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NERVE CONDUCTION STUDIES IN UPPER LIMB OF HEALTHY INDIVIDUALS: EFFECT OF ANTHROPOMETRIC VARIABLES

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ABSTRACT

Background: Nerve conduction study (NCS) is routinely used for evaluation of neuromuscular function. It assesses neuromuscular impairment. Several studies had shown a significant effect of anthropometric variables on nerve conduction variables. Thus, we would like to study the nerve conduction parameters of upper limbs and also, to study the effect of anthropometric variables on it. **Objectives:** To study the nerve conduction parameters of upper limbs in healthy subjects and to study the effect of anthropometric variables on it. **Materials and Methods:** This study was conducted on thirty healthy subjects both male and female of age 20 -35 years selected from BPKIHS by a convenient sampling method. Anthropometric variables such as age, height, weight, BMI were recorded. In all subjects NCS were performed in median and ulnar nerve using Nihon Kohden machine. **Results:** Mean age, height, weight and BMI of subjects were 29.27± 6.21 years, 1.59± 0.07 m, 60.10± 10.73 kg, 23.85±4.63 kg/m^2 respectively. Among sensory parameters of NCS; height showed significant positive correlation with onset latencies of bilateral median nerve (rt; r=.425, p=0.019; lt; r= .369, p=0.045) and significant negative correlation with SNAP amplitude of bilateral median nerve (rt; r=-.398, p=0.029; lt; r=-.511, p=0.004). Similarly, among motor parameters; height showed significant positive correlation with onset latencies, and significant negative correlation with nerve conduction velocity of bilateral median and ulnar nerve. CMAP amplitude of bilateral median nerve showed significant positive correlation with height. F wave latencies of bilateral median and ulnar nerve also showed significant positive correlation with height. **Conclusion:** In our study among anthropometric variables, mostly height showed significant correlation with NCS parameters of upper limb in both sensory and motor parameters of median and ulnar nerve. We should consider height as strong variable while making diagnostic conclusion in NCS lab.

KEYWORDS: Nerve conduction studies in upper limb of healthy individuals: effect of anthropometric variables.

INTRODUCTION

Nerve conduction study (NCS) is routinely used for evaluation of neuromuscular function. It examines the state of rapidly conducting myelinated fibers in a peripheral nerve.[1] NCS along with electromyography provides the evaluation of suspected nerve, muscle or neuromuscular impairment.[2] It helps clinicians to differentiate the major group of peripheral diseases; axonal degeneration and demyelination. It includes assessment of motor, sensory and mixed nerves. Motor NCS assesses compound muscle action potential (CMAP) whereas sensory NCS assesses sensory nerve action potential (SNAP) of the accessible peripheral nerves of upper and lower limb. The median, ulnar, radial nerves in upper limb and tibial, common peroneal and sural nerves in lower limb are commonly examined nerves. The NCS parameters of CMAP include latency, duration, amplitude, conduction velocity, F responses; similarly for SNAP, latency, amplitude and conduction velocity are routinely measured.[3] NCS parameters are affected by anthropometric variables such as age, height, gender, temperature etc.

Study done by flack et al reported that conduction velocity in new-borns is approximately 50% of adult values and progressively increase, reaching the adult value up to age 3. Later the nerve conduction velocity decreases with age and more pronounced in lower limb

than upper limb.[4] Similarly Rivner et al found in their study that correlation of height with NCS parameters was more than that of age.[5] Several studies have shown effect of anthropometric variables on NCS parameters.[4,5,6]

Thus we aimed to study the nerve conduction parameters of upper limb in healthy subjects and to correlate anthropometric variables such as age, height, and weight with nerve conduction parameters. So that appropriate adjustment may be considered while finding normal values.

