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PREVALENCE AND CLINICAL PARAMETERS OF THE LEFT MAIN CORONARY ARTERY DISEASE IN ST-ELEVATION MYOCARDIAL INFARCTION: IN-DEPTH CLINICAL PERSPECTIVE

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ABSTRACT:

BACKGROUND: *LMCAD is considered one of the most serious manifestations of CAD because of its association with a high ischemic burden in the myocardium and an increased risk of mortality. STEMI is considered one of the main subsets of ACS and still heads the list of the most life-threatening conditions all over the world.*

AIMS & OBJECTIVE: *With the coexistence of STEMI and LMCAD, the management of STEMI gets really challenging and we aimed at assessing the prevalence of LMCAD disease association with STEMI and related clinical characteristics and management modalities.*

MATERIAL & METHODS: *This is a cross-sectional analysis carried out over six months, from January to June of 2019, at the National Institute of Cardiovascular Diseases, Karachi. A total of 132 patients, between the age group of 40 to 75 years of age, presenting with an acute STEMI were enrolled. Diagnostic coronary angiography was done to diagnose significant LMCAD, which is ≥50% stenosis in the left main coronary artery. Baseline characteristics of the subjects included age, sex, cardiovascular risk factors like hypertension, diabetes mellitus, smoking and obesity were also taken in consideration. LMCAD prevalence and its association with different characteristics of patients was statistically analyzed using SPSS version 20.*

RESULTS: *The 132 patients diagnosed with acute STEMI had a mean age of 57.26 ± 8.65 years, with a male preponderance of 79.5%. This study showed that significant LMCAD was found in 6.1% of the patients presenting with STEMI. While comparing the baseline characteristics, the presence of LMCAD did not reflect any remarkable difference among the subjects in terms of gender, age group, diabetes mellitus, hypertension, smoking status, and obesity ($p > 0.05$).*

CONCLUSION: *This study shows that significant LMCAD is common in patients presenting with acute STEMI. Early detection and management improves the clinical outcome based on the anatomical characteristics of the lesion. Revascularization remains a choice between both the PCI and CABG. Early recognition of LMCAD and comprehensive cardiovascular care may provide a key approach in attempts to reduce morbidity and mortality in patients with STEMI associated with this condition.*

KEY WORDS: *Left main coronary artery disease, STEMI, coronary angiography, percutaneous coronary intervention, coronary artery bypass grafting.*

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INTRODUCTION:

Ischemic Heart disease remains the major cause of morbidity and mortality globally, and ACS contributes significantly to this cause. STEMI is remarkable for the high complication rate and mortality associated with the absence or delay of timely intervention. STEMI refers to an acute myocardial infarction caused by a complete occlusion of the coronary artery and further leads to myocardial ischemia followed by the infarction process [1]. Although the use of reperfusion therapy and primary percutaneous coronary intervention has vastly improved outcomes with major developments in the management of STEMI, management is trickier when STEMI is complicated by LMCAD. The LMCA supplies blood to the major part of the myocardium [2].

Accordingly, stenosis of this vessel may have catastrophic consequences since the amount of myocardial territory that can be jeopardized is so huge, extending to as high as 75-100% depending on the dominance of the coronary circulation. Thus, significant LMCAD defining ≥50% stenosis of the LMCA should be regarded as a high risk lesion due to its higher mortality and increased heart failure rates alongside other cardiovascular complications compared with non-LM coronary artery disease. The coexistence of left main coronary artery disease in STEMI patients is associated with a higher level of difficulty at many levels in diagnosis, risk stratification, and management; hence, the effective method of treatment is the rapid restoration of myocardial perfusion through revascularization[3].

CABG was traditionally considered a standard of care in significant LMCAD, as early clinical trials demonstrated survival benefits over medical therapy. However, unparalleled improvements in the technology of PCI, in antithrombotic agents, and in procedural techniques over the past few decades have led to a paradigm shift to feasibility for percutaneous interventions for LMCAD, especially in selected populations of patients [4].

Both the American College of Cardiology/American Heart Association ACC/AHA and the European Society of Cardiology ESC have put forward guidelines on recommendations for revascularization in patients with ≥50% stenosis of the LMCA, regardless of symptomatic status. The decision to use PCI or CABG will depend on many aspects, including the complexity of coronary anatomy, multi-vessel disease, and urgency in clinical presentation, and patient co-morbidities. While considering complex LMCA lesions, those involving multi-vessel disease, CABG remains the preferred strategy; whereas in less complex situations or in patients considered at high surgical risk, PCI has become an alternative. However, long-term patency, the risk of restenosis, and

repeat revascularization remain concerns, particularly for LMCAD [5].

