

Surgical Repair of a Ruptured Sinus of Valsalva Aneurysm Draining into the Right Atrium: A Case Report

Asjed Sanaullah^{1*}, Adnan Haider¹ and Irfan Azmatullah Khwaja¹

¹Department of Cardiac Surgery, King Edward Medical University, Mayo Hospital, Lahore, Pakistan

Abstract

Ruptured sinus of Valsalva aneurysm is an uncommon cardiac defect that can be a life-threatening condition, which may lead to serious left-to-right shunting and progressive heart failure unless treated early. The clinical presentation varies depending on the location and size of the rupture and may delay diagnosis. In this report, a case of a 23-year-old female patient who has progressive dyspnea was presented, and the diagnosis of a ruptured sinus of Valsalva aneurysm originating from the non-coronary sinus and forming an aorto-atrial fistulous communication with the right atrium was made. Transthoracic echocardiography demonstrated severe pulmonary hypertension and tricuspid regurgitation. The patient was operated on successfully with cardiopulmonary bypass and an uneventful postoperative course. Early surgical intervention led to significant symptomatic improvement and a positive clinical outcome. The case highlights the importance of a high index of suspicion for ruptured sinus of Valsalva aneurysm in young patients complaining of unexplained dyspnea and with indicators of right-sided heart failure. Early echocardiographic evaluation and timely surgical referral remain the main determinants of excellent outcomes.

Keywords: Sinus of valsalva aneurysm, rupture, right atrium, pulmonary hypertension, cardiac surgery.

INTRODUCTION

Sinus of Valsalva aneurysm (SVA) is an uncommon cardiac defect characterized by localized dilation of the aortic sinus, caused by structural weakness at the border of the aortic media and annulus fibrosus [1]. It is mainly a congenital condition, although it could also be acquired secondary to infective endocarditis, trauma, connective tissue disorders, or degenerative alteration of the aortic wall [2]. Though unruptured SVAs can be clinically silent over long periods of time, rupture may cause sudden left-to-right shunting, acute overload of the heart volume, and rapid heart failure.

The most common rupture is that of the right coronary sinus communicating with the right atrial space or right ventricle. The non-coronary sinus rupture is less common, and rupture of the left coronary sinus is extremely uncommon [3]. The clinical manifestation is very diverse, including exertional dyspnea and persistent cardiac murmur to cardiogenic shock and sudden death, depending on the size, location of rupture, and hemodynamic load [4]. The main diagnostic modality is transthoracic echocardiography, which, in most cases, can reveal the characteristic appearance of the ruptured aneurysm, known as the windsock. In some instances, further anatomic detail may be necessary, which can be provided by transesophageal echocardiography [5].

Surgery is the ultimate cure for ruptured SVA, as it is associated with both short- and long-term positive outcomes when performed timely [6]. There is thus

a need to identify and treat at an early age to avoid irreversible cardiac dysfunction and fatal complications. The current report presents a case of ruptured sinus of Valsalva aneurysm draining into the right atrium in a young woman patient, who has been treated using surgical repair, and the case puts in perspective important diagnostic and treatment considerations that can be used in clinical practice.

CASE PRESENTATION

A 23-year-old woman presented in the Department of Cardiac Surgery, King Edward Medical University / Mayo Hospital, Lahore, with progressive dyspnea on exertion, which had progressed over a period of about eleven months. The patient denied chest pain, palpitations, syncope, fever, intravenous drug use, or any known congenital heart disease. They did not report any structural cardiac abnormalities in family history.

At admission, the patient was in no acute distress, with a blood pressure of 110/70 mmHg and a heart rate of 74–85 bpm. A physical exam showed a continuous systolic–diastolic murmur of the left sternal border and an accentuated second heart sound at the pulmonary area. The right-sided heart failure was the cause, as jugular venous pressure was slightly elevated, and abdominal examination showed hepatomegaly.

Initial lab studies showed elevated liver enzymes: 569 U/L for alanine aminotransferase (ALT) and 581 U/L for aspartate aminotransferase (AST). These elevated liver enzymes were considered secondary to hepatic congestion resulting from right-sided heart failure. C-reactive protein level was 18.3 mg/L. There was no protein leakage, as evidenced by normal renal function parameters, including serum creatinine (1.0 mg/dL).

*Corresponding author: Asjed Sanaullah, Department of Cardiac Surgery, King Edward Medical University, Mayo Hospital, Lahore, Pakistan, Email: asjedsanaullah@gmail.com
Received: February 04, 2026; Revised: March 12, 2026; Accepted: March 19, 2026
DOI: <https://doi.org/10.37184/jlnh.2959-1805.4.24>

Arterial oxygen saturation was 99.7% on room air. The BSA was calculated as 1.24 m².

