ORIGINAL ARTICLE

COMPARISON OF ULNAR AND MEDIAN NERVE CONDUCTION PARAMETERS BETWEEN MALES AND FEMALES

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Background: Nerve conduction study (NCS) is a tool to assess the integrity of peripheral nervous system. It helps in diagnosis, planning of treatment, and prognosis of diseases of peripheral nerves. NCS parameters are affected by several physical factors like temperature, demography and ethnicity besides age, gender, height, weight, BMI etc. The present study was targeted at finding out the differences between male and female NCS parameters. **Methods:** This was a cross-sectional study with a total of 75 participants, 40 males and 35 females. Baseline investigations were performed to exclude any co-morbid conditions. Individuals with normal investigations were subjected for nerve conduction studies on ulnar and median nerves. Independent sample *t*-test was done to compare NCS parameters of male and female participants. **Results:** There was no significant differences between male and female median motor, ulnar motor, and median sensory NCS parameters. Only ulnar sensory NCS parameters latency and amplitude were significantly different in males and females, latency being more in males (p=0.043) while amplitude being more in females (p=0.019). **Conclusion:** No significant gender-based differences were found in median motor, ulnar motor, and median sensory NCS parameters and only ulnar sensory NCS parameters had significantl differences between males and females.

Keywords: Nerve conduction study, NCS, Sensory, Motor, Median nerve, Ulnar nerve, male, female

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INTRODUCTION

Electro diagnostic studies (EDX) are an important tool for diagnosis and evaluation of peripheral motor and sensory nerves integrity.[1] These studies include nerve conduction studies (NCS) and needle electromyography (EMG).[2] Electrical stimulation of the nerve initiates an impulse that travels along the motor or sensory nerve fibres. The assessment of conduction characteristics depends on the analysis of compound evoked potentials.[3] They are recorded from the muscle and the nerve in the study of the motor fibres and the sensory fibres. The NCS parameters include CMAP (compound muscle action potential), SNAP (sensory nerve action potential), latency, duration and nerve conduction velocity.[4] All these NCS parameters are greatly affected by demographic and physiologic factors like age, gender, height, weight, BMI, skin temperature and ethnicity. The diameter of nerve and degree of myelination also affect the values of NCS parameters.[5]

EDX can be used for assessment of degree of axonal loss/demyelination, for determining disease severity, prognosis and assessment of duration of neuropathy whether it is acute, sub-acute or chronic.[6]

The proportion of elderly population over 50 years is rising especially in developed countries due to improvement in life expectancy, it is therefore important to identify the neurological diseases early and screen for curable causes.[7] Polyneuropathy affects about 7% of elderly population and NCS is the most important tool to diagnose polyneuropathy. Therefore early identification of changes in nerve function may be able to forecast strength decline leading to timely intervention which may be helpful in preventing disability.[8] In previous studies, it has been shown that incidence ratio of polyneuropathy between males and females is 2:1.[9]

It is thus important to take these factors into consideration while recording NCS. Currently we are using the reference values set by Europe/USA; we must have our own reference values for males and females for comparing NCS parameters in various neuropathic disorders. The findings of our study may serve as a basis of large scale studies. The present study was targeted at finding out the differences in NCS parameters of men and women of 40−70 year age.

METHODOLOGY

It was a cross-sectional study with a sample size of 75 selected through convenient sampling. The sample size was calculated through STAT (UBA) by keeping the power 0.80 and α value 0.05. The study was approved from ASRB and Ethical Board of Khyber Medical University. People having no confounding medical or surgical illness and no history of previous upper limb injury/myopathy/neuropathy were included in the study if their fasting blood sugar (FBS), urea, creatinine, liver function tests (LFTs) and Erythrocyte Sedimentation Rate (ESR) were within normal limits. Pregnant women, people of age <40 or >70 years, those with bleeding disorders or on anticoagulant therapy, and

patients with compression symptoms of median or ulnar nerve were excluded from the study. A detailed history and informed consent were taken from all participants by using a questionnaire.

