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Original Article

Internal Medicine Section

Angiographic Profile of Type 2 Diabetic Patients with ST Elevation Myocardial Infarction: A Cross-sectional Study

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ABSTRACT

Introduction: Coronary atherosclerosis is common in diabetics, and it is diffuse in form, with multivessel involvement. It demonstrates the involvement of multiple vessels rather than a single vessel.

Aim: To evaluate the angiographic profile of diabetic patients with ST Elevation Myocardial Infarction (STEMI).

Materials and Methods: The present study was a cross-sectional study which enrolled 104 diabetic patients presenting with STEMI from December 2019 to March 2020. Seventy percent or more stenosis in any major coronary artery or its major branches (>2.5 mm) was considered as significant.

Results: Mean age of the patients was 55.61±11.32 years, with 75 subjects being males and 29 subjects being females. A total of 28 (26.92%) had Anterolateral Wall Myocardial Infarction (ALWMI), 4 (3.84%) had Anteroseptal Wall Myocardial Infarction (ASWMI) 39 (37.5%) had Anterior Wall Myocardial Infarction (AWMI), 1 (0.96%) had extensive AWMI, 2 (1.9%) had Inferolateral Wall Myocardial Infarction (ILWMI), while 30 (28.84%) patients had Inferior Wall Myocardial Infarction (IWMI). Furthermore, 51 (49.0%) were thrombolysed while 53 (50.96%) patients were non thrombolysed. Thirty eight (36.53%) had single vessel disease, 40 (38.46%) had double vessel disease, while 26 (25%) had triple vessel disease. Among these patients, Left Main Coronary Artery (LMCA) was involved in 3 (2.88%) of patients. Seventy three patients had a Glycated Haemoglobin (HbA1c) of greater than 8.5 and had multivessel involvement, whereas 31 had a HbA1c of less than 8.5. Major Adverse Cardiac Events (MACE) was observed during hospital stay in the form of death, recurrent myocardial infarction and cardiovascular stroke, which occurred in 20 (19.23%) patients of the total 104 diabetic patients.

Conclusion: In the present study, the severity and extent of Coronary Artery Disease (CAD) and incidence of triple/multivessel disease was significantly high in diabetics. Diabetic patients with high HbA1c had more coronary vessel involvement. In this case, Coronary Artery Bypass Graft (CABG) is the mode of treatment.

Keywords: Coronary artery disease, Left main coronary artery, Major adverse cardiac events

INTRODUCTION

Diabetes mellitus is the second most common disease in the world, after cardiovascular disease. It is estimated that roughly 100 million people globally are affected by diabetes [1]. Diabetes is a condition that causes both chronic and acute consequences. Cardiac disease is by far the most common cause of death among diabetics [2]. Dyslipidaemia is seen in all patients with type 2 diabetes, and diabetics with high cholesterol have a 2-3 times higher risk of Coronary Artery Disease (CAD) than non diabetics.

Coronary artery disease is the most common symptom of cardiac involvement in diabetics. Diabetic cardiomyopathy and cardiac autonomic neuropathy are less common. In hospital, autopsy, and epidemiological as well as longitudinal studies in many populations, accelerated and increased prevalence of CAD has been well documented. Cardiovascular disorders account for 70-80% of deaths in diabetics. Coronary artery disease is responsible for 40% of diabetic deaths in their fourth decade, and it accounts for 50-70% of deaths among diabetics over the age of 65 years [2].

The deleterious macrovascular effects of diabetes mellitus are well known, and these are associated with an increased rate of atherosclerosis, which predisposes individuals to occlusive CAD, Myocardial Infarction (MI), and death. Patients with diabetes are more likely to develop a diffuse and fast progressing form of atherosclerosis, which increases the need for revascularisation [3].

