Echocardiographic Assessment of Patients With Isolated Mitral Stenosis

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Summary:

Isolated mitral stenosis for all intents and purposes is Rheumatic in origin. This study assessed some variables, i.e., MVA, AML-EF slope, LV Ejection Fraction, and LVPW diastolic motion, in 52 patients with isolated mitral stenosis. As there is poor correlation of AML-EF slope and MV Area, 2D is superior to M-Mode Echo. Reduced LV Ejection Fraction may indicate Rheumatic Carditis. Loud P2 may be heard in cases with large RV but may not necessarily indicate pulmonary hypertension.

Introduction:

The incidence of Rheumatic fever is common between ages of 5-15 years and Rheumatic heart disease around 25 years. The disease is disappearing from the western society. It is however major cardiovascular problem in developing countries like Pakistan.

MVA measured by 2D-echocardiography[2,6,10,11,14,21,25] is accepted all round the world equivalent to measurement done by angiography.

Mitral valve area, in these cases was less than 2.25cm^2. EF slope of Anterior mitral leaflet, diastolic motion of LVPW was reduced in all the patients in comparison to normal subjects of the same age and sex. Left ventricular ejection fraction remained normal in all the patients except 6.

Fifty Two patients with isolated mitral stenosis assessed by above procedure show poor correlation[10,14,15,17] of Anterior mitral leaflet EF slope and LVPW[23] diastolic slope to MVA.

Six cases with reduced LV ejection fraction in cases of isolated mitral stenosis are due to Rheumatic myocarditis.

Material and Methods

Subjects of study: Cases suffering from isolated mitral stenosis were picked up from department of cardiology since 1986. The diagnosis of mitral stenosis is made on history, clinical exam, x-ray chest P/A & left anterior oblique view.

All were subjected to confirmation by M-Mode Echocardiography using Echopan KS. Siemen's machine with 2.2 mhz transducer. Patients with combined valvular lesion's even minor mitral regurge, were excluded from this study.

These patients are those individuals who came to the hospital after becoming symptomatic usually with complaints of palpitation, dyspnoea or haemoptysis.

All patients were isolated mitral stenosis had initial check up on Echopan KS machine were subjected to echo recordings and measurements. The recordings were done on sono ranger MI 1000 with 3.5 mhz transducer with in built computer, Fuji thermal imaging is used for various frames, left parasternal long axis, short axis, apical 4 chamber view and M-Mode echo recordings are done with above sector scanners Special attention was given to gain settings and resolution of pictures.

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Amplitudes, slopes, velocities, MVA, Ejection fraction of LV are done according to Feigenbaum[10].

Thirtyfive normal individuals of approximately same age, gender are also assessed by the sector scanner for comparative normal values.

Results:

Isolated MS is frequently seen in this part of the region, 52 cases with isolated MS : 22 males with mean age 26 years and 30 female patients with mean age 33 years are presented in this on going study for comparative study, 35 normal subjects of the same age and gender were also assessed (table-1).

TABLE-1

PATIENT OF ISOLATED MITRAL STENOSIS

Under Study	=	52
Males	=	22 (42.3%) Mean Age 26 Yrs.
Females	=	30 (57.7%) Mean Age 33 Yrs.

Mitral stenosis is not the disease of Mitral leaflets alone[2,11,12], but it affects the whole mitral apparatus to variable extent. The severity[10,12,14,25] of disease (table-2) is assessed by recording mitral valve area, 27 patients had severe disease, 20 had moderate disease, 5 had mild disease (table-2).

