

# Rupture of Sinus of Valsalva – A 15 Years Single Institutional Retrospective Review: Preoperative Heart Failure has an Impact on Post Operative Outcome?

## Abstract

**Background:** We reviewed our experience with ruptured sinus of Valsalva aneurysms (RSOV) to determine a correlation with preexisting heart failure (HF) and coexisting cardiac lesions (aortic regurgitation [AR] and ventricular septal defect [VSD]) to postoperative left ventricular (LV) dysfunction and postoperative outcomes. **Materials and Methods:** Retrospective review of RSOV cases over 15 years showed that RSOV repair was done in 87 patients. We looked for patients who presented with HF and patients having AR and/or VSDs. Statistical analysis was done to see if the coexisting lesions and preoperative HF were associated with postoperative LV dysfunction. Chi-square test was used on contingency table for statistical analysis. Complications in the postoperative period and prolonged Intensive Care Unit stay were noted. **Results:** 17% (15/87) presented with HF. Fifty-two patients had moderate to severe AR and 50 patients had VSD. Seventeen patients had postoperative LV dysfunction. The correlation of preoperative HF and coexisting lesions with postoperative LV dysfunction was not statistically significant. Two patients underwent redo surgery for residual RSOV and AR. Two patients had arrhythmias. One patient had cerebrovascular accident. No mortality was seen in the study. **Conclusion:** Preoperative HF and the presence of VSD and/or AR have no statistical significant correlation with postoperative LV dysfunction. As the outcome of RSOV repair is good, all patients need to undergo early repair to avoid complications.

**Keywords:** Aortic regurgitation, heart failure, outcomes, ruptured sinus of Valsalva aneurysm, ventricular dysfunction, ventricular septal defects

## Introduction

Sinus of Valsalva aneurysm arises mainly from a congenital defect of the aortic media or may follow injury, endocarditis, syphilis, Behcet's disease, and Marfan syndrome.<sup>[1,2]</sup> It comprises up to 3.5% of all congenital cardiac anomalies.<sup>[2,3]</sup> It is more prevalent in people from Asian descent. The aneurysms originate predominantly from the right coronary sinus (67-85%).<sup>[4]</sup> Coexisting cardiac lesions, such as a ventricular septal defect (VSD) or aortic valve regurgitation (AR), may both be present in about 30%–40% of patients.<sup>[2,5]</sup> VSD is more common in Asian population (52%).<sup>[4]</sup> The aneurysm may lead to myocardial ischemia and/or conduction disturbances due to compression of a coronary artery or the conduction system, respectively.<sup>[2]</sup>

An aneurysm of the sinus of Valsalva ruptures in 35%, leading to acute symptoms

in one-fourth of the patients. A ruptured sinus of Valsalva (RSOV) aneurysm is associated with a severe left-to-right shunt when it communicates with the right-sided heart chambers. If timely intervention is not done, it leads to the deterioration of heart function.<sup>[2]</sup> Symptoms associated with rupture are shortness of breath, chest pain, and fatigue.<sup>[2,3]</sup> The severity of symptoms depends on the degree of the shunt, the presence of associated lesions, and age at presentation.<sup>[6]</sup> Most aneurysms rupture into the right-sided heart chambers and rarely into the left-sided heart chambers and pulmonary artery.<sup>[5]</sup> In patients with untreated ruptured sinus of Valsalva aneurysm (SVA), a mean survival period of 1-2 years has been documented by Moustafa *et al.*<sup>[6]</sup> The operative results for SVA repair has been excellent, with long-term survival rates being 93% at 20 years.<sup>[7]</sup> Since surgical treatment of SVA is safe and effective, ruptured SVA or unruptured SVA

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with VSD and/or AR should be repaired surgically as early as possible.<sup>[4]</sup>

We hypothesized that the presentation with heart failure (HF) and the presence of associated lesions will have an impact on the postoperative left ventricular (LV) function and the outcome.

