



CLINICAL AND COLOR DOPPLER ECHOCARDIOGRAPHIC CORRELATION OF SEVERITY OF MITRAL REGURGITATION

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ABSTRACT Corvisart in 1808 was the first to recognise mitral regurgitation, subsequently in the nineteenth and early twentieth centuries, it was the most frequently diagnosed valve lesion, and the presence of an apical systolic murmur was said to portend a grave outlook.

MR can be detected in <3% in children but its incidence increases with age by 20–40% in adults and reaches 80% by the age of 80 years. The early twentieth century English cardiologists, with improved diagnostic capabilities, began to diagnose mitral regurgitation with increased confidence. However, they tended to attribute the cardiac failure more to myocardial disease and dysfunction than to mechanical effects of mitral regurgitation. When in 1948, mitral valve surgery became possible, mitral regurgitation was seen in better perspective but it was not until the mid 1950s with the advent of left heart catheterisation and cineangiography that a totally accurate diagnosis of Mitral Regurgitation was achieved. Advances in surgical technique and valve substitutes play an important role in the management of patients with severe chronic mitral regurgitation, achieving both symptomatic improvement and modification of the natural history. Controversy still surrounds the exact timing of surgery for patients with varying degrees of chronic mitral regurgitation.

The present study was undertaken to assess the clinical and 2 dimensional colour doppler echocardiographic severity of mitral regurgitation and assess the value of the various physical signs in diagnosing severe mitral regurgitation

KEYWORDS : Mitral regurgitation , 2 dimensional echocardiograph

AIMS AND OBJECTIVES

- To correlate the clinical science and 2D Colour Doppler echocardiographic findings in assessing the severity of mitral regurgitation.
- To assess the value of various physical signs in diagnosing severe mitral regurgitation.

MATERIALS AND METHODS

Clinical evaluation and Echocardiographic study was carried out in 30 cases of mitral regurgitation who have attended medical / cardiology OP/IP. The patients with significant mitral stenosis, aortic valve diseases were not included in this study.

Patients were taken up for detailed clinical examination, routine electrocardiogram, chest X-ray and detailed echocardiographic study was done in all the cases, as per the proforma.

Assessment of MR was done clinically by the conventional criteria :-

MILD MR :

Systolic murmur present at the apex in a case of MR.

MODERATE MR:

With or without cardiomegaly, hyperdynamic apex, left parasternal lift, length of the murmur, presence of LV S3, absent MDM.

SEVERE MR :

Cardiomegaly, Hyperdynamic apex, left parasternal lift soft S1, presence of LV S3, length and grade of systolic murmur, presence of MDM.

ECHOCARDIOGRAPHY:

Was performed on the Toshiba SSH 160A, 2 Dimensional colour doppler echocardiography instrument with transducer frequency at 2.5MHz. The 2 Dimensional picture for the valve morphology was studied. The assessment of MR was then done by the colour Doppler echocardiography at velocity mode using a 300 sector angle at pulse repetition frequency of 3KHz, wall filter at 600Hz and scanning rate at 13 frames. S-1 with optimal gain. MR jet was mapped and the area calculated. LA was mapped in the same plane and area calculated. The percentage of the LA occupied by the MR jet was determined in the parasternal long axis and apical 4 chamber views. Criteria for severity of MR was as follows.

MILD MR:

<20% of LA occupied by MR jet.

MODERATE MR:

20-40% of LA occupied by MR jet.

SEVERE MR:

>40% of LA occupied by MR jet.

OBSERVATIONS AND RESULTS

30 cases of Mitral Regurgitation (MR) were studied. Clinical evaluation was followed by 2D colour doppler echocardiography.

The ages ranged from 12 years to 65 years (Mean 17.9y) of which 19 were females and 11 were males.

In the past history there was history of Rheumatic Fever in 20 cases, hypertension 3, diabetes mellitus 1, myocardial infarction-1, infective endocarditis-1, SVT-1, atrial fibrillation-2, ventricular tachycardia-2. Family history of CAD in-3, tall stature in-3.

The functional class according to the New York Heart Association (NYHA) classification was as follows: Class I – 4 patients, class II – 17 patients, class III – 7 patients and class IV- 2 patients.

