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ST SEGMENT DEPRESSION IN ANTERIOR CHEST LEADS V1-V6 IN CASE OF ACUTE INFERIOR MYOCARDIAL INFARCTION

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ABSTRACT

Background: Though precordial ST segment depression is debated for long time, preceding various researches has showed that precordial ST segment depression along with acute Inferior Myocardial Infarction independent to left coronary artery stenosis or extension of inferior ischemia. However purpose of the different pattern of precordial ST segments depression is a review study. **Objective:** In this study our main goal is to determine ST segment depression in anterior chest leads V_1-V_6 in case of acute inferior myocardial infarction. **Methods:** We examined enlisted eighty four (n=84) consecutive patients with acute inferior myocardial infarction within 12 hours of onset of chest pain and underwent thrombolysis in coronary care unit. Consequently patients were classified in two groups on the basis of admission electrocardiogram. Group A patients with acute inferior myocardial infarction associated significant (≥ 0.1 mV) precordial ST segment depression in leads V_1-V_6 (n=44, 52.38%); whereas group B had no remarkable precordial ST segment change (n=40, 47.62%). Thereafter Echocardiography was recorded within 3rd day and catheterization with coronary angiography was done within 4 weeks of infarction. **Result:** Patients with anterior ST segment deviation in association with acute inferior myocardial infarction (group A) had larger wall motion abnormality with posterior or lateral wall extension and Ejection Fraction (EF%) lower (50.47 ± 4.18 Vs55.25 ± 4.32, *p*=0.001) than that of patients with no precordial ST change (group B). Serum level of Troponin-I (34.25 ± 18.35 Vs 32.86 ± 7.12, p=0.721) and CK-MB (117.15 ± 40.49 Vs 97.65 ± 7.06, p=0.012) both were higher in group A rather than group B. **Conclusion:** In overall outcome, patients with ST segment depression in acute inferior myocardial infarction liked with more wideness of ischemic area of infracted zone and more prevalence to multi vessel lesion (double or triple vessel) and index of worse prediction.

KEYWORDS: Myocardial infarction, ST segment, electrocardiograph, anterior ischemia.

INTRODUCTION

Acute coronary syndrome is primary manifestation or expression of acute myocardial infarction which is due to anterior or inferior or both myocardial walls involvement. Among all myocardial infarction, inferior infarction comprises at least 40-50%. In case of isolated inferior myocardial infarction exhibit more friendly prognosis that of anterior infarction. Inferior myocardial infarction associated with anterior ischemia also worse indicator and ascends both acute and chronic infarction related complications.

Concern of precordial ST segment depression in relation with acute inferior myocardial infarction (AIMI) enhances both mortality and morbidity. Noticing from electrocardiograph (ECG), isolated acute ST elevation in II, III, aVF suggested that sign of transmural inferior myocardial infarction with some occasion posterior extension. However, concomitant precordial ST segment depression in anterior chest leads V_1-V_6 in conjugation with acute inferior myocardial infarction, evidence suggested of extensive transmural lateral or anterior ischemia. Previous studies have showed that precordial ST segment depression in case of acute inferior myocardial infarction consist of approximately half of acute myocardial infarction. This ST segment depression may due to 1st anterior ischemia owing to left sided coronary artery involvement alongside of inferior infarction, 2nd extension of inferior infarction comprises infero-lateral or postero-lateral wall and 3rd it may be reciprocal change resulting from vasospasm or inflammatory reaction to inferior infarction.[1-15]

Though, maximum ST segment depression in V_1-V_6 is different cause and varied ways of mechanism, resulting LV dysfunction because of diverse appointments. Patient with highest ST depression in V_1-V_3 likely engaged posterior or inferoseptal wall extension of acute infarction. On the other hand, greater ST depression in leads V_4-V_6 possibly suggests multi coronary artery disease, mostly trend to anterior descending coronary artery involved.[16,17]

To investigate the underlying mechanisms of different pattern of ST depression in chest leads V_1-V_6were assessed by Angiographic findings in patients with acute inferior myocardial infarction. ECG is the simplest, inexpensive and noninvasive bedside available test to diagnosis as well as categorizes patients in subgroups and may help to identify patients who have multi vessel coronary artery disease. These kinds of patient are at high risk and therefore may get more benefit from invasive approach. Early aggressive reperfusion therapy is beneficial which significantly reduces the risk of major complications, in-hospital deaths and long term mortality and morbidity. Considering these, much effort has been put into correlating ECG changes in acute ischemic episode with coronary angiogram which is the aim of our current study.

