# Diagnostic Shelf

# Evaluation of a Precordial Continuous Murmur

## Rupture of Aneurysm of Sinus of Valsalva into the Right Ventricle

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A THIRTY year old man was seen with the complaint of dyspnea on effort of one year's duration. His present illness had begun thirteen months before, with severe upper abdominal pain occurring during strenuous exercise, followed by collapse and transient loss of consciousness from which he recovered spontaneously. He was kept on bedrest for thirty days but on resuming activity dyspnea on effort was noted. No history of rheumatic fever or known cardiac murmurs was obtained. The patient completed his army service without disturbances, and no cardiac abnormalities were detected on his military medical examination.

Physical examination revealed a thin young man with peculiar cervical pulsations. A positive venous pulse was present, with the characteristics of the undulating venous pulse. Carotid pulsations were strong and bounding and a water-hammer pulse was evident on forearm palpation.

Examination of the precordial region indicated cardiac enlargement, the apex beat being palpable at the sixth left intercostal space, 3 cm. beyond the nipple line. A left parasternal diffuse beat was present. Palpation revealed a continuous thrill at the fourth left intercostal space, 4 cm. to the left of the sternum. On auscultation, a loud, rough, continuous murmur with protodiastolic accentuation was heard. The second heart sound at the pulmonary area was split, both components being increased in intensity when compared with the first sound. Brachial arterial pressure was 130/65 mm. Hg.

An electrocardiogram (Fig. 1) revealed an rSR′ complex in right precordial leads, and tall R waves with depressed ST segments and diphasic (minus-plus) T waves in the left precordial leads. T wave negativity was present from leads $V_4R$ to $V_3$. Digitalis effect was also present in leads I and $V_6$. The record was interpreted as indicating biventricular hypertrophy and strain. Whether the rSR′ complex in the right precordial leads represented "incomplete right bundle branch block," late activation of the right ventricular outflow tract, or right ventricular hypertrophy was difficult to establish with the available data.

Radiologic examination revealed cardiac enlargement and pulmonary plethora in the posteroanterior position (Fig. 2a). The aortic knuckle, pulmonary artery and left lower segment were prominent. In the right anterior oblique position, right ventricular enlargement was evident and the left atrial esophageal impression was slightly prominent (Fig. 2B). In the left anterior oblique position, the left ventricular enlargement was apparent (Fig. 2C).

### DIAGNOSIS

Several diagnostic possibilities were considered. Patent ductus arteriosus was unlikely, as the position of the murmur was too

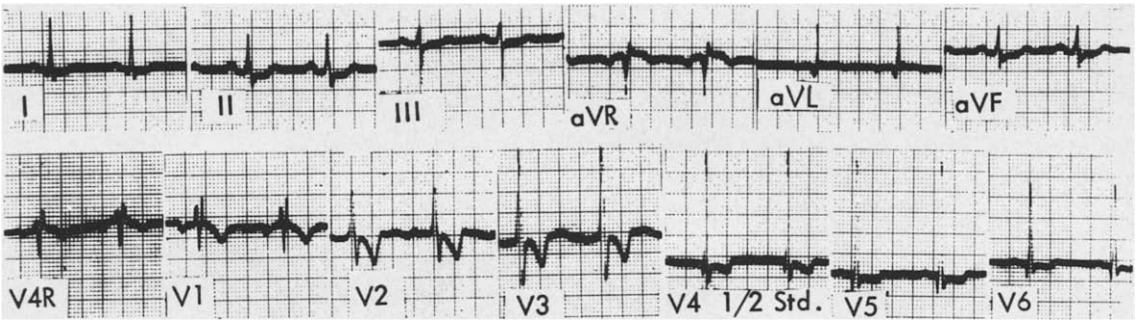


FIG. 1. Electrocardiogram showing rSR′ complex in lead $V_1$, tall R waves in lead $V_5$, and negative precordial T waves. It was interpreted as indicating biventricular hypertrophy and strain. Digitalis effect is also present.

low for this condition. Aortic-pulmonary septal defect was probable, on the basis of auscultatory signs and the peripheral pulse (Corrigan pulse). An intrathoracic arteriovenous fistula was another possibility. The previous negative medical examinations, the sudden development of upper abdominal pain and collapse one year previously, and the diastolic accentuation of the continuous murmur aroused the suspicion of a possible ruptured aortic aneurysm of the sinus of Valsalva into the right cardiac chambers.

