

DIAGNOSTIC ACCURACY OF ECHOCARDIOGRAPHY IN DETERMINING LEFT ANTERIOR DESCENDING ARTERY OCCLUSION

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ABSTRACT

Objective: To determine the diagnostic accuracy of echocardiography in left anterior descending artery occlusion proximal to first diagonal (D1) branch in acute anterior wall myocardial infarction (AWMI) by comparing it with angiography.

Study Design: Cross sectional validation study.

Place and Duration of Study: Department of cardiology, Pakistan Institutes of Medical Sciences (PIMS), Islamabad from May 2011 to Nov 2011.

Material and Methods: This was a cross sectional study which included 200 patients with left anterior descending myocardial infarction (LADMI). All the patients had 12-lead ECG followed by coronary angiography (gold standard) for the detection of LAD occlusion proximal to D1. Diagnostic accuracy of 12-lead ECG was detected by determining sensitivity, specificity and accuracy.

Results: The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of 12-lead ECG for diagnosis of LAD occlusion proximal to D1 was 91%, 70.45%, 91.61%, 68.88% and 86.50%, respectively.

Conclusion: Twelve-lead ECG is a reliable test for detection of LAD occlusion proximal to D1 and should be done in every patient with AWMI.

Keywords: Anterior wall myocardial infarction, Left anterior descending artery occlusion, 12-lead ECG.

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INTRODUCTION

Coronary artery disease (CAD) is the leading cause of mortality following ischemic stroke. The annual risk for myocardial infarction (MI) following ischemic stroke is approximately 2.2%¹. By 2020 it is estimated that it will be the major cause of death in all regions of the world². It is estimated to be 6.1% in men and 4.0% in women in Pakistan³.

Risk factors for CAD are now well recognized and modification of these factors can prevent heart attacks and prolong life. Age, male sex and family history are the non-modifiable risk factors. Smoking, hypertension, diabetes mellitus, sedentary lifestyle, obesity and high cholesterol diet are the modifiable risk factors⁴.

Electrocardiography (ECG) is still the most readily available and fastest method for the

diagnosis of ST segment elevation myocardial infarction (STEMI). The initial stages of acute MI resulting from an occlusive thrombus are easily picked up by ECG. Ischemic changes are picked up easily on ECG on the criteria of ST segment elevation of 1 mm or more in two contiguous leads. This ST segment elevation is considered a standard sign of myocardial injury⁵.

Acute anterior MI caused by proximal occlusion of the left anterior descending (LAD) coronary artery is associated with unfavorable outcome. On the ECG, ST segment elevation in at least two contiguous precordial chest leads with either ST segment elevation >0.5 mm in lead aVL or in lead aVR has a sensitivity of 94%, specificity of 49%, positive predictive value of 85% and negative predictive value of 71% to predict a proximal left anterior descending (LAD) artery lesion. Reciprocal ST segment depression of >1mm in leads II, III and aVF have sensitivity of 34%, 66%, 54% and specificity of 98%, 75% and 85% respectively. In addition, abnormal Q-wave (width >30 ms) in lead aVL has sensitivity of 44%

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and specificity of 85% in detecting proximal LAD occlusion⁶.

The current gold standard to assess CAD is invasive conventional coronary angiography (CCA). In acute cardiac ischemia the size of the cardiac area at risk is related to the site of occlusion of the culprit coronary artery. The closer to the origin of the coronary vessel the larger the jeopardized area. Therefore the purpose of this study was to find out how good the ECG was to give information about the size of the area at risk, helping decision making about the best and quickest way to prevent myocardial damage.

MATERIAL AND METHODS

It was a cross sectional validation study

excluded. After getting a detailed history and examination, all relevant investigations were performed including ECG, cardiac enzymes (CK-MB, Trop-T) were done. These patients then underwent coronary angiography after 4 days by consultant cardiologist and the site of obstruction was confirmed and entered in the proforma.

The collected data were entered in SPSS version 12.0. Descriptive statistics such as mean, median and standard deviation were calculated for age, height, weight and frequencies for gender. To calculate the diagnostic accuracy, 2x2 tables was plotted as (table-I).

