

Frequency of Left Main Artery/Three Vessel Disease Predicted through ECG Changes in Patients Presenting with Non-ST Segment Acute Coronary Syndrome

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ABSTRACT

BACKGROUND: Electrocardiography (ECG) is simple, quick and economic investigation for diagnosis of acute coronary syndrome. Its applicability in prediction of left main coronary artery/ 3 vessel coronary disease can be of very useful in saving precious time in the critical care of coronary patients.

OBJECTIVE: Electrocardiography changes as a predictor of left main coronary artery / 3 vessel coronary disease in patients presenting with Non-ST segment elevation acute coronary syndrome.

METHODOLOGY: This cross sectional study was executed from July 2014 to June 2015 at Isra University hospital Hyderabad taking 114 consecutive patients of age ≥ 20 , of either gender, presenting with symptoms of Non-ST segment elevation MI or that showed ECG changes in lead aVR. Informed written consent for the study was taken from the immediate family members of patients. Approval from ethics review committee of Isra University was taken. Data analysis was done through SPSS. Descriptive statistics (Mean \pm standard deviation for continuous & frequencies and percentages for categorical variables) were expressed.

RESULTS: Patients' mean \pm SD age was 56.65 ± 15.44 years (Range: 20-89 years). Male to female ratio was 3.4:1. More than a half (52%) of these patients had Left main (LM) / 3 vessels disease. About a quarter other (25%) had 2 vessels while (22%) had single vessel disease (P value < 0.0001). Patients having ST elevation in lead aVR, were associated with increased risk of developing LM / three vessels disease (P value < 0.0001).

CONCLUSION: ST elevation in lead aVR and ST depression in leads II, III, and aVF can be practically used for evaluation left main / 3 vessel disease among NSTEMI-ACS patients.

KEYWORDS: ST elevation MI, Acute coronary syndrome, ECG Lead aVR, 3 vessels Disease.

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INTRODUCTION

Acute myocardial infarction (AMI) causes about 1.5 million deaths in USA annually. Earlier it was thought a problem of industrialized nations but the current scenario is contrary to this belief. It is an astonishing fact that $>75\%$ of all cardiovascular deaths in the world are occurring in two south Asian nations i.e. India and Pakistan. In Pakistan about 11% of deaths in all ages are attributed to IHD, being the 2nd most common cause of mortality¹⁻³.

When patients' presenting with symptoms suggestive of myocardial infarction (MI) with no evidence of ST elevation on ECG, the diagnosis of acute coronary syndrome is made. Most common presentation of patients' at coronary emergencies is with Non ST-Elevation myocardial infarction (NSTEMI). Most of deaths can be averted if early recognition of these

patients can be made. STEMI in these patients is due to complete blockage of coronary artery & partial or subtotal occlusion results in unstable angina pectoris (UAP), which is also called as NSTEMI. The presentation of later is never same and may vary from no ECG sign to ST depression, T wave flattening, or T wave inversion⁴⁻⁶.

The most extensive and fatal myocardial infarction is usually caused due to occlusion of left main coronary artery (LMCA). It is because, the two of its main branches; left anterior descending (LAD) and left circumflex (LCX) coronary artery arise at the bifurcation of LMCA which supply the major portion of heart⁷⁻⁹.

Case fatality rate among patients of NSTEMI is much higher. In the absence of timely management with PTCA or CABGs, the critical stenosis of left main coronary artery ends in high death rate. Therefore; it is very crucial to quickly identify the LMCA critical

stenosis. Studies have documented that outcome of left main or three vessels disease can more accurately be predicted & managed successfully if it's prompt or quick identification can be made. LMCA / 3 vessels disease has been thought to be predictable through characteristic ECG^{10,11}.

Being an economical, easy to access, quick to perform, simple and free of any complication, the electrocardiogram (ECG) has key importance in identification of NSTEMI patients which may have bad prognosis. Thus; it plays a crucial role in early provision of important prognostic information even in the modern period with advanced diagnostic methods. Various studies has been performed, however yet no scientific consensus have been achieved regarding prediction of left main coronary artery (LMCA) though ECG. To some ST elevation of 0.5 mm or depression of 2mm of ST-segment in aVR of ECG is sufficient to label it as left main / 3 vessel disease.

The current study was done with the aim of assessing the Electrocardiography changes as a predictor of left main coronary artery / 3 vessel disease in patients presenting with Non-ST segment elevation acute coronary syndrome at Isra University hospital Hyderabad, so that these such patients can be prospectively rationalized and can managed accordingly based on the findings of our study.