At presentation 24 patients had palpitate, cough in 20, 20 had dyspnea out of which 4 had PND and 4 had orthopnea. Fatigue was present in 18, cough in 3, angina in 2 and atypical chest pain in 8.

Palpitation was the commonest symptom in 80%, dyspnoea in 66.6% and fatigue in 60% of the cases. Other symptoms included anorexia 6.6%, loss of weight 3%, edema feet 10% involuntary movements (chorea) 3%.

1. CLINICAL VERSUS ECHOCARDIOGRAPHIC CORRELATIONS OF SEVERITY

TABLE -1

Etiology	Clinical Severity	No. of Cases	Severity of MR by ECHO		
			20% of LA Mild	20%-40% Moderate	40% of LA Severe
Rheumatic MR (RhMR)	Mild	3	-	2	1
	Moderate	5	-	1	4
	Severe	12	-	5	7
	Total	20	-	8	12

Non-Rheumatic MR (NRMR)	Mild	1	-	1	-
	Moderate	7	-	4	3
	Severe	2	-	-	2
Total		10	-	5	5
Total RhMR + NRMR		30	-	13	17

20 of the cases were Rheumatic Mitral Regurgitation (RhMR) and 10 cases Non-Rheumatic Mitral Regurgitation (NRMR).

Rheumatic MR :

3 were assessed by clinical criteria to be mild MR. Echocardiographically 2 were moderate and 1 severe MR. Of the 5 cases which were clinically moderate, 1 was moderate by echo and 4 severe MR by echo. 12 cases assessed as sever MR, had a moderate MR in 5 cases and severe MR in 7 cases by Echo.

Non Rheumatic MR :

1 mild case was moderate MR By Echo, of the 7 cases of moderate MR, 4 were moderate and 3 severe by Echo, 2 cases were severe by clinical and Echo findings. Precordial bulge was present in 7 cases (6 RhMR and 1 NRMR) 4 of these cases were severe MR and 3 moderate MR by Echo.

2. CARDIOMEGALY IN RELATION TO SEVERITY OF MR

RhMR: Of the 12 cases with cardiomegaly 7(55%) were severe and 5(42%) Moderate MR.

NRMR: Of the 6 cases with cardiomegaly 4(66%) were severe and 2(34%) Moderate MR. 8 cases of RhMR and 4 cases of NRMR had no cardiomegaly.

3. LEFT PARASTERNAL LIFT IN RELATION TO SEVERITY OF MR

RhMR: 17 cases had a LPSL of which 10 cases (59%) were severe MR and 7(41%) moderate MR.

NRMR: 5 cases had a LPSL of which 3 cases (60%) were severe MR and 2(40%) moderate MR.

4. TYPE OF APEX IN RELATION TO SEVERITY OF MR

RhMR: 7 cases had a normal apex, 4(58%) were severe MR, 3(42%) moderate MR. 13 cases had a hyperdynamic apex, 8(61%) were severe MR, 5(39%) moderate MR.

NRMR: 3 cases had a normal apex all were moderate MR. 7 cases had a hyperdynamic apex 5(71%) had severe MR, 2 (29%) had moderate MR.

5. INTENSITY OF P2 IN RELATION TO SEVERITY OF MR

RhMR: 3 cases had a normal P2 all were severe MR. 17 cases had a loud P2, 9(53%) were severe MR and 8(47%) were moderate MR

NRMR: 7 cases had a normal P2, 2(29%) were severe MR and 5(71%) a moderate MR. 3 cases had a loud P2 all (100%) were severe MR.

6. APICAL MID DIASTOLIC MURMUR IN RELATION TO SEVERITY OF MR

RhMR: 12 cases with a MDM, 7(60%) had severe MR, 5(40%) had a moderate MR. 8 cases without MDM, 5(62%) had severe MR, 3(38%) had a moderate MR.

NRMR: 1 case with MDM (100%) had severe MR. 9 cases without MDM, 4(44%) had severe MR, 5(56%) had a moderate MR.

