A Case Report of a Left Modified Blalock-Taussig Shunt Carried Out on a Neonate with Congenital Heart Disease

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ABSTRACT

Blalock-Taussig shunts are typically performed on the right side; however, certain cases necessitate left-sided shunts. There are very few published reports about left Blalock-Taussig shunts and their success. We report a case of a newborn diagnosed with heterotaxy, double outlet right ventricle, and hypoplastic pulmonary atresia, among other defects. The management plan called for a single ventricular-staged repair. Therefore, a left-modified Blalock-Taussig shunt and duct ligation were performed for palliation. Despite being less commonly performed and reported, left-modified Blalock-Taussig shunts can still be executed, depending on the surgeon's experience, medical infrastructure, and anatomical complexity, with success rates comparable to right Blalock-Taussig shunts.

Keywords: Congenital Heart Disease, Congenital Heart Surgery, Cardiac Surgery, Pediatric.Shunts (Left Modified Blalock-Taussig)

INTRODUCTION

Congenital heart diseases (CHDs) refer to structural defects found in the heart or its major vessels, present at birth. Globally, significant cardiac anomaly affects eight out of every 1,000 live births. Of these, 30% (approximately two infants) require urgent medical intervention within their first year[1]. In Bahrain, the prevalence of CHD is five per 1,000 live infant births and continues to increase[2]. Every year, more than 20,000 infants in Bahrain are born with CHD, most of whom suffer from acyanotic CHD[3].

The Blalock-Taussig (BT) Shunt is a surgical procedure performed on patients with CHD where pulmonary blood flow is obstructed. It serves as a form of temporary palliation before complete repair. Introduced in the 1940s[4], BT shunts increase pulmonary blood flow by creating a vascular anastomosis between the subclavian/carotid artery and the pulmonary artery on the same side. Classical BT shunts are achieved by dividing the subclavian artery and allowing it to anastomose with the pulmonary artery. Alternatively, modified BT shunts facilitate anastomosis between the two vessels using a graft [5]. Regardless, BT shunts are predominantly performed on the right side, making left BT shunts a relatively rare procedure.

This report describes a complex case of CHD in a newborn infant with eight undetected congenital defects, which remained undiscovered during pregnancy. The infant was treated within its first month of life using a left-modified BT shunt. Very few existing case reports discuss the use of this treatment modality, particularly in the Middle East, making this a significant case to report. Consequently, this report aims to communicate the progression and challenges encountered in this difficult CHD case.

CASE PRESENTATION

We present a case involving a male newborn diagnosed with heterotaxy, double outlet right ventricle (DORV), and hypoplastic pulmonary atresia, detected via ultrasound during the second stage of labour. The patient, born on November 29, 2021, through a regular vaginal delivery at 39 weeks, was admitted to the NICU at Salmaniya Medical Complex, Bahrain. The newborn, weighing 3 kg at birth and with an APGAR score of 9, was deemed a normally active baby and appropriate for his gestational age. A physical examination revealed a heart shunt murmur upon auscultation and peripheral cyanosis. However, there was no relevant familial history of cardiac or genetic diseases.

Upon admission to the NICU, the patient received an infusion of Prostaglandin E1 (PGE1) to maintain blood oxygen saturation and flow via the ductus arteriosus. The echocardiography revealed ventricular inversion, DORV, ventricular septal defect (VSD), transposition of the great arteries (TGA), atrial septal defect (ASD), patent ductus arteriosus (PDA), pulmonary atresia (PA), a hypoplastic pulmonary artery, and visceral situs inversus. The result was a final presentation where the left atrium is connected to the right ventricle located on the right anatomical side of the heart, while the right atrium is linked to the left ventricle situated on the left anatomical side of the heart. Also, the superior and inferior vena cava were both connected to the left-sided right atrium, and the pulmonary artery, pulmonary veins, and the aorta were attached to the right-sided right ventricle. The great arteries were altered, with absent pulmonary forward flow noted. The diameters of the morphologically inverted left and right pulmonary arteries were both 4 mm. Both an ASD measuring 8 mm and a VSD with a diameter of 8.5 mm were visualized. The aortic valve annulus measured 8 mm on the echocardiogram, the pulmonary valve annulus was 4 mm, and

