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Relationship between Clinical Signs & Symptoms and Electrophysiological Findings in Carpal Tunnel Syndrome Patients

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Abstract: ***Background: CTS (Carpal tunnel syndrome) has been reported to be the commonest entrapment neuropathy. Clinical symptoms of CTS and Phalen's test & Tinel's sign are the two signs used commonly to diagnose clinically CTS. Aim & objective: To co-relate electrophysiological findings with clinical signs & symptoms of CTS. Materials and methods: Sensory and motor nerve conduction study were carried out in 100 CTS patients and 60 controls in department of physiology, KIMS Karad.Subjects were divided into 4 groups . Control group , group I (clinical symptoms along with both test (-) ve, group II (clinical symptoms along with either of the test (+)ve, group III (clinical symptoms along with both the test (+)ve. Sensory nerve conduction velocity(SNCV) of Median nerve, Difference in distal sensory latency(DSL)of median & ulnar nerve, Difference in distal motor latency(DML) of median & ulnar nerve, DML of Median nerve were compared between four groups. Result: For all the parameters studied Significant differences were observed between control & Three Groups (p<0.01). No significant differences were observed between three Groups (I,II.&III). Conclusion: Alone clinical symptoms, with negative Phalens and Tinel's sign shows no electrophysiological evidence for CTS. So clinical symptoms along with one of the test (Phalen's & Tinels) Should be positive to get the electrophysiological evidence for CTS.***

Keywords: carpal tunnel syndrome, Phalen's test, Tinel's sign

1. Introduction

Carpal tunnel syndrome is the most common entrapment neuropathy in upper extremity. The carpal tunnel is bounded by carpal bones and transverse ligaments which are attached to scaphoid, trapezoid and hamate bones. The diameter of carpal tunnel is 2-2.5cm and median nerve passes through it along with nine digital flexor tendons. some degree of compression of median nerve and focal nerve conduction slowing is common at this level which is more pronounced 2-3cm distal to the origin of the ligaments. Autopsy study has also confirmed focal abnormality in median nerve in 5 out of 12 asymptomatic subjects[1, 2].

CTS has also been reported to be the commonest entrapment neuropathy in western countries. In Rochester, Minnesota the prevalence of CTS was estimated at 125 per 100,000 in 1976-1980.Earlier hospital based studies from India reported CTS rarely. In recent study from south India CTS accounted for 7% of patients with peripheral nerve disorders and 84% of entrapment neuropathies referred for electro diagnostic evaluation. Early diagnosis of CTS may help to plan the treatment in early stage before structural damage to median nerve occurs. The results of electro diagnostic studies have been found to be highly sensitive and specific [3].

Phalen's test & Tinel's sign are the two signs used commonly to diagnose clinically Carpal tunnel syndrome [4,5]. In the early stage of disease patient may get tingling , numbness & pain in palm, however phalen's & Tinel's sign may not be positive(+). When median nerve is more compressed either Tinel's or phalen's sign or both become positive [5]. Electrophysiological evaluation is more sensitive for early diagnosis of carpal tunnel syndrome. Here we are expecting more deterioration of nerve conduction in Group-II compared to Group-I & still more deterioration of nerve conduction in Group-III compared to Group-I.

Electrophysiological evaluation will able to test exact deterioration of nerve conduction of median nerve. For every patient NCS may not be possible. So the present study is carried out to co-relate electrophysiological findings with clinical signs and symptoms of carpal tunnel syndrome patients.

2. Materials and Method

All the CTS patients referred to dept. of Physiology, KIMS, Karad for electro diagnosis were selected for present study. Sensory and motor nerve conduction studies of right hand were carried out in 100 clinically diagnosed patients of CTS and 60 controls to find out electro physiologic changes. Recorder and Medicare System (RMS) machine from Chandigarh was used.
Institutional ethical committee approval was taken for the study. Patients and subjects were informed the detailed procedure of nerve conduction study and written consent was taken.

Inclusion criteria
Patients having symptoms suggestive of CTS i.e.- Tingling, numbness, pain in palm more than 4weeks with or without phalen's test positive or Tinels sign positive [5].

Exclusion criteria
Patients having open wounds on hand and all the conditions where nerve conduction is contraindicated.

In the present study subjects were divided into 4 groups. Healthy subjects without any signs & symptoms of CTS

were considered as control group. Clinically diagnosed patients of carpal tunnel syndrome were divided into 3 groups.

Group-I: Clinical Symptoms tingling, numbness, pain in palm more than 4weeks & both Phalen's & Tinel's test negative(-)
Group-II: Clinical Symptoms tingling, numbness, pain in palm more than 4weeks & either of the test is positive(+)
Group-III: Clinical Symptoms tingling, numbness, pain in palm more than 4weeks & both Phalen's & Tinel's test positive(+)

Sensory nerve conduction velocity(SNCV) of Median nerve, Difference in distal sensory latency(DSL)of median & ulnar nerve, Difference in distal motor latency(DML) of median & ulnar nerve, Distal motor latency of Median nerve are very sensitive indicator for early diagnosis of CTS.[6,9] Study of F wave is also useful indicator for early diagnosis of CTS.[7,8]
In this study 4 sensitive indicators of carpal tunnel syndrome were compared.

1) Sensory Nerve Conduction Velocity(SNCV) of Median nerve
2) Difference in Distal Sensory latency (DSL) of median & ulnar nerve
3) Difference in Distal Motor latency (DML)of median & ulnar nerve
4) Distal Motor latency(DML) of Median nerve

For recording motor conduction of Median nerve, recording electrode was placed close to the motor point of Abductor Pollicis Brevis and reference electrode 3cm distal to it at first metacarpo phalangeal joint. A supramaximal stimulus was given at wrist and at elbow near volar crease of brachial pulse.

