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A STUDY OF MEDIAN NERVE CONDUCTION VELOCITIES IN YOUNG HEALTHY INDIVIDUAL IN RELATION TO ISOTONIC EXERCISE

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ABSTRACT

Nerve conduction velocity [NCV] test is an important aspect of Nerve conduction study that aids in the diagnosis of various peripheral neuropathies and demyelinating conditions where in the conduction velocities reduces or become non existent.Nerve conduction study primarily includes the assessment of Compound muscle action potential and sensory nerve action potential [SNAP] from accesible parts of the body for peripheral nerves in upper and lower limbs including median,ulnar,radial,commonperoneal,tibial and sural nerves

Aims of the study-To study median motor nerve conduction and ulnar nerve conduction velocity in young healthy individual in relation to isotonic exercise

Materials and Methods

STUDY DESIGN

The cross sectional study was carried was carried out in 60 healthy subjeets in Gauhati Medical College

INCLUSION CRITERIA

The sujects who were aged between 18 to 25 years were selected.Only healthy individual were included in the study after a detail clinical history with the help of standard questioner

EXCLUSION CRITERIA

The subjects having symptoms of peripheral sensory neural deficits and execessive muscle weakness were excluded . Also subjects with history of chronic alcohol abuse were excluded

METHOD OF COLLECTION –Nerve conduction study [NCS] comprising of Motor Nerve conduction velocity [MNCV]and Sensory nerve conduction velocity was carried in both hands .The NCV parameters

That were recorded and studied for both MNCV and SNCV were latency,amplitude and conduction velocities respectively.

Parameters recorded are

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1. Hand dominence pattern

2.Median motor nerve conduction velocities

3.Median sensory nerve conduction velocities

4.Ulnar Motor nerve conduction velocities

5.Ulnar sensory nerve conduction

STASTICAL ANALYSIS

Comparative analysis is done by using ANOVA single factor and student unpaired t test

CONCLUSION

Although the study did not find any significant variation in the parameters of NCS in to isotonic exercise but study showed gender variation inNCS parameters

KEY WORDS: Median Ulnar NCV Demyelination

INTRODUCTION

Cauda equina syndrome (CES) results from damage to a neuromuscular bundle below the spinal cone in the spinal canal. The neuromuscular bundle includes motor nerve fibers, which control skeletal muscle, sensory nerve fibers of the skin, and parasympathetic nerves in the sacral region.[1] The 3 common signs of CES include saddle anesthesia, urinary retention, and lower extremity weakness. As peripheral nerve function is lost, the bulbospongiosa reflex, perianal reflex, and tendon reflex of the lower extremities are also lost.[2] The most common cause of CES is compression due to a herniated disc, followed by traumatic fracture, tumor, infection, stenosis, subdural hematoma, inflammation, and vascular causes.[3] The incidence rate of CES is 1 in 33,000 to 100,000 people, and it is common among men in their 30s and 40s. CES has been reported to occur in 4 of 10,000 patients with low back pain.[4] When CES is suspected, magnetic resonance imaging (MRI) should be immediately performed to identify structural lesions. Since spinal canal compression is the primary cause, urgent surgical decompression is needed in acute CES as it may cause neurological paralysis if left untreated.[5]

Unlike other spinal cord syndromes, CES causes peripheral nerve damage due to neuromuscular injury and has a high possibility of recovery through nerve regeneration.[6] To determine the prognosis of the peripheral syndrome, it is important to understand the degree of damage to the peripheral nervous system. Prognostic factors for CES include the lower extremity isometric strength score and the American Spinal Injury Association Impairment Scale. However, these methods of evaluation are not considered absolute or objective since they require active patient cooperation. Therefore, alternative objective tests such as nerve conduction studies (NCSs) and electromyography (EMG) are widely used to diagnose and evaluate the severity of

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nerve damage.[7] This is because a decrease in the compound motor action potential (CMAP), an NCS parameter, indicates the loss of motor neuron axons, muscle weakness, and the severity of the damage.[8] Hollie and Power reported that the decreased CMAP amplitude measured in the first dorsal interosseous muscle was superior to the decrease in the nerve conduction velocity inching test performed at the elbow joint for predicting preoperative grip strength and key pinch test in cubital tunnel syndrome patients. Furthermore, CMAP amplitude is an important indicator of the severity of cubital tunnel syndrome, and CMAP can be used to decide surgical interventions.[9] Sasaki et al reported that the CMAP for abductor pollicis brevis and second-finger sensory nerve action potentials (SNAPs) measured by palmar stimulation before surgery in carpal tunnel syndrome could predict postsurgery improvement. Another study stated that the CMAP amplitude was an indicator of the number of remaining axons, in which functional recovery could be predicted, and that Bland scale improvement could be expected if most axons remain.[10] Although there have been several studies on single-nerve damage, there are few studies on the prognosis and relationship between NCS, CMAP, and muscle strength in multiple root neuropathy with damaged nerve root bundles, such as in CES. This study aims to present a guideline that can be used for the objective evaluation of the degree of lower extremity paralysis caused by CES or the degree of lumbar nerve root injury via NCS by analyzing the correlation between the muscle strength of knee extensor (KE), ankle dorsiflexor (ADF), and ankle plantarflexor and NCS variables in patients with CES.

