The Heart Surgery Forum #2008-1063
11 (6), 2008 [Epub December 2008]
doi: 10.1532/HSF98.20081063

Online address: http://cardenjennings.metapress.com

A Case with Noncoronary Sinus of Valsalva Aneurysm: Multidetector Computed Tomography Findings

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ABSTRACT

We report the case of a 23-year-old man with an unruptured noncoronary sinus of Valsalva aneurysm and Marfan syndrome, which were diagnosed by 16-row multidetector computed tomography (MDCT). MDCT has enabled imaging of the cross-sectional anatomy of the heart with excellent spatial and temporal resolution that reflects the anatomical and functional changes in cardiac pathologies. Thus, the knowledge of the CT anatomy of the heart has become increasingly important for radiologists. This report aimed to confirm the contribution of MDCT in establishing the diagnosis and to show the potential association of nodular septation in the noncoronary sinus of Valsalva with aneurysm.

INTRODUCTION

Sinus of Valsalva aneurysm is a rare cardiac anomaly thought to be caused by a deficiency involving fusion of the aorta's media with the aortic valve's annulus fibrosis or by actual detachment [Zhao 2003]. Most often, these aneurysms are congenital [Goldberg 1990]. More rarely, aneurysms can be acquired because of trauma, endocarditis, syphilitic heart disease, and/or Marfan syndrome [Goldberg 1990].

Multidetector computed tomography (MDCT) has provided images of the cross-sectional anatomy of the heart with excellent spatial resolution. Thus, the knowledge of the CT anatomy of the heart has become increasingly important. There have been only a few case reports of a sinus of Valsalva aneurysm diagnosed by MDCT. We report a rare case of an unruptured noncoronary sinus of Valsalva aneurysm with Marfan syndrome and the related MDCT findings.

Received July 6, 2008; received in revised form September 20, 2008; accepted September 24, 2008.

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CASE REPORT

A 23-year-old man was admitted to our hospital with a 5-year history of chest pain and shortness of breath. The patient had no history of heart disease, hypertension, or diabetes.

The physical examination revealed the patient to be a tall, thin young man with unusually long limbs. The patient appeared to have Marfan syndrom. An ophthalmologic examination showed no signs of ectopia lentis. The blood pressure and heart rate were normal. Osculation revealed a 2/4 diastolic murmur in the aorta focus and a 3/6 systolic air leak in the mitral apex.

A transthoracic echocardiography evaluation displayed the appearance of a structure 4 × 2 mm in diameter that was compatible with a membrane in the left ventricular exit. Moreover, the aortic valve had a bicuspid appearance, and second-degree aortic failure was determined. In the left ventricular outflow tract, we determined a maximum gradient of 70 mm Hg and a mean gradient of 30 mm Hg.

MDCT was performed with a CT scanner with 16 detector rows (Aquillon; Toshiba Medical Systems, Tokyo, Japan) during a single-breath holding time (16 ± 24 seconds). Scans were obtained with 16- to 0.5-mm collimation, a 1.0-mm slice thickness, and a 1.0-mm reconstruction interval. Iodinated contrast medium (90 mL of Omnipaque; GE Healthcare/Amersham Health, Cork, Ireland) was injected intravenously at 4.5 mL/s, followed by 40 mL of saline solution at 2.5 mL/s. The CT scans were obtained from 1 cm below the carina to the diaphragmatic face of the heart with retrospective electrocardiogram gating. For image analysis, 5 data sets were reconstructed at 50%, 60%, 70%, 75%, and 80% of the R-R interval. Reconstructed images were then transferred to a processing workstation for further analysis with specialized software (Vitrea 2; Vital Images, Minneapolis, MN, USA). In addition to the traditional axial images, all other available techniques (multiplanar reconstructions, curved multiplanar reformation, sliding thin-slab maximum intensity projection [MIP], and 3-dimensional volume-rendering images) were used to assess the coronary artery branches that supply the ventricular septum and to detect any variations in coronary arteries. All the findings were recorded. On the MIP images and 3-dimensional volume-rendering images of MDCT (Figures 1 and 2), 2.5-cm nodular septations were observed

Fig 1 A

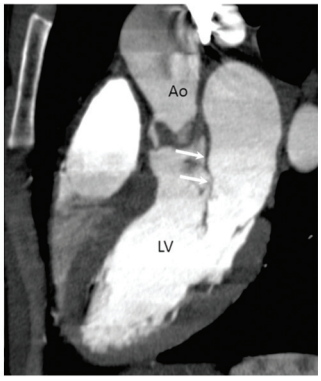

Fig 1 B

Figure 1. A, Nodular septations in the noncoronary sinus of Valsalva apparent in axial maximum intensity projection (MIP) images (arrows). B, Septations belonging to the noncoronary sinus of Valsalva aneurysm in the left ventricular outflow tract were observed on the sagittal MIP image (arrows). Ao, aorta; LV, left ventricle.

in the noncoronary sinus of Valsalva locations, and thus noncoronary sinus of Valsalva aneurysms were suspected. The patient was referred to the surgery department. During the surgical process, the aneurysm was found to have the same size as that measured by CT.

Cardiopulmonary bypass was accomplished following the induction of general anesthesia, a median sternotomy, and heparinization. The aorta was bicuspid and fibrotic, and the noncoronary cusp was prolapsed and aneurysmatic after aortotomy (Figure 3). Valvulary and supravalvulary stenoses were also detected. Posterior enlargement with a polytetrafluoroethylene (PTFE) graft was performed after excision of the aortic valve. The left atriotomy incision was then made. We detected chordal rupture in the mitral valve anterior leaflet and found bilateral commissural fusion. The mitral valve was resected (with protection of anterior and posterior leaflets) and replaced with a mechanical valve. The aortic valve was subsequently replaced with a mechanical aortic valve, and the aortotomy incision was closed with a PTFE graft. The interventricular septum was intact. The postoperative period was uneventful, and the patient was discharged on the 10th postoperative day.

