Original Research Article

Comparative study of Diabetic Neuropathy Examination Scoring &Nerve Conduction Velocity in patients of Diabetic Neuropathy

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Received: 10-02-2021 / Revised: 30-03-2021 / Accepted: 09-04-2021

Abstract

Background and aims: Diabetes Mellitus (DM) is a metabolic disease affecting the worldwide population. It causes Neuropathy with significant morbidity (Paraesthesia, hyperesthesia, gait disturbance, distal weakness, insensitive extremities, predisposition to foot ulcers and even leading to amputations). The pain associated with diabetic neuropathy has a substantial impact on the quality of life. Diabetic Neuropathy Examination Scoring (DNE Scoring) and Electrophysiological study (NCV study) help in early diagnosis, treatment, and decreasing the morbidity caused due to DM. **Aim:**The main objective of the study was to examine the correlation between Clinical examination(DNE Scoring) and Electrophysiological study(NCV) in patients with Diabetic Neuropathy. **Material and methods**: A total of 52 patients were studied from January 2019 to June2020 between the age group of 40-89years. Meticulous history, Clinical examination (DNE scoring), and NCV Study were done. **Result and Conclusion** :NCV testing and DNE Scoring helps in early diagnosis and management and retard the progression with better control. The ideal diagnosis of Diabetic sensorimotor polyneuropathy (DSPN) is made by both the compatible clinical findings and the related electrophysiological changes.The usefulness of Diabetic neuropathic examination (DNE scoring) and its correlation with NCV is helpful in early diagnosing of diabetic neuropathy.

Keywords: DNE scoring, NCV study, Diabetes mellitus.

Introduction

Diabetes mellitus is a metabolic disease. Long-standing metabolic malfunctioning in type 1 & type 2 DM causes changes in multiple organ systems and results in complications like Neuropathy, Nephropathy, and Retinopathy, etc. Neuropathy may manifest as Polyneuropathy, Mononeuropathy, and or Autonomic Neuropathy. The most common form ofneuropathy is Diabetic Sensorimotor Polyneuropathy DSPN is numbness, tingling, prickling sensation affecting the toe and foot.Paraesthesia ascends to the legs and then hands in a stocking-glove distribution. Gait disturbance and distal weakness occur later. Painful or insensitive extremities predispose to foot ulcers. Autonomic symptoms include impotence, nocturnal diarrhea, difficulty voiding, abnormal sweating, orthostatic hypotension. Clinical examination reveals distal sensory loss to pain, temperature, touch, and vibration sense. Ankle reflexes are invariably reduced or absent. Motor weakness if present is mild and involves toe flexors and extensors.

Diabetic Neuropathy Examination Score {DNE SCORE:It is a modification of the Neuropathy Disability Score of Dyck.[1] in which a thorough neurological examination is carried out and DNE scoring is done.Nerve conduction velocity testing (NCV) is an electrophysiologic (EP) measurement, it has become one of the fundamental tools in the evaluation of patients suffering from diabetic neuropathy.[3]Electro-diagnostic tests are far more superior to clinical examinations as the latter fails to provide comprehensive quantitative analysis. Moreover, they are minimally invasive techniques. The popularity of these studies has stemmed from the fact that the degree of variability of these tests is significantly smaller than that of other non-invasive tests of nerves.[4]Asymptomatic patients might have the nerve conduction abnormality with an abnormal or normal clinical examination.[1] There is a significant decrease in sensory and motor amplitudes on nerve conduction studies leading from progressive degeneration and nerve fiber loss. The sensory nerve conduction is more impaired compared to motor nerve conduction.[5]Members of the American Diabetic Association found that diabetic neuropathy results in the reduction of both nerve conduction and amplitude this indicates demyelination and axonal degeneration.[6]

Electrophysiological studies have found that there is a strong correlation between nerve conduction studies, disability scores, and quantitative autonomic testing.[2] it has been accepted that the ideal diagnosis of DPN is made by both the compatible clinical findings and the related electrophysiological changes. [2]

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Material &Methods

This is a prospective observational study.-The OPD/IPD patients attending Mahatma Gandhi medical college and hospital with diabetes and having complaints about diabetic neuropathy were enrolled in the study. They underwent detailed history, clinical examination, and electrophysiological studies. A total of 52 patients with type 2 DMwere subjected to detailed history & physical examination and DNE scoring was done. Investigations were done which include –CBC, ESR, MCV, FBS, PP, HbA1C, Urine, serum creatinine, and NCV Study.

