

SENSORY NERVE CONDUCTION STUDIES OF MEDIAN & ULNAR NERVE IN NORMAL HEALTHY SUBJECTS IN BHAVNAGAR, GUJARAT.

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Background: Sensory nerve conduction studies (SNCS) 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. Median and ulnar nerves are two important nerves in the upper limb. **Objectives:** To study normal SNCS of median & ulnar nerve in normal healthy subjects & to obtain and compare SNCS parameters in different age groups. **Methods:** 91 normal healthy subjects of both gender, 15-65 years age were participated for SNCS parameters of bilateral median & ulnar nerve by using RMS Aleron EMG/NCV instrument & analyzed for statistical significance. **Results:** In right and left median nerve, mean latency, duration, amplitude, Sensory nerve conduction velocities (SNCV) were 2.28(\pm 0.26), 2.84 (\pm 0.79), 66.07(\pm 28.20), 56.08(\pm 6.40) and 2.23(\pm 0.27), 2.73(\pm 0.67), 85.95(\pm 19.56), 58.99(\pm 6.46) respectively. In right and left ulnar nerve, mean latency, duration, amplitude, SNCV were 2.18(\pm 0.21), 2.62(\pm 1.18), 55.32(\pm 19.84), 51.53(\pm 5.0) and 2.11(\pm 0.33), 2.53(\pm 0.71), 73.08(\pm 26.3), 54.86 (\pm 6.27) respectively. **Conclusion:** Values of SNCS of bilateral median & ulnar nerve in normal healthy subjects were established. Latency increases with reduced SNCV as age advances due to ageing effects of peripheral nervous system.

Key Words: Sensory nerve conduction studies, Median nerve, Ulnar nerve.

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Introduction:

SNCS 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.¹ SNCS help delineate the extent and distribution of the neural lesion and distinguish two major categories of peripheral nerve disease: demyelination and axonal degeneration.²

Median and ulnar nerves are two important nerves in the upper limb. They are responsible for the movements as well as sensation of the hand. Entrapment of these nerves will cause reduction in these modalities, for instance in carpal tunnel syndrome.³ There are various conditions which affect Nerve Conduction Velocity (NCV) like age, upper and lower limb, temperature, hence there cannot be a universal one reference value of a particular nerve taking into consideration of geographical variation of climate in the world.⁴ We have

tried to establish normal values of bilateral median & ulnar nerve in Bhavnagar, Gujarat.

Objectives: To study normal sensory nerve conduction studies of median & ulnar nerve in normal healthy subjects & to obtain, compare, correlation of Sensory nerve conduction studies parameters with different age groups.

Materials & Methods:

After obtaining permission from IRB (Human Ethics Committee) Government Medical College, Bhavnagar, 91 normal healthy subjects of both gender, age between 15-65 years were participated for SNCS of median & ulnar nerve of both hands by using RMS Aleron EMG/NCV EPII Mark 401, 4-Channels instrument. Sensory nerve conduction parameters like latency, duration, amplitude and SNCV were taken out and analyzed for statistical significance.

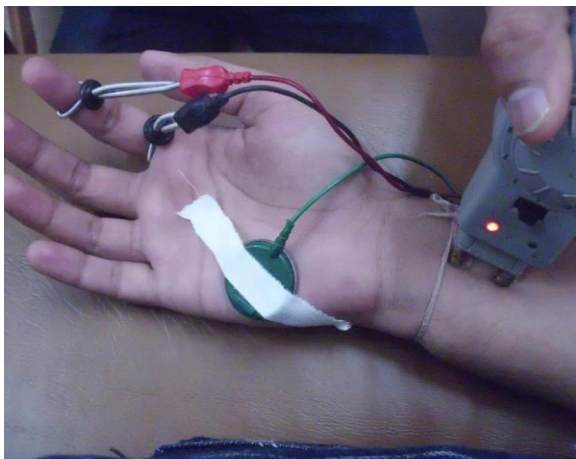
Participants were kept in supine position for their relaxation. Participants' skin surface was cleaned with spirit swab and allowed dry to avoid any error before placing electrodes on upper limbs. The electrodes were placed with good contact with surface as per

standard method². Supramaximal stimulation (upto 50mA) was used to stimulate both nerves for sensory recording in antidromic direction level till good quality graph was obtained.

