

ECHOCARDIOGRAPHY IN THE EVALUATION OF MITRAL VALVE DISORDERS

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INTRODUCTION

APPLICATION OF ultrasound for diagnosis in cardiology was initially reported by Edler and Hertz (1954). These studies were mainly on the recognition of mitral valve motion and the evaluation of mitral stenosis. Following this report development in this area of diagnostic cardiology has been rather slow and it is only in the last decade or so that significant advances have been made and its applications in clinical cardiology given adequate attention and recognition. Echocardiography as a diagnostic aid was introduced into this country at the University Hospital in May 1976. The purpose of this paper is to review its value with reference to evaluation of mitral valve disease in patients seen at the University Hospital.

MATERIALS AND METHODS

Six hundred and fifty examinations which yielded technically satisfactory echocardiograms recorded over the period 1st June 1976 to 30th July 1978 were reviewed.

Echocardiograms were obtained with a Smith-Kline Ekoline 20A ultrasonoscope using a 1.5 cm diameter 2.25 m Hz transducer focused at 10 cm and a repetition rate of 1000 per second permitting an examination of up to 20 cm tissue depth with excellent resolution. Simultaneous electrocardiographic recordings were obtained in all patients. Echocardiograms were recorded on a polaroid photographic system and more recently on a Cambridge multi-channel photographic strip chart recorder. Patients were examined either supine or propped up, the transducer was positioned in the 3rd or 4th left intercostal space parasternally and a systematic examination of the heart was performed by the standard technique (Feigenbaum, 1977).

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RESULTS AND DISCUSSION

A large proportion of patients (37%) referred for screening had normal echocardiograms. Majority of these patients had borderline clinical abnormalities. A typical example of such a normal mitral valve echo is as illustrated (Fig. 1).

Rheumatic Mitral Stenosis: 63.8% of abnormal echocardiograms were performed for mitral stenosis. A review of the 261 echograms (40%) has shown that ultrasound is an excellent method of confirming the presence of mitral stenosis. The abnormalities noted are mainly those of the pathologic processes affecting the mitral valve and an assessment of the functional disturbances. In the diagnosis of mitral stenosis synchronous movement of the two leaflets (Duchak *et al.*, 1972) is an important sign and it distinguishes mitral stenosis (Fig. 2) from other disorders with a reduced EF slope and decreased C-E amplitude as seen in low cardiac output states. With respect to the pathological processes affecting the valve, fibrotic thickening is represented by thick lines instead of the fine lines of a normal mitral valve leaflet. The presence of very thick heavy irregular multi-layered lines indicate the presence of calcification (Fig. 3). Nanda *et al.* (1972) have shown ultrasound to be a sensitive method of assessing the presence of mitral valve calcification.

The severity of the mitral stenosis may be somewhat assessed by ultrasound. A slow anterior mitral valve leaflet diastolic closure rate as manifested by a reduced E-F slope (Fig. 2) gives some idea of the severity of the stenosis. Several investigators have found this to be a useful parameter to assess severity (Edler, 1967 and Effert, 1967). It has been our experience that this is so. We have found it useful for the follow up of patients after mitral commissurotomy. An increase in the anterior mitral valve leaflet diastolic closure rate has been noted in our patients in the immediate and 6 month post-operative follow up. Its long term value in assessment of these patients is currently being evaluated at our centre. However,

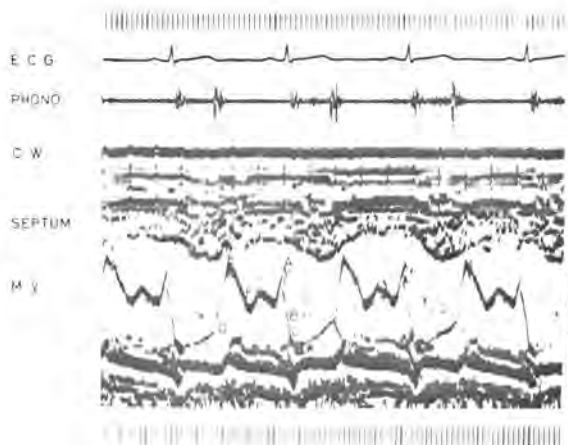


Fig. 1 Normal mitral valve echogram.
(C.W. = Chest Wall; M.V. = Mitral Valve)

