



To Detect Left Atrial Enlargement in Patient with Rheumatic Mitral Stenosis with Electrocardiography and It's Corelation with Transthrasic 2D Echocardiography

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Abstract

Introduction: Rheumatic heart disease is still common heart disease in India accounting for about 40% of total hospitalized cardiac cases in India and is most common cause of cardiac morbidity and mortality in the country. Mitral valve is most commonly affected, mitral stenosis (MS) being the most common manifestation. Female patients are more affected as compared to male patients.

Aims and Objectives: To correlate Electrocardiography (ECG) and 2D ECHO cardiography in detecting left atrial enlargement (LAE) in rheumatic mitral stenosis (RMS).

Material and Methods: The present study was a hospital based cross sectional study carried out from August 2014 to May 2015 at a tertiary care teaching hospital of central India. A total of 70 cases of RMS who came to Medicine department were enrolled in the study.

Observations: Out of 70 patients 30 were male and 40 females majority being in the age group <30 years. Severe mitral stenosis was found in 44.3% of the patients and that too, more in females as compared to males. On ECG, P-mitrale (ECG criteria for LA abnormality) was most common finding, found in 36.3% patients. 41.4% of patients showed LAE on 2D ECHO.

Conclusion: Currently 2D ECHO is used for diagnosis left atrial enlargement in RMS, which although considered more efficacious is costly and time consuming. The findings of present study suggests that ECG can detect LAE in RMS with nearly same efficacy as that of 2D ECHO with added advantage of being less costly and less time consuming.

Keywords: Electrocardiography, 2D echocardiography, Left atrial enlargement.

Introduction

Acute Rheumatic fever (RF) and its long term upshot Rheumatic heart disease (RHD) linger to be foremost health peril in developing countries like

India and is one of the most common cause of valvular heart disease in the world affecting children, adolescents and young adults.^[1] About 15.6 million people are affected by RHD worldwide,

with approximately 470,000 occurring as newly diagnosed cases while 233,000 deaths attributable to RHD. [2,3] In India, amongst cardiac diseases RHD is most common cause of morbidity and mortality contributing to 25 to 60% of all hospitalized cardiac patients with a prevalence of 0.2 to 1.1 per 1000 for RHD and 0.2 per 1000 population for RF. [4] Mitral valve is most commonly affected in RHD and it manifests most commonly as mitral stenosis (MS) encountered most commonly in females as compared to males. [5] Normal mitral orifice is 4-6 cm² in an average adult. Decrease in orifice below this normal range is termed as mitral stenosis. However it becomes more symptomatic when mitral orifice is reduced below 2.5 cm². Apart from RF as the most common cause of MS, left atrial myxoma, calcified mitral annulus, Rheumatoid arthritis, Systemic lupus erythematosus (SLE), Coxsackie virus infection are some of the other culprits. [6] Mitral stenosis results in impediment to left ventricular inflow. This obstruction is contemplated as substantial when orifice area is reduced to ≤ 2 cm² since such a situation blood can drift from left atrium to left ventricle only by the virtue of aberrantly augmented left atrio-ventricular pressure gradient, which is a token of severe MS. MS manifests itself as dyspnea (difficulty in breathing), palpitations, fatigability, hemoptysis, chest pain, pulmonary infections, symptoms of right ventricular failure, dysphagia, hoarseness of voice and bronchitis. [7] Left atrium is dilated, owing to volume overload ensuing from stranding of more and more amount of blood with each diastole and inability of systole to propel the blood into left ventricle due to obstruction created by MS, which crafts diastolic murmur. [4] This is accompanied by elevated atrial pressure and is seen on left atrial pressure pulse as prominent “a” wave and “y” descent depicting increased and sustained left atrial contraction in pursuit of forcing maximum possible blood through narrowed orifice. Normal left atrial size is estimated from antero-posterior (A-P) diameter on echocardiography, which is ≤ 40 mm. [8] Left atrial enlargement (LAE) is the most common finding which is seen on Electrocardiogram (ECG) as P-

mitrale, which is wide, notched P wave seen in leads I, II, V5 and V6. A variant called “silent MS” is sometimes encountered in clinical practice which is non-audible diastolic murmur even in presence of severe MS. Atrial fibrillation is the most common snag of MS, and it worsens the prognosis of MS patients by precipitating or hastening symptoms owing to obstruction to left ventricular inflow. Also it increases the risk of thromboembolism originating in the left atrium. [9] In addition to detecting the etiology of MS (especially RHD), echocardiography is also principally expedient in reckoning pressure gradients across the mitral valve, valve area, gaging left atrium and evaluating right ventricular function and size. Echocardiography, in rheumatic MS shows “hockey stick” distortion of anterior mitral valve leaflet which is a consequence of trussing of leaflet tips and relative suppleness of leaflets. Thus severity of MS can be established by appraisal of left atrial and right ventricular size. [10]

