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CORRELATION OF TYPE OF ST SEGMENT ELEVATION IN ACUTE ANTERIOR WALL MYOCARDIAL INFARCTION ON ECG WITH LEFT VENTRICULAR FUNCTION ON ECHOCARDIOGRAPHY

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Abstract:
Background: *The implication of the shape of ST elevation in the acute phase of myocardial infarction (MI) remains unclear.* ***Aims and Objectives:*** *When blood supply to the heart is decreased it causes myocardial ischemia that is expressed clinically by chest pain and on ECG three different patterns may be seen depending on the amount of damage. It was 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 + ST segment elevation(straight type) and in grade 3 there was tombstone appearance on ECG with the changes involving T waves + ST segment and QRS complex(convex type). We had assumed that there was maximum damage in grade 3 which was assessed on echocardiography. Our objective was to see the correlation between type of acute ST segment anterior wall myocardial infarction on ECG and LV function on echocardiography.* ***Study Design****: Non probability purpose sampling.* ***Duration:*** *Jan 2014 to Mar 2014 in the cardiology department of Jinnah Hospital Lahore.* ***Results:*** *we examined 50 patients with the diagnosis of anterior wall myocardial infarction who presented within 12 hours of presenting complaints and were thrombolysed by streptokinase. We determined the correlation between types of acute anterior wall myocardial infarction that was assessed on ECG with the left ventricular function that was assessed on echocardiography. Majority of the patients were found between the 46 to 60 years, while 34% were below 45 years and 16% were above 65 years. Mean and standard deviation was 52.66±10.873. Male and female distribution was 88% and 22% respectively. There were 20 patients who were falling in the category 1with the mean EF was 48.25± 8.926, while 11 patients in grade 2 and mean EF was 35.45±6.502 while 19 patients enrolled in grade 3 who had maximum decrease in EF with mean 31.05±7.375.* ***Conclusions:*** *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 predicting left ventricular function at discharge.*
Key Words: *ST segment elevation Anterior wall MI, Echocardiography, Electrocardiography.*

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INTRODUCTION:

ST-segment elevation myocardial infarction is the most severe form of acute coronary syndrome (ACS) after sudden cardiac death. In USA at present, STEMI comprises approximately 25% to 40% of MI presentations[1]. Acute myocardial infarction resulting from an occlusive thrombus is recognized on an electrocardiogram by ST-segment elevation [2]. 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 [3]. 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 smoking, hypertension, diabetes mellitus, hypercholestremia, atherosclerosis 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 broad array 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 with symptom onset within the prior 12 hours [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 bundle-branch block MI are well established, with a time-dependent reduction in both mortality and morbidity rates during the initial 12 hours after symptom onset [9,10]. As streptokinase is not frequently used in developed countries but used frequently in developing countries. That is the reason streptokinase is being used in our local setup. 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 Kosuge M et all [13]. studied the correlation between infarct size and shape of ST elevation in total 77 patients who had anterior wall myocardial infarction and reperfusion was done within 6 hours of onset of symptoms. The calculated ejection fraction on left ventriculography after 14 days was 58% for concave type, 48% for straight type and 41% for convex type type. (P <.05; concave type versus the other 2 types).

MATERIAL METHODS:

INCLUSION CRITERIA:

1. Both males and females of age above 15yrs.
2. Patients having typical ischemic chest pain.
3. Patients positive (fulfilling the ECG criteria for acute anterior wall MI) 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[3]as per operational definition.

EXCLUSION CRITERIA:

Patients with following diseases were excluded from the study.

1- Patient with previous documented infarction.
2- Ascites by history, physical examination, and laboratory investigations.
3- Patient with history of cardiac surgery.
4- Patient with history of stroke (ischemic or hemorrhagic).
5- Any malignancy
6- Bleeding diathesis
7- Pregnancy
8- Active peptic ulcer
9- Valvular heart disease
10- AV malformation diagnosed on CT scan.
11- Renal failure.

12- Left ventricular aneurysm on the basis of history, previous echo reports and electrocardiogram.

SAMPLING TECHNIQUE:

- Non probability purposive sampling

DATA COLLECTION PROCEDURE:

Total 50 patients who presented in the cardiology emergency department and fulfilled the clinical and ECG criteria were included in the study. All of these patients were thrombolysed with SK and shifted to cardiology ward where their echocardiography was done 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 single 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.