The prognostic implications are the interests in the prevalence of LMCAD among patients presenting with ACS, especially STEMI. Previous studies have derived that the variable prevalence rate of LMCAD ranges from 2.4% to 10.5%, depending on the population and the diagnostic criteria used[3].

LMCAD diagnosis in the acute setting of STEMI is of paramount importance for determining the optimal revascularization strategy and improving outcomes. However, data on the frequency and clinical characteristics of LMCAD among South Asian populations-in particular, Pakistan is lacking, whose population bears a high burden of ischemic heart disease. The present study will be directed at assessing the incidence of significant LMCAD in patients who present with acute STEMI to a tertiary care center in Karachi, Pakistan, and determining any association of this lesion with patient demographics and cardiovascular risk factors. The study will develop tailored management strategies and optimize outcomes in STEMI patients with this high-risk coronary lesion, providing perhaps important insights into the prevalence and characteristics of LMCAD in this cohort. Furthermore, it also emphasizes the need for regional data to enhance the understanding of LMCAD and ultimately improve cardiovascular care among residents in the locality.

MATERIAL AND METHODS:

Study Design and Setting

This was a single center, descriptive, cross-sectional study carried out in the inpatient department of Cardiology at the National Institute of Cardiovascular Diseases, Karachi after obtaining permission from the ethical board of the institution. The duration of the study was six months, starting from January 1, 2019, and ending on June 30, 2019.

Study Population and Sampling Size/ Technique

The population targeted for this study included those patients presenting with acute STEMI. Using the WHO sample size calculator and assuming 32.5% as the frequency of LMCAD among STEMI presentation, at a 95% confidence level with an 8% margin of error. This provided a sample size of 132 patients, which were selected using a non-probability consecutive sampling method.

Inclusion and exclusion criteria

Inclusion criteria:

- Candidates should be aged between 40 and 75 years old.
- Both sexes.
- Presenting with ACS having STEMI was defined as typical chest pain that lasted for more than 20 minutes, electrocardiogram showing precordial lead ST elevation of >2mm or limb lead elevation of >1mm, and cardiac enzymes twice the normal range.

Exclusion criteria:

- Patients with chronic renal failure receiving dialysis [glomerular filtration rate <15 ml/min/1.73m^2].
- CDC Case Definition: Severe anemia with hemoglobin <7g/dl.
- Patients with dextrocardia as evidenced by chest X-ray.
- History of circulatory collapse that required cardiopulmonary resuscitation or major complications during angioplasty, such as cardiogenic shock, renal failure, or unconsciousness.
- The patients with ejection fraction below 20% patients.
- Prior history of coronary artery bypass grafting (CABG).

DATA COLLECTION AND PROCEDURE:

After taking approval from the institutional review board, all eligible patients who were admitted to the Cardiology department at NICVD with STEMI were enrolled. The informed written consent of each patient was taken after explaining the benefits and risks of the procedure. Characteristics like age, gender, and contact details along with the admission date were recorded on a pre-designed proforma. All the following procedures were preceded by a detailed history and clinical examination. Coronary angiography was performed by a consultant cardiologist who has experience of more than five years. The demographic data, clinical data, and angiographic results were duly recorded by the principal

investigator.

STATISTICAL ANALYSIS

Data analysis was done using SPSS software version 20. Quantitative variables included age, height, weight, body mass index, and duration of chest pain, and were summarized as mean and SD. Qualitative variables included gender, diabetes mellitus, hypertension, smoking status, and obesity, and were presented as frequency and percentage. The outcome variable of interest was the diagnosis of LMCAD, which was done using coronary angiography. The obtained data were stratified with respect to the analysis of the association of LMCAD with potential risk factors for age, duration of chest pain, gender, body mass index, hypertension, diabetes mellitus, smoking status, and obesity. The chi-square test was applied to compare stratified groups; the level of significance was set at p-value ≤ 0.05.

RESULTS:

Out of the total 132 patients who were included in the study, 79.5% (n=105) were male, and 20.5% were female (n=27).

The mean age of the population in this study was 57.26 ± 8.65 years. The age distribution showed that 46.2% of the patients aged between 40-55 years and 53.8% were aged between 56-75 years.

