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Correlation of the ECG changes (ST segment depression with or without T wave inversion in lateral leads 1, avl. V_4-V_6) with coronary angiographic findings in ACS patients

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Introduction:

A large part of the myocardium of the left ventricle is perfused by the left main coronary artery and its obstruction thus causes severe hemodynamic deterioration frequently resulting in rapid fatality.[1]

Acute coronary syndrome (ACS) is an emergency situation requiring immediate diagnosis and treatment. Presentation of ACS is different depending on the coronary artery involvement, severity, degree of collateral circulation and myocardial oxygen demand. Critical stenosis in the proximal part of the left anterior descending, severe three vessel disease and left main stem stenosis have all been recognized as clinical conditions complicated by a high incidence of large infraction, pump failure, arrhythmias and sudden death. As because many effective treatment modes are available currently, early recognition of those circumstances is crucial for appropriate management.[2]

Significant narrowing of the left main coronary artery puts the patients at high risk, since occlusion of this vessels if unprotected by collateral flow or a patients bypass grafts to either the left anterior descending (LAD) or left circumflex (LCX) artery compromise flow to approximately 75% of the left ventricle.[3]

Thus prediction of left main coronary artery (LMCA) obstruction is important with regard to selecting appropriate treatment strategy and estimating prognosis.[2]

Electrocardiogram (ECG) leads specially 1 avl, V_{4-6} can be very helpful and valuable in ACS in diagnosing the site of coronary artery obstruction. It was reported that ST segment depression with T wave inversion in leads 1 avl, V_{4-6} is the predictor of left main (LM) or left main equivalent coronary artery disease (LMECAD).[4]

In this prospective study we assessed the value of ECG in lateral leads to predict the occlusion site of the LMCA or LMECA.

Methods:

This perspective study was carried out during the period of January 2006 to December 2007. One hundred consecutive patients admitted in CCU, Dept. of Cardiology, BSMMU, University Cardiac Center with the diagnosis of ACS accompanied by ST segment depression with or without T wave inversion. We divided patient in two group: Group I-50 patients having ST depression with T wave inversion in lateral leads 1 avl, v4-6. Group –II 50 patients having ST segment depression without T wave inversion in the same leads. Among them ECG criteria plus coronary angiogram (CAG) findings 30 patients group I & 30 patients from group II were finally selected.

Patients in this study groups where CAG were done during in hospital stay, were included finally and stenosis ≥50% in LM or ≥70% in LMECA were considered significant.

Results:

The mean age of gr-I was 53.4±9.2 years and group were 48.8±10 years among them 44 (50.8±10) were male & 16 (52±9.5) were female. Among study patients in gr-I UA were 24(80%) & gr-II 27(90%), non ST elevated mycardial infarction (NSTEMI) group I, 6(20%) & group 2 (10%) proportion of unstable angina was lower 80% and ST elevated myocardial infarction (STEMI) was higher (20%) in gr-I compared to gr-II patients where it was 90% & 10% respectively.

Analysis were found no statistically significant mean difference of pulse rate systolic & diastolic blood pressure between two group of patients (P>0.05), where as the mean systolic & diastolic blood pressure were higher in gr-II patients compared to gr-I patients.

The mean percent of ejection fraction was 55.4±7.3 in group I patients & 56.3±5.9 in group II. There was no statistically significant mean difference was found between two group of patients (P>0.05), the mean percent of ejection fraction was low in group I compared to group II patients. It was found that the proportion of mean percent ejection fraction < 50 was higher in group I patients (26.7%) then group II (10%).

Table-I

Distribution of the study patients by risk factors (n=60)

Risk factors	Groups		P value
	Group I N (%)	Group II N (%)	
Smoking	19 (63.3)	18 (60)	0.790^{NS}
Hypertension	17 (56.7)	19 (63.3)	0.598^{NS}
Diabetes mellitus	14 (46.7)	8 (26.7)	0.108^{NS}
Dyslipidaemia	11 (36.7)	3 (10.0)	0.015^{S}
Family history of IHD	4 (13.3)	9 (30.0)	0.117^{NS}
Mean±SD (What?)	2.2±0.8	1.9±0.8	0.224^{NS}