MATERIAL AND METHODS

This prospective observational study was conducted from July 2014 to June 2015 at Isra University hospital Hyderabad through convenience sampling technique.

Inclusion Criteria: All patients with NST-ACS along with ECG findings of ST segment elevation in leads aVR along with ST segment depression in leads II, III, and aVF having age ≥ 20 - 80 years of either gender were included in our study.

Exclusion Criteria: We excluded all patients presenting with left bundle branch block, transient or persistent ST segment elevation in chest leads or in lead aVR. Likewise those who had Q-wave acute MI, PCI or CABG in previous 6 months, having infectious, inflammatory or hematological diseases were also excluded.

We used (12 leads ECG machine of cardimax Fx-2III, Fakuda Denshi) to collect the initial ECG of the patients who presented in coronary care unit (CCU). These patients were shifted to cardiology ward once stabilized and then continuously monitored for three days followed by serial ECGs to assess the development of acute STEMI or arrhythmias. Data on demographic and disease related variable were collected on a proforma. Data analysis was done using SPSS version 21.

Informed written consent for the study was taken from

the immediate family member of patients'. Approval from ethics review committee of Isra University was also taken. All patients were treated as per internationally recommended & institutionally practiced protocols under care of the experienced consultant cardiologist. Presence of LM / 3VD was confirmed through angiography. To prevent researcher bias, the coronary angiography of all patients was checked by two different interventional cardiologists who were blinded to the study and patients. They labeled severe lesion if left main coronary artery occlusion was $> 50\%$ or all other vessels occluded $> 70\%$.

Age & other continuous variables were presented as mean \pm standard deviation while the categorical data like gender, co-morbidity & frequency of LM / 3VCAD was presented as frequencies and percentages. Association of ECG changes with frequency of LM/ 3VCAD was tested through chi-square taking and a p value ≤ 0.05 was taken as statistically significant.

RESULTS

The mean \pm SD age of patients was 56.65 ± 15.44 years (Range: 20-89 years). (Table I). Median age was 56 years. The sample of population was normally distributed as the mean and median ages were identical. Male to female ratio was 3.4:1. Table I shows results on other demographic variables. Most of the patients were middle aged as shown in table II.

Figure I shows the distribution of patients as per age categories. According to which patients of middle age are predominated. There was less proportion of patients at the both extremes of age. All patients (n = 114) included in this study who had non-ST elevation ACS, were monitored & evaluated for having left main/ 3 vessels disease. However; as shown in figure: II; more than a half (52%) of these patients had LM/ 3 vessels disease (P value < 0.0001). About a quarter other (25%) had 2 vessels while 22% had single vessel disease. Table III significantly shows that patients having ST elevation in lead aVR, had more risk of developing LM/ 3 vessels disease. (P-value < 0.0001)

TABLE I: DEMOGRAPHIC DATA OF PATIENTS

Variable	Value
Age(mean \pm SD)	56.65 \pm 15.44
Gender	(Percent %)
Male	77.19
Female	22.81
Hypertensive	(Percent %)
Yes	46.5

No	53.5
Diabetics	(Percent %)
Yes	24.6
No	75.4
Current Smoker	(Percent %)
Yes	50.9
No	49.1
Family History of IHD	(Percent %)
Yes	44.7
No	55.3

FIGURE I: DISTRIBUTION OF STUDY PARTICIPANTS AS AGE CATEGORIES

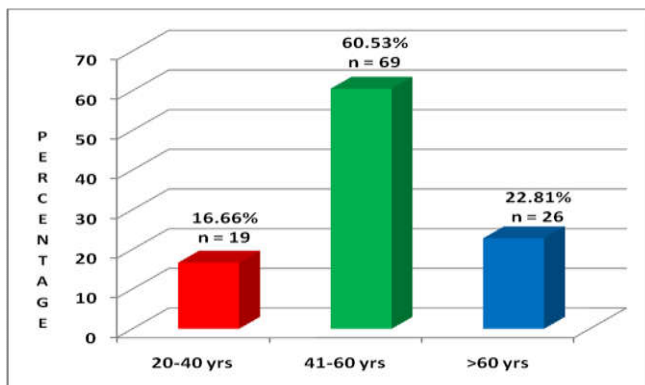
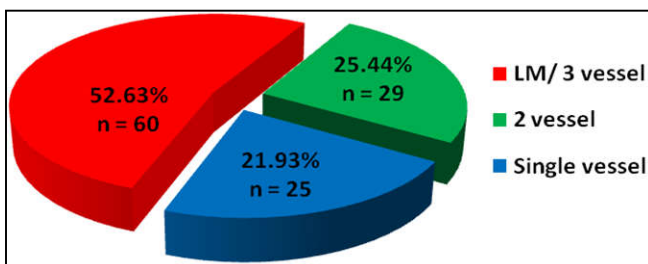


