Clinical Case Reports

WILEY

Clinical Case Reports Open Access

CASE REPORT OPEN ACCESS

Surgical Repair of a Giant Unruptured Left Sinus of Valsalva Aneurysm in an Older Patient: A Case Report

Shinichi Oki | Hirotaka Sato

Department of Cardiovascular Surgery, Shin-Oyama City Hospital, Tochigi, Japan

Correspondence: Shinichi Oki (s-oki@ka2.so-net.ne.jp)

Received: 12 June 2024 | **Revised:** 13 August 2024 | **Accepted:** 29 October 2024

Funding: The authors received no specific funding for this work.

Keywords: aged 80 and over | aneurysm | aortic valve insufficiency | case report | coronary artery bypass | sinus of Valsalva

ABSTRACT

A giant unruptured left sinus of Valsalva aneurysms is extremely rare. Even if asymptomatic, surgical repair should be performed, considering comorbidities, and patient's physical condition. In this case, patch repair with coronary artery bypass, correction of sinotubular junction, and aortic annulus for aortic regurgitation benefited the older patient.

JEL Classification: Cardiothoracic Surgery, Cardiovascular Disorders, Cardiology, Vascular Surgery

1 | Introduction

Sinus of Valsalva aneurysm (SVA) is an uncommon cardiovascular disease. In ruptured cases, Xin-jin et al. reported that surgically repairing ruptured SVAs constituted 0.32% of all heart operations and 0.72% of congenital open heart operations [1]. Chu et al. reported that it represents 0.96% of all cardiac operations in their institution [2]. Since asymptomatic unruptured SVAs are diagnosed incidentally, the exact prevalence is unknown.

An unruptured SVA itself is asymptomatic and mostly located in the right coronary sinus(65%–85%) [3–7]. Left SVAs are rare(< 5%) and often symptomatic because of a left coronary event, such as acute coronary syndrome [8–11]. In many cases, patch closure, root replacement with aortic valve replacement, or valve-sparing procedures is performed for the management of SVAs [5, 6]. Surgical repair of giant SVAs is an invasive procedure using open heart techniques, with cardiopulmonary bypass and cardioplegic arrest. Determining the surgical indication in asymptomatic older patients is not often easy. If physical condition of an older patient assists in tolerating surgery, surgical repair should be performed because giant SVA poses serious risks, such as rupture, coronary artery stenosis, aortic regurgitation, and thromboembolism [4, 5, 7, 8, 10].

Herein, we describe the case of an asymptomatic unruptured large left SVA that was successfully managed with patch repair and coronary artery bypass grafting.

2 | Case Presentation

2.1 | Case History and Examination

An 82-year-old female with hypertension was referred to our hospital after abnormal electrocardiogram (ECG) findings were noted during a routine medical checkup by her family doctor. Although the patient was asymptomatic, detailed tests were scheduled for suspected ischemic heart disease.

2.1.1 | Past Medical History

She had undergone Halsted radical mastectomy for left breast cancer at the age of 32 years, without any radiation therapy at

that time, and cholecystectomy for cholelithiasis at the age of 53 years.

She had no history of infectious diseases, such as syphilis, tuberculosis, or infectious endocarditis, without history of trauma or inflammatory diseases, such as aortitis.

2.1.2 | Examinations

Electrocardiography revealed a heart rate of 50/min, regular sinus rhythm, poor R wave progression in $V_{1–3}$, and ST depression in $V_{4–6}$ (Figure 1).

Chest radiography showed dilatation of the upper left heart border (Figure 2).

Further, echocardiography revealed a left SVA. No asynergy was observed, the ejection fraction was 73%, and moderate aortic regurgitation was observed.

Three-dimensional and multiplanar cardiac computed tomography angiography images confirmed the presence of a saccular left SVA measuring 50×48×45 mm. A small mural thrombus was observed in the aneurysm (Figure 3). Furthermore, extrinsic compression of the left anterior descending artery was observed, and approximately 50% stenosis was noted (Figure 4).

Preoperative examinations did not show any problems with surgery. The patient opted for undergoing surgical treatment. Therefore, we decided to perform it.

