

Prevalence of Microvascular Complications in Newly Diagnosed Type-2 Diabetes Mellitus

Fayaz Ahmad Wani¹, Rakesh K Koul¹, Akhtar A Raina², Arjumand Nazir³, Muzaffar Maqbool¹, M Hyat Bhat⁴, Parvaiz A Shah⁵

¹Assistant Professor, Department of Medicine, Government Medical College, Srinagar, Jammu and Kashmir, India, ²Registrar, Department of Medicine, Government Medical College, Srinagar, Jammu and Kashmir, India, ³Registrar, Department of Ophthalmology, Government Medical College, Srinagar, Jammu and Kashmir, India, ⁴Consultant, Government Medical College, Srinagar, Jammu and Kashmir, India, ⁵Professor and Head, Department of Medicine, Government Medical College, Srinagar, Jammu and Kashmir, India

Abstract

Background: The onset of Type-2 diabetes mellitus (T2DM) is often silent and insidious. Untreated long standing hyperglycemia is responsible for the relatively high prevalence of microvascular complications in newly diagnosed DM. Our study was aimed at assessing the prevalence of microvascular complications in newly diagnosed T2DM patients of a public tertiary care hospital in India.

Materials and Methods: A prospective, cross-sectional study was conducted in the out-patient department of medicine at a tertiary care hospital. A total of 100 consecutive patients newly diagnosed with T2DM (<6 months duration) were included in the study. Detailed history, clinical examination, and relevant investigations were done to diagnose microvascular complications.

Results: Out of the total of 100 patients in this study, 56 were males and 44 females. The age range was 30-70 years, with mean age of 53.4 ± 21.5 years. Neuropathy was present in 33% patients; retinopathy was present in 6% of patients and nephropathy was present in 50% patients. Microalbuminuria was present in 44% patients, whereas macroalbuminuria was present in 6% patients. Subjects were classified into two groups on the basis of glycated hemoglobin (HbA1C) levels. Subjects with HbA1c >7.5% had more microvascular complications than with HbA1C 6.5-7.5%, the association was not statistically significant.

Conclusion: A long phase of asymptomatic hyperglycemia in T2DM patients is responsible for microvascular complications at diagnosis. A high prevalence of microvascular complications at the time of diagnosis in our study reconfirms that assessment for these complications must be done at the time of diagnosis in all patients. Once complications develop, in addition to strict control of hyperglycemia, steps have to be taken to prevent or retard further progression of these complications and even reverse these initial phase of complications.

Key words: Diabetes mellitus, Microvascular complications, Nephropathy, Neuropathy, Retinopathy

INTRODUCTION

The onset of Type-2 diabetes mellitus (T2DM) is often silent and insidious. DM is a common disorder with an annual prevalence of 8.2%.¹ T2DM being the most common form (90%). There is usually an asymptomatic phase between the actual onset of diabetic hyperglycemia

and clinical diagnosis. This asymptomatic phase is estimated to last 4-7 years, and consequently, 30-50% may remain undiagnosed. Untreated long standing hyperglycemia is responsible for the relatively high prevalence of microvascular complications in newly detected DM.² T2DM has significant morbidity and mortality that is attributed to the microvascular and macrovascular complications. Coronary artery disease, peripheral arterial disease, and cerebrovascular disease account for macrovascular disease, whereas retinopathy, nephropathy, and neuropathy constitute microvascular disease.³ The "Asian Indian Phenotype" refers to certain unique clinical and biochemical abnormalities in Indians including insulin resistance, higher waist circumference despite lower body mass index (BMI), lower adiponectin and higher

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Corresponding Author: Dr. Fayaz Ahmad Wani, Department of Medicine, GMC Srinagar, Jammu and Kashmir, India.
 Phone: +91-9205062319. E-mail: wanifayaz.a@gmail.com

levels of highly sensitive C-reactive protein levels. This phenotype makes Asians more prone to diabetes and its complications.⁴ Microvascular complications from T2DM are common, and evidence shows that early detection and identification of risk factors for retinopathy, nephropathy, and neuropathy may delay or prevent progression of microvascular complications.⁵ Clinical trials have demonstrated that strict blood glucose control correlates with a reduction in the microvascular complications.⁶

Screening for microvascular complications in newly detected DM (NDDM) patients will have important implications for understanding the need of vigorous screening, effective prevention, and management of T2DM. Our study was aimed at assessing the prevalence of microvascular complications in newly detected T2DM patients of a public tertiary care hospital in India.

