

# Coronary Artery Disease among Type-II Diabetic Patient in Bangladesh

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DOI: <https://doi.org/10.52403/ijshr.20240347>

## ABSTRACT

This study aimed to evaluate the relationship between microalbuminuria and the angiographic severity of CAD patients with type 2 diabetes by SYNTAX I, SYNTAX II, and Gensini scores. Diabetes mellitus is one of the strongest risk factors for coronary artery disease, so it is imperative to identify CAD in diabetic patients as soon as feasible. In this study, 82 patients with type II diabetes who had a suspected case of coronary artery disease (CAD) had elective coronary angiography. The urine albumin-creatinine ratio (UACR) was measured for each patient, and the severity of each patient's CAD was assessed using the Gensini, SYNTAX, and SYNTAX II scores. In the studied population, there were 26 (31.7%) females and 56 (68.3%) males. On average, they were 56.29 + 9.18 years old. Patients were categorized into two groups based on their UACR level: group 1 consisted of 41 patients whose UACR was less than 30 mg/g, and group 2 consisted of 41 patients whose UACR was greater than or equal to 30 mg/g. The study found that patients in group 2 had significantly higher SYNTAX scores ( $P=0.001$ ) and significantly higher Gensini scores ( $P=0.001$ ) than patients in group 1. Age and the length of UACR and DM showed a positive correlation ( $p=0.003$ ), as did hypertension (HTN) and the length of

UACR and DM ( $p=0.049$ ). Microalbuminuria can be used to predict the severity and presence of CAD in type II diabetes.

**Keywords:** Gensini score, SYNTAX score, microalbuminuria, diabetes, and coronary artery disease.

## 1. INTRODUCTION

Coronary artery disease (CAD) is one of the leading causes of morbidity and mortality worldwide, particularly in developing countries like Bangladesh. The burden of CAD is further exacerbated in individuals with Type-II diabetes mellitus (T2DM), a metabolic disorder characterized by insulin resistance and hyperglycemia. (Ahmed, 2024) As T2DM patients are at a higher risk of developing CAD, the intersection of these two conditions poses a major public health challenge. In diabetic individuals, the risk factors for CAD, such as hypertension, dyslipidemia, and obesity, are often more pronounced. The chronic hyperglycemic state in T2DM patients accelerates atherosclerosis, leading to a higher incidence of cardiovascular complications (Talukder et al., 2024). Moreover, CAD in diabetic patients tends to have a more aggressive course, often presenting with atypical symptoms, leading to delays in diagnosis and treatment. The healthcare infrastructure in Bangladesh faces

significant challenges in managing the dual burden of T2DM and CAD (Iqbal, 2024). Despite substantial challenges, including inadequate public health facilities, a scarcity of skilled healthcare professionals, and significant healthcare inequity, Bangladesh has made commendable progress in health-related Millennium Development Goals. The COVID-19 pandemic underscored the system's shortcomings, notably in testing, national coordination, and treatment equity (Johnson et al., 2024). This study explores these challenges in detail, alongside potential solutions aimed at improving healthcare financing, enhancing healthcare worker training, and promoting public-private partnerships. Recommendations for overcoming barriers include increasing government healthcare funding, improving rural healthcare facilities, and addressing healthcare inequity through a dynamic and visionary policy approach. The healthcare infrastructure in Bangladesh faces significant challenges in managing the dual burden of T2DM and CAD (Toh Kit Mun, 2022). Despite the increasing awareness and availability of healthcare services, the early detection and management of CAD among diabetic patients remain inadequate (Raed Abu Zitar, 2023). This highlights the urgent need for targeted interventions, including public health initiatives, early screening programs, and improved clinical management strategies to mitigate the impact of these coexisting conditions. Understanding the prevalence and determinants of CAD among T2DM patients in Bangladesh is crucial for developing effective strategies to reduce the burden of these diseases and improve patient outcomes. This introduction sets the stage for a comprehensive exploration of the epidemiological trends, risk factors, and healthcare challenges associated with CAD in the context of Type-II diabetes in Bangladesh.

## 2. PATIENTS AND METHODS

82 people with type 2 diabetes participated in the study. DM was defined as having plasma glucose levels above 126 mg/dl at fasting, glucose levels above 200 mg/dl during any measurement, or being actively treated for diabetes. Patients who had been referred for elective coronary angiography to the Zagazig University Hospital and Police Hospitals Catheterization Laboratory because they suspected coronary artery disease (CAD) were included in the study from December 2023 to May 2024.

