Journal Homepage: - www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/17046
DOI URL: http://dx.doi.org/10.21474/IJAR01/17046

RESEARCH ARTICLE

CORRELATIVE STUDY OF CORONARY ARTERY DISEASE SEVERITY AND GLYCOSYLATED HEMOGLOBIN IN DIABETIC AND NON-DIABETIC PATIENTS

Deepthi Manchu, Srinivasa S.V., Yashwanth L., Kiranmai V., Charchit Mehta and Meghashri V.
Department of Medicine, Sri Devaraj Urs Academy of Higher Education and Research, Kolar, Karnataka, India.

Manuscript Info

Manuscript History
Received: 05 April 2023
Final Accepted: 10 May 2023
Published: June 2023

Key words:-
Diabetes Mellitus, Cardiovascular Disease, Coronary Artery Disease, HbA1c

Abstract

Context: Diabetes mellitus and coronary heart disease are closely associated with each other and generally coexist. The severity of coronary artery disease is related directly to the quality of glucose control in diabetic patients

Aims: To correlate coronary artery disease severity and glycosylated hemoglobin in diabetic and non-diabetic patients.

Settings and Design:Study site: This study was conducted in the department of General Medicine at Sri Devaraj Urs Academy of Higher Education and Research, Kolar.Study design: The was a descriptive observational cross-sectional study.

Methods and Material: Descriptive observational cross-sectional study conducted for a period of 1.5 years from January 2019 to June 2020. A total of 400 subjects were included in the final analysis.

Statistical analysis used: Categorical outcomes were compared between study groups using Chi square test /Fisher's Exact test .P value < 0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.[63]

Results: The mean age of the participants was 57.97 ± 11.59. Majority of the participants were males with 82.25%. ST-elevation MI, non-ST elevation MI, unstable angina, and stable angina were the clinical presentation identified with 61.25%, 18.5%, 11.25% and 9% respectively. Troponin I was elevated in 80.5% of the participants. NSTEMI and STEMI were identified in 18.5% and 61.25% of the participants. The mean of LV Function in the study population was 47.32 ± 10.15. Among the study population, LMCA was identified in 9.25% whereas, Whereas, LCX and RCA in 52.25% and 65%. The mean of Hba1C in the study population was 7.47 ± 2.26.

Conclusions: Increased HbA1c levels in the diabetes group was significantly associated with severity of CAD.

Introduction:-

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycaemia resulting from defects in insulin secretion, response to insulin or both.1 The presence of diabetes mellitus increases the risk of cardiovascular diseases. The

Corresponding Author:- Deepthi Manchu
Address**:-** Department of Medicine, Sri Devaraj Urs Academy of Higher Education and Research, Kolar, Karnataka, India.

main cause of death in both “type 1 and type 2” patients are the coronary artery disease.2 Worldwide, coronary artery disease has emerged as the single most important cause of mortality and morbidity.3

India is on the verge of a cardiovascular disease epidemic. The incidence of CAD has more than doubled in the past 2 decades in India. In the year 1990, there was an estimated death of around 1.17 million due to CAD in India, and by the year 2010, the number had almost doubled to 2.03 million.4 An estimated increase of 6.3 million deaths is expected to occur due to coronary artery disease throughout the world between the year 2008 and 2030.5

Glycated hemoglobin levels can be used as a predictive value for cardiovascular disease & mortality of patients with DM (diabetes mellitus).6 Also, the elevated hemoglobin A1C is regarded as an independent risk factor for coronary artery disease in patients with or without diabetes mellitus.7

In a number of studies, the increased incidence and risk of developing coronary artery disease have been positively linked with the diabetes mellitus. Lowering the level of HbA1c can decrease the neuropathic, macrovascular and microvascular complications.1 The present study was conducted to correlate the coronary artery disease severity and glycosylated hemoglobin in diabetic and non-diabetic patients.

