

## Original Research Article

# Microvascular complications and their prevalence in newly diagnosed type-2 diabetes mellitus

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## ABSTRACT

**Background:** A group of metabolic diseases is 'diabetes' which has become a major global concern is characterized by high blood sugar. In the world about 347 million people have diabetes. Untreated long standing hyperglycemia leads to microvascular complications in newly diagnosed DM. The objective of the study was to find out prevalence of microvascular complications in newly diagnosed Type-2 diabetes mellitus.

**Methods:** The present cross-sectional study was conducted over a period of 6 months involved 200 patients who were diagnosed with T2DM having  $\leq 6$  months duration was conducted in the out-patient department of medicine and ophthalmology at a tertiary care hospital. Informed consent was taken from all the participants who were willing to participate. Detailed history, clinical examination and relevant investigations were done to diagnose microvascular complications.

**Results:** Maximum number of studied subjects i.e. 54% were seen in age group of 41-50 yrs. Males were 56% whereas females comprised 44%. Total of 52% of subjects were from rural background. Nephropathy was the most common microvascular complication present in 54% patients followed by neuropathy in 30% and retinopathy in 8% (NPDR in 7% and PDR in 1%) of patients.

**Conclusions:** From the present study it has been concluded that nephropathy is the most common microvascular complication in newly diagnosed T2DM followed by neuropathy and retinopathy. Authors recommend that 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. Screening for diabetes at a younger age in view of lower average age at presentation and high prevalence of microvascular complications.

**Keywords:** Diabetes mellitus, Nephropathy, Neuropathy, Retinopathy

## INTRODUCTION

Diabetes Mellitus is a common disorder with 8.2% of annual prevalence. Type 2 diabetes mellitus being the most common form (90%) which is often silent and

insidious in onset.<sup>1</sup> In India there are approximately over 35 million people with diabetes which will increase to around 80 million by 2030.<sup>2</sup> There are certain unique clinical and biochemical abnormalities in Indians (referred to as "Asian Indian Phenotype") which include

insulin resistance, higher waist circumference despite lower body mass index (BMI), lower adiponectin and higher levels of highly sensitive C-reactive protein. This “Asian Indian Phenotype” makes Asians more prone to diabetes and its complications.<sup>3</sup> Diabetes will be the 7th leading cause of death by 2030 as projected by WHO. T2DM has significant morbidity and mortality due to complications i.e. micro-vascular and macro-vascular which affect many organs of the body.<sup>4</sup> Coronary artery disease, peripheral arterial disease and cerebrovascular disease account for macrovascular complications whereas retinopathy, nephropathy and neuropathy constitute microvascular complications.<sup>5</sup> A high prevalence of microvascular complications in newly detected DM occur due to untreated long standing hyperglycemia.<sup>6</sup>

Diabetes mellitus is an important ocular risk factor for various ophthalmological disorder which commonly include cataract, glaucoma, macular edema, retinal vascular changes and diabetic retinopathy and thus one of the major concern of blindness in India and worldwide.<sup>7</sup> The most common and serious complications of diabetes is diabetic retinopathy and is a leading cause of blindness worldwide in adults aged 20-60 years.

In newly-diagnosed T2DM patients the prevalence of retinopathy ranges from 5 to 35%. With timely detection and appropriate therapy blindness from DR can be delayed/prevented.<sup>8</sup> Evidence shows that microvascular complications from T2DM are common and early detection and identification of risk factors for retinopathy, nephropathy, and neuropathy may delay or prevent progression of microvascular complications.<sup>9</sup> For effective prevention and management of T2DM, screening for microvascular complications in newly detected DM (NDDM) patients will have important role.

## METHODS

The present cross-sectional study was conducted over a period of 6 months from November 2018 to April 2019 in the out-patient department of medicine and ophthalmology at government medical college, Jammu, Jammu and Kashmir, India after approval from the Institute Ethical Committee. American Diabetic Association criteria for the diagnosis of diabetes were applied. Subjects with fasting plasma glucose of  $\geq 126$  mg/dl on two separate occasions or random plasma glucose of  $\geq 200$  mg/dl with osmotic symptoms or glycated hemoglobin (HbA1c) of  $\geq 6.5$  were considered to be diabetic. The informed consent from all the participants were undertaken before inclusion in the current study.