DATA ANALYSIS:

Variable 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 (P= .000). 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 on echocardiography.

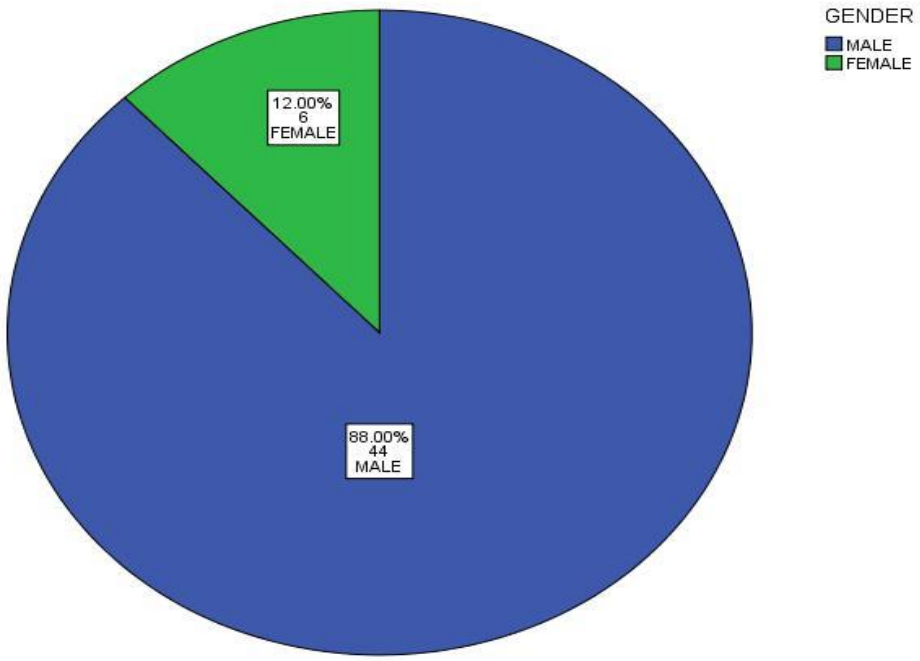
This research work shows majority of the patients between 45-65 years of age 50% (n=25), while 34% (n=17) patients were found between 30 to 45 years and 16% (n=08) were found between 61 to 75 year (TABLE 1). Mean and standard deviation was found on 52.66±10.873. (Table 2). When age distribution of patients was calculated it was found that 88% were males and only 22% were females who presented with anterior wall myocardial infarction(GRAPH 1). 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± 8.926 that minimum decrease in EF, while mean EF of the patients who presented with straight type ST elevation (n=11) was 35.45±6.502 and large decrease in the EF was noticed in convex type C which showed mean EF of 31.05±7.375(n=19).(TABLE 3).

TABLE 1:Age distribution of patients

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	30 - 45 yrs	17	34.0	34.0	34.0
	46 - 60 yrs	25	50.0	50.0	84.0
	61 - 75 yrs	8	16.0	16.0	100.0
	Total	50	100.0	100.0	

STATISTICS OF AGE

N	Valid	50
	Missing	0
Mean		52.66
Median		54.00
Mode		60
Std. Deviation		10.873
Minimum		30
Maximum		75



GRAPH 1

PATIENT DISTRIBUTION ACCORDING TO EF

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
CONCAVE TYPE A	20	48.25	8.926	1.996	44.07	52.43	35	60
STRAIGHT TYPE B	11	35.45	6.502	1.960	31.09	39.82	20	40
CONVEX TYPE C	19	31.05	7.375	1.692	27.50	34.61	25	45
Total	50	38.90	11.033	1.560	35.76	42.04	20	60

TABLE 3

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
EF * TYPE OF ST ELEVATION	Between Groups	(Combined)	3049.075	2	1524.538	24.577	.000
	Within Groups		2915.425	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. in 2001[14] 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. In another study by Kosuge M et all [13] in 1999 that also showed maximum loss of EF in type C.

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 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. We conclude that those patients that showed type C or convex type ST elevation showed the maximum damage of EF on echocardiography.

CONCLUSIONS:

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 predicting left ventricular function at discharge.

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