

Sinus of Valsalva Aneurysm, A Delayed Sequelae of Aortic Valve Endocarditis.

- Basmah AlTinawi MD MHSC
 - University of Toronto
 - Alfaisal University, Riyadh, Saudi Arabia
 - Corresponding author
 - bstinawi@gmail.com
- Salim Aziz MD FACS
 - Clinical Professor GW University, Washington DC
- Jenna E Aziz BS, BA, MS
 - MD Candidate, Howard University College of Medicine 2022, Washington DC, Jenna.aziz@bison.howard.edu
- Junewai Reoma MD, FACS
 - Walter Reed, Washington DC. Junewai Reoma MD, junewai2013@gmail.com

Sinus of Valsalva Aneurysm, A Delayed Sequelae of Aortic Valve Endocarditis.

Basma AlTinawi MD MHSC, Salim Aziz MD FACS, Jenna E Aziz BS, BA and Junewai Reoma MD, FACS

KEY WORDS: Aneurysm, Aortic Valve, Endocarditis, Sinus of Valsalva, Delayed Sequelae, chronic, complication

ABSTRACT: Sinus of Valsalva aneurysms are unusual complications of endocarditis that can be fatal if not detected and treated. As the incidence of endocarditis continues to increase, and in patients not subjected to early surgery, our case suggests long term follow up should include imaging (echocardiography and computerized axial tomography), especially in patients with ongoing and unusual symptoms, despite negative blood cultures. This can also aid in planning of the surgical approach and treatment.

Background:

Endocarditis of the aortic valve can be associated with many local and distal complications [1]. Recognition and management of these complications can be challenging. Spread of the infections in the vicinity of the valve and root resulting in a pseudoaneurysm or aneurysm is an unusual occurrence [2]. We report a case of detection and surgical management of an aneurysm of the left sinus of Valsalva (SVA) five weeks after initial diagnosis of aortic valve endocarditis and while on continuous antibiotic therapy.

Ethics:

Ethics approval IRB/ equivalent approval was obtained along with a written consent from the patient.

Case Presentation:

A 64-year-old African American male presented to the emergency department with shortness of breath, fatigue and a history of dark stool two days previously, there was no prior history of ulcers. On examination he was afebrile with temperature of 98.6F, blood pressure (106/64) and a heart rate of 88/min. His laboratory tests showed a hemoglobin of 4.7gm/L, white blood cell count 20.72k, serum iron 10 µmol/L, transferrin 329 mg/dl. He was given a two-unit PRBC transfusion and was to be seen as an out-patient. He presented 3 days later with increasing chest pain and shortness of breath on minimal exertion. A transthoracic echocardiography (TTE) showed left ventricular systolic dysfunction with ejection fraction of (40-45%) grade two diastolic filling abnormality with elevated left ventricle pressure and moderate-to-severe aortic

regurgitation, moderate aortic stenosis, with thickening and calcification compatible with vegetation (Figure.1). However, the pressure half-time was 574 ms. There was no evidence of an aneurysm of the sinus of Valsalva. Electrocardiography (EKG) showed normal sinus rhythm with increased PR interval of 194 milliseconds and signs of left ventricular hypertrophy. Blood cultures grew *Streptococcus Sanguinis*. He was edentulous. A diagnosis of aortic valve endocarditis was made and he was started on intravenous Vancomycin. He had a past history of cocaine, heroin and opioid intravenous drug use. A computed tomography (CT) scan showed a left upper lobe mass which on biopsy was invasive moderate differentiated adenocarcinoma. He was transferred to a long-term facility to complete a four-week course of antibiotics. The laboratory tests are outlined in (Figure 2).

