

## Influence of gender on nerve conduction velocity in healthy adults in urban population of a developing country

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### Abstract

**Background:** Gender plays important role on amplitude, duration and latency of motor and sensory nerve conduction studies.

**Aims:** To compare the effect of gender on nerve conduction properties of upper and lower limbs in Median and Tibial nerves in an urban population of eastern India.

**Materials and methods:** 60 healthy adults (30 male and 30 female volunteers) in the age group of 18 to 60 years without any significant present or past systemic illness were selected for the study. Nerve Conduction Study of both Right and Left Median nerve in case of Upper Limbs and both Right and Left Tibial nerve in case of Lower Limb were performed. Results were analysed using SPSS version 16.

**Results:** In right median nerve Proximal and Distal Latency were more in males; Proximal and Distal Amplitude were more in females; Nerve Conduction Velocity was more in males; F-Wave Latency was more in males. In left median nerve Proximal and Distal Latency were more in male; Proximal and Distal Amplitude were more in females; Nerve Conduction Velocity was more in males; F-Wave Latency was more in males. In right Tibial nerve Distal Latency was more in males; Proximal and Distal Amplitude were more in females; Nerve Conduction Velocity was more in males; F-Wave Latency was more in females. In left tibial nerve Distal Latency was significantly more in males; Proximal and Distal Amplitude were more in females; Nerve Conduction Velocity was more in males; F-Wave Latency was significantly more in females.

**Conclusions:** The Nerve Conduction Study Parameters varies according to gender. This variation is due to difference in Height, Limb Length, Weight, BMI, Thickness and Density of subcutaneous tissue, Muscle Mass. Influence of gender must be taken into consideration during Nerve Conduction Study and establishing normative data for reference value of Neurophysiological Laboratories for different population remains essential.

**Keywords:** Nerve Conduction Velocity, gender, normative data.

### 1. Introduction

Nerve Conduction Study is an important tool to evaluate peripheral nerve abnormalities. Nerve Conduction Velocity (NCV) test has been used as a simple non-invasive technique for diagnosis, monitoring and prognostic evaluation of nerve injuries and neuropathies [1]. Several factors may influence nerve conduction studies such as temperature, age, sex, height, weight, BMI and laboratory conditions which should be taken into consideration otherwise sensitivity and specificity of NCV study will

decrease[2]. As the body composition of different population varies with demographic profile, every population should have its own normative data to identify abnormal subjects [3].

Nerve conduction studies help to delineate the extent and distribution of the neural lesion and distinguish two major categories of peripheral nerve diseases: demyelination and axonal degeneration. Although the method is based on simple, pitfalls abound in practices.

Variabilities in nerve conduction measurement may result from temperature change; variations among nerve segments and effect of age and gender, other sources of error include excessive spread of stimulation current, anomalous innervations, temporal dispersion and inaccuracy of surface measurement. Unlike a bipolar derivation which selectively records near field potentials a referential recording may give rise to stationary far field peaks from a moving source. Overlooking these possibilities can lead to an incorrect interpretation of findings [1-3].

Routine nerve conduction study includes assessment of compound muscle action potential (CMAP) and sensory nerve action potentials (SNAP) of accessible peripheral nerves in upper and lower limbs including median, ulnar, radial, common peroneal, tibial and sural nerves. Commonly measured parameters of CMAP include latency, amplitude, duration, conduction velocity and late response, e.g. F-waves. Similarly, for SNAP, latency, amplitude, duration and conduction velocity are routinely measured. These parameters are known to vary with demographic profile, anthropometric measurements of the population studied and laboratory conditions of the test [4-6].

Longer nerves may generally conduct more slowly than shorter nerves, as suggested by inverse relationship between height and nerve conduction velocity. Nerve conduction velocity is generally faster in proximal than distal segment of a nerve [1].

Males have greater velocity but lesser amplitude compared to females, so same reference data cannot be used for both gender<sup>4</sup>. Gender has definite effects on amplitude, duration and latency of motor and sensory nerves. These effects are not identical in different motor and sensory nerves. Males had higher CMAP amplitude, longer latencies and duration than the females. SNAP latencies and duration were longer in males whereas amplitude was higher in females. Using the same reference data in patients with different gender may result in erroneous reporting; thus both the sexes should have their own reference data for clinical purpose [4-6].

