IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)
e-ISSN: 2278-3008, p-ISSN:2319-7676. Volume 10, Issue 3 Ver. IV (May - Jun. 2015), PP 32-37
www.iosrjournals.org

Clinical and Electrophysiological Study in Carpel Tunnel Syndrome

Dr. W. Maruthi M.D*[1], Dr. C. Indira Devi M.D[2].
[1,2,] Associate Professor, Department of Physiology, Guntur Medical College, Guntur.

Abstract: *Carpal Tunnel Syndrome (CTS) is the most common entrapment neuropathy, caused by compression of median nerve in the Carpal Tunnel at wrist, presenting with tingling and numbness of the thumb, index and middle fingers.*

Aim*: To study the signs and symptoms and various Electrophysiological parameters in patients suggestive of CTS.*

Materials And Methods*: A Total number of 50 patients suggestive of Carpal Tunnel Syndrome were examined in both the hands. A of total number of 30 healthy volunteers served as controls. Electro Physiological evaluation was done bilaterally using neuro perfect model – Medicaid system.*

Results And Conclusion*: The clinical tests like Tinel's sign and Phalen's signs are having variable sensitivities and the Phalen's sign is more sensitive sign in diagnosis of CTS. The longer the duration of the symptoms in CTS, the more the sensitive are the electrodiagnositic studies. Various parameters that are studied like distal motor latencies, distal sensory latencies are sensitive enough to bring out the diagnosis even in the asymptomatic hands. Increasing the number of parameters for study increase the certainty in the diagnosis of Carpal Tunnel Syndrome. The elecrodiagnosis study are helpful in confirm in the diagnosis and bringing out the sub-clinical cases to light.*

Key words*: Carpel tunnel syndrome, Electro Physiological study, Tinel's sign, Phalen's signs.*

I. Introduction:

Carpal Tunnel Syndrome (CTS) is the most common entrapment neuropathy, caused by compression of median nerve in the Carpal Tunnel at wrist. The wrist is surrounded by a band of fibrous tissue which normally functions as a support for the joint. The tight space between this fibrous band and wrist bone is called carpal tunnel. The median nerve along with flexor tendons that extend from forearm into hands nerve passes through carpal tunnel of the hand and motor branch supplies Abductor pollicis brevis, Opponens pollicis and Flexor pollicis brevis by recurrent motor branch by dividing near the distal edge of carpal tunnel.

Ischemia and increase in pressure in the carpal tunnel results in chronic compression of nerve trunk causing focal demyelination. .CTS is often bilateral with more marked symptoms on dominant side. Presenting with tingling and numbness of the thumb, index and middle fingers. The basic median nerve compression in carpal tunnel causes focal demyelination of the nerve resulting in prolonging of conduction of impulse in carpal tunnel studied electro physiologically by nerve conduction studies.

Carpal Tunnel Syndrome Clinical Presentation

Paresthesias:
Early in the syndrome, sensory symptoms are intermittent – patients frequently characterize the paresthesia as their hand "going to sleep" and often attribute the symptoms to "cutting off circulation". Sometimes accompanied by pain, characteristically interrupt sleep and also can be present on awakening in the morning or recur at rest during the day.

Hand and Arm Pain:
Hand and arm pain usually accompanies the paresthesias however, painless paresthesias do occur, particularly early in the evolution of symptoms.

Motor Symptoms:
Patients report stiffness, clumsiness, and even weakness of their hands.

Examination: Patients being evaluated for CTS should have regional arm and neck examination and neurologic examination that should include such details as pupils, strength and sensation in all extremities, gait and tendon reflexes. Routine sensory and motor examination of the hand should to be done.

Provocative Tests:
Phalen's Sign: Phalen (1966) describe the "wrist flexion test". The patient is asked to hold the forearms vertically and to allow both hands to drop into complete flexion at the wrist for approximately one minute.
An individual who has a positive Phalen's sign reports numbness or paresthesias in the distribution of the median nerve within 1 minute of sustained wrist flexion.

Tinel's Sign: Tinel's Sign is percussion over the median nerve at the wrist. If the parestheisas is present in the distribution of median nerve the test positive.

Electrophysiology Of Carpal Tunnel Syndrome: The motor nerve conduction studies (MNCS) and the sensory nerve conduction studies (SNCS) are routine studies that are conducted in aiding the clinical diagnosis of the CTS.

