Profile of Chronic Complications of Type 2 Diabetes Mellitus

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Abstract

Introduction

Diabetes mellitus as a leading global health problem is one of the important non communicable diseases with considerable morbidity and complications. Diabetes mellitus is a heterogeneous group of diseases, characterized by a state of chronic hyperglycemia, resulting from a diversity of aetiologies both environmental and genetic, which leads over time to serious damage to the heart, blood vessels, eyes, kidneys and nerves. It is also a known risk factor for blindness, vascular brain diseases, renal failure, and limb amputations. Type 2 diabetes encompasses individuals who have insulin resistance (IR) and usually relative (rather than absolute) insulin deficiency. [1]About 422 million people worldwide have diabetes, the majority living in low-and middle-income countries, and 1.6 million deaths are directly attributed to diabetes each year.[2] According to World Health Organization (WHO) reports, India tops the world in the number of diabetic subjects.[3] The prevalence of diabetes mellitus in India is 8.9% in the (20-79) years age group and around 77 million are affected with diabetes mellitus and are expected to cross 123.5 million by 2040.[4]

The average age of onset of Type 2 DM is 42.5 years. Nearly one million Indians die due to diabetes every year. According to the Indian Heart Association, a study by the American Diabetes Association reports that India will see the greatest increase in people diagnosed with diabetes mellitus by 2030.[5]

Diabetes mellitus is a chronic disease that requires a long term medical attention both to limit the development of its devastating complications and to manage them when they do occur characterized by

asymptomatic phase between actual onset of diabetic hyperglycemia and clinical diagnosis. This phase has been estimated to last at least 4-7 years, and 30-50% cases of type 2 diabetes patients remain undiagnosed.[5] Diabetes mellitus may present with characteristic symptoms such as thirst, polyuria, blurring of vision, and weight loss. In its most severe forms, ketoacidosis or a non-ketotic hyperosmolar state may develop and lead to stupor, coma and, in absence of effective treatment, it may lead to death. Often symptoms are not severe or may be absent, and consequently hyperglycaemia of sufficient degree to cause pathological and functional changes may be present for a long time before the diagnosis is made.

The pathologic hallmark of DM involves the vasculature leading to microvascular, macrovascular and non-vascular complications. Moreover, approximately 193 million diabetics remain undiagnosed worldwide predisposing them to the development of several long term complications of untreated chronic hyperglycemia.[5]

The long-term effects of diabetes mellitus include progressive development of the specific complications of retinopathy with potential blindness, nephropathy that may lead to renal failure, and/or neuropathy with risk of foot ulcers, amputation, and features of autonomic dysfunction, including sexual dysfunction. People with diabetes are at increased risk of cardiovascular, peripheral vascular and cerebrovascular disease.[6]

Since last two decades, one of the leading causes of blindness worldwide and in India is diabetes mellitus.[7] Diabetic retinopathy (DR) is a retinal vascular lesion in patients with diabetic mellitus[8] and the most common ocular complication of diabetes with 5% of diabetics, progressing to severe visual loss.[9] About 50-80% of all individuals with diabetes die of cardiovascular disease. Diabetic patients have 2-3 times higher risk of having myocardial infarction as well as stroke compared to non-diabetics. Cerebrovascular disease and kidney failure are also among the leading causes of death. Also the incidence of gangrene is 5 times higher in diabetics and 50% of all non-traumatic complications are result of diabetes.[10] Chronic complications are the major outcome of T2DM progress, which reduce the quality of life of patients, incur heavy burdens to the health care system, and increase diabetic mortality.[11] Poor glycemic control and duration of diabetes seem to be the strongest risk factors for the development of vascular complications while other factors such as hypertension, dyslipidemia, obesity, smoking, age, and genetic factors also contributes to the development of complications. It is also notable that the incidence of Coronary Artery Disease (CAD) among South Asians is higher when compared to that among Europeans.[12]

Therefore, it is important that such prevalence studies are done from time to time to detect the changing trends in order to plan out the course of action. Even though many such studies have been done in different parts of the country, a comprehensive study on the complications and the risk factors contributing to the complications in diabetic mellitus is scarce in this part of the country. Hence this study was undertaken to evaluate the patients with type 2 Diabetes Mellitus clinically as well as with relevant investigations to see the spectrum of various complications (vascular and non-vascular) of the disease.

Aims and objectives

- To assess the profile of chronic complications in adult patients of Type 2 Diabetes Mellitus.
- To determine the association between the risk factors and the complications in adult patients of Type 2 Diabetes Mellitus

Materials and Methods

Study Design

A hospital based cross sectional analytical study was conducted among the type 2 diabetic mellitus patients who attended/admitted in the Department of Medicine, Regional Institute of Medical Sciences (RIMS), Imphal.

Study Setting

Regional Institute of Medical Sciences, Imphal is situated at Lamphelpat, Imphal, Manipur. It is a 1200+ bedded teaching hospital, equipped with modern state of the art equipment's. The hospital normally provides services to more than 2.4 lakh outpatients and admits over 31 thousand inpatients in a year.

Study Duration

The study was conducted for a period of two years from September 2018 to August 2020.