The present study was designed to compare the effect of gender on nerve conduction properties of upper and lower limbs in Median and Tibial nerves in an urban population of eastern India where there still exists lack of availability of reference data for this population.

## 2. Materials and methods

The present study was conducted in the Department of Physiology of Burdwan Medical College, West Bengal, India during the period of May 2014 to April 2015 after taking institutional ethical clearance and informed consent of the subjects.

### 2.1 Inclusion criteria

60 healthy adults (30 male and 30 female volunteers) of age group 18 to 60, residing in Burdwan town without any significant present or past systemic illness were selected for the study. The subjects were age and BMI matched.

### 2.2 Exclusion criteria

Persons with known diabetes, known hypothyroidism, any sign/symptom of neuropathy or nerve compression syndrome, any history of nerve injury/fracture of bone, chronic alcoholic/heavy smoker, females on OCP and history of regular intake of any drug/Chemical that may affect NCV were excluded.

Five hundred subjects from the local area were randomly selected using an online randomizer. Among them 260 were males and 240 were females. On the day of appointment, particulars of the subject, personal history, family history, history of past illness and treatment history of the subjects were carefully recorded. General physical examinations were done, one hundred and ten subjects who met the inclusion and were selected. 45 subjects had to be excluded as they met exclusion criteria. 5 subjects refused to participate. Pre-test instructions were given regarding the test.

### 2.3 Anthropometric measurement:

**(a) Body Weight:** A digital adult type weighing scale was used to measure body weight with an accuracy of + 100 gm. Subjects were weighed without their shoes.

**(b) Height:** Standing body height was measured without shoes to the nearest 0.5 cm with the use of height stand with shoulders in relaxed position and arms hanging freely.

**(c) Limb Length:** Limb Lengths were measured in standing position by Non stretchable measuring tape to the nearest 0.5 cm. Upper Limb length was measured from acromion process to tip of middle finger. Lower Limb length was measured from iliac crest to lateral malleolus.

**(d) Body Mass Index (BMI):** BMI was calculated as body weight in kilograms divided by square of body height in meters.

### 2.4 Nerve Conduction Study

**Apparatus:** Nerve Conduction Study Unit (NIHON KOHDEN NEUROPACK).

**Procedure:** At first the subject was explained about the procedure and was asked to remove any jewellery, hairpin, and eyeglasses with metal handle, hearing aids, or any other metal object that may interfere with the procedure.

Nerve Conduction Study of both Right and Left Median nerve in case of Upper Limbs and both Right and Left Tibial nerve in case of Lower Limb were performed afterwards. The procedure was performed in supine position with complete physically and mentally relaxed state. The room temperature was kept at  $26\pm 2^{\circ}\text{C}$ .

NCS of Median nerve was done with fully extended hand and in case of Tibial nerve it was done with knee joint keeping in semiflexed position.

At first the nerve was located to be examined and the skin over the nerve was cleaned with spirit. The recording electrode was attached to the skin over the nerve with a special paste after proper cleaning with spirit. The stimulating electrode was placed at a known distance away from the recording electrode [1-6].

The nerve was stimulated by a mild and brief electrical shock given through the stimulating electrode. The subjects experienced minor discomfort at this time, explained before the procedure.

The stimulation of the nerve and the detected response was displayed on the monitor of the Nerve Conduction Study unit as wave form.

### Calculation

From the wave form Proximal and Distal Latency, Proximal and Distal Amplitude, and F-wave Latency measured. Motor Nerve Conduction Velocity was calculated by measuring the distance in millimeter between two points of stimulation, which is divided by the latency difference in milliseconds.

$$\text{Conduction Velocity} = \frac{D}{PL-DL} \text{ m/sec.}$$

D = distance between two points of stimulation.

PL = Proximal Latency.

DL = Distal Latency.

### 2.5 Statistical analysis

The computer software "Statistical Package for the Social Sciences (SPSS) version 16 (SPSS Inc. Released 2007. SPSS for Windows, Version 16.0. Chicago, SPSS Inc). P value < 0.05\* was considered as significant and P value <0.01\*\* as highly significant.

