



MANAGEMENT OF CONCOMITANT AORTIC REGURGITATION IN PATIENTS UNDERGOING VSD CLOSURE - OUR EXPERIENCE

Cardiothoracis

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ABSTRACT

Background : VSD-AR syndrome includes hearts in which AR is rarely present at birth, and is caused by cusp prolapse or a Bicuspid Aortic Valve. Cusps may prolapse not only into but at times through the VSD (Venturi Phenomenon). Early VSD closure have been proposed to prevent the onset of AR or the worsening of the existing AR. **Aim** - To assess the resolution of Aortic Regurgitation in patients undergoing VSD Closure with or without Aortic Valve intervention. **Method** - Retrospective - Prospective study of patients undergoing cardiac surgery at ABVIMS and DR RML Hospital, New Delhi between November 2019 to October 2024. Inclusion Criteria was All patients with VSD and concomitant AR who underwent VSD closure with or without intervention to the aortic valve. Exclusion Criteria was patients with other major cardiac anomalies, connective tissue disease or aortopathy. The patients were analysed based on the Severity of AR & Intervention to their Aortic Valve. Severity of AR was classified as Mild, Moderate, and Severe based on Pre operative 2D Echo assessment. Type of Aortic valve intervention was classified as No intervention (NI), Aortic Valve repair (AVr) And Aortic Valve Replacement (AVR). Outcomes of each of these were reviewed together with the factors that contributed to them. Patients were followed up for 1 month, 6 months & 1 year post operatively. **Results:** Total of 30 patients who met the inclusion criteria between November 2019 to October 2024 were included in the study. The mean age at surgery was 9.80 years, with 73% (22) of the patients being Male. Most of the patients had perimembranous VSD 20 (67%), followed by 10 doubly committed subarterial VSD (33%). The mean VSD size was 1.02 ± 0.42 cm. 3 patients underwent Trans Aortic VSD Closure + AV Repair (Trusler Repair) (AVr). 2 patients underwent Trans Aortic VSD closure + AVR (Mechanical Valve) (AVR) & 25 patients underwent VSD Closure without Aortic Valve Intervention. 22 patients (73%) had no residual AR post isolated VSD Closure on 1 year follow up. **Conclusion:** Early VSD Closure in Patients having VSD with Concomitant AR resulted in gradual regression of AR. Early VSD Closure should be considered to prevent further progression of AR. If VSD is left untreated, AR will progress to a more severe form in future, necessitating Aortic Valve Intervention. Intervention to the Aortic Valve (AVr or AVR) along with VSD closure is considered when there is Severe Aortic Regurgitation.

KEYWORDS

Ventricular septal defect, Aortic regurgitation, Aortic insufficiency, Laubry Pezzi syndrome, Venturi effect

INTRODUCTION

Combination of Ventricular Septal Defect (VSD) and Aortic Regurgitation (AR) due to prolapse of right coronary or, less frequently, non-coronary cusp is known as Laubry-Pezzi syndrome.^[2]

Anatomic and hemodynamic features of the VSD contribute greatly to development of aortic valve cusp deformity and subsequent AR. VSD-AR syndrome includes hearts in which AR is rarely present at birth, and is caused by cusp prolapse or a Bicuspid Aortic Valve. AR is most often caused by prolapse of the right coronary cusp (RCC) of the aortic valve (about two thirds of patients) the remaining third have prolapse of the noncoronary cusp (NCC) or of both noncoronary and right coronary cusps.^[1]

The common feature of all these defects associated with AR is that the affected cusp or cusps lack the normal muscular support provided by attachment of the sinus of Valsalva to the muscular ventricular septum. Cusps may prolapse not only into but at times through the VSD (Venturi Phenomenon).

Protrusion of Aortic cusps through the VSD increases during diastole and effectively plugs the defect, limiting the shunt even when the defect is large. Extensive cusp prolapse through a large VSD may also lead to RV outflow obstruction.^[1]

In advanced cases, the center of the prolapsed free margin of the cusp is thickened and retracted leading to resuspension of the leaflet less effective, resulting in worsening of AR. Additional damage may be produced by endocarditis in some patients.