Aims of the study-To study median motor nerve conduction and ulnar nerve conduction velocity in young healthy individual in relation to isotonic exercise

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METHOD OF COLLECTION –Nerve conduction study [NCS] comprising of Motor Nerve conduction velocity [MNCV]and Sensory nerve conduction velocity was carried in both hands .The NCV parameters

EQUIPMENT AND APPARATUS

A computer system preinstalled with neurostim software

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NeuroPerfect EMG2000machine

Surface disc electrodes

Ring Electrodes

Pre amplifier

Medi aid system stimulator

Conducting electrode jelly

Mosso's Ergography

SAMPLE SIZE

The study was carried out in 60 healthy subjects in Guwahati Medical College

MEDIAN MOTOR NERVE CONDUCTION STUDY AND ISOTONIC EXERCISE

With the help of electrode /conducting jelly ,the recording was placed closed to motor of Abductor Policis Brevis and referance electrode 3cm distal at the metacarpophalangeal joint.The ground electrode is placed between stimulation and recording electrode .A supramaximal stimulation was given at first to wrist and then at below .

The difference between two latent period in msec gives the time taken by the impulses to travel from the elbow to the wrist.The distance between two stimulation point at the wrist

And the elbow was taken in mm and median motor nerve conduction velocity in m/sec was calculated .

For isotonic exercise the forearm was fixed properly on the ergograph by means of clamps.The middle finger was put into the loop to be pulled and a weight of 2kg was suspended ,the index finger

were inserted into the metal tubes provided in the ergograph . A series of maximal contraction without moving the shoulder at regular interval for 10 minutes and then for 15 minutes was done.A resting time of 5 minutes between each procedure was undertaken .Thus the median nerve conduction was recorded at rest ,then after 10 minutes of isotonic exercise on the ergograph

MEDIAN SENSORY NERVE CONDUCTION STUDY AND ISOTONIC EXERCISE

The Orthodromic conduction recording was done in this case.Here the recording electrode was placed 3cm proximal to the distal wrist crease 3cm proximal to the recording electrode.The ring electrode were placed in the second and third digit and it was used for stimulation of the nerve with the cathode placed at the proximal interphaleangeal .The grounding electrode was placed between stimulating electrode and grounding electrode.Supermaximal stimulation was

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ring electrode.The onset of latency in msec and the distance betweenstimulating electrode and the recording electrode. RESULTS AND OBSERVATIONS

The present study titled, " A study of Median nerve conduction velocities in young healthy individuals in relation to isotonic exercise in the Department of Physiology, Gauhati Medical college" was conducted in the department of Physiology, Gauhati Medical College, Guwahati from July 2017 till June 2018.

A total of 60 individuals of age group 18 to 25 years from both genders were selected randomly after a proper clinical history and examination.

The results and observations and relevant data were analysed using the Microsoft Excel, 2007, Graph Pad version 7.0.1. Data have been represented in Mean and standard Deviation (SD) wherever applicable and p value calculated. The results and observations of the study groups have been expressed in the form of tables complemented by Pie diagrams, columns, Grapgs, Scatter diagrams etc as per requirement.

DEMOGRAPHIC PROFILES:

The participants were divided accordingly to their gender as shown in the Table 5.1a and Fig 5.1a:

