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RESEARCH ARTICLE

Nerve conduction velocity in median nerve and tibial nerve of healthy adult population with respect to gender

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ABSTRACT

Background: The reference values for nerve conduction velocity (NCV) for different nerves vary considerably in different population and region. There are factors that affect NCV such as age, gender, and temperature. The importance of motor nerve conduction study for the evaluation of the functional status of the patient's median and tibial nerve for comparing the effect of therapeutic intervention with other diseases, which affect NCV is well-known in various studies. **Aims and Objectives:** To establish the normal electrophysiological data, NCV variables, i.e., compound muscle action potential for the right median and right tibial nerve in normal healthy adults and to establish gender effect on NCV study variables in them. **Materials and Methods**: All together 38 females and 80 male subjects, from first year MBBS, BDS, staff members of the Index Medical College Hospital and Research Center, Indore, Madhya Pradesh, India, between age group of 20-60 years were evaluated. All tests were done on JAVA RMS Aleron-201 series. Analysis was done using Statistical Package for Social Sciences 10.0 version. **Results**: The mean ages of male were more than that of female with *P* value non-significant. The mean NCV of elbow-wrist and knee-ankle of males was more than that of female with $P = 0.038$ and 0.020, respectively, which was found to be highly significant. **Conclusion**: The normative conduction parameter of commonly tested peripheral nerve in upper and lower limb could be used for the evaluation of peripheral nerve injury. Gender has a definite effect on NCS variables diagnostic conclusion could also be made from the nerve conduction study data.

KEY WORDS: Nerve Conduction Velocity; Motor Nerve Conduction Study; Compound Muscle Action Potential; Median Nerve; Tibial Nerve Gender

INTRODUCTION

Peripheral nerves are most commonly used to measure nerve conduction velocities (NCV). Electrodiagnostic assessment of peripheral nerve includes two major components: Nerve conduction study (NCS) and needle electromyography (EMG).[1]

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Several factors influence nerve conduction study such as age, height, gender, and body mass index. All such factors are taken into consideration while doing nerve conduction study. However, different geographic regions have influence on these factors. Many studies had been published regarding normative data from foreign countries with cold and hot climatic conditions.[2]

A nerve conduction study is a test, which is used to evaluate the functional ability of electrical conduction of the motor and sensory nerves of the human body. NCV is a common measurement made during the test, which measures how quickly electrical impulse travel along a nerve. It is to be done at the same time as an EMG, to exclude or detect muscular disorder.

A healthy nerve conducts signals faster with greater speed and strength than a damaged nerve. The speed of nerve conduction is influenced by the myelin sheath that provides insulating coating, which surrounds the nerve. Most neuropathies are caused by damage to the nerve axons neither than damage to the myelin sheath surrounding the nerve.

The median nerve is one of the important nerves in the upper limb. They are responsible for the movement as well as the sensation of the hand. Entrapment of this nerve will cause a reduction in these modalities for instance in carpal tunnel syndrome.

The right tibial nerve is among the nerve studied in the lower limb. It supplies muscles of the back of leg and cutaneous sensation of the lower limb. Sufficient stimuli from the electric stimulator can trigger nerve impulses once the action potential threshold of a nerve fiber is reached. The velocity is directly dependent on the diameter and myelination of nerve fibers.

Nerve conduction studies are mainly for the evaluation of paresthesias (numbness, burning and tingling or weakness) of arm and leg. This type of study required dependence on the part by the symptom presented. A physical examination and complete present and past history also help to detect the investigation. It helps the clinician to differentiate between peripheral degeneration and axonal degeneration.[1]

The main purpose of this study was to provide electrophysiological data for commonly tested upper and lower limb nerves in carefully screened healthy adults, using standard distance and temperature control. To establish the normal electrophysiological data NCV variables, i.e., CMAP for the right median and tibial nerve in normal healthy adults and to study the effect of gender on NCV in right median and tibial nerve in healthy adults. The objective of this study was to determine a reference value for motor NCV (MNCV) in young healthy adults.

MATERIALS AND METHODS

Study Population

This study was conducted in the Neurophysiology Laboratory of Physiology Department of Index Medical College Hospital and Research Centre, Indore, Madhya Pradesh, India, from June 2012 to March 2013. The subject included in the study was 1st year MBBS student, 1st year BDS student and nursing student, and staff member of this institute.