### Inclusion criteria

- Individuals of both sexes.
- Newly diagnosed T2DM individuals ( $\leq 6$  months duration).

### Exclusion criteria

- Uncooperative patients.
- Those who didn't gave consent
- Diabetics with a co-morbid illness such as CHF, stroke, chronic liver disease, and chronic kidney disease
- Patients having other ocular diseases which could contribute to eye problems.

### All the patients underwent complete examination as under

Detailed clinical history regarding symptoms of diabetes, microvascular complication, family and personal history, drug history etc. was taken. A thorough clinical examination and anthropometric measurements were done in each subject. Mercury sphygmomanometer was used to check the blood pressure. Other investigations like HbA1c, complete lipid profile, kidney function tests (including urea, creatinine and blood urea nitrogen), Urinalysis (especially for glucose, proteins, and ketone bodies), complete blood counts etc were done. Diabetic nephropathy was graded as macroalbuminuric if mean urine albumin concentration was 30-300 mg/dl and macroalbuminuric if  $>300$  mg/dl.

Diabetic neuropathy was diagnosed on clinical grounds by 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 and indirect ophthalmoscopic examination of the dilated fundus, slit lamp examination by 90D lens and fundus fluorescence angiography test (wherever required) by an ophthalmologist. Diabetic retinopathy was graded as per ETDRS classification as under.<sup>10</sup>

### Non-proliferative diabetic retinopathy

- NPDR.
- Moderate NPDR.
- Severe NPDR.
- Very severe NPDR.

### Proliferative diabetic retinopathy

- Early PDR.
- High risk PDR.
- Advanced PDR.

### Diabetic maculopathy

ETDRS (1991) study defined maculopathy as “clinically significant macular edema” if it has any of the following characteristics:

- Retinal oedema at or within 500 microns from fovea.
- Exudates at or within 500 microns from fovea with thickening of the adjacent retina.
- Thickening larger than 1 disc area and a part of it if located within 1 disc diameter of the centre of macula.

Non-proliferative diabetic retinopathy was described by the presence of microaneurysms, exudates (cotton-wool spots or lipid exudates) and/or retinal hemorrhages. Optic disc and/or retinal neo-vascularization or presence of vitreous or preretinal hemorrhage was graded as proliferative diabetic retinopathy.

**Statistical analysis**

The data was analyzed using statistical software MS Excel / SPSS version 17.0 for windows. Data presented as percentage (%) as discussed appropriate for quantitative and qualitative variables.

**RESULTS**

An insidious illness with a long preclinical asymptomatic phase is Type-2 diabetes mellitus during which patients may be exposed to the ill-effects of asymptomatic hyperglycemia for many years before they are diagnosed.<sup>11</sup> Due to untreated long standing hyperglycemia a high prevalence of microvascular complications in newly detected DM occur.<sup>6</sup> Retinopathy, nephropathy and neuropathy constitute microvascular complications whereas coronary artery disease, peripheral arterial disease and cerebrovascular disease account for macrovascular complications in diabetes mellitus patients.<sup>5</sup>

**Table 1: Demographic and clinical characteristics of studied subjects.**

Characteristics	Number (%) of studied subjects
Age (in years)	
≤40	44(22)
41-50	108(54)
≥51	48(24)
Sex	
Males	112(56)
Females	88(44)
Residence	
Urban	96(48)
Rural	104(52)
Complications	
Neuropathy	60(30)
Nephropathy	108(54)
Retinopathy	16(8)

Out of total no. maximum number of studied subjects i.e.54% were seen in age group of 41-50yrs followed by

24% in ≥51yrs. Males i.e. 56% outnumbered females in present study. Total of 52% were from rural background. Nephropathy was present in 54% patients followed by neuropathy in 30% patients and retinopathy which was present in 8% of patients (Table 1).

**Table 2: Distribution of studied subject as per grades of diabetic retinopathy.**

Grades of retinopathy	Number (%) of studied subjects
NPDR	14(7)
PDR	2(1)
CSME	0
No retinopathy	184(92)
Total	200

Total of 92% had no retinopathy in the present study. Out of 8% of diabetic retinopathy patients 7% of patient had non-proliferative diabetic retinopathy followed by proliferative diabetic retinopathy in 1% (Table 2).

