Aortic root translocation with atrial switch: Another surgical option for congenitally corrected transposition of the great arteries with isolated pulmonary stenosis

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The aortic root translocation procedure has been used for transposition of the great arteries (TGA) with a ventricular septal defect and pulmonary stenosis (PS). We report a case of aortic root translocation combined with the atrial switch operation for a patient with congenitally corrected TGA (ccTGA) with isolated PS.

CLINICAL SUMMARY

A 12-year-old boy with ccTGA (S,L,L) and isolated PS underwent anatomic repair (aortic root translocation with morphologic left ventricular outflow tract [m-LVOT] widening and a modified Senning procedure). The diagnosis was made at the age of 20 days. Catheterization data at 3 years of age showed nearly equal systolic pressure between the morphologic left ventricle (m-LV) and the morphologic right ventricle (m-RV; m-LV: 100 mm Hg vs m-RV: 103 mm Hg). The patient was clinically stable. We followed him with annual echocardiographic analysis.

At 12 years of age, the patient complained of mild exercise intolerance. Catheterization and angiographic analysis revealed suprasystemic m-LV pressure (m-LV, 140 mm Hg vs m-RV, 119 mm Hg), severe PS, and an oxygen saturation of 94% on room air (Figure 1). At this point, anatomic repair was considered.

The operation was performed by using a standard cardiopulmonary bypass (CPB) technique. A modified Senning procedure was performed first on the fibrillating heart. After an atrial rerouting procedure, an antegrade cardioplegic solution was infused, the coronary arteries were detached from the aortic sinuses, and the aortic root was harvested. The coronary arteries showed an usual pattern in TGA (S,L,L). The main pulmonary artery was transected at just above the sinotubular junction. The incision for widening the m-LVOT was made in the middle of the conal septum (the area between the facing sinuses) and extended toward the apex to the level relieving the left ventricular outflow tract obstruction without injury of the intracardiac

structures, such as the atrioventricular valve. This ventriculotomy area was widened by using a bovine pericardium, with the stitches placed on the m-RV side of the septum. The harvested aortic root was turned 180°, translocated posteriorly, and anastomosed to the original pulmonary root site. The detached coronary arteries were reimplanted in the aortic root. Anastomosis of the transected aorta was performed after the Lecompte maneuver. After unclamping the aorta, m-RVOT reconstruction was completed with a 22-mm Carpentier-Edwards porcine-valved conduit. CPB weaning was uneventful, but the sternum was left open to avoid compression. CPB and aortic crossclamping times were 539 and 243 minutes, respectively. Delayed sternal closure was performed on the third postoperative day, and ventilator weaning was performed the following day. The patient was discharged after 48 days because of prolonged pleural effusion. PredischARGE echocardiographic analysis showed both good ventricular function and slight left ventricular outflow tract narrowing, with a peak pressure gradient of 20 mm Hg. The postoperative electrocardiograph showed normal sinus rhythm. Six months after the operation, the patient showed good functional status (New York Heart Association functional class I).

DISCUSSION

For the treatment of ccTGA with isolated PS, several surgical options have been reported, such as pulmonary valvotomy or subvalvular widening, m-LV to PA conduit interposition, and conventional one-and-a-half ventricle repair. Concerns regarding the first 2 surgical options include progression of tricuspid regurgitation and right ventricular dysfunction, which might cause ventricular septal deviation to the m-LV and tethering of the tricuspid valve after complete relief of PS. Backer and colleagues¹ reported good outcomes of one-and-a-half ventricle repair, with partial relief of PS. In their report the ventricular septum and tricuspid valve maintain their configuration because the m-LV is not fully decompressed by the remaining PS. However, the fate of the m-LV with partially relieved PS remains uncertain. Furthermore, this conventional one-and-a-half ventricle repair still leaves the m-RV to be exposed to systemic circulation. The importance of the anatomic repair of ccTGA has been emphasized to prevent progressive dysfunction of the m-RV and tricuspid regurgitation.² This is why some surgeons have modified the original aortic translocation procedure to extend the indications.³ With our modification,

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FIGURE 1. Preoperative images. A, Three-dimensional reconstructed image obtained by means of computed tomography. B, Angiograph showing severe pulmonary stenosis (PS) and left ventricular outflow tract obstruction (LVOTO). m-LV, Morphologic left ventricle.

FIGURE 2. Postoperative images. A, Three-dimensional reconstructed image obtained by means of computed tomography. B, Computed tomographic image showing the newly reconstructed left ventricular outflow tract. Ao, aorta; m-RV, morphologic right ventricle; m-LV, morphologic left ventricle.

a wide systemic outflow tract (from the m-LV to the aorta) with laminar flow could be established (Figure 2).

Avoiding injury of the atrioventricular conduction pathway is also important. The incision we made in the conal septum for widening the m-LVOT was leftwardly located from the anterior part of the original pulmonary root away from the right of and anterior to the pulmonary valve where the conduction pathway might be present.⁴ Hosseinpour and associates⁵ reported many cases of normal posteroinferior conduction pathways in patients with ccTGA with PS on autopsy cases. Therefore the surgeon must consider possible atrioventricular conduction pathways during widening of the m-LVOT. The incision area in our case was distant from both possible atrioventricular conduction pathways.

Although this procedure is complicated, it can be performed safely and without significant morbidity. In addition, we anticipate better long-term results and hemodynamic

status than obtained with conventional repairs in which the m-RV is used as a systemic ventricle.

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