Objective

General objective

The aim of current study is to explore the motive of ST segment depression in anterior chest leads V_1-V_6 in case of acute inferior myocardial infarction and find out number of coronary artery involved in comparison with acute inferior myocardial infarction without significant (<0.1mV) precordial ST segment change.

Specific objective

- Determine the relationship between precordial ST segment depression in association with acute inferior myocardial infarction and number of coronary artery stenosis by direct catheterization and coronary angiogram.
- Correlate the reasons of precordial ST segment depression with acute inferior myocardial infarction.
- Compare to prevalence of involved coronary artery (if it is single or multivessel disease) in acute inferior myocardial infarction relation with presence of precordial ST segment depression and absence of ST depression in V_1-V_6 and objective is to early detection of multivessel disease and prevention of short and long term complications.

METHODOLOGY

Type of study	It was a Prospective and observational study.
Place of study	National Institute of Cardiovascular Diseases, Shere-e-Bangla Nagar, Dhaka, Bangladesh.
Study period	February 2012 to December 2012.
Study population	Patients with precordial ST segment depression in case of acute inferior myocardial infarction got admission within 12 hours of commencement of chest pain in coronary care unit of above mentioned Hospitals. Every selected patient have got IV streptokinase in CCU and undergone coronary angiogram within 28 days of acute attack.
Sampling technique	Non-probability purposive sampling method

Selection criteria

Inclusion criteria

- Patients admitted with definite diagnosis of Acute Inferior Myocardial Infarction
  within 12 hours onset of symptoms (WHO criteria).
- Patient with or without precordial ST segment depression was included and all
  patients got thrombolytic therapy streptokinase IV in Coronary Care Unit (CCU).
- Therefore subsequent catheterization and coronary angiography was conducted
  within four weak of acute myocardial infarction.

Exclusion criteria

- Acute Myocardial Infarction after PCI (percutaneous coronary invasion) or CABG (Coronary Artery Bypass Grafting).
- AMI patients admitted after 12 hours of onset of symptoms.
- Previous myocardial infarction.
- Associated complication after or in association with Acute Myocardial Infarction

Study procedure and data collection

After patient's admission in coronary care unit, initial evaluation was done by detail history taking, through clinical examination and relevant laboratory investigations. Demographic data like age, sex and risk factors including dyslipidemia, hypertension, diabetes mellitus, family history of heart attack and smoking were noted. All data was recorded in a pre-designed form. The continuous variables were expressed in their mean (±SD). The mean difference was compared by unpaired "t" test and / or ANOVA. The categorical data (variables) was presented in percentage or p ratio. The difference of percentage or p ratio was compared by chi-square test or Fisher's exact test. The correlation and regression test was done to find out the correlation and predictability of the variables. The results of the study were expressed by different tables, graphs, charts, diagrams etc. in relevant cases. At the end of the study data analysis, result, discussion, summery and conclusion of the whole research had presented.

Statistical analysis

After collecting the data, statistical analysis was done by using computer based SPSS (Statistical Package for Social Science) version 12. Continuous data were expressed as mean ± standard deviation. Dichotomous data were disclosed as percentage. Student's t-test, chi-square test, Fisher's exact test were used as when applicable. P value of less than 0.05 was considered as statistically significant.

RESULTS

Enlisted eighty four patients were distributed in two groups- Group A (44 or 52.38%) patient with acute inferior myocardial infarction accompanied by precordial ST segment deflection in leads V_1-V_6 (≥0.1 mV) and Group B (40 or 47.62%) had no significant precordial ST segment change.

Clinical data correlation

There were no significant differences in two groups in respective of diabetes mellitus, smoking and dyslipidemia. According to sex distribution male patients are predominant in both groups (group A 86.4% vs. 13.6% & group B 90% vs. 10%, p=0.746). Figure of female patients less another cause might be female less careful about their health, only complicated cases are attended to hospital. Male are in ascending may due to male sex hormone, occupation, smoking prevalence.

Table I: Distribution of patient according to sex.

Sex	Group		p value
	Group A (Presence of significance of ST depression)	**Group B** (Absence of significance of ST depression)	
Male	38 (86.4)	36 (90.0)	0.741
Female	6 (13.6)	4 (10.0)	
Total	**44 (100.0)**	**40 (100.0)**	

* Fisher's Exact Test was done to measure the level of significance.

