A Comparative Angiographic Severity of Coronary Artery Disease in Diabetic and Non Diabetics in a Tertiary Cardiac Centre

Hirachan A*, Maskey A, Sharma R, Neupane P, Bhattarai M, Hirachan GP and Adhikari J

Nepal Mediciti Hospital, Lalitpur, Nepal

*Corresponding author:
Haricharan A

✉ hirachananish@gmail.com

Nepal Mediciti Hospital, Lalitpur, Nepal

Abstract

Introduction: Diabetes is a major risk factor for various cardiovascular diseases including coronary artery disease. Coronary atherosclerosis is not only more prevalent in diabetic patients but is also more severe. Diabetics are more prone to multi vessel involvement as well as associated with poor outcomes to acute coronary events.

Methods: This is a hospital based descriptive cross-sectional study including 300 patients (diabetic and non-diabetic) undergoing coronary angiography at Sahid Gangalal National Heart Centre over a period of one year (January to December 2016).

Results: Out of the total 300 patients studied at angiography, majority (68.3%, 205 patients) were male with the age group ranging from 29 to 86 years of age. Significant number of diabetics had associated risk factor as hypertension (88%) as the most common. Brahmins and Madhesi (27% each) ethnic group of origin formed the major group studied. Significant coronary artery disease defined as >50 % stenosis was evident in 118 patients (78.7%) among diabetics whereas it was present in 99 patients (66%, p value 0.01, significant). Maximum number of diabetic patients had presence of triple vessel disease (52 patients, 34.7 %) followed by double vessel and single vessel disease (25.3 % and 18.7 %) respectively as well as more number of diffuse vessel disease (28 % ,p value 0.006) . The mean Gensini score studied was 33.07±28.7 with the highest Gensini score of 126. Diabetic group of patients had a higher Gensini scores (37.2 ± 28.4) as compared to non-diabetic (28.9 ± 28.6, p value <0.05).

Conclusion: Diabetic patients had higher total Gensini scores at angiogram which reflect greater severity of coronary artery disease as compared to non-diabetics as well as higher incidence of triple vessel disease and diffuse coronary artery disease.

Keywords: Non-diabetes; Coronary artery disease; Diabetic patients; Coronary heart disease

Introduction

Coronary heart disease (CHD) due to atherosclerosis is a major cause of death all over the world and is the most common form of heart disease. Diabetes mellitus is associated with varied complications out of which cardiac affliction is the major cause of mortality in these patients [1]. Cardiac involvement in diabetes commonly manifest as coronary artery disease (CAD) and less commonly as diabetic cardiomyopathy and cardiac autonomic neuropathy [2].

Diabetic patients have higher incidence triple-vessel and less single- vessel CAD than non-diabetics [3]. Association of more extensive CAD with DM has been described in post-mortem, angiographic and IVUS-based studies and in studies

with multi-slice coronary computed angiography [4]. Coronary atherosclerosis is not only more prevalent in diabetic patients but also more severe. The reported prevalence of coronary artery disease in diabetic patients ranges from 9.5% to 55% [5,6]. It is also well proven that diabetic patients with CAD have higher Gensini scores at angiography . When diabetic and non-diabetic subjects are compared, more number of diabetic subjects (95%) had abnormal Gensini scores as compared to non-diabetics (83%) [7]. Thus, this prospective cross sectional study is designed to find out the morphological pattern of coronary lesion in patient with diabetes mellitus and to compare with non-diabetic patients in a tertiary cardiac centre of Nepal [8].

Methods

This was a hospital based; single centre cross-sectional study done at Sahid Gangalal National Heart Centre, Kathmandu done over a period of 12 months (January 2016- December 2016) till the sample size was obtained. The sample size was calculated as follows:

A type I (α) error less than 5% was used. That is p < 0.05, confidence interval 95%. The power of study was taken as 80% with a type II error (β) of 0.2 .The incidence of CAD in diabetes (P1) was taken as 20 % and that in non-diabetics (P2) as 5% .The estimated sample size was estimated with using the following formula;

Sample size: $\frac{P1(1-P1) + P2(1-P2) \times f(\alpha,\beta)}{(P1 - P2)^2}$

This gives the sample size of 270 patients.

