Dual Transcatheter Intervention in Ventricular Septal Defect and Pulmonary Valvular Stenosis

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Introduction

Balloon pulmonary valvuloplasty was first performed by Kan et al. [1]. Percutaneous transcatheter closure of muscular ventricular septal defect (VSD) was first reported by Lock et al. [2]. Simultaneous dual intervention of VSD device closure and balloon pulmonary valvuloplasty as a treatment for these two congenital anomalies has been reported only twice in literature [3, 4]. We report a successful transcatheter closure of mid muscular VSD and balloon pulmonary valvuloplasty in a child of less than two years of age.

Case Report

A 22 month old boy, weighing 11 kg, born of non-consanguineous marriage presented with history of recurrent chest infections. Clinically he had cardiomegaly, signs of left ventricular volume overload, grade 4/6 pansystolic murmur in left lower sternal edge radiating all over the precordium. Electrocardiogram showed sinus rhythm with biventricular hypertrophy (Fig.1). Chest radiograph showed cardiomegaly with increased pulmonary blood flow. Echocardiography showed situs solitus, levocardia, a large eight mm mid muscular VSD with left to right flow, a peak systolic doppler gradient of 16 mm Hg and pulmonic valvular stenosis (PS) with peak systolic doppler gradient of 90 mmHg. The pulmonary valve was doming and the annulus measured 11 mm. The patient was taken up for dual intervention of VSD closure and pulmonary valve balloon dilation. The procedure was performed under general anaesthesia with transthoracic echocardiographic and fluoroscopic guidance. After obtaining venous (right femoral vein 5.0 F and right internal jugular vein 5.0 F) and arterial (right femoral artery 5F sheath) accesses, unfractionated heparin was given and further doses were given to maintain activated clotting time between 200 and 250 seconds. Left ventricular angiography with 5F marker pigtail catheter showed mid muscular VSD measuring eight

mm and left to right flow (Fig.2). A right ventricle (RV) angiography showed pulmonic valvular stenosis (Fig. 3).

A Cournand 5F catheter was used to introduce a Terumo glide wire in the left descending pulmonary artery (Fig.4). The gradient across the pulmonary valve was 90 mm Hg as measured by a 5F multi-track catheter. The left to right shunt across the VSD had a Qp/Qs 2.5:1. In order to close the VSD an arterio-venous loop was established. A JR 5F catheter with a Terumo glide wire was used to cross the VSD from LV

Fig. 1 : Electrocardiogram showing normal sinus rhythm, right axis deviation and bi-ventricular hypertrophy

Fig. 2 : Left ventricular angiography with a marker 5F marker pigtail catheter showing mid muscular VSD

Fig. 3 : Right ventricular angiography showing valvular pulmonary stenosis

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Fig. 4 : Terumo wire across the pulmonary valve

Fig. 5 : Formation of arteriovenous loop

Fig. 6 : Left ventricular angiography post placement of VSD device

side and after crossing to the RV the Terumo glide wire was exchanged for a noodle wire. This noodle wire was negotiated to pulmonary artery where it was snared and exteriorized through the right internal jugular vein (RIJV) (Fig.5). A 7F Balkan sheath was introduced from the RIJV to ascending aorta. The dilator and the noodle wire were removed and an Amplatzer muscular VSD occluder device (size 8) was taken through this sheath and deployed under fluoroscopic and echocardiographic guidance. Check LV angio revealed a trivial shunt across (Fig.6). The gradient across the pulmonary valve fell to 70 mm of Hg.

The pulmonary valvuloplasty was then performed by exchanging the Terumo wire which was placed in the left pulmonary artery (LPA) for a 0.035" Amplatzer super stiff wire. A Tyshak-II 14 x 5 balloon (Numed, Ontario, Canada) was passed over this stiff wire to the pulmonary valve. The balloon was dilated at 3.5 atms with the disappearance of the waist. The gradient across pulmonary valve came down to 20 mmHg. There was no significant pulmonary regurgitation. Repeat echocardiography after 48 hours showed well deployed VSD device with no flow across. Post procedure aspirin in a dose of 3 mg/kg was given for three months.

Discussion

Percutaneous balloon pulmonary valvuloplasty is an established transcatheter technique for valvular pulmonary stenosis. Transcatheter techniques have also been increasingly used to close mid muscular VSD's safely and effectively with a number of devices [5]. Successful results of use of Amplatzer device for closure of muscular VSD have been reported in the literature [5,6]. Use of both the interventions simultaneously in a child is rare, with only two reports in literature [3,4].

In a patient having large VSD with severe congenital valvular pulmonary stenosis, treating one defect may lead to adverse hemodynamic effect on the other. In the first case report [3] the pulmonary valve was dilated first and then the VSD was closed whereas in the second case the VSD closure was followed by the pulmonary

valve dilation [4]. We closed the VSD first and then dilated the pulmonary valve for fear of pulmonary edema occurring if the pulmonary valve was dilated first with the resultant surge in the pulmonary blood flow into a previously protected pulmonary circulation.

Muscular VSD and PS are usually treated surgically, but complete closure of muscular VSD may present difficulties and small residual defect is not rare [7].

We believe that advances in transcatheter based interventions will allow us to apply these techniques to more complicated heart defects in younger patients.

Conflicts of Interest

None identified

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