7. PRESENCE OF S3 IN RELATION TO SEVERITY OF MR

Etiology	Clinical	No. of	S3 (LV)	MR Severity by Echo			S3 (LV)			MR Severity by Echo		
				Mild	Mod	Severe	Absent	Mild	Mod	Severe		
	Severity	Cases	Present									
Rh MR:	Mild	3	-	-	-	-	3	-	-	1	2	
	Moderate	5	4	-	1	3	1	-	-	-	1	
	Severe	12	9	-	3	6	3	-	-	2	1	
Total		20	13	-	4	9	7	-	-	3	4	
NRMR:	Mild	1	-	-	-	-	1	-	-	1	-	
	Moderate	7	7	-	4	3	-	-	-	-	-	
	Severe	2	2	-	-	2	-	-	-	-	-	
Total		10	9	-	4	5	1	-	-	1	-	
RhM R &	Total	30	22	-	8	14	8	-	-	4	4	

RhMR: 13 cases had a LVS3, 9(69%) had severe MR, 4(31%) had moderate MR.

7 cases had no LVS3, 4(57%) had severe MR, 3(43%) had moderate

MR.NRMR: 9 cases had a LSV3, 5(55%) had severe MR, 4(45%) had moderate MR.

1 case had no LVS3 was moderate MR.

Systolic murmur was pansystolic in 27(90%) of the cases and early systolic in 3(10%) of the cases. Grade-2/6 early systolic murmur was present in 1 case of moderate NRMR.

Grade-3/6 pansystolic murmur was present in 5 cases of moderate and 5 cases of severe RhMR. 2 of these cases had a chordal rupture. There were 3 cases of moderate and 1 case of severe NRMR, with a 3/6 systolic murmur.

Grade—4/6 pansystolic murmur was present in 3 cases of moderate MR and 8 cases of severe RhMR, 3 cases of moderate and 5 cases of severe NRMR. 5 of these cases had the chordal rupture.

8. DIRECTION OF SELECTIVE CONDUCTION OF THE SYSTOLIC MURMUR IN RELATION TO DIRECTION OF THE MRJET

In 22 cases the murmur had a selective conduction to the left axilla and left interscapular region. In 18(81%) of these cases the MR jet was directed to the lateral wall going on to the posterior wall of the left atrium. In 4 cases (19%) the jet was going to the centre of the LA. 18 of these cases (81%) had RhMR and 4 cases (19%) had NRMR.

Of the 8 cases which had a basal conduction of the murmur 3 cases (37.5%) had an eccentric jet going towards the centre of LA, 1 case (12.5%) had the jet going towards the lateral wall of LA and these cases were NRMR and the rest of the 4 cases MR Jet was directed eccentrically towards inter atrial septum of which 2 cases had RhMR and 2 had NRMR.

9. DIRECTION OF MR JET IN RELATION TO THE ETIOLOGY OF MR

Of the 20 cases of RhMR, 17(85%) had the MR jet going towards the lateral wall onto the posterior wall of the LA. 2 cases (10%) had an eccentric jet going towards the interatrial septum, (one of these had a chordal rupture). 1 case (5%) had a central jet.

Of the 10 cases of NRMR, 6(60%) had an eccentric jet going towards the centre of the LA, 2 cases (20%) the jet was eccentrically directed towards the interatrial septum (one of these had a chordal rupture) in 2 cases (20%) the MR jet was directed towards the lateral wall of the LA going onto the posterior wall.

One(1) case of infective endocarditis with a pericardial rub had pericardial effusion and vegetations on the mitral valve.

An ejection click was present in 2 cases of NRMR. A non-ejection click was present in 1 case of severe RhMR with a severe PAH. Pulmonary Arterial Hypertension was diagnosed clinically in 20 cases, but was

confirmed by echo in only 12 cases, 11 were severe MR and 1 moderate MR.

The sensitivity and specificity of the various clinical signs in assessing severe MR were calculated.

True positive (TP): Cases of severe MR positive for the particular sign.
False negative (FN): Cases of severe MR negative for the particular sign.

True negative (TN): Cases of mild and moderate MR negative for the particular sign.