Techniques
Motor Nerve Conduction Studies : Surface Recording electrodes should be on the thenar eminence with the Active electrode over the motor point of the abductor pollicis brevis, two-thirds of the way along a line running from the metacarpophalangeal joint to the carpal metacarpal joint of the thumb. In this position the electrode detects potentials from multiple thenar muscles.
The reference electrode should be at the metacarpal phalangeal joint of the thumb.
The Ground electrode may be on the dorsum of the hand.
The stimulation sites are typically at the wrist, just medial to the tendon of the Flexor Carpi Radialis and in the antecubital space just medial to the Biceps tendon.
The amplitude of the CMAP in mill volts and the latency in milliseconds between the time of stimulation and the onset o CMAP are recorded.

Sensory Nerve Conduction Studies: Median nerve sensory conduction antidromic stimulation, the nerve is stimulated at the wrist or palm while recording with ring electrodes on any of the first four digits. Orthodromic stimulation, the nerve is stimulated on a Median-innervated digit or at the palm whether antidromic or orthodromic approaches are used has little practical effect on normal or pathologic values.

Test Sensitivity in C T S: Normal tests in patients who have clinical symptoms and signs of C T S are false-negative results. The sensitivity of a test for CT S is defined as the ratio of positive tests in patients who have the syndrome (true-positive results) to total number of tested patients (true-positive results and true-negative results) who have syndrome.
Test sensitivity= true positive results / True positive +true negative × 100

II. Materials And Methods

A of total number of 30 asymptomatic normal healthy volunteers of both the hands served as controls.
Both median and ulnar nerves were examined for;
Distal Motor latencies.
Amplitudes of Compound Motor Action Potential (CMAP)
Motor nerve conduction velocity
Distal sensory latency
Amplitude of sensory nerve Action Potential
Sensory nerve conduction velocities.

Machine Used:
Electro Physiological evaluation was done bilaterally using neuro perfect model – Medicaid system (Computerized Electro Myography Machine). A Total number of 50 patients who have symptoms and signs suggestive of CTS were examined in both the hands for paresthesias, sensory loss, and pain, motor weakness in the hands and muscle wasting in the median nerve distribution.
Both median and ulnar nerves were studied in all the patients.

The diagnosis of carpal tunnel syndrome is established by
When the distal motor latency in median nerve is prolonged more than 4.2 milliseconds.
When the distal sensory latency in median nerve is prolonged more than 2.91 milliseconds.
The difference between median and ulnar distal motor latency is more than 1.1 milliseconds.
The difference between median and ulnar distal sensory latency more than 0.4 milliseconds.

III. Results

Among the 50 patients studied 41 were females and 9 were males. The 50 patients were in the age group 21-60yrs.

Table – I Age distribution

	No of patients (Total 50)
21-30	11
31-40	21
41-50	14
51-60	4

Table – II Occupation Distribution

Occupation	**No of patients (Total 50)**
Housewives	29
Teacher	5
Typist	5
Industrial Workers	3
Tailor	3
Coli	3
Cook	2

All the patients were symptomatic in one or both hands of the total 50 patients examined of 100 hands, 73 hands were symptomatic and 27 hands were asymptomatic.

Table – III Hand Distribution of Parathesia

	Present (n=73)			Absent (n=27)		
	Single Hand	Both Hands	Total (73)	Single hand	Both Hands	Total (27)
Left	8 (11%)	23 (31.5%)	31 (42.5%)	19 (70%)	-	19
Right	19 (26%)	23 (31.5%)	42 (57.5%)	8 (30%)	-	8

Table – IV Hand Distribution of Weakness of APB

	Present (n=35)			**Absent (n=65)**		
	Single Hand	Both Hands	Total (35)	Single hand	Both Hands	Total (65)
Left	4 (11%)	7 (19.5%)	11 (30.5%)	18 (27%)	21 (32.5%)	39 (59.5%)
Right	17 (50%)	7 (19.5%)	24 (69.5%)	5 (8%)	21 (32.5%)	26 (40.5%)

Table – V Hand Distribution of Tinel's Sign

	Present (n=53)			**Absent (n=47)**		
	Single Hand	Both Hands	Total (35)	Single hand	Both Hands	Total (65)
Left	4 (8%)	15 (28%)	19 (36%)	20 (43%)	11 (23%)	31 (66%)
Right	19 (36%)	15 (28%)	34 (64%)	5 (11%)	11 (23%)	16 (34%)

