CASE REPORT

Echocardiographic Manifestation of Right Sinus of Valsalva Aneurysm

By Donald A. Rothbaum, M.D., James C. Dillon, M.D., Sonia Chang, B.A., and Harvey Feigenbaum, M.D.

SUMMARY
This case report describes the distinctive echocardiographic pattern in a patient with a congenital right sinus of Valsalva aneurysm. The echocardiogram demonstrated an abnormal structure extending from the aortic root into the left ventricular chamber adjacent to the interventricular septum. The structure showed diastolic motion away from the septum and systolic motion toward the septum. This movement was consistent with cineangiographic filling of the aneurysm during diastole and emptying during systole. After operative closure of the aneurysm, the echocardiogram showed dense thickening along the aortic root and contiguous interventricular septum, probably representing thrombosis and fibrosis within the obliterated aneurysmal sac; but no abnormal movement of the structure was present.

Additional Indexing Words:
Bicuspid aortic valve  Aortic valve echocardiogram  Aortic insufficiency  Aortic stenosis  Ultrasound

Since Edler's original echocardiographic description of the aortic valve, abnormal aortic valve echo patterns have been described in such conditions as valvular aortic stenosis, hypertrophic and discrete subaortic stenosis, truncus arteriosus and low cardiac output, and endocarditis. In the present report we describe a patient with clinical features of aortic stenosis and insufficiency who had a distinctive echocardiographic structure within the aorta and base of the left ventricle which at cardiac catheterization was found to be a right sinus of Valsalva aneurysm protruding into the left ventricle. After surgical closure of the aneurysm, the region of the left ventricular outflow tract and aortic root remained thickened; but the abnormal preoperative echocardiographic motion of the aneurysm was no longer present.

Case Report
A 31-year-old male was first noted to have the murmurs of aortic stenosis and insufficiency at age 22. During a routine cardiac clinic visit, an unusual echocardiographic pattern was noted in the aortic valve region; and the patient was admitted to the Indiana University Medical Center for further evaluation. Symptoms at the time of admission included exertional dyspnea, dizziness and palpitations. He denied chest pain, fever, chills or weight loss.

On physical examination the pulse was 80 and the blood pressure was 115/50 mm Hg. The jugular venous pressure was not elevated. The carotid upstroke was brisk with bisferiens quality. The lungs were clear to auscultation and percussion. On cardiac examination the patient had an enlarged heart with the PMI in the anterior axillary line in the sixth left intercostal space. There was a prominent left ventricular lift and a systolic thrill along the left sternal border. The first heart sound was normal, the second heart sound was paradoxically split. There was an ejection click followed by a grade 4/6 systolic ejection murmur which was loudest in the aortic area and radiated to the carotids. There was a grade 4/6 prolonged diastolic decrescendo murmur along the left sternal border. A fourth heart sound was present. The remainder of the physical examination was normal. The electrocardiogram showed...
ULTRASOUND IN SINUS OF VALSALVA ANEURYSM

Figure 1

Echocardiogram of patient with right sinus of Valsalva aneurysm. The anterior aortic valve echo (AV) demonstrates exaggerated anterior systolic motion with eccentricity of the aortic valve leaflets. Although this abnormal echo occupies the position of the normal right aortic valve cusp in the aortic area, it protrudes (arrows) into the left ventricular cavity (LV). With the onset of diastole the echo moves rapidly away from the interventricular septum, only to return toward the septum with systole. LA = left atrium; MV = mitral valve.

Figure 2

Left anterior oblique cineangiogram of patient with right sinus of Valsalva aneurysm. A. Diastole. Contrast-filled aneurysm (arrows) projects from the aortic root into the left ventricular cavity along the septal margin. B. Systole. Aneurysm empties of contrast medium. Three aortic sinuses are seen.

