

## **Research Article**

# **Prevalence of Sub-Clinical Carpal Tunnel Syndrome in Asymptomatic Pregnant Women- the Electro neuro diagnostic Study**

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**Abstract:** To investigate the prevalence of carpal tunnel syndrome (CTS) in asymptomatic pregnant women in any of the trimesters of pregnancy and to compare their mean $\pm$  SD values with that of non-pregnant controls. A single point cross-sectional study was performed in forty five pregnant women of 20-40 yrs age group in any trimester of the pregnancy, presenting to Obstetrics outpatient department. An equal number of age-matched non-pregnant women were taken as controls in the study. The pregnant females were evaluated first by detailed clinical and neurological examination. Then the electro neuro diagnostic studies were conducted on Median nerve and Ulnar nerve B/L for both motor as well as sensory parameters. The mean $\pm$  SD values of the subjects were compared with that of non-pregnant controls. In conclusion forty five pregnant women studied, none had neurological signs and symptoms history and local neurological examination. The abnormal median nerve electro neuro diagnostic findings suggestive of carpal tunnel syndrome (CTS) due to median nerve compression at wrist were observed in two patients (4.44%).

**Keywords:** neurological signs and symptoms, electro neuro diagnostic tests, carpal tunnel syndrome (CTS), pregnant women

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### **INTRODUCTION:**

The compression neuropathies are common during pregnancy as well as in the postpartum period. The most common neuropathies are Bell's palsy, Carpal tunnel syndrome (CTS), Meralgia paresthetica and lower extremity neuropathies [1]. The most of these neuropathies are usually mild and reversible, can limit functioning and require treatment. The carpal tunnel syndrome (CTS) is entrapment of median nerve in the carpal tunnel of wrist. This is seen in pregnancy as a complication of pregnancy, one of the most frequent conditions for this situation. The prevalence as well as severity of CTS can be affected by pregnancy [2]. CTS often presents bilaterally and leads to more severe pain in dominant hand [3], which frequently radiates proximally into the forearm. Many pregnant women complain of frequent pains at night and it can be exacerbated by forceful activity and extreme wrist positions. Also most present with paresthesias such as numbness and tingling in lateral three and half fingers. Other common manifestations include burning pains in the wrist along with the loss of grip strength [4]. Up to 20% of pregnant women complain of paresthesias in hands at night. These paresthesias are a common complaint during pregnancy. Even in non pregnant

women, the most common symptom of CTS is observed to be hand paresthesias [3].

The prevalence of CTS is found to be much variable, was reported from low to as high as 62% in a study. In a study, prevalence of CTS was reported 0.6% in men and 6.8% in women in Netherland while the overall incidence is reported 2.7% in America [3].

A number of different mechanisms are explained to know the physiopathology of CTS but it is not understood completely. According to Sunderland theory an increase in the internal pressure of the carpal tunnel causes disturbance in the nutrition of the nerve. The extent of CTS is directly related to pressure and duration of pressure. CTS severity during onset of treatment is a very important issue [4]. Conduction blocks are also much more frequent especially affecting the motor (18%) or sensory (44%) conduction, resulting from acute compression of the nerve due to hormone-dependent tenosynovitis or due to the Infiltrations (85%) as studied [5].

Although hand signs and symptoms are useful, electro neuro diagnostic studies are more reliable test [2]. There are two classic tests for clinical evidence of median

nerve compression at the wrist; the Tinel test and the Phalen test [6]. This syndrome can be diagnosed by clinical manifestations and electro-neuro diagnostic studies [3,6]. For diagnosis of this syndrome and severity, the electro neuro diagnostic studies are very useful. Documentation of abnormalities in the median nerve is helpful to establish the diagnosis for CTS. Routine median nerve conduction study is valuable. There are several types of electro neuro diagnostic evaluations of the median nerve across the wrist. Prolonged terminal latency of motor or sensory median nerve would be found in most CTS cases [6]. The most sensitive electro neuro diagnostic test for diagnosis is sensory nerve conduction velocity of median nerve. As compared to motor conduction techniques, sensory nerve conduction studies can reveal an abnormality of median nerve action potential because the sensory fibers are usually affected first and to a greater degree than motor fibers [7]. The Electroencephalography (EEG) and electromyography (EMG) can be performed without any risk in the pregnancy. Pregnancy is not an absolute contraindication to these electro neuro diagnostic tests [8].

