

# Study of Angiography Findings in Diabetic and Non Diabetic Patients with Cardiac Symptoms

Bharath S<sup>1</sup>, Gosavi Satish<sup>2</sup>, Patange Aparna<sup>3</sup>, Botre Amit<sup>4</sup>

## ABSTRACT

**Introduction:** Diabetes mellitus is a complex metabolic disorder associated with an increased risk of microvascular and macrovascular disease. Type 2 diabetes mellitus is a prevalent metabolic disorder that often leads to cardiovascular diseases and diabetic cardiomyopathy, which may lead to chronic pressure overload and myocardial infarction. The present study aimed at studying the extent and complexity of cardiovascular lesions among diabetic patients and compare same with non-diabetic patients.

**Materials and methods:** The present study was a Case-Control (Analytical and Interventional) Study conducted over 18 months (October 2016 to March 2018). Case group consisted of 250 Diabetic patients with cardiac symptoms, with or without ECG changes, who have undergone coronary angiography. And Controls group consisted of 250 Non-Diabetic patients with cardiac symptoms, with or without ECG changes, have undergone coronary angiography.

**Results:** In the present study, among diabetics, there were 52.8% male patients and 47.2% female patients, similarly among non diabetic group, 57.2% were males and 42.8% cases were females. 12.4% people were found normal, 37.6% were suffering from Single vessel disease, 28.8% people with Double vessel disease and 21.2% people with Triple vessel disease.

**Conclusions:** According to the present study, among coronary angiography diagnosis, severe forms of coronary artery lesions were found common among diabetic patients as compared to non diabetic patients.

**Key words:** Diabetes Mellitus, Coronary Artery Disease, SYNTAX Score, Single Vessel Disease, Double Vessel Disease, Triple Vessel Disease, Two-Dimensional Transthoracic Echocardiogram

## INTRODUCTION

Diabetes mellitus is a complex metabolic disorder associated with an increased risk of microvascular and macrovascular disease. It has been characterised by remarkable advances in our understanding of the mechanisms. The central role of insulin in glucose metabolism regulation was clearly demonstrated during the early 1920s.<sup>1</sup> In the recent years, many studies showed the contribution of insulin resistance and  $\beta$ -cell insulin secretion in 'type II' diabetes. Furthermore, a central role for insulin resistance in the development of a cluster of cardiometabolic alterations (dyslipidaemia, inflammation, high blood pressure) was suggested.<sup>2</sup>

Type 2 diabetes mellitus is a prevalent metabolic disorder that often leads to cardiovascular diseases and diabetic cardiomyopathy, which may lead to chronic pressure

overload and myocardial infarction. Pathogenetic mechanisms includes mainly hyperglycemia and chronic as well as sustained hyperinsulinemia. Intracellular signaling pathways, increased susceptibility to ischemia, redox status, energy production are the other possible mechanisms. Both the conditions are multifactorial (genetic and environmental factors) in causation and the close relationship between Type 2 DM and cardiovascular diseases has been proved in various researches. Type 2 DM has been established as an independent risk factor for heart disease and stroke. Above the age of 65 years, about 70% of the patients of Type 2 DM die due to cardiovascular diseases. Type 2 DM patients without history of coronary artery diseases have equal cardiovascular diseases risk as patients with previous myocardial infarction. Cardiovascular complications among diabetics, can be classified into microvascular (commonly: renal, ophthalmologic and neurologic) and macrovascular (commonly: peripheral vascular, coronary, cerebrovascular). Diabetic patients have increased risk of cardiovascular risk specifically for coronary artery diseases.<sup>3,4,5</sup> Hyperglycemia and Insulin resistance are often associated with low-grade inflammation, oxidative stress, which triggers endothelial dysfunction and hence promotes atherogenesis. Type 2 diabetes mellitus is also associated with enhanced platelet and hemostatic functions.<sup>6</sup> The present study aimed at studying the extent and complexity of cardiovascular lesions among diabetic patients and compare same with non-diabetic patients.