So, a total number of 300 patients with 150 diabetic and 150 non diabetics with coronary artery disease and undergoing coronary angiography were studied. Patients with hypertrophic or dilated cardiomyopathy, congenital heart disease were excluded. Patients with suspected CAD were taken up for coronary angiography which was performed by the standard Judkin's technique after adequate preparation. The indication for performing coronary angiography was unstable angina, NSTEMI and STEMI and post infarct angina and chronic stable angina. Severity of lesions as noted in angiography were 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 . Significant CAD was defined as more than 50% angiographic diameter stenosis in one or more of the epicardial coronary arteries. Based on disease severity, obstructive CAD was classified as single, double-, or triple- vessel disease whereas coronary artery lesions < 50 % narrowing were taken as non-significant stenosis [9]. Assessment of the severity of coronary artery disease can be done by using the Gensini score [10]. Gensini score grades narrowing of the lumen of the coronary artery and scores it with numerical values with the following method; Score 1 for 1-25% narrowing, Score 2 for 26-50% Score 4 for 51-75%, Score 8 for 76-90%, Score 16 for 91-99%, Score 32 for completely occluded artery. This score is then multiplied by a factor that represents the importance of the lesion's location in the coronary artery system. For the location scores, 5 points were given for the left main lesion; 2.5 for the proximal left anterior descending (LAD) or left circumflex (LCX) artery; 1.5 for the mid segment LAD and LCX; 1 for the distal segment of LAD and LCX, first diagonal branch, first obtuse marginal branch, right coronary artery, posterior descending artery, and intermediate artery; and 0.5 for the second diagonal and second obtuse marginal branches. Gensini score was expressed as the sum of the scores for all three coronary arteries to evaluate the entire extent of coronary artery disease **(Figure 1)**.

All consecutive patients under the study were enrolled after fulfilling the inclusion and exclusion criteria over one year period or until the required sample size was met. Different variables studied were entered in the structured patient preform as well as entered in the master chart. All patients had their routine blood tests done like renal function test (Urea, Creatinine), Hb% as well as have their fasting lipid profile done during their clinic visit or within 24 hours of admission after acute coronary syndrome All data were entered into an electronic spread sheet (Microsoft Excel, Redmond) and THE STATISTICAL ANALYSIS WAS DONE USING THE SPSS VERSION 20 SOFTWARE (SPSS INC , CHICAGO, III). After processing of all available information, statistical analysis of their significance was done. The significance of difference between two groups were determined by using unpaired student's 't' test, Pearson's chi-square test & 'z' test where applicable. 'P' value of less than 0.05 was considered to be significant.

Results

Out of the total 300 patients undergoing angiography for suspected coronary artery disease with history of stable angina or acute coronary syndrome, majority 68.3% of patients were male and 31.7% were females. Most common risk factor for CAD observed was hypertension (74%) followed by smoking (182 patients, 60.7%). Other demographic profile studied in between the groups was not significant **(Table 1)**.

The clinical presentation of coronary artery disease varied from chronic stable angina to acute ST elevation myocardial infarction. Chronic stable angina was the most common presentation of coronary artery disease in both diabetics and non-diabetics undergoing coronary angiography (56.7%, 170 patients) followed by ST elevation MI and Unstable Angina. The pattern of clinical presentation was not statistically significant in between the groups (p value- 0.25). There was prior history of myocardial infarction in 16 patients (10.7 %) in diabetics whereas 11 patients (7.3%) in non-diabetics undergoing angiography.

