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Case Report

Effectiveness of One Stage Balloon Pulmonary Valvuloplasty and Percutaneous Closure of Atrial Septal Defect

Raja Mohammed[1]*, Elangovan Govindaswamy[2] and Anandaraja Subramanian[3]

[1]*Senior Cardiologist, Department of Cardiology, Indira Gandhi Government General Hospital and Post Graduate Institute, Pondicherry, India*

[2]*Interventional Cardiologist, Department of Cardiology, A G Padmavatis Hospital Limited, Pondicherry,*

[3]*Senior Specialist Cardiologist, Department of Cardiology, Indira Gandhi Government General Hospital and Post Graduate Institute, Pondicherry, India*

***Corresponding Author:** Raja Mohammed, Senior Cardiologist, Department of Cardiology, Indira Gandhi Government General Hospital and Post Graduate Institute, Pondicherry, India.

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Abstract

Background: The combined percutaneous treatment of structural and congenital defects in single stage, eliminates the longer two stage preparation period, minimizes invasive catheterization related risks and the emotional burden especially in younger patients, and avoids allocating personnel and catheterization lab employees at two stages. Treating two defects by single stage procedure reduces not only the cost and also the in hospital stay to nearly half when compared to two stage procedure. We bring here a report of a combined one stage percutaneous procedure of pulmonary valvuloplasty by double balloon technique and device closure of atrial septal defect (ASD) performed in our center. This report brings out the possibility of combining both procedures in a single stage effectively.

Methods: Pulmonary valvuloplasty was performed by double balloon technique followed by ASD device closure as a combined percutaneous procedure. The left to right shunt was closed using a septal occluder device.

Results: The effectiveness of the procedure brought down the pre-valvuloplasty pulmonary gradient of 80 mmHg to 15 mmHg. The successful placement of septal occluder device closed the left to right shunt. The one stage percutaneous procedure was feasible, effective and without complications.

Conclusion: Severe pulmonary stenosis with atrial septal defect combined is not a common occurrence and very few cases were reported in the past. Our report shows safe and effective treatment of severe valvular pulmonary stenosis and secundum type ASD by one stage combined percutaneous procedure. There are compelling advantages in combining the procedure than doing at multi stage.

Keywords: *Pulmonary Stenosis; Atrial Septal Defect; Double Balloon Dilatation; Septal Occluder; Cost Effective; Combined Percutaneous Procedure*

Introduction

Secundum type atrial septal defect (ASD) combined with severe pulmonary stenosis is relatively an uncommon condition in adolescent or adult patients. Percutaneous closure of ASD is an effective alternative to surgical treatment in indicated ASD patients. Percutaneous balloon pulmonary valvuloplasty (BPV) for valvular pulmonary stenosis, described in 1982, is a procedure of choice for both adolescent and adult patients, class I recommendation according to the European Society of Cardiology (ESC) guidelines 2010 new version [1]. There are few reports in the past, which have combination of both conditions being treated by a percutaneous technique as a single stage

procedure. The single stage procedure reduces cost, shortens radiation exposure, minimizes expert handling time, lessens hospital stay and recovery period. Pavol Tomasov of Prague in 2010 reported a combined successful procedure of percutaneous balloon pulmonary valvuloplasty and device closure of atrial septal defect [2-4].

Case Report

A south Asian female patient aged 18 years presented to our hospital with complaints of chest pain associated with palpitations. She was born of full term normal delivery and a second child of non-consanguineous parents. No other relevant family or past medical history available. Her physical examination revealed a lean built young women, had no cyanosis or clubbing, a normal blood pressure and a regular normal volume pulse, and a harsh systolic murmur at upper left sternal border.

Her transthoracic Echocardiogram (TTE) revealed Ostium secundum type of Atrial Septal defect, with dimensions 15 × 17 mm, Left to Right shunt, dilated right atrium (RA) and right ventricle (RV), Mild Tricuspid Regurgitation, a well doming Pulmonary valve and severe Pulmonary stenosis [3], Gradient across pulmonary valve calculated as 90 mm Hg, normal LV function with an ejection fraction of 65%. Transeosophageal Echocardiogram (TEE) revealed Congenital Heart Disease, Ostium secundum type of Atrial Septal Defect, with dimensions 18 × 20 × 23 mm, left to right shunt, with adequate inferior vena cava (IVC) rim, required ASD device size calculated around 28 mm, severe Pulmonary stenosis, with a gradient of 90 mm Hg, no left atrium (LA) or LA Appendage clot, and a calculated BPV balloon size of around 28 mm.