Selection Criteria

Healthy individual of different age groups (20-60 years). Free of any neurological disorder or problem or any history of it.

Exclusion Criteria

1. Any individual of neurological disorder or neuromuscular transmission disorder
2. Any individual suffering from diabetes
3. Any individual suffering from renal disorder
4. Any individual suffering from weakness of upper limb and lower limb or myopathy.

Protocol

Informed consent was obtained from the individual. The examination was performed in a calm setting after the patient was thoroughly briefed about the procedure and rest for 30 min. The considerable gap was given between examinations, so as to minimize discomforts to subject as well as to enhance their enthusiastic participation.

Electrophysiological Methods

All tests were done on JAVA RMS Aleron-201 series. The JAVA RMS Aleron-201 series is a clinically customized for a quick and flexible operation. It is particularly designed with the consideration of actual test being done in the field machine which can be totally customized for various tests, nerve muscle and size with computer choice of amplifier filter and sweep setting and also analytical setting.

The nerve conduction study was performed in a special room whose temperature was maintained between 30°C and 31°C. Further subject should be made comfortable with the laboratory set up, so as to completely relax. For median nerve, the active surface electrode should be put on the motor point of abductor pollicis brevis in the upper third of thenar eminence close to 1st metacarpophalangeal joint and stimulating electrode was kept at the ante-cubital fossa proximally and wrist distally and ground electrode at the back of the palm.

For each subject, data of distal motor latency 1 (lat1), latency 2 (lat2), MNCV, and compound muscle action potential (CMAP) from the distal stimulation have been included from statistical analysis for this study.

CMAP has following component, which is defined as:

i. Amplitude: It is the measurement from baseline to the positive peak
ii. Lat1: It is the time from the stimulus to the first positive deflection off the baseline
iii. Lat2: Time taken for 1st deflection of CMAP after stimulation at S2 (site)
iv. Duration: It correlates with the density of small fibers. It is measured from the onset to the positive peak
v. Area: The area comes from the difference between the lat1 and lat2. However, it needs computer analyses.

In each subject, orthodromic motor parameters of the nerve were measured. Surface electrodes were used. The recording electrodes were fixed to the subject's skin using tape. Special skin preparation was not needed. The targeted nerve was maximally stimulated using a square wave current with duration 0.2 ms, and the action potential was picked up by the recording electrode. The length of each nerve was estimated with a flexible measuring tape. For safety, a ground electrode was placed in between the stimulating and recording electrode.[1]

Principle of Motor Nerve Conduction

The motor nerve is stimulated at least at two points along its course. The pulse is adjusted to record a CMAP. It is important to ensure a supra maximal stimulation keeping the cathode close to the active recording electrode. This prevents hyper polarization effect of anode and anodal conduction block. The surface recording electrode was commonly used and placed in belly-tendon montage, keeping the active electrode close to the motor point and reference to the tendon. Ground electrode was placed between stimulating and recording electrode. A biphasic action potential with initial negativity was thus recorded. Surface stimulation of healthy nerve requires a square wave pulse of 0.1 ms duration with an intensity of 5-40 mA. Filter setting for motor nerve conduction study (MNCS) was 20 Hz to 3 KHz, and sweep speed was 10 ms/division.

The measurements for MNCS include the onset latency, duration and amplitude of CMAP and NCV. The latency is the time in milliseconds from the stimulus artefact to the first positive deflection CMAP for better visualization of the takeoff; the latency should be measured at a higher gain than the one used for CMAP amplitude measurement.

The latency is a measure of conduction, in the fastest conducting motor fibers. It also includes neuromuscular transmission time and the propagation time along the muscle membrane from the baseline to the positive peak. The amplitude correlates with the number of nerve fibers. The duration of CMAP was measured from the onset to the positive peak. Duration correlates with the density of small fibers. The area under CMAP was also measured. However, it was computer generated analysis.

MNCV was calculated by measuring the distance in millimeter between two points of stimulation, which is divided by the latency difference in millisecond. The NCV was expressed as m/s.

$$\text{Conduction velocity: } \frac{D}{PL-DL} \text{ m/s}^{[3]}$$

Where,

PL is the proximal latency and

DL is the distal latency and

D is the distance between the proximal and distal latency.

Ethical Approval

Approval from Institutional Ethical Committee was obtained.

