Section: Physiology

Original Research Article

NERVE CONDUCTION STUDY IN HEALTHY INDIVIDUALS

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ABSTRACT

Background: The ability of the conduction of the motor and sensory nerves were evaluatedby Nerve conduction studies. The aim of the study is to To establish the normative data for conduction velocity of motor and sensory division of median nerve in population of Trichy, South India.

Materials and Methods: This Prospective cross sectional study was conducted among healthy individuals in a Tertiary care hospital, Trichy for a period of 18 months. The study participants fulfilling the inclusion and the exclusion criteria were included in the study throughout the study period. The final attained sample 200. The demographic data like name, age of the patient, were analysed. Anthropometric measurements & Nerve conduction study were performed at the clinical physiology laboratory in the hospital. The data collected will be entered in the MS Excel and statistical analysis done through SPSS 23.P value <0.05 is considered as statistically significant.

Results: The mean age of the study group in males was found to be 28.10 ± 8.77 years,in females was found to be 26.79 ± 6.79 years. The left hand median motor latency in males were found to be more than females and it was found to be 2.68 ± 0.41ms. This value was statistically significant (p value < 0.05). The right and left hand median sensory latency was found to be more in males compared to females and it was found to be statistically significant (p value < 0.05).

Conclusion: The average motor and sensory nerve parameters are almost same with the other existing studies.

Keywords: Nerve conduction study, sensory nerve, motor nerve, latency, velocity, CAMP, SNAP.

INTRODUCTION

Nerve Conduction Studies are part of electro diagnostic methods utilised in the clinics for assessing the normal functioning status of the peripheral nerves. The development of nerve conduction study dates back to the early part of the 20 th century.[1] Nerve conduction studies play a vital role in describing the disease conditions of the peripheral nerves. The basic technique consists of an electrical stimulation of nerves and the recording of the evoked potentials, either from the muscles or from the nerves themselves.[2,3] In clinics NCS plays an important role in identifying the limit of damage and the point of neural injuries. Demyelination and axonal degeneration are the two main peripheral nerve diseases which can be distinguished with the help of nerve conduction velocity.

Nerve conduction velocity is an invasive simple procedure to evaluate the peripheral nerve fiber status. They are now commonly used for the precise localization of injured nerve fiber and exact description of the peripheral nerve functions.

Nerve conduction studies are part of routine tests in the present scenario which help in identifying and defining the condition of the tested nerve fiber. The peripheral nervous system can be completely examined by the NCS. Nerve conduction study involves the examination of motor, sensory and mixed nerves. The examined nerve fiber is activated by applying a small milli amperes of electric current on the skin overlying the nerve and the obtained

action potential is recorded for interpretation of its function. The values from the conduction velocity is compared with the existing normative data available in the literature and research works for its interpretations.[1,4]

Normative data can be defined as a value or range of parameters common for a population at a point of time. These data describes the normal values which is below or above gives us the result of the test for diagnosis. Normative data plays an essential role for clinicians in making decisions differentiating from normal conditions and pathological conditions. Normative data are necessary for clinicians for the following reasons.

- Defining the history of a disease condition in a particular population.
- Improving quality of patient care by clinicians.
- Instituting the proper definitions of diseases for primary physicians.

The researchers should concentrate on methodologies to develop normative data. A cross sectional study can be utilised for making normative data in stipulated time.

Normative data can also be obtained from longitudinal studies, case control studies and existing data sets. The data should be precisely interpreted with clear methodology and the results should be simplified for benefit of patients and to provide a good quality primary care.[5]

Aim and Objective

To establish the normative data for conduction velocity of motor and sensory division of median nerve in population of Trichy ,South India.

MATERIALS AND METHODS

Study Design: Cross Sectional Study

Study Setting: This study was conducted during the period of December 2017 to June 2019 at Tertiary care hospital, Trichy. Anthropometric measurements & Nerve conduction study were performed at the clinical physiology laboratory in the hospital.

Study Duration: one & half years.

Selection of Subjects: The healthy volunteers were selected for this study using simple randomization technique.

Sample Size: The calculated sample size was 200 (100 male subjects and 100 female subjects.) with 95% confidence interval.

Using the formula $= \frac{Z^2 \sigma^2}{d^2}$

where Z - calculated table value for confidence interval with 95 % is 1.96.

σ - standard deviation from previous study.44

d - absolute error taken as 1 %.

Study Population: 100 Male and 100 Female subjects from trichy population.

Inclusion Criteria

- 100 healthy male and 100 healthy female volunteers.
- Age group - 17 years to 60 years of age.

Exclusion Criteria

- A known case of systemic and neurological disorders such as (Diabetes mellitus, systemic hypertension, and hypothyroidism.)
- Neuropathy.
- Myopathy.
- History of upper limb injury.
- Alcoholism.
- Subjects with drugs affecting nerve conduction (eg: antidepressants).