## Materials and Methods

Eighty-seven patients of RSOV coming for surgical closure between 2001 and 2016 at Sri Sathya Sai Institute of higher medical sciences were reviewed retrospectively. Age of presentation, presentation with HF, i.e. symptoms of congestive HF, association of coexisting heart lesions, postoperative ventricular function, the Intensive Care Unit (ICU) stay, and complications in the recovery were assessed. Postoperative LV dysfunction was defined as ejection fraction <50%. It was assessed by transthoracic echocardiography before discharge; this was done to rule out cardiopulmonary bypass-related LV dysfunction. Prolonged ICU stay was defined as stay more than 48 h in ICU. Statistical analysis was done to see if the coexisting lesions and preoperative HF were associated with postoperative LV dysfunction. Other postoperative outcomes were clinically not significant. Chi-square test was used on contingency table for statistical analysis. Average follow-up was for 10 months (range: 2 months to 8 years). Eleven patients were lost to follow-up.

## Results

The mean age of presentation was 30 years. Presentation with failure was seen in 15/87 (17%). Five patients had preoperative LV dysfunction and one had RV dysfunction. Fifty-two patients had aortic regurgitation (AR), of which fifteen were moderate to severe, five of them required valve replacement, and others underwent repair. Fifty patients had VSD who underwent closure. The data of all patients is shown in Table 1.

Seventeen patients had postoperative LV dysfunction, of which four had preoperative HF, eight had preoperative VSD, ten had preoperative AR, and seven patients had both VSD and AR [Table 2]. Aortic valve replacement was done for one patient and others underwent a repair. ICU stay was prolonged in six patients with three of them having preoperative LV dysfunction and other three did not. ICU stay was prolonged due to complications such as sternal wound dehiscence, arrhythmias, residual RSOV shunt, and severe AR postoperatively requiring replacement.

Of the 17 patients with postoperative LV dysfunction, only two patients continued to have severe LV dysfunction on follow-up. Two patients were lost to follow-up. Average follow-up was for 10.3 months (range: 2 months to 8 years). Long-term complications such as moderate to severe AR and severe LV dysfunction were noted in two patients, incisional scar in one, and depressive disorder in

one patient. Four patients had small residual shunts at the ruptured site and two patients had tiny residual VSD. No mortality was seen in our study.

Statistical analysis was done to see if the coexisting lesions and the preoperative HF were associated with postoperative LV dysfunction.

Chi-square test was used on contingency table; there was no statistically significant correlation between coexisting lesions, preoperative HF, and postoperative LV dysfunction [Figures 1-3].

## Discussion

The natural history of the lesion depends on the size of the shunt and presence of associated defects. Large shunt and associated lesions accelerate development of symptoms and also time of presentation. LV volume overload, right ventricular hypertension, and ultimately, congestive HF occur due to increased pulmonary blood flow. The presence of the lesion is usually an indication for repair. Endocarditis also affects symptoms and presentation.<sup>[7,8]</sup>

Clinical presentation ranges from infancy to seventh decade; it is usually within the third decade of life. In Azakie *et al.*'s series, patients ranged from 7 to 57 years of age.<sup>[8]</sup> In our review, the mean age of presentation was 30 years (range: 10–55 years).

The lesion is five times more common in Asians. Various reports indicate a male preponderance in Asians;<sup>[4,6]</sup> similarly, in our study, 64% were males. The right coronary sinus is most commonly affected, followed by the noncoronary sinus. Rupture of the aneurysm most commonly occurs into the right ventricle followed by the right atrium. The most common site of rupture in our study was into right ventricular outflow tract (68%); the rest ruptured into right atrium.