Group I: ST segment depression with T wave inversion maximally in leads 1, avL, V_{4-6}

Group II: ST segment depression without T wave inversion maximally in leads 1, avL, V_{4-6}

Table-II

Distribution of patients by number of coronary artery lesion observed by coronary angiogram (n=60)

Number of disease vessels	Groups		P value
	Group I N (%)	Group II N (%)	
0 VD	0 (0.0)	13 (43.4)	0.000^{S}
1 VD	4 (13.3)	8 (26.7)	NS
2 VD	5 (16.67)	7 (23.3)	NS
3 VD	0 (0.0)	1 (3.3)	NS
LM or LME	21 (70.0)	1 (3.3)	0.000^{S}
Total	30 (100)	30 (100)	

Group I: ST segment depression with T wave inversion maximally in leads 1, avL, V_{4-6}

Group II: ST segment depression without T wave inversion maximally in leads 1, avL, V_{4-6}

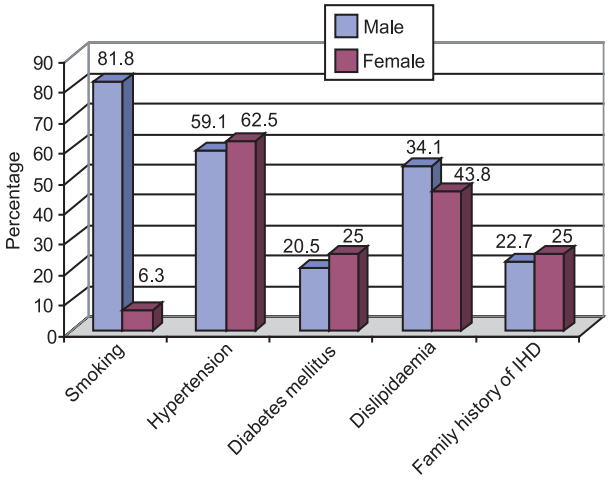

Fig.-1: *Bar diagram showing distribution of the study patients by risk factors & sex*

Table-III

Distribution of study patients by validity of screening test (validity of what? Validity of ECG in the diagnosis of CAD)

Test	Group I	Group II
Sensitivity	95%	4.54%
Specificity	76%	24.3%
Positive predictive value	70%	3.33%
Negative predictive value	97%	30%
Accuracy	83%	16%

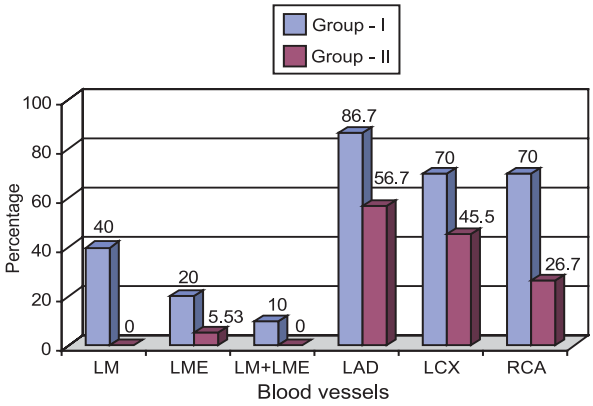

Fig.-2: *Bar diagram showing distribution of patients by pattern of coronary artery lesions*

Table-IV

Distribution of study patients by risk factors and number of disease vessels (Group result needed)

Number of vessels	Smoking		Hyperten-sion		Family history of IHD		Diabetes mellitus (n=60)		Dyslipidaemia (n=60)	
	No	%	No	%	No	%	No	%	No	%
0 VD	6	16.2	9	25	3	23.1	1	4.5	2	14.3
1 VD	5	13.5	7	19.4	1	7.7	5	22.7	3	21.4
2 VD	10	27	5	13.9	4	30.8	4	18.2	2	14.3
3 VD	1	2.7	0	00	0	00	1	4.5	0	00
LM or LME	15	40.4	15	41.7	5	38.5	11	50	7	50
Total	37	100	36	100	13	100	22	100	14	100

Discussion:

This article describe findings regarding the ECG prediction of LM/LME CA occlusion of ST segment depression with or without T wave inversion in lateral lead.