Following age distribution in group A had larger number of patients within 51 to 60 years (22 out of 44 and 50.0%). It may due to at this age change of vascular connective tissue which reduce vessel wall flexibility result may acts in favor of atherosclerosis. On the other hand in group B highest number of patients was in between 41 to 50 years (22 out of 40 and 55.0%)and statistically it were 50.81 ± 8.28, 48.75± 8.68; p=0.267 (table- 2).

Table II: Distribution of patient according to age.

Age group	Group		p value
	Group A Presence of significance of ST depression	**Group B** Absence of significance of ST depression	
<=40	7 (15.9)	7 (17.5)	0.267
41 – 50	13 (29.5)	22 (55.0)	
51 – 60	22 (50.0)	7 (17.5)	
>=61	2 (4.5)	4 (10.0)	
Total	44 (100.0)	40 (100.0)	
Mean ± SD	50.81 ± 8.28	48.75± 8.68	

* Independent t-test was done to measure the level of significance.

Next to test of occupation had showed no significant variation of coronary atherosclerotic disease between different professionals (table-3).

Table III: Distribution of patient according to occupation.

Occupation	Group		p value
	Group A (Presence of significance of ST depression)	**Group B** (Absence of significance of ST depression)	
Service	14 (31.8)	15 (37.5)	0.586
Business	13 (29.5)	13 (32.5)	
Sedentary Job	1 (2.3)	2 (5.0)	
Farmer	4 (9.1)	4 (10.0)	
House-wife	7 (15.9)	4 (10.0)	
Other	5 (11.4)	1 (2.5)	
Retired	0 (.0)	1 (2.5)	
Total	44 (100.0)	40 (100.0)	

* Chi-square test was done to measure the level of significance. Figure within parentheses indicates in percentage.

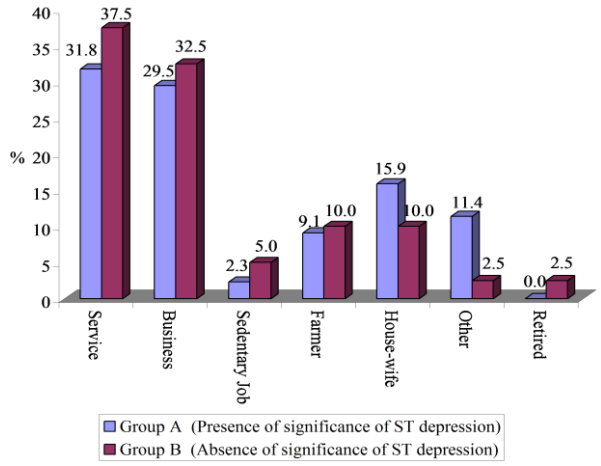

Figure 1: Bar diagram of patient according to occupation.

Electrocardiographic Records

All patients in two group with ST elevation in ≥ 1 mV in leads II, III and aVF were included. Only in group A magnitude of maximum precordial ST segment depression ≥ 1 mV during acute inferior leads ST elevation was assimilated. In group B patients without precordial ST depression or insignificant (≤ 1 mV) ST segment changed.

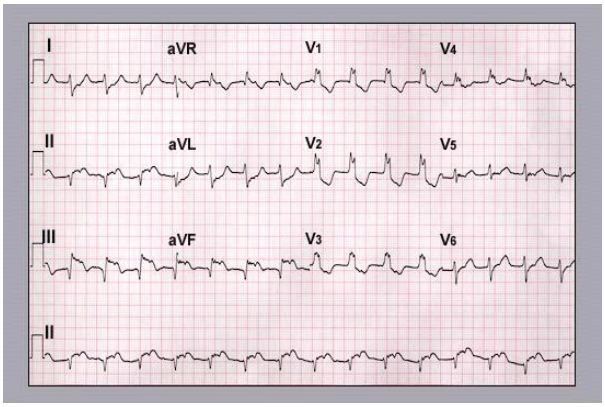

Figure-II: Acute inferior myocardial infarction with precordial ST segment depression (V_1-V_6).

According to ECG finding all patients got inferior infarction and based on right sided ECG ($V_{3,\ 4}$)five patients from group A and seven patients from group B had have right ventricular infarction. True posterior ECG ($V_{8,\ 9}$) revealed fifteen patients from group A got posterior injury and eighteen patients had lateral necrosis.