Material And Methods:-

This study was a descriptive cross-sectional study conducted in the department of General Medicine at Sri Devaraj Urs Academy of Higher Education and Research, Kolar. Patients undergoing coronary angiogram between January 2019 and June 2020, were included after obtaining the approval from Institutional Ethics Committee. Sample size with an estimated base with differences observed in multivessel disease in type 2 diabetes with CAD and nondiabetics with CAD, to observe a difference of min 14% in multivessel disease in diabetes and non-diabetes as per the study by Tong-guo et al.8 with 80% power, 95%confidence, the estimated sample size per group is 194.The data collection for the study was done between January 2019 to June 2020 for a period of 1.6 years. Inclusion criteria:All patients undergoing coronary angiogram for suspected CAD;Diabetics and non-diabetics with hypertension are included in this study; Nondiabetics found to be prediabetic are included in this study. Exclusion criteria: Presence of valvular disorders; Presence of congenital heart disease; History of past coronary revascularization, or heart failure; Uncontrolled arrhythmia; h/o allergy to contrast dye; Pregnant women; Active bleeding; Acute or chronic kidney injury.

Methodology:-

All study subjects detailed history was taken, they were examined, and relevant investigations including FBS, PPBS, and HbA1c was done. The history collected, examination details, blood investigations and coronary angiogram findings were studied and correlated.For the final analysis based on the level of HBA1 value, the study population was classified as follows: Normal (<=5.69),Prediabetic (5.7 to 6.4),Diabetic (>= 6.5). Significant stenosis(CAD) was defined as 50% or more in the left main coronary artery and >70% or more in LAD, LCX and RCA arteries.9 The coronary angiogram findings of single-vessel disease (VD),2VD,3VD are taken and compared between the diabetic and non-diabetic group and correlated with HbA1c. The severity of the coronary lesions in the patient was defined with the ACC/AHA classification of coronary lesions.

Statistical Methods:

LMC ACC/AHA grade, LAD ACC/AHA grade, LCX ACC/AHA grade, RCA ACC/AHA grade Final AHA/ABC class were considered as primary outcome variables. HBA1C and the final diagnosis was considered as secondary outcome variables. Diabetic and pre-diabetic were considered as primary explanatory variables. Age, gender and other demographic variable were considered as other explanatory variables. Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency, and proportion for categorical variables. Categorical outcomes were compared between study groups using Chi square test /Fisher's Exact test (If the overall sample size was < 20 or if the expected number in any one of the cells is < 5, Fisher's exact test was used.) P value < 0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.10

Results:-

A total of 400 subjects were included in the final analysis.

Table 1:- Summary of baseline parameters

Parameter	Summary statistics
Age (Mean ± SD) (in years)	57.97 ± 11.59 (25,85)
Male	329 (82.25%)
Female	71 (17.75%)
Clinical Presentation	
ST Elevation MI	45 (11.25%)
Non-ST elevation MI	36 (9%)
Unstable angina	
Stable angina	
Past history	
Diabetes	200 (50%)
Hypertension	186 (46.5%)
Hypothyroidism	8 (2%)
PVD	5 (1.3%)
Family History (heart disease)	18 (4.5%)
Personal history	
H/O Smoking	121 (30.25%)
Alcohol	58 (14.5%)
Pulse (Mean ± SD)	81.37 ± 12.39 (40,170)
SBP (Mean ± SD)	120.78 ± 22.39 (110,220)
DBP (Mean ± SD)	77.28 ± 11.39 (40,150)
Respiratory Rate (Mean ± SD)	17.57 ± 2.29 (16,30)
Temperature (Mean ± SD)	99.1 ± 0.41 (98.4,99.8)
BMI (Mean ± SD)	27.96 ± 3.91 (18.6,39)
Total Cholesterol	
Normal (<200)	233 (58.25%)
Borderline (200 to 239)	108 (27%)
High (>=240)	59 (14.75%)

Mean ± SD

Mean ± SD

Mean ± SD

Mean ± SD

Mean ± SD

Mean ± SD

Total Cholesterol

(N=400)