Table 5.1a: showing gender distribution

Gender	**Counts**	**Total**
Male	**34 (57%)**	**60**
Female	**26 (43%)**	

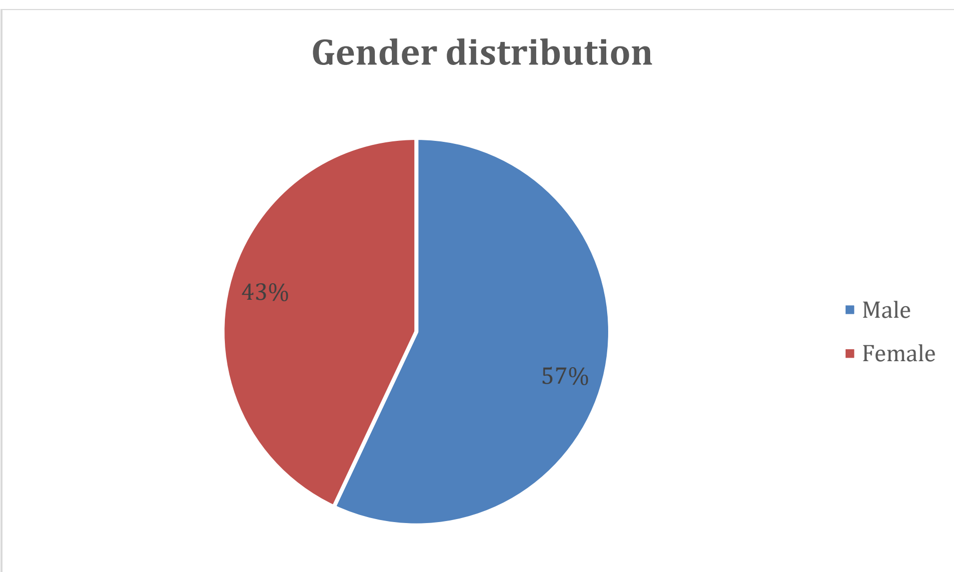

Fig 5.1a: showing percentage of gender distribution

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Interpretation: Table 5.1a and Fig 5.1a shows that out of 60 participants 34 were male participants accounting for 57% and 26 were female participanis accounting for 43 %. They were found to fulfil the inclusion criteria necessary for the study.

The mean of the age distribution in years of the participants for both genders were seen to be as shown in table 5.1b and Fig 5.1b:

Table 5.1b: showing mean age distribution between genders:

Gender	Age in Mean ± SD (years)
Male	21.147±2.0617
Female	19.462±1.2077

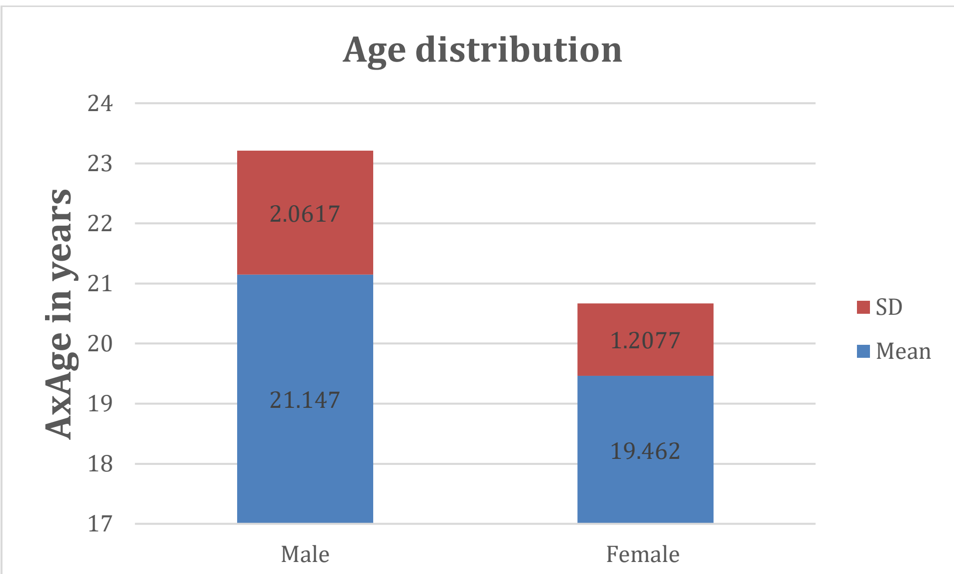

Fig 5.1b : Bar diagram showing mean age distribution for genders

Interpretation: Table 5.1b and Fig 5.1b shows that the mean age of male participants were 21.147± 2.0617 years and that of female participants was 19.462 ± 1.2077 years. Young healthy college going individuals were preferably sought from the age group of 18 – 25 years.

The hand dominance pattern of the individuals irrespective of the age and gender are shown in table 5.1c and figure 5.1c.

MEDIAN MNCV IN RELATION TO ISOTONIC EXERCISE /CONTRACTIONS

Table 5.2a : Distal latency (DL) in relation to Isotonic Exercise/Contraction

	Right Median MNCV (ms)			Left Median MNCV (ms)		
	At rest	10 min	15 min	At rest	10 min	15 min
Mean	3.83	3.814	3.806	3.841	3.828	3.827
SD	0.512	0.496	0.493	0.485	0.482	0.494
p value	0.9638			0.986		

N.B. p-value was calculated using ANOVA single factor. SD : Standard Deviation

*p< 0.05 is considered as significant.

Interpretation : Table 5.2a shows the distal latency in Mean ± SD at rest, after 10 minutes of isotonic exercise and after 15 minutes of isotonic exercise respectively **.** between each reading

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a resting time of 5 minutes was undertaken. For right Median MNCV, at rest DL was found to be 3.83 ±0.512, after 10 minutes it was 3.814±0.496 and then after 15 minutes DL was found to be 3.806 ± 0.493 respectively. For left Median MNVC, at rest the DL was found to be 3.841 ± 0.485 , after 10 minutes it was 3.828 ± 0.482 and then after 15 minutes DL was found to be 3.827 ± 0.494 respectively.

The p value was found to be > o.05 in both the cases and hence it was found to be not significant.

