

Aortic Translocation with Autologous Tissue

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Aortic translocation, although technically demanding, could be an excellent surgical option for d-transposition of the great vessels and left ventricular outflow tract obstruction. We report a modification of the aortic translocation technique that uses autologous tissue. The aortic root is mobilized from the right ventricle with an extension of infundibular free-wall muscle for use in closure of the ventricular septal defect, which is similar to the technique for harvesting pulmonary autograft in the Ross-Konno procedure. Our modification may offer an even better surgical outcome for aortic translocation. (Tex Heart Inst J 2007;34:420-2)

In the surgical management of d-transposition of the great vessels and left ventricular outflow tract (LVOT) obstruction, aortic translocation with biventricular outflow reconstruction may be superior to more conventional repairs such as the Rastelli and LeCompte operations, since the result more closely approximates the normal anatomy. Aortic translocation is accompanied by prosthetic patch repair of the ventricular septal defect (VSD), if the VSD is not too small and restrictive. Avoiding the use of any prosthetic material may offer an even better surgical outcome. We report a technical modification of the aortic translocation technique that uses autologous tissue.

Case Report

In April 2005, a 3-year-old boy who weighed 15 kg and had significant cyanosis was referred to our hospital for surgical repair of d-transposition, VSD, and LVOT obstruction. He had undergone 2 previous central shunt placements to alleviate severely hypoplastic arborization of the pulmonary artery. Preoperative cardiac evaluation with echocardiography and catheterization showed transposition of the great vessels {S,D,L} and a 1L-2RCx coronary pattern¹ (Fig. 1).

After heart re-exposure and takedown of the previous shunt, we established complete cardiopulmonary bypass with dual venous cannulation and instituted cardiac arrest. Upon opening the right atrium, we noted a conoventricular type of VSD (diameter, 25 mm) with an inlet extension. After division of the ascending aorta a few millimeters distal to the sinotubular junction, we mobilized the aortic root from the right ventricle together with an extension of infundibular free wall muscle, by means of a technique (Fig. 2) similar to pulmonary autograft harvesting in the Ross-Konno procedure. We took care to harvest the aortic root from the right ventricular free wall along a line that would enable a good fit in closing the VSD. The right coronary artery button was removed with a small cuff from the sinus of Valsalva, while the left coronary artery takeoff was left intact to enable aortic root rotation. The defect of the right coronary ostium that was left after harvesting was closed primarily by suture. The LVOT was opened, and the subpulmonic stenotic lesion was resected. The mobilized aortic root was repositioned to the vicinity of the LVOT by means of a 60° counterclockwise rotation. The VSD was closed with the extension cuff of the right ventricular free wall muscle. Next, we performed the LeCompte maneuver, before reattaching the ascending aorta with a rotation and reimplanting the right coronary button. Reconstruction of the right ventricular outflow tract (RVOT) included direct anastomosis of the posterior wall of the pulmonary trunk to the anterior surface of the harvested right ventricular free wall extension. An autologous fresh pericardial patch was used to complete the anterior half of the RVOT.

The patient's postoperative hemodynamic recovery was excellent, and he was doing well 30 months after the operation.

Key words: Abnormalities, multiple/surgery; aorta/surgery; cardiac surgical procedures; heart ventricles/surgery; transposition of great vessels/surgery

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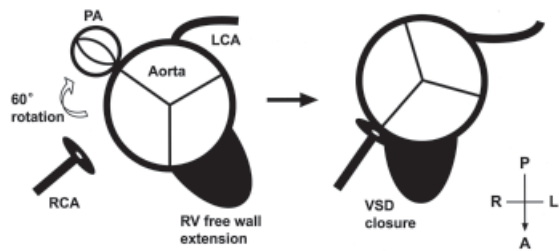


Fig. 1 A cross-sectional drawing shows aortic translocation with use of autologous tissue.

