

Rupture of Non-coronary Sinus of Valsalva Aneurysm Contained by Ventricular Wall: A Case Report

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Abstract

Case Report

Sinus of Valsalva aneurysm is a typically asymptomatic, rare cardiac pathology that is defined as a dilation of a sinus of the aorta. If large enough, the patient may present with symptoms reflective of dysfunction of adjacent structures caused by compressive effect. Sinus of Valsalva aneurysms have high rate of morbidity and mortality in the rare event that they rupture. Consequences of aneurysmal rupture vary depending on which sinus is affected and the location of the aneurysm. Contained aneurysms of this type have rarely been reported. Early surgical intervention is indicated for symptomatic aneurysms and aneurysmal rupture. We present a case of a contained rupture of the non-coronary sinus of Valsalva aneurysm and demonstrate the need to maintain a high index of suspicion in asymptomatic patients who have risk factors for the development of this type of aneurysm.

Keywords: sinus, Valsalva aneurysm, aneurysmal rupture, asymptomatic patients.

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INTRODUCTION

Sinus of Valsalva aneurysms are the dilation or enlargement of the aortic sinuses between the aortic valve annulus and the sinotubular junction. These aneurysms are extremely rare with an incidence of 0.15% open heart surgery patients and 10% are aneurysms of the non-coronary sinus [1]. Most aneurysms of this type are asymptomatic and are incidentally discovered in the process of evaluating the patient for other cardiovascular disease such as those that are risk factors for their development including trauma, infective endocarditis, and atherosclerosis as well as diseases associated with congenital aneurysms like bicuspid aortic valve, ventricular septal defects, and aortic regurgitation. These aneurysms can cause heart block or atrial fibrillation when symptomatic, the aneurysm can be revealed as the cause during evaluation [2]. In these cases, mass effect of the aneurysm causes symptoms by compression the conduction system leading to arrhythmias, compression of the aortic valve leading to valvular dysfunction, compression of outflow tracts leading to obstruction of flow, and the compression of coronary ostia leading to ischemia [3]. Surgical intervention is indicated when these symptoms are present [1].

A rare complication of Valsalva sinus aneurysms is rupture which has different consequences, and therefore different symptoms, depending on the location. Rupture into the pericardial space can cause cardiac tamponade. Rupture of a left Valsalva sinus is the least clinically significant as it forms communication to the left atrium or left ventricular outflow tract. However, rupture of aneurysms of the right and non-coronary Valsalva sinus lead to communication between either the right atrium or right ventricular outflow tract which can result in insidious onset heart failure with volume overload and hemodynamic compromise [2]. Symptoms typically present with rupture of the aneurysm into one of the chambers [3]. Early surgical intervention is required for ruptured Valsalva sinus aneurysms as untreated ruptures have a median survival of less than 4 years [1].

While rupture of an aneurysm of a Valsalva sinus is rare, a contained rupture is even less frequently described in the literature. The contained rupture can produce the compressive symptoms similar to those caused by mass effect of an expanding aneurysm described above [2].

CASE PRESENTATION

A 70 year-old man with a history of chronic obstructive pulmonary disease, bicuspid aortic valve, coronary artery disease with percutaneous coronary intervention 7 years prior, and essential hypertension was referred to a cardiothoracic surgeon by his cardiologist for evaluation of expanding aortic aneurysm. His only complaint was of mild dyspnea after strenuous exertion. Cardiac auscultation revealed normal first and second heart sounds with a normal split and a 3/6 diastolic murmur most prominent at the left lower sternal border. Initial chest x-ray showed protuberant right cardiac silhouette. Echocardiogram showed moderate aortic insufficiency, severe aortic root dilation with 5.4 centimeter (cm) diameter, and moderate ascending aortic dilation with 4.4 cm diameter as well as calcification and sclerosis of the aortic root. Contrast-enhanced computed tomography (CT) of the chest performed about 3 weeks later confirmed the dilated segments of the aorta with the aortic root diameter measuring 5.4 cm that tapered to the mid-ascending aorta with 4.3 cm diameter as well as a previously diagnosed thoracic schwannoma. In this series of images, the non-coronary SOV was seen to be larger than the two other sinuses without visualization of aneurysmal rupture (Figure 1). These findings were re-demonstrated on three-dimensional CT of the chest performed for surgical planning (Figure 2). Pre-operative cardiac assessment for surgical clearance included left heart catheterization to evaluate the patient for underlying progression of coronary artery disease. The study revealed 70% in-stent stenosis of the left anterior descending artery and 100% stenosis of the proximal right coronary artery. An aortic root study was not performed during the catheterization as there was no suspicion for rupture and surgery was already planned. After completion of pre-operative work-up, the patient was scheduled to undergo aortic valve replacement with conduit and coronary artery bypass graft of the stenotic vessels. Valve-sparing root surgery was considered but the patient had mild aortic stenosis with disease leaflets that were projected to become stenotic in the near

