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Case Report

Hemodynamic effect of transcatheter patent ductus arteriosus closure on gradient across stenotic aortic valve in a patient with co-existing bicuspid aortic valve, severe aortic stenosis and patent ductus arteriosus: a rare case report

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ABSTRACT

Bicuspid aortic valve is the commonest congenital heart disease. It progresses to aortic stenosis, aortic regurgitation and aortopathy. However, most of the patients remains asymptomatic. Patent ductus arteriosus is relatively common congenital heart disease presenting as left to right shunt and pulmonary over circulation. Co-existence of bicuspid aortic valve, severe aortic stenosis and Patent ductus arteriosus is rare. These diseases are amenable to transcatheter treatment. Transcatheter closure is recommended treatment for patent ductus arteriosus and balloon aortic valvotomy is used as temporizing measure in paediatric severe aortic stenosis to relieve left ventricular outflow tract obstruction. Hemodynamic effect of one disease can affect the severity of other co-existing disease. In this case report we tried to understand hemodynamic effect of transcatheter closure of patent ductus arteriosus on severity of aortic stenosis. We found that transcatheter closure of patent ductus arteriosus decreased the peak-to-peak gradient across aortic valve.

Keywords: Patent ductus arteriosus, Aortic stenosis, Transcatheter closure, Pressure gradient

INTRODUCTION

Reported prevalence of patent ductus arteriosus (PDA) is 5-10% in term infant.[1] Rarely a PDA is associated with bicuspid aortic valve and severe aortic stenosis. Left to right shunt across PDA depends upon the pressure gradient between aorta and pulmonary artery. Transcatheter closure is currently recommended treatment of PDA.[2] Transcather balloon valvotomy is used as temporizing measure in children with severe aortic stenosis. A clinical dilemma exists when faced with patient with hemodynamically significant PDA associated with severe aortic stenosis as which transcatheter procedure should be done first, PDA closure or balloon aortic valvotomy. Hemodynamic effect of PDA closure on severity of associated aortic stenosis has not been described to the best of our knowledge. We are reporting a rare case of PDA associated with severe AS where dramatic reduction of aortic stenosis gradient was noted after transcatheter closure of PDA.

CASE REPORT

8-year-old male child presented with complaints of easy fatigability, his weight to height ratio was within normal limits. On auscultation a continuous murmur at parasternal area and ejection systolic murmur radiating to carotid was audible. Echo showed bicuspid aortic valve, fusion of right and left coronary cusp and severe aortic stenosis with peak and mean gradient of 84 and 60. Patient also had 3 mm patent ductus arteriosus with left to right shunt. Patient underwent cardiac catheterization under conscious sedation. Pressure was recorded simultaneously from left ventricle and femoral artery. A peak-to-peak pressure of 53 was recorded (Figure 1). PDA was closed using 6/8 cocoon PDA occlude. Post procedure pressure gradient

was again measured which reduced to 14 (Figure 2). Pre procedure echo measurements slightly over estimated the gradient which was consistent with pressure recovery phenomenon. Aortic valve gradient was measured at discharge which showed a peak and mean gradient of 24 and 18 respectively. Patient was followed up at one week and two months. Echocardiography was done at both the outpatient follow up visit. no shunt across PDA with device in situ was noted. No difference in peak and mean aortic valve gradient was noted on follow up.

Figure 1: Transvalvular gradient before PDA closure outcome.

Figure 2: Transvalvular gradient after PDA closure.

DISCUSSION

Irrespective of number of aortic valve cusp paediatric aortic stenosis is usually congenital in origin causing left ventricular outflow tract obstruction.[3] Surgical aortic valvuloplasty and balloon aoric valvuloplasty are acceptable treatment for pediatric aortic stenosis , however long term outcomes are relatively better with surgical aortic valvuloplasty.[4] Treatment option is individualised based on clinical condition as valve morphology is not an important predictor of treatment outcome echocardiographic assessment of aortic valve gradient using Doppler has been found to overestimate it because of pressure recovery phenomenon.[5,6]

Pressure gradient across stenotic valve is a function of valvular cross-sectional area and flow rate across the valve. Considering valvular cross-sectional area to be constant increased flow across valve will increase gradient.[7] Hemodynamic effect of PDA includes pulmonary over circulation, increased diastolic left ventricular volume and increased flow across aortic valve. This increased flow across aortic valve may overestimate gradient in a mildly or moderately stenotic valve. Trancatheter closure of PDA will have opposite effect. Our patient presented as aptly can be labelled as high flow high gradient aortic stenosis analogous to low flow low gradient valves. Transcather closure of PDA reduced flow and gradient across aortic valve.

CONCLUSION

Bicuspid aortic valve is the commonest congenital abnormality with prevalence of 1-2%, it is usually associated with aortopathy and progresses to aortic stenosis or aortic regurgitation.[8] In older patient with bicuspid aortic valve and patent ductus arteriosus, left ventricular systolic dysfunction has been reported after transcatheter closure of patent ductus arteriosus.[9]

Aortic stenosis causes obstruction to left ventricular outflow and patent ductus arteriosus causes left to right shunt throughout the cardiac cycle. Echocardiographic study to assess flow across these co existent lesion has shown importance of inter arterial communication in determining hemodynamic.[10] Invasive hemodynamic of co-existing congenital heart diseases have been rarely described in the literature, however it becomes imperative before making management decisions. we are reporting a case where co existing patent ductus arteriosus was increasing the severity of aortic stenosis due to increases flow across the valve. Transcather closure of patent ductus arteriosus helped us deferring transcatheter treatment of aortic stenosis. we emphasize the importance of invasive hemodynamic study in co-existing congenital heart disease, before planning definitive therapeutic strategy.

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