2.2 | Surgical Treatment

Surgery was performed via median sternotomy on standard cardiopulmonary bypass under cold blood cardioplegic arrest with moderate hypothermia. The SVA originated from the left aortic sinus and expanded into the left extracardiac space. The ascending aorta was clamped and transected. The orifice of the SVA was approximately 20 mm in diameter and located close to the left coronary ostium. However, the vascular wall of the left coronary ostium was preserved. The right and non-coronary sinuses were not dilated and had intact intimae. The aortic valve cusp was neither calcified nor thickened. Only the left aortic annulus was elongated because of an aneurysmal defect in the left sinus wall.

2.2.1 | Operative Procedures

1. The patch (Hemashield Woven Double Velour Fabric; GETINGE) was cut into a D-shape, similar to that of the other sinuses. The left sinus wall was resected. The left coronary button was trimmed.

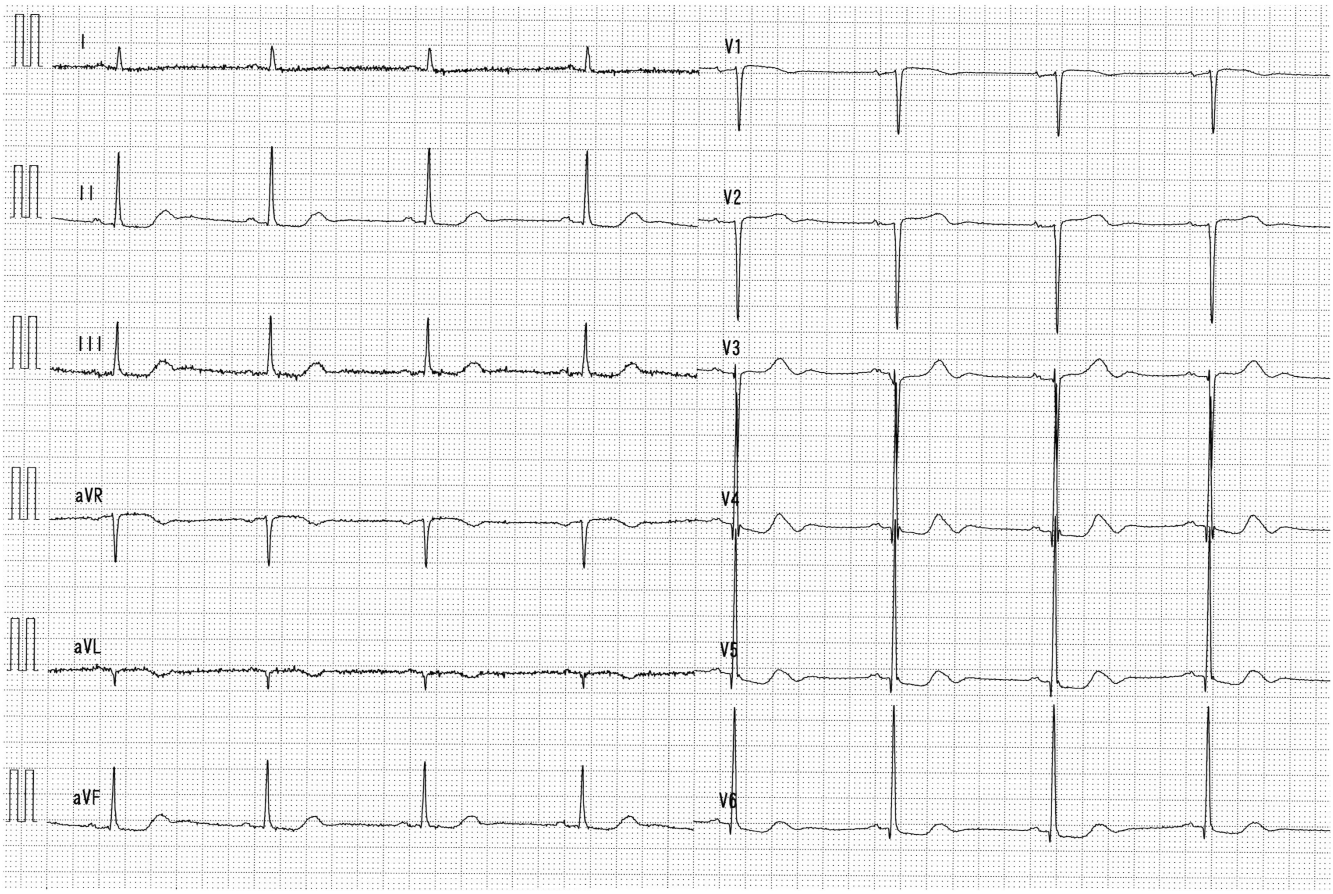

FIGURE 1 | ECG showing a heart rate of 50/min, sinus rhythm, poor R wave progression in $V_{1–3}$ (R wave height ≤ 3 mm in V_3), and ST depression in $V_{4–6}$. ECG, electrocardiogram.

2. The patch was sutured along the left aortic annulus and replaced the resected sinus wall via interrupted sutures using a 2–0 polyethylene terephthalate suture. Dilated left sinus and aortic annulus were corrected in this procedure.