In some cases, subjects were neurologically asymptomatic but abnormal findings in favor of CTS were seen during the electro physiologic testing or sometimes, the clinical evidence of CTS was there but they were found to be normal on electro physiologic testing [9]. Sensory-motor nerve conduction studies (NCS) of the median nerve across the wrist compared to another nerves that does not go through the carpal tunnel such as ulnar nerve are the most sensitive and accurate techniques(10).None other technique had not been found to be as sensitive as traditional NCS.

All neuropathies associated with the pregnancy should be followed even after the childbirth as some may be persistent and require follow-up and appropriate treatment [1]. Treatment of CTS is different based on severity of syndrome. CTS during pregnancy is mostly mild and relieve with conservative treatment such as using splint during bedtime with the wrist in mid-position or slightly flexed [3, 8]. Sometimes it is severe enough to require surgical intervention. Carpal tunnel syndrome regresses within a few weeks after childbirth spontaneously as studied in 95% of women [8].

A number of studies have been performed in the past to study the prevalence and severity of CTS in the pregnancy. As per our knowledge, no such kind of study has been performed in this region. Most of the pregnant women unaware of the neurological complaints and present to Obstetrics and Gynae clinics for the routine ante-natal checkups or due to pregnancy related problems. So, this motivated us to conduct such kind of study to determine the prevalence of sub-clinical cases of carpal tunnel syndrome in the

asymptomatic pregnant women presenting to our institute, with the help of electro neuro diagnostic tests.

#### **AIMS AND OBJECTIVES:**

1. To investigate the prevalence of carpal tunnel syndrome in pregnant women in any of trimester of pregnancy.
2. To compare their mean  $\pm$  SD values with that of non-pregnant controls.
3. To correlate the electro neuro diagnostic findings with any existing neurological signs and symptoms.

#### **EXPERIMENTAL SECTION:**

##### **Materials:**

A single point cross-sectional study was performed at our institute, over the duration of 14 months. Forty five pregnant women in any of the trimesters of the pregnancy in the 20-40 yrs age group were taken into the study. They presented with general pregnancy related problems and for routine Ante-natal checkups to Obstetrics and Gynae outpatient department. Only the asymptomatic pregnant women were taken into the study. So, they might not be presenting with the neurological symptoms as their complaints. An equal number of age-matched non-pregnant women as controls were included in the study.

Exclusion criteria: pregnant women with any kind of neurological symptoms in upper limbs in pregnancy, any history of CTS diagnosed in the past (before the current pregnancy), Past or Family History of neuropathy or neuromuscular diseases , H/o hypothyroidism, diabetes mellitus, alcoholism, liver and kidney disease, use of drugs known to cause neuropathy. The pregnant women with H/o Pregnancy induced Hypertension (PIH) and PET was excluded from the study. Our purpose was to consider only the uncomplicated cases of pregnancy.

##### **Methods:**

After taking the history about the presence of neurological symptoms, all the women were evaluated first by detailed both physical as well as local neurological examinations. Then the electro neuro diagnostic studies in upper limb nerves were conducted. The height and weight of all the women was measured in first visits and body mass index (BMI) of each woman was calculated. The neurological examination consisted of motor and sensory system separately on all the women. For the motor system examination, the assessment of strength of flexors and extensors of elbow and wrist on the both sides was done. The sensory modalities (tactile sensibility as fine /gross touch, 2-point discrimination testing, pin prick, and vibration sense) were tested and graded according to a standard protocol. Also the examination for the thinner muscle atrophy and weakness, the Phalen's test and

Tinel's sign at the wrist were done on all the patients to find out the neurological signs.