MATERIALS AND METHODS

We conducted a prospective, cross-sectional study in the Out-Patient Department of Medicine at Government Medical College, Srinagar, Jammu and Kashmir, India after approval from the Institute Ethical Committee. The total of 100 consecutive patients newly diagnosed with T2DM (<6 months duration) were included in the study. American Diabetic Association criteria for the diagnosis of diabetes were applied. Subjects with fasting plasma glucose of ≥ 126 mg/dl on two separate occasions or random plasma glucose of ≥ 200 mg/dl with osmotic symptoms or glycated hemoglobin (HbA1c) of ≥ 6.5 were considered to be diabetic. Diabetics with a co-morbid illness such as CHF, stroke, chronic liver disease, and chronic kidney disease were excluded from the study.

Detailed clinical history regarding symptoms of diabetes, microvascular complication, family and personal history was taken from the subjects. A thorough clinical examination and anthropometric measurements were done in each subject. BMI (kg/m^2) was calculated after measuring height (m^2) and weight (kg) by a stadiometer. A BMI of 18-24.9 was taken as normal, 25-29.9 as overweight and more than 30 as obese. Waist circumference was measured by inelastic and flexible tape at the midpoint between the lower margin of least palpable rib and the highest point on the iliac crest to the nearest 1 cm.

Mercury sphygmomanometer was used to check the blood pressure in sitting and standing position in right arm to the nearest 2 mmHg. BP was recorded twice 10 min apart in both arms, lying down and standing. Subjects were considered to be hypertensive if systolic blood pressure was ≥ 140 mmHg or diastolic blood pressure of ≥ 90 mmHg or

subjects were taking antihypertensive medications as per records. HbA1c was measured using the variant machine. Serum cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), and triglycerides were measured by autoanalyzer. Dyslipidemia was diagnosed if serum cholesterol was >200 mg/dl, serum LDL >100 mg/dl, and HDL <40 mg/dl or serum triglycerides >150 mg/dl. Kidney function tests included urea, creatinine, and blood urea nitrogen. Urinalysis was done for glucose, proteins, and ketone bodies.

Diabetic neuropathy was diagnosed on clinical grounds by Semmes-Weinstein 10 g monofilament pressure sensation, deep tendon reflex testing by percussion hammer and vibration sense by 128 Hz Tuning fork. Non-diabetic causes of neuropathy were excluded. Autonomic neuropathy in the form of resting tachycardia, orthostatic hypotension, gastroparesis/diarrhea, or abnormal sweating was noted. Diabetic retinopathy was assessed by direct ophthalmoscopic examination of the fundus by an ophthalmologist. Diabetic retinopathy was graded as proliferative, non-proliferative, and clinically significant macular edema. Optic disc and/or retinal neo-vascularization, or presence of vitrous or preretinal hemorrhage was graded as proliferative diabetic retinopathy. Non-proliferative diabetic retinopathy was described by the presence of microaneurysms, exudates (cotton-wool spots or lipid exudates), and/or retinal hemorrhages. Diabetic nephropathy was graded as microalbuminuric if mean urine albumin concentration was 30-300 mg/dl and macroalbuminuric if >300 mg/dl.

Data were collected over a period of 6-month from May 2015 to October 2015. Data were entered in a Microsoft excel spreadsheet. Continuous variables were summarized as mean \pm standard deviation. Categorical variables as frequency and percentage. The prevalence of microvascular complications was reported as a percentage. The relationship between microvascular complications and HbA1C was analyzed using independent samples *t*-test. A $P > 0.05$ was taken as statistically significant. Analysis of data was done using SPSS version 20.0. Quantitative variables were described as mean \pm 1 SD, qualitative variables were described as percentages.

RESULTS

Out of the total of 100 patients in this study, 56 were males and 44 females (Table 1). The age range was 30-70 years, with mean age of 53.4 ± 21.5 years. In this study, 30% study subjects had normal BMI (18.5-24.99 kg/m^2), 50% subjects were overweight (25-29.99 kg/m^2), and 20% subjects were obese (>30 kg/m^2). Neuropathy was present in 33% patients, 20 (35.71%) males, and 13 (29.54%)

females. Retinopathy was present in 6 (6%) of patients, 4 (7.14%) males, and 2 (4.54%) females. The majority (83.33%) of patients had non-proliferative diabetic retinopathy. Only 1 patient (16.66%) had proliferative diabetic retinopathy, and he also had clinically significant macular edema. Nephropathy was present in 50% patients including 23 (41.07%) males and 27 (61.36%) females. Microalbuminuria was present in 44% patients, 20 (35.71%) males and 24 (54.54%) females, whereas macroalbuminuria was present in 6% patients, 3 (5.35%) males, and 3 (6.81%) females. Tripathy was present in one male patient.

