



Left Pulmonary Artery Stenting with Glenn Shunt: Introducing a Hybrid Procedure

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Abstract

Complexity of some congenital heart diseases sometimes necessitates a combination of interventional procedures and surgery, amongst which intraoperative stent implantation is one of the most common. We herein report a successful hybrid procedure in a cyanotic adult patient who had undergone no procedure in childhood. The patient was a 24-year-old cyanotic male (oxygen saturation in the room air was 65%) who presented with dyspnea. According to echocardiography, catheterization, and cardiac magnetic resonance imaging data, the patient was amenable to the Fontan surgery. However, because of significant left pulmonary stenosis and his age, he first underwent a hybrid procedure (Glenn shunt and left pulmonary artery [LPA] stenting). After the procedure, oxygen saturation rose to 83%. At six months' follow-up of the patient, exercise capacity and cyanosis had improved significantly, with O₂ saturation having reached near 85% by pulse oximetry.

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Introduction

Although intervention is sufficient for many simple congenital lesions, many other complex lesions necessitate surgery. However, there is sometimes a need to combine these two modalities in order to minimize the risk of surgery, reduce the pump time, and improve the outcome of surgery.^{1, 2} The hybrid procedure has indeed been in use for several complex lesions begotten by congenital heart disease since its introduction by Bhati and Coley for temporary occluding a patent ductus arteriosus in 1972.³ We herein report a successful hybrid procedure in a 24-year-old patient with a single-ventricle anatomy.

Case Report

The patient was a 24-year-old male who presented with dyspnea. He was cyanotic, and the oxygen saturation in the room air was 65%. The patient had clubbing in his toes and fingers. No procedure had been performed for this patient until then.

Echocardiography revealed moderate enlargement and normal function of a predominant morphologic right ventricle (RV). Both of the atrioventricular (AV) valves opened to the RV with mild regurgitation, and both great arteries arose from the RV with severe subvalvular and valvular pulmonary stenosis. The position of the great arteries was D-malposed;

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i.e. the aorta was anterior and right-sided.

The patient's ventricular function rendered him amenable to the Fontan surgery. Catheterization measured the mean pulmonary artery pressure (PAP) and left ventricular end diastolic pressure (LVEDP) as 10 mm Hg and 12 mm Hg, respectively. During RV injection, it was observed that the left pulmonary artery (LPA) was not opacified; decision was, therefore, made to conduct magnetic resonance imaging (MRI) so as to better evaluate the pulmonary artery branches. The procedure showed a long, significant stenosis of the LPA, which was 25 mm in length and 4 mm in diameter (Figures 1 and 2).



Figure 1. Magnetic resonance angiography in the coronal view, showing a severe diffuse lesion at the proximal portion of the left pulmonary artery branch (arrow)

Given the posterior position of the LPA and the relative distant location of the stenosis from the bifurcation and the desire to reduce surgery time, a hybrid LPA stenting procedure was opted for. After median sternotomy and routine cannulation, cardiopulmonary bypass was performed, the heart was arrested, and the Glenn Shunt was conducted on the beating heart with low-grade hypothermia and without an aortic clamp. Next, the main of the pulmonary artery (PA) was incised before the bifurcation, and a 3-mm Bare Stent (Genesis, Cordis Co.) was mounted on a 12 × 40-mm balloon (Opta Pro, Cordis Co.), which was passed through the LPA. The course of the catheter and stent as well as the covering of the lesion with the stent was monitored via transesophageal echocardiography (TEE). The acceptable position of the stent having been ascertained, the balloon

was inflated up to 5 Atm and the final diameter of the stent reached 12 mm. TEE confirmed the correct position of the stent and the diameter of the LPA after stenting (Figure 3). After the procedure, oxygen saturation rose to 83%.

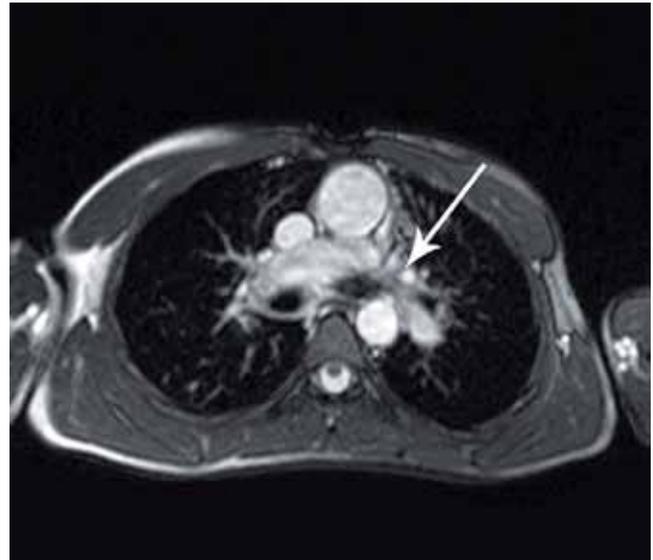


Figure 2. Magnetic resonance imaging in the axial view, demonstrating a severe long stenosis at the proximal portion of the left pulmonary artery branch (arrow)

