

Alternative to Reconstruction of the Pulmonary Outflow Tract in the Ross Procedure

Kiyofumi Morishita, MD, PhD, Tomio Abe, MD, PhD, Johji Fukada, MD, Hiroki Sato, MD, PhD, and Cikara Shiiku, MD

Department of Thoracic and Cardiovascular Surgery, Sapporo Medical University School of Medicine, Sapporo, Japan

We report our experience with 2 cases in which we used the native ascending aorta and a porcine valve to reconstruct the right ventricular outflow tract in the Ross procedure. Unfortunately, in many parts of the world, the lack of homografts for reconstruction of the right ventricular outflow tract limits the use of the Ross procedure. The technique described herein can be an alternative to a cryopreserved pulmonary homograft replacement for adult patients.

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In the Ross procedure, various materials have been used for the right ventricular outflow tract (RVOT). Currently, a cryopreserved pulmonary allograft is accepted worldwide as a material useful for this procedure. Unfortunately, in most countries, the Ross procedure is limited because pulmonary allografts cannot be used for reconstruction of the RVOT. To circumvent the problem, other materials should be considered instead. We report on our experience with use of a valved conduit constructed from the native ascending aorta and a porcine valve.

Case Reports

Patient 1

A 55-year-old woman presented with an upper mediastinal widening on the chest radiograph. Echocardiography demonstrated severe stenosis with a transaortic gradient of 65 mm Hg and a small aortic root (20 mm). Aortic angiography revealed a 5-cm ascending aortic aneurysm.

Operation was performed with moderate hypothermic cardiopulmonary bypass and antegrade cardioplegia. The pulmonary autograft was harvested in the usual fashion. The ascending aorta was removed from the sinotubular ridge to a point 2 cm proximal to the origin of the innominate artery, corresponding to the aneurysm. A 25-mm Carpentier-Edwards supraannular valve (Baxter

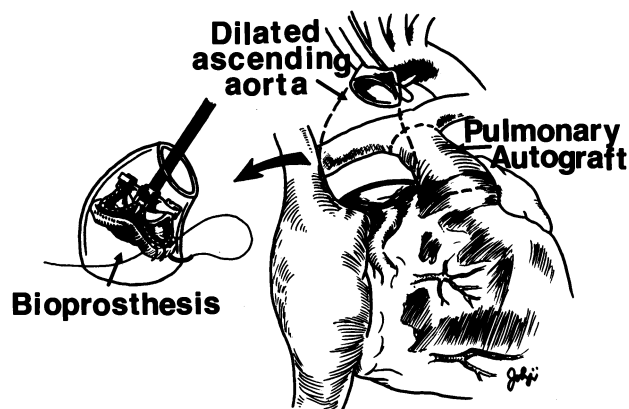


Fig 1. A valved conduit reconstructed with the native ascending aorta and a porcine valve.

Healthcare Corp, Santa Ana, CA) was chosen for the pulmonary valve position. The removed aorta was opened and then the xenograft was sewn into the opened aorta, 1 cm above the proximal end. The valved conduit was closed, with redundant tissue trimmed. Both ends of the valved conduit were trimmed obliquely so that the conduit could lie comfortably in the pulmonary artery position (Fig 1). The pulmonary autograft was implanted as an aortic root replacement. The coronary arteries were reimplemented with a button technique. The RVOT was reconstituted with the prepared valved conduit. The distal anastomosis was performed first. Then the proximal suture line to the RVOT was initiated in the posterior aspect of the RVOT using interrupted 4-0 monofilament sutures, followed by anterior continuous suturing. Because the distal end of the implanted autograft did not reach the proximal end of the aorta, a collagen-impregnated woven Dacron Hemashield graft (Meadox Medicals, Inc, Oakland, NJ) was interposed to achieve aortic continuity (Fig 2). The aortic clamp time was 162 minutes. The mean peak Doppler gradient across the neopulmonic bioprosthesis was 4 mm Hg 1 month after the operation. A routine echocardiogram at 1 year

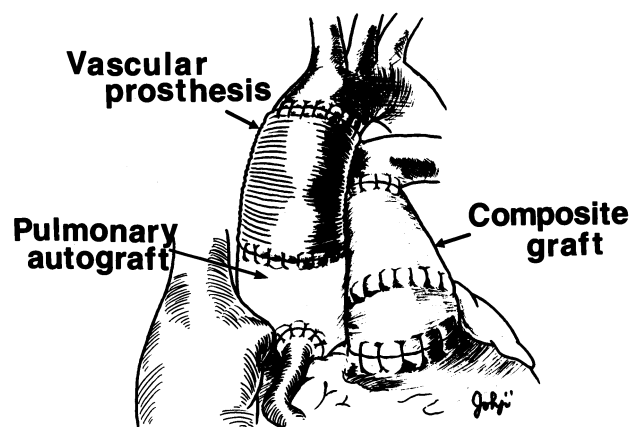


Fig 2. Modified Ross procedure completed.