MATERIALS AND METHODS

Nerve conduction study is routinely used for evaluation of neuromuscular function. It evaluates motor and sensory parameters of the peripheral nerves. In sensory and motor NCS, bilateral median and ulnar nerves were assessed. The study was conducted at Neurophysiology Lab II of BPKIHS. Thirty healthy both male and female subjects of 20-35 years were selected from the institute by a convenient sampling method. Subjects with history of diabetes, hypothyroid, neuropathy or neuromuscular disorder were excluded. Subjects were explained about the study procedure in detail and informed written consent was taken before the NCS test. Anthropometric and NCS variables were studied.

Recording of motor NCS: NCS of median and ulnar nerves of bilateral limb were recorded using Digital Nihon Kohden (NM_420S, H636, Japan) by belly tendon montage following its standard procedure. For each site of stimulation; latency, CMAP amplitude, nerve conduction velocity were recorded. Latencies of F waves were also recorded.

Recording of Sensory NCS: Orthodromic method of stimulation was employed for testing median and ulnar nerve using ring electrode. Latency, SNAP amplitude and conduction velocity were recorded.

The data were analyzed by SPSS 11.5 version. Descriptive analysis was done for anthropometric and nerve conduction variables while Pearson's correlation was applied between anthropometric and nerve conduction variables.

RESULTS

Mean and SD were calculated for anthropometric and nerve conduction variables of bilateral median and ulnar nerves. (Table:1-6). Among motor parameters of NCV; proximal onset latencies of bilateral median and ulnar nerves were positively correlated with height. Nerve conduction velocities of bilateral median and ulnar nerves were negatively correlated with height. Similarly, CMAP amplitude of bilateral median nerves was positively correlated with height. Minimum F wave latencies of bilateral median and ulnar were positively correlated with height. Among sensory parameters of NCV; onset latencies of bilateral median nerve were positively correlated with height whereas SNAP amplitude were negatively correlated with height. (Table 7).

Table 1: Anthropometric variables.

	Age (yrs)	Height (m)	Weight (Kg)	BMI (Kg/m^2)
Mean±SD	29.27±6.21	1.59±0.07	60.10±10.73	23.85±4.63

BMI- body mass index, kg- kilogram, m-meter.

Table 2: Nerve conduction parameters of median nerves.

NCS Variables	Mean±SD
LMNDL (ms)	2.79±0.55
LMNPL (ms)	6.64±0.66
LMNDA (mv)	10.75±2.79
LMNPA (mv)	10.61±2.18
LMNCV (m/s)	61.24±12.78
RMNDL (ms)	2.75±0.53
RMNPL (ms)	6.79±0.65
RMNDA (mv)	10.81±2.84
RMNPA (mv)	9.60±2.71
RMNCV (m/s)	57.53±6.73

ms-millisecond, mv-millivolt, m/s-meter/second, LMNDL- left median distal latency, LMNPL- left median proximal latency, LMNDA- left median distal amplitude, LMNPA-left median proximal amplitude, LMNCV- left median nerve conduction velocity RMNDL- right median distal latency, RMNPL- right median proximal latency, RMNDA-right median distal amplitude, RMNPA- right median proximal amplitude, RMNCV- right median nerve conduction velocity.

Table 3: Nerve conduction parameters of ulnar nerves.

NCS Variables	Mean ±SD
LUNDL (ms)	2.10 ±0.39
LUNPL (ms)	5.87±0.65
LUNDA (mv)	7.62±1.98
LUNPA (mv)	7.22±1.52
LUNCV (m/s)	61.61±7.86
RUNDL (ms)	2.00±0.30
RUNPL (ms)	5.88±0.75
RUNDA (mv)	8.69±2.07
RUNPA (mv)	8.19±1.80
RUNCV (m/s)	60.38±9.12

ms-millisecond, mv-millivolt, m/s-meter/second, LUNDL- left ulnar distal latency, LUNPL- left ulnar proximal latency, LUNDA- left ulnar distal amplitude, LUNPA-left ulnar proximal amplitude, LUNCV- left ulnar nerve conduction velocity RUNDL- right ulnar

distal latency, RUNPL- right ulnar proximal latency, RUNDA-right ulnar distal amplitude, RUNPA- right ulnar proximal amplitude, RUNCV- right ulnar nerve conduction velocity.