Patients are symptomatic with dyspnea, pain, palpitations, or fatigue on presentation in 80% to 85% of the cases.<sup>[7]</sup>

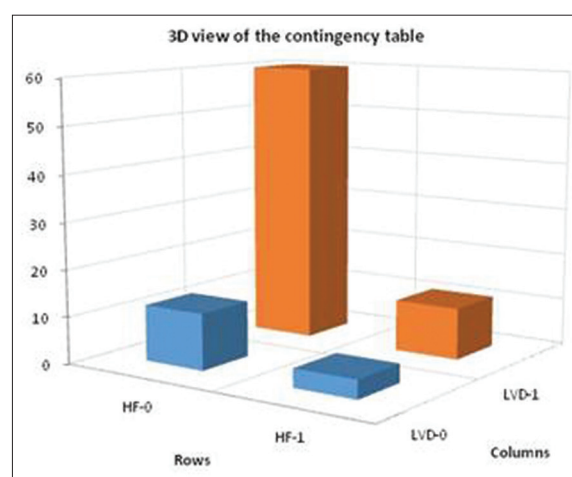


Figure 1: Correlation between Preoperative Heart failure and post operative LV dysfunction ( $P = 0.363$ ): HF 0 – no preoperative heart failure, HF 1 – presented with heart failure, LVD 0 – no postoperative left ventricular dysfunction, LVD 1 – post operative left ventricular dysfunction present

**Table 1: Pre and postoperative data of all patients**

Case No	PRE OP HF	PREOP VSD	PRE OP AR	POST OP LVD	POST OP COMPLICATIONS	PROLONGED ICU STAY
1	+	+	+	-	-	-
2	-	+	+	-	-	-
3	-	-	-	+	-	-
4	-	+	+	-	-	-
5	-	+	+	-	-	-
6	-	+	+	-	-	-
7	-	+	+	-	-	-
8	-	-	+	-	-	-
9	-	+	+	-	-	-
10	-	+	-	-	-	-
11	-	+	+	-	-	-
12	-	-	-	+	+1	+
13	-	+	+	-	-	-
14	+	+	-	+	+2	+
15	-	+	+	-	-	-
16	-	+	+	+	-	-
17	-	-	+	-	-	-
18	-	+	+	-	-	-
19	+	-	-	-	+3	+
20	-	+	-	-	-	-
21	-	-	+	-	-	-
22	-	+	+	-	-	-
23	-	+	+	-	-	-
24	+	-	-	-	-	-
25	-	+	+	-	-	-
26	-	+	+	-	-	-
27	-	-	+	+	+4	+
28	+	-	+	-	-	-
29	-	-	+	+	-	-
30	+	-	-	+	-	-
31	-	+	+	-	-	-
32	-	-	-	+	-	-
33	-	-	+	-	-	-
34	-	+	+	-	-	-
35	-	+	-	-	-	-
36	-	+	+	+	-	-
37	-	-	+	-	-	-
38	-	+	-	-	-	-
39	-	+	+	-	-	-
40	-	-	+	-	-	-
41	-	-	+	-	-	-
42	-	-	-	-	-	-
43	-	-	-	-	-	-
44	-	-	-	-	-	-
45	-	+	+	-	-	-
46	-	+	+	-	-	-
47	-	+	+	-	-	-
48	-	+	+	+	-	-
49	+	+	+	-	-	-
50	-	-	+	-	-	-
51	-	+	-	-	-	-
52	-	-	-	+	-	-
53	-	-	-	-	-	-
54	-	+	-	-	-	-

*Contd...*

**Table 1: Contd...**

CASE NO	PRE OP HF	PREOP VSD	PRE OP AR	POST OP LVD	POST OP COMPLICATIONS	PROLONGED ICU STAY
55	+	+	-	-	-	-
56	+	-	-	-	-	-
57	+	+	-	-	-	-
58	+	-	+	-	-	-
59	-	-	-	-	-	-
60	+	-	-	-	-	-
61	-	-	+	-	-	-
62	-	-	+	-	-	-
63	-	+	-	-	-	-
64	-	-	-	-	-	-
65	-	-	+	-	-	-
66	-	+	-	-	-	-
67	-	+	-	-	-	-
68	-	+	+	-	-	-
69	-	+	+	-	-	-
70	-	+	+	-	-	-
71	-	+	+	-	-	-
72	-	-	-	-	-	-
73	-	+	+	-	-	-
74	-	+	+	-	+5	+
75	-	+	+	+	-	-
76	-	-	-	-	-	-
77	-	-	-	-	-	-
78	+	+	+	+	-	-
79	-	+	+	+	-	-
80	-	+	-	-	-	-
81	-	+	+	-	+6	+
82	-	-	-	-	-	-
83	+	+	+	+	-	-
84	+	-	-	-	-	-
85	-	-	+	+	-	-
86	-	+	-	-	-	-
87	-	-	-	+	-	-

