

THE MITRAL VALVE PROLAPSE SYNDROME

by Ferris J. Siber, M.D., Assoc. Med. Director & Frank I. Pitkin, M.D., Second Vice President & Medical Director
New England Mutual

One of us (F.J.S.), in an earlier edition of the *Journal of Insurance Medicine*, (Volume X, No. 1, Pages 4-7, January-March, 1979), described those anatomic considerations and measurements that have proven to be useful in the non-invasive technique of echocardiography.

This paper will discuss the application of ultrasonography to a specific cardiac disorder, the mitral valve prolapse syndrome, and discuss the manifestations on echocardiography.

Synonyms for this disorder include: Ballooning posterior leaflet syndrome; prolapsed mitral-leaflet myocardiopathy; systolic murmur-click syndrome; syndrome of apical systolic click, late systolic murmur, and abnormal T-waves; Barlow's syndrome; mitral ballooning; the billowing posterior mitral leaflet syndrome; mitral insufficiency due to myxomatous formation; "floppy" valve syndrome. (This last designation is especially appropriate since the syndrome is usually associated with myxomatous degeneration of part or all of the anterior and posterior leaflets of the mitral valve.)

We shall not develop the clinical picture other than to note that one group may consist of essentially asymptomatic individuals who present with a mid-systolic click, a late systolic murmur, or both.

The second group of patients present with a vague clinical picture consisting of fatigue, palpitations, both atypical and anginal types of chest pain, or fainting episodes.

In general, this syndrome has been considered to be entirely benign. However, reports in the literature have documented sudden death, presumably through the mechanism of an episode of a fatal arrhythmia. There is also growing recognition that a significant number of cases of bacterial endocarditis are associated with this syndrome. Mitral Valve prolapse occurs more frequently in females. Normally patent coronary arteries are usual, although coronary spasm has been reported. It should also be noted that up to 1/5th of the patients with mitral prolapse may also have tricuspid prolapse.

A number of patients have abnormalities of the bony thorax: straight-back syndrome, narrow anterior posterior diameter of the thorax, scoliosis, or pectus excavatum. The auscultatory hallmark of the mitral valve prolapse syndrome remains the mid-systolic click, the late systolic apical murmur, or both. Investigators have also described an early (rather than a mid) systolic click; a murmur throughout systole

(rather than late systole); and the absence of any other physical findings on examination.

The ECG may be normal or show infero-lateral ST-T changes, borderline prolonged QT interval, supraventricular and ventricular arrhythmias, atrio-ventricular block and pre-excitation.

In both groups of patients, echocardiography demonstrates the prolapse of the anterior and/or posterior leaflets of the mitral valve.

Simultaneous recording of the phonocardiogram and the echocardiogram show that the systolic click occurs about 0.06 seconds after the onset of the posterior prolapse of the leaflets with the murmur accompanying the posterior displacement.

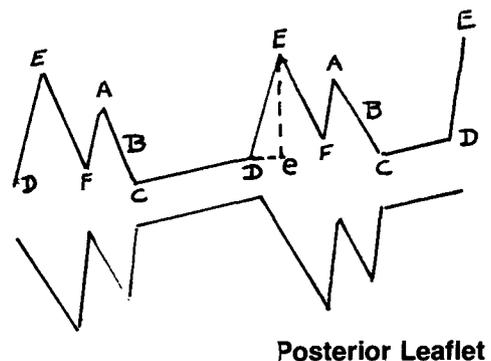
The conspicuous posterior displacement of the anterior and/or posterior leaflets of the mitral valve during ventricular systole does not occur in that individual presenting with a systolic click, but without a systolic murmur.

The echogram of the normal mitral valve is described and illustrated (Figure 1) in order that the echocardiographic manifestations of mitral valve prolapse can be better appreciated.

