



Prevalence and Severity of Carpal Tunnel Syndrome in Women

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Abstract

Background: Carpal tunnel syndrome (CTS) is entrapment of median nerve in carpal tunnel of the wrist. The prevalence of CTS related to pregnancy and non-pregnancy is unknown in some countries such as Iran. The main aim of this study was to determine the prevalence of CTS in women of Boyerahmad Township located in South-West part of Iran.

Methods: This cross-sectional descriptive analytic study was done since February 2010 to January 2011 in Obstetrics and Gynecology clinics in 2656 non-pregnant and 1508 pregnant women. The women that had clinical symptoms of CTS performed standard electro diagnostic techniques for rule in or rule out of CTS.

Results: The prevalence of CTS in pregnant and non- pregnant women was 3.4 and 2.3 percent respectively. The prevalence of CTS in all women was 2.7%. Overall, 51 pregnant women had CTS that 59.4% had mild, 18.8 % had moderate and 21.9% had severe CTS. Sixty-one non-pregnant women had CTS that 73.6 % had mild, 20.8 % had moderate and 5.6 % had severe CTS.

Conclusion: Although the prevalence of CTS in Iranian pregnancy is higher than non-pregnancy women conservative treatment is safe and more effective.

Key words: Carpal tunnel syndrome, Prevalence, Severity, Pregnancy, Women, Iran

Introduction

Carpal tunnel syndrome (CTS) is entrapment of median nerve during passing the wrist within carp (1). The median nerve passes, with nine extrinsic digital flexors, through the tunnel bound by the carpal bones and transverse ligament, which is attached to the scaphoid, trapezoid, and hamate. Anatomically the carpal tunnel narrows in cross section at 2.0 to 2.5 cm distal to the entrance (2). An abnormally high intracarpal tunnel pressure also peaks at this level in patients with carpal tunnel syndrome (3).

Carpal tunnel syndrome is the most common entrapment mononeuropathy. Symptoms of carpal tunnel syndrome include paresthesias

(numbness, tingling, and burning) involving the median nerve distribution (first 3 digits and median half of 4th finger) along with a deep aching pain in the hand and wrist (4). These symptoms are intermittent and typically worse at night where the patient is awakened from sleep and relieves the discomfort by vigorously shaking the hand (Flick sign) (5).

Physical examination findings in CTS vary according to the severity. Sensory changes such as hypesthesia involve the first three digits and the radial half of the fourth digit and wasting of the thenar muscles may be seen in severe cases of CTS (2).

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The prevalence of CTS in different populations is not same. The prevalence of this disorder in the general population for a community in the Netherlands is 0.6% for men and 5.8% for women(6).A more recent study has concluded that approximately 2.7% of the population has both clinically and electrophysiologically documented carpal tunnel syndrome(7) .Women are considerably more prone to this disorder in a ratio of 3:1 to about 10:1(4).CTS are bilateral in up to 87% of patients clinically and approximate 50% through neurophysiologic testing (8).Certain conditions, such as diabetes mellitus, amyloidosis, hypothyroidism, and rheumatoid arthritis, can predispose to CTS (6).Obesity and pregnancy are also risk factors for CTS (9).

Various physical maneuvers designed to stress the median nerve in the carpal tunnel (Phalen's test, reverse Phalen's test, etc) may exacerbate symptoms .Additional clinical testing include a Tinel's sign, median nerve compression test and two-point discrimination. Tinel's sign in particular may be abnormal in 45-60% of patients with CTS and in about 30% of patients without CTS (10).

Electrodiagnostic studies are an important electrophysiologic extension of the history and physical in diagnosing CTS with high degree of sensitivity and specificity. Nerve conduction studies and EMG can determine the presence and the severity of median neuropathy at the wrist (4).The needle electromyographic examination is less sensitive than nerve conduction studies in diagnosis of CTS. The sensitivities of electrodiagnostic methods have ranged between 49% and 84% with specificities of 95% or higher (11).Sensory nerve conduction studies as opposed to motor conduction techniques are more likely to reveal an abnormality of median nerve action potential propagation because the sensory fibers are usually affected first and to a greater degree than motor fibers (5).The criteria for electrodiagnostic of CTS are:

1-A difference of greater than 0.5 ms between the median and ulnar nerve sensory latencies in the same hand

2- A difference of greater than 1 msec between the median and ulnar nerve motor latencies in the same hand (12).

Grading severity of CTS includes:

Mild: Prolonged sensory nerve action potential (SNAP), and /or slightly reduced SNAP amplitude

Moderate: Abnormal median SNAP as above, plus prolonged median motor distal latency

Severe: Prolonged median motor and sensory distal latencies, plus either an absent SNAP or low amplitude or absent thenar compound muscle action potential (CMAP). Needle examination often reveals fibrillation, reduced recruitment, and motor unit potential changes (13).