Echocardiography is time consuming and costly although its efficacy in detecting LAE is considered to be more as compared to ECG, which is less time consuming and less costly. Incongruities between ECG and echocardiography have been studied various authors. [11,12,13] However it is noteworthy to point out that majority of such studies either used scarce ECG criteria for diagnosing LAE or had trivial study population. [14] So, the present study was undertaken to compare the efficacies of echocardiography and ECG in detecting LAE using variety of criteria in patients of rheumatic mitral stenosis (RMS)

Aims and Objectives

The present study was undertaken in pursuit of fulfilling the following objectives:

1. To study clinical profile of RMS,
2. To evaluate LAE in RMS by 2D echocardiography,
3. To detect efficacy of ECG to perceive LAE in RMS,
4. To compare efficacy of ECG with 2D echocardiography in detecting LAE in patients of RMS.

Materials and Methods

The present study was a hospital based cross sectional study carried out from August 2014 to May 2015 at NKP Salve Institute of Medical Sciences and Research Centre and Lata Mangeshkar Hospital, Nagpur (M.S.). The study was initiated after approval from Institutional Ethics Committee (IEC). Consecutive type of sampling technique was used in which a total of 70 sequential patients of RMS who came to Medicine Department were included in the study after taking duly signed informed consent.

Inclusion Criteria:

1. Patient who were older than 12 years of age, irrespective of sex,
2. Clinically suspected cases of RMS,
3. Diagnosed cases of RMS,
4. Unsuspected cases who were incidentally diagnosed with RMS on echocardiography done for indication,
5. Patients willing to give informed consent.

Exclusion criteria

1. Patients younger than 12 years of age,
2. Patients with mitral valve replacement,
3. Patients not willing to give informed consent,
4. Patients with atrial fibrillation,
5. Patients on digitalis/verapamil/beta-blockers,
6. Patients with other cardiac lesions.

Extra care was taken to follow protocol, throughout the study. In compliance with ethical considerations any patient was free to withdraw from the study at any point of time. After enrollment, demographic details of the patient like age at the time of study, sex, and detailed history-history of present illness, past history, family history general examination, cardiovascular system (CVS) examination and findings of ECG and echocardiography of each patient was taken. All the data was entered in specially designed case record form. Standard 12 lead ECG with paper speed of 25mm/second and standardization of 1 mv was used. Following criteria were used to analyze P-wave morphology for detecting LAE:

- A. P wave duration in lead II- >110 milliseconds denote LAE,
- B. P wave notching in Lead II (inter-peak distance)- ≥ 40 milliseconds denote LAE,
- C. Duration of negative phase of P wave in Lead VI- >40 milliseconds denote LAE,
- D. Depth of negative phase of P wave in Lead VI- >1mm denote LAE.

A 3.5 MHz transducer was used to perform echocardiogram with patient in left lateral decubitus posture. Using the aortic window and tweaking angulation and position, parasternal long axis view was used to perform 2D echocardiogram, out of which left atrial size was determined by opting M-mode measurement (uses criteria of >38 mm as LAE). Left atrial size was recorded at end-systole and at a paper speed of 50 mm/second.[14] Severity of MS was assessed by Wilkins score, 2D echocardiography.

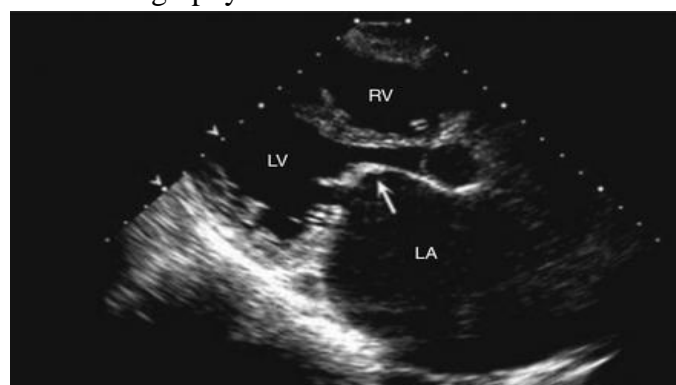


Figure 1: Transthoracic 2D ECHO Shows Mitral Valve Hokeystik Appearance.

Statistical analysis: All the collected data was entered in Microsoft Excel sheet using Microsoft Excel 2013. All the results were expressed and analyzed by percentage method.