Methodology

The study was conducted using nerve conduction machine RMS (Recoders medicare system) EMG ALERON 201 channel machine in the clinical physiology laboratory located in the hospital block of Tertiary care hospital, Trichy

MEDIAN NERVE - MOTOR COMPONENT

The procedure was to activate the median nerve by a supra maximal stimulus at the wrist and elbow. A Compound Muscle Action Potential (CMAP) was recorded using surface electrodes and then the values are interpreted.

MEDIAN NERVE – SENSORY COMPONENT

Median nerve is stimulated at wrist and sensory nerve action potentials are recorded from digital nerve of index finger antidromically using ring electrodes.

NERVE STIMULATION

A supramaximal stimulus was used to stimulate the nerves. Site : At wrist , between the tendons of palmaris longus and flexor carpi radialis approximately 1 cm proximal to the most distal wrist crease .

Procedure

All the subjects who will be selected are asked to fill the data sheet with informed written consent. After obtaining written informed consent from the participants, The nerve conduction study was Performed using RMS EMG ALERON 201 channel machine in the clinical physiology lab . The proximal and distal ends of the overlying skin is cleaned with spirit. Electrode should be fixed properly disc electrodes for motor conduction and ring electrodes for sensory conduction. Check the connecting elements in the recording machine. Sweep speed maintained at 5ms/cm. Supramaximal stimulus is used in the distal and proximal end to obtain a desired amplitude .The distance between the two stimulation points is measured and entered in the computer. The conduction velocity and distal latency is calculated by the computer.[12,13,14]

PRECAUTIONS TO BE TAKEN

1. Detailed instructions was given to the selected subjects of the study procedure before conducting the study and a informed written consent was obtained.
2. Before stimulation the subjects were relaxed.
3. Optimum temperature was maintained in clinical physiological laboratory.
4. Electrode placements were checked before to stimulation.[12,13]

RESULTS

A total of 200 subjects were included in the nerve conduction study, out of which were 100 male subjects and 100 female subjects. The demographic characteristics are shown in table 1.

Table 1: Demographic data of the subjects

S.no	Variable	Male (N=100)	Female (N=100)	Overall mean
1	**Age (years)**	28.10± 8.77	26.79± 6.79	27.44±7.85
2	**Height (meters)**	1.66± 0.06	1.56±0.05	1.61±0.07
3	**Weight (kilograms)**	65.32± 12.00	54.09± 8.02	59.70±11.63
4	**BMI**	23.46± 3.87	21.98± 2.90	22.72±3.49

The mean age of the study group in males was found to be 28.10 ± 8.77 years, in females was found to be 26.79 ± 6.79 years with the range of 17 to 60 years. The mean height of the study group in males was found to be 1.66 ± .065 meters, in females it was found to be 1.56 ± .052 meters. The mean weight in males was found to be 65.32 ± 12.00 kilograms, in females it was found to be 54.09 ± 8.02 kilograms. The mean Body Mass Index (BMI) in male subjects were found to be 23.46 ± 3.87,in female subjects were found to be 21.98 ± 2.90.

Table 2: Median motor nerve parameters in males and females

Variable		Male Mean ± S.D	Female Mean ± S.D	P value
Latency (ms)	Rt	2.84 ± 0.51	2.69 ± 0.35	0.19
	Lt	2.91 ± 0.51	2.68 ± 0.41	0.01
Velocity (m/s)	Rt	55.29 ± 6.76	55.39 ± 5.81	0.91
	Lt	54.32 ± 5.96	53.37 ± 7.12	0.30

Table 2. shows the mean ± S.D of latency and conduction velocity of male and female subjects for right and left hand median motor conduction. The left hand median motor latency in males were found to be more than females and it was found to be 2.68 ± 0.41ms. This value was statistically significant (p value < 0.05). Whereas the right median latency, Right median velocity and left median velocity was found to be not statistically significant.

Table 3: Median sensory nerve parameters in male and female subjects

Variable		Male Mean ± S.D	Female Mean ± S.D	P value
Latency (ms)	Rt	2.64 ± 0.36	2.51 ± 0.27	0.006
	Lt	2.61 ± 0.37	2.50 ± 0.30	0.02
Velocity (m/s)	Rt	55.50 ± 6.40	56.41 ± 5.71	0.29
	Lt	56.47 ± 6.66	57.27 ± 6.36	0.38

The right and left hand median sensory latency was found to be more in males compared to females and it was found to be statistically significant (p value < 0.05). The left and right hand median sensory conduction velocity was found to be more in females compared to males and the difference was found to be not statistically significant (p value > 0.05). The mean median nerve motor conduction velocity in the healthy study population was 55.34 ± 6.29 m/s.

The mean latency of median nerve in the healthy volunteers was 2.77 ± 0.45 ms.

