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SHORT COMMUNICATION

EFFECT OF LIMB DOMINANCE ON MOTOR NERVE CONDUCTION

SEEMA BHORANIA* AND RATI B. ICHAPORIA

Department of Physiology,
Topiwala National Medical College,
Mumbai – 400 008

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Abstract : The economic, social and personal burden of common neurological disorders has been the subject of intense study all over the world. Nerve conduction velocity being affected by factors like age, gender and temperature is a well known fact. The effect of handedness on nerve conduction is not known much and needs further evaluation. In the present study 50 medical students divided into 2 groups of 25 each, depending on the handedness were incorporated. Motor nerve conduction of the median and ulnar nerve was studied. It was found there was no significant difference in velocity between the dominant and non dominant limbs of the same individuals, but nerve conduction in right handed subjects was more as compared to their counterparts for both dominant and non dominant limbs. This finding suggests that there should exist a separate set of normative data for both right and left handed individuals to be used in practice.

Key words : motor nerve conduction handedness median nerve ulnar nerve

INTRODUCTION

In the past few decades, major changes have taken place in the field of peripheral nerves especially in the relation to its ultra structure, histochemistry, neurophysiology and axonal transport system. The widespread interest in disorders of peripheral nervous system, which has burgeoned in recent years, primarily has its origin in the introduction of new investigating techniques. With the advent of newer technologies there has been a tremendous increase in the number of patients with nerve disorders.

Nerve conduction study is a part of electro diagnostic procedures that help in establishing the type and extent of the abnormality of the nerves. There are anatomical and physiological aspects to nerve conduction velocity. The conduction velocity of the nerve depends on the fibre diameter, degree of myelination and the internodal distance. Other factors such as age, temperature, height, gender, and limb are the physiological variables affecting nerve

*Corresponding Author : Dr. Seema Bhorania, 502, Aashiana Bldg., 22 Maratha Mandir Marg, Mumbai – 400 008; Tel. No. : 9870031599

conduction study (1). The use of conduction velocity measurement as a diagnostic procedure in neurology requires a knowledge of the range of values encountered in healthy individuals. Normal values for maximum conduction velocity in human peripheral nerve have already been described way back in 1850 by Helmholtz who measured median conduction velocity of humans using crude mechanical instruments and had found the normal range to be 61.0±5.1m/sec (2).

Cerebral dominance is a known fact and has its effect in terms of speech, handedness, facial recognition etc. So far, not much data has been collected on the values of motor nerve conduction taking handedness aspect into consideration. In our present study, we have compared motor nerve conduction in right handed students with their counterparts left handed students. Motor nerve conduction in the median and ulnar nerves has been recorded so as to have a normal set of reference values.

MATERIALS AND METHODS

Study included 50 young medical students of both the genders of the age group 18–30 years out of which 25 were right handed and 25 left handed. Study was performed in accordance with ethical standards of the institute.

Complete history with preliminary details was taken for each subject. Exclusion criteria included any metabolic disorder, fracture, deformity, radiculopathy, nerve compression, neurological disorder, intake of drugs, any addictions etc.

Subjects were called in the morning after light breakfast. They were made to sit for half an hour in an air-conditioned room with temperature being maintained at 21–23 degree Centigrade. All the measurements were taken with the subject sitting up comfortably on a wooden stool. The procedure was fully explained to the subject and written informed consent was taken.

In the present study only motor nerve conduction velocity across the median and ulnar nerve is studied using NEUROCARE™ 2000 which is a computerised EMG/NCV/EP Equipment. For motor nerve conduction study, the nerve was stimulated at two or more points along its course. The stimulating electrodes were placed with anode 2–3 centimetres proximal to cathode. Supramaximal strength of stimulus was used. For motor studies: sensitivity: 2–5 mv/mm, low frequency filter: 2–5 Hz, high frequency filter: 10 KHz, sweep speed: 2–5 ms/cm.

The compound muscle action potential was recorded using a pair of surface electrodes, which were in the form of small discs around 1 cm in diameter. They were fixed to skin with conductive gel (electrolyte jelly) by sticking plaster. The active electrode was placed on the belly of the muscle, at the motor point and the indifferent electrode was placed on the tendon. After recording from each stimulation site, the latency was measured from the stimulus artefact to the take off i.e. first negative deflection from the baseline. The distance was then measured between each stimulation point, cathode stimulation point to cathode stimulating point. Dividing the distance between two stimulation points by the latency difference of the related response, conduction velocity was determined of that segment of the nerve in m/sec (1, 3, 4).