## MATERIAL AND METHODS

The present study was a Case-Control (Analytical and Interventional) Study conducted over 18 months (October 2016 to March 2018). Case group consisted of 250 Diabetic

<sup>1</sup>Resident, Department of General Medicine, Krishna Institute of Medical Sciences, Karad, <sup>2</sup>Assistant Professor, Department of General Medicine, Krishna Institute of Medical Sciences, Karad, <sup>3</sup>Associate Professor, Department of General Medicine, Krishna Institute of Medical Sciences, Karad, <sup>4</sup>Assistant Professor, Department of General Medicine, Krishna Institute of Medical Sciences, Karad, Maharashtra, India.

**Corresponding author:** Dr. Bharath S., Department of Medicine, Krishna Institute of Medical Sciences, Malkapur, Karad 415110, Maharashtra, India.

**How to cite this article:** Bharath S, Gosavi Satish, Patange Aparna, Botre Amit. Study of angiography findings in diabetic and non diabetic patients with cardiac symptoms. International Journal of Contemporary Medical Research 2019;6(2):B9-B13.

**DOI:** <http://dx.doi.org/10.21276/ijcmr.2019.6.2.15>

patients with cardiac symptoms, with or without ECG changes, who have undergone coronary angiography, and Control group consisted of 250 Non-Diabetic patients with cardiac symptoms, with or without ECG changes, who have undergone coronary angiography.

#### Inclusion criteria

- Cases- Diabetic patients with cardiac symptoms, with or without ECG changes, who have undergone coronary angiography.
- Controls- Non-Diabetic patients with cardiac symptoms, with or without ECG changes, have undergone coronary angiography.

#### Exclusion criteria

- Cases-
  1. Non-diabetic patients
  2. Age < 30 years.
  3. Diabetic patients who were asymptomatic.
  4. Diabetic patients with advanced age (> 90 years, relative).
- Controls- Diabetic patients

Outcome in the present study was calculated using Blood Sugar Level (BSL), HbA1c (Glycosylated Hb), Fasting Lipid profile, Blood Urea Level, Serum Creatinine, ECG (Electrocardiogram), Two-dimensional transthoracic echocardiogram, Troponin- I, HIV, HBsAg, HCV

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

#### STATISTICAL ANALYSIS

The collected data was coded and entered with the help of Microsoft Word. The data was analyzed with the help of SPSS Trial Version 22 statistical package. Descriptive statistics were derived in the form of tables and charts for frequency analysis.

Quantitative variables were analysed and compared using parametric tests (students 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.

SYNTAX score was calculated with the help of online SYNTAX Score calculator (<http://www.syntaxscore.com/calculator/start.htm>) and it was correlated with the coronary artery involvement among diabetics and non diabetic patients with the help of spearman's correlation methods.

#### RESULTS

In the present study, among diabetics, there were 52.8% male patients and 47.2% female patients, similarly among non diabetic group, 57.2% were males and 42.8% cases were females. Majority of the cases among both the groups were males. The present study analyzed age distribution among both the groups, it was observed that the majority of the cases among diabetic group belonged to age groups of 51-60

2D ECHO Findings		Diabetic		Non Diabetic	
		n=250	%	n=250	%
LVEF (Systolic function)	Normal (>50%)	129	51.6	162	64.8
	Mild (40-49%)	48	19.2	55	22
	Moderate (<40%)	44	17.6	23	9.2
	Severe (<30%)	29	11.6	10	4
	Total	250	100	250	100

**Table-1:** Distribution of study population according to their LVEF.

Diagnosis on coronary angiography	Diabetic		Non Diabetic	
	n=250	%	n=250	%
Single vessel disease	94	37.6	129	51.6
Double vessel disease	72	28.8	55	22
Triple vessel disease	53	21.2	39	15.6
Total	219	87.60	223	89.20
significance	Chi-square value: 6.95%, p-value: 0.0308			

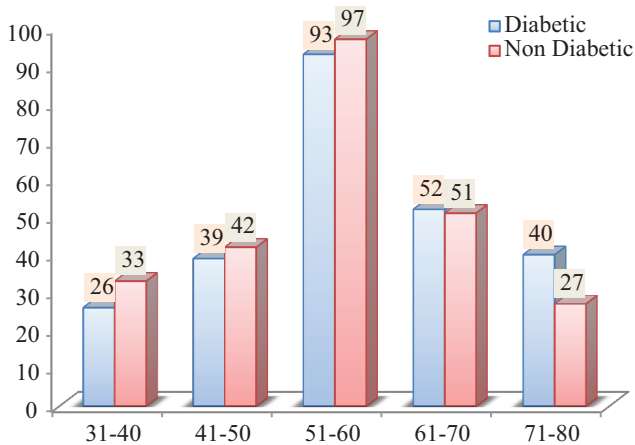
**Table-2:** Comparison between coronary angiography diagnosis among diabetic and nondiabetic patients