Table 5.2b : Amplitude in relation to Isotonic Exercise/Contraction

	Right Median MNCV (µV)			Left Median MNCV (µV)		
	At rest	10 min	15 min	At rest	10 min	15 min
Mean	6.902	6.88	6.89	6.909	6.9155	6.909
SD	0.529	0.531	0.532	0,5022	0.5062	0.5277
p value	0.9845			0.9977		

N.B. p-value was calculated using ANOVA single factor. SD : Standard Deviation

*p< 0.05 is considered as significant.

Interpretation : Table 5.2bshows the amplitude in Mean ± SD at rest, after 10 minutes of isotonic exercise and after 15 minutes of isotonic exercise respectively **.** between each reading a resting time of 5 minutes was undertaken. For right Median MNCV, at rest the amplitude was found to be 6.902±0.529, after 10 minutes it was 6.88±0.531 and then after 15 minutes amplitude was found to be 6.89 ± 0.532 respectively. For left Median MNVC, at rest the amplitude was found to be 6.909 ± 0.0.5022 , after 10 minutes it was 6.9155 ± 0.5062 and then after 15 minutes amplitude was found to be 6.909 ± 0.5277 respectively.

The p value was found to be > o.05 in both the cases and hence it was found to be not significant.

Table 5.2c : NCV in relation to Isotonic Exercise/Contraction

	Right Median MNCV (m/s)			Left Median MNCV (m/s)		
	At rest	10 min	15 min	At rest	10 min	15 min
Mean	55.014	55.201	55.298	54.778	55.003	55.239
SD	4.178	4.128	4.219	3.951	3.918	4.037
p value	0.9309			0.81673		

N.B. p-value was calculated using ANOVA single factor. SD : Standard Deviation

*p< 0.05 is considered as significant.

Interpretation : Table 5.2c shows the NCV in Mean ± SD at rest, after 10 minutes of isotonic exercise and after 15 minutes of isotonic exercise respectively **.** between each reading a resting time of 5 minutes was undertaken. For right Median MNCV at rest NCV was found to be 55.014± 4.178, after 10 minutes it was 55.201± 4.128 and then after 15 minutes NCV was found to be 55.298 ± 4.219 respectively. For left Median MNVC, at rest the NCV was found to be 54.778± 3.951, after 10 minutes it was 55.003 ± 3.918 and then after 15 minutes NCV was found to be 55.239 ± 4.037 respectively.

The p value was found to be > o.05 in both the cases and hence it was found to be not significant.

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Table 5.3a : Median MNCV in Mean ± SD between male and female:

	Distal latency (ms)	Amplitude (µV)	NCV (m/s)
Male (n= 34)	4.1747 ±0.3297	6.5718 ±0.33875	53.03875±2.8499
Female (n= 26)	3.3979± 0.3189	7.3338± 0.3494	57.602± 4.2648
Df	53	54	39
p value	0.001	0.001	0.001

NB: p value was calculated using unpaired t-test. * p<0.05 is considered as significant.

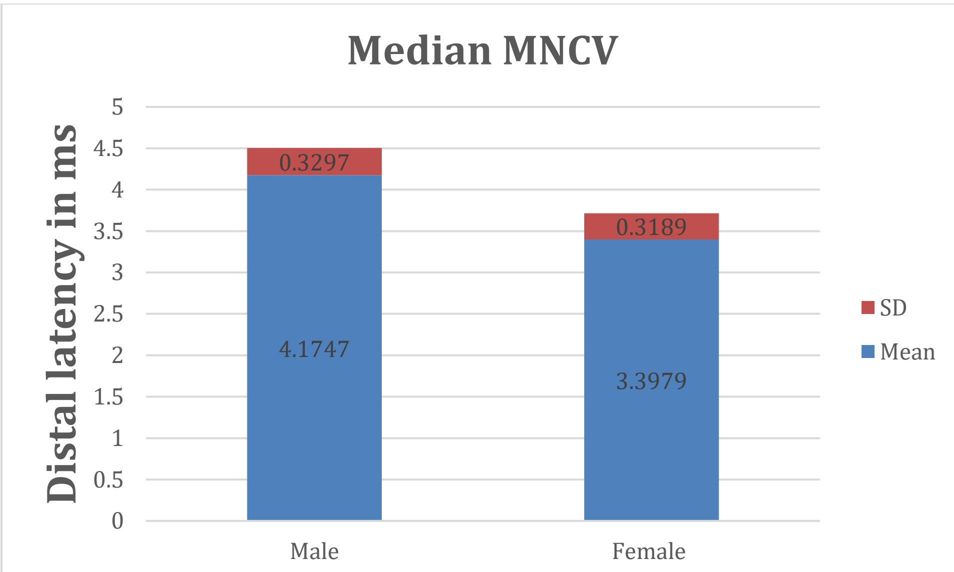

Fig 5.3a : Bar diagram showing distal latency in mean ±SD in males and females.