Recording Procedure

Motor NCS variables

Estimator with water soaked felt tips was placed at right median and tibial nerve which was recorded as:

Right median nerve

The median nerve is a mixed nerve derived from C5 to T1, roots via medial and lateral cords of brachial plexus. It supplies most forearm flexors and thenar muscles and provides sensory innervations to the lateral aspect of palm and dorsal surfaces of terminal phalanges along with the palmer surface of thumb, index, middle and half of ring fingers (Figure 1).

Position

This study was performed in the supine position.

Active electrode: Placement was half way between the mid-point of distal wrist crease and 1st metacarpophalangeal joint.

Reference electrode: It was placed slightly distal to the 1st metacarpophalangeal joint.

Ground electrode: Placement was on the dorsum of the hand. If stimulus artefact interferes with the recording, the ground may be placed near the active electrode between the electrode and the cathode.

Stimulation point (S1): The cathode was placed 8 cm proximal to the active electrode in a line measured first to the mid-point of the distal wrist crease and then to a point

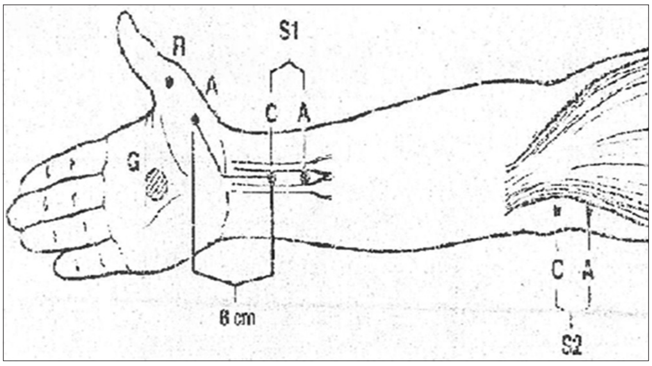

Figure 1: Electrode placement for right median nerve

slightly ulnar to the tendon of the flexor carpi radialis. The anode was proximal.

Stimulation point (S2): The cathode was placed slightly medial to the brachial artery pulse in the ante-cubital region. The anode was proximal.

Nerve fiber tested: C8 and T1 nerve root through the lower trunk of the anterior division and medial cord of the brachial plexus.

Machine setting: Sensitivity - 10 mv/division, low-frequency filter – 20 H2, high-frequency filter – 3 KHz, and sweep speed - 10 ms/division.

Care should be taken not to concomitantly stimulate the ulnar nerve. The direction of thumb twitch would help in making sure that only median nerve was stimulated.[4]

Applied: Entrapment of median nerve leads to three important syndromes:
i. Carpal tunnel syndrome
ii. Anterior interosseous syndrome
iii. Pronator teres syndrome.

Right tibial nerve
The tibial nerve is the continuation of the sciatic nerve below popliteal fossa. In leg, it supplies both the head of gastrocnemius and soleus along with deep muscles of the back of the leg. At the ankle, the nerve passes under the flexor retinaculum and divides into medial and lateral planter nerve after giving a calcaneal branch (Figure 2).

Position: The study was performed in the supine position.

Active electrodes: Was placed over the medial foot, slightly anterior and inferior to the tubercle of the navicular bone at the most superior point of the arch formed by the junction of plantar skin and dorsal foot skin.

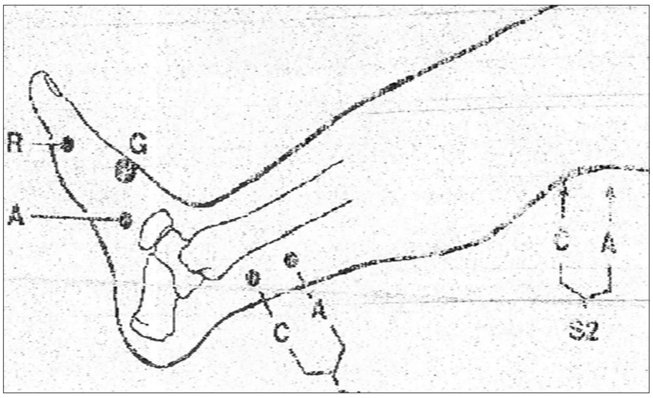

Figure 2: Electrode placement for the right tibial nerve

Reference electrode: It was placed slightly distal to the 1st metacarpophalangeal joint on the medial surface of the joint.

Ground electrode: It was placed on the dorsum of the foot.

