NORMATIVE DATA OF UPPER LIMB NERVE CONDUCTION IN YOUNG POPULATION IN AND AROUND BARPETA TOWN, ASSAM

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ABSTRACT

INTRODUCTION

Goal of our work was to establish the data of normal nerve conduction velocity (NCV) for the median and the ulnar nerves in normal healthy adults in Barpeta town area, Assam, India.

METHODS

Nerve conduction studies were performed prospectively in the upper limbs of 100 carefully screened, healthy individuals of either sex, who were between the ages of 20 and 60 years, by using a standardized technique.

RESULTS: MOTOR STUDIES

The median distal latency (DL) in men was 3.48 (0.26) ms, the amplitude (CMAPA) was 9.86 (1.92) mV, the conduction velocity (MNCV) was 55.94 (2.94) m/s and the F-wave (min latency) was 26.86 (2.12) minute. In the ulnar nerve, the motor DL was 2.3 (0.26) ms, the amplitude (CMAPA) was 9.97 (3.90) mV, MNCV was 62.97 (3.90) m/s and the F-Wave (min latency) was 25.98±2.41. In the sensory studies, the median nerve DL was 1.89 (0.25) ms, SNCV was 53.14±3.80 m/s and the amplitude (SNAPA) was 42.69 (20.48) µV for was. For the ulnar nerve the DL was 1.89 (0.36) ms, SNCV was 56.86 (6.23) m/s and the amplitude (SNAPA) was 40.92 (168.4) µV.

CONCLUSION

The normative conduction parameters of the commonly tested nerves in the upper limb were established in research laboratory of physiology department of our institute. The mean motor nerve conduction parameters for the median and the ulnar nerves correlated favorably with the existing literature data. However, for the sensory nerves, a higher value for the nerve action potential amplitude was demonstrated in this study.

KEYWORDS

Nerve Conduction Study (NCS), Compound Muscle Action Potential Amplitude (CMAPA), Sensory Nerve Action Potential (SNAPA) Median Nerve, Ulnar Nerve.

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INTRODUCTION: The peripheral nerves are the nerves outside the brain and the spinal cord. These nerves help us control our muscles and experience important senses. Healthy nerves send electrical signals more quickly and with greater strength than damaged nerves. For this reason, an NCV is helpful in determining the existence, type, and extent of nerve damage in a patient.

Nerve Conduction Studies (NCS) are useful in evaluating the functions and the diseases of the peripheral nerves. NCS help in delineating the extent and the distribution of neural lesions and they distinguish two major categories of peripheral nerve diseases: demyelination and axonal degeneration. (1)

With the steady improvement and the standardization of these methods, they have become reliable tests in clinical settings. They are now widely used, not only for the precise localization of lesions, but also for the accurate characterization of the peripheral nerve functions. The technique consists of an electrical stimulation of nerves and the recording of the evoked potentials, either from the muscles or from the nerves themselves. Nerve conduction studies are influenced by number of physiological and technical variables (2,3) such as standardized measurements, temperature, height, the gender and the age of normal healthy individuals and parameters like the nerve diameter and myelination. Stetson et al. (4) Showed that in randomly selected adults without an occupational exposure to high forces or repetitive hand exertions, the age, height, and the index finger circumference were found to be important

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predictors of the median, ulnar, and the sural nerve conduction measures. [4]

Many studies have been published with regards to the normative data for the nerves of the upper and lower limbs. However, no study has been performed in this region of Assam till date. We were therefore interested to obtain a set of data in healthy adults, in order to establish the reference values for our neurophysiology laboratory and to compare our values with other published data in the literature.

For the upper limb, the median and the ulnar nerves were the most commonly tested nerves. Hence, this paper provides the normative electrophysiological data for the median and the ulnar nerves in healthy adult individuals who were carefully screened by using standard distances and temperature controls.

MATERIALS AND METHODS: This study was carried out in the Research laboratory of Physiology Department, in Fakhruddin Ali Ahmed Medical College, Assam, India. 100 healthy individuals who were aged 20–60 years (x= 31.24±11.57 years) were included in the study. These included 60 women and 40 men. An informed consent was obtained from the study subjects. All the individuals were screened, and the inclusion criteria were the adults with no history of systemic or neuromuscular diseases or any kind of limb injury. The neurological examination and the laboratory findings, which included the blood sugar levels, electrolytes and the renal functions, were found to be normal.

A standardized questionnaire was used to exclude those with a history of systemic or neuromuscular diseases. The individuals who were above the age of 60 years, those with a history of alcohol abuse or medications that could affect the results, and those with a history of diabetes, hypothyroidism and systemic diseases, were excluded.