**DISCUSSION**

A condition of hyperglycemia, which is usually due to defects in insulin secretion or insulin action is diabetes mellitus.<sup>12</sup> There are certain unique clinical and biochemical abnormalities in Indians (including insulin resistance, higher waist circumference despite lower body mass index (BMI), lower adiponectin and higher levels of highly sensitive C-reactive protein ) refers to as “Asian Indian Phenotype” which makes Asians more prone to diabetes and its complications.<sup>3</sup> A large proportion of patients with T2DM develop microvascular complications of various organs even before the time of diagnosis.<sup>13</sup> The major outcome of type 2 diabetes mellitus progression are microvascular complications i.e. nephropathy, neuropathy, retinopathy which place heavy economic burdens to the health care system, reduce the quality of life and increase diabetic mortality.<sup>14</sup> Hence the present study was conducted to evaluate the microvascular complication profile of newly diagnosed T2DM patients.

Maximum number of studied subjects i.e. 54% were seen in age group of 41-50 yrs followed by 24% in ≥51 yrs. Sosale A et al, in a study found that the prevalence of newly diagnosed diabetes was more in age group 41-50 years (40%).<sup>11</sup>

Males i.e. 56% outnumbered females in present study. In a study by Sosale A et al, males comprised 67%.<sup>11</sup> Wani FA et al, also found 56% males in a study on prevalence of microvascular complications in newly diagnosed Type-2 diabetes mellitus.<sup>13</sup>

In the present study among all microvascular complication nephropathy was present in 54% patients. Wani FA et al, in a study found nephropathy the most

common microvascular complication in 50%. Macroalbuminuric nephropathy was more common (88%) as compared to macroalbuminuric (12%).<sup>13</sup> Ali et al, in their study have also documented nephropathy in 44.24% of subjects.<sup>14</sup>

Neuropathy was seen in 30% patients in the present study. Wani FA et al, in a study found neuropathy in 33% of patients.<sup>13</sup> Yash P et al, found neuropathy in 36% of patients at presentation while Nambuya AP found neuropathy in 46%.<sup>15,16</sup> However, others found neuropathy only in 9% to 14% of patients.<sup>17,18,11</sup>

Better skin micro-vascularization among Indians may be the main reason for lower rate of diabetic neuropathy when compared to Europeans despite having similar risk factors.<sup>11</sup>

Only 8% of patients had retinopathy while 92% patients didn't had any retinopathy in the present study. Out of 8%, non-proliferative diabetic retinopathy was seen in 7% of patient followed by proliferative diabetic retinopathy i.e.1%. Wani FA et al, in a study found retinopathy in 6%.<sup>13</sup> Sosale A et al, in their study found retinopathy in 6% whereas Cathelineau G et al, found retinopathy in 10% of patients.<sup>11,19</sup> Another study by Xu Z et al, found retinopathy in 19.6% while Yash P et al, found retinopathy in 24% of patients, respectively.<sup>20,15</sup>

A major cause of morbidity and mortality in DM are microvascular complications which can be present at the time of diagnosis of T2DM. Once complications develop, steps have to be taken to prevent or retard further progression of these complications (in addition to strict control of hyperglycemia). Poor glycemic control even in newly diagnosed patients with diabetes is responsible for increased microvascular complications.<sup>14</sup> In order to prevent or delay the progression of microvascular complication, screening for early detection and identification of risk factors for neuropathy, nephropathy, and retinopathy must be done. Patients who are newly diagnosed diabetes with poor glycemic control should be referred from primary care to tertiary care for tight glycemic control.

It was a tertiary care hospital-based study and not a community-based study. This is the limitations of the study.

## CONCLUSION

Microvascular complications are a major cause of morbidity and mortality in DM. A high prevalence of microvascular complications (i.e. Nephropathy in 54% patients followed by neuropathy in 30% and retinopathy 8% of patients) at the time of diagnosis in present study reconfirms that assessment for these complications must be done at the time of diagnosis in all patients. Thus, from present study we may conclude that nephropathy is the most common microvascular complication in newly

diagnosed T2DM followed by neuropathy and retinopathy.

## Recommendations

Authors recommend that 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. Screening for diabetes at a younger age in view of lower average age at presentation and high prevalence of microvascular complications. Screening prevent or delay the progression of microvascular complication. Primary health care providers should be encouraged to look for microvascular complications in all T2DM patients at the time of diagnosis.

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