These electro neuro diagnostic studies were performed in the research lab in the department of Physiology at our institute by using the Clarity vision NCS/EMG machine after the recommendations by the concerned obstetrician written on the OPD slip. The informed written constant from all the subjects was taken. The procedure was done according to standardised protocols to obtain and record the action potentials for the motor and the sensory studies [11]. The subjects were examined in the sitting or supine position. The room temperature was kept at 26-28°C. The skin was adequately prepared before the application of the stimulating and recording electrodes to ensure good contact between these electrodes and the skin.

The filters and sweep speed for the motor studies were set at 2 Hz to 5 kHz and 5ms/division and for the sensory studies at 20 Hz to 2 kHz and 2 ms/division respectively. A stimulus current of 0-40 mA with duration of 50 -1000 µs was required for effective nerve stimulation in upper limb nerves after delivering supramaximal stimuli in order to get adequate responses. The surface fixed bar stimulating electrodes and the surface 1cm disc recording electrodes were used for all the nerve studies.

The nerve conduction studies were performed on Median and Ulnar nerve on both sides to compare the sensory as well as the motor parameters of these nerves with that of controls.

The nerve conduction studies included:

1) Motor nerve conduction studies - Determination of distal motor latency (DL), amplitude of the compound muscle action potentials (CMAPs) and motor nerve conduction velocity (MNCV) in median and ulnar nerves proximally at the wrist and distally at

elbow (5cm below /above the medial epicondyle) in both upper limbs.

2) Sensory nerve conduction studies – Determination of sensory latency (SL), duration of the sensory nerve action potentials (SNAPs) and sensory nerve conduction velocities (SNCV) of median and ulnar nerves in both upper limbs ortho-dromically. The median and ulnar nerve were stimulated in the palm (Palm-wrist sensory conduction).The stimulus is 8 cm distal to active electrode on the wrist, with the distance between active and recording electrode about 3-4cm.

The distal motor and sensory latencies, amplitudes and conduction velocities between the median and ulnar nerves were compared to establish the diagnosis of median nerve compression at wrist (conventional conduction studies). The sensory and motor nerve conduction studies of the median nerve segment across the wrist compared to another nerve such as ulnar nerve are the most sensitive and accurate techniques for making a diagnosis of Carpal tunnel syndrome (15). Electromyography was not done because it is a painful method and not absolutely necessary for the CTS diagnosis.

**Ethics:**

The study was approved by our institutional research and ethics committee. The study was done without the usage of any chemical /drug and animals. The cost of the nerve conduction studies will be born by the institute.

**Statistical Analysis:**

The statistical analysis was carried out by using the appropriate tests. The data was expressed as mean ± SD and the p values <0.05 was taken as significant.

**RESULTS:**

**Table 1: Comparison of the neurological involvement and electrophysiological evidence (%age) in pregnant women during three trimesters.**

Number of pregnant Women	First trimester	Second trimester	Third trimester
Without CTS symptoms	4(8.88%)	22(48.88%)	19(42.22%)
With electrophysiological evidence of CTS	0	1(2.22%)	1(2.22%)

**Table 2: Comparison of the anthropometric parameters in pregnant women and controls (Mean±SD)**

	Pregnant women	Controls
<b>Age(yrs)</b>	26.68± 2.34	23.36 ± 1.46
<b>Height(cm)</b>	158.98± 3.12	157.89±4.68
<b>Weight(kg)</b>	63.13±3.67	60.67±5.78
<b>BMI</b>	25.15±1.78	23.41±1.89

