Open Access

Original Article

Comparative Study of Detection of Diabetic Neuropathy by Clinical Assessment and Nerve Conduction Study in Type 2 Diabetes Mellitus Patients

Natasha Sarwar, Khalid Mehmood Raja, Sarah Khan, Sana Uruj, Amina Hussain, Maria Tariq

Pak Emirates Military Hospital/National University of Medical Sciences (NUMS), Rawalpindi Pakistan

ABSTRACT

Objective: To compare the detection of diabetic neuropathy by clinical assessment and nerve conduction study in type 2 diabetes mellitus patients.

Study Design: Prospective comparative study.

Place and Duration of Study: Department of Medicine, Pak Emirates Military Hospital Rawalpindi Pakistan, Jan 2020 to May 2021.

Methodology: A total of 300 patients having type 2 diabetes mellitus for more than ten years were included in the study. Revised neuropathy disability score was calculated by the consultant medical specialist on all the patients to make a clinical diagnosis of neuropathy. Nerve conduction studies were performed in the Department of Neurology. Findings of both methods to diagnose the patterns of diabetic neuropathy were compared.

Results: Out of 300 patients suffering from type 2 diabetes mellitus, 188 (62.7%) were males, while 112 (37.3%) were females. The mean age of the study participants was 53.33±4.55 years, and the mean duration of diabetes mellitus was 11.22±5.71 years. Symmetrical neuropathy, motor polyneuropathy and sensory neuropathy had a statistically significant diagnostic pattern when assessed from clinical method and nerve conduction study (p-value <0.05).

Conclusion: Neuropathy had been a common finding among patients suffering from type 2 diabetes mellitus for more than ten years. A significant difference existed in diagnosing various patterns and types of neuropathies when clinical methods were compared with nerve conduction studies.

Keywords: Diabetes mellitus, Nerve conduction studies, Neuropathy.

How to Cite This Article: *Sarwar N, Raja KM, Khan S, Uruj S, Hussain A, Tariq M. Comparative Study of Detection of Diabetic Neuropathy by Clinical Assessment and Nerve Conduction Study in Type 2 Diabetes Mellitus Patients. Pak Armed Forces Med J 2022; 72(4): 1302-1305.*

DOI: https://doi.org/10.51253/pafmj.v72i4.5522

INTRODUCTION

Diabetic neuropathy is a common complication in patients suffering from diabetes mellitus.[1,2] Control of diabetes is one of the most important factors in determining the occurrence of complications among these patients.[3] Use of neurodiagnostic studies can be helpful in these patients to make a more accurate diagnosis.[4,5]

Clinical neuropathy scores represent a simple tool for evaluation and follow-up of patients with diabetic polyneuropathy compared to nerve condition studies.[6] Weng *et al.* in 2020 concluded that the thermal threshold test combined with nerve conduction tests could detect most of the patients.[7]

The wide availability of neurodiagnostic studies has helped clinicians to diagnose the causes of neuropathies more effectively and efficiently.[8,9] Still, the utility of clinical methods cannot be minimized in this regard. Asad *et al.* published a study on local data concluding that clinical scores for diabetic neuropathy can help prompt evaluation of diabetic sensorimotor polyneuropathy, but nerve conduction studies remain the gold standard tool.[10] We planned this study with to compare the detection of diabetic neuropathy by clinical assessment and nerve conduction study in type 2 diabetes mellitus patients.

Correspondence: Dr Natasha Sarwar, Department of Medicine, Pak Emirates Military Hospital, Rawalpindi, Pakistan

Received: 19 May 2021; revision received:10 Aug 2021; accepted: 16 Aug 2021

METHODOLOGY

This prospective comparative study was conducted at the Department of Medicine in Pak Emirates Military Hospital, Rawalpindi Pakistan from January 2020 to May 2021. The WHO sample size calculator was used for sample size calculation with the reference prevalence of neuropathy in type 2 diabetes patients as 24.5%.[11] The Ethical Review Board Committee of the hospital was approached to get the ethical approval for this study (via letter-number A/28/EC/275/2021). Non-probability consecutive sampling technique was used to gather the sample.