Coronary angiography is the "gold-standard" procedure for identifying and evaluating CAD. Coronary artery disease manifests itself in a variety of ways, from stable angina to Acute Coronary Syndrome (ACS) to asymptomatic illness [4,5]. To build an effective therapeutic plan, it is necessary to understand coronary architecture [5]. The prognosis of CAD is largely determined by the severity of the illness, the involvement of the left main and left anterior descending arteries, and Left Ventricular (LV) function [6].

Coronary atherosclerosis is common in diabetics, as revealed by angiography, and it is diffuse in form, with multivessel involvement. It demonstrates the involvement of multiple vessels rather than a single vessel. Diabetic patients had a much higher rate of left main coronary artery involvement than non diabetic patients [7].

Coronary artery narrowing of more than or equal to 70% was considered as significant stenosis [8]. When compared to non diabetic individuals, diabetic patients exhibit a worse angiographic picture of ischaemic heart disease, with a higher prevalence of multivessel disease, narrow arteries, calcification, intracoronary thrombus, and less developed collaterals. Insulin-dependent diabetics have a higher prevalence of diffuse CAD with narrow arteries, presumably due to the metabolic illness's longer progression and severity [9].

Diabetic patients with ACS are at a higher risk for recurrent heart attacks and strokes, but they also benefit more from vigorous treatment than their non diabetic counterparts. Potent antiplatelet therapy, such as aspirin, clopidogrel, and Glycoprotein (GP) IIb/IIIa receptor antagonists, heparin or Low Molecular Weight Heparin (LMWH) early invasive evaluation, and, if suitable, stent-based Percutaneous Coronary Intervention (PCI) are the mainstays of treatment [10]. In patients with complicated coronary architecture, Coronary Artery Bypass Graft (CABG) may be a viable option. Surgeons, on the other hand, are typically hesitant to operate in the presence of ongoing ischaemia. The use of drug-eluting stents has been linked to a significant reduction in restenosis in both non diabetic and diabetic patients. This results in further improvement in the outcomes of diabetic patients with ACS [11].

The present study aimed to assess diabetic patients' risk factors and angiographic profile, as well as the impact of diabetes mellitus on the clinical course of patients with ST Elevation Myocardial Infarction (STEMI).

MATERIALS AND METHODS

The present study was a single-centre cross-sectional study carried out in the Intensive Coronary Care Unit (ICCU), Department of General Medicine, Karnataka Institute of Medical Sciences, Hubli, Karnataka, India, from December 2019 and March 2020. The Institutional Ethics Committee (IEC) approved the study vide letter number KIMS: ETHICS COMM: 107/2: 2018-19. The patients were enrolled into the study after obtaining written consents from them or their attendants.

Sample size estimation:

$n=(z)^2pq/d^2$ n=sample size, CI=95%, d=0.2, z=1.96, p=0.125, q(100-p)=0.875

$n=(1.96)^2$ x0.125x0.875/$(0.2)^2$x10

n=104

Inclusion criteria: Diabetic patients with acute MI who had ST segment elevation and T wave changes with reciprocal changes, as well as new pathological Q waves on their Electrocardiogram (ECG).

Exclusion criteria: Patients with acute STEMI who were non-diabetic.

Detailed history, clinical examination and the following investigations with coronary angiography were carried out: Complete Blood Count (CBC), blood urea, serum creatinine, serum electrolytes, Liver Function Test (LFT), ECG, 2D ECHO, Glycated Haemoglobin (HbA1c), and coronary angiography.

STATISTICAL ANALYSIS

The data was entered into Microsoft Excel datasheet and was analysed using International Business Machines (IBM) Statistical Package for the Social Sciences (SPSS) statistics software version 23.0. Data collected was represented as number and percentages in tabular form. $p<0.05$ was considered for statistical significance after assuming all the rules of statistical tests. Chi-square test was used as test of significance for qualitative data.

RESULTS

The study included a total of 104 diabetic patients with acute STEMI admitted in ICCU. Mean age of subjects was 55.61±11.32 years; 75 subjects were males and 29 subjects were females. Majority of subjects were in the age group of 51 to 70 years (28.9%).

