Available Online at http://www.recentscientific.com

ISSN: 0976-3031

International Journal of Recent Scientific Research
Vol. 6, Issue, 6, pp.4477-4482, June, 2015

International Journal of Recent Scientific Research

RESEARCH ARTICLE

STUDY OF NERVE CONDUCTION VELOCITY IN TIBIAL NERVE OF HEALTHY MALE AND FEMALE OF DIFFERENT AGE GROUPS

Kumar A[1], Prasad A [2], Dutta A[3]and Roohi F[4]

[1,3] Department of Physiology, Index Medical College and Hospital & Research Centre, Indore MP
[2]Department of Anatomy, Index Medical College and Hospital & Research Centre, Indore MP
[4]Department of Physiology, Index Medical College, Hospital & Research Centre, Indore MP

ARTICLE INFO

Article History:

Received 5th, May, 2015
Received in revised form 12th, May, 2015
Accepted 6th, June, 2015
Published online 28th, June, 2015

Key words:

Nerve Conduction Velocity (NCV), Motor Nerve Conduction Study (MNCS), Compound Muscle Action Potential (CMAP), Tibial Nerve, Gender.

ABSTRACT

The reference values for NCV for different nerve vary considerably from population to population & from region to region. There are number of factors that affect NCV like age, gender & temperature. The importance of MNCS for the evaluation of the functional status of the patient's tibial nerve for comparing the effect of therapeutic intervention with various diseases that affect NCV is well known in various studies.

Aims: To establish the normal electrophysiological data, **NCV variables** i.e. CMAP for the Rt. Tibial Nerve in normal healthy adults and **to study the effect of gender** on NCS variables in normal healthy adults.

Materials and Method: All together 38 females and 80 male subjects, from first year MBBS, BDS, Staff members of Index Medical College Hospital & Research Center, Indore (M.P), between age group of 20 to 60 years were evaluated. All tests were done on JAVA RMS Aleron-201 series. Analysis was done using statistical package for social sciences (SPSS) 10.0 version.

Results: The mean ages of male were more than that of female with P value non-significant. The mean NCV knee – ankle of male is more than that of female with P value = 0.020 which is found to be statistically highly significant. Its range is between (18.17-70.34 m/sec).

Conclusion: The normative conduction parameter of commonly tested peripheral nerve in lower limb could be used for the evaluation of peripheral nerve injury. Gender has definite effect on NCS variables. Diagnostic conclusion could also be made from the nerve conduction study data.

INTRODUCTION

Nerve conduction velocities (NCV) can be easily measured on peripheral nerve. Electro-diagnostic assessment of peripheral nerve includes two major components, nerve conduction study (NCS) and needle electromyography (EMG) **(**Mishra U K *et al.* 2nd Ed. B.I. Churchill livingstone.)

There are several factors which may influence nerve conduction study such as Age, Height, Gender, BMI etc. They have to be taken into consideration while doing nerve conduction study. However these factors vary according to different geographic region. Many studies had been published regarding normative data from western countries with cold climatic condition (Chouhan S. 2011).

A nerve conduction study is a test commonly used to evaluate the function especially the ability of electrical conduction of the motor and sensory nerves of the human body. Nerve conduction velocity (NCV) is a common measurement made during the test which measures how quickly electrical impulses move along a nerve. It is often done at the same time as an EMG, in order to exclude or detect muscle disorder.

A healthy nerve conducts signals with greater speed and strength than a damaged nerve. The speed of nerve conduction is influenced by the Myelin Sheath the insulating coat that surrounds the nerve. Most neuropathies are caused by damage to the nerve axons rather than damage to the Myelin Sheath surrounding the nerve.

The Rt. tibial nerve is among the nerve studied in lower limb. It supplies muscles of back of leg and cutaneous sensation of lower limb. Sufficient stimuli from the electric stimulator can trigger nerve impulses once the action potential threshold of a nerve fibre is reached, its electrical impulses will propagate at a rate of hundred meters per second. The velocity is directly dependent on the diameter of fibre, myelination and temperature.

