ORIGINAL RESEARCH

THE DETERMINANTS AND PREDOMINANCE OF PERIPHERAL NEUROPATHY AMONG T2DM INPATIENTS OF AN INDIAN DIABETES CENTER

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ABSTRACT

Background: Diabetes-related consequences, including microvascular and macrovascular, pose a significant burden in India. Diabetes mellitus (DM) is becoming more common, resulting in an increase in the number of people suffering from DM complications. Diabetic peripheral neuropathy (DPN) is the most prevalent complication among DM patients, affecting 18.8 to 61.9 percent of those in India. DPN problems can be reduced if diagnosed early. Screening programmes at the primary care level can aid in the early detection of problems and improve health outcomes in diabetic patients. The purpose of this research was to determine risk factors for peripheral neuropathy in newly diagnosed Type 2 diabetic patients in Cuttack, Odisha.

Methods: This was part of a cross-sectional study to determine the prevalence of peripheral neuropathy among newly diagnosed T2DM patients attending the Cuttack Primary Care Clinic in Odisha. It included a total of 254 patients. A set of case report forms containing sociodemographic data, clinical examination results, and investigation findings was used. Diabetic peripheral neuropathy exists when the patient is unable to feel the monofilament 5.07 (10g) at one or more of the sites examined.

Results: The participants' mean (SD) age was 53.3 (9.06) years. Peripheral neuropathy was found in 8.7 percent of the individuals. Age (p 0.001) and the existence of retinopathy (p = 0.001) were factors that contributed to the development of peripheral neuropathy in newly diagnosed type 2 diabetes patients.

Conclusion: All T2DM patients should be tested for peripheral neuropathy at the time of diagnosis so that preventive interventions can be implemented to prevent diabetic foot disease. Patients with retinopathy should be tested for neuropathy as well.

Keywords: Peripheral neuropathy, Diabetes Mellitus, Primary Care

INTRODUCTION

T2DM is frequently preceded by a long period of unnoticed metabolic abnormalities, and brain damage is likely to be detectable at the time of diabetes diagnosis [1]. Distal symmetrical sensory-motor poly neuropathy is the most prevalent type of diabetic peripheral neuropathy (PN). Early distal sensory-motor neuropathy is usually asymptomatic, and motor

involvement occurs later with distal weakness, although sensory abnormalities can be detected by neuro-physiological tests such as nerve conduction studies and electromyography [2, 3]. In India, the burden of diabetes-related complications, both microvascular and macrovascular, is enormous [4, 5]. As the prevalence of diabetes rises, so will the number of persons suffer from complications [6, 7].

Diabetic peripheral neuropathy (DPN) is the most prevalent consequence among patients with type 2 diabetes [8]. In the literature, the prevalence of DPN ranged from 18.8 to 61.9 percent [9, 10, 11, 12]. DPN can be symptomatic or asymptomatic. When symptomatic, it is characterised by scorching pain, tingling sensations, and hyperaesthesia, all of which are uncomfortable to the patient. Half of them will have no symptoms and will be less inclined to seek medical attention. Furthermore, among them, basic care providers may ignore the need for a foot examination. These asymptomatic DPN patients can only be diagnosed through examination or by presenting with a painless foot ulcer [13].

Foot ulcers are related with numerous unfavourable outcomes and substantial treatment costs [14]. Patients' ability to conduct routine, everyday tasks and participate in leisure activities is hampered by the loss of mobility caused by foot ulcers. These frequently result in despair and a low quality of life. Early detection of DPN can assist to prevent the high prevalence of diabetic foot. The majority of amputations in diabetic patients begin with ulcers [15, 16, 17]. This can be avoided by using proper foot care techniques and conducting frequent screenings to identify the risk of foot issues. As a result, all DM patients should be checked for DPN at diagnosis and on a frequent basis thereafter.Several studies have indicated that optimising blood sugar regulation and avoiding significant blood glucose swings can ameliorate neuropathic symptoms before serious morbidity develops [16, 18, 19]. The goal of this study was to determine the prevalence of DPN among type 2 DM patients attending a rural health centre and the risk factors for it.

METHODS

The study was a cross-sectional study of 254 newly diagnosed T2DM patients who attended a primary care clinic in Cuttack for a year. According to WHO defining criteria, the inclusion requirements were 18 years of age or older and newly diagnosed T2DM. Those using medicine (isoniazid, vincristine, thiazide, or gold treatment), working in pesticide and herbicide industries, having a thyroid disease, a history of stroke affecting the legs, being pregnant, or having gestational diabetes mellitus were all barred from participating.