[Table/Fig-1] shows duration of diabetes, other co-morbidities and risk factors among patients. Majority of patients were diabetic for more than 5 years, associated with other co-morbidities like hypertension and risk factors like alcoholism, smoking, and tobacco chewing.

There were 55 (52.88%) patients who had atypical chest pain and 49 (47.12%) people who had typical chest pain. Along with chest pain they also presented with other symptoms like dyspnoea, sweating, vomiting, and abdominal pain [Table/Fig-2].

Among 104 patients, 39 patients had AWMI, 28 patients had ALWMI, 30 patients had IWMI. Most of the patients were in the age group of 51-70 years. [Table/Fig-3,4] shows that there was no association between HbA1c values, diabetes duration, and type of STEMI.

There were 51 thrombolysed patients and 53 patients who were non thrombolysed. Thrombolysis was performed on 44 patients with typical chest pain, while thrombolysis was not done on five patients with typical chest pain. Seven individuals with atypical chest pain received thrombolysis, but the remaining 48 patients did not. Sixty three (60.58%) patients had LV dysfunction, while 41 (39.42%) had a normal 2D ECHO. Twenty three of the 51 patients who underwent thrombolysis showed LV dysfunction. Left ventricular dysfunction was found in 40 of the 53 individuals who did not receive thrombolysis [Table/Fig-5]. Seventy three patients had a HbA1c of greater than 8.5, whereas 31 had a HbA1c of less than 8.5.

Coronary angiography was used in the study. Double Vessel Disease (DVD) was found in 40 (38.46%) patients, Single Vessel Disease (SVD) in 38 (36.54%), and Triple Vessel Disease (TVD) in 26 (25%). The observation that DVD/TVD was more than SVD, suggests that in diabetes there was multivessel involvement [Table/Fig-6].

The Left Anterior Descending (LAD) vessels were involved in 79 individuals in the study, 60 of whom were males and 19 of whom were females. It also demonstrates that diabetic individuals are more likely to have LAD involvement. Left Circumflex (LCX) vascular involvement was found in 62 patients, 45 of whom were males

Diabetes duration	Gender		Total
	Female	Male	
Less than 5 yrs	13 (30.23%)	30 (69.76%)	43 (41.35%)
More than 5 yrs	16 (26.23%)	45 (73.77%)	61 (58.65%)
Co-morbidities			
Hypertension	15 (36.59%)	26 (63.41%)	41 (39.42%)
Alcoholism	0	37 (100%)	37 (35.58%)
Smokers	0	33 (100%)	33 (31.73%)
Tobacco chewers	26 (48.15%)	28 (51.85%)	54 (51.92%)

[Table/Fig-1]: Duration of diabetes, other co-morbidities and risk factors among patients.

Symptoms	Gender		Total
	Female	Male	
Atypical chest pain	13 (44.83%)	42 (56%)	55 (52.88%)
Typical chest pain	16 (55.17%)	33 (44%)	49 (47.12%)
Backache	0	1 (1.33%)	1 (0.96%)
Cough	1 (3.45%)	2 (2.67%)	3 (2.88%)
Dyspnoea	10 (34.48%)	19 (25.33%)	29 (27.88%)
Giddiness	0	1 (1.33%)	1 (0.96%)
Pain abdomen	1 (3.45%)	11 (14.67%)	12 (11.54%)
Sweating	7 (24.14%)	22 (29.33%)	29 (27.88%)
Vomiting	10 (34.48%)	18 (24%)	28 (26.92%)

[Table/Fig-2]: Clinical presentation.

