ORIGINAL ARTICLE
Frequency of Left Anterior Descending Artery Involvement as a Culprit Vessel in Young Patient with ST Elevation Myocardial Infarction

MEHWISH SABEEN[1], GHULAM KUBRA[2], MAROOF HASSAN[3], FAIZA SIKANDARI[4], DEEBAJ NADEEM[5], ASMA MURTAZA[6]
[1]Post-Fellow Cardiac Imaging, National Institute of Cardiovascular Diseases (NICVD), Karachi, Pakistan.
[2]Assistant Professor of Electrophysiology, National Institute of Cardiovascular Diseases (NICVD), Hayderabad, Pakistan.
[3]Clinical Fellow Adult Cardiology, National Institute of Cardiovascular Diseases (NICVD), Karachi, Pakistan.
[4]Post-Fellow Cardiac Electrophysiology and Pacing, National Institute of Cardiovascular Diseases (NICVD), Karachi, Pakistan.
[5]Post-Fellow Electrophysiology, National Institute of Cardiovascular Diseases (NICVD), Karachi, Pakistan.
[6]Clinical Fellow Adult Cardiology, National Institute of Cardiovascular Diseases (NICVD), Karachi, Pakistan.
Correspondence to: Ghulam Kubra, Email: dockubrakhaliq@yahoo.com, Cell: +92 340 3002972

ABSTRACT
Objective: To determine the frequency of left anterior descending artery involvement as a culprit vessel in young patient with ST elevation myocardial infarction (STEMI) at tertiary care hospital.
Study Design: A cross-sectional study.
Place and Duration: The Department of Cardiology, "National Institute of Cardiovascular Diseases, Karachi" Pakistan from October 2019 to April 2020.
Methodology: Patients of both genders aged 25-45 years who were presented with onset of chest pain for more than 30 minutes with STEMI were included. All patients were clinically evaluated after detailed history. Routine biochemistry investigations were asked and ECG and echocardiography were performed. Frequency of left anterior descending artery involvement in patients with STEMI was noted.
Results: In a total of 191 patients, mean age was 33.6±6.7 years while mean duration of chest pain was 42.5±8.3 minutes. There were 135 (70.7%) male and 56 (29.3%) female cases. In distribution of vessel disease, 76 (39.8%) had single vessel disease (SVD), 37 (19.37%) had double vessel disease (DVD) while 78 (40.84%) had triple vessel disease (TVD). Left anterior descending artery found to be positive in 88 (46.1%) patients.
Practical Implications: To reduce the complications of STEMI, it is very important to increase the awareness and proper knowledge in the general public.
Conclusion: Involvement of left anterior descending artery as a culprit vessel was fairly common in young patient with ST elevation myocardial infarction.
Keywords: Left anterior descending artery, culprit vessel, ST elevation myocardial infarction, coronary artery disease.

INTRODUCTION

Myocardial infarction (MI) is a fatal indication which can cause immediate death in young adults. The MI is significantly associated to morbidity, psychological consequences and financial restraints for both patient and its family.[1,2] Among developed countries, coronary artery disease (CAD) is one of the leading causative factor of mortality.[3] The coronary arteries get narrow to cause CAD. The sudden complete blockage of the coronary artery can lead towards MI. Mortality rates due to cardiovascular diseases (CVDs) among the Asian population are higher than the rest of the world.[4]

Pertaining to the circulatory system, CVDs are non-transmissible diseases. Despite the factor that during the last forty years or so, mortality rates owing to chronic heart disease (CHD) have fallen considerably all over the world, but CHD is still causing more than one-third of the total deaths reported among the population aged 35 years or more.[5] Statistics show that Pakistani population is at higher risk for the development of CHD in comparison to other parts of the world.[6] Recent global data established CVDs as the major cause of death, and about 80-86% contribution to these deaths is from low- and middle-income countries (LMICs).[7,8] Every year, the deaths caused by non-communicable diseases (NCDs) are approximately 16 million, out of which 82% occur in LMICs and 37% of them are associated with CVDs.[9]

Cardiac surgeons often face certain difficulties for its grafting by using the left internal mammary artery (LIMA).[10,11] It was more common that in 36-38% of the left anterior descending (LAD artery) cases, obstructive coronary lesions narrowing it up to 50% were observed and in the left circumflex artery (LCX) same was the case, whereas in 27-29% of the cases, it was right coronary artery (RCA).[9] According to the standard protocol suggested by "The American College of Cardiology/American Heart Association", the selection of coronary angiographic projections was made to visualize classification of the map of the coronary artery.[12] Addressing "ST-elevation myocardial infarction (STEMI)" and "non-ST-elevation myocardial infarction (NSTEMI)", clinicians are dependent to electrocardiograms (ECG) or echocardiograms to spot the area of myocardium at high risk, and to make a conclusion that an artery was "culprit" i.e., there had been at least one lesion in the artery in the need of acute intervention.[13]