In this study highest percentage (43.3%) had age group was 45-54 years & group II (46.7%) in 45-54 years. Similar age incidence was reported Barrabee et al.[5] Age is an unmodifiable strong independent risk factor for CHD

which increase markedly with the increase of age upto and above 65 years. In this study 10% of patients in group I and 26.7% in group II were below 45 years of age. Out of 60 patients 73.3% were male & 26.7% were female with male female ration 2.75:1. The overall lesser incidence of ACS among female population in our country in probably due to the protective effect of estrogen in premenopausal female, lesser incidence of smoking, poverty ignorance & social custom prevent women from seeking medical help. The mean age of female patients was higher 52±9.5 years then the male patients 50.08±10. The incidence of CAD in women increases after menopause & equal to that of men by the age of 75 years.

This study showed that smoking was the commonest risk factor 63.3% followed by hyper tension 56.7%, DM 46.7% dyslipedemia 36.7% & family history of ischemic heart disease (IHD) 13.3%. No statistically significant difference was found between two groups of patients in risk factors analysis (P>0.05) except dyslipidemea. History of smoking, diabetes mellitus (DM) & dyslipidemia were higher among group I, whereas hypertension, family history of IHD were higher among group II. This findings consisted with Cannon et al. study which was 31% patients were diabetes.[6] The proportion of smoking 81.1% were higher among the male patients & found statistically significant. Whereas hypertension (62.5%, DM 43.8%, dyslipedemia (25%) & family history of IHD 25% were higher among female patients but not found statistically significant (Fig. 1).

Clinical distribution of ACS patients this study showed that among group I patients highest percentage (80%) had unstable angina & 20% had non STEMI, whereas group II unstable angina was 90% & non STEMI was 10%. This may be due to the occurrence of higher mortality in NSTEMI in patients having LM/LME CA lesion before their arrival in the hospital.

Analysis was found no statistically significant mean difference of pulse rate, systolic & diastolic blood pressure between two groups (P>0.05). In present study most of the patients were haemodynamically stable, predict less myocardial damage.

In this study the mean percent of EF was low in group I (55.4%) compared to group II (56.3%) but no statistically significant mean difference was found (P>0.05). It was also found that proportion of mean percent EF <50 was higher in group I (26.7%) than group II (10%) & EF 50-60% was higher group II (66.7%) then group I (50%). This finding predict group I patients were more critical.

In group I patients at rest angina 70% had LM & LME CHD, DVD 16.7% , SVD 13.3% in group II LM & LME CHD (3.33%, DVD 26.7%, zero VD 43.4%) and statistically higher significant was found between two group (P<0.001) (Sensitivity 95%, specificity 76%, positive predictive value 70%, negative predictive value 97% and accuracy 83%). Similar pattern of coronary artery lesion distribution (LM-90%) were reported by Anton et al.[2] This predict that ST segment depression with T wave inversion in lead 1, avl, V_{4-6} was useful predictor of LM or LME CA lesion.

This study also showed that among group I patients 40% had stenosis in LM, 20% in LME & 10% in LM+LME CA whereas had no stenotic lesion in LM or LM+LME & 3.33% had LME lesion in group II. Chi-square analysis revealed statistically significant difference between two group of patients (P< 0.001). This indicated that in group I patients the risk of LM stenosis was 100 time higher than group II patients.

LM/LME CA disease were more common in male gender, older age, DM & dyslipidaemia patients with increasing number of risk factor. O'Rourke[7] & Hubbar et al.[8] & reported male gender, increasing age, DM, dyslipidaemia and increasing number of risk factors were associated with LM/LME CA disease.

Conclusion:

Left main coronary artery supply large part of myocardium of the left ventricle and its obstruction causes severe hemodynamic deterioration which may lead to rapid fatality. In electrocardiography, ST segment depression with T wave inversion maximally in lateral leads 1, avl, v4-v6 suppose to be useful predictor of LM or LME CAD with high sensitivity, specificity & predictive accuracy.

Thus the present study shows that in patients with ACS careful attention in the lateral leads 1avl, v4-v6 with maximum ST segment depression with T wave inversion to predict the critical LM or LME CA obstruction is clinically important with respect to early diagnosis and selecting treatment strategy. So that we should able to provide prompt and appropriate management earlier to reduce the mortality & morbidity.

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