A surgical consult was obtained 26 days after initial diagnosis because of increasing shortness of breath and atypical chest pain while on long term antibiotics. Further evaluation included a repeat transthoracic echocardiogram (TTE) which showed moderate to severe Aortic insufficiency (AI) with AR PHT of (574 ms) and a moderate size vegetation (1 cm) on the aortic valve. The ejection fraction was between (55 - 60%). A full body computed tomography (CT) scan did not show evidence of distal emboli or aneurysms. To rule out underlying coronary artery disease a cardiac computed tomography angiography (CTA) scan was done. Unexpectedly this demonstrated the presence of a sinus of Valsalva aneurysm measures (2.3 x1.5 cm (axial) x 2.8 cm) (Figure. 3 A&B). Blood cultures were now negative.

He was taken to the operating room for management of the sinus of Valsalva aneurysm (SVA) and endocarditis related aortic insufficiency. In the operating room a transesophageal echocardiogram (TEE) confirmed the presence of a sinus of Valsalva aneurysm extending between the ascending aorta and pulmonary artery, large vegetations on the aortic valve,

moderate to severe aortic insufficiency and depressed ejection fraction (Figure 4 A). After the median sternotomy a bulge was seen between the pulmonary artery and ascending aorta. On cardiopulmonary bypass, and with the heart arrested, opening the aorta confirmed the presence of an aneurysm adjacent to the left main ostia (Figure 3. A&B). The annulus along the lower margin was very friable. The aortic valve was tri-leaflet.

The aortic valve was removed, the annulus repaired beneath the left main ostia with native pericardium and the sinus of Valsalva aneurysm repaired with autologous pericardium with care being taken to avoid injury of the left coronary ostia. The root was enlarged along the non-coronary cusp up to the annulus with native pericardium to accommodate a size 23 porcine bioprosthesis (Epic size 23 St Jude Medical, Inc, St Paul, Minn). The aortic cross-clamp and bypass times were 135 and 158 minutes respectively. He was weaned off bypass uneventfully and in sinus rhythm.

The post-operative computed tomography angiography (CTA) showed that the sinus of Valsalva aneurysm had been corrected, and the valve well seated (Figure.3 C&D). A repeat echocardiogram (ECHO) showed improved cardiac function, no paravalvular leak, and a well seated valve (Figure 4. C) The cultures from the operating room tissue were negative as were repeat blood cultures. He was discharged on post-operative antibiotics.

Discussion:

Endocarditis can be associated with local and distal complications. Mycotic aneurysms associated with endocarditis were first described by Osler in 1885 [3] and are rare with an incidence of 4.15 % in patients with endocarditis [4, 5].

In the region of the aortic root abscesses can develop that result in communications between the valve, aortic root, the sinus of Valsalva and the various cardiac chambers resulting in fistulae, pseudoaneurysms, aneurysms, conduction system abnormalities and rupture.

Sinus of Valsalva aneurysm (SVA) is a dilatation of the aortic sinuses between the aortic valve annulus and the sino-tubular junction [6-8]. SVA can be congenital or acquired. The acquired causes include degenerative disease, thoracic trauma, and less commonly diseases affecting the aortic wall like infection (bacterial/fungal endocarditis, syphilis or tuberculosis) [19-20]. The acquired SVA is usually associated with a paravalvular abscess, which occurs in 28% of endocarditis cases [21]. SVA are associated with a high risk of bleeding, rupture, compression of the surrounding structures, fistula formation and a source of chronic infection [22, 23].

Although it is relatively common to see aortic insufficiency secondary to bacterial endocarditis, the occurrence of SVP or SVA with bacterial endocarditis is very unusual [9-16]. The first reported case of SVP was in 1740 [17]. Approximately 80% of these aneurysms involve the right coronary sinus, 16% the noncoronary sinus and 4% the left coronary sinus [18]. In our case the left Sinus of Valsalva was involved. It was likely related to the underlying endocarditis even though blood cultures were negative on appropriate antibiotics at the time of diagnosis.