3. The trimmed left coronary button was reattached to the left sinus patch using a 6–0 polyvinylidene fluoride continuous suture.
4. Regarding repairing the transected aorta, the aortic sinotubular junction diameter was fixed at 30 mm in diameter with a polytetrafluoroethylene felt strip to prevent the exacerbation of aortic regurgitation caused by the dilatation of the sinotubular junction.
5. Coronary artery bypass grafting (CABG) to the stenotic left anterior descending artery using a saphenous vein graft was performed (Figure 5).

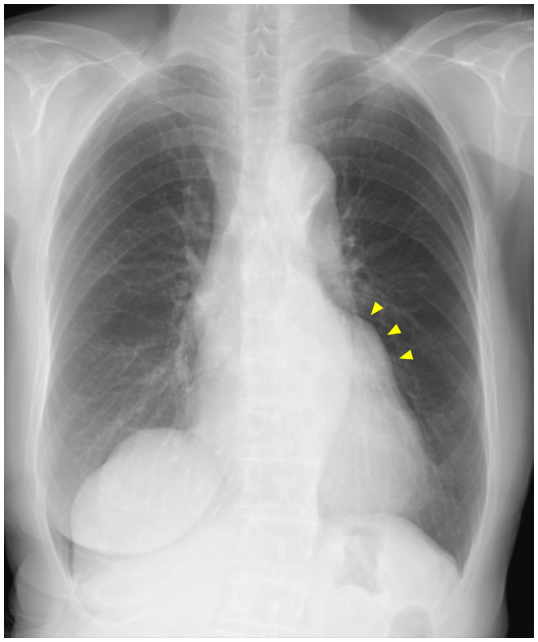

FIGURE 2 | Chest radiography showing dilatation of the upper left heart border (yellow arrowheads).

After these procedures, no aortic regurgitation was observed on intraoperative transesophageal echocardiography.

2.3 | Outcome and Follow-Ups

The patient began rehabilitation early postoperatively and continued until discharge. Low-dose aspirin was administrated for post-CABG. We were concerned about her median sternotomy wound healing after a left radical mastectomy. Nevertheless, she had no major postoperative complications and was discharged on postoperative Day 24. She visited our hospital and was checked monthly for a year after discharge. At follow-up 1 year

