



A STUDY THE PERIPHERAL NEUROPATHY AMONG TYPE 2 DIABETES MELLITUS PATIENTS BY BIOTHESIOMETER

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Abstract:

Purpose To study the peripheral neuropathy among type 2 diabetes mellitus patients by biothesiometer.

Methods: This study was conducted at tertiary care hospital, in medicine out patient department (OPD) and ward with a sample size of 87. All patients having type 2 diabetes mellitus including males and females, who met both inclusion and the exclusion criteria were recruited into the study. Blood samples were collected to measure fasting blood sugar, post prandial blood sugar, glycated hemoglobin (HbA1c) to indicate the glycemic status of the subjects and lipid profile. The use of vibration perception threshold (VPT) testing has also been validated as a method of diagnosing diabetic peripheral neuropathy (DPN).

Results: Out of 87 subjects, 68 subjects had peripheral neuropathy and 19 subjects did not have peripheral neuropathy on biothesiometer whereas according to nerve conduction velocity 79 subjects had peripheral neuropathy and 8 subjects did not have peripheral neuropathy.

Conclusion: From the present study we recommend use of biothesiometer in patients with type 2 diabetes mellitus for early detection of peripheral neuropathy.

Aim: To study the peripheral neuropathy among type 2 diabetes mellitus patients by biothesiometer

Objectives:

- To determine the presence of peripheral neuropathy in Type 2 Diabetes mellitus patients by detecting vibration perception threshold by an instrument called biothesiometer.
- To determine the usefulness of biothesiometer in the early diagnosis of diabetic neuropathy.
- To assess and compare the presence of peripheral neuropathy in Type 2 Diabetes mellitus patients according to HbA1c levels.

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1. Introduction

India has one of the highest prevalence of type 2 diabetes mellitus (T2DM) in the world.^[1] It is estimated that by the year 2030 there will be nearly 80 million Indians with type 2 diabetes mellitus (T2DM) in the country.^[2,3] The prevalence of diabetic peripheral neuropathy (DPN) varies greatly in different studies, ranging from 8% to 59%.^[4] Diabetic peripheral neuropathy (DPN) significantly increases the risk of complications such as foot infections, deformities, gangrene, and amputations.^[5] In India, the adverse effects of peripheral neuropathy (PN) are compounded by poor foot hygiene, improper foot wear and frequent barefoot walking.^[5] In view of the poor awareness and lack of regular screening programs, the initial presentation to the physician is frequently delayed. This may predispose to an increased rate of microvascular complications at onset.^[6] Neuropathy and neuropathic pain are among the strongest determinants of reduced health-related quality of life in patients with type 2 diabetes mellitus. Apart from the direct costs involved, diabetic peripheral neuropathy (DPN) can also lead to work absence, change in employment and disability.^[7] Standard methods of diagnosing diabetic peripheral neuropathy (DPN) include nerve conduction studies and skin biopsies; however, clinical symptom scales and monofilament testing are more commonly used in primary care settings.^[8,9] The use of vibration perception threshold (VPT) testing has also been validated as a method of diagnosing diabetic peripheral neuropathy (DPN).^[10]

2. Materials and Methodology:

This study was conducted at tertiary care hospital, in medicine out patient department (OPD) and ward with a sample size of 87. All patients having type 2 diabetes mellitus including males and females, who met both inclusion and the exclusion criteria were recruited into the study. Patients were explained about the experimental procedure in detail, signed the informed consent forms and anthropometric readings were taken

. Blood samples were collected to measure fasting blood sugar, post prandial blood sugar, glycated hemoglobin (HbA1c) to indicate the glycemic status of the subjects and lipid profile.

Biothesiometer:

The vibrator probe was placed on each foot in a sequential manner. The knob was turned slowly in clockwise direction allowing some time for each increment to be registered. Continue to turn slowly to the right till the patient gets the sensation and says yes. Increase it a little to see if the sensation is more pronounced.

Interpretation

Below 15 Volts – Normal study

Between 16 and 20 Volts -

Mild neuropathy (mild loss of sensation)

Between 21 and 25 Volts -

Moderate neuropathy (moderate loss of sensation)

Above 25 Volts -

Severe neuropathy (severe loss of sensation)

This above interpretation is not accepted by all but every one accepts more than 25 Volts is considered as severe loss of sensation.

