



ISSN: 2456-0057

IJPNE 2021; 6(1): 195-197

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www.journalofsports.com

Received: 03-11-2020

Accepted: 15-12-2020

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Ulnar nerve conduction study in healthy young adults from Punjab, India: Normative data

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DOI: <https://doi.org/10.22271/journalofsport.2021.v6.i1d.2210>

Abstract

Background: Nerve conduction studies (NCSs) play a pivotal role in diagnosis of local nerve lesions and diffuse neuropathies serving as an extension of the clinical findings or examination. The neurophysiology laboratories in Punjab have to rely on data generated by studies from other Indian states and western literature, due to paucity of local NCS data.

Aim: To establish the normative data for ulnar nerve conduction parameters in young Punjabis.

Materials and Methods: As per the standardized technique, nerve conduction study was done on 320 participants (165 males and 155 females) aged 17-21 years. The data were analyzed separately for both genders using SPSS version 2.0, consisting of distal latencies and conduction velocities of sensory and motor divisions of ulnar nerve. Student's unpaired t-test was used for statistical analysis.

Results: There was no effect of gender on ulnar nerve conduction parameters. For ulnar motor nerve, the values of distal Latency and conduction velocity in males were 3.30 ± 1.18 ms and 63.08 ± 2.53 m/s respectively, whereas in Females, they were 3.42 ± 0.30 ms and 62.95 ± 2.74 m/s. Also, for ulnar sensory nerve, the latency and velocity values in males were 2.63 ± 0.48 ms and 55.69 ± 3.14 m/s, whereas, in females, they were 2.51 ± 0.28 ms and 55.50 ± 3.72 m/s, respectively.

Conclusion: The data established in this study compared favorably with already existing data. For assessing the ulnar nerve abnormalities with greater accuracy in this population subset, the established data would help the local electrophysiology laboratories in the region.

Keywords: Distal latency, ulnar nerve, nerve conduction velocity, neuropathies, peripheral neuropathies

Introduction

Nerve conduction studies provide the most sensitive and accurate account of peripheral neuropathology and are being increasingly used for evaluation of nature of pathophysiology, quantification of severity of involvement, detection of level of neurological deficit, and determining prognosis [1]. The procedure involves the application of small and safe electrical impulses at various points over skin of limbs to cause activation of nerves [2, 3]. Available evidence suggests that using motor nerve conduction study is more practical for localizing nerve damage than conventional methods [4]. Due to high prevalence rate of ulnar neuropathy and importance of its proper management, it is imperative to have a baseline reference data of ulnar nerve conduction study [5].

Apart from fiber diameter, degree of myelination and internodal distance, physiological variables such as age, ambient temperature, height, weight, and gender influence nerve conduction study [6, 7]. Normative data in neurophysiology laboratories should be specific to the population in that area [8]. Neurophysiology laboratories in Punjab have to correlate with standard values generated by authors of other areas while diagnosing ulnar neuropathy which can lead to an increased rate of false – negative and false – positive reporting. There is a scarcity of data from this part of country, although numerous studies have been done in other parts of India and around the world [9-14].

This study is therefore intended to provide reference values for local electrophysiological laboratories by obtaining a set of nerve conduction study data for ulnar motor and sensory nerves and comparing the obtained data with worldwide published data.

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Materials and Methods

The present study was conducted in the neurophysiology laboratory of the institute over a period of 3 years. The procedures followed were in accordance with the ethical standards of the Institutional Committee on human experimentation and with the Helsinki Declaration of 1975, revised in 2000.

Study Participants

The present cross-sectional study was carried out among 17-21 year old healthy medical students of the Institute. The sample size was calculated using Cochran's formula for continuous data and the participants were selected using simple random sampling technique [15]. Written consent was obtained from all the participants after being explained the study details in their own language. Volunteers and apparently healthy participants were included in the study. As per exclusion criteria 80 were excluded from initial 400 participants and the remaining 320 eligible participants underwent the nerve conduction study.

Exclusion criteria

The following individuals were excluded from study those with a history of diabetes mellitus, hypothyroidism, and systemic diseases; those with a history of alcohol abuse or medications that might affect the results. Neuropathy, myopathy and neuromuscular disorders were excluded.

Medical and biochemical examination

Before doing nerve conduction study the participants went through the steps of a detailed history with the help of self-administered questionnaire to know about medical history, and a detailed general physical examination. A basic neurological examination to assess muscle power, stretch reflex and sensations both superficial and deep was done. Biochemical parameters of serum urea, creatinine, fasting blood glucose and electrolytes were examined.

Nerve conduction study

As per the guidelines of a standardized protocol for ulnar motor and sensory nerve testing, study was performed [15, 16, 17]. The data was recorded with a PC-based RmS EmG Ep Mark -II channel machine (Recorders and medicare systems Pvt Ltd, Chandigarh, India).

Prior to performing test, age was calculated to the nearest completed year, standing height (in centimeter) was measured without shoes, and weight (in kilograms) with minimal clothing was put on record. The machine was properly earthed. With the room temperature being maintained at 25-27 °C, nerve conduction study was performed with the participants sitting comfortably in a chair.

