

Tricuspid Valve Dilatation in a Case of Ostium Secundum Atrial Septal Defect: Therapeutic Dilemmas in the Perioperative Period and a Call for Building the Evidence

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ABSTRACT

The adult literature on managing tricuspid regurgitation (TR) in left heart disease is in evolution. Tricuspid valve repair in pediatrics, on the other hand has more or less been restricted to disease subsets, such as children developing TR secondary to right ventricular disease or tricuspid valve anomalies. The pediatric literature on 'acquired' TR [as in congenital heart diseases, such as atrial septal defect (ASD)] is sparse. Some of the concerns that need to be addressed are thresholds for intervention, optimal annular reduction and methods of surgical reduction (DeVega vs ring annuloplasty). We present a case of a 5 years old female child who primarily presented for closure of her ostium secundum ASD. However, intraoperative transesophageal echocardiography (TEE) revealed TR and a tricuspid annular dimension beyond $z +3$ for her size. The surgeon chose to perform a DeVega annuloplasty and both the ASD closure and the annuloplasty were uneventful, postoperative TEE revealed no residual defect, no TR or stenosis. We seek to highlight this case in order to urge a more systematic study of such patients with a local focus since patients in our country present later than usual with asymptomatic heart disease and are more likely to undergo progressive right heart enlargement for a given shunt.

Keywords: TEE evaluation of tricuspid valve, TEE measurement of tricuspid annulus, TR in pediatric patients, DeVega in pediatric patients, TEE in congenital heart surgery.

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CASE REPORT

A 5-year-old girl with a large ostium secundum atrial septal defect (ASD) (transthoracic echocardiographic dimensions of 38 mm), dilated right sided chambers, a Q_p/Q_s of 2.5:1, moderate tricuspid regurgitation (TR), mild mitral regurgitation and mild pulmonary arterial hypertension [right ventricular systolic pressure (RVSP) = 35 + mean right atrial pressure (RAP_{mean}) mm Hg] was referred for ASD closure. Clinical history was significant for recurrent respiratory tract infections alone, biochemistry and hematologic investigations were within normal limits. She weighed 18 kg and her body surface area was calculated to be 0.74 kg m².

After standard induction of anesthesia and endotracheal intubation a pediatric transesophageal echocardiographic probe was inserted and hooked onto the iE33 Matrix Echocardiography System (Philips, Andover MA). Transesophageal echo confirmed the preoperative findings, there was no additional ASD, pulmonary venous drainage was normal and the RVSP as obtained from the TR jet was 30 + 7 (RAP_{mean} obtained from central venous catheterization) mm Hg. The tricuspid annulus was measured in both midesophageal modified bicaval view (Fig. 1) and the transgastric right ventricular inflow-outflow view—it measured 34 mm in both of these views. TR was deemed mild as evidenced from a vena contracta width of 27 mm.

Cardiopulmonary bypass was instituted with bicaval cannulation with right heart exclusion. Cold blood cardioplegia was used to secure cardioplegic arrest. Following a right atriotomy the echocardiographic findings were confirmed and a valve sizer determined the tricuspid valve to be 35 mm. She underwent Dacron patch closure of the ASD and a DeVega suture annuloplasty of the tricuspid valve downsized to 28 mm. Postoperative TEE revealed complete closure of the ASD, no tricuspid valve stenosis (Fig. 2) and trivial TR on color Doppler examination (Fig. 3). She made an uneventful postoperative recovery.

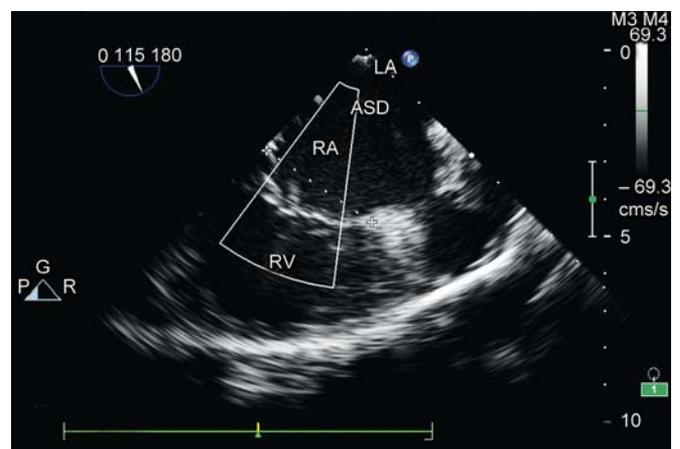


Fig. 1: Measurement of tricuspid annulus in modified bicaval view. LA: Left atrium, ASD: Atrial septal defect, RA: Right atrium, RV: Right ventricle. The annulus measured was 34 mm in both modified bicaval and transgastric RV in flow-outflow view