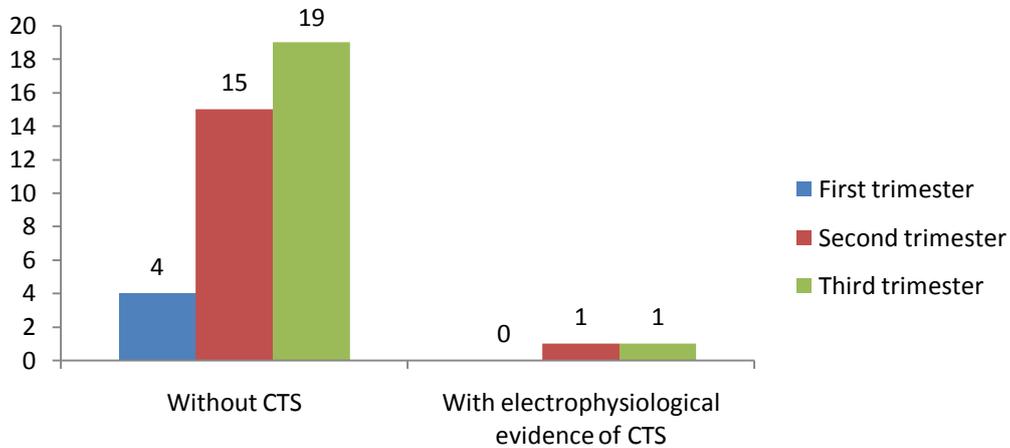
**Table3: Motor Electroneurodiagnostic findings in the upper limbs in pregnant women vs control (Mean±SD).**

UPPER LIMB	Pregnant women (Mean±SD)			Controls (Mean±SD)		
Motor	DL(ms)	MNCV (m/sec)	CMAP(mv)	DL(ms)	MNCV (m/sec)	CMAP(mv)
Median	2.90±0.38	54.40±11.18	9.16±3.40	3.10±0.60	55.47±2.15	12.60±3.10
Ulnar	2.17±0.41	63.14±9.06	8.85±3.25	2.13±0.25	61.69±3.51	5.95±1.56

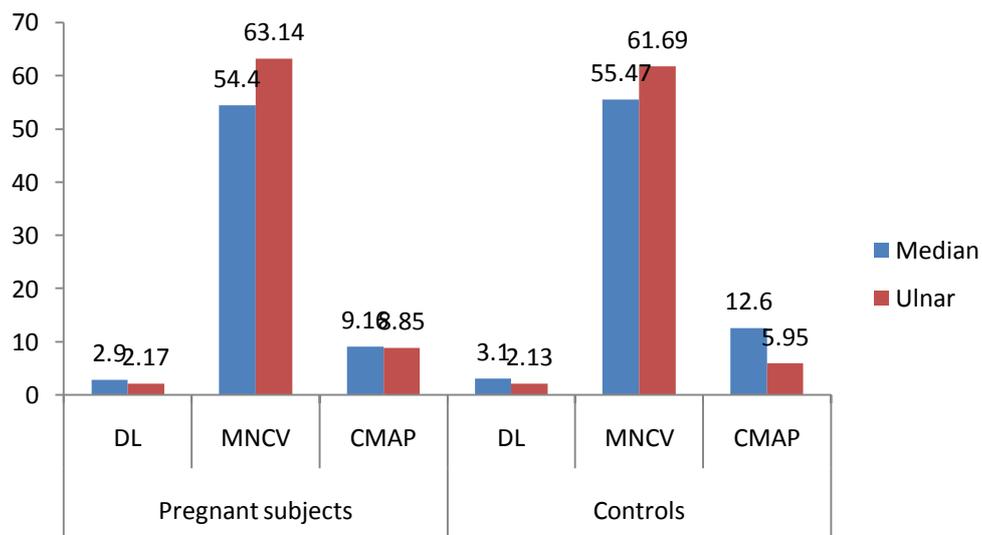
\* = significant (p-value < 0.05); \*\* = highly significant (p-value < 0.001), NS =Non-significant (p-value >0.05)

**Table 4: Sensory Electroneurodiagnostic findings in the upper limbs in pregnant subjects vs controls (Mean±SD)**

UPPER LIMB	Pregnant subjects (Mean±SD)			Controls (Mean±SD)		
Sensory	SL(ms)	SNCV (m/sec)	SNAP(□ v)	SL(ms)	SNCV (m/sec)	SNAP(□ v)
Median	1.43±0.17	55.12±9.80	23.32±10.16	1.45±0.25	51.17±7.82	33.14±8.43
Ulnar	1.31±0.18	58.77±12.91	19.54±9.53	1.25±0.25	56.67±3.24	31.83±10.37



**Fig. 1: Comparison of the neurological involvement and electrophysiological evidence (%age) in pregnant women during three trimesters.**



**Fig 2: Motor Electroneurodiagnostic findings in the upper limbs in pregnant women vs control (Mean±SD).**

## DISCUSSION:

The symptoms of CTS are frequent in pregnancy but not all the cases have definite diagnosis. The prevalence of CTS is reported differently in different studies. The common trimester of involvement is third trimester found in different studies. Median nerve function is impaired most frequently during the third trimester and even in asymptomatic pregnant women [4].

