THE SIGNIFICANCE OF ATRIAL FIBRILLATION IN RHEUMATIC MITRAL STENOSIS: AN ECHOCARDIOGRAPHIC STUDY

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INTRODUCTION

THE onset of atrial fibrillation in patients with mitral stenosis is associated with progression of the severity of the disease. The present study was undertaken to correlate left atrial size, severity of mitral stenosis and the occurrence of calcified and/or rigid fibrotic mitral valves with the presence of atrial fibrillation or sinus rhythm using reflected ultrasound to evaluate the mitral valve.

MATERIAL AND METHODS

Two hundred and fifty patients with rheumatic heart disease echocardiographically confirmed to have mitral stenosis seen over a 2 year period May 1976 to June 1978 were admitted into the study. Echocardiograms were performed using a Smith-Kline Ekoline 20A ultrasonoscope using a 15 mm diameter 2.25 mHz transducer prefocused at 10 cm and a repetition rate of 1000 per second permitting an examination of up to 20 cms tissue depth with excellent resolution. Simultaneous electrocardiograms were recorded in all patients. Echocardiograms were recorded using either a polaroid photographic system or a cambridge multichannel fiberoptic photographic strip chart recorder. The 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 a standard technique (Feigenbaum, 1976).

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The criteria used to diagnose mitral stenosis (Fig. 1) was the presence of a slow diastolic closure rate of the anterior leaflet of the mitral valve associated with synchronous movement of both leaflets (Duchak *et al.*, 1972). The severity of the stenosis were assessed using the diastolic closure rate of the anterior mitral valve leaflet (Feigenbaum, 1976). Mild mitral stenosis was said to be present when the anterior mitral valve leaflet diastolic closure rate was between 26 mm/sec to 35 mm/sec. Moderate mitral stenosis was defined as an anterior mitral valve leaflet diastolic closure rate of 15 to 25 mm/sec. and severe mitral stenosis was defined as an anterior mitral valve leaflet diastolic closure rate of less than 15 mm/sec. (Feigenbaum, 1976). Mitral valve calcification was noted to be present if either anterior and/or posterior leaflet was found to have multiple layered echos (Fig. 2). The

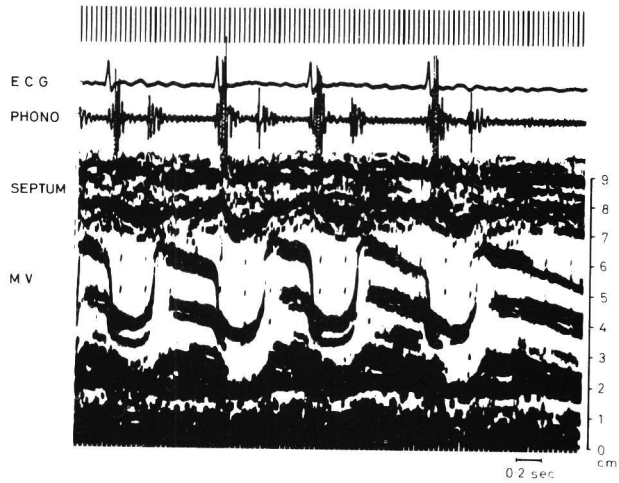

Fig. 1. Mitral stenosis with atrial fibrillation. [MV = mitral valve]

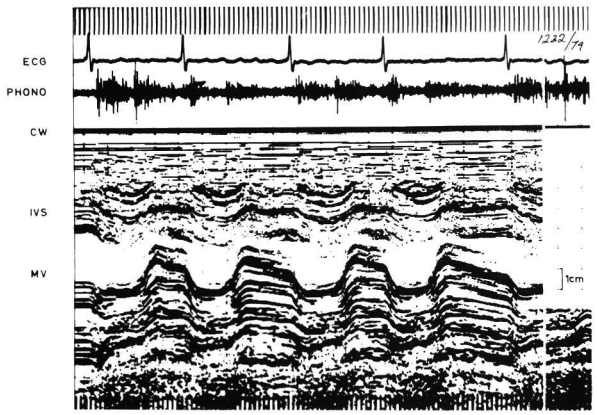

Fig. 2. Mitral stenosis with heavy calcification and atrial fibrillation [MV = mitral valve; IVS = interventricular septum; CW = chest wall].

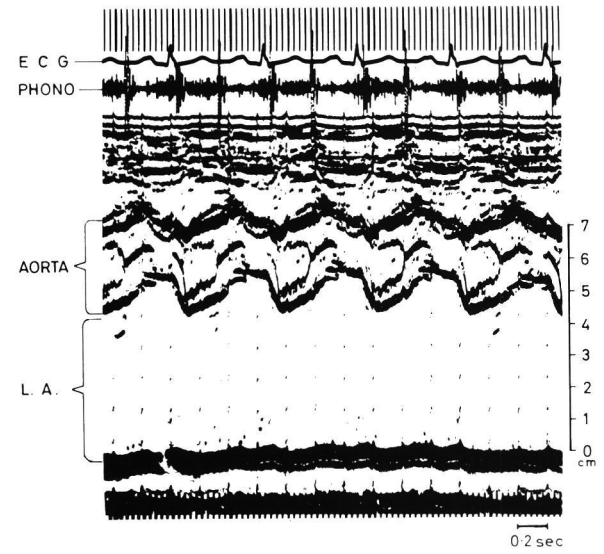

Fig. 3. Enlarged left atrium [LA = left atrium].

valve was assessed as rigid if the amplitude of opening of the anterior mitral valve leaflet was less than 20 mm. Left atrial enlargement was considered to be present if the anteroposterior diameter measured by ultrasound exceeded 4 cms (Fig. 3). The data obtained were subjected to statistical tests of significance.

