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Brief Report

Approach to the neoaortic valve for replacement after the arterial switch procedure in patients with complete transposition

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Abstract We report our experience of aortic valvar replacement subsequent to the arterial switch procedure, incorporating the Lecompte maneuver, in patients with complete transposition. The anterior wall of the neoaorta was incised in continuity with the posterior wall of the pulmonary trunk. The aortic root was reconstructed with or without augmentation using a patch after the operative procedures to the aortic valve. With this approach, the neoaortic root could readily be exposed without extensive dissection, and valvar replacement was safely achieved. These patients experienced no postoperative complications.

Keywords: Aortic valvar replacement; arterial switch procedure; complete transposition

When replacement of the neoaortic valve is needed subsequent to the arterial switch procedure in patients with complete transposition, the neoaortic root is not always readily exposed, as the Lecompte maneuver[1] is commonly employed at the time of the arterial switch. We describe herein our experience of aortic valvar replacement in such circumstances, particularly in terms of surgical options for the approach to the neoaortic root.

Patients and methods

Of 158 patients with complete transposition, defined as the combination of concordant atrioventricular and discordant ventriculo-arterial connections, undergoing the arterial switch procedure at our institution, 3 patients have subsequently undergone replacement of the aortic valve because of significant regurgitation through the neoaortic root (Table 1). In all 3 patients, the new pulmonary trunk had been translocated anteriorly to the neoaortic root. In the first two patients, regurgitation through the neoaortic valve appeared at a relatively early stage after the arterial switch. In the first patient, plasty to the regurgitant neoaortic valve had been attempted, but was not very efficient. In our third patient, progressive volume overload of the left ventricle was secondary to either mitral or aortic regurgitation.

In all 3 patients, the pericardial cavity was opened via re-median sternotomy. Dissection was carefully carried out around the heart and the great arteries. Adhesions between the ascending aorta and the pulmonary trunk were left undissected. With cannulation into the high portion of the ascending aorta, as well as into the superior and inferior caval veins, cardiopulmonary bypass was established. With cross-clamping of the ascending aorta, myocardial contraction was stopped with antegrade infusion of sufficient amounts of crystalloid cardioplegic solution. In the first patient, the anteriorly located pulmonary trunk was obliquely incised, and the incision was extended to the anterior wall of the aortic root (Fig. 1). After replacement of the valve, the aortic wall, once incised, was directly sutured in a continuous fashion. For reconstruction of the right pulmonary artery, we used a trimmed bovine pericardial patch. In the second and

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Table 1. Profile of patients and results.

	Patient 1	Patient 2	Patient 3
Intracardiac malformation	VSD	VSD, ASD	ASD, mitral cleft
Previous procedures	Mustard + VSDclo conversion to switch aortic valve plasty	PT banding switch + VSDclo	switch
Age at switch (y: years, m: months)	5 y	6 m	9 m
Age at AVR (y: years, m: months)	11 y 6 m	7 y 5 m	10 y 8 m
Interval between ASO & AVR (months)	66	83	119
Preoperative catheterization			
LVEDV (% of normal)	315	260	247
cardiac index (l/min/m^2)	4.3	3.3	2.3
Preoperative echocardiography			
LVDd (mm)	65	51	61
RVOT flow velocity (m/sec)	2.3	3.2	1.5
Aortic regurgitation	Severe	Severe	Moderate
Pathologic changes of neoaortic valve	Myxomatous	Dysplastic	Fibrous
Prosthetic valve used for AVR	CM 25 mm	SJM 23 mm	ATS 22 mm
Coexisting RVOTO	Slight	Moderate	None
Follow-up term (months)	57	39	2
Postoperative echocardiography			
LVDd (mm)	55	37	47
RVOT flow velocity (m/sec)	2.4	2.3	2.2

third patients, the anterior wall of the pulmonary trunk was longitudinally incised (Fig. 1). This was followed by longitudinal incision of the anterior wall of the ascending aorta together with the posterior wall of the pulmonary trunk. The incised wall between the aorta and the pulmonary trunk was closed using a bovine pericardial patch. Subpulmonary musculature was resected as appropriate to avoid progressive obstruction across the right ventricular outflow tract. The pulmonary arterial trunk was augmented using another bovine patch. In the third patient, the regurgitant mitral valve, which had a cleft in its arterial leaflet along with dilation of the annular attachment, was repaired. Warfarin and an antiplatelet agent have been administrated for postoperative anticoagulation.

Results

With these approaches, we obtained good exposure of the leaflets of the regurgitant valve, and replacement using a mechanical prosthetic valve was readily achieved. Postoperative courses were smooth and excellent in all 3 patients. No episodes of thromboembolism, nor complications related to anticoagulant therapy, have been noted thus far. Diastolic dimension of the left ventricle decreased significantly after the valvar replacement. No obvious obstruction has been detected between the pulmonary arteries and the right ventricle. Electrocardiography and scintigraphy have revealed no signs of myocardial ischemia. All the patients are currently doing well.

Discussion

It has been reported that regurgitation through the aortic valve can occur subsequent to the arterial switch procedure. The incidence of this postoperative problem varies between different series, but is not high. In the majority of patients, the regurgitation is not significant. Successful replacement of the aortic valve, nonetheless, has been reported in several cases.[2–5]

There are various speculations to account for the regurgitation. Banding of the pulmonary trunk prior to the arterial switch procedure was suspected to be one such cause. The manner and the site for translocation of the coronary arterial cuffs could also be contributing factors. A disproportionately large neoaortic root, to which the distal stump of the ascending aorta is to be attached, may also produce unfavorable function of the neoaortic valvar leaflets. In our second patient, who previously underwent banding of the pulmonary trunk, aortic regurgitation was probably related to transection of the initial pulmonary trunk at a relatively proximal level because of the previously placed band. The translocation of the coronary arteries was carried out almost within the neoaortic sinuses. In the other 2 patients, no obvious reasons could be identified for progression of regurgitation.