future. Bioprotective conduit was chosen due to patient refusal of lifelong anticoagulation and bioprotective aortic valves do not require anticoagulation with vitamin K antagonists or novel oral anticoagulants at our institution. Cardiopulmonary bypass was initiated after median sternotomy and coronary ostial cardioplegia was infused. The patient was placed on our standard aortic and triple-stage right atrial appendage drainage cannula with a left ventricular vent catheter via the right superior pulmonary vein. Intraoperative transesophageal echocardiography (TEE) showed moderate to severe aortic insufficiency with mild-to-moderate restriction of aortic valve leaflet motion, mild aortic stenosis, estimated left ventricular ejection fraction of 43%, and relatively larger non-coronary SOV (Figure 3). The distal coronary bypass anastomoses were done first. Then the diseased portion of the ascending aorta was resected and dissection of the aortic root was conducted. Upon dissecting the non-coronary SOV, the sinus wall was seen to be very thin and adherent to the ventricular muscle. Once we were able to dissect around the root and return to this area, it was noted that the unusual appearance of the sinus was a 1cm by less than 1 cm contained rupture with the muscle was acting as the sinus wall which was confirmed by the absence of blood in the pericardium. The Bentall procedure was then performed using the bioprotective aortic valve conduit (Konect Resilia® 29 mm). The coronary buttons were anastomosed in the usual fashion. Once the aortic graft anastomosis was completed, the reversed saphenous vein graft (rSVG) was anastomosed to the aortic graft under a single cross clamp. The patient tolerated the procedure well and was transferred to the intensive care unit in stable condition. Post-operative ileus resolved with the use of a nasogastric tube. On post-operative day 5, the patient developed atrial fibrillation with rapid ventricular response which was intermittent until discharge and was prescribed apixaban for anticoagulation. The patient discharged home without any further complications.

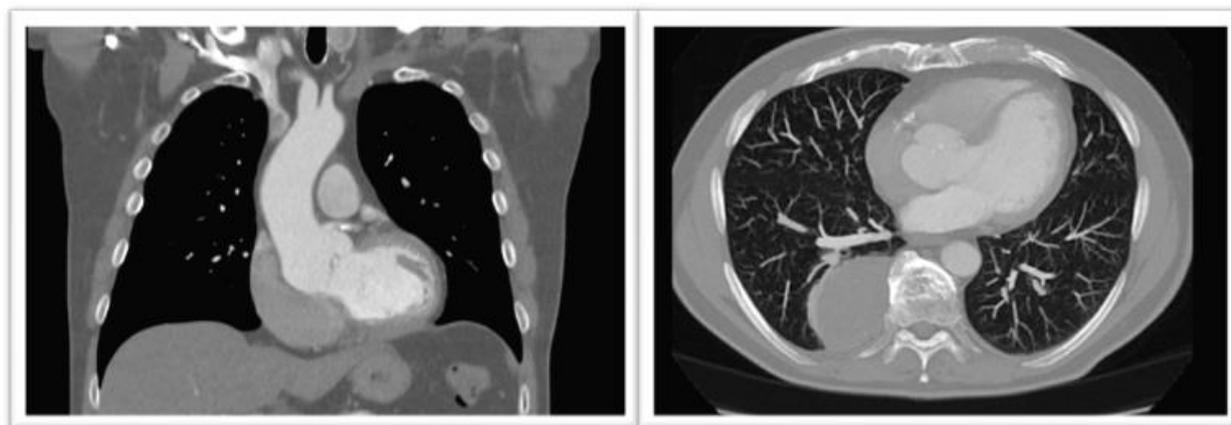


Fig 1: Contrast-enhanced computed tomography (CT) of the chest demonstrating dilated aortic root and significantly larger non-coronary sinus of Valsalva compared to the other sinuses



Fig 2: Three-dimensional Computed Tomography (CT) of the patient's thoracic aorta showing the non-coronary sinus of Valsalva larger relative to the two sinuses without visualization aneurysmal rupture