The nerve conduction studies were performed on Nihon Kohden Neuropack M1 EP/EMG measuring system MEB-9200/MEB-9300. The sensory and motor nerve conduction studies were recorded for both median and ulnar nerves both proximally (elbow) and distally (wrist) in the forearm. A standard technique was used to obtain and record action potentials for sensory and motor functions by using NCS data acquisition system. All electrodes were placed on specific and measured distances from each other according to the standard technique given by AANEM.[2] The proximal and distal latency was automatically calculated by machine. In case of motor studies, it automatically took out the difference between proximal and distal latencies. The distance between stimulation sites (mm) was measured and manually entered in Dist. column in conduction study measurement table window.[10] The sensory conduction velocity was calculated by dividing the distance between the stimulating (active) and recording (reference) electrodes by Latency of that nerve (using formula V=S/t). All these parameters were then organized, and imported into SPSS-22. The nominal variables were looked for frequencies and percentages while numerical variables were analysed for Mean±SD. The two groups were compared using independent sample *t*-test and $p<0.05$ was taken as significant.

RESULTS

There were 40 males and 35 females included in this study. Demographic parameters are described in Table-1. There was no significant difference between male and female demographic parameters except for height, which was more in men than women ($p=0.02$).

The nerve conduction study parameters were compared for gender-based differences by using independent sample *t*-test. Mean latency and mean amplitude was more in males (Mean±SD of latency was 3.49±0.37 in men *vs* 3.33±0.39 in women while mean amplitude was 9.62±2.40 in men *vs* 9.00±2.11 in women). Mean NCV was more in women (57.08±3.72) compared to men (54.68±3.49).

Mean latency was 2.61±0.23 in men and 2.25±0.21 in women. Mean amplitude was 9.29±1.76 in men and 8.79±1.46 in women. Mean NCV was 58.09±4.46 in women *vs* 56.57±4.83 in men) (Table-3).

Mean latency was more in men (2.61±0.35 in men *vs* 2.47±0.36 in women) while mean amplitude was more in women (2.47±0.36 in women *vs* 28.30±10.35 in men). Mean NCV was more in men (56.23±7.24 in men *vs* 56.07±7.44 in women) (Table-4).

The ulnar sensory parameters showed remarkably significant differences between male and female NCS parameters. The mean latency was longer in males than females (2.24±0.31 in males *vs* 1.86±0.23 in females, $p=0.043$). The mean amplitude was more in females than males (41.07±17.32 in females *vs* 28.97±10.51 in males, $p=0.019$). Mean NCV was more in females than males with a mean value of 62.01±7.05 in females and 55.69±6.98 in males (Table-5).

Table-1: Demographic parameters of male and female participants (Mean±SD)

Parameters	Male n=40	Female n=35	*p*
Age (Years)	54.23±8.13	53.37±8.64	0.23
Height (Cm)	167.44±7.1	157.23±4.58	0.022*
Weight (Kg)	75.74±11.81	68.98±9.83	0.16
BMI (Kg/m^2)	26.87±3.47	27.82±3.88	0.52

*Significant

Table-2: Comparison of male and female NCS parameters for median motor nerve (Mean±SD)

	Male n=40	Female n=35	*p*
Median motor nerve conduction parameters (wrist)			
Current (mV)	30.69±5.46	31.07±4.51	0.60
Latency (mSec)	3.49±0.37	3.33±0.39	0.786
Amplitude(mV)	9.62±2.40	9.00±2.11	0.309
Median motor nerve conduction parameters (elbow)			
Current (mV)	34.37±4.99	34.71±5.93	0.387
Latency (mSec)	7.94±0.56	7.25±0.51	0.642
Amplitude(mV)	9.27±2.41	8.32±2.18	0.433
Wrist-elbow distance (mm)	242.50±12.40	223.71±10.38	0.665
Wrist-elbow interval (mSec)	4.45±0.32	3.92±0.26	0.288
NCV (m/Sec)	54.68±3.49	57.08±3.72	0.766

NCV: Nerve Conduction Velocity

Table-3: Comparison of male and female NCS parameters for ulnar motor nerve (Mean±SD)

	Male n=40	Female n=35	*p*
Ulnar motor nerve conduction parameters (wrist)			
Current (mV)	30.81±3.46	29.07±4.50	0.219
Latency (mSec)	2.61±0.23	2.25±0.21	0.939
Amplitude (mV)	9.29±1.76	8.79±1.46	0.592
Ulnar motor nerve conduction parameters (elbow)			
Current (mV)	33.37±2.68	31.07±4.03	0.155
Latency (mSec)	6.86±0.51	6.06±0.41	0.115
Amplitude (mV)	8.49±1.89	8.24±1.57	0.716
Wrist-elbow distance (mm)	238.00±12.23	219.28±11.25	0.901
Wrist-elbow interval (mSec)	4.24±0.42	3.79±0.32	0.173
NCV (m/Sec)	56.57±4.83	58.09±4.46	0.858