PRE OP HF: Preoperative heart failure, PRE OP VSD: Preoperative Ventricular septal defect, PRE OP AR: Preoperative Aortic regurgitation, POST OP LVD: Postoperative left ventricular dysfunction, POST OP COMPLICATIONS: Postoperative complications, Complications : 1- Sternal wound dehiscence, 2- Supraventricular tachycardia, 3-Bradycardia, 4- Redo surgery for residual RSOV, 5- Aortic valve replacement on postoperative day 3 for severe AR, 6- Cerebrovascular accident due t right atrial clot

Acute presentation with HF was seen in 17 of 87 patients in the present study.

Associated lesions are common in patients with congenital, RSOV aneurysm.<sup>[1]</sup> AR occurred in 25% of patients, and VSDs in 54% of patients in a study by Murashita *et al.*<sup>[7]</sup> In our study, fifty-two patients (59%) had AR, of which fifteen were moderate to severe, five of them (9%) required valve replacement, and others underwent repair in our study. However, most published reports indicate that the AV requires replacement in 20%–30%.<sup>[5,6]</sup> Studies have shown that AR has an important influence on cardiac function postoperatively. Cardiac function decreases because of worsening AR.<sup>[4]</sup> In our study, worsening of aortic incompetence was seen in only two patients and only one of them had low EF. Most of our patients had follow-up up to 1 yr, so no analysis could be done.

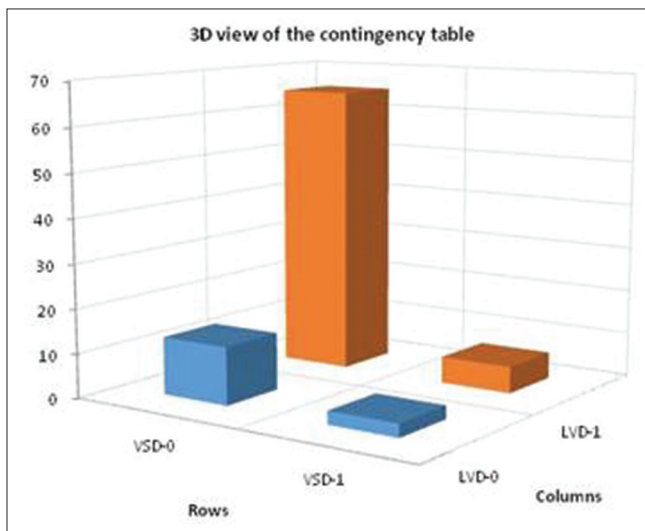
VSDs are more common in the Asian population with 52% incidence; similarly, our study also showed an incidence of about 50%. The origin and ruptured points of SVA are affected by the presence or absence of VSD. It also affects aortic valve and hence modifies therapeutic management.<sup>[9]</sup>

Patients with untreated ruptured aneurysms of the sinus of Valsalva die within 1 year. Congestive HF is known to be the main cause of death.<sup>[10]</sup> Hence, the presence of left-to-right shunt caused by ruptured aneurysms of the sinus of Valsalva is an indication for surgical intervention. SVA associated with VSD or with VSD and AR and unruptured SVAs that are producing hemodynamic derangements and enlarging should be repaired. The presence of congestive HF suggests a large shunt and warrants urgent operation.

