

## Research Article

# Profile of Microvascular Complications in Newly Diagnosed Type 2 Diabetics and its Association with Correlates of Metabolic Syndrome in a Tertiary Hospital: An Observational Study

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## ABSTRACT

**Aim:** The primary objective was to study the profile of microvascular complications in newly diagnosed type 2 diabetics in a tertiary hospital and to determine its association with correlates of Metabolic Syndrome.

**Settings and Design:** This was a prospective observational study conducted over a period of six months among patients attending the Endocrinology outpatient of a tertiary care centre in a South Indian city.

**Materials and Methods:** We studied the correlation of microvascular complications (neuropathy, nephropathy, retinopathy and foot ulcers) in 44 newly diagnosed type 2 diabetics with associated risk factors i.e., hypertension, obesity and dyslipidemia.

**Results:** The prevalence of peripheral neuropathy, nephropathy and retinopathy was 15.9%, 2.3% and 2.3% respectively. The study showed that out of 44 patients, 18 had hypertension (40.91%). Four out of the 18 hypertensive patients had microvascular complications (22.2 %). There was a significant association between obesity and peripheral neuropathy ( $P < 0.05$ ).

**Conclusion:** There was a maximum prevalence of peripheral neuropathy amongst the newly diagnosed diabetics thus they should be wary of the corresponding symptoms of numbness and tingling of feet. It was seen that out of the total 44 diabetic patients, 9.09% had both hypertension and microvascular complications. The low percentage is because 52% of the total hypertensives were on antihypertensive medication. There was also a significant association between obesity and neuropathy. Thus, those with obesity and hypertension are at a high risk of developing microvascular complications.

**Keywords:** Dyslipidemia, obesity, neuropathy, metabolic syndrome

## INTRODUCTION

Diabetes mellitus (DM) is a metabolic disease that affects many people across the world but more so in India. India is known as the "diabetes capital of the world". From 51 million people in 2010, the number of persons with type 2 diabetes mellitus in India is estimated to register a 58% increase to reach an alarming level of 87 million by the year 2030. In a recent study from India, the prevalence of microvascular complications in newly diagnosed type 2 diabetics was reported as 32.55% (one in three patients) <sup>1,2,3</sup>.

The basic pathogenesis of microvascular complications in patients with type 2 diabetes mellitus is the insulin deficiency combined with insulin resistance leading to hyperglycemia and the formation of advanced glycation products. In the long run, diabetes can lead to microvascular complications like retinopathy, nephropathy and peripheral neuropathy which lead to early deaths and increasing health care costs. Often patients present with symptoms of these

complications like foot ulcers, numbness and tingling of feet etc. Occurrence of these complications is accelerated by many factors like uncontrolled blood sugars, obesity, hypertension, dyslipidemia, etc. However, these patients do not go in for routine screening for complications and thus go undiagnosed for years thus worsening their prognosis. Detection of microvascular complication is an important step for early intervention and subsequent management<sup>4,5</sup>.

The primary objective was to study the profile of microvascular complications in newly diagnosed type 2 diabetics in a tertiary care centre and secondarily, to determine its association with correlates of Metabolic Syndrome.

## MATERIALS AND METHODS

This was a prospective observational study conducted at the Endocrinology department of a tertiary care hospital in South Indian city for duration of 6 months. Forty-four newly diagnosed diabetics (<6 months duration) were included. The study was approved by the Institutional Ethics Committee.

Patients with Type 1 DM, gestational DM and secondary form of DM and those showing symptoms of neuropathy who do not have type 2 diabetes were excluded.

For this study, microvascular complications were defined as follows:

### **Nephropathy:**

Measurement of a spot urine sample for albumin alone (whether by immunoassay or by using a sensitive dipstick test specific for albuminuria) was done. Values  $\geq 30\mu\text{g}/\text{mg}$  creatinine was taken as increased urinary albumin excretion as given by ADA guidelines<sup>6</sup>.

### **Neuropathy:**

Patients were screened using tests such as pinprick sensation, vibration perception (using a 128-Hz tuning fork), and 10 g monofilament pressure sensation at the distal plantar aspect of both great toes and metatarsal joints, and assessment of ankle reflexes.

### **Retinopathy:**

All patients underwent evaluation by an ophthalmologist and classified as diabetic retinopathy as per Early Treatment Diabetic Retinopathy Study.