Detection of SVA is by echocardiography, computed tomography angiography and magnetic resonance imaging. As our case suggested these aneurysms can develop despite ongoing antibiotic treatment and resolution of septicemia. The management of SVA associated with aortic valve endocarditis is usually surgical. The type of intervention depends on the parameters found intra-operatively which may include: the size of the SVA, the presence of aortic valve pathology or associated cardiac anomaly [24]. A number of surgical techniques have been described since the first reported PSV repair in 1957. The main three reported approaches are: (1)

through the aortic root via an aortotomy, (2) if an aneurysm has ruptured through the cardiac chamber, or (3) a dual approach through both an aortotomy and an incision into the involved cardiac chamber. Closure of the aneurysm can be primary closure which is routinely used for small PSV and patch closure for larger PSV [25]. In cases with extensive root destruction more complex operations and use of homograft may be necessary [26]. In case of limited destruction, valve replacement plus repair of the SVA, with autologous pericardium is a suitable option. Others have described direct suture closure of the sinus of Valsalva aneurysms or use of Dacron patch [9]. Care must be taken to prevent obstruction of the adjacent coronary ostia. In some cases, concurrent coronary artery bypass grafting may be needed if the coronary ostium is compromised [27].

Conclusion:

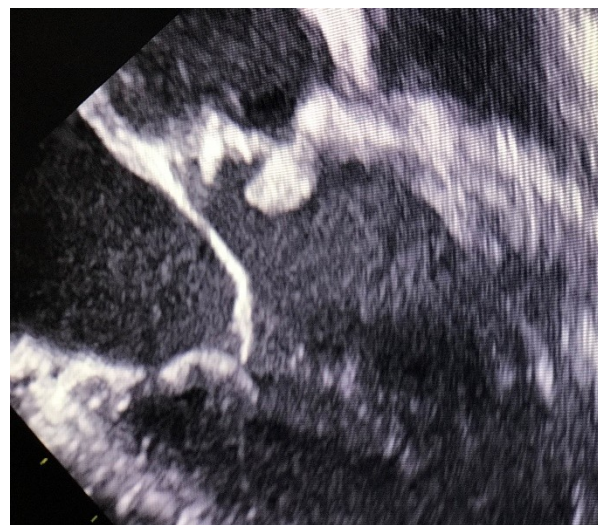
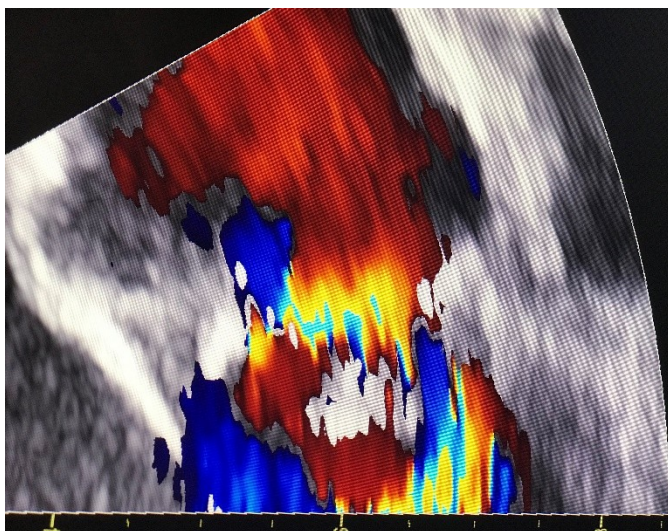
We describe the diagnosis and management of a sinus of Valsalva aneurysms in a patient with known aortic valve endocarditis adjacent to the orifice of the left main ostium. This was detected by pre-operative CTA despite negative blood cultures and ongoing treatment with appropriate antibiotics of the endocarditis. We report this case to emphasize the need for routine long term clinical and imaging follow-up in patients with endocarditis.

Data availability statement: This is a case report highlighting a rare sequelae of chronic endocarditis that we believe should be take into consideration is such clinical presentation.

Funding: None

Conflict of Interest: None

Appendix 1.