Nerve conduction studies are mainly for the evaluation of parasthesias (numbness, burning and tingling or weakness) of arm and leg. This type of study required dependence on the part

*Corresponding author: **Kumar A**
Department of Physiology, Index Medical College and Hospital & Research centre, Indore MP

by the symptom presented. A physical examination and complete present and past history also helps to detect the investigation. It enables clinician to differentiate the two major groups, peripheral degeneration and axonal degeneration. (Mishra U K *et al*. 2nd Ed. B.I. Churchill livingstone.)

The primary purpose of this study was to provide normative electrophysiological data for commonly tested lower limb nerves in carefully screened normal healthy adults individual using standard distance and temperature control.

Aims and Objectives

1. To establish the normal electrophysiological data NCV variables i.e. CMAP for the Rt. Tibial nerve in normal healthy adults.
2. To study the effect of gender on NCV in Rt. Tibial nerve in normal healthy adults.
3. The objective of this present study was to determine reference value for motor NCV in young healthy adults.

MATERIAL AND METHODS

Study Population

The present study was carried out in neurophysiology laboratory of physiology dept. of Index Medical College Hospital and Research Centre, Indore (MP) from June 2012 to March 2013. The subjects included in the study were MBBS students, BDS students, Nursing students, and staff member of this institute.

Selection Criteria

Healthy individual of different age group (20-60) yrs. free of any neurological disorder or problem or any history of it.

Exclusion Criteria

1. Any individual of neurological disorder or neuromuscular transmission disorder.
2. Any individual suffering from diabetes.
3. Any individual suffering from renal disorder.
4. Any individual suffering from weakness of upper limb and lower limb or myopathy.

Protocol

Informed consent was obtained from the individual. The examination was performed in a calm setting after the patient was thoroughly briefed about the procedure and rest for 30min. Considerable gap was given between examination, so as to minimize discomforts to subject as well as to enhance their enthusiastic participation.

Electrophysiological Methods

All tests were done on JAVA RMS Aleron-201 series. The JAVA RMS Aleron-201 series is a clinically customized for a quick and flexible operation. Its software and hardware is particularly designed with the consideration of actual test being done in the field machine which can be totally customized for various test, nerve muscle and size with computer choice of amplifier filter and sweep setting and also analytical setting like marker.

The nerve conduction study was performed in a separate room without any air-conditioning facility but the room temperature was between 30-31° C. Further subject should be made comfortable with the laboratory set up, so as to completely relax. The tibial nerve was stimulated either at the distal, 6cm from ankle or proximal (popliteal fossa) sites respectively and recorded at the abductor hallucis brevis muscle.

For each subject data of distal motor lat1, lat2, motor nerve conduction velocity (MNCV) and compound muscle action potential (CMAP) from the distal stimulation were included from statistical analysis in this study.

CMAP has following component which is defined as

1. ***Amplitude-*** It is measured from base line to the positive peak.
2. ***Latency1:-***This is the time from the stimulus to the initial positive deflection off the baseline.
3. ***Latency2:-*** Time taken for 1st deflection of CMAP after stimulation at S2 (site).
4. ***Duration: -*** It correlates with the density of small fibres. It is measured from the onset to the positive peak.
5. ***Area: -*** The area comes from the difference between the lat1 and lat2. However it needs computer analyses.

In each subject orthodromic motor parameter of the nerve were measured. Surface electrodes were used. The recording electrodes were fixed to the subject's skin using adhesive tape. No special skin preparation was needed. The targeted nerve was supra maximally stimulated using a square wave current with duration 0.2ms and the action potential was picked up by the recording electrode. The length of each nerve was estimated with a flexible measuring tape. For safety a ground electrode was placed in between the stimulating and recording electrode. (Mishra U K *et al*. 2nd Ed. B.I. Churchill livingstone.)

Principle of Motor Nerve Conduction:- The motor nerve is stimulated at least at two points along its course. The pulse is adjusted to record a compound muscle action potential (CMAP). It is important to ensure a supra maximal stimulation keeping the cathode close to the active recording electrode. This prevents hyper polarization effect of anode and anodal conduction block. The surface recording electrode was commonly used and placed in belly tendon montage, keeping the active electrode close to the motor point and reference to the tendon. Ground electrode was placed between stimulating and recording electrode. A biphasic action potential with initial negativity was thus recorded. Surface stimulation of healthy nerve requires a square wave pulse of 0.1ms duration with an intensity of 5-40mA. Filter setting for motor nerve conduction study was 20Hz to 3 KHz and sweep speed was 10ms/division. The measurements for motor nerve conduction study include the onset latency, duration and amplitude of CMAP and nerve conduction velocity. The latency is the time in milliseconds from the stimulus artifact to the first positive deflection CMAP

for better visualization of the take off, the latency should be measured at a higher gain than the one used for CMAP amplitude measurement.