FINDINGS

The findings in this study are summarised in Tables 1, 2 and 3. In comparing the groups with rigid mitral valves, calcified mitral valves and pliable mitral valves in Table 1 there is an overall significant difference in the occurrence of sinus rhythm or atrial fibrillation (x^2 = 31.6825; $p<0.001$). A comparison of patients with rigid mitral valves with those with calcified mitral valves shows no statistical difference between the two as to the occurrence of atrial fibrillation or sinus rhythm (x^2 = 0.0148 with Yate's correction $p>0.05$). The overall significant difference observed in Table 1 is contributed by the difference between those with pliable mitral valves as compared with rigid and calcified mitral valves taken together (x^2 = 29.7697 with Yate's correction $p< 0.001$). The data suggests that while patients with rigid and calcified mitral valve stenosis tend to be in atrial fibrillation more frequently, those with pliable mitral valves tend to be in sinus rhythm.

A comparison of the three grades of severity of mitral valve stenosis as to the occurrence of sinus rhythm or atrial fibrillation (Table 1) shows a statistically significant result at the 5% level of significance (x^2 = 8.2583; O.O2>p> O.O1). A comparison of the groups with moderate and severe degrees of stenosis as to the occurrence of atrial fibrillation or sinus rhythm produced a non-significant result (x^2 = O.O185 with Yate's correction p>O.O5). However a comparison of patients with mild mitral stenosis against those with moderate and severe stenosis taken together produced a significant result (x^2 = 7.1OO6 with Yate's correction p<O.O1). Examination of the data suggests that a larger proportion of those with mild mitral stenosis tend to be in sinus rhythm compared to those with moderate and severe mitral stenosis. A test for linear trend in proportions observed in Table II was carried out as follows: Total x^2 = 8.2583 O.O2> p> O.O1; Linear trend x^2 = 6.5060 O.O2> p> O.O1; Deviations x^2 = 1.7523 O.20> p> O.1O.

Table I

Echocardiographic assessment of pathological changes on the valve in Mitral Stenosis

Rhythm	Rigid valves	Calcified valves	Pliable valves	Total
Atrial fibrillation	19	19	56	94
Sinus rhythm	7	9	140	156
Total	26	28	196	250

Table II

Echocardiographic assessment of the severity of mitral stenosis

Rhythm	Mild Stenosis	Moderate Stenosis	Severe Stenosis	Total
Atrial fibrillation	5	20	69	94
Sinus rhythm	28	31	97	156
Total	33	51	166	250

Table III

Left Atrial Size in Mitral Stenosis

Rhythm	Enlarged Left atrium	Normal Left atrium	Total
Atrial fibrillation	55	39	94
Sinus rhythm	50	106	156
Total	105	145	250

At a significance level of 5 per cent the evidence suggests that there is a significant linear trend in the increase in proportions of cases with atrial fibrillation.

An analysis comparing patients with a normal sized left atrium and those with a large left atrium revealed a significant difference between the two as to the occurrence of sinus rhythm or atrial fibrillation ($x^2 = 16$; $p < 0.001$). Examination of the data suggests that a greater proportion of those with a large left atrium have atrial fibrillation and that there is a higher proportion of patients with sinus rhythm amongst those with normal sized left atria. (Table III).

DISCUSSION

The natural history of rheumatic mitral stenosis has been well documented since the advent of cardiac catheterization and cardiac surgery (Wood, 1954; Goodwin *et al.*, 1955; McDonald *et al.*, 1967). It is well recognised clinically that the onset of atrial fibrillation is related to the occurrence of increasing effort dyspnoea of a moderate degree. However, the significance of atrial fibrillation in relationship to the pathological changes occurring in the valve in the clinical setting has not been worked out. Earlier studies have indicated a higher incidence of atrial fibrillation in patients with an enlarged left atrium and rheumatic mitral valve disease. This is confirmed in this study as well. In keeping with previous clinical studies (Hurst *et al.*, 1974) this echocardiographic study has demonstrated that a larger proportion of patients with mild mitral stenosis tend to have sinus rhythm whereas those with moderate to severe stenosis tend to have an increasing incidence of atrial fibrillation. In addition to this, it has been shown in this study that the presence of calcified or rigid mitral valves predisposes to the presence of atrial fibrillation more frequently than those with pliable mitral valves who tend to have sinus rhythm.

Evaluation of the patients with mitral stenosis by echocardiography is thus essential preoperatively as has been borne out by this study as mitral commissurotomy can be performed in virtually all patients with moderate to severe mitral stenosis and a mitral valve mobility of greater than 20 mm, in the absence of calcification. However, presence of calcification or rigid valves indicates that the valve is unsuitable for commissurotomy.

SUMMARY

Two hundred and fifty patients with echocar-

diographic evidence of mitral stenosis were analysed to correlate the presence of atrial fibrillation or sinus rhythm with the severity of the mitral stenosis, left atrial size and the presence of mitral valve calcification or heavy fibrosis resulting in rigid stenotic mitral valves. There appears to be a higher probability of the occurrence of atrial fibrillation in patients with calcified or rigid valves than those with pliable mitral valves. Patients with mild mitral stenosis tend to be in sinus rhythm compared to those with a more severe degree of mitral valve stenosis. As the mitral stenosis progresses from a mild to severe degree there is a significant linear trend in the increase in proportions of cases with atrial fibrillation. It appears that a greater proportion of those with large left atrial tend to have atrial fibrillation.

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