Figure 1

Anterior Displacement

Anterior Leaflet



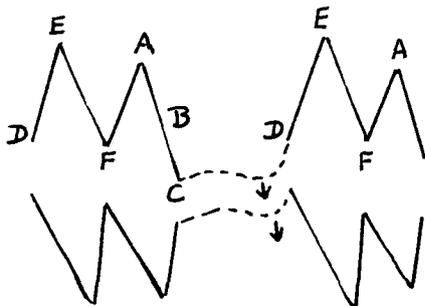
Anterior leaflet motion characteristics: an upward movement of the Mitral leaflet represents anterior displacement.

Posterior leaflet motion characteristics: the course mirrors that of the Anterior leaflet in DIASTOLE, but in the opposite direction, inscribing a W-shaped motion.

- A. As a result of Atrial Systole, the Anterior leaflet moves anteriorly. Thickness of Mitral valve leaflet: 1-3 mm.
- B. The Mitral valve then closes, producing a notched appearance.
- C. The Mitral valve is closed. This is Final End Diastolic Position. (Coincides with downstroke of the S complex).
- C-D. The anterior and posterior leaflets remain closed during systole. (Marked by the ECG Q-T interval). The leaflets move anteriorly slightly during systole.
- D. Closed position of Mitral valve just before Ventricular Diastole.
- D-E. Opening movement of Anterior Mitral Leaflet.
- E. Most anterior position of Anterior Mitral Leaflet, and marks start of Ventricular Diastole.
- E-F. Mitral Diastolic Downstroke, during the period of rapid ventricular filling = 80-200 mm/sec.
- F. Furthestmost posterior movement in mid-diastole of anterior leaflet.
- Ee. Height in millimeters = Mitral valve mobility = 25-35 mm.

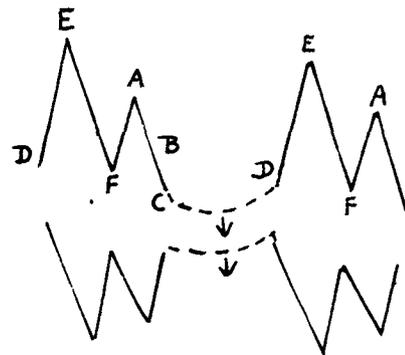
The echogram of the patient with the mitral valve prolapse syndrome (Figure 2) shows that the normal continuous anterior motion of the mitral valve leaflets is interrupted in mid-systole, with a posterior protrusion (in a semi-lunar pattern) into the left atrium, during middle and late systole. That is, there is an abrupt, sharp, mid-systolic posterior protrusion (bowing, ballooning, or buckling) of the anterior and/or posterior leaflets of the mitral valve into the left atrium.

Figure 2



Another established echographic pattern of prolapse records ballooning *throughout* systole, resulting in a "hammock" pattern. That is, there is pansystolic, posterior bowing of the anterior and/or posterior leaflets of the mitral valve.

Figure 3



Currently, it is noted that one may expect to observe mid systolic as frequently as pansystolic ballooning.

Numerous studies have demonstrated the constancy of the echocardiographic abnormality and its correlation with the angiographic and anatomic abnormalities of the mitral valve prolapse syndrome.

The anterior and posterior leaflets of the mitral valve are redundant and result in the reflection of multiple echos (multiple lines) during systole. However, this systolic mitral layering may also be observed normally as well as in association with mitral valve prolapse.

Mitral regurgitation is also associated with this syndrome, but is only occasionally of such hemodynamic significance as to require revision of the mitral ring or valvular replacement. The mechanism of mitral regurgitation appears to be as follows: There is a posterior displacement of the anterior and posterior leaflets of the mitral valve, beginning in mid-systole. The posterior leaflet apparently moves slightly more posteriorly than the anterior leaflet, resulting in incomplete coaptation of the leaflets (during middle and late systole) with resultant regurgitation.

In summary, echocardiography provides an accurate non-invasive technique for the assessment of the mitral valve prolapse syndrome.