

One-and-a-Half Ventricular Repair through the Right Lateral Thoracotomy: An Alternative to Midline Approach in a Patient with Previous Mediastinitis

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We report a patient who successfully underwent a one-and-a-half ventricular repair (1.5 VR) through a right lateral thoracotomy. In the case of possible hazardous complications at the sternal reentry because of previous mediastinitis, this approach was thought to be an option in selected patients to complete a functional correction by means of 1.5 VR. (Ann Thorac Cardiovasc Surg 2008; 14: 390–392)

Key words: one-and-a-half ventricular repair, thoracotomy, pulmonary atresia with intact ventricular septum, mediastinitis, methicillin-resistant *Staphylococcus aureus*

Introduction

A one-and-a-half ventricular repair (1.5 VR) is a surgical option for congenital cardiac anomalies characterized by a hypoplastic but potentially or partially usable right ventricle. In the hemodynamic physiology of this circulation, because the superior vena cava (SVC) is in series with the pulmonary artery, the lungs are important also in Fontan circulation.¹⁾ We employed a thoracotomy approach to complete this surgical repair in a patient who had had a previous bidirectional Glenn shunt with right ventricular outflow patency and she had experienced complications from mediastinitis after the operation.

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Case

The patient was a 6-year-old girl with pulmonary atresia with intact ventricular septum. Several palliative procedures had been performed in her early infancy, including the Brock operation and a right modified Blalock-Taussig (B-T) shunt. At 2 years of age, she underwent a bidirectional Glenn shunt as an adjunct to ligation of the B-T shunt through a median sternotomy. The right ventricular outflow tract was left open as an additional pulmonary blood source. Following the operation, she suffered from mediastinitis resulting from methicillin-resistant *Staphylococcus aureus*. Subsequent cardiac corrections have been postponed because despite repetitive debridement procedures, her midline wound infection persisted as chronic osteomyelitis. She was referred to our institution at the age of 5 years. A prompt operation, including radical debridement and sequestrectomy, was carried out in cooperation with a plastic surgeon. We have had no confirmed evidence of recurrent infection for 6 months.

A cardiac catheterization prior to a 1.5 VR showed a mean pulmonary artery pressure of 8 mm Hg and a systemic arterial oxygen saturation of 84%. The indexed pulmonary artery resistance was calculated in 1.2 Wood's, units/m². Angiocardiography revealed a small but tripertile right ventricle, showing 22% of the predicted normal volume. A continuity of the right

ventricular outflow to the main pulmonary artery was verified, and no sinusoidal communications were observed. Diameters of the tricuspid and pulmonary valves were found to be 61% and 74%, respectively, of the anticipated normal values. These diameters corresponded to Z values of -4.6 and -3.1 , respectively.²⁾ We indicated a 1.5 VR for this patient as a functional radical correction rather than a Fontan type operation.

Because of presumable adhesion and the potential hazard of a recurrence of mediastinitis, we employed a right lateral approach to perform a 1.5 VR. The right chest was entered through the fourth intercostal space. The lungs were gently dissected and freed from adherence as little as possible so as not to damage the parenchyma. Opening the pericardium, we found very tight adhesion, necessitating scrupulous care to expose the right atrium, aorta, and inferior vena cava (IVC). A cardiopulmonary bypass was initiated with ascending aortic perfusion and bicaval drainage. The aorta was cross-clamped with antegrade cardioplegic arrest. When the right atrium was opened, a relatively large amount of blood spurted from the left atrium and was controlled carefully to avoid its being emptied (Fig. 1). The ostium secundum atrial septal defect (ASD) measured 10 mm by 7 mm, and the tricuspid valve measured 10 mm in diameter. The ASD was closed directly, leaving an aperture of 3 mm in diameter. As soon as the aortic clamp was released, an aortic needle vent was utilized to remove air from the left heart. The bypass was discontinued with SVC and IVC pressures of 11 and 13 mm Hg, respectively.

The postoperative course was uneventful. The patient was extubated 6 hours after entering the intensive care unit (ICU) with an arterial oxygen saturation of 95% on room air and discharged on postoperative day 19. Echocardiography showed that the interatrial shunt had spontaneously disappeared 2 months after the surgery. She has been completely asymptomatic during the 2-year follow-up period, with no evidence of recurring infection.

Discussion

For anatomical or functional radical correction, a staged strategy is often employed in the management of a congenital heart disease. Various palliative procedures are indicated and carried out prior to the final correction. However, several disadvantages are associated with staged strategy because the patient must sustain risks in



Fig. 1. Intraoperative surgical view through a right lateral thoracotomy.

The aorta and the superior and inferior venae cavae were cannulated, respectively. Opening the right atrium under cardioplegic arrest, the atrial septal defect (*) and the tricuspid valve (†) were well visualized. To control blood spurting from the left atrium, a flexible suction tube was inserted into it through the atrial septal defect.

regard to redoing a sternotomy and surgical site infection. The incidence of deep sternal wound infection is known to be no more than 1% to 4%,^{3,4)} but the patient is exposed to the risk every time he or she undergoes a procedure. Dobell and Jain reported a high incidence of catastrophic bleeding with a high mortality rate at the time of sternal reentry.⁵⁾ Although techniques have improved with cumulative experience,⁶⁾ re-sternotomy still might be a challenge because of severe adhesion and the risk of recurrent infection, especially in a patient who suffered from mediastinitis during a prior operation. To circumvent these problems at a later-stage operation, we prefer to employ a thoracotomy approach in a patient with a history of mediastinitis.

Right lateral thoracotomy is one of the well-established approaches as an alternative to median sternotomy, which some surgeons prefer to use for the repair of ASD.⁷⁾ This approach allows an excellent surgical view within the right atrium; several drawbacks cited include lung compression, ventilation-perfusion mismatch, and deairing of the left heart. In 1.5 VR circulation, the lungs are as important as in Fontan circulation because the SVC connects directly to the pulmonary artery.¹⁾ We gently manipulated the lungs when entering the chest, which was adherent to them because of the previous thoracotomy. When the bypass was turned off, the lungs were inflated so that returning systemic venous blood

could easily pass through them. General anesthesia, especially in the lateral position, has been known to form atelectasis and to have adverse effects on the ventilation-perfusion ratio.⁸⁾ For these theoretical hazards, we deliberately failed to completely close the ASD. To avoid massive air entry into the left heart, we paid close attention to the usage of intracardiac suction. When declamping the aorta, an aortic needle vent was opened to enable a careful removal of air.

In this complicated case, the retained right ventricular outflow patency, in anticipation of pulmonary vascularity growth at the time of a Glenn shunt, consequently leads to a functional radical correction by 1.5 VR. A right lateral approach was thought to be a surgical option in selected patients to complete a 1.5 VR.

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