For recording motor conduction of Ulnar nerve, recording electrode was placed close to the motor point of Abductor Digiti Minimi and reference electrode 3cm distal to it at fifth metacarpophalangeal joint. A supramaximal stimulus was given at wrist and at elbow in cubital tunnel behind medial epicondyle. For ulnar nerve stimulation at elbow arm position was maintained at 135^0.[1]

Care was taken to keep same distance between stimulating and recording electrodes for both median and ulnar nerves at wrist so that distal latencies of Median and Ulnar nerves could be compared.[1]

For orthodromic sensory conduction of median nerve, surface recording electrode was placed 3cm proximal to distal wrist crease and reference electrode at 3cm proximal to recording electrode. For stimulation ring electrodes was fixed on second digit.

For orthodromic sensory conduction of ulnar nerve, recording electrode was placed 3cm proximal to distal palmer crease and reference electrode at 3cm proximal to recording electrode.

For sensory stimulation ring electrodes was fixed on fifth digit. Cathode was placed at first interphalangeal joint and anode at 3cm distal to cathode. For both median and ulnar sensory conduction, 20 supramaximal stimuli were delivered and average was recorded. During both median and ulnar sensory conduction recording, ground electrode was placed between recording and stimulating electrodes. Care was taken to keep same distance between stimulating and recording electrode for both median and ulnar nerves at wrist.

During nerve conduction study, laboratory temperature was maintained between 21^o C to 23^0C.

Statistical Analysis
SPSS Software was used .Mean & SD were calculated from all the groups. ANOVA test was used to find out differences between the groups. The difference was considered to be highly significant when P value was < 0.001 and significant when P value was < 0.05.

Table

	Control(n=60) Mean±SD(m/s)	Group-I(n=16) Mean±SD(m/s)	Group-II(n=18) Mean±SD(m/s)	Group-III(n=43) Mean±SD(m/s)
Sensory Nerve Conduction Velocity(SNCV) Median	52.97±11.08	42.57±9.116	39.97±13.72	36.96±10.1
Distal Sensory Latency(DSL) difference of median & ulnar	0.12±0.072	0.88±0.89	1.61±1.048	1.52±1.12
Distal Motor Latency(DML) difference of median & ulnar	0.66±0.3	1.60±0.48	1.95±1.16	2.29±1.43
Distal Motor Latency(DML)median	Mean±SD 2.98±0.36	Mean±SD 3.84±0.384	Mean±SD 4.34±1.15	Mean±SD 4.7±1.60

3. Results

i) It was observed that compared to controls (52.97±11.08) sensory nerve conduction velocity of median nerve was significantly reduced in group-I (42.57±9.116), group-II (39.97±13.72) & group-III (36.96±10.1) (P< 0.001).
ii) It was also observed that difference in the distal sensory latency of median & ulnar nerve was significantly increased in Group-I (0.88±0.89), group-II (1.61±1.048) & group-III (1.52±1.12) (P<0.001).
iii) The difference in Distal Motor Latency of median and ulnar nerve was compared with controls(0.66±0.3) and found to be significantly increased in Group-I (1.6±0.48), Group-II(1.95±1.16)and Group-III (2.29±1.43) (P<0.001).
iv) It was also found that compared to controls(2.98±0.36) Distal Motor latency of median nerve(3.84±0.384) was significantly increased in Group-I, Group-II(4.34±1.15) and Group-III(4.7±1.606) (P<0.001).

When all above parameters (i,ii,iii,iv) were compared between the Groups I,II,III no significant differences were observed.

4. Discussion

Characteristic findings in the electrophysiological diagnosis of CTS were slowing sensory conduction of median nerve, decrease in SNAP amplitude, and increase in DSL and DML in median nerve [10,11,12]. As ulnar nerve does not pass through tunnel and passes lateral to tunnel, its DML and DSL are expected to be normal. So difference between DML and DSL of madian and ulnar nerve may be considered as very sensitive indicator of CTS [2,10,13].

In the present study it was observed that compared to control, in Group-I (Clinical Symptoms more than 4weeks & both Phalen's & Tinel's test negative) no statistically significant differences were observed. However compared to control, for Group-II(Clinical Symptoms more than 4weeks & either of the test positive)and Group-III (Clinical Symptoms more than 4weeks & both Phalen's & Tinel's the test positive) statistically significant differences were observed for all the parameters studied which indicates that alone clinical symptoms & negative Tinel's and Phalens sign are not adequate enough to show electrophysiological findings suggestive of CTS.

When GroupI,II &III were compared by ANOVA test, no significant differences were observed between the groups which indicates that electrophysiological findings are not exactly co-related with both the tests and signs &symptoms. However our study indicates that to show electrophysiological findings ,alone clinical symptoms are not adequate .If either one of the test or both the test are positive, patient shows electrophysiological changes. So there is a partial relationship between clinical signs & symptoms and electrophysiological findings.

We were expecting progressive deterioration of nerve conduction in group-I, group-II & group-III. However there were no significant differences observed between the groups for all parameters studied.

So when physician or surgeon wants to know exact deterioration of nerve conduction, electrophysiological study is must. However large scale study is required o confirm the finding.

5. Conclusion

Alone clinical symptoms, with negative Phalens and Tinel's sign shows no electrophysiological evidence for CTS. So clinical symptoms along with one of the test (Phalen's & Tinels) should be positive to get the electrophysiological evidence for CTS.

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