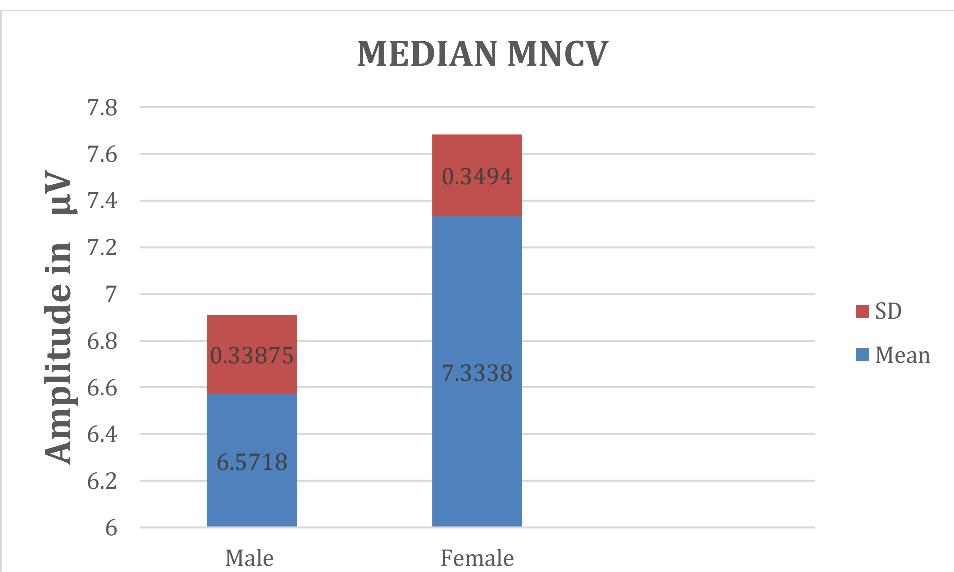

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Fig 5.3b: Bar diagram showing amplitude in mean ±SD in males and females.

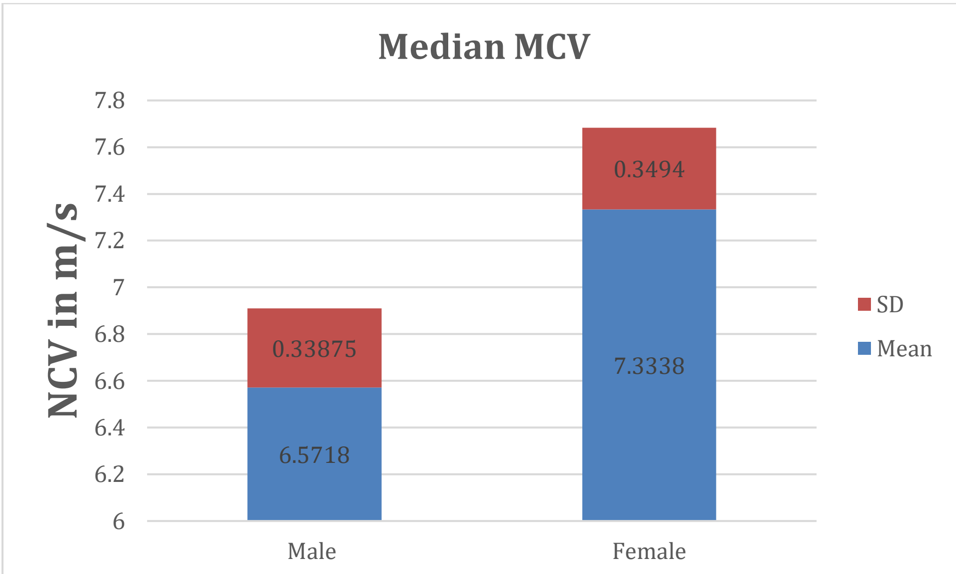

Fig 5.3c: Bar diagram showing conduction velocity in mean ±SD in males and females.

Interpretation : Table 5.3a, Fig 5.3a, 5.3band 5.3c showst he Median MNCV in mean ±SD for distal latency in ms, amplitude in µV and NCV in m/s. For males, the distal latency was found to be 4.1747± 0.3297, the amplitude was 6.5718±0.3875 and NCV was found to be 53.035±2.8499 respectively. For Females, the distal latency was found to be 3.3979± 0.3189, the amplitude was 7.3338±0.3494 and NCV was found to be 57.602±4.2648 respectively. The df(degree of freedom) was found to be 53 for latency, 54 for amplitude and 39 for the NCV respectively.

In the three comparisons for the p value, it was found to be < 0.05 and hence considered significant, the distal latency in case of males was found to be significantly higher than the females whereas amplitude and NCV parameters were significantly higher in females than in males.

MEDIAN SNVC IN RELATION TO ISOTONIC EXERCISE/CONTRACTIONS

Table 5.4a : Distal latency (DL) in relation to Isotonic Exercise/Contraction

	Right Median SNCV (ms)			Left Median SNCV (ms)		
	At rest	10 min	15 min	At rest	10 min	15 min
Mean	2.8387	2.831	2.8248	2.831	2.8122	2.8387
SD	0.5076	0.5073	0.4988	0.5073	0.5288	0.5076
p value	0.9898			0.9645		

N.B. p-value was calculated using ANOVA single factor. SD : Standard Deviation

*p< 0.05 is considered as significant.

