tricuspid palliation may be considered an acceptable alternative in selected cases.

References

Pulmonary Autograft Implantation in the Dilated Aortic Annulus
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The application of the pulmonary autograft (Ross) procedure in the treatment of dilated aortic annulus is still controversial, because technical errors of implantation are more likely to occur as the host annular diameter increases. The Ross procedure was successfully employed in a 28-year-old woman with a dilated aortic annulus after simple annular plication. The annulus was plicated beneath the three commissures where the pulmonary autograft was subsequently attached. The diameter of the annulus was reduced from 32 to 26 mm. This technique may provide a number of advantages compared with aortic valve replacement, especially for women of child-bearing age.

Although the pulmonary autograft (Ross) procedure is more complex than simple aortic valve replacement, it recently has been employed by a number of surgeons, with excellent short-term and long-term results [1–3]. The application of the pulmonary autograft procedure in the treatment of dilated aortic annulus is, however, still controversial [4–8]. Because of the numerous advantages afforded by the Ross procedure compared with valve replacement, we performed this operation after annular plication in a young female patient with a severely dilated aortic annulus.

A 28-year-old woman had a heart murmur, which had been identified at age 2 years. Aortic operation was recommended after cardiac catheterization at age 6 years. She was unable to exercise, but otherwise was well until left ventricular severe dilatation was noted at age 28 years. Again, operation was recommended. Physical examination showed no signs of Marfan’s syndrome. Preoperative cardiac catheterization revealed severe aortic insufficiency and left ventricular dilatation, with a left ventricular end-diastolic volume index to end-systolic volume index of 281/151 mL/m² (Fig 1). Echocardiography revealed a left ventricular diastolic to systolic dimension of 76/61 mm, a dilated aortic annulus (30 mm), and a dilated sinus of Valsalva (44 mm) (Fig 2). The internal diameter of the pulmonary valve was 23 mm.

Under neuroleptanalgesia with the patient in the supine position, a median sternotomy was performed. Cardiac bypass perfusion was initiated with an ascending aortic and inferior and superior vena caval cannulas. First, the distal pulmonary trunk was opened. The right ventricular outflow tract was opened 5 mm beneath the pulmonary cusp. The incision was then extended to harvest the pulmonary graft. After cross-clamping of the aorta, the area around the septal branch was dissected. The first septal branch was kept intact. Cold St. Thomas’ cardioplegia solution was given antegrade (1,000 mL) and retrograde (300 mL). Mild hypothermic systemic perfusion (34°C) was instituted.

The aortic root was transected just above the commissure. Examination of the aortic valve revealed a large perforation in the noncoronary cusp on the left, near the commissure. The noncoronary cusp was severely prolapsed. The annulus, which was dilated to greater than 32 mm, was plicated 7 mm beneath the three commissures using 4-0 Ticron Z-sutures (Fig 3). The diameter was reduced to 26 mm. Annular sutures (4-0 Prolene; Ethicon, Somerville, NJ) were placed from the bottom of the right coronary cusp, advancing counter-clockwise. Between the bottom of the coronary cusp and the commissure, seven to eight sutures were placed. There were a total of 47 sutures. The pulmonary autograft was lowered, and the sutures were tied. The suture line was reinforced with an autologous pericardial strip. Both coronary arteries were reconstructed on the side of the autograft using continuous 6-0 Prolene sutures on a Carrell patch. After longitudinal plication of the distal native ascending aorta, the distal end of the autograft was sutured to the native aorta with continuous 4-0 Prolene, reinforced with native aortic wall. Finally, the right ventricular outflow tract and the pulmonary trunk were reconstructed with a pulmonary allograft (24 mm) using continuous 4-0 Prolene suture. The allograft was obtained from a 35-year-old male donor, and was preserved for 51 months at our institution.