She was posted for a single stage elective balloon pulmonary valvuloplasty (BPV) for severe valvular pulmonary stenosis, Class I Indication for Pulmonary Valvuloplasty According to the 2008 Guidelines of the American College of Cardiology/American Heart Association and non-surgical device closure of ostium secundum type Atrial Septal Defect (ASD) based on echocardiographic findings. Two units of blood were readily available after cross matching. Surgical back up was kept ready for intervention if required. Antibiotic injections were given prior as per the infective endocarditis prevention guidelines. Under general anaesthesia and with transeosophageal echocardiogram coverage both procedures were performed at our cardiac catheterisation laboratory. Pulmonary valvuloplasty was performed followed by ASD device closure [4-7].

Procedure was done through the right femoral vein approach and catheter was advanced through right atrium, right ventricle (RV) and across the pulmonary valve. Pulmonary artery (PA) pressure recorded was 20 mm Hg and RV pressure as 100 mm Hg. The gradient recorded was 80 mm of Hg across the pulmonary valve. Two .035 inch diameter exchange wire was advanced through the catheter and the catheter was removed. A 5 French (F) Pigtail catheter was advanced into RV and RV injection was given in antero-posterior (AP) and left lateral views which showed valvular pulmonary stenosis. Two power injections of 25 ml at 15 ml per second were given. Two numbers of .035 inch × 260 cm J tip super stiff AMPLATZ exchange wire was advanced into PA and 6 F Pigtail catheter was removed. An ATLAS BARD balloon of size 20 mm x 4 cm was placed across the Pulmonary valve and another ATLAS BARD balloon of size 14 mm x 4 cm was placed across the pulmonary valve and both the balloons were dilated simultaneously for 4 times (Figure 1). The waist disappeared after 4th dilatation. The whole balloon assembly and the sheaths were removed. The effectiveness of the procedure brought down the pre - valvuloplasty gradient of 80 mmHg to 15 mmHg.

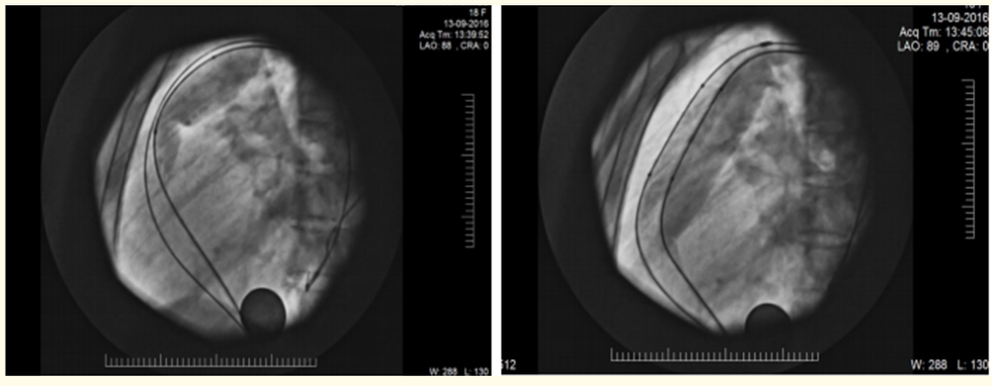

Figure 1: *Double balloon dilation of stenosed pulmonary valve.*

Recorded pressures

- Pre Valvuloplasty RV pressure: 100 mm of Hg
- Pre PA pressure: 20 mm of Hg
- Pre BPV Gradient: 80mm of Hg
- Post Valvuloplasty RV pressure: 40 mm of Hg
- Post PA pressure: 25 mm of Hg
- Post BPV gradient 15 mm of Hg.

Procedure of non-surgical closure of ASD (as per class I ESC guideline recommendation for grown up - adult congenital heart disease) was taken up immediately after the successful dilatation of pulmonary valve. Through the right femoral vein a 9 F sheath was placed and 4 F RCA catheter was advanced into left atrium (LA). The tip of the catheter was parked at left upper lobe pulmonary vein. A .035 inch diameter extra support wire was advanced into RCA catheter and tip was parked at the left upper lobe pulmonary vein and RCA catheter was removed. Over the extra support wire 12 F Mullins sheath was advanced into RA and the extra support wire was removed. 12 F Mullins sheath was drained well to let out all the air inside the catheter and then the sheath was advanced into LA. A 26 mm COCOON septal occluder (CSO) device was loaded into 11 F sheath and advanced through 12 F Mullins sheath and the device was well deployed across the ASD (Figure 2). After confirming the device position by transeosophageal Echo and by fluoroscopy the delivery cable was unscrewed. Both the sheaths were removed and venous puncture route was compressed and the plastered. Both procedures lasted for an hour fifty minutes. The procedure was effective and without any complications.

