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Assessment Of the Nerve Conduction Parameters in Patients with Cervical Spondylosis in A Tertiary Care Center of Northeast India - A Cross-Sectional Study.

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ABSTRACT:
Background:
Cervical spondylosis is a common degenerative disorder of the cervical spine that can lead to nerve root compression and neurological deficits. Nerve conduction studies (NCS) are useful in evaluating peripheral nerve function and detecting abnormalities associated with cervical spondylosis.
***Objectives: 1.** To assess nerve conduction parameters in patients with cervical spondylosis. 2.To estimate the proportion of patients with altered sensory and motor nerve conduction.*
***Materials and Methods:** This hospital-based cross-sectional study was conducted over a period of six months in 59 clinically diagnosed patients with cervical spondylosis attending the Department of Orthopaedics, AGMC & GBP Hospital. Motor and sensory nerve conduction studies of the median and ulnar nerves were performed using standard protocols. Data were recorded in a predesigned case study format and analyzed using SPSS version 21. A p-value < 0.05 was considered statistically significant.*
Results:
The mean age of the participants was 47.93 ± 13.15 years. The mean motor nerve conduction velocities of the median and ulnar nerves ranged from 45.86 ± 9.55 m/s to 48.25 ± 9.58 m/s, while the mean sensory conduction velocities ranged from 46.96 ± 7.98 m/s to 47.11 ± 9.51 m/s. Reduced motor nerve conduction velocity was observed in 46–59% of study subjects, whereas reduced sensory nerve conduction velocity was observed in 58–59% of subjects. Sensory nerve involvement was slightly more frequent than motor nerve involvement, with no appreciable side-to-side variation.
Conclusion:
Cervical spondylosis is associated with significant alterations in both motor and sensory nerve conduction parameters, with sensory nerves being slightly more affected. The involvement is largely symmetrical. Nerve conduction studies serve as a valuable adjunct in the assessment of neurological involvement in cervical spondylosis.

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I. INTRODUCTION

Cervical spondylosis is a common degenerative disorder of the cervical spine associated with age-related changes in the intervertebral discs and vertebral elements. Its prevalence increases with age, affecting nearly 50% of individuals over 40 years and up to 85% above 60 years. The most commonly involved levels are C6–C7 and C5–C6.[1]

Clinically, cervical spondylosis presents as axial neck pain, cervical radiculopathy, or myelopathy, either alone or in combination. Patients frequently report neck pain, stiffness, and neurological symptoms such as numbness, tingling, and weakness in the upper limbs.[2]

Magnetic Resonance Imaging (MRI) is the preferred modality for structural assessment; however, it does not provide functional evaluation of nerve involvement. Nerve conduction studies (NCS) are valuable electrodiagnostic tools used to assess peripheral nerve function and help differentiate radiculopathy from other neuropathies. [3]

Despite their clinical utility, limited studies have evaluated nerve conduction parameters in patients with cervical spondylosis, particularly in the northeastern region of India. Therefore, the present study aims to assess nerve conduction parameters in patients with cervical spondylosis in a tertiary care setting.

OBJECTIVES

1. To assess motor and sensory nerve conduction parameters in patients with Cervical spondylosis.
2. To estimate the proportion of patients with Cervical spondylosis having altered Sensory and Motor nerve conduction.

II. MATERIALS AND METHOD

Study type: Observational study
Study design: Hospital based Cross- sectional study
Study duration: Six months
Study area / location: Department of Physiology in collaboration with Department of Orthopedics, Agartala Govt. Medical College (AGMC).
Study population: Adult patients with cervical spondylosis from the Orthopedics OPD of AGMC & GBP Hospital.
Sample size: 59 patients diagnosed with cervical spondylosis.
Sampling procedure: This cross-sectional study was conducted using a convenience sampling technique. All eligible participants who fulfilled the inclusion and exclusion criteria during the six-month study period were consecutively recruited.