Frequency and percentage of patients with respect to age Mean height for the patients was 164.48 ± 11.95 cm, while their mean weight was 68.98 ± 11.56 kg. The calculated body mass index had a mean value of 25.80 ± 5.67 kg/m^2, ranging from a minimum of 14.10 to a maximum of 60.10 kg/m^2.(Table-1) The duration of chest pain had an average duration of 218.73 ± 158.04 minutes with a minimum of 15 and a maximum of 1200 minutes. Regarding the distribution of the duration, 66.7%(88 patients) had chest pain above 120 minutes and 33.3% (44 patients) had chest pain that lasted for up to 120 minutes. (Table-2)

Moreover, 21.2% (28 patients) have diabetes mellitus while Hypertension was noted among 59.8% and 22% were active smokers and 13.6% were obese. (Table-1)

Among the patients with acute STEMI, 6.1% (8 patients) presented with LMCAD, and 93.9% (124) did not have significant LMCAD. (Table-3)

Association of LMCAD with baseline characteristics LMCAD alone was analyzed for association with various characteristics of patients. There were no statistical differences between women and men regarding LMCAD, 6.7% versus 3.7% respectively, with a p = 0.485. Age stratification showed

Table 1: Descriptive Statistics of Research Participants.

Variable		f(%)
Age		57.26±8.65
Grouped Age	40-55 years	61(46.2%)
	56-75 years.	71(53.8%)
Sex	Male	105(79.5%)
	Female	27(20.5%)
Height		164.48±11.95
Weight		68.98±11.56
BMI (kg/m^2)		25.80 ± 5.67
BMI Rang(mini maxi)		14.10-60.10
Risk Factors		
Hypertension	Yes	79(59.8%)
	No	53(40.2%)
Diabetes Mellitus	Yes	28(21.2%)
	No	104(78.8%)
Active Smokers	Yes	29(22.0%)
	No	103(78.0%)

Table 2: Duration of Chest Pain Before Presentation.		
Variable		**f(%)**
Duration of Chest Pain (minutes)	Mean (mini-Maxi)	218.73 ± 158.04
	Minimum	15
	Maximum	1200
	≤ 120 minutes	44(33.3%)
	≥ 120 minutes	88(66.7%)

Table 3: Frequency of Left Main Coronary Artery Disease in STEMI Patients.		
Variable		**f(%)**
LMCA Disease in STEMI Patients	No LMCA Disease	124(93.9%)
	LMCA Disease	8(6.1%)

Table 4: Comparison of Left Main Coronary Artery Disease (LMCAD) with respect to Research Variables.			
Research Variable		(%)	p-value
LMCA Disease in	Male	3.7%	0.485
	Female	6.7%	
Grouped Age	40-55 years	3.3%	0.192
	56-75 years.	8.5%	
Duration of Chest Pain	≤ 120 minutes	2.3%	0.187
	≥ 120 minutes	8.0%	
Diabetes Mellitus	Yes	4.8%	0.226
	No	10.7%	
Hypertension	Yes	7.5%	0.408
	No	5.1%	

that 8.5% of cases with LMCAD were in the age group of 56-75 years, while 3.3% fell in the age groups of 40-55 years, which is not significant i.e p = 0.192. Comparing the patients who presented with chest pain duration of more than 120 minutes to within 120 minutes, the prevalence is 8.0% versus 2.3%, respectively with a p-value 0.187. The prevalence of LMCAD in diabetic and non-diabetic patients was 4.8% and 10.7%, respectively which is not statistically significant with a p-value of 0.226. while comparing hypertensive and non-hypertensive cohort, the prevelance of LMCAD was7.5% and 5.1% respectivelt with a p = 0.408. No statistically significant associations with baseline characteristics were found concerning gender, age, diabetes mellitus, hypertension, smoking status, obesity, or duration of chest pain. (Table-4)

DISCUSSION:

The LMCA lesion is considered a high-risk lesion, and the clinical outcomes of LMCA disease are worse compared to non-LMCA CAD[6]. This underlies its pathophysiology. The large myocardial territory that may be supplied by the left coronary artery when occluded may result in extensive ischemia and necrosis. This territory encompasses both the LAD and the LCX artery; accordingly, significant stenosis or occlusion of the LMCA may compromise blood supply to most of the left ventricle, making this a particularly virulent subset of CAD. Such occlusions in the context of STEMI,as reflected in our cohort, necessitate immediate and effective revascularization to prevent adverse outcomes[7,8].