Study Population

All patients with type 2 diabetes mellitus attending as outpatient and inpatient of Medicine department

Inclusion Criteria

Patients aged 18 years and above with the diagnosis of Type 2 Diabetes Mellitus

Exclusion Criteria

- Patients of type 1 Diabetes Mellitus
- Gestational DM
- Immunocompromised patients like HIV infections/AIDS

- Malignancies
- Patients not willing to participate

Sample Size and Sampling

Assuming the prevalence of complications among the patients with diabetes mellitus as 40.0%[13] with 10% absolute precision at 95% confidence level and 10% non-response rate, the sample size was estimated to be 101 patients with type 2 diabetes mellitus.

$$N = \frac{z^2 \times p \times q}{l^2}$$

where N=sample size

z=z value= 1.96 for 95% confidence level (CI)

p=percentage prevalence of complications =40.0%

q= 100-p=60.0%

l=absolute allowable error=10%

Non response rate =10%

The calculated sample size= 101

All the consecutive patients fulfilling the inclusion criteria were selected based on purposive sampling until the sample size was reached.

Study Procedure

After obtaining permission from the institution ethics committee and informed consent from the participants, the patients were subjected to detailed history and clinical examination with special focus to complications of type-2 diabetes mellitus.

Study Tools and Instruments

- Pre-defined proforma consisting of the following sections
  - Socio demographic characteristics
  - Clinical history
  - Clinical examination findings
  - Laboratory investigations
- Clinical Examination to define peripheral vascular disease (Absence of one or more peripheral pulses in limbs or presence of ulcer or amputation)

- Clinical Examination to define neuropathy (Bilateral absence of ankle jerks and/or Bilateral loss of sensation to touch, pain & temperature & foot ulcers

- Autonomic dysfunction if indicated

- Skin changes like Necrobiosis Diabeticorum

- Investigations

S. No	Investigation		Method
1.	Complete Blood Count		Automatic cell counter, HORIBA MICROS – 60
2.	Kidney Function Test		
	• Serum Urea		Kinetic Method
	• Serum Creatinine		JAFFE's Method
3.	Liver Function Test		
	Total Bilirubin		Jendrassic Method
	SGOT/ AST		UV- Modified IFCC/DGKC
	SGPT/ ALT		UV- Modified IFCC/DGKC
	Total Protein		
	• Albumin		Biuret Method
	• Globulin		BCG Method
4.	Urine Analysis		Manually
5.	24 hours urine protein		ESBACH. S
6.	Blood glucose(Fasting and PP/RBS)		GOD/ PAP method
7.	Lipd profile-	LDL HDL VLDL TG	Enzymatic assay
8.	HbA1c		Enzymatic assay / HPLC
9.	Ultrasound whole abdomen (if indicated)		
10.	CT Scan whole abdomen (If indicated)		
11.	NCCT Brain (if indicated)		
12.	MRI Brain(if indicated)		
13.	ECG (if indicated)		
14.	Fundoscopy/Opthalmoscopy		
15.	Chest Xray PA view		
16.	NCV(If indicated)		

Working Definitions

- **Blood glucose estimation:** Diabetes was diagnosed according to American Diabetic Association (ADA) criteria.

- Fasting blood glucose ≥126 mg /dl

- 2 hour plasma glucose ≥ 200 mg/dl

- Glycosylated Hemoglobin (HbA1c) ≥6.5

- Random blood glucose ≥200 mg/dl with symptoms
- **Glycemic target** [14]

    HbA₁C: less than 7.0%, if they are achievable without significant hypoglycemia

Fasting blood glucose: 3.9 to 7.2 mmol/L (80 to 130 mg/dl)

2-hour postprandial blood glucose: <10 mmol/L (<180 mg/dl)

- **Classification of Hyperlipidemia**

Classification	Cholesterol (mg/dl)	Triglyceride (mg/dl)	HDL-C(mg/dl)	LDL (mg/dl)
Optimal	NA	NA	NA	< 100
Desirable	< 200	< 150	NA	100-129
Borderline high	200-239	150-199	NA	130-159
High	≥ 240	200-499	≥ 60	160-189
Very high	NA	≥ 500	NA	≥ 190
Low	NA	NA	< 40	NA

Patients were also labelled as hyperlipidemic if the patient was already on lipid lowering medication for more than 4-6 weeks.

- **Body Mass Index (BMI) (Asia- Pacific classification)**[15]

    Underweight: BMI < 18.5

    Normal: BMI between 18.5 and 22.9

    Overweight: BMI between 23 and 24.9

    Obese: BMI of 25 and more

- **Neuropathy:** Bilateral absence of ankle jerks and/or Bilateral loss of sensation to touch, pain & temperature & foot ulcers

- **Peripheral vascular disease:** Absence of one or more peripheral pulses in limbs or presence of ulcer or amputation

- **Diabetic nephropathy:**[16] When the serum creatinine >1.4 or creatinine clearance <60 or

urinary protein >300 mg/24 hours or renal parenchymal disease on ultrasound.

Study Variables

Independent/Predictor Variables

- Age in years
- Gender
- BMI (kg/m2)
- Diabetic control (FBS,PPBS and HbA₁C)
- Renal function test
- Liver function test
- Dyslipidemia
- Retinopathy
- Nephropathy
- Neuropathy
- Hypertension
- Cerebro Vascular Accidents/Coronary Artery Disease
- Peripheral vascular diseases

- Autonomic dysfunction
- Skin manifestations

Dependent/ Outcome Variables

- Proportion of the patients with complications (Prevalence of complications)
- Factors associated with complications of diabetes mellitus

Statistical Analysis

Data was entered and analysed using SPSS V21 (IBM Corp., Armonk, NY, United States) for windows. Categorical variables like gender, Body Mass Index (BMI) are expressed as frequency and percentages. Continuous variables like age, HbA_1C are expressed as mean [Standard Deviation (SD)] or median [Inter Quartile Range (IQR)], depending on the type of distribution. Prevalence of complications is expressed as frequency and percentages with 95% Confidence Interval (CI). Chi square test was used to determine the association between two proportions. Independent samples 't' test was used to determine the association between age and complication. A 'p' value of <0.05 was considered statistically significant.