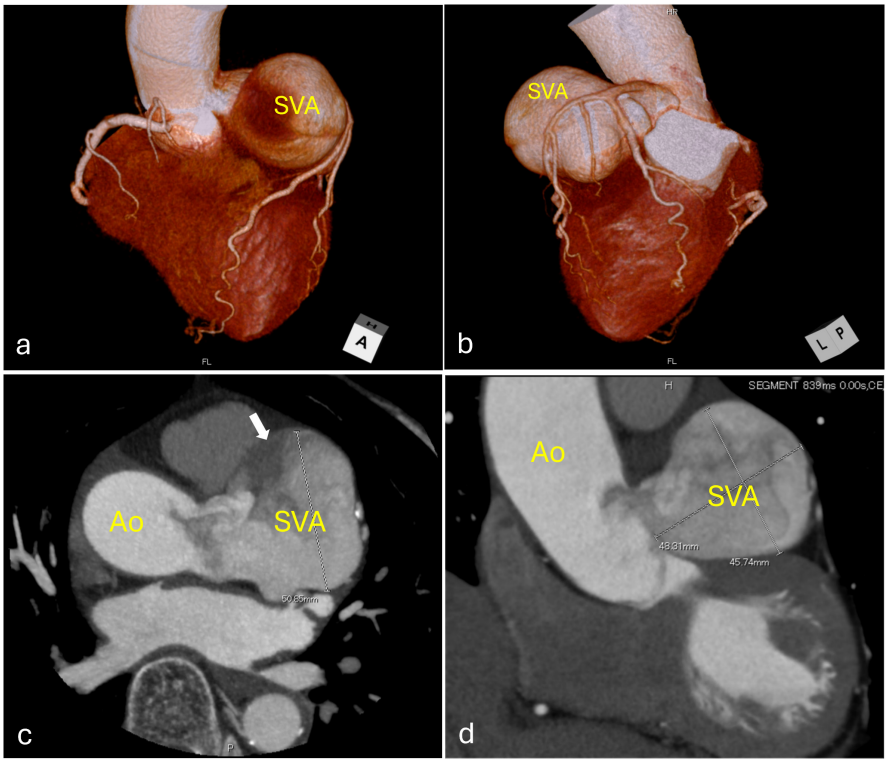

FIGURE 3 | Three-dimensional (a and b) and multiplanar (c and d) cardiac computed tomography images. The saccular left SVA protrudes into the extracardiac space, measuring 50 × 48 × 45 mm. A small mural thrombus was observed in the aneurysm (white arrow). Ao, ascending aorta; SVA, sinus of Valsalva aneurysm.

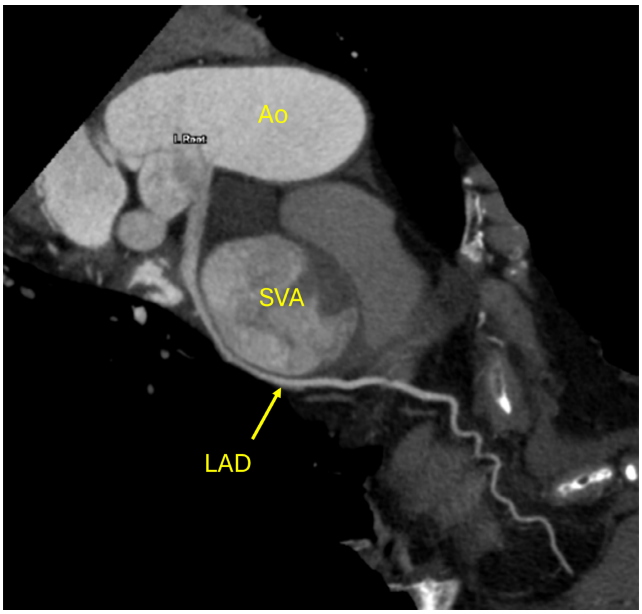

FIGURE 4 | Curved multiplanar coronary computed tomography angiography showing extrinsic compression of the left anterior descending artery by the aneurysm sac. Ao, ascending aorta; LAD, left anterior descending artery; SVA, sinus of Valsalva aneurysm.