A study conducted by Sinha SK et al among patients of MI, single vessel disease (SVD), double vessel disease (DVD) and triple vessel disease (TVD) were found in 71.5%, 16.1% and 6.6% respectively, whereas anomalous coronary artery in 2.3% and left main artery in 3.2% were detected.[14] In 58.1% patients, LAD artery was involved in the infarction, in 28.2% right coronary artery (RCA) and in 13.7% the left circumflex coronary artery (LCX). Lesion of type A was present in 42%, in 22% type B and in 36% type C. Median of the stented lesion lengths was 28±16mm.[14]

Globally, it is considered that CVD is a major health issue for the entire population and a sign of worsening condition thus, requiring early management to prevent adverse consequences especially in developing countries our population, there is a paucity of studies which focused on the clinical characteristics of LAD related STEMI. This study was designed to assess the frequency of LAD artery involvement as a culprit vessel in young patient with STMI. The results of our study were thought to add latest information in existing pool of literature that can influence clinical expertise and patient outcomes in our local population. It is the need of the hour to develop such types of strategies so that morbidity, burden of the disease and duration of hospitalization could be reduced as these patients are already compromised.

METHODOLOGY

This cross-sectional study was done at The Emergency Department of Cardiology, "National Institute of Cardiovascular Diseases (NICVD)", Karachi from October 2019 to April 2020. Sample size was calculated considering the prevalence of LAD artery infracted in STEMI as 58.1%[14] using confidence level=95% and marginal of error =7%. The total sample size of patients came out to be 191. Approval from "Institutional Ethical Committee" was acquired. Written and informed consents were sought from all study participants.

Inclusion criteria were patients of both genders aged 25 to 45 years and presented with onset of chest pain for more than 30 minutes with STEMI. Exclusion criteria were patients with electrolyte abnormalities, cases with bundle branch block or left ventricular hypertrophy, coronary artery bypass graft surgery or percutaneous coronary intervention or those with suspected myocarditis, pericarditis, hypothermia, receiving amiodarone treatment. All patients underwent clinical and physical examination while detailed medical history was recorded. Necessary laboratory and radiological and echocardiographic examinations were performed. Myocardial infarction was diagnosed in the presence of the following criteria: persistent chest pain for more than 30 minutes; elevated cardiac enzymes (CK-MB>200 and TROP I>0.04ng/ml) and ECG changes indicative of new ischemic (new ST-T changes or new left bundle branch block [LBBB]). For STEMI, it was at least > 2mm ST segment elevation in two contiguous precordial leads or >1mm ST elevation in limb leads or new left bundle branch block were found on the qualifying ECG. Left anterior descending (LAD) artery was described as it passes at first behind the pulmonary artery and then comes forward between that vessel and the left atrium to reach the anterior interventricular sulcus along which it descended to the notch of cardiac apex. Diagnosis of culprit artery was made on the angiographic finding as "culprit" that was the artery had at least one lesion needing acute intervention.

Data was analzed by "Statistical Package for Social Sciences (SPSS)" version 26.0. Stratification was done on age, gender, potential factors, duration of chest pain, vessel disease and dyslipidemia. Post stratification chi-square was used to see the effect of modifiers on outcome. P-value <0.05 was considered as significant.

RESULTS

In a total of 191 patients, 135 (70.7%) were male. The mean age was 33.6±6.7 years. Mean duration of chest pain was 42.5±8.3 minutes. Diabetes mellitus was noted in 60 (31.4%) patients whereas hypertension was reported in 90 (47.1%) patients. Family history of CAD was present in 65 (34.0%). Obesity was observed in 79 (41.4%) patients. Table-1 and 2 are showing details of baseline demographical and clinical characteristics.

