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Prevalence of Macrovascular Complications among Diabetic Patients at a Tertiary Care Hospital in Bangladesh

Md. Rezaul Alam[1*], Ferdous Jahan[1], Muhammad Nazrul Islam[2], Syed Fazlul Islam[1], Md Kabir Hossain[1], Rana Mokarram Hossain[2], Md. Masudul karim[3], Md Mizanur Rahman Khan[4], A.K.M Shahidur Rahman[3]

[1]Associate Professor, Department of Nephrology, Bangladesh Medical University (BMU), Dhaka, Bangladesh
[2]Professor, Department of Nephrology, Bangladesh Medical University (BMU), Dhaka, Bangladesh
[3]Medical Officer, Department of Nephrology, Bangladesh Medical University (BMU), Dhaka, Bangladesh
[4]Associate Professor, Department of Medicine, Bangladesh Medical University (BMU), Dhaka, Bangladesh

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***Corresponding author:** Dr. Md. Rezaul Alam
Associate Professor, Department of Nephrology, Bangladesh Medical University (BMU), Dhaka, Bangladesh.
Email: nipponreza@gmail.com

Abstract | **Original Research Article**

***Background*:** Macrovascular complications such as coronary artery disease, stroke, and peripheral arterial disease are major causes of illness and death in patients with diabetes mellitus (DM). These complications are often overlooked in nephrology settings, where patients commonly have overlapping conditions like chronic kidney disease (CKD). ***Aim*:** To determine the prevalence of macrovascular complications among patients with type 2 diabetes mellitus. ***Method*:** This hospital-based cross-sectional study was conducted at Bangladesh Medical University (BMU), Dhaka, involving 283 adult patients with type 2 diabetes mellitus (T2DM). Participants were recruited consecutively from Outpatient Department of Nephrology, BMU. Data were collected through interviews, medical record reviews, and from recent laboratory results. Macrovascular complications- including coronary artery disease (CAD), myocardial infarction (MI), angina, stroke, and peripheral vascular disease (PVD) were assessed accordingly. Data were analyzed and compared by statistical tests. ***Results*:** Out of 283 patients with type 2 diabetes mellitus, 55.8% had at least one macrovascular complication. Coronary artery disease (31.8%) was the most prevalent, followed by myocardial infarction (19.4%), angina (16.3%), peripheral vascular disease (13.4%), acute coronary syndrome (5.7%), and stroke (12.7%). Most patients were middle-aged (mean age 55.7 ± 10.03 years), male (64%), and had a diabetes duration of less than 10 years (57.6%). Hypertension was common (70.7%) and significantly associated with macrovascular complications ($p=0.028$). Biochemically, patients with complications had higher mean serum creatinine (3.67 mg/dL) and lower eGFR (22.69 mL/min/1.73 m²), both showing strong statistical significance ($p=0.001$ and $p<0.001$, respectively). CKD stage was also significantly associated ($p<0.001$), with more complications observed in advanced stages. Lipid abnormalities and glycemic status- glycated hemoglobin (HbA1c) and fasting blood sugar (FBS) were elevated overall but did not differ significantly between groups with and without complications. No significant associations were found with sex, socioeconomic status, body mass index (BMI), family history of diabetes, or lipid levels. ***Conclusion*:** Macrovascular complications are highly prevalent among type 2 diabetes patients, with coronary artery disease and myocardial infarction being most common. Older age, longer diabetes duration, hypertension, impaired renal function, and advanced CKD stage were significantly associated with these complications. These findings highlight the need for routine cardiovascular screening and integrated management strategies in diabetic patients, especially those with renal involvement.

Keywords: Diabetes Mellitus (DM); Macrovascular Complications; Coronary Artery Disease (CAD); Myocardial Infarction; Stroke; Peripheral Vascular Disease (PVD); Chronic Kidney Disease (CKD).