When approaching the neoaortic root behind the pulmonary trunk after the Lecompte maneuver, transection of the pulmonary trunk is undoubtedly an attractive operative option. Our surgical maneuver is a useful alternative. By incising the aortic wall

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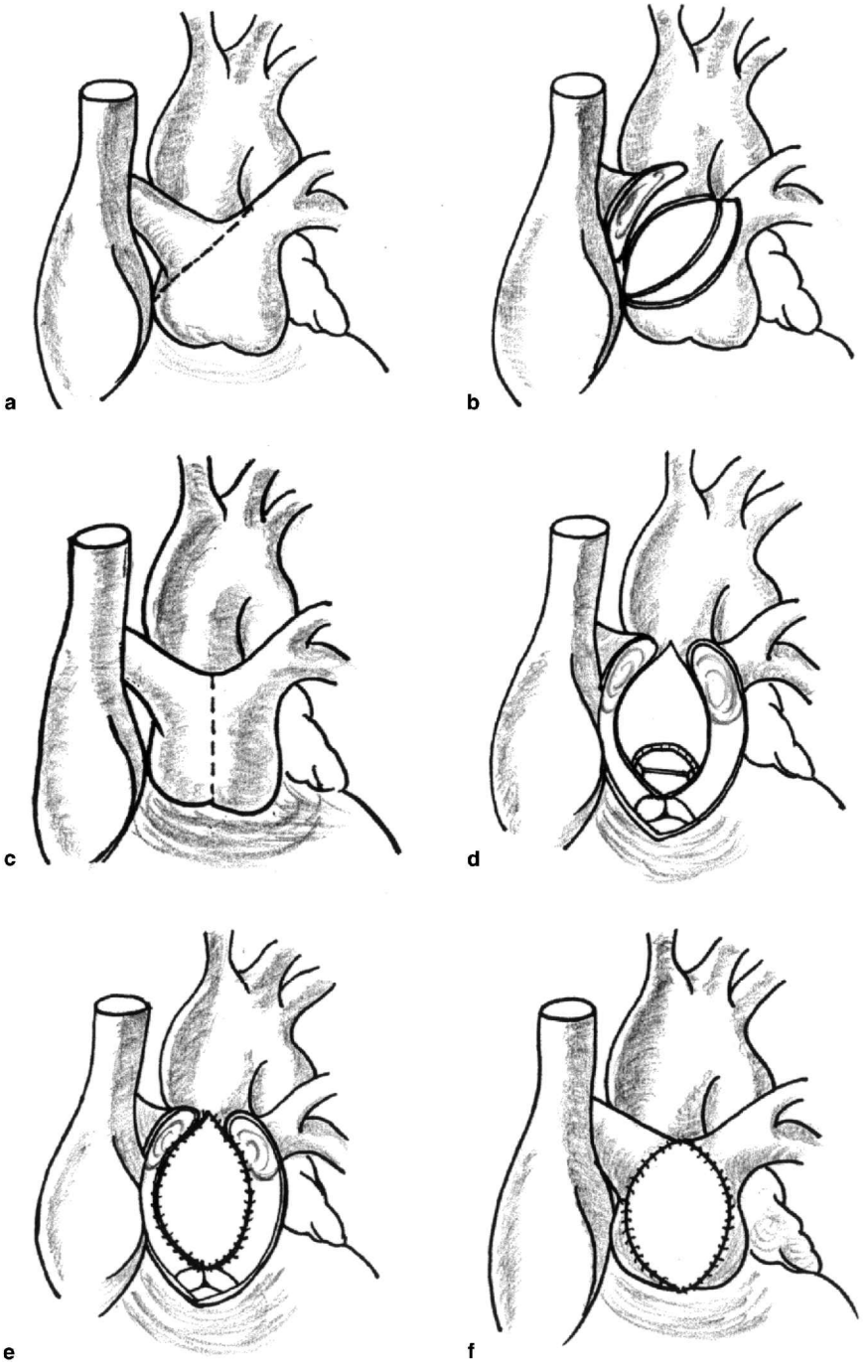

Figure 1.
(a) In the first patient, the anterior wall of the pulmonary trunk was initially incised in an oblique direction. (b) The incision was then extended to the common wall composed of the aortic and the pulmonary arterial walls. (c) In the subsequent patients, the anterior wall of the pulmonary trunk was longitudinally incised. (d) This was followed by longitudinal incision to the common wall between the ascending aorta and the pulmonary trunk. (e) The incised common wall was closed using a bovine pericardial patch. (f) Augmentation of the pulmonary trunk was carried out using a second bovine pericardial patch.

together with the pulmonary arterial wall, visualization of the aortic root was excellent. Extensive dissection was not needed between the aortic root and the pulmonary trunk. When reconstructing the aortic root, the tissues at the suture line, which were composed of the aortic and the pulmonary arterial walls, were substantial. In addition, patch augmentation of the aortic root should be advantageous if the ascending aorta has obstruction or deformity related to the previous reconstruction of the aortic root. The pulmonary arterial trunk, as well as the right and left pulmonary arteries, was also readily enlarged using a patch so as to avoid obstruction across the channel between the pulmonary arteries and the right ventricle.

We believe that the incidence of fistulous formation between the aortic and pulmonary walls will be reduced because this method retains the mural strength of both great vessels. On the basis of our experience, therefore, it is concluded that this operative method is safe and provides excellent exposure of the neoaortic root when a surgical approach is

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required subsequent to the arterial switch procedure and the Lecompte maneuver.

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