Inclusion Criteria: All the patients of type 2 diabetes mellitus for more than ten years were included in the study.

Exclusion Criteria: Patients with neuropathic symptoms prior to the diagnosis of type 2 diabetes mellitus, malignancies (solid or haematological), severe infection or any organ failure in the past six months were excluded from the study. Patients diagnosed with B-12 or folate deficiency or who were on replacement therapy or had recent surgery or had neuropathy secondary to any identifiable cause or any autoimmune disorder or were using illicit drugs were also excluded from the study.

Written informed consent was taken from all the participants before the start of the study. The study details, including nerve conduction studies procedure, were briefed to the participants. Revised neuropathy disability score was calculated by the consultant medical specialist on all the patients to make the clinical diagnosis of neuropathy. It comprises vibrations sensation, temperature sensation, pinprick and ankle reflex.[12] Nerve conduction studies were performed in the Neurology Department of the same hospital. The parameters included in nerve conduction studies were; distal motor and sensory latency, compound muscle action potential amplitude measured from negative to the negative peak, sensory nerve action potential amplitude measured from the negative to positive peak, and the motor and sensory conduction velocity.[13]

Statistical analysis was performed using Statistics Package for Social Sciences version 24.0 (SPSS-24.0). Characteristics of participants and the clinical and nerve conduction study findings were described using descriptive statistics. Pearson chi-square test was used to determine the difference between revised neuropathy disability score findings and nerve conduction studies. Differences between groups were considered significant if *p*-values were less than or equal to 0.05.

RESULTS

Out of 300 patients suffering from type 2 diabetes mellitus studied in the given period, 188 (62.7%) were males, while 112 (37.3%) were females. The mean age of the study participants was 53.33±4.55 years, and the mean duration of diabetes mellitus was 11.22±5.71 years. Table-I summarized the general charac-teristics of patients included in the study. 97 (32.3%) patients were diagnosed with diabetic neuropathy when assessed from revised neuropathy disability score, while 101 (33.7%) had the same diagnosis on nerve conduction studies. Table-II revealed that symmetrical neuropathy, motor polyneuropathy and sensory neuropathy had a statistically significant diagnostic pattern when assessed from clinical method and nerve conduction study (*p*-value <0.05).

Table-I: Characteristics of Patients With Type II Diabetes Mellitus Included in Study (n=300)

Factors	Frequency (Percentage)
Age (Years)	
Mean±SD	53.33±4.55
Range (min-max)	29-64
Gender	
Male	188 (62.7)
Female	122 (37.3)
Presence of Neuropathy on Clinical Scale	
No	97 (32.3)
Yes	193 (67.7)
Presence of Neuropathy of Nerve Conduction Studies	
No	101 (33.7)
Yes	199 (66.3)
Mean Duration of Type II	
Fastng Glucose level (mmol/L)	11.22±5.71

Table-II: Comparison of Types And Patterns of Neuropathies Found on Clinical Test and Nerve Conduction Studies (n=300)

	Clinical findings Frequency (%)	Nerve conduction study findings Frequency (%)	*p*-value
Symmetrical			
No	103 (68.7)	7 (51.3)	0.002
Yes	47 (31.3)	73 (48.7)	
Asymmetrical			
No	53 (35.3)	49 (32.7)	0.626
Yes	97 (64.7)	101 (67.3)	
Pure Sensory			
No	53 (35.3)	57 (38.0)	0.632
Yes	97 (64.7)	93 (62.0)	
Pure Motor			
No	58 (38.7)	90 (60.0)	<0.001
Yes	92 (61.3)	60 (40.0)	
Sensory Motor			
No	85 (56.7)	57 (38.0)	0.001
Yes	65 (43.3)	93 (62.0)	

DISCUSSION

This study showed that neuropathy had been a common finding among patients suffering from type 2 diabetes mellitus for more than ten years. A significant difference existed in diagnosing various patterns and types of neuropathies when clinical methods were compared with nerve conduction studies.