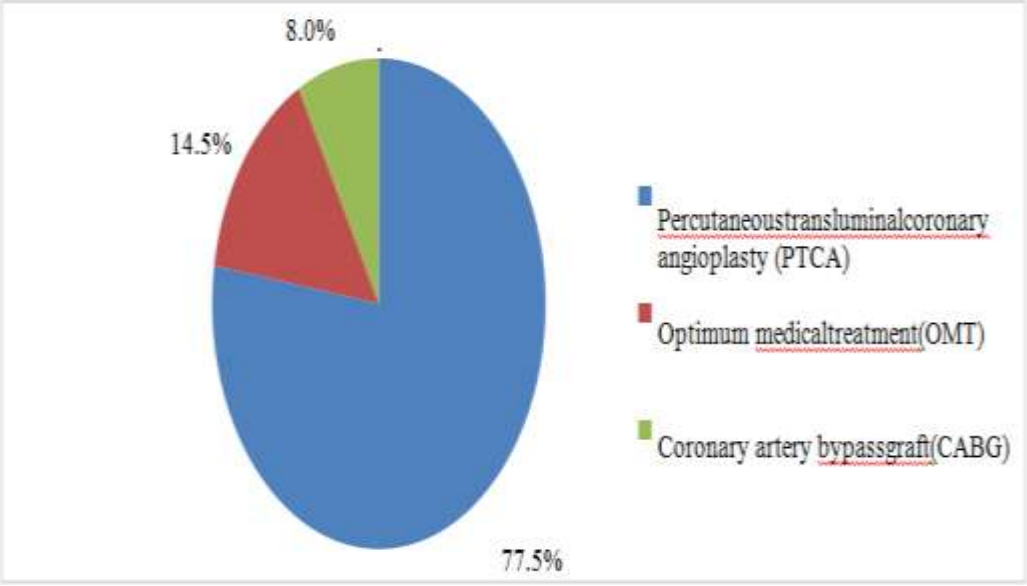
Sr. Triglycerides	
Normal (<150)	161 (40.25%)
Borderline (150-200)	166 (41.5%)
High (201-499)	72 (18%)
Very high (>500)	1 (0.25%)
	245 (61.25%)
	74 (18.5%)

Table 2:- Descriptive analysis of cardiac parameters in the study population (N=400).

Cardiac parameter	Summary statistics
Troponin I	
Elevated	322 (80.5%)
Normal	78 (19.5%)
ECG	
Normal	81 (20.25%)
NSTEMI	74 (18.5%)
STEMI	245 (61.25%)
LV Function (%) (Mean ± SD)	47.32 ± 10.15 (20,61)
LV Function (%)	Mean ± SD
Normal (>=50)	187 (46.75%)
Mild (40 to 49)	140 (35%)
Moderate (30 to 39)	63 (15.75%)
Severe (<30)	10 (2.5%)
Cardiac evaluation (LMCA)	
Type A	15 (3.8%)
Type B	7 (1.8%)
Type C	15 (3.8%)
Cardiac evaluation (LAD)	
Type A	65 (16.3%)
Type B	63 (15.8%)

Type C	217 (54.3%)
Cardiac evaluation (LCX)	
Type A	45 (11.3%)
Type B	64 (16%)
Type C	101 (25.3%)
Cardiac evaluation	evaluation (RCA)
Type A	55 (13.8%)
Type B	45 (11.3%)
Type C	162 (40.5%)
Final Diagnosis	
Critical triple vessel disease	10 (2.5%)
Triple vessel disease	101 (25.25%)
Double vessel disease	119 (29.75%)
Single vessel disease	150 (37.5%)
Minor coronary artery disease	20 (5%)

Pie chart of treatment in the study population (N=400)



A majority of them showed raised troponin I levels with majority belonging to STEMI. The mean of LV Function (%) was 47.32 ± 10.15 in the study population, and 187 (46.75%) participants lv

function (%) was normal (>=50), 140 (35%) participants lv function (%) was mild (40 to 49), 63 (15.75%) participants LV function (%) was moderate (30 to 39) and 10 (2.5%) participants lv function (%) was severe (<30).Among the study population, 37 (9.25%) participants involved in LMCA, 345 (82.255%) participants involved in LAD, 209 (52.25%) participants involved in LCX, 260 (65%) participants involved in RCA. (table 2)

Table 3:- Descriptive analysis of clinical parameters in the study population (N=400).

Clinical parameter	Summary statistics
Treatment	
Percutaneous transluminal coronary angioplasty (PTCA)	310 (77.5%)
Optimum medical treatment (OMT)	58 (14.5%)
Coronary artery bypass graft (CABG)	32 (8%)
Hba1C (Mean ± SD)	7.47 ± 2.26 (4.45,16.2)
Mean ± SD	
Hba1C	
<5	5 (1.25%)
5 to 5.69	95 (23.75%)
5.7 to 6	44 (11%)
6.1to 6.49	56 (14%)
6.5 to < 7	33 (8.25%)
7 to 7.99	32 (8%)
8 to 9.99	80 (20%)
10 to 11.99	32 (8%)
12 to 13.99	16 (4%)
>= 14	7 (1.75%)
Diabetes	
Normal	100 (25%)
Pre-diabetes	100 (25%)
Diabetes	200 (50%)
Final AHA/ABC Class	
Low disease (Type A)	34 (8.5%)
Moderate disease (Type B)	33 (8.25%)
Severe disease (Type C)	333 (83.25%)

Table 4:- Comparison of HBA1C with other parameters.