Age (years)	Diagnosis						Total	Test performed, p-value
	ALWMI	ASWMI	AWMI	Extensive AWMI	ILWMI	IWMI		
31-40	0	0	0	1 (100.0%)	0	2 (6.67%)	3 (2.88%)	Chi-square-54.176 df-20 p-value <0.05
41-50	5 (17.86%)	1 (25.0%)	14 (35.89%)	0	0	7 (23.33%)	27 (25.96%)	
51-60	9 (32.14%)	0	8 (20.51%)	0	2 (100%)	11 (36.67%)	30 (28.84%)	
61-70	10 (35.71%)	3 (75.0%)	9 (23.08%)	0	0	8 (26.67%)	30 (28.84%)	
>70	4 (14.29%)	0	8 (20.51%)	0	0	2 (6.67%)	14 (13.46%)	
Total	28 (100.0%)	4 (100.0%)	39 (100.0%)	1 (100.0%)	2 (100.0%)	30 (100.0%)	104 (100.0%)	

[Table/Fig-3]: Electrocardiographic profile of patients with age distribution.
ALWMI: Anterolateral wall myocardial infarction; ASWMI: Anteroseptal wall myocardial infarction; AWMI: Anterior wall myocardial infarction; ILWMI: Inferolateral wall myocardial infarction; IWMI: Inferior wall myocardial infarction

Variables		Diagnosis						Total	Test performed, p-value
		ALWMI	ASWMI	AWMI	Extensive AWMI	ILWMI	IWMI		
HbA1c	<8.5%	7 (25.0%)	0	12 (30.77%)	0	2 (100%)	10 (33.33%)	31 (29.81%)	Chi-square -7.338 df-5 p-value- 0.197
	8.5% and more	21 (75.0%)	4 (100.0%)	27 (69.23%)	1 (100.0%)	0	20 (66.67%)	73 (70.19%)	
Total		28 (100.0%)	4 (100.0%)	39 (100.0%)	1 (100.0%)	2 (100.0%)	30 (100.0%)	104 (100.0%)	
Diabetes duration	Less than 5 years	9 (32.14%)	1 (25.0%)	15 (38.46%)	1 (100.0%)	2 (100%)	15 (50.0%)	43 (41.35%)	Chi-square - 6.735 df- 5 p-value- 0.241
	More than 5 years	19 (67.86%)	3 (75.0%)	24 (61.54%)	0	0	15 (50.0%)	61 (58.65%)	
Total		28 (100.0%)	4 (100.0%)	39 (100.0%)	1 (100.0%)	2 (100.0%)	30 (100.0%)	104 (100.0%)	

[Table/Fig-4]: HbA1c and diabetes duration with electrocardiographic profile.

Typical or atypical chest pain	Thrombolysed or Not		Total	Test performed, p-value
	No	Yes		
Atypical	48 (90.57%)	7 (13.73%)	55 (52.88%)	Chi-square - 61.589 df- 1 p-value- <0.05
Typical	5 (9.43%)	44 (86.27%)	49 (47.12%)	
Total	53 (100%)	51 (100%)	104 (100%)	
2D ECHO				
LV Dysfunction	40 (75.47%)	23 (45.1%)	63 (60.58%)	Chi-square - 10.040 df- 1 p-value- 0.002
Normal	13 (24.53%)	28 (54.9%)	41 (39.42%)	
Total	53 (100%)	51 (100%)	104 (100%)	

[Table/Fig-5]: Status in relation to thrombolysis.

Angiography	Sex		Total	Test performed, p-value
	Female	Male		
DVD	9 (31.03%)	31 (41.33%)	40 (38.46%)	Chi-square - 2.702 df- 2 p-value- 0.253
SVD	11 (37.93%)	27 (36%)	38 (36.54%)	
TVD	9 (31.03%)	17 (22.67%)	26 (25%)	
Total	29 (100%)	75 (100%)	104 (100%)	

[Table/Fig-6]: Angiography profile of diabetic patients.
DVD: Double vessel disease; SVD: Single vessel disease; TVD: Triple vessel disease

and 17 of whom were females. There were 50 patients with Right Coronary Artery (RCA) vascular involvement, 33 of whom were men and 17 of whom were women. Three patients, one male and two females, had Left Main Coronary Artery (LMCA) vascular involvement [Table/Fig-7]. Patients had Percutaneous Transluminal Coronary Angioplasty (PTCA) with stenting in 58 cases, CABG in 28 cases, and medical treatment in 18 cases.