Early VSD closure have been proposed to prevent the onset of AR or the worsening of the existing AR.^[1]

The VSD is usually perimembranous, doubly committed juxtaarterial, or rarely, outlet muscular (Anderson Classification). VSD-AR syndrome is related to congenital sinus of Valsalva aneurysm and tetralogy of Fallot with AR.^[1]

Aim

To assess the Resolution of AR in patients undergoing VSD Closure with or without Aortic Valve intervention.

Study Method

Retrospective - Prospective study of patients undergoing cardiac surgery at ABVIMS and DR RML Hospital, New Delhi between November 2019 to October 2024.

Inclusion Criteria :

All patients with VSD and concomitant AR who underwent VSD closure with or without intervention to the aortic valve.

Exclusion Criteria :

Patients with other major cardiac anomalies.
Patients with connective tissue disease or aortopathy.
The patients were analysed based on the Severity of AR & Intervention to their Aortic Valve.

Severity of AR was classified as Mild, Moderate, and Severe based on Pre operative 2D Echo assessment.

AR is graded based on the ratio of the diameter of the regurgitant jet to the diameter of the left ventricle outflow tract (LVOT)

Mild AR - with a ratio below 25%

Moderate AR - with a ratio between 25 – 64 %

Severe AR - with a ratio of 65% and above

Type of Aortic valve intervention was classified as No intervention (NI), AV repair (AVr) And AV Replacement (AVR). Outcomes of each

of these were reviewed together with the factors that contributed to them.

Patients were followed up for 1 month, 6 months & 1 year post operatively.

Statistical Analysis

All data were entered and analyzed using IBM SPSS Statistics for Windows, Version 20.0. Statistical significance was set at a P-value of <0.05.

Chi-Square test of independence and Paired t-test was used accordingly to analyse correlations.

RESULTS

A total of 30 patients who met the inclusion criteria between November 2019 to October 2024 were included in the study.

The mean age at surgery was 9.80 years, with 73% (22) of the patients being Male.

Most of the patients 20 (67%) had perimembranous VSD, followed by 10 (33%) doubly committed subarterial VSD (Anderson Classification).

The mean VSD size was 1.02±0.42 cm (range: 0.4–2.0 cm).

Table 1. Demographic Data

Cases	30
Demographic Data	
Age	9.80 years
Sex	
M	22 (73%)
F	08 (27%)
Severity of AR with VSD (Pre Op)	
Mild AR	19 (63%)
Moderate AR	06 (20%)
Severe AR	05 (16%)

Fig. 1 – Gender Distribution Chart

Table 2. Grade of AR & Intervention to the Aortic Valve

Grade of AR	Intervention			Total	P Value
	AVr	AVR	NI		
Mild	0	0	19 (63%)	19 (63%)	<0.001
Moderate	0	0	6 (20%)	6 (20%)	
Severe	3 (10%)	2 (7%)	0	5 (17%)	
Total	3 (10%)	2 (7%)	25 (83%)	30 (100%)	

Table 3. Number of Prolapsed cusps & Intervention to the Aortic Valve

Number of Prolapsed Cusps	Intervention			Total	P Value
	AVr	AVR	NI		
0	0	0	11 (37%)	11 (37%)	<0.001
1	0	0	14 (47%)	14 (47%)	
2	3 (10%)	2 (7%)	0	5 (17%)	
3	0	0	0	0	
Total	3 (10%)	2 (7%)	25 (83%)	30 (100%)	

Table 4. Follow up 2D Echo Assessment

Grades of AR	Pre op	POD 0	1 Month	6 months	1 year	P Value
No AR	-	17	17	21	23	<0.001
Mild AR	19	10	11	07	04	
Moderate AR	06	03	02	01	01	
Severe AR	05	00	00	00	00	

Table 5. Resolution of AR (1 Year Follow up)

Grade of AR (Pre Op)	Cases (n=30)	No AR	Mild AR	Moderate AR	Severe AR
Mild	19	19	0	-	-
Moderate	06	01	05	00	-
Severe	05	03	01	01	00