Parameter	Median (IQR)	Kruskal Wallis test (P value)
HBA1C vs LMC ACC/AHA grade		
A (N=15)	6.32 (5.67 to 8.2)	0.959
B (N=7)	6.28 (5.75 to 9.64)	
C (N=15)	6.35 (5.7 to 10.64)	
No (N=363)	6.5 (5.68 to 8.9)	
HBA1C vs LAD ACC/AHA grade		
A (N=65)	6.2 (5.61 to 8.09)	0.082
B (N=63)	7.01 (5.9 to 8.9)	
C (N=217)	6.51 (5.78 to 8.97)	
No (N=55)	6.2 (5.64 to 9.45)	
HBA1C vs LCX ACC/AHA grade		
A (N=45)	6.9 (5.98 to 8.97)	<0.001
B (N=64)	7.21 (6.21 to 9.36)	
C (N=101)	6.92 (5.85 to 9.2)	
No (N=190)	6.2 (5.64 to 8.2)	
HBA1C vs RCA ACC/AHA grade		
A (N=55)	6.7 (5.67 to 8.9)	0.001
B (N=45)	7.6 (6.11 to 9.05)	
C (N=162)	6.9 (5.89 to 9.35)	

No (N=138)	6.2 (5.64 to 7.81)	
HBA1C vs Final AHA/ABC Class in study population (N=400)		
Low risk (N=34)	6.2 (5.62 to 8.33)	
Moderate risk (N=33)	6.7 (5.68 to 8.58)	0.314
High risk (N=333)	6.5 (5.77 to 8.96)	
HBA1C vs Final AHA/ABC class among Normal (<5.7) HBA1C (N=100)		
Low risk (N=13)	5.5 (5.38 to 5.64)	
Moderate risk (N=10)	5.55 (5.49 to 5.67)	0.227
High risk (N=77)	5.46 (5.38 to 5.63)	
HBA1C vs Final AHA/ABC Class among Pre diabetic (5.7 to 6.49) HBA1C (N=100)		
Low risk (N=7)	6.2 (5.96 to 6.28)	
Moderate risk (N=4)	5.9 (5.87 to 6.22)	0.584
High risk (N=89)	6.12 (5.85 to 6.24)	
HBA1C vs Final AHA/ABC class among diabetic (>= 6.5) HBA1C (N=200)		
Low risk (N=14)	8.45 (7.52 to 9.69)	
Moderate risk (N=19)	7.95 (7.18 to 9)	0.12
High risk (N=167)	8.96 (7.65 to 10.54)	

Among the study population, the difference between HBA1C vs LCX ACC/AHA grade and HBA1C vs RCA ACC/AHA grade were shown statistically significant (p value <0.05), the difference between HBA1C with all other variables were shown statistically not significant (P value >0.05) (table 4)

