

Original Article

The Prevalence and Associated Risk Factors of Peripheral Diabetic Neuropathy in Hamedan, Iran

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Abstract

Background: Diabetic neuropathy is one of the most common complications of diabetes mellitus, of which its most prevalent form is chronic sensorimotor neuropathy. The aim of this study is to assess the prevalence of diabetic peripheral neuropathy (DPN) and its associated risk factors among diabetic patients who reside in Hamedan, Iran.

Methods: A cross-sectional study of 600 types 1 and 2 diabetic patients was performed using the standard Neuropathy Symptom Score (NSS) and Neuropathy Disability Score (NDS) criteria for the diagnosis of diabetic neuropathy.

Results: Overall prevalence of DPN in this population was 45.7% (95% CI: 42.6%-48.8%). The prevalence of DPN in type 1 diabetic patients was 21.5%, whereas in type 2 diabetic patients it was 49.3% ($P < 0.001$). Duration of diabetes and education level were significantly associated with DPN in type 1 diabetic patients and a history of foot ulcer, age, duration of diabetes, weight, education level, and sex had a significant association with DPN in type 2 diabetic patients according to multiple logistic regression analysis.

Conclusion: The results of our study showed a relatively high prevalence of DPN in our diabetic population. A significant difference existed in the prevalence of DPN between types 1 and 2 diabetic patients.

Keywords: Diabetes, neuropathy, prevalence, risk factors

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Introduction

Diabetic neuropathy is one of the most common complications of diabetes mellitus, and its morbidity and mortality is a large part of the cost of diabetes care.¹ The most common form of diabetic neuropathy is chronic sensorimotor neuropathy. Several mechanisms are involved in pathogenesis of diabetic neuropathy, such as hyperglycemia, the polyol pathway, glycation, and oxidative stress, among others.²

Earlier studies have reported a worldwide prevalence of 22.7% to 54% for diabetic peripheral neuropathy (DPN).³ Estimates of the prevalence of diabetic neuropathy vary to a large extent, due to the differences in the type of patients, the neurological effects of ageing and diagnostic methods and criteria.⁴⁻⁶

A few studies have evaluated the prevalence of DPN in different regions of Iran, with a reported prevalence from 32% to 75.1%.⁷⁻⁹

The aim of this study was to estimate the prevalence of DPN and its associated risk factors in a population of diabetic patients in Hamedan, a province in Western Iran.

Patients and Methods

This cross-sectional study was conducted at the Diabetes Center of Hamedan, Western Iran. Convenience sampling was used to enroll patients. Patients who matched the ADA criteria¹⁰ for diabetes (types 1 and 2) were asked to participate in this project by invitation. We recruited 600 patients from April 18 to September 4, 2011. After obtaining written informed consent, a questionnaire that included general information, height and weight, smoking status, duration of diabetes, type of medication, history of foot ulcer, and laser photocoagulation was completed. Then height, weight and blood pressure were recorded. Patients were considered hypertensive if on medication or if they had a systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 80 mmHg. An endocrinologist examined the patients for the presence of DPN. We used the standard Neuropathy Symptom Score (NSS) and Neuropathy Disability Score (NDS) criteria for the diagnosis of diabetic neuropathy.^{11,12} First, the NSS questionnaire that included questions regarding the type of sensation, location and time of symptoms, waking up from sleep, and factors that relieved symptoms were asked and recorded. Then, the NDS data sheet was completed. This data sheet contained neurologic examination parameters such as the ankle reflex and perceptions of pinprick, cold, and vibration. A score of 0 to 2 was assigned for each parameter. Total NSS and NDS scores were the sum of these scores. The criteria for diagnosis of DPN was an NDS score of at least 6, irrespective of NSS score, or an NDS score of 3 – 5 in combination with an NSS score of at least 5.³ We used the t-test for data analysis to compare quantitative variables; and qualitative variables were compared with the chi-square or Fisher's exact tests. P -values less than 0.05 were considered statistically

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significant. Because of the numerous risk factors involved in the occurrence of DPN, we have used multiple logistic regression models to identify those risk factors associated with DPN. In the backward method, we used the Wald test to evaluate the significance of the variables. The Wald test is equal to beta divided by the standard error of beta, where the obtained value (± 1.96) is not statistically significant. The exit and entrance of the variables into the model were at the level of $\alpha = 0.05$. All statistical analyses were performed using SPSS for Windows.

