CORONARY ARTERY DISEASE;
ACUTE INFERIOR WALL MYOCARDIAL INFARCTION WITH ST SEGMENT DEPRESSION IN ANTERIOR CHEST LEADS

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ABSTRACT… Objectives: To determine the frequency of multivessel coronary artery disease (CAD) in patients suffering from inferior wall acute myocardial infarction (AMI) having ST segment depression in anterior chest leads. **Study Design:** Cross Sectional Survey. **Setting:** Department of Cardiology, Faisalabad Institute of Cardiology, Faisalabad. **Period:** December 2013 to June 2014. **Materials and Methods:** After fulfilling the inclusion criteria, 120 patients with acute inferior wall MI were studied. Patients were divided in two groups. Group I included patients with ST segments depression in leads V1-V3 and Group II with ST segment depression in leads V4-V6. Age of patients ranged from 25 to 70 years. **Results:** The mean age was 52.5 ± 10.5 years. As regards sex distribution, 100 patients were male, 54 in Group I and 46 in Group II. There were 20 female patients, 11 in Group I and 9 in Group II. Thirty six (30%) patients were diabetic, 22(33.8%) in Group I and 14(25.5%) in Group II. Forty five (37.5%) patients were hypertensive. Fifty two (43.3%) patients were smokers. Forty three (35.8%) patients had family history of ischemic heart disease, 25(38.5%) in Group I and 18(32.7%) in Group II. Thirty five (29.2%) had hyperlipidemia, 20 (30.8%) in Group I and 15(29.2%) in Group II. All patients underwent coronary angiogram. Thirty eight (31.7%) patients had single vessel disease, 29(44.6%) patients in Group I and 9(16.4%) in Group II. Forty three (35.8%) patients had double vessel coronary artery disease, 23 patients (35.4%) in Group I and 20(36.4%) in Group II. Thirty nine (32.5%) had three vessel coronary artery disease, 13 (20%) in Group I and 26 (47.3%) in Group II. Eighty three (69.2%) patients had multivessel coronary artery disease 37(56.8%) in Group I and 46 (83.6%) in Group II (p value <0.002). **Conclusion:** The presence of precordial ST depression during acute inferior wall myocardial correlates well with multivessel CAD. Precordial ST-segment depression in acute inferior wall MI is related to anterior injury due to LAD stenosis and these patients tend to have more severe CAD.

Key words: Acute inferior wall myocardial infarction, ST segment depression, coronary angiography, multivessel coronary artery disease.

INTRODUCTION

Coronary artery disease (CAD) is global epidemic causing about 4.5 millions deaths in developed World and is the leading cause of cardiovascular mortality.[1] By 2020 cardiovascular disease (CVD) will be the leading cause of death worldwide.[2] One in four middle aged adults in Pakistan has CAD.[3] In 2002, nearly 100,000 patients suffered from AMI in Pakistan.[4]

Electrocardiogram (ECG) is used to diagnose AMI. AMI is confined to leads facing the infarcted area.[5] Depression of reciprocal ST-segment is frequently seen in the wall opposite to the infarcted territory during AMI.[6]

Reciprocal depression of ST-segment in anterior leads is common ECG finding in patients with AMI of inferior wall and its presence indicates multivessel CAD and may not be just an electrical phenomenon.[7] There is considerable evidence to support that presence of reciprocal changes is associated with severe CAD or absence of collaterals. Reciprocal depression of ST-segment is an index of high risk sub-sets in inferior wall AMI with respect to clinical outcome.[8] Multivessel disease is more often seen in patients with maximum depression of ST segment in V4 – 6 leads as compared to those having depression in V1 – 3 leads.[9-10]

In an international study the frequency of multivessel CAD with inferior wall infarction having ST segment depression in anterior V1-6 chest leads was 58%.[7] Multivessel CAD determines high morbidity and mortality. Pakistan is a low resource country, unluckily having high prevalence of CAD.[11] In Pakistan previous studies have been done on in-hospital outcome of AMI[12,13] but as yet no study has examined the frequency of multivessel CAD in acute inferior wall MI having depression of ST segment in anterior chest leads. This study was aimed to determine the frequency of multivessel CAD in AMI of inferior wall having depression of precordial ST-segment in anterior leads.

MATERIALS AND METHODS
This Cross Sectional Survey was conducted at FIC, Faisalabad from December 2013 to June 2014 one hundred and twenty patients were enrolled. Non-probability purposive sampling technique was used. Patients were divided in two groups. Group I included 65(54.16%) patients with depression of ST-segment in chest leads V1-3 and Group II 55(45.83%) patients with depression of ST-segment in chest leads V4-6.