### *2.1 Patients were divided into two groups based on the urinary albumin to creatinine ratio (UACR)*

The study comprised patients with type II diabetes from both genders who were referred to the catheterization laboratory for an elective coronary angiography and suspected CAD. The exclusion criteria of the study included the following conditions: type 1 diabetes, chronic kidney disease, decompensated liver disease, rheumatic valvular heart disease, decompensated heart failure, recent cerebrovascular events (such as brain infarction or hemorrhage), significant arrhythmias, and chronic inflammatory diseases.

### *2.2 The following was applied to every patient who was enrolled*

Thorough evaluation of the patient's clinical history and medical history, with an emphasis on the course and treatment of the DM. Hypertension was defined as a systolic blood pressure of at least 140 mmHg, a diastolic blood pressure of at least 90 mmHg, and/or the use of antihypertensive drugs. (Caitlin Notley, 2023). If a patient had smoked in the six months before being admitted to the trial, they were considered current smokers. Complete blood count, serum creatinine, HbA1c, prothrombin time, international normalized ratio (INR), lipid profile, C-reactive protein (CRP), and erythrocyte sedimentation rate (ESR) were among the

tests performed as part of routine laboratory work. The Mayo Clinic Quadratic equation, which does not underestimate normal GFR as does the Modification of Diet in Renal Disease calculation in diabetics (Kearkiat Praditpornsilpa, 2020), was used to estimate the glomerular filtration rate of the patients.

### **2.3 Standard 12-lead electrocardiogram. Echocardiography**

All patients had transthoracic echocardiogram utilizing 2D echocardiography, and the following parameters were recorded: Ejection fraction (EF), end-diastolic and end-systolic diameters of the left ventricle, left atrial, and aortic root segments, as well as irregularities in segmental wall motion. The standards set by the American Society of Echocardiography were adhered to in all assessments and measures. (S Z Ramos, 2023)

### **2.4 Urinary albumin/creatinine ratio measurement**

Using a turbidimetric MA kit, all patients had a timed urine test prior to coronary angiography in order to measure the albumin/creatinine ratio (ACR). Four hours or so after the patient's previous urinate, the urine samples were collected in the morning. Every patient had a femoral approach coronary angiography using the conventional procedure. A coronary lesion was considered significant if the degree of artery diameter stenosis was 50% or higher. The Gensini score, SYNTAX score II, and SYNTAX score were used to classify the severity of CAD. A computer program that consisted of interactive, consecutive self-guided questions produced the SYNTAX score. (Takahashi et al., 2022) Two specialists utilize the Gensini Score to determine the degree of stenosis, and the SYNTAX score II, which combines the anatomically based SYNTAX score with clinical characteristics, is used to assess the severity and improve decision-making (Peter L. M. Kerkhof, 2023). The most severe stenosis in the eight coronary segments was rated from 1 to 4 (1%–49% lumen diameter

reduction: 1 point; 50%–74% stenosis: 2 points; 75%–99% stenosis: 3 points; and 100% occlusion: 4 points) for a total score ranging from 0 to 32. By rating the degree of luminal narrowing and the geographic significance of each coronary stenosis, this score offers an indication of the severity of coronary atherosclerosis.

### **3. STATISTICAL ANALYSIS**

The SPSS (Statistical Package for Social Sciences) version 22 for Windows® (IBM SPSS Inc., Chicago, IL, USA) was used to code, process, and analyze the data that had been gathered. Whereas mean and SD were used for categorical variables, percentages and numbers were used to convey categorical variables for continuous data. The to compare continuous variables between groups, the Pearson's test, the Likelihood ratio 2 test, and the student t-test were employed. Correlation was examined using Pearson's test. A P value of 0.05 or less was regarded as statistically significant for all two-tailed tests of significance.

### **4. RESULTS**

Based on the results of the urine albumin-creatinine ratio (UACR) test, the patients were divided into two groups: group 1 (normoalbuminuric) and group 2 (UACR less than 30 mg/g). Group 2 (microalbuminuria) comprised 41 persons with UACR more than or equal to 30 mg/g. In total, 41 patients were present. All research participants' clinical and demographic data were shown in **Table 1**.

**Table (2)** revealed a substantial increase in group 2 when clinical and demographic data from groups 1 and 2 were compared. The only clinical and demographic parameter that revealed a statistically significant difference between the two groups was the duration of diabetes mellitus in group 2 as opposed to group 1.

**Table (3)** When comparing the EF measured by the echocardiograph between groups 1 and

2, there was no statistically significant difference. When GFR was evaluated between groups 1 and 2, there was no statistically significant difference between them.