1. INTRODUCTION

Diabetes mellitus (DM) is a growing global epidemic, with an increasing number of individuals developing both microvascular and macrovascular complications [1]. Although, microvascular outcomes of DM such as nephropathy, neuropathy, and retinopathy are well documented, macrovascular complications- including coronary artery disease (CAD), stroke, and peripheral vascular disease (PVD)- remain the leading causes of morbidity and mortality in diabetic populations [2]. These complications often progress silently and are frequently underdiagnosed, especially in settings where

renal disease coexists. Macrovascular complications in diabetes arise primarily from accelerated atherosclerosis, driven by chronic hyperglycemia, insulin resistance, oxidative stress, hypertension, and lipid abnormalities [3, 4]. Diabetic patients are at significantly increased risk-two to four times higher for cardiovascular events compared to non-diabetic individuals [2]. In diabetic nephropathy patients, this risk is further compounded by impaired renal clearance, volume overload, and inflammatory processes [4]. In a large cohort study from Saudi Arabia, reported that among 184 diabetic nephropathy patients, 57.6% had angiography-proven CAD, 14.6% had myocardial infarction (MI), and 65.7% had PVD. Similarly, stroke was present in 11.4% of patients, and angina in 47.2%, highlighting the high burden of cardiovascular complications in patients already under nephrology care [4]. Similar rates of overall macrovascular complications (29.5%) in which PVD (11.6%), CAD (14.4%), and cerebrovascular disease (CVD) (3.5%) were identified in a research conducted at the United Arab Emirates (UAE) [5]. Another study reported overall 25.4% of Yemeni patients with type 2 diabetes had macrovascular complications: of them 5.8% was diagnosed as CVD, 9.1% showed evidence of PVD, and 17.8% had a history of CAD [6]. In South Asia, macrovascular complications were in 26% of a type 2 diabetes mellitus (T2DM) outpatient cohort, with risk significantly associated with age and longer disease duration [3]. Their findings also pointed out that male patients had higher rates of CAD and diabetic foot, suggesting possible gender disparities in disease expression and access to care [3]. Renal impairment, assessed by estimated glomerular filtration rate (eGFR) and serum creatinine, is independently associated with cardiovascular morbidity in T2DM patients [7]. Declining renal function not only reflects vascular damage but also contributes to a higher cardiovascular load due to fluid retention and hypertension [4, 8]. Chronic kidney disease (CKD) stages are increasingly used to stratify cardiovascular risk in diabetic patients [2]. Despite this knowledge, macrovascular complications are often under-recognized in diabetic patients attending nephrology clinics, where focus is typically centered on renal outcomes. As many of these patients already have overlapping risk factors, such as hypertension and dyslipidemia, the nephrology setting presents a critical opportunity for early identification and integrated management of cardiovascular risk. This study was aimed to determine the prevalence of macrovascular complications among T2DM patients attending at nephrology outpatient department in a tertiary care hospital, Bangladesh. Additionally, it examines key clinical and biochemical risk factors associated with these complications, to inform more comprehensive and targeted care strategies for high-risk diabetic population.

2. METHODS

This hospital-based cross-sectional study was conducted at the Department of Nephrology. Bangladesh Medical University (BMU), Dhaka, Bangladesh over one year. A total of 283 adult patients (181 males and 102 females), age 20 years or older with a confirmed diagnosis of type 2 diabetes mellitus (T2DM), were enrolled using consecutive sampling technique from Outpatient Department of Nephrology, BMU. Patients with acute kidney injury, non-diabetic renal disease, or incomplete clinical data were excluded.

Data were collected through face-to-face interviews using a pre-structured questionnaire, along with reviews of medical records and recent laboratory investigations. Collected variables included demographic characteristics (age, gender, BMI), age at diabetes onset, duration of disease, comorbid conditions such as hypertension, and biochemical parameters including- glycated hemoglobin (HbA1c), lipid profile [total cholesterol (TC), low-density lipoprotein (LDL) cholesterol, triglyceride (TG) and high-density lipoprotein (HDL) cholesterol], serum creatinine, and 24-hour urinary protein (UTP). Chronic kidney disease (CKD) was staged using estimated glomerular filtration rate (eGFR) derived from serum creatinine values. Macrovascular complications assessed in this study included coronary artery disease (CAD), myocardial infarction (MI), acute coronary syndrome (ACS), angina, stroke, and peripheral vascular disease (PVD), based on clinical history, diagnostic reports, and physician assessment. Data were compiled and analyzed using a software- statistical package for social sciences (SPSS) version 27.