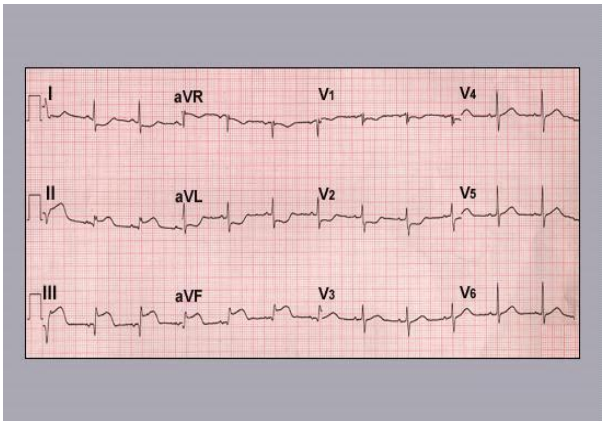

Figure- III: Admission electrocardiogram of a patient showing acute ST elevation in lead II, III, aVF and concomitant ST segment depression in chest lead I, aVL, $V_2 - V_6$.

Table- IV: depicts clinical history of patients at the time of admission. It exhibit majority of patient complain with compressive chest pain (>95%) and significant number of patients had experiment of shortness of breath (SOB), previous angina, associated sweating and nausea. Sense of referred pain to shoulder or jaw or radial border also was common complain. Duration of chest pain was similar in both groups but persistent of pain was prolong & severe in patient with precordial ST segment depression after admission in CCU.

Table IV: Distribution of patient according to clinical history.

Clinical history	Group		p value
	Group A (Presence of significance of ST depression)	Group B (Absence of significance of ST depression)	
Previous angina	34 (77.3)	29 (72.5)	0.614
Chest compression	42 (95.5)	38 (95.0)	1.000
Shortness of breath	39 (90.7)	39 (97.5)	0.361
Associated sweating	35 (79.5)	23 (57.5)	0.029
Nausea/Vomiting	22 (50.0)	17 (42.5)	0.491
Pain referred	35 (79.5)	32 (80.0)	0.959

* Chi-square test was done to measure the level of significance. Figure within parentheses indicates in percentage:

Risk Factors and Complication Analysis

Data of risk factors displayed as smoking was near about common risk factor in both groups (70.5% for group A & 75.0% in group B, p=0.641). Next to that hypertension (HTN) was second high risk factor in group A to cause coronary disease (47.7% vs. 32.5%, p=0.156). Following of that diabetes mellitus showed slightly upper risk factor in group A (43.2% vs. 35.0%, p=443). Dyslipidemia proportionately mild variable between groups which was not important (245.0% vs. 17.5%, p=0.403) for individual group. But dyslipidemia is culprit to development of atherosclerosis. Though diabetes mellitus was more in group B, but significant number also in group A (33.33%). Family history was not strongly established in current study regarding risk factor for infarction.

Table V: Distribution of patient according to risk factors.

Risk factors	Group		p value
	Group A (Presence of significance of ST depression)	**Group B** (Absence of significance of ST depression)	
Smoking	31 (70.5)	30 (75.0)	0.641
Hypertension	21 (47.7)	13 (32.5)	0.156
Diabetes Mellitus	19 (43.2)	14 (35.0)	0.443
Dyslipidemia	11 (25.0)	7 (17.5)	0.403
Family history of IHD	2 (4.5)	1 (2.5)	1.000

* Chi-square test was done to measure the level of significance.

Table VI: Distribution of patient according to echocardiographic findings.

Echocardiographic findings	Group		p value
	Group A (Presence of significance of ST depression)	**Group B** (Absence of significance of ST depression)	
LV EF (%)	50.47 ± 4.18	55.25 ± 4.32	0.001
LV IDd (mm)	50.86 ± 2.98	48.12 ± 2.864	0.252
LV IDs (mm)	34.06 ± 5.46	32.35 ± 4.32	0.795

* Independent t- test was done to measure the level of significance.

Data were analyzed with using Student t-Test and presented as mean ± SD

Table VII: Distribution of patient according to number of diseased coronary vessel: Group A majority patients got multivessel disease and group B highest number of patients with single artery block.

Diseased coronary vessel	Group		p value
	Group A (Presence of significance of ST depression)	**Group B** (Absence of significance of ST depression)	
Single vessel	3 (6.8)	30 (75.0)	0.001
Double Vessel	34 (77.3)	9 (22.5)	
Triple Vessel	7 (15.9)	1 (2.5)	
Total	**44 (100.0)**	**40 (100.0)**	

* Chi-square test was done to measure the level of significance.