ECG showed sinus rhythm and incomplete right bundle block. Chest radiography showed good lung fields without cardiomegaly. Despite echocardiographic evidence of right atrial and right ventricular dilation, cardiomegaly was not prominent on chest radiography, possibly reflecting early chamber enlargement. Transthoracic echocardiography showed that there was a dilated right atrium and right ventricle with an estimated right ventricular systolic pressure of 76mmHg (**Fig. 1**), which was in line with severe pulmonary hypertension. It was determined to be a ruptured sinus of Valsalva aneurysm that has its origin at the non-coronary sinus, thus creating a continuous aorto-atrial fistulous communication with a large left-to-right shunt. The related results were severe tricuspid regurgitation and mild mitral regurgitation, provided that the left ventricular systolic function remained intact.

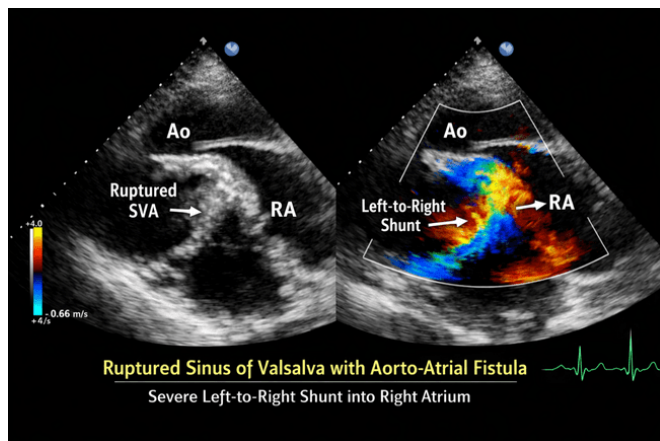


Fig. (1): Transthoracic echocardiography demonstrating a ruptured sinus of Valsalva aneurysm originating from the non-coronary sinus with fistulous communication into the right atrium. The arrow indicates the aneurysmal windsock structure and turbulent left-to-right shunting from the aorta into the right atrium.

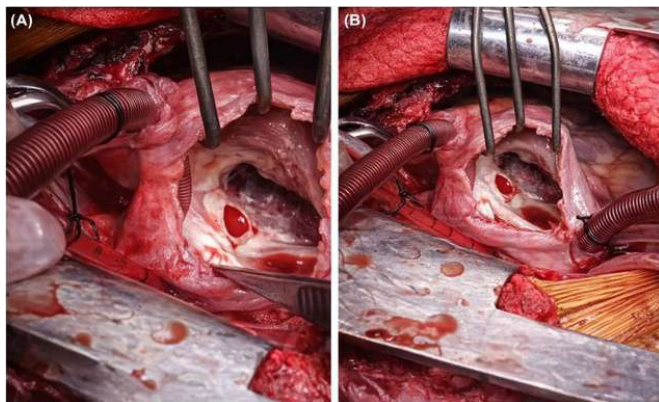


Fig. (2): Intraoperative view of the ruptured sinus of Valsalva aneurysm. (A) Arrow indicating the fistulous opening between the non-coronary sinus and the right atrium. (B) Surgical exposure of the fistulous tract during cardiopulmonary bypass prior to repair.

Since the lesion was hemodynamically relevant and right-sided volume overload was proven, surgery was indicated. Early surgical repair was recommended due to the presence of significant left-to-right shunting, right-sided chamber dilation, and severe pulmonary hypertension. The patient underwent median sternotomy under general anesthesia. Aortic cannulation with a 22-Fr aortic cannula and bicaval venous cannulation were used to establish the cardiopulmonary bypass. The aortic cross-clamp was 81 minutes, and the total cardiopulmonary bypass was 116 minutes. It was under moderate hypothermia that cold Del Nido microplegia was used to cause myocardial arrest. Bypass arterial pressure was kept at about 70 mmHg. Intraoperative urine output was 900 mL, and the activated clotting time was 564 seconds. During the operation, the ruptured sinus of Valsalva aneurysm originating from the non-coronary sinus and communicating with the right atrium was clearly identified. The fistulous tract was approached through a right atriotomy, which allowed direct visualization of the communication between the non-coronary sinus and the right atrium. The defect measured approximately 6–8 mm in diameter and demonstrated a windsock-like morphology. Due to the relatively small size of the fistulous opening and the presence of adequate surrounding tissue, direct suture closure using pledgeted polypropylene sutures was performed. Patch repair was not required because direct closure provided a secure repair while preserving the integrity of the aortic valve structures (**Figs. 2 and 3**). The patient was discharged after cardiopulmonary bypass repair without inotropic support and was transferred to the intensive care unit to observe the postoperative period. At follow-up evaluation, the patient reported significant symptomatic improvement with no evidence of residual shunt on echocardiography. At three-month follow-up, transthoracic echocardiography demonstrated no