Stimulation point (S1): The cathode was placed 8 cm proximal to the active electrode (measured in a straight line with the ankle in central position) and slightly posterior to the medial malleolus. The anode is proximal.

Stimulation point (S2): The cathode was placed at the mid-popliteal fossa or slightly medial or lateral to the midline. The anode is proximal.

Nerve fiber tested: S1 and S2 nerve roots through the anterior division of the lumbosacral plexus and the sciatic nerve.

Machine setting: Sensitivity - 10 mv/division, low-frequency filter - 20 Hz, high-frequency filter = 3 kHz, and sweep speed - 10 ms/division.

Ankle stimulation should be approximately half way between the medial malleolus and the Achilles tendon. Care should be taken not to stimulate the peroneal nerve concomitantly at the knee. Stimulation should be close to the midline of the popliteal fossa, but the stimulator may need to be moved slightly or laterally to obtain an optimal response watching for the direction of foot motion on stimulation which would help to ensure that the proper nerve was stimulated.[2]

Applied: Entrapment of tibial nerve leads to tarsal tunnel syndrome.

Statistical Methods

Analysis was done using Statistical Package for Social Sciences 10.0 version. Values obtained were expressed in the form of mean and standard deviation. *P* value was taken as significant if it was found to be <0.05. The test used was *Z*-test with two sample mean.

RESULTS

Table 1 shows that the mean ages of the study subjects (male 35.4 ± 12.7 and female 33.8 ± 13.7) were not significantly different between genders. The mean NCV of elbow-wrist and knee-ankle of male is more than that of female with $P = 0.038$ and 0.020, respectively, which is found to be highly significant. Its range is in between 29.67-98.36 m/s and 18.17-70.34 m/s, respectively.

Table 2 shows the following effect of gender on CMAP as:
1. Elbow: The mean difference for all parameters, i.e., Lat1, Lat2, Dur, Amp, and Area shows non-significant differences ($P > 0.05$) between genders

Table 1: Comparison of mean age and NCV for male and female				
Parameters	**Range**	**Male** *n*=80	**Female** *n*=38	**Statistical analysis**
Age	20-60 years	35.4±12.7	33.8±13.7	*P*=0.542 Df=68 Non-significant
NCV of right median nerve (elbow-wrist segment)	29.67-93.36 m/s	69.1±29.8	55.9±32.4	*T*=2.22 *P*=0.038, >0.05 Df=67 highly significant
NCV of right tibial nerve (knee-ankle segment)	18.17-70.34 m/s	62.9±27.7	48.5±32.0	*T*=2.38 *P*=0.020, >0.001 Df=64 highly significant

NCV: Nerve conduction velocity

Table 2: Effect of gender on motor nerve conduction variables (CMAP)									
Motor nerve	**Site of stimulation**	**Age range**	**Gender**	**Number of subjects**	**CMAP variables (Mean±SD)**				
					Lat1 (ms)	**Lat2 (ms)**	**Duration (m/s)**	**Amplification (mv)**	**Area (m^2)**
Right median nerve	Elbow	20-60	Male	80	8.34±2.28	21.87±9.92	13.50±4.59	4.63±3.41	19.3±11.7
			Female	35	8.79±3.46	21.14±5.83	12.56±4.52	4.19±4.00	16.6±13.6
				Statistical analysis	*T*=0.73 *P*=0.0470 Non-significant	*T*=0.68 *P*=0.498 Non-significant	*T*=1.05 *P*=0.297 Non-significant	*T*=0.65 *P*=0.521 Non-significant	*T*=1.05 *P*=0.297 Non-significant
	Wrist	20-60	Male	80	3.06±1.03	18.55±6.96	15.38±7.13	2.31±1.65	23.8±16.4
			Female	35	3.76±1.74	16.62±4.82	12.86±4.92	2.90±2.13	22.1±15.4
				Statistical analysis	*T*=2.28 *P*=0.027 Df=49 Significant	*T*=1.75 *P*=0.083 Non-significant	*T*=2.23 *P*=0.028 Df=10.0 Significant	*T*=1.48 *P*=0.143 Non-significant	*T*=0.55 *P*=0.584 Non-significant
Right tibial nerve	Knee	20-60	Male	80	12.23±7.15	25.20±8.76	14.7±15.6	49.3±84.4	150±258
			Female	35	12.26±6.96	27.23±8.90	14.98±9.47	27.4±62.2	118±277
				Statistical analysis	*T*=0.02 *P*=0982 Non-significant	*T*=1.16 *P*=0.248 Non-significant	*T*=010 *P*=0.919 Non-significant	*T*=1.59 *P*=0.116 Non-significant	*T*=0.61 *P*=0.545 Non-significant
	Ankle	20-60	Male	80	6.36±1.53	15.76±3.77	8.97±1.47	8.47±6.54	19.7±19.4
			Female	35	5.97±1.77	18.08±5.10	12.11±5.79	11.37±7.43	33.2±21.5
				Statistical analysis	*T*=1.16 *P*=0.250 Non-significant	*T*=2.45 *P*=0.016 Significant	*P*=0.002 Df=40 Significant	*T*=−2.01 *P*=0.048 Significant	*T*=−3.53 *P*=0.001 Df=53 Significant