DISCUSSION

Though it has been debated for long time, however from various studies it is well established that meaningful precordial ST segments depression in association with acute inferior myocardial infarction having worse prognosis and greater mortality and morbidity and manifestation of more than one vessel coronary artery disease. Therefore it accepted that precordial ST segment depression has more chance to have multivessel coronary artery stenosis.[18-21] But there is great deal of disparity among different studies concerning patho-physiology of this ST depression.

We examined involved coronary arteries in both two groups according to angiographic findings which disclosed that group A had more tendency to stenosis more than one coronary vessel, means double or in some cases triple vessels disease with left coronary artery comprised (77.3% DVD, 15.9% TVD & 6.8% SVD only), whereas in group B majority showed single vessel disease (75% SVD, 22.5% DVD, 2.5% TVD). Though it is established from various studies that associated ST depression is indicator of multi vessel disease, but some researchers reported with disagree of such association.[22-25] Some studies had differentiated among V_1-V_3 and V_4-V_6 result of which corroborated those of Birbaum *et al*. Investigation of Stasberg *et al.* Hasdai *et al*. and others

also reported patient with precordial ST segment depression in lead V_4-V_6 has higher rates of left anterior descending artery (LAD) lesion and concomitant multi vessel disease.[26,27] Their study also demonstrated that patients more often had AMI inferior due to proximal RCA occlusion. The result of current study and announcement of other experimental researches suggest that combined ST segment depression in precordial leads V_1-V_6 has illustrated the link with more likely anterior ischemia owing to LAD lesion which in favor of multi epicardial coronary vessel disease.

In accordance with study response of there was no significant difference in RV involvement between subgroups with various pattern of precordial ST segment depression. Other studies they did not assess the relation of RVI with different pattern of precordial ST segment depression in case acute inferior myocardial infarction. Our result has found no major discrimination between groups.[28]

All proximal right coronary artery lesions did not get right ventricular (RV) infarction, because it is thought to be less myocardial O_2 demand of Right Ventricle, comparatively thinner wall of RV or greater diastolic flow ratio in coronary vessel perfusion. It also thought that increased ability to consume more O_2 during stressful condition. In some cases presence of extensive collateral vessels to protect Right Ventricle from Ischemic damage. Some studies reported that ST segment elevation in right sided ECG during acute inferior myocardial inflation due to transient stress extension which correlates with duration of ischemia. Diagnosis of Right Ventricular infarction on the basis of ST segment elevation in V_4R, it's specificity 78%, sensitivity 88% and diagnostic efficiency about 83%. During acute inferior infarction changes ST-segments in leads of RV infracted wall and infarction of inferior or postero-lateral wall are opposite influence. In case of RV Infarction, ST segment tends to elevate whereas in case of inferior or infero-lateral infarction express reciprocal ST segment depression.

The mean age of group-A was 50.81 ± 8.28 years with age range 30 to 70 and in Group B mean age was48.74 ± 8.68 years and the age range between 30 to 70 years (Table 1), but no significant mean age difference ware noted between two Groups of patients (p= 0.267). According to age highest percentage (50%) of patients were in Group A of51 to 60. On the other hand in Group B highest percentage (55%) of patients was in the age between 41 to 50 years. Previous study by Mallik *et al.* and Jamal had reported as near about similar incidence.[26,27]

Following sex distinction male were 86.4% and female 13.6% in Group A, similarly male 90% and female 10% in Group B out of total eighty-four study populations with male: female ratio were 10:1. Overall female are lower incidence of myocardial infarction is due to mainly female hormone estrogen which is established by various studies. Premenopausal women have low atherogenic complications. But this picture turns dramatically to develop coronary atherosclerosis with ischemic episode in post-menopausal period. Among other causes female is less careful about won health, poverty, ignorance in family, less habit of smoking.

Comparison of risk factors for coronary artery stenosis current study showed that most prevalence was smoking 70.5% vs. 75.5% followed by hypertension 47.7% vs. 32.5%, next of diabetes mellitus 43.2% vs. 35.0%, dyslipidemias25%vs 17.5% and family history4.5% vs. 2.5% of heart attack.

CONCLUSION

From this study it was demonstrated that patients with precordial ST segment depression have higher tendency of multi vessel disease with little up trends of left anterior descending artery lesion. In contrast patients with no significant precordial ST depression displayed more frequent single vessel disease mainly right coronary artery entangled.

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