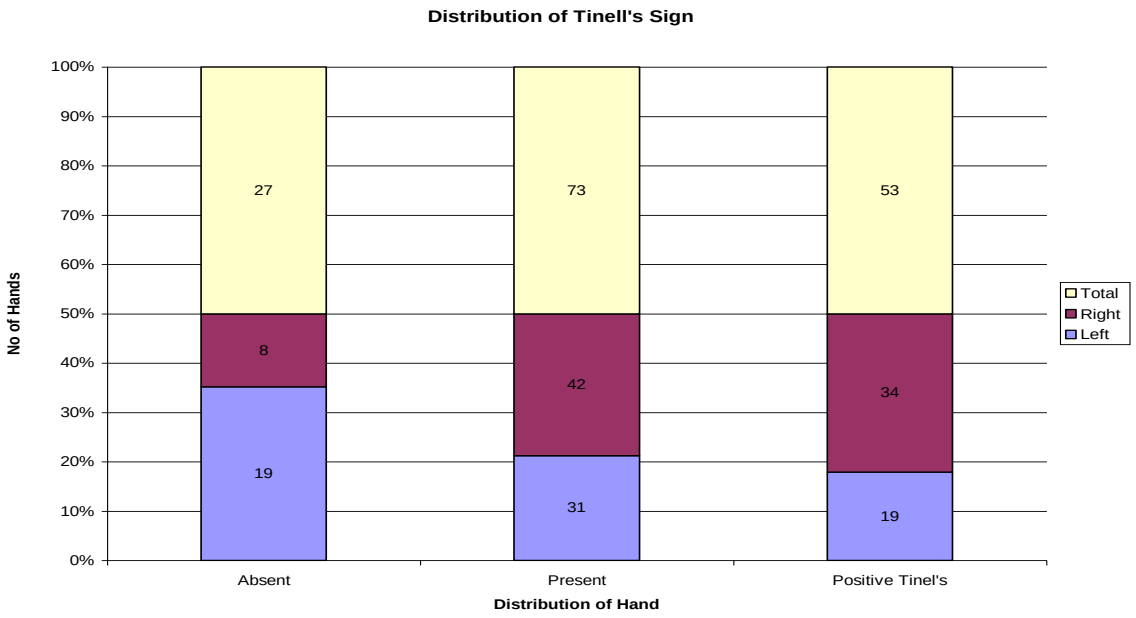
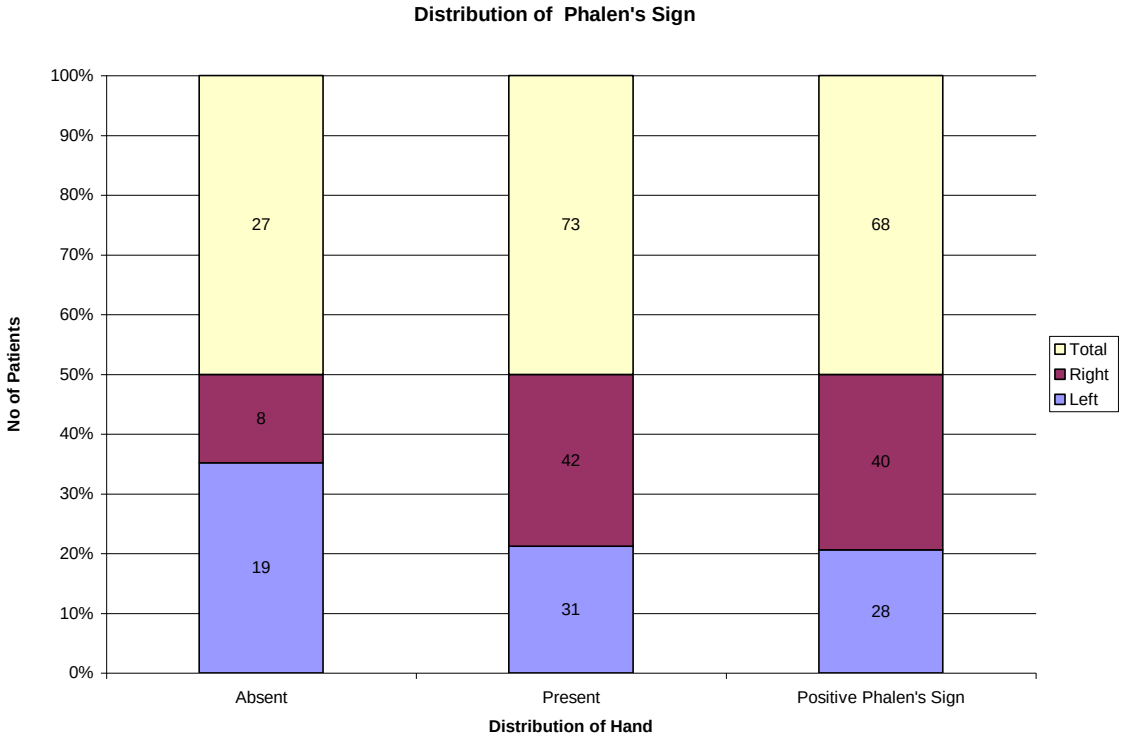