None of the individuals were taking any medication at the time of the study. A simple neurological examination was performed, which included muscle power testing, muscle stretch reflexes and sensation, which included a superficial and a deep sensory testing.

THE RECORDING PROCEDURE: This study was performed with the Neuroperfact NCV/EMG machine in the Dept. of Physiology, with the subject sitting comfortably in the upright position. The room temperature was kept at 25-28°C. The filters were set at 2-5 kHz for the motor studies and at 20-2kHz for the sensory studies. The sweep speed was set at 5ms/division for the motor studies and at 2 ms/division for the sensory studies. Stimulus duration of 50 ¼s to 1000¼s and a current of 0–100 mA are required for effective nerve stimulation. The supramaximal stimuli were delivered in order to get adequate responses.

1-cm disc recording electrodes were used for the motor studies and ring recording electrodes were used for the sensory studies. The data was collected for the following parameters: for the motor nerve: the onset/Distal Latency (DL), the conduction velocity (MNCV) and the amplitude of the Compound Muscle Action Potential (CMAPA) and for the sensory nerve: the distal latency, the Sensory Nerve Conduction Velocity (SNCV) and the Sensory Nerve Action Potential (SNAPA) were measured from the peak of the negative potential, to the peak of the positive potential. A standardized technique was used to obtain and to record the action potentials for the motor and sensory studies. [5,6,7,8]

The motor and sensory studies were performed on the right ulnar and the median nerves, both proximally and distally along the forearm. The ground electrode was placed on the dorsum of the hand, between the stimulating and the recording electrodes.

For the motor studies, 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 4 cm distal over the 1st metacarpophalangeal joint for the median nerve and over the 5th metacarpophalangeal joint for the ulnar nerve.

The sites of stimulation for both were the wrist and the elbow. With surface bar 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. The proximal stimulation for the median nerve was performed medial to the biceps tendon, on the volar crease of the brachial arterial pulse, whereas for the ulnar nerve, the proximal stimulation was 3-4cm distal to the medial epicondyle, with the wrist and the elbow in 90° of flexion. [9] A 90° or 130° flexion during the stimulation and the measurement of the distance is recommended. [10]

For the sensory studies, the median and the ulnar nerves were examined antidromically. The active 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 4 cm distal to the active 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.

The F–wave study was also done with the supra-maximal stimulation of the median and the ulnar nerves. The F wave, a long latency response, is a muscle action potential that occurs, following the regular compound action potential. It is induced by the backfiring of the antidromically activated motor neurons. The F wave latencies are measured from the stimulus artifact to the beginning of the evoked potential. It may vary by a few ms from one stimulus to the other. Hence, a no. of ten stimuli was given to obtain the F-waves and the minimum F wave latency (F-min) was noted. The dominant limbs were chosen for the study, and a majority of the subjects in the study were right handed.

The data from the upper limb of all the individuals were evaluated on a computer by using the Statistical Package for Social Sciences (SPSS) for the data processing. The values were expressed in form of the mean and the standard deviation.

RESULTS: 100 individuals who were aged 20-60 years (x =31.24±11.57 years), who included 60 women and 40 men, participated in the study. Their arm lengths ranged from 67 to 87 cm, with a mean value of 77.6 cm for males and a mean value of 73.6 cm for females. The mean and standard deviation for the parameters of the median and the ulnar motor nerves and the sensory nerves have been summarized in Table 1 and Table 2 respectively.

Median nerve	100 subjects	Ulnar nerve	100 subjects
DL(ms)	3.48±0.26	DL(ms)	2.3±.19
NCV(m/s)	55.94±2.94	NCV(m/s)	62.97±.3.90
CMAPA(mv)	9.86±1.92	CMPA (mv)	9.76±2.90
F wave latency(min)	26.86±2.12	F wave latency (min)	25.98±2.41

Table 1: Motor nerve parameters (mean±SD) in right upper limbs

DL=Distal motor latency measured from the onset of action potential; MNCV=Motor nerve conduction velocity; CMAPA =compound muscle action potential amplitude measured from peak to peak.

Median	100 Subjects	Ulnar	100 Subjects
DL(ms)	1.89±0.25	DL(ms)	1.89±0.36
SNCV(m/s)	53.14±3.80	SNCV(m/s)	56.86±6.23
SNAPA(μv)	42.69±20.48	SNAPA(μv)	40.92±16.84

Table 2: Sensory nerve parameters (mean SD) in right upper limbs

DL=Distal onset latency; SNCV=Sensory nerve conduction velocity; SNAPA=sensory nerve action potential amplitude (peak to peak).