Ethical Issues

Approval was obtained from the Institute Research Ethics Board, Regional Institute of Medical Sciences, Imphal before the commencement of the study (REB ref no -A/206/REB – Comm (SP)/RIMS/2015/421/39/2018). Signed Informed Consent was taken from all the participants. Details of all the participating individuals were kept confidential and privacy was maintained during the study procedure.

Results and Observations

In our study (N=101) duration of diabetes mellitus was≤5 years in 38.6% of the patients followed by 5-10 years in 36.6% of the patients. The mean duration of diabetes mellitus was 7.4 (4.0) years. Duration of more than 10 years was reported by 24.8% of the patients. Nearly half (49.5%) of the patients were under the treatment of oral hypoglycaemic agents alone. (**Table 1**)

Table 1: Clinical profile of the patients with type-2 diabetes mellitus (N=101)

Clinical profile	Frequency (n)	Percentage
Duration of diabetes (years) [Mean (SD)]	7.4 (4.0)	
Duration of diabetes mellitus (years)		
≤5	39	38.6
5-10	37	36.6
>10	25	24.8
Type of treatment		
Oral hypoglycaemic drugs	50	49.5
Insulin	28	27.7
Oral hypoglycaemic drugs + Insulin	20	19.8
Others*	3	3.0

* Life style modifications, no medication

Out of 101 patients the disease was under control in 24.8 %, 7.9% and 13.9% as per HbA1c, fasting blood glucose and post prandial blood glucose respectively (**Table 2**)

Table 2: Distribution of glycaemic control status (N=101)

Control status	Frequency (n)	Percentage
HbA$_1$C% [Mean (SD)]	8.9 (1.9)	
HbA$_1$C%		
Under control (<7.0%)	25	24.8
Not under control (7-9%)	37	36.6
Not under control (>9%)	39	38.6
Fasting blood sugar (mg/dl) [Mean (SD)]	179.3 (49.5)	
Fasting blood sugar (mg/dl)		
Under control (80-130)	8	7.9
Not under control (131-200)	51	50.5
Not under control (>200)	42	41.6
Post prandial blood sugar (mg/dl) [Mean (SD)]	302.9 (88.7)	
Post prandial blood sugar (mg/dl)		
Under control (<180)	14	13.9
Not under control (180 - 200)	54	53.5
Not under control (>200)	33	32.7

When examined in T2DM patients, pallor was found in 26.75% and oedema was present in 3.0% of the patients. Tachycardia and bradycardia was present in 6.9% of the patients each. Stage-1 hypertension was present in 25.7% of the patients and stage-2 hypertension was present in 17.8% of the patients (**Table 3**)

Table 3: General physical examination and vital signs in type 2 diabetes mellitus patients (N=101)

General physical examination and vital signs	Frequency (n)	Percentage
General physical examination		
Normal	71	70.3
Pallor`	27	26.7
Pedal oedema	3	3.0
Pulse rate/min		
<60	7	6.9
60-100	87	86.2
>100	7	6.9
Blood pressure (mmHg)		
Normal	52	51.5
Pre-hypertensive	5	5.0
Stage 1 hypertension	26	25.7
Stage 2 hypertension	18	17.8

Prevalence of complications was higher among the patients who had poor glycemic control over their diabetic status and it was found to be statistically significant ($p<0.05$)**(Table 4)**

Table 4: Association between diabetic control status and diabetic complications (N=101)

Diabetic control status	Complications		PRR (95% CI)	p value#
	Yes	No		
	n (%)	n (%)		
HbA$_1$C%				
Under control (<7.0%)	8 (32.0)	17 (68.0)	Reference	
Not under control (7-9%)	12 (32.4)	13 (13.3)	1.0 (0.5-2.1)	0.971
Not under control (>9%)	24 (61.5)	15 (38.5)	1.9 (1.1-3.6)	0.021
Fasting blood sugar (mg/dl)				
Under control (80-130)	0	8 (100.0)	Reference	
Not under control (130-200)	25 (49.0)	26 (51.0)	NA	0.009
Not under control (>200)	19 (45.2)	23 (53.8)	NA	0.015
Post prandial blood sugar (mg/dl)				
Under control (<180)	4 (28.6)	10 (71.4)	Reference	
Not under control (180 - 200)	20 (37.0)	34 (63.0)	1.3 (0.5-3.2)	0.554
Not under control (>200)	20 (60.6)	13 (39.4)	2.1 (1.1-5.1)	0.044