Presence of any two of the following criteria define Acute Myocardial Infarction:-
1   Ischemic chest pain which last more than 30 minutes (on history).
2   More than 1 mm ST-segment elevation in leads II, III and aVF (acute inferior wall MI) on ECG.
3   Increase more than twice upper limit of normal (assessed on blood test) in serum creatinine kinase (MB fraction).

Reciprocal change in ST segment was defined as horizontal 0.05mm or more depression of ST segment depression in chest leads between V1 – 3 or V4 – 6. Multi vessel Coronary Artery Disease was defined as, significant stenosis (more than 70%) in two or more coronary arteries on coronary angiography.

Male and female patients were included between 25-70 years of age. Patients with acute inferior wall MI with reciprocal changes in precordial V1-V6 leads on ECG (within 48 hours) were enrolled.

Exclusion Criteria were patients having myocardial infarction other than inferior wall (on ECG). Previous history of MI in any territory (on ECG findings). Patients of acute inferior wall MI not undergoing coronary angiography due to any reason, e.g. renal failure, failure to give consent etc.

One hundred and twenty admitted patients were included after taking consent on a consent form. They were explained about the procedure of the study. The demographic characteristics of the patients who present with acute inferior wall MI were recorded. Effect modifiers were gender, age and risk factors for IHD like HTN, DM, smoking, history of IHD and hyperlipidemia in family. These were addressed by stratifying the data. Each patient underwent coronary angiogram. Multivessel disease was assesed on coronary angiogram. All the information was collected through a specially designed proforma.

STATISTICAL ANALYSIS
The data was subjected for analysis by using SPSS Version 10.0. Continuous variable like age was expressed as Mean±SD (Standard deviation). Frequency of multivessel coronary artery disease with acute inferior wall MI having depression of ST segment in anterior chest leads was calculated and presented in tabulated form. Data was obtained for risk factors like DM, hypertension, smoking, hyperlipidemia and ECG findings (V1-V3, V4-V6) to address effect modifiers. Categorical variables like risk factors for ischemic heart disease and disease severity were compared between Group I and Group II by using Chi Square test. A p value of ≤0.05 was taken as significant.

RESULTS
Age of patients ranged from 25 to 70 years. The mean age was 52.5±10.5 years. As regards sex distribution 100(83.3%) patients were male, 54 (83.1%) in Group I and 46(83.6%) in Group II. There were 20(16.7%) female patients, 11(16.9%)

in 1st Group and 9(16.4%) in 2nd Group. Thirty six (30%) patients were diabetic, 22(33.8%) in Group I and 14(25.5%) in Group II. Forty five (37.5%) patients were hypertensive, 23(35.4%) in Group I and 22(40%) in Group II. (Table-I)

Fifty two (43.3%) patients were smokers, 31(47.7%) were in Group I and 21(38.2%) in Group II. Forty three (35.8%) patients had family history of ischemic heart disease, 25(38.5%) in Group I and 18(32.7%) in Group II. Thirty five (29.2%) had hyperlipidemia, 20(30.8%) in Group I and 15(29.2%) in Group II. (Table-II)

Sixty six (55%) patients had elevation of ST segment in leads II, III and aVF, 34(52.3%) patients in 1st Group and 32(58.2%) in 2nd Group (p value <0.561). ST segment elevation in lead II>III was observed in 3(2.5%) patients, one patient in Group I and 2 in Group II. Fifty one (42.5%) patients had more ST segment elevation in lead III as compared to lead II, 30(46.2%) patients in Group I and 21(38.2%) in Group II (p<0.561). (Table-II)

All patients underwent coronary angiogram. Thirty eight (31.7%) patients had single vessel disease, 29 (44.6%) patients in 1st Group and 9(16.4%) in 2nd Group. Forty three (35.8%) patients had double vessel coronary artery disease, 23 (35.4%) patients in 1st Group and 20(36.4%) patients in 2nd Group. Thirty nine (32.5%) had three vessel coronary artery disease, 13(20%) in 1st Group and 26(47.3%) in 2nd Group. (p value <0.001). (Table-III)

Eighty three (69.2%) patients had multivessel coronary artery disease, 37(56.8%) in 1st Group and 46(83.6%) in 2nd Group. (p value <0.002). (Figure-1)

RCA was diseased in majority of patients 100(83.3%), 52(80%) in 1st Group and 48(87.3%) in 2nd Group. Followed by disease in LAD which occurred in 70(58.3%) patients, 29(44.6%) in 1st Group and 41(74.5%) in 2nd Group (p<0.001). (Table-IV).