The main goal of this study had been to find out the incidence of LMCAD in individuals presenting with acute STEMI

and to assess its association with clinical characteristics. The prevelanve of LMCAD was 6.1% in selected STEMI population and no association was found between incidence of LMCAD and notable routine risk factors. The usual cardiovascular risk factors such as male gender, older age, diabetes mellitus, hypertension, smoking, and obesity have been implicated for a long time to have an important role in the development and progression of CAD[9]. But our study did not show any significant association of these baseline characteristics in the prevalence of LMCA disease in STEMI patients. There can be several reasons for this. First, while these risk factors are indeed associated with CAD in general, LMCA disease may have different pathophysiological mechanisms less influenced by such factors[10]. For example, diabetes and hypertension are strongly associated with diffuse atherosclerosis, but the development of focal LMCA disease could be mediated by other mechanisms such as plaque instability and pro-thrombotic states. Interestingly, several large studies, including that by the SYNTAX trial, suggested that clinical manifestations of ACS including STEMI are surrogates for the complexity of CAD and outcomes rather than simply the presence of traditional risk factors[11]. These would seem to be classic determinants of the development of atherosclerosis but, perhaps, dynamic factors such as plaque vulnerability, endothelial dysfunction, and inflammatory activity may more commonly determine the clinical course and manifestations of LMCA disease in STEMI[12]. These findings underline the complex interaction of risk factors in STEMI patients and suggest that, though LMCAD remains a significant finding with management implications, it does not seem to show strong associations with baseline characteristics examined in this population. The findings thus support a more aggressive approach to diagnosis and management in patients with STEMI who are suspected of having LMCA involvement[13].

Our findings were in concordance with an emerging number of studies indicating a notable prevalence of LMCA disease in acute coronary syndromes, where significant LMCA disease was identified in 6.1% of patients who presented with STEMI[14]. This contrasts with the findings of Noor et al. who, within a similar cohort, showed that the prevalence was 10.5%. In a larger cohort with ACS, Soleimani et al. reported that the prevalence was 3.6%. The relatively higher prevalence in our cohort may point to a different epidemiological pattern from that in other regions, due to genetic factors and lifestyle or environmental influences peculiar to the population under study[15]. For example, a higher prevalence of smoking, dyslipidemia, and diabetes in South Asian populations may predispose them to more aggressive and diffuse atherosclerosis. The distribution and prevalence of LMCA disease in STEMI may be further influenced by inequalities in healthcare delivery, utilization of emergency services, and adherence to the guidelines based on evidence[16]. Our findings accentuate the fact that treatment guidelines and public health policy need to take into consideration locally adapted approaches regarding the population's prevailing cardiovascular risk profile.

Current clinical practice in the management of LMCAD is based on timely and effective revascularization, either by CABG or PCI. Evolving Evidence and Outcomes CABG was considered for many years to be the standard of care for revascularization in LMCA disease, especially with associated multivessel disease, given the survival advantage that existed in early clinical trials[17]. The role of PCI has become increasingly important over the past two decades with advances in stent technology, including the development of DES, and improved procedural techniques. The management of LMCA disease requires a "Heart Team" approach, especially in acute presentations like STEMI. Because the decision-making is complex, current guidelines now suggest a collaborative approach by interventional cardiologists, cardiac surgeons and other non-invasive specialists to weigh the benefits and risks of different revascularization strategies[18]. Long-term follow-up has suggested that, while PCI may result in similar mortality rates compared with CABG, there is a potential

increased risk of repeat revascularization with the use of PCI, whereas a slight increased risk of stroke has been found with CABG. Thus, the strategy for treatment must be individualized and focus on the optimization of both short and long-term outcomes[19].

Future studies in populations of larger size are warranted to further delineate these associations. There is still considerable scope for further research to optimize risk stratification, refine the treatment, and improve the outcome of STEMI patients associated with LMCAD. Future work should be directed at examining optimal revascularization practice in this subset of patients and developing strategies to reduce the progression and consequences of this high-risk disease.

LIMITATIONS:

Several limitations of this study deserve consideration. The relatively small sample size may limit the generalizability of this study, especially regarding the associations of LMCAD with baseline characteristics. Another limitation is that this study was single-center; selection bias cannot be excluded. Further studies are required, especially large-scale multicenter studies, in order to confirm these results and possible differences in LMCAD prevalence and outcomes in different populations.

CONCLUSION:

LMCAD was found in considerable patients of STEMI. There was no associations of all baseline characteristics with LMCAD. This underlines the critical need for early recognition and proper management of LMCAD in STEMI due to prognostic importance.

CONFLICT OF INTEREST STATEMENT:

The authors have no conflict of interest to declare in the publication of this article.

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