Table 6. VSD PATIENTS WITH SEVERE AR

Sr No.	Age (Years)	Type of VSD	Size of VSD (mm)	Grade of Pre Op AR	No. of Prolapsed Cusps	AV Morphology	Intervention	Grade of AR POD 0	Grade of AR @ 1 Year
1	07	Perimembranous	12	Severe	2	Trileaflet	AVr	Moderate	Mild
2	04	Perimembranous	15	Severe	2	Trileaflet	AVr	No	No
3	17	Perimembranous	10	Severe	2	Trileaflet	AVr	Moderate	Moderate
4	18	Perimembranous	15	Severe	2	Bicuspid	AVR	No	No
5	15	Doubly Committed Sub Arterial	15	Severe	2	Trileaflet	AVR	No	No

OPERATIVE RESULTS

In this study, 5 patients having Severe AR & more than 1 Cusp prolapse on Pre op 2D Echo assessment were considered for AV Intervention.

3 patients underwent Trans Aortic Dacron Patch VSD closure + AV Repair (Trusler Repair) (Avr).

2 patients underwent Trans Aortic Dacron Patch VSD closure + AVR (Mechanical Valve) (AVR).

25 patients underwent Trans RA Dacron Patch VSD closure without Aortic Valve Intervention (NI).

1 patient had Bicuspid Aortic Valve Morphology (who undergone AVR), Rest all patients had Trileaflet Aortic Valve.

Intra operative assessment of residual AR post intervention was done with saline Insufflation test.

DISCUSSION

Patients with VSD & concomitant AR have several treatment options.

In Our Study, 23 patients (76%) had no residual AR post isolated VSD Closure. Two patients are yet to complete their 1 year follow up.

It was observed that size of the VSD was underestimated in Pre op 2D echo assessment when compared to the Intra operative findings.^[4]

In our study, following factors were having significant association with the type of aortic valve intervention (AV repair/ AVR/ No Intervention): **Grade of preoperative AR & Number of prolapsed cusps.**

In the Retrospective study by Sivakumar Krishnasamy et al (2021), total of 261 patients, 105 patients had intervention (40%) to their aortic valve during VSD closure, rest 156 had NI (60%), concluded that all moderate and severe AR with small VSD and more than one cusp prolapse will need intervention to their aortic valve during the closure of VSD. If VSD is left untreated, AR will progress to a more severe form in future, necessitating Aortic Valve Intervention.^[8]

Previous reports have pointed out that the grade of AR is associated with the size of VSD^[8], but this relationship was not seen in this study (P value 0.75), owing to small sample size.

A large VSD has been shown to have a lower AR gradient. The reason for this has been mainly related to the venturi effect that happens to the leaflets. In a smaller VSD, the suction effect to the leaflet is far greater than in a larger defect, which exaggerates the prolapse of the leaflets

resulting in worsening of the AR.^[8]

AV Repair Techniques include Trusler stitch, Commissuroplasty, Leaflet Plication and Ring Annuloplasty.^[1]

Syed M. Bukhari et al (2023) also concluded that Aortic valve intervention can be avoided at the time of VSD closure in patients with trivial to mild AR. An early VSD closure alone improves aortic valve disease.^[11]

Eroglu and colleagues reported a prevalence of aortic cusp prolapse of 12% and aortic regurgitation of 7% among patients with perimembranous VSD.^[5]

Tatsuno and colleagues in Japan obtained good results by VSD closure alone when AR is mild.^[1]

In most patients, AR tends to be detected between the ages of three to eight years.^[12]

Limitations

Small sample size was analysed in this study. The decision to intervene the valve was solely of the operating surgeon and there was no strict criteria or guideline that was followed for the valve intervention.

CONCLUSION

In Patients having concomitant Aortic Regurgitation with small VSD, early VSD Closure should be considered to prevent further progression of AR.

Intervention to the Aortic Valve (AVr or AVR) along with VSD Closure is considered when there is Severe Aortic Regurgitation.

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