

## FREQUENCY OF SENSORY NEUROPATHY IN FOOT OF ASYMPTOMATIC TYPE2 DIABETIC PATIENTS USING SEMMES-WEINSTEIN MONOFILAMENT

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### ABSTRACT

**Objective:** To detect neuropathy in diabetics who are clinically asymptomatic, using SW monofilament and to correlate the frequency of detected neuropathy with the duration of diabetes.

**Methodology:** Known patients of type 2 diabetes that do not have symptoms of peripheral neuropathy were included. Height, weight and duration of diabetes were measured and BMI calculated. SW monofilament was pressed perpendicular to the test site with enough pressure to bend it for one second. Comparison of frequency of SW monofilament test among gender was done by  $\chi^2$  test. Bivariate correlation of SW monofilament test result with duration of diabetes was done by Kendall's test.

**Results:** A total of 700 patients including 324 males and 376 females were examined. Asymptomatic neuropathy was detected in 14.4% of patients. The mean age of males was significantly more ( $50.4 \pm 9.0$  vs  $46.7 \pm 8.4$  yrs;  $P < 0.0001$ ) but BMI was lower than females ( $24.4 \pm 2.8$  vs  $26.2 \pm 4.2$ ;  $P < 0.0001$ ). No correlation of asymptomatic neuropathy with duration of diabetes was detected ( $P = 0.995$ ).

**Conclusions:** Asymptomatic neuropathy is prevalent in our diabetic population and it does not correlate with the duration of diabetes. Diabetics should be actively screened for asymptomatic neuropathy by SW monofilament.

**KEY WORDS:** Semmes-Weinstein Monofilament, Neuropathy, Diabetes mellitus.

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## INTRODUCTION

Diabetes Mellitus is a syndrome with a disordered metabolism and inappropriate hyperglycemia.<sup>1</sup> Type-2 diabetes mellitus is the more prevalent form of diabetes.<sup>2</sup> It results from a combination of insulin resistance and defective insulin secretion.<sup>1</sup> Type 2 diabetic patients are asymptomatic initially. Late clinical manifestations of diabetes include a large number of pathologic complications such as micro and macrovascular complications and cranial and peripheral neuropathies.<sup>3-5</sup> Diabetic peripheral neuropathy is a debilitating complication affecting as many as one half of all patients

with diabetes during the course of their disease.<sup>6,7</sup> Distal Symmetric Polyneuropathy has a variable prevalence of around 30% and increases the risk of ulcers and amputations in diabetic foot patients.<sup>8</sup>

It has been reported that 3% of the patients had overt neuropathy and 10% had borderline neuropathy at the time of diagnosis of diabetes mellitus; while another 10% subsequently developed neuropathy.<sup>7,9</sup> Early detection of Peripheral neuropathy can therefore reduce the development of foot ulcers.<sup>10</sup> Although nerve conduction studies have been used as the gold standard; International Diabetic Federation and World Health Organization have recommended the 5.07/10 gm Semmes-Weinstein (SW) monofilament as a simple and inexpensive tool for the detection of peripheral neuropathy, in a primary care setting.<sup>10,11</sup> Till date there are no reports from Pakistan regarding frequency of neuropathy in asymptomatic diabetic patients.

## METHODOLOGY

This cross sectional study was conducted at diabetic clinic & medical OPD of Civil Hospital Karachi during the period of January 2008 to November 2008. Known patients of type 2 diabetes that do not have symptoms of peripheral neuropathy at the time of examination were included after taking informed consent. Patients with systemic illnesses such as chronic renal failure, hypothyroidism, alcohol intoxication, Gullian-Barre Syndrome, leprosy, vesicular dermatosis, allergic contact dermatitis and furunculosis were excluded. Patients previously diagnosed as having neuropathy were also excluded. Patients were labeled diabetic if they fulfilled any one of the following criteria:

- \* Fasting plasma glucose (FPG) > 126 mg/dl on two separate occasions.
- \* Two hours post-load glucose >200mg/dl during an oral glucose tolerance test (OGTT).

Patient was labeled as hypertensive if their blood pressure was more than 135/85mm of Hg. Patient's age, gender, duration of diabetes was recorded. A detailed clinical examination

was done. Patient's height, weight, and blood pressure were recorded.

*SW monofilament testing procedure:* The 5.07 filament has been accepted as the medical standard for the screening of the minimum level of protective sensation in the foot. The reproducible buckling stress force required to bend the 5.07 filament is 10 gram of force. The rationale of monofilament is to measure the patient's ability to sense a point of pressure. Inability to sense a 10gm of force pressure is considered as "insensate". The foot under examination was wiped with alcohol. The SW monofilament is pressed perpendicular to the test site with enough pressure to bend it for one second.<sup>12</sup> The test were applied on the following sites ; the dorsal surface of foot between the base of the first and second toes, the first, third and fifth toes, the first, third and fifth metatarsal heads, the medial and lateral midfoot and the heel were tested in random order. Results were recorded in the proforma.

*Sample size:* The prevalence of neuropathy at the time of diagnosis of diabetes in asymptomatic subjects has been reported at 3%.<sup>7</sup> Using this value and to detect the difference of 2% at the power of 80% with 2-sided error of 0.05 the sample size is calculated as 571.

*Statistical analysis:* Means of age, weight, height, BMI, systolic pressure and diastolic pressure were compared among gender by Student's 't' test. The data for duration of diabetes was skewed so it was reported in median  $\pm$  interquartile range (IQR) and compared using Mann-Whitney U test. Frequency of hypertension and SW monofilament test among gender was done by  $X^2$  test. Bivariate correlation of SW monofilament test result with duration of diabetes was done by Kendall's test. Significance level was set at <0.05. SPSS version 17.0 was used for analysis.