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Address reprint requests to Dr Morishita, Department of Thoracic and Cardiovascular Surgery, Sapporo Medical University School of Medicine, South 1, West 16, Chuo-ku, Sapporo, Hokkaido 060-0061, Japan.

showed the same gradient. In addition, there was no evidence of calcification or dilatation of the autograft used for the RVOT reconstruction.

Patient 2

A 42-year-old man presented with syncope episodes caused by aortic stenosis. An echocardiogram showed a small aortic root (20 mm) and a gradient of 120 mm Hg across the aortic valve. Poststenotic dilatation of the ascending aorta reached 4 cm.

The RVOT was reconstituted in the same fashion as for patient 1. The aortic clamp time was 178 minutes. An echocardiogram at 6 months postoperatively showed a transpulmonary gradient of 5 mm Hg with no findings of dilatation of the valved conduit.

Comment

Currently, the indication for the Ross procedure is expanding to adults with long life expectancy [1]. Of them, patients with a small aortic root are particularly good candidates. Clear hemodynamic superiority of autografts compared with artificial prostheses has been demonstrated in such patients. Moreover, autografts have good longevity, require no anticoagulation, and are resistant to infection. These properties are attractive even though the procedure is time-consuming.

Unfortunately, in most parts of the world, the use of this attractive procedure is limited by the reduced availability of homografts for reconstruction of the RVOT. Therefore, alternatives are necessary to make the Ross procedure available. These alternatives include an autologous valved conduit [2], a valveless conduit, a monocusp valve [3], and a reverse valvular switch operation [4]. The autologous pericardium, however, is not reliable for durability [1]. Regarding valveless conduits, right ventricular dysfunction is a major concern. Nonfunctioning monocusps are often observed in late follow-up. A reverse valvular switch operation consists of implanting the native diseased aortic valve in the pulmonary position. DeLeon and associates [4] commented that the valve could function well at a lower pressure and be free of immunologic rejection, which would result in a long survival. This procedure is certainly ingenious, but it seems difficult to perform.

Our technique has several issues. First of all, the use of bioprostheses is a key issue. Guerra and colleagues [5] have reported that, of four explanted bioprostheses from the tricuspid position in patients 30 to 40 years of age, only one showed a severe deterioration. Theoretically, the closing stress placed on pulmonary bioprostheses, which is a major cause of their destruction, is lower than that placed on tricuspid ones. Therefore, pulmonary bioprostheses are also expected to have good longevity. Based on our experience, bioprostheses in the pulmonic position are durable in patients older than 30 years [6]. Accordingly, it would be justified to use a bioprosthesis even in young adult patients. To put a diseased aorta in the pulmonary position is a point of concern. However, it is unlikely that the diseased aorta expands further be-

cause of the low pressure to which it will be subjected. Moreover, we reduce the diameter of the aorta by trimming tissue to decrease wall stress. The flexibility of the native aorta is an advantage that probably outweighs the risk of aortic expansion, especially during an anastomosis of friable myocardium in the right ventricular infundibulum. Another issue is the long aortic clamping time. To minimize the ischemic time, we will modify our procedure as follows: reconstruction of the RVOT will be performed after the clamp is released, and pulmonary autograft and Dacron extension will be carried out before the aortic root is replaced.

Based on our experience, we suggest that our procedure should be employed as an alternative for reconstructing the RVOT in the Ross procedure. However, long-term follow-up is required to evaluate the usefulness of the valved conduit.

References

1. Gonzalez-Lavin L, Metras D, Ross DN. Anatomic and physiologic bases for the Ross procedure. *J Heart Valve Dis* 1996;5:383-90.
2. Urrea MS, Herrera V, Rey A, Vargas J. Ross operation using a bovine bioprosthetic valve with autologous pericardial conduit in the pulmonary position. *Tex Heart Inst J* 1993;20:271-4.
3. Couetil JP, Fuzellier JF, Berrebi A, Austin C, Deloche A, Carpentier AF. New approach for reconstruction of the pulmonary outflow tract during the Ross procedure [Abstract]. *Circulation* 1997;96(Suppl 2):430.
4. DeLeon SY, Quinones JA, Miles RH, et al. Use of the native aortic valve as the pulmonary valve in the Ross procedure. *Ann Thorac Surg* 1995;59:1007-10.
5. Guerra F, Bortolotti U, Thiene G, et al. Long-term performance of the Hancock porcine bioprosthesis in the tricuspid position. *J Thorac Cardiovasc Surg* 1990;99:838-45.
6. Fukada J, Morishita K, Komatsu K, Abe T. Influence of pulmonic position on durability of bioprosthetic heart valves. *Ann Thorac Surg* 1997;64:1678-81.

Delayed Presentation of Foreign Body Reaction Secondary to Retained Pacing Wires

Darryl A. Chung, FRCS, and Edward E. J. Smith, FRCS

Department of Surgery, St. George's Hospital, London, England

Temporary pacing wires are often left behind, assumed not to cause problems. We present 2 cases of delayed presentation of anterior mediastinal foreign body reaction secondary to retained pacing wires after coronary operations performed more than 5 years previously.

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Address reprint requests to Mr Chung, Department of Thoracic Surgery, Norfolk and Norwich Hospital, Norwich NR1 3SR, England.