Results

Out of 81 cases, a total of 70 cases were finally enrolled in the study after subjecting through inclusion and exclusion criteria. Since our study had no follow up, no drop-outs were seen, nor any patient refused to give consent. Out of 70 patients 30 were male and 40 were females (Table 1).

TABLE 1: Showing sex wise distribution of MS.

Sex	Severity of MS n(%)			Total
	Mild	Moderate	Severe	
Male	10(33.3%)	10(33.3%)	10(33.3%)	30
Female	16 (40%)	3 (7.5%)	21(52.5%)	40
Total	26(37.1%)	13 17.1%)	31 44.3%)	70

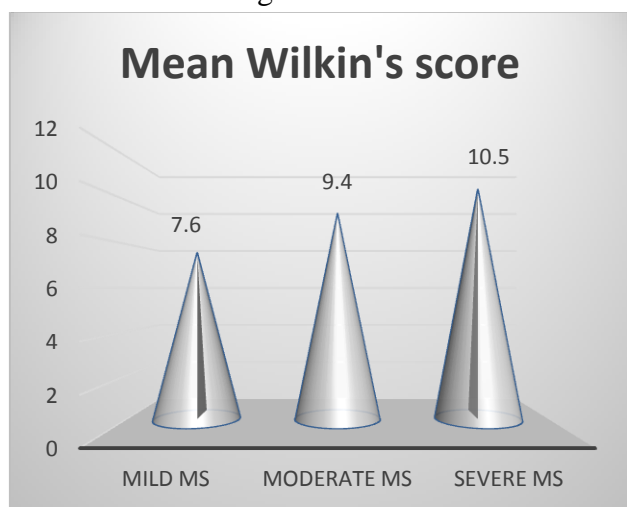
Age wise maximum patients were in the age group <30 years (31.4%) and least in the age group >60 years (5.7%). Severe MS was found in 44.3% of the patients, moderate MS in 18.6% of the patients and mild MS in 37.1% of the patients. Gender wise, severe, moderate and mild MS was found in equal number of males (33.3% in each category) and 52.5%, 7.5% and 40% respectively, in case of females. Severe MS was found in majority in the age group of 31-40 years (Table 2).

TABLE 2: showing age wise distribution of MS.

Age (in years)	Severity of MS n(%)			Total
	Mild	Moderate	Severe	
<30	10(45.5)	5(22.7)	7(31.8)	22
31-40	4(20)	2(10)	14(70)	20
41-50	7(46.7)	3(20)	5(33.3)	15
51-60	3(33.3)	3(33.3)	3(33.3)	9
>60	2(50)	0	2(50)	4
Total	26(37.1)	13(18.6)	31(44.3)	70

Mean Wilkin’s score was 7.6, 9.4 and 10.5 in mild, moderate and severe MS, respectively. Thus mean Wilkin’s score increased with increased severity of MS (Figure 2).

FIGURE 2: Showing mean Wilkin’s score in patients with various grades of MS.



Symptom wise, dyspnea was reported by 59 (84.3%) patients, chest pain by 44 (62.9%) patients, palpitations by 33 patients (47.1%), cough by 19 (27.1%) patients and pedal edema by 22 (31.4%) patients. Dyspnea was the most common symptom associated with severe MS (87.1%) followed by chest pain and palpitations (both 64.5%) (Table 3).

TABLE 3: showing symptoms found in the present study.

Symptom	Severity of MS n(%)			Total
	Mild	Moderate	Severe	
Dyspnoea	22(84.6)	10(83.3)	27(87.1)	59
Chest pain	17(65.4)	7(58.3)	20(64.5)	42
Palpitation	12(46.2)	1(8.3)	20(64.5)	33
Cough	6(23.1)	3(25)	10(32.3)	19
Pedal Oedema	11(42.3)	1(8.3)	10(32.3)	22

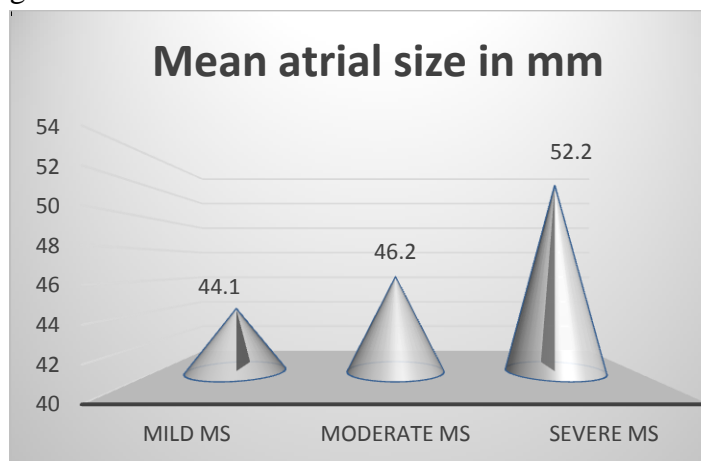
LAE, detected on ECG by the criteria mentioned in material and methods, was found in 25 patients (35.7%) out of which, criteria A was fulfilled by 8 patients, criteria B by 17, criteria C by 14 and criteria D by 10 patients. 11 (44%) had severe MS, 6 (24%) had moderate MS and 8 (32%) patients had mild MS. Other findings are given in Table 4.