The latency is a measure of conduction in the fastest conducting motor fibers. It also includes neuromuscular transmission time and the propagation time along the muscle membrane from the baseline to the positive peak. The amplitude co-relates with the no. of nerve fibers. The duration of CMAP was measured from the onset to the positive peak. Duration Co-relates with the density of small fibers. The area under CMAP was also measured. However it was computer generated analysis.

Motor nerve conduction velocity was calculated by measuring the distance in millimeter between two points of stimulation, which is divided by the latency difference in millisecond. The nerve conduction velocity was expressed as m/s.

Conduction velocity: - $\frac{D}{PL-DL}$ m/s (Pal G.K. 2011)

Where PL is the proximal latency and
DL is the distal latency and
D is the distance between the Proximal and distal latency.

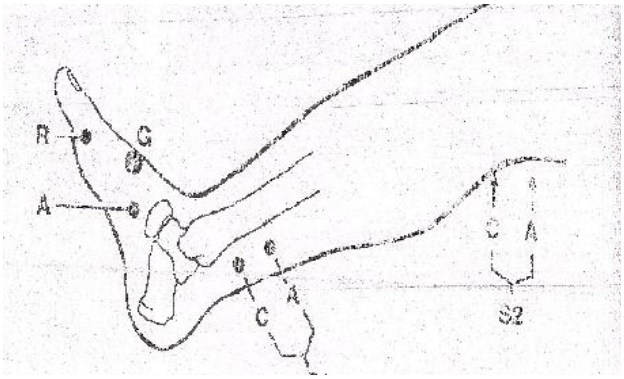
Ethical approval

An approval from institutional ethical committee was obtained.

Recording Procedure

Motor NCS Variables: - Estimator with water soaked felt tips were placed at rt. Tibial nerve which was recorded as:-

Rt. Tibial Nerve



Electrode Placement

Tibial nerve is the continuation of the sciatic nerve below opliteal fossa. In leg it supplies both the head of gastrocnemius and soleus along with deep muscles of back of leg. At the ankle, the nerve passes under the flexor retinaculum and divides into medial and lateral planter nerve after giving a calcaneal branch.

Position:- The study was performed in the supine position.

Active Electrodes:- Placement was over the medial foot, slightly anterior and inferior to the navicular tubercle at the most superior point of the arch formed by the junction of plantar skin and dorsal foot skin.

Reference Electrode:- Placement was slightly distal to the 1st metacarpophalangeal joint on the medial surface of the joint.

Ground Electrode:- Placement was on the dorsum of the foot.

Stimulation Point(S1):-The cathode was placed 8cm proximal to the active electrode (measured in a straight line with the ankle in central position) and slightly posterior to the medial malleolus. The anode is proximal.

Stimulation Point(S2):-The cathode was placed at the mid-popliteal fossa or slightly medial or lateral to the mid-line. The anode is proximal.

Nerve Fibre Tested:-S1 and S2 nerve roots through the anterior division of the lumbosacral plexus and the sciatic nerve.

Machine Setting:- Sensitivity-10mv/division, low frequency filter-20H**z**, high frequency filter=3 kHz and sweep speed-10msec/division.

Ankle stimulation should be approximately half-way between the medial malleolus and the Achilles tendon. Care should be taken not to stimulate the peroneal nerve concomitantly at the knee. Stimulation should be close to the midline of the popliteal fossa but the stimulator may need to be moved slightly or laterally to obtain an optimal response watching for the direction of foot motion on stimulation which would help to ensure that the proper nerve was stimulated. (Buschbacher RM. 1978)

Applied

Entrapment of tibial nerve leads to tarsal tunnel syndrome.

Statistical Methods

Analysis was done using statistical package for social sciences (SPSS) 10.0 version. Values obtained were expressed in the form of mean and standard deviation (SD). P-value was taken as significant if it was found to be less than 0.05. The test used was z-test with two sample mean.

