

Nerve conduction study in healthy individuals

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Abstract

Background: Nerve conduction studies (NCS) are electrodiagnostic tests which are used to evaluate the ability of the conduction of the motor and the sensory nerves. NCS tests are used in the diagnosis of polyneuropathies, mononeuropathies, radicular lesions, tunnel syndromes and nerve damages caused by trauma and compression.

Objective: The objective of this study was to evaluate the normative data of nerve conduction study (NCS) parameters among healthy young adults and effect of gender on nerve conduction study parameters..

Materials and methods: This study was conducted in Kathmandu University School of Medical Science, Dhulikhel from January to November, 2015. The study was done in total 40 out of which 20 were males and 20 were females consenting healthy adults. The compound muscle action potential (CMAP) and sensory nerve action potential (SNAP) were recorded.

Result: The mean age of participants was 20.50±1.56 years, height was 167.24±7.32 cm, weight was 60.22±5.47 kg with mean BMI 20.12±3.24 kg/m². The motor nerve conduction duration is least in median nerve while maximum in radial nerve. Amplitude is higher in median nerve while lower in radial nerve. The motor nerve conduction duration is least in median nerve while maximum in radial nerve. Amplitude is higher in median nerve while lower in radial nerve. The sensory nerve conduction duration, amplitude and latency are more in median nerve than in ulnar nerve.

Conclusion: Nerve conduction study variables are within the normal range compared to previous studies.

Keywords: Nerve conduction study (NCS), compound muscle action potential (CMAP), sensory nerve action potential (SNAP).

1. Introduction

Nerve conduction studies are routinely performed in electrodiagnostic medicine as an important method to evaluate peripheral nerve function.[1] They help in the diagnosis prognosis, extent and distribution of peripheral nerve injury. NCS assesses peripheral motor and sensory functions by the motor NCS requiring stimulation of a nerve while recording from a muscle innervated by that nerve, whereas sensory NCS by stimulating a mixed nerve while recording from a mixed or cutaneous nerve. [2] 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.[2]Common measurement made during the test is nerve conduction velocity (NCV) and the nerves that are

tested in the upper and lower limbs including median, ulnar, radial, common peroneal, tibial and sural nerves.[2-4] Stimulation of any of these nerves evokes both an electrical and a mechanical response in the muscles innervated by the nerve distal to the site of stimulation.[5,6] So the aim of our study was to record the nerve conduction studies in healthy adult individuals.

2. Material and methods

The study was conducted in Department of Physiology, Kathmandu University School of Medical Science (KUSMS) with the approval of Institutional Review Committee, Kathmandu University School of Medical Sciences, Dhulikhel, Nepal. The study was done in total 40 subjects out of which 20 were males and 20 were

females consenting healthy adults. After obtaining written consent, the anthropometric measurements such as height and weight were recorded and body mass index (BMI) was calculated. The compound muscle action potential (CMAP) and sensory nerve action potential (SNAP) were recorded. Electrodes were taped on the clean skin along the nerves that are being studied i.e. median, ulnar, radial, tibial, common peroneal. Small stimulus was applied (electric current) to activates the nerves. The electrodes measured the current that travel down the nerve pathway. Parameters of CMAP which includes latency, amplitude and duration and that of SNAP i.e. latency, amplitude and duration were calculated. Data collected were first entered in the

Microsoft Excel Worksheet and then statistically analyzed using SPSS 21.0 version.

3. Results

Table 1: Demographic characteristic of study participants

Variables	Mean±SD	Min.	Max.
Age (Years)	20.50±1.56	19	22
Height (cm.)	167.24±7.32	148	178
Weight (Kg.)	60.22±5.47	43	74
BMI (kg/m ²)	20.12±3.24	16.58	23.4

The mean age of participants was 20.50 ± 1.56 years, height was 167.24±7.32 cm, weight was 60.22±5.47 kg with mean BMI 20.12±3.24kg/m².

