

# Prevalence of Nerve Dysfunction in Individuals in Satara District Suffering from Chronic Neck Pain - A Nerve Conduction Velocity Study

Anushka Vijay Rane<sup>1</sup>, Prachi Kulkarni<sup>2</sup>, Trupti S. Yadav<sup>3</sup>

<sup>1,2</sup> Department of Neurology, Krishna College of Physiotherapy, Krishna Institute of Medical Sciences Deemed to Be University, Karad, Satara, Maharashtra, India, <sup>3</sup> Department of Musculoskeletal Sciences, Krishna Institute of Medical Sciences Deemed to Be University, Karad, Satara, Maharashtra, India.

## ABSTRACT

### BACKGROUND

Chronic neck pain is one of the common and painful musculoskeletal conditions. Determining the prevalence of nerve impairment in chronic neck pain patients is faced with various challenges such as individual perception and coping patterns of pain and likelihood to seek and receive treatment. We wanted to determine the prevalence of nerve impairment in patients of chronic neck pain and estimate the occupation, age, and gender wise involvement of nerve impairment in chronic neck pain patients.

### METHODS

Population in and around Karad diagnosed with chronic neck pain by an orthopaedician fulfilling the inclusion criteria with prior consent were taken for the study. In the first half of the study, participants were assessed based on a questionnaire and a clinical assessment using Upper Limb Tension Tests following which the participants were assessed using nerve conduction velocity studies.

### RESULTS

Participants having chronic neck pain and showing nerve dysfunctions were 32.14 %. Based on F min, frequency of nerve dysfunction within age groups showed the highest percentage that was 10.72 % in the age group of 39 - 42 years. Higher involvement was observed in males than females which was 23.21 %. Occupation wise nerve involvement for nerve dysfunction showed physically demanding occupations which had higher percentage of 14.28 %.

### CONCLUSIONS

This study shows large population of chronic neck pain with no symptoms of nerve involvement but having nerve dysfunction and were not receiving any treatment for their condition thereby allowing it to progress into a radiculopathy.

### KEY WORDS

Chronic Neck Pain, NCV Study, Cervical Radiculopathy, F Min Latency

*Corresponding Author:*  
Dr. Trupti S. Yadav,  
Mangalwar Peth, Karad,  
Satara, Maharashtra, India,  
E-mail: drtruptiwarude@gmail.com

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## BACKGROUND

Pain is defined as an unpleasant, emotional, sensory experience associated with actual or potential tissue damage.<sup>1</sup> Pain is often self-managed and does not require intervention but if persistent, it is a sign that pain is no longer a symptom but has become a disease in itself. A large population in India seems ignorant of pain,<sup>2</sup> not seeking any consultation and self-administration of analgesics. Seeking medical help only when the pain becomes unbearable or is physically disabling further worsens the condition. Lack of knowledge on pain awareness and pain management techniques indicate high prevalence of chronic pain in this population.<sup>3</sup> Chronic pain as defined by International Association for study of pain is "pain without apparent biological value that has persisted beyond the normal tissue healing time (usually taken to be 3 months)". Chronic pain is a significant global health burden<sup>4</sup> and hence the campaign for World Physiotherapy day 2019 was focussed around this theme. The campaign also considered cervical pain as the second leading cause of chronic pain. Chronic Pain can thus be rightly considered as one of the disabling problems especially in Indian demographics. According to American chronic pain association, pain is mainly classified into two categories according to their type of damage - Pain caused by tissue damage called nociceptive pain and pain caused by nerve damage called as neuropathic pain.<sup>5</sup> This classification is helpful for the diagnosis as well as management of pain. Screening and differentiating neuropathic pain is a crucial aspect of chronic pain management.<sup>6</sup>

Neck pain is mostly considered as a musculoskeletal condition with major contributing factors such as bad postural habits,<sup>7</sup> altered biomechanics, neck strain, occupational injuries, followed by anxiety or other psychological causes, arthritis, disc prolapse and many others. Mechanical pain in the cervical region, especially in younger individuals is often due to faulty postures, sedentary lifestyle, long sitting hours without proper back support and altered biomechanics while lifting. What needs to be considered here is that ignoring pain for long durations would further lead to inflammation, muscle spasm and finally nerve involvement that is conversion of nociceptive pain into neuropathic pain.<sup>8</sup> Knowledge of prevalence of nerve dysfunction in patients of chronic neck pain could make the treating physicians and physical therapists more vigilant of the potential nerve dysfunction among them thus preventing chances of cervical radiculopathies in the long run.