Cardiac catheterization was performed, revealing slight elevation of the right ventricular and pulmonary arterial pressures and an increase in the oxygen content of the right ventricular outflow tract.

In an effort to elucidate the diagnosis further, a retrograde aortogram was performed. The pulmonary arterial trunk and ascending aorta were simultaneously visualized. On the basis of this finding the radiologist suggested an aortic-pulmonary septal defect. The history and physical examination, however, strongly indicated a ruptured aneurysm of the sinus of Valsalva into the right heart chamber. The marked cardiac enlargement and other clinical manifestations pointed to a progressive course and surgical correction seemed advisable.

*Surgical Findings:* Bilateral thoracotomy with sternal section was performed. The right atrium and ventricle were explored with a finger introduced through the right atrial appendage. An orifice of approximately 0.5 cm. in diameter between the right ventricle and aorta was found. Sutures were placed on the right ventricular wall in order to close or reduce the size of the defect.

The patient's postoperative course was uneventful except for a slight transfusion reaction. Dyspnea disappeared and cardiac enlargement diminished slightly. Physical findings and electrocardiographic abnormalities persisted.

## COMMENT

The present case shows the value of clini-

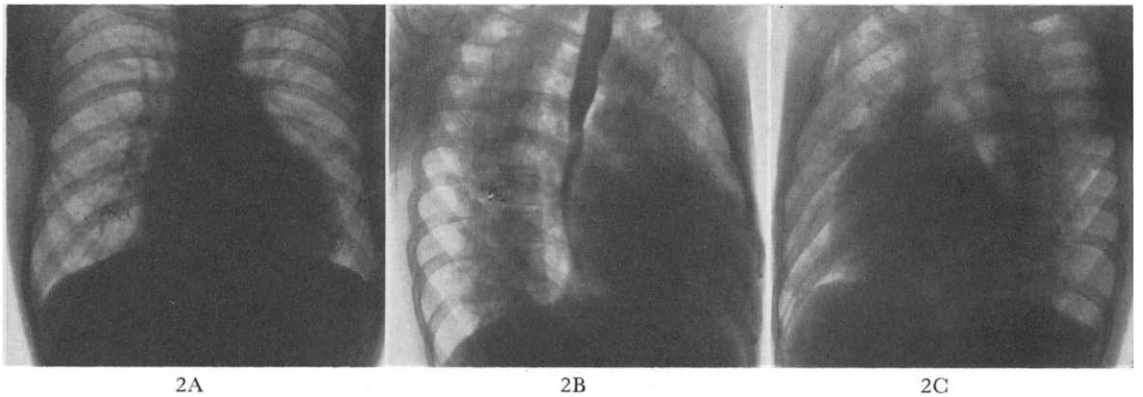


FIG. 2. A, chest x-ray in posteroanterior position, indicating cardiac enlargement and pulmonary plethora. There is prominence of the aortic knob, pulmonary trunk and lower left contour. B, in the right anterior oblique position, the right ventricular enlargement is evident. C, in the left anterior oblique position, the left ventricular border is well over the spine, indicating enlargement of that chamber.

cal examination, since the instrumental findings employed were unable to distinguish several anatomic abnormalities which produce similar hemodynamic alterations. As retrograde aortography failed to visualize the aortic-right ventricular shunt, only dye-dilution methods would have helped to establish a definite diagnosis.

There are several points worthy of emphasis in this case: (1) The normal findings in previous examinations in the presence of a loud and rough continuous murmur which could hardly be overlooked, even by an inexperienced observer; (2) the sudden onset of upper abdominal pain, collapse and syncope, indicating the actual rupture and; (3) the combination of an undulating venous pulse, revealing tricuspid regurgitation, and arterial dance in the neck, produced by the aortic-right ventricular shunt, suggestive of this condition. The protodiastolic accentuation of the continuous murmur suggests that the maximal blood shunting was produced during this phase of the cardiac cycle, when the muscular walls encircling the abnormal communication are relaxed and the right ventricular pressure is low. All clinical data pointed against the presence of the shunt since birth, and suggested instead a ruptured aneurysm of the sinus of Valsalva which was confirmed at operation.

Readers are invited to submit reports of interesting cases and illustrative tracings for this department. These should not exceed 1,000 words in length. Although not necessarily original, all material submitted should have teaching value.