Peripheral Neuropathy among Elderly Diabetes in a Tertiary Center, Malaysia

Azidah A.K., Hasniza H., Lili Husniati Y *

Department of Family Medicine, School of Medical Sciences, Universiti Sains Malaysia, Kubang Kerian,16150, Kelantan, Malaysia

**** Corresponding Author:*** Dr. Lili Husniati Yaacob
Department of Family Medicine, School of Medical Sciences, Universiti Sains Malaysia
16150, Kubang Kerina, Kelantan, Malaysia
Tel: Office: 6097676613 | Mobile:6013-9844838 | Fax: 609-7676611
Email: husniati@usm.my

Abstract

Introduction: The presence of peripheral neuropathy in elderly diabetic patients has a great impact on the health status as it can result in a lot of complications such as fall.

Aims and Objective: The purpose of this study is to determine the prevalence of peripheral neuropathy and its associated factors among elderly diabetes type 2 patients attending Hospital Universiti Sains Malaysia

Methods/study design: We conducted a cross sectional study among 288 elderly diabetes type 2. The data collected includes data on socio-demographic, diabetes history, co-morbid diseases, drugs use and occurrence of falls for the past year. Assessment of impaired foot sensation was documented objectively using a 5.07 Semmes Weinstein Monofilament (SWM). Review of patients hospital records for medications usage, laboratory investigations results and medical illnesses were done. Patients also had visual assessment by the ophthalmologist.

Findings: The mean age of the study participant was 66.9 (5.81). The prevalence of peripheral neuropathy in this study was 51.0 %. Univariate analysis showed that age ($p<0.05$), insulin used ($p<0.05$), duration of diabetes ($p<0.01$), having retinopathy ($p<0.01$), poly pharmacy ($p<0.01$) and serum creatinine ($p<0.05$) level were associated with peripheral neuropathy. The prevalence of falls among elderly diabetes was 18.8 %. Falls was significantly associated with peripheral neuropathy ($p<0.001$, 95% CI 1.59 – 5.81).

Conclusion: The prevalence of peripheral neuropathy among the diabetic elderly was high and significantly associated with falls. Falls screening should be advocated in diabetic clinic especially among the elderly.

Key words: elderly, older people, diabetes, falls, peripheral neuropathy

Introduction

Diabetes mellitus (DM) is highly prevalent in older people.[1] DM in persons over 65 years has been projected to increase by 56% between 2002 and 2020 in the United State.[2] Over 25% of older persons have impaired glucose tolerance (IGT).[3] The greatest increases in prevalence of diabetes are expected among the elderly: from 25.2% among women 65–74 years of age to 53.7% among men ≥75 years of age.[4] The prevalence of elderly with diabetes in the UK was estimated between 11% and 14%.[5] In Asian countries such as India, 20% of the elderly population has DM.[6]

The negative effect of diabetes are either directly related to the disease itself or through its associated complications. Elderly diabetic population whose functional status is already declining due to aging is further affected by presence of the complications associated with diabetes such as peripheral vascular disease, cardiovascular diseases, retinopathy, neuropathy and nephropathy, to name a few. There were many previous studies which have shown a reduction in physical function and health status in elderly patients with diabetes compared with age-matched control subjects.[7,8] It is therefore important to recognize the impact of diabetes complications on top of the functional decline which is known to occur in the elderly.

Walking and balance are important functions which declined with ageing. There are however, important for maintenance of mobility and ensuring the independence of the elderly in the community. Peripheral neuropathy, a common complication of diabetes, is associated with gait abnormalities and poor balance.[9] The presence of peripheral neuropathy in elderly diabetics therefore compounded the negative effect of ageing on mobility and balance. This will increase the risk of fall in the elderly which will have a great impact not only at personal level but also on overall health economics.

There is still minimal data in Malaysia on the presence of peripheral neuropathy in elderly diabetic patients. It is hoped that this study will provide further data on the prevalence and factors associated with the above issue. This data will be beneficial to use in designing a better health care program for geriatric patients with diabetes mellitus.

Subject and Methods

We conducted a cross sectional study commencing from 1st April 2007 until 30th March 2008, among 288 elderly patients suffering from type 2 diabetes. This study was conducted in a tertiary center in the East Coast of Peninsular Malaysia (Hospital Universiti Sains Malaysia). The elderly is defined as those over 60 years of age. Non ambulatory patients and those unable to stand unassisted for a minimum of one minute were excluded from the study.

The subjects were identified during their regular diabetes clinical follow-up and were selected using a systematic random sampling method. The subjects were approached based on the ratio of 1: 2 centered upon registration lists at the clinic. Written informed consent was obtained from the subjects or caretakers for the participations of the study.