Observations And Results

Table No. 1 and graph No. 1 shows that the mean ages of the study subjects (male 35.4 + 12.7 and female 33.8 + 13.7) were not significantly different between genders. The mean NCV of rt. Tibial nerve (knee – ankle segment) of male is more than that of female with P value = 0.020 which is found to be highly-significant. Its range is in between (18.17-70.34 m/sec).

Table No. 2 and graph no. 2 & 3 shows

Knee- The mean difference for all parameters i.e. Lat1, Lat2, Duration, Amp and Area show non-significant differences ($p>0.05$) between gender.

Ankle - The mean difference for parameters Lat1 is found to be non significant ($p>0.05$) between gender, whereas mean difference for parameters Lat2, Duration, amplitude and area are statistically significant ($p<0.05$).

DISCUSSION

118 healthy individual were studied over a period of 1 year from June 2012 to May 2013 in neurophysiology lab. of physiology dept. of Index Medical College Hospital and Research Centre. There were 80 male and 38 females in the study group. The study shows the association of biological factors i.e. Age and gender which was further supported by previous studies as:-

Age

Present study showed a difference in the various parameters for the CMAP of right Tibial Nerve for Knee ankle segment. For knee present study showed a increase in lat**1**, for older subject as compared to younger while lat**2,** amp, duration showed a decrease for older as compared to younger while area slightly increases in case of older as compared to younger and p value for all parameter (CMAP) is found to be statistically non-significant. In contrast to present study for popliteal fossa Thakur[5] *et al* found slightly increase in lat**1**, lat**2** for Rt. Popliteal fossa in case of older subject in comparison to younger one and was statistically non significant while amplitude was also higher in older group with statistical significance. Duration was more for younger as compared to older one and was found statistically highly significant. For ankle in present study lat**2,** duration, amplitude, area get decreased in case of older in comparison to younger and was found statistically significant and while for lat**1**, older has more than that of younger and was statistically found to be non-significant.

Thakur[5] *et al* didn't calculated area of CMAP for popliteal fossa. In adult nerve conduction velocity decreases with age as it starts to decline at a rate of 1.5 percent per second. This was related to gradual loss of neuron with aging.

The age factor was negatively correlated to amplitude in motor nerve conduction study reported by Chi – Ren – Huang[6] *et al.* Saufi M[7] *et al* in their study on motor tibial nerve in healthy subject found that conduction velocity decreases while latency increases with advancing age. The present study correlates with the Saufi M[7] *et al***.**

Gender The following parameters were analyzed in the present study in relation to gender as

Comparison of effect of age of Various studies comprising of different components Of CMAP and NCV with the present study

S. No.	*Study By*	*No. of Subject.*	*Age Gr.*	*Segment*	*Lat1(ms)*	*Lat2(ms)*	*Duration (ms2)*	*Amp. (mv)*	*Area (mu)*	*NCV*
1.	Kathleen M[8] *et al*	80	Young females P value	Ankle	4.2±0.7 0.003	4.3±0.6 <0.001	-------	7.9±2.9 <0.001	------	45.3±3.1 <0.001
2.	Thakur D[5] *et al*	34	Younger Older P value	Rt. Popliteal fossa	10.7±0.99 11.0±1.3 0.551	40.6 ± 43 42.15 ± 6.37 0.088	7.28± 1.12 0.28± 0.81 0.004	3.74±1.22 7.94± 2.71 0.033	------	6.28±0.81 7.28±1.12 <0.01
3.	Chi- Ren Huang[6] *et al*	101	Younger Older	Rt. Popliteal fossa	4.0±0.7 4.9±1.0	4.7±1.1 4.9±1.0	-----	16.5±4.7 8.8±4.0	-----	47.5±2.8 49.1±5.2
4.	Saufi M[7] *et al*	250	20-59	Ankle	------	------	------	-------	-------	50.73±4.60
5.	Present Study	80	Younger (20-60) Older P value	Knee	11.68 ± 5.39 12.02 ± 8.11 0.864	25.98 ± 8.59 24.88 ± 9.98 0.665	14.66 ± 9.27 12.51 ± 8.05 0.339	9.6 ± 10.7 6.74 ± 4.89 0.149	6.51 ± 7.82 6.74 ± 4.89 0.882	62.9 ± 27.7
			Younger Older P value	Ankle	6.01 ± 1.80 6.76 ± 1.18 0.120	17.18 ± 5.06 16.09 ± 2.40 0.222	11.18 ± 5.81 9.32 ± 1.67 0.042	11.31 ± 7.66 7.51 ± 4.50 0.016	29.4 ± 19.7 18.6 ± 12.5 0.008	

