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COMPARATIVE ANGIOGRAPHIC PROFILE IN DIABETIC AND NON-DIABETIC PATIENTS PRESENTING WITH ACUTE CORONARY SYNDROME AND THEIR IN-HOSPITAL OUTCOME IN A CARDIAC TERTIARY CARE HOSPITAL IN INDIA

Cardiology

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ABSTRACT

Background And Objectives: Coronary artery disease (CAD) is the commonest cause of mortality in people with diabetes. The definitive diagnosis, assessment and assessing severity of CAD requires coronary angiography. The main objective of this study is to analyze the coronary angiographic findings in people with diabetes and non-diabetic individuals with acute coronary syndromes.

Methodology: This is a prospective observational cross-sectional study in which patients presenting with acute coronary syndrome to hospital (n =800) were divided into two groups of people with diabetes (n= 311) and non-diabetic individuals (n=489) and observed. Patients who matched the inclusion and exclusion criteria was selected randomly during the study period. Demographic, laboratory and angiographic data were analysed and compared between two groups.

Results: The peak incidence of ACS in people with diabetes was in fourth and fifth decade as compared to fifth and sixth decade in non-diabetics. Male preponderance was seen among patients with ACS in both the groups. 55% diabetic patients presented with some form of LV dysfunction comparing to 48% of non-diabetic patients. Diabetic patients with poor glycemic control, i.e. HbA1c >8.5%, 48% of them had triple vessel disease and 33% had double vessel disease. 32% of diabetics had total occlusion of coronary artery. CABG was required in 20% of the cases in diabetic group whereas only 6.3% patients required CABG in non-diabetic group. The in-hospital complications were more common in diabetes group.

Conclusion: ACS in diabetic patients presented much earlier in life, the severity and extent of CAD and incidence of triple / multi vessel disease was significantly high in diabetics when compared to non-diabetics with ACS. Diabetic patients with high levels of HbA1c had a greater number of coronary vessel involvement and the mode of treatment required in them was CABG.

KEYWORDS

Acute coronary syndrome, Diabetes, Angiography, Coronary artery disease.

INTRODUCTION

Diabetes mellitus (DM) is a global epidemic with an estimated worldwide prevalence of 463 million in 2019, a figure projected to reach 578 million by 2030 and 700 million by 2040. [1] The increasing prevalence of DM is attributed to a variety of factors, including the rise in the aging population, ethnicity, change in lifestyle, obesity, socioeconomic status, and urbanization.[2] The increasing prevalence in DM is associated with a significant increase in complications like cardiovascular diseases, end-stage renal disease, neuropathy, and retinopathy. [3]

There is a strong correlation between cardiovascular disease (CVD) and diabetes. The American Heart Association considers diabetes to be one of the seven major controllable risk factors for cardiovascular disease. Adults with diabetes are two to four times more likely to die from heart disease than adults without diabetes. At least 68 % of people age 65 or older with diabetes die from some form of heart disease; and 16% die of stroke.[4]

Diabetes has become predominantly a disease of the cardiovascular system and hence now a days its termed as cardio-daibetology is fast emerging as subspecialty throughout the world to tackle the menace of cardiac related mortality and morbidity in Type 2 diabetes mellitus (T2DM). The risk of CAD among diabetic patients is directly related to the levels of blood pressure, cigarette smoking and total cholesterol. Dyslipidemia is observed in practically all people with T2DM and high level of cholesterol in people with diabetes have 2-3 times higher coronary artery disease (CAD) risk than non-diabetic individuals. [5]

Although the patients history, physical examination and non-invasive techniques like resting ECG, Holter monitoring, stress test (TMT), stress echocardiography, stress thallium imaging are valuable in establishing the diagnosis of myocardial ischemia in diabetes, the definitive diagnosis of CAD, its precise assessment and anatomic severity requires invasive diagnostic modality like coronary angiography. Coronary angiography remains the 'Gold-standard' technique for diagnosing and evaluating coronary artery disease. This study was carried out to analyze the coronary angiographic findings (extents, type and number of vessels, composition of lesion and any complicated lesion involving coronary artery and its branches) in patients with acute coronary syndrome and to compare the same in diabetic and non-diabetic patients with acute coronary syndromes.

MATERIALS AND METHODS

This is a prospective observational cross-sectional study conducted in Sri Jayadeva hospital, Bengaluru, Karnataka, India, during the period of August 2016 to August 2017. Patients presenting with acute coronary syndrome to hospital (n =800) were observed. Two groups were categorized as per the status of diabetes in these patients. People with diabetes (n = 311) and non-diabetic individuals (n= 489). Patients who matched the inclusion and exclusion criteria was selected randomly during the study period. Ethical approval for the study was taken from the Institutional Ethics Committee. After obtaining written informed consent from each subject, detailed history and clinical examination was conducted and the details were entered in pre-designed proforma.