Interpretation : Table 5.4a shows the distal latency in Mean ± SD at rest, after 10 minutes of isotonic exercise and after 15 minutes of isotonic exercise respectively **.** between each reading a resting time of 5 minutes was undertaken. For right Median SNCV, at rest DL was found to be 2.8387 ±0.5076, after 10 minutes it was 2.831±0.5073 and then after 15 minutes DL was found

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to be 2.8248 ± 0.4988 respectively. For left Median MNVC, at rest the DL was found to be 2.831 ± 0.5073 , after 10 minutes it was 2.831 ± 0.5073 and then after 15 minutes DL was found to be 2.8387 ± 0.5076 respectively.

The p value was found to be > o.05 in both the cases and hence it was found to be not significant.

Table 5.4b : Amplitude in relation to Isotonic Exercise/Contraction

	Right Median SNCV (µV)			Left Median SNCV (µV)		
	At rest	10 min	15 min	At rest	10 min	15 min
Mean	5.694	5.6875	5.6895	5.7992	5.7902	5.7593
SD	0.5059	0.5083	0.5102	0.5428	0.5952	0.6382
p value	0.9965			0.9317		

N.B. p-value was calculated using ANOVA single factor. SD : Standard Deviation

*p< 0.05 is considered as significant.

Interpretation : Table 5.4 b shows the amplitude in Mean ± SD at rest, after 10 minutes of isotonic exercise and after 15 minutes of isotonic exercise respectively **.** between each reading a resting time of 5 minutes was undertaken. For right Median SNCV, at rest the amplitude was found to be 5.694±0.5059, after 10 minutes it was 5.6875±0.5083 and then after 15 minutes amplitude was found to be 5.6895 ± 0.5102 respectively. For left Median MNVC, at rest the amplitude was found to be 5.7992 ± 0.0.5428 , after 10 minutes it was 5.7902 ± 0.5952 and then after 15 minutes amplitude was found to be 5.7593 ± 0.6382respectively.

The p value was found to be > o.05 in both the cases and hence it was found to be not significant.

Table 5.4c : NCV in relation to Isotonic Exercise/Contraction

	Right Median SNCV (m/s)			Left Median SNCV (m/s)		
	At rest	10 min	15 min	At rest	10 min	15 min
Mean	46.612	46.687	46.747	46.687	47.314	46.612
SD	4.3569	4.3183	4.2586	4.3183	5.379	4.3569
p value	0.9873			0.6867		

N.B. p-value was calculated using ANOVA single factor. SD : Standard Deviation

*p< 0.05 is considered as significant.

Interpretation : Table 5.4 c shows the NCV in Mean ± SD at rest, after 10 minutes of isotonic exercise and after 15 minutes of isotonic exercise respectively. between each reading a resting time of 5 minutes was undertaken. For right Median SNCV, at rest the amplitude was found to be 46.612± 4.3569, after 10 minutes it was 46.687±4.3183 and then after 15 minutes amplitude was found to be 46.747 ± 4.2586 respectively. For left Median SNVC, at rest the amplitude was found to be 46.687 ± 4.3183 , after 10 minutes it was 47.314 ± 05.379 and then after 15 minutes amplitude was found to be 46.612 ± 4.3569respectively.

The p value was found to be > o.05 in both the cases and hence it was found to be not significant.

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Table 5.5a : Median SNCV in Mean ± SD between male and female:

	Distal latency (ms)	Amplitude (µV)	NCV (m/s)
Male (n= 34)	3.1856 ±0.2891	5,389±0.361	45.856±4.1418
Female (n= 26)	2.385± 0.3465	6.092± 0.377	47.6 ± 4.5124
Df	46	51	51
p value	0.001	0.001	0.11799

NB: p value was calculated using unpaired t-test. * p<0.05 is considered as significant.