Table – VII Hand Distribution of Phalen's Sign

	Present (n=68)			**Absent (n=32)**		
	Single Hand	Both Hands	Total (35)	Single hand	Both Hands	Total (65)
Left	7 (10%)	21 (31%)	28 (41%)	20 (63%)	2 (6%)	22 (69%)
Right	19 (28%)	21 (31%)	40 (59%)	8 (25%)	2 (6%)	10 (31%)



Sensitivity of the Tests:

Test positive	Symptom positive (A)
Test Negative	Symptom Positive (B)

$$\text{Sensitivity} = \frac{A}{A+B} \times 100$$

DML of median nerve more than 4.22 ms in 73 symptomatic hands.

Tests	Right	Left	Total (73)
Test positive	Symptoms positive (36)	Symptoms positive (30)	Symptoms positive (66)
Test Negative	Symptoms negative (6)	Symptoms negative (1)	Symptoms negative (7)

$$\text{Sensitivity of DML more than 4.22 ms} = \frac{A}{A+B} \times 100 \qquad \frac{66}{73} \times 100 = 90.4\%$$

Difference more than 1.1 ms in DML of median and ulnar nerves of 73 symptomatic hands.

Tests	**Right**	**Left**	**Total (73)**
Test positive	Symptoms positive (40)	Symptoms positive (30)	Symptoms positive (73)
Test Negative	Symptoms negative (2)	Symptoms negative (1)	Symptoms negative (3)

$$\text{Sensitivity} = \frac{A}{A+B} \times 100 \qquad \frac{70}{73} \times 100 = 95.8\%$$

DSL of median nerve more than 2.91 ms.

Tests	**Right**	**Left**	**Total (73)**
Test positive	Symptoms positive (37)	Symptoms positive (30)	Symptoms positive (67)
Test Negative	Symptoms negative (5)	Symptoms negative (1)	Symptoms negative (6)

$$\text{Sensitivity} = \frac{A}{A+B} \times 100 = \frac{37}{42} \times 100 = 88.00\%$$

Difference between sensory latency more than 0.4 ms of Median and Ulnar.

Tests	Right	Left	Total (73)
Test positive	Symptoms positive (40)	Symptoms positive (30)	Symptoms positive (70)
Test Negative	Symptoms negative (2)	Symptoms negative (1)	Symptoms negative (3)

$$\text{Sensitivity} = \frac{A}{A+B} \times 100 = \frac{70}{73} \times 100 = 95.8\%$$

IV. Discussion

Many studies including Yamagnehi et al., 1965, Phale 1960, Mac Donald, Meyerhof & Bihrle, 1983 have shown the female preponderance over the males in CTS to a ration of 70:30 respectively. The present study also reflects the similar pattern with even slightly more female preponderance over males to a ratio of 82:18 respectively.

CTS is a condition which affects the middle aged and elderly with highest incidence in the middle ages of life. Data from J C Stevens, S Sun, CM Beard, WM O' Fallon, LT Kurland, Carpal Tunnel Syndrome in Rochester, Minnesota, 1961 to 1980. The present study reflects the maximum prevalence of the disease in the ages groups between 31 – 40 yrs (21 cases out of 50) followed by 41-50 yrs (14 cases out of 50). The study reflects the earlier age of onset of disease compared to western literature. The reason for this young age of onset in this study probably which involves housewives more in the household duties to which Indian women are exposed by nature of their domestic duties like washing and rinsing clothes, sweeping with broom stick, washing utensils etc.,

The right hand being dominant hand is used more in the activities conforming the finding of the prevalence of CTS to increased hand use. Thus the present study reflects the patterns similar to the various published studies. Other professions on the present study also reflect the occupations with increased hand use.

Paresthesias of the hands are the most common presenting symptoms of CTS. The diagnosis is more likely to be CTS when the sensory changes are limited to or at least include two or three median innervated digits (Katz & Stirrat CR, 1990).

The present study also reflects the established reports. Out of the 73 symptomatic hands all the hands (100%) are having paresthesias as the leading and presenting symptom and out of these 73 hands, 35 hands 48% have motor weakness as their secondary symptom, thus reflecting the fact of paresthesias being the leading and prominent and presenting symptom.