Determining the prevalence of nerve impairment in chronic neck pain patients is additionally faced with challenges such as individual perception and coping patterns of pain and likelihood to seek and receive care. An objective tool is therefore used to assess asymptomatic nerve dysfunction that might aid in excluding all but patients with nerve dysfunction. Electrodiagnostic examination is an extension of clinical neurological examination with lowest false positive rate.<sup>9</sup> Nerve conduction velocity study enables the clinician to detect signs that cannot be confirmed by clinical neurological examination alone and can guide diagnosis and treatment. Various F wave parameters are well established in the diagnostic evaluation. A study conducted on the late responses in the Electrodiagnosis of cervical radiculopathies suggest that in terms of F-waves of the median

and ulnar nerves, the minimum latency of this wave was changed in 12 %. Normal value of F min latency for median nerve is 25.7 and for ulnar nerve 26.45.<sup>7</sup>

This study was done to not only determine the prevalence of nerve dysfunction but also co-relate the presence of nerve dysfunction with age, gender and occupation of the individuals.

## METHODS

This cross-sectional study was conducted in Karad from October 2019 to March 2020. After receiving ethical clearance from the Ethical committee of Krishna College of Physiotherapy, KIMSDU, Karad, subjects of either gender, between the ages 18 and 40 years complaining of neck pain for over three months without any history of trauma in the neck region or diabetes mellitus in the last five years, with varied occupations were included. The subjects were screened based on radiology reports for any signs of early degenerative changes. A total of 56 subjects were included. This was calculated using the formulae  $n = 4pq/L^2$  where p is the prevalence of the condition/ health state, q when p is in percentage terms is (100 - p) and L is precision of the estimate. From previous studies, chronic pain can be estimated at 16.6 % of general population.<sup>10</sup> Thus taking:

P as 16.6 %

q as (100 - p) = (100 - 16.6) = 83.4 %

L as 10

$N = 4pq/L^2$

Calculation:

$N = 4pq/L^2$

Therefore,  $n = (4 \times 16.6 \times 83.4) / 10^2$

= 5537.76/100

= 55.37

Sample size: 56

Simple random sampling method was used to select the subjects, and these were evaluated for presence of chronic neck pain using The Brief Pain Inventory.<sup>11</sup> This questionnaire included body charts and evaluated pain using Numerical rating scale, also interference of pain with daily activities was examined. The presence of nerve dysfunction in them was first assessed based on the clinical examination. The clinical examination included various upper limb tension tests, results of which were noted based on presence or absence of tingling sensation. The participants with negative upper limb tension test were included in further study. Final confirmation of the level of nerve dysfunction was obtained using nerve conduction velocity studies, wherein we tested for the F wave parameters of median and ulnar nerve. F min latency values were considered. (Figure 1)

Procedure for performing nerve conduction velocity studies.<sup>12</sup> For the median nerve, stimulation was applied at the wrist, between the tendons of flexor carpi radialis and palmaris longus, with the cathode oriented proximally. The recordings were made with surface electrodes, the active one applied on the muscle belly of abductor pollicis brevis and the reference distal to it was at least 3 cm, with the examined muscle being relaxed. The ground electrode was placed on the dorsal aspect of the hand. The skin was cleaned with alcohol before placing electrodes.

For the ulnar nerve stimulation was applied at the wrist medial to the flexor carpi ulnaris tendon, with the cathode oriented proximally. The recordings were made with surface electrodes, the active one applied on the muscle belly of abductor digiti minimi and the reference distal to it was at least 3 cm, with the examined muscle being relaxed. The ground electrode was placed on the dorsal aspect of the hand. The skin was cleaned with alcohol before placing electrodes.