Treatment of CTS is different based on severity of syndrome. Conservative therapy of CTS consists of patient education, wrist splinting, B vitamins, non-steroidal anti-inflammatory medication, steroid injections, and job changes or modification (14). Carpal tunnel decompression also benefits patients with advanced thenar atrophy and sensory deficits (15), and those with underlying peripheral neuropathy (16). The aim of this study was to determine prevalence and severity of CTS by electrodiagnostic studies in pregnant and non-pregnant women.

Materials and Methods

This cross-sectional descriptive-analytic was performed on 1508 pregnant women and 2656 non-pregnant women since February 2010 to January 2011 in Obstetrics and Gynecology clinics of Yasouj City (center of Kohgiluyeh & Boyerahmad Province) in south-west of Iran. All these women were visited by OB&GYN specialists due to different OB&GYN problems. Exclusion criteria in this study were diabetes mellitus, hypothyroidism, amyloidosis, and rheumatoid disease, positive family history of neuropathy, previous wrist fracture, pre-pregnancy CTS and carpal tunnel surgery. The women that had symptoms of CTS examined provocative tests such as Tinel's and Phalen's tests. Those women

that had clinical symptoms of CTS and positive Tinel and /or Phalen test, referred to physiatrist for electrodiagnostic evaluation. Electrodiagnostic studies performed with Medelec machine that manufactured in United Kingdom. The settings of electromyography are as follows:

Pulse duration: 0.2 ms, Stimulus speed: 2ms/division, Sensitivity: 20 μ v/division for sensory, 1 v/division for motor, filter settings were 3 Hz to 10 kHz in motor and 10Hz to 3Khz in sensory study.

In this study, median nerve' motor component was stimulated orthodromically and the sensory component antidromically. For evaluation of motor nerve conduction study of median nerve, stimulating electrode was stimulate at the wrist, 3 centimeter proximal to the distal crease and recording surface electrode over the belly (G1) and tendon (G2) of the abductor pollicis brevis (APB), ground electrode is located in the palm. For evaluation of sensory nerve conduction study of median nerve, recording electrode was done on 3 rd digit with stimulation of sensory median nerve antidromically 14 and 6 cm proximal to G1 electrode. The ground electrode is located in the distal of forearm.

For evaluation of motor and sensory conduction study of ulnar nerve, the stimulation at the wrist, 3 cm proximal to the distal crease, and recording over the belly (G1) and tendon (G2) of the adductor digiti minimi (ADM) for motor conduction (8cm), and around the proximal (G1) and distal (G2) interphalangeal joints of the fifth digit for antidromic sensory conduction (14 cm) and ground electrode is located in the distal of forearm.

Latency (the time from onset of stimulation until wave appearance or peak of wave) also is important and was determine. In evaluation of nerve conduction studies of motor nerve's CMAP, onset latency and in sensory nerve's SNAP, peak of latency were calculated. Peak-to-peak amplitude is calculated in evaluation of nerve conduction studies. The surface temperature of upper limbs was greater than 32 degree centigrade.

With attention to distance between two region of stimulation (proximal and distal), nerve conduction velocity was determined. The ranges of normal values of median and ulnar nerves are as follows:

1. A-Median motor: stimulate median nerve 8 cm proximal to APB; record from APB; distal motor latency is 2.2-4.2, amplitude is 5000-25000 microvolt and NCV of 50-60m/s.

B-Median sensory: G2 on 3 rd digit with stimulation of median 14 cm proximal to G1 recording electrode: 2.9 -3.6 ms, amplitude of 10-1000microvolt and NCV of 48-65 m/s.

2. A-Ulnar motor: stimulate ulnar nerve 8 cm proximal to ADM; record from ADM; distal motor latency is 2.3-4ms.

B- Ulnar sensory: G2 on 5 th digit with stimulation of median 14 cm proximal to G1 recording electrode: 2.6 -4.1 ms.

3. Median distal sensory latency -Ulnar distal sensory latency in same hand <0.5 ms and in opposite hand <0.5 ms.

4. Median distal motor latency-Ulnar distal motor latency in same hand <1 ms, in opposite hand (median nerve) <1 ms and in opposite hand (ulnar nerve) <1 ms (13).

The above-mentioned tests were performed in both hands of 175 women that clinically had symptoms and signs of CTS. Neurophysiological tests grade the CTS into the mild, moderate, and severe categories, according to the American Association of the Electrodiagnostic Medicine (AAEM) criteria (13).

We used Chi-square test for evaluation of difference between levels of variables (significant level was considered 0.05).

Results

About 175 women (4.2 %) clinically had symptoms of CTS that 112 women (2.7%) had confirmed electrophysiologically and 1.5 % of women had not electrodiagnostic criteria of CTS. The most age group of women that clini-

cally had CTS was 25-50 years old (about 76.6 %).