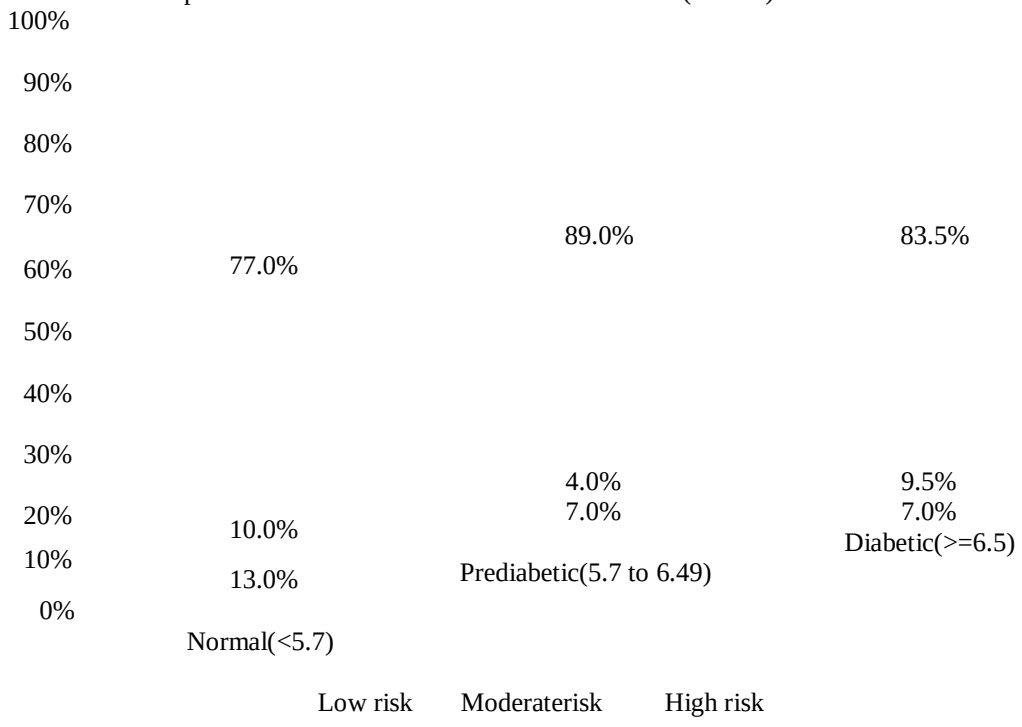
Table 5:- Comparison of final aha/abc class across hba1c (N=400).

Final Aha/Abc Class	Hba1C Normal (<5.7) (N=100)	Hba1C Pre-Diabetic (5.7 To 6.49) (N=100)	Hba1C Diabetic (>= 6.5) (N=200)	P value
Low Risk	13 (13%)	7 (7%)	14 (7%)	
Moderate Risk	10 (10%)	4 (4%)	19 (9.5%)	0.137
High Risk	77 (77%)	89 (89%)	167 (83.5%)	

The difference in proportion between HBA1C and final Aha/Abc Class was statistically not

significant (P value 0.137) (table 5).

Staked bar chart of comparison of final AHA/ABC class across hba1c (N=400)



Discussion:-

In a number of studies, the increased incidence and risk of developing coronary artery disease have been positively linked with diabetes. The present study was conducted to correlate coronary artery disease severity and glycosylated hemoglobin in diabetic and non-diabetic patients. A total of 400 subjects were included in the final analysis.

In the present study, 57.97 ± 11.59 was the mean age of the study population. Dutta B et al[6], conducted a study in 346 patients in which 58.1 ± 10.4 years was the mean age of the participants. In the present study, the proportion of males and females were identified with 82.25% and 17.75% respectively. In a prospective study performed by Dutta B et al[6], in which 91.9% of the participants were males, and 8.1% were females.

In the present study, the history of diabetes was identified in 50% of participants whereas, hypertension, hypothyroidism and PVD were identified with 46.5%, 2% and 1.3% respectively. In a prospective study performed by Hong L-F et al[11], the history of diabetes, hypertension and PVD were identified in 26.1%, 63.4% and 1.8% respectively. Ewid M et al[5], conducted a cross-sectional study in 38 patients in which 55.3% had diabetes whereas, 29.4% had hypertension.

In the current study, the mean of pulse, SBP, DBP, respiratory rate and temperature were noticed with 81.37 ± 12.39, 120.78 ± 22.39, 77.28 ± 11.39, 17.57 ± 2.29 and 99.1 ± 0.41 respectively. Habib S et al.,[12] conducted a study in 119 participants in which the median of SBP and DBP were 120 (110-130) and 78 (70-80) respectively. In the present study, the mean BMI was 27.96 ± 3. In a cross-sectional study performed by Ewid M et al[5], in which 28.3 ± 5.8 was the mean BMI of the participants.

In the present study, 25% of the participants were belonged to normal weight 44.75% of participants to overweight, 24.5% participants to type 1 obesity and 5.75% to type 2 obesity. Dar MI et al[13], performed a study in 208 patients in which normal weight, overweight, obesity class I were identified with 69.05%, 16.43% and 14.39% respectively.