Inclusion criteria for cases:

1. Patients willing to participate in the study.
2. Patients diagnosed with Cervical Spondylosis.

Cervical spondylosis was diagnosed based on clinical signs and symptoms.
Signs:[4]

i. Poorly localised tenderness
ii. Limited range of motion
iii. Minor neurological changes (e.g. slight weakness in hand grip but no muscle wasting)

Symptoms:

i. Cervical pain aggravated by movement
ii. Referred pain (occiput, between the shoulder blades, upper limbs)
iii. Retro-orbital or temporal pain
iv. Cervical stiffness
v. Vague numbness, tingling or weakness in upper limbs
vi. Dizziness or vertigo
vii. Poor balance

Exclusion criteria for cases:
Cases of Neurological involvement other than cervical spondylosis like

1. Radial mononeuropathy
2. History of trauma
3. Metastatic disease of spine and related structures
4. Migraine headache, cluster headache, tension headache,
5. Multiple sclerosis
6. Inflammatory causes like Rheumatoid Arthritis, Ankylosing Spondylosis.

Study tools:

- Stadiometer: Bioplus; height -200cm
- Weight Machine (Mechanical EQ-BR -9201): Brand- Equinox, Weight Limit- 130kg
- 2/4 Channel portable RMS EMG.NCV.EP machine
- Case study format

Study procedure:

All the study subjects were selected consecutively during the study period following the inclusion and exclusion criteria. The data were collected from the Cervical spondylosis patients attending Orthopedic OPD of AGMC & GBP Hospital, during the study period.

All the participants were personally subjected to detailed history regarding name, age, sex, occupation, socioeconomic status, educational status, medical history and clinical features etc. These findings were recorded in a predesigned and pretested standard questionnaire. Blood sugar level, thyroid level and other laboratory findings were recorded from previous and current medical documents. Written informed consent was obtained from all the participants. Complete general physical and systemic examination was performed.

1. Age: Was recorded from birthdays to the nearest completed years.
2. Standing height: Height of the subjects was measured barefooted in centimeters to the nearest 0.1 cm.
3. Weight: Weight of the subject was recorded to the nearest 0.1kg.
4. Nerve Conduction Study (NCS):

After explaining the procedure and obtaining written informed consent from the subjects, nerve conduction recordings were performed. The subjects were allowed to lie down comfortably on a couch and relax fully to ensure good-quality recordings. The skin areas selected for electrode placement were cleaned thoroughly with spirit to remove dirt, dead cells, and grease.

NCS was performed using a 2/4 Channel portable RMS EMG.NCV.EP machine. The motor nerves tested included the Median and Ulnar nerves. Surface disc electrodes were placed over the corresponding muscles. The ground electrode was positioned between the stimulating and recording electrodes. A belly–tendon montage was used, with the cathode and anode positioned 3 cm apart. For the motor study, filters were set between 2 Hz and 5 kHz, and the sweep speed was maintained at 5 ms per division. For the sensory study, filters were set between 20 Hz and 3 kHz, and the sweep speed was maintained at 2 ms per division. The stimulus duration for both motor and sensory studies was set at 100 µs. Parameters such as Distal Motor Latency (DML), Compound Muscle Action Potential (CMAP) amplitude, and Conduction Velocity (CV) were evaluated for the motor nerves.

Sensory conduction study (antidromic) involved proximal stimulation of the sensory nerves and recording of the Sensory Nerve Action Potential (SNAP) using electrodes placed distally over the dermatomal distribution. Sensory conduction velocity was calculated by automatically dividing the distance between the active electrode and the cathode of the stimulator by the onset latency. SNAP amplitude was measured from peak to baseline. The sensory nerves tested included the Median and Ulnar nerves. Parameters such as SNAP amplitude and conduction velocity were evaluated for the sensory nerves.[5]

Data analysis: Data were analyzed using SPSS 20. Descriptive statistics and other suitable statistical tests were used as per applicability. Data were expressed in terms of mean and standard deviation. A p-value < 0.05 was considered statistically significant.