TABLE II: COMPARISON OF THREE DIFFERENT AGE GROUPS BY GENDER

Age groups (years)	Male (n = 88)		Female (n = 26)	
	Frequency	Percentage	Frequency	Percentage
20 – 40	13	14.77	6	23.07
41 – 60	55	62.5	14	53.84
≥60	20	22.72	6	23.07

FIGURE II: FREQUENCY OF LEFT MAIN CORONARY ARTERY DISEASE/ THREE VESSEL DISEASE IN NSTEMI



*P value = 0.0001

TABLE III: STRATIFICATION OF FINDINGS OF LEAD AVR WITH LEFT MAIN/ 3 VESSEL DISEASE

ST- elevation ≥ 0.5 mm in lead aVR	Left Main/ Three Vessel Disease		Total	P value
	Yes	No		
Yes	51 (62.96%)	30 (37.03%)	81 (100%)	The chi-square = 11.98
No	9 (29.03%)	24 (70.96%)	33 (100%)	
Total	60 (52.63%)	54 (47.37%)	114 (100%)	P-value <0.0001

PICTURE I: CRITICAL OSTIAL LEFT MAIN



PICTURE II: 70% DISTAL LEFT MAIN, CRITICAL OSTIAL AND PROXIMAL DISEASE IN LAD, CRITICAL DISEASE IN OM2 AND CIRCUMFLEX



DISCUSSION

Due to rapid adoption of sedentary lifestyle, there is steep rise in cases of heart diseases among which acute coronary syndrome is common presentation in our population as in other Asian countries. Patients presenting with NSTEMI in whom left main or 3 vessel coronary artery disease is involved usually end up in worst prognosis. This dictate need of clinical expertise of early and correct prediction of significant disease of left main or 3 vessel coronary artery based on some simple, easy, and non-invasive diagnostic measures like ECG¹²⁻¹⁴.

ECG being the first diagnostic tool for diagnosing acute myocardial infarction at first medical contact, it also play an important role in early recognition of severity of the disease through ECG changes that suggest severe stenosis of the left main coronary artery, mandates urgent referral to an interventional cardiologist, with a view to urgent/ timely coronary angiography followed by angioplasty or CABG (Coronary Artery Bypass Graft surgery)¹⁵⁻¹⁷. In this regard the most important yet often ignored lead is lead aVR which gives a typically opposite image of the chest leads aVL^{18,19}.

The current study found that more than half (52.63%) patients presented with NSTEMI had left main / 3 vessel disease (P value = 0.0001). Our study finding is comparable with the other contemporary studies. Hussein A, et al, reported that in their series 44.7% patients presented with significant LM/ 3 vessels disease while another study by Masami et al reported that as much as 31% patients presented with NSTEMI and had left main / 3 vessel disease. Barrabes JA, et al.²⁰ analyzed the initial ECG in patients of MI presenting without ST-segment elevation & found that in such patients, prognosis with severity of disease can be more correctly predicted using lead aVR. Thus the patients presenting with NSTEMI should be treated with rapid coronary interventions like PTCA or CABG. ST-segment elevation in lead aVR >0.5 mm and QRS duration >90 ms were found to be good ECG predictors of left main or three vessel disease in patients with NSTEMI²¹.

In a study it was found that ST-segment elevation even >1.0 mm in lead aVR and positive troponin T on admission were strong predictors of severe LM / 3 vessels disease. In the current study we also noted that ST-segment elevation in lead aVR >0.5mm was found to be associated with severe left main coronary disease (P value < 0.0001). To summaries it can said that finding of these studies provide sufficient evidence for improving the effectiveness of the ECG in prediction of the clinical outcome in patients with NSTEMI by considering the extent or the distribution of ST-segment depression²².

Limitation of the Study: Presence of different comorbid condition like hypertension, smoking & diabetes which are potential risk factors of acute coronary syndrome, may also have effect in the presentation as well as predictive value of ECG in assessing the severity of disease. But it was beyond the scope of this study. The results of current study cannot be generalized as it was conducted in a single tertiary care setup.

CONCLUSION

The current study has come up with the fact that ECG

analysis especially ST elevation in lead aVR and ST depression in leads II, III, and aVF can practically be use for evaluation of left main /3 vessel disease among NSTEMI-ACS patients.

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