CAMP: Compound muscle action potential, SD: Standard deviation

2. Wrist: The mean difference for parameters Lat1 and Dur is found to be significant ($P < 0.05$) between genders, whereas all other parameters Lat2, amp, and area is non-significant ($P > 0.05$)
3. Knee: All parameters show non–significant changes between genders
4. Ankle: The parameters Lat2, Dur, Amp, and Area show significant differences between genders except Lat1.

DISCUSSION

A total of 118 healthy individuals were studied over a period of 1-year from June 2012 to May 2013 in the Neurophysiology Laboratory of Physiology Department of Index Medical College Hospital and Research Centre. There were 80 male and 38 females in the study group. The study shows the association of biological factors, i.e., age and gender which was further supported by previous studies.

In adult, NCV decreases with age as it starts to decline at a rate of 1.5% per second, more so in the upper limb than the lower limb. This was related to gradual loss of neuron with aging. A similar finding was observed by Flack and Stalberg,[5] 1993 for MNCV. This study shows a decrease in NCV as age advances. Tong et al.,[6] 2004 found in their study on the effect of aging on the motor nerve that the rate of change in parameter was significantly greater in the median nerve as compared to the ulnar nerve.

The age factor had been negatively correlated to amplitude in MNCS conducted by Huang et al., 2009.[7] This study showed that the conduction velocity was slightly more in upper limb than lower limb as this was attributed to the length of the nerve.

Comparison of effect of age of various studies comprising of different components of CMAP and NCV with this study (Table 3).

On comparing this study for the adult between 20 and 60 years, the NCV for elbow-wrist segment found to be more than that of Chouhan,[2] Kimura et al.,[10] and Ginzburg et al.[8] While comparing the CMAP, its component Lat1 for the elbow was found to be more in this study as compared to various studies. This study also shows the calculation of NCV of elbow-wrist segment and area while these parameters were not calculated by various workers. So, our study was first of its kind.

The conduction velocity of nerve was low in infant and children. In neonates, it was nearly half of the adult values. It attains the adult value by 3-5 years of age, and then it remains relatively stable until 60 years of age.

While further study when done on right tibial nerve showed a difference in the various parameters for the CMAP of right tibial nerve for the knee-ankle segment. For knee, this study showed an increase in Lat1, for the older subject as compared to younger while Lat2, amp, and duration showed a decrease for older as compared to younger, while area slightly increases in case of older as compared to younger and *P* value for all parameter (CMAP) is found to be statistically non-significant.

In contrast to this study for popliteal fossa, Thakur et al.[11] found slightly increase in Lat1, Lat2 for right popliteal fossa in case of the older subject in comparison to the younger one and was statistically non-significant while amplitude was also higher in older group with statistical significance. Duration was more for younger as compared to older one and was found statistically highly significant. For ankle in this study, Lat2, duration, amplitude, and area get decreased in case of older in comparison to younger and was found statistically significant while for Lat1, older had more than that of younger and was statistically found to be non-significant.

Thakur et al.[11] did not calculate area of CMAP for popliteal fossa. In adult, NCV decreases with age as it starts to decline at a rate of 1.5% per second. This was related to gradual loss of neuron with aging.

The age factor had been negatively correlated to amplitude in MNCS reported by Huang et al.[7] Saufi et al.[12] in their study on motor tibial nerve in healthy subject found that conduction velocity decreases while latency increases with advancing age. This study correlates with the Saufi et al.[12]

Comparison of effect of age of various studies comprising of different components of CMAP and NCV with this study (Table 4).

