A Comparison of Nerve Conduction Properties in Male and Female of 20 to 30 Years of Age Group

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Abstract

Objective: The study aimed to compare nerve conduction properties of both gender in 20-30 age group. Method: Total 70 subjects of both genders ranging in age between 20 to 30 years were selected as per inclusion and exclusion guidelines of the study. Nerve conduction properties of median and ulnar nerves of both genders were recorded as per set guidelines. Result: Gender has definite effects on, latency, amplitude and conduction velocity of motor and sensory nerves. These effects are not identical in different motor and sensory nerves. Females had higher amplitude and conduction velocity in both motor and sensory stimulation of median and ulnar nerves, whereas, motor and sensory latency of median and ulnar nerve is higher in males.

Key words: Gender, Median Nerve, Ulnar Nerve, H- reflex, Amplitude, Latency

Introduction

In the recent years electro-diagnostic studies have been identified to play a key role in the evaluation of patients with various neuromuscular disorders. The nerve conduction studies are most often used to diagnose disorders of the peripheral nervous system. Conduction velocity of the nerves depends on the fibre diameter, degree of de-myelination and internodal distance. Motor nerve conduction studies require stimulation of a peripheral nerve while recording from a muscle innervated by the nerve. Sensory nerve conduction studies are performed by stimulating a mixed nerve while recording from a mixed or cutaneous nerve. These studies have been used clinically for many years to identify the location of peripheral nerve disease in single nerves and along the length of nerves and to differentiate these disorders from diseases of muscle or neuromuscular junction *Aminoff (1999)*. It is a diagnostic tool for various neuropathies. The nerve conduction velocity is the speed at which an electrical stimulus passes through the nerves. The motor nerve conduction velocity (MNCV) is performed by the electrical stimulation of a peripheral nerve and by using the recording from a muscle which is supplied by this nerve. The time it takes for the electrical impulse to travel from the stimulation site to the recording site is measured. This value is called the latency and it is measured in milliseconds (ms). The size of the response called the amplitude is also measured. The motor amplitudes are measured in millivolts (mv). Routine nerve conduction study

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includes assessment of compound muscle action potential (CMAP) and sensory nerve action potentials (SNAP) of accessible peripheral 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.

There are several factors which may influence nerve conduction study such as temperature, age, height, BMI etc. *(Campbell et al, 1981, Soudmand et al, 1982, Kimura, 1984, Robinson et al, 1993, Falco et al, 1994).* They have to be taken into consideration while doing nerve conduction study. However, these factors vary according to different geographic region. Many studies have been published regarding normative data from Western countries with cold climatic condition *(Kumar & Gill, 1985, Falco et al, 1992, Hennessey et al, 1994).*

The present study was designed to compare the effect of gender on nerve conduction properties of dominant hand in selective nerves. In the present endeavour the motor as well as sensory nerve conduction properties of Median and Ulnar nerve in both sex of subjects have been evaluated.

Materials & Methods

This study was done in 70 (35 males and 35 females) healthy adults of age between 20-30 yrs either sex in the Prem Physiotherapy and Rehabilitation College, Panipat. An informed written consent was taken from the volunteers and they were screened to exclude any history of orthopaedic, systemic or neuromuscular disorder by relevant history taking with psychological, musculoskeletal and neurological examination. Subjects were excluded if any of them did not fit to the inclusion criteria. All the participants were examined through NEUROPERFECT 2000 machine, which was used to check nerve conduction properties of the subjects. Nerve conduction properties were evaluated by using standard techniques of supramaximal percutaneus stimulation with a constant current stimulator and surface electrode recording for both nerves of each subject. The room temperature of the laboratory was maintained at the thermo neutral zone i.e. 26±2 degree Celsius.

The motor and sensory evaluations were performed on the ulnar and the median nerves in the present study. The ground electrode was placed on the dorsum of the hand, between the stimulating and the recording electrodes. For the motor evaluation, the active electrodes were placed over the motor point of the abductor pollicis brevis for the median nerve, and over the abductor digiti minimi for the ulnar nerve. The reference electrode was placed 3 cm distal over the 1st metacarpo-phalangeal joint for the median nerve and over the 5th metacarpo-phalangeal joint for the ulnar nerve. The sites of stimulation for both were the wrist, elbow and the axilla. With surface electrodes, distal stimulations were performed at the wrist (3cm proximal to the distal wrist crease) between the flexor carpi radialis and the Palmaris longus tendon for the median nerve, while they were performed posterior to the flexor carpi ulnaris for the ulnar nerve. Similarly stimulation of the median nerve at the elbow was performed

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medial to the biceps tendon, on the volar crease of the brachial arterial pulse, whereas for the ulnar nerve, stimulation was 3-4cm distal to the medial epicondyle, with the wrist and the elbow in 90° of flexion *(Harding & Haler, 1983).* For the proximal stimulation the stimulation was given at Axilla for both nerves *(Checkles et al, 1971).* For the sensory studies, the median and the ulnar nerves were examined antidromically. The ring electrode was placed over the 2nd and 5th digits to record the responses along the median and the ulnar nerves, respectively. The reference electrode was placed about 3 cm distal to the ring electrode. The median nerve stimulation was performed 14 cm proximal to the active electrode and medial to the flexor carpi radialis tendon. For the ulnar sensory nerve, the stimulation was performed 10cm proximal to the active electrode and posterior to the flexor carpi ulnaris tendon *(Mishra & Kalita, 2006).*