*PRR- Prevalence risk ratio   #Chi-square test

Prevalence of complications was 43.6% (**95% CI:** 33.8%-53.8%). Among the macrovascular complications, stroke (cerebral-vascular) was present in 16.8% of the patients. Cardiovascular and peripheral vascular disease was present in 14.9% and 5.0% of the patients's respectively. Among the microvascular complications, nephropathy, neuropathy and retinopathy was present in 25.7%, 24.8% and 13.9% of the patients respectively.**(Figure 1**
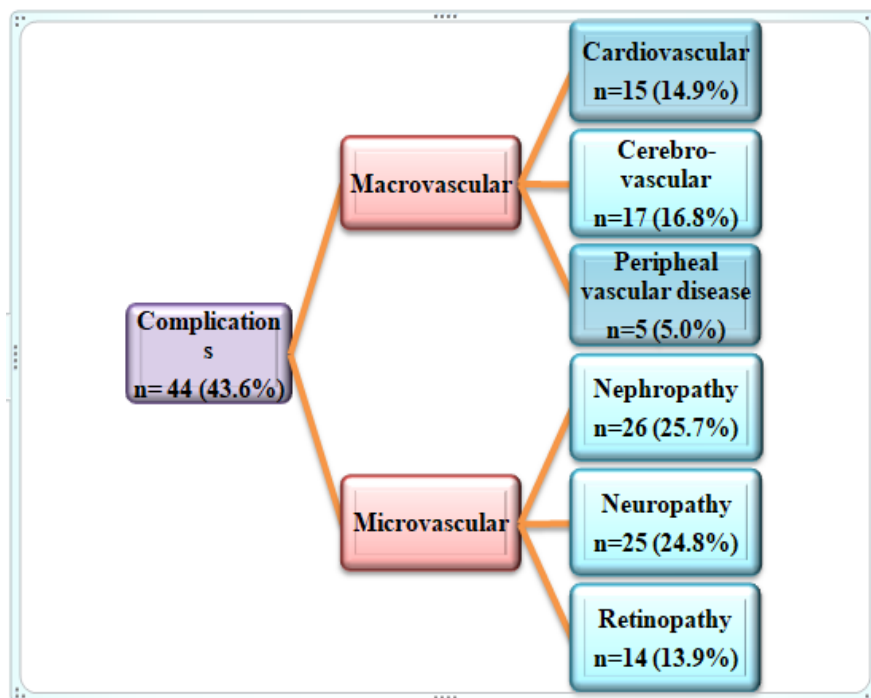

Figure 1: Prevalence of complications among the study patients (N=101)

Table 5: Complications and the glycemic control among the patients with type 2 diabetes mellitus (N=101)

Complications	HbA₁C%			FBG (mg/dl)			PPBG (mg/dl)		
	<7.0	7-9	>9	80-130	130-200	>200	<180	180-200	>200
Microvascular									
Neuropathy (n=25)	4 (16.0)	14 (56.0)	7 (28.0)	0	12 (48.0)	13 (52.0)	0	11 (44.0)	14 (56.0)
Nephropathy (n=26)	0	9 (34.6)	17 (65.4)	0	10 (38.5)	16 (61.5)	0	16 (61.5)	10 (38.5)
Retinopathy (n=14)	3 (21.4)	2 (14.3)	9 (64.3)	0	5 (35.7)	9 (64.3)	0	5 (35.7)	9 (64.3)
Macrovascular									
Cardio-vascular	5 (33.3)	5 (33.3)	5 (33.3)	0	7 (46.7)	8 (53.3)	0	13 (86.7)	2 (13.3)
Cerebro-vascular	8 (47.1)	0	9 (52.9)	0	8 (47.1)	9 (52.9)	5 (29.4)	7 (41.2)	5 (29.4)
Peripheral vascular	0	1 (50.0)	1 (50.0)	0	1 (50.0)	1 (50.0)	1 (50.0)	0	1 (50.0)

Prevalence of complications was higher among those who were aged above 50 years (56.3% vs 13.3%) and it was found to be statistically significant (**PRR**=4.2 [**95% CI:** 1.6-10.8]; p<0.001) (**Table 6**)

Table 6: Association between age category and diabetic complications (N=101)

Age category (years)	Complications		PRR (95% CI)	p value
	Yes n (%)	**No** n (%)		
≤50	4 (13.3)	26 (86.7)	Reference	
>50	40 (56.3)	31 (43.7)	4.2 (1.6-10.8)	0.00006807

*PRR- Prevalence risk ratio

Prevalence of complications was higher among the males when compared to the females (49.1% vs 37.0%), but it was not found to be statistically significant (p=0.221) (**Table 7**)

Table 7: Association between gender and diabetic complications (N=101)

Gender	Complications		PRR (95% CI)	p value
	Yes n (%)	**No** n (%)		
Female	17 (37.0)	29 (63.0)	Reference	
Male	27 (49.1)	28 (50.9)	1.3 (0.8-2.1)	0.221

*PRR- Prevalence risk ratio

Prevalence of diabetic complications were higher among those with overweight patients when compared to the patients who were with normal BMI (73.7% vs 35.4%) and it was statistically significant (**PRR**=2.1 [**95% CI:** 1.4-3.1];p=0.002) (**Table 8**)

Table 8: Association between BMI category and diabetic complications (N=101)

BMI category	Complications		PRR (95% CI)	p value
	Yes n (%)	No n (%)		
Normal	28 (35.4)	52 (64.6)	Reference	
Overweight	14 (73.7)	5 (26.3)	2.1 (1.4-3.1)	0.002
Obese	2 (66.7)	1 (33.3)	1.9 (0.8-4.4)	0.271

*PRR - Prevalence risk ratio

Patients with duration of the disease >10 years and 5-10 years were found to have higher prevalence of diabetic complications when compared to the patients who had duration of the disease 5 years or lesser and it was found to be statistically significant, p<0.001 and p=0.036 respectively (**Table 9**)

