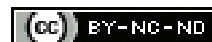


Diabetic Peripheral Neuropathy and its Association with Diabetes Self-care: A Clinic-based Study in an Urban Health Centre, Kolkata

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ABSTRACT

Introduction: Diabetes mellitus is considered as silent epidemic worldwide including India. Peripheral neuropathy is one of the most common complications of diabetes mellitus. Diabetes Self-Management (DSM) is crucial in mitigating the afflictions of diabetes and its after effects. There was dearth of studies in view of Diabetic Peripheral Neuropathy (DPN) and diabetes self-management in Kolkata, West Bengal.

Aim: To assess the associations between diabetes self-management and DPN in Type 2 Diabetes Mellitus (T2DM) patients attending an urban health clinic in Kolkata.

Materials and Methods: This study was conducted from December 2018 to March 2019 among known case of T2DM patients aged 30 years and above attending the Non-Communicable Disease (NCD) clinic at Chetla, under the purview of field practice areas of Urban Health Unit and Training centre

(UHU and TC) of All India Institute of Hygiene and Public Health (AIIH and PH) Kolkata, West Bengal. A pre-designed and pre-tested schedule was used to collect data which were analysed using International Business Machines Statistical Product and Service Solutions (IBM SPSS) version 16.0 and represented using various tables.

Results: The mean (SD) age of the participants was 54.89 (8.98) years. About 32.4% of the patients had DPN which was significantly associated with increased duration of T2DM {AOR (95% CI)}={1.52 (1.22-1.91)}, lower glucose management sub-scale score {AOR (95% CI)}={2.84 (1.42-5.67)} and lower healthcare use sub-scale score {AOR (95% CI)}={1.86 (1.05-3.31)}.

Conclusion: Early screening and education regarding diabetes self-care would be helpful in glycaemic control and in prevention of DPN.

Keywords: Diabetic neuropathic symptoms, Diabetes self-management questionnaire, Semmes-weinstein 5.07 (10 g) monofilament test, Type 2 diabetes mellitus

INTRODUCTION

Diabetes mellitus is a chronic disease that poses major health problems worldwide and World Health Organisation declared this as a silent epidemic. The prevalence of diabetes has been increasing more rapidly in low and middle-income countries. The global prevalence of diabetes among adults over 18 years of age has risen from 4.7% in 1980 to 8.5% in 2014 [1].

As per the International Diabetes Federation (IDF) prevalence of diabetes in adults is 8.8% in 2017. Among 425 million people having diabetes in the world, about 82 million people residing in South-East Asia Region and estimated that this will rise to 151 million by 2045. Evidence suggests that patients with diabetes have a higher risk of developing micro-vascular consequences that lead to considerable morbidity and mortality [2].

Peripheral neuropathy is a common type of nerve damage in diabetic patients that typically affects the feet and legs and sometimes affects the upper arms and hands. About one-third to one-half of people with diabetes has peripheral neuropathy [3]. About 30% to 45% of patients with type 2 diabetes are affected by micro-vascular diseases like peripheral neuropathy, retinopathy, and nephropathy [4]. The most important risk factors for these types of complications include poor glycaemic control, increased duration of diabetes, and hypertension [5]. Some studies have found that poor diabetes self-management among diabetes patients lead to poor glycaemic control which causes long-term diabetic complications peripheral neuropathy being one of these complications [6,7]. Diabetes self-management activities such as dietary modifications, adequate physical activity, glucose control,

regular monitoring of blood glucose levels, and maintaining a healthy lifestyle play a crucial role in the care of diabetes mellitus [8,9]. There is dearth of studies on DPN and their association with diabetes self-management in this part of West Bengal.

This study was conducted to determine the proportions of DPN among patients of T2DM to find out the associations of peripheral neuropathy in patients with T2DM with diabetes self-management and other co-variates.

MATERIALS AND METHODS

A clinic based cross-sectional study was conducted from December 2018 to March 2019 among known T2DM patients aged 30 years and above attending this Non-Communicable Disease (NCD) clinic at Urban Health Unit and Training centre (UHU and TC), under the purview of field practice areas of AIIH and PH, Kolkata. Total sample of 105 diabetic patients were selected for the study. The study was conducted in accordance to the Declaration of Helsinki (2013) for ethical consideration. Informed written consent for participation in the study were obtained from every participant selected for the study after explaining to them the purpose of the study and ensuring anonymity and confidentiality.

Inclusion criteria: All the patients, who were 30 years and above and having T2DM for at least 6 months of duration, who came to the NCD clinic during the study period and gave their consent for participation were included in the study.