For the purpose of this study the normative values<sup>9</sup> were considered to be as shown (Table 1)

Parameter	Median Nerve	Ulnar Nerve
F min Latency	26.8 ± 2.4	26.5 ± 2.5

**Table 1. Normal Values of F Min Latency for Median and Ulnar Nerve**



**Figure 1. Nerve Conduction Velocity Apparatus Used**

**Statistical Analysis**

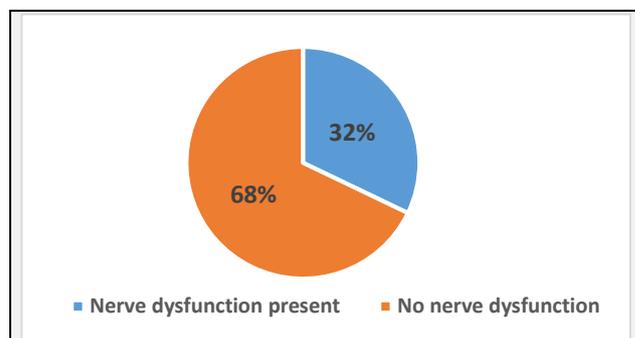
After analysing the data, it was found that participants having chronic neck pain and showing nerve dysfunctions were 32.14%. Further these individuals were analysed based on age, gender and occupation using significance testing in GraphPad Instat software. While analysing frequency of nerve dysfunction with age groups from the included population, P value for age-wise distribution was 0.0045 that is  $P < 0.01$  and hence statistically significant. This establishes a positive correlation between advancing age and increasing frequency of nerve dysfunction among population. P values for gender-wise distribution were 0.0036 which means  $P < 0.01$  thus very

significant. This implies that gender does indeed affect nerve dysfunction in chronic neck pain patients.

By analysing occupation-wise nerve involvement for nerve dysfunction, statistical data showed p values for occupation-wise distribution as 0.0412 which was  $P < 0.05$  thus significant. The significant P value suggests nature of occupation to be a significant causative factor in increasing nerve dysfunction in chronic neck pain patients.

**RESULTS**

Of the 56 total subjects included and examined for this study, 32.14 % showed presence of nerve dysfunction on F min latency examination. (Figure 2)



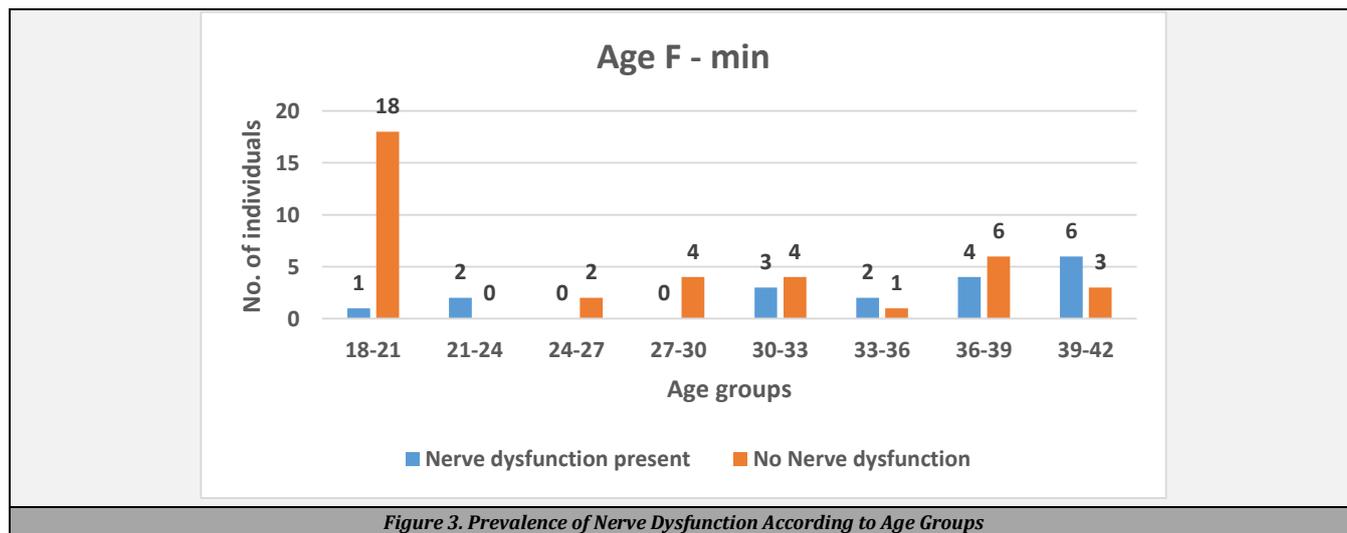
**Figure 2. Distribution of Nerve Dysfunction in Chronic Neck Pain Participants**