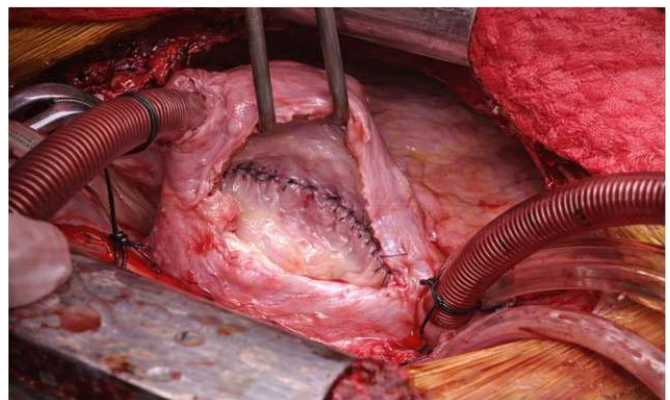


Fig. (3): Intraoperative view after surgical repair showing successful closure of the fistulous communication and preservation of the aortic valve structures.

residual shunt and a significant reduction in pulmonary artery pressure. The estimated right ventricular systolic pressure decreased from 76 mmHg preoperatively to 38 mmHg, indicating substantial improvement in pulmonary hypertension following surgical repair.

The postoperative course was uneventful. The patient was hemodynamically stable; the patient was successfully extubated and showed slow clinical improvement. She moved out of the intensive care unit after four days and out of the hospital on postoperative day eight after close observation, with her symptoms showing significant improvement and no significant complications. This report describes the successful surgical repair of a ruptured non-coronary sinus of Valsalva aneurysm draining into the right atrium in a young female patient and highlights important diagnostic and surgical considerations (**Table 1**).

Table 1: Preoperative clinical and laboratory findings.

Parameter	Value
Blood pressure	110/70 mmHg
Heart rate	74–85 bpm
ALT	569 U/L
AST	581 U/L
CRP	18.3 mg/L
Creatinine	1.0 mg/dL
RVSP	76 mmHg
Oxygen saturation	99.7%
BSA	1.24 m ²

DISCUSSION

SVA is a rare cardiac defect, which is mostly of a congenital nature, and is caused by focal weakness of the junction between the aortic media and annulus fibrosus. Even though the incidence among the general population is low, the reported incidence of SVAs is higher in Asian groups and distinctly predominant in males [7]. SV rupture is a life-threatening event as it suddenly develops a left-to-right shunt and causes volume overload, pulmonary hypertension, and progressive heart failure unless it is addressed immediately.

In the present case, the aneurysm originated from the non-coronary sinus and ruptured into the right atrium, creating a continuous aorto-atrial shunt. This resulted in right atrial and right ventricular volume overload, severe pulmonary hypertension, and symptoms of progressive dyspnea. Such cases can be challenging to diagnose early because the symptoms may initially mimic other causes of right-sided heart failure.

Clinical presentation and hemodynamic outcomes depend on the anatomical origin and place of rupture.

Rupture is most often caused by the right coronary sinus into the right ventricle, and rupture by the non-coronary sinus into the right atrium, which is the case in the current scenario, is not that often reported [8]. This aortic-atrial fistula results in persistent shunting throughout the cardiac cycle. Usually, it causes a continuous murmur, cardiac right-sided congestive heart failure manifested by hepatomegaly and raised liver enzymes due to the congestion of the liver [9]. Elevated liver enzymes in this patient were likely secondary to hepatic congestion caused by increased right-sided cardiac pressures.

Ruptured SVA diagnosis is still pegged on echocardiography. Transthoracic echocardiography generally shows right-sided chamber enlargement and increased pulmonary artery pressures and, compared with transesophageal echocardiography, provides better anatomical boundaries when needed [10]. Echocardiographic results of the patient in the current study, including severe cases of pulmonary hypertension, right atria and ventricular dilatation, and persistence of aorto-atrial shunting, were clearly in line with those of the previous diagnostic characteristics [11]. Although transoesophageal echocardiography (TEE), computed tomography angiography, and right heart catheterization are useful adjuncts in the evaluation of ruptured sinus of Valsalva aneurysm, transthoracic echocardiography in this case clearly demonstrated the aneurysmal origin, the fistulous communication with the right atrium, and the associated hemodynamic consequences. The imaging findings were sufficient for surgical planning; therefore, additional imaging modalities were not considered necessary before surgery. Right heart catheterization and hemodynamic measurements, such as Qp/Qs ratio and pulmonary vascular resistance, were not performed due to the clear echocardiographic diagnosis and the need for prompt surgical intervention. The absence of invasive hemodynamic measurements represents a limitation of this report.