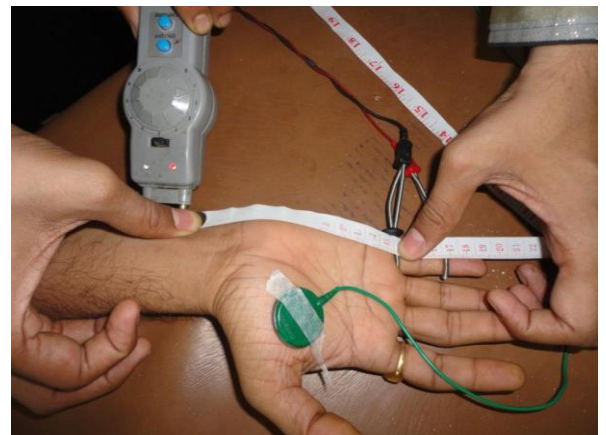
SNCS Filter Setting: Low frequency filter:20 hz High frequency filter: 3 KHz, Sweep Speed :2 ms /division, Sweep Gain:3 μ V/ division, Averager: 20, Display: Analogue Analogue to digital cover, Stimulus: Duration :(100 μ s) 50 to 1000 μ s, Intensity current:0–50 mA, Rate of stimulation: 1 Hz

Material Used: Electrode paste, Micropore, Cotton Swab, Weight scale, stadiometer, Measure tape, Infrared Digital Thermometer (Sun- Surgical Ltd).

Procedure of SNCS in Median Nerve^{2,5,6} :Ring electrodes such as Active (Black colour) and Reference electrode (Red colour) were placed 4cm apart around proximal & distal inter-phalangeal joints on index finger for median nerve. Ground electrode (Green colour) was place on thenar eminence between stimulating and recording electrode. The sensory branch of median nerve was stimulated to lateral to Flexor carpi ulnaris tendon just 3 cm proximal to wrist crease in which cathode was placed 3 cm proximal to the wrist crease and anode was placed at distally which are shown in figure 1



Procedure of SNCS in Ulnar Nerve^{2, 5, 7} :Ring electrodes such as Active & Reference electrode were placed 4 cm apart around proximal & distal inter-phalangeal joints on little finger for ulnar nerve. Ground electrode was placed on thenar eminence in between stimulating and recording electrode. Ulnar nerve was stimulated 5-8 cm proximal to ulnar styloid process between flexor carpi ulnaris and ulna in which cathode was placed 3 cm proximal to the wrist crease & anode was placed at distally which are shown figure 2.



Statistical analysis: The results were expressed as Mean \pm SD and analyzed by using Anova test ('p' value <0.05 was considered significant) & correlation coefficient in GraphPad trial version software.

Result:

The present normative study comprises of sensory nerve conduction study on 91 normal subjects in age group range of 15-65 years in period from October 2011 to May 2013. The study population was divided on basis of age of subject into 5 groups

- Group A --15-25years,
- Group B --26-35years,
- Group C --36-45years,
- Group D --46-55years,
- Group E --56-65years.

In present study, an analysis of all SNCS parameters (Latency, Duration, Amplitude, SNCV) of bilateral median & ulnar nerve of the five different age groups has been attempted in Table.1, 2, 3, 4 respectively.

Table 1: SNCS parameters in bilateral median & ulnar nerve (Mean ± SD)

Nerve	Latency (ms)	Duration (ms)	Amplitude (µv)	SNCV (m/s)
Right(Rt) Median Nerve	2.28 ±0.26	2.84 ±0.79	66.07 ±28.20	56.08 ±6.40
Left(Lt) Median Nerve	2.23 ±0.27	2.73 ±0.67	85.95 ±19.56	58.99 ±6.46
Right(Rt) Ulnar Nerve	2.18 ±0.21	2.62 ±1.18	55.32 ±19.84	51.53 ±5.00
Left(Lt) Ulnar Nerve	2.11 ±0.33	2.53 ±0.71	73.08 ±26.30	54.86 ±6.27

Table 2: SNCS parameters in each age group (Mean ± SD)

Group	Age (years)	Height (cm)	Weight (kg)	BMI (Kg/cm ²)
A (N=17)	19 ±2.7	165.6 ±7.32	59.29 ±11.73	21.61 ±4.01
B (N=23)	31 ±3.2	165.2 ±9.68	66.87 ±10.12	24.43 ±2.70
C (N=18)	40 ±3.4	165.6 ±10.17	67.89 ±10.23	24.69 ±2.28
D (N=18)	50 ±2.6	163.2 ±6.62	62.83 ±7.21	23.63 ±2.86
E (N=16)	59 ±2.8	162.3 ±9.44	68.88 ±11.11	26.19 ±3.91

Table.3 Correlation of parameters with age

Age →SNCS Parameters	Rt Median Nerve	Lt Median Nerve	Rt Ulnar Nerve	Lt Ulnar Nerve
Latency	0.32	0.15	0.16	0.13
Duration	0.04	-0.05	0.16	0.01
Amplitude	-0.32	0.04	0.04	0.33
SNCV	-0.33	-0.17	-0.16	-0.25

