Stent migration after right ventricular outflow tract stenting in the severe cyanotic Tetralogy of Fallot case

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ABSTRACT
We report our experience with a stent migration after right ventricle outflow tract stenting and converted to patent ductus arteriosus stenting in Tetralogy of Fallot (TOF) with severe infundibular stenosis. Finally, the patient achieved to TOF repair, and the migrated stent was removed without any complication.

Keywords: Right ventricular outflow tract, stenting, Blalock–Taussig shunt

INTRODUCTION
With advances in pediatric cardiac surgery, surgical repair of Tetralogy of Fallot (TOF) in early infancy has become standard practice in many institutions worldwide. However, in a critically ill neonate with severe hypoxia, surgical repair is expected to carry a high morbidity and mortality risk. Generally a modified Blalock Taussig (mBT) shunt is the preferred initial palliation. However, neonatal mBT shunt unlike that performed in older infant is also associated with increased morbidity and mortality. A less invasive alternative is stenting the right ventricular outflow tract (RVOT) or the patent ductus arteriosus (PDA) in the catheterization laboratory. RVOT stenting is technically less demanding compared to PDA stenting and has been shown provide good palliation with low complications. Furthermore, the ductus arteriosus is not always patent beyond the first 2-3 weeks of life.

CASE REPORT
A 1-month-old boy was referred to our hospital due to severe and progressively worsening cyanosis and tachypnea. He weighed 3.3 kg. On examination, he was saturating 58% and had severe respiratory distress. The child was intubated and put on ventilator. Echocardiogram showed Tetralogy of Fallot (TOF) with severe infundibular stenosis. Right and left pulmonary arteries were 4.8 mm and 3.3 mm, respectively. Nakata index was 131. Pulmonary artery valve annulus was rather large 5.6 mm (z-score - 2.1), but the infundibular area was 2.2 mm. Patent ductus arteriosus (PDA) was almost closing despite prostaglandin E1 infusion. The patient was brought to the catheterization laboratory as an emergency case for the PDA or right ventricular outflow tract (RVOT) stenting. Descending aortogram was done using 4F pigtail catheter, and PDA anatomy was profiled. The ductus came from underneath transverse aortic arch with tight curve and constricted at the pulmonary artery side [Figure 1]. We decided to proceed the RVOT stenting at first. Right ventricular angiogram was done using 5F Judkins right (JR) catheter. Outflow tract was severely thickened with the prominent muscle bundle at end systole, and valve was doming. 5F Launcher guiding JR catheter was positioned at the lower part of outflow tract, and Hi-torque Balance Middleweight Elite guidewire 0.014 inch (Abbott Laboratories, Abbott Park, Illinois, USA) was advanced distally in the right pulmonary artery. After removing 4F Judkins catheter, Accuforce coronary balloon (Terumo Interventional

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postprocedure descending aortogram revealed good stent position, entirely covering PDA [Figure 3]. Postprocedure echocardiography showed the migrated stent hung at the tricuspid valve and ventricular septal defect but did not cause valve insufficiency. Complete atrioventricular block improved 1 day after the procedure, and the temporary pacemaker was discontinued. The child was extubated on the 4th day and transferred to the step-down unit ward on the 6th day. Six months later, the patient was referred to the TOF repair. Computed tomography before surgery showed well-developed pulmonary arteries. Right and left pulmonary artery sizes were 6.4 mm and 5.6 mm, respectively, and Nakata index increased to 200. At the surgery, PDA stent was divided and removed. The migrated stent was located in the trabecular portion below the aortic valve. The stent was retrieved completely. There were no adhesions on its surface. Pulmonary valve and branch pulmonary artery sizes were good. TOF repair was completed without using transannular patch.

**DISCUSSION**

Surgical repair of TOF during infancy has become standard practice in many institutions worldwide.[1] Hence, the need for initial palliation – usually by Blalock-Taussig (BT)
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shunt – has decreased significantly. Palliation is largely reserved for ill neonates with severe hypoxia or those with very small pulmonary arteries as surgical repair in these patients is considered a high-risk procedure. RVOT stenting and PDA stenting in those where the ductus is still patent are gaining acceptance as a less invasive alternative compared to palliation with modified BT (mBT) shunt.[2] Complications related to thoracotomy such as pleural effusion and diaphragm paralysis are avoided.

Technically, RVOT stenting is relatively less challenging compared to PDA stenting. It has also the merit of increasing pulmonary blood flow from the systemic venous blood, hence reducing the LV volume overload that occurs with PDA stenting or BT shunt. At the same, equal distribution of flow to both pulmonary arteries can be expected compared to mBT shunt or PDA stenting as the PDA has a tendency to connect to a branch pulmonary artery (usually left pulmonary artery in the left aortic arch).

Much emphasis in the current surgical literature on the merit of pulmonary valve preservation at the time of surgical repair in TOF to prevent late sequelae of severe pulmonary regurgitation.[3] The majority of cases subjected to RVOT stenting have small pulmonary valve annulus that will require transannular patch, hence anchoring the stent across the annulus – which also destroys the valve cusps – is not an issue.

The RVOT stent was able to be placed as planned. However, as the RVOT is a contractile structure, the stent position was unstable and migrated into the RV body. For a stent to remain stable in such a structure, a considerably larger size would be needed, but we have to pay attention to excessive flow to the lungs and pulmonary edema.

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Conflicts of interest
There are no conflicts of interest.

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Figure 3: 4F Judkins right catheter was inserted through right axillary artery (a). Predilatation of patent ductus arteriosus was done (b). Stent was deployed across patent ductus arteriosus (c). Good flow to branch pulmonary arteries (d)