3. RESULTS

Table-1 shows that most patients (63.3%) were between 41 and 60 years old, with a mean age of 55.7 ± 10.03 years, indicating that middle-aged adults form the bulk of the cohort. Males comprised 64.0% of the participants, resulting in a male-to-female ratio of 1.8:1. Over half of the patients (57.6%) had diabetes for less than 10 years, and 44.9% had a family history of diabetes. Hypertension was common, affecting 70.7% of the patients. In terms of nutritional status, 65.7% had normal BMI, while 27.9% were overweight, and a small proportion were either underweight (4.2%) or obese (2.1%) (Table- 1).

Table- 1: Baseline characteristics of the diabetic patients attending at the nephrology outpatient department (N= 283)

Variables	Frequency (n)	Percentage (%)
Age group (years)		
<40	16	5.7
41-60	179	63.3
>60	88	31.1
Mean±SD age (years)	55.7±10.03	
Sex		
Male	181	64.0
Female	102	36.0
Male: Female ratio	1.8: 1	
Duration of diabetes (years)		
<10	163	57.6
10-20	105	37.1
>20	15	5.3
Mean±SD	10.5±6.08	
Family history of DM	127	44.9
Hypertension	200	70.7
BMI (kg/m^2)		
Underweight	12	4.2
Normal weight	186	65.7
Overweight	79	27.9
Obese	6	2.1

Table-2 shows that patients had poor metabolic control, with elevated mean fasting blood sugar (8.24 mmol/L) and HbA1c (7.25%), indicating suboptimal glycemic management. The lipid profile reflects dyslipidemia, with raised mean levels of total cholesterol (169.81 mg/dL), LDL (116.16 mg/dL), and triglycerides (187.96 mg/dL), and relatively low HDL (44.20 mg/dL), all of which are known risk factors for macrovascular complications. The mean serum creatinine was 3.31±2.14 mg/dL, and mean eGFR was 26.03±14.64 mL/min/1.73 m², indicating moderate to severe kidney impairment. Average BMI was 23.49±3.06 kg/m², suggesting most patients were within normal to overweight range (Table- 2).

Table- 2: Biochemical and clinical profile of the diabetic patients (N= 283)

Variables	Mean±SD	Range (minimum – maximum)
24h UTP (gm/day)	4.90±21.05	0.6-8.0
Serum TC (mg/dl)	169.81±55.18	103.0-320.0
Serum LDL (mg/dl)	116.16±47.31	108.0-288.0
Serum HDL (mg/dl)	44.20±30.37	33.0-55.0
Serum TG (mg/dl)	187.96±99.98	110.3-777.0
FBS (mmol/L)	8.24±3.62	5.3-26.7
HBA1c (%)	7.25±1.72	5.0-17.0
Serum creatinine (mg/dL)	3.31±2.14	1.2-13.0
BMI (kg/m^2)	23.49±3.06	16.2-36.9
eGFR (mL/min/1.73 m²)	26.03±14.64	13.3-69.1

It was observed that, 55.8% of the diabetic patients had at least one macrovascular complication. Coronary artery disease (CAD) was the most prevalent (31.8%), followed by myocardial infarction (19.4%) and angina (16.3%), indicating a high burden of cardiac involvement. Other notable complications included stroke (12.7%) and peripheral vascular disease (PVD) (13.4%) (Table- 3).

Table- 3: Prevalence of macrovascular complications among diabetic patients (N= 283)

Variables*	Frequency (n)	Percentage (%)
CAD	90	31.8
MI	55	19.4
ACS	16	5.7
Angina	46	16.3
Stroke	36	12.7
PVD	38	13.4
Overall macrovascular complications	158	55.8

*Multiple response

We observed the association of macrovascular complications with clinical and demographic factors among study patients. Analysis showed that, macrovascular complications were significantly associated with older age (p= 0.003), longer duration of diabetes (p= 0.023), presence of hypertension (p= 0.028), lower eGFR (p<0.001), and higher serum creatinine (p= 0.001), 24h UTP (p= 0.26), serum TC (p= 0.23) levels. CKD stages also showed a strong association, with advanced kidney disease more common among those with complications (p<0.001). No significant associations were found with sex, socioeconomic status, BMI, lipid profile, or glycemic markers (Table- 4).