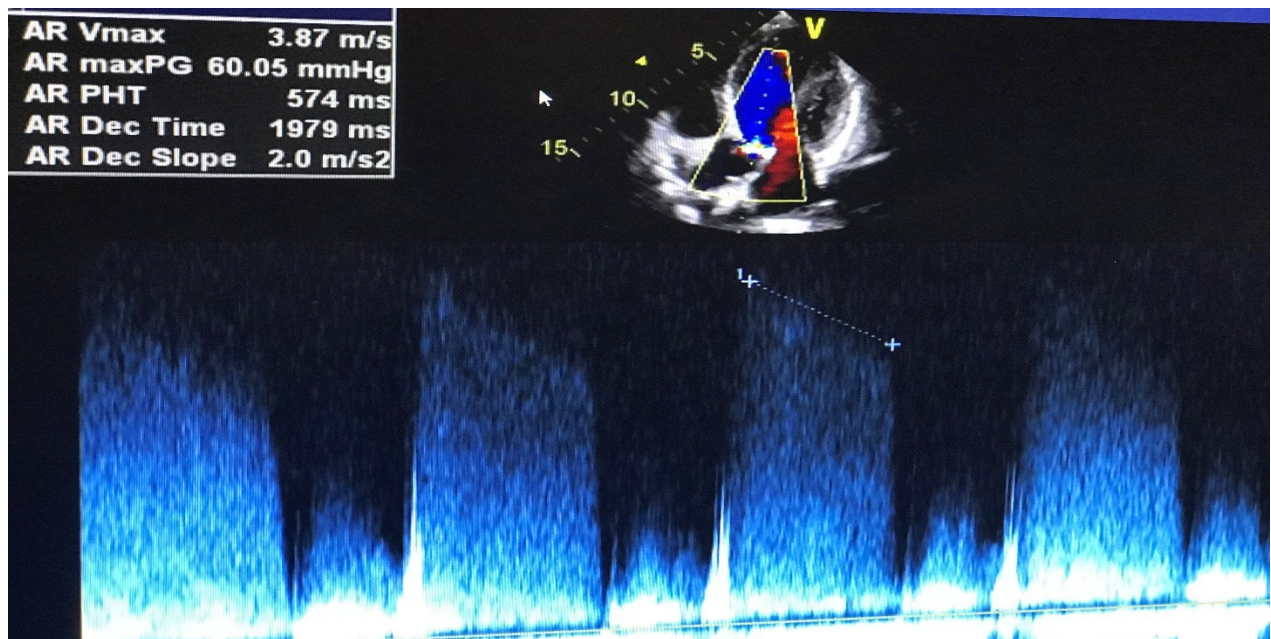


Figure.1 Transthoracic echocardiography (TTE) showed left ventricular systolic dysfunction with ejection fraction of (40-45%) grad two diastolic filling pattern with elevated left ventricle pressure, moderate-to-severe aortic regurgitation, moderate aortic stenosis, bicuspid aortic valve with thickening and calcification compatible with vegetation

