



## Carpal Tunnel Syndrome: A Clinical and Electrophysiological Appraisal in Carpal Tunnel Syndrome

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### Abstract

**Background:** Indian studies, especially from this part (NCR Region) are scarce in Carpal tunnel syndrome (CTS), the most common entrapment neuropathy. Aim of this study was to analyze clinical and electrophysiological profile in CTS.

**Materials and Methods:** 50 hands (35 patients) with clinical features compatible with CTS were included in the study. Detailed clinical, laboratory and electrophysiological evaluations of patients were done. The patients were followed up to a period of one year.

**Results:** The mean age of patients was 43.5 years with M: F ratio of 15: 38. Symptoms were bilateral in 30% of patients. The most common symptom was numbness sensation in hands, followed by pain while least common was colour change. Sensory loss was observed in 60% while clumsiness was noted in 40% of hands. Thyroid abnormalities were associated with 30% of hands. Mean EPS Grade was 3.32, with the most common electrophysiological abnormality was increase in latency difference between median and ulnar sensory nerves. This was also seen as the only electrophysiological abnormality in 8%. The least common abnormality was un-recordable CMAP. The patients with only a change in the sensory latency responded well to drugs and use of splint. Those who had in addition abnormal CMAP did not respond so well. The patients with thenar atrophy also did not respond well.

**Conclusion:** Carpal tunnel syndrome commonly presents with numbness in both hands with frequently associated hypothyroidism. Electrophysiological abnormalities can help in predicting the therapeutic response and prognosis. Abnormalities of CMAP and presence of atrophy are predictors of poor prognosis.

**Keywords:** Carpal tunnel syndrome, Clinical, Nerve conduction study, Electrophysiological.

### INTRODUCTION

Carpal tunnel syndrome (CTS) is the most commonly occurring peripheral nerve compression syndrome, and accounts for about 90% of all entrapment neuropathy with a 10% lifetime risk of development.<sup>[1,2,3]</sup> The incidence and prevalence varies 0.1–1% and 5–16%, depending upon the

criteria used for the diagnosis.<sup>[1,4,5]</sup> It most often occurs after the age of 30 years, with women affected more than men by a factor of 3 to 1<sup>[6,7,8]</sup>. CTS involve median nerve compression at the level of the wrist. Median nerve entrapment can result in sensory and motor impairment, as well as pain in the hand and or arm. There is no single

reference standard for diagnosis of the syndrome and CTS is primarily a clinical diagnosis supplemented by stress tests such as Phalen test and Tinel's test. Nerve conduction study (NCS) is must for diagnosis and prediction of therapeutic success.<sup>[1,4,6]</sup> Distinction should be made between CTS (a clinical syndrome involving a cluster of symptoms) and distal median neuropathy (a structural abnormality with patho-physiological findings on nerve conduction studies). It should be noted that distal median neuropathy can sometimes be asymptomatic; conversely, patients with CTS can occasionally have normal nerve conduction study results.

Although most cases are idiopathic (have no identifiable cause), the usual predisposing factors are diabetes mellitus, obesity, hyperlipidemia, rheumatoid arthritis, hypothyroidism, recurrent twisting turning of hands while working, work with vibrating tools and postpartum period. Because the carpal tunnel runs between the transverse carpal ligament and the carpal bones, damage to this region can result from a number of compression lesions, including local trauma, overuse of the hand or wrist, or prolonged improper positioning. Occupational causes contribute to the occurrence of CTS.<sup>[9,10]</sup>

We undertook this study to study the clinical and electrophysiological profile of CTS patients and the correlation between them.