Table 9: Association between duration of diabetes mellitus and diabetic complications (N=101)

Duration of diabetes mellitus (years)	Complications		PRR (95% CI)	p value
	Yes n (%)	No n (%)		
≤5	9 (23.1)	30 (76.9)	Reference	
5-10	17 (45.9)	20 (54.1)	1.9 (1.0-3.9)	0.036
>10	18 (72.0)	7 (28.0)	3.1 (1.7-5.8)	0.00001104

*PRR- Prevalence risk ratio

Prevalence of complication was found to be higher among the smokers and alcoholics when compared to those who doesn't smoke or consume alcohol and it was found to be statistically significant (p<0.05) (**Table 10**)

Table 10a: Association between smoking and diabetic complications (N=101)

Smoking status	Complications		PRR (95% CI)	p value
	Yes n (%)	No n (%)		
No	18 (29.0)	44 (71.0)	Reference	
Yes	26 (66.7)	13 (!3.3)	2.3 (1.5-3.6)	0.0002042

*PRR- Prevalence Risk Ratio

Table 10b: Association between alcohol consumption and diabetic complications (N=101)

Alcohol consumption	Complications		PRR (95% CI)	p value
	Yes n (%)	No n (%)		
No	27 (34.6)	51 (65.4)	Reference	
Yes	17 (73.9)	6 (26.1)	2.1 (1.4-3.1)	0.001

*PRR- Prevalence Risk Ratio

Prevalence of diabetic complications increases as the stage of hypertension increases when compared to the normal patients and it was found to be statistically significant (p<0.05)**(Table 11)**

Table 11: Association between hypertension and diabetic complications (N=101)

Blood pressure (mmHg)	Complications		PRR (95% CI)	p value
	Yes n (%)	No n (%)		
Normal	9 (17.3)	43 (82.7)	Reference	
Pre-hypertensive	4 (80.0)	1 (20.0)	4.6 (2.2-9.7)	0.036
Stage 1 hypertension	17 (65.4)	9 (34.6)	3.8 (1.9-7.3)	0.000021
Stage 2 hypertension	14 (77.8)	4 (22.2)	4.5 (2.4-8.5)	0.0000025

*PRR- Prevalence risk ratio

Anaemia and dyslipidaemia were significantly associated with increased diabetic complications among the study participants (p<0.05) **(Table 12)**

Table 12a: Association of anaemia with diabetic complications (N=101)

Anaemia	Complications		PRR (95% CI)	p value
	Yes n (%)	No n (%)		
No	2 5(34.2)	48 (65.8)	Reference	
Yes	19 (67.9)	9 (32.1)	1.9 (1.3-2.9)	0.002

*PRR- Prevalence risk ratio

Table 12b: Association of lipid profile with diabetic complications (N=101)

| Dyslipidaemia	Complications		PRR (95% CI)	p value
	Yes n (%)	No n (%)		
No	19 (32.2)	40 (67.9)	Reference	
Yes	25 (59.5)	17 (40.5)	1.8 (1.2-2.9)	0.006

In our study there was a significant positive correlation between age and HbA$_1$C% (r=0.190; p=0.046) **(Table 13 and Figure 2)**

Table 13: Correlation between age and HbA$_1$C% (N=101)

Correlation	Correlation coefficient (r)	p value*
Age (years) HbA$_1$C%	0.190	0.046

*Pearson correlation

Figure 2: Scatter plot for correlation between age and HbA$_1$C% (n=101)
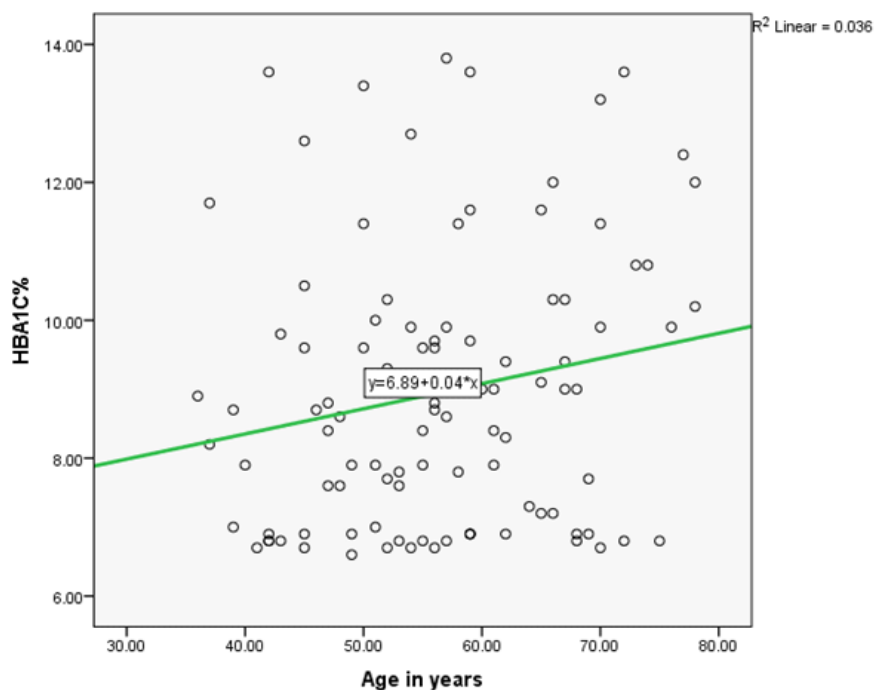
Positive correlation was observed between age and FBG, but it was not statistically significant (r=0.136; p=0.175) **(Table 14 & Figure 3)**