False positive (FP): Cases of mild and moderate MR positive for the particular sign.

$$\text{Sensitivity} = \frac{\text{TP}}{\text{TP} + \text{FN}}$$

$$\text{Specificity} = \frac{\text{TN}}{\text{TN} + \text{FP}}$$

Example : Value of MDM in assessing severity of MR.

True positive : Cases of severe MR with MDM.

False negative : Cases of severe MR without MDM.

True negative : Cases of mild and moderate MR without MDM.

False positive : Cases of mild and moderate MR with MDM.

10. VALUE OF VARIOUS CLINICAL SIGNS IN ASSESSING SEVERE MR TABLE-3

	Clinical Signs	Rheumatic MR		Non Rheumatic MR		Total Cases	
		Sensitivity	Specificity	Sensitivity	Specificity	Sensitivity	Specificity
1.	Parasternal Lift	83	12.5	60	60	76	30
2.	Precordial bulge	25	62	20	--	23	--
3.	Cardiomegaly	53.8	28.5	80	60	61	41.6
4.	Hyperdynamic apex	66	37.5	100	60	74.5	46
5.	Wide & Variable S2 Split	33.3	62.5	40	100	35.3	77
6.	Loud P2	75	--	60	100	70.5	38.5
7.	S3 (LV) for Severe MR	69	42.8	100	20	77.7	33
8.	S3 (LV) for Moderate & Severe MR	65	100	90	100	73	100 58
9.	Apical Mid Diastolic Murmur	58.3	37.4	20	100	44	
10.	Grade 4/6 of Systolic Murmur	58	62	80	80	64.7	69.2

DISCUSSION

The present study was undertaken to assess the clinical and 2

dimensional colour doppler echocardiographic severity of mitral regurgitation and assess the value of the various physical signs in diagnosing severe mitral regurgitation.

Helmecke et al (1987) compared multiple measurements of the regurgitant jet by colour flow mapping to angiographic grading in 82 patients of MR. Regurgitant jet area/ left atrial area (RJA/LAA) was under 20 in 34 of 36 patients with angiographic grade—I MR, between 20—40% in 17 of 18 patients with grade—II MR and over 40% in 26 of 28 patients with severe MR.

In the present study this criteria was taken to assess the severity of MR by echocardiography.

In the 30 patients studied the ages ranged from 12 years to 65 years (Mean 17.9 years) female to male ratio was 19:11.

4(13.3%) of the cases were in New York Heart Association class—I, 17(56.6%) were in class—II, 7(23.3%) were In class—III and 2(6.6%) in class—IV.

The commonest symptoms present were palpitation (80%), Dyspnoea (66.6%). weakness and fatigue (60%) PND, Orthopnoea, cough, angina, atypical chest pain, were also present with lesser frequency.

The etiology was confirmed by echocardiography and 20 cases (66.6%) had rheumatic mitral regurgitation (Rh.MR) 10 cases (33.3%) had non-rheumatic mitral regurgitation (NRMR).

In RhMR, 40% of the cases were diagnosed as mild to moderate MR by clinical criteria but 62.5% of these had severe MR by echocardiography and the rest 37.5% of the cases were underestimated by clinical criteria in assessing the severity of MR.

In the RhMR, 60% of the cases were diagnosed as severe MR by clinical criteria of which 58.33% only had severe MR by echocardiography and the rest 41.67% had moderate MR, so the verity was over estimated by clinical criteria in 40% of the cases.

In NRMR, 80% of the case were diagnosed as mild to moderate MR clinically of which 62.5% correlated with echocardiographic severity of moderate MR and the rest 37.5% had severe MR. Hence, 37.5% of the cases were under estimated by clinical criteria.

The value of the various clinical signs in assessing severe MR was as follows.

Left parasternal lift had a sensitivity of 83% but a specificity of only 12.5% in RhMR. The sensitivity and specificity were 60% in NRMR. Precordial bulge had a sensitivity of 23% and specificity of 62% in all the cases of MR.

Cardiomegaly, in Rh MR had a sensitivity of 53.8% and specificity of 28.5%. In NRMR sensitivity was 80% and specificity 60%. This is one of the valuable signs in diagnosing severe MR.