## 3. Results

There was no significant difference in BMI and limb length between the two groups (Table1). The Mean  $\pm$ SD Values of study parameters of right median nerve among males and females were as follows (Table 2):

Male; Proximal Latency-7.26 $\pm$ 0.4, Distal Latency-3.13 $\pm$ 0.36, Proximal Amplitude-6.39 $\pm$ 0.64, Distal Amplitude-8.4 $\pm$ 0.62, Conduction Velocity-55.6 $\pm$ 3.2, F-Wave Latency-27.82 $\pm$ 1.04.

Female; Proximal Latency-6.92 $\pm$ 0.24, Distal Latency-2.9 $\pm$ 0.27, Proximal Amplitude-7.8 $\pm$ 0.56, Distal Amplitude-9.45 $\pm$ 0.45, Conduction Velocity-53.24 $\pm$ 2.25, F-Wave Latency-25.72 $\pm$ 0.78. Mean Values of Proximal and Distal Latency were more in male than female. Proximal and Distal Amplitude were more in females than males; Nerve

Conduction Velocity was more in males than females; F-Wave Latency was more in males.

The Mean  $\pm$ SD Values of study parameters of left median nerve among males and females were as follows (Table3): Male; Proximal Latency-7.43 $\pm$ 0.43, Distal Latency-3.29 $\pm$ 0.52, Proximal Amplitude-6.57 $\pm$ 0.67, Distal Amplitude-8.5 $\pm$ 0.7, Conduction Velocity-56.42 $\pm$ 2.79, F-Wave Latency-27.82 $\pm$ 0.89. Female; Proximal Latency-6.99 $\pm$ 0.21, Distal Latency-3 $\pm$ 0.21, Proximal Amplitude-7.66 $\pm$ 0.47, Distal Amplitude-9.44 $\pm$ 0.52, Conduction Velocity-53.36 $\pm$ 2.15, F-Wave Latency-25.58 $\pm$ 0.59. Mean Values of Proximal and Distal Latency were more in male than female and statistically highly significant; Proximal and Distal Amplitude were more in females than males; Nerve Conduction Velocity was more in males than females; F-Wave Latency was more in males.

The Mean  $\pm$ SD Values of study parameters of Right Tibial nerve among males and females are as follows (Table 4):

Male- Proximal Latency-12.6 $\pm$ 0.99, Distal Latency-5.01 $\pm$ 0.91, Proximal Amplitude-4.02 $\pm$ 0.61, Distal Amplitude-6.22 $\pm$ 0.62, Conduction Velocity-46.55 $\pm$ 3.06, F-Wave Latency-47.22 $\pm$ 4.21.

Female- Proximal Latency-12.28 $\pm$ 0.98, Distal Latency-4.46 $\pm$ 0.64, Proximal Amplitude-5.14 $\pm$ 1.02, Distal Amplitude-7.25 $\pm$ 0.97, Conduction Velocity-44 $\pm$ 2.73, F-Wave Latency-50.19 $\pm$ 3.96.

Mean Value of Proximal Latency was more in males but the difference was statistically not significant and Distal Latency are more in male than female and the difference was highly significant. Mean Values of Proximal and Distal Amplitude were more in females than males and the difference was highly significant. Mean Value of Nerve Conduction Velocity was more in males than females. Mean Values of F-Wave Latency was more in females.

The Mean  $\pm$ SD Values of study parameters of Left Tibial nerve among males and females were as follows (Table5): Male- Proximal Latency-12.72 $\pm$ 0.90, Distal Latency-5.16 $\pm$ 0.79, Proximal Amplitude-4.09 $\pm$ 0.69, Distal Amplitude-6.26 $\pm$ 0.65, Conduction Velocity-46.67 $\pm$ 3.35, F-Wave Latency-47.32 $\pm$ 4.55.

Female: Proximal Latency-12.70 $\pm$ 0.95, Distal Latency-4.72 $\pm$ 0.70, Proximal Amplitude-5.50 $\pm$ 0.88, Distal Amplitude-7.56 $\pm$ 0.75, Conduction Velocity-42.90 $\pm$ 2.28, F-Wave Latency-50.07 $\pm$ 3.03. Distal Latency was significantly more in males than females. Proximal and Distal Amplitude were more in females than males. Nerve Conduction Velocity was more in males than females. F-Wave Latency was significantly more in females as compared to males.