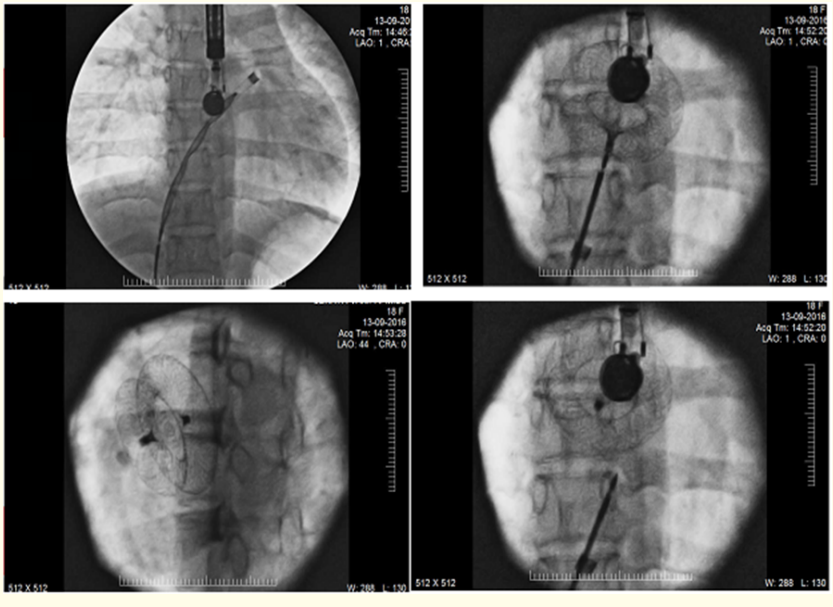

Figure 2: *Septal occluder in closure of atrial septal defect*

Her post procedure echocardiogram at 24 hours revealed ASD device in situ without any residual shunt across the atrial septal defect. Gradient across the pulmonary valve was recorded as 15 mmHg. Patient was sent home with advice to take aspirin and strictly adhere with infective endocarditis prophylaxis for six months [8-10]. Patient came for her follow up at 1 month which showed ASD device in situ with no evidence of thrombus or vegetations and gradient across the pulmonary valve around 15 mmHg. Because of the complex structural intervention she was advised to have follow up visits at 1 month, 3 months, 6 months, 12 months and annually thereafter [11,12].

Discussion

In adolescent as well as adult patients, combined occurrence of secundum type ASD and pulmonary stenosis is an uncommon condition. In isolated occurrence, both conditions can be treated percutaneously and are done worldwide. There are very few reports describing a one stage trans-catheter combined treatment of secundum type ASD and pulmonary stenosis but all vary in answering the question which defect should be treated first and whether the procedures should be staged or combined together. Dilating the pulmonary stenosis first lowers the peri-procedural risk of ASD occluder device dislodgement. Treating the ASD first should eliminate the left to-right shunt and thus also the right ventricle volume overload. We suggest the readers to address ASD first for the catastrophic reasons of device dislodgement.

Our patient with pulmonary valvular stenosis and ASD was much younger than patients in previously published reports for a combined procedure. The pulmonary valuloplasty procedure eliminated the very high pre-procedure gradient. The safe deployment of the septal occluder device effectively closed the left to right shunt. The combined percutaneous treatment of structural and congenital defect in single stage, eliminates the longer two stage preparation period, minimizes invasive catheterization risks and the emotional burden especially in younger patients, effectively removes the long waiting period for two stages as in some countries, is cost effective and avoids allocating personnel and cath lab employees at two stages. Combined percutaneous procedures and hybrid procedures are going to become increasingly relevant, safe and effective for complex structural and congenital heart disease in the future [13,14].

Conclusion

Our case report shows safe and effective treatment of secundum type ASD with severe valvular pulmonary stenosis by one-stage combined percutaneous procedure. Though there might be disagreement which should be treated first we suggest for a careful and thorough hemodynamic and screening assessment prior and during the procedure. There are compelling advantages in combining the procedure than doing at multi stage.

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