Table-1: Baseline Characteristics of Patients (n=191)

Baseline Characteristics		Frequency (%)
Gender	Male	135 (70.7%)
	Female	56 (29.3%)
Age (years)	25-35	110 (57.6%)
	>35	81 (42.4%)
Duration of chest pain (minutes)	30-60	105 (55.0%)
	>60	86 (45.0%)
LDL (mg/dl)	60-130	100 (52.4%)
	>130	91 (47.6%)
HDL (mg/dl)	<40	86 (45.0%)
	≥40	105 (55.0%)
TG (mg/dl)	≤150	79 (41.4%)
	>150	112 (58.6%)
Diabetes Mellitus		60 (31.4%)
Hypertension		90 (47.1%)
Family history of CAD		65 (34.0%)
Smoking		49 (25.7%)
Obesity		79 (41.4%)

Table-2: Descriptive Statistics for Quantitative Variables (n=191)

	Mean	Standard Deviation	Minimum	Maximum
Age (years)	33.6	6.7	25	45
Duration of chest pain (minutes)	42.5	8.3	30	90
LDL (mg/dl)	125.7	22.4	60	180
HDL (mg/dl)	37.2	7.9	20	50
TG (mg/dl)	179.6	28.2	100	200

With regards to coronary artery findings, 82 (42.9%) patients had non-obstructive CAD while 47 (24.6%) had spontaneous

dissection. Normal coronaries were found in 62 (32.5%) patients as shown in figure-1. Distribution of vessel disease is shown in figure-2. Left anterior descending (LAD) were found positive in 88 (46.1%) patients.
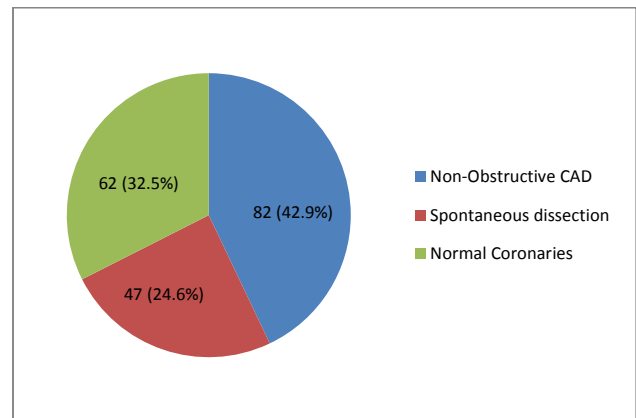

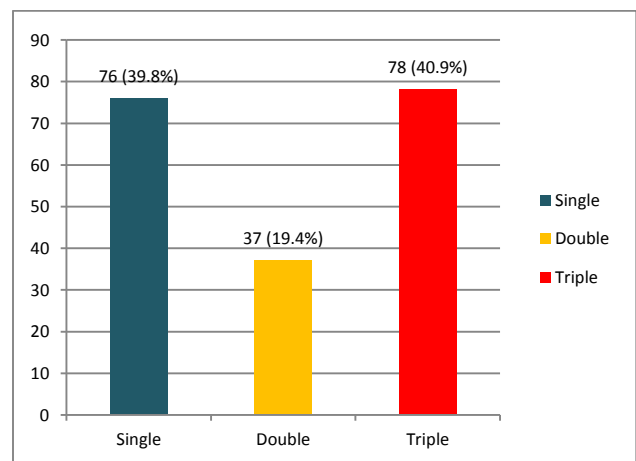Figure-1: Coronary Artery Findings (n=191)

Figure-2: Vessel Disease Findings

HDL <40 mg/dl (p=0.002), TG >150 mg/dl (p=0.0001) and positive family history of CAD (p=0.0001) were found to have significant association with LAD while all other study variables were not found to have any statistically significant association with LAD (p>0.05) as show in table-3.

Table-3: Stratification of Study Variables with respect to Left Anterior Descending (N=191)

Study Variables		Left Anterior Descending		P-Value
		Yes (n=88)	No (n=103)	
Gender	Male	61 (69.3%)	74 (71.8%)	0.702
		27 (30.7%)	29 (28.2%)	
Age groups (years)	25-35	48 (54.5%)	62 (60.2%)	0.431
	>35	40 (45.5%)	41 (39.8%)	
Duration of chest pain (minutes	30-60	50 (56.8%)	55 (53.4%)	0.636
	>60	38 (43.2%)	48 (46.6%)	
LDL (mg/dl)	>130	40 (45.5%)	51 (49.5%)	0.575
HDL (mg/dl)	<40	29 (54.5%)	57 (55.3%)	0.002
TG (mg/dl)	>150	64 (72.7%)	48 (46.6%)	0.0001
Vessel Disease	Single	44 (27.3%)	31 (30.1%)	0.006
	Double	20 (22.7%)	17 (16.5%)	0.278
	Triple	39 (44.3%)	39 (37.9%)	0.366
Diabetes Mellitus		23 (26.1%)	37 (35.9%)	0.146
Hypertension		38 (43.2%)	52 (50.5%)	0.313
Smoking		69 (78.4%)	73 (70.9%)	0.235
Family history of CAD		43 (48.9%)	22 (21.4%)	0.0001
Obesity		41 (46.6%)	38 (36.9%)	0.175

