Two-dimensional Echocardiographic Diagnosis of a Ruptured Right Sinus of Valsalva Aneurysm*

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The presence of rupture of a sinus of Valsalva aneurysm can be clinically suspected when an abrupt onset of congestive heart failure is accompanied by a continuous murmur, evidence of right and left ventricular volume overload, and bounding peripheral pulses. Classically, the diagnosis has been confirmed by angiography, but several reports suggest that M-mode and two-dimensional echocardiography can be of great value in diagnosing sinus of Valsalva aneurysms. We report the use of two-dimensional echocardiography, utilizing multiple views and contrast technique, as an adjunct to angiography in defining the nature, location, and size of a ruptured sinus of Valsalva aneurysm.

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CASE REPORT

A 23-year-old American-Samoan man was referred to our institution for evaluation of congestive heart failure. The patient had a history of heart murmur since the age of three years, but enjoyed normal growth and development. In December 1978, following several dental procedures, he developed fever, malaise, and nocturnal dyspnea. Physical examination revealed blood pressure of 140/40 mm Hg, and a regular heart rate of 90 beats per minute. A continuous thrill was palpated over the upper sternum. A grade 6/6 continuous murmur and a grade 2/6 murmur of aortic insufficiency were heard on auscultation. Repeated blood cultures were positive for coagulase negative Staphylococcus aureus. Despite treatment with antibiotics, digoxin, and diuretics, the patient's altered hemodynamic state persisted.

An M-mode echocardiogram from the left parasternal window revealed a dilated left ventricle with preservation of normal fractional shortening and moderate dilatation of the right ventricle. An ill-defined mobile target was noted in the right ventricular outflow tract anterior to the aortic root. This structure disappeared at the level of the mitral valve with the echocardiographic sweep.

We performed a two-dimensional echocardiogram with the patient in the left lateral decubitus position. In the short axis view of the left ventricle at the papillary muscle level, a windsock-shaped target appeared early in diastole in the right ventricular outflow tract just below the level of the pulmonary valve. This target disappeared late in diastole and was seen early in systole. This target could be traced through systole by M-mode echocardiography. The echocardiograms were consistent with the presence of a ruptured right sinus of Valsalva aneurysm.

Figure 1. Two-dimensional echocardiogram, short axis view, at level of papillary muscles. Sinus of Valsalva aneurysm (SVA) appears as well-defined target early in diastole, protruding into right ventricular outflow tract (RVOT). During early systole this target could not be seen. IVS = interventricular septum; RV = right ventricle; LV = left ventricle.
the pulmonic valve (Fig 1). At the aortic root level in short axis (Fig 2), a large outpouching of the right coronary sinus was noted to protrude anteriorly into the right ventricular outflow tract. Transducer position was left unchanged, and a 4 ml bolus of agitated saline solution was forcefully injected into a vein in the right arm. The contrast filled the right ventricular outflow tract and silhouetted the windsock-shaped target, confirming that it was an extension of the right coronary sinus. There was a dramatic negative contrast effect early in diastole, representing unopacified blood passing from the right coronary sinus into the right ventricular outflow tract through a small defect (Fig 3). Similar findings were noted when the long axis of the left ventricle was scanned.

We felt that these echocardiographic findings were consistent with a large sinus of Valsalva aneurysm of the right coronary sinus that had ruptured into the right ventricular outflow tract proximal to the pulmonic valve. The location of the aneurysm suggested that it had caused a loss of integrity of the aortic valve, with resultant aortic insufficiency. These findings were confirmed at angiography and subsequent surgery.

**DISCUSSION**

Although angiography has been the primary means of confirming the diagnosis of sinus of Valsalva aneurysms, several reports have indicated the value of M-mode echocardiography in making the diagnosis noninvasively. Findings that should suggest the diagnosis include echoes in the right ventricular outflow tract anterior to the aortic root, particularly if they are in a two-layered redundant pattern and are present between mid-systole to early diastole; systolic fluttering of the tricuspid valve; and premature opening of the pulmonary
valve. However, to date, no single M-mode echocardiographic feature has emerged as being diagnostic of ruptured sinus of Valsalva aneurysm.

Two-dimensional echocardiography, however, by permitting direct noninvasive visualization of the base of the heart, has resulted in fairly specific recognition of this lesion. Matsumoto et al. and Nishimura et al. have reported cases in which two-dimensional echocardiography demonstrated the location of the sinus of Valsalva aneurysm, as well as the actual site of rupture, in one patient and an associated ventricular septal defect (VSD) in another.

Three noteworthy defects present similarly to a sinus of Valsalva aneurysm by M-mode and two-dimensional sector scanning. The first, a ventricular septal aneurysm, is most frequently seen in the pediatric population, usually in association with a small VSD. Distinguishing features of this abnormality by two-dimensional scanning are (1) its subvalvular location and (2) the fact that it bulges into the right ventricle throughout systole, whereas a sinus of Valsalva aneurysm does so in early diastole. Second, aneurysms of both coronary arteries have been reported that can be differentiated from sinus of Valsalva aneurysms by their distant location from the aortic wall. Finally, coronary artery fistula can be confused with sinus of Valsalva aneurysms by echocardiography. To date, however, no two-dimensional echocardiographic feature has been reported that can distinguish the two.

Our case confirms the value of two-dimensional echocardiography in making the diagnosis of sinus of Valsalva aneurysm noninvasively. The addition of short axis views of the left ventricle and aortic root to long axis scanning of the left ventricle provided improved delineation of the anatomy. The use of contrast echocardiographic technique utilizing intravenous saline proved to be of great benefit in delineating the size and shape of the aneurysm, demonstrating the site of rupture, and proving that it was a left-sided supravalvular structure. We recommend two-dimensional long and short axis analysis of the left ventricle and right ventricular outflow tract with contrast technique when the diagnosis of ruptured sinus of Valsalva aneurysm is suspected or when the presence of such an aneurysm must be differentiated from the other causes of continuous murmur or aortic insufficiency.

REFERENCES
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