IV. Results

This study included 60 patients with cervical spondylosis. 41% of the subjects were female and 59% were male as shown in Figure 1. Mean age of the study participants were (47.93±13.15) years, mean height (155.83±10.99) cm and weight was (67.15±10.99) as mentioned in Table1.

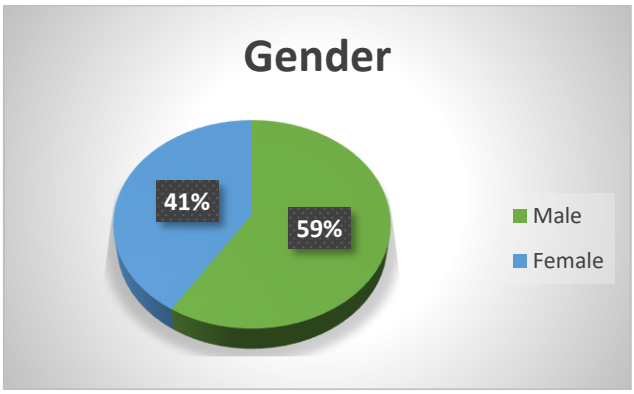


Figure 1. Gender distribution among study participants

Parameters	Mean	Std. Deviation
AGE (Yrs)	47.93	13.15
HT (cm)	155.83	10.99
WT (kg)	67.15	10.74

Table 1. Variables among the study subjects

Right median motor nerve conduction velocity was found to be decreased in 56% of the study participants as shown in Figure 2. Left median motor nerve conduction velocity was reduced in 52% of the study participants (Figure 3). Right and left ulnar motor nerve conduction velocity was decreased in 59% and 46% of the study population respectively (Figure 4&5).