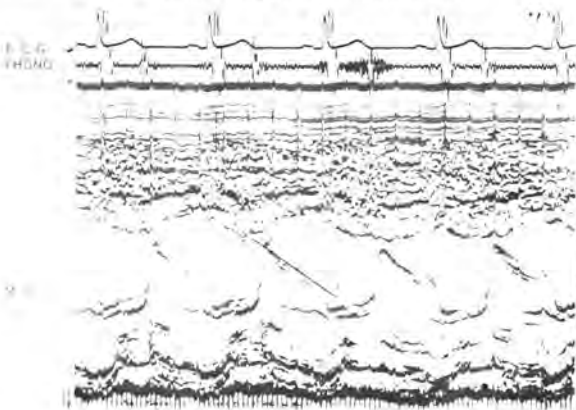


Fig. 2. Mild Mitral Stenosis (MV = Mitral Valve)

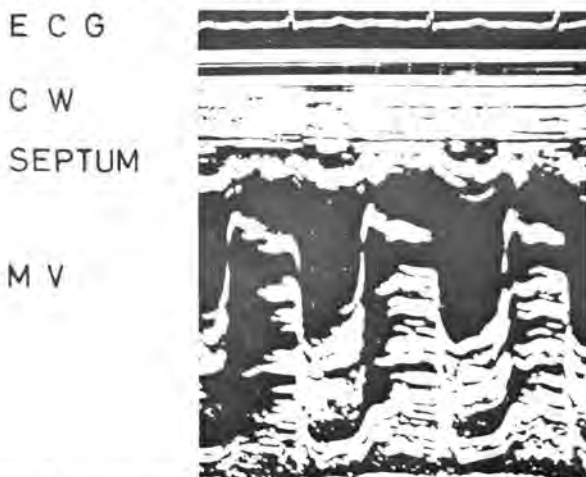


Fig. 3. Severe mitral stenosis with calcification of the posterior mitral leaflet.
(C.W. = Chest Wall; M.V. = Mitral Valve)

several authors (Mary *et al.*, 1973; Cope *et al.*, 1975 and Shiu, 1977) have refuted this and the accuracy of the E-F slope as an indicator of the severity of the mitral stenosis is doubted. A rough guide is that patients with synchronous movement of both leaflets and anterior mitral leaflet closing velocity (E-F slope) of under 35 mm/sec probably have mitral stenosis (Feigenbaum, 1977). Those with a velocity under 15 mm/sec have severe mitral stenosis (Feigenbaum, 1977). However any condition producing impaired left ventricular filling such as low cardiac output states and hypertrophic cardiomyopathy should be excluded. It has been our experience that the mitral valve closure index as proposed by Shiu (1977) has been useful in assessing the severity in patients with mitral stenosis and following their progress after mitral commissurotomy. A reduced amplitude of motion (C-E) of the anterior mitral valve leaflet is related to the severity of obstruction but may also be seen in patients with heavily fibrotic or calcified and rigid valves (Fig. 4) which are therefore unsuitable for mitral commissurotomy and should be replaced.

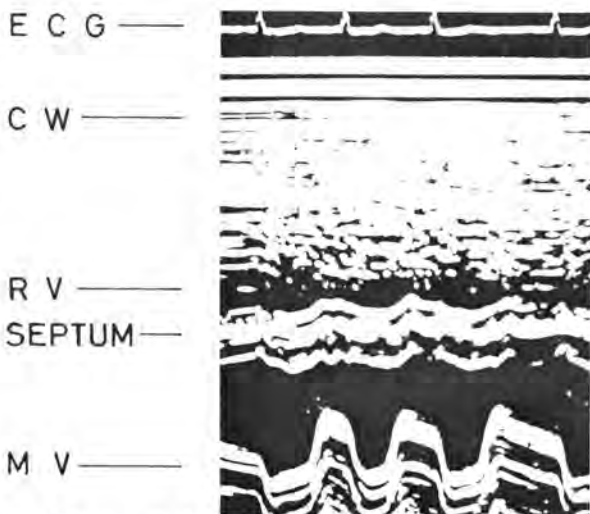


Fig. 4. Severe mitral stenosis with a rigid, fibrotic and calcified valve. (C.W. = Chest Wall; R.V. = Right Ventricle, M.V. = Mitral Valve).