Characteristics	Group I V1-V3 n=65	Group II V4-V6 n=55	Total n=120	P Value
Age	52±10.8	52.3±10.2	52.5±10.5	< 0.446
Gender Male Female	54 (83.1%) 11 (16.9%)	46 (83.6%) 9 (16.4%)	100 (83.3%) 20 (16.7 %)	< 0.935
Diabetese Mellitus	22 (33.8 %)	14 (25.5%)	36 (30 %)	<0.318
Hypertension	23 (35.4 %)	22 (40%)	45 (37.5 %)	<0.603
Smoking	31 (47.7 %)	21 (38.2%)	52 (43.31 %)	<0.295
Family History	25 (38.5 %)	18 (32.7 %)	43 (35.8 %)	<0.323
Hyperlipidemia	20 (30.8 %)	15 (27.3 %)	35 (29.2 %)	<0.415

Table-I. Basic demographic characteristics.

| ST Elevation	Group I V1-V3 n=65	Group II V4-V6 n=55	Total n=120	P VALUE
II, III, AVF	34 (52.3%)	32 (58.2%)	66 (55%)	
II >III AVF	1 (1.5%)	2 (3.6%)	3 (2.5%)	<0.561
III >II AVF	30 (46.2%)	21 (38.2%)	51(42.5%)	

Table-II. ST Segment elevation in different leads.

No of Diseased Vessels	Group I V1-V3 n=65	Group II V4-V6 n=55	Total n=120	P value
Single Vessel Disease	29 (44.6%)	9 (16.4%)	38 (31.7%)	
Two Vessel Disease	23 (35.4%)	20 (36.4%)	43 (35.8%)	<0.001
Three Vessel Disease	13 (20%)	26 (47.3%)	39 (32.5%)	

Table-III. Number of diseased vessels in the two Groups.

ARTERIES	Group I V1-V3 n=65	Group II V4-V6 n=55	Total n=120	P VALUE
LMS	1(1.5%)	4(7.3%)	5(4.2%)	<0.135
LAD	29(44.6%)	41(74.5%)	70(58.3%)	<0.001
LCX	30(46.2%)	34(61.8%)	64(53.3%)	<0.063
RCA	52(80%)	48(87.3%)	100(83.3%)	<0.207
RI	2(3.1%)	2(3.6%)	4(3.3%)	<0.625

Table-IV. Coronary Artery involvement in the study population.
LAD=Left anterior descending; LCX=Left circumflex; LMS=Left main stem; RCA=Right coronary artery; RI=Ramus intermediate.
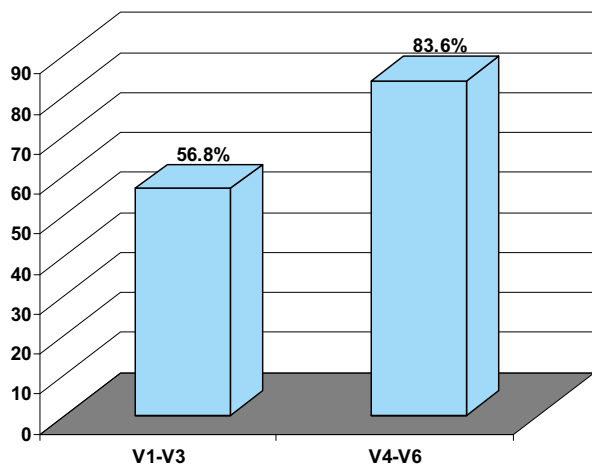
Figure-1. Comparison of multivessel disease in the two groups.

DISCUSSION

Reciprocal depression of ST-segment in the wall opposite the infracted territory is a common finding in ECG during AMI. Depression of ST-segment may depict subendocardial ischemia, infarction, or reciprocal changes secondary to infarction at a remote site.[14] We observed that reciprocal depression of ST segment is indicative of associated ischemia and its not just an electrical phenomenon. We observed multivessel disease in 69.2% of patients with resting depression of ST-segment in precordial leads in acute inferior wall MI.

There is worse prognosis with precordial depression of ST segment on accompanying acute inferior wall infarction.[15-26] According to Peterson et al[25], there is marginal correlation of magnitude of precordial depression of ST segment with the magnitude of elevation of ST segment in inferior AMI.