In a study conducted by Bahrami *et al.*; [2], prevalence of CTS was reported 17% in women and it was bilateral in 41 % [15]. In a study conducted by Shaafi *et al.*; [3], ninety pregnant women (50% asymptomatic and 50% with symptoms of CTS) were examined for CTS clinically or electro physiologically and CTS was confirmed in fifteen women (16.6%). In eleven patients (73%), the median nerve was bilaterally involved. Seror studied fifty- two pregnant women with symptoms of carpal tunnel syndrome (CTS) with less duration, clinically as well as electro physiologically. His study revealed a higher incidence of persistent, painful diurnal symptoms. In pregnancy-related CTS (PRCTS). Nerve conduction studies demonstrated median nerve motor and sensory conduction blocks at the wrist in twenty women [12]. Median nerve distal latency was more prolonged in pregnant women compared with non-pregnant controls especially in women with symptoms of CTS than in asymptomatic women [13]. Out of all one hundred pregnant women examined in a study, 42% were asymptomatic and nineteen (19%) had CTS electro neuro diagnostically, with only nine (47.5%) had bilateral involvement. The prevalence in the first, second, and third trimesters were 11%, 26%, and 63%, respectively [14]. Baumann *et al.*; studied sixty-nine pregnant women in the third trimester electro physiologically. Eight (11%) were diagnosed as cases of CTS [15]. There was found significant prolongation of median sensory nerve latencies with reduction in amplitudes of sensory nerve action potential in the pregnant women as compared with the control group.

In our study, the aim was to find out the prevalence of sub-clinical CTS in asymptomatic pregnant women, forty five asymptomatic pregnant women were taken after they fulfilled the inclusion and exclusion criteria. Their mean age at the time of presentation was  $26.68 \pm 2.34$  yrs and weight gain was  $11.8 \pm 5.1$  kg. Equal numbers of age matched non-pregnant women were taken as controls and their mean age was  $23.36 \pm 1.46$  yrs. Most of pregnant women were housewives and according to gravidity distribution, 10(22.3%), 18(40%) and 17(37.73%) had their first, second, and third or more pregnancy, respectively;

On the detailed history, all the pregnant women were asymptomatic at the time of presentation to Obstetrics OPD. None had muscle weakness, marked muscle fatigability, stiffness, cramps and sensory complaints such as pain, parasthesias such as tingling and numbness in the upper limbs. On local neurological examination, there was observed normal muscle strengths in all the muscle groups studied. Their hands were also tested for sensations such as touch, pinprick and/or two-point discrimination. All the pregnant women were found to have normal sensations. Tinel sign and phalen tests were performed in all the subjects and there were found no abnormality in these test results.

Table 1 and fig.1. shows the comparison of the neurological involvement in pregnant women (%age) during three trimesters. It showed the number of pregnant women with electro neuro diagnostic evidence which is similar in second and third trimesters, thus showing no statistical significance.

In table 2 The mean  $\pm$ SD values of anthropometric measurements eg.. Age, height, weight and BMI in pregnant women and control groups were compared and did not show any statistical significance.

