A Study of Nerve Conduction Test & Other Hematological Parameters in Diabetics

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Abstract

Background: Nerve conduction studies (NCS) are most sensitive, reliable and non-invasive investigation to detect diabetic neuropathy. Sensory nerves are more affected as compared to motor nerves in diabetic neuropathy. Understanding the Nerve conduction studies is useful for early detection polyneuropathy and prevention of its dreaded complications.

Materials and Method: The present study was conducted among 30 subjects of type 2 Diabetic and 30 non diabetics subjects. Haematological parameters such as HbA1c, platelet count, prothrombin time, APTT, triglycerides, LDL and HDL levels were estimated. Motor nerve conduction velocity median, ulnar, common peroneal and posterior tibial nerve and sensory nerve conduction velocity median, ulnar and sural nerve were recorded.

Result: Mean age of diabetic patients was 51±4.8 year. Most of the subjects (86.7%) were male. Sensory nerve conduction of sural nerve was significantly reduced in diabetic patients as compared to non diabetic patients. SNCV of sural nerve showed deterioration with the duration of diabetes, poor glycemic control and patients with altered lipid profile.

Conclusion: Nerve conduction velocity testing of sural nerve is useful for early detection of diabetic neuropathy and reduce the burden of complication and to improve the quality of life in diabetics.

Keywords: Sensory nerve conduction velocity, Sural nerve, Diabetic peripheral neuropathy, HbA1c

Introduction

Diabetes mellitus (DM) is a metabolic disorder characterized by chronic hyperglycaemia with abnormalities in carbohydrate metabolism.¹ In India, prevalence of diabetic peripheral neuropathy in Type 2 diabetic patients was 26.1%.² Distal symmetric sensorimotor polyneuropathy is the most common clinical type of DPN. Three fourth of neurologically asymptomatic patients may have abnormal nerve conduction.¹ Age, male gender, duration of diabetes, glycated hemoglobin levels and insulin use increase risk of peripheral neuropathy.³ Nerve conduction studies (NCS) are most sensitive, specific, reliable and non-invasive investigation to detect diabetic neuropathy.⁴ Routine NCS include evaluation of motor conduction velocity of the median, ulnar, peroneal and tibial nerves, and sensory conduction velocity of median, ulnar and sural nerves.¹ Sensory nerves are more affected as compared to motor nerves in diabetic neuropathy.⁵,⁶ Relationship between poor glycaemic control and DPN has been reported by various authors.⁷,⁸ The Nerve conduction studies (NCS) is crucial for early detection and prevention of its dreaded complications of DPN.⁹,¹⁰

Aims & Objectives

➢ To study nerve conduction velocity in type 2 diabetes mellitus patients and non diabetic patients.
➢ To study corealtion of haematological parameter
like HbA1c, platelet count, prothrombin time, APTT, triglycerides, LDL and HDL levels with development of polyneuropathy.

**Materials and Method**

The present study was conducted among 30 subjects of type 2 Diabetic Subjects in age group (30-65 years) attending out patient clinic of Nalini Chowdhary’s neuro center in Hanamkonda, Telangana. The another 30 patients of age group of 30-65 years who seeking for various other medical problems without diabetes were included in control group. Patients with neuropathy due to any other cause were excluded. Detail history regarding complaints of neuropathy was taken. Haematological parameters such as HbA1c, platelet count, prothrombin time, APTT, triglycerides, LDL and HDL levels were estimated in diagnostic center at Hanamkonda.

Nerve conduction studies were performed with Clarity Octopus NCV/EMG machine. Written consent was taken from each patient. Patient’s limb was placed in relaxed position. Room temperature was maintained between 21–23°C as any degree rise or fall in temperature can change the results. Electrode gel was applied under the electrode and affix the electrode with adhesive tape to the skin for reduction of electrode impedance. Motor nerve conduction velocity median, ulnar, common peroneal and posterior tibial nerve and sensory nerve conduction velocity median, ulnar and sural nerve were recorded.

Data was entered in Microsoft Excel 2010 and analyzed using Epi info 7.1 and analyzed in terms of mean and SD. T-test for difference of means was used. “P” values equal to or less than 0.05 was considered as significant.

**Result**

Mean age of diabetic patients (51±4.8) and control group (48.2 ± 9.2) was comparable (p > 0.05). Twenty six male (86.7%) had diabetes. Twenty five patients (83.3%) in control group were male. Mean duration of diabetes was 7.0 ± 3.4 year.

| Characteristic | Case | Control | P value |
|----------------|------|---------|---------|
| Age            | 51±4.8 | 48.2 ± 9.2 | > 0.05  |
| Male           | 26 (86.7%) | 25 (83.3%) | > 0.05  |
| Female         | 4 (13.3%) | 5 (16.7%)  |         |

Table 1: Gender and age wise distibution of case and control group.

