Original Article

Diabetic peripheral neuropathy among Saudi diabetic patients: A multicenter cross-sectional study at primary health care setting

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Abstract

Background: Diabetic peripheral neuropathy (DPN) is one of the most common complications of diabetes and is responsible for morbidity and disability among diabetic patients. **Objectives:** The aim of this study was to assess the prevalence of painful DPN and its associated risk factors in patients with diabetes mellitus. **Materials and Methods:** A cross-sectional study was conducted among 430 diabetic patients attending primary healthcare centres (PHC) in AL Madinah city, Saudi Arabia. The validated Douleur Neuropathique-4 (DN4) questionnaire was used to identify the presence of painful DPN. **Results:** The majority were female (54.7%) and had type 2 diabetes mellitus (74.9%). The prevalence of DPN was 30.1% in type 2 diabetic patients and 25.9% in type 1 diabetic patients with an overall prevalence of 29.1%. DPN was associated significantly with age, duration of diabetes milieus, uncontrolled A1c, and positive family history of diabetes mellitus ($P < 0.05$). All the investigated comorbidities were also associated significantly with DPN ($P < 0.05$). **Conclusions:** The prevalence of DPN was 25.9% and was associated with age duration of DM and uncontrolled HbA1c. PHC physicians treating diabetes should be more aware of the importance of screening for DPN and the treatment plan.

Keywords: Diabetic peripheral neuropathy, glycaemic control, pain, primary care

Introduction

Diabetes mellitus is prevalent worldwide, and Saudi Arabia ranks as the second highest in the Middle East, and the seventh in the world for the rate of diabetes (34.1% in males and 27.6% in females).[1,2] Diabetic peripheral neuropathy (DPN) is a nerve damaging disorder caused by diabetes and is related to duration and degree of glycemic control.[3] Neuropathy results in significant morbidities such as a pain, loss of sensation, foot ulcers, gangrene, and amputations.[4,5] The prevalence of DPN internationally ranges between 26.4% and 35.78% and nationally between 19.9% and 35%.[6-8] The foot ulceration is not only the most common complication of neuropathy but also among the preventable diabetes complications.[9] The prevalence rate of diabetic foot in the world is about 4.6–12%.[10-12] In the literature, the risk of DNP was found to be associated with age, duration of DM, glycemic control (high level of HbA1c), gender, and smoking.[13] The aim of this study was to assess the prevalence of painful DPN and its associated risk factors in patients with diabetes mellitus attending primary healthcare (PHC) in AL Madinah city, Saudi Arabia.

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Materials and Methods

This cross-sectional study was carried out in the PHCs in AL Madinah city. Twelve centers were selected randomly from a total of 40 centers in the city. Thirty-one diabetic patients were selected by systematic random sampling from each health center to get a total sample of 430 patients. Data was collected 5/7 days for 1 week. Patients were included if they met all the following criteria: aged ≥18 years; presenting at an outpatient clinic; current diagnosis of diabetes mellitus type 1 (duration ≥5 years) or type 2 (any duration); no other type of neuropathic pain of non-diabetic origin. Gestational diabetes was excluded. Diagnosis of diabetes mellitus was based on the American Diabetes Association (ADA) guidelines (random blood sugar >200 mg/dL or fasting blood sugar >126 mg/dL).[14]

The first part of the questionnaire included questions on the sociodemographic characteristics, comorbidities, duration, and type of diabetic mellitus. The second part included the validated Douleur Neuropathique-4 (DN4), which was used to identify the presence of painful DPN and is a brief 10-item questionnaire.[15] The first seven items of the DN4 based on patient's interview and the final three items are based on physical examination of sensory function. All questions were answered either "yes" or "no." "Yes" answer was given 1 point and "No" answer was given zero. The total score ranges from 0 to 10 and a score of 4 or more is considered the cutoff point for the diagnosis of neuropathic pain. The original version was validated by Bouhassira *et al.* (2005) and the Arabic version used in this study was validated by Harifi *et al.* (2013).[15,16] The first three questions investigated the characters of pain (burning, painful cold, and electric shocks), the next four questions investigated the symptoms associated with the pain (tingling, pins and needles, numbness, and itching). The next two questions investigated hypoesthesia to touch and hypoesthesia to prick. The last question investigated if the pain be caused or increased by brushing. The last measure of hemoglobin A1c (HbA1c) for each participant was taken from the hospital records.

