ILLUSTRATIVE ECHOCARDIOGRAM

Mitral Valve Motion in Atrial Tachycardia with Block*

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A 56-year-old man was found to have Wolff-Parkinson-White Syndrome in 1968 after a sudden episode of atrial tachycardia had reverted to normal sinus rhythm. He discontinued maintenance medication and did well until March, 1973, when he presented with a one week history of dyspnea on exertion due to obvious congestive heart failure; he was found to have atrial tachycardia (atrial rate 240/minute) with varying A-V block (ventricular rate around 130/minute). The heart failure improved with digitalis and diuretics but the arrhythmia persisted even with the addition of quinidine sulfate. Digitalis was then withheld for three days and electrical cardioversion was performed with a synchronized countershock. The electrocardiogram just prior to conversion showed 4:1 conduction (Fig 1). The echocardiogram at this time (Fig 2) compared to one later during sinus rhythm (Fig 3) showed a number of interesting alterations of anterior mitral leaflet motion:

1. The velocity of opening (D-E) motion was increased (207 mm/sec compared to 182 mm/sec after cardioversion).
2. The amplitude of motion was increased (18 mm compared to 14 mm).
3. The diastolic (E-F) slope was increased (105 mm/sec compared to 63 mm/sec).
4. A well-defined extra anterior movement (x) was observed during diastole between the two seen normally (E and A points), as well as a similar but diminutive anterior movement occurring during ventricular systole (x), at least in the first two cycles depicted. The transducer direction apparently shifted slightly and the third cycle showed discontinuities in mitral and septal echoes and a more rounded hump during systole.

These echocardiographic features reflect hemodynamic alterations secondary to the arrhythmia. Although the atrial contraction corresponding to the P wave marked 1 occurs during systole when the mitral valve is closed due to ventricular contraction, it is nevertheless reflected in the mitral echogram by the tiny anterior movement (x) of the leaflet.

The atrial contraction corresponding to P wave marked 2 coincides with the opening of the mitral valve in early diastole and augments blood flow through the valve orifice. Increased blood flow through the mitral orifice may be reflected by increased velocity of opening motion, and also by increased amplitude of motion which then leads to a steeper E-F slope. Indeed P wave 2 does increase the velocity of opening (D-E) motion, the diastolic (E-F) slope and amplitude of excursion of the anterior mitral leaflet, but because the opening velocity change is small, its significance may be questionable.

The atrial contraction corresponding to the P wave marked 3 occurs during mid-diastole and displaces the anterior leaflet anteriorly causing a well-defined extra anterior movement (x).

The atrial contraction corresponding to the conducted P wave marked 4 occurs during late systole, as in a normal atrial kick, and displaces the leaflet anteriorly (A point) in the usual fashion.

Although the echocardiographic literature with respect to arrhythmias is scanty, diastolic fluttering of the anterior valve leaflet has been described in several conditions. Definite low amplitude movements (30-40 Hz) are present in about one-third of the cases of aortic insufficiency. Atrial fibrillation also produces fluttering during diastole but of slower frequency (5-10 Hz) and mid-diastolic oscillations of the mitral valve may be noted with slow heart rates in the absence of any atrial activity.4

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In the presence of atrial flutter, mitral valve fluttering motions are readily identifiable when sufficient atrioventricular block is present and indeed may be brought out by the appropriate use of carotid massage. In addition, in atrial flutter, oscillations of mitral valve prostheses may occur, the amount of which varies depending on the extent of left ventricular filling.

By contrast, similar movements of the mitral valve apparatus during ventricular systole have not been generally recognized. Indeed, although the echocardiogram has not generally been thought of as being particularly helpful in elucidating arrhythmias, the finding of small anterior movements despite systolic mid-position of the mitral valve apparatus, as in the present case, suggests that some possibility may exist, however limited, for echocardiographic detection of atrial activity otherwise hidden in QRS complexes. Although this has recently been confirmed by studies of several of our other patients with atrial arrhythmias and 2:1 conduction where alternate P waves were buried, the overall prevalence of this phenomenon and therefore, the potential usefulness of the technique is as yet unknown.

REFERENCES
4 Popp RL, Harrison DC: Echocardiography. In Noninvasive Cardiology. ed by Weissler AM, New York, Grune and Stratton, 1974. Pages 106, 173 (Fig. 3-15 C & D), 181