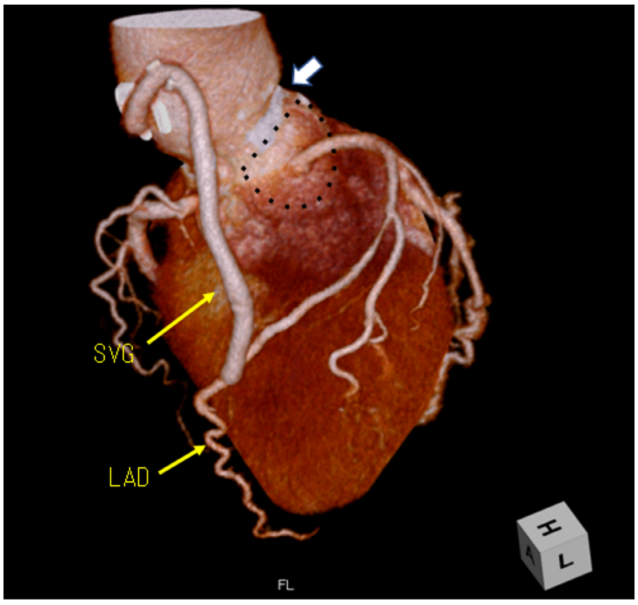

FIGURE 5 | Three-dimensional computed tomography image of post-surgical repair. The black dotted area shows the left sinus of Valsalva repaired with a patch. Coronary artery bypass grafting was performed with an SVG. The white arrow waistline shows the ring-fixed sinotubular junction. LAD, left anterior descending artery; SVG, saphenous vein graft.

after surgery, there was no aneurysmal lesion on CT, and she was well and had no complications.

3 | Discussion

SVA is a rare congenital or acquired disease. Congenital cases may be associated with ventricular septal defect or bicuspid aortic valve. Acquired cases result from infections, such as syphilis, tuberculosis, and bacterial endocarditis, as well as trauma, aortitis, and connective tissue diseases, such as Marfan syndrome [3, 4, 6, 7].

SVAs mostly originate from the right sinus (65%–85% cases); non-sinus origin is observed in 10%–30% cases, and left sinus origin is even rarer, accounting for < 5% cases [3, 4].

Similar to other aneurysms, an unruptured SVA is often asymptomatic. However, as the aneurysm grows, it causes difficulties in adjacent structures. When an unruptured left SVA grows, it can cause chest pain due to acute coronary syndrome caused by the compression of the left coronary artery by the aneurysm [8–11].

Aortic regurgitation caused by aortic annulus enlargement and/or cusp prolapse is often associated with SVA. A non-ruptured SVA is associated with aortic regurgitation in 30%–50% cases [7].

Symptomatic aneurysms, including ruptured ones, are indications for surgical repair. However, in the case of unruptured and asymptomatic SVA, the indication and timing of surgery should be determined based on the evaluation of the risk of SVA, which is calculated by determining aneurysm size, grade of aortic regurgitation, and risk of thrombus formation [12, 13]. Considering physical conditions and complications in older patients, determining the indications for surgery is necessary.

Patch closure has been used in many cases for SVAs [5, 6, 9]. Coronary artery bypass grafting and/or prosthetic valve replacement may be performed depending on the lesion. Depending on the condition of the aortic root, such as multiple sinus lesions, aortic root replacement with a prosthetic valve or a valve-sparing procedure can be selected [11, 12].

This case was asymptomatic, and the SVA was incidentally discovered after a close examination when the family doctor noted an abnormal ECG. The ECG findings showed poor R wave progression in V_{1-3} and ST depression in V_{4-6}. The patient had no history of myocardial infarction or signs of left ventricular dysfunction in preoperative echocardiography, and postoperative ECG findings did not differ from those observed preoperatively. Therefore, we concluded that the ECG findings were nonspecific changes. However, since the ECG abnormality had been the factor in detecting the asymptomatic SVA, easy diagnosis of an abnormal ECG as a false positive may miss asymptomatic cardiac disease.

In addition to the risk of rupture caused by the large saccular aneurysm protruding into the extracardiac space, the risk of embolism caused by a thrombus in the aneurysm and the risk of myocardial ischemia caused by coronary artery compression, we determined that surgery was necessary. The patient tolerated the operation without any major complications despite her advanced age.

Aortic root replacement using a biological prosthetic valve or a valve-sparing aortic root replacement has been reported for repairing left SVAs, which were symptomatic and complicated

aortic regurgitation and acute coronary syndrome [11, 12]. In this case, because the lesion was localized in the left sinus, we decided to reconstruct only the left sinus with an artificial patch. Coronary artery bypass grafting was performed to prevent cardiac ischemia. Ning et al. reported a case of extrinsic compression of the left coronary artery by a giant SVA like our case [9]. They performed only patch repair to the localized lesion and obtained improvement of coronary stenosis without CABG. However, we consider that CABG is necessary because there is a possibility of not improving the coronary stenosis caused by intimal degeneration due to long-term extrinsic compression.