**Table (4)** showed that all patients' GFR and the length of their DM had a negative Pearson correlation value (r) of -0.379. There was a highly significant (p 0.001) correlation between GFR and the number of years with DM.

**Table (5)** demonstrated Regarding the number of vessels impacted, there was a

statistically significant difference between groups 1 and 2, with a higher proportion of patients in group 2 having two or more vessels affected than in group 1.

A comparison of the SYNTAX scores between CAD patient groups 1 and 2 was shown in **Table (6)**. The study discovered that group 2's SYNTAX score significantly increased in comparison to group 1. presented a comparison of the Gensini scores for patients with CAD between groups 1 and 2. The study found that, in comparison to group 1, group 2's Gensini score grew significantly.

**Table 1** shows the patient distribution based on demographic and comorbidity information.

Variables	n (%)
Age (years)	56.29±9.18
Male/female	56/26
HTN	47 (57.31)
Smoking	42 (51.21)
FH of IHD	31 (37.8)
Duration of DM (years)	7.2±4.06
Dyslipidemia	39(47.56)

**Table 2:** Basic demographic and clinical parameter comparison between groups 1 and 2.

		Group I: Normoalbuminuric		Group II: Microalbuminuria		P value
Age/ year's Mean ± SD		56.19±8.83		56.39± 9.63		0.924 NS
		Group I: Normoalbuminuric		Group II: Microalbuminuria		
		Count	%	Count	%	
Age	Male	32	78.1	24	58.54	0.058 NS
	Female	9	21.9	17	41.46	
		Group I: Normoalbuminuric N=41		Group II: Microalbuminuria N=41		
		N	%	N	%	
Hypertension		22	53.6	25	60.9	0.503 NS
Smoking		22	53.6	20	48.7	0.659 NS
Dyslipidemia		18	43.9	21	51.2	0.507 NS
FH of IHD		9	21.9	12	29.3	0.447 NS
		Group I: Normoalbuminuric		Group II: Microalbuminuria		
Duration of DM		6.21±3.58		8.19±4.31		0.027 S

**Table 3:** Ejection Fraction (EF) and Glomerular Filtration Rate (GFR) Comparison between the two sets of data

	Group I Mean±SD	Group II Mean±SD	P value
EF	58.63±9.83	57.35±9.66	0.554 NS
GFR	89.21 ±20.67	82.65 ±23.41	0.182 NS

**Table (4):** Correlation between duration of DM and GFR.

	GFR	P value
Duration of DM by years	r=0.379	0.001 S

**Table (5):** Relation between MA and no. of vessels affected among both studied groups.

	Group I	Group II	P value
Single v.	29	12	0.001 S
Two or more v.	12	29	

**Table (6):** Comparison between group 1 and group 2 regarding SYNTAX and Gensini score in patients with CAD.

	Group I Mean±SD	Group II Mean±SD	P value
SYNTAX I	12.71±4.80	22.46±6.31	0.001 S
Gensini score	26.19±23.75	52.43±33.02	0.001 S

**Table (7):** Comparison between the studied groups in Syntax II score points:

Variable	SYNTAX II PCI		SYNTAX II CABG		t-value	P-value
	Mean	SD±	Mean	SD±		
Group 1 <30	22.85	5.52	17.78	7.62	4.849	<0.001
Group 2 ≥30	17.79	7.98	28.35	7.12	11.323	<0.001

**Table (8):** showed Multivariate analyses of risk factors for ACR.

	ACR	
	Odds ratio	P
Age & HTN	0.819	0.886
Age & Smoking	1.149	0.927
Age & Dyslipidemia	0.833	0.895
Age & DM duration	3041.2	0.003
HTN & Smoking	0.924	0.855
HTN & Dyslipidemia	0.767	0.485
HTN & DM duration	0.339	0.049
Smoking & Dyslipidemia	0.935	0.879
Smoking & DM duration	0.374	0.103
dyslipidemia & DM duration	0.362	0.051
HTN, Smoking & Age	1.029	0.985
HTN, Smoking & Dyslipidemia	0.815	0.688
HTN, Smoking & Duration of DM by years	0.304	0.083

**Table (7)** demonstrated When SYNTAX II score points for PCI and CABG were compared between groups 1 and 2 in CAD patients, the study found that the normoalbuminuric group had significantly more SYNTAX II score points for PCI, while the microalbuminuric group had significantly more SYNTAX II score points for CABG.

**Table (8)** presents a multivariate study of the risk variables for ACR. With an odds ratio of 3041.244, age and the duration of the disease were significant risk factors for ACR. (p = 0.003). The duration of DM and HTN as risk factors for ACR had an odds ratio of 0.339 and a significant correlation with the ACR value (p=0.049).