Table 2: Motor nerve conduction study variables in upper limb

Motor Nerves	CMAP Duration (ms)	CMAP Amplitude (mv)	CMAP Latency (ms)	F-wave Latency (ms)
Right median	7.82±1.51	10.22±1.56	8.84±1.04	24.21±1.15
Left median	10.54±1.22	9.84±1.12	5.86±1.02	24.54±0.98
Right ulnar	11.24±1.16	7.25±1.06	8.34±1.10	25.16±0.87
Left ulnar	11.56±1.14	7.02±1.54	7.96±1.06	24.76±1.14
Right radial	14.48±1.36	4.98±0.65	5.56±0.64	NA
Left radial	13.27±1.34	5.01±0.56	5.12±0.55	NA

The motor nerve conduction duration is least in median nerve while maximum in radial nerve. Amplitude is higher in median nerve while lower in radial nerve.

Table 3: Motor nerve conduction study variables in lower limb

Motor Nerves	CMAP Duration (ms)	CMAP Amplitude (mv)	CMAP Latency (ms)	F-wave Latency (ms)
Right tibial	7.02±0.35	15.22±1.14	10.84±0.64	40.23±1.05
Left tibial	7.16±1.02	10.24±1.26	10.26±0.67	42.54±1.18
Right common peroneal	7.34±0.96	5.12±0.56	9.98±0.35	41.86±1.81
Left common peroneal	7.85±1.11	4.02±0.59	9.25±0.96	41.92±1.54

The motor nerve conduction duration tibial nerve is lower than in common peroneal nerve. Amplitude is higher in tibial than in common peroneal and latency is also longer in tibial than common peroneal nerve.

Table 4: Sensory nerve conduction study variables

Motor Nerves	SNAP Duration (ms)	SNAP Amplitude (µV)	SNAP Latency (ms)
Right median	1.64±0.93	25.32±1.77	2.15±0.06
Left median	1.11±0.05	19.73±2.39	2.12±0.05
Right ulnar	1.14±0.12	11.35±0.09	1.68±0.21
Left ulnar	1.09±0.12	12.32±0.19	1.76±0.16

The sensory nerve conduction duration, amplitude and latency are more in median nerve than in ulnar nerve.

4. Discussion

This study was aimed to see the nerve conduction study in healthy individuals to create a normative data and reference values in our lab. When this study was compared with other studies conducted on Nepalese and Indian populations it agreed generally with those studies which may be due to similar anthropometry of these populations. This study was conducted on healthy adult students studying medicine so the subjects were quite young so it established a base for the similar studies in hospital setup with larger sample size and wide range of age groups. This study showed lowest nerve velocities in the median nerve in while highest velocities were found in radial nerve which

is similar to the study done by Thakur *et al* and Shahabuddin *et al*. [2,6] Many studies have shown that NCV both motor and sensory are relatively slower in taller subjects. It is estimated that the velocity decreases by 2-3 m/s per 100mm in height.[6]

Thakur *et al* in his study found that the gender has definite effect on NCS variables. Likewise in our study with some dissimilarity the males had higher CMAP amplitude, longer latencies and duration. SNAP latencies and duration were longer in males whereas amplitude was higher in females.[7] Stetson *et al* in their study demonstrated smaller amplitude in female as compared to male.[8] However, Robinson *et al* in their study found that three of four

sensory amplitudes were larger in females as compared to males.[9] Hennessey *et al* found that there is no influence of gender for nerve conduction velocity and distal latency but the effect of gender is only significant and affects the sensory nerve potential amplitude.[10]

If one of the waveforms is attenuated or there is a discrepancy in shape of the CMAP, this may have pathologic implications. Velocities are generally greater than 50m/s in the upper limb and greater than 40m/s in the legs. Slow motor NCV, decreased amplitude or altered waveform of the CMAP correlates with nerve dysfunctions so regular evaluation and monitoring is suggested.

5. Conclusions

In conclusion, normative conduction parameters of commonly tested peripheral nerves in upper and lower limb were established. This can be used for evaluation for peripheral nerve injury. The overall motor and sensory nerve conduction parameters for median, radial and ulnar nerve of upper extremity and tibial and common peroneal nerve for lower extremity were comparable with existing literature data. Gender has been shown to have an effect on SNAP amplitude, distal motor and F-minimum latency of following measured nerves.

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