According to the findings, 15 diabetic individuals within a period of less than 5 years had DVD, 18 had SVD, and 10 had TVD. There were 25 DVD patients, 20 SVD patients, and 16 TVD patients with a duration of more than 5 years. It shows that diabetic patients who have had the disease for more than 5 years have multivessel involvement [Table/Fig-8].

Vessels	Female	Male	Total	Test performed, p-value
LAD	19 (65.52%)	60 (80%)	79 (75.96%)	Chi-square - 2.402 df- 1 p-value- 0.121
LCX	17 (58.62%)	45 (60%)	62 (59.62%)	
RCA	17 (58.62%)	33 (44%)	50 (48.08%)	
LMCA	2 (6.9%)	1 (1.33%)	3 (2.88%)	

[Table/Fig-7]: Coronary angiography findings.
LAD: Left anterior descending coronary artery; LCX: Left circumflex coronary artery; LMCA: Left main coronary artery; RCA: Right coronary artery

Angiography	Diabetes duration		Total	Test performed, p-value
	Less than 5 yrs	More than 5 yrs		
DVD	15 (34.88%)	25 (41.0%)	40 (38.46%)	Chi-square - 6.735 df- 5 p-value- 0.241
SVD	18 (41.86%)	20 (32.79%)	38 (36.54%)	
TVD	10 (23.26%)	16 (26.23%)	26 (25%)	
Total	43 (100%)	61 (100%)	104 (100%)	

[Table/Fig-8]: Association between duration of diabetes and angiography.

Outcome

The MACE was observed during the hospital stay in the form of death, recurrent MI, and cardiovascular stroke occurred in 20 (19.23%) of patients of total 104 diabetic patients.

DISCUSSION

A total of 104 diabetic patients with acute STEMI were included in the study. The study looked at risk factors, diabetes duration, HbA1c levels, and angiographic profile. Among the predominant male sample, multivessel/triple vessel involvement was more common. Diabetic patients with poor glycaemic control (HbA1c>8.5%) made up 70.2% of the participants in this study. This shows that inadequate glucose management causes greater coronary artery involvement and stenosis severity to increase. This observation was consistent with Malthesh MK et al., [1]. In the index study, the peak incidence of MI in diabetics was observed in the fifth and sixth decades. This result resembled the findings of Chowdhary I and Sambyal V [2].

With a diabetic duration of more than 10 years, triple/multivessel disease was significantly greater (58.7%). These findings are consistent with another study by Lüscher TF et al., which found that the risk of coronary heart disease increased 1.38 times for every 10 years of diabetes duration [3].

The LAD was the most commonly affected vessel in the index study, and coronary angiography revealed that diabetics had a considerably greater prevalence of multivessel illness. This finding is consistent with other studies that also found that diabetics have a greater incidence of multivessel disease [4,5]. Few other authors reported an increased incidence of TVD, and more diffuse lesions were noted. As a result, the extent and severity of CAD in diabetic patients with ACS were much higher [6,7]. Further, there is literature that showed the angiographic extent and severity of CAD to be high among diabetic patients with ACS [8-13].

Limitation(s)

It was a single-centred study. There was no follow-up data, that could have provided more information regarding MACE.

CONCLUSION(S)

The severity and extent of CAD and triple/multivessel disease was significantly high among diabetics. With a diabetic duration of more than 10 years, the risk of triple vessel or multivessel illness was found to be significantly higher. Diabetics with poor control, high HbA1c levels, and a greater number of coronary vascular involvement required CABG as a therapy option. Involvement of LMCA was significantly high and severity of stenosis and total occlusion of vessels were more commonly seen in diabetic patients. The LAD artery was the most commonly involved vessel.

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