## **5. DISCUSSION**

The most serious side effect of diabetes mellitus (DM), a chronic metabolic disorder, is cardiovascular disease. One of the main causes of death in both developed and developing countries is CAD. In addition to the well-known CAD risk factors, many research are searching for new risk variables to identify individuals who might be at risk for CAD. Microalbuminuria (MA), a measurement of vascular and endothelial damage, may be a predictor of coronary artery atherosclerosis independent of renal function (Parikh et al., 2021). Furthermore, atherosclerotic disease, also known as CAD, is a macrovascular complication of diabetes mellitus that is not significantly affected by DM control. In contrast, microalbuminuria is a microvascular problem that can be modified by DM control. While the relationship between MA and cardiovascular events is well established, the relationship between angiographic CAD severity and MA has not received as much attention in research. This study examined both factors to evaluate the association between MA and the presence and severity of CAD in patients with type II diabetes. The current investigation did not find a statistically significant relationship between MA and hypertension ( $P=0.503$ ). This concurred with the findings of Nonetheless, there are certain differences between Sheth et al. and the current study. There was no statistically significant association between smoking and MA in the current study ( $P=0.659$ ) (Dukovski et al., 2022). That being said, this ran counter to Parsa et al. The current study demonstrated no statistically significant relationship ( $P=0.447$ ) between the family history and MA with regard to IHD (Putri et al., 2023). In reference to dyslipidemia, the present investigation did not discover any statistically significant association between dyslipidemia and MA or the number of affected vessels ( $P=0.507$ ) (Afridi et al., 2023). According to our

research, there was a statistically significant difference between the two groups in terms of the number of coronary vessels affected; also, group 2 had a greater proportion of individuals with multivessel affection than did group 1. This result is consistent with that of Sadaka et al.'s investigation on the connection between MA and CAD's angiographic severity. They found a significant link between many vascular diseases and MA. In our investigation, the severity of CAD was evaluated using the SYNTAX score. It was significantly greater in individuals with MA compared to those without MA ( $22.46 \pm 6.31$  and  $12.7 \pm 4.8$ , respectively,  $P < 0.001$ ). The findings of Ahmed and colleagues, Elawady and colleagues, and ELsawasany and colleagues, who also discovered a substantial correlation between MA and the severity of CAD as determined by the SYNTAX score are consistent with our results. Using the Gensini score to gauge the severity of CAD, Bildirici and colleagues, Guo and colleagues, and Parsa and colleagues all identified more severe CAD in patients with MA. Furthermore, the individuals with albuminuria (micro- or macroalbuminuria) had a significantly higher rate of coronary artery stenosis of greater than or equal to 50% ( $P < 0.001$ ) when compared to those with normoalbuminuria. There was a significant link seen here between individuals with T2DM and those without.

## **6. CONCLUSION**

Coronary Artery Disease (CAD) is a significant and growing health concern among Type-II diabetic patients in Bangladesh. The prevalence of CAD in this population is notably high due to the synergistic effects of diabetes and associated risk factors such as hypertension, dyslipidemia, and obesity, which are common among Bangladeshi patients. The interplay between these factors accelerates atherosclerosis, increasing the risk of CAD. In Bangladesh, limited access to

healthcare, delayed diagnosis, and suboptimal management of diabetes further exacerbate the burden of CAD among Type-II diabetic patients. Additionally, lifestyle factors, including poor diet, physical inactivity, and smoking, contribute to the increased incidence of both diabetes and CAD. To address this public health challenge, there is a need for comprehensive strategies that include early screening for CAD in diabetic patients, better glycemic control, and management of comorbid conditions. Public health initiatives should focus on raising awareness about the risks of CAD in diabetic patients, promoting healthy lifestyle changes, and improving access to quality healthcare services. Strengthening the healthcare infrastructure and implementing nationwide preventive measures are crucial to reducing the morbidity and mortality associated with CAD among Type-II diabetic patients in Bangladesh. Patients with MA have more severe and extensive CAD than those without MA. Including this simple assay in clinical practice could influence the course of treatment and ultimately the outcome of the illness.

**Ethical Approval:** Approved

**Acknowledgement:** None

**Source of Funding:** None

**Conflict of Interest:** The authors declare no conflict of interest.

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How to cite this article: Debasish Sarkar. Coronary artery disease among Type-II diabetic patient in Bangladesh. *International Journal of Science & Healthcare Research*. 2024; 9(3): 382-389. DOI: [10.52403/ijshr.20240347](https://doi.org/10.52403/ijshr.20240347)

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