TABLE -2

SEVERITY OF MITRAL STENOSIS DISEASE

MS	No. Cases	MVA cm^2
Severe	27 (51.9%)	$<1cm^2$
Moderate	20 (38.5%)	1.01-1.5 cm^2
Mild	5(9.6%)	1.5.01-2.25 cm^2
Normal	35 cases	3.5-5.8 cm^2

Thirtyfive normal subjects had MVA during end diastole 3.5-5.8cm^2, left ventricular regional and global functions assessed by 2D and M-Mode Echo(table-3) show 6 cases out of 52 with EF of LV less than 40. All the remaining 46 cases had EF equal to that of normal subjects. EF slope of AML is a function of amount and velocity of the blood flow through mitral orifice during diastole and was decreased (table-4). All the patients in comparison to 35 normal subjects had EF slope of AML less than 35 mm/sec. When this data, was subjected to statistics, the correlation of MVA to EF slope was found to be[10,21,23,25] very poor. Anterior mitral leaflets were thickened in all the patients and posterior mitral leaflet showed Diastolic anterior motion (Fig. 3F) in all the patients. During diastole 2-D Echo shows thickening of valve leaflets with reduced separation of tips of leaflets and doming.

TABLE-3

LV EJECTION FRACTION BY ECHOCARDIOGRAPHY

		EF		Correlation With MVA.
Normal	= 35 Cases	55-88	100%	-0.87
MS	= 46 Cases	50-80	88.5%	-0.15
*	= 6 Cases	<40	11.5%	
	*3 Males 1 Mod: Disease+2 severe disease *3 Females 2 Mod disease+1 severe disease			<40

TABLE-4

EF SLOPE OF ANTERIOR MITRAL LEAFLET

				Correlation With, MVA
MS	0-35	Mean	14 mm/sec	- 0.27
Normal	50-150mm	Mean	98 mm/sec	- 0.30

Infact the whole mitral apparatus seems to be shifted anteriorly during systole. The LVPW diastolic velocity early and overall is reduced in MS cases. 65% of the MS patients had marked

reduction of early diastolic velocity of LVPW, and 20% had marked reduction in the LVPW overall velocity, statistically both variables have poor correlation with MVA (Table 5).

TABLE-5

LVPW DIASTOLIC VELOCITY

	Normal N	Mitral STENOSIS	Correlation with MVA.	
			Normal	MS.
Early Diastolic Velocity	50-90 mm/sec	23-56 mm/sec (65% cases had decreased values)	+ .31	+0.36
Overall Diastolic Velocity	16-42 mm/sec	14-34 mm/sec (20% cased had decreased values)	4.26	-0.2

Discussion:

Rheumatic heart disease, a consequence of Rheumatic fever, is a major cardiovascular problem in developing countries like Pakistan.

Mitral regurgitation can occur in a patient who suffers from Rheumatic fever during active course of Rheumatic fever. However it takes tens[6,12] of years for mitral stenosis to develop. In developing countries mitral stenosis is seen in much younger age than in western countries[11], this is probably due to more virulent and recurrent attacks of Rheumatic fever in developing countries.

Non invasive technology[1,10,14,15,21,23,25] has been now in use for about three decades to assess various variables of cardiac cycle for grading valvular diseases. M-Mode echo cardiography found its clinical utility[11] by diagnosing mitral stenosis. These days it has become easier to see and assess structural and functional abnormalities of the heart.

Both types of echo, M-Mode and 2D were used in this study to confirm mitral stenosis and assess variables for functional and anatomical changes in cases of mitral stenosis.

Fiftytwo cases, 22 males with mean age 26 and 30 female with mean age 33 years were seen at the Cardiology department Hyderabad. They came to the hospital after they became symptomatic. For comparison 35 normal subjects of nearly same age and gender were picked up from attendants of these patients and underwent study.

It is acknowledged[10,14,21,25] fact that MVA measured by 2D Echo and by Cardiac Catheter techniques have identical values. Mitral valve orifice acts as passage for the blood from LA to LV during diastole. In fact it is the composite action of various components of the MV apparatus to carry on this function.

In normal individuals 60 to 65% of blood flow from LA to LV occurs during early diastole due to the pressure gradient between two chambers. The Rheumatic heart disease usually initially involves mitral leaflet but may extend to other parts of MV apparatus.