In the current study, the mean of Hb, WBC, platelets, urea, serum creatinine, sodium, potassium, chloride, RBS, HbA1c, TC, HDL, serum triglycerides, LDL and VLDL were observed with 14.04 ± 5.94, 12.35 ± 35.42, 259.09 ± 81.89, 25.95 ± 9.61, 1.19 ± 5.14, 137.61 ± 61.37, 4.66 ± 5.45, 100.81 ± 12.82, 167.55 ± 77.68, 7.69 ± 4.71, 190.56 ± 44.09, 35.86 ± 9.11, 171.93 ± 60.27, 114.42 ± 29.1 and 33.55 ± 12.49 respectively. In a prospective study performed by Hong L-F et al[11], in which the mean of Hb, WBC, platelets, serum creatinine, TC, HDL, triglycerides and LDL were 139.9 ± 15.1, 6.4 ± 1.6, 205.1 ± 60.7, 75.6 ± 16.2, 4.2 ± 1.1, 1.1 ± 0.3, 4.2 ± 1.1 and 2.5 ± 0.9 respectively. Kamal A et al[14], conducted a study in 150 patients in which the mean of HbA1c, TC, triglycerides, HDL, LDL and creatinine were 7.7 ± 2.4, 194.7 ± 49.5, 168.6 ± 67.4, 34.5 ± 8.6, 126.2 ± 41.5 and 1± 0.28 respectively.

In the present study, the total cholesterol was normal in 58.25% whereas, on the borderline in 27% and high at 14.75%. Whereas, the HDL was low at 75.75% while normal at 23% and high in 1.25%. And LDL was identified normally in 32.5% whereas, on the borderline in 29.75% and high in 4.5%. Serum triglycerides were normal in 40.25% while on the borderline in 41.5% and high in 18% of participants.

In the current study, troponin I was high in 80.5% of the patients and the remaining 19.5% of participants had a normal level of troponin I. In the present study, 20.25% of the participants had a normal ECG, whereas, 18.5% of participants had NSTEMI, and 61.25% of participants had STEMI. In a population of 150 participants Kamal A, et al[14], conducted a study in which unstable angina, STEMI and NSTEMI were identified with 45.3%, 26.7% and 28% respectively. In the current study, the mean of LV Function was 47.32 ± 10.15. Kamal A et al[14], conducted a study in 150 patients in which 53.8 ± 11.7 was the mean of LV function.

In the present study, 46.75% of participants had a normal LV Function, while 35% participants had mild LV Function, 15.75% participants had moderate LV Function, and 2.5% participants had severe LV Function. Ewid M et al[5], conducted a cross-sectional study in 38 patients in which normal, mild, moderate and severe LV function were identified with 47.37%, 7.89%, 7.89% and 5.27% respectively.

In the current study, LMCA was identified in 9.25% Whereas, ACC/AHA Grade A, ACC/AHA Grade B and ACC/AHA Grade C were identified with 3.8%, 1.8% and 3.8% respectively.

In the present study, 2.5% participants were identified with critical triple vessel disease, 25.25%

participants had triple vessel disease, 29.75% participants had double vessel disease, 37.5% had single-vessel disease, 5% participants had minor coronary artery disease. Habib S et al[12], conducted a study in 119 participants in which single vessel, double and triple vessel disease were identified in 37,8%, 26.9% and 33.8% respectively.

In the current study, 77.5% of participants were received with percutaneous transluminal coronary angioplasty, 14.5% with optimum medical treatment and 8% of participants with a coronary artery bypass graft. Zarif HMA. et al[15], conducted a descriptive comparative study in 458 patients in which 39.87% were belonged to CAG, 58.16% were belonged to CAG + PCI, and 1.96% were belonged to CA + PTCA.

In the present study, the mean of Hba1C was 7.47 ± 2.26. In a cross-sectional study performed by Ewid M, et al[5], in which 5.7 ± 0.45 was the mean of Hba1C identified in participants.

In the current study, HBA1C was less than 5 in 1.25%, HBA1C was between 5 to 5.69 in 23.75%, Whereas, between 5.7 to 6 in 11%, 6.1to 6.49 in 14%, 6.5 to 6.99 in 8.25%, 7 to 7.99 in 8%, 8 to 9.99 in 20%, 10 to 11.99 in 8%, 12 to 13.99 in 4% and more than or equal to 14 1.75%. Mirza AJ, et al[16], performed a study in 320 patients in which 19.25% had HbA1c < 4.8%, 30.74% had HbA1c between 4.8-5.3%, 26.1% had HbA1c between 5.4-5.8% and 24% had HbA1c between 5.9-6.5%.