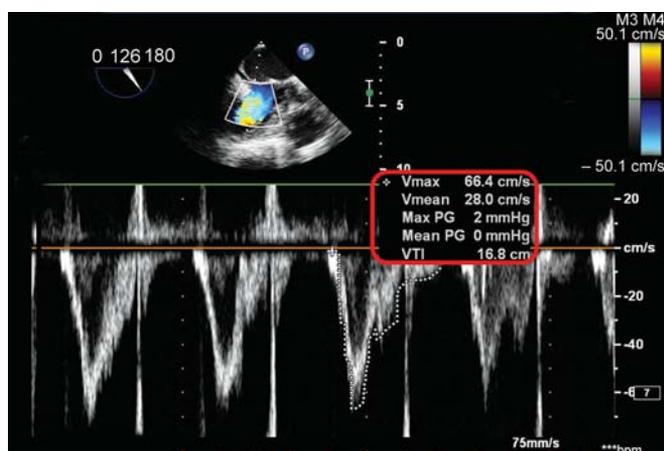


Fig. 2: Measurement of tricuspid inflow velocity in modified bicaval view post correction. The mean gradient was 0 across tricuspid valve

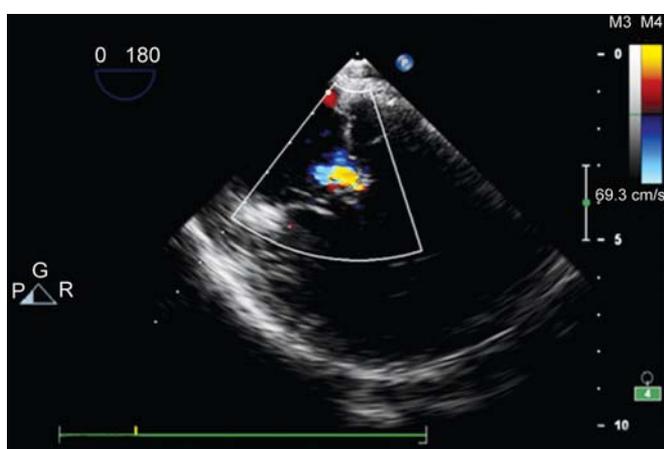


Fig. 3: Vena contracta measured in four chamber view at tricuspid regurgitant jet post TV repair

DISCUSSION

The natural course of ASDs is considered, on the whole benign.¹ However, shunting from the left heart to the right actually increases with age. With large nonrestrictive communications the shunt is determined by the relative compliances of the left and right ventricles (RV). While in infancy, shunt fraction is limited by the relatively low compliance of the RV, the shunt increases as the RV becomes more compliant with age even as the left ventricular compliance falls. This sets the stage for dilation of the right side of the heart. In our case, this purportedly is the cause of tricuspid annular dilation. Tricuspid valve repair as an adjunct to uncomplicated ASD closure has scant reportage in the medical literature, tricuspid valve intervention in childhood restricted to special subsets of congenital heart diseases, such as Ebstein's anomaly,² TR secondary to the RV exposed to excessive afterload^{3,4} or those with a congenitally deformed valve.⁵

In our approach to this particular patient we decided to size the tricuspid valve given the size of the ASD and the

extent of right heart dilation, the right heart diameter as sized on a previously published normogram and based on z scores.⁶ The tricuspid valve was sized in multiple views from both esophageal and gastric windows,⁷ in this particular patient the midesophageal modified bicaval and transgastric RV inflow-outflow view measurements approximated each other.

To determine whether a tricuspid valve intervention was required or not we based therapeutic rationale based on two principles—how much the annular dimension varied from normal and the learning we have, as on date from follow-up data in left heart disease and 'functional' TR. Falling back on the normogram generated data (vide supra⁶) a tricuspid valve dimension of 35 mm in the indexed patient corresponded to a z score of $>+3$. This alone, in the absence of mitigating data determined our decision to perform an annuloplasty. Primary congenital abnormalities of the tricuspid valve are considered rare.⁸ When secondary to congenital heart problems this is regarded to occur most often with right sided obstructive lesions.⁹ DeVega suture annuloplasty has excellent results in the postoperative follow-up when used in congenital heart disease.^{10,11} Although right ventricular volume overload is under-represented in these case series it seems reasonable to expect similar outcomes in this subgroup as well. There is some concern that annuloplasty predisposes to tricuspid stenosis, in our patient since the undersizing was to the point of $z+1$ this was not expected and the same was evident in the Doppler interrogation after annuloplasty (Fig. 2). The other concern has been fixing the tricuspid annulus in a growing child potentially risking future tricuspid stenosis; even this has not been usually evident.⁸ In adults, the echocardiographic evaluation of TR, especially from the point of evaluation for intervention has undergone continuous refinement, such as the addition of parameters such as tenting area and coaptation depth;¹² this will undoubtedly be applied to the pediatric subset in time.

In summary, we report the management of tricuspid valve in a patient with a large left to right shunt based on tricuspid valve dimensions based on z scores with good immediate outcome. However, one swallow does not make a summer and, in countries like ours where congenital heart disease presentation and intervention occur at later ages than our Western counterparts this calls for greater preoperative and intraoperative vigilance and acquiring appropriate data sets for planning evidence based surgical protocols.

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