A hyperdynamic apex in RhMR had a sensitivity of 66%, specificity of 37.5%. In NRMR the sensitivity was 100% and specificity 60%. This is also a valuable sign in the assessment of severe MR.

Wide and variable S2 split was not a very sensitive sign in severe MR with a sensitivity of only 33.3% but had a specificity of 77%.

Loud P2 had a sensitivity of 75% in Rh MR and 60% in NRMR. Its specificity was 100% for severe NRMR. This is a good sign for assessing severe MR.

Left ventricular S3 had a sensitivity of 77.7% and specificity of 33% for severe MR. For diagnosing both moderate and severe MR the sensitivity was 73% and specificity 100%.

The apical MDM in RhMR had a sensitivity of 58.3% but a specificity of only 37.4% as 5(40%) of the cases with this sign were moderate MR by echo.

In NRMR sensitivity of MDM was only 20% and specificity 100%. Therefore in the absence of MDM other physical signs should be taken

into consideration to differentiate severe from moderate MR.

Grade 4/6 systolic murmur had an overall sensitivity and specificity of 64.7% and 69.2% respectively in severe MR.

Colour flow mapping showed that in RhMR regurgitant jet was directed to the lateral wall going on to the posterior wall of the LA in 81.25% of the cases, towards the interatrial septum in 12.5% of the cases, and centrally directed in 6.25% of the cases. In NRMR 55.5% of the cases had the MR jet which was centrally directed, 22.2% had a jet directed towards the interatrial septum, and in 22.2% of cases towards the lateral wall going onto the posterior wall of LA.

Yoshikawa et al noted that the regurgitant jets of RhMR were not eccentric; in 37 patients with MVP abnormal eccentric jets were detected in 35 cases.

The direction of the jet by colour flow mapping provided a useful clue to the probable etiology of the MR.

In cases with selective conduction of the murmur to the left axilla and left interscapular region, the MR jet was directed to the lateral wall of LA going on to the posterior wall in 77.7% of the cases and was directed centrally in 22.2% of the cases.

When the murmur was conducted to the base of the heart the regurgitant jet was directed centrally into the LA in 75% of the cases and towards the lateral wall of the LA in 25% of the cases.

Unless a careful search is made by doppler interrogation these eccentric jets are likely to be missed or the severity of MR underestimated. A careful examination for the selective conduction of the murmur gives a clue to the direction of the MR jet and also the probable etiology of the MR.

CONCLUSION

1. The diagnosis of severe Rheumatic MR using the conventional clinical criteria correlated with echocardiography severity in 60% of the cases. Severity was over estimated by clinical criteria in 40% of the cases.
2. The diagnosis of mild to moderate Rheumatic MR by clinical criteria, has under estimated the severity of MR in 60% of the cases.
3. Clinically 60% of the cases of Non Rheumatic MR correlated with the echocardiographic severity of MR and 40% of the cases had been underestimated by clinical criteria.
4. The sensitive signs of severe Rheumatic MR are left parasternal lift, cardiomegaly, hyperdynamic apex, loud LVS3, apical mid diastolic murmur. The specific signs are wide and variable S2 split, LVS3, soft S1, grade 4/6 pansystolic murmur.
5. The specific and sensitive signs of severe non-rheumatic MR are left parasternal lift, cardiomegaly, hyperdynamic apical impulse, loud P2 LVS3, soft S1 grade 4/6 systolic murmur. Wide and variable S2 split and apical mid diastolic murmur are specific, but not sensitive for severe NRMR.
6. The selective conduction of the systolic murmur correlated with the direction of the regurgitant jet.
7. Rheumatic MR had jets directed to the lateral wall of LA going on to the posterior wall in 77% of the cases and was related to the selective conduction of the systolic murmur to the left axilla and left interscapular region.
8. Cardiomegaly was correlated in 60% of the cases with echocardiographic severity of MR in both RhMR and NRMR.
9. Non-Rheumatic MR had eccentric jets, these were directed to the centre of left atrium and Inter Atrial Septum (75%) and the murmur conducted to base and left sternal border.
10. Careful clinical assessment is very useful in the detection of severe MR and can be used along with other non invasive techniques in the assessment and follow up of severe

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