In aortic regurgitation, if the valve cusps are preserved under normal conditions, correcting enlargement of the aortic valve annulus and dilated sinotubular junction to control aortic regurgitation is important [14, 15]. In this case, moderate aortic regurgitation was observed before surgery, and the left aortic annulus was stretched and unstable owing to the aneurysmal wall defect in the left sinus, but no major abnormalities were observed in the cusp. The left sinus and aortic annulus were formed with a patch, and the sinotubular junction was ring-fixed with a felt strip. Aortic regurgitation improved with these procedures.

This is a rare case of SVA in an older patient aged > 80 years. In a literature review by Nguyen et al. covering reports from 2000 to 2020, there was only one other case [16] of an unruptured SVA in a patient aged > 80 years [6]. In older patients, treating an SVA with a less invasive surgical procedure if lesion is localized is preferable, as in this case.

If aortic enlargement, multiple dilated sinus lesions, marked aortic annular enlargement or severe aortic regurgitation caused by aortic cusp lesions had been observed, aortic root replacement with a biological prosthetic valve would have been performed.

4 | Conclusion

This is an extremely rare case of the SVA, with 80 years of age or older, asymptomatic, unruptured, giant, and left aortic sinus origin, complicated moderate aortic regurgitation, and coronary artery stenosis. For managing the localized aortic sinus lesion, patch repair, coronary artery bypass grafting, and sinotubular junction modification were performed with good results.

To avoid the risk of acute coronary syndrome, coronary artery bypass should be performed aggressively if extrinsic compression of the left coronary artery is obvious. Aortic valve replacement may be avoided by correcting the aortic annular enlargement and correcting the dilated sinotubular junction if aortic regurgitation is complicated, as in this case.

Determining the indication for surgery of an unruptured SVA in asymptomatic older patients is usually difficult. Consequently, if the risk associated with the SVA is high, such as rupture, cardiac ischemia, or thromboembolism, and the patient's condition is deemed operable, a less invasive procedure should be considered.

Author Contributions

Shinichi Oki: conceptualization, data curation, investigation, writing – original draft, writing – review and editing. **Hirotaka Sato:** supervision, writing – review and editing.

Acknowledgments

I thank all clinicians involved in the management of this patient. The Shin-Oyama City Hospital supports this work.

Ethics Statement

The Shin-Oyama City Hospital Ethics Committee approved this study.

Consent

We obtained her written informed consent for the publication of this case report, including the accompanying images, using the patient consent form of this journal.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

References

1. L. Xin-Jin, L. Xuan, P. Bo, et al., "Modified Sakakibara Classification System for Ruptured Sinus of Valsalva Aneurysm," *Journal of Thoracic and Cardiovascular Surgery* 146, no. 4 (2013): 874–878, https://doi.org/10.1016/j.jtcvs.2012.12.059.

2. S. H. Chu, C. R. Hung, S. S. How, et al., "Ruptured Aneurysms of the Sinus of Valsalva in Oriental Patients," *Journal of Thoracic and Cardiovascular Surgery* 99, no. 2 (1990): 288–298.

3. W. S. Ring, "Congenital Heart Surgery Nomenclature and Database Project: Aortic Aneurysm, Sinus of Valsalva Aneurysm, and Aortic Dissection," *Annals of Thoracic Surgery* 69, no. 4 suppl (2000): S147–S163, https://doi.org/10.1016/s0003-4975(99)01242-4.

4. M. J. Arcario, S. S. Lou, P. N. Taylor, and S. H. Gregory, "Sinus of Valsalva Aneurysms: A Review With Perioperative Considerations," *Journal of Cardiothoracic and Vascular Anesthesia* 35, no. 11 (2021): 3340–3349, https://doi.org/10.1053/j.jvca.2020.12.016.