This study protocol was approved by the ethical committee of the Institutional Review Board in Al-Madinah. Objectives and benefits of the study were explained to the participants. Participant's confidentiality and anonymity were assured. Signed consent was obtained from those who agreed to participate.

Statistical analysis was carried out by using Statistical Package for the Social Sciences (SPSS®) software (version 20). Descriptive statistics was employed to obtain frequencies, mean, and standard deviations. Chi-square test was employed to assess association between DPN and categorical data. The accepted level of significance was set below 0.05 ($P < 0.05$).

Results

The majority were female (54.7%), aged between 46 and 65 years (44%), had type 2 diabetes mellitus (74.9%), and had family history of DM (61.2%). Most of the participants had uncontrolled HA1c (82.1%). The most common reported comorbidity was hypertension (45%) [Table 1].

The prevalence of DPN was 30.1% in type 2 diabetic patients and 25.9% in type 1diabetic patients with an overall prevalence of 29.1%.

The most common symptoms and signs of pain were tingling (26.7%), hypoesthesia to touch (23.3%), and pins and needles (23%) [Table 2].

Table 3 shows factors associated with DPN. The prevalence of DPN increased significantly with increased in the age and

Table 1: Sociodemographic characteristics of the participants

Variable	*n*	Percentage
Age (years)		
≤25	66	15.3
26-45	79	18.4
46-65	189	44.0
>65	96	22.3
Gender		
Male	195	45.3
Female	235	54.7
Type of DM		
Type 1	108	25.1
Type 2	322	74.9
Family history of DM		
Yes	263	61.2
No	167	38.8
Duration of DM (years)		
<5	131	30.5
6-10	109	25.3
11-20	115	26.7
>20	75	17.4
HA1c status		
Controlled HA1c	77	17.9
Un-controlled HA1c	353	82.1
Smoking		
Yes	96	22.3
No	334	77.6
Foot ulcer	68	15.8
History of amputation	25	5.8
Hypertension	197	45
Hyperlipidemia	123	28.6
Cardiac diseases	43	10
Asthma	34	7.9
Stroke	29	6.7
Thyroid diseases	38	8.8
Renal diseases	21	4.9
Vision loss	23	5.3

Table 2: Symptoms and signs of DPN pain among diabetic patients

Symptoms and signs	*n* (%)
Burning pain	79 (18.4%)
Painful cold	50 (11.6%)
Electric shocks	39 (9.1%)
Tingling	115 (26.7%)
Pins and needles	99 (23%)
Numbness	96 (22.3%)
Itching	41 (9.5%)
Hypoesthesia to touch	100 (23.3%)
Hypoesthesia to pinprick	77 (17.9%)
Pain on brushing	43 (10%)

Table 3: Factors associated with DPN among diabetic patients

Variable	Diabetic Peripheral Neuropathy		Odds Ratio	95% CI	*P*
	Yes	No			
Gender					
Male	60 (30.8)	135 (69.2)	1.2	0.7 - 1.7	0.274
Female	65 (27.7)	170 (72.3)			
Age (years)					
18-25	8 (12.1)	58 (87.9)	Ref		
26-45	16 (20.3)	63 (79.7)	6.4	2.7 - 14.8	<0.001
46-65	56 (29.6)	133 (70.4)	3.5	1.7 - 6.8	<0.001
>65	45 (46.9)	51 (53.1)	2.1	1.2 - 3.4	0.004
Smoking					
Yes	32 (33.3)	64 (66.7)	1.3	0.7 - 2.1	0.179
No	93 (27.8)	241 (72.2)			
Type of DM					
Type 1	28 (25.9)	80 (74.1)	0.8	0.4 - 1.3	0.241
Type 2	97 (30.1)	225 (69.9)			
Duration of DM (years)					
<5	17 (13.0)	114 (87.0)	Ref		
6-10	22 (20.2)	87 (79.8)	6.9	3.4 - 13.6	<0.001
11-20	48 (41.7)	67 (58.3)	4.1	2.1 - 7.7	<0.001
>20	38 (50.7)	37 (49.3)	1.4	0.7 - 2.5	0.228
HA1c Level					
Controlled HA1c	27 (14.9)	154 (85.1)			
Un-Controlled HA1c	98 (39.4)	151 (60.6)	3.7	2.3 - 6.0	<0.001

all the age groups had higher prevalence of DPN compared to the age group 18–25 years ($P < 0.05$). The prevalence of DPN increased significantly with increased in the duration of DM ($P < 0.05$). Patients with uncontrolled A1c had higher prevalence of DPN (39.4%) compared to patients with controlled A1c (14.9%) (OR = 3.7, 95% CI 2.30–6.0).