Nerve conduction velocity:

In a nerve conduction velocity study, several flat metal disc electrodes are taped or pasted to your skin. A shock-emitting electrode is placed directly over the nerve to be studied. A recording electrode is placed over the muscles supplied by that nerve. Several, brief electrical pulses are sent to the nerve. The study subject will feel a brief, burning pain, a tingling sensation and a twitching of the muscle when the electrical pulse is applied. It feels like the tingling you feel when you rub your feet on the carpet then touch a metal object. The testing can be quite uncomfortable and makes some people nervous. Keep in mind that only a very low-voltage electrical current is used. Each pulse is very brief (less than a millisecond).

3. Observations and Results:

A total 87 subjects were enrolled for the present cross-sectional study with type 2 diabetes mellitus as per inclusion criteria.

Table 1: Gender distribution of study subjects with type 2 diabetes mellitus

Gender	(n= 87)	Percent
Male	56	64.4
Female	31	35.6

Total	87	100
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Table2:Frequencydistributionofageinstudysubjectswithtype2diabetesmellitus

Ageinyears	(n= 87)	Percent
40 to 50	22	25.2
51to 60	26	30
>60	39	44.8
Total	87	100

Table3:Distributionofstudypopulationaccordingtomeanandstandarddeviationof numericalvariables of laboratory parameters

Parameter	Mean	SD(±)
Fastingblood sugar (FBS) (mg/dl)	160.9	61.2
Postprandialbloodsugar (PPBS)(mg/dl)	251	113.8
HbA1c(%)	7.1	1.8
Totalcholesterol(TC)(mg/dl)	141.8	48.2
Triglyceride(TG)(mg/dl)	146.8	113.4
Highdensitylipoprotein(HDL)(mg/dl)	39.7	27
Verylowdensitylipoprotein(VLDL)(mg/dl)	32	26.2
Lowdensitylipoprotein (LDL)(mg/dl)	77.5	35.1

Table4:Evaluationof studypopulationbynerveconductionvelocity

Nerveconductionvelocity	(n= 87)	Percent
Normalstudy	8	9.1
Earlychangesofperipheralpolyneuropathy	49	56.3
Establishedpolyneuropathy	30	34.5
Total	87	100

Table 5: Nerve conduction velocity evaluation of patients with type 2 diabetesmellitusin study population

Peripheralneuropathy	(n= 87)	Percent
Present	79	90.8
Absent	8	9.2
Total	87	100

Table6:Evaluationofstudypopulationaccordingtobiothesiometer

Peripheralneuropathy	(n= 87)	Percent
Present	68	78.2
Absent	19	21.8
Total	87	100

Table 7: Distribution of study population according to HbA1c and peripheral neuropathy by biothesiometer⁴⁷

HbA1c	Peripheral neuropathy		Total
	Present	Absent	
<6	19 (70 %)	8(30 %)	27 (31.1 %)
>6	49 (81 %)	11 (19 %)	60 (68.9 %)
Total	68	19	87

Table 8: Comparison of biothesiometer and nerve conduction velocity among the study population

Parameter	Peripheral neuropathy present	Peripheral neuropathy Absent	Total	Chisquare value- 5.3DF-1 P value 0.021
Biothesiometer	68	19	87	
Nerve conduction velocity	79	8	87	

A Study the Peripheral Neuropathy among Type 2 Diabetes Mellitus Patients by Biothesiometer

4. Discussion

We cannot exactly compare our study with other studies as there is scarcity of literature pertaining to the use of biothesiometer, a tool to assess peripheral neuropathy. The present study was conducted to study the peripheral neuropathy among type 2 diabetes mellitus patients by biothesiometer and it was a single centre hospital-based cross-sectional study, conducted in patients admitted to tertiary care institute, over a period of 18 months and included 87 patients with diagnosis of type 2 diabetes mellitus.

Agedistribution of study samples

Mean age of study subjects was 59.6 (± 11.5) years. Majority 44.8% were in age group >60 years. Study by Young MJ et al^[11] reported that mean age was 51 years and ranging between 30 to 80 years. Study by Nagaraja BS et al^[13] quoted that mean age was 41.1 (± 15) years. Study by Gill HK et al^[14] reported that mean age was 47.6 (± 10.2) years. Study by Iyengar MF et al^[15] quoted that mean age was 48.2 years. Study by Mettayil JJ et al^[16] reported that age range was 27 to 76 years.

