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PREVALANCE OF MICROVASCULAR COMPLICATIONS IN PATIENTS OF POORLY CONTROLLED TYPE 2 DIABETES MELLITUS WITH HBA1C LEVELS >9 IN PATIENTS ATTENDING TERTIARY CARE HOSPITAL

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ABSTRACT

Diabetes mellitus (DM) is a global health problem and India is considered as "Diabetes Capital of India". Type 2 Diabetes mellitus is the most common form of diabetes and the load of microvascular and macrovascular complications is considerable among Type 2 DM patients. Microvascular complications include Retinopathy, Nephropathy and Neuropathy. This study was conducted in a tertiary care hospital among uncontrolled type 2 diabetes mellitus patients with HbA1C >9% to assess the prevalence of microvascular complications and to emphasize clinical examination as a tool for screening for early diagnosis and treatment to improve quality of life of patient. It was observed that prevalence of complications was 77.31%. Neuropathy was the most common complication followed by Retinopathy. It was further observed that severity of neuropathy increases as the duration of diabetes mellitus increases from the time of diagnosis.

KEYWORDS: Diabetes mellitus, complications, poorly controlled, HbA1c.

INTRODUCTION

Diabetes mellitus (DM) is a substantial global health problem. Insulin-dependent (Type 1) and non-insulin-dependent (Type 2) diabetes have typically been recognized from each other. Diabetes Mellitus type 2 is the most common form of diabetes, estimated to account for 85–90% of diabetes. Type 2 diabetes is on the rise everywhere in the world, but it is most prevalent in developing nations (1).

The WHO claims that there were 35 million cases of diabetes worldwide in 2007, earning INDIA the moniker "Diabetes Capital of the World" (2)." Worldwide, the prevalence of diabetes was reported among all age groups as 2.8% in 2000 (177 million) and is expected to rise 4.4% by 2030 (366 million). The number of people having diabetes in India currently is around 66.8 million and is expected to increase to 101.2 million by 2030 (3).

Macrovascular complications of diabetes includes coronary heart disease, cerebrovascular disease, and peripheral vascular disease. Microvascular complications include nephropathy, neuropathy, and retinopathy (2). Nearly all of the body's organ systems are affected by diabetes as a single disease. Cardiovascular disease is the most frequent cause of mortality from macro vascular complications. Among the microvascular complications, Peripheral vascular disease and neuropathy (diabetic foot disease), are the most frequent causes of amputations, disability, and significant medical expense (4).

The major cause of end-stage renal disease is diabetic kidney disease (Diabetic nephropathy), and the most prevalent cause of blindness in persons under 65 years is diabetic eye disease (diabetic retinopathy) (4). The worldwide load of micro as well as macrovascular complications is considerable among the patients with type 2 diabetes who are relatively early in the disease course. This highlights the additive advantage for robust early risk modification, particularly in the regions with higher prevalence of compllexities. The risk of chronic complications also increases proportional to the duration of hyperglycemia as well as the patient's glycemic control throughout the course of disease(5).

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Hence this study was conducted to determine the prevalence of the microvascular complications of Type 2 DM in patients with uncontrolled glycemic index defined by Hba1C>9 mg/dl attending the outpatient and inpatient medicine department in a tertiary care hospital and to emphasize the importance of clinical examination as a screening tool and screening target organs for complications leading to early treatment and improving the quality of life of the patient.

MATERIALS AND METHODS
This cross-sectional study was conducted in outpatient and inpatient medicine department at BGS Global Institute of Medical Sciences in Bengaluru among the patients aged >30 years having type 2 diabetes mellitus and HbA1c >9%. Patients having Type 1 DM, Gestational diabetes mellitus, known cases of hypertension, hypothyroidism, tuberculosis and HIV infections, anemia, CKD secondary to other known causes, patients on corticosteroid therapy or history of corticosteroid therapy in the last 3months, patients with COVID 19 infection in the last 3months and patients on drugs known to cause peripheral neuropathy as an adverse effect or a long-term complication were excluded from study.

