
The authors reply:

To the Editor:

As Dr. Mirsky points out, clinical determinations of cardiac contractility are complicated both by errors inherent in obtaining data and difficulties in interpretation. We attempted in the manuscript to discuss these problems in detail. It does not seem fruitful to repeat the discussion; however two points deserve further comment.

Dr. Mirsky states: "In numerous studies with children it has been observed that analysis of data taken from Statham SF-1 and P23Db pressure transducers yield significantly different results." We are not aware of any data to document that statement. The only published studies in children which we have seen are from the laboratory of Dr. Mirsky and his associates.1 2 They utilized both catheter-tip transducers and fluid-filled catheter systems and imply that similar results were obtained. Our conclusion, based on detailed estimates of the errors introduced by the limited dynamic response of fluid-filled catheters presented in our paper, is that well-designed systems can be used successfully to obtain \( V_{\text{max}} \).

In our initial studies,3 we obtained results in a small group of 12 patients which were similar to those of Gault et al.4 in 15 patients. As we expanded the series and included more patient groups, we found that the correlations based on \( V_{\text{CG}} \) at peak stress and peak \( V_{\text{CF}} \) were not useful in separating patients.

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Ultrasonic Echoes

To the Editor:

Ultrasonic echoes show motion of the mitral ring, not the opening of the valve. Ultrasonic echoes from the pericardium, the walls of the heart chambers and the valves have given useful diagnostic information. But we must realize that the echo labeled "anterior mitral leaflet" only shows motion of the ring, and tells us nothing about separation and approximation of the leaflets, for there rarely is any echo from the posterior leaflet.

Siggars5 suggests that the motion observed is a composite of motion of the leaflet and that of the ring. Actually it has only the pattern of ring motion, familiar to us for a quarter of a century in the studies of calcific rings by fluoroscopy,2 slit kymography,3 and cinefluorography.4 It moves toward the apex during systole as the papillary muscles, through tension on the chordae and leaflets, pull the base of the heart down. It moves toward the atrium during diastole when muscular relaxation, the filling of the ventricle, and emptying of the atrium allow the ring to move back up.

The leaflet echo shows only the motion of the ring, whose septal edge has the largest excursion of any part of the heart,5 and a separation of a posterior leaflet from the conventional echo in diastole is observed only in markedly dilated hearts.6 The diastolic aperture is a crescentic slit and motion of the leaflets relative to the ring or to each other is "surprisingly" small.7

The actual motion of the leaflets, as described in dogs, has been confirmed in man by cineangiography.8 It has been best analyzed by ultrasonic echoes and cineangioograms of the mitral area in patients whose chordae and papillary muscles have been removed and who have an aortic homograft with semilunar cusps in the mitral orifice.9 These valve leaflets bulge toward the atrium throughout systole and remain wide open, pushed toward the apex, during diastole. Their pattern of motion matches that of normal mitral leaflets in studies which exclude annular motion, and is quite different from the conventional "anterior leaflet" echogram.

It is desirable to name an echo which moves like a ring as though it originated in the ring, and
to avoid a name which suggests that it might reveal the opening and closing of the leaflets of the mitral valve. Leaflets move swiftly when pressure reversal occurs at the orifice; the annulus moves slowly as the whole ventricle recoils from ejection into the aorta and the papillary muscles contract. The ring returns slowly toward the base when ventricular inflow is slow, as in mitral stenosis, and very swiftly when inflow is rapid, as in mitral insufficiency10,11 (see fig. 1). It thus provides valuable data for the clinician when its motion is recorded. It does not disclose the swift closure and reopening of the valve which might occur with third and fourth sounds in diastole, since transient reversals of pressure gradients at the mitral valve have been recorded in horses, which usually have third and fourth sounds.12 Perhaps ultrasonic echoes from horses would regularly show echoes from both leaflets in these huge and relatively slowly moving organs.

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**Reply to Dr. Dock:**

To the Editor:

I have to disagree with Dr. Dock's Letter to the Editor entitled "Ultrasonic Echoes." I believe there is ample evidence from several investigators documenting that the echocardiogram does indeed record echoes from the leaflets of the mitral valve and not just the mitral ring. This evidence ranges from work done a number of years ago by Dr. Edler. There is also anatomical data obtained from a group from Philadelphia. Our studies with intracardiac injections of indocyanine green dye also demonstrate that the mitral valve echo is truly intracavitary and is not a border-forming structure as would be the case with the mitral ring.

There is no question that the mitral valve echoes do reflect ring motion as well. This fact is
Ultrasonic Echoes
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