Angiographic Severity of Coronary Artery Disease in Diabetic and Non-diabetic Acute STEMI Patients in a Tertiary Care Centre of Nepal

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ABSTRACT

Background

Patients with diabetes mellitus have a higher prevalence of atherosclerotic heart disease and a higher incidence of myocardial infarction than the general population. Definitive diagnosis and precise assessment of anatomic severity of Coronary Artery Disease requires invasive diagnostic modality like coronary angiography.

Objective

To study angiographic characteristics and severity involving coronary arteries in patients with acute ST segment elevation Myocardial infarction and to compare the same in diabetics and non-diabetics.

Method

Among 150 patients with acute coronary syndrome, 75 diabetics and 75 non-diabetics admitted in Manmohan Cardiothoracic vascular and transplant Centre were selected randomly during a period of one year formed the study group. Random Blood Sugar, Fasting Blood Sugar was done in all 150 patients, HbA1c in all diabetics. All subjects with acute ST Elevation Myocardial Infarction were taken up for coronary angiography intended for primary PCI.

Result

In our study, 35 (46.7%) out of 75 diabetic patients had triple or multi-vessel disease compared to 10 (13.4%) out of 75 non diabetics. Non-diabetic patients had significantly higher single vessel disease (65.3%). There was a statistically significant association of duration of DM with vessels involved. The occurrence of Triple Vessel Disease/Multivessel Disease was significantly higher in the patients with DM duration > 10 years compared to patients with DM duration < 10 years (64.7% vs. 35.3%, P < 0.001), however there was no significant difference in type of vessel involved. Similarly, a significantly higher proportion of Triple vessel disease was observed in patients with poor glycemic control (HbA1c > 8.5%). 72.2% of the patients with HbA1c > 8.5% had Triple vessel disease/Multi vessel disease, whereas patients with good glycemic control (HbA1c < 7.0%) had predominantly Single vessel disease (90.0%), with no occurrence of Triple vessel disease/Multi vessel disease

Conclusion

Diabetic patients presenting with ST Elevation Myocardial Infarction are likely to have triple/multiple vessel disease compared to non-diabetic patients. The occurrence of Triple Vessel Disease/Multivessel Disease was significantly higher in the patients with DM duration > 10 years compared to patients with DM duration <10 years.

KEY WORDS

Diabetes mellitus, Acute coronary syndrome, STEMI, Coronary angiography

INTRODUCTION

Cardiovascular disease is the commonest cause of mortality and morbidity worldwide.[1] Globally, different risk factors are associated with increased incidence and mortality from coronary artery disease, diabetes mellitus (DM) is one of these risk factors.[2] It is estimated that, around 100 million populations are affected with diabetes worldwide. Dyslipidemia is also common in patients with diabetes and higher level of LDL - cholesterol is associated with 2-3 times higher risk of CAD in patients with diabetes.[3]

The reported prevalence of CAD in diabetic patients ranges from 9.5% to 55%.[4] Type 2 DM is an important independent risk factor for the development of Coronary artery disease (CAD) and most patient of DM die due to cardiovascular disease.[5] Cardiovascular complications among patients with diabetes can be classified as microvascular (commonly: ophthalmologic, renal and neurogenic) and macrovascular (coronary, cerebrovascular, peripheral vascular). Diabetes is associated with an increased risk for myocardial infarction (MI) and has worse cerebrovascular (CVD) outcomes after ACS events. Coronary atherosclerosis is more prevalent, is more severe and extensive in diabetes patients, which has been described in angiographic, Intravascular Ultrasound based studies and in studies with multislice coronary computed angiography.[5]

Coronary angiography (CAG) remains the gold standard for the diagnosis and characterization of CAD, offers therapeutic options and determines prognosis.

Hence, this study titled Angiographic Severity of Coronary Artery Disease in Diabetic and Non-Diabetic Acute STEMI Patients, was undertaken and an attempt was made to find, how ACS in diabetics differ from that of non-diabetics, with special interest on their angiographic profile.

METHODS

The present study is a hospital based cross sectional study. This study was conducted on 150 patients with acute ST segment elevation Myocardial infarction (STEMI) who underwent Primary percutaneous coronary intervention, among which 75 patients were Diabetics and others were non Diabetics admitted in Manmohan Cardiothoracic vascular and transplant Centre, Kathmandu Nepal from July 2019 to June 2020. Approval for the study was obtained from the Institutional Review Committee of Institute of Medicine.

Inclusion Criteria

• Group 1(Diabetic): Previously known diabetic or first time detected diabetic by American Diabetes Association (ADA) criteria presenting with STEMI.

• Group 2(Non-Diabetic): Cases presenting with STEMI that is non-diabetic or not fulfilling ADA criteria

Exclusion Criteria

• Patient with hypertrophic or dilated cardiomyopathy

• Patient with valvular heart disease

• Patient with congenital heart disease

• Patient with Type I DM

• Patient who do not give written consent for the study

Following investigations were done after selection: Fasting blood glucose, HbA1c in diabetic and newly detected diabetes mellitus patients, complete haemogram, Blood urea, Serum creatinine, Lipid profile, Cardiac enzymes-troponin I, ECG, 2D Echocardiography and Coronary Angiogram. Patients were diagnosed as STEMI on the basis of fourth universal definition of MI.