Table 4 shows the association between comorbidities and DPN. All comorbidities were associated significantly with DPN: hypertension (OR = 2.1, 95% CI1.47–3.44), asthma (OR = 2.3, 95% CI1.15–4.75), thyroid diseases (OR = 2.1, 95% CI 1.08–4.18), cardiac diseases (OR = 2.6, 95% CI1.37–4.92), stroke (OR = 2.4, 95% CI1.14–5.21), and renal diseases (OR = 4.3, 95% CI1.73–10.67).

Discussion

The prevalence of DPN was 29.1% in this study, which was higher than a worldwide estimate of DPN prevalence among diabetics (8.1 – 12.2%).[17] In Saudi Arabia, a prevalence of 65.3% has been previously reported for painful DPN in a nationally representative diabetic population in 2010.[18] In other Middle East countries, the prevalence rates of painful DPN were 61.3%, 57.5%, 53.9%, and 37.1% for Egyptian, Jordanian, Lebanese, and Gulf States population, respectively.[19] Similar high prevalence was found in India (69%).[20] Duration of diabetes showed significant association with DPN in this study. It was reported in the literature that the prevalence of neuropathy increases after 5 years of the diagnosis of DM.[21] So it is imperative to perform the neurological testing in the laboratory and scoring systems should also be included. It is better to educate patients to examine their foot at least annually and the early detection of DN makes the healthcare professionals and patients to initiate the preventive measures and can evaluate the therapeutic options. Previous studies found that the prevalence of DNP was higher among females.[22] However, the current study did not find such association and this finding is consistent with a previous study by Popescu *et al.* (2015).[23] This study found that prevalence of DNP increased by age. This finding is consistent with the previous studies.[23-25] In the current study, we found a significant association between the HbA1c levels DNP. Similar finding was reported in the previous studies.[23,26] This study found a significant association between DNP and comorbidities such as hypertension, asthma, thyroid diseases, cardiac diseases, stroke, and renal diseases. A previous study found significant association between DNP and chronic kidney disease but not with hypertension.[23]

The strength of this study is apparent in its large and representative sample size and by using a validated tool. However, several limitations of this study warrant attentions. First, the cross-sectional nature of this study design limits the inference of causal relationship between correlates and DPN. Therefore, our findings need to be confirmed in prospective studies. Second, the diagnosis of DPN was based on a combination of decreased sensation and neuropathic sensory symptoms, without nerve conduction test.

In conclusion, the prevalence of DPN was 30.1% in type 2 diabetic patients and 25.9% in type 1diabetic patients with an overall prevalence of 29.1%. DNP was associated with age duration of DM and uncontrolled HbA1c. PHC physicians treating diabetes should be more aware of the importance of screening for DPN and the treatment plan.

Table 4: Comorbidities associated with DPN among diabetic patients

Comorbidities	Diabetic Peripheral Neuropathy		Odds Ratio	95% CI	*P*
	Yes	No			
Hypertension					
Yes	75 (38.1)	122 (61.9)	2.2	1.4 - 3.4	<0.001
No	50 (21.5)	183 (78.5)			
Asthma					
Yes	16 (47.1)	18 (52.9)	2.3	1.1 - 4.7	0.016
No	109 (27.5)	287 (72.5)			
Thyroid diseases					
Yes	17 (44.7)	21 (55.3)	2.1	1.1 - 4.1	0.023
No	108 (27.6)	284 (72.4)			
Cardiac diseases					
Yes	21 (48.8)	22 (51.2)	2.5	1.3 - 4.9	0.003
No	104 (26.9)	283 (73.1)			
Stroke					
Yes	14 (48.3)	15 (51.7)	2.4	1.1 - 5.2	0.019
No	111 (27.7)	290 (72.3)			
Renal diseases					
Yes	13 (61.9)	8 (38.1)	4.3	1.7-10.6	0.001
No	112 (27.4)	297 (72.6)			

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Conflicts of interest

There is no conflicts of interest.

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