Table- 4: Association of macrovascular complications with clinical and demographic factors among diabetic patients (N= 283)

Variables	Macrovascular complications				p- value
	Present (n=158)		Absent (n=125)		
	n.	%	n.	%	
Age group (years)					
<40	5	3.2%	11	8.8%	*0.003[s]
41-60	92	58.2%	87	69.6%	
>60	61	38.6%	27	21.6%	
Sex					
Male	104	65.8%	77	61.6%	*0.462
Female	54	34.2%	48	38.4%	
Duration of diabetes (years)					
<10	80	50.6%	83	66.4%	*0.023[s]
10-20	67	42.4%	38	30.4%	
>20	11	7.0%	4	3.2%	
Mean±SD					
Family history of DM	72	45.6%	55	44.0%	*0.792
Hypertension	120	75.9%	80	64.0%	*0.028[s]
BMI (kg/m^2)					
Underweight	6	3.8%	6	4.8%	*0.071
Normal weight	114	72.2%	72	57.6%	
Overweight	36	22.8%	43	34.4%	
Obese	2	1.3%	4	3.2%	
CKD stages (by eGFR)	1	0.6%	6	4.8%	
60-89 (Stage II)	39	24.7%	54	43.2%	*<0.001[s]
30-59 (Stage III)	68	43.0%	43	34.4%	
15-29 (Stage IV)	50	31.6%	22	17.6%	
<15 (Stage V)	158	100.0%	125	100.0%	
24h UTP (gm/day)	5.23±35.26		3.63±3.07		**0.262
Serum TC (mg/dl)	174.40±49.74		166.34±58.89		**0.232
Serum LDL (mg/dl)	118.76±38.51		114.49±52.32		**0.566
Serum HDL (mg/dl)	44.12±33.08		44.35±24.84		**0.966
Serum TG (mg/dl)	192.01±87.06		185.01±108.61		**0.574
FBS (mmol/L)	8.62±3.69		8.22±3.53		**0.930
HBA1c (%)	7.21±1.72		7.29±1.73		**0.701
Serum creatinine (mg/dL)	3.67±2.18		2.85±2.02		**0.001[s]
eGFR (mL/min/1.73 m^2)	22.69±13.35		30.25±15.15		**<0.001[s]

p-value obtained by *Chi-square test and **Unpaired t-test, s= significant

4. DISCUSSION

Diabetes mellitus (DM) is associated with several vascular complications. These are either microvascular like- retinopathy, nephropathy, and neuropathy or macrovascular such as- peripheral vascular disease (PVD), coronary artery disease (CAD), and cerebrovascular disease (CVD) [9]. Macrovascular complications in diabetes mellitus (DM) occur as a result of damage to the large blood vessels; this condition affects the large blood vessels, such as the aorta, the coronary arteries, and the major arteries in the brain and limbs [10, 11]. Atherosclerotic alterations and the emergence of macrovascular complications are accelerated by the ensuing prothrombotic state and rise in inflammatory mediators [12]. Patients with diabetes who have macrovascular complications are thought to have a two to four times higher chance of developing peripheral vascular disease (PVD), cerebrovascular disease (CVD), and coronary artery disease (CAD) [13].

The present study highlights a substantial burden of macrovascular complications among patients with type 2 diabetes mellitus (T2DM) attending at nephrology outpatient department in a tertiary care setting. Most participants (63.3%) were middle-aged (41–60 years), with a mean age of 55.7 ± 10.03 years, consistent with regional data showing that diabetes predominantly affects individuals in their fifth and sixth decades of life [14]. A similar age distribution was reported in a related study, found over 70% of T2DM patients aged above 55 years [15]. This age pattern reflects the typical onset of vascular complications, which tend to appear after years of metabolic dysfunction. A male predominance was noted in the current study (64%), comparable to other studies showing higher healthcare access or disease reporting among males in similar settings [3, 16, 17].