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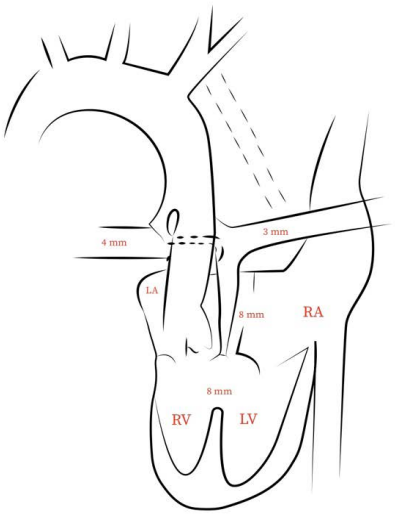

Figure 1: An illustrative representation of the heart defects present in the patient. The dotted line is the modified left Blalock-Taussig shunt proposed for the patient.

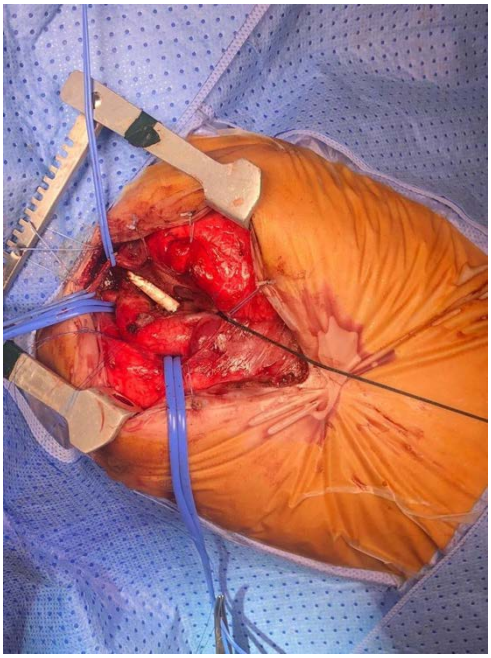

Figure 2. Visual extract from the surgery (modified left Blalock-Taussig shunt) performed on the newborn

a tortuous PDA had an inner diameter of 3.5 mm (**Figure 1**). A chest X-ray (AP view) showed a central heart (mesocardia), a hypoplastic pulmonary artery, and a visceral situs inversus. On day 29 after birth, a pre-operative workup confirmed the diagnosis of situs inversus, DORV, TGA, ASD, PA, and PDA. The management plan decided was a single ventricle staged repair.

Thirty days after birth, a newborn underwent a modified left BT shunt and duct ligation procedure, serving as a bridge for a second operation. During the procedure, the surgeon performed a median sternotomy incision and used a left-modified BT shunt of 3.5 mm diameter to link the left brachiocephalic artery and the left-right pulmonary artery. Additionally, a PDA ligation was executed. The operative findings confirmed a substantially large PDA originating from the posterior aspect (**Figure 2**). Postoperatively, while still on mechanical ventilation, the patient developed a pneumothorax; other than this, the postoperative course was uneventful. The patient was discharged on January 19, 2022.

DISCUSSION

Left BT shunts remain a complex and challenging area in pediatric cardiac surgery. A study by the American Heart Association underscores these challenges, indicating that left BT shunts are four times more likely to fail than right BT shunts (95% CI, 1.19 to 13.57; P=0.02)[6]. The causes of technical failure are attributed to the complexity of cardiac disease, a lack of evidence, and insufficient research on left BT shunts. The study concluded that the side on which the shunt is performed (right or left) acts as a "direct predictor" of surgical outcomes.

A case study from the BMJ documents a left BT shunt performed on a 3-year-old Bengali boy with CHD. This boy later experienced dilatation of the left pulmonary artery, mediated by blood flowing across the shunt[7], a potential complication of left BT shunts. Meanwhile, the same publication describes the case of a 4-year-old boy from Poland, who underwent a modified left BT shunt complicated by occlusion of the left subclavian artery and subsequent subclavian steal syndrome[7]. This report underscored the absence of any case in the available literature to guide the handling of complications specific to left BT shunts.

CONCLUSION

Our case presents an example of how modified BT shunts may be performed on the left side should the condition dictate it, even though the current literature on this topic is not comprehensive. Which side will receive the shunt is determined intra-operatively, based on the individual's anatomy. The success of a left BT shunt procedure depends on a variety of interrelated factors, such as the surgeons' experience, medical infrastructure, disease complexity, and readiness to respond to complications. Therefore, this case study reinforces the idea that modified left BT shunts can be performed in a safe and manageable manner.

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Competing Interest: None

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