**Table 1: Anthropometric measurements of study subjects**

Anthropometric Parameters	Male	Female	P Value
BMI	27.8 $\pm$ 3.2	25.96 $\pm$ 3.9	0.051
Upper Limb Length	75.27 $\pm$ 3.57	68.4 $\pm$ 4.88	0.806
Lower Limb Length	93.7 $\pm$ 4.68	92.2 $\pm$ 5.26	0.25

**Table 2: Comparison of motor Nerve Conduction Study Parameters of Right Median Nerve of males & females**

NCS Parameters		Male	Female	P Value
Latency (ms)	Proximal Latency	7.26±0.4	6.92±0.24	0.00025**
	Distal Latency	3.13±0.36	2.9±0.27	0.0044**
Amplitude (mV)	Proximal Amplitude	6.39 ±0.64	7.8±0.56	6.59 × 10 <sup>-13**</sup>
	Distal Amplitude	8.4±0.62	9.45±0.45	6.3 × 10 <sup>-10**</sup>
Nerve Conduction Velocity		55.6 ±3.2	53.24±2.25	0.0017**
F-Wave Latency (ms)		27.82±1.04	25.72±0.78	3.86 × 10 <sup>-12**</sup>

P value &lt; 0.05 \* (significant)

P value &lt; 0.01 \*\* (highly significant)

**Table 3: Comparison of motor Nerve Conduction Study Parameters of Left Median Nerve of males & females**

NCS Parameters		Male	Female	P Value
Latency (ms)	Proximal Latency	7.43±0.43	6.99±0.21	7.38 × 10 <sup>-6**</sup>
	Distal Latency	3.29±0.52	3.0±0.21	0.0065**
Amplitude (mV)	Proximal Amplitude	6.57±0.67	7.66±0.47	1.39 × 10 <sup>-9**</sup>
	Distal Amplitude	8.5±0.7	9.44±0.52	2.52 × 10 <sup>-7**</sup>
Nerve Conduction Velocity		56.42±2.79	53.36±2.15	1.47 × 10 <sup>-5**</sup>
F-Wave Latency (ms)		27.82±0.89	25.58±0.59	9.34 × 10 <sup>-16**</sup>

P value &lt; 0.05 \* (significant)

P value &lt; 0.01 \*\* (highly significant)

**Table 4: Comparison of motor Nerve Conduction Study Parameters of Right Tibial Nerve of males & females**

NCS Parameters		Male	Female	P Value
Latency (ms)	Proximal Latency	12.6±0.99	12.28±0.98	0.23
	Distal Latency	5.01±0.91	4.46±0.64	0.009**
Amplitude (mV)	Proximal Amplitude	4.02±0.61	5.14±1.02	5.28 × 10 <sup>-6**</sup>
	Distal Amplitude	6.22±0.62	7.25±0.97	1.06 × 10 <sup>-5**</sup>
Nerve Conduction Velocity		46.55±3.06	44.0±2.73	0.001**
F-Wave Latency (ms)		47.22±4.21	50.19±3.96	0.007**

P value &lt; 0.05 \* (significant)

P value &lt; 0.01 \*\* (highly significant)

**Table 5: Comparison of motor Nerve Conduction Study Parameters of Left Tibial Nerve of males & females**

NCS Parameters		Male	Female	P Value
Latency (ms)	Proximal Latency	12.72±0.90	12.70±0.95	0.96
	Distal Latency	5.16±0.79	4.72±0.70	0.03*
Amplitude (mV)	Proximal Amplitude	4.09±0.69	5.50±0.88	5.35 × 10 <sup>-9**</sup>
	Distal Amplitude	6.26±0.65	7.56±0.75	1.86 × 10 <sup>-9**</sup>
Nerve Conduction Velocity		46.67±3.53	42.90±2.28	1.02 × 10 <sup>-5**</sup>
F-Wave Latency (ms)		47.32±4.55	50.07±3.03	0.008**

P value &lt; 0.05 \* (significant)

P value &lt; 0.01 \*\* (highly significant)

#### 4. Discussion

The electro-diagnostic assessment of peripheral nerves includes two major components: nerve conduction (NCS) and needle electromyography (EMG) studies. Commonly measured parameters of CMAP include latency, amplitude, duration, conduction velocity and late response, e.g. F-waves. Similarly, for SNAP, latency, amplitude, duration and conduction velocity are routinely measured [1-6].

