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.

left bundle branch block; the chest X-ray showed marked left ventricular enlargement. The echocardiogram revealed an abnormal structure extending from the aortic root into the left ventricular chamber adjacent to the interventricular septum (fig. 1). During diastole the structure moved away from the septum and toward the anterior mitral valve leaflet. During systole the structure moved toward the septum and into the aortic root in the position normally occupied by the right aortic valve leaflet. Also in the echocardiogram there was marked left ventricular dilatation and abnormal septal motion characteristic of left bundle branch block.7 Fluttering of the anterior mitral valve leaflet was noted, indicative of aortic insufficiency. Cineangiography demonstrated a right sinus of Valsalva aneurysm protruding into the left ventricle along the interventricular septum (fig. 2). The diastolic filling and systolic emptying of the aneurysm corresponded to the diastolic and systolic motion of the abnormal structure on the echocardiogram. Aortic stenosis and insufficiency were present (table 1).

On physical examination there were the following changes: the systolic ejection click was no longer sinus tract in the right aortic leaflet (fig. 3). Two months postoperatively, the patient was re-evaluated. The patient underwent surgical closure of the aneurysm sac by the placement of a patch over the present; both the systolic and diastolic murmurs were decreased in intensity, and the diastolic murmur was shortened in duration. The echocardiogram demonstrated dense thickening along the aortic root and contiguous interventricular septum; however the septum became thinner as the ultrasonic beam was directed deeper into the left ventricular cavity (fig. 4). Since the aneurysm was not excised but merely closed, the dense echoes probably represented thrombosis and fibrosis within the aneurysmal sac. Cineangiography revealed deformity of the right sinus of Valsalva in the area of the patch graft but no evidence of aneurysmal filling (fig. 5). There was a decrease in both the aortic stenosis and insufficiency (table 1).

**Discussion**

Aneurysms of the sinus of Valsalva may be either congenital or secondary to such underlying diseases

**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>15/10* (8)†</td>
<td>3/3* (1)</td>
</tr>
<tr>
<td>PA (mm Hg)</td>
<td>35/20 (26)</td>
<td>23/10 (14)</td>
</tr>
<tr>
<td>PCW (mm Hg)</td>
<td>22/26* (22)</td>
<td>14/20* (15)</td>
</tr>
<tr>
<td>LV (mm Hg)</td>
<td>150/26</td>
<td>118/11</td>
</tr>
<tr>
<td>AA (mm Hg)</td>
<td>110/40 (90)</td>
<td>95/71 (80)</td>
</tr>
<tr>
<td>CO (l/min)</td>
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<td>5.8</td>
</tr>
<tr>
<td>CI (l/min/m²)</td>
<td>3.6</td>
<td>3.6</td>
</tr>
<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 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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**Figure 3**

Diagram of surgical closure of right sinus of Valsalva aneurysm with a patch graft.
displacement of the associated, non-supported right aortic valve leaflet often results in aortic incompetence.\textsuperscript{13–15} 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.\textsuperscript{13–16} 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 anatomically with a right sinus of Valsalva aneurysm.\textsuperscript{9, 10} 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,\textsuperscript{11} 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 echocardiographic pattern of this patient was similar to that seen previously in patients whose congenitally bicuspid aortic valve was prolapsing into the left ventricle because of aortic root dilatation.\textsuperscript{23} The pattern is characterized by the absence of the normal echo complex at the aortic root and the presence of an abnormal echo complex at the base of the right sinus of Valsalva. The abnormal echo complex is usually seen in patients with congenitally bicuspid aortic valve, either alone or in combination with other congenital anomalies of the heart such as hypoplastic left heart syndrome, polyplasia, and aortic coarctation. The abnormal echo complex is also seen in patients with aneurysm of the right sinus of Valsalva, either alone or in combination with other congenital anomalies of the heart such as hypoplastic left heart syndrome, polyplasia, and aortic coarctation. The abnormal echo complex is also seen in patients with aneurysm of the right sinus of Valsalva, either alone or in combination with other congenital anomalies of the heart such as hypoplastic left heart syndrome, polyplasia, and aortic coarctation.
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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