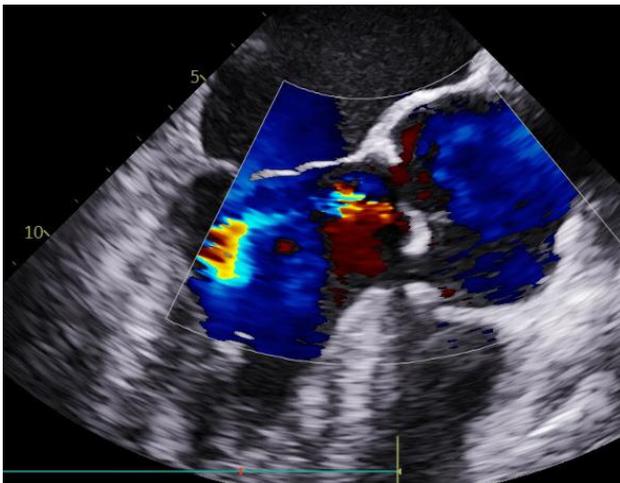


Fig 3a: Intraoperative Transesophageal Echocardiography (TEE) showing moderate to severe aortic insufficiency

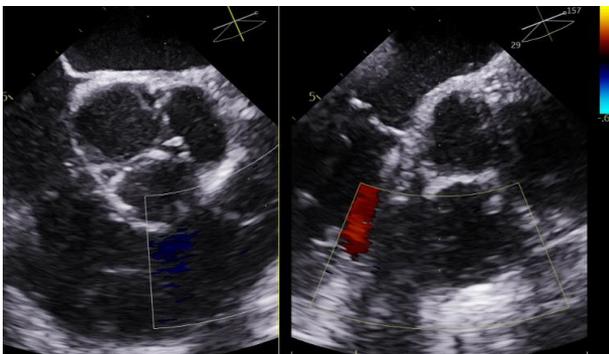


Fig 3b: Intraoperative TEE showing dilated non-coronary sinus of Valsalva with very thin wall near the area of contained perforation

DISCUSSION

This is a case of a contained rupture of the non-coronary sinus of Valsalva aneurysm which was incidentally discovered during an open heart surgery. The patient undergoing aortic valve replacement for aortic root dilation and ascending aortic aneurysm which were seen on imaging for evaluation of a lung mass. He only described non-specific complaint of dyspnea with strenuous activity which was expected with his smoking history and generally age-appropriate. The area of the rupture was not large enough to cause compressive symptoms and was not visible on diagnostic imaging performed for pre-operative evaluation. However, the patient's past medical history confirmed several risk factors for the development of aneurysms of this type.

The risk factors for Valsalva sinus aneurysm, its rupture, or the containment thereof, are all related to cardiovascular diseases which may produce a similar presentation. Additionally, the identifying physical exam finding of this pathology is a continuous machinery murmur, its presence depends on the auscultation skills of the examiner. With this in consideration, a degree of suspicion should exist in patients who have these risk factors regardless of symptoms as untreated Valsalva sinus aneurysm rupture has a high mortality rate. It is likely that the patients that meet these criteria will undergo diagnostic cardiac imaging at some point. Imaging modalities should be additionally used for surveillance of Valsalva sinus aneurysm and to monitor for complications.

Although a 2-dimensional echocardiogram can confirm the diagnosis of Valsalva sinus aneurysm, TEE is the gold standard. Doppler mode only correctly diagnoses a ruptured aneurysm in 75% of patients and typically is unable to define the anatomy of the aneurysm. However, color-flow Doppler mode can be used to accurately characterize the aneurysm by anatomy, location, and size as well as identifying any complications [2].

CONCLUSIONS

Aortic root operations can be routine or sometimes very complex, especially if there are intraoperative complications or incidental findings. The possibility of Valsalva sinus aneurysm rupture should be ever present in the surgeon's mind prior to any root operation. Although rare, rupture of a Valsalva sinus aneurysm should be considered in patients who present with acute onset of symptoms consistent with decompensated heart failure, chest pain, or palpitations as the risk factors for these aneurysms can present similarly. Surveillance for this type of aneurysm should occur whenever imaging modalities are employed in patients with risk factors as untreated SOV aneurysms have a high mortality rate. Early surgical intervention confers prognostic improvement to that of the healthy

population and an excellent 15-year event-free survival rate.

Patient Consent

Written consent for this case report and associated imaging was obtained from the patient.

HCA Healthcare Disclaimer

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