Results

General characteristics of the study population are shown in Table 1. A total of 600 diabetic patients (79 type 1 and 521 type 2) were included in this study. The mean age of the patients was 53.26 ± 14.46 years and the mean duration of diabetes was 9.26 ± 7.44 years. Overall prevalence of DPN was 45.7% (95% CI: 42.6%–48.8%). Prevalence of DPN in type 1 diabetic patients was 21.5% and the prevalence in type 2 diabetic patients was 49.3% ($P < 0.001$). We observed that the prevalence of DPN was higher among men (51.5%) than women (42.8%; $P = 0.045$). In terms of diabetes duration, there was no significant difference between men (9.5 ± 7.1 years) and women (9.1 ± 7.5 years; $P = 0.569$).

Of the patients with DPN, 36.9% were male whereas 29.1% of the patients without DPN were male ($P = 0.045$). Patients with DPN were 59.3 ± 11.6 years old compared to patients without

DPN, who were 48.16 ± 14.6 years old ($P < 0.001$). Those with DPN had a longer duration of diabetes (11.4 ± 8 years) compared with those without DPN (7.3 ± 6.3 years; $P < 0.001$).

Multiple logistic regression analysis was used to evaluate the correlation between DPN and multiple factors such as age, sex, weight, height, hypertension, systolic and diastolic blood pressure, smoking, duration of diabetes, type of diabetes, type of medication (insulin or oral agent), history of foot ulcer and education level separately for type 1 and type 2 diabetes. Factors that have a significant association are shown in Table 2. In this model, the duration of diabetes and education level were significantly associated with DPN in type 1 diabetic patients and history of foot ulcer, age, duration of diabetes, weight, education level and sex had a significant association with DPN in type 2 diabetic patients.

Discussion

In general, the prevalence of DPN in our studied population was 45.7% and history of foot ulcer, age, duration of diabetes, weight, diastolic blood pressure, education level and sex were associated with DPN. Previous studies of the prevalence of neuropathy in diabetic patients have reported different results. In one Portuguese study, the prevalence of clinical DPN was reported to be 32.2%, however DPN was defined as the presence of altered sensitivities and reflexes, regardless of symptoms.¹³ In two studies conducted in Spain, Cabezas-Cerrato and colleagues⁶ reported a prevalence

Table 1. Baseline characteristics of the study population and prevalence of diabetic peripheral neuropathy (DPN) in types 1 and 2 diabetic patients.

	Type 1	Type 2	P-value
Number (%)	79 (13.1)	521 (86.8)	<0.001
Age (years)	28.2±10.6	57.0±10.6	<0.001
Duration (years)	9.5±7.2	9.2±7.4	0.703
Education level (%)			<0.001
Illiterate	4 (5)	185 (35.5)	
Elementary	12 (15.1)	118 (22.6)	
< High school	46 (58.2)	176 (33.7)	
≥ High school	17 (21.5)	42 (8)	
Height (cm)	164.0±9.8	158.8±8.5	< 0.001
Weight (kg)	64.0±12.4	71.5±11.9	< 0.001
BMI (kg/cm²)	23.7±4.3	28.3±4.3	< 0.001
Systolic blood pressure (mmHg)	110.8±15.2	125.6±19.6	<0.001
Diastolic blood pressure (mmHg)	62.8±8.6	70.7±11.8	<0.001
Hx of hypertension (%)			<0.001
No	75 (94.9)	285 (54.7)	
Yes	4 (5.1)	236 (45.3)	
Smoking (%)			0.148
No	71 (89.9)	490 (94.1)	
Yes	8 (10.1)	31 (5.9)	
Medications (%)			<0.001
Oral agent	4 (5.1)	313 (60.1)	
Insulin	72 (91.1)	119 (22.8)	
Oral agent + insulin	3 (3.8)	89 (17.1)	
Hx of foot ulcer (%)			0.821
No	70 (88.6)	457 (87.7)	
Yes	9 (11.3)	64 (12.2)	
Hx of laser photocoagulation (%)			0.004
No	77 (97.4)	448 (85.9)	
Yes	2 (2.5)	73 (14)	
DPN (%)			<0.001
No	62 (78.5)	264 (50.7)	
Yes	17 (21.5)	257 (49.3)	