Among normal study population, Age>60, male, hypertension, hypothyroidism, smoking, family history, dyslipidemia, BMI>25 PVD were identified with 21%, 85%, 33%, 0%, 30%, 11%, 46%, 72% and 1% whereas, in prediabetics with 47%, 90%, 28%, 2%, 35%, 4%, 50%, 63% and1% and in diabetics with 49.5%, 77%, 55.5%, 1.5%, 28.5%, 1.5%, 61.5%, 77.5% and 1.5%. Zarif HMA., et al[15], conducted a descriptive comparative study in which among the normal study population, male gender, hypertension, smoking, family history, dyslipidemia were identified with 86.71%, 25.17%, 34.26%, 8.39% and 78.32% Whereas in pre diabetic group, male gender, hypertension, smoking, family history, dyslipidemia were identified with 86.36%, 43.63%, 56.36%, 26.36%, 88.18% and in diabetic group with 79.02%, 59.51%,50.24%, 20.98% and 92.20% respectively.

Among the study population, the median of HBA1C was 6.32 (5.67,8.2) in LMC ACC/AHA grade A whereas, LMC ACC/AHA grade B and LMC ACC/AHA grade C were identified with 6.28 (5.75,9.64) and 6.35 (5.7,10.64) respectively. In the present study, the median of HBA1C was 6.2 (5.61,8.09) in LAD ACC/AHA grade A, whereas, LAD ACC/AHA grade B and LAD ACC/AHA grade C were identified with 7.01 (5.9,8.9) and 6.51 (5.78,8.97) respectively.

In the current study, the median of HBA1C was 6.9 (5.98,8.97) in LCX ACC/AHA grade A, While LCX ACC/AHA grade B and LCX ACC/AHA grade, C was identified with 7.21 (6.21,9.36) and 6.92 (5.85,9.2) respectively. In the present study, the median of HBA1C was 6.7 (5.67,8.9) in RCA ACC/AHA grade A, whereas, RCA ACC/AHA grade B and RCA ACC/AHA grade C were identified with 7.6 (6.11,9.05) and 6.9 (5.89,9.35) respectively.

In the current study, the median of HBA1C was 6.2 (5.62,8.33) in the low-risk group whereas, in the moderate-risk group and high-risk group were 6.7 (5.68,8.58) and 6.5 (5.77,8.96) respectively. In the present study, the median of HBA1C was 5.5 (5.38,5.64) in a low-risk group, whereas, 5.55 (5.49,5.67) in the moderate-risk group and 5.46 (5.38,5.63) in the high-risk group. Among the pre-diabetic study population, the median of HBA1C was 6.2 (5.96,6.28) in a low-risk group, 5.9 (5.87,6.22) in the moderate-risk group and 6.12 (5.85,6.24) high-risk group. Among the diabetic study population, the median of HBA1C was 8.45 (7.52,9.69) in a low-risk group, whereas, 7.95 (7.18,9) in the moderate-risk group and 8.96 (7.65,10.54) in the high-risk group. ,

Out of 100 normal people, 13% of the participants were belonged to low risk in final AHA/ABC class whereas, 10% to moderate risk in final AHA/ABC class and 77% to high risk in final AHA/ABC class. Whereas, out of 100 pre-diabetic people, 7% of the participants were belonged to low risk in final AHA/ABC class, 4% to moderate risk in final AHA/ABC class and 89% to high risk in final AHA/ABC class. Out of 200 normal people, 7% participants were belonged to low risk in final AHA/ABC class, while 9.5% to moderate risk in final AHA/ABC class and 83.5% to high risk in final AHA/ABC class.

Our study found increased HbA1c levels in all 3 groups; low risk, moderate risk and high -risk group of CAD, although there was no statistical difference across the groups.

In the present study majority of the patients are males, and this was mainly because of the demographic profile of the admitted patients. This is a single-centre study so that some subgroup comparisons may have lacked the power to detect significant differences for selected variables. Third, we used a single baseline measurement of HbA1c. Hence, we cannot evaluate the effects of changes in this parameter over the long-term. So, a prospective long-term study would be ideal for analyzing prognostic importance and outcomes.

Conclusion:-

Our study found increased HbA1c levels in all 3 groups; low risk, moderate risk and high -risk group of CAD, although there was no statistical difference across the groups. Hence, through our study, we found that increased HbA1c levels can be one of the independent risk factors for the development of CAD.