Note: '-' indicates negative correlation
 '+' indicates positive correlation

Table 4: SNCS parameters in each age group (Mean± SD)

Nerve	Group	Latency	Duration	Amplitude	SNCV
Rt Median Nerve	A	2.15 ±0.21	2.93 ±1.00	76.71 ±30.79	58.89 ±6.12
	B	2.25 ±0.24	2.68 ±0.56	74.58 ±30.54	57.08 ±6.76
	C	2.30 ±0.24	2.73 ±0.48	61.99 ±21.90	57.06 ±5.57
	D	2.31 ±0.23	2.85 ±0.82	56.66 ±26.61	55.51 ±5.75
	E	2.43 ±0.33	3.07 ±1.08	57.72 ±25.67	51.19 ±5.59
Lt Median Nerve	A	2.13±0.21	2.79 ±0.47	84.01 ±23.97	60.17 ±6.63
	B	2.17±0.29	2.80 ±0.55	85.63 ±12.96	59.92 ±7.11
	C	2.27±0.29	2.64 ±0.66	85.84 ±24.63	58.43 ±6.44
	D	2.29±0.21	2.70 ±0.63	87.19 ±13.29	59.19 ±60.6
	E	2.27±0.29	2.64±0.66	85.84±24.63	58.43±6.44
Rt Ulnar Nerve	A	2.12±0.29	2.38±0.42	53.01±16.01	53.85±5.97
	B	2.17±0.22	2.42±0.93	54.00±20.26	50.86±4.60
	C	2.18±0.19	2.47±1.19	55.63±23.46	51.51±5.20
	D	2.20±0.17	2.93±1.83	55.98±21.64	51.17±4.42
	E	2.24±0.20	3.02±1.08	58.61±18.64	50.45±4.64
Lt Ulnar Nerve	A	2.05±0.22	2.60±0.45	60.02±19.76	56.51±5.07
	B	2.08±0.35	2.31±0.68	63.75±28.79	54.95±7.44
	C	2.10±0.44	2.71±0.70	78.26±23.21	57.07±6.34
	D	2.12±0.28	2.48±1.00	77.55±19.08	53.99±6.08
	E	2.18±0.30	2.60±0.61	89.51±29.52	51.47±4.54

Latency of right median nerve is statically significant in A group with E group (p value < 0.05). SNCV of right median nerve is statically significant in E group with A group (p value < 0.01), B group (p value < 0.05), C group (p value < 0.05). Amplitude of left ulnar nerve is statically significant in E group with A group (p value < 0.01), B group (p value < 0.05) There was no statically significant difference of SNCV parameters with any age group.

Discussion:

The present normative study on SNCS parameters may become an important clinical tool in future to aid in diagnosis of peripheral nerve lesions. When age increases, latency increases with SNCV decreases but duration and amplitude remain more or less same throughout the age groups. A positive correlation is seen in age with latency & negative correlation is seen in age with SNCV. There is no uniform correlation in age with duration and amplitude. This study has almost same finding as with other studies^{1, 3, 7, 8, 11}

Increase in latency & slowing of nerve velocities may be due to aging which affects functional & electro-physiological properties of the PNS, including decline in nerve conduction velocity, muscle strength, sensory discrimination, autonomic responses & endoneurial blood flow.¹²

These values were within the favorable range as compared with other researcher's values for SNCS of median & ulnar nerve.^{1, 2, 7, 9, 10, 11}

While a few nerve parameters showed considerable differences. This difference between the results of the present study & the data could be attributed to a variety of causes. Firstly, the difference in distance between stimulating and recording electrodes, inflicted well on the lower values. Secondly; the age of the subjects who were studied. Thirdly, the diversity of the methods and techniques (the studies differed in the maneuvering, setting, recording of the electrical responses & equipment which was used). Finally, the type of electrode which was used could also be a source of this variation. Besides, different studies were done on different ethnic groups.³

Limitation:

As there are less number of subjects taken in our study in each of five groups. Small-fiber neuropathy being a commonly encountered disorder, routine NCSs assess only large-fiber function.¹³

Conclusion:

Nerve conduction study is very important, low cost & highly objective tool in detecting peripheral nerve diseases which are poorly diagnosed & reflect subclinical involvement of peripheral nervous system even before the disease clinically manifests. It is useful for neurologists & neurosurgeons.

The normal values of sensory NCV of bilateral median & ulnar nerve in normal healthy normal subjects were established in Bhavnagar, Gujarat. Latency increases with reduced SNCV as age advances due to ageing effects of peripheral nervous system.

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