Inclusion Criteria:

Group 1(Diabetic): Previously known diabetic or first time diagnosed with diabetes by American Diabetes Association (ADA) diagnostic criteria, presenting with acute coronary syndrome.

Group 2 (Non-Diabetic): Cases presenting with acute coronary syndrome who are non-diabetic or not fulfilling ADA diagnostic criteria.

Exclusion Criteria:

Patients having impaired fasting glucose and impaired glucose tolerance (FPG ≤ 126mg/dl but ≥ 110mg/dl, PPG 140-200mg/dl) presenting with acute coronary syndrome. History of prior revascularization (PCI or CABG), Anemia (Hb<10 g/dl) and hemoglobinopathies.

Patients presenting with complaints of acute chest pain, breathlessness were diagnosed to have ACS based on ECG and cardiac enzymes. Random Blood Sugar (RBS), Fasting Blood Sugar (FBS) were done for all the patients. HbA1c was sent in patients whose RBS or FBS was in higher range to confirm newly detected diabetes and in all diabetic patients to know the glycemic control. Patients with ACS, both diabetics and non-diabetics were treated and once they were stabilized was taken up for coronary angiography which was performed by the standard Judkin's technique after adequate preparation. Coronary artery narrowing of more than or equal to 70% was considered as significant stenosis. Details of the angiography were obtained and weighed using SYNTAX score. The SYNTAX scores were calculated with the help of professional website tool: www.syntaxscore.com

HbA1c was done in all 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. Depending on the angiographic findings, further treatment was planned whether the patient requires medical line of management, PTCA or CABG. Angiographic parameters and further treatment required were compared between diabetic patients and non-diabetic patients with ACS.

Statistical Analysis:
Categorical data was expressed as number and percentages. Chi-square test was used to determine any significant difference between two groups. A P value of less than 0.05 was considered for statistical significance.

RESULTS

Table 1: Distribution Of Diabetics And Non-diabetics With ACS In Different Age Groups

Age in years	≤30	31-40	41-50	51-60	61-70	71-80	>80
Diabetics (n=311)	12 (3.85 %)	49 (15.75 %)	106 (34.08 %)	73 (23.47 %)	61 (19.61 %)	10 (3.21 %)	0
Non-Diabetics (n=489)	4 (0.81 %)	67 (13.70 %)	125 (25.56 %)	164 (33.53 %)	111 (22.69 %)	15 (3.06 %)	3 (0.61 %)

(ACS – Acute Coronary Syndrome)

Table 2: Risk Factors In Diabetic & Non-diabetic Groups

	Diabetics	Non-Diabetics	Total	X^2	P Value
Smoking	136 (43.72%)	190 (38.85%)	326	1.871	0.171
Dyslipidemia	251 (80.70%)	309 (63.19%)	560	27.77	**0.0001***
Hypertension	159 (51.12%)	147 (30.06%)	306	35.71	**0.002***

Table 3: Types Of ACS Seen In Diabetic & Non-diabetic Groups

Type of ACS	Diabetic (n=311)	Non- Diabetic (n=489)	X^2	P Value
UA	44 (14.14%)	47 (9.61%)	3.88	0.048
NSTEMI	40 (12.86%)	38 (7.77%)	5.59	0.017
STEMI	227 (72.99%)	404 (82.61%)	10.57	0.001

(ACS -Acute Coronary Syndrome, UA- Unstable Angina, NSTEMI - Non-ST elevation myocardial infarction, STEMI – ST elevation myocardial infarction)

Table 4: Echocardiographic Findings In Diabetic And Non-diabetic Groups

	Diabetics (n=311)	Non-Diabetics (n=489)
Normal LV functions	140 (45.01%)	252 (51.53%)
Mild LV dysfunction	137 (44.05%)	180 (36.80%)
Moderate LV dysfunction	29 (9.32%)	55 (11.24%)
Severe LV dysfunction	05 (1.60%)	02 (0.40%)

(LV – Left Ventricular)

Table 5: Significance Of HbA1c Control With Number Of Vessels Involved In Diabetic Group

HbA1C	Normal CAG	SVD	DVD	TVD/MVD	Total
< 7	15 (16.66%)	44 (48.88%)	20 (22.22%)	11 (12.22%)	90
7-8.5	01 (0.89%)	53 (47.32%)	32 (28.57%)	26 (23.21%)	112
>8.5	01 (0.91%)	19 (17.43%)	36 (33.02%)	53 (48.62%)	109

(SVD – Single vessel disease, DVD- Double vessel disease, TVD – Triple vessel disease, MVD – Multiple vessel disease)