A = anterior; L = left; LCA = left coronary artery; P = posterior; PA = pulmonary artery; R = right; RCA = right coronary artery; RV = right ventricle; VSD = ventricular septal defect

Discussion

In 1984, Nikaidoh² reported an innovative surgical technique in which the entire aortic root is translocated to the posterior of the heart for treating the complex congenital cardiac anomaly present in patients such as ours. Aortic translocation has a potential benefit over more conventional repairs. In a conventional repair, the aortic root is left in the original position, and the rerouted outflow of each ventricle inevitably must make a sharp-angled turn, which may contribute to the suboptimal late outcome that has been reported with this approach.³ To date, the use of aortic translocation has not been

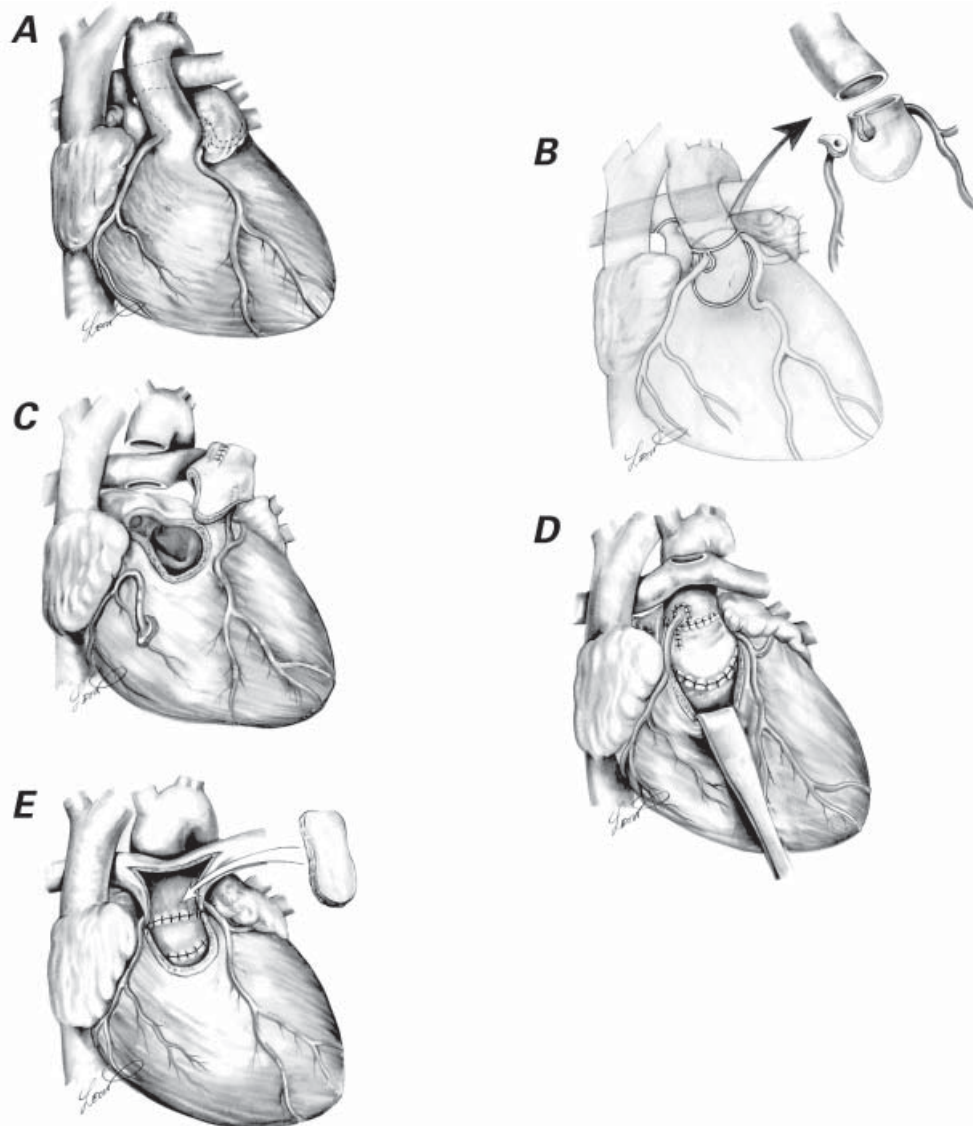


Fig. 2 Schematic representation of the surgical technique of aortic translocation with use of autologous tissue. **A)** Appearance of the gross anatomy, with transposition of the great vessels (S,D,L). **B)** The planned incision sites at the aorta, pulmonary trunk, right coronary takeoff, and right ventricular outflow tract. **C)** The mobilized aortic root and detached right coronary artery. **D)** Aortic translocation with ventricular septal defect closure by means of the right ventricular free wall muscle extension. **E)** Reconstruction of the right ventricular outflow tract without the use of a prosthesis.