Exclusion criteria: Those who did not give informed written consent were excluded

Sample size: The proposed study was intended to get an estimate of DPN. Therefore the researchers had considered 33.7% as the prevalence (p) to calculate the minimum sample size for this study, using the formula [10];

$$n = Z\alpha^2 \times p \times (1-p) / d^2$$

Where, $Z\alpha$ = standard normal deviate at desired 95% confidence (1.96), $p=0.337$, $q(1-p)=0.667$, d = absolute error of 10%. Taking non-response rate as 10%, minimum sample size calculated was 95. Data was collected on 105 patients.

The schedule was developed in the Department of Preventive and Social Medicine under the astute guidance of the faculty members of this department. The schedule was translated in Bengali (local language) and was translated in English, and the latter was back translated into Bengali. Pretesting of the study tool was done among ten patients of T2DM patients who were not included in the study population, and the schedule was modified according to the feedback. The final schedule was unambiguous, simple to understand, had semantic equivalence, and conformed to the objectives of the study. Face and content validity were ensured by the experts in the Department of PSM.

The contents of the schedule were as follows:

Outcome Variable

DPN was assessed using pre-designed and pre-tested Diabetic Neuropathy Symptom/Signs (DNS) questionnaire and Diabetic Neuropathic Examinations (DNE) using Semmes-Weinstein 5.07 (10 gram) Monofilament Examination (SWME). All patients were questioned regarding the presence of DNS. Patients were asked if they have foot drop, aching pain, numbness, tingling sensation, presence of ulcer and infection in their legs or feet during the last 2 weeks. For each of the items with response "yes" (positive) the score was 1 and with "no" (negative) the score was 0. Maximum attainable score was 6. Score zero was considered as neuropathy absent and scores 1 to 6 as neuropathy present.

SWME was performed as per the guideline for diabetic and neuropathic ulcers to assess the loss of protective sensation over the feet. The monofilament was placed perpendicular to the heel, sole and three other points symmetrically in at plantar surface of feet and pressure was applied until the filament just bent with a contact time of 2 seconds. Inability to perceive the sensation at any one site was considered abnormal. A patient was considered to have DPN if he or she had at least one positive symptom and one abnormal SWME finding.

Independent Variables

1. Socio-demographic information (Age, Sex, Socio-economic status).
2. Duration of Diabetes Mellitus.
3. Presence of hypertension as co-morbidity.
4. Independent Proximate Variable (Explanatory): Diabetes Self-Management Questionnaire (DSMQ).

The Diabetes self-management questionnaire DSMQ is a reliable and valid tool for the assessment of self-care activities associated with glycaemic control [11]. The DSMQ consists of 16 items divided into four subscales and maximum attainable score is 43;

- The first subscale is glucose management subscale, and is scored by items 1, 4, 6, 10, and 12 of the questionnaire.
- The second subscale evaluates dietary control and is scored by items 2, 5, 9, and 13.
- The third subscale measures physical activity and is scored by items 8, 11, and 15 of the questionnaire.
- While the fourth subscale address healthcare use and is scored by items 3, 7, and 14 of the questionnaire.

A sum scale score is a global measure of self-care.

DSMQ scoring: Scale scores were calculated as sums of item scores and then transformed into score ranging from 0 to 10 (raw score/theoretical maximum score *10).

First the patients were explained regarding the purpose and importance of the research work. After obtaining informed written consent from participants, face to face interview was done to obtain data regarding socio-economic and demographic characteristics, duration of T2DM, treatment of T2DM, and other co-morbidities. In order to measure diabetes self-care activities, the Diabetes Self-Management Questionnaire (DSMQ) was used. Assessment of Peripheral Neuropathy was done with DNS and Semmes-Weinstein 5.07 (10 gram) Monofilament test. Medical records (if any) were reviewed. At the end of the interview, any misconceptions or queries regarding diabetes and diabetes self-care management was clarified and the participants were thanked for extending their co-operation.

STATISTICAL ANALYSIS

Data were entered and analysed by univariate and multivariate analyses to find out the association between DPN and other co-variables using IBM SPSS version 16.0 and were represented by various tables. The fitting of this model evaluated through Hosmer and Lemeshow goodness of test while variability of dependent variable was explained by the model Cox and Snell and Nagelkerke.

RESULTS

The study was conducted on a total of 105 adults suffering from type 2 diabetic patients aged between 32 and 72 years with a mean age of 54.89 years (SD=8.98). Female participants were more (59%) than the male participants. Majority (77%) of the participants belonged to upper-lower and lower socio-economic class according to modified Kuppuswamy Scale 2018 [12]. About 56.2% patients had hypertension as co-morbidity. The mean duration of diabetes was 6.18 years (SD=4.78), more than half (54.3%) of participants were having diabetes for less than five years [Table/Fig-1]. [Table/Fig-2] shows mean±SD score of different sub-scales of DSMQ. [Table/Fig-3] shows that the proportion of Diabetic Peripheral Neuropathy (DPN) was 34 (32.4%).