Data collection: Participants were recruited using a non-probability sampling method, and those who met the criteria were informed about the study and provided informed consent. Those who agreed were interviewed for demographic information and their medical history was evaluated from their medical records. The assistant nurse at the triage counter took the patient's blood pressure, heart rate, height, and weight. Blood pressure was measured with a mercury column sphygmomanometer after the patient had been fully rested and seated.

Hypertension was defined as having a blood pressure more than 140/90 mmHg or being on hypertensive medication on a regular basis. Weight and height were measured without shoes or socks using an SECA measuring scale, and body mass index (BMI) was determined by dividing the patient's weight in kilogrammes by the square of their height in m^2. Blood sugar, HBA1c, lipid profile, and creatinine level were all measured in a fasting blood sample. The

Cockcroft Gault method was used to compute the estimated glomerular filtration rate, and nephropathy is defined as a GFR less than 60mL/min/1.73m^2.

Dyslipidemia was defined as total cholesterol greater than 5.6 mmol/L, triglycerides greater than 2.1 mmol/L, LDL greater than 3.4 mmol/L, and HDL less than 0.9 mmol/L. A conventional 12-lead ECG was taken, and ischemic heart disease was defined as the presence of ischemic alterations in the ST segment, T waves, or the presence of a Q wave in the reciprocal lead, as well as a history of previous myocardial infarction, angina, or coronary-artery bypass surgery. Fundus photograph was taken by professional employees using a fundus camera kowa non Myd 10 Mega 7. Retinopathy is classified based on fundus images and includes background retinopathy, maculopathy, pre-proliferative retinopathy, and proliferative retinopathy.

STATISTICAL ANALYSIS

Data was input and analysed using the Statistical Program for Social Sciences (SPSS) version 18.0. The frequency and percentage for the categorical variable were reported as descriptive analysis. For regularly distributed data, numerical variables were reported as mean and standard deviation (SD) or median and interquartile range (IQR) for non-normally distributed data. The independent factors included age, gender, race, BMI, SBP, DBP, triglyceride, LDL-C, HDL-C, total cholesterol level, smoking status, retinopathy, nephropathy, and ischemic heart disease. The related factors for diabetic peripheral neuropathy were determined using simple logistic regression. Multiple logistic regression was employed in the model to determine the related factors while controlling for other confounders.

RESULTS

SOCIO-DEMOGRAPHIC AND MEDICAL CHARACTERISTIC OF PARTICIPANTS

There were 140 females (58 percent) and 110 males among the 250 participants (42 percent). The participants' mean (SD) age was 53.3+ 9.06 years, and 81.5 percent of them were hypertensive. The most common consequence was retinopathy (14.6 percent), followed by nephropathy (11%), neuropathy (8.7%), and ischemic heart disease (6.7 percent). 60.2 percent of individuals had fasting blood sugar levels greater than 7.0mmol/l, and 56.2 percent had HBA1c levels greater than 8.0 percent at the time of diagnosis. 88.6 percent of patients had total cholesterol levels greater than 5.2mmol/l, 46.1 percent had HDL-C levels less than 1mmol/l, 53.1 percent had TG levels greater than 1.7mmol/l, and 86.6 percent had LDL-C levels greater than 2.6mmol/l. (Table 1).

Table 1: Socio demographic medical characteristics of participants

Variable (n=250)	n
Age (years)	
Gender	
Female	140
Male	110
HBA1c (%)	
>8	130
7-8	53
<7	67
DBP(mmHg)	
SBP(mmHg)	
FBS(mmol/L)	
> 7.8	146
6.7 - 7.8	38
< 6.7	66
LDL-C(mmol/L)	
≥2.6	201
<2.6	49
HDL-C(mmol/L)	
<1	108
≥1	142
Hypertension	
Yes	174
No	76
TC(mmol/L)	
≥5.2	216
< 5.2	34
TG(mmol/L)	
≥1.7	129
<1.7	121
Neuropathy	
Yes	18
No	232
Nephropathy	
Yes	36
No	214
Retinopathy	
Yes	27
No	223
IHD	
Yes	20

No	230

FACTORS ASSOCIATED WITH PERIPHERAL NEUROPATHY

In this study, 8.3 percent of people had diabetic peripheral neuropathy (95 percent CI: 5.23 - 12.17). Using simple logistic regression, the variables related with diabetic peripheral neuropathy were age (p= 0.001), weight (p= 0.041), and retinopathy (p= 0.001). The Multiple Logistic Regression using backward stepwise approach was used to identify variables, and the results suggest that peripheral neuropathy is related to age (p <0.001) and retinopathy (p= 0.001). Those with retinal were 5.51 times more likely to have neuropathy than those without retinopathy, and for every 1-year increase in age, the odds of having neuropathy increased by 1.11 times (Table 2).