The surgery is considered the best treatment for ruptured SVA and is associated with excellent long- and short-term results [12]. Operative intervention includes direct closure of the fistulous tract, patch repair of the fistulous tract, including or without aortotomy, based on the size and the location of the defect. The fistulous communication was closed using a direct suturing technique without the need for patch repair. It is also important to note that preservation of aortic valve integrity is a critical decision, as postoperative aortic regurgitation is a significant factor in long-term prognosis [13]. In the current case, the surgical

repair was successfully performed with close attention to hemostasis and preservation of the surrounding valvular structures, resulting in a smooth postoperative course.

Late treatment of ruptured SVA has been linked to bad results, such as irreversible pulmonary vascular disease, refractory heart failure, and high mortality rates [14]. Pulmonary hypertension has been reported to be reversible with early surgical management despite pulmonary hypertension and has been found to improve functional status [15]. The positive response in this patient confirms other data indicating the importance of surgery after diagnosis.

The present case highlights several clinically relevant features. Rupture of the non-coronary sinus draining into the right atrium is less frequently reported compared with rupture of the right coronary sinus into the right ventricle. The presence of severe pulmonary hypertension in a young female patient illustrates the significant hemodynamic burden that may develop even with relatively gradual symptom progression. Early surgical intervention in this case likely contributed to the reversibility of pulmonary hypertension, as demonstrated by the postoperative reduction in right ventricular systolic pressure. This observation reinforces the importance of prompt diagnosis and timely surgical referral to prevent irreversible pulmonary vascular changes.

The case serves as a reminder of the relevance of having a high index of suspicion of ruptured SVA in patients who appear in the ED with dyspnea of unexplained origin and with evidence of right-sided heart failure. Echocardiographic screening at an early stage and prompt referral to surgery are critical for an optimal outcome in this infrequent, but potentially lethal condition. Hemodynamic measurements, such as the Qp/Qs ratio and pulmonary vascular resistance, were not obtained because right heart catheterization was not performed.

CONCLUSION

Ruptured sinus of Valsalva aneurysm is an uncommon but potentially life-threatening cardiac condition that slow signs of right-sided heart failure can characterize. Without delay, surgical intervention, echocardiographic evaluation, and hemodynamic deterioration should be recognized and prevented. Early surgical repair provides excellent clinical outcomes despite pulmonary hypertension when performed in early life. The case highlights the need to diagnose and treat early to achieve a good clinical outcome.

ABBREVIATIONS

SVA – Sinus of Valsalva aneurysm

RA – Right atrium

RVSP – Right ventricular systolic pressure

CPB – Cardiopulmonary bypass

CONSENT FOR PUBLICATION

Written informed consent was obtained from the patient for publication of this case report and the accompanying clinical images. Patient anonymity has been preserved, and no identifiable personal information is included in this article.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ACKNOWLEDGEMENTS

The authors acknowledge the surgical support staff of the Department of Cardiac Surgery, Mayo Hospital, Lahore, for their assistance with perioperative data collection and for providing intraoperative images used in this case report. Full responsibility for the content, interpretation, and accuracy of the manuscript rests with the authors.

AUTHORS' CONTRIBUTION

AS: Conceptualization, literature review, manuscript drafting and data collection.

AH: Clinical supervision and critical revision of manuscript.

IAK: Manuscript review and final approval.

GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this work, the authors used ChatGPT (OpenAI) only for language improvement, grammar refinement, and minor proofreading of selected sections of the manuscript. The scientific content, study design, data collection, data analysis, interpretation of results, and conclusions were conceived, verified, and approved entirely by the authors. After using this tool, the authors carefully reviewed and edited the manuscript and take full responsibility for the content of the published article.