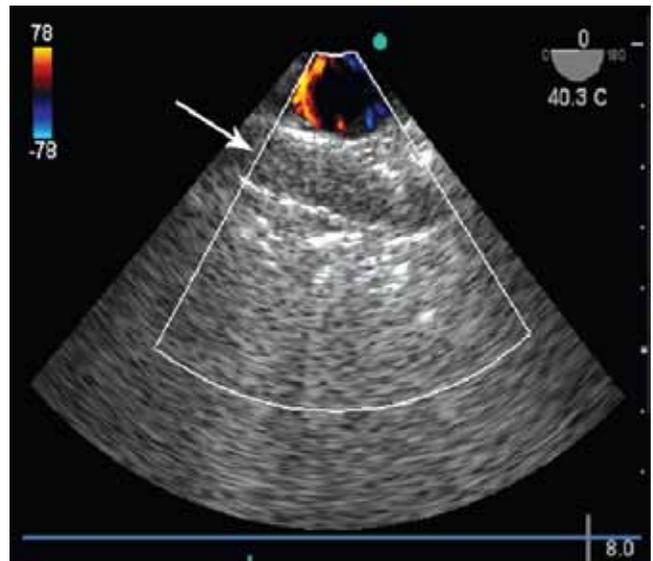


Figure 3. Intraoperative transesophageal echocardiography (mid esophageal short-axis view with left angulation), demonstrating the proper position of the stent (arrow)

At six months' follow-up of the patient, exercise capacity and cyanosis had improved significantly, with O₂ saturation having reached near 85% by pulse oximetry. Furthermore, no restenosis was seen in the follow-up imaging by transthoracic echocardiography (Figure 4).

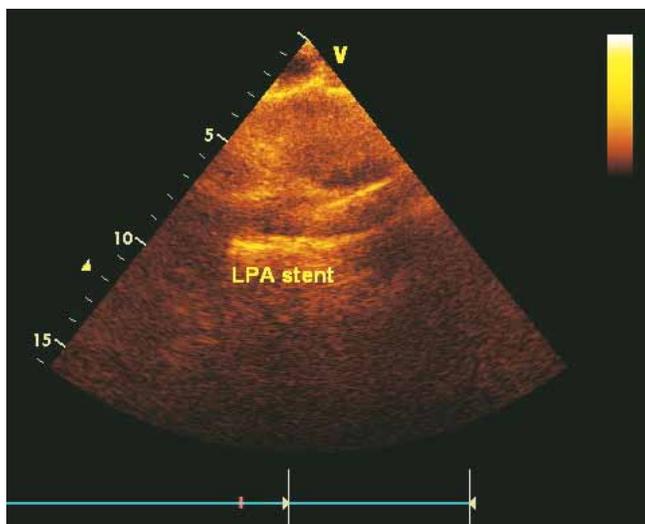


Figure 4. Transthoracic echocardiography (high left parasternal view) 6 months after stenting, depicting the patency and position of the stent in the left pulmonary artery (LPA)

Discussion

Hybrid therapy is an important alternative treatment in complex congenital heart diseases. Intraoperative stent implantation is one of the common hybrid procedures and has gained considerable acceptance as an alternative to patch angioplasty in recent years.⁴ Trant et al.⁵ revealed that PA stenting had intermediate-term success, which was not different from the surgery outcome. In our case, not only was the patient's PA stenosis not accessible to the surgeon easily, but also the stenosis was very long. Angiograms help to optimize stent positioning,⁶ however, we had no access to fluoroscopy and endoscopy in the operating room and were, consequently, obliged to resort to TEE in order to determine the exact length of the stenosis pre-procedurally and to ascertain the correct deployment of the stent intra-procedurally.

Conclusion

The hybrid procedure not only helps shorten the cardiopulmonary arrest duration, which is vital in cyanotic patients with some degree of myocardial dysfunction, but also prevents the extensive dissection of the pulmonary artery and injury to the phrenic nerve and other vascular and lymphatic structures.

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