In this study, just over half of the cohort (57.6%) had been diagnosed with diabetes for less than 10 years. This duration is shorter than that observed (19.5 years) in a previous study [4]; aligns with averages reported across South Asian populations, suggesting early onset and rapid progression to complications in this region [18]. Hypertension was present in 70.7% of the cohort, a well-established comorbidity in diabetes, although it was slightly lower (97%) than a related study [4]. Regarding BMI, in this cohort most patients were within the normal (65.7%) or overweight (27.9%) categories. This contrasts with a study in Bangladesh where patients with macrovascular complications had significantly higher BMI levels (mean 31.5 ± 3.7 kg/m²), possibly due to differences in referral bias or population-level lifestyle factors [17].

Biochemically, the cohort exhibited poor metabolic control. Mean fasting blood sugar (8.24 ± 3.62 mmol/L) and HbA1c (7.25 ± 1.72%) were elevated, consistent with related nephropathy cohort, which had a mean HbA1c of 9.2%, indicating poor glycemic control- a well-known risk factor for macrovascular events [4]. Dyslipidemia was prevalent, with elevated triglycerides (187.96 mg/dL) and LDL (116.16 mg/dL), and low HDL (44.20 mg/dL). These values align with findings of a previous study, which reported similar lipid trends in patients with cardiovascular complications [15]. Renal impairment was marked, with mean serum creatinine level of 3.31 ± 2.14 mg/dL and mean estimated glomerular filtration rate (eGFR) of 26.03 ± 14.64 mL/min/1.73 m², indicating advanced CKD. Comparable values were reported in a recent study, that emphasized the predictive role of reduced eGFR in cardiovascular risk [19].

Macrovascular complications were present in 55.8% of patients, with CAD being most frequent (31.8%), followed by MI (19.4%), angina (16.3%), PVD (13.4%), and stroke (12.7%). These rates were comparable to a couple of similar studies [4, 20]. The high burden observed supports the notion that nephrology patients with diabetes represent a high-risk cardiovascular subgroup. Data analysis revealed that. significant associations were existed between macrovascular complications and older age ($p = 0.003$), longer diabetes duration ($p = 0.023$), hypertension ($p = 0.028$), and advanced CKD ($p < 0.001$). Renal markers were notably impaired in those with complications, as shown by elevated serum creatinine level (3.67 mg/dL) and reduced eGFR (22.69 mL/min/1.73 m²), reinforcing findings from a related study, which identified eGFR as an independent predictor of cardiovascular events [21]. These associations highlight the cumulative vascular burden from prolonged metabolic disease and kidney dysfunction. Conversely, variables such as sex, socioeconomic status, BMI, lipid profile, fasting blood sugar, and HbA1c were not significantly associated with macrovascular events. While this partially contrasts with findings from one previous study, where dyslipidemia showed a strong association [3], it aligns with data from the UAE suggesting that traditional glycemic markers do not consistently predict cardiovascular outcomes in late-stage diabetic patients [5].

Overall, the findings of this current study highlighted that in patients with type 2 diabetes mellitus, particularly those with coexisting renal impairment, macrovascular complications are strongly influenced by non-glycemic factors such as advancing age, hypertension, longer disease duration, and reduced kidney function. Traditional metabolic markers like HbA1c and lipid levels, while elevated, did not show significant associations with cardiovascular outcomes in this cohort. These findings suggested that in advanced diabetic population managed in nephrology settings, vascular risk may be more closely linked to cumulative end-organ damage and systemic hemodynamic stress rather than isolated glycemic parameters. These insights

emphasize the need for comprehensive risk assessment models that integrate renal function and cardiovascular status into routine diabetic care, especially for high-risk patients at tertiary settings.

5. CONCLUSION

This study reveals a substantial burden of macrovascular complications in diabetic patients attending at nephrology outpatient department, underscoring the cardiovascular risks in this high-risk group. The significant associations with age, duration of diabetes, hypertension, and deteriorating renal function emphasize the intertwined progression of vascular and renal disease. Despite elevated glycemic and lipid values, these were not statistically linked to macrovascular events, suggesting that traditional cardiovascular risk factors and kidney function markers may play a more dominant role in this population. Proactive screening and early multidisciplinary intervention are essential to reduce complications and improve outcomes.

Limitations of the study

The current study had several limitations. It was a single center study having cross-sectional design and the sample size was relatively small. The study was unable to perform a long-term follow up. Therefore, the findings cannot be applied to the entire population.

Competing interests

All author declare that they have no competing interests.

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