Gender: The following parameters were analyzed in this study in relation to gender as:

1. Age: Out of total number of cases 80 male with mean ± standard deviation (SD) of 35.4 ± 12.7 and 38 female with mean ± SD of 33.8 ± 13.7 in the age range of 20-60 years and *P* = 0.54 which is found to be statistically non-significant
2. The NCV of right median nerve (elbow-wrist segment) was 69.1 ± 29.8 for the male which was more than that of female who had NCV 55.9 ± 32.1 with *P* = 0.0387 and was highly significant
3. The NCV of right tibial nerve (Knee-ankle segment)

Table 3: Comparison of effect of age of various studies comprising of different components of CMAP and NCV

Study	Number of subject	Age group	Segment	Lat1 (ms)	Lat2 (ms)	Duration (ms^2)	Amp. (mv)	Area (mu)	NCV
Ginzburg et al.[8]	21	26-55	Elbow Wrist	3.2 (0.4)	-	-	12.1 (3.8)	-	45.1-54.4
Falco et al.[9]	44	Young adults	-	3.7 (0.5)	-	-	10.2 (3.6)	-	-
Buschbacher[4]	249	-	-	-	-	-	-	-	-
Kimura et al.[10]	61	11-74	Wrist Elbow	3.49±0.34 7.39±0.69	- -	- -	7.0±3.0 7.0±2.7	- -	- 5.77±4.9
Mishra and Kalita[1]	26	16-35	Wrist Elbow	3.77±0.40 7.62±0.65	-	-	8.10±2.62	-	-
Chouhan[2]	50	17-20	Wrist Elbow	3.54±0.43 7.21±0.69	- -	- -	17.84±3.41 10.63±3.96	- -	- 58.85±3.57
Present study	80	20-60	Elbow Wrist	8.34±2.28 3.06±1.03	21.98±9.92 18.55±6.96	13.50±4.59 15.38±7.13	4.63±3.41 2.31±1.65	19.3±11.7 23.8±16.4	69.1±29.8

NCV: Nerve conduction velocity

for male $n = 80$ with mean ± SD of 62.9 ± 27.7 which was more than that of female $n = 38$ with mean ± SD of 48.5 ± 32.0 with $P = 0.020$ and was highly significant statistically

4. CMAP: In earlier reports, the gender difference in some NCS had been largely explained by height although amplitude difference persists despite correction report. Gender has definite effect in NCV variables as:
   i. At elbow: Lat1 was slightly increased while other parameters of CMAP were slightly decreased in females as compared to male
   ii. At wrist: There was a reduction in Lat2, amp, area, and they were not statistically significant for female while Lat1, in female, was more and duration was less than that of male and was statistically significant
   iii. The NCV of elbow-wrist segment of male was more than that of female and was significant
   iv. For knee: Lat2 and duration were slightly increased in females, and it was statistically non-significant. Amp and area were increasing in male as compared to female and was non-significant
   v. For ankle: In ankle there was reduction in Lat2, dur, amp, area in male as compared to female and

Table 4: Comparison of effect of age of various studies comprising of different components of CMAP and NCV

Study	Number of subject	Age group	Segment	Lat1 (ms)	Lat2 (ms)	Duration (ms^2)	Amp. (mv)	Area (mu)	NCV
Kathleen et al.[13]	80	Young females *P* value	Ankle	4.2±0.7 0.003	4.3±0.6 <0.001	-	7.9±2.9 <0.001	-	45.3±3.1 <0.001
Thakur et al.[11]	34	Younger Older *P* value	Right. popliteal fossa	10.7±0.99 11.0±1.3 0.551	40.6±43 42.15±6.37 0.088	7.28±1.12 0.28±0.81 0.004	3.74±1.22 7.94±2.71 0.033	-	6.28±0.81 7.28±1.12 <0.01
Huang et al.[7]	101	Younger Older	Right popliteal fossa	4.0±0.7 4.9±1.0	4.7±1.1 4.9±1.0	-	16.5±4.7 8.8±4.0	-	47.5±2.8 49.1±5.2
Saufi et al.[12]	250	20-59	Ankle	-	-	-	-	-	50.73±4.60
Present study	80	Younger (20-60) Older *P* value	Knee	11.68±5.39 12.02±8.11 0.864	25.98±8.59 24.88±9.98 0.665	14.66±9.27 12.51±8.05 0.339	9.6±10.7 6.74±4.89 0.149	6.51±7.82 6.74±4.89 0.882	50.73±4.60
		Younger Older *P* value	Ankle	6.01±1.80 6.76±1.18 0.120	17.18±5.06 16.09±2.40 0.222	11.18±5.81 9.32±1.67 0.042	11.31±7.66 7.51±4.50 0.016	29.4±19.7 18.6±12.5 0.008	62.9±27.7

