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EFFECT OF TYPE OF ST SEGMENT ELEVATION IN ACUTE ANTERIOR MI ON LEFT VENTRICULAR FUNCTION

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Contribution

AH and AJ conceived, the idea and designed the study. MM and UA did data collection and manuscript writing. IU and MI did review. All the authors contributed equally to the submitted manuscript

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ABSTRACT

Objective: To see the correlation between acute ST segment anterior wall myocardial infarction on ECG and LV function on echocardiography.

Methodology: This cross-secitonal study was conducted on 1st January to 31st Mar 2017 in the Cardiology Department of Jinnah Hospital Lahore. ECG pattern were categorized into three grades of changes. In grade 1 there were only hyper acute T waves(concave type), in grade 2 there were hyper acute T waves and ST segment elevation(straight type) and in grade 3 there was tombstone appearance on ECG with the changes involving T waves and ST segment and QRS complex(convex type). We had assumed that there was maximum damage in grade 3, which was assessed on echocardiography. Patients with the diagnosis of anterior wall myocardial infarction who presented within 12 hours of presenting complaints and were thrombolysed by streptokinase were included.

Results: About 50 patients with acute anterior wall MI were included in the study. Majority of the patients were between the 46 to 60 years, while 34% were below 45 years and 16% were above 65 years with mean of 52.66 ± 10.87 years. Males were 88%. There were 20 patients who were falling in the category 1with the mean EF $48.25 \pm 8.926\%$, while 11 patients in grade 2 had mean EF $35.45 \pm 6.502\%$ and19 patients were in grade 3 who had maximum decrease in EF with mean of $31.05 \pm 7.375\%$.

Conclusion: In patients who presented with acute anterior MI and were reperfused with SK, left ventricular function was preserved or there was less damage in grade 1, intermediate damage in grade 2 and maximum damage in grade 3. This simple classification is useful for the prediction of left ventricular function at discharge.

Key Words: ST segment elevation anterior wall MI, Echocardiography, Electrocardiography.

INTRODUCTION

ST-segment elevation myocardial infarction (STEMI) is the most severe form of acute coronary syndrome (ACS) after sudden cardiac death. In USA at present, approximately 25% to 40% of all MI presentations are of STEMI.[1] Acute myocardial infarction resulting from an occlusive thrombus is recognized on an electrocardiogram by ST-segment elevation.[2] Anterior wall contributes maximum to the ejection fraction and similarly when it is damaged it may cause maximum damage to the heart. There are three major coronary arteries that maintain the blood supply of the heart. It is the left system that consists of left anterior descending artery and left circumflex artery that supply the blood to the anterolateral surface of the heart. Obstruction in any of these arteries causes ischemia which if prolonged may cause permanent damage to myocardial cells resulting in infarction.

Risk factors for coronary artery disease include hypertension, smoking, diabetes mellitus, hypercholestremia and some other novel risk factors. Atherosclerotic plaque which is one of the major causes of coronary artery disease causes obstruction of coronary flow. This obstruction produces ischemia of the affected myocardium. This ischemia may be produced by increased demand or decreased blood supply to the myocardium. If this ischemia is prolonged that can produce infarction. An increase in demand is manifested by changes only in the ST segments but a decrease in perfusion can produce a wide range of changes in the ST segments, T waves, and QRS complexes.[4,5] This ST segment elevation can be categorized in three different patterns. Sclarovsky and Birnbaum have developed a method for classifying the gradation of changes observed in decreased supply.[6] According to them in grade 1 there are changes only in T wave and ST segment is of concave type, in grade 2 there are changes not only in T wave but also in ST segment which becomes straight type and the last grade 3 which includes the changes in T wave, ST segment and QRS complex that makes the shape as convex type or tombstone appearance.

Reperfusion therapy should be administered to all eligible patients with STEMI within 12 hours of the onset of the symptoms.[7,8] Reperfusion therapy includes primary PCI, non-primary PCI and thrombolytic therapy. These options are offered to the patients depending on timing of onset of symptoms, risk factors, financial status and logistical support. The benefits of fibrinolytics therapy in patients with ST elevation or acute left bundle-branch block MI are well established, with a time-dependent reduction in both mortality and morbidity rates during the initial 12 hours after the onset of the symptoms. As streptokinase is not frequently used in developed countries but is used frequently in developing countries.[10]

LVEF should be measured in all patients with STEMI .Best method for the assessment of the LV function is transthoracic echocardiography which may provide evidence of focal wall motion abnormalities and correlation can be made between echocardiography findings and ECG findings. If doubt persists, immediate referral for invasive angiography may be necessary to guide therapy in the appropriate clinical context.[11,12] In a study by KosugeM et al. the correlation between infarct size and shape of ST elevation in total 77 patients who had anterior wall myocardial infarction and reperfusion done within 6 hours of onset of symptoms was studied[13]. The calculated ejection fraction on left ventriculography after 14 days was 58% for concave type, 48% for straight type and 41% for convex type.
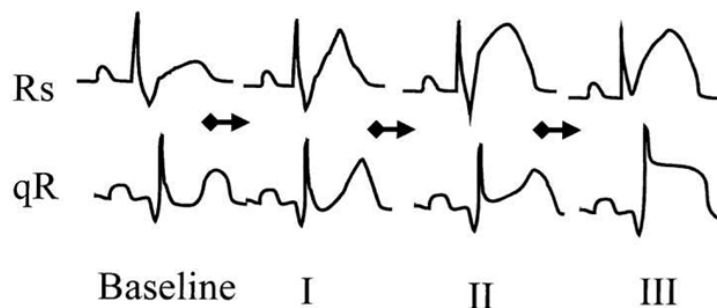
METHODOLOGY