Angiographic Profile

A total of 83 patients (27.7 %) had non-significant coronary artery lesion or normal coronaries. Majority of non-diabetic patients (51 patients, 34 %) undergoing angiography had normal findings as compared to diabetics. Significant coronary artery disease defined as > 50 % stenosis was evident in 118 patients (78.7%) among diabetics and 66% in non-diabetics. The pattern of coronary artery involvement was also variable among both diabetics and non-diabetics ranging from single vessel to triple vessel disease. Maximum number of diabetic patients had presence of triple vessel disease (52 patients, 34.7%) followed
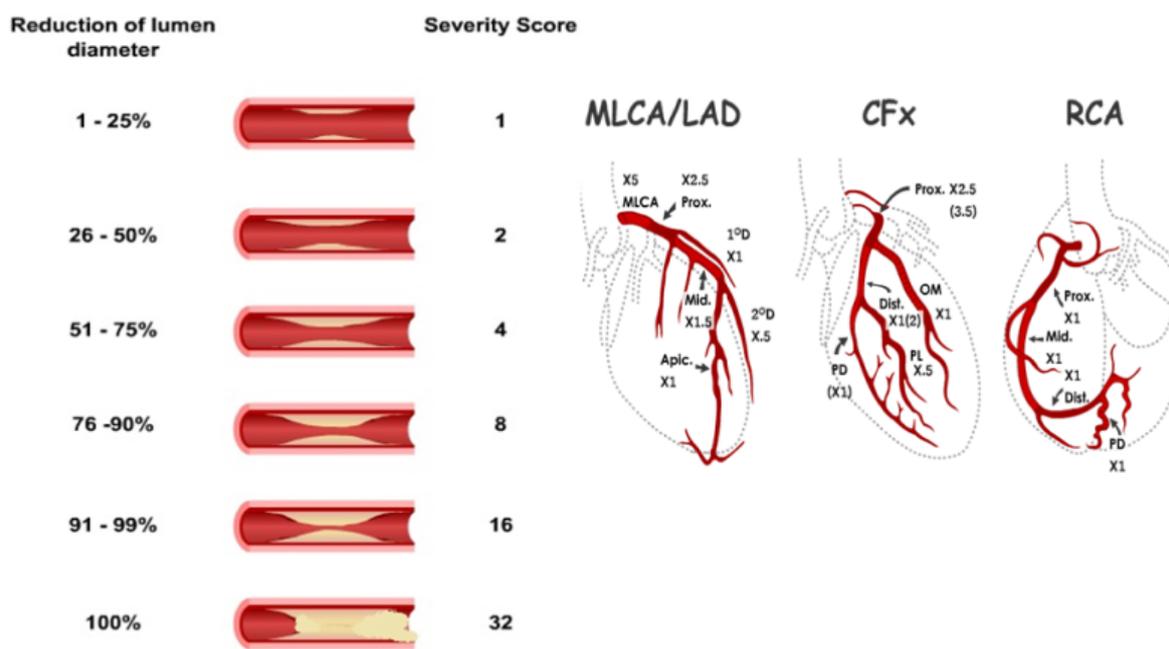
Figure 1   Gensini Score.

Table 1: Demographic and risk profile.

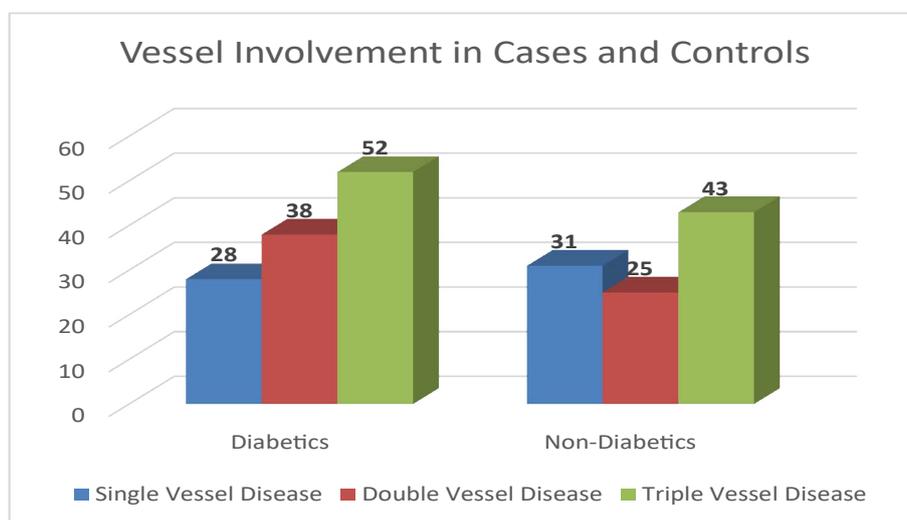| Characteristics	Diabetics (n=150)	Non Diabetic(n=150)	Overall	P Value
Age	58.2 ± 10.23	59.29 ± 10.8	58.79 ± 10.52	0.408
Gender				
- Male	95(63.3 %)	110 (73.3%)	205 (68.3%)	0.06
- Female	55 (36.7 %)	40 (26.7 %)	95 (31.7 %)	0.08
Literacy	118 (78.7 %)	111(74%)	229 (76.3 %)	0.39
Hypertension	132 (88%)	90 (60 %)	222 (74 %)	<0.001
Smoking	92 (61.3%)	90 (60 %)	182 (60 .7 %)	0.81
Alcohol C.	40 (26.7%)	23 (15.3%)	63 (21 %)	0.016
Family history	6 (4%)	5 (3.3 %)	11 (3.7 %)	0.75
Dyslipidemia	7 (4.7%)	6 (4 %)	13 (4.3 %)	0.779