Gender plays important role on amplitude, duration and latency of motor and sensory nerve conduction studies<sup>4-6</sup>. The present study was conducted to compare the effect of gender on nerve conduction properties of upper and lower limbs in Median and Tibial nerves in an urban

population of eastern India. 60 healthy adults (30 male and 30 female volunteers) in the age group of 18 to 60 years without any significant present or past systemic illness were selected for the study.

We found that both proximal and distal Median amplitudes were more in females and which are similar to earlier studies [7-8]. The probable reason may be due to lesser wrist circumference, lesser height, lesser limb length and lesser density of subcutaneous tissue in females than males. In our study it was revealed that the median motor nerve conduction velocity was more in males than females and it was due to greater height and limb length of male volunteers than females. We also found that F-wave latencies of Median nerve were longer in males as

compared to females and the probable reason is greater height and limb length in male volunteers. Eman *et al* [7] in 2013 conducted a study on nerve conduction study on median nerve in the Department of Clinical Neurophysiology, Cairo University; Egypt. In this study, female subjects had higher amplitude and had shorter latency in the upper limbs which is similar to results our study.

Huang *et al* [4] in 2009 conducted a study to evaluate the effect of various physiological factors on nerve conduction study. Female subjects had higher median amplitude. Females had shorter latency in the upper limbs.

Karnain *et al* [5] in 2013 conducted a study to find out the influence of Gender on various parameters of nerve conduction study in Upper Limb in healthy individuals of North India. The distal motor latency of Median and Ulnar motor nerves as well as distal onset latency of sensory Median nerve were found to be greater in males and were statistically significant.

In our study we found that both the proximal and distal latencies of Tibial nerve were more in males as compared to females which are similar to earlier reports. Probably the reason behind these findings may be due to poor volume of conduction, large muscle fibre length and/or the large motor units in males. We found that the proximal and distal amplitudes of Tibial nerve were more in females than males and these may be due to lesser ankle circumference, lesser height, lesser limb length and lesser density of subcutaneous tissue in females than males. In our study Tibial nerve conduction velocity was more in males than females which agreed with previous studies [9-10]. The possible reason was greater height and limb length in male volunteers than females. Our study also revealed that F-wave latencies in Tibial nerve were greater in females which were supported by the study of Huang *et al* [4]. Similar results were found by Kumar *et al* [10] in 2015. They conducted a study on tibial nerve to obtain normative data. The mean NCV knee – ankle of male was more than that of female with P value of 0.02.

We found that both proximal and distal Median latencies are more in males as compared to females which are supported by previous studies [4,5,11,12]. This may be due to the poor volume of conduction, large muscle fibre length and/or the large motor units in males. We also found that both the proximal and distal latencies of Tibial nerve were more in males as compared to females which are similar to earlier reports.

In 2010 Thakur *et al*[13] in their study found latencies of all the motor nerves of upper and lower limbs were longer in males than the females similar to our study. Probably, the reason behind this finding may be the greater height and limb length of the male volunteers.

In 2015 Arvind *et al*[12] performed a study to compare the effect of gender on nerve conduction

properties in subtropical climate of Haryana. The motor nerve conduction studies for median and ulnar nerve revealed a statistically significant difference in distal motor latency. Pawar *et al*[11] in their study found that latencies of Median and Ulnar Nerves were significantly greater in males than females which are in agreement with our study. In 2013 Karnain *et al* [5] found that the distal motor latency of Median nerves were greater in males.

We found that both proximal and distal amplitudes of both Right and Left Median nerve are more in females and which are similar to earlier studies [7-8] and proximal and distal amplitudes of both Right and Left Tibial nerve were more in females than males. The probable reason may be due to lesser wrist circumference, lesser height, lesser limb length and lesser density of subcutaneous tissue in females than males.

Similar results were found by Arvind *et al* [12]. In 2009 Huang *et al* [4] conducted a study to evaluate the effect of various physiological factors on nerve conduction study. Female subjects had higher median amplitude. Karnain *et al* [5] found that the amplitudes of Median nerves were greater in females.