DISCUSSION

The CVD can exhibit even at a very young age as was demonstrated in this study.[15] Among study participants, male were 70.7%. This male predominance could be due to the presence of estrogen that provides shielding effects against atherosclerosis in females and in males, as smoking is more prevalent to make them the major contributor and that has been established through a number of epidemiological studies.[16] Atypical manifestation being more frequent in females is also characterized to be instrumental; an aspect of the INTERHEART study described overall contribution of male gender as 76% and 85% its South Asian cohort of myocardial infarction.[17]

We found in our study that majority of the very young CAD patients were reported in the absence of preliminary symptoms of MI. Some of the histopathological studies have mentioned that plaques are comprised of lipids as major portion and cellular scar tissues as minor portion and remain for a small instance of time or form rapidly than plaques observed in elderly patients.[18] These plaques are open to cause rupture of the artery resulting in the increase of STEMI frequency among younger people as compared to chronic stable angina.[19] Stressful happenings in the life might be the cause of destabilizing the plaque to end up into STEMI by rupturing the artery. Diabetes has been established to be a risk factor of CAD as the frequency of DVD (21.4%) and TVD (7.8%) was observed in diabetic patients whereas in non-diabetics it was 10.4% and 4.5% respectively.[19] According to our study, among the patients with vessel disease, 39.79% had SVD, and with DVD and TVD they were 19.37% and 40.84% respectively.

We found in our study that 47.1% of the contributors were reported with hypertension, more prevalent as compared to 31.1% mentioned by INTERHEART a cohort study of South Asia.[17] Some of the studies showed that in this age group, for CAD, the most frequent and considerable risk factor was smoking, ranging between 62-90%.[20,21] We also came up with an equivalent prevalence of smokers i.e., 74.3%. The adverse effects of smoking affect all stages of atherosclerosis as it fastens the process of thrombosis, endothelial malfunctioning, and coronary vasoconstriction, encourages proinflammatory responses and finally constructs a thrombotic atmosphere.[20,21] In the prevention of risk factors to avoid, discontinuation of smoking is a must. Strict laws should be passed and implemented to restrict smoking in order to minimize the potential risk. Bhardwaj R, et al mentioned that in their study 58.8% of the participants were smokers[22] whereas according to Mustafa A, et al 45.8% were smokers.[23]

Researchers established that obesity had an insignificant association showing an incidence of 3.3-20% among patients of MI.[20] We found in our study that 41.4% of the cases were obese, the prevalence of obesity mentioned in the INHEART cohort study of South Asia was 44.2% which was comparable to our findings.[17] Lakka et al found in their study that obese men of middle age were at a higher risk for ACS and chances were 5.5 times increased if they were smoker too the.[24] In a study done by Sinha SK, et al obesity was 39.1%.[20] The mean age of our study cases came out to be 33.6±6.7 years. The mean age recorded by Bhardwaj R, et al was 35.94 years.[51]

In current study, mean LDL, HDL and TG were 125.7±22.4 mg/dl, 37.2±7.9 mg/dl and 179.6±28.2 mg/dl respectively. Moustafa A et al also reported mean LDL as 107±43 mg/dl and HDL as 38.7±12 mg/dl.[23] In present study, diabetes mellitus was documented in 31.4% of the patients. Bhardwaj R, et al reported that 17.7% of the patients were diabetic.[51] Moustafa A, et al noted diabetes in 37.3% of the younger patients with MI.[22]

In our study, family history of CAD was found to be positive in 34% of the patients. Moustafa A et al noted the history of CAD in 36.4% of the patients.[23] Sinha SK et al reported that 46.8% of the patients had family history of CAD.[14]

In this study, in distribution of coronary arteries, 43.0% of the patients having non-obstructive CAD symptoms, 24.6% had spontaneous dissection while 32.5% had normal coronaries artery. Similar findings were reported by Bhardwaj R, et al showing CAD

significant as 71.0% and in 10.5% normal coronaries were observed.[22] In our study, left anterior descending (LAD) found to be positive in 46.1% of the patients. Bhardwaj R et al also noted that the most frequently involved vessel was LAD, showing a lesion frequency of 62.4%.[22] Sinha SK, et al reported LAD in 58.1% patients.[14] To reduce the complications, it is very important to increase the awareness and proper knowledge in the general public.

CONCLUSION

Involvement of left anterior descending artery as a culprit vessel was fairly common in young patient with ST elevation myocardial infarction.

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