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Original Article

Distal Motor (M) Latency, F-wave Latency, and M/F Ratio in the Diagnosis of Diabetic Neuropathy

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Abstract

Introduction: Most common complication of diabetes mellitus is diabetic neuropathy and when compared to non-diabetic participants and diabetic patients have 12 times higher risk of amputations due to diabetic neuropathy.

Aim: To investigate the usefulness of distal motor (M) latency, F-wave latency, and M/F ratios in the early diagnosis of diabetic neuropathy.

Materials and Methods: A total of 30 patients with diabetic neuropathy and 30 healthy control participants without diabetes were recruited. Distal motor (M) latency and F-wave latency were measured, and M/F ratios were calculated.

Results: M and F latencies were longer in patients with diabetic neuropathy when compared to control group, and M/F ratios were smaller in the patient group than the control group in all the nerves.

Conclusion: According to the results of the present study, M-latency, F-latency, and M/F ratio were the useful parameters in the diagnosis of diabetic neuropathy.

Key words: Diabetes mellitus, Diabetic neuropathy, F-wave latency, M/F ratio

INTRODUCTION

India was in top position in the diabetes mellitus, in 2000, with 31.7 million people affected with it.[1] The causes of the rapid growth of diabetes in India is multifactorial which includes genetic, environmental factors and changing lifestyle.[2] The World Health Organization has estimated that the number of adults with diabetes in the world would increase alarmingly from 135 million, in 1995, to 300 million in 2025.[3] Most common complication of diabetes mellitus is diabetic neuropathy and when compared to non-diabetic participants and diabetic patients have 12 times higher risk of amputations due to diabetic neuropathy.[4] Diagnosis of diabetic neuropathy is based on symptoms and physical examination, which may include the Semmes-Weinstein monofilament and the 128 hz tuning fork. However, simple screening methods are of limited value in early neuropathy. Nerve conduction studies (NCS) are the most sensitive and specific methods to detect diabetic neuropathy.[5]

When other NCS have been normal, F-wave has been found of use in diagnosis of certain types of peripheral neuropathies. F-waves were reported by Magladery and McDougal, in 1950, on foot muscles. The F-wave is so named because it was originally studied in the small muscles of the foot.[6] F-waves are one of the late responses by supramaximal electrical stimulation of peripheral motor nerves. It is generated by stimulation of anterior horn cells of the spinal cord following antidromic propagation of the stimulus on the motor nerve.[7] The aim of the present study was to investigate the use of F-wave latency, distal motor (M) latency, and M/F ratio in the diagnosis of diabetic neuropathy.

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MATERIALS AND METHODS

The present study was conducted on 60 participants in the following groups: 30 patients with diabetic neuropathy

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(15 men and 15 women) and 30 non-diabetic participants as control group (15 men and 15 women). All the research participants were between the age group of 40 and 60 years. The mean age of cases and controls were same. Mean duration of diabetes mellitus was 21.02 ± 17.65 years. The diabetic participants without any other associated medical conditions were included in the study. The diabetic patients with other associated diseases which may affect nerve conduction were excluded from the study. The present study was a non-invasive method of estimation of nerve conduction using electromyography)/evoked potential system (Nicolet/Systems - USA make). The F-wave latency and M-latency were measured, and M/F ratios were calculated and recorded. All the measurements were recorded in median, ulnar, tibial, and common peroneal nerves bilaterally in cases and controls.

Statistical Analysis

Data were presented with mean and standard deviation. F-wave latency, M-latency, and M/F ratio were evaluated by unpaired Students *t*-test and regression analysis along with ANOVA with duration of diabetes as the independent variable and other parameters as dependent variables. A level of $P < 0.05$ was accepted as statistically significant.

RESULTS

The mean and standard deviations of M-latency, F-latency, and M/F ratio for median, ulnar, common peroneal, and tibial nerves were presented in Table 1. The M and F latencies are slower in diabetic neuropathy (patient) group than that of non-diabetic (control) group, and M/F ratios in the diabetic neuropathy group were significantly smaller than that of the control group.

There was a statistically significant difference between the diabetic neuropathy group and control group in relation to M-latency in all the 4 nerves ($P < 0.05$). F-latency was longer in patient group when compared to control group in all the 4 nerves, but statistically significant difference was found only in ulnar and common peroneal nerves. M/F ratios were smaller in the patient group than in control group in all the nerves, but statistically significant difference was found only in median and common peroneal nerves.

In the study of electrophysiological properties of nerve conduction, taking the duration of diabetes as an independent variable, we got negative slope values for velocity and amplitudes and positive slope values for F-latency, M-latency, and M/F Ratio for median, ulnar, common peroneal, and tibial nerves on both sides.

DISCUSSION

F-wave studies were added to conventional NCS to detect the diabetic neuropathy in early stage.[8] In the present study, the F and M latencies were longer in diabetic than in controls. We observed a symmetric pattern in delaying of conduction velocities and decrease of amplitudes and corresponding changes in F and M latencies. This is in confirmative with previous studies by Partanen *et al.*[9]

The M/F ratio is not influenced by age, whereas motor conduction velocity, sensory conduction velocity, and F-latency may be influenced by age.[10] In the present study, M/F ratio was calculated from M and F latencies and found smaller values in the patient group than in controls. The results in relation to M/F ratio were similar with another study by Parkhad and Palve. Pathological changes in diabetic neuropathy are very complicated; some studies suggest that electrophysiological and pathological evidence of segmental demyelination as the primary lesion; other studies state that axonal damage to be the initiating events. Segmental demyelination and axonal damage both coexist in patients with diabetic neuropathy. The F-latency and M/F ratio have been used in an effort to clarify this patterns.[11]

CONCLUSION

There was a positive correlation between the duration of diabetes and M and F latencies in all the nerves. The m and F latencies were longer in the patient group than control group in all the nerves. Based on the results of the present study, M-latency, F-latency, and M/F ratio were the useful parameters in the diagnosis of diabetic neuropathy.

Table 1: M latency, F latency and M/F ratio of median, ulnar, common peroneal and tibial nerves in patients of diabetic neuropathy and controls

Nerve / Parameters	M-latency		F-latency		M/F ratio	
	Diabetic	Non diabetic	Diabetic	Non-diabetic	Diabetic	Non-diabetic
Median nerve	3.88±1.32	2.96±0.43	26.26±9.59	24.92±1.43	6.35±2.63	8.53±1.28
Ulnar nerve	2.75±1.00	2.40±0.43	28.36±6.76	25.24±1.1.56	10.52±2.26	10.81±1.90
Common peroneal nerve	3.88±1.05	2.86±2.18	42.72±7.06	32.89±24.38	9.24±8.80	12.46±5.95
Tibial nerve	4.41±0.69	3.84±2.22	44.12±7.75	41.54±19.78	9.31±13.12	10.25±2.43

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