The conduction velocity was then determined using the following formula :

Conduction Velocity = Distance (mm)/Lp-Ld millisecond.

Lp : proximal latency; Ld : distal latency

Statistical analysis

Results are expressed as mean±S.D. For comparisons between dominant and non dominant limbs in the same individual, Student's unpaired 't' test was used. For comparison between groups, one-way ANOVA was performed followed by Tukey-Kramer post test. P value less than 0.05, was considered as significant.

RESULTS AND DISCUSSION

In our study we found that the motor nerve conduction for both median and ulnar nerve was greater in the dominant limb as compared to the non dominant limb (Table I). This difference was found in both right and left handed individuals. But on applying test of significance it was found to be statistically not significant. When we compared the conduction velocity of the dominant limb in right handed subjects with the dominant limb of their counterparts it was found to be statistically significant (Table I). Nerve conduction was found to be greater in right handed subjects as compared to left handed individuals. Similar difference was noted in the non dominant limb of the 2 groups. This difference was not reflected in the latency.

Our study is in accordance with the study of Pardaman Singh, B.K.Maini & Inderbir Singh (1977) who compared the conduction velocity in the efferent fibres of the right and left forelimbs of 38 human subjects. They found the conduction velocity to be faster on the right side in the majority of right-handed subjects and on the left side in left-handed subjects (5). Another study done by Anuradha et al in 1990 showed a definite relationship between limb dominance and median nerve conduction although the results are not so clear in case of ulnar nerve. The reason may be purely anatomical in that the median nerve has greater dermato-myotomal distribution than the ulnar nerve (6).

The disparity in the size of motor neurons of the 2 limbs can be accounted for the difference in nerve conduction. It was found that motor neurones of spinal cord supplying right upper limb were larger as compared

TABLE I : Latency and nerve conduction velocity of median and ulnar nerves.

Parameters	*Median Nerve*				*Ulnar Nerve*			
	Right Handed		*Left Handed*		*Right Handed*		*Left Handed*	
	Dominant limb	*Non-Dominant limb*	*Dominant limb*	*Non-Dominant limb*	*Dominant limb*	*Non-Dominant limb*	*Dominant limb*	*Non-Dominant limb*
Latency	3.25±0.44	3.34±0.52	3.28±0.46	3.48±0.37	2.88±0.48	2.91±0.46	2.87±0.36	3.0±0.27
Conduction velocity	65.15±1.49*	64.67±1.64*	63.63±1.52*	62.99±3.0*	66.54±2.23*	66.02±2.08*	64.63±1.89*	63.37±3.1*

Values are mean±SD. *P<0.05.

with motoneurones supplying the left upper limb (7).

Contrary to the above studies is the study of Tan U (8). He measured the velocities of motor and sensory conduction in median and ulnar nerves on the left and right arms of 33 right-handed and 12 left-handed normal subjects. He found no statistically significant difference in the nerve conduction velocity on the left and right sides of these subjects. It was suggested that the mechanisms of handedness do not contribute to the differences in nerve conduction velocities (8).

In a similar study done by Hennessey et al (1994) on median and ulnar nerve conduction in young adults concluded that handedness has no effect on the nerve conduction parameters (9). Another study conducted by Navin Gupta, Sharmila Sanyal and Rashmi Babbar (2008) also demonstrated that there is no significant difference in motor conduction velocity of right as well as left median nerve in left handed subjects as compared with right handed ones (10). This difference between the dominant limbs and nondominant limbs which exists in right and left handed individuals should be taken into account before making any neurological diagnosis. There should be a separate set of reference values for the two groups. If the same set of reference values is used for all individuals, the chances of error in diagnosing will increase and a normal healthy individual would wrongly be labeled as a patient suffering from nerve disorder.

Conclusion

Though our current study did not show a significant difference in conduction velocity between the dominant and nondominant limbs of the same individual, probably a larger sample size would be of great value in predicting this relationship. Hence it is essential to do further studies related to the effect of handedness on nerve conduction. Also studies related to sensory nerve conduction should be undertaken, to properly ascertain the effect of limb dominance on nerve conduction velocity.

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