In this study, 51 pregnant women (64 hands) clinically and electrophysiologically had CTS (3.4%), those there were 38(59.4%) mild, 12(18.8%) moderate, and 14 (21.9%) severe CTS.

There were 61 non-pregnant women (72 hands) that clinically and electrophysiologically had CTS (2.3%), those 53 (73.6%) mild, 15(20.8%) moderate and 4(5.6%) severe CTS (Table 1). Regarding the severity of CTS in all women the most common form is mild. Severe CTS in pregnant and non-pregnant women is 21.9 and 5.6 percent respectively. The difference severity of CTS between pregnant and non-pregnant women was significant

(Chi Square=7.918, df=2, $P=0.019$). The prevalence of CTS in women of Boyerahmad Township was 2.7 percent (Table 2).

The most common complaint in women that had clinically CTS were paresthesias (88.8%) and common findings in physical exam were Tinel's sign (58.9%) and Phalen's sign (50.9%). Difference between CTS and trimesters of pregnancy level was insignificant ($P=0.648$).

Most cases of pregnant women that had CTS were in third trimester (about 49%) (Table 3). Difference between the prevalence of CTS and gravity is insignificant ($P=0.641$). There were bilateral CTS in 50 and 45 percent of pregnant and non-pregnant women that had CTS respectively.

Table 1: Relative frequency distribution of CTS in women with regard to Severity and pregnancy status

| Group | Severity | Confirm n (%) |
|--------------------|----------|------------------|
| Pregnant n=51 | Mild | 38 (59.4) |
| | Moderate | 12 (18.8) |
| | Severe | 14 (21.9) |
| Non- pregnant n=61 | Mild | 53 (73.6) |
| | Moderate | 15 (20.8) |
| | Severe | 4 (5.6) |

Table 2: Prevalence of confirmed CTS in women

| Group | Negative n (%) | Positive n (%) | Total n (%) |
|--------------|-------------------|-------------------|----------------|
| Pregnant | 1457(96.6) | 51(3.4) | 1508(100) |
| Non-pregnant | 2595(97.7) | 61(2.3) | 2656(100) |
| Total | 4052(97.3) | 112(2.7) | 4164(100) |

Table 3: Comparison of CTS percent based on trimester of pregnancy women

| Trimes- ter | Frequency | Percent | CTS n (%) |
|----------------|-----------|---------|--------------|
| 1 | 496 | 32.9 | 5(9.8) |
| 2 | 549 | 36.4 | 21(41.2) |
| 3 | 463 | 30.7 | 25(49.0) |
| Total | 1508 | 100.0 | 51 |

Discussion

Many studies have been performed about prevalence of carpal tunnel syndrome in women in different countries such as Iran. But the results vary a lot (from 3% to 62%) and sometimes paradox. The previous studies had difficulties such as low cases, identical socioeconomic classes, no match of age, education level and job, rural or urban.

In the present study, 4164 women of rural and urban were studied at Shahid Mofateh Clinic and OB&GYN clinics in Boyerahmad Township in south-west of Iran. The preference of this study, was adequate cases, match of effective factors on prevalence of carpal tunnel syndrome in pregnant and non-pregnant women and detection of prevalence of CTS.

In a study which was done in 2466 subjects, the prevalence of CTS in general population was 2.7% (7). In a survey on 715 subjects (33% men) aged 25 to 74 years, the prevalence of electrophysiologically confirmed CTS was 5.8% in women and 0.6% in men (6). Prevalence of CTS was reported 17%, which showed 23.5% bilateral involvement and 17.5% had severe CTS (17). In a study which performed in 69 pregnant women in third trimester, 8(11%) pregnant women were electrophysiologically diagnosed as CTS (18).

Results of one study in Australia on 1216 pregnant women showed that 35% of pregnant women had hand symptom, and 20% of them were clinically positive for CTS (7% of pregnant women). But in this study no electrophysiologic studies were used (19).

In the other research study, 2385 pregnant women were studied that 56 women had CTS (prevalence of 2.3%). The most common symptom was pares-

thesia, then nocturnal pain. Tinel and Phalen positive in 46 patients. In this research the electrophysiologic studies were not performed (20). In other study, the prevalence of CTS was 16.6 percent (21). The prevalence of CTS in our study was the same with other studies such as (7) and (20), but different with (17), (19) and (21) studies. In our study, there were many cases that clinically had CTS, but they did not refer for electrodiagnostic study, hence, the true prevalence of CTS in pregnant and non-pregnant women was higher than these estimations.

