Case Report

Total correction in tetralogy of Fallot with anomalous major coronary artery: an alternative method to conduit use

B SARITAS, E OZKER, C VURAN, U YORUKER, C AYABAKAN, R TURKOZ

Abstract

Introduction: A coronary artery anomaly precludes the use of a trans-annular patch in right ventricular outflow tract (RVOT) reconstruction. Herein we present three patients with coronary artery anomalies who underwent total corrective operations without using a conduit.

Methods: Between 2007 and 2010, 84 patients with tetralogy of Fallot (TOF) were operated on. Nine (9.4%) of them had a coronary artery anomaly. Three (3.1%) of the patients were operated on using the double-outflow technique and two had a Blalock-Taussig shunt before the total corrective operation. In two patients, the left anterior descending artery (LAD) and in one, the right coronary artery (RCA) crossed the RVOT.

Results: Postoperatively, the right-to-left ventricular pressure ratios were 0.45, 0.59 and 0.60 after cardiopulmonary bypass. No gradient was detected in the RVOT in postoperative echocardiographical measurements (< 15 mmHg gradient). In all three patients, there were moderate pulmonary insufficiencies. All were discharged home on the sixth day postoperatively. Mean follow-up duration was 9.8 ± 8 months. In the follow up of all three patients, there were moderate pulmonary insufficiencies but no right ventricular dysfunction.

Conclusion: The ‘double-outflow’ technique is appropriate for TOF patients with a major coronary artery anomaly since it can easily be performed without the need of a conduit.

Keywords: coronary artery anomaly, tetralogy of Fallot, total correction

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continuity between the apical end of the ventriculotomy and the pulmonary artery was maintained with autogenous pericardium. The RVOT reconstruction was performed by sewing the pericardial patch to the right ventriculotomy, pulmonary artery flap and pulmonary artery (Fig. 2).

Results

The demographics of the patients are shown in Table 1. At the time of the total corrective operations, the pulmonary vascular indices were normal in all three cases. In two patients, the LAD originated from the RCA and crossed the RVOT, whereas in the third, the RCA crossed the RVOT.

Pre-operatively, the RVOT gradients were 78, 78 and 90 mmHg, respectively. After the termination of cardiopulmonary bypass, modified ultrafiltration was performed and then the pressure ratio of the right-to-left ventricle was measured. The results were 0.45, 0.59 and 0.60, respectively. There was no gradient between the right ventricle and the pulmonary artery.

The postoperative course was uneventful. All three patients were extubated on the first postoperative day, they left the ICU on the second day and were discharged home on the sixth day. Mean follow-up duration was 9.8 ± 8 months. No gradient was detected in the RVOT in the echocardiographic measurements (< 15 mmHg gradient). In all three patients, there were moderate pulmonary insufficiencies but no right ventricular dysfunction.

Discussion

A case of an anomalous coronary artery that crosses the RVOT is a significant problem in the total corrective operation of TOF. The LAD artery mostly originates from the RCA. Various techniques such as extracardiac conduit use, transatrial or transpulmonary muscle resection have been described to overcome this obstacle.

Klara and colleagues reported 25 cases with coronary artery anomalies, in which they performed transatrial muscle resection. In their study, which presented a mean follow up of 40 months, the authors reported the results to be successful and the gradients between the right ventricle and the pulmonary arteries as acceptable. They also mentioned the risk of coronary artery injury during muscle band resection with this technique. Sometimes only limited resection can be performed and the RVOT cannot be totally relieved, hence in the follow up of two patients, the RVOT gradients were higher than that measured at the time of hospital discharge. Although our follow-up duration was not long, the gradients measured with echocardiography were less than 15 mmHg in all three patients. Therefore we concluded that the ‘double-outflow’ technique may be more appropriate in these cases.

There are various reports indicating the need for early total corrective operations in the treatment of TOF. They all aimed to prevent the organ damage and ventricular arrhythmia induced by long-term hypoxia and to obtain better results. However, in order to use conduits in patients with coronary artery anomalies, secondary operations are inevitable since the conduits have no potential to grow. This will lead to relative stenosis in the RVOT as the child grows.

With conduit use, the unfavorable effects of hypoxia are still of concern, but the most important disadvantage of conduit use is reoperation due to conduit degeneration. The difficulty in obtaining the conduits and the minor antigenicity of the conduit material are further disadvantages. With the help of this technique, we safely enlarged the RVOT in patients with coronary artery anomaly without using conduits. In addition, the auto-

![Fig. 1. View of the pulmonary artery flap sewn to the right ventriculotomy and native outflow tract.](image1)

![Fig. 2. View of the RVOT reconstruction with pericardial patch.](image2)

<table>
<thead>
<tr>
<th>TABLE 1. PRE- AND POSTOPERATIVE DEMOGRAPHICS</th>
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<tbody>
<tr>
<td>Patient</td>
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<tr>
<td>Age (months)</td>
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<td>Weight (kg)</td>
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<td>Previous operation</td>
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<td>PPG (mmHg)</td>
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<td>Postoperative Prv/Plv (mmHg)</td>
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<td>CPB (min)</td>
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<td>ACC (min)</td>
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<td>Follow-up time</td>
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| PPG: pre-operative pulmonary gradient, Prv; right ventricular pressure, Plv; left ventricular pressure, CPB; cardiopulmonary bypass time, ACC; aortic cross-clamp time.
genous flap from the pulmonary artery decreases the risk of reoperation in the future.

The main disadvantage of this technique is the necessity for a non-hypoplastic main pulmonary artery. Continuity between the right ventriculotomy and the main pulmonary artery was achieved through the flap produced from the main pulmonary artery. Therefore the posterior wall of the main pulmonary artery must be preserved for the integrity of the artery. This will ensure sewing of the pericardial patch to both pulmonary arteries (the flap and the in-situ posterior pulmonary artery).

In long-term follow up of TOF operations, intractable malign arrhythmias and pulmonary insufficiency leading to right ventricular dysfunction are the main problems that surgeons face. Although the follow up in our patients was not long enough, we detected pulmonary insufficiency in the short term. However, we did not observe right ventricular dysfunction or arrhythmia in any of our patients.

Conclusion

The ‘double-outflow’ technique is appropriate for TOF patients with coronary artery anomalies, since it is easy to perform, has no additional cost or the need for a conduit. The technique has highly favorable outcomes; reoperation rates are low due to the use of a tissue conduit which has the potential to grow. The technique can be applied to infants, so they are protected from the deleterious effects of hypoxia.

References