Figure 2   Bar diagram showing various percentage of pattern of vessel involvement in diabetic and non-diabetic.

by double vessel and single vessel disease; 25.3 % and 18.7 % respectively (**Figure 1**). Similarly, triple vessel involvement was seen in 28.7 % (n=43) patients who were in non-diabetic group (**Figure 1**). Hence, diabetics revealed major number of multi vessel involvement as compared to the non-diabetic group. However, single vessel involvement was more common with non-diabetic (n = 31, 20.7 % patients) as compared to diabetics (n=28, 18.7%). A significant number of diabetic patients (n = 65, 43.3%) undergoing angiogram revealed diffuse vessel involvement as compared to 42 patients (28%) among non-diabetic group (**Figure 2**).

Among diabetic group of patients, 44 % had ACC/ AHA Type C lesion; whereas patients 19.3% had Type B lesion and 15.3 % had Type A lesions on coronary angiography. As compared to diabetics, the non-diabetic group had 25.3 % (38 patients) with Type C lesion followed by 26.7% and 14.7 % with Type A and Type B lesions respectively . The mean Gensini score studied was 33.07±28.7 with the highest Gensini score of 126. Diabetic group of patients had a higher Gensini scores (37.2 ±28.4) as compared to non-diabetic (28.9±28.6, p value - 0.013).

Discussion

Diabetes mellitus (DM) is a worldwide epidemic. Its prevalence is rapidly increasing in both developing and developed countries. Coronary heart disease (CHD) is highly prevalent and is the major cause of morbidity and mortality in diabetic patients. Diabetes is a major risk factor for incidence of coronary artery disease and it is well proven fact that diabetes patients have more aggressive coronary artery lesions at angiography.

This study focused primarily on various risk factors, clinical profile as well as the angiographic characteristics in diabetic CAD patients with compared to those without diabetes in a tertiary cardiac centre. The present observational study was also done to evaluate the prevalence of coronary artery disease among different ethnic groups of Nepal as well as to study the variation in angiographic characteristics and severity of CAD among these ethnic groups. In the study of total 300 patients, equal number (150 each) from both diabetes and non-diabetes group were enrolled. Majority of (68.3% ,n=205) of patients were male and the mean age at presentation was 58.2 ± 10.23 years in diabetic patients as compared to 59.29 ± 10.8 years among non-diabetic (p value > 0.05, NS) .

Diabetic patients in the study had a significant number of patients with additional CAD risk factors as hypertension in 132 patients (88 %) followed by smoking history in 61 % of patients as compared to non-diabetics. On the other hand, no significant statistical difference as per other risks factors as smoking, dyslipidemia and family history CAD was evident among both the group of studied patients. Mahdi et al. showed that diabetics had higher prevalence of hyperlipidemia compared with non-diabetics, and no difference was found for the presence of hypertension, smoking and family history [11]. Majority of patients in the study included Brahmins and Madhesi (27 % each) group of ethnic origin followed by Newar, Chhetri and others. Majority of patients in the diabetic group was Madhesi origin (38 patients, 25.3 %) and Brahmin group (32 patients, 21.3 %).

In a study by Koju R et al. in 73 patients, the greater number of coronary artery disease was associated with the advancing age (80%) and male (60%, OR 2.47; CI 0.94 –6.48, p < 0.05) as well as positive correlation to Diabetes mellitus with CAD [12].

Diabetics are well known to present with CAD with varied forms as chronic angina to frank ST elevation MI or even asymptomatic ischemia .Silent myocardial ischemia is a well-known manifestation in diabetics which is due to increased pain perception threshold and autonomic neuropathy [13]. Chronic stable angina was the most common presentation of coronary artery disease in both diabetics and non-diabetics undergoing coronary angiography (56.7%, 170 patients) followed by ST elevation MI and Unstable Angina. In addition, among the diabetics group as well, chronic stable angina was the most common mode of presentation of CAD (58% , n=87) [14]. Bogaty et al. and Safiuddin mentioned similarly stable angina as main presentation in diabetes group [15]. Peter et al. and Muataz FH showed similar prevalence of stable angina, STEMI and NSTEMI / UA in diabetics and non-diabetics [15-17]. Stable angina symptoms are usually caused by the development of atherosclerotic plaque obstructing more than 70% of the lumen of the coronary vessel and are visualised easily at the time of coronary angiography. This could be due to the prevalence of multi vessel disease as well as small vessel disease in coronaries in diabetic patients which result in more of chronic ischemic lesions.