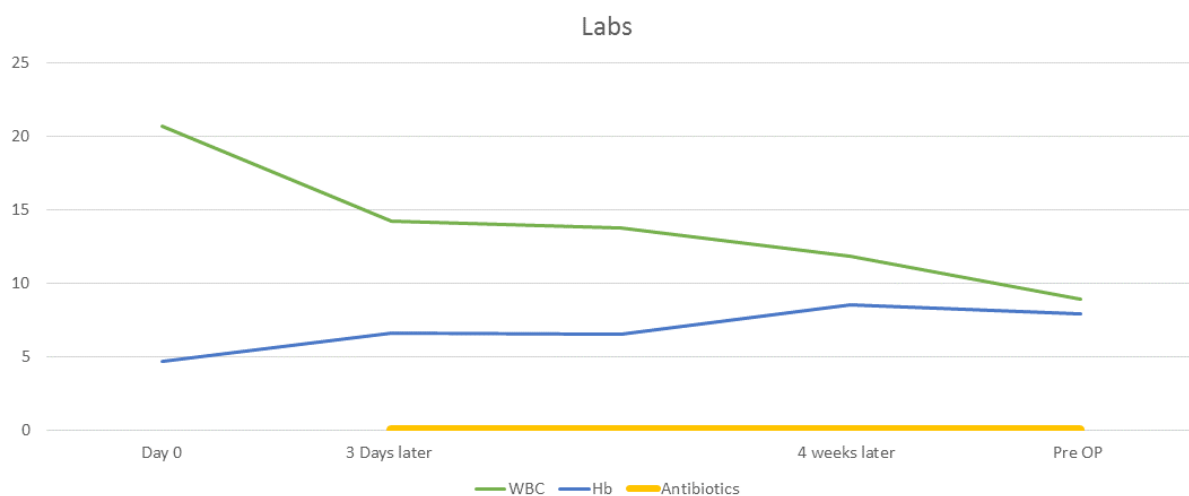


Figure 2. Labs

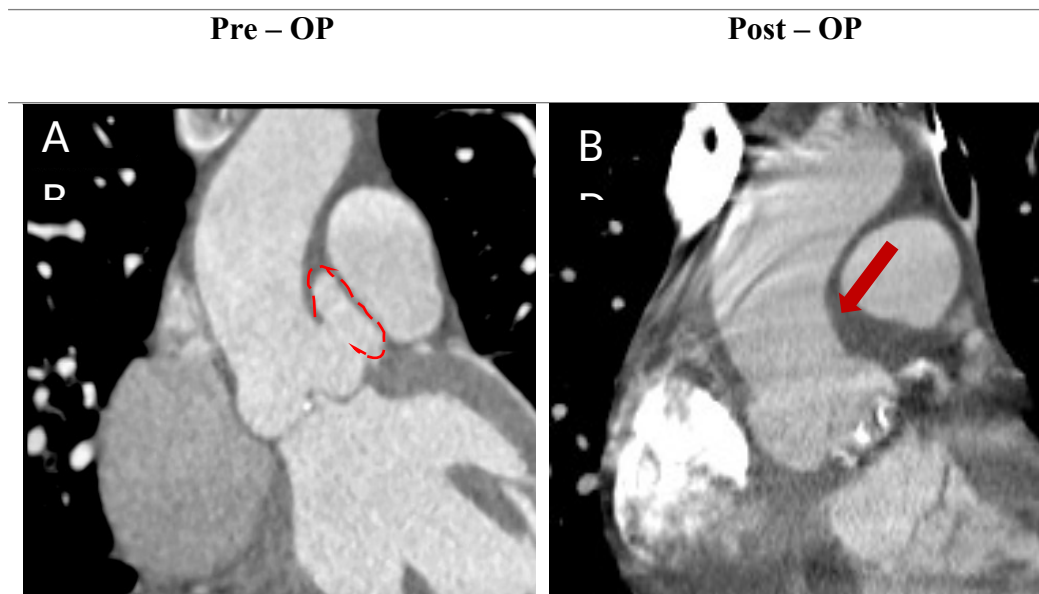


Figure 3. (A) **Pre – OP CT scan** showing large aneurysm of the Sinus of Valsalva.
 (B) **Post – OP CT scan:** Showing repair of the Sinus of Valsalva aneurysm.