RESULTS

The total number of patients included in the study was 200. The mean age of the patients was

Table-I: Diagnostic accuracy of ECG and coronary angiography.

ECG Proximal LAD Occlusion	Coronary Angiography Proximal LAD Occlusion	
	Positive	Negative
Positive	True positive (TP) a	False positive (FP) b
Negative	False negative (FN) c	True negative (TN) d

Table-II: Distribution of patients by age (n=200).

Age (Years)	No.	Percentage
31-40	16	08
41-50	62	31
51-60	86	43
61-70	22	11
71-80	14	07
Mean ± SD	53.21 ± 9.58	
Range	37-78	

SD: Standard deviation.

carried out in department of cardiology, PIMS, Islamabad after getting approval of the hospital ethical committee from May 2011 to November 2011. The sampling technique was non probability convenience sampling. After getting informed consent of patients; 200 patients presenting to the cardiology department of age more than 30 years with ST elevation anterior wall MI were included in the study. However patients less than 30 years or having coronary artery bypass grafting (CABG), percutaneous coronary intervention (PCI), cardiomyopathy, valvular or congenital heart disease were

53.21 ± 9.58 years (range 37-78 years). There were 16 (8%) patients of age range of 31-40 years, 62 (31 %) patients of age range of 41-50 years, 86 (43%) patients of age range of 51-60 years, 22 (11%) patients of age range of 61-70 year and 14 (7%) patients of age range of 71-80 years of age (table-II).

Patients were also distributed according to sex. There were 126 (63%) male patients in the study, while 74 (37%) patients were female. Male to female ratio was 1.7:1 (figure).

Among the 200 patients in the study, diabetes mellitus was seen among 128 (64%)

patients, hypertension among 151 (75.5%) patients and smoking among 66 (33%) patients.

ST segment elevation in precordial leads along with ST segment depression of >1 mm in inferior leads II, III, aVF was noticed among 155 (77.5%) patients; abnormal Q-waves of width >30

Proximal LAD occlusion has been documented as an independent predictor of poor outcome related to higher mortality and recurrent MI. Ischemia provoked by LAD occlusion is reflected by ST elevation in precordial leads⁸. In this series, we studied a total 200 patients with

Table-III: Distribution of patients by ECG findings (n=200).

ECG findings	No	Percentage
ST - segment depression in of >1 mm in inferior leads II, III, aVF	155	77.5
Abnormal Q - waves of width >30 ms in lead aVL	69	34.5
ST - segment elevation of >3-5 mm in lead I and aVL	82	42

Table-IV: Comparison of FAST versus operative findings (n=200).

ECG proximal LAD occlusion	Coronary angiography proximal LAD occlusion (gold standard)		Total
	Positive	Negative	
Positive	142 (TP)	13 (FP)	155
Negative	14 (FN)	31 (TN)	45
Total	156	44	200

TP = True positive, FP = False positive, FN = False negative, TN = True negative

ms in lead aVL among 69 (34.5%) patients and ST segment elevation of >3-5 mm in lead I and aVL was seen among 82 (42%) patients (table-III).

Out of 200 patients included in the study, the ECG was detected to be positive in 155 patients. Of these, 142 were proved on coronary angiography findings so were labeled as true positive, while the remaining 13 patients were labeled as false positive. ECG was negative in total 45 patients. Out of these 14 were positive on coronary angiography findings (false negative) and 31 were also seen negative on angiographic findings (true negative). To calculate the diagnostic accuracy, 2 x 2 tables was plotted as (table-IV).

The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of 12 lead ECG for diagnosis of LAD occlusion proximal to D1 was 91%, 70.45%, 91.61%, 68.88% and 86.5%, respectively .

DISCUSSION

Occlusion of the LAD artery may lead to a very extensive anterior MI, or only septal, apical-anterior or mid-anterior according to the site of occlusion⁷.

STEMI. We detected that diagnostic accuracy of ECG was 86.5% which shows that this is a reliable test.

