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Original Research

Comparison of nerve conduction parameters in type 2 diabetic subjects: recently diagnosed versus chronic diabetes

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Abstract

Introduction: Diabetes mellitus (DM) is one of the major non-communicable diseases and may cause blindness, renal failure, and non-traumatic limb amputations in chronic condition. Periodic clinical assessment with supportive electrophysiological tests is highly recommended for early diagnosis of peripheral neuropathy in diabetic patients. **Materials and Methods:** In order to compare the nerve conduction study parameters on diabetes with two different durations of the disease, the recruited diabetic patients were divided into two groups, Group I - Recently diagnosed type 2 diabetes (within 1–2 years) and Group II -chronic diabetic patients with more than 5 years of disease. Nerve conduction study was done with RMS-EMG machine and latency, duration, and amplitude parameters of sural nerve conduction recordings were measured. The significance of study parameters between groups was analyzed by using independent sample "t" test. **Results:** There is no statistically significant change in the latency, amplitude, and conduction velocity of the sural nerve among the aforesaid study groups.

Keywords: Diabetic neuropathy, nerve conduction study, sural Nerve.

Introduction

Type 2 diabetes is a major public health issue and the expected worldwide diabetes population could surpass 640 million by the year 2040 [1]. India and China together have become a global epicentre of the diabetic epidemic as 60% of the world's diabetic population is from Asia [2]. Microvascular complications such as nephropathy, neuropathy, and retinopathy and macrovascular complications such as stroke, and peripheral artery disease are common among chronic diabetics and accountable for significant morbidity and mortality [1].

Diabetic neuropathy involves damage in sensory, motor, and autonomic nerve fibres and accounts for 28% complications in diabetics [3]. It is the crucial risk factor in 90% of diabetic foot ulcers [4] and foot ulceration is the first indicator in diabetic patients, who underwent non-traumatic lower-limb amputations later [5]. As the appearance of symptoms of diabetic neuropathy occurs after a long duration of disease, it is imperative to identify diabetic neuropathy in the early stage itself. Clinically, the monofilament test, vibration test, tests for pinprick sensation, and ankle reflex are generally employed in the diagnosis of diabetic neuropathy [4]; however, electrophysiological studies help us to detect early abnormalities in diabetic patients that may not be clinically apparent [6].

Nerve conduction study is a widely used electrodiagnostic test to assess the nerve functions in diabetic neuropathy, which affects the nerve conduction velocity, amplitude, and latency. As the complications of neuropathy show its symptoms after many years of diabetic duration, we wanted to know whether the neurophysiological

test shows any changes in the earlier years. This study was done to compare the nerve conduction parameters in the diabetics of recently diagnosed (1–2 years) and chronic (> 5 years).

Material and Methods

This cross-sectional study was conducted after obtaining approval from the Institutional Ethical Committee and written informed consent from the participants concerned. This study was undertaken in the Department of Physiology in collaboration with Department of Medicine, Sri Manakula Vinayagar Medical College and Hospital, Puducherry, India.

Study subjects

The diabetic patients who attended the Medicine OPD in the institutional hospital were recruited and study subjects were divided into two groups as following.

Group 1: Recently diagnosed T2MD patients (1–2 years prior to the study) (n = 24)
Group 2: Chronic type 2 diabetes mellitus (T2DM) patients (>5 years prior to the study) (n = 24)

Sample size

Based on the study, conducted by Nidhi Yadav et al [7], the mean values of sural nerve conduction velocity in T2DM (45.58±3 m/s) and control subjects (49.05±4 m/s) were taken into account and the requisite sample size for this study was calculated by considering non-response rate as 10% by using OpenEpi software (version 3.01). The estimated requisite total sample size is 48 (n) and 24 samples for each group.

Inclusion and exclusion criteria

T2DM patients in the age group of 40–70 years including both genders, who were recently diagnosed (within 1–2 years prior to study) and chronic (>5 years prior to study) were recruited for the study.

Type 2 diabetic patients with any medical condition associated with polyneuropathy, unusual dietary habits, family history of peripheral nerve disease, consumption of alcohol or drugs with potential neurotoxic effects, and dependent on insulin therapy were excluded in the study. Also, type 1 diabetic patients were omitted.

Study parameters

A detailed review of medical history through a structured questionnaire and physical examination were performed. In addition to the patient's age, the anthropometric data including height, weight, and body mass index (BMI) were acquired from the study participants. Body mass index was calculated by using the formula, i.e. body weight in kg/(Height in meters)^2.

Nerve conduction study was systematically performed with all the study participants (Group I, n=24 and Group II, n=24) by using surface electrodes of computerized RMS EMG System. In the present study, three parameters of nerve conduction study namely nerve conduction velocity, amplitude, and the latency of sural nerve were measured.

Statistical analysis

The values are expressed as mean ± SD and the statistical significance of the test parameters between the study groups was compared by using an independent sample 't' test, executed with the EpiData Analysis software package (version 4.5). A "p" value of <0.05 was considered to be statistically significant.

Results

The mean value with standard deviation in the participant's age, duration of diabetic diagnosis prior to the study, and anthropometric data of height, weight, and BMI of the study subjects are given in the under mentioned table (table 1).

The mean values of latency (ms), amplitude (μV) and velocity (m/s) of sural nerve in Group I (recently diagnosed diabetic patients) were 2.78 ± 0.49, 13.22 ± 5.38 and 52.53 ±6.78, while in Group 2 (chronic diabetic patients) were 2.88 ± 0.466, 12.64 ± 5.70 and 49.67 ± 7.59 (table 2). Though there is an increase of latency and decrease in amplitude and conduction velocity in diabetic patients of long duration (>5 years) compared to diabetic patients recently diagnosed (<2 years), the difference is not statistically significant (figure 1).