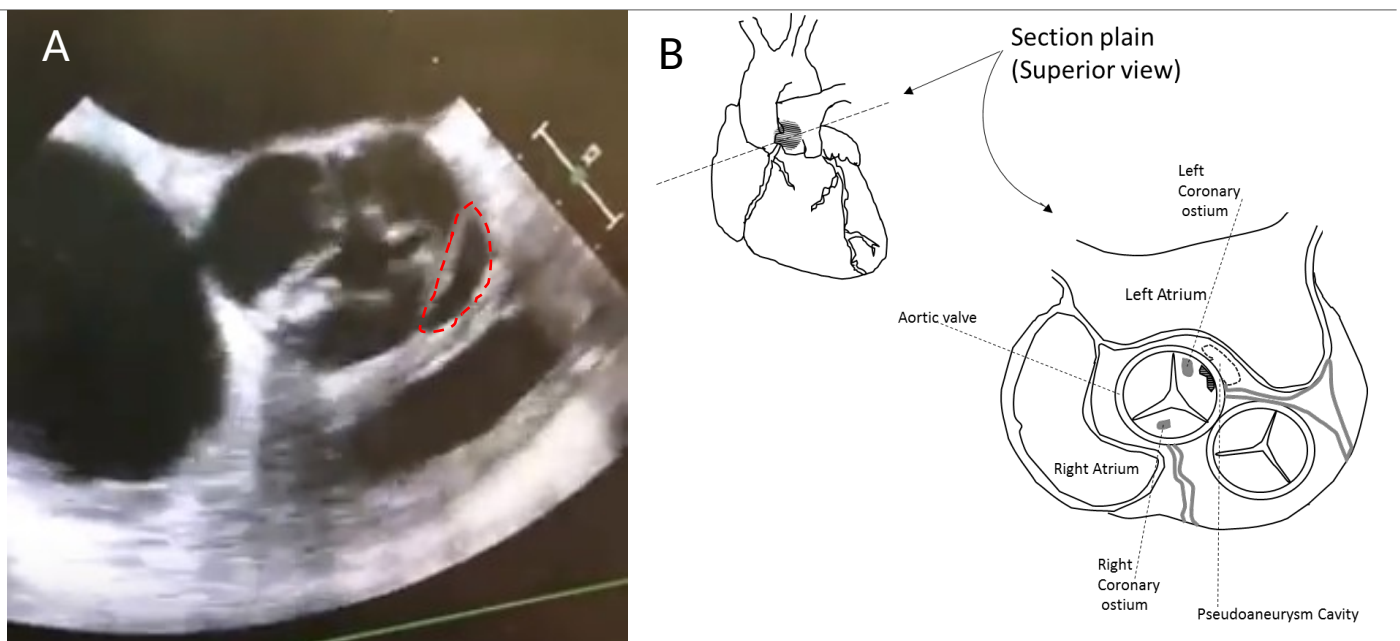


Figure 4. (A) Intraoperative transesophageal echocardiography (TEE) showing vegetation on the aortic valve and the aneurysm. (B) Illustrative drawing of sinus of Valsalva aneurysm. (this graph was drawn and created by author Dr.Basmah AlTinawi)