**Age**

Total population grouped according to age, showed nerve dysfunction calculated based on F min latency parameter and higher in adult population. Highest in age group of 39 - 42 yrs. that is 10.71 % and 7.14 % in age group 36 - 39 followed by 5.35 % in age group 30 - 33 years. (Figure 3)

**Gender**

Nerve dysfunction calculated based on F min parameter was present more in males (23.21 %) than females (8.92 %). (Figure 4)



**Figure 3. Prevalence of Nerve Dysfunction According to Age Groups**

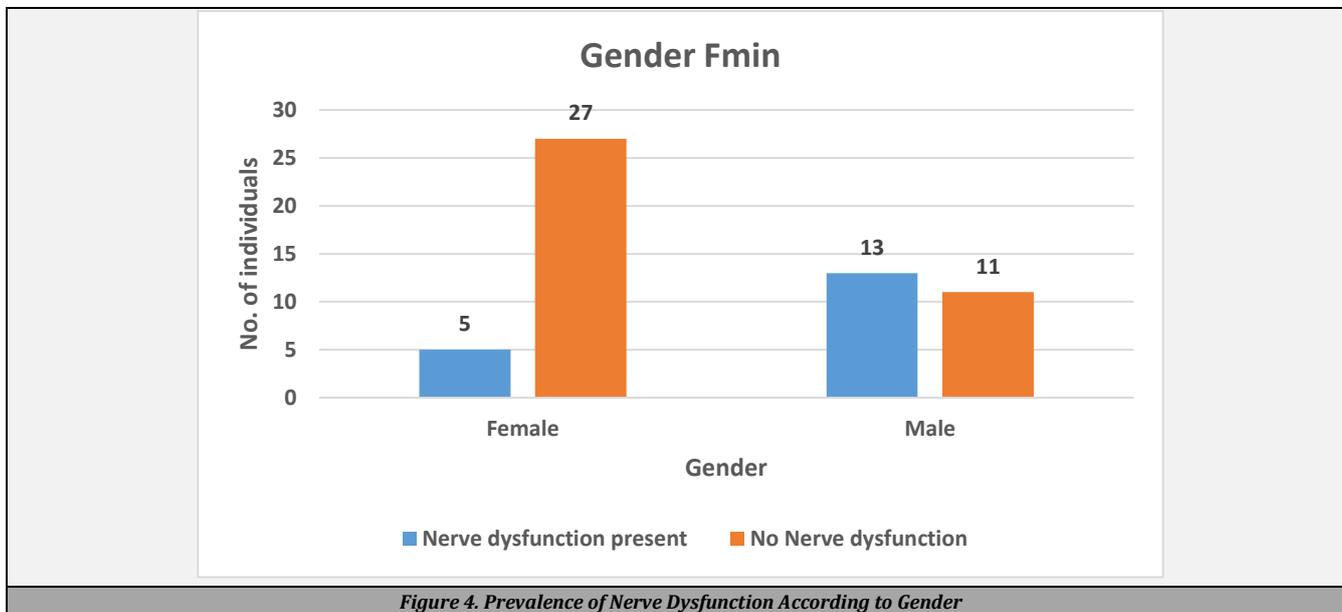


Figure 4. Prevalence of Nerve Dysfunction According to Gender

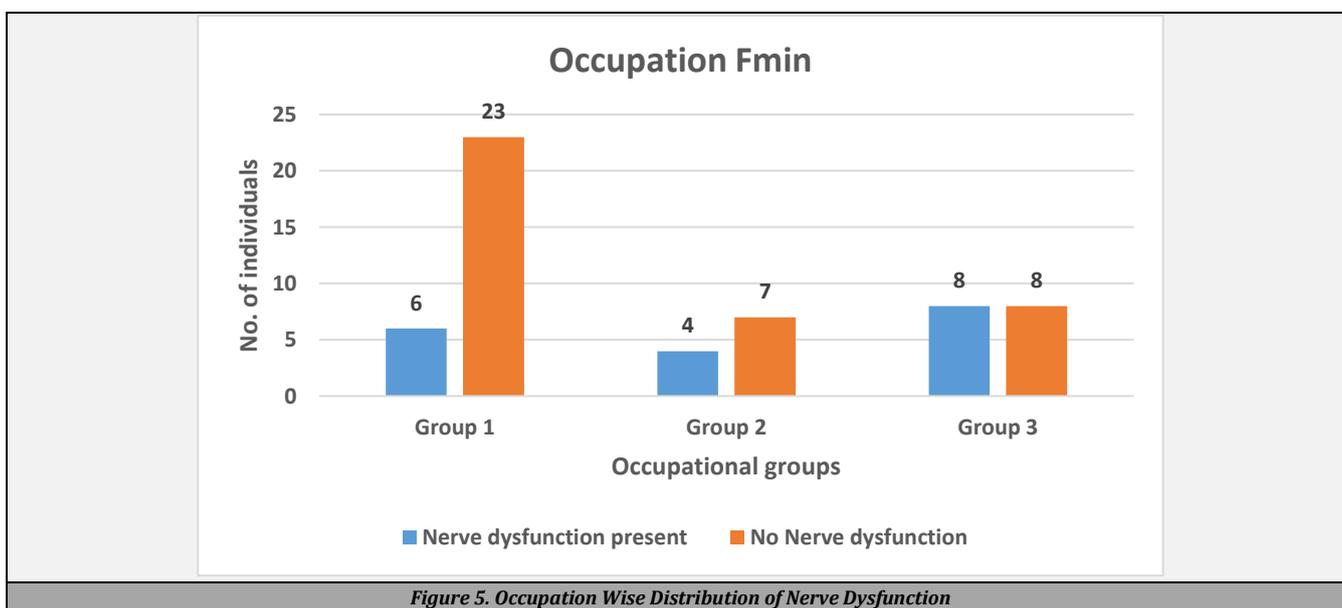


Figure 5. Occupation Wise Distribution of Nerve Dysfunction

**Occupation**

All the different occupations of the participants, for the convenience of this study were grouped as follows - Group 1 consists of occupations requiring patients to sit in the same position for long hours, writing or working on a computer. Group 2 has individuals with physically demanding occupations, constant bending, or heavy lifting. Group 3 includes individuals with moderately strenuous occupations.

Results based on F min latency parameters showed group 3 had higher affection percentage (14.28 %) this was followed by group 1 with 10.71 % affection and lastly 7.14 % participants had nerve dysfunction in group 2. (Figure 5)

**DISCUSSION**

This study estimates the prevalence of nerve dysfunction in individuals suffering from chronic neck pain that is it evaluates the presence of nerve involvement in patients suffering from