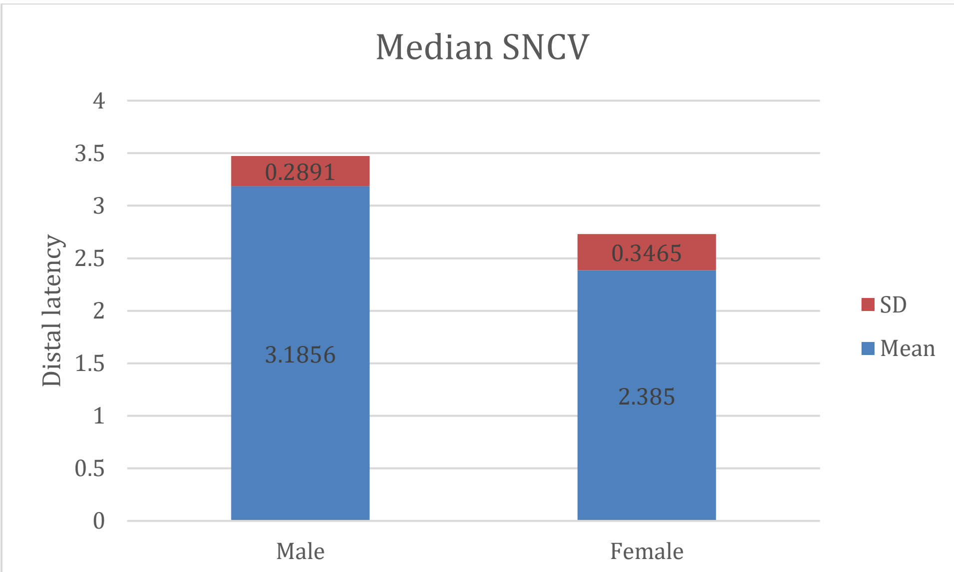

Fig 5.5a : Bar diagram showing distal latency in mean ±SD in males and females.

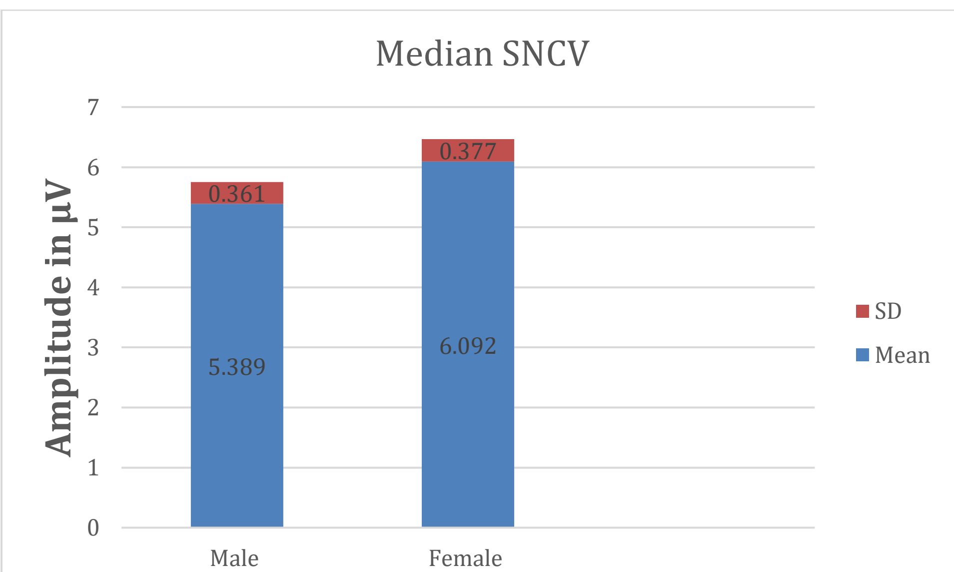

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Fig 5.5b: Bar diagram showing amplitude in mean ±SD in males and females.

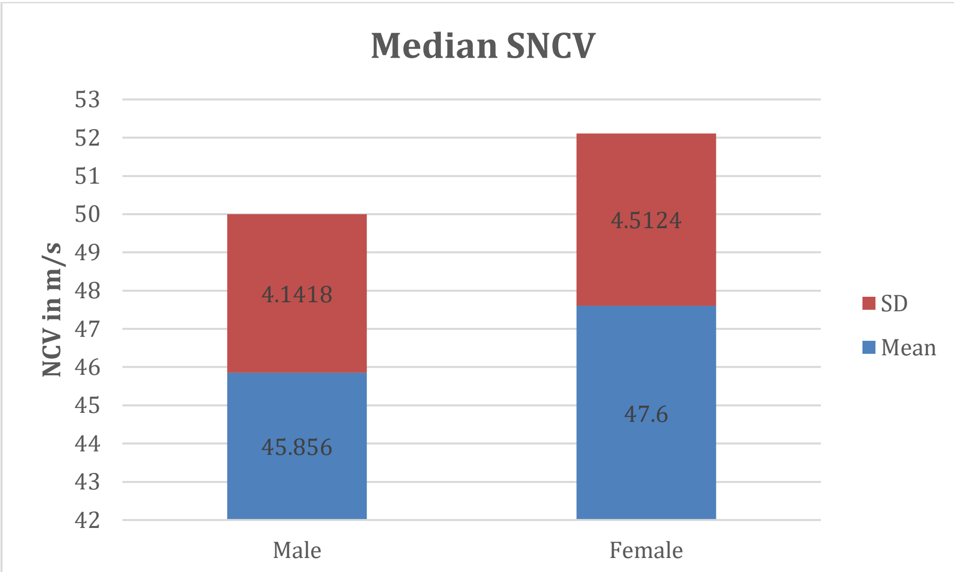

Fig 5.5c : Bar diagram NCV in mean ±SD in males and females.