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Table 1

<table>
<thead>
<tr>
<th>Hemodynamic Data</th>
<th>Preoperative</th>
<th>Postoperative</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR (beats/min)</td>
<td>95</td>
<td>110</td>
</tr>
<tr>
<td>RA (mm Hg)</td>
<td>13/10* (8)‡</td>
<td>3/3* (1)</td>
</tr>
<tr>
<td>PA (mm Hg)</td>
<td>35/20 (20)</td>
<td>23/10 (14)</td>
</tr>
<tr>
<td>PCW (mm Hg)</td>
<td>22/20* (22)</td>
<td>14/20* (15)</td>
</tr>
<tr>
<td>LV (mm Hg)</td>
<td>156/26</td>
<td>118/11</td>
</tr>
<tr>
<td>AA (mm Hg)</td>
<td>110/40 (90)</td>
<td>95/71 (80)</td>
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<tr>
<td>CO (l/min)</td>
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<td>5.8</td>
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<tr>
<td>CI (l/min/m²)</td>
<td>3.6</td>
<td>3.6</td>
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<tr>
<td>AVG (mm Hg)</td>
<td>46</td>
<td>23</td>
</tr>
<tr>
<td>AI</td>
<td>Severe</td>
<td>Mild</td>
</tr>
</tbody>
</table>

Abbreviations: HR = heart rate; RA = right atrial pressure; PA = pulmonary artery pressure; PCW = pulmonary capillary wedge pressure; LV = left ventricular pressure; AA = ascending aortic pressure; CI = cardiac index; AVG = aortic valve gradient; AI = aortic insufficiency.
* ‘a’ and ‘v’ wave pressures respectively.‡ Mean pressures in parentheses.

Figure 3

Diagram of surgical closure of right sinus of Valsalva aneurysm with a patch graft.
as syphilis, bacterial endocarditis, atherosclerosis, and aortic dissection. As our patient had no findings to support an acquired etiology, his aneurysm was considered to be congenital in origin. In congenital sinus of Valsalva aneurysm, the basic defect is believed to be in the development of the annulus fibrosis. As a result of the failure of fusion between the bulbar septum and the aortopulmonary septum at the annulus fibrosis, the high intraluminal aortic pressure eventually causes aneurysmal dilatation of the sinus of Valsalva at the site of congenital weakness. Congenital sinus aneurysms are confined almost exclusively to the right coronary sinus. The ventricular septum lies below all parts of this sinus. Aneurysmal dilatation of the right sinus usually results in herniation or perforation into the right ventricle. Occasionally, the aneurysm prolapses into the left ventricle; the displacement of the associated, non-supported right aortic valve leaflet often results in aortic incompetence. Because of the usual location of an unruptured right sinus of Valsalva aneurysm in the outflow tract of the right or left ventricle, the clinical findings characteristically mimic aortic valvular disease. Our patient was typical in this regard; he presented with murmurs of aortic stenosis and insufficiency. The echocardiogram, however, delineated the aneurysm and its anatomic relation to surrounding structures. The aneurysm extended from the aortic root into the left ventricle; it filled during diastole and emptied during systole. Since the right aortic cusp exhibits anterior systolic motion in the aortic root, the presence of the aneurysmal echo in this location would imply an origin from the right sinus of Valsalva. Also, the herniation of the aneurysm into the left ventricular cavity adjacent to the interventricular septum would be most compatible anatomic with a right sinus of Valsalva aneurysm. In our experience the only other entity which is associated with a similar echocardiographic pattern in the aorta is a congenitally bicuspid aortic valve (fig. 6). However, the abnormal echoes are confined exclusively to the aortic root in the case of a congenitally bicuspid aortic valve, whereas the abnormal echo extended well into the left ventricular cavity in this patient with a sinus of Valsalva aneurysm (fig. 1).

Although right ventricular outflow tract obstruction has been reported due to an unruptured sinus of Valsalva aneurysm, significant left ventricular outflow obstruction has not been previously described. Preoperatively the aortic valve gradient was 46 mm Hg; postoperatively it was 23 mm Hg. The decrease in the aortic valve gradient was felt to be a result of the elimination of the left ventricular outflow obstruction produced by the aneurysmal sac. Also, the patch graft gave added support to the right aortic valve leaflet, thereby decreasing the amount of aortic valve prolapse and insufficiency.

Of clinical importance, the abnormal echocardiogram...
graphic pattern in this patient demonstrated that this was not a case of uncomplicated aortic valvular disease. Although this echocardiographic pattern may not always be present in unruptured sinus of Valsalva aneurysm, the presence of such an abnormal echo-producing structure should suggest this lesion.

**Acknowledgment**

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**References**

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