Inclusion criteria:- Diabetic patients with a clinical diagnosis of Diabetic sensory-motor polyneuropathy.

Exclusion criteria:-Patients with other causes of sensorimotor neuropathy(Drugs, Hypothyroidism, Alcoholism,etc).

DNE scoring: it consists of testing of two muscle strengths, one a tendon reflex and five sensations. The maximum score is 16. A score of >3 points is considered abnormal. Those with a score of more than 3 are considered to be suffering from diabetic neuropathy.

Muscle strength

1. Quadriceps femoris: Extension of the knee
2. Tibialis Anterior: Dorsiflexion of the foot
3. Ankle reflex
4. Sensitivity to pinpricks; Sensation: Index finger
5. Sensitivity to pinpricks; Sensation: Big toe
6. Sensitivity to touch
7. Vibration perception
8. Sensitivity to joint position

Only the right leg and foot are tested. If the right leg is amputated, then the left leg is tested.

Scoring from 0 to 2

0 = Normal

1 = Mild/moderate deficit

Muscle strength: MRC scale 3-4

Reflex: Decreased but present

Sensation: Decreased but present

2 = Severely disturbed/absent

Muscle strength: MRC scale 0-2

Reflex: Absent

Sensation: Absent

Those with a score of more than 3 are considered to be suffering from diabetic neuropathy.

Scoring to DNE

4 to 8 = Mild Grade I

9 to 12 = Moderate Grade II

13 to 16 = Severe Grade III

NCV TESTING: It is a diagnostic test performed to evaluate the ability of electrical conduction, of the motor and sensory nerves. The stimulation is like a low-intensity electric shock which is not painful. Sensory testing is done on the sural nerve behind the lateral malleolus. Action potentials were recorded at a standard distance of 14 cm. Motor testing produced assessments of MNCV and distal latency for tibial and peroneal nerves. All the neurophysiological tests were according to a standardized setup with distance specified. The impulses produced by this electrical current are viewed on a computer screen and data were recorded. Patients being hemodynamically stable with normal body temperature and room being maintained at 32°C.

Distal Latency Grading

Normal distal latency is considered to be upto 6ms.[7]

Grading is done according to increase from normal 5% greater than normal is considered as a result of an error.

Distal Latency Score

Upto 25% of normal - 0

26% - 50% - 1

>50 % - 2

Grading of SNCV and MNCV[7]

Normal SNCV (sural) and MNCV (tibial and peroneal) are considered upto 41m/sec.[7]

Grading is done according to decrease in NCV from normal[8]

SNCV/MNCV Score

85%-95% of normal - 0

75% - 85% - 1

<75% - 2

Upto 5% decrease to be considered as part of the error.

Scoring of SNAP (Sural Sensory Nerve Action Potential)

Normal SNAP is considered to be upto 6μV [7]

Grading of SNAP according to decrease from normal value.

SNAP Score

>75% of normal - 0

50% to 75% - 1

< 50% - 2

Those with normal NCV/ SNAP/ distal latency are to be given a score = 0.

Scoring in EP

Grade I 0 - 4 Mild

Grade II 5 - 8 Moderate

Grade III 9 - 12 Severe

Observation and Result

In the study, there was male(39) dominance with the maximum number of cases in-between age group, 50-59 year(36.5%.) along with 64.5 years mean age. 48% of the population suffered from diabetes from 5-10 years with the mean age before developing symptoms of neuropathy being 7.8 yrs. Tingling is experienced by the highest number of patients(34) 65.38% of the total patients, followed by numbness in 27 patients(52%), hyperesthesia in 19 cases(36%), foot ulcer in 7 cases (13%), and weakness in 18 cases(34%).