Subjects were classified into two groups on the basis of HbA1C levels. Group first with HbA1C in the range 6.5-7.5% and group second with HbA1C >7.5%. Although subjects in the group second with HbA1c >7.5% had more microvascular complications than the first group, the association was not statistically significant (Table 2).

DISCUSSION

T2DM is an insidious illness with a preclinical asymptomatic phase of many years during which body is exposed to ill-effects of asymptomatic hyperglycemia. This study has reconfirmed that a large proportion of patients with T2DM

has developed microvascular complications of various organs even before the time of diagnosis.

We evaluated microvascular complication profile of newly diagnosed T2DM patients. Mean age of our patients was 53 years which confirms that in developing countries majority of patients with diabetes are in young, productive age group (45-64 years) as compared to developed countries who develop diabetes at a higher age (>65 years).^{7,8} In our 100 patients evaluated for complication profile nephropathy was more common (50%) as compared to neuropathy (33%) and retinopathy (6%), whereas other studies have shown neuropathy as the most common complication.⁹⁻¹⁴ Microalbuminuric nephropathy was more common (88%) as compared to macroalbuminuric (12%). As the study was conducted on newly detected T2DM patients meaning patients diagnosed <6 months duration, results of nephropathy need to be reproduced after 6 months, which could have led to increased nephropathy in our study population. However, the study by Ali *et al.* have also documented nephropathy in 44.24% of subjects.¹⁵

Neuropathy was found to be a second most common microvascular complication in our study and was detected in 33% patients. Our results were comparable to Yash *et al.*, who found neuropathy in 36% of patients at presentation and Nambuya, who found neuropathy in 46%.^{16,17} However, Karmakar *et al.*, Engelgau *et al.*, and Sosale *et al.* found neuropathy only in 9%, 14%, and 13.5% patients, respectively.¹⁸⁻²⁰

In our study, we found that retinopathy as the least common microvascular complication (6%). Sosale *et al.* and Cathelineau *et al.* found retinopathy in 6% and 10% of patients.^{20,21} Whereas Xu *et al.* and Yash *et al.* found retinopathy in 19.6% and 24% of patients, respectively.^{16,22}

In our study, we found that microvascular complications were more common in patients with HbA1C more than 7.5% than in patients with HbA1C <7.5%. However, none of the values attained statistically significant difference ($P > 0.05$).

Limitations of Our Study

Our study was a tertiary care hospital-based study and not a community-based study. The sample size was relatively small. A bigger sample size and comparing the difference between the prevalence of microvascular complications in a hospital-based and community-based study in our population would be worthwhile.

CONCLUSION

Microvascular complications are a major cause of morbidity and mortality in DM. These complications can be present

Table 1: Demographic and clinical characters of study subjects

Patient characteristics	Frequency (%)
Age (mean±SD)	
53.4±21.5 years	
Sex	
Males	56
Females	44
BMI (kg/m ²)	
18.5-24.99	30
25-29.99	50
>30	20
Complications	
Neuropathy	33
Nephropathy	50
Retinopathy	6
HbA1c	
6.5-7.5	40
>7.5	60

SD: Standard deviation, HbA1C: Glycated hemoglobin, BMI: Body mass index

Table 2: Relationship between HbA1C and diabetic complications

Complication	HbA1C (%)		P value
	6.5-7.5 (n=40)	>7.5 (n=60)	
Neuropathy	12 (30)	21 (35)	0.761
Nephropathy	17 (42.5)	33 (55)	0.307
Retinopathy	0	6 (10)	0.102

HbA1C: Glycated hemoglobin

even at the time of diagnosis of T2DM. A long phase of asymptomatic hyperglycemia in T2DM patients is responsible for microvascular complications at diagnosis. A high prevalence of microvascular complications at the time of diagnosis in our study reconfirms that assessment for these complications must be done at the time of diagnosis in all patients. Once complications develop, in addition to strict control of hyperglycemia, steps have to be taken to prevent or retard further progression of these complications and even reverse these initial phase of complications. Education of high-risk group regarding diabetes and its complications by electronic and print media is required so that they seek medical consultation at the earliest. We may need to screen our population for diabetes at a younger age in view of lower average age at presentation and high prevalence of microvascular complications. Primary health care providers should be sensitized to have a low threshold for screening for diabetes and encouraged to look for microvascular complications in all T2DM patients at the time of diagnosis. Screening for early detection and identification of risk factors for neuropathy, nephropathy, and retinopathy may prevent or delay the progression of microvascular complication.

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