NCV: Nerve Conduction Velocity

Table-4: Comparison of male and female NCS parameters for median sensory nerve (Mean±SD)

Nerve conduction parameters (wrist)	Male n=40	Female n=35	*p*
Current (mV)	21.18±3.34	19.42±3.93	0.363
Latency (mSec)	2.61±0.35	2.47±0.36	0.590
Amplitude (µV)	28.30±10.35	35.32±13.70	0.093
Wrist-elbow Distance (mm)	144.25±6.75	135.14±5.87	0.554
Wrist-elbow Interval	2.61±0.35	2.49±0.36	0.462
NCV (m/Sec)	56.23±7.24	56.07±7.44	0.739

NCV: Nerve Conduction Velocity

Table-5: Comparison of male and female NCS parameters for ulnar sensory nerve (Mean±SD)

Nerve conduction parameters (wrist)	Male n=40	Female n=35	*p*
Current (mV)	21.12±3.71	19.35±3.99	0.905
Latency (mSec)	2.24±0.31	1.86±0.23	0.043*
Amplitude (µV)	28.97±10.51	41.07±17.32	0.019*
Wrist-elbow distance (mm)	123.37±12.97	114.14±7.42	0.000*
Wrist-elbow interval (mSec)	2.24±0.31	1.86±0.22	0.043
NCV (m/Sec)	55.69±6.98	62.01±7.05	0.788

*Significant, NCV: Nerve Conduction Velocity

DISCUSSION

Regarding differences in motor NCS between males and females in present study it was observed that there were no significant differences between males and females. For ulnar sensory parameters, it was found that males had longer sensory mean latencies, while sensory mean amplitude was higher in females. This observation is in accordance with the study conducted by Gakhar *et al*[11] and Hennessey *et al*[12]. The more SNAP amplitude in females may be due to more skin thickness in males and the shorter distal latency may be due to shorter height and hence limb length in females. Shehab *et al*[13] also found that gender affected SNAP amplitude of median and ulnar nerves, this is favouring our findings. Similarly, Pawar *et al*[14] found out differences in SNAP amplitude and distal latency of both median and ulnar nerves between males and females. Alemdar *et al*[15] observed that female SNAP latency was more in males while amplitude was more in females; our study is in agreement to their findings. Kumar *et al*[16] observed that median motor CMAP amplitude and NCV was more in males as compared to females while latency was slightly increased in females. It is not true in case of our study. The gender-based differences in NCS parameters can be due to differences in anatomical and physiological factors between males and females like height, limb length, etc.

A study by Ovais Karnain *et al*[17] showed that both the ulnar and median sensory nerve action potential (SNAP) amplitude was significantly greater in females than in males. In our study, only ulnar SNAP amplitude was significantly high in females than males which may be due to demographic, ethnic, or any other factor between the two populations. Fujimaki *et al*[18] also found that females had greater SNAP amplitude than males which favours our study.

The larger SNAP amplitude in females may be due to less subcutaneous tissue nearby the recording electrode. More resistance offered by thick skin in males and distance between recoding electrode and the nerve might be the reason for more SNAP amplitude in females than in males. Our results which don't go in accordance with other studies may be due to ethnic differences, different environmental or skin temperature at the time of study, due to instrument to instrument variations, or other technical factors.

CONCLUSION

There was no significant difference between male and female ulnar and median motor NCS parameters and median sensory NCS parameters. Ulnar sensory latency was significantly high in males as compared to females while ulnar sensory amplitude was significantly high in females than males. Further studies are needed to look for association of height, weight, BMI, skin thickness, nature of work and other parameters with NCS parameters in both males and females so that the amount of difference between male and female NCS parameters can be quantified.

LIMITATIONS OF THE STUDY

Our findings should be interpreted with some caution given the limitations of our design. Our findings may be subject to selection bias as it was a single-centre hospital-based study rather than a community-based or a multi-centre study.

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