1–4]. We report the use of a valve-sparing procedure with correction of leaflet prolapse in a patient with progressive dilatation of the pulmonary autograft and severe regurgitation of the neo-aortic valve.

2. Case report

A 38-year-old man previously underwent a Ross procedure at the age of 32 years for moderate aortic insufficiency with a tricuspid valve. At the time of that operation, aortic annulus was measured at 33 mm after removal of the aortic valve and pulmonary valve was 29 mm. During insertion of the autograft valve, the autograft and the left ventricular outflow tract was sutured with 4-0 prolene. The right ventricular outflow tract was replaced with a 23-mm pulmonary homograft. The patient was evaluated at yearly intervals; he was always normotensive and received no medications. Although he remained asymptomatic, serial echocardiographic studies demonstrated progressive dilatation of the aortic annulus and sinuses. During the 6 years and 4 months follow-up interval, the diameter of the aortic annulus increased to 36 mm, the diameter of the sinus of valsalva increased to 51 mm, the sinotubular junction increased to 37 mm and the progression of neoaortic valve regurgitation from nil to severe regurgitation was noted by Doppler color flow imaging. Prolapsed noncoronary cusp and no abnormal change in other cusps was noted by transesophageal echocardiography. Aortography confirmed the same dilatation. This patient is one of two (3.7%) patients requiring reoperation for pulmonary autograft in 54 consecutive patients who underwent Ross procedure by one of the authors (H.K.) since 1995.

The chest was opened by means of median sternotomy, and the patient was begun on extracorporeal circulation by aortic and bicaval cannulations. After aortic cross-clamping, cardiopulmonary arrest was induced by cold crystalloid cardioplegia. After opening the aorta, the aortic root was inspected carefully and particular care was taken to assess the geometry of the aortic valve and leaflet morphology. In the presence of a tricuspid valve, the left coronary cusp appeared dilated, the noncoronary cusp and the right coronary cusp of the pulmonary autograft were prolapsed and the annulus was also dilated remarkably. The dilated neo-aortic sinuses were excised and a Haemashield 28 mm graft was sutured using the technique of the David-I operation. One 6-0 prolene suture (Ethicon, Somerville, NJ) was passed through the noduli of Arantius and the relative length of the free margins of all leaflets was estimated. Leaflet prolapse was corrected by plication sutures placed in the left–right and left–non-commissures of the leaflets.
Fig. 1. Postoperative transesophageal echocardiography demonstrating trivial aortic regurgitation.

with 6-0 prolene sutures. The coronary arteries were mobilized and implanted into the aortic graft. At the completion of the procedure, transesophageal echocardiography demonstrated trivial aortic regurgitation (Fig. 1). The postoperative course was uneventful. Good opening and smooth blood flow were revealed by Cine-MRI. The excised autograft tissue of this patient demonstrated medial myxoid degenerative change with necrosis by hematoxylin-eosin stain and severe fragmentation of elastic fiber by arusian-blue stain. The original aortic tissue had no histological changes (Fig. 2).

3. Comment

After replacement of the aortic root with a pulmonary autograft, progressive dilatation of the neo-aortic sinuses was observed in some patients [1]. This may be the result from younger age, larger preoperative dimensions of aortic root, use of root replacement technique, absence of peri-cardial strip buttressing, length of follow up [2] and structural abnormalities of the pulmonary autograft. It is not clear whether myxoid change in neo-aorta is the cause or result of autograft dilatation. This degeneration can be caused by the systemic pressure which was created by the Ross procedure, because the native ascending aorta did not have any histological changes. The treatment options are composite replacement, aortic root replacement with a stentless valve or valve-sparing root replacement. Valve-composite replacement, aortic root replacement with a have any histological changes. The treatment options are Ross procedure, because the native ascending aorta did not caused by the systemic pressure which was created by the autograft dilatation following Ross procedure. Four main-stays of treatment for prolapse were reported: triangular resection; central plication; free margin reinforcement; and commissural suspension. The methods of repair depended on the degree of prolapse, and the quality of the cusps tissue [9]. Though leaflet shortening at the central portion of the free margin was the mainstream recently, particularly in Marfan syndrome patients, we used the last method because the excessive firm tissue was adjacent to the left–right and left–non-commissures of the leaflets in this patient. The latest follow-up, 8 months after the successful operation, showed normal autograft valve function with no change of regurgitation. The additional experience and longer follow-up are needed to determine the efficacy and durability of this valve-sparing procedure.

Fig. 2. Histology of the resected pulmonary autograft (a, c) and ascending aorta (b, d). The autograft shows medial myxoid degenerative change with necrosis and severer fragmentation of elastic fiber than the ascending aorta (hematoxylin-eosin stain; a and b, original magnification 50×; arusian-blue stain; c and d, original magnification 50×).

replacement does not result in increased morbidity or hospital mortality [7,8].

This correction of leaflet prolapse could be applied in the autograft dilatation following Ross procedure. Four main-stays of treatment for prolapse were reported: triangular resection; central plication; free margin reinforcement; and commissural suspension. The methods of repair depended on the degree of prolapse, and the quality of the cusp tissue [9]. Though leaflet shortening at the central portion of the free margin was the mainstream recently, particularly in Marfan syndrome patients, we used the last method because the excessive firm tissue was adjacent to the left–right and left–non-commissures of the leaflets in this patient. The latest follow-up, 8 months after the successful operation, showed normal autograft valve function with no change of regurgitation. The additional experience and longer follow-up are needed to determine the efficacy and durability of this valve-sparing procedure.

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