Characteristics	Frequency (%)	Descriptive statistics
Age categories (years)		
32-41	11 (10.5)	Mean age=54.89 years SD=8.98 Range=32;72
42-51	32 (30.5)	
52-61	43 (41.0)	
62-72	19 (18.0)	
Gender		
Male	43 (41.0)	
Female	62 (59.0)	
Socio-economic class (Modified Kuppuswamy scale 2018)		
Upper-middle class (score 16-25)	7 (6.7)	Monthly income of the family (in INR)- Mean=11552.38 SD=7604.69 Median=9000.00 Range=2000;45000
Lower-middle class (score 11-15)	17 (16.3)	
Upper-lower class (score 5-10)	55 (52.3)	
Lower class (score below 5)	26 (24.7)	
Hypertension		
Yes	59 (56.2)	
No	46 (43.8)	
Duration of T2DM		
≤5 years	57 (54.3)	Mean duration=6.18 years SD=4.78 Median duration=5.00 years Range=6 months; 30 years
5-10 years	35 (33.3)	
>10 years	13 (12.4)	
Total	105 (100)	

[Table/Fig-1]: Socio-demographic characteristics and some disease related information of the study participants (N=105).

T2DM: Type 2 diabetes mellitus; SD: Standard deviation

DSMQ	Score* (Mean±SD)
Glucose management subscale	5.71±1.05
Diet control subscale	5.75±1.49
Physical activity subscale	5.09±1.58
Healthcare use subscale	6.52±1.17
DSMQ sum scale	1.55±0.97

[Table/Fig-2]: Distribution of DSMQ subscale score among the diabetic patients (N=105).

*Score calculated after transformation; DSMQ: Diabetes self management questionnaire; SD: Standard deviation

Diabetic Neuropathy Symptoms (DNS)*	Number (%)
Infection	28 (26.7)
Tingling sensation	27 (25.7)
Numbness	16 (15.2)
Pain	15 (14.3)
Ulcer	4 (3.8)

SWME

Positive	53 (50.5)
Negative	52 (49.5)

[Table/Fig-3]: Distribution of study participants according to diabetic neuropathic symptoms and SWME of feet (N=105)#.

#multiple responses and none of them had foot drop.

*About 43.8% patients were found to have at least one positive symptom and 50.5% patients had at least one abnormal SWME finding. Those patients who had at least one DNS and one positive SWME were considered to have DPN which was 34(32.4%).

SWME: Semmes-Weinstein 5.07 (10 gram) Monofilament Examination

[Table/Fig-4] shows that DPN was significantly associated with increased duration of T2DM {AOR (95% CI)}={1.52 (1.22-1.91)}, lower glucose management subscale score {AOR (95% CI)}={2.84 (1.42-5.67)} and lower healthcare use subscale score {AOR (95% CI)}={1.86 (1.05-3.31)}. Increasing age, increasing duration of T2DM along with decreasing glucose management subscale score, diet control subscale score and healthcare use subscale score was significant in univariate regression analysis and all five variables were included in the final model. Odds of having DPN with increasing age (AOR=0.98, p-value=0.611) and decreasing diet control subscale score (AOR=1.07, p-value=0.776) were attenuated and lost their significance whereas odds of having DPN with increasing duration of T2DM (AOR=1.52, p-value=0.001), decreasing glucose management subscale score (AOR=2.84, p-value=0.003) and healthcare use subscale score (AOR=1.86, p-value=0.031) were increased and continued to remain significant. The fitting of this model is good (Hosmer and Lemeshow goodness of test p-value is 0.55) [13] while 39% to 55% variability of dependent variable was explained by the model (Cox and Snell R²=0.39, Nagelkerke R²=0.55) [14,15].

DISCUSSION

Socio-demographic profile: This cross-sectional study was conducted to estimate the prevalence of DPN among patients of T2DM and to find out the co-variables associated with DPN. In this study, majority (71.5%) participants were in the age group of 42 to 61 years. About 52.3% of the participants belonged to upper-lower socio-economic class according to modified Kuppaswamy scale 2018 [12].

In a descriptive study conducted by Karmakar M and Mandal D, to assess the foot self-care knowledge and practice among the patient with diabetes mellitus in a selected hospital of Kolkata, about 41.33% of patients were in the age group of 51-60 years, 55.33% were females and 51.33% had DM for 10-15 years [6].