Coronary angiography was performed in the standard manner with angiography system SIEMENS.

Severity of lesions as noted in angiography was graded as follows:

Grade 0: No disease

Grade 1: Intimal disease <50% stenosis

Grade 2: 50-69% stenosis

Grade 3: 70-95% stenosis

Grade 4: 96-99% stenosis

Grade 5: Total occlusion

Coronary artery narrowing of more than or equal to 70% was considered as significant stenosis.

HbA1c was done in all the diabetic patients and in newly detected type 2 diabetic patients. We classified the diabetic patients with their HbA1c control as < 7 is good control, 7 – 8.5 is fair control and > 8.5 poor control.

Diabetic and non-diabetic patients fulfilling the inclusion criteria were selected in the present study after obtaining their informed written consent. Detailed history of Diabetes Mellitus and coronary angiography findings were recorded with the help of pre-validated, semi-structured case record proforma. Data was collected from diabetic patients who underwent coronary angiography and compared with angiography done in non-diabetics.

The collected data was coded and entered with the help of Microsoft Word. The data was analyzed with the help of SPSS Version 22 statistical package. Descriptive statistics were derived in the form of tables and charts for frequency analysis. Quantitative variables were analyzed and compared using parametric tests (student's t-test), whereas qualitative data was analyzed with the help of non-parametric tests (Chi-square test). P-values were derived. P values lower than 0.05 were considered as significant.

RESULTS

Total of 150 patients meeting the criteria were included in the study from July 2019 to June 2020. Among them 75 patients were Diabetics and the mean age of presentation in Diabetic group were 60.7±11.1. The incidence of acute Myocardial infarction in male was 60% in diabetics and 65.3% in non-Diabetics. In female the incidence of AMI was 40% in diabetics and 34.7% in non-Diabetics.

The demographic characteristics and risk profile were not significantly different among two groups except for Dyslipidemia, which was more prevalent in Diabetics group (p= 0.005).

Table 1. Baseline characteristics of the study population (n = 75)

Characteristics	Patients with DM	Patients without DM	P-value
Age (years), mean ± SD	60.7 ± 11.1	61.3 ± 12.3	0.74
Age category			
30 – 40 y	0 (0.0)	4 (5.3)	0.08
41 – 50 y	15 (20.0)	11 (14.7)	
51 – 60 y	22 (29.3)	24 (32.0)	
Above 60 y	38 (50.7)	36 (48.0)	
Gender, n (%)			
Male	45 (60.0)	49 (65.3)	0.48
Female	30 (40.0)	26 (34.7)	
Duration of pain (h), median (min – max)	8 (1 – 48)	9 (1 – 72)	0.11
Smoking, n (%)	38 (50.7)	40 (53.3)	0.74
Hypertension, n (%)	38 (50.7)	35 (46.7)	0.62
Dyslipidemia, n (%)	41 (54.7)	24 (32.0)	0.005*
Family history of CAD, n (%)	11 (14.7)	8 (10.7)	0.46
Duration of DM	7.65 (2 – 20)		
Biochemical characteristics			
HbA1c	8.6 ± 1.2	5.8 ± 0.8	<0.001
TG	175 (74 – 491)	150.5 (66 – 312)	0.03
TC	189 (97 – 273)	159 (89 – 274)	0.02

Angiographic characteristics

The incidence of Triple vessel Disease (TVD)/ multi vessel disease in diabetes was significantly higher (46.7%) as compared to non-diabetes (13.4%), likewise Single vessel disease (SVD) was much higher in non-diabetic (65.3%) patients.

Total number of vessel involved in both Diabetes and non-diabetes was 290, out of which 58.26% were involved in diabetes and 41.74% was in non-diabetes, which is statistically significant suggesting that patients with diabetes have more vessel involvement.

The commonest vessel involved in both the groups (diabetes/non diabetes) was LAD (23.79%/20.68%).

Table 2. Of vessel involved by angiography (n=75)

Characteristics	Patients with DM	Patients without DM	P-value
Coronary Angiogram			
SVD	22 (29.3)	49 (65.3)	
DVD	18 (24.0)	16 (21.3)	< 0.001
TVD	35 (46.7)	10 (13.4)	

Table 3. Types of vessel involved (n=75)

	Patients with diabetes	Patients without diabetes	P-value
Vessel involved, n (%)			
LMCA	5 (1.72)	2 (0.68)	0.04
LAD	69 (23.79)	60 (20.68)	0.008
LCx	42 (14.48)	20 (6.89)	0.004
RCA	53 (18.27)	39 (13.44)	0.36
Total	169 (58.26)	121 (41.74)	

Duration of Diabetes

In our study majority of Patients (57.33%) had Diabetes of less than 10 years, 8% were newly diagnosed diabetes and 34.67% had diabetes for more than 10 years.