Table 14: Correlation between age and FBG (N=101)

Correlation	Correlation coefficient (r)	p value*
Age (years) * FBG	0.136	0.175

*Pearson correlation

**Figure 3: Scatter plot for correlation between age and FBG (N=101)**
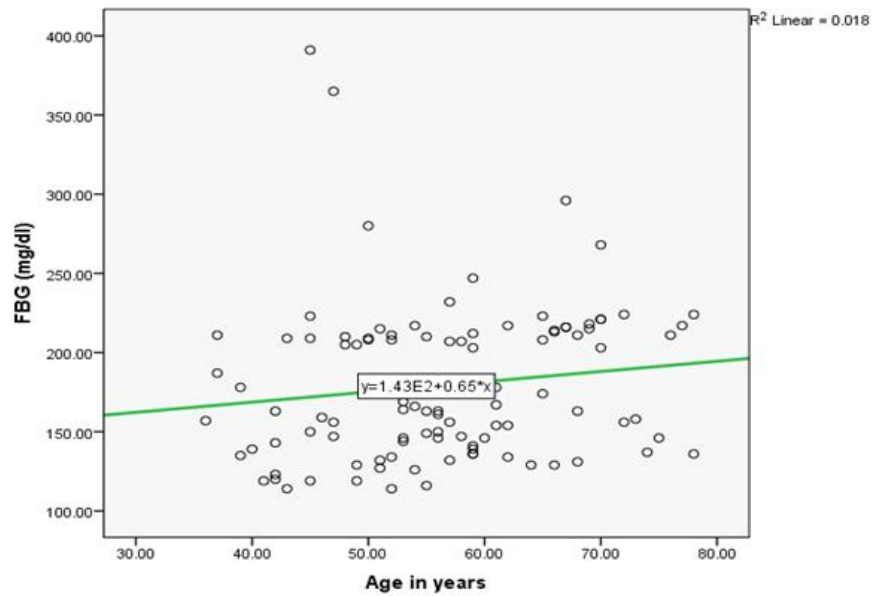
In this study there was a significant positive correlation between age and PPBG (r=0.275; p=0.005) (**Table 15 & Figure 4)**

Table 15: Correlation between age and PPBG (N=101)

Correlation	Correlation coefficient (r)	p value*
Age (years) * PPBG	0.275	0.005

*Pearson correlation

Figure 4: Scatter plot for correlation between age and PPBG (N=101)
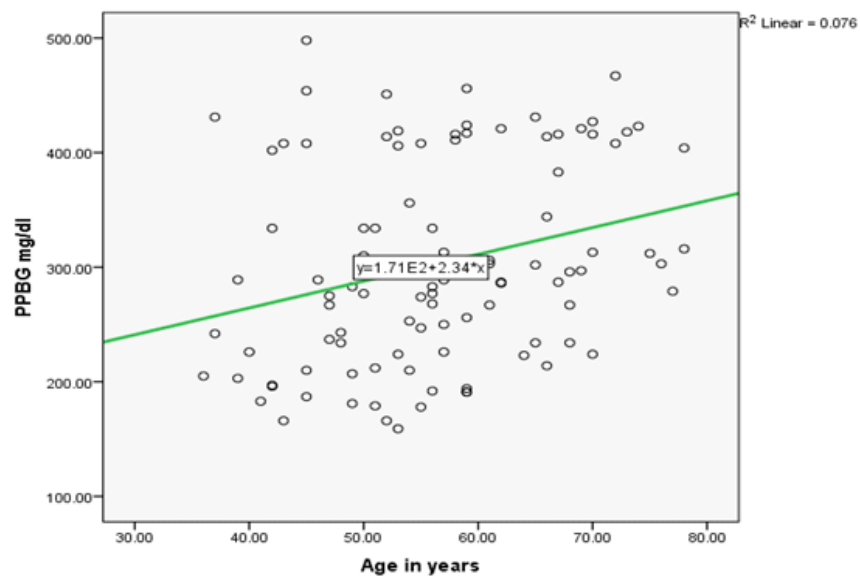
Study shows significant positive correlation between duration of diabetes mellitus and $HbA_1C\%$ (r=0.301; p=0.002) (**Table 16 & Figure 5**)

Table 16: Correlation between duration of diabetes and $HbA_1C\%$ (N=101)

Correlation	Correlation coefficient (r)	p value*
Duration of DM(years) * $HbA_1C\%$	0.301	0.002