Contrary to the above narrated studies, we observed that multivessel disease was more common in patients having depression of ST segment in leads V4-6 (83.6%) compared to 56.8% in Group I (V1-3) with acute inferior MI thus indicating the association of depression of ST segment in anterior leads with CAD. The results correlate with the studies of Zoghi et al[7] and Magar et al.[27]

Zoghi et al[7] has observed that in 58% patients presenting with multivessel disease, there is resting depression of ST segment in precordial leads. According to location of reciprocal changes, multivessel disease was present in significantly more patients with anterior depression of ST segment concomitant with or without lateral ST segment depression.

Magar et al[27] in their study observed that three vessel CAD was more common in patients having depression of ST segment in leads V4-6 than in leads V1-3. Multivessel CAD was present in 62.7% in V4-6 and 13.4% in V1-3. On the contrary single vessel CAD was less common in V4-6 than in V1-3 (8.4% versus 50.7%, p<0.00001 for both). The mean age was higher in V4-6 group 62.7 ± 11.7 as compared to V1-3 group 58± 9.6 years. No statistical significant difference between V1-3 and V4-6 groups apart form age.

Parale et al[10] studied the relevance of the ECG changes in the reciprocal leads in patients with AMI of inferior wall. Patients with depression of ST segment in V4-6 leads were found to have more occurrence of MVD i.e 78% (p<0.001). These patients were also noted to have decreased

ejection fraction. Haraphongse studied 57 patients with inferior wall AMI. Mean age of the patients was 50 years. 26 patients (Group A) had minimal or no precordial depression of ST segment. 31 patients (Group B) had significant precordial depression of ST segment. The two groups showed consistent differences in frequency of multivessel CAD and stenosis of Left anterior descending (LAD) artery. Multivessel CAD in group A was 35% whereas in group B it was 81%. LAD supplies blood to important territory of left ventricle and was diseased in 68% of patients in Group B. In Group A there was only 35% patients having disease in LAD. The patients of Group B showed more complications in the acute phase and in the follow up period (p value <0.05) as compared to group A.[28]

In our study significant LAD disease was present in 70 patients (58.3% p <0.001). LAD involvement was more common (74.5%) in patients having depression of ST segment in V4-6 (group B) whereas it was 44.6% in V1-3 (group A).

Strasberg et al studied that the reciprocal depression of ST segment in leads V5 and V6 as an important indicator of the LAD stenosis in AMI of inferior wall. 24 of 28 patients (85%) with depression of ST segment in leads V1-6 had significant lesion of the LAD whereas 16 of 18 patients with depression of ST segment in V1-4 had insignificant or no lesion in the LAD.[29]

Birnbaum et al divided their study population into 3 Groups, Group I comprised of patients having no ST depression in precordial leads, Group II included maximum ST depression in leads V1-3, and Group III included depression of ST segment in leads V4-6. Three vessel disease (26%) is more often present in patients with maximum depression in leads V4-6 than having no precordial depression of ST segment (13.5%) or having depression of ST segment in leads V1-3 (15.7%, p=0.002).[30]

Vaidyanathan et al[8] studied angiographic correlates of anterior depression of ST segment in AMI of inferior wall, and observed higher frequency of MVD (76%). Our results are in accordance with those of Strasberg et al, Prale et al[10], Harpaphonges et al[28] And Zoghi et al[7] who found that patients with AMI of inferior wall and greater depression of ST segment in leads V4-6 had a higher rate of multivessel CAD and a trend towards a higher rate of LAD stenosis.

CONCLUSION

The presence of precordial depression of ST segment during acute inferior wall myocardial correlates well with multivessel CAD. Precordial depression of ST-segment in acute inferior wall MI is concerned with anterior injury due to LAD stenosis. These patients tend to have more severe CAD. To identify the subgroups of patients with acute inferior wall MI having diffuse CAD at the time of admission, ECG might be a helpful tool because it is a simple, easily obtained, noninvasive, and inexpensive. Therefore they may be benefited from a more invasive approach. This will result in reduced morbidity and mortality. **Copyright© 15 May, 2017.**

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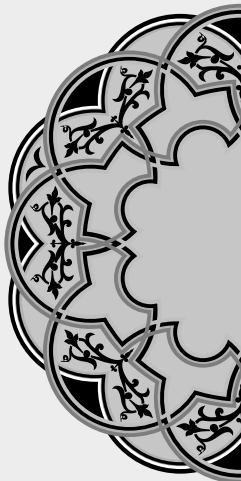
"Anyone can deal with victory.

Only the mighty can bear defeat."

Adolf Hitler

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