Recent advancements in cerebrospinal fluid markers, histo-pathological support and nerve conduc-tion studies have made the diagnostic picture quite clear, and clinicians in our part of the world have been diagnosing these conditions with more confidence and

authority.[14] There is still a debate regarding nerve conduction studies in diagnosing routine cases of diabetic polyneuropathy. Clinicians have to assess the added benefit of nerve conduction studies in diagnosing diabetic polyneuropathy once the clinical diagnosis has been made.

Mohan *et al.*[15] in 2018 performed a study to detect sensory-motor neuropathy in type 2 Diabetes mellitus by clinical examination and nerve conduction study and to correlate clinical features of peripheral neuropathy with nerve conduction study in patients with type 2 diabetes mellitus. They concluded that 84% of patients were diagnosed with neuropathy on nerve conduction studies. In contrast, only 61% of patients were found to have neuropathy on clinical examination, and the detection rate with nerve conduction study was statistically significant (p<0.001) compared to clinical examination.[15]

Kaymaz *et al.*[16] in 2021, performed a study to validate the Turkish version of the Michigan neuropathy screening instrument and compared the findings on this instrument with nerve conduction studies on patients of diabetes mellitus for neuropathies. They concluded that clinical findings incorporated in Michigan neuropathy screening instrument have similar strength to diagnose neuropathic conditions as that of nerve conduction studies. Our study design was different from Kaymaz *et al*. We found that the clinical diagnosis and findings on the nerve conduction study might differ in some parameters.

A Swedish study published in 2014 compared the diagnostic usefulness of tuning fork, monofilament, biothesiometer and skin biopsies in peripheral neuropathy in individuals with varying glucose metabolism.[17] They concluded that biothesiometer in clinical routine might be a sensitive method to detect significant nerve fibre dysfunction in the lower extremity. In contrast, skin biopsies combined with methods measuring vibrotactile sense could increase the diagnostic sensitivity of detecting peripheral neuropathy early.

Lindholm *et al.* concluded that incorporating multi-frequency measurement of vibration perception thresholds in examining patients for diabetic neuropathies may prevent the formation of ulcers.[18]

Though our study highlighted that differences exist between results of clinical examination and nerve conduction studies in the diagnosis of diabetic neuropathies, still we cannot conclude that clinical examination is inferior to nerve conduction studies.

LIMITATIONS OF STUDY

Our study had few limitations. A current non-invasive gold standard method was part of the comparison. Therefore, we cannot conclude which method is better. Ideally, two methods under study should be compared with a standard gold diagnosis to find out the better method to diagnose polyneuropathy in patients suffering from type 2 diabetes mellitus for more than ten years.

CONCLUSION

Neuropathy had been a common finding among patients suffering from type 2 diabetes mellitus for more than ten years. A significant difference existed in diagnosing various patterns and types of neuropathies when clinical methods were compared with nerve conduction studies.

Conflict of Interest: None.

Author's Contribution

NS: Abstarct, introduction, discussion, methodology, statistical analysis, KMR: Abstract, discussion, SK:, SU: Introduction, AH: Discussion, MT: Statistical analysis.