In the present study, out of the 73 symptomatic hands 35 hands (48%) had only APB weakness which is also minimal and was only a secondary symptom.

In different studies the sensitivity of the Tinel's sign in patients with carpal tunnel syndrome ranged from 14% to 65% (Golding, Rose and Selvarajah, 1986; Gerr and Letz, 1998). The present study also having sensitivity of 72.6% (53 out of 73) conforms to the previously published data.

In CTS, Phalen found that the Phalen's test was positive in 74% of hands.

In the present study out of the 73 symptomatic hands, 68 hands (93%) are found to have positive Phalen's sign appearing as more sensitive sign compared to previously published data. This increased sensitivity of this sign probably reflects as an indicator of more severe and prolonged nature of the predominant presenting symptom i.e., the paresthesias in the present study.

Regarding duration of symptoms, out of 73symptomatic hands, 46 (63%) had symptom duration of less than 6 months thereby (seeing earlier medical attention. Patients with longer duration of symptoms hand more positive electro diagnostic confirmation. In the present study the upper limit of the control value for the median. DML is taken as 4.2 ms and the sensitivity of this test is 90.4%. The higher sensitivity of this test in the present study reflects the severity and duration for the symptoms. Nerve conduction is more likely to be abnormal in patients with longer duration of symptoms.

In carpal tunnel syndrome, sensory nerve conduction studies are sensitive than motor conduction studies. In the present study the upper limit of the median DSL is taken as 2.91 ms as normative value and the sensitivity of this test in the present study is 88% again indicating the high sensitivity of this test proportionate to the severity and duration of the symptoms.

In the present study the median motor and sensory conductions are compared with the ipsilateral motor and sensory conductions. In this study the normal upper limit of the difference between the median and ulnar motor latencies is taken as 1.1 ms and that of sensory latencies is taken as 0.4ms.

The present study has shown the sensitivity for motor conduction as 95.8% and for sensory conductions as 95.8%. This also has shown that where the median motor conductions are abnormal the sensory

conductions have become equally abnormal after comparative studies. Thus the comparative studies are more sensitive for the diagnosis of Carpal Tunnel Syndrome.

In Carpal Tunnel Syndrome studies of various parameters increase the diagnostic sensitivity of the disease. Thus the 3 parameters are positive in 78 hands and one test positive are 3 hands. Thus, increasing the number of parameters helps in bringing out the more certainty in diagnosis.

V. Conclusions

- Carpal tunnel syndrome is a common entrapment neuropathy in patients commonly affects middle aged females.
- The occupations, which involve the increased use of hands is more likely to be associated with increased incidence of CTS in that particular hand.
- The paresthesias are the most predominant and prevalent symptom in the carpal tunnel syndrome followed by weakness of median innervated muscles predominantly abductor pollicis brevis.
- The clinical tests like Tinel's sign and Phalen's signs are having variable sensitivities and the Phalen's signs are more sensitive sign in diagnosis of CTS.
- The longer the duration of the symptoms in CTS, the more the sensitive are the electro diagnostic studies.
- Various parameters that are studied like distal motor latencies, distal sensory latencies are sensitive enough to bring out the diagnosis even in the asymptomatic hands.
- The comparative studies in the electro diagnosis are more sensitive for the diagnosis of Carpal Tunnel Syndrome.
- Increasing the number of parameters for study increase the certainty in the diagnosis of Carpal Tunnel Syndrome.
- The diagnosis of carpal tunnel syndrome is most often on clinical grounds. The electro diagnosis study are helpful in confirm in the diagnosis and bringing out the sub-clinical cases to light. The electro diagnosis study is complementary to the clinical diagnosis but not substitute.

Bibliography

[1]. Mishra UK, Kalita J. Clinical neurophysiology. BI Churchill Livingstone, 1999.
[2]. Reviews Neurology Edited by S Mohandas Rupam Borgohain Meena AK, Indian Academy of Neurology 1999.
[3]. Text book of Medical Physiology Enth Edition: Aurthur C. Guyton, John E Hall.
[4]. Manual of Practical physiology first edition: Profl. A K Jain.
[5]. Erlanger J, Gasser HS. Electrical signs of nervous activity. University of Pennsylvania Press, Philadelphia 1937.
[6]. Carpal tunnel, Carpal tunnel syndrome, Wrist pain. Description, causes and incidence; http://www.srv.net/~jxt/carpal tunnel.html.
[7]. Phalen GS. The carpal – tunnel syndrome. Seventeen years experience in diagnosis and treatment of six hundred fifty four hands. J. Bone joint surg. 1966; 48A: 211-28.