Echocardiographic Manifestations of Postinfarction Ventricular Septal Rupture*

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The echocardiographic features of three patients with postinfarction ventricular septal rupture are described. All patients showed a decreased or paradoxical motion of the ventricular septum, and two of the patients demonstrated an unusual motion of the tricuspid valve. There were no abnormalities in mitral valve motion. The echocardiogram can be helpful in the diagnosis of postinfarction ventricular septal rupture and can assist in distinguishing this condition from acute disruption of the mitral valve complex.

Postinfarction ventricular septal rupture is an uncommon complication of acute myocardial infarction. Clinically, it is difficult to distinguish a ruptured ventricular septum from acute mitral regurgitation. The diagnosis is usually made in the catheterization laboratory with right ventricular catheterization and angio- graphic; however, rapid bedside differentiation can be accomplished by the use of a Swan-Ganz catheter.

In the coronary care unit, echocardiographic evaluation of three patients with postinfarction ventricular septal rupture showed that this technique was useful in evaluating this condition.

METHODS

The echocardiographic examination was carried out by the method described by Feigenbaum et al. Patients 1 and 3 were studied with the Smith-Kline Ekoline 20-A ultrasonic scope utilizing a Honeywell Fibro-optic continuous recorder. In patient 2 the Unirad ultrasonic scope was used in association with a Tektronix continuous recorder. Each patient was studied with a 2.5-mHz transducer of 1-cm diameter focused at 10 cm. Patients were in a recumbent position, and a watersoluble gel was used to obtain close contact between transducer and skin. The tricuspid valve was identified by placing the transducer in the third or fourth intercostal space at the left sternal border angulating 30° to 45° in a medial direction.

Case Reports

Case 1

A 62-year-old man was admitted to the coronary care unit with acute anteroseptal myocardial infarction on July 9, 1974. He had a three-year history of exertional chest discomfort relieved by rest but no prior history of myocardial infarction. Physical examination revealed a grade 2/6 aortic-flow murmur which was clearly heard in the neck; otherwise the findings from cardiovascular examination were unremarkable. The patient suffered several additional episodes of chest pain over a four-day period and then suddenly developed a grade 5/6 holosystolic murmur with thrill at the lower left sternal border. The chest x-ray film showed pulmonary vascular congestion. A Swan-Ganz catheter was inserted, and oxygen step-up was demonstrated at the ventricular level, confirming the diagnosis of ruptured interventricular septum. The patient remained stable for the following seven days and then had a recurrence of chest pain and died on July 20, 1974. Echocardiograms were recorded on the first two days after admission to the coronary care unit, six hours after the ventricular septal rupture, and on the day prior to death. The following features were noted (Fig 1): (1) a very strong echo was recorded from the tricuspid valve which had increased D-E excursion (25 mm), a flat E-F slope (17 mm/sec), and echoes of uncertain origin behind the valve in diastole; (2) there was diminished motion of the interventricular septum; (3) there was normal motion of the mitral valve.

Case 2

A 56-year-old man suffered an acute anterior myocardial infarction on July 1, 1974. On the second hospital day, the patient developed prolonged substernal chest pain, and on the third day a loud systolic murmur without thrill which radiated to the axilla and to the apex was noted along the lower left sternal border. A chest x-ray film revealed a large cardiac silhouette with interstitial pulmonary edema. A Swan-Ganz catheter was placed into the pulmonary artery; and during insertion, an oxygen step-up was demonstrated at the

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ventricular level. The patient subsequently underwent coronary and left ventricular angiography which revealed paradoxical motion of the interventricular septum and a defect in the interventricular septum at its midportion. There was total occlusion of the left anterior descending artery, and three-quarters of the ventricle was found to be akinetic. The patient was not believed to be an operative candidate and died on Aug 14, 1974.

An echocardiogram was performed 12 hours after the interventricular septal rupture; it demonstrated the following features (Fig 2): (1) There was paradoxical motion of the interventricular septal motion. (2) Portions of the tricuspid valve could be visualized within the right ventricular cavity. (3) Mitral valve motion was normal.

CASE 3

A 70-year-old man experienced severe, recurrent precordial pain for three weeks prior to admission, culminating in a severe attack of chest pain associated with syncope on Nov 26, 1973. On admission to the hospital, the patient was found to have acute anterior myocardial infarction. Physical examination revealed a holosystolic, diamond-shaped, grade 4/6 high-pitched murmur best heard at the lower left sternal border. No thrill was palpable, but an increased jugular venous "A" wave was noted. A chest x-ray film showed marked cardiomegaly and pulmonary congestion. The patient died on Dec 3, 1973. Postmortem examination of the heart revealed rupture of the anterior interventricular septum.

An echocardiogram was performed on the day of admission and revealed the following findings (Fig 3): (1) there was prominent motion of the tricuspid leaflet with increased D-E excursion (19 mm.) and a reversal of the E-F slope; (2) there was a decrease in the interventricular septal motion; (3) the patient had normal mitral valve motion.

DISCUSSION

The echocardiogram is utilized in this study to evaluate new murmurs in patients with acute myocardial infarction. There are no specific echocardiographic abnormalities which permit an unequivocal diagnosis of ruptured ventricular septum or ruptured papillary muscle; however, certain anatomic differences are identifiable on the echocardiogram. The tricuspid valve was visualized in each of the patients in this study. In two of these patients, a prominent motion of the tricuspid valve was present with an increase in the opening excursion and a decrease or reversal in the E-F slope. This motion results from both the right ventricular dilation and

![Figure 1. Abnormal motion of tricuspid valve is seen with increase in valve excursion and decrease in E-F slope. Electrocardiogram is distorted by artifact.](Image)

![Figure 2. Paradoxical motion of interventricular septum is demonstrated. Tricuspid valve is seen, and right ventricle is not dilated.](Image)
from the increased right ventricular diastolic pressure. In a recent study of echocardiographic findings in septal rupture, Chandraratna et al. described dilation of the right ventricle in each of the patients in their study and presented an illustration which showed a similar tricuspid valve motion. The ventricular septal rupture may also disrupt the chordae tendineae, another possible explanation for the abnormal tricuspid valve motion and for the unusual echoes noted behind the valve in one patient.

Paradoxical motion of the interventricular septum has been recorded in patients with ischemic heart disease and attributed to either aneurysm or to infarction of the septum. Each of the patients in this study had diminished septal motion at the level of the chordae tendineae, and one patient had definite paradoxical movement. This is in contrast to the study of Chandraratna et al., which demonstrated normal septal motion. The location of the septal injury may explain this difference. Each patient in our study had an anterior septal myocardial infarction, while two of their patients had an inferior infarction.

Echocardiographic features which might be anticipated from disruption of the mitral complex were not recorded. There was no flail motion of the mitral valve leaflets, the mitral E-F slope was not increased, nor was there prolapse of the mitral valve in systole. Left ventricular and left atrial sizes were normal initially, dilating only after the patients had been in persistent heart failure. The abnormal motion of the mitral valve seen by Chandraratna et al. was not noted in any of our patients.

The echocardiogram permits identification of some of the anatomic differences displayed between postinfarction septal rupture and mitral regurgitation. The role of the echocardiogram in patients with acute myocardial infarction has not been completely defined. This study suggests that the echocardiogram may be a helpful technique that is safe, atraumatic, and easy to apply at the bedside for differentiating between these two serious complications of the disease.

**REFERENCES**

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