Translucent granules appearing at the edges of mitral valve leaflet during the attack of Rheumatic fever are followed by thickening, fibrosis and adhesions of the commissures and calcification of the leaflets and other parts of the MV apparatus, thus creating obstruction to the flow of blood from LA to LV. Mitral stenosis may involve only leaflet and commissures and subvalvular chordae tendinae; papillary muscles which may develop adhesions on the cordae and ankylosis of the MV. This diseased MV becomes conical in shape with its apex towards LV.

Normally anterior mitral leaflet and posterior mitral leaflet move in opposite direction during early diastole, but in cases of mitral stenosis as seen in this study both leaflets of MV move in anterior direction in these cases with decreased, amplitude of the motion. The flow of blood from LA to LV is reduced not only in quantity but the velocity of flow is also reduced. Due to the disease process both AML and PML are thickened and EF slope of AML is reduced in comparison to normal individuals (table-4). In the cases of MS it takes longer time of interval for raised LVEDP to equal or by pass the LA pressure; so as to cause closure of the MV due to early closure of Aortic valve and higher pressure in LA. Aortic valve opens earlier than normal.

The reduced EF slope of AML is seen in all the cases of MS (table-4) but it is not diagnostic of MS as it is also reduced in cases with diminished compliance of LV.

The LVPW diastolic motion is reflection of LV filling pattern[2,10,25]. In this study it is noted (table-5) the LVPW diastolic velocity early and overall both are reduced in cases of MS. Marked reduction is noted in the early diastolic velocity (table-5) with poor correlation to MVA.

The ejection fraction of the LV reflects the global function of the chamber in cases of MS. All the cases had normal EF of LV but (6 cases had reduced EF less than 40 (table-3). This unusual finding seen in 6 cases is suggestive of LV dysfunction, due to Rheumatic carditis. Echo study 2D and M-Mode both showed huge LV with reduced IVS and LVPW motion completely, but no regional pattern, which is commonly seen in cases of ischaemic heart disease.

Some cases but not the all with loud P^2 on ascultation, on 2D and M-Mode showed huge RV with dilated RVOT and PA. These patients on short axis left parasternal 2D Echo Frames at the level of MV show diastolic dipping of the IVS towards the LV.

2D Echo is used to see the anatomy and functional abnormalities, and is superior than M-Mode, is an example as to how the various measurements are made on 2D echo. In this figure one finds leaflet edges are thickened and they are narrowly apart. The AML with shorter base and big leaflet having surface area equal to that PML showing doming of the leaflet body, this doming of AML is seen due to increased amount of blood available on the atrial side of the leaflet than the small amount of blood MVO allows to pass through the thickened and fibrosed leaflets body which stretches wide apart causing doming. Mitral valve area assessed by 2D echo is the most reliable index for MS cases. The severity of the disease could only be better judged by this para meter recording (table-2). Though EF of AML and diastolic slope of LVPW are decreased in all the cases but with poor correlation with MVA.

Conclusion:

1. M-Mode and 2D Echo cardiography both could be used to confirm MS but 2D is superior to M-Mode in correct measurement of MVA and thus grading the disease properly.

2. EF slope of AML is reduced in all the cases of MS but with poor correlation with MVA. It can also be reduced in cases with diminished compliance of LV.

3. All the cases of MS had diastolic anterior motion of PML but this commonly occurs if the leaflets are adhered at the edges; there by pulling the PML anteriorly during diastole.

4. The LVPW diastolic velocity, a reflection of LV filling pattern, is reduced in all the cases with again poor correlation with MVA.

5. Ejection Fraction of LV was normal in all the cases of MS but 6 cases out of 52 had EF<40% and showed LV dysfunction on mild exertion and on rest due to Rheumatic carditis.

6. Patients with loud P^2 on ascultation may have large RV but not necessarily Pulmonary hypertension.

Acknowledgement:

I am highly indebted to Prof. A.K. Abbasi for his encouragement.

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