Significant coronary artery disease defined as > 50 % stenosis was evident in 118 patients (78.7%) among diabetics whereas it was present in 99 patients (66%, p value 0.01, significant). Majority of non-diabetic patients (51 patients, 34 %) undergoing angiography had normal findings as compared to diabetics. So, the likelihood of significant CAD was more prevalent in diabetics undergoing angiography. In this study, diabetics had a higher percentage of involvement with triple vessel disease (n=52, 34.7 % v/s n=42, 28.7%) and double vessel disease (25.3 % v/s 16.7 %) as compared to non-diabetic. However, single vessel involvement was more common with non-diabetic (n= 31, 20.7 % v/s 18.7 %). Diabetics group studied also had higher number of patients with diffuse vessel disease on angiography (43.3 % v/s 28 %). This finding is consistent with that of study done by Muataz et al. [17]. Mahdi et al which mentioned higher distribution of TVD and lower distribution of SVD in diabetic CAD patients whereas Hoque et al. however found higher prevalence of SVD and TVD and low prevalence of DVD in diabetics than in non-diabetics [18].

It has been recognized since the inception of percutaneous coronary intervention (PCI) that lesion morphology is a major determinant of both clinical and technical success and a predictor of complications. Lesion morphology at angiogram may vary from simple discrete lesion to diffusely diseased vessels and totally occluded vessels with higher grades. Accordingly, lesion severity is divided according to ACC AHA classification as Type A, B or C lesion with Type B and C having more lesion complexity and more chances of per procedural complications and procedural failure. Majority of diabetic patients had Type C lesions (44% v/s 25.3 %) as compared to non-diabetic as well as higher Type B lesions (19.3% v/s 14.7 %). Non diabetic group had more number of Types A coronary lesions (26.7% v/s 15.3 %). Dubey L et al. [19] found that the prevalence of multi vessel and

small vessel lesion was significantly higher in patients with type 2 diabetes than in those without diabetes. Importantly, complex Type C lesion was significantly higher in type 2 diabetes patients than in non-diabetes patients. Previous studies have reported that triple vessel disease is more frequent in patients with type 2 diabetes [20,21] although other studies have demonstrated that the angiographic profiles are similar among diabetic and non-diabetic patients [22]. In addition, the diabetic group had a higher average Gensini score values (37.2±28.4) as compared to non-diabetic (28.9±28.6, p value 0.013) reflecting a greater severity of coronary artery disease at angiography. This finding is consistent with Mahadeva et al. and Peppes et al. [23,24] who found significant association of severe coronary artery disease in patients with diabetes mellitus in comparison to non-diabetes patients.

The results of this study showed that there is a statistically significant higher severity of CAD in subjects with diabetes than non-diabetics. Coronary artery disease in diabetics is characterized by a more rapid progression, being diffuse, affecting more often the left main and multiple vessels as compared with non-diabetic patients. This is often because myocardial ischemia in diabetic patients typically occurs without symptoms resulting more incidence of multi vessel coronary atherosclerosis at time of the diagnosis.

Similar to the previous studies, our study done in Nepalese population also reveal similar findings of more severe CAD in diabetic population. However, this is only a single centre study at a tertiary centre and hence a large scale epidemiological study should be carried out to determine the incidence & prevalence of coronary artery disease in Nepal to identify the magnitude of problem and timely primary and secondary prevention strategies should be vigorously pursued. Certain factors still need to be addressed in certain ethnic groups of Nepal besides the conventional risk factors like diabetes, smoking, hypertension, dyslipidemia etc. Various other factors such as dietary patterns, literacy, sedentary living style, genetic factors etc. are yet too studied in detail in certain group of population.

Conclusion

Diabetic patients were found to have severe coronary artery disease in the form of multi vessel disease, diffuse disease and higher Gensini scores at angiography.

Conflict of Interest

None

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