### **Foot Ulcers:**

Patients were asked about history of previous foot ulceration or amputation, neuropathic or peripheral vascular symptoms, impaired vision, tobacco use, and foot care practices. A general inspection of skin integrity and musculoskeletal deformities was done in a well-lit room. Vascular assessment included inspection and assessment of pedal pulses.

Other parameters like anthropometry (height, weight, hip circumference and waist circumference), blood pressure (SBP, DBP), lipid profile (Cholesterol, triglycerides, LDL, VLDL, HDL), obesity (BMI>25), presenting with diabetic symptoms (polyphagia, polydipsia, loss of weight, etc.), concomitant illnesses, current medication status and clinical evidence of microvascular complications were documented from case files.

**Hypertension:** Hypertension was defined as a SBP value  $\geq 140$  mm of Hg and/ or DBP  $\geq 90$  mm of Hg according to JNC 7 values or when taking anti-hypertensive therapy<sup>7</sup>.

**Dyslipidemia:** Values of total triglycerides  $\geq 150$  mg/dl and /or HDL <40mg/dl for men and <50 mg/dl for women was considered abnormal.

**Obesity:** For anthropometry, BMI cut-off of  $25 \text{ kg}/\text{m}^2$  was used for making a diagnosis of obesity as recommended by various studies with Indians (Asian-Indian Phenotype).

## STATISTICS

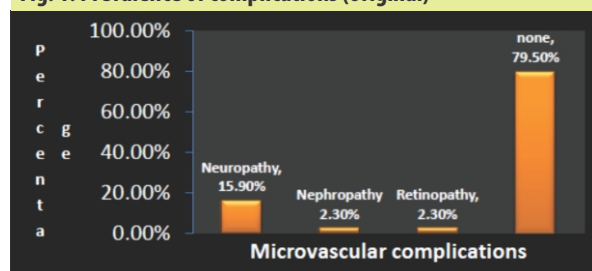
Numerical/continuous variables were reported as mean  $\pm$  standard deviation and qualitative/categorical variables were described as the number of cases and percentages. The group's means are compared by t-test and is applied for categorical variables. A p value <0.05 was considered statistically

significant, based on two-sided tests. SPSS for Windows version 17.0 was used for all analyses.

## RESULTS

The given study shows that there was a high prevalence of peripheral neuropathy at 15.9% i.e., 7 out of the 44 diabetics had peripheral neuropathy. There was a comparatively lower incidence of retinopathy and nephropathy, each having a prevalence of 2.3% (1 out of 44) and no one presented with foot ulcers (Fig 1).

**Fig. 1: Prevalence of complications (Original)**



47.73% (21 out of 44) presented with hypertension which clearly indicates a relationship between hypertension and development of type 2 diabetes in newly diagnosed patients. Only 19.04% (4 out of the 21) hypertensive patients had microvascular complications (2 with neuropathy, 1 with both neuropathy and retinopathy and 1 with both neuropathy and nephropathy). The percentage is low presumably because 8 of the hypertensive patients were on anti-hypertensive medication (Fig.2).

The prevalence of patients with obesity was high at 38.6% showing that there is a higher incidence of diabetes in obese patients. Out of the total 44 patients, there were 5 (11.5%) patients who presented with both peripheral neuropathy and obesity. There was a significant association between peripheral neuropathy and obesity by Pearson's Chi square test ( $P < 0.05$ ). There was no significant association between microvascular complications like nephropathy and retinopathy and the other risk factors like hypertension, dyslipidemia and obesity (Pearson's Chi Square Test). 36.36% patients

presented with dyslipidemia but there were no significant associations between dyslipidemia and any microvascular complications.

The most prevalent presenting symptoms in Type 2 DM were weight gain/obesity at 38.6%. 36% had no symptoms on presentation as shown in (Table 1).

As shown in (Table 2), the most common concomitant illness present in our study was hypertension at 47.73%. 54.54% had no concomitant illnesses. (Table 3) demonstrates the baseline values obtained from the study.

