'P' MITRALE AND LEFT ATRIAL ENLARGEMENT: COMPARISON WITH ECHOCARDIOGRAPHY

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Background: This study was carried out to determine the sensitivity and specificity of 'P' Mitrale in diagnosing left atrial enlargement by comparing it with the Gold Standard of echocardiography. **Methods:** The study was carried out at the department of Physiology, Army Medical College, Rawalpindi and department of Cardiology at Armed Forces Institute of Cardiology / National Institute of Heart Diseases**.** 50 clinically diagnosed cases of left atrial enlargement were included in the study. ECG of the patients was recorded and 'P' Mitrale observed. This was followed by echocardiography and using 2-D echocardiogram as a guideline M-mode recording was obtained and left atrial size was calculated. **Results:** 'P' Mitrale has a sensitivity of 22.5% and specificity of 100%. The positive and negative predictive value and diagnostic efficacy of the test were also calculated. **Conclusion:** Sensitivity of ECG is low in detecting left atrial enlargement. However its sensitivity can be increased by combining 'P' Terminal Force in lead V_1 and P/P-R ratio to 'P' Mitrale. ECG is however still recommended as a routine investigation because of its cost effectiveness and easy availability.

Keywords: Left atrial enlargement, ECG, 'P' Mitrale, echocardiography

INTRODUCTION

Left atrial (LA) enlargement diagnosed by electrocardiography or echocardiography is a common finding in hypertensive patients, indicating hypertensive heart disease.[1] Echocardiographic LA size in hypertension has been related to systolic blood pressure and left ventricular hypertrophy hypertrophy (LVH) in older patients with isolated systolic hypertension.[2] Left atrial enlargement (LAE) has also been considered to be a marker of left ventricular diastolic function.[3] Echocardiographic studies in men with mild to moderate hypertension have suggested age, obesity, and race as other important covariates of LA size.[4] Studies have also shown that LA enlargement is a risk factor for atrial fibrillation and stroke, especially in men. LV hypertrophy has been suggested to mediate, at least partially, the relation between hypertension and LA enlargement.[5]

Several criteria exist for the electrocardiographic detection of left atrial enlargement. From the earliest times of electrocardiographic use, many indices for the magnitude and duration of QRS complexes have been developed. Electrocardiographic evidence of LAE is a predictor for subsequent development of atrial fibrillation, stroke, congestive heart failure and increased cardiac mortality.[3,6]

Despite their high specificity, the ECG indices still bear low sensitivity. Although echocardiography has become the gold standard for LAE detection in clinical practice, ECG remains widely used due to its simplicity and accessibility. Caution should nevertheless be taken when using ECG criteria for LAE detection because they exhibit only limited accuracy (generally due to poor sensitivity).[7–10] Unrestricted applicability of these criteria in nonwhite individuals remains to be demonstrated. Historically, these criteria have been almost exclusively elaborated on and calibrated in white (or mixed) populations, and several interethnic differences in ECG characteristics have been demonstrated.[11–13]

The present study was designed to study one of the ECG criteria for detection of LAE by comparing it with the gold standard of echocardiography.

MATERIAL AND METHODS

The present study was conducted from June 2004 to December 2004 in Physiology Department, Army Medical College, Rawalpindi and Armed Forces Institute of Cardiology/National Institute of Heart Diseases (AFIC/NIHD), Rawalpindi. Fifty patients of either sex between the ages of 13–65 years who were provisionally diagnosed by the cardiologist on the basis of clinical signs and symptoms, for LAE were included in the study.

Obese, smokers, and patients with physical abnormalities of chest wall such as kyphosis or scoliosis were excluded from the study. Known cases of ischemic heart diseases, obstructive lung disease and patients manifesting ECG findings of bundle branch block, atrial fibrillation or flutter and Wolff

Parkinson-White syndrome were not included. Patients on digitalis therapy or other drugs, which can alter ECG, were also excluded.

General physical examination of the patients was done and detailed history was taken. Body surface area and body mass index using the Mosteller formula[14,15] were calculated. A standard 12-lead ECG was recorded with subjects lying comfortably in supine position by Cardiofax electrocardiograph. The machine was calibrated before recording ECG with paper speed at 25 mm/sec and amplitude of stylus deflection at 1 mV/cm. 'P' Mitrale (double-peaked, notched or 'camel humped' P wave) was calculated in lead II. An interval of >40 mSec between the notches of 'P' wave was taken as 'P' Mitrale.[16]

Using 2-D echocardiogram as a guideline M-mode recording was obtained with the help of Toshiba Power Vision 6000™ machine. Normal echocardiographic left atrial dimensions for body surface area between 1.45 to 2.22 m^2 are between 1.9 and 4.0 cm. Any dimension above this value was taken as left atrial enlargement.[17]