Patients were given questionnaire on socio demographic details to fill in which consists of questions to assess age, ethnicity, gender, marital status, educational status, occupational status, smoking status, and living arrangement. The second part of questionnaire assess diabetes mellitus history, duration of illness and its complications such as diabetes retinopathy, nephropathy and neuropathy, other medical illness, hypoglycemia episode, medication list, poly pharmacy practice and falls occurrence for the past year. Review of patients hospital records for medications usage, laboratory investigations results and medical illnesses were done.

Physical examinations were performed on the subjects by the doctor. The physical examination includes measurement of height, weight, blood pressure during standing and sitting. Monofilament test -Semmes-Weinstein was used to assess protective sensation status because it effectively quantifies the degree of neuropathy present in affected individuals.[10] Assessment of impaired foot sensation was documented objectively using a 5.07 Semmes Weinstein Monofilament (SWM). Patients were asked to respond with 'Now' when they were able to sense randomly applied pressure by this monofilament on the great toe, third toe and the plantar arch. Application of the SWM was conducted in accordance with recommended testing protocols including avoidance of heavily calloused areas, avoidance of patient prompting, and visually blinding the patients to the sites being tested. Insensitivity to the SWM 5.07 monofilament at either 2 or 3 of the tested sites was considered to be impaired sensation and loss of protective sensation. Patients' hospital records were then reviewed for medications usage, laboratory investigations results and presence of co-morbidity.

Hypoglycemia episodes are defined as the presence of hypoglycemia in a person occurring within the past one year based upon symptoms reported by patients and polypharmacy was defined as using four or more types of medications. The presence of retinopathy is defined based on the finding of either fundus camera or ophthalmologist assessment. The presence of nephropathy was based upon positive urine microalbuminaemia on two occasions, three to six months apart and serum creatinine levels reaching more than133 mmol/l. The diagnosis of hypertension was defined by a self report from a physician's diagnosis or as reported in the case note.

Statistical analysis

All data was entered and analyzed using Statistical Program for Social Sciences (SPSS) version 12.0 (SPSS Inc.2003). Simple logistic regression was used as a screening in selection of variables for further analysis. All variables with P value less than 0.25 and clinically significant variables were included in the multiple logistic regression analysis. The method that was used for variable selection was backward and forward stepwise procedure. All possible 2 way interactions were checked and those significant variables were included in the model. The independent variables were fitted into multiple logistic regression and variance inflation factors were obtained to check for multicollinearity. Fitness of model was tested by Hosmer Lemeshow Goodness of Fit test, the classification table and receiver operator characteristic curve.

Approval by the research and ethics committee

The protocol was approved by the Research and Ethical Committee, School of Medical Sciences, Universiti Sains Malaysia on 22nd March 2007.

Results

Characteristic

A total 286 subjects that fulfilled the inclusion and exclusion criteria were approached during study period. The prevalence of peripheral neuropathy in this study was 51.0 %. Table 1 shows the demographic and clinical characteristics of the study participants. The mean age of the study participant was 66.9 (5.81) and it was noted that the mean age for the elderly diabetic with neuropathy was 67.9 (6.6) which was higher than those without it [65.9 (4.7)].

More than 80 % had poly pharmacy and majority had hypertension 96.25%.

The occurrence of retinopathy, hypoglycemia episodes, orthostatic hypotension and falls were higher in those with neuropathy. The prevalence of falls among elderly diabetes was 18.8 %. Falls was significantly associated with peripheral neuropathy ($p<0.001$, 95% CI 1.59 – 5.81).

Univariate analysis showed that age ($p<0.05$), insulin used ($p<0.05$), duration of diabetes ($p<0.01$), having retinopathy ($p<0.01$), poly pharmacy ($p<0.01$) and serum creatinine ($p<0.05$) level were associated with peripheral neuropathy. (Table 1)

Table 2 showed the results of multiple logistic regression analysis of associated factors for peripheral neuropathy among elderly diabetes. Those who used insulin and had longer duration of diabetes were significantly associated with peripheral neuropathy.

Discussion

One of the main findings of the study is the highly prevalent occurrence of peripheral neuropathy in elderly patients with diabetes. Half of our study subjects (51.0%) were found to have peripheral neuropathy by monofilament testing. Previous studies have also shown association between age and the presence of neuropathy in diabetic patients.[11, 12]

However the prevalence of peripheral neuropathy in this study is much higher compared to the studies of peripheral neuropathy done in diabetic patients. A study in Sweden involving adult type 2 diabetes patients stated a 14% prevalence of peripheral sensory neuropathy with monofilament testing.[13] The Swedish study involved adult patients from the age of 40 to 70 years old with mean age of 61.7 ± 7 years. The study also used other modalities to test for neuropathy such as tuning fork and

neurothesiometer (VPT). Presence of neuropathy of any kind using these methods affected 67% of the study population in this study.