Table 6: Type Of Vessel Involved In Diabetic And Non-diabetic Groups

	Diabetic (n=311)	Non-Diabetic (n=489)	X^2	P Value
LMCA	24 (4.05%)	07 (1.04%)	11.87	**0.0005***
LAD	243 (41.04%)	304 (45.37%)	2.39	0.121
LCX	149 (25.16%)	139 (20.74%)	3.49	0.061
RCA	176 (29.72%)	220 (32.83%)	1.41	0.235
Total	592 (100%)	670 (100 %)	16.60	**0.0008***

(LMCA-Left Main Coronary Artery, LAD – Left Anterior Descending artery, LCX- Left circumflex artery, RCA- Right coronary artery)

Table 7: Treatment Options In Diabetic And Non-diabetic Groups

	Diabetic	Non-Diabetic
Medical	38 (12.21%)	87 (17.79%)
PTCA	210 (67.53%)	371 (75.86%)
CABG	63 (20.25%)	31 (6.33%)

(PTCA -Percutaneous transluminal coronary angioplasty, CABG - Coronary artery bypass grafting)

Table 8 : Correlation Between Coronary Artery Involvement Among Diabetic And Non-diabetic Cases And SYNTAX Score

SYNTAX Score in Coronary artery involvement	Spearman's correlation coefficient (r)
Diabetic	+0.80
Non- Diabetic	+0.60
Over all	+0.70

Table 9: In Hospital Outcomes

	Diabetics	Non-Diabetics
CHB	5	3
CHF	5	7
Reinfarction	4	0
Mechanical complications	2	1
Death	1	0

(CHB – Complete Heart Block, CHF – Congestive Heart failure)

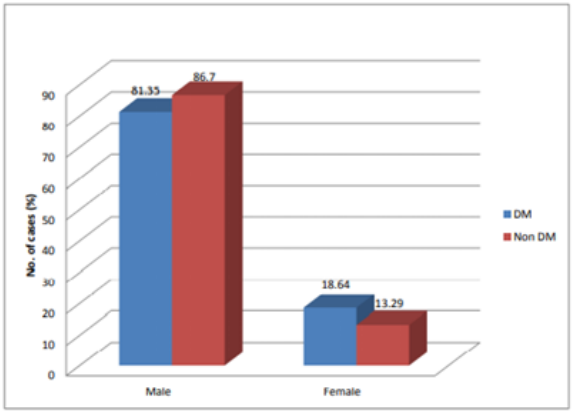

Fig 1: ACS Sex Distribution In Diabetic And Non-diabetic Groups

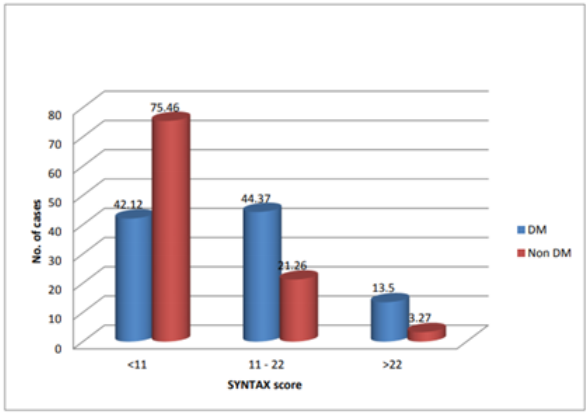

Fig 2 : SYNTAX Score Comparison Between Diabetic & Non-diabetic Groups

(SYNTAX -Synergy between PCI with Taxus and cardiac surgery)

DISCUSSION

Previous studies have found that individuals with T2DM are at increased risk for Acute Coronary Syndrome. With this background in this present study the diabetic patients and non-diabetic patients with ACS were analyzed with special emphasis laid on the coronary angiographic findings.

The peak incidence of ACS in diabetics was in the fourth and fifth decade as compared to fifth and sixth decade in non-diabetics [Table 1]. The highest frequency of ACS with DM was in the age group between 41-50 years with 106 cases (34.08%) and the highest

incidence of ACS without DM was in the age group 51-60 years with 164 cases (33.53%). Similar observations in incidence of ACS in people with diabetes in fourth and fifth decade was found by Hegde SS et al.,[6] and M K Malthesh MK et al., [7]. Whereas Hasabi IS et al.,[8] observed the mean age of subjects in diabetes group was 55.86±11.08 years and in non-diabetic group, the mean age was 53.19±11.11 years.