In our study it was revealed that the motor nerve conduction velocity of both Right and Left Median nerve was more in males than females and Tibial nerve conduction velocity was more in males than females. Karnain *et al* [5] in 2013 in their study among healthy adults of North Indian found that the conduction velocity of both the motor Median nerves were significantly greater in females.

We found that F-wave latencies of Median nerve were longer in males as compared to females and the probable reason is greater height and limb length in male volunteers. These findings are supported by earlier studies [4,13]. Our study also revealed that F-wave latencies in both Tibial nerves were greater in females which were supported by the study of Huang *et al*[9]. In 2009 studies by Huang *et al* [4] demonstrated that males had shorter latency in the upper limbs. In 2011 Power *et al* [11] showed F-Wave latencies of motor nerves were found to be significantly influenced by gender ( $P < 0.05$ ). In their study they showed that F-wave latencies of all motor nerves were greater in males as compared with females. In 2010 Thakur *et al* [13] demonstrated that F-wave latencies of all the motor nerves of upper and lower limbs were longer in males as compared to females.

## 5. Conclusion

The Nerve Conduction Study Parameters i.e., Latency, Amplitude, Nerve Conduction Velocity, F-wave Latency all varies according to gender. This variation is due to difference in Height, Limb Length, Weight, BMI, Thickness and Density of subcutaneous tissue, Muscle Mass etc. Influence of gender must be taken into

consideration during Nerve Conduction Study and establishing normative data for reference value of Neurophysiological Laboratories for different populations remain essential.

## References

- [1]. Kimura J. Principles and pitfalls of nerve conduction studies. *Ann Neurol*. 1984; 16:415–29.
- [2]. Stetson DS, Albers JW, Silverstein BA, Wolfe RA. Effects of age, sex, and anthropometric factors on nerve conduction measures. *Muscle Nerve*. 1992; 15:1095–1104.
- [3]. Robinson LR, Rubner DE, Whal PW. Influences of height and gender on nerve conduction studies. *Arch Phys Med Rehabil*. 1993; 74:1134-8.
- [4]. Huang CR, Chang WN. Effects of age, gender, height, and weight on late responses and nerve conduction study parameters. *Acta Neurol Taiwan*. 2009; 18:242-249.
- [5]. Karnain WO, Singh S, Agrawal B K, Kamra, Gupta S. Gender effect on upper limb nerve conduction study in healthy individuals of North India. *J Pharm Biomed Sci*. 2013; 33(33): 1589-1593.
- [6]. Sajadi S, Mansoori K, Raissi GR, Seyede Z. Razavi E, Ghajarzadeh M. Normal Values of Posterior Antebrachial Cutaneous Nerve Conduction Study Related to Age, Gender, Height and Body Mass Index. *Journal of Clinical Neurophysiology* 2014; 31: 523-528.
- [7]. Eman A. Maher, Mye A. Basheer, Saly H. Elkholy. Egyptian Demographic Effects on Median Nerve Conduction Studies. *Egypt J Neurol Psychiat Neurosurg*. 2013; 50(3):277-283.
- [8]. Gakhar M., Verma S.K. and Lehri A. A Comparison of Nerve Conduction Properties in Male and Female of 20 to 30 Years of Age Group. *Journal of Exercise Science and Physiotherapy*. 2014; 10(1): 16-20.
- [9]. Mossa M. Marbut, Raja S. Najim, Muammar Abdul Mohsen. Determination of normal values of nerve conduction of Tibial and Peroneal nerves among normal healthy subjects. *Tikrit Medical Journal* 2012; 18(2):1-8.
- [10]. Kumar A, Prasad A, Dutta A, Roohi F. Study of Nerve Conduction Velocity in Tibial Nerve of Healthy Male and Female of Different Age Groups. *International Journal of Recent Scientific Research* 2015; 6(6):4477-4.
- [11]. Pawar SM, Taksande AB, Singh R. Normative data of upper limb nerve conduction in Central India. *Indian J Physiol Pharmacol*. 2011; 55(3): 241–45.
- [12]. Arvind A, Goel V, Sood S. Nerve Conduction: A Comparative Study in Males and Females of Haryana. *IJHSR*. 2015; 5(9): 232-236.
- [13]. Thakur D, Paudel BH, Bajaj BK, Jha CB. Nerve Conduction Study in Healthy Individuals: A Gender Based Study. *Health Renaissance*. 2010; 8 (3):169-175.