Table 4: Nerve conduction parameters of sensory median nerves.

NCS variables	Mean±SD
LMNOL (ms)	1.86 ±0.24
LMNA (mv)	38.24 ±0.24
LMNCV (m/s)	60.40 ±0.24
RMNOL (ms)	1.76 ±0.24
RMNA (mv)	37.01 ±0.24
RMNCV (m/s)	62.75 ±0.24

ms-millisecond, mv-millivolt, m/s-meter/second, LMNOL-left median onset latency, LMNA- left median amplitude, LMNCV- left median nerve conduction velocity, RMNOL- right median onset latency, RMNA-right median amplitude, RMNCV- right median nerve conduction velocity.

Table 5: Nerve conduction parameters of sensory ulnar nerves.

NCS variables	Mean±SD
LUNOL (ms)	1.63 ±0.20
LUNA (mv)	18.35 ±0.20
LUNCV (m/s)	59.47 ±0.20
RUNOL (ms)	1.58 ±0.20
RUNA (mv)	17.50 ±6.79
RUNCV (m/s)	64.54 ±7.46

ms-millisecond, mv-millivolt, m/s-meter/second, LUNOL-left ulnar onset latency, LUNA- left ulnar amplitude, LUNCV- left ulnar nerve conduction velocity, RUNOL- right ulnar onset latency, RUNA-right ulnar amplitude, RUNCV- right ulnar nerve conduction velocity.

Table 6: F wave variables of median and ulnar nerves.

NCS variables	Mean±SD
LMNFmin	24.11±2.35
RMNFmin	24.37±2.81
LUNFmin	24.15±2.64
RUNFmin	24.94±3.01

LMNFmin- left median F wave minimum latency, RMFmin- right median F wave minimum latency, LUNFmin- left ulnar F wave minimum latency, RUNFmin-right ulnar F wave minimum latency.

Table 7: Correlation of anthropometric variables with NCS variables.

NCS Variables	Age	Wt	Ht	BMI
LMNDL	r =0.215	r =0.299	r =-0.106	r =0.322
	p =0.255	p =0.109	p =0.578	p =0.083
LMNPL	r =0.034	r =0.290	**r =.514****	r =0.007
	p =0.857	p =0.119	**p =0.004**	p =0.969
LMNDA	r =-0.171	r =0.177	**r =.378***	r =-0.026
	p =0.366	p =0.350	**p =0.039**	p =0.891
LMNPA	r =-0.238	r =0.001	r =0.240	r =-0.132
	p =0.206	p =0.996	p =0.202	p =0.487
LMNCV	r =0.201	r =0.015	**r =-.491****	r =0.259
	p =0.286	p =0.939	**p =0.006**	p =0.167
LMNMinF	r =-0.046	r =-0.180	**r =.432***	r =-.184
	p =0.810	p =0.341	**p =0.017**	p =0.236
RMNDL	r =0.167	r =0.260	r =0.003	r =0.224
	p =0.378	p =0.165	p =0.989	p =0.234
RMNPL	r =-0.034	r =0.193	**r =.551****	r =-0.112
	p =0.858	p =0.307	**p =0.002**	p =0.557
RMNDA	r =-0.191	r =-0.038	r =0.152	r =-0.100
	p =0.311	p =0.840	p =0.421	p =0.601
RMNPA	r =-.208	r =-0.160	**r =.405***	r =-0.357
	p =0.214	p =0.398	**p =0.026**	p =0.053
RMNCV	r =0.306	r =0.120	**r =-.731****	r =.185
	p =0.100	p =0.526	**p =0.001**	p =0.107
RMNMinF	r =-0.114	r =-0.072	**r =.484****	r =-0.291
	p =0.549	p =0.705	**p =0.007**	p =0.119