Comparison of effect of gender on motor nerve conduction variables(CMAP) with other study

S.No.	*Study By*	*Motor No.*	*Gender*	*Site*	*Lat1*	*Lat2*	*Duration*	*Amplitude*	*Area*	*NCV*
1.	**Thakur D[5]**	Rt. Tibial Nerve	Male Female P Value	Rt. Popliteal Fossa	11.34 ± 1 10.22 ± 1 0.003	43.38 ± 4.57 38.72 ± 5.32 0.001	7.12 ± 1.26 6.41 ± 0.72 0.040	16.57 ± 5.82 12.3 ± 5.83 0.023	------ ------- -------	--------
2.	**Present Study**	Rt. Tibial Nerve	Male Female P Value	Knee	12.23 ± 7.15 12.26 ± 6.96 0.982	25.20 ± 8.76 27.23 ± 8.90 0.248	147 ± 15.6 14.98 ± 9.47 0.919	49.3 ± 84.4 27.4 ± 62.2 0.116	150 ± 258 118 ± 277 0.545	NCV knee-ankle segment Male = 62.9 ± 27.7 Female= 48.5 ± 32.0 P Value = 0.020 Highly Significant.
			Male Female P Value	Ankle	6.36 ± 1.53 5.97 ± 1.77 0.250	15.76 ± 3.77 18.08 ± 3.10 0.016	8.97 ± 1.47 12.11 ± 5.79 0.002	8.47 ± 6.54 11.17 ± 7.43 0.048	19.7 ± 19.4 33.2 ± 21.5 0.001	

1. ***Age*:-** Out of total no. of cases 80 male with M±Sd of 35.4 ± 12.7 and 38 female with M±Sd of 33.8 ± 13.7 in the age range of 20 to 60 years and p value = 0.54 which is found to be statistically non-significant.
2. The NCV of Rt. Tibial nerve (Knee - ankle segment) for male n=80 with M±Sd of 62.9 ± 27.7 which was more than that of female n=38 with M±Sd of 48.5 ± 32.0 with p value = 0.020 and was highly significant statistically.

3. ***CMAP***:- In previous reports, gender difference in some NCS can be largely explained by height although amplitude difference still persist despite correction report. Gender has definite effect in NCV variables as:-

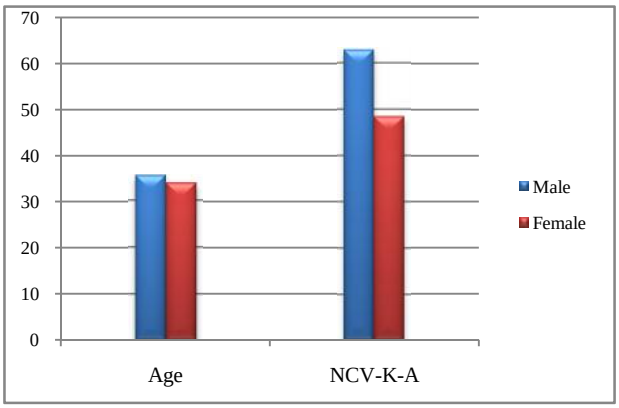
1. ***For knee:*** **-** Lat2, and duration was slightly increased in females and it was statistically non-significant. Amp and area was increasing in male as compare to female and was non-significant.
2. ***For ankle*** :- In ankle there was reduction in lat**2**, dur, amp, area in male as compared to female and was found to be statistically significant. Males had longer Lat**1** as compared to female and were non-significant.
3. The NCV of Knee - ankle segment of male was more than that of female and was significant.

In contrast to present study, Thakur D[5] *et al* found an increase in all component of CMAP for males as compared to female and was statistically significant for Rt. Popliteal fossa.