The mean median sensory conduction velocity in the healthy population was found to be 55.95 ± 6.07 m/s. The mean latency of median sensory nerve was found to be 2.57 ± 0.36 ms.

DISCUSSIONS

Nerve conduction velocity values are far most important in describing the limits of normal function. The reference values beyond the range suggests the abnormality in conduction of the nerves tested. This study was conducted in both male and female genders of Trichy population for the period of one and half years. The nerve conduction study involved both motor and sensory part of median nerve. A comparison was made with the previous studies of the median motor and sensory nerve conduction velocities.

The mean age group of the in our study was 27.44 ± 7.85 which is lower than Shaik shababuddin et al (42.93 ± 10.40), Mohamed Saufi Awang et al (34.38 ± 10.79) ,).6,7. The median motor nerve latency was 2.77 ± 0.45 in our study was in correlation with Shebab DK (3.1 ± 0.3) , Hennesey et al (3.2 ± 0.4), Sachin M Pawar et al (3.25 ± 0.50).[8,9,10]

The median motor nerve had lower latencies compared to Robinson et al (3.60 ± 0.4), Kimura (3.49 ± 0.34), Falco et al (3.5 ± 0.5). The reason for this may be inclusion more number of young adults in our study when compared to other studies which included more number of higher age group subjects, as distal latency is prolonged with increasing age supported by previous studies.[11,12,13]

The median motor velocity was 55.34 ± 6.29 in our study was in correlation with Shebab DK (56.5 ± 3.5), Sacin M Pawar et al (56.33 ± 4.57), Robinson et al (54.4 ± 3.8) , Falco et al (54.4 ± 5.4).[8,10,13,11]

The Median motor velocity had lower values in comparison with Hennessey et alaa (59.5 ± 4.4), Kimura (57.7 ± 4.9).9,12 The reason for this is connected to the decreased anthropometric parameters (arm length) in our population when compared to other population (Americans & Europeans) whose anthropometric parameters are higher, supported by previous literatures.

The median sensory nerve latency was 2.57 ± 0.36 in our study, was in correlation with Shebab DK (2.3 ± 0.3) , Hennesey et al (2.5 ± 0.2) , , Falco et al (2.8 ± 0.4).[8,9,11] The median sensory nerve had lower latencies when compared to Robinson et al (3.7 ± 0.3) , Kimura (2.84 ± 0.34).[13,12]

The median sensory velocity was 55.95 ± 6.07 in our study was in correlation with Shebab DK (56.6 ± 7.6), Robinson et al (54.6 ± 3.7) , Falco et al (56.0 ± 4.5), Kimura , (56.2 ± 5.8).[8,13,11,12] The Median sensory velocity had lower values in comparison with , Hennessey et al (61.2 ± 4.3).[9]

The median motor latency values was found to be longer in males than in females (2.84 ± 0.51 & 2.69 ± 0.35), this was also observed by Balasubhramaniam et al.[14] They connect this with the higher arm length in males when compared to females. A study by Shahabuddin et al also reported the decresed latencies in females than in males.[6]

The motor conduction velocity did not show any gender differences in males and females in our study (55.29 ± 6.76 & 55.39 ± 5.81), earlier studies by, Balasubhramaniam et al , and Shahabuddin et al were also in line with our results, that conduction velocities have no gender variations in median motor nerve.[6,14]

The median sensory latency values was found to be more or less equal in both males and females (2.64 ± 0.36 & 2.51 ± 0.27) ,this was also observed by Balasubhramaniam et al. A study by Shahabuddin et al also reported that sensory latencies of males and females are almost equal.[14,6]

The sensory conduction velocity did not show any gender differences. The values in our study were (55.50 ± 6.40 & 55.6.41 ± 5.71)in males and females respectively. Earlier studies by Shahabuddin et al and Balasubhramaniam et al were also in line with our sensory conduction velocity.[14,6]

The Nerve conduction parameters of the median motor and sensory nerves are almost in coordination with the most of the existing research works. The variations found with the other research works might be because of the difference in nerve conduction machinery, electrodes, and techniques involved in the study. The reason for variation of the conduction parameter cannot be connected to a single parameter as it involves different ethnic population, different regions of climatic conditions , anthropometric parameters, age, and activities of daily living.

CONCLUSION

This study was conducted in both male and female genders of Trichy population for the period of one and half years. The nerve conduction study involved both motor and sensory part of median nerve. A total of 200 healthy volunteers consisting of 100 males and 100 females participated in the study. The normative conduction parameters of median nerve motor and sensory conduction velocity was established for our clinical physiology laboratory in Trichy population. The average motor and sensory nerve parameters are almost same with the other existing studies.

Limitations of the study

The limitations of the study was the study design was a cross – sectional study. The sample size was small. No equal representation of age groups was in the study . Variations of distance in the electrode placement of the study population. Temperature of the laboratory setup. It is a single centre study so the results cannot be generalised.

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