SYNTAX score	Diabetic		Non-Diabetic	
	n=250	%	n=250	%
Less than 10	19	7.6	57	22.8
11-20	77	30.9	97	38.8
21-30	91	36.4	85	34.8
>30	63	25.2	11	4.4
Total	250	100	250	100

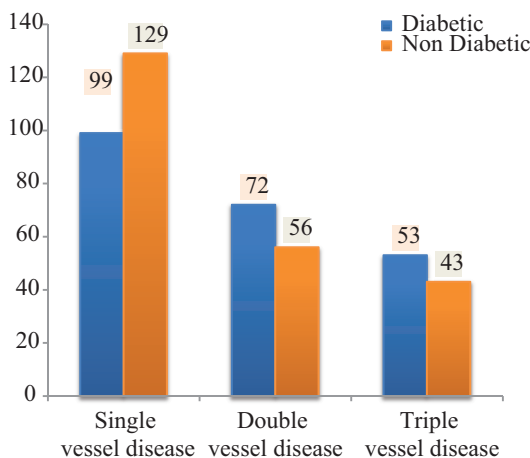
**Table-3:** Distribution of SYNTAX scores between diabetic and non diabetic patients.

SYNTAX Score in comparison with:		Spearman's correlation coefficient (r)
Coronary artery involvement	Diabetics	+0.81
	Non -diabetics	+0.66
	Overall Comparison	+0.72

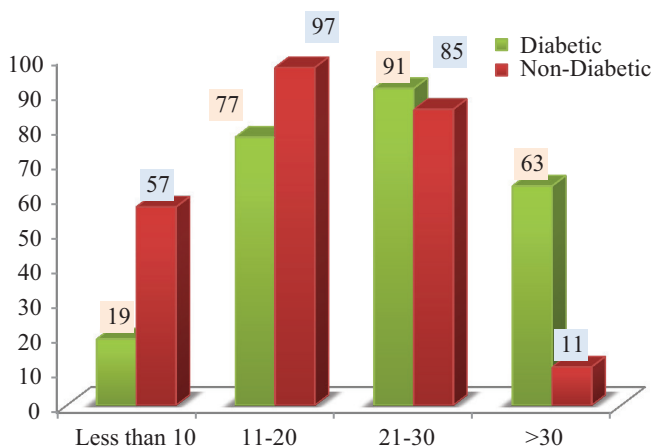
**Table-4:** Correlation between coronary artery involvement among diabetic and non-diabetic cases and SYNTAX Score



**Figure-1:** Distribution of study population according to their age (Comparison between diabetic and non-diabetic patients)



**Figure-2:** Comparison between coronary angiography diagnosis among diabetic and non-diabetic patients



**Figure-3:** Distribution of SYNTAX scores between diabetic and non diabetic patients

years followed by 61-70, 41-50 and 71-80 each.(Figure 1)  
The present study analysed Left ventricular ejection fraction

among our study subjects. Left ventricular ejection fraction is categorised in three groups accordingly -normal (EF >50%) mild (EF between 40%-49%), moderate (EF between <40%) and severe (EF <30%). It was observed that diabetic patients had more severe systolic dysfunction as compared to non diabetic patients (Table 1)

The present study categorized different subjects from study sample according to their coronary angiography diagnosis. Diabetic patients were divided into Normal, Single vessel, Double vessel and Triple vessel disease, according to their coronary angiography diagnosis. 12.4% people were found normal, 37.6% were suffering from Single vessel disease, 28.8% people with Double vessel disease and 21.2% people with Triple vessel disease. (Table 2)

The non diabetic patients were divided into Normal, Single vessel, Double vessel and Triple vessel disease. The results are as in table 6- according to their coronary angiography diagnosis. 10.8% people were found normal, 51.6% were suffering from Single vessel disease, 22% people with Double vessel disease and 15.6% people with Triple vessel disease. It can be seen from the table given below that, occurrence of severe forms of coronary artery disease, seems to be more among diabetics. The findings using Chi-square test were found to be statistically significant. (Table 2) (Figure 2)