*Pearson Correlation

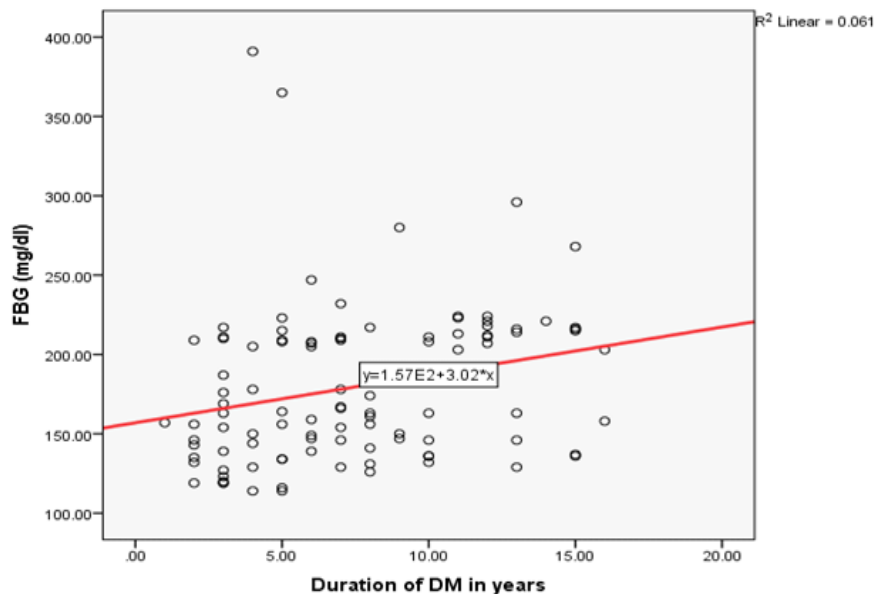**Figure 5: Scatter plot for correlation between duration of diabetes mellitus and $HbA_1C\%$ (N=101)**
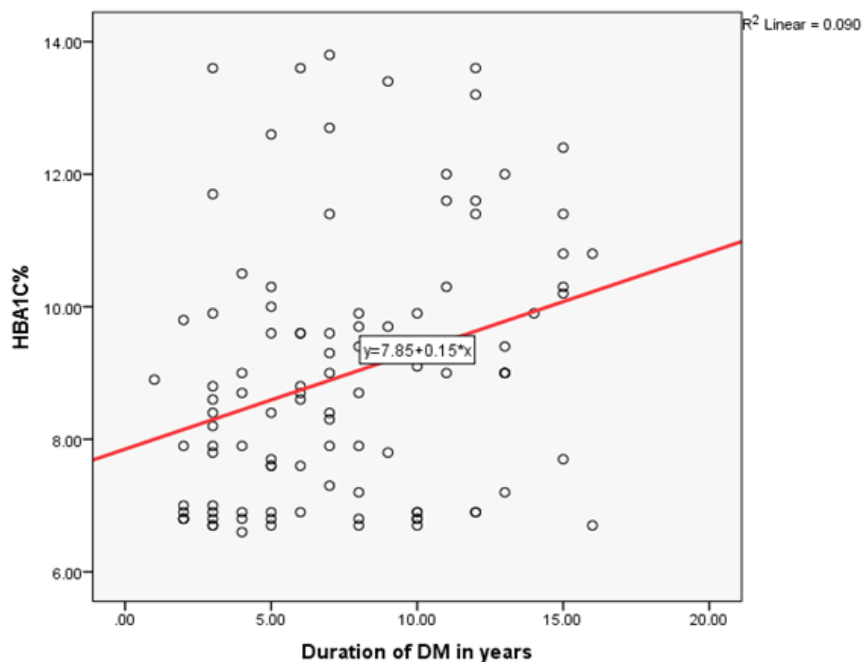
In our study there was a significant positive correlation between duration of diabetes mellitus and FBG (r=0.247; p=0.013) (**Table 17 &Figure 6**)

Table 17: Correlation between duration of diabetes and FBG (N=101)

Correlation	Correlation coefficient (r)	p value*
Duration of DM(years) * FBG (mg/dl)	0.247	0.013

*Pearson correlation

Figure 6: Scatter plot for correlation between duration of diabetes mellitus and FBG (N=101)


Study showing significant positive correlation between duration of diabetes mellitus and PPBG (**Table 18 & Figure 7**)

Table 18: Correlation between duration of diabetes and PPBG (N=101)

Correlation	Correlation coefficient (r)	p value*
Duration of DM(years) * PPBG (mg/dl)	0.262	0.008

*Pearson correlation

Figure 7: Scatter plot for correlation between duration of diabetes mellitus and PPBG (N=101)
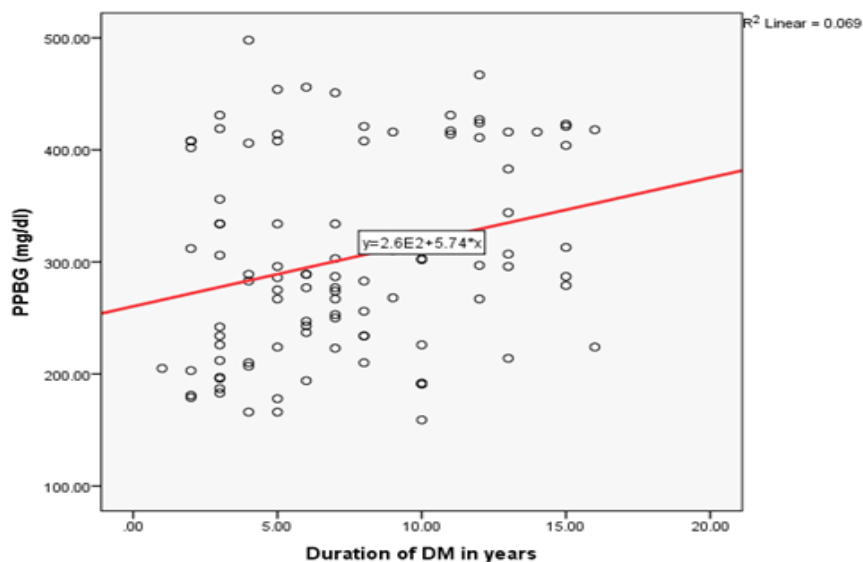
Discussion

- The mean age of the participants was 56.4 (±10.4) years and the majority of the participants were in the age group of 51-60 years (36.6%) followed by 61-70 years (24.8%). Our study showed that 54.5% of the participants were males with a M:F ratio of 1.2:1. Our results are similar to the study conducted across various parts of the globe.[13,17,18,19,20,21] The longer the time to obtain a diagnosis, lower the control of blood glucose and greater the chance of developing complications.