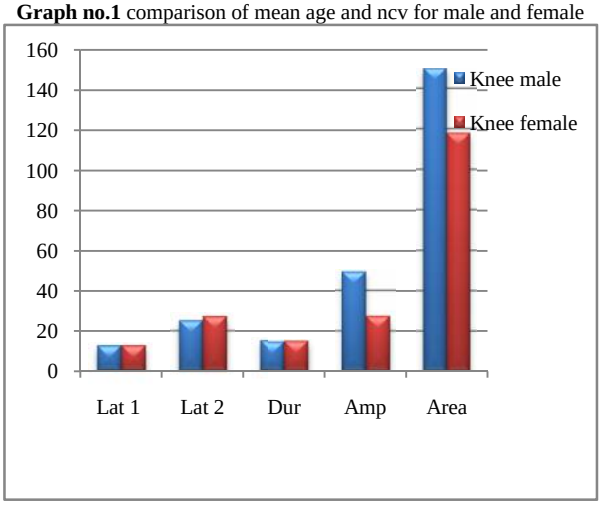
Table. No. 1 comparison of mean age and ncv for male and female

S. NO.	*Parameter*	*Range*	*Male n = 80*	*Female n =38*	*Statistical Analysis*
			Mean ± SD	Mean ± SD	P Value =0.542
1.	Age	20-60 Yrs.	35.4 ± 12.7	33.8 ± 13.7	Df. =68 Non significant
2.	NCV of Rt. Tibial Nerve(knee-ankle segment)	18.17-70.34 m/s	62.9 ± 27.7	48.5 ± 32.0	T = 2.38 P = 0.020 > 0.001 Df. 64 highly significant.

parameter	Male	Female
Age	35.4	33.8
NCV-K-A	62.9	48.5



Graph no.1 comparison of mean age and ncv for male and female



Knee

Graph no. 3 showing effect of gender on motor nerve conduction variables (cmap) of ankle region

Table 2 Effect Of Gender On Motor Nerve Conduction Variables (Cmap)

S.No.	Motor nerve	Site of stimulation	Age range	Gender	No. of subject	Compound muscle action potential CMAP variables M±SD	M±SD	M±SD	M±SD	M±SD
						Lat 1 (ms)	Lat 2 (ms)	Dur (ms)	Amp (mv)	Area (mv)
				(i) Male	80	12.23±7.15	25.20±8.76	14.7±15.6	49.3±84.4	150±258
				(ii)Female	35	12.26±6.96	27.23±8.90	14.98±9.47	27.4±62.2	118±277
		1. Knee	20-60		Statistical analysis	T=0.02 P=0982 non Significant	T=1.16 P= 0.248 Non significant	T=010 P= 0.919 Non significant	T=1.59 P= 0.116 Non significant	T=0.61 P= 0.545 Non significant
I	Rt median nerve			(i) Male	80	6.36±1.53	15.76±3.77	8.97±1.47	8.47±6.54	19.7±19.4
				(ii)Female	35	5.97±1.77	18.08±5.10	12.11±5.79	11.37±7.43	33.2±21.5
		2. Ankle	20-60		Statistical analysis	T=1.16 P=0.250 non Significant	T=2.45 P=0.016 Significant	p=0.002 Df=40 Significant	T=-2.01 P=0.048 Significant	T=-3.53 P=0.001 Df=53 Significant

Table No. 2 shows: Knee- The mean difference for all parameters shows non –significant differences between genders.
Ankle- The mean difference for parameters **Lat2, Dur, Amp and Area** shows significant differences between genders except Lat1.

While present study showed that for knee all the CMAP variables are increased in females **except** amplitude and area. For the ankle it is observed that in present study all the CMAP variables is increased in females **except** lat1 and NCV knee – Ankle segment. In present study area was also calculated because of computer analysis. Thakur *et al* didn't calculated area and NCV for the gender of upper and lower limb.

Soudman R[9] *et al* reported that nerve conduction velocity is not influenced much by gender . Gender differences in nerve conduction parameter could also be due to difference in height.

While according to Kimura[10] *et al* gender related amplitude differences persist despite adjustment of height. As male has thicker subcutaneous tissue which provides greater distance between digital nerve and surface ring electrode as compare to female.