Results & Discussion

75 healthy volunteers (35 males & 35 Females) of 20 to 30 years of age group were included in the study. Mean age for males was 23.74±2.5 years and in female it was 22.65±1.69 years. Average height of the males was 171.9±7.3 cm and of the females was 154.3±4.35 cm. The mean weight of male sample was 66.17±11.04 kg and of the females was 55.69±10.54 kg. The B.M.I for males was 22.43±2.82 and that of females was 23.36±3.99. Among the physical parameters height, weight are observed to reveal statistically significant differences between males and females. Males had greater height, weight, than that of the females. However, gender wise differences in body mass index were not found to be statistically significant.

Effect of gender on motor nerve conduction study variables:

- Motor latency of median nerve is longer in males than females but in statistical sense the differences are not significant.
- Motor amplitude of Median nerve in females is higher than males but but in statistical terms the differences are not significant..
- Motor velocity of median nerve in females is statistically significantly greater as compared to males.

Table 1: Comparison of motor median & ulnar nerve conduction properties of males & females

Nerve	Gender	Motor Nerve Conduction Properties		
		Latency Mean±SD	Amplitude Mean±SD	Velocity Mean±SD
Median	Male	2.99 ±0.49	7.90 ±4.17	54.44 ±6.44
	Female	2.72 ±0.68	8.72 ±3.44	57.85 ±5.13
Ulnar	Male	2.73 ±0.99	6.61 ±2.51	50.93 ±8.17
	Female	2.60 ±0.58	8.42 ±2.12	53.97 ±5.92

- Average Motor latency of ulnar nerve is observed to be longer in males than females but in statistical sense the differences are not significant.
- Mean Motor amplitude of ulnar nerve in females is observed to be significantly greater than the males.
- Mean Motor conduction velocity of ulnar nerve in females is greater than males but in statistical sense the differences are not significant.

Effect of gender on Sensory nerve conduction study variables:

- Mean Sensory latency period of median nerve is observed to be longer in males than the females

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with statistically significant differences.

Table 2: Comparison of sensory median & ulnar nerve conduction properties of males & females

Nerve	Gender	Sensory Nerve Conduction Properties		
		Latency Mean±SD	Amplitude Mean±SD	Velocity Mean±SD
Median	Male	2.30±0.59	14.65±5.55	49.57±9.20
	Female	2.06±0.28	12.08±4.62	56.55±6.46
Ulnar	Male	2.32±0.42	12.03±9.35	45.82±9.19
	Female	2.11±0.23	12.85±4.57	49.85±5.45

- Average Sensory amplitude of Median nerve has been observed to be greater in males than the females but in statistical sense the differences are not significant.
- Mean Sensory conduction velocity of median nerve in females is observed to be significantly greater as compared to the males.
- Average sensory conduction velocity, sensory latency period are observed to show statistically significant differences among the males and females with males demostraing significantly longer sensory latency period and females demonstrate signicantly faster sensory conduction velocity.
- Sensory amplitude of ulnar nerve in females is higher than males but in statistical sense the differences are not significant.

Discussion:

This study examined the nerve conduction parameters of the two commonly tested nerves i.e the median and the ulnar nerves, in the upper limbs of a healthy adult population of both gender in Haryana.

In our study, latencies of both the nerves i.e median and ulnar for motor and sensory were observed to be longer in males than the females which are similar to previous researches done by *LaFratta & Smith, (1964), Stetson et al, (1992), Falck & Stålberg, (1995), Shehab, (1998), Kimura, (2005).* Probably, the reason behind this finding may be the greater height and limb length of the male volunteers.

According to *Kimura,* gender related amplitude differences persist despite of the adjustment of height. *Huang et al, (2009)* found that female subjects had higher median and ulnar sensory amplitude. *Robinson et al (1993)* in their study found that three of the four sensory amplitudes were larger in women; two of four motor amplitudes were larger in men and women had significantly faster conduction velocities than men for all nerves except median motor. Our study has some similarity and some dissimilarity with this study, in our study all the four motor and sensory nerve amplitudes of both the nerves were higher in the females than males. Whereas the conduction velocity for motor and sensory of median and ulnar is observed to be greater in females. *Hennessey et al (1994)* in their study found that women had greater SNAP amplitude than men in the upper limb nerves (median, ulnar, and radial) which is in accordance with our study. Whereas *Stetson et al (1992)* in their study in the upper limb nerves (median, ulnar) confirmed that gender did not have any statistically significant effect on

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SNAP amplitude.

Conclusion: The overall mean motor and sensory nerve conduction parameters for the median and the ulnar nerves correlated favourably with the literature data. Gender has definite effects on, latency, amplitude and conduction velocity of motor and sensory nerves. These effects are not identical in different motor and sensory nerves. Females had higher amplitude and conduction velocity in both motor and sensory stimulation of median and ulnar nerve. Where as motor and sensory latency of median and ulnar nerves are observed to be higher in males.

The results of the present study have many similarities and some dissimilarity with the reported NCS variables, the probable reasons could be the true differences among populations, and small sample size.

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