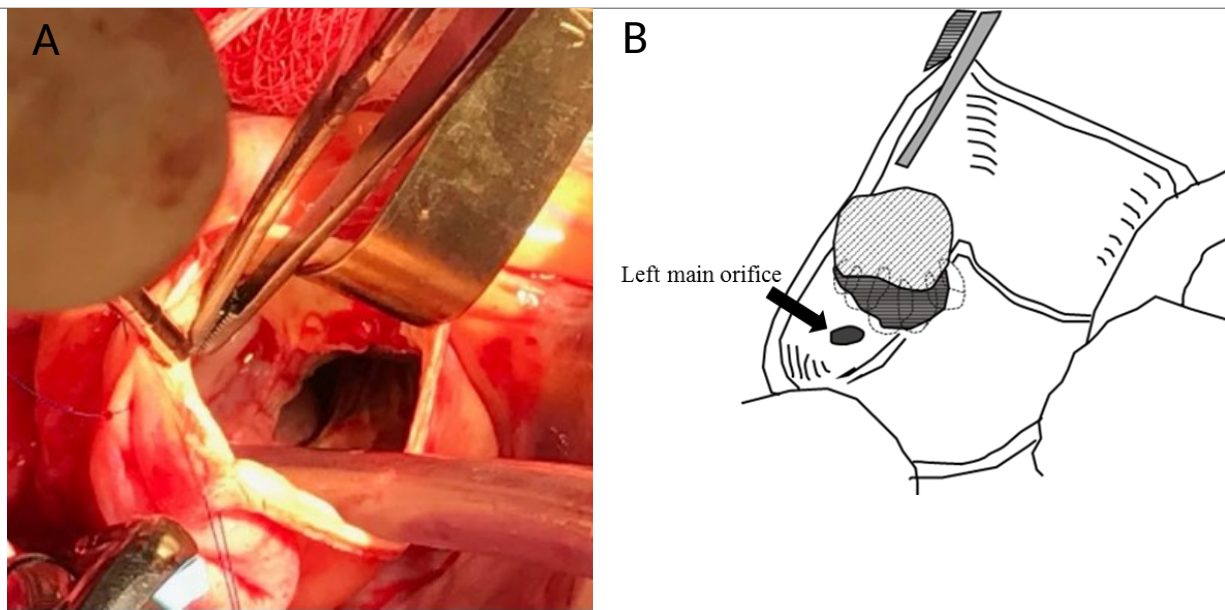


Figure 5. The patient's intraoperative gross image showing oblique incision in anterior wall of the ascending aorta. A): The view from inside the ascending aorta showed a large cavity (Sinus of Valsalva aneurysm) Image B: Repair with autologous pericardium coverage and location of left main orifice. (this graph was drawn and created by author Dr. Basmah ALTinawi)

Appendix 2.

References:

1. Özbudak, Ersan et al. PP-138 A Pseudoaneurysm of the Ascending Aorta American Journal of Cardiology (2015) , Volume 115: 158 – 159
2. Mulder EJ, van Bockel JH, Maas J, van den Akker PJ, Hermans J. Morbidity and mortality of reconstructive surgery of noninfected false aneurysms detected long after aortic prosthetic reconstruction. Arch Surg. 1998 Jan; 133(1):45–49.

3. Bisdas T, Teebken OE. Mycotic or infected aneurysm? Time to change the term. *Eur J Vasc Endovasc Surg* 2011; 41:570.
4. Chan FY, Crawford ES, Coselli JS, Safi HJ, Williams TW Jr. In situ prosthetic graft replacement for mycotic aneurysm of the aorta. *Ann Thorac Surg* 1989;47(2):193–203.
5. Mansur, A. J., et al. “Extracranial Mycotic Aneurysms in Infective Endocarditis.” *Clinical Cardiology*, vol. 9, no. 2, 1986, pp. 65–72.
6. Takach TJ, Reul GJ, Duncan JM, et al. Sinus of Valsalva aneurysm or fistula: management and outcome. *Ann Thorac Surg*. 1999;68:1573–1577.
[https://doi.org/10.1016/S0003-4975\(99\)01045-0](https://doi.org/10.1016/S0003-4975(99)01045-0).
7. Chu SH, Hung CR, How SS, et al. Ruptured aneurysms of the sinus of Valsalva in Oriental patients. *J Thorac Cardiovasc Surg*. 1990;99:288–298.
8. Hoey ET, Kanagasingam A, Sivananthan MU. Sinus of valsalva aneurysms: assessment with cardiovascular MRI. *AJR Am J Roentgenol*. 2010;194:W495–504.
9. Gonzalez-Lavin, L., Scappatura, E., Lise, M., and Ross, D. N. Mycotic aneurysms of the aortic root: A complication of aortic valve endocarditis. *Ann. Thorac. Surg*. 9:551, 1970.