There was a statistically significant association of duration of DM with vessels involved. The occurrence of TVD/MVD was significantly higher in the patients with DM duration >10 years compared to patients with DM duration < 10 years (64.7% vs. 35.3%, p < 0.001).

Incidence of SVD and DVD was much higher in patients with diabetes less than 10 years.

Table 4. Association of duration of diabetes with number of vessels involved

	Duration of DM		P-value
CAG finding	≤ 10 years	>10 years	
SVD (n = 19)	19 (100.0)	0 (0.0)	Fisher's exact test, p < 0.001
DVD (n = 16)	13 (81.2)	3 (18.8)	
TVD/MVD (n = 34)	12 (35.3)	22 (64.7)	

Similarly, a significantly higher proportion of TVD was observed in patients with poor glycemic control (HbA1c > 8.5%). 72.2% of the patients with HbA1c > 8.5% had TVD/MVD, whereas patients with good glycemic control (HbA1c < 7.0%) had predominantly SVD (90.0%), with no occurrence of TVD/MVD.

Table 5. HbA1c control with no. of vessel involved

	CAG finding			P-value
HbA1c (%)	SVD	DVD	TVD/MVD	
< 7.0% (n=10)	9 (90.0)	1 (10.0)	0 (0.0)	Fisher's exact test, p < 0.001
7.0 - 8.5% (n=24)	10 (41.7)	9 (37.5)	5 (20.8)	
> 8.5% (n=41)	3 (7.3)	8 (19.5)	30 (72.2)	
Total	22	18	35	

DISCUSSION

In the present study of 75 diabetes and 75 non diabetic patients with ACS were analyzed with special emphasis given on the coronary angiographic findings. Our study showed that coronary artery disease was more severe in diabetes patients compared to non-diabetes patients presenting with STEMI ACS.

The mean age of presentation in patients with diabetes was 60.7±11.1 years and in patients without diabetes was 61.3±12.3 years, which was similar with the study conducted in india by Bharath et al. and Raheja et al.[3,6] In our study the incidence of ACS in male was 60% in diabetes and 65.3 % in non-diabetes patients. In female the incidence was 40% and 34.7% in diabetes and non-diabetes respectively. So the risk of developing ACS in diabetic female was more as compared to non-diabetes.

In our study 58.66% of diabetic patients had shorter duration of diabetes of less than 10 years while 8.01% had new onset diabetes and 33.33% had long duration of diabetes of more than 10 years. Incidence of triple vessel disease/multi vessel disease was significantly higher in patients with diabetes duration of more than 10 years as compared to diabetes of less than 10 years (64.7% vs 35.3%). This finding was similar to a study conducted by Saleem et al. and Fox et al. which showed that the risk of CHD was 1.38 times higher for each 10 year increase in the duration of diabetes (95% CI, 0.99 – 1.92).[7,8] In diabetic patients there is increased risk and accelerated development of atherosclerosis.[9] Several studies have shown that multiple factors such as dyslipidemia with increased levels of atherogenic LDL, hyperglycemia, oxidative stress, increased inflammation and insulin resistance play a vital role for such acceleration and subsequent vulnerable atherosclerotic plaque formation.[10,11]

Likewise, in our study a significantly higher proportion of TVD was observed in patients with poor glycemic control (HbA1c > 8.5%), 72.2% of the patients with HbA1c > 8.5% had TVD/MVD, whereas patients with good glycemic control (HbA1c < 7.0%) had predominantly SVD (90.0%),

with no occurrence of TVD/MVD. This was similar to a study conducted in India by Ishwar et al. and another study conducted by Hossain et al. showed that higher level of HbA1c had significant severe lesions with higher Gensini score and can be used as a predictor of severity of CAD.[12,13]

In our study coronary angiography showed that the incidence of TVD/MVD was significantly higher (46.7%) in patients with diabetes as compared to non-diabetes patients which was only 13.4%. Malthesh et al. in their study reported that, the incidence of triple vessel disease in diabetics was much higher (44%) compared to non-diabetics (16%).[14] In a study by Henry et al. and Sousa et al. there was increase in the incidence of triple vessel disease, and more diffuse lesions were noted in diabetic patients.[15,16] These were similar to our study.

The commonest vessel involved was LAD in both the groups followed by RCA and LCx. In our study it showed that 23% of the diabetic patients had total occlusion whereas only 6% in non-diabetic patients had total occlusion which was statistically significant (p < 0.01). Hence the severity of the disease as well as the extent of the disease was significantly higher in patients with diabetes as compared to non-diabetes with acute coronary syndrome.

The findings of this study was similar to other studies conducted by Uddin et al., Nichoils et al. which showed that the angiographic extend and the severity of CAD was significantly higher in diabetes with STEMI.[17,18]

CONCLUSION

CAD is more severe and extensive and have more triple/multi vessel disease in patients with Diabetes as compared to non-diabetes. LM disease and TVD involvement was more common with diabetes patients and it correlates with adequate glycemic control. Likewise, severity of stenosis and total occlusion of vessel were also seen more commonly with diabetes patients. Hence routine checkup, adequate control of blood sugar level and adopting healthy lifestyle and medication might decrease cardiovascular complications and morbidity from Diabetes.

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