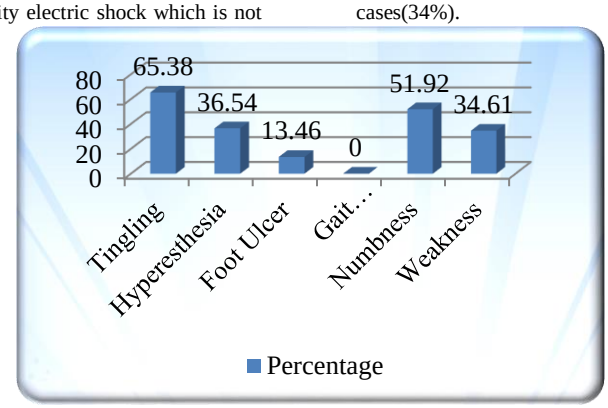

Fig. 1: Bar chart showing Symptoms of Diabetic neuropathy in study patients

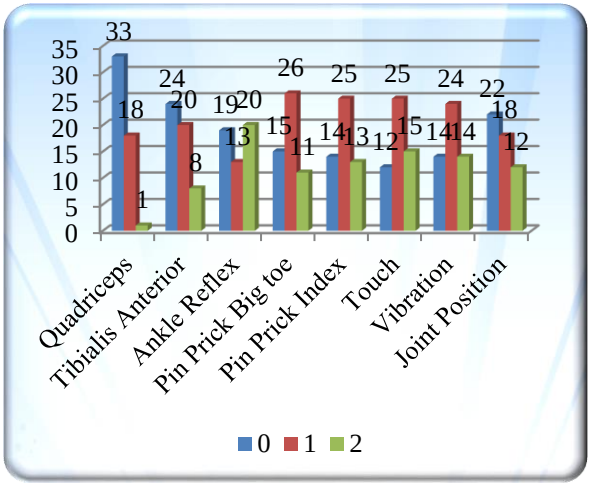

Fig. 2: Bar graph representing neurologic Signs in Study patients with Diabetic Neuropathy (DNE Scoring)

The neurologic signs were observed and graded based on the DNE score. The scoring was divided into 0, 1, and 2. The score 0, represents the absence of the sign while 1 and 2 indicate the presence of neuropathy. The quadriceps signs showed that 33 participants did not present with the sign while 1 participant has a score of 2 and 18 participants had 1 score. The T-Anterior results showed that 24 participants scored 0, while 20 participants scored 1 and 8 participants scored 2. Based on the ankle reflex, 19 participants scored 0, while 13 of them scored 1 and 20 of them scored 2. The sign of pinprick big toe results showed that about 15 participants presented with 0, while 26 participants scored 1 and 11 participants scored 2. The pinprick index results showed that 14 participants scored 0, while 25 participants scored 1 and 13 participants scored 2. For the signs of touch, vibration, and joint position, 12, 15, and 23 participants present with 0 respectively, and 25, 22 and 17 scored 1 and 15, 15 and 12 participants scored 2 respectively.

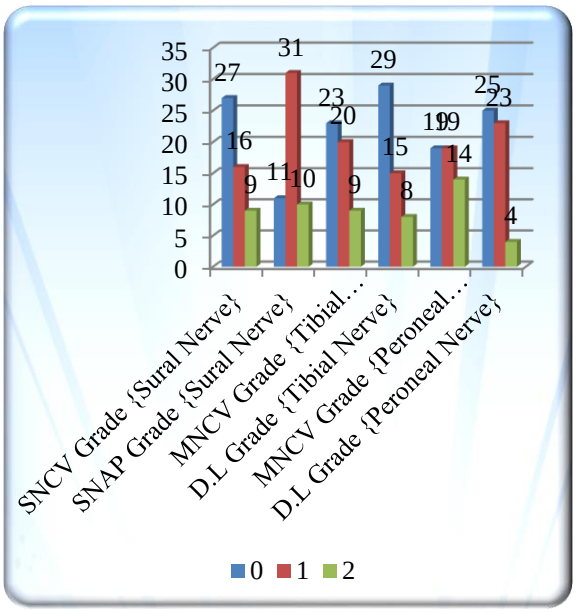

Fig. 3: Distribution of NCV grade in the sample size by bar graph NCV findings showed that the sural nerve was most frequently involved followed by tibial and peroneal nerves respectively

A correlation coefficient of DNE Score V/s NCV Score is 0.61 that indicates that a strong linear relationship exists between DNE and NCV scores with P-value = <0.001.

The grading of diabetes neuropathy was divided into three grades. According to the diabetic neuropathy examination, 29 respondents were in first grade, 21 were in second grade and 2 respondents were graded three. According to NCV grading, 25 participants have graded I, 22 participants were graded II and 5 participants were graded III. The Chi-square value to DNE and NCV is p>0.05 {NS}.