DISCUSSION: This study examined the nerve conduction parameters of the two commonly tested nerves: the median and the ulnar nerves, in the upper limbs of a healthy adult population, in Barpeta town region, to provide the normative and the reference values in EMG laboratory of Fakhruddin Ali Ahmed Medical College, Barpeta Assam.

A comparison was made between this study and other published studies. The results of this study for the motor nerve conduction parameters of the ulnar and the median nerves were in accordance with those of other studies, as has been seen in Table 3 and Table 4.

Nerve	Parameter	Robinson et al	Kimura	Falco et al	Kalita & Misra	Present study
Motor Median	DL(ms)	3.6±0.4	3.9	3.5±0.5	3.77±0.40	3.48±0.26
	AMP (μv)	9.5±2.9	7.0	9.2±3.1	8.10±2.62	9.86±1.92
	NCV(m/s)	54.4±3.8	57.7	54.4±5.4	58.52±3.76	55.94±2.94
	F min	-	26.6	-		26.86±2.12
Motor ulnar	DL(ms)	2.9±0.4	2.59	2.7±0.3	2.59±0.04	2.35±0.19
	AMP(μv)	8.4±2.1	5.7	9.9±1.8	8.51±2.03	9.76±2.90
	NCV(m/s)	56.3±6.2	58.7	61.6±4.1	61.45±5.73	62.97±3.90
	F min	-	27.6	-	-	25.98±2.41

Table 3: Comparing the motor parameters of median and ulnar nerves with studies of other publishers

Nerve	Parameter	Robinson et.al	Kimura	Falco et.al	Misra and Kalita	Present study
Sensory Median	AMP	35.6±11.8	38.5	27.1±11.2	38.5±15.6	1.89±0.25
	NCV	54.6±3.7	56.2	56.0±4.5	56.2±5.8	53.14±3.80
Sensory Ulnar	AMP	32.3±13.1	35.0	-	5.54±2.13	1.89±0.36
	NCV	57.7±5.6	54.8	60.0±7.5	54.17	56.86±6.23

Table 4: Comparing the sensory parameters of median and ulnar Nerve with studies of previous Publishers

The findings of this study are in agreement with other workers in terms of motor parameters of median and ulnar nerve. Sensory parameters are somewhat lesser as compared to Robinson et.al and Kimura. [11,1]

This indicates the difference in reference values among different population.

In conclusion, normative conduction parameters of commonly tested peripheral nerves in upper limbs were established in our neurophysiology laboratory and it can be used for evaluation for peripheral nerve injury. The overall mean motor and sensory nerve conduction parameters of median and ulnar were comparable with existing literature data.

REFERENCES:

1. Kimura J. Principles and pitfalls of nerve conduction studies. Ann Neurol. 1984; 16: 415–29.
2. Gassel MM. Sources of error in motor nerve conduction studies. Neurology. (Minneap) 1964; 14: 825.

3. Simpson JA. Facts and fallacy in measurement of velocity in motor nerves. J Nerol Neurosurg Psychiat. 1964; 27: 381.
4. 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.
5. Kimura J. Electro diagnosis in Diseases of Nerve and Muscle: Principles and Practice. 3. Philadelphia: Davis; 2001.
6. Hennessey WJ, Falco FJ, Braddom RL. Median and ulnar nerve conduction studies: Normative data for young adults. Arch Phys Med Rehabil. 1994; 75: 259–64.
7. Falco FJ, Hennessey WJ, Braddom RL, Goldberg G. Standardized nerve conduction studies in the upper limb of the healthy elderly. Am J Phys Med Rehabil. 1992; 71: 263–71.
8. Hennessey WJ, Falco FJ, Goldberg G, Braddom RL. Gender and arm length: Influence on nerve conduction parameters in the upper limb. Arch Phys Med Rehabil. 1994; 75: 265–6.
9. Checkles NS, Russakov AD, Piero DL. Ulnar nerve conduction velocity: Effect of elbow position on movement. Arch Phys Med Rehabil. 1971; 52: 362–65.
10. Haler HC. Motor and sensory nerve conduction velocities:Effect of Elbow position. Arch Phy Med Reab. 1983; 64: 227.
11. Robinson LR, Rubner DE, Wohl PW, Fujimoto WY, Stolor WC. Influences of height and gender on normal nerve conduction studies. Arch Phys Med Rehabil. 1993; 74: 1134–38.