- Duration of diabetes mellitus was≤5 years in 38.6% of the patients followed by 5-10 years in 36.6% of the patients. The mean duration of diabetes mellitus was 7.4 (4.0) years. Duration of more than 10 years was reported by 24.8% of the patients. In our study, patients having duration of diabetes >10 years (p< 0.001) were associated with maximum complications followed by duration of diabetes between (5-10) years which is comparable with a study conducted by

Chakrabarty N et al[13], which also showed similar results .Regarding life style factors, smoking was present in 38.6% of the patients and alcohol consumption was reported in 22.8% of the patients, which is a satisfactory result, since the association between smoking and limb amputations in diabetic patients is well known.

- The prevalence of complications was 43.6% (95% CI: 33.8%-53.8%). Our study results are in concordance with various other studies across the countries. However a study by Garg S et al[22] had shown that only 24% of the patients had diabetic complications. Among the macrovascular complications, stroke (cerebro-vascular disease) was present in 16.8% of the participants and cardiovascular and peripheral vascular disease was present in 14.9% and 5.0% of the participant's respectively. Among the microvascular complications, nephropathy, neuropathy and retinopathy was present in 25.7%, 24.8% and 13.9% of the participants respectively.

- It is noteworthy to mention that the microvascular complications were higher when compared to the macrovascular complication and it was comparable with other studies.[17,19,20,21,22] Some of the complications of particular mention is that, peripheral neuropathy was present in the range of 5.8%[21]-62.6%[19] by various studies conducted in different countries. Similarly, retinopathy and nephropathy were reported in the range of 5.3%[18] -39.5%[17] and 10.7%[20]-50.8%[19].

- There could be various reasons for the wide range of prevalence of complications starting from the duration of diabetes, glycemic control to the prevalence of other risk factors like smoking, alcohol, hypertension, anaemia and dyslipidemia for that matter. Our study finding was supporting this assumption in a way that the patients with longer duration of the disease, smokers, alcoholics, hypertensives, anaemia and dyslipidemia were found to have significantly higher chance of complications. However, there was no association for age, gender and religion of the patients with the presence of complications. Similarly, the prevalence of coronary artery disease was in the range of 1.2%[18]-30.5%[21]. The prevalence of cerebrovascular and peripheral vascular disease was lower in other studies similar to our study.[19,20,21]

- Patients with T2DM with insulin resistance have a proatherogenic cardiovascular risk profile, which includes risk factors such as poor glycemic control, hypertension, abdominal obesity, microalbuminuria, smoking, and atherogenic lipid profile with reduced LDL cholesterol, increased TG, and reduced HDL cholesterol levels. This is not unusual as such variations have been reported previously.[23,24]

- Hypertension in diabetics is an important issue as the combination often coexists. The presence of hypertension will increase the risk of CAD, stroke, retinopathy, and nephropathy. In this study, the prevalence of hypertension was 43.5%. Smoking is an independent risk factor for all-cause mortality mainly due to CVD as proved by various other studies. Our study also showed that there was a significant correlation between duration of diabetes mellitus and the control status based on HbA1C%, FBG and PPBG. In regard to age, the correlation was present only for age and PPBG.

- One of the major limitations of the study is that the study was a hospital based study. The target population of patients attending the clinic in a tertiary referral centre reflects a population with more complex disease burden. Therefore, the prevalence reported may be an over estimation of the actual disease burden. Thus, a more appropriate approach would be a community based study. Moreover, some of the diagnosis was just subjective and hence the chance of bias. As with all other cross sectional studies, the cause effect relationship could not be ascertained as there is always a chance of reverse causation.

Conclusion

The mean age of the participants was 56.4 ±10.4 years and the majority of the participants were in the age group of 51-60 years (36.6%). More than half (54.5%) were males. Mean duration of diabetes mellitus was 7.4 ±4.0 years. Nearly half (49.5%) of the patients were under the treatment of oral hypoglycaemic agents alone. The disease was under control in 24.8%, 7.9% and 13.9% as per HbA1C%, fasting blood sugar and postprandial blood sugar respectively. The prevalence of complications was 43.6% (95% CI: 33.8%-53.8%). Among the macrovascular complications, stroke (cerebro-vascular disease) was present in 16.8% of the participants. Cardiovascular and peripheral vascular disease was present in 14.9% and 5.0% of the participant's respectively. Among the microvascular complications, nephropathy, neuropathy and retinopathy was present in 25.7%, 24.8% and 13.9% respectively. Patients with longer duration of the disease, smokers, alcoholics, hypertensives, anaemia and dyslipidemia were found to have significantly higher chance of complications. However, there was no association for age, gender and religion of the patients with the presence of complications. There was a significant correlation between duration of diabetes mellitus and the control status based on HbA1C%, FBG and PPBG. In regard to age, the correlation was present only for age and PPBG. Appropriate measures to intensify medical therapy and lifestyle measures to control modifiable risk factors and routine screening for the detection of new complications need to be emphasized in order to prevent morbidity and mortality. In order to gain more insight in to the real picture, a large community based longitudinal study is the need of the hour.

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