10. Shumacker, H. Aneurysms of the sinuses of Valsalva secondary to bacterial endocarditis with special reference to their operative management. *J Thorac. Cardiovasc. Surg.* 63:896, 1972.
11. Utley, J. R., and Mills, J. Annular erosion and pericarditis. *J . Thorac. Cardiovasc. Surg.* 64:76, 1972.
12. Kanemitsu S, Tanabe S, Ohue K, Miyagawa H, Miyake Y, Okabe M. Aortic valve destruction and pseudoaneurysm of the sinus of Valsalva associated with infective endocarditis. *Ann Thorac Cardiovasc Surg.* 2010;16(2):142–4.
13. Pelicano NJ, Branco LM, Agapito AF, Salomao S, Figueiredo L, Cunha J et al. Infective endocarditis complicated by large aortic pseudoaneurysm after cardiac surgery. *Eur J Echocardiogr.* 2006;7(5):394–7.
14. Tsai KT, Cheng NJ, Chu JJ, Lin PJ. Aortic root pseudoaneurysm following surgery for aortic valve endocarditis. *Chang Gung Med J.* 2002;25(2):133–8.
15. Afridi I, Apostolidou MA, Saad RM, Zoghbi WA. Pseudoaneurysms of the mitral-aortic intervalvular fibrosa: dynamic characterization using transesophageal echocardiographic and Doppler techniques. *J Am Coll Cardiol.* 1995;25(1):137–45.
16. Fazlinezhad A, Fatehi H, Tabaee S, Alavi M, Hoseini L, Yousefzadeh H.
Pseudoaneurysm of mitro-aortic intervalvular fibrosa during the course of mitral valve

endocarditis with aorto-left ventricle outflow tract fistula. J Saudi Heart Assoc. 2012;24(3):201–4.

17. Valsalva AM: Viri celeberrimi Antonii Mariae Valsalvae. Opera 1740.
18. Chu SH, Hung CR, How SS, Chang H, Wang SS, Tsai CH et al. Ruptured aneurysms of the sinus of Valsalva in Oriental patients. J Thorac Cardiovasc Surg. 1990;99(2):288–98.
19. Batiste C, Bansal RC, Razzouk AJ: Echocardiographic features of an unruptured mycotic aneurysm of the right aortic sinus of Valsalva. J Am Soc Echocardiogr 2004; 17: 474-477.
20. Sobrinho JH, Silva MA, Fontes WF, Santos MA, Pontes Junior SC, Silva MV, Rubayo EM, Arnoni AS: Syphilitic aneurysm communicating with an aortic sinus of Valsalva. A case report. Arq Bras Cardiol 1989; 52: 341–344.
21. Greiss I, Ugolini P, Joyal M, Bouchard D, Mercier LA: Ruptured aneurysm of the left sinus of Valsalva discovered 41 years after a decelerational injury. J Am Soc Echocardiogr 2004; 17: 906–909
22. Arnett EN, Roberts WC. Valve ring abscess in active infective endocarditis. Frequency, location, and clues to clinical diagnosis from the study of 95 necropsy patients. Circulation. 1976;54(1):140–5.

23. Katsumata T, Moorjani N, Vaccari G, Westaby S. Mediastinal false aneurysm after thoracic aortic surgery. *Ann Thorac Surg*. 2000 Aug; 70 (2):547–552.
24. Quevedo, Henry C. et al. “Systematic Review of Interventions to Repair Ascending Aortic Pseudoaneurysms.” *The Ochsner Journal* 14.4 (2014): 576–585
25. Weinreich, M., Yu, P., & Trost, B. (2015). Sinus of Valsalva Aneurysms: Review of the Literature and an Update on Management. *Clinical Cardiology*, 38(3), 185-189.
26. Holmes, E., Bredenberg, C. and Brawley, R. Aneurysm of the Sinus of Valsalva Resulting from Bacterial Endocarditis. *JUNE*, (1973), 15 (6).
27. Lee CC, Siegel RJ. Sinus of Valsalva Pseudoaneurysm as a Sequela to Infective Endocarditis. *Tex Heart Inst J*. 2016 Feb 1; 43(1):46-8.