REFERENCES

1. Jaswal V, Maaz M, Thingnam SKS, Puri GD. Surgical repair of ruptured sinus of valsalva aneurysm carries low operative risk and excellent outcomes: a single-centre experience. *J Card Surg* 2021; 36(11): 4210-6. DOI: <https://doi.org/10.1111/jocs.15358> PMID: 33476446
2. Tahir MF, Munim A, Mughal S, Changez MIK, Khan MA, Yousaf A, *et al.* Rupture of sinus of valsalva in a young laborer:

- a rare case report. *Clin Case Rep* 2024; 12(3): e9184.
DOI: <https://doi.org/10.1002/ccr3.9184> PMID: 39040606
3. English K. Diagnosis and treatment options for sinus of valsalva aneurysms: a narrative review. *World J Cardiol* 2025; 17(6): 102722.
DOI: <https://doi.org/10.4330/wjc.v17.i6.102722> PMID: 40575421
 4. Moguillansky N, Bleiweis M, Reid J, Jacobs JP, Moguillansky D. Ruptured sinus of valsalva aneurysm: three case reports and literature review. *Cureus* 2024; 16(4): e59220.
DOI: <https://doi.org/10.7759/cureus.59220> PMID: 38813300
 5. Bigg H, Bolin E, Zakaria D, Bornemeier R. Ruptured sinus of valsalva aneurysm with resultant myocardial pouch formation in the fetal heart - a diagnostic challenge. *J Cardiovasc Dev Dis* 2024; 11(1): 23.
DOI: <https://doi.org/10.3390/jcdd11010023> PMID: 38248893
 6. Mi J, Cao X, Zhou J. Misdiagnosis of ruptured sinus of valsalva aneurysm in a young adult: a case report and review of literature. *J Med Case Rep* 2025; 19: 163.
DOI: <https://doi.org/10.1186/s13256-025-05143-z> PMID: 40197382
 7. Ayati A, Toofaninejad N, Hosseinsabet A, Mohammadi F, Hosseini K. Transcatheter closure of ruptured sinus of valsalva aneurysm: a systematic review. *Front Cardiovasc Med* 2023; 10: 1227761.
DOI: <https://doi.org/10.3389/fcvm.2023.1227761> PMID: 37727309
 8. Mao Y, Wang C, Li Y, Guan X, Zhang X, Wu X. Percutaneous closure *versus* surgical repair for ruptured sinus of Valsalva aneurysm: a systematic review and meta-analysis. *Front Cardiovasc Med* 2023; 10: 1158906.
DOI: <https://doi.org/10.3389/fcvm.2023.1158906> PMID: 37139136
 9. Sarhan HHT, Shawky AH, Anilkumar S, Elmaghraby A, Sivadasan PC, Omar AS, *et al.* Ruptured sinus of valsalva aneurysm associated with other cardiac anomalies: a case report. *Eur Heart J Case Rep* 2021; 5(7): ytab233.
DOI: <https://doi.org/10.1093/ehjcr/ytab233> PMID: 34557627
 10. Zhang L, Ji D, Li X, Liang K. Left coronary sinus of valsalva aneurysm dissecting into adjacent structures: a rare case report. *J Cardiothorac Surg* 2024; 19(1): 53.
DOI: <https://doi.org/10.1186/s13019-024-02513-4> PMID: 38311759
 11. Savvoulidis P, Nadir AM, Mechery A, Lawton E, Khan K, Maqableh GM, *et al.* Routine postaccess-closure angiography to detect vascular complications following transfemoral TAVR. *Catheter Cardiovasc Interv* 2023; 102(7): 1311-6.
DOI: <https://doi.org/10.1002/ccd.30894> PMID: 37890001
 12. Pollak AL, Vega E, Whitacre M, Nicoara A. Ruptured sinus of Valsalva aneurysm with dynamic aortic regurgitation. *Echocardiography* 2023; 40: 74-81.
DOI: <https://doi.org/10.1111/echo.15502> PMID: 36522841
 13. Vriza O, Eltayeb A, Landi I, Anwar K, Alenazy A, Hiristova K, *et al.* Transthoracic echocardiography for arrhythmic mitral valve prolapse: phenotypic characterization as first step. *Echocardiography* 2022; 39: 1158-70.
DOI: <https://doi.org/10.1111/echo.15439>
 14. Fang ZF, Huang YY, Tang L, Hu XQ, Shen XQ, Tang JJ, *et al.* Long-term outcomes of transcatheter closure of ruptured sinus Valsalva aneurysms using patent ductus arteriosus occluders. *Circ J* 2014; 78(9): 2197-202.
DOI: <https://doi.org/10.1253/circj.cj-14-0106> PMID: 25030418
 15. Bass D, Tivakaran VS. Sinus of Valsalva aneurysm. *StatPearls*. Treasure Island (FL): StatPearls Publishing; 2024.