Rheumatic Mitral Regurgitation: In mitral regurgitation uncomplicated by mitral stenosis a very rapid E-F slope is a common manifestation (Fig. 6). If mitral stenosis and incompetence co-exist the E-F slope is frequently reduced. The latter is probably the commoner manifestation. A frequent accompaniment is a very large left atrium. Sixteen

patients were examined for chronic rheumatic mitral regurgitation.

Non-Rheumatic Mitral Incompetence: In non-rheumatic mitral incompetence reflected ultrasound is useful in the diagnosis of a floppy mitral valve, ruptured chordae or papillary muscle dysfunction. Twenty seven patients had echocardiographic evidence of mitral valve prolapse (floppy mitral valve). A mid-systolic click in the phonocardiogram associated with a prominent mid- or late-systolic posterior displacement of the anterior and/or posterior leaflet(s) is of diagnostic value in patients with a floppy mitral valve (Fig. 5). Occasionally a holosystolic prolapse may be noted. A ruptured chordae will frequently show a prominent posterior prolapse of the posterior mitral leaflet in systole (fig. 6). Fine oscillation may be present and a rapid diastolic closure rate is a common accompaniment.

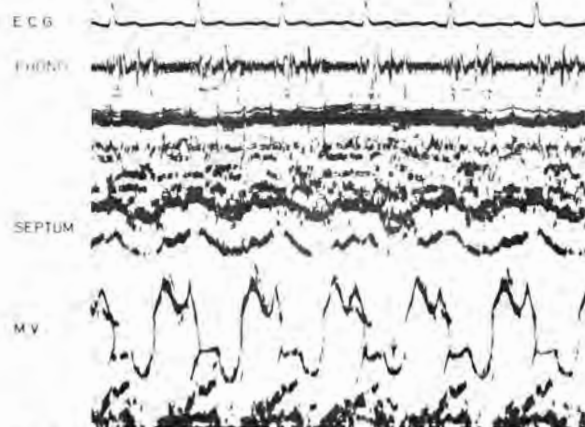


Fig. 5. Mitral valve prolapse (arrowed) [M.V. = Mitral Valve]

Changes in the mitral valve echogram in other disorders:

The mitral valve echogram has been found in our experience to be particularly valuable in the diagnosis of the following diseases of the heart: left atrial myxomas; demonstration of mitral valve vegetations; excluding the presence or organic mitral stenosis in patients who have a mitral diastolic murmur (Austin-flint) with aortic regurgitation; assessing the degree of premature closure of the mitral valve in acute aortic regurgitation; demonstration of aorto-mitral continuity in cyanotic congenital heart disease and thus excluding transposition of the great arteries or



Fig. 6. Posterior mitral valve chordae rupture.

double outlet right ventricle and the demonstration of systolic reopening of the anterior leaflet of the mitral valve in patients with hypertrophic obstructive cardiomyopathy.

CONCLUSION

Hence it appears that the echocardiographic study of the mitral valve is of value in the diagnosis of various disorders. It is of particular value in the evaluation of patients with mitral stenosis with specific reference to their suitability for mitral commissurotomy. Confirmation of mitral valve prolapse and mitral chordal rupture can be easily obtained. Apart from this, the mitral echogram can assist in the diagnosis of a variety of other disorders which indirectly affect the mitral valve. Its main advantage is that it is entirely non-invasive and offers total safety of the patient. It can supply information to the physician which can assist him in making an accurate analysis of the pathological processes that affect the mitral valve. In certain instances this information cannot be obtained by any other known examination of the heart, including invasive procedures.

SUMMARY

The clinical application of echocardiography in the evaluation of mitral valve disorders in Malaysian patients as seen in the study of 650 examinations performed during the period June 1976 to July 1978 at the University Hospital is reviewed. Diagnosis and evaluation of chronic rheumatic mitral stenosis appears to be its most valuable and frequent contribution. In addition it is useful in a variety of other disorders which directly or indirectly affect the mitral valve.

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