widespread, partly because of the highly demanding nature of the procedure and the associated risk of coronary kinking and aortic valve regurgitation. However, several surgeons have recently introduced innovations in the performance of aortic translocation.⁴ For example, the ascending aorta may be once divided and re-anastomosed with some rotation, with or without the LeCompte maneuver. One or both of the coronary arteries may be detached from the aortic root and then reimplanted in the appropriate new position if coronary kinking is likely to develop. These surgical procedures are quite analogous to the arterial switch operation.

In our patient, we further modified the technique by using autologous tissue from the harvested aortic root together with an extension of the right ventricular free wall. This manner of harvesting is similar to that used in the Ross-Konno procedure.⁵ We determined the optimal location of the most proximal edge of the right ventricular free wall extension by use of a right-angle forceps placed through the ascending aorta and the aortic valve to ensure that the extension would close the VSD, which was previously inspected through a right atriotomy.

Our modification—autologous tissue reconstruction of the LVOT—has several advantages. First, this technique saves 1 suture line between the anterior aortic annulus and the prosthetic patch, therefore simplifying aortic translocation and eliminating a potential site of surgical bleeding and a residual defect. Second, with this technique, the aortic root is free of any suture load when the RVOT is reconstructed, because it has been lowered below the level of the aortic annulus and because the configuration of the aortic sinus of Valsalva is better preserved. Third, when our modification is used, the anterior aortic wall is not tethered, in contrast with aortic translocation performed with VSD patch closure, which tethers the anterior aortic wall and may cause late aortic regurgitation. Lack of a prosthetic patch

in the LVOT, which includes the aortic annulus, subjects the aortic annulus to less shear stress and enables the LVOT to grow more uniformly, which might improve the long-term result. Our patient's cardiac anatomy is not uncommon in patients with this anomaly. Therefore, an autologous tissue repair could be used in most cases; patients in whom it would not be appropriate include those with an abnormal coronary artery crossing the right ventricular free wall, a small right ventricular volume, or multiple muscular VSDs.

This report shows that aortic translocation with biventricular outflow reconstruction by means of autologous tissue is technically feasible. Possible advantages over the classic Rastelli, LeCompte, and Nikaidoh procedures need to be demonstrated over time, through the accumulation of surgical experience and long-term follow-up.

References

1. Gittenberger-de Groot AC, Sauer U, Oppenheimer-Dekker A, Quagebeur JM. Coronary arterial anatomy in transposition of the great arteries: a morphologic study. *Pediatr Cardiol* 1983;4(Suppl 1):15-24.
2. Nikaidoh H. Aortic translocation and biventricular outflow tract reconstruction. A new surgical repair for transposition of the great arteries associated with ventricular septal defect and pulmonary stenosis. *J Thorac Cardiovasc Surg* 1984;88:365-72.
3. Kreutzer C, De Vive J, Oppido G, Kreutzer J, Gauvreau K, Freed M, et al. Twenty-five-year experience with Rastelli repair for transposition of the great arteries. *J Thorac Cardiovasc Surg* 2000;120:211-23.
4. Morell VO, Jacobs JP, Quintessenza JA. Aortic translocation in the management of transposition of the great arteries with ventricular septal defect and pulmonary stenosis: results and follow-up. *Ann Thorac Surg* 2005;79:2089-93.
5. Reddy VM, Rajasinghe HA, Teitel DF, Haas GS, Hanley FL. Aortoventriculoplasty with the pulmonary autograft: the "Ross-Konno" procedure. *J Thorac Cardiovasc Surg* 1996; 111:158-67.