5. Y. S. Chaganti, S. M. Husain, V. R. Iyer, and N. Desai, "Sinus of Valsalva Aneurysm: A Single Institutional Experience With 216 Patients Over 30 Years," *Journal of Cardiac Surgery* 37, no. 12 (2022): 4448–4455, https://doi.org/10.1111/jocs.17021.

6. Q. Nguyen, D. Vervoort, K. Phan, and J. G. Y. Luc, "Surgical Management for Unruptured Sinus of Valsalva Aneurysms: A Narrative Review of the Literature," *Journal of Thoracic Disease* 13, no. 3 (2021): 1833–1850, https://doi.org/10.21037/jtd-20-2682.

7. D. Bass and V. S. Tivakaran, "StatPearls," in *Sinus of Valsalva Aneurysm. NCBI Bookshelf. A Service of the National Library of Medicine, National Institutes of Health* (Treasure Island (FL): StatPearls Publishing, 2024), https://www.ncbi.nlm.nih.gov/books/NBK448198/.

8. A. Gurbuz, S. Iscan, O. Gokalp, E. Karaagac, S. Girgin, and M. Aksun, "Surgical Management of Left Sinus of Valsalva Aneurysm Presenting With Exertional Chest Pain," *Brazilian Journal of Cardiovascular Surgery* 35, no. 4 (2020): 573–576, https://doi.org/10.21470/1678-9741-2019-0437.

9. F. Ning, M. Tang, M. Wang, et al., "Case Report: Extrinsic Compression of the Left Main Coronary Artery by a Giant Sinus of Valsalva Aneurysm," *Frontiers in Cardiovascular Medicine* 8 (2021): 753154, https://doi.org/10.3389/fcvm.2021.753154.

10. G. Mizokami, M. Nozoe, S. Kato, et al., "Left Sinus of Valsalva Aneurysm Causing Acute Myocardial Infarction With Compression of the Left Main Coronary Trunk," *Journal of Cardiology Cases* 29, no. 1 (2024): 50–54, https://doi.org/10.1016/j.jccase.2023.10.003.

11. A. J. Pedroza, Z. E. Brewer, and A. M. Lee, "Emergency Valve-Sparing Aortic Root Replacement and Coronary Artery Bypass Grafting for Giant Left Sinus of Valsalva Aneurysm Presenting as Acute Coronary Syndrome," *Journal of Thoracic and Cardiovascular Surgery* 156, no. 2 (2018): e81–e84, https://doi.org/10.1016/j.jtcvs.2018.03.009.

12. K. Ozawa, K. Kuwaki, H. Furuya, M. Yamaguchi, and A. Yamamoto, "Surgical Management of Giant Unruptured Left Sinus of Valsalva Aneurysm With Severe Aortic Regurgitation," *Texas Heart Institute Journal* 50, no. 5 (2023): e238134, https://doi.org/10.14503/THIJ-23-8134.

13. V. V. Thomas, J. M. Thomas, and R. Iyadurai, "Cardioembolic Stroke in Sinus of Valsalva Aneurysm, A Case Report," *Neurology India* 71, no. 5 (2023): 998–1001, https://doi.org/10.4103/0028-3886.388106.

14. M. Boodhwani, L. de Kerchove, D. Glineur, et al., "Repair-Oriented Classification of Aortic Insufficiency: Impact on Surgical Techniques and Clinical Outcomes," *Journal of Thoracic and Cardiovascular Surgery* 137, no. 2 (2009): 286–294, https://doi.org/10.1016/j.jtcvs.2008.08.054.

15. P. Youssefi and E. Lansac, "Aortic Annulus and the Importance of Annuloplasty," *Indian Journal of Thoracic and Cardiovascular Surgery* 36, no. 1 (2020): 88–96, https://doi.org/10.1007/s12055-019-00852-9.

16. M. Sohal, R. Rajani, and A. de Belder, "Sinus of Valsalva Aneurysm–An Unusual Cause of Syncope," *Echocardiography* 27, no. 6 (2010): E60–E61, https://doi.org/10.1111/j.1540-8175.2009.01141.x.