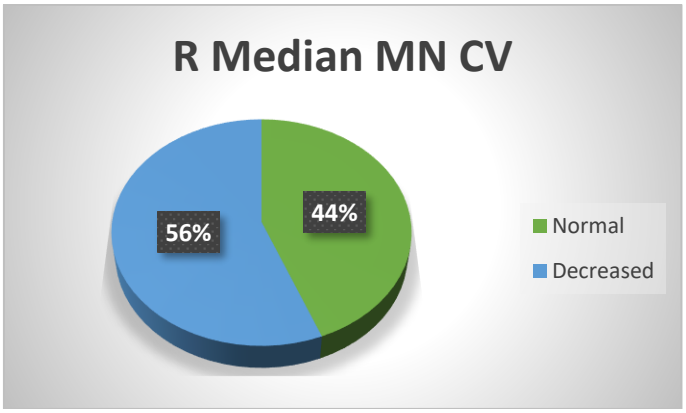


Figure 2. Right median motor nerve conduction velocity

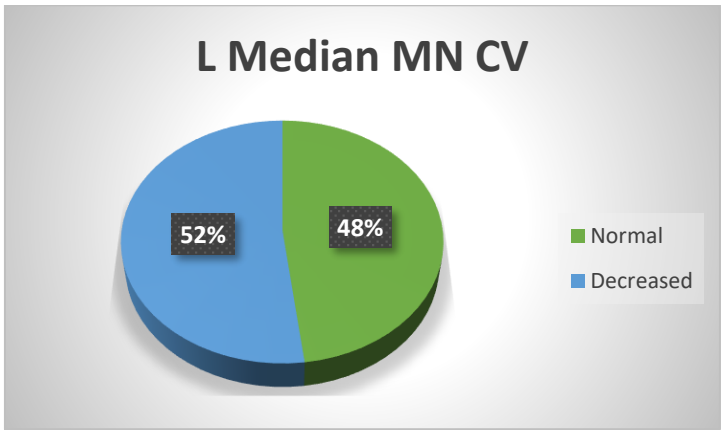


Figure 3. Left median motor nerve conduction velocity

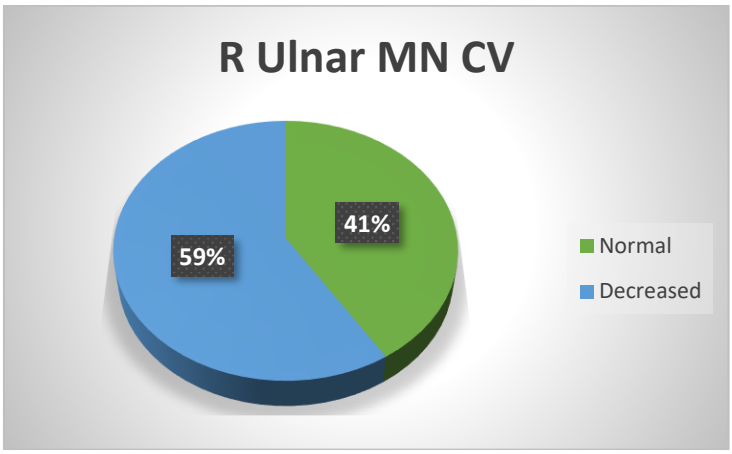


Figure 4. Right ulnar motor nerve conduction velocity

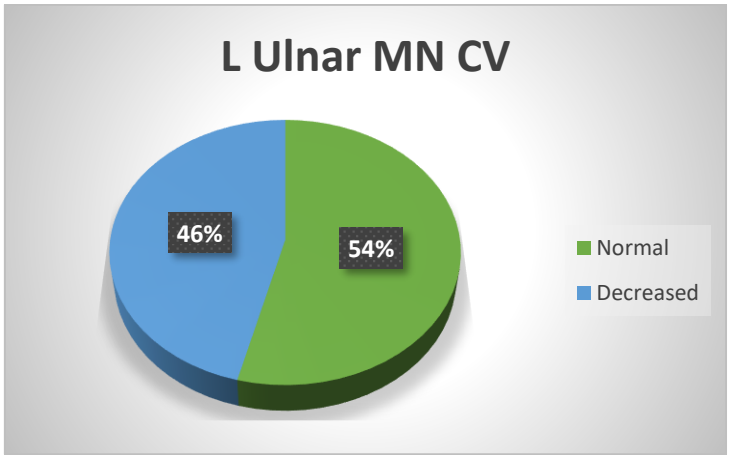


Figure 5. Left ulnar motor nerve conduction velocity

Mean conduction velocity of right and left median motor nerve were (46.88±9.25) m/s and (46.95±8.43) respectively. Nerve conduction parameters of median motor nereve are tabulated in Table 2. Mean motor nerve conduction velocity of right and left ulnar nerve were (45.86±9.55) m/s and (48.25±9.58) m/s respectively as shown in Table 3.

VARIABLES (Median motor)	Mean	±Std. Deviation
Distal motor latency (Right) ms	3.87	±0.99
CMAP amplitude (Right) mv	10.58	±3.78
Conduction velocity (Right) m/s	46.88	±9.25
Distal motor latency (Left) ms	3.85	±1.01
CMAP amplitude (Left) mv	10.52	±3.96
Conduction velocity (Left) m/s	46.95	±8.43

Table 2. Median motor nerve conduction parameters

VARIABLES (Ulnar motor)	Mean	±Std. Deviation
Distal motor latency (Right) ms	3.80	±1.05
CMAP amplitude (Right) mv	10.22	±3.98
Conduction velocity (Right) m/s	45.86	±9.55
Distal motor latency (Left) ms	3.75	±0.97
CMAP amplitude (Left) mv	10.90	±4.27
Conduction velocity (Left) m/s	48.25	±9.58

Table 3. Ulnar motor nerve conduction parameters

Sensory conduction velocity of median nerve was reduced in 58% of the study participants as shown in Figure 6&7. Sensory conduction velocity of ulnar nerve was reduced in 59% and 58% of the study participants as shown in Figure 8&9.