TABLE 4: showing number of patients fulfilling criteria for LAE on ECG.

Criteria fulfilled	Number of patients fulfilling criteria n(%)
A	6(24)
B	14(56)
C	11(44)
D	9(36)
A+B	4(16)
A+C	3(12)
A+D	4(16)
B+C	7(28)
B+D	6(24)
C+D	4(16)
A+B+C	3(12)
A+B+D	2(8)
B+C+D	6(24)
A+B+C+D	2(8)

On echocardiography LAE (A-P diameter >40 mm) was found in 29 patients (41.4%) distributed across all the grades of MS. Mean left atrial size increased progressively with advancing grade of MS. Mean atrial size was 52.2 mm in severe MS, 46.2 mm in moderate MS and 44.1 mm in mild MS (Figure 3).

FIGURE 3: depicting mean atrial size in different grades of MS.



29 patients were detected with LAE by echocardiography, out of which 25 were detected by ECG.

Discussion

In the present study ratio of male: female in MS was found to be 1: 1.3, which is in contrast with other studies which showed much higher incidences amongst females. [14,15] Most common symptom found in our study was dyspnea which was same as that of finding of other such study. [16] Severity of MS was done by Wilkin's score and the findings of the present study were similar to that of other studies. [17,18] Around 20% of left ventricular stroke volume is subsidized by "booster pump" function of left atrium. But this little contribution becomes ominously imperative in diseases impairing left ventricular function sternly. [8] Many complications like atrial fibrillation and thromboembolic events are known to be associated with LAE. [19,20] 25 patients were detected with LAE on ECG, by using various criteria. If unswerving criteria are used, ECG can be considered as simple, cost-effective and less time consuming modality to detect LAE as well

as for follow-up. However, atrial conduction defect [11,21] and/ pressure overload on left atrium [22,23] can cause some of the certain electrocardiographic oddities which are conventionally ascribed to LAE. From the above findings it can safely assumed that diagnostic precision of previously established criteria for detecting LAE on ECG may have very restricted implication in face of higher obligation it acknowledged. Atrial fibrillation leads to loss of P wave, which makes diagnosis of LAE by ECG virtually impossible. [24] Keeping above mentioned finding in mind, we excluded patients with atrial fibrillation. Also, in the present study, with the pursuit of reducing effects of defective conduction and left atrial pressure overload, patients taking drugs that are anticipated to affect PR interval like beta blockers, verapamil, digitalis, etc. and patients with left ventricular failure were excluded. Like ECG, echocardiography also encounters limitation although not a major one. 29 patients were detected with LAE by 2d echocardiography. The M-mode/2D echocardiography for measuring left atrial size uses proper angulation of transducer, which when done overenthusiastically may The use of M mode echocardiography as a diagnostic standard represents a minor limitation because extreme angulation of the transducer may produce amendment left atrial size measurements. However, this hitch can be nullified by performing echocardiography through 3rd and 4th intercostal space along the left sternal border, at the level of aortic root. [14] Although angiography is considered as most accurate of the available methods of estimating left atrial dimensions, it is not feasible to perform angiography in large chunk of population, especially in India, owing to its high cost, invasiveness and complex procedure. [25,26] It has been found in some studies that echocardiography can detect left atrial size with analogous accuracy as that of angiography. [27] But in India, cost effectiveness becomes the major concern in healthcare, due to which ECG is still widely used as a diagnostic modality for detecting LAE. Also the finding in the present study that out of 29 patients with LAE detected by 2D echocardiography, 25

were detected by ECG, thus supporting use wide use of ECG in detecting LAE.

Conclusion

From the findings of the present study it can be concluded that ECG can detect LAE with fair accuracy and although it cannot replace echocardiography as a diagnostic modality. Although angiography is considered as most accurate of the available methods of estimating left atrial dimensions, it is not feasible to perform angiography in large chunk of population, especially in India, owing to its high cost, invasiveness and complex procedure. It has been found in some studies that echocardiography can detect left atrial size with analogous accuracy as that of angiography. Thus, in absence of echocardiography ECG serves as economical, time and money saving option for detecting LAE in Rheumatic Mitral Stenosis.

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