neck pain for more than three months with no actual symptom of nerve dysfunction like numbness or tingling sensations.

This study focuses particularly on the neck region as pain in the neck and its associated complications are regular features to any orthopaedic clinic.<sup>4</sup> Chronic neck pain which is often musculoskeletal to begin with and is generally caused by repeated muscular strains, disc lesions, ligamentous and capsular instability, spondylolisthesis, levator scapulae syndrome, spondylosis, spondylolysis and congenital deformities which are either preventable or manageable if detected early. Neurological symptoms are potential complications of this condition when prolonged. The study especially focuses on this particular complication estimating its prevalence rate, thus urging treating professionals to be vigilant towards the occurrence of nerve dysfunction while diagnosing and treating chronic neck pain thereby managing the condition better.

The participants included in this study belonged to age group 18 – 40 yrs. that is young adults and adult population as these groups are exposed to repeated strains while performing

activities of daily living. These contain mostly the working class who undergo tremendous mechanical stresses with their everyday work, be it a sedentary job or a physically demanding one. Individuals above this age were excluded to eliminate pain caused by degenerative changes. This can be supported by a study conducted in 2011 on the age related changes in the cervical vertebrae which suggested 50 % of adults over the age of 40, and 85 % of adults over the age of 60 showed some evidence of disc degeneration.