## RESULTS

A total of 700 patients fulfilling inclusion/exclusion criteria were selected. These included 324 (46.3%) males and 376 (53.7%) females. Mean age  $\pm$ SD for males was 50.4  $\pm$ 9.0 yrs and that for females was 46.7  $\pm$ 8.4 yrs. The mean age of females was significantly less as com-

pared to males using Student's 't' test ( $P < 0.0001$ ; 95% CI 2.4 to 5.0). Mean weight of all selected patients was  $64.5 \pm 10.2$  kg while that of males and females was  $67.4 \pm 8.9$  kg and  $61.9 \pm 10.6$  kg respectively. The mean weight of females was significantly less as compared to males ('t' test:  $P < 0.0001$ ; 95% CI 4.0 to 6.9). Similarly mean height of the females was also significantly less. Height of all patients was  $159.6 \pm 8.5$  cm, males  $166.4 \pm 5.5$  cm, females  $153.8 \pm 5.8$  cm ('t' test:  $P < 0.0001$ ; 95% CI 11.7 to 13.4). Although both mean height and weight of females were less but mean BMI was found significantly more in females. Mean BMI of total patients was  $25.4 \pm 3.7$  while that of males was  $24.4 \pm 2.8$  and that of females was  $26.2 \pm 4.2$  ('t' test:  $P < 0.0001$ ; 95% CI -2.3 to -1.3). Mean systolic pressure of males was  $130.1 \pm 16.1$  mm of Hg while that in females was  $132.6 \pm 16.7$  mm of Hg, the difference was statistically significant ('t' test:  $P = 0.045$ ; 95% CI -4.9 to -0.05). But the difference in means of diastolic pressures was not statistically significant with males having  $86.7 \pm 11.1$  mm of Hg while females having  $88.0 \pm 12.1$  mm of Hg ('t' test:  $P = 0.165$ ; 95% CI -2.9 to 0.5). Hypertension was present in 312 (44.6%) of patients out of which 129 (41.3%) were males and 183 (58.7%) were females. Hypertension was statistically more prevalent in females ( $X^2$  test:  $P = 0.019$ ,  $df = 1$ ). The median duration of diabetes  $\pm$  IQR in males was  $57.1 \pm 44.1$  months while that in females was  $58.6 \pm 43.7$  months. The difference in duration of diabetes between genders was not statistically significant. (Mann-Whitney U test:  $P = 0.565$ ). (Tables-I)

The SW monofilament test detected insensate in 101 (14.4%) out of these 41 (40.6%) were males and 60 (59.4%) were females. The difference in frequency of insensate when tested by  $X^2$  test did not reveal any significant difference in frequency among gender ( $X^2$  test:  $P = 0.215$ ,  $df = 1$ ). The presence of insensate result on SW monofilament test was tested for correlation with duration of diabetes by Kendall's Bivariate Correlation test did not show any correlation between duration of diabetes with frequency of insensate result by SW monofilament ( $P = 0.995$ ).

Table-I: Comparison of Demographic Data of Studied Patients by Gender

Variables	Gender				P value
	Male		Female		
	Mean	$\pm$ SD	Mean	$\pm$ SD	
Age (yrs)	50.4	9.0	46.7	8.4	<0.0001
Weight (kg)	67.4	8.9	61.9	10.6	<0.0001
Height (cm)	166.4	5.5	153.8	5.8	<0.0001
Body Mass Index	24.4	2.8	26.2	4.2	<0.0001
Systolic Pressure	130.1	16.1	132.6	16.7	0.045
Diastolic Pressure	86.7	11.1	88.0	12.1	0.165
DM Duration (months)	57.1	44.1	58.6	43.7	0.565

## DISCUSSION

The study showed a high frequency of 14.4% of patients with probable neuropathy in diabetics without any symptoms thereof. SW monofilament has been extensively validated previously to detect neuropathy.<sup>13-16</sup> Autonomic, central, optic and multifocal motor neuropathies have been documented presenting asymptotically.<sup>17-22</sup> Detection of asymptomatic neuropathy in foot is important for better management and care of foot in diabetic patients who are susceptible to complications and amputations.<sup>8,23</sup> Frequency of insensate was not different among gender thus both genders are equally susceptible. The mean height and weight of males were significantly more than females but BMI of females was significantly higher.

Amputations of lower extremity are more common in patients with poor glycemic control and it has also been shown that incidence of lower extremity amputations was greatly reduced when organized foot care was instituted.<sup>8,24</sup> SW monofilament testing could detect these patients before they become symptomatic and thus foot care could be started before overt complications occur, some have also coined the term of silent neuropathy in such cases.<sup>14,25</sup> It has been equally effective in detecting neuropathy in older adults too.<sup>26</sup> A study from Karachi has also shown that com-

plications of diabetes were more prevalent in those who had inadequate blood pressure and diabetic control and in those who were hyperlipidemic.<sup>27</sup>

Another important finding in our study was absence of any correlation of neuropathy detected in asymptomatic patients with duration of diabetes. This could be due to the fact that we recruited only asymptomatic patients and with long duration these patients become symptomatic and thus were excluded. This finding highlights the fact that SW monofilament testing should be done routinely in asymptomatic patients regardless of duration of diabetes.

## CONCLUSION

Neuropathy is prevalent in asymptomatic diabetics that could easily be detected by SW monofilament test and asymptomatic neuropathy has no correlation with duration of diabetes.

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