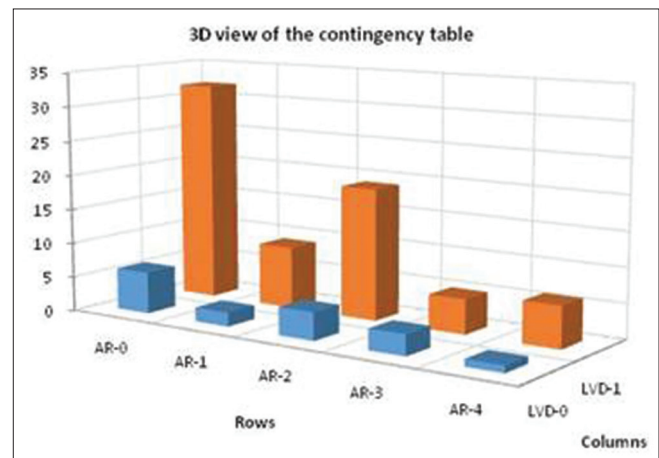
**Table 2: Pre and postoperative Data of patients with postoperative LV dysfunction**

CASE NO	PRE OP HF	PRE OP VSD	PRE OP AR	POST OP LVD	POST OP COMPLICATIONS	PROLONGED ICU STAY
1	-	-	-	+	-	-
2	-	-	-	+	+	+
3	+	+	-	+	+	+
4	-	+	+	+	-	-
5	-	-	+	+	+	+
6	-	-	+	+	-	-
7	+	-	-	+	-	-
8	-	-	-	+	-	-
9	-	+	+	+	-	-
10	-	+	+	+	-	-
11	-	-	-	+	-	-
12	-	+	+	+	-	-
13	+	+	+	+	-	-
14	-	+	+	+	-	-
15	+	+	+	+	-	-
16	-	-	+	+	-	-
17	-	-	-	+	-	-

PRE OP HF – Preoperative heart failure, PRE OP VSD – Preoperative Ventricular septal defect, PRE OP AR – Preoperative Aortic regurgitation, POST OP LVD – Postoperative left ventricular dysfunction, POST OP COMPLICATIONS – Postoperative complications



**Figure 2: Correlation between Preoperative VSD and post operative LV dysfunction (P = 0.222). VSD 0 – no ventricular septal defect, VSD 1 - ventricular septal defect present : LVD 0 –no postoperative left ventricular dysfunction, LVD 1 – post operative left ventricular dysfunction present**



**Figure 3: Correlation between Preoperative Aortic regurgitation and post operative LV dysfunction (P = 0.697): AR 0 – no aortic regurgitation, AR 1- mild aortic regurgitation, AR 2 mild plus aortic regurgitation, AR 3 moderate aortic regurgitation, AR 4 severe aortic regurgitation: LVD 0 –no postoperative leftventricular dysfunction, LVD 1 – post operative left ventricular dysfunction present**

The presence of VSD, AR, or both adds to the volume overload caused by the rupture of SVA. Although the presence of preexisting VSD may reduce the symptoms of acute rupture, postoperative LV dysfunction is anticipated with significant volume load either due to acute rupture leading to HF or the presence of coexisting lesions. Hence, statistical analysis was done to see if patients with HF and with coexisting VSD or AR had postoperative LV dysfunction.

The postoperative outcome was not different in RSOV patients presenting with or with out heart failure in our study. Statistical analysis for correlation of preoperative

heart failure and postoperative left ventricular dysfunction was not significant. The post operative complications and ICU stay were also not clinically significant which suggest good outcomes with RSOV repair presenting with heart failure. There was no correlation with preoperative VSD and postoperative LV dysfunction. Assessment of postoperative LV dysfunction occurring due to AR needs a good long-term follow-up while our study has only mean duration of 1 year.

Most patients survive the early period after operation. Mortality is <5% in largest reported series.<sup>[10]</sup> Similarly, outcome was good and there was no mortality in our study.

## Conclusion

RSOV repair outcomes are good with patients presenting with HF or having AR or VSDs; hence, all patients need to undergo the surgical repair and have better quality of life.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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