## DISCUSSION

In our study, 20.45% presented with microvascular complications and 15.9% with peripheral neuropathy and 2.3% each for retinopathy and nephropathy. Thus, there was a relatively high prevalence of peripheral neuropathy compared to nephropathy and retinopathy. These findings were similar to a study conducted by Raman *et al* in Chennai in 2012. In that study, the prevalence of microvascular complications in newly diagnosed type 2 diabetics was 30.2%, neuropathy was 10.5%, nephropathy 10.5% and retinopathy was 4.8%.

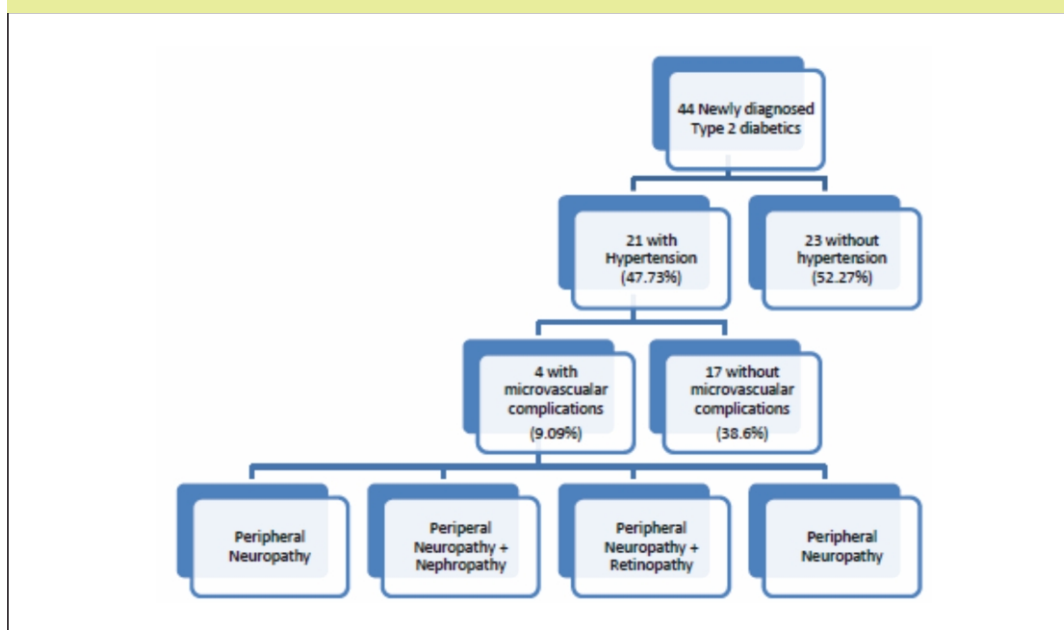
**Table 1: Prevalence of presenting symptoms in Type 2 DM**

Symptoms	N (%)
Polyuria and polydipsia	8 (18.18%)
Polyphagia	2 (4.5%)
Loss of weight	9 (20.5%)
Obesity	17 (38.6%)
Infections	5 (11.4%)
No symptoms	16 (36.30%)

**Table 2: Concomitant Illnesses**

Concomitant Illness	N (%)
Hypertension	21 (47.73%)
Dyslipidemia	16 (36.36%)
Thyroid Dysfunction	5 (11.4%)
None	23 (54.54%)

**Fig 2: Microvascular complications in newly diagnosed diabetics with hypertension (Original)**



**Table 3: Baseline Values (Original)**

	Mean± Standard Deviation
Age(years)	45.59±14.057
SBP(mm of Hg)	126.02±17.402
DBP(mm of Hg)	79.45±7.537
Pulse (bpm)	83.11±13.903
weight (kg)	76.6±14.47
Height (cm)	159.1 ± 23.72
BMI (kg/m <sup>2</sup> )	29.63 ±10.23
FBS (mg/dl)	194.99± 74.80
PPBS (mg/dl)	291.53 ± 113.97
RBS (mg/dl)	282.56±103.25
Urine micro albumin (µg/mg of creatinine)	22.50±38.22
Serum creatinine (mg/dl)	1.19±1.65
Blood urea(mg/dl)	26.25 ±11.66
Blood urea nitrogen (mg/dl)	17.86± 26.44

HbA1c	9.32 ±2.26
Triglycerides (mg/dL)	235.50 ±113.11
Cholesterol (mg/dL)	201.08 ±53.37
HDL (mg/dL)	37.43 ±9.05
LDL (mg/dL)	111.25 ±30.08
VLDL (mg/dL)	37.14 ±19.20
SGPT (IU/L)	40.27 ±32.76
SGOT (IU/L)	21.35 ±17.26