SAMPLE SIZE CALCULATION
The sample size was calculated based on the study conducted by Akila Govindarajan et al, in which they reported 52.1% microvascular complications among the patients with DM Type 2. At 95% confidence level and absolute allowable error of 8% $n = Z^2 1-\alpha/2 *p *(1-p)/d^2$ n=149.8, considering 10% (14.9) dropouts, the estimated sample size is 164.8. Therefore, minimum 165 patients were to be enroll in the study. But, during the study period we enrolled 194 patients in the study.

After obtaining clearance and approval from the IEC (Institutional Ethics Committee), patients satisfying inclusion criteria and who gave consent to take part in the study were enrolled. A detailed history of enrolled patients particularly the duration of DM, Comorbidities, Complications, Family History of Diabetes Mellitus, Obesity, Dyslipidemia etc. were taken. Anthropometric measurements including height, weight and BMI were recorded. Patients with BMI ≥25kg/m² were classified as obese (7). Glycemic control was measured by HbA1c with high performance liquid chromatography. Diabetic retinopathy is classified as non- proliferative diabetic retinopathy, proliferative diabetic retinopathy and clinically significant macular edema (8). Kidney disease improving Global outcomes (KDIGO) guidelines were used to classify Chronic kidney disease (CKD) into five stages in which stage 4 and 5 includes glomerular filtration rate <30ml/min/1.73m² (9). Diabetic neuropathy was assessed by internationally validated and commonly used scoring systems like Revised Neuropathy Disability Score (NDS), the Michigan Neuropathy Screening Instrument (MNSI) score, Clinical Examination Score of Valk (CES-V) with the 10 gram Monofilament test were performed and scored.

The Revised NDS includes the ankle reflex, vibration, pin-prick and temperature (cold tuning fork) sensation at both sides of the great toes with a maximum score of 10 points. People with an NDS of six points or more are considered to show abnormal reactions (10). The MNSI includes appearance of feet, ulceration, ankle reflexes and vibration perception and the score ranges from 0 (normal) to 1(abnormal/absent) (11).

The CNE-V involves clinical testing of sensory dysfunction (pinprick, light touch, vibration, and position sense) of the feet, the anatomic level below which light touch sensation is impaired, muscle strength of the feet and ankle reflexes. The maximal score of the CNE is 33 points. A total score of zero can be graded as no polyneuropathy, 1 to 9 as mild, 10 to 18 as moderate, and 19 to 33 as severe polyneuropathy (12).

RESULTS
This was a hospital based cross-sectional study conducted among 194 patients with Type 2 diabetes mellitus satisfying inclusion criteria. Majority of patients 55 (28.4%) were in the age group 41-50 years and the mean age of patients was 54.72 years. Maximum number of patients 113 (58.2%) were males and 81(41.8%) patients were females. Maximum number of patients 60(30.92%) were diabetic since more than 15 years and HbA1c levels were 9-12% among majority 94(48.45%) patients as shown in Table 1. The prevalence of microvascular complications in this study was among 150 (77.31%) patients.

Table 1: Characteristics of study participants

Characteristics	Frequency (n=194)	Percentage
Duration of DM		
Newly detected	14	7.21
<5years	41	21.13
6-10 years	47	24.22
11-15 years	32	16.49
>15 years	60	30.92
Family history of DM		

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Yes	98	50.51
No	96	49.48
BMI classification		
Underweight	14	7.21
Normal	57	29.38
Overweight	22	11.34
Obesity class I	62	31.95
Obesity class II	39	20.10
HbA1c levels (%)		
9-12	94	48.45
12.1-15	81	41.75
>15	19	9.79

Table 2: Distribution of microvascular complications among patients

Microvascular complications	Frequency (n=194)	Percentage
Retinopathy	129	66.49
Nephropathy	69	35.56
Neuropathy	136	70.10

Table 2 shows distribution of microvascular complications among patients. Neuropathy was the most common complication among maximum number 136(70.10%) patients followed by Retinopathy among 129 (66.49%) patients. Among Retinopathy cases, 45(23.19%) patients had new vessels everywhere else and 44(22.68%) patients had new vessels on disc. In Nephropathy, 125(65.4%) patients had no proteinuria and 26(13.4%) patients had 3+ proteinuria on urine routine test and about 59(30.41%) patients were in stage 2 CKD. Neuropathic disability score (NDS) was 6-8 among majority 45(23.2%) patients. Michigan neuropathic screening instrument (MNSI) showed that 136(70.1%) patients had neuropathy. CNE-V scores were 1-9 among 69(35.6%) patients followed by 19-33 among 53(27.3%) patients.