This cross-secitonal study was conducted on 1st January to 31st Mar 2017 in the Cardiology Department of Jinnah Hospital Lahore. Patients with either gender of age above 15yrs having typical ischemic chest pain with positive ECG criteria for acute anterior wall MI defined by the Universal definition of Myocardial Infarction as new ST elevation at the J point in at least 2 contiguous leads of ≥ 2 mm (0.2 mV) in men or ≥ 1.5 mm (0.15 mV) in women in leads V2-V3 and/or of ≥ 1 mm (0.1 mV) in other contiguous chest leads or the limb leads were included.[3]

Patients with previous documented infarction, ascites, history of cardiac surgery and history of stroke (ischemic or hemorrhagic), any malignancy bleeding diathesis pregnancy active peptic ulcer valvular heart disease av malformation diagnosed on ct scan renal failure, left ventricular aneurysm on the basis of history, previous echo reports and electrocardiogram were excluded.

Sampling technique was non probability purposive sampling all of these patients were thrombolysed with SK and shifted to cardiology ward where their echocardiography was done the next day. To rule out other co morbid conditions, a thorough clinical examination and all other necessary investigations were also done. Standard settings and protocol was opted to do ECG by a single technician. Similarly when patients were shifted to cardiology ward their echocardiography was done by same consultant and on single echocardiography machine i.e Gee Machine model Vivid 7 to minimize inter observer variability. Ejection fraction was calculated by using M- mode on parasternal long axis, parasternal short axis or Simpson method. Variables like age was presented by calculating their mean and standard deviation and frequency. Qualitative variables like gender and true positive cases were presented as frequency and percentage. Anova test was applied that showed significant p value of 000).

ECG pattern were categorized into three grades of changes. In grade 1 there were only hyper acute T waves(concave type), in grade 2 there were hyper acute T waves and ST segment elevation(straight type) and in grade 3 there was tombstone appearance on ECG with the changes involving T waves and ST segment and QRS complex(convex type) (Figure 1).

Figure 1: ECG Changes

RESULTS

In this study, a total of 50 patients were recruited that were fulfilling the inclusion/exclusion criteria to determine the correlation between type of ST elevation in acute anterior wall myocardial infarction and ejection fraction onechocardiography.

Majority of the patients were between 45-65 years of age (50%) while 34% patients were between 30 to 45 years and 16% between 61 to 75 year of age with mine age of 52.66 $\pm$ 10.8 years (Table 1).

Table 1: Age Distribution of Patients (n=50)

Age	Frequency (n)	Percentage (%)
30 - 45 yrs	17	34.0
46 - 60 yrs	25	50.0
61 - 75 yrs	8	16.0
Total	50	100.0

About 88% of patients were males and only 22% were females. When analysis of correlation between type of ST segment elevation and EF was made it showed that 20 patients presented with concave type A ST segment elevation and their mean EF was 48.25$\pm$ 8.926% (minimum decrease in EF), while mean EF of the patients who presented with straight type ST elevation was 35.45$\pm$6.502% and large decrease in the EF was noticed in convex type C which showed mean EF of 31.05$\pm$7.375% respectively (p=0.000) (Table 2 and 3)

Table 2: Patient Distribution According to EF (n=50)

ECG Pattern	Frequency (n)	Mean	Std. Deviation	Std. Error
Concave type a	20	48.25	8.926	1.996
Straight type B	11	35.45	6.502	1.960
Convex type C	19	31.05	7.375	1.692
Total	50	38.90	11.033	1.560

Table 3: Corellation Between ST Elevation Type and Echo (n=50)

EF*Type of ST Elevation	Sum of Squares	df	Mean Square	F	P value
Between Groups (Combined)	3049.075	2	1524.538	24.577	.000
Within Groups	3049.075	47	62.030		
Total	5964.500	49			

DISCUSSION

There have been many studies on the correlation between changes in ECG in LV function on echocardiography. In a study by Kosuge M et al. they compared the type of ST-T changes in lead aVR with the LV function on echocardiography in 105 patients who had anterior wall MI and had gone successful reperfusion within 6 hrs. In group A they included those patients who had ST segment elevation > or = 0.5 mm, in group B they included those patients who did not have ST deviations and in group C they included those patients who had ST segment depression > or =0.5 mm in aVR. They concluded that EF was maximally decreased in those patients who had type C changes on ECG and ST-T changes in lead aVR is a good predictor of infarct size and LV function before discharge. Another study by Kosuge M.et al. also showed maximum loss of EF in type C.[13]

The difference between this study and our study was that for the calculation of EF they used ventriculography, that was done after 14 days of infarction but in our study EF was calculated by echocardiography which is more sensitive method for calculation of EF. We also calculated EF within 24 hours of acute anterior wall myocardial infarction which may show decreased EF than the normal due to myocardial stunning. Another drawback of our study may be we included those patients who had anterior wall MI and were reperfused within 12 hours by streptokinase which is not used in developed countries and its efficacy is less than other fibrin specific thrombolytics and primary PCI.

CONCLUSION

We conclude that those patients who showed type C or convex type ST elevation had maximum damaged to LV wall with reduced EF on echocardiography.

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