How-to-do-it

Aortic translocation, Senning procedure and right ventricular outflow tract augmentation for congenitally corrected transposition, ventricular septal defect and pulmonary stenosis

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Abstract

The management of congenitally corrected transposition of the great arteries and associated lesions is frequently challenging. Significant pulmonary stenosis is a contraindication to the conventional double-switch. Instead repair may be accomplished by the Rastelli—Senning procedure, using an extracardiac conduit to achieve continuity between the morphological left ventricle and the pulmonary arteries. This however can be accompanied by conduit and intra-ventricular baffle-related problems that can necessitate surgical re-intervention and lead to late mortality. We describe the use of aortic translocation, Senning procedure and reconstruction of the right ventricular outflow tract using autologous tissue and valved homograft to facilitate anatomical correction in congenitally corrected transposition. The advantages of this technique in this group of patients and the implications for conduction tissue are discussed.

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1. Introduction

We describe aortic translocation with Senning procedure and novel reconstruction of the right ventricular outflow tract using autologous tissue and valved homograft to achieve anatomical correction in a patient with congenitally corrected transposition [S,L,L] and pulmonary stenosis.

2. Technique

A 7-year-old boy (26.0 kg) with congenitally corrected transposition (ccTGA) presented with reduced exercise tolerance. Preoperative echocardiography demonstrated usual atrial arrangement, mesocardia, normal atrioventricular valves, a stenosed, bicuspid pulmonary valve ($V_{\text{max}}$ 4.3 m/s) within a hypoplastic annulus, a restrictive 10 mm perimembranous VSD and a right-sided aortic arch.

At operation it was felt that a Rastelli repair would be suboptimal given the restrictive VSD and the likelihood of further compromising the small, hypertrophied morphological right ventricle. Cardiopulmonary bypass was conducted at 30 °C with aortobicaval cannulation and intermittent ante-grade cold blood cardioplegia. The pulmonary arteries were mobilised extensively to the level of lobar branches.

The aorta was opened and the two coronary arteries (1mRCA; 2mLAD,Cx) mobilised on buttons. Aortic and pulmonary roots were then excised using a right-angle clamp passed retrogradely into the ventricle to indicate the starting point for dissection. Inspection of the right ventricular outflow tract confirmed a small, bicuspid pulmonary valve with a diminutive annulus, precluding its sole use in right reconstruction.

The aortic autograft was translocated without the Lecompte manoeuvre and secured to the restrictive VSD and the likelihood of obliterating the VSD without requiring a prosthetic patch. The coronary arteries were re-implanted into their original sinuses. A Senning procedure was then performed using autologous pericardium for the systemic venous baffle and 0.6 mm thick polytetrafluoroethylene patch for the pulmonary venous channel. The right ventricular outflow tract was augmented by suturing a patch...
of native pulmonary artery to the right ventricular septal crest (Fig. 2) before restoring continuity with a 19 mm aortic homograft. Cardiopulmonary bypass and aortic cross-clamp times were 280 and 158 min, respectively.

3. Results

The patient was weaned from cardiopulmonary bypass in sinus rhythm with an infusion of dobutamine 7.5 μg/kg/min; transoesophageal echocardiography confirmed unobstructed systemic and pulmonary venous baffles, good biventricular function and competent atrioventricular and ventriculoarterial valves. The patient was extubated on the morning following surgery, discharged on the 7th postoperative day and remains well in sinus rhythm eighteen months later.

4. Discussion

Described by Nikaidoh [1] and based on principles established by Konno et al. [2] and Bex et al. [3], aortic translocation and biventricular outflow tract reconstruction has become an established [4] option for patients with transposition of the great arteries, right-hand ventricular topography, ventricular septal defect and pulmonary stenosis. Alternative strategies such as the Rastelli [5] or REV [6] are accompanied by conduit and intra-ventricular baffle-related problems, leading to surgical re-intervention and late mortality.

Aortic translocation offers anatomical correction in patients with variations that are known to complicate a Rastelli repair namely a small morphological right ventricle, remote ventricular septal defect, straddling atrioventricular valve and anomalous coronary anatomy. As reported by Morell et al. [4,7,8], patients with ccTGA can also benefit from the advantages offered by aortic translocation and more pertinently, avoid a suboptimally-placed ventriculotomy and long valved conduit dictated by the location of papillary muscles on the anterior wall of the morphological right ventricle.

Although a longer procedure, aortic translocation is considerably simpler than the construction of a complex intra-ventricular baffle, especially in the context of mesocardia and usual atrial arrangement. In this patient, the VSD could be closed directly with total control of the suture line without prosthetic material. Augmentation of the RVOT maximises its length, reducing traction on the pulmonary arteries. The proximal homograft suture line is also placed outside the immediate confines of the heart away from conduction tissue, facilitating safe homograft replacement should this be necessary in the future (Fig. 2).

In ccTGA, the conduction bundle typically runs anterior to the pulmonary valve and cephalad to the anterior margin of the VSD before dividing into bundle branches [9]. Enlargement of the VSD to construct an intra-ventricular baffle risks damaging abnormally placed conduction tissue. In this particular heart, it is probable that because of the severe pulmonary stenosis and relatively well-aligned atrial and ventricular septae, a posterior bundle was also present, forming a sling with the anterior bundle [10]. Dissection of the aortic and pulmonary roots and enlargement of the left ventricular outflow tract to accommodate the larger aortic root would have likely removed any anterior conduction tissue. We reason that the posterior bundle may have been primarily dominant or functionally equivalent to any anterior bundle as evidenced by continuing sinus rhythm.

Aortic root translocation was initially described with the coronary arteries mobilised but still attached to the aortic root [3,4]. Individual coronary transfer was later adopted to minimise rotational or longitudinal tension during translocation. Here the disposition of the atrial and ventricular septae and diminutive pulmonary artery combined to reduce the distance of coronary movement but nonetheless the coronary arteries were mobilised on individual buttons as a precautionary measure.

In conclusion, we believe that aortic translocation with augmentation of the right ventricular outflow tract is technically feasible and superior to a Rastelli-type repair in a subset of patients with ccTGA.
References