Risk factors for DPN and DSMQ: In this study mean (SD) score for glucose management subscale, diet control subscale, physical activity subscale, healthcare use subscale and DSMQ sum scale were 5.71 (1.05), 5.75 (1.49), 5.09 (1.58), 6.52 (1.17) and 1.55 (0.97)

Variables	DPN present, n (%)	OR (95% CI)	AOR (95% CI)*	p-value#
Age (years)	_____	1.10 (1.04-1.17)	0.98 (0.90-1.05)	0.610
Sex				
Male	13 (30.2)	1.43 (0.65-3.14) 1	_____	
Female	21 (33.9)			
Socio-economic status				
Lower class	11 (42.3)	1.78 (0.71-4.46) 1	_____	
Upper-lower and above class	23 (29.1)			
Hypertension				
Yes	23 (39.0)	2.03 (0.86-4.78) 1	_____	0.102
No	11 (23.9)			
Duration of T2DM (years) (↑)	_____	1.43 (1.22-1.67)	1.52 (1.22-1.91)	0.001
Glucose management subscale (↓)	_____	2.21 (1.37-3.54)	2.84 (1.42-5.67)	0.003
Diet control subscale (↓)	_____	1.48 (1.09-2.02)	1.07 (0.66-1.71)	0.776
Physical activity subscale (↓)	_____	1.06 (0.83-1.36)	_____	
Healthcare use subscale (↓)	_____	1.36 (1.01-1.96)	1.86 (1.05-3.31)	0.030
DSMQ Sum-scale (↓)	_____	0.85 (0.55-1.32)	_____	

[Table/Fig-4]: Factors associated with Diabetic Peripheral Neuropathy (DPN): univariate and multivariable logistic regression (N=105).

OR: Odds ratio; CI: Confidence interval; *AOR: Adjusted odds ratio; #p<0.05 was considered to be statistically significant; Hosmer and Lemeshow Goodness of test, p-value is 0.55; Nagelkerke R²=0.55, Cox and Snell R²=0.39; denote the increase (↑); denote the decrease (↓)

respectively. In a study conducted by Meharavar F et al., in Iran showed that mean (SD) score for glucose management subscale, diet control subscale, physical activity subscale, healthcare use subscale and DSMQ sum scale were 4.62 (1.04), 4.64 (1.32), 3.93 (1.18), 2.61 (1.42) and 1.08(0.65), respectively [7]. In another study conducted by Kakade AA et al., Mean±SD score of different DSMQ subscale in glycaemic controlled vs glycaemic not controlled group were as glucose management subscale (9.59±1.41 vs 8.60±2.4), the 'dietary control' subscale (8.49±1.46 vs 7.61±1.1), for physical activity (4.78±1.2 vs 4.80±1.17), health care use subscale (5.14±0.97 vs 4.97±2.1) and finally, the sum scale score was (1.85±0.7 vs 1.62±0.9) [16].

DPN: In this study, about 32.4% of the patients were found to have DPN which was found to be significantly associated with increased duration of T2DM, along with poor glucose management subscale and poor healthcare use subscale higher odds of DPN. In a study conducted by Bansal D et al., showed a prevalence of 29.2% of DPN among T2DM patients in north India and DPN was found to be positively associated with increasing age of the participants (OR 1.02, 95% CI 1.01-1.03) and longer duration of diabetes (OR 1.044, 95% CI 1.02-1.06) [10]. In another study, conducted by Meharavar F et al., in Iran, neuropathy was found to be significantly associated with diabetes self-management sum scale (p=0.01), the glucose management subscale (p=0.03), and the healthcare use subscale (p=0.02) [7]. In a hospital based study conducted by Khawaja N et al., in Jordan it was observed that the overall prevalence of DPN was 39.5% and patients on oral hypoglycaemic agents were found to be protective to DPN (OR=0.63, p-value=0.01) compared to those who were receiving insulin therapy in addition to oral hypoglycaemic agents, which might be considered as concordant with the present study due to the reason that the patients usually have controlled glucose level kept on oral hypoglycaemic agents only unless contraindicated. T2DM duration was the strongest predictor for

DPN [17]. The difference in the prevalence of DPN with previous other studies might be due to different study settings and different methods of screening of DPN used by the researchers.

Limitation(s)

This study was conducted in a clinical setting with a small sample size and purposive sampling technique which might have jeopardised its external generalisability of the results obtained.

CONCLUSION(S)

In this clinic based cross-sectional study DPN was found to be highly prevalent. This neurological disorder derails the normal life of an individual and therefore mandatory screening of this complication of DM must be undertaken as early as possible so that steps may be taken for its timely and appropriate prevention and management. Structured health education programme at community level and at all levels of health care service on comprehensive self-care management for diabetes would be helpful in glycaemic control and in prevention of DPN. Thus, the findings of this study reiterate the necessity for early screening and effective management of diabetes and its complications. Further studies with larger sample size are suggested for better elucidation of DPN and its predictors.

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