| Parameter  | Case     | Control   | p value |
|------------|----------|-----------|---------|
| HbA1C      | 8.1 ± 1.1 | 5.5 ± 0.8 | < 0.05  |
| FBS        | 136 ± 13.0 | 81 ± 9.7  | < 0.05  |
| PPBS       | 212 ± 35.0 | 130 ± 9.3 | < 0.05  |
| HDL        | 25 ± 3.6  | 72 ± 9.5  | < 0.05  |
| TG         | 161 ± 23.0 | 36 ± 7.5  | < 0.05  |
| LDL        | 130 ± 28.0 | 82 ± 8.9  | < 0.05  |
| Platelet count | 4.4 ± 0.5 | 2.1 ± 0.4 | < 0.05  |
| PT         | 13 ± 1.9  | 13 ± 1.9  | > 0.05  |
| APTT       | 34.8 ± 2.5 | 33.5 ± 2.5 | > 0.05  |

Table 2 shows comparison of various laboratory parameters in subjects of case and control group. HbA1c, fasting blood sugar (FBS), post prandial blood sugar (PPBS) and platelet count were significantly higher in diabetic patients as compared to control group. There was no any significant difference in PT and APTT among two groups. Lipid profile was also significantly altered in diabetic patients.
Table 3: Motor nerve conduction velocity (MNCV) among case and control group.

| Nerve                  | Case         | Control      | p value |
|------------------------|--------------|--------------|---------|
| Median nerve           | 57.3 ± 3.2   | 57.0 ± 3.3   | >0.05   |
| Ulnar nerve            | 57.4 ± 3.1   | 57.3 ± 3.2   | >0.05   |
| Common peroneal nerve  | 46.0 ± 2.6   | 46.6 ± 2.5   | >0.05   |
| Posterior tibial nerve | 49.4 ± 3.5   | 46.9 ± 8.1   | >0.05   |

Table 3 shows the MNCV in median, ulnar, common peroneal, and posterior tibial nerves. MNCV of all these nerves were normal in diabetic and non diabetics patients .

Table 4: Sensory nerve conduction velocity (SNCV) among case and control group.

| Nerve       | Case         | Control      | p value |
|-------------|--------------|--------------|---------|
| Median nerve| 48.8 ± 3.9   | 49.2 ± 4.0   | >0.05   |
| Ulnar nerve | 58.3 ± 2.7   | 54.9 ± 9.6   | >0.05   |
| Sural nerve | 46.8 ± 6.8   | 49.7 ± 3.9   | <0.05   |

Results of SNCV of median, ulnar and sural nerve are reported in Table 4. The SNCV of median & ulnar nerves are normal in control & cases group. However, sensory nerve conduction in sural nerve of diabetic patients (46.8 ± 6.8) was significantly lower as compared to control group (49.7 ± 3.9). The normal range of sural sensory nerve conduction velocity is 45.5-56.3 m/s. Eleven subjects (36.6%) in cases group were observed with decreased sensory nerve conduction velocity of sural nerve. The mean sensory conduction velocity of sural nerve in these 11 subjects was 38.98 m/s. They were having subclinical distal sensory peripheral neuropathy.

Correlation between HbA1c and NCV in different nerves was summarized in figure 1. Only SNCV of sural nerve was negatively correlated with HbA1c (r=-0.72).
Figure 2: Correlation of SNCV of sural nerve with laboratory parameter and duration of diabetes.

SNCV of sural nerve was negatively correlated with duration of diabetes ($r=-0.77$), HbA1c ($r=-0.72$), FBS ($r=-0.72$), PPBS ($r=-0.69$), TG ($r=-0.59$) and LDL ($r=-0.68$).

**Discussion**

In the present study, mean age of diabetic patients was 51±4.8 year. Therefore, the result is applicable only to patients over 50 year age group. Our study group is comparable to other studies with the same age group of subjects. Most of the subjects (86.7%) were male. Other studies also show a higher prevalence of DM in male as compared to females.

In the present study, sensory nerve conduction of sural nerve was significantly reduced in diabetic patients as compared to non diabetic patients. Involvement of sural nerve is suggesting that long nerves are commonly affected. Lower limb is more commonly affected due to length dependent dying back process. We observed that sensory NCS of sural nerve was f inferior with poor glycemic control (higher HbA1c, FBS and PPBS). Previous study reported that HbA1c > 6.5% increased risk for polyneuropathy in DM patients by more than 5-fold. In the present study, SNCV of sural nerve also showed deterioration with the duration of diabetes. Lee et al. also observed that sural sensory amplitude was significantly associated with polyneuropathy in DM patients. Oguejiofor et al. reported a higher in patients with a duration of DM >15 years and lower prevalence of neuropathy in those with duration of DM <5 years. Various studies suggested risk factors for the neuropathy development such as high cholesterol levels, smoking, hypertension, male sex, older age and poor glycaemic control.

**Conclusion**

The current study shows that diabetic neuropathy is more common in middle and elderly male patients. It was positively relating with duration of diabetes, poor glycemic control and altered lipid profile. Sural nerve was more commonly involved. Nerve conduction velocity testing of sural nerve is useful for early detection of diabetic neuropathy and reduce the burden of complication and to improve the quality of life in diabetics.

**Ethical Clearance**: Ethical clearance taken from Ethical Review Board, Nalini Chowdhary’s neuro center in Hanamkonda, Telangana.

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**Conflict of Interest**: Nil

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