## MATERIAL AND METHODS

This prospective study was performed over 12 months from August 2015 to July 2016 at Saraswathi Institute of Medical Sciences, Hapur, Ghaziabad. Patients attending Outdoor Department of Neurology and referred from Medicine and Orthopedics Outdoor Departments were included in the study. Patients were screened for symptoms suggestive of CTS and clinical provocative tests of CTS were done. Phalen test, Tinel's test were performed in all patients. A total of 50 hands (35 patients) diagnosed as having CTS clinically, were included. Twenty-five

control patients were included. Then, patients were subjected to NCS on Medelec Synergy Machine, Oxford, UK measuring sensory and motor latency, amplitude, and velocity. Patients were also subjected to orthodromic mixed median nerve study, median to ulnar nerve, and median to radial nerve comparative study. All NCS positive patients were classified into subgroups for analysis according to padua et al as follows: Extreme CTS (absence of median motor, sensory responses), Severe (absence of sensory response, abnormal DML), Moderate (abnormal SNCV, abnormal DML), Mild (abnormal SNCV, normal DML), Minimal (abnormal R or other segmental/comparative test, normal standard tests).<sup>[11]</sup>

Statistical analysis of the data was performed in Microsoft Excel format and analyzed using SPSS for Windows and Data was expressed in mean, percentage, and standard deviation. Pearson's correlation coefficient was used for comparing clinical data with Electro physiological parameters. Informed consent was taken from all patients and approval of the Institutional Ethics Committee was obtained.

## OBSERVATIONS

Clinical findings are summarized in Table 1, 2 and 3. Electrophysiological grading is summarized in Table 4. A total of 50 hands (35 patients) diagnosed as having CTS clinically, were included.

**Table 1.** Clinical Symptoms

Clinical symptoms	Feature-	Number of hands with positive history	Number of hands with negative history	Percent of total no. of hands with positive history
Numbness		40	10	80
Pain		35	15	70
Swelling		25	25	50
Colour change		15	35	30
Weakness		20	30	40
Clumsiness		35	15	70
Aggravating factor- More after use		45	5	90
Aggravating factor- More in night		46	04	94
Relieving factor- Shaking		30	20	60
Relieving factor- Rest		45	05	90
Relieving factor- Massage		30	20	60

**Table 2.** Clinical Signs

Clinical signs	Feature-	Number of hands with positive sign	Number of hands with negative sign	Percent of total no. of hands with positive sign
Sensory deficit		30	20	60
Motor Deficit		20	30	40
Atrophy		10	40	20
Teinel Sign		30	20	50
Phalen Sign		25	25	50

**Table 3.** Associated illness

Associated Illness	No. of Hands positive	No. of Hands negative	Percent of total no. of hands with positive
Hypothyroidism	16	34	32
Diabetes Mellitus	05	45	10
Obesity	05	45	10
Pregnancy	02	48	04
Post Partum	03	47	06
Rheumatoid Arthritis	02	48	04
Others	05	45	10

**Table 4.**Electrophysiological grading

Electrophysiological grade	No. of Hands in grade	Percent of total no. of hands
Extreme (absence of median motor, sensory responses)	02	04
Severe (absence of sensory response, abnormal DML),	02	04
Moderate (abnormal SNCV, abnormal DML),	28	56
Mild (abnormal SNCV, normal DML),	14	28
Minimal (abnormal R or other segmental/comparative test, normal standard tests)	04	08

## DISCUSSION

A total of 50 hands (35 patients) diagnosed as having CTS clinically, were included. The mean age of patients was 43.5 years with M:F ratio of 15: 38. Symptoms were bilateral in 15 (30%) patients. In study by Vinay G et al the mean age was 44.21 years with female predominance (M:F 3:11). Sixty four (91.4%) patients had bilateral involvement.<sup>[12]</sup> The patients' mean age was 43.9 ± 14 years, and most of them were females, with male to female ratio being 13:79 in study by Kasundra G M et al.<sup>[13]</sup>

The most common complaint of patients was numbness in hand, first started in thumb and soon followed into index finger and radial part of hand up to ring finger. Many patients just said numbness as complaint but on close enquiry they were able to relate that at least in early phase it was confined to the radial part of hand. Though in most of severe cases it was well complained on whole of hand though on examination sensory loss was confined to median nerve distribution. This numbness was more distressful in night and was somewhat relieved by shaking hands. Pain was a common complaint second only to numbness and was in radial part of hand, aggravated by use and relieved by rest and was more distressful full again in night. In severe cases it was felt in whole of hand and even in forearm and whole of upper limb raising the question of associated cervical spondylosis though neck pain was absent and MRI Cervical spine was normal corroborating that at least in some cases pain of CTS may have wider distribution.