Gender distribution of study population

In present study male preponderance was seen, 64.4% were males and 35.6% were females. Study by Young MJ et al^[11] reported that 75 were females and 25 were male patients. Study by Nagaraja BS et al^[13] reported that 64.7% were males and 35.2% were females. Study by Iyengar MF et al^[15] reported that 50.3% were females.

Evaluation of laboratory investigations in study population

Mean Fasting BSL was 160.9, PP BSL was 251, random sugar was 226.9, HbA1c was 7.1, TC was 141.8, TG was 146.8, HDL was 39.7, VLDL was 32 and LDL was 77.5.

Nerve conduction velocity results in study population

On nerve conduction velocity, majority 56.35% had early changes of polyneuropathy and 34.5% had sensory motor polyneuropathy and 9.1% had normal study. Total of 90.8% had polyneuropathy on nerve conduction velocity. Study by Ashok Setal^[12] reported that 19.1% of the patients had evidence of neuropathy. Study by Nagaraja BS et al^[13] reported that 27% had Diabetic peripheral neuropathy. Study by Gill HK et al^[14] reported that 29.2% had Diabetic peripheral neuropathy. Study by Bansal et al^[14] reported that 29.2%

had Diabetic peripheral neuropathy. Study by Iyengar MF et al^[15] reported that 89.5% had Diabetic peripheral neuropathy.

Biothesiometer results in study population

Result on Biothesiometer showed 78.2% had peripheral neuropathy, while 21.8% did not have peripheral neuropathy. Study by Young MJ et al^[11] reported that out of 100 patients, 21 patients had normal value, 35 had grade I and 44 had grade II on the biothesiometer machine. Study by Mettayil JJ et al^[16] reported that on Biothesiometer, 26 patients had normal value, 50 patients had grade I neuropathy and 24 had grade 2 neuropathy on the Biothesiometer.

Association of HbA1c and peripheral neuropathy

On association between HbA1c and peripheral neuropathy, there were 19 cases with peripheral neuropathy and 8 cases without peripheral neuropathy having HbA1c <6, while 49 cases with peripheral neuropathy and 11 cases without peripheral neuropathy had HbA1c >6. Study by Gill HK et al^[14] reported that similar results with HbA1c.

Comparison between biothesiometer and nerve conduction velocity

Comparison between biothesiometer and nerve conduction velocity showed statistical significance, applying chi square test, 'p' value was 0.021.

On comparison between nerve conduction velocity and biothesiometer based on duration of type 2 diabetes mellitus, majority 34 cases had disease from 5 to 10 years. Among them majority were positive on nerve conduction than biothesiometer.

Out of 87 subjects, 68 subjects had peripheral neuropathy and 19 subjects did not have peripheral neuropathy on biothesiometer whereas according to nerve conduction velocity 79 subjects had peripheral neuropathy and 8 subjects did not have peripheral neuropathy.

Study by Gill HK et al^[14] reported that screening for diabetic peripheral neuropathy at diagnosis of diabetes warranted, especially among older subjects. Study by Bansal et al^[14] reported that timely screening with earlier detection and intervention would be useful in preventing the progression of neuropathy. Use of vibration perception threshold using Biothesiometer is a simple and sensitive assessment for early detection of significant diabetic peripheral neuropathy in out patient setting.^[16] Madhavi Latha also concluded that the diagnosis of diabetic neuropathy by biothesiometer has been reliable to be compared with diabetic neuropathy symptoms score and can aid

A Study the Peripheral Neuropathy among Type 2 Diabetes Mellitus Patients by Biothesiometer

the earlier detection of the disease.

5. Conclusion:

Present cross-sectional study was conducted to evaluate the presence of peripheral neuropathy among type 2 diabetes mellitus by biothesiometer and nerve conduction velocity. About eighty percent of patients with peripheral neuropathy were having evidence of peripheral neuropathy by biothesiometer in present study. Biothesiometer seem to be feasible, non-invasive, less time consuming and inexpensive for early detection of peripheral neuropathy in type 2 diabetes mellitus. We suggest for routine use of biothesiometer in patients with type 2 diabetes mellitus for early detection of peripheral neuropathy.

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