Data was analysed by SPSS version 14. Sensitivity (%) was calculated by dividing true positives by the sum of true positives and false negatives, then multiplying the quotient by 100. Sensitivity is the quality of a test to diagnose true cases. Specificity (%) was calculated by dividing true negatives by the sum of true negatives and false positives, then multiplying the quotient by 100. Specificity is the quality of a screening test to identify healthy cases. Cases diagnosed as LAE on both ECG and echocardiography were labelled as True Positive. Those patients who were not diagnosed as LAE on both ECG and echo were True Negative. Those patients whose ECG did not reveal any findings of LAE but were diagnosed as LAE by echocardiography were False Negative. Positive predictive value, negative predictive value and diagnostic efficacy of 'P' Mitrale was also calculated.

RESULTS

The age of the patients was 54.08±6.33 years (Mean±SD). Out of 50 patients studied, the number of true positive cases for 'P' Mitrale was 9 and false negative cases were 31. The number of true negatives was 10 while no subject was found to be false positive for the test. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic efficacy of the test were calculated. The calculated sensitivity and specificity were 22.5% and 100% respectively (Figure-1). The positive predictive value was 100% whereas negative predictive value was 24.39%. The diagnostic efficacy of the test was calculated as 38%.

Prevalence of echocardiographic LAE was higher in women than in men. Sensitivity of 'P' Mitrale was slightly higher in women than in men (25% vs. 21.42%). Specificity was high in both the sexes (100%).

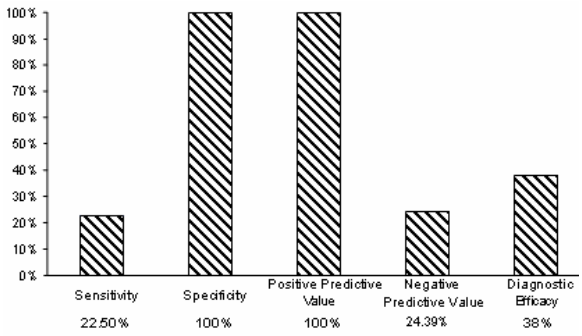

Figure-1: Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value and Diagnostic Efficacy of 'P' Mitrale on ECG in diagnosis of Left Atrial Enlargement using Echocardiography as Gold Standard.

DISCUSSION

'P' Mitrale is one of the established criterions for the diagnosis of left atrial enlargement by electrocardiogram. The electrocardiogram (ECG) has a ubiquitous role in clinical practice to evaluate patients with cardiovascular disease.[3] Electrocardiographic criteria for LAE, particularly those that are heavily reliant on voltage criteria, are dependent on subjective analysis. Echocardiography provides direct information concerning LA enlargement and chamber size.

In the present study it was found that 'P' Mitrale was present in 18% of the cases. Munusawamy *et al*[18] calculated the sensitivity and specificity of 'P' Mitrale for the diagnosis of left atrial enlargement as 15% and 100% respectively. The difference in their sensitivity of their study and the present data may be due to the difference in sample size. Out of 99 patients included in their study, 42 had normal atrial size whereas 57 patients were suffering from left atrial enlargement. Similarly Fragola *et al*[19] have calculated the sensitivity of 'P' Mitrale to be 18% and specificity as 97%. Although the specificity calculated in their study is very close to the results of the present study, yet their sensitivity calculation was much less than our data. Out of 1000 patients included in their study a well defined inclusion or exclusion criteria was not followed. They included the patients suffering from all types of heart diseases whereas in the present study patients suffering from surgical problems of the heart, ischemic heart disease and bundle branch blocks were not included as this affects the electrical recording from the heart. They also calculated the positive predictive value of less than 35% and a negative predictive value of 91%. This differs from the present

study because the number of false positive and true negative cases in their study was much higher.[19]

We found that the sensitivity of the 'P' Mitrale of ECG for echocardiographic LAE is marginally higher in women than in women, possibly because of lesser number of female patients included in the study. Traditionally the sensitivity of ECG criterion has been found to be lesser in female population than in male. This is because of attenuation of voltage by the greater spatial separation of myocardium from precardial electrodes because of breast tissue in women. Consistent with this is the finding that precardial QRS voltage is lower in women than in men.[20] Similarly mastectomy results in increased QRS amplitude.[21] Diminished electrocardiographic sensitivity in women is also, in part, a result of less voltage generated by the female heart, which contains approximately 25% less wall mass than the male heart.[22]

In conclusion 'P' Mitrale showed a low correlation with the echocardiogram, and also was a difficult method to apply, because it was dependent on a close subjective analysis, which may generate doubts and cannot always be regularly applied, as for instance, in atrial fibrillation. However the sensitivity of ECG to detect LAE can be increased by adding P-Terminal Force and 'P' wave time in Lead-II to 'P' Mitrale.

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