The present study calculated the SYNTAX score of the study participants, based on their coronary angiography findings. The SYNTAX score was calculated ONLINE using the website <http://www.syntaxscore.com/calculator/start.html>, by putting the present study observations according to coronary angiography findings on the webpage. (Table 3)

SYNTAX score was compared between diabetic and non diabetic groups. It was observed that as the disease gets severe, SYNTAX score tends to be more among diabetics as compared to non-diabetics. Non-diabetics tends to have lower SYNTAX score as compared to diabetics. (Table 3)

The present study analyzed the coronary artery disease involvement among diabetic and non diabetic patients, with SYNTAX score with the help of Spearman's correlation methods. We found positive correlation between SYNTAX score and coronary artery involvement (Single, double and triple vessel disease). The SYNTAX score was tested with same diagnosis between two groups, i.e. diabetic and non diabetic. There was strong positive correlation between coronary artery disease involvement and SYNTAX score of Diabetic patients. (Table 4) (Figure 3)

**DISCUSSION**

The present study has total 500 patients (250 diabetic and 250 non diabetic) with cardiac symptoms admitted in cardiology ward or ICU under department of cardiology in KIMS Hospital during the period of 18 months. We

compared various parameters coronary angiography findings among diabetic and non diabetic cases.

The present study was conducted among total of 250 diabetic and 250 non diabetic cases presenting with cardiac symptoms. Among diabetic group, there were 52.8% male cases and 47.2% female cases, similarly among non diabetic group, 57.2% were males and 42.8% cases were females. Majority of the cases among both the groups were males. The analysis of age distribution of the study subjects among both the groups was observed that the majority of the cases among diabetic group belonged to age groups of 51-60 years followed by 61-70, 40 cases (15.68%) belonged to age group of 41-50 and 71-80 years each. Avishek Saha et al conducted a study among 240 patients who presented with chest pain. In their study the mean age of presentation with cardiac symptoms was  $55.27 \pm 10.76$  years., and it was consistent with our study.<sup>7</sup> M K Mallesh et al in their study among diabetics and non diabetic cases presented with acute coronary syndromes, observed that the peak incidence of ACS in diabetics was in the fourth and fifth decade as compared to the fifth and sixth decade in non-diabetics.<sup>8</sup>

The present study analysed Left ventricular ejection fraction among study subjects. Left ventricular ejection fraction is also categorised in three groups according to normal (EF >50%) mild (EF between 40%-49%), moderate (EF between <40%) and severe (EF <30%). It was observed that diabetic patients had more reduced Left ventricular ejection fraction as compared to non diabetic patients. M K Mallesh et al in their study reported that the Left ventricular dysfunction was relatively more common (46%) in diabetics than in non-diabetics (10%), these results were similar to the present study.<sup>8</sup>

The present study categorized different cases from study sample according to their coronary angiography diagnosis. Diabetic patients were divided into Normal, Single vessel, Double vessel and Triple vessel disease as shown in table 5 according to their coronary angiography diagnosis. 12.4% people were found normal, 37.6% were suffering from Single vessel disease, 28.8% people with Double vessel disease and 21.2% people with Triple vessel disease. The table shows the distribution of Diabetic patients for these categories along with their percentages.

The non diabetic patients were divided into Normal, Single vessel, Double vessel and Triple vessel. 10.8% people were found normal, 51.6% were suffering from Single vessel disease, 22% people with Double vessel disease and 15.6% people with Triple vessel disease.

The present study analyzed coronary angiography diagnosis between diabetic and non-diabetic patients to study any association of diabetes mellitus with coronary artery disease. The present study showed severe forms of coronary artery disease, - more among diabetics. The findings using Chi-square test were found to be statistically significant. M K Mallesh et al in their study reported that, The incidence of triple vessel disease in diabetics was much higher (44%) compared to non-diabetics (16%). The incidence of double vessel disease was slightly higher (26%) compared to non-

