Aortic root reimplantation for successful repair of an insufficient pulmonary autograft valve after the Ross procedure

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Dilation of the pulmonary autograft after Ross operation is a potential problem that can cause autograft valvular regurgitation, which eventually necessitates aortic valve rereplacement.¹ In most cases of pulmonary autograft dilation, the valve leaflets appear macroscopically to be within normal limits. The reason for autograft valve regurgitation is not the dilation of the sinuses of Valsalva itself, but rather dilation of the sinotubular junction or aortic anulus.^{2,3} Thus these valves could potentially be repaired by valve-sparing aortic root reimplantation, as first described by David and Feindel.⁴ Here we report the case of a patient in whom severe regurgitation of the pulmonary autograft valve developed 28 months after a Ross procedure for aortic valve regurgitation. Autograft valve function was restored by valve-sparing aortic root reimplantation.

Clinical Summary

A 37-year-old male patient with severe aortic valve regurgitation underwent aortic valve replacement by pulmonary autograft valve implantation. Complete aortic root replacement was performed. At this time the diameter of the ascending aorta was judged to be within normal range. A bicuspid aortic valve was excised. The diameter of the aortic anulus was measured to be 31 mm and was downwardly sized to 23 mm by commissural plication. A specimen of the ascending aorta obtained for histologic evaluation revealed fibrosis of the medial layer but no cystic medial necrosis. The postoperative course was uneventful, and the patient was discharged from hospital on the ninth postoperative day. Intraoperative transesophageal echocardiography and transthoracic echocardiography at the first follow-up examination 12 months after the operation showed a competent pulmonary autograft valve with normal dimensions of the sinotubular junction, sinuses of Valsalva, and aortic anulus (by intraoperative transesophageal echocardiography 25 mm, 31 mm, and 25 mm, respectively, and by 12-month follow-up transthoracic echocardiography 26 mm, 29 mm, and 25 mm, respectively). Twenty-eight months later, routine echocardiography revealed severe autograft valve regurgitation

with echocardiographic signs of left ventricular volume overload (left ventricular end-diastolic dimension 70 mm). In addition, dilations of the sinotubular junction (44 mm), sinuses of Valsalva (47 mm), and aortic anulus (39 mm) were diagnosed. A computed tomographic scan showed significant dilations of the sinotubular junction (42 mm), the sinuses of Valsalva (48 mm), and the aortic anulus (40 mm; Figure 1).

For aortic valve reoperation, a median sternotomy was performed and cardiopulmonary bypass was established through proximal aortic arch cannulation. The operation was performed under moderate hypothermia during cardiopulmonary bypass. For myocardial protection, intermittent cold blood cardioplegia was applied. During the operation the preoperatively diagnosed dilations of the sinotubular junction and sinuses of Valsalva were verified. The autograft valve leaflets macroscopically appeared normal. We therefore decided to leave the autograft valve in place and perform a valve-sparing aortic root reimplantation procedure.⁴ After excision of the sinuses, the autograft was implanted into a straight, nontailored Dacron polyester fabric tube, similar to the implantation of an aortic valve homograft, followed by reimplantation of the coronary ostia. The slightly prolapsing noncoronary leaflet was resuspended by a Trusler commissural plasty between the left and noncoronary leaflet commissure. The patient was successfully weaned from cardiopulmonary bypass, and intraoperative transesophageal echocardiography revealed a fully competent reimplanted autograft. After an uneventful postoperative course, the patient was discharged from the hospital on postoperative day 10. The latest follow-up, 14 months after the operation, showed normal autograft valve function, with no signs of regurgitation and stenosis.

Comment

To our knowledge this is the first report on a successful repair by aortic root reimplantation technique of an insufficient pulmonary autograft after a Ross operation. Basically, the Ross procedure can be performed in three different ways: (1) by aortic root replacement, (2) by aortic root inclusion, and (3) by subcoronary implantation of the pulmonary autograft. Elkins and coworkers² described a higher incidence of aortic valve regurgitation after aortic root inclusion and therefore recommended aortic root replacement as the safest technique for Ross procedures, which is currently the technique of choice.⁵ However, David and associates¹ reported recently on an increased frequency of pulmonary autograft valve dilation after freestanding root replacement that might subsequently lead to autograft valve regurgitation necessitating reoperation. For these patients, replacement of the aortic root with a composite graft is currently the surgical intervention of choice. However, most of these patients have normally functioning autograft valve leaflets, and valvular regurgitation is caused by dilation of either the sinotubular junction or the aortic anulus.

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Figure 1. Computed tomographic scan of left ventricular outflow tract, neo-aortic root, and proximal ascending aorta 28 months after Ross procedure, demonstrating dilations of aortic annulus (A, 40 mm), sinus of Valsalva (B, 48 mm), and sinotubular junction (C, 42 mm) resulting in severe autograft valve regurgitation.

Under these conditions, valve-sparing aortic root reimplantation may be a beneficial approach with the option of preserving the native valve. There are concerns about the safety and feasibility of this technique after previous aortic root surgery. Reoperation of the aortic root in these cases challenges the surgeon because of ex-

cessive adhesive scar tissue of the adjacent aortic root tissue. However, we have recently reported on the feasibility and safety of valve-sparing aortic root replacement after aortic root surgery for acute type A dissection with favorable midterm results.⁶

Because of the increasing popularity of the Ross procedure for aortic valve replacement, the number of patients requiring reoperation for aortic root dilation after this procedure will also increase. We believe that a significant number of these patients will meet the criteria for successful autograft valve repair by means of valve-sparing aortic root reimplantation. For final judgment on this surgical approach, however, larger numbers of patients and additional data obtained from extended follow-up studies are required. We hope that this report will help to initiate a change in thinking about the surgical management of pulmonary autograft dilation in the aortic position after a Ross procedure.

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