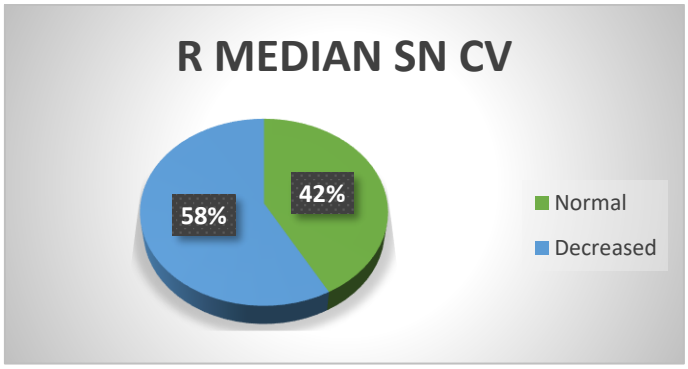


Figure 6. Right Median sensory nerve conduction velocity

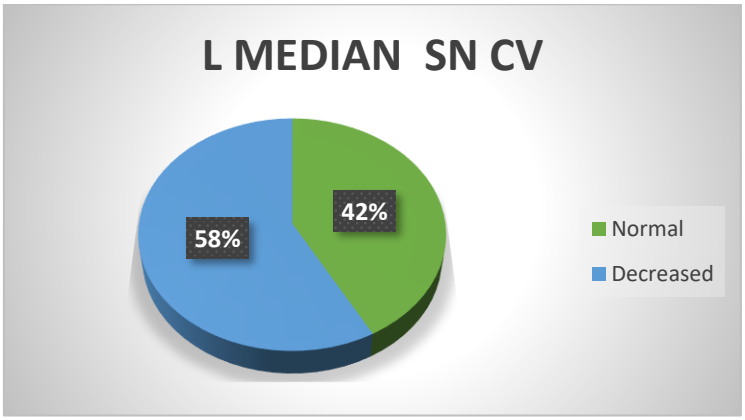


Figure 7. Left Median sensory nerve conduction velocity

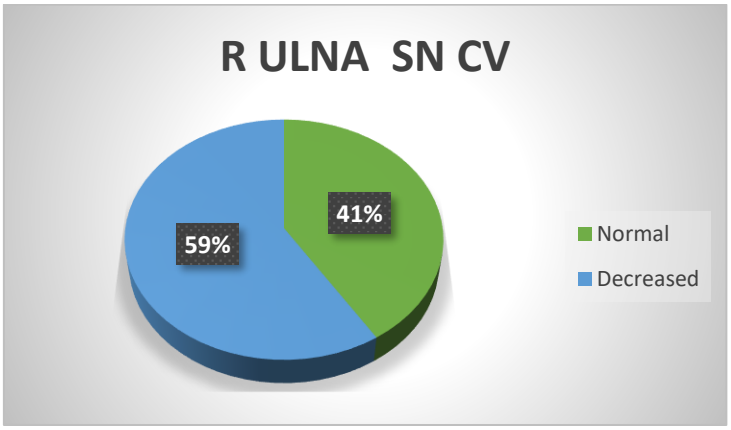


Figure 8. Right Ulnar sensory nerve conduction velocity

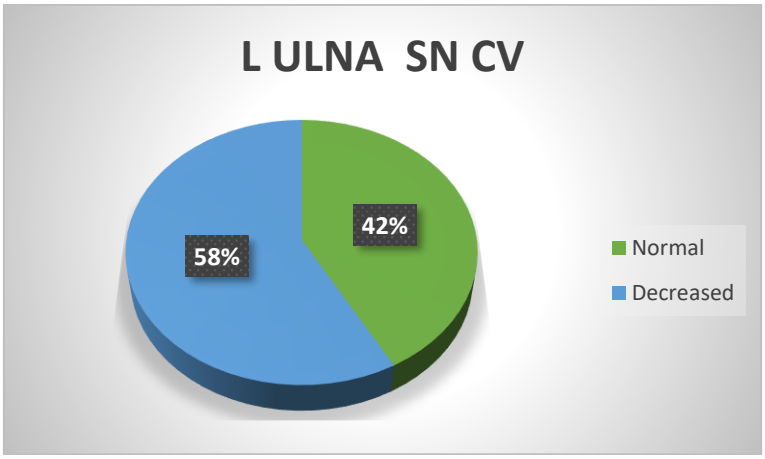


Figure 9. Left Ulnar sensory nerve conduction velocity

Mean conduction velocity of right and left median sensory nerve were (47.04±9.72) m/s and (46.99±8.78) respectively. Nerve conduction parameters of median sensory nereve are tabulated in table 4. Mean sensory conduction velocity of right and left ulnar nerve were (46.96±7.98) m/s and (47.11±9.51) m/s respectively as shown in table 5.

VARIABLES (Median sensory)	Mean	±Std. Deviation
Sensory nerve latency (Right) ms	3.83	±0.94
SNAP amplitude (Right) mv	10.65	±4.07
Conduction velocity (Right) m/s	47.04	±9.72
Sensory nerve latency (Left) ms	3.76	±0.94
SNAP amplitude (Left) mv	10.19	±3.79
Conduction velocity (Left) m/s	46.99	±8.78

Table 4. Median sensory nerve conduction parameters

VARIABLES (Ulnar sensory)	Mean	±Std. Deviation
Sensory nerve latency (Right) ms	3.69	±1.01
SNAP amplitude (Right) mv	10.45	±3.85
Conduction velocity (Right) m/s	46.96	±7.98
Sensory nerve latency (Left) ms	3.87	±1.03
SNAP amplitude (Left) mv	10.56	±3.83
Conduction velocity (Left) m/s	47.11	±9.51

Table 5. Ulnar sensory nerve conduction parameters

V. Discussion

In the present study we have found that the motor and sensory conduction velocity of median and ulnar nerve in patients with cervical spondylosis was reduced. The CMAP and SNAP amplitide was within normal limit.