hx: History, DPN: Diabetic peripheral neuropathy

Table 2. Multiple logistic regression analysis of associated risk factors with diabetic peripheral neuropathy (DPN) in types 1 and 2 diabetes.

Type 1 diabetes			
Variable	Wald	P-value	Adj. OR (95% CI)*
Duration	5.85	0.016	1.16 (1.03–1.32)
Education level	9.43	0.002	0.17 (0.05–0.53)
Type 2 diabetes			
Variable	Wald	P-value	Adj. OR (95% CI)*
Hx of foot ulcer	8.76	0.003	2.73 (1.40–5.31)
Age	28.60	<0.001	1.06 (1.03–1.08)
Duration	13.81	<0.001	1.05 (1.02–1.08)
Weight	4.06	0.044	1.01 (1.00–1.03)
Education level	9.53	0.002	0.72 (0.58–0.88)
Sex	7.63	0.006	0.51 (0.32–0.82)

hx: History, Adj. OR (95% CI)*: Adjusted odds ratio (95% CI)

of 22.7% and Garcia and colleagues³ reported a prevalence of 39.6% for diabetic polyneuropathy. Also, another study in Canada reported a prevalence of 15% for neuropathy in established diabetic patients.¹⁴ However, these studies all used different diagnostic methods to diagnose neuropathy. Some studies have evaluated the prevalence of diabetic neuropathy in Iran. According to a study in Tehran, the prevalence of DPN was reported at 31.9% amongst 124 diabetic patients as determined by the Michigan criteria.⁷ A study in Isfahan on 810 diabetic patients reported a DPN prevalence of 75.1%, as diagnosed by symptoms, signs and nerve conduction velocity studies.⁹ Another study in Yazd Province, Iran reported a prevalence of 51.7% for diabetic sensory neuropathy in 2350 patients by considering physical signs for diagnosis.⁸

Various factors are associated with neuropathy such as age, male sex, duration of diabetes and glycemic control. In the present study, neuropathy was associated with duration of diabetes in type 1 diabetics. In type 2 diabetic patients, neuropathy was associated with history of foot ulcer, age, duration of diabetes, weight and sex. Neuropathy was inversely associated with patient's education level in both types 1 and 2 diabetes. The association of neuropathy with duration of diabetes and age noted in the current study were similar to other studies. We observed no association between neuropathy and height or BMI, which supported results of some studies,¹⁰ however contrasted other studies' findings.¹⁵ Our study did not show any correlation between smoking and neuropathy, unlike some previous studies.¹⁴

The current study had some limitations. First, it was possible that our patients were not representative of all diabetic patients since this study was performed in one center. A multicenter study could better estimate the true prevalence of DPN. Patients' glycemic control was not clear; it might have been better to determine H_{A1C} levels of the patients. Finally, we did not evaluate other causes of neuropathy.

The results of our study showed a relatively high prevalence (45.7%) of DPN that was associated with a history of foot ulcer, age, duration of diabetes, weight, diastolic blood pressure, education level and sex.

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