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Weaning from cardiopulmonary bypass was performed without difficulty. Transesophageal echocardiography showed satisfactory graft function and a mild aortic regurgitant jet. The intraoperative and postoperative courses were uneventful. No blood transfusions were required. Postoperative echocardiography revealed a reduced left ventricular diastolic/systolic dimension (from 76/61 mm to 53/38 mm) and mild residual aortic insufficiency (see Fig 2).

Comment

Size mismatch between the host aortic annulus and the allograft or the autograft annulus has been reported as the major cause of residual aortic insufficiency, even using the root replacement technique [4]. Technical errors of implantation are more likely to occur as the host annular diameter increases [5, 6]. O’Brien and associates [6] have reported that an allograft valve with an internal diameter 2 to 3 mm less than the host annulus diameter can be used to obtain ideal leaflet coaptation in hosts with a large annulus. In this case, the aortic annulus diameter was 32 mm and the pulmonary autograft annulus diameter was 23 mm. Although this patient was not a suitable candidate, the risk of further dilatation of the annulus is extremely low after the Ross procedure following reduction of the annulus diameter because the large annulus was secondary to dilatation from severe aortic insufficiency over a long time period, not secondary to a connective tissue disorder.
There have been a few descriptions of methods to plicate the aortic annulus during allograft or autograft implantation [4, 7, 8]. Kasegawa and associates [7] have reported a repair technique for the dilated annulus using a short tubular Dacron graft, which may be applicable in patients with Marfan’s syndrome. Mortiz and colleagues [8] have resected the aortic root by up to 6 mm using commissuroplasty in seven Ross operations. In our patient, the aortic annulus was plicated beneath the three commissures at the site where the pulmonary autograft was subsequently attached. To reduce the diameter from 32 to 26 mm, about 18 mm of circumference should be plicated (6 mm in each commissure). The three commissures should be located at equal angles (120 degrees) before and after these plications.

The Ross procedure was successfully applied in the treatment of a patient with a dilated aortic annulus after simple annular plication. Although longer follow-up will be necessary to confirm the reliability of this procedure, this technique is associated with a number of potential advantages over valve replacement, particularly in women of child-bearing age.

References

INVITED COMMENTARY

Eishi and associates report the successful management of a patient with significant dilatation of the aortic annulus and of the ascending aorta with an annuloplasty technique consisting of plication of the three commissures of the aortic annulus, support of the plicated annulus with an autologous pericardial strip, and a longitudinal aortoplasty by plication of the distal native ascending aorta. The early results with this management technique were quite successful. Doctor Tirone David has recently reported on the intraoperative measurements of the aortic and pulmonary root in 77 patients. Reduction in the diameters of the aortic annulus and sinotubular junction was performed in 27 patients, reduction of the aortic annulus in an additional 12, and of the sinotubular junction alone in 10. The operative technique described by Dr David consists of plication of the aortic annulus involving the two commissures associated with the non-coronary leaflet. It is Dr David’s opinion that the dilatation that occurs in patients with aortic insufficiency and a bicuspid valve occurs primarily in the noncoronary sinus and that the aortic annuloplasty should be limited to this area of the aortic annulus. It is also his contention that the appropriate sizing for the aortic annulus should be based on the measured diameter of the sinotubular junction of the pulmonary valve with the assumption that the pulmonary annulus is normally 10% larger than the diameter of the sinotubular junction. Using this technique he reports excellent midterm results with this operative procedure.

At our institution we have noted that failure of the Ross operation due to progressive autograft valve insufficiency has been associated with dilatation of the aortic annulus that may be rapidly progressive and associated with early as well as late failure. Management of this complication and prevention of aortic annular dilation was accomplished with the use of an aortic annuloplasty technique that is a modification of a technique described by Alain Carpentier. Fixation of the aortic annulus after annuloplasty has been accomplished with the use of an external woven Dacron strip to ensure stabilization of the reduction annuloplasty. This technique has become a very important modification of the Ross operation for management of patients who have aortic annular dilatation. These patients, most of whom have evidence of dilatation of their ascending aorta and in some the presence of an ascending aortic aneurysm, have required longitudinal...