Table 3: Duration of Diabetes mellitus (DM) - Correlation in relation to NDS grading and CNE-V grading among patients

Grading	Duration of DM				
	Newly detected	1-5 years	6-10 years	11-15 years	>15 years
NDS grading					
None	08	37	19	06	05
Mild	03	03	29	03	00
Moderate	03	00	00	23	19
Severe	00	00	00	00	36
CNE-V grading					
None	04	22	06	00	00
Mild	06	18	34	06	05
Moderate	03	00	08	26	03
Severe	01	00	00	00	52

Table 3 shows Duration of Diabetes mellitus (DM) - Correlation in relation to NDS grading and CNE-V grading among patients. It was observed that as the duration of diabetes mellitus increases, the neuropathy severity increases. Hence, it is important to prevent emergence of risk factors at an early age.

DISCUSSION

In this study total males were 113 (58.2%) and females were 81 (41.8%). Average age of study population was 54.72 years. These findings correlated with studies done by Rajeha et al (13) which showed mean age of 53.3 years and another study by National Rural Diabetic survey of 1989-91 (14) which showed mean age of 52.3 years. It was found that out of 194 patients, family history was reported among 98 (50.51%) patients. These findings were higher compared to other studies like Shah et al (15) which reported family history among 24.9%.

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Prevalence of obesity in our study population is high with 22 (11.34%) patients being overweight and 101 (52.06%) patients being obese out of which 62 (31.44%) patients were in Obesity-I and 39 (20.10%) patients were in Obesity-II. These findings are slightly less than studies done by Channaraya et al (16) which showed obesity of 69%. It was further found that 94 (48.45%) patients showed HbA1c values ranging from 9 to 12 and 81 (41.75%) patients had between 12.1 to 15 and 19 (9.79%) patients had >15 in our study. .

Diabetic retinopathy was the second most common complication after neuropathy in our study. Out of 194 subjects 129 (66.49%) patients had Retinopathy. This study showed higher prevalence compared to studies done by G. Premalatha, V Mohan et al (17) among the urban South Indian population where the prevalence was reported to be 34.1% and another study by M Ranka et al (18) reported to be 28.9% in North India. As our study included only patients with uncontrolled diabetes, the prevalence of retinopathy was reported to be significantly higher than other studies conducted among the Indian population.

Nephropathy was the least common complication in our study. Out of 194 subjects 69 (35.57%) patients had Nephropathy. Out of 194 patients 125 (64.4%) patients had no proteinuria, 9 (4.6%)
patients had 1+, 34 (17.5%) patients had 2+ and 26 (13.4%) patients had 3+ Proteinuria on urine routine test. This study showed a higher value than the Ramachandran et al's study (19), in which prevalence of proteinuria was reported as 19.7% .

The prevalence of diabetic neuropathy in the present study was 70.10%. this was higher than the study conducted by Govindarajan et al (20) which showed a prevalence of 44.9% and was observed to be significantly higher than the study done by G. Premalatha, V.Mohan et al (17) who had 19.1% patients showing neuropathy because our study only included patients with HbA1c >9.

The Revised NDS scale showed 45 (23.2%) patients had scores of 6-8, 43(22.2%) patients had scores of 1-2. 75 (38.7%) patients were having no neuropathy, 45 (23.2%) patients had moderate neuropathy, 38 (19.6%) patients had mild neuropathy and 36 (18.6%) patients had severe neuropathy. The severity of neuropathy increased as duration of diabetes increased. MNSI scoring showed that out of 194 patients, 136 (70.1%) patients had Neuropathy. CNE-V scoring showed that out of 194 patients, 69 (35.57%) patients had scores of 1-9, 53 (27.31%) patients had scores of 19-33. The patients with prolonged history of diabetes mellitus had severe grade according to CNE-V scoring.

CONCLUSION
Prevalence of microvascular complications observed to be 77.31% in the present study. Neuropathy was found to be the most common microvacular complication present among 70.10% patients followed by Retinopathy among 66.49% patients.

CONFLICT OF INTEREST: None

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