Table 2: Factors associated with peripheral neuropathy

Variables	Neuropathy		Crude OR[a]	(95%CI[b])
	No	Yes		
Age (year)			1.11	(1.04,1.11)
Gender				
Male	94	16	0.61	(0.23,1.58)
Female	123	17	1.01	
HBA1c (%)				
≤7	58	9	1.01	
7-8	38	15	1.02	(0.29,3.47)
>8	111	19	0.62	(0.19,1.96)
BMI			0.92	(0.83,1.05)
Weight(kg)			0.05	(0.95,1.00)
Height(meters)			0.03	(0.00,3.67)
FBS (mmol/l)				
< 6.7	32	21	1.00	
6.7 - 7.8	9	29	0.98	(0.206,4.58)
> 7.8	94	52	1.45	(0.47,4.55)
LDL-C(mmol/l)				
<2.6	30	6	1.00	
≥2.6	48	42	2.44	(0.313,18.90)
HDL-C(mmol/l)				
≥1	119	9	1.01	
<1	97	18	0.94	(0.39,2.30)
Hypertension				
Yes	32	144	2.54	(0.89,7.09)
No	51	13	1.02	
TC(mmol/l)				
<5.2	24	5	1.01	
≥5.2	120	39	1.33	(0.30,5.96)
TG(mmol/l)				

<1.7	134	14	1.01	
≥1.7	115	18	1.63	**(0.66,3.98)**
Nephropathy				
Yes	26	6	2.68	**(0.89,7.93)**
No	202	15	1.00	
Retinopathy				
Yes	19	14	6.34	**(2.49,16.05)**
No	195	24	1.00	
IHD				
Yes	11	4	1.45	**(0.30,6.76)**
No	**203**	**33**	**1.00**	

DISCUSSION

The related factors of peripheral neuropathy in this study were age, weight, and retinopathy. When all of the related factors in the multivariate analysis were adjusted, the significant associated factors of peripheral neuropathy among newly diagnosed T2DM in this study were age and the existence of retinopathy. Other studies, like this one, suggest that age is one of the factors related with neuropathy [19, 20, 21, 22]. Neuropathy rose with age, and for every one-year rise in age, the odds of having neuropathy increased by 1.11 times when compared to non-neuropathy.

Other studies, like those by Sosenko J and Franklin et al, complement the finding, indicating that increasing age was 1.74 (95 percent CI 1.40, 2.16) 20 and 1.3 (95 percent CI 1.1, 1.6) 22 risk for neuropathy. These investigations, however, were conducted on long-term T2DM patients. It is possible that our patient had preclinical diabetes and inadequate glycemic control at the time of diagnosis. Those with retinopathy were 5.51 times more likely to have neuropathy than those without retinopathy.

Franklin et al. supported this finding by investigating the risk variables for distal (sensory) neuropathy among T2DM in a population-based study in Southern Colorado.They discovered that having neuropathy was three times more likely in participants with retinopathy (CI = 1.2, 7.7) [22]. In IDDM, the relative probability of developing neuropathy was 2.0 (95 percent CI 1.5, 2.8) in the background retinopathy and 5.4 (95 percent CI 3.4,8.6) in the proliferative retinopathy, respectively [19]. This was due to the fact that they both had the disease's microangiopathy consequence. Another study conducted in China by Fang Liu et al discovered that those with diabetic retinopathy are 6.06 times more likely to develop peripheral neuropathy. Their risk was increased because the frequency of PN was 17.2 percent and there were known diabetes cases in the study population [23].

Franklin and colleagues discovered that higher glycohemoglobin percentages and insulin use were linked to neuropathy [22]. Because this study was conducted on newly diagnosed diabetics, all of the above characteristics were not related with neuropathy. We found no evidence of a link between lipid profile and neuropathy in this investigation. Agrawal et al found the same thing in 4067 people with T2DM in Northwest India [24]. However, the findings contradicted those of Tesfaye et al, who discovered that all types of lipoproteins were significant for diabetic peripheral neuropathy in T1DM.Perhaps further research is

needed to determine the link between peripheral neuropathy and the lipid profile in newly diagnosed T2DM patients. Other characteristics, such as diabetes duration and height, have been linked to neuropathy in long-term T2DM patients, but not in this study group because it was conducted on newly diagnosed patients [19, 20].

CONCLUSION

According to this study, 8.3 percent of newly diagnosed T2DM patients have peripheral neuropathy. Age, with an odd ratio of 1.11 (95 percent CI 1.05, 1.18), and retinopathy, with an odd ratio of 5.51, both contribute to the likelihood of developing peripheral neuropathy (95 percent CI 2.07, 14.69).

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