The main difference between the study mentioned and ours is the characteristic of the population sampled and the duration of diabetes. Our study is a hospital based study whereas the Swedish study is a population based. Our hospital is also a referral centre for the surrounding area, therefore received more patients with complications. The mean duration of diabetes of our study subjects are 10 years compared to 7 years in the other study. These two factors could account for the higher prevalence of peripheral sensory neuropathy in our sample.

Insulin usage is significantly associated with peripheral neuropathy. In Malaysia the use of insulin is often delayed for various reasons.[14] Many patients were started on insulin after they have been on maximum number of oral hypoglycaemic and failed to achieve the target control. Therefore insulin initiation is often delayed leading to more patients with complications. It is interesting to note that HbA1C level is not significantly associated with the presence of peripheral neuropathy in this study. This is in contrast to a study by Franklin et al which showed that both insulin use and HbA1C level was associated with distal neuropathy.[11] A possible explanation for the significant association between insulin use and not HbA1C level in this study is that the risk of peripheral neuropathy is more related to the presence of long standing uncontrolled diabetes and not the current status of control as determined by the HbA1C level.

This explanation is supported by our finding that duration of diabetes is significantly associated with the presence of neuropathy. The mean duration of diabetes in our study population with neuropathy was 13.4 ± 7.3 years. The same finding was noted in other studies. A study by Cabezas-Cerrato in Spanish population found that duration of diabetes since diagnosis is significantly associated with presence of peripheral neuropathy. The mean duration of diabetes in their study was 10.2 +/- 0.2 years. They also noted that the prevalence of peripheral neuropathy increases with the increase in duration of diabetes whereby the prevalence of peripheral neuropathy was 14.2% among those with duration < 5 years and 44.2% among those with duration > 30 years.[15]

Limitation of this study is the use of only monofilament to detect the presence of peripheral neuropathy. Other widely accepted methods of detecting neuropathy are deep ankle reflex and vibration. Ankle reflex is a powerful screening tool with high sensitivity and negative predictive value, but a combination of ankle reflex and vibration sense has superior sensitivity and specificity compared with either of them done alone for the detection of DPN in clinical settings.[13] We did not use ankle reflex since the assessment is difficult to evaluate and requires considerable skill. It is possible that the use of combination of these methods will yield a higher prevalence of neuropathy in the sample.

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Conflict Of Interest Statement

We declare there is no financial and personal relationship with other people or organizations that could inappropriately influence the research

Authors' Contributions

a. Conception and design : Azidah AK and Hasniza H
b. Acquisition of data and analysis : Azidah AK and Hasniza H
c. Interpretation of data : Azidah AK and Hasniza H
d. Drafting : Azidah AK, Hasniza H and Lili Husniati Y
e. Critical revision and Final approval of completed manuscript : Azidah AK Hasniza H and Lili Husniati Y

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Table 1: Demographic and clinical characteristics of the study participants.

Variables	**Overall (n = 286) n %**	**Neuropathy (n =146) n %**	**Non Neuropathy (n =140) n %**
Age (years)	66.9 (5.8)	67.9 (6.6)	65.9 (4.7)
Sex			
Male	131(45.8)	69 (42.3)	62 (44.3)
Female	155 (54.2)	77 (52.7)	78 (55.7)
Duration of DM (years)	10.0 ± 11.0	13.4 ± 7.3	7.7 ± 6.1
Hypertension	180 (62.5)	86 (58.9)	88 (62.9)
Nephropathy	44 (15.3)	22 (15.1)	21(15.0)
Retinopathy	55 (19.1)	37(25.3)	18 (12.9)
Use of insulin	58 (21.0)	41(28.1)	17 (12.1)
Poly pharmacy	232 (80.6)	126 (86.3)	105 (0.75)
Hypoglycemia episode	57 (19.8)	34 (23.3)	22 (15.7)
Orthostatic hypotension	34 (11.8)	22 (15.1)	12 (8.6)
Falls occurrence	54 (18.8)	39 (26.7)	15 (10.7)
FBS level (mmol/l)	6.9 ± 4.4	8.2 ± 34.4	7.9 ± 4.2
HbA1C level (mmol/l)	8.3 ± 2.2	8.3 ± 2.2	8.2 ± 2.7
LDL level (mmol/l)	3.0 ± 1.2	3.1 ± 1.5	4.0 ± 11.2
Serum Creatinine (mmol/l)	115.0 ± 40.7	120.2 ± 36.6	110.4 ± 44.0

Table 2: Multiple logistic regression analysis of associated factor for neuropathy among elderly diabetes

Variables	OR[a]	95% CI[b]	Wald[c]	P value
Use of insulin	2.04	1.01, 4.11	3.98	0.044
Duration of DM (years)	1.15	1.09, 1022	24.9	<0.001

[a]Adjusted OR [b]Confidence interval [c]Wald statistic

positive univariate: age, insulin users, age of DM diagnosis, duration of DM, retinopathy, polypharmacy, serum creat.