REFERNCES

1. Khan MAB, Hashim MJ, King JK, Govender RD, Mustafa H, Al Kaabi J. Epidemiology of Type 2 Diabetes-Global Burden of Disease and Forecasted Trends. J Epidemiol Glob Health 2020; 10(1): 107-111.
2. Goyal R, Jialal I. Diabetes Mellitus Type 2. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2021, [Internet] available at: https://www.ncbi.nl.nih.gov/books/NBK513253/.
3. Trikkalinou A, Papazafiropoulou AK, Melidonis A. Type 2 diabetes and quality of life. World J Diabetes 2017; 8(4): 120-129.
4. Bodman MA, Varacallo M. Peripheral Diabetic Neuropathy.In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2021, [internet] available at: https://www.ncbi.nlm.nih.gov/books/NBK442009.
5. Yang H, Sloan G, Ye Y, Wang S, Duan B, Tesfaye S, et al. New Perspective in Diabetic Neuropathy: From the Periphery to the Brain, a Call for Early Detection, and Precision Medicine. Front Endocrinol (Lausanne) 2020; 10(1): 929-932.
6. Won JC, Park TS. Recent Advances in Diagnostic Strategies for Diabetic Peripheral Neuropathy. Endocrinol Metab (Seoul) 2016; 31(2): 230-238.
7. Weng YC, Tsai SS, Lyu RK, Chu CC, Ro LS, Liao MF. Diabetic Distal Symmetrical Polyneuropathy: Correlation of Clinical, Laboratory, and Electrophysiologic Studies in Patients with Type 2 Diabetes Mellitus. J Diabetes Res 2020; 2020(3): 6356459.
8. Zhao Z, Ji L, Zheng L, Yang L, Yuan H, Chen L, et al. Effectiveness of clinical alternatives to nerve conduction studies for screening for diabetic distal symmetrical polyneuropathy: A multi-center study. Diabetes Res Clin Pract 2016; 115(2): 150-156.
9. Afifi L, Abdelalim AM, Ashour AS, Al-Athwari A. Correlation between clinical neuropathy scores and nerve conduction studies in patients with diabetic peripheral neuropathy. Egypt J Neurol Psychiatry Neurosurg 2016; 53(3): 248-252.
10. Asad A, Hameed MA, Khan UA, Butt MU, Ahmed N, Nadeem A. Comparison of nerve conduction studies with diabetic neuropathy symptom score and diabetic neuropathy examination score in type-2 diabetics for detection of sensorimotor polyneuropathy. J Pak Med Assoc 2009; 59(9): 594-598.

11. Gogia S, Rao CR. Prevalence and Risk Factors for Peripheral Neuropathy among Type 2 Diabetes Mellitus Patients at a Tertiary Care Hospital in Coastal Karnataka. Indian J Endocrinol Metab 2017; 21(5): 665-669.
12. Yang Z, Chen R, Zhang Y, Huang Y, Hong T, Sun F et al. Scoring systems to screen for diabetic peripheral neuropathy. Cochrane Database Syst Rev 2018; 2018(7): CD010974.
13. Park JH, Won JC. Patterns of Nerve Conduction Abnormalities in Patients with Type 2 Diabetes Mellitus According to the Clinical Phenotype Determined by the Current Perception Threshold. Diabetes Metab J 2018; 42(6): 519-528.
14. Hammi C, Yeung B. Neuropathy. In: StatPearls Treasure Island (FL): StatPearls Publishing 2021, [Internet] available at: https://www.ncbi.nlm.nih.gov/books/NBK542220/.
15. Mohan G, Chandey M, Monga A, Dev P. Comparative study of detection of diabetic neuropathy by clinical and nerve conduction study in type 2 diabetes mellitus patients. Int J Adv Med 2018; 5(1): 380-383.
16. Kaymaz S, Alkan H, Karasu U, Çobankara V. Turkish version of the Michigan Neuropathy Screening Instrument in the assessment of diabetic peripheral neuropathy: a validity and reliability study. Diabetol Int 2020; 11(3): 283-292.
17. Pourhamidi K, Dahlin LB, Englund E, Rolandsson O. Evaluation of clinical tools and their diagnostic use in distal symmetric polyneuropathy. Prim Care Diabetes 2014; 8(1): 77-84.
18. Lindholm E. Strong association between vibration perception thresholds at low frequencies (4 and 8 Hz), neuropathic symptoms and diabe-tic foot ulcers. PLoS One 2019; 14(2): e0212921.

.....