The mean age of the patients in our study was 53.21 ± 9.58 years. In a study by Hafeez et al⁸,

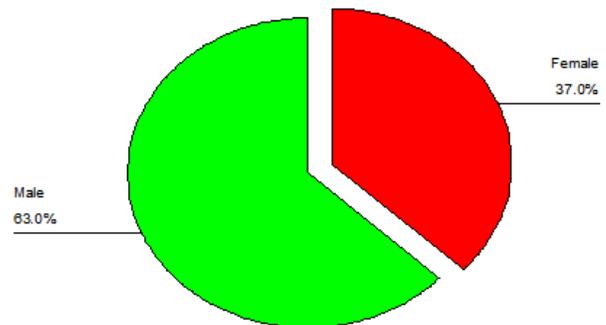


Figure: Distribution of patients by sex (n=200).

the mean age was 58 ± 11 years. Almas et al⁹, on evaluation of patients presenting in emergency department with chest pain, noted that the mean age of the patients was 54.05 ± 13 years. This reflects that MI is common in middle age as detected in other local studies.

In our study, there were 63% male patients while 37% patients were females. In a study by Hafeez et al⁸, the male patients also dominated

the study population i.e. 78%. Almas et al⁹, detected that 61.9% patients were males.

Hypertension was seen among majority of the patients in our study, i.e. among 75.5%, diabetes mellitus was the second most common seen among 64% patients and smoking was the least in 33% patients. In a study by Uddin et al¹⁰ hypertension was observed among 60% patients, diabetes 40% patients.

In our study, the sensitivity of detection of proximal to D1 LAD occlusion by ECG was high (91%), this test was found specific among 70.45%, and accuracy was also high i.e. 86.5%. In a study by Meissner et al¹¹, which was conducted among 386 patients for evaluation of myocardial infarction, the sensitivity of ECG was found to be 93%. In another study by Aertker et al¹², 52.3%, specificity of 92.9%, positive predictive value of 91.7%, and negative predictive value of 56.5% for proximal LAD occlusion was found respectively. Waduud et al¹³ studied the ECG for detection of proximal LAD occlusion and found that sensitivity, specificity, positive predictive value and negative predictive value were 74.1%, 96.1%, 92.4% and 85.4% respectively.

In our study, ST segment elevation in precordial leads with reciprocal ST depression of >1 mm in inferior leads was seen among 155 (77.5%). All the patients with these findings had positive angiographic findings for occlusion of LAD proximal to D1. This observation reflects that this finding has 100% specificity. This similar observation has also been noticed by Fiol et al¹⁴ who showed that ST segment depression has 100% specificity. They also found that ST segment depression of >5 mm was also indicative of unfavorable outcome i.e. death, reinfarction, recurrent angina, persistent left ventricular failure, or sustained ventricular arrhythmia during hospitalization). Similarly study by Iwasaki et al¹⁵ observed that ST segment depression was present among 90% of the patients who had LAD occlusion proximal to D1. A study by Aertker et al¹² found that sensitivity of ST segment depression was 52.3% and high

specificity of 92.9%, positive predictive value of 91.7%, and negative predictive value of 56.5% for LAD occlusions proximal to D1 respectively.

ST segment elevation of >3-5 mm in I and aVL in association with ST elevation in precordial leads was another criteria used among our patients and was seen among 42% cases in our study. Koju et al¹⁶ also used similar criteria and showed that an elevation of >0.5 mm ST segment in lead aVL or aVR was of value in predicting a proximal LAD lesion (sensitivity 73 and 42%, respectively and specificity 78 and 97% respectively). Q wave abnormalities were found among 34.5% patients of our study. However, this criterion is not very sensitive. In a study by Engelin, the sensitivity of Q wave abnormality was 44% and specificity of 85%⁶ respectively.

This study had some limitations. This was a single centre study with limited population size. This was not a double blind study.

CONCLUSION

Twelve-lead ECG is a reliable test for detection of LAD occlusion proximal to D1 and should be done in every patient with AWMi.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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