Limitations:

In the present study majority of the patients are males, and this was mainly because of the demographic profile of the admitted patients. This is a single-center study so that some subgroup comparisons may have lacked the power to detect significant differences for selected variables. Third, we used a single baseline measurement of HbA1c. Hence, we cannot evaluate the effects of changes in this parameter over the long-term. So, a prospective long-term study would be ideal for analyzing prognostic importance and outcomes.

Recommendations:-

The study can be conducted with an increased duration of the study period. Follow-up of the study population can also be performed in the study.

Acknowledgement:-

Authors would like to acknowledge all the subjects participated in the study. Everyone who contributed in the completion of the study including the technical staff.

Funding:
No funding sources.

Conflict of interest:
None declared.

Ethical Approval:
The study was approved by the Institutional Ethics Committee.

References:-

1. Ul-Haque I, Ud Deen Z, Shafique S, Ur Rehman SI, Zaman M, Basalat ST, et al. The Role of Glycated Hemoglobin A1c in Determining the Severity of Coronary Artery Disease in Diabetic and Non-Diabetic Subjects in Karachi. Cureus. 2019;11(6):e4982.
2. Aronson D, Edelman ER. Coronary artery disease and diabetes mellitus. Cardiol Clin. 2014;32(3):439-55.
3. Dubey T, Mundada K, Arya A. Correlation of HbA1c with mortality and severity in acute coronary syndrome. IJCMR. 2016;3:2244-7.
4. Simon AS, Vijayakumar T. Molecular studies on coronary artery disease-a review. Indian J Clin Biochem. 2013;28(3):215-26.
5. Ewid M, Sherif H, Billah SMB, Saquib N, AlEnazy W, Ragab O, et al. Glycated hemoglobin predicts coronary artery disease in non-diabetic adults. BMC Cardiovascular Disorders. 2019;19(1):309.
6. Dutta B, Neginhal M, Iqbal F. Glycated Hemoglobin (HbA1c) Correlation with Severity of Coronary Artery Disease in Non-diabetic Patients - A Hospital based Study from North-Eastern India. J Clin Diagn Res. 2016;10(9):Oc20-oc3.
7. Sahal NEHS. Impact of glycated hemoglobin level on severity of coronary artery disease in non-diabetic patients. J Cardiol Curr Res. 2016;4(4):00258.
8. Tong-guo W LW. Angiographic characteristics of the coronary artery in patients with type 2 diabetes. Exp Clin Cardiol. 2000;7:199-200.
9. Jameson J FA, Kasper D, Hauser S, Longo D, Loscalzo J Harrison's Principles of Internal Medicine. 20th ed: McGraw-Hill Education; 2018.
10. IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.
11. Hong LF, Li XL, Guo YL, Luo SH, Zhu CG, Qing P, et al. Glycosylated hemoglobin A1c as a marker predicting the severity of coronary artery disease and early outcome in patients with stable angina. Lipids Health Dis. 2014;13:89.
12. Habib S, Ullah SZ, Saghir T, Syed Muhammad A, Ud Deen Z, Naseeb K, et al. The Association between Hemoglobin A1c and the Severity of Coronary Artery Disease in Non-diabetic Patients with Acute Coronary Syndrome. Cureus. 2020;12(1):e6631.
13. Dar MI, Beig JR, Jan I, Shah TR, Ali M, Rather HA, et al. Prevalence of type 2 diabetes mellitus and association of HbA1c with severity of coronary artery disease in patients presenting as non-diabetic acute coronary syndrome. Egypt Heart J. 2020;72(1):66.
14. Kamal A, Mostafa A, Bayoumi B. Severity of atherosclerotic coronary artery disease in relation to glycated hemoglobin level in diabetic patients. Menoufia Med J. 2019;32(3):844-50.
15. Zarif HMA, Farid MS, Shahid M, Khan MR, Abid MS, Akhtar B, et al. Severity of Coronary Artery Disease in Prediabetic Patients Undergoing Elective Coronary Angiography. Cureus. 2020;12(5):e7913.
16. Mirza AJ MH, Jaefer F, Singh J, Lang CC. glycated hemoglobin level as a predictor of severity of coronary artery disease in non diabetic patients. J Diabetes Treat. 2020;5(2):1-5.