LUNDL	r =-0.348	r =-0.143	r =0.226	r =-0.236
	p =0.059	p =0.452	p =0.230	p =0.210
LUNPL	r =-0.136	r =0.159	**r =.585****	r =-0.128
	p =0.474	p =0.402	**p =0.001**	p =0.499
LUNDA	r =-0.173	r =0.086	r =0.205	r =-0.004
	p =0.361	p =0.652	p =0.276	p =0.983
LUNPA	r =-0.205	r =0.006	r =0.081	r =-0.033
	p =0.278	p =0.975	p =0.671	p =0.862
LUNCV	r =-0.078	r =-0.340	**r =-.514****	r =-0.070
	p =0.681	p =0.066	**p =0.004**	p =0.712
LUNMinF	r =-0.225	r =-0.040	**r =.475****	r =-0.279
	p =0.232	p =0.833	**p =0.008**	p =0.136
RUNDL	r =-0.096	r =-0.063	r =-0.144	r =-0.021
	p =0.615	p =0.742	p =0.447	p =0.911
RUNPL	r =-0.190	r =0.136	**r =.374***	r =-0.072
	p =0.315	p =0.473	**p =0.042**	p =0.703
RUNDA	r =0.030	r =0.220	r =0.056	r =0.186
	p =0.876	p =0.243	p =0.770	p =0.326
RUNPA	r =-0.039	r =-0.122	r =-0.041	r =-0.088
	p =0.838	p =0.520	p =0.830	p =0.644
RUNCV	r =0.235	r =-0.140	**r =-.534****	r =0.136
	p =0.211	p =0.460	**p =0.002**	p =0.474
RUNMinF	r =-0.202	r =-0.083	r =0.195	r =-0.177
	p =0.284	p =0.663	p =0.301	p =0.350
LMNOL	r =-0.054	r =0.339	**r =.369***	r =0.136
	p =0.777	p =0.067	**p =0.045**	p =0.473
LMNA	r =0.182	r =-0.137	**r =-.511****	r =0.143
	p =0.336	p =0.469	**p =0.004**	p =0.452
LMNCV	r =0.085	r =-0.339	r =-0.335	r =-0.157
	p =0.654	p =0.067	p =0.071	p =0.406
RMNOL	r =-0.202	r =0.114	**r =.425***	r =-0.115
	p =0.284	p =0.549	**p =0.019**	p =0.544
RMNA	r =0.081	r =-0.268	**r =-.398***	r =-0.050
	p =0.671	p =0.152	**p =0.029**	p =0.792
RMNCV	r =0.319	r =0.056	r =-0.349	r =0.238
	p =0.086	p =0.767	p =0.059	p =0.206
LUNOL	r =-0.216	r =0.033	r =0.323	r =-0.126
	p =0.253	p =0.862	p =0.082	p =0.506
LUNA	r =0.315	r =0.129	r =-0.122	r =0.202
	p =0.089	p =0.498	p =0.519	p =0.285
LUNCV	r =0.167	r =-0.109	r =-0.230	r =0.005
	p =0.378	p =0.566	p =0.222	p =0.980
RUNOL	r =-0.140	r =0.088	r =0.350	r =-0.084
	p =0.461	p =0.642	p =0.058	p =0.658
RUNA	r =-0.098	r =-0.004	r =-0.288	r =0.117
	p =0.607	p =0.985	p =0.123	p =0.539
RUNCV	r =0.057	r =0.049	r =-0.275	r =0.179
	p =0.765	p =0.797	p =0.141	p =0.343

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

DISCUSSION

Mean and SD values for both motor and sensory NCS variables of bilateral median and ulnar nerves were derived. Among motor parameters; our study showed significant positive correlation of height with latencies and significant negative correlation with nerve conduction velocities with bilateral median and ulnar nerves. Similarly CMAP amplitude of bilateral median nerve showed significant positive correlation with height. Findings are supported by Thakur et al.[6] in which influence of height on nerve conduction parameters was studied. They found significant positive correlation of height with latency and CMAP amplitude of bilateral median nerve, negative correlation with conduction

velocity of bilateral ulnar nerve. They did not found any correlation between height and conduction velocity in bilateral median nerve. CMAP amplitude of bilateral ulnar nerve also didn't show any correlation with height in Thakur et al.[6]