Clumsiness, typically difficult in performing fine works with hands which demand precision and endurance like writing or doing house hold works was quite common. Thug Weakness win demonstrable lower power griming was not that common as clumsiness. Wasting of thenar eminence was seen in some of severe cases and was correlated with poor response to therapeutic measures including drugs like gabapentin and splinting of wrists. On examination commonest abnormality was sensory deficit (60%), followed

by positive Phalen test and Tinel's test(50%). Phalen's test was positive in 84.9% whereas Tinel's test was present in 78.5% of patients in study by Kasundra G M et al.<sup>[13]</sup>

The most common risk factor was hypothyroidism (32%), followed by obesity (10%) and diabetes mellitus (10%). In study by Kasundra G M et al the most common risk factor was obesity (15%) followed by hypothyroidism (12.9%), diabetes mellitus (10.75%), work related (8.6%), and postpartum state (7.50%).<sup>[13]</sup>

Earliest realization of the median motor nerve conduction studies in the diagnosis of CTS was by Simpson in 1956.<sup>[14]</sup> Brown ,in intraoperative conduction studies ,confirmed that the median nerve conduction abnormalities in CTS are focal and localised to the segment of the median nerve in the carpal tunnel.<sup>[15]</sup> NCS tend to become abnormal after significant compression leads to ischemic demyelination of the median nerve. This occurs first in the fast conducting fibres which travel deep to the flexor retinaculum. Thus, routine NCS measuring superficial sensory branch of median nerve may fail to pick up the pathology. Thus as per the AAEM guidelines, orthodromic mixed nerve studies and comparative studies (median to ulnar digit four, median to radial thumb) should be done. These techniques increase the sensitivity and specificity of diagnosing CTS. Thus, NCS has been considered as gold standard.<sup>[1,5,7]</sup>

In our study mean EPS Grade was 3.32, with the most common electrophysiological abnormality was increase in latency difference between median and ulnar. Increased inter latency difference as the only electrophysiological abnormality was observed in 4(8%). The least common abnormality was un-recordable CMAP. The patients with only a change in the sensory latency with a lower EPS Grade, responded well to drugs and use of splint. Those who had in addition abnormal CMAP did not respond so well. In study of 140 hands by Vinay G et al mean EPS was reported 3.18.<sup>[12]</sup>

Median sensory nerve conduction across the wrist over a short conduction distance has been reported to be more sensitive than antidromic or orthodromic sensory conduction studies. [7,10,12] The difference between the median and ulnar nerve latency measurements with palmar stimulation has also been found quite useful by many authors.<sup>[16]</sup> Sensitivity evaluation of the different median nerve conduction studies has also concluded median sensory NCSs confirm the clinical diagnosis of CTS more often than the median motor NCSs, the median sensory or mixed nerve conduction from wrist to digit is less sensitive for confirmation of the clinical diagnosis of CTS, compared to evaluation of median sensory or mixed nerve conduction over a short conduction distance across the carpal tunnel, or comparison of sensory or mixed nerve conduction of the median nerve through the carpal tunnel to sensory or mixed nerve conduction of the ulnar nerve or radial nerve in the same hand. [12,16]

## CONCLUSION

Carpal tunnel syndrome commonly presents with numbness, pain in both hands and clumsiness in doing fine tasks. It is frequently associated with hypothyroidism and obesity. Clinical tests such as Phalen test and Tinel's test do help in supporting diagnosis. Common electrophysiological abnormalities seen are prolonged latency of median sensory nerve especially when compared with ulnar nerve across the wrist. Various parameters of Nerve Conduction can help in predicting the therapeutic response and prognosis. Abnormalities of motor amplitudes and presence of atrophy are predictors of poor prognosis.

## CONFLICT OF INTEREST

The authors of the manuscript have no conflict of interest to declare.

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