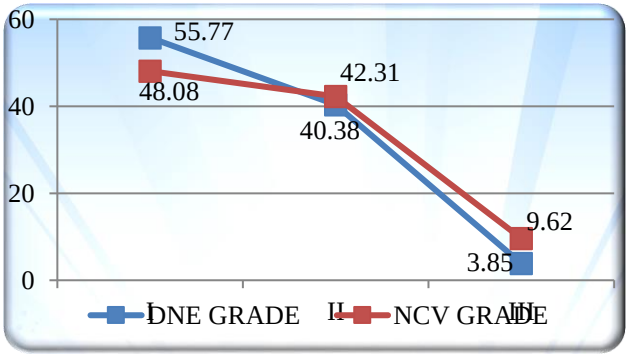

Fig. 4: Line diagram showing Grading in relevance to DNE and NCV

Discussion

Diabetic neuropathy is the impairment of the function of the nerves which is caused by uncontrolled or chronic diabetes mellitus. Uncontrolled diabetes often damages the nerves which affects their function. It mostly affects the nerves of the hands and the feet.

From the analysis of the collected data, it was found that those with high blood sugar and a greater duration of diabetes suffer from diabetic neuropathy. It is well known that nerve sensitivity to various somatic sensations increases in the early stage of diabetic neuropathy and particularly so in insulin-dependent patients.[5-8]It is found out that people within the age of 50-59 are the worst sufferers of diabetic neuropathy. Few past studies have found that if diabetic patients are able to keep their blood sugar level close to normal, the chances of developing nerve damage are less. The current study was conducted among 52 such patients who were diagnosed with diabetic sensory-motor polyneuropathy and then assessed by DNE scoring. With the dominant 39 male and 13 female participants, the age group of 50-59 years presents with the highest number accounting for 36.5%. The mean age group for the given study population was 64.5 years.Tingling was the most common presenting symptom present in 65.38% of the total participants. This is followed by numbness which is experienced by 52% of the participants.About 36%, 13%, and 34% of the participants experienced hyperesthesia, foot ulcer, and weakness respectively.DNE scoring showed that ankle reflex was deranged in the maximum of 33 respondents followed by pinprick sensation over the toes.NCV findings showed that the sural nerve was most frequently involved followed by tibial and peroneal respectively. A correlation coefficient of DNE Score V/s NCV Score is 0.61 that indicates that a strong linear relationship exists between DNE and NCV scores. The P-value is <0.001. Asad et al. **(**2009) state that the result of the study to compare nerve conduction studies and clinical scores to detect sensorimotor polyneuropathy revealed that there is a significant association between nerve conduction studies (NCS) and the clinical scores. NCS and clinical scores both are beneficial in detecting DPN. The EP parameter can be correlated with the severity of nerve neuropathy. NCS has proved to be highly beneficial in the study over clinical scores.Feki and Lefaucheur also conducted a similar study to observe the correlation between the nerve conduction studies and clinical scores. It was found that a correlation existed between neuropathy disability score and index of polyneuropathy.

Pfeifer et al. (2012) state that the EP study has found that there is a strong correlation between nerve conduction studies, disability scores, and quantitative autonomic testing.[7]

Conclusion

Diabetic Neuropathy is the most common complication of long-standing diabetes and is known to correlate with the duration of diabetes and poor glycaemic control.Early diagnosis of Neuropathy can be achieved by performing detailed clinical examination(DNE Scoring), which is cheap and done easily Electrophysiological studies(NCV Study) which help in initiating and maintaining better control and thus retard the progression of Neuropathy and improving the quality of life. Electrophysiologic (EP) studies are not easily available and are costly, so all patients with Diabetes Mellitus should undergo for Diabetic Neuropathic Examination.

All patients with diabetes and having complaints pertaining to diabetic neuropathy were examined using the DNE clinical scale and the results were correlated to the findings of those of electrophysiological study. The study showed a positive correlation between NCV studies and DNE scoring (r=0.61, p<0.001).

The study thus favors that in resource-poor settings where electrophysiological studies are not available, diagnosis and grading of neuropathy can be done by the combination of clinical score and glycaemic control of the patients.Early diagnosis of diabetic neuropathy and stringent glycaemic control can limit the morbidity associated with the disease.

Conflict of Interest: Nil Source of support: Nil

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