CONCLUSION

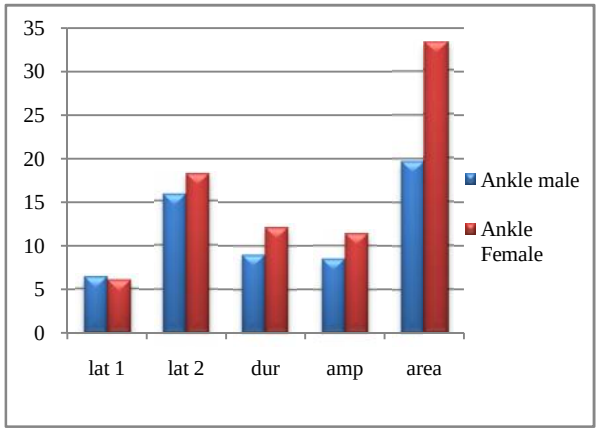
In conclusion the normative conduction parameter of commonly tested peripheral motor nerve in lower limb was

established in our neurophysiology laboratory of the department of Physiology of our institute.

Graph no. 2 showing effect of gender on motor nerve conduction variables (cmap) of right knee region

CMAP	Knee male	Knee female
Lat 1	12.23	12.26
Lat 2	25.2	27.23
Dum	14.7	14.98
Amp	49.3	27.4
Area	150	118

CMAP	Ankle male	Ankle Female
Lat 1	6.36	5.97
Lat 2	15.76	18.08
Dur	8.97	12.11
Amp	8.47	11.37
Area	19.7	33.2



Ankle

The present study could be used for the evaluation of peripheral nerve injury. Diagnostic conclusion could also be made from the nerve conduction study data. The study created a preliminary normative data of our population abet in a limited sample. A study with larger sample size will certainly add more strength. Our present studies have many similarities and some dissimilarity with the reported NCS variable (i.e. CMAP). The present study reported high conduction velocity as compared to other worker i.e. (Thakur[5] *et al*).

The probable reason could be true differences among population and small sample sizes, nevertheless the normative data may be used as preliminary working reference while reporting clinical NCS finding. In this way these studies hold a big strength.

References

1. Buschbacher RM. median Nerve motor condition to the abductor pollicis brevis *Am J Pugs Med.Rehabil.*1978 Nov, (6 Suppl) S1-8.
2. Chi-Ren=H, Wen-Nen C etal. Effect of age, gender, Height and weight on late responses and nerve conduction study parameter. Acta Neurol Taiwan.2009; 18(9) 242-249.
3. Chouhan S, Motor Nerve conduction studies of median nerve in young adult group. *Indian Journal of Biological and Medical Research* 2011, 3(2),1751-1753.
4. Kathleen Ma etal. Clinical utility of tibial motor and sensory nerve conduction studies with motor recording from the flexor hallucis brevis- a methodological and reliability study. *Journal of foot and research* 2011 15(2) 236-239.
5. Kimura J, Murphy MJ, Varga V *et al*. Electrophysiological study of anomalous innervations of intrinsic hand muscles. Neurology 1975, 51, 1387-1427.
6. Mishra UK, Kalita J. Clinical Neurophysiology – Nerve conduction, Electromyography and evoked potentials. 2nd Ed.B.I. Churchill livingstone.
7. Pal G.K. Textbook of Practical Physiology. 3rd Edition 2011.
8. Saufi M, Awang AS, Abdullah *et al*. Nerve conduction study among healthy Malays. The influence of Age, Height and B.M.I. on median, ulnar, common peronael and sural nerve. *Malagsian Journal of medical sciences*2006 vol-13 July 19-23.
9. Soudmand R , Ward LL *et al*. Effect of height on nerve conduction velocity. *Journal of Acta Neurology*-1982,32(2),407-410.
10. Thakur D. Pandel B, Bajaj BK *et al*. Nerve conduction study in healthy individual; a gender based study. Health Renaissance Sept-Dec 2010; 8(3) 169-75.

How to cite this article:
Kumar A *et al*, Study Of Nerve Conduction Velocity In Tibial Nerve Of Healthy Male And Female Of Different Age Groups. *International Journal of Recent Scientific Research Vol. 6, Issue, 6, pp.4477-4482, June, 2015*

****