Rescue of Coronary Injury with Right Internal Mammary Artery Bypass during Repair of a Complex Congenital Heart

Ming-Yuan Kang, Hao-Ji Wei, Chung-Ci Wang and Yen Chang

A 10-year-old boy with polysplenia syndrome was diagnosed with complex congenital heart disease, including common atrium, bilateral superior vena cava, complete atrioventricular canal defect, severe pulmonary stenosis, interrupted inferior vena cava, and patent ductus arteriosus. Previously, he underwent a bilateral bidirectional Glenn shunt operation with ligation of the patent ductus arteriosus in April, 2009, when he was six years old. During the operation, his left anterior descending coronary artery (LAD) was injured accidentally due to abnormally high coronary artery takeoff. Consequently, a coronary artery bypass graft [right internal mammary artery (RIMA) to LAD proximal, end-to-end] was performed. On July 24, 2013, he received the last stage of a total cavopulmonary connection with an extracardiac conduit (22 mm PTFE graft) at ten years of age. The RIMA was not injured during redo-sternotomy and he was discharged uneventfully 11 days after the operation.

Key Words: Congenital heart disease • Coronary artery bypass surgery • Coronary injury

INTRODUCTION

The main technical challenges of coronary artery bypass graft (CABG) in children are the small target vessels and selection of an appropriate graft conduit. The internal mammary artery is more frequently used now than the saphenous vein graft because it has excellent long-term patency and the ability to grow along with the developing child. In the present case, the patient underwent CABG for the iatrogenic injury of the coronary artery. To our knowledge, this is the first report of such a condition. We performed the last stage of total cavo-pulmonary connection with an extracardiac conduit 4 years later. Patent graft was still noted and the graft was not injured during the redo-sternotomy procedure.

CASE REPORT

A 10-year-old boy had a birth history of G1P1, full-term newborn, normal spontaneous delivery, and a birth body weight of 3105 gm. Prenatal sonography revealed congenital heart disease at the gestational age of 32 weeks. Polysplenia syndrome and complex congenital heart disease with common atrium, bilateral superior vena cava, complete atrioventricular canal defect, severe pulmonary stenosis, interrupted inferior vena cava, and patent ductus arteriosus (PDA) were diagnosed after birth, and he was followed up at a pediatric outpatient department.

The patient underwent a bilateral bidirectional Glenn shunt operation with PDA ligation in April, 2009, when he was six years old. The pulmonary artery (PA) trunk is located next to the right of the aorta. It was freed from the adjacent aorta and carefully looped. However, be-
cause the left anterior descending artery rises from the underside of the aortic arch and adheres to the PA trunk (Figure 1), it was transected accidentally during the operation. Although we dissected part of the distal LAD, reanastomosis of the ascending aorta with the distal LAD was not possible. Therefore, the right internal mammary artery (RIMA) was harvested for coronary artery bypass surgery and the RIMA was anastomosed to the transected end of LAD using the end-to-end method. The patient was thereafter successfully weaned from cardio-pulmonary bypass machine.

In July, 2013, the patient was admitted to our facility for the last stage of total cavopulmonary connection when he was 10 years old. On examination, the patient was in mild respiratory distress with a respiratory rate of 20 breaths per minute and a pulse of 90 beats per minute; his saturation was around 84~85%, with a body weight of 38.5 Kg and height of 145 cm. Additionally, the patient suffered from apparent clubbing of fingers, and pansystolic and diastolic murmur was heard at the left sternal border. The patient’s chest radiograph revealed mild enlargement of cardiac shadow. The electrocardiogram also showed irregular heart beats and ectopic atrial rhythm. Echocardiography revealed patent Glenn shunt, mild aortic regurgitation, and mild atrioventricular valve regurgitation. Further diagnostic testing by multiple detector computed tomography (MDCT) showed patent RIMA to LAD (Figure 2).

After serial evaluation, the patient received the last stage of total cavopulmonary connection with an extra-cardiac conduit (22 mm PTFE graft). RIMA was not injured during redo-sternotomy and he was discharged uneventfully 11 days after the operation.

**DISCUSSION**

Anomalies of the coronary arteries in children are very rare. They can be isolated, or may accompany other congenital heart defects, such as Tetralogy of Fallot, transposition of the great arteries, or pulmonary atresia. In patients with congenital heart disease that require surgical treatment, the anomalies of coronary arteries could alter the surgical methods, increasing both the complexity of the operation and the operative risk. Furthermore, the unusual coronary arterial system can be injured during the operation.

Coronary artery bypass surgery is one of the methods used to treat a coronary injury complication. Currently, the indications for coronary artery bypass grafting in children include: (1) Kawasaki disease with coronary artery stenosis or occlusion, (2) anomalous course
of the LAD coronary artery between the aorta and pulmonary artery, (3) anomalous origin of the left coronary artery from the pulmonary artery, (4) intraoperative coronary artery injury, (5) coronary ostial stenosis, and (6) transplant coronary artery disease after orthotopic cardiac transplantation.2

The main technical challenges of CABG in children are the small target vessels and selection of an appropriate graft conduit. Another concern is the long-term patency rate of the graft. The graft conduits can be either saphenous vein or arterial conduits (thoracic or gastroepiploic arteries). However, the patency rate was significantly higher for arterial grafts than for venous grafts and this difference was even greater in children younger than 7 years of age at the time of operation.3,4 More importantly, in the pediatric population, arterial grafts have been demonstrated to grow with the rest of the body.2,4-6 The internal mammary arteries have also been reported to retain their natural curvature from the time of operation until long afterwards, and were not stretched excessively by patient somatic growth.5 Good mid-term and long-term result and patency were documented in several studies.3,4,6,7 Because of the superior rate of patency, the ability to grow along with the developing child and excellent long-term results, IMAs grafts have been widely used since they were introduced in the late 1980s.

Therefore, in this patient, we chose the RIMA as the bypass graft to LAD. Four years later, MDCT was arranged before the last stage of total cavopulmonary connection, and patent RIMA graft was still noted. The operation was performed without injury of the graft during re-do sternotomy and the patient was discharged uneventfully 11 days after the operation.

REFERENCES