Table 1: Patient's age, duration of diabetes, and their anthropometric data (Mean ± SD).

	Group I (n - 24)	Group II (n - 24)
Patient's age (years)	48.04 ± 5.27	62.1 ± 7.66
Duration of diabetes (years)	1.12 ± 0.46	7.16 ± 2.09
Height (cm)	154.62 ± 12.97	152 ± 11.74
Body weight (kg)	59.08 ± 11.12	57.8 ± 9.95
Body mass index	25.51 ± 7.88	25.45 ± 6.34

Table 2: Nerve conduction study parameters in sural nerve (Mean ± SD).

Study Parameters	Group I (n - 24)	Group II (n - 24)
Latency (ms)	2.78 ± 0.49	2.88 ± 0.466
Amplitude (μV)	13.22 ± 5.38	12.64 ± 5.70
Velocity (m/s)	52.53 ± 6.78	49.67 ± 7.59

Discussion

This present study showed that there is no statistically significant difference in the nerve conduction parameters viz. latency, amplitude, and velocity of sural nerve between the study groups. The consideration of sural nerve in this study is due to the fact that this nerve is the first affected and also a most prevalent indicator of peripheral nerve dysfunction [8]. Although polyneuropathy is uncommon in the initial stage of diabetes, existence of polyneuropathy during the diagnosis of T2DM is seen in many cases due to late diagnosis of the disease [11]. The experimental design of this study entailed to compare the results of the nerve conduction test of sural nerve of the chronic diabetic patients from recently diagnosed diabetic patients and study results showed that there is no significance change in any of the three test parameters (latency, amplitude,

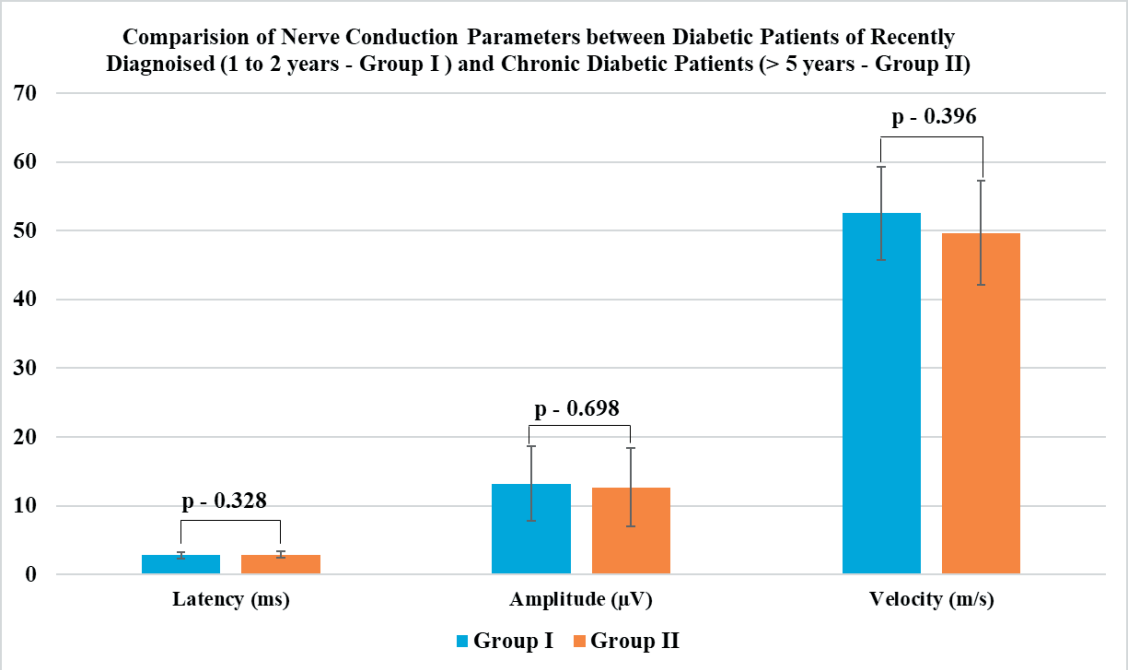

Figure 1: Graphical representation of mean values with standard deviation of nerve conduction parameters (p values are given).

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and velocity). On the contrary, the published study of Gauhar Hussain et al on 2014 demonstrated significant reduction of a nerve conduction velocity in lower limbs even in patients of shorter duration while they have normal nerve conduction velocity in upper limb [12].

Sonawane P. P and Shah S. H (2017) performed the nerve conduction test in the groups of diabetic patients, i.e., 0–5 years diabetic patients and 5–10 years diabetic patients, both having controlled blood sugar levels and it was revealed that sensorimotor conduction is reduced in the lower limb over the duration of diabetes [13].

Apart from the duration of the disease and degree of hyperglycemia, diabetic neuropathy is also associated with other risk factors such as dyslipidaemia and hypertension [9] and it has been revealed that chronic diabetic subjects with a duration of more than 10 years have associated neuropathy and therefore, they are at high risk for diabetic foot disease [10]. The levels of glycosylated Hb (HbA1c) and lipid profile were not correlated with the parameters of the nerve conduction test and it is the main limitation of this study. If selection of patients and comparison of groups based on their HbA1c values were done, the study would have given more meaningful results.

Conclusion

The present study results show that there is no correlation between duration of the disease and the occurrence of peripheral neuropathy. Few other recent studies also establish the same results. Therefore, further studies with more sample size and with all relevant parameters are warranted to rule out the specific causes of diabetic neuropathy.

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Conflict of Interest

The authors declare no conflict of interest.

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