NCV: Nerve conduction velocity

Table 5: Comparison of effect on gender in motor nerve conduction variables (CMAP)

Study	Motor number	Gender	Site	Lat1	Lat2	Duration	Amplitude	Area	NCV
Thakur et al.[11]	Right median nerve	Male Female *P* value	Ante-cubital fossa	9.28±0.96 8.54±0.59 0.017	25±2 22.56±1.18 0.001	8.46±1.30 7.5±1.03 0.021	10.47±3.14 7.75±2.39 0.021	- - -	-
	Right post tibial nerve	Male Female *P* value	Right popliteal fossa	11.34±1 10.22±1 0.003	43.38±4.57 38.72±5.32 0.001	7.12±1.26 6.41±0.72 0.040	16.57±5.82 12.3±5.83 0.023	 - -	
Present study	Right median nerve	Male Female *P* value	Elbow	8.34±2.28 8.79±3.46 0.470	21.87±9.92 21.14±5.83 0.498	13.50±4.59 12.56±4.52 0.297	4.63±3.41 4.19±4.00 0.521	19.3±11.7 16.6±13.6 0.297	NCV elbow-wrist segment male=69.1±29.8 Female=55.9±32.4 *P*=0.03 significant
		Male Female *P* value	Wrist	3.06±1.03 3.76±1.74 0.027	18.55±6.96 16.62±4.82 0.083	15.38±1.13 12.86±4.92 0.028	2.31±1.65 2.90±2.13 0.143	23.8±16.4 22.1±15.4 0.584	
	Right post tibial nerve	Male Female *P* value	Knee	12.23±7.15 12.26±6.96 0.982	25.20±8.76 27.23±8.90 0.248	147±15.6 14.98±9.47 0.919	49.3±84.4 27.4±62.2 0.116	150±258 118±277 0.545	NCV knee-ankle segment male=62.9±27.7 Female=48.5±32.0 *P*=0.020 highly significant
		Male Female *P* value	Ankle	6.36±1.53 5.97±1.77 0.250	15.76±3.77 18.08±3.10 0.016	8.97±1.47 12.11±5.79 0.002	8.47±6.54 11.17±7.43 0.048	19.7±19.4 33.2±21.5 0.001	

NCV: Nerve conduction velocity

was found to be statistically significant. Males had longer Lat1 as compared to female and were non-significant

vi. The NCV of the knee-ankle segment of male was more than that of female and was significant.

Comparison of effect on gender in motor nerve conduction variables (CMAP) with other studies (Table 5).

In contrast to this study, Thakur et al.[11] found an increase in all component of CMAP for male as compared to female and was statistically significant for ante-cubital fossa and right popliteal fossa. While this study showed a decrease in all NCV variables, i.e. CMAP except duration but they were non-significant. In this study area was also calculated because of computer analysis. Thakur et al. did not calculate area and NCV for the gender of upper and lower limb.

Soudman et al.[14] reported that NCV is not influenced much by gender. Gender difference in nerve conduction parameter could also be due to the difference in height.

While work of Kimura et al.[10] reveals that gender-related amplitude differences persist despite adjustment of height. As male has thicker subcutaneous tissue which provides greater distance between digital nerve and surface ring electrode as compared to female. While Garg et al.[15] found that male had a higher CMAP and longer latencies and duration than the females.

CONCLUSIONS

In conclusion, the normative conduction parameter of commonly tested peripheral motor nerve in the upper and lower limb was established in our Neurophysiology Laboratory of the Department of Physiology of our institute. This study could be used for the evaluation of peripheral nerve injury. The diagnostic conclusion could also be made from the nerve conduction study data.

The study created a preliminary data of this population abet in a limited sample. A study with larger sample size will be more useful. Our present studies have many similarities and some dissimilarity with the reported NCS variable (i.e., CMAP). This study reported high conduction velocity as compared to other workers, i.e., Thakur et al., 2010.[11] The probable reason could be true differences among the population and small sample sizes; nevertheless, this data may be used as a preliminary working reference while reporting clinical NCS finding. In this way, this study holds a strong strength.

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