For ulnar nerve conduction study (NCS) machine was set as follows: for motor nerve conduction, the low cut filter was 2-5 Hz and the high cut was 10 Hz; for sensory nerve conduction, the low cut was 5-10 Hz and high cut was 2-3 KHz; the amplification between 20,000 and 1,00,000 times; electrode impedance was kept below 5k Ω ; Sweep speed for motor nerve conduction: 2-5 ms / division while for sensory nerve conduction: 1-2 ms / division A stimulus duration of 50 to 1000 μ s and current of 0-50 mA were applied for effective nerve stimulation for obtaining adequate responses. Supramaximal stimulation (10% to 30% more than the current required for maximal action potential) was used

The ulnar motor nerve was examined ortho-dromically using

two stainless steel electrodes (Natus Medical Inc, Canada) that were placed on skin surface and fixed with self-adhesive surgical tape. For ensuring proper skin contact, skin on the recording areas was cleaned with 70% alcohol solution and conduction jelly was used between the electrodes and the skin. The ground electrode was placed on the dorsum of the hand between the stimulating and recording electrodes. The NCS was done on the right upper limb of the participants. The active electrode was placed over the motor point of abductor digit minimi and reference electrode was placed 3 cm distally over the 5th metacarpophalangeal joint. The sites of stimulation were the wrist and elbow. Distal stimulation was performed at the wrist posterior to flexor carpi ulnaris tendon and proximal stimulation 3-4 cm distal to medial epicondyle with the wrist and elbow in 135° of flexion.

The sensory part of ulnar nerve was examined antidromically. Two stainless steel spring loaded ring electrodes (Natus Medical Inc, Canada) were placed over proximal and distal interphalangeal joints of the fifth digit, serving as recording and reference electrodes respectively stimulation was performed 10 cm proximal to the active electrode and posterior to the flexor carpi ulnaris tendon.

By repeating the test the best possible response was obtained.

Statistical analysis

The data were analyzed using the statistical package for the Social sciences software version 20 (SPSS Inc. Chicago, IL, USA). All the values were expressed in mean and standard deviation student's unpaired t-test was used to assess the significance of difference between the mean values of ulnar nerve latency and velocity of males and females. $P < 0.05$ was considered statistically significant. The normal reference range of nerve conduction values was set by the 2^{1/2} and 97^{1/2} percentiles so that the reference ranges contain the central 95% of the distribution.

Results

The present study was conducted on a total of 320 participants (165 males and 155 females) in the age group of 17-21 years. A gender wise comparison of the mean anthropometric & NCS parameters is shown in Tables 1, 2 & 3. As shown in Table 1, groups were comparable in terms of age, but height and weight of males were higher than females significantly ($P < 0.05$). Also values of latency and velocity of both motor and sensory divisions of ulnar nerve in both groups were comparable ($P > 0.05$).

Tables

Table 1: Comparison of demographic parameters of study participants

Parameter	Mean \pm SD		P value
	Males(n=165)	Females(n=155)	
Age (Years)	19.12 \pm 0.80	18.60 \pm 0.22	0.52
Height (cm)	168.21 \pm 6.10	162.14 \pm 5.49	0.03**
Weight (kg)	62.90 \pm 8.98	57.11 \pm 4.80	0.04**

n= Number of participants **= Statistically significant
SD= Standard deviation

Table 2: Distribution of ulnar motor nerve conduction study parameters according to gender

Under motor nerve	Mean \pm SD		P value
	Males(n=165)	Females(n=155)	
Latency (Milli)	3.30 \pm 1.18	3.42 \pm 0.30	0.35

sec)			
Velocity (m/sec)	63.08 ± 2.53	62.95 ± 2.74	0.52

Table 3: Distribution of ulnar sensory nerve conduction study parameters according to gender

Under sensory nerve	Mean ± SD		P value
	Males(n=165)	Females(n=155)	
Latency (Mille sec)	2.63 ± 0.48	2.51 ± 0.28	0.31
Velocity (m/sec)	55.69 ± 3.14	55.50 ± 3.72	0.60

Discussion

According to our present study latency and velocity of motor and sensory divisions of ulnar nerve are not influenced by gender in young adults. The findings of our study are in complete agreement with most other authors [8, 10, 12, 18] showing a non-significant difference in the ulnar motor and sensory conduction motor part of ulnar nerve showed a good similarity with studies by Shehab [12] Kimura [15] Karagozetal, [19] and Buschbacher [20]. The data regarding ulnar sensory nerve velocity was in agreement with Shehab [12] and Kimura [15] but less as compared to Awang *et al.* [21]. The motor nerve conduction velocity of ulnar nerve was higher as compared to Awang *et al.* [21].

The difference between the results of the present study and the data published in literature could be due to various reasons, one of them being the number of subjects examined. Increasing the number of subjects examined will reduce the bias in statistics. The second reason could be the age of subjects studied. In our study, only young adults were included in the study. Another reason for different set of values can be the difference in the distance between the stimulating and recording electrodes. Finally, the diversity of the methods and geographical differences could be responsible for reported variation in results of nerve conduction study.

Conclusion

The present study has generated normative data for ulnar nerve conduction in young adults of Punjab. The overall mean sensory and motor nerve conduction parameters compared favorably with existing literature data. The values established by this study will be helpful for diagnosis and prognosis of ulnar nerve abnormalities in young Punjabi population.

Acknowledgment

We acknowledge with thanks the contribution of all study participants for their active participation in our study.

Financial support and sponsorship: None

Conflicts of interest: There are no conflicts of interest.

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