Half-turned truncal switch operation for single coronary in a patient with transposition of the great artery and pulmonary stenosis

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Intraoperative photograph showing coronary implantation after truncal block rotation.

Central Message

The half-turned truncal switch operation in a patient with transposition of the great artery and pulmonary stenosis is the procedure of choice for single coronary artery.

See Editorial Commentary page 271.

Since Yamagishi and colleagues¹ reported a successful modification of the aortic root translocation named half-turned truncal switch operation (HTTSO) for the anatomic repair of transposition of the great arteries (TGA), double-outlet right ventricle (DORV), ventricular septal defect (VSD), and pulmonary stenosis (PS) in 2003, other successful variations on HTTSO have been reported and its indication has been expanded. Although the procedure is still challenging in unusual coronary arteries such as single take-off or intramural origin, we have developed a variation for TGA, DORV, and PS with single coronary artery.

CLINICAL SUMMARY

A boy weighing 3100 g was referred to our medical center immediately after birth for cyanosis. Further examination was consistent with TGA, DORV, and valvular PS. He underwent a left systemic-pulmonary shunt on day13.

Catheterization performed at 5 months of age showed a single coronary taking off from the right facing sinus and a right coronary running anteriorly, leading into a large conus branch around the aorta. The left coronary was running posteriorly around a pulmonary valve annulus, as in Shaher's classification 3B.² Computed tomography scan demonstrated a very close relationship between the pulmonary valve and the left coronary artery (Figure 1, A and B).

Echocardiography showed an 11-mm remote type VSD, and the z value of the bicuspid pulmonary valve was -2.93. Moderate mitral regurgitation was also detected.

At 10 months, definitive repair was performed through a median sternotomy. Aortic and bicaval cannulations were performed to initiate cardiopulmonary bypass. The heart was arrested with crystalloid cardioplegia.

The aorta was divided 7 mm above the sinotubular junction, and the pulmonary artery was divided at its bifurcation. The single coronary was cut, yielding a tear-drop button, and extensive dissection was performed to mobilize the proximal part of left and right coronary arteries as well as the conus branch in front of the right ventricular outflow tract (RVOT) (Figure 1, C). The truncal block was harvested en bloc, preserving the pulmonary valve, because there was a significant distance of 3 mm between the left coronary artery and the pulmonary annulus. Thick leaflets of the bicuspid pulmonary valves were thinned, and a commissurotomy was performed to enlarge the valve orifice, achieving a normal valve area and obviating the need for artificial materials for RVOT reconstruction. The VSD was patched with 0.4 mm polytetrafluoroethylene to make the new left ventricular outflow tract (LVOT) exactly the same size as the aortic valve.

The truncal block was rotated 180 degrees, and its aortic component was anastomosed by the use of 6-0 interrupted nonabsorbable and continuous absorbable sutures to the LVOT. A J-shaped trap door was opened and a coronary button was sutured to the door using Bay window³ technique (Figure 2, A). The ascending aorta was

FIGURE 1. A, Preoperative CT shows that the great arteries were the right AO and left posterior PA. Previous shunt (BT) can be seen between the left subclavian artery and left pulmonary artery. B, Cross-sectional view at the level of the sinotubular junction shows the single origin of the coronary artery. The RCA runs separately anteriorly and the LCA runs posteriorly around the PA, branching off into the LAD and CX. C, Operative photograph shows a single coronary button cut off in tear-drop shape. AO, Anterior aorta; PA, pulmonary artery; RV, right ventricle; LAD, left anterior-descending artery; CT, computed tomography; CX, circumflex artery; LCA, left coronary artery; RCA, right coronary artery; LA, left atrium.

reconstructed behind the pulmonary artery with the Lecomte maneuver.

After mitral annuloplasty, the aortic crossclamp was released and the RVOT was reconstructed with the use of autologous pericardial patch augmentation of the pulmonary artery. The patient was weaned off cardiopulmonary bypass uneventfully with sinus rhythm.

Two months after surgery, computed tomography showed the fluent single coronary originated from the posterior aorta (Figure 2, B and C). Catheterization 3 months after surgery showed no obstruction of ventricular outflow tracts; however, the right ventricular/left ventricular pressure ratio was 0.5 because of pulmonary hypertension, which was being treated with sildenafil. The patient currently is doing well despite mild pulmonary hypertension.

DISCUSSION

HTTSO brings aortic root directly over the left ventricular outflow, allowing straight blood flow at the ventricular exit in case of TGA and PS. The other surgical option, the Rastelli procedure, potentially can cause obstruction of both ventricular outflow tracts.⁴ Although

Yamagishi and colleagues¹ mentioned that HTTSO was contraindicated in case of several dangerous coronary anatomies, Mair and colleagues⁵ reported that the only coronary anatomy contraindicating this procedure was a single intramural coronary arising from the posterior sinus; the authors did mention, however, that very extensive mobilization of the right coronary would be needed if it was around the RVOT. Our patient's coronary anatomy suggested some of these risks, but coronary transfer was performed successfully with no ischemic change to date.

Proximity between the left coronary and the posterior pulmonary annulus may lead to difficulty in detaching the block and achieving hemostasis for the suture line on LVOT. Our result suggested that 3 mm might be a marginal distance for harvesting a truncal block safely. An aortic translocation sacrificing the pulmonary annulus is the procedure of choice in case of the distance less than 3 mm.

Although our result may expand the indication for HTTSO, care must be taken in applying it to unusual coronary anatomies such as those with the main branch in front of the aorta or between the great arteries.

FIGURE 2. A, Intraoperative photograph showing coronary implantation. The truncal bloc has been rotated 180 degrees and sutured to the left ventricular outflow tract. B, Postoperative CT shows PA positioned anterior to AO after Lecomte maneuver. C, Cross-sectional view of sinotubular junction shows a new origin of the single coronary from the posterior neo-aorta. RV, Right ventricular; Neo Ao, neo-aorta; AO, anterior aorta; PA, pulmonary artery; RCA, right coronary artery; LCA, left coronary artery; LA, left atrium; RA, right atrium.

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