In a study entitled "Chronic complications in newly diagnosed patients with Type 2 diabetes mellitus in India"(CINDI) and a study by Rani *et al*, prevalence of peripheral neuropathy was 13 %<sup>9,10</sup>. This was dissimilar to our results which were lower at 2.1%. A study from Sri Lanka showed 25.2% and Amsterdam showed 48.3%. Explanation for a lower rate of diabetic neuropathy among Indians may be due to better skin micro-vascularization compared to Europeans despite having similar risk factors<sup>11</sup>.

In a European study, the prevalence of nephropathy was 26.7% and retinopathy was 1.9%. The relatively low rate of diabetic retinopathy (6%) in CINDI was similar to some of the studies from South India (7.3%) and abroad including Denmark (5%). It was suggested that the low prevalence is due to the Danish health system, which is free of charge and results in early diagnosis of diabetic patients<sup>12-14</sup>. It can be noted that the low prevalence of microvascular complications can be attributed to the good education of the patients coming to a tertiary care centre. This accounts for their knowledge of diabetic symptoms and hence their early diagnosis providing little to no interim period for establishment of complications.

In contrast to our study wherein prevalence of obesity, dyslipidemia and hypertension in newly diagnosed type 2 diabetics was 38.6%, 36.36% and 47.73%, CINDI results showed a lower prevalence of 26%, 27% and 23.3% respectively<sup>15</sup>. Many of the patients in our study were on medication for the concomitant illnesses. For example, 8 out of the 18 patients with hypertension were all on anti-hypertensive medication.

In our study, 47.73% of newly diagnosed patients presented with hypertension. This was 4.8% to a study by Hillier *et al*<sup>16</sup> wherein 49% of those with early type 2 diabetes had hypertension. In a study entitled "Hypertension in Diabetes Study (HDS): I, the prevalence of hypertension was 39%<sup>17</sup>.

In our study, we found no significant association between complications and hypertension. Differing from this, a study by Raman *et al* showed that increasing systolic blood pressure was a risk factor in developing diabetic retinopathy and nephropathy in newly diagnosed type 2 diabetics<sup>18</sup>. Similarly, Agarwal *et al* found a significant correlation between blood pressure and incidence of nephropathy being as high as 66.67% at BP > 160/100 mm Hg<sup>19</sup>.

In a study by Bansal *et al*, it was seen that triglycerides were significantly associated with neuropathy and retinopathy which was dissimilar to our study as we found no such association. Concurring with our study, Bansal *et al* found no significant association of HDL levels and microvascular complications.<sup>20</sup> Contradictory to our study, in a study by Agarwal *et al*,

it was found that the incidence of nephropathy increased with increase in BMI whereas we found no such association<sup>19</sup>. Rather we found an association between obesity and neuropathy. The baseline values found were similar to those as in the study by Ali *et al*.<sup>21</sup>

From this study, we see that hypertension and obesity are the main risk factors affecting occurrence of microvascular complications in newly diagnosed type 2 diabetics. Thus, we can conclude that to prevent or reduce the chances of occurrence of complications, control of hypertension, diet and weight loss is essential. Screening tests for complications are strongly recommended at the time of diagnosis not only for early detection, but also to prevent the progression to end-stage disease. This is probably because of the insidious onset of diabetes and long duration of asymptomatic disease before symptoms develop.

## CONCLUSION

There was a relatively high prevalence of peripheral neuropathy (15.9%) compared to retinopathy and nephropathy (2.5%). Thus, newly diagnosed type 2 diabetics should be highly cautious of symptoms like tingling of feet and numbness. It was seen that out of the total 44 diabetic patients, 9.09% had both hypertension and microvascular complications. The low percentage maybe on account of 52% of the total hypertensives being on antihypertensive medication. There was also a significant association between obesity and neuropathy. Thus, those with obesity and hypertension are at a high risk of developing microvascular complications. Awareness should be spread among newly diagnosed diabetics about the prevalence of these complications. It is the need of the hour to ensure that screening tests for complications are done especially in hypertensive and obese patients. They should also be educated about the importance of weight loss, diet and control of hypertension.

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