In our study, Male preponderance was seen among patients with ACS. Incidence of ACS in males was 81% in diabetic and 86% in non-diabetic patients in our study. [Fig 1]. This is similar to the results of studies conducted in Newcastle, New South Wales and Australia [9] and another study in UK [10] In another study conducted in the Netherlands found that the prevalence of diabetes was higher in older women compared to similarly aged men.[11] various studies from India observed similar results as our study. [6-8]

Presence of diabetes itself is one of the major risk factors, the incidence of ACS is rising significantly in people with diabetes and it is also associated with poor outcomes of ACS patients [12]. In our study majority (59%) of the patients had duration of diabetes between 5-10 years. 30% had shorter duration of diabetes less than 5 years and 11% had longer duration of diabetes more than 10 years. Other risk factors which contribute to cause ACS are dyslipidemia, smoking, age and gender. In our study the diabetic patients showed significant association with dyslipidemia and hypertension when compared to non-diabetic patients [Table2]

In our study significant difference was present in clinical presentation of ACS cases and diabetic status. 14% and 12% of the cases presented with unstable angina and NSTEMI in diabetic group whereas 9% and 7% patients in non-diabetic group respectively. Majority of cases presented with STEMI 82% non-diabetic patients and 72% diabetic patients. [Table 3]

Diabetes has been implicated as an important determinant of left ventricular mass in most population-based studies. In T2DM patients without cardiac involvement, uncontrolled hyperglycemia is described to provoke diastolic left ventricular dysfunction.[13] Alteration in left ventricular diastolic function seems to be related to concentrations of fasting plasma glucose and glycated hemoglobin even below the threshold of diabetes. [14]. In our study the echo graphic findings show 55% diabetic patients presented with some form of LV dysfunction comparing to 48% of non-diabetic patients. [Table4].

In regard to Significance of HbA1c levels and severity of CAD, in our study the diabetic patients with poor glycemic control, i.e. HbA1c >8.5%, 48% of them had triple vessel disease and 33% had double vessel disease suggesting poor glycemic control with higher HbA1c levels having more severe CAD [Table 5]. This finding correlates with the study conducted by Saleem T et al.,[15] This finding correlate with the other study by Calton et al.,[16] showed a higher incidence of MVD in diabetics (57.3%) compared to 41.3% in non-diabetics. In a study by Henry et al., [17] and Sousa et al.,[18] there was increased the incidence of triple vessel disease, and more diffuse lesions were noted. The commonest vessel involved in our study was Left anterior descending (LAD) in both the groups diabetic patients (42%) and non-diabetic individuals (45%) followed by right coronary artery (RCA) and Left circumflex artery (LCX). [Table 6]

The present study calculated the SYNTAX score of the study participants, based on their coronary angiography findings. The SYNTAX scores were calculated with the help of professional website tool: www.syntaxscore.com. [Fig 2] 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. [Fig 2] 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.[Table 8] 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.

In our study, the number of patients having total occlusion was 32% in diabetics and 6% in non-diabetics. The extent and severity of CAD were significantly high in diabetic patients with ACS when compared to non-diabetic with ACS. This finding was similar in various other studies such as Mossavi M et al.,[19] Uddin SN et al.,[20] where they found the angiographic extent and severity of CAD was high in diabetic patients with ACS.

As a treatment option in our study majority of patients required PTCA as treatment option in both groups, 67.5% in diabetics and 75.8% in non-diabetics. CABG was required in 20% of the cases in diabetic group whereas only 6.3% patients required CABG in non-diabetic group. 17.7% of non-diabetics and 12% of diabetics were on medical management. [Table 7] Ten patients in diabetic group with SYNTAX score more than 15 were advised medical management, 8 of them had TVD with distal diffuse disease with blood vessel not suitable for grafting and two patients were not willing to undergo any form of revascularization.

In our current study the in-hospital outcomes in the form of Complete heart block, mechanical complication, re-infarction, death was more common in diabetic group. [Table 9] The outcomes of this study present numerous challenges. High prevalence of diabetes in the general population, to be addressed as a primary preventive measure such as educational campaigns focusing on healthy diets, weight control, and exercise, is vital in reducing future acute vascular events. Diabetes management with multidisciplinary clinics or diabetic centers is needed to reduce long-term complications. Diabetic patients' education about symptoms of ACS can help them reach the medical attention at the earliest and potentially decrease adverse cardiac events.

CONCLUSION

Acute Coronary Syndrome in diabetic patients presented much earlier in life than non-diabetic patients. The severity and extent of coronary artery disease in diabetics was more compared to non-diabetics. The incidence of triple vessel or multivessel disease was significantly higher with diabetic patients with poor glycemic control. The severity of stenosis and total occlusion of vessels were more commonly seen in diabetic patients. In diabetic patients the incidence of triple or multivessel disease and requiring CABG as the mode of treatment correlated with poor glycemic control. Majority of the diabetic patients with ACS require CABG as the main mode of treatment. The in-hospital complications are more common in people with diabetes.

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