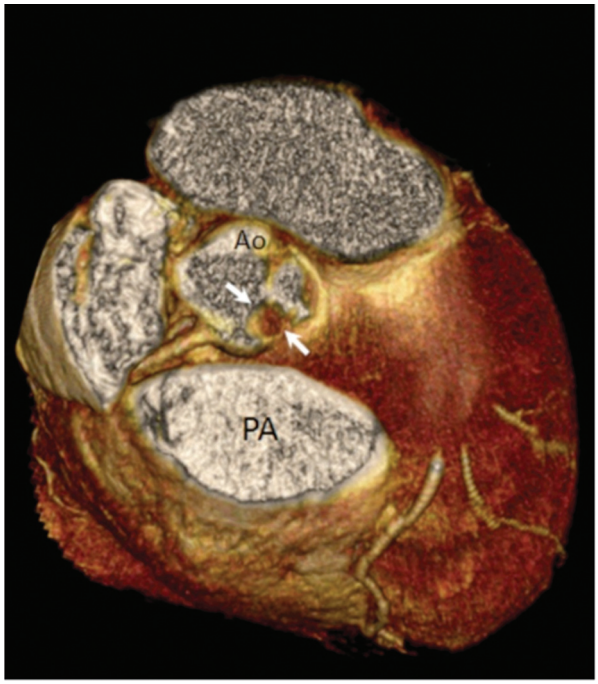

Figure 2. A noncoronary sinus of Valsalva aneurysm was observed in the superior view of the 3-dimensional volume-rendered image (arrows). Ao, aorta; PA, pulmonary artery.

DISCUSSION

Aneurysm of the sinus of Valsalva is a rare congenital anomaly that usually involves the right coronary sinus (76.8%), the noncoronary sinus (20.2%), or the left coronary sinus (3%) [Chu 1990]. The male-female ratio is 3.5:1, and symptoms usually develop in the adult population [Choudhary 1997]. Acquired sinus of Valsalva aneurysms can be caused by a deficiency of the aortic media, which may result from trauma, endocarditis, syphilis, connective-tissue diseases such as Marfan syndrome or Behcet syndrome, or a senile type of dilatation [Kutay 2005].

In the present study, the patient had Marfan syndrome; however, the case was previously undiagnosed. Because Marfan syndrome is one of the etiologic factors of sinus of Valsalva aneurysms, its identification was important for our case. Marfan syndrome is a hereditable connective-tissue disorder with a median survival time of 40 years. Cardiac disease is the

Figure 3. Cartilage structures of the surgically removed noncoronary sinus of Valsalva aneurysm.

major cause of death, with 80% of these deaths being related to disease of the aorta. Occasionally, the cardiovascular lesions of Marfan syndrome (especially those related to structures of the aortic root) are nonspecific in presentation; nevertheless, recognition of such lesions is crucial to prevent rupture [Murdoch 1972].

Sinus of Valsalva aneurysm may be asymptomatic or may present with angina or symptoms of valvular regurgitation or cardiac insufficiency. Once ruptured, usually in the third or fourth decade of life, these aneurysms may produce serious hemodynamic instability, such as acute heart failure, usually followed by emergency operation [Islam 1996] or even sudden death. All patients with a ruptured aneurysm of the sinus of Valsalva should be treated surgically [Chen 1980]; therefore, correct and early diagnosis is especially important. In addition, patients with an unruptured aneurysm usually undergo surgery, because the repair of aneurysms of the sinus of Valsalva can be performed with an acceptably low operative risk and with the expectation of a good and symptom-free long-term outcome [Takach 1999; Vural 2001]. Our patient did not have any ruptures, and the diagnosis was made during routine MDCT evaluations. We believe that MDCT has an important place in the diagnosis and follow-up of unruptured and ruptured sinus of Valsalva aneurysms.

Color Doppler echocardiography is highly useful in diagnosing an aneurysm of the sinus of Valsalva [Goudevenos 1990; Sahasakul 1990]. Nevertheless, obesity and accompanying pulmonary diseases limit the use of transthoracic echocardiography [Sahasakul 1990]. Transesophageal echocardiography offers the potential for a more accurate characterization of the aneurysm [Wang 1997], but this procedure is moderately invasive. MDCT is useful for delineating a sinus of Valsalva aneurysm and its rupture, especially in patients who have a suboptimal evaluation in an echocardiography examination [White 2001; Utsunomiya 2006]. MDCT produces a cross-sectional anatomy of the heart that has excellent spatial and temporal resolution, which reveals the anatomical and functional changes in cardiac pathologies [Kantarcı 2007]. The noninvasive nature and speed of MDCT and the 3-dimensional information on structure and location that MDCT provides are among the technology's advantages. In addition, MDCT provides information on the coronary arteries, the aorta, and pulmonary artery pathologies on the same image [White 2001; Utsunomiya 2006].

In conclusion, MDCT provides a cross-sectional anatomy of the heart with excellent spatial and temporal resolution. Thus, the knowledge of the CT anatomy of the heart has become increasingly important for radiologists. MDCT should especially be performed on young patients with chest pain, and a sinus of Valsalva aneurysm should be suspected if images of the sinus reveal nodular septations.

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