In our study, there were bilateral CTS in about 48% of women which was the same with another study (8). In this study, the most common trimester of involvement was third trimester which was similar to (22). Entrapment neuropathies (such as CTS) are common in the later stages of pregnancy, presumably as a result of fluid retention (22). In our study, Tinel's sign was positive in 58.9% of confirmed CTS women that is same with Stewart JD study (10). The prevalence of CTS in pregnant women was higher than non-pregnant women. With attention to the high prevalence of CTS in pregnancy, fortunately it is often mild. Severe CTS in pregnancy was more than non-pregnancy. We suggest a worldwide grading severity of CTS rather than AAEM criteria, because of difficulties in practice.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

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References

1. Johnson EW (1997). *Practical EMG*. 3rd ed. Williams&Wilkins, USA, pp.: 195-98.
2. Jun K (2001). *Electrodiagnosis in Diseases of Nerve and Muscle: Principles and Practice*. 3rd ed. Oxford University Press, New York, pp.: 720-24.
3. Luchetti R, Schoenhuber R, Alfarano M, Deluca S, De Cicco G, Landi A (1990). Carpal tunnel syndrome: Correlations between pressure measurement and intraoperative electrophysiological nerve study, *Muscle & Nerve*, 13(2):1164-68.
4. Randall LB, Ralph MB, Leighton C et al. (2007). *Physical Medicine & Rehabilitation*. 3rd ed. Elsevier Saunders, Philadelphia, pp.:1079-80.
5. Daniel D, Anthony AA, Machiel JZ (2002). *Electrodiagnostic Medicine*. 2nd ed. Hanley & Belfus, Philadelphia, pp.: 1058-69.
6. de Krom MC, Knipschild PG, Kester AD et al. (1992). Carpal tunnel syndrome: Prevalence in the general population. *J Clin Epidemiol*, 45:373-76.
7. Atroshi I, Gummesson C, Johnsson R, et al. (1999). Prevalence of carpal tunnel syndrome in a general population. *JAMA*, 282(2): 153-58.
8. Padua L, Pauda R, Nazzaro M, Tonali P (1998). Incidence of bilateral symptoms in carpal tunnel syndrome. *Hand Surg*, 23B, pp: 603-06.
9. Becker J, Nora DB, Gomes I, et al. (2002). An evaluation of gender, obesity, age, and diabetes mellitus as risk factors for carpal tunnel syndrome. *Clin Neurophysiol*, 11(9): 1429-34.
10. Stewart JD, Eisen A (1978). Tinel's sign and the carpal tunnel syndrome. *Br Med J*, 2:1125-26.
11. Jablecki CK, Andary MT, So YT, et al. (1993). Literature review of the usefulness of nerve conduction studies and electromyography for the evaluation of patients with carpal tunnel syndrome. *Muscle & Nerve*, 16:1392-1414.
12. Felsenthal G (1979). Carpal tunnel syndrome diagnosis. *Arch Phys Med Rehabil*, 60:90.
13. Stevens JG (1977). AAEE Minimonograph#26: The electrodiagnosis of carpal tunnel syndrome. *Muscle & Nerve*, 20: 1977-86.
14. Chang MH, Chiang HT, Lee SSJ, Ger LP, Lo YK (1998). Oral drug of choice in carpal tunnel syndrome. *Neurology*, 51:390-93.
15. Nolan WB III, Alkatis D, Glickel SZ, Snow S (1992). Results of treatment of severe carpal tunnel syndrome. *Hand Surg*, 17A:1020-23.
16. Morgenlander JC, Lynch JR, Sanders DB (1997). Surgical treatment of carpal tunnel syndrome in patients with peripheral neuropathy. *Neurology*, 49:1159-63.
17. Bahrani MH, Rayegani SM, Fereidouni M, Bghbani MI (2005). Prevalence and severity of carpal tunnel syndrome during pregnancy. *Electromyogr Clin Neurophysiol*, 45(2):123-5.
18. Baumann F, Karlikaya G, Yuksel G, Citci B, Kose G, Tireli H (2007). The subclinical incidence of CTS in pregnancy :Assessment of median nerve impairment in asymptomatic pregnant women. *Neurol Neurophysiol Neurosci*, August 2. Available from: <http://www.neurojournal.com/article/view/1164/917>
19. Lennon MC (1987). Survey of hand symptoms in pregnancy. *The Medical Journal of Australia*, 147(5):542-48.
20. Ekman Ordbieg G (1987). Carpal tunnel syndrome in pregnancy. *Acta Obstetrica Gynecologica Scandinavica*, 66(31):235-237.
21. Shaafi Sh, Naimian Sh, Iromlou H, Sayyah Melli M (2006). Prevalence and severity of carpal tunnel syndrome during pregnancy based on electrophysiologic studies. *Shiraz E-Medical Journal*, 31:7-14.
22. Fauci AS, Braunwald E, Kasper DL, Hauser SL, Longo DL, Jameson JL, Loscalzo J (2008). *Harrison's Principles of Internal Medicine*. 17th ed. Mc Graw Hill, New York, pp.:47.