Yadav N. et al conducted a study on Thirty-five patients with unilateral cervical radiculopathy confirmed by clinical and magnetic resonance imaging (MRI) evidences. The study demonstrated a significant reduction in Compound Motor Action Potential (CMAP), slightly delayed distal motor latency with decreased conduction velocity on symptomatic side as compare to asymptomatic side[6]. In a study conducted by Garg M et al, there were significant decrease in the conduction velocity of both median nerve, ulnar nerve (50.60±5.6)) and significant increase in the mean latency of both nerves in patients with cervical radiculopathy[7].

Sachin Pawar et al in their study concluded that motor CV had greater specificity and DML had least negative predictive value. Sensory nerve conduction parameters were found to have less sensitivity but higher specificity as compared to motor parameters[8]. In one study conducted by Khan MR et al took a total of 57 patients of cervical spondylosis who underwent NCV, SSEP, EMG to aid the diagnosis. They concluded that NCV, SSEP, and concentric needle electromyography were useful tests in distinguishing between root lesions and peripheral entrapment neuropathy[9].

Cervical spondylosis is a progressive degenerative disease that affects all the components of cervical spine. Cervical nerve root enters the foramen medially at the level of the superior articular facet of the inferior vertebrae. The impingement of an existing nerve root caused by degeneration and hypertrophy of the vertebral or facet joints results in compression and irritation of the nerve. Chronic mechanical compression and ischemia of the nerve roots damages the protective myelin sheath and underlying nerve fibres, slowing down the electrical signals travelling through the nerves.

VI. Conclusion

In our study motor and sensory nerve conduction velocity was found to be decreased in patients with cervical spondylosis. Nerve conduction studies might be a useful supportive diagnostic tool for suspected cervical spondylosis.

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