diabetics (20%).<sup>8</sup>

In another study conducted at CMC Vellore (1996) also showed that MVD was more common in diabetics (87.5% vs. 79.6%) in 2 separate groups of 516 diabetic and non-diabetic patients. 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.<sup>9</sup> Natali et al in their study showed that diabetic patients with atherosclerotic disease score higher on coronary compromise (the sum of all atherosclerotic lesions detected) than the non-diabetic:  $352 \pm 232$  versus  $211 \pm 201$  units,  $p < 0.0001$ , respectively.<sup>10</sup> Also, Melidones et al conducted a randomized study, distributed patients with atherosclerotic lesion detected by coronary angiography in two groups: group A with 463 diabetic patients, and group B with 210 non-diabetic patients. There were no differences in these groups concerning other risk factors, age, and sex. However, diabetic patients more frequently had more triple vessel disease and less frequently single-vessel disease; diabetic patient vessel involvement was 2.2 vessels versus 1.8 vessels among the non-diabetic,  $p < 0.01$ . They also reported that Diabetes mellitus is linked to a poor prognosis in patients with coronary atherosclerotic disease, especially in women.<sup>11</sup> Stein et al in their study demonstrated that, in patients who underwent angioplasty, the presence of diabetes was related to a poor prognosis.<sup>12</sup> Silva et al compared the angiographic features of 55 patients with acute coronary syndrome, 31% of which were diabetic. Ulcerated plaques were found in 94% of diabetic and in 60% of non-diabetic patients ( $p < 0.01$ ); intracoronary thrombus was observed in 94% of diabetic and only 55% of non-diabetic patients ( $p < 0.004$ ). They concluded that diabetic patients had more complex atherosclerotic lesions regarding these aspects.<sup>13</sup>

The present study calculated the SYNTAX score of the study participants based on their coronary angiography findings. The SYNTAX score was calculated online using the website <http://www.syntaxscore.com/calculator/start.html>, by putting the present study observations according to coronary angiography findings on the webpage.

The study compared SYNTAX score between diabetic and non diabetic groups. It was observed that as the disease gets severe, SYNTAX score tends to be more among diabetics as compared to non-diabetics. Non-diabetics tends to have lower SYNTAX score as compared to diabetics.

Avishek Saha et al<sup>7</sup> in their study, observed that all the patients underwent coronary angiography and the findings are divided according to the severity and complexity of disease based on Syntax score. Syntax score divided the study population into three categories: Low score  $\leq 22$ , Intermediate score 23-32 and High score  $\geq 33$ . Out of the 240 patients, 168 (69.75%) had low Syntax score ( $\leq 22$ ), 46 (19.33%) had intermediate Syntax score (23-32) and 26 (10.92%) had high Syntax score of  $\geq 33$ . Konstantinou DM et al studied a consecutive sample of 150 patients undergoing coronary angiography for the evaluation of chest pain. Individual components of the syndrome, such as impaired fasting blood sugar, had a stronger association with coronary artery disease than

the metabolic syndrome.<sup>14</sup> Rana et al also reported more coronary artery disease in diabetes mellitus versus non-diabetes mellitus individuals [single vessel disease (19 vs. 14%), double vessel disease (9 vs. 7%), and triple vessel disease (9 vs. 5%) ( $P < 0.0001$  for all)]. These results support the hypothesis of a greater severity of angiographic proven coronary artery disease in diabetic than in non-diabetic patients. Diabetics suffer from higher prevalence of diffuse and extensive coronary atherosclerosis.<sup>15</sup>

The present study analyzed the coronary artery disease involvement among diabetic and non diabetic patients with SYNTAX score of the cases, with the help of Spearman's correlation methods. There was strong positive correlation between SYNTAX score and coronary artery disease involvement (Single, double vessel and triple vessel disease). The SYNTAX score was tested with same diagnosis between two groups, i.e. diabetic and non diabetic. There was strong positive correlation between coronary artery disease involvement and SYNTAX score of Diabetic patients.

## CONCLUSION

There was no statistical difference between demographic factors, when compared among diabetic and non diabetic patients. According to 2D ECHO findings, it was observed that reduced Left ventricular ejection fraction (systolic dysfunction) was more among diabetic patients. According to the present study, among coronary angiography diagnosis, severe forms of coronary artery lesions were found common among diabetic patients as compared to non diabetic patients. SYNTAX score has shown a strong positive correlation with severity of coronary artery disease involvement (Single, double and triple vessel disease).

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**Source of Support:** Nil; **Conflict of Interest:** None

**Submitted:** 31-12-2018; **Accepted:** 10-01-2019; **Published:** 12-02-2019