In table 3 and table 4, are shown the motor and sensory electro neuro diagnostic findings (Mean $\pm$ SD) of nerves in upper limbs in pregnant women respectively and are compared to controls. According to table 3 and fig.2., in pregnant women the values of the median motor nerve conduction parameters (Mean $\pm$ SD), DL was found to be  $2.90 \pm 0.38$  msec, MNCV was  $54.40 \pm 11.18$  m/sec and CMAPA was  $9.16 \pm 3.40$  mv as compared to median motor nerve conduction values (Mean $\pm$ SD) in non-pregnant women taken as controls, where DL was found to be  $3.10 \pm 0.60$ , msec, MNCV was  $55.47 \pm 2.15$  m/sec and CMAPA was  $12.60 \pm 3.10$  mv. These showed no statistical significance ( $p > 0.05$ ).

In case of the median sensory nerve conduction values (Mean $\pm$ SD) in pregnant women as compared to) nerve conduction values (Mean $\pm$ SD in controls, SL was found to be  $1.43 \pm 0.17$  msec vs  $1.45 \pm 0.25$  msec, SNCV was  $55.12 \pm 9.80$  m/sec vs  $51.17 \pm 7.82$  m/sec and SNAPA was  $23.32 \pm 10.16$   $\mu$ v vs  $33.14 \pm 8.43$   $\mu$ v thus showed no statistical significance ( $p > 0.05$ ).

In our study, two asymptomatic pregnant women were found to have abnormal median nerve electro neuro diagnostic tests only in the dominant (right) hands and they were found to be normal on clinical and local neurological examination. The tests in these women showed prolonged DL at wrist  $> 4.4$  msec with failure of median motor nerve conduction distally at the elbow with decreased amplitude of action

potential(CMAPA). Theirs sensory nerve conduction was also delayed with prolongation of SL and decreased SNAPA values. On comparison with ulnar nerve conduction values, the median motor and sensory nerve conduction values were found to be abnormal. Thus, two out of forty five (4.44%) pregnant women studied were electro physiologically diagnosed as unilateral CTS but this turns out to be statistically non-significant results for our study ( $p>0.05$ ).

In case of ulnar nerve electro neuro diagnostic studies, both motor and sensory nerve conduction values were compared in both the groups. These findings also showed no statistical significant difference ( $p>0.05$ ). Ulnar nerve electro neuro diagnostic studies are done along with as required for exclusion of CTS.

The results of median nerve conduction in our study were statistically insignificant and different from those of other studies done so far in the pregnant women [3, 12, 13, 14, 15]. Also the ulnar motor and sensory conduction studies values showed no statistically significant difference, the results are consistent as found in other studies [12, 13, 15]. The variations in the results could be due to the reason that in our study, preferably only asymptomatic pregnant women were taken for electro neuro diagnostic examination. The pregnant women complaining of neurological symptoms were excluded from the study.

{\*An interesting case of 25-year-old woman with 39 weeks 2 days of pregnancy and multigravida (experiencing her second pregnancy) presented to OPD for routine ante-natal follow up and had neurological symptoms such as pain in right hand only since 29 weeks of gestation. On taking the history, woman had frequent and severe pains in right hand, more pronounced at night tending to disturb the sleep. No history of such complaint was present in first pregnancy. The local neurological examination results were abnormal. The electro neuro diagnostic studies were performed as she presented to physiology department. The median motor as well as sensory nerve conduction in her right hand was abnormal, with DL at wrist was 5.67msec (normal: DL<4.4msec) and MNCV could not be recorded as there was no conduction at elbow. SL at wrist was 2.15 msec with SNCV 37.21m/sec and SNAPA 10.34 mcv. On left side, the results of motor and sensory nerve conduction of both the nerves were normal. Thus, she was diagnosed to be case of unilateral CTS. She delivered after 5 days and experienced symptomatic improvement following her delivery.}

#### CONCLUSIONS:

Median nerve compression leading to a type of neuropathy called 'Carpal tunnel syndrome' occurs frequently in pregnancy even in asymptomatic women.

The prevalence of CTS in our study was observed to be 4.44%, less as compared with other studies as only asymptomatic pregnant women were taken for the study. We conclude by saying that the electro neuro diagnostic studies need to be done in pregnant women even if they are asymptomatic to find out the prevalence and make a definite diagnosis of CTS.

#### RECOMMENDATIONS:

We suggest more extensive research work in the same field in a large population in the future.

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