Our study showed significant positive correlation of height with F wave latencies in bilateral median and ulnar nerve. Findings are supported by Thakur et al and others[7,8] it may be due to longer conduction distance in tall subjects; they have longer conduction time of F response.

Among sensory parameters; our study showed significant positive correlation of height with SNAP latencies whereas significant negative correlation with SNAP amplitude in bilateral median nerve. Findings are supported by sulaxane et al.[9] They found significant positive correlation with SNAP latency and significant negative correlation with SNAP amplitude in median and ulnar nerve. Hennessey et al. and others also reported height to be negatively associated with the sensory amplitude.[10,11]

Age and BMI didnt show significant correlation with NCS parameters in our study contrary to other study.[12] Weight and obesity do not have significant impact on nerve conduction parameters. Findings are supported by stetson et al.[12,13]

CONCLUSION

In our study among anthropometric variables, mostly height showed significant correlation with NCS parameters of upper limb in both sensory and motor parameters of median and ulnar nerve. We should consider height as strong variable while making diagnostic conclusion in NCS lab and also for setting reference normative data for different nerves.

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REFERENCES

1. Hendriksen P, Oey P, Wieneke G, Bravenboer B, van Huffelen A. Subclinical diabetic polyneuropathy: early detection of involvement of different nerve fibre types. Journal of Neurology, Neurosurgery & Psychiatry, 1993; 56(5): 509-514.
2. Preston D Shapiro B. Basic Nerve Conduction Studies, Electromyography and Neuromuscular disorders. Boston: Butterworth Heinemann, 1998.
3. Misulis KE, Head TC. Nerve conduction study and electromyography. In "Essentials of Clinical Neurophysiology" 3rd Ed. Pioli SF (eds). Butterworth- Heinemann, 2003; 987.
4. Flack B, Stalberg E, Bischoff C. Sensory nerve conduction studies with surface electrodes. Methods in Clinical Neurophysiology, 1994; 5: 1-20.
5. Rivner M, Swift T, Malik K. Influence of age and height on nerve conduction. Muscle & Nerve., 2001; 24(9): 1134-1141.
6. Thakur D, Jha S, Pandey N, Jha C, Bajaj B, Paudel B. Influence of height on the nerve conduction parameters of the peripheral nerves. Journal of Clinical and Diagnostic Research, 2011; 5(2): 260-263.
7. Peioglou-Harmoussi S, Howel D, Fawcett P, Barwick D. F-response behaviour in a control population. Journal of Neurology, Neurosurgery & Psychiatry, 1985; 48(11): 1152-1158.
8. Lin KP, Chan MH, Wu ZA. Nerve conduction studies in healthy Chinese: correlation with age, sex, height and skin temperature. Zhonghua Yi Xue Za Zhi (Taipei)., 1993; 52(5): 293-7.
9. Sulaxane YD, Bhavasar RP. Impact of height on sensory nerve conduction. Natl J Physiol Pharm Pharmacol, 2017; 7(8): 851-854.
10. 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(3): 265-9.
11. Kokotis P, Mandellos D, Papagianni A, Karandreas N. Nomogram for determining lower limit of the sural response. Clin Neurophysiol, 2010; 121(4): 561-3.
12. Stetson DS, Albers JW, Silverstein BA, Wolfe RA. Effects of age, sex, and anthropometric factors on nerve conduction measures. Muscle & nerve., 1992; 5(10): 1095-104.
13. Buschbacher R. Body mass index effect on common nerve conduction study measurements. Muscle & Nerve., 1998; 21(11): 1398-1404.