The study uses an objective method to confirm nerve dysfunction in the form of nerve conduction velocity studies instead of relying on patient's complaints or other subjective measures. Also, subjective measures could not be used as this study excludes patients with radicular symptoms. Nerve conduction velocity studies have lowest false positive rate<sup>13</sup> and hence could be used as an outcome measure. This study used minimum F wave latency as parameters of ulnar and median nerve F wave as these are particularly useful even in milder cases where EMGs are inconclusive.

A book on Clinical Electrophysiology<sup>12</sup> by Andrew J. Robinson and Lynn Synder Mackler suggested the normal values of F wave parameter of F min latency to be 25.7 for median nerve and 26.45 for ulnar nerve. Any value higher than these were considered abnormal and hence a positive report. The nerve conduction velocity study reports showed 32.14 % of the participants having chronic neck pain and showing no signs of nerve involvement like tingling or numbness had higher F min latency value than normal in either ulnar or median nerve root. Thus 32.14 % participants suffered from nerve dysfunction. This data raises some serious concerns regarding the health and fitness of the working-class population. Currently asymptomatic individuals are at great risk of developing radiculopathies and thus facing various limitations at work. Also, individuals with radiculopathies will have a low quality of life<sup>3</sup> with advancing age. This is preventable and the responsibility of the professionals to increase awareness in the masses and in case of a patient promptly manage the condition preventing these future complications.

Further when co-relating frequency of nerve dysfunction with age groups among the included population, higher frequency of nerve dysfunction is seen in older age groups. This finding is well in line with various similar research conducted over the years. Based on F min as an outcome measure statistical data showed highest percentage (10.72 %) in age group 39 - 42 years. A trend of decreasing percentage of population with nerve dysfunction can be observed with decreasing age. This trend from the current research is well in line with another nation-wide research conducted in French population from 2007 to 08 with prevalence of neuropathic characteristics in chronic pain.<sup>15</sup> Also, possible reasons for these findings could be the duration of chronic neck pain suffered by these individuals and the physiological age-related changes in the vertebrae.

Also, percentage of nerve dysfunction is seen to be significantly higher in males than females. Many past research showed females to be having higher percentages of chronic neck pain and other musculoskeletal disorders than males. This study showed similar results where chronic neck pain patients were slightly higher among females than males as the total chronic neck pain participants had more females (32) than males (24) but when nerve involvement was tested in

these individuals using f wave minimum latency it had more males with positive report for nerve involvement than females. This trend could be justified by the larger population of male participants who were involved in physically demanding tasks which in turn could have had a greater toll on their health and rapid progression of chronic neck pain into neuropathic pain.

Now, considering the effect of occupational demands on the physical health of chronic neck pain individuals revealed greater percentage of nerve dysfunction patients who belonged to group performing physically demanding tasks. This data supports the findings noted in the past suggesting higher musculoskeletal disorders and neuropathic pain in workers with repetitive work and heavy lifting.<sup>16</sup> Awkward postures also lead to these conditions. Here similar reports were noted revealing high percentage of individuals with nerve dysfunction work in occupations requiring them to sit for long hours. Thus, stooped sitting, bending, writing or other clerical works<sup>19</sup> with has a negative effect on the workers causing them to suffer not only from chronic neck pain but also is progressing to neuropathic condition. These findings are of great value in improving work practices, workstation design and plan ergonomic strategies.

All these trends and patterns of nerve dysfunction in chronic neck pain patients established in this study could be used as guidelines to help create awareness among both patients and health professionals, formulate better treatment strategies and ergonomic advices ultimately ensuring the health and well-being of the nation. This study also considered other factors such as duration of pain, average pain intensity and interference of pain with daily activities but no clear correlation could be established between nerve dysfunction and these factors. The results of this study are helpful in indicating the high-risk population and thereby implementing safety measures for the betterment of the community.

## CONCLUSIONS

This study shows that a significant population of chronic neck pain with no symptoms of nerve involvement actually have nerve dysfunction and are not receiving any treatment for their condition allowing it to progress into a radiculopathy. Here positive co relations were established between nerve dysfunction in chronic neck pain, age, gender, and occupation respectively. Percentage of population with nerve dysfunction is higher with advancing age, males and in physically demanding occupations.

Data sharing statement provided by the authors is available with the full text of this article at jemds.com.

Financial or other competing interests: None.

Disclosure forms provided by the authors are available with the full text of this article at jemds.com.

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