Interpretation : Table 5.5a, Fig 5.5a, 5.5b and 5.5c shows the Median SNCV in mean ±SD for distal latency in ms, amplitude in µV and NCV in m/s. For males, the distal latency was found to be 3.1856± 0.2891, the amplitude was 5.389±0.361and NCV was found to be 45.856±4.1418 respectively. For Females, the distal latency was found to be 2.385± 0.3465, the amplitude was 6.092±0.377 and NCV was found to be 47.6±4.5124 respectively. The df (degree of freedom) was found to be 46 for latency, 51 for amplitude and NCV respectively.

The p value for NCV was found to be > 0.05 and therefore was considered as not significant. Whereas p value for distal latency and amplitude was found to be < 0.05 and hence considered significant. The distal latency in case of males was found to be significantly higher than the females. However amplitude was significantly higher in females than in males.

DISCUSSION: The present study entitled “A study of Median nerve conduction velocities in young healthy individuals in relation to isotonic exercise in the department of Physiology, Guahati Medical College) was undertaken to measure , compare & provide an overview of how NCV parameters of upper limb response to isotonic exercise/ contractions & to see any changes that may take place following isotonic exercises/ contractions. The study was carried out on 60 young healthy individuals who made the inclusion criteria. The median nerve was considered for the study. The nerve conduction study was done & three consecutive readings were taken i.e first reading at rest, followed by second reading after 10 min of isotonic exercise on ergograph & the third reading following 50 min of ergographic exercise. A 5 min rest time was allotted in between each reading to allow adequate rest to the muscles. Also, the variations in NCV parameters of males & females.

The NCV parameters that were studied comprised of median MNCV & SNCV. The parameters recorded on MNCV were CMAP (compound Muscle Action Potential) for distal latencies,

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amplitudes & NCV ; and the parameters recorded in SNCV was SNAP (Sensory Nerve Action Potential) for distal latencies, amplitudes & NCV[1].

In the present study there was no significant variation in the NCS parameters for distal latencies, amplitudes & NCV for median nerve following isotonic exercise/Contraction for 10min & 15 min. this was evident by p value of >0.05.

These findings contrast it some of the other studies which brings the following facts to light as discussed below with relevant earlier studies & findings by different researchers & scholars.

In 2013 Broges et al in Brazil conducted a study to measure the MNCV of the median & common fibular nerves in three groups of sport modalities viz groups middle distance runners (MRG), groups of sprint runners (SRG) & groups of hand ball players against a control group (CG). In their study they found significant difference between trained & untrained individuals for the SRG & MRG and in the MRG only the DL presented significant difference compared with the control group[8]. The probable cause for this was explained by Elam in 1987 in his study wherein he stated that lower body fat percentage of the individuals have an opposite relation with MNCV & may have lead to better efficiency of the integration function of the neuromuscular system facilitating the neural transmission[89]. A similar study done by Wei et al in 2005 suggested that the functional overload to which these athletes are exposed to may have contributed to the increase in the diameter of the nerve fibres& the myelin sheath which in turn leads to higher nervous conduction velocity[65].

Bonfiglioli et al in 2005 found a significant reduction of NCS parameters & association of early symptoms of carpal tunnel syndrome in workers performing repetitive jobs[93]. Another study done by Stenson et al on industrial workers in 1993 found that in industrial asymptomatic population the mean Median sensory amplitudes were smaller significantly & the motor & distal latencies were significantly longer compared to the control group. They suggested that the possible cause may be the long term exposure of the workers to high grid forces as compared to those who were not exposed.

In the present study the variations of NCV parameters to gender were also compared & studied. We found significant variations in the median nerve parameters. In the case for median MNCV it was found that the distal latencies was significantly longer for males ($p<0.05$) than in females. However the amplitude & conduction velocities were found to be higher & faster in females than males ($p<0.05$). A similar result for median SNCV was found for distal latencies being significantly longer for males than females & amplitude being higher in females than in males (bot $p <0.05$) but the conduction velocity between male & female showed no significant changes].

A similar result was documented by Misra & Kalita where they reported that females have shorter latencies & higher NCV compared to males[1]. A similar result was obtained by Gakhar et al in 2013 wherein they found that the latencies of both median & ulnar nerves for motor & sensory were longer in males than females. The amplitudes were higher in females & conduction velocity faster than females than males[95]

Conclusion

The present study was undertaken to provide an overview of how peripheral nerves responds to isotonic exercises/contractions and to see any variations in the NCS parameters in relation to gender of the individuals.

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The study did not find any significant variations in the parameters of CCS in relation to isotonic exercises/contractions. However, the study did manage to find a significant variation in the NCS parameters in relation to gender which was in accordance with the previous studies. The study showed that the distal latencies tended to be longer in males as compared to females. The amplitudes were found to be higher and the conduction velocities tended to be faster in females as compared to males.

The study had various limitations as it was across-sectional study implementing a cross-sectional analysis to find out the response of Median nerve to short duration of isotonic exercises/contractions. Also various confounding factors such as duration of exposure to isotonic exercises/contractions, age height, BMI, temperature etc needs to be included and adjusted for the statistical accuracy in the study to find out the changes in the variables independent of these factors.

Moreover the sample size (n=60) was small which further limited the results of the study appropriately.

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