# PATTERN OF SEVERITY ON THE BASIS OF ELECRODIAGONOSTIC STUDIES IN PATIENTS WITH CARPAL TUNNEL SYNDROME

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## ABSTRACT

***Objective:*** To study the pattern of severity in patients with Carpal Tunnel Syndrome (CTS) presented at electro-diagnostic clinic at Armed Forces Institute of Rehabilitation Medicine (AFIRM), Rawalpindi.

***Study Design:*** Cross-sectional descriptive study.

***Place and Duration of the Study:*** Electro-diagnostic Department of Armed Forces Institute of Rehabilitation Medicine (AFIRM), Rawalpindi for 6 months from 1st July 2012 to 31st Dec 2012.

***Subjects and Methods:*** One hundred and fifty hands from 96 Patients, both male and female were sampled according to inclusion criteria by non-probability purposive sampling. Nerve conduction studies (both motor and sensory studies) were performed using Xeltec electrodiagnostic machine. In patients with normal standard testing but with positive clinical features comparison testing was performed. Results were interpreted and graded according to severity.

***Results:*** Out of total 150 hands, 38 hands (25.3%) had minimal CTS, 31 (20.7%) had mild, 56 (37.3%) had moderate, while 21 (14%) had severe CTS. Four (2.7%) patients had extensive lesion. Out of all 96 patients 54 (56.25%) had bilateral disease and rest 42 (43.75%) had unilateral disease.

***Conclusion:*** The study showed that the most frequent grade at the time of presentation to electro diagnostic clinic is "moderate" followed by minimal. Since in a large fraction of symptomatic population standard tests were normal, comparison testing is important for early diagnosis.

**Keywords:** Carpal Tunnel Syndrome, Nerve Conduction Studies, Severity

## INTRODUCTION

Carpal Tunnel Syndrome (CTS) is the entrapment of the median nerve within the carpal tunnel. In the carpal tunnel the median nerve lies immediately beneath the Palmaris Longus tendon and anterior to the flexor tendons[1]. Certain conditions, such as diabetes mellitus, amyloidosis, hypothyroidism, and rheumatoid arthritis, can predispose to CTS. Obesity and pregnancy are also risk factors for CTS[2]. In Europe, in 1998, over 60% of upper limb musculoskeletal disorders recognized as work-related were CTS cases[3].

CTS is the most frequent entrapment neuropathy causing numbness, tingling, discomfort, pain and weakness in hands ranging from mild to debilitating extent, especially for those whose work or recreational activities require extensive use of hands. In a study, done in Sweden to know prevalence of the disease it is believed to be present in 3.8% of the general population[4]. The prevalence of CTS in different populations is not same. Its prevalence in the United Kingdome (UK) alone is 7-16%[5], while it is 5% in the United States (US)[6]. Diabetic patients have a prevalence rate of 14% and 30% without and with diabetic neuropathy[7], respectively, whilst the prevalence during pregnancy has been reported to be around 2%[8]. Its occurrence is commonly bilateral with a peak age range of 40 to 60 years; although it occurs in all age groups[9]. Women are considerably more prone to this disorder in a ratio of 3:1 to about 10:1[10]. CTS are bilateral in up to 87% of patients clinically and approximate 50% through neurophysiologic testing[11].

In Pakistan it was found that CTS is frequently (50.23%) bilateral and is more common

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*Received: 08 Feb 2013; Accepted: 05 Jun 2013*

in females. Female : male ratio was 4.8:1. Right hand is affected more (185 out of 320 hands)[12].

Electro diagnostic studies are an important electrophysiological extension of the history and physical examination in diagnosing CTS. Nerve conduction studies (NCS) are considered to be the gold standard in the diagnosis of CTS because it is an objective test that provides information on the physiological health of the median nerve across the carpal tunnel[9]. The test can determine the presence and the severity of median neuropathy at the wrist[13]. The needle electromyographic examination is less sensitive than NCS in diagnosis of CTS[11]. The sensitivities of electro diagnostic methods have ranged between 49% and 84% with specificities of 95% or higher[14]. Sensory NCS 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[11]. Prolonged motor and sensory latencies of the median nerve, and reduced sensory and motor conduction velocities are accepted as diagnostic criteria for CTS. Even so, some authors have recently reported that optimal diagnostic criteria still remain uncertain. When there is doubt, comparative testing (difference in peak sensory latencies of median and ulnar nerve in digit 4 study) should be done to rule out CTS[13].

Electro diagnostic grading of CTS is as follows[15,16].

Grade 1. Very mild CTS - normal standard tests, abnormal comparative tests.

Grade 2. Mild CTS - abnormal sensory with a normal motor response.

Grade 3. Moderate CTS - abnormal median sensory and motor response.

Grade 4. Severe CTS -absence of sensory response, abnormal distal motor latency.

Grade 5. Extensive CTS - absence of median motor and sensory responses.

Since condition is progressive and may lead to devastating effects on hand function, early diagnosis is important as it leads to better management of disease, just by conservative methods. Comparison testing is helpful for diagnosis of CTS at an early stage which may provide an opportunity to offer early ergonomic modifications and other non surgical interventions to reverse symptoms and to reduce repeated strains. The aim of this study is to determine pattern of severity of disease in a cohort of CTS patients presented at AFIRM.

## MATERIAL AND METHODS

The study was carried out at the Electro-diagnostic department of (AFIRM), Rawalpindi from 1st July 2012 to 31st Dec 2012 (6 months). Total 150 hands from 96 patients from both genders age > 20 years were recruited by non-probability purposive sampling. Patients with traumatic median nerve injury, poly-neuropathy, history of malignancy, pregnancy and those who have been previously operated for CTS were excluded.

It was a cross sectional study. Approval from hospital ethical committee was taken. Patients were enrolled as per inclusion criteria. Verbal informed consent was taken after explaining the purpose of study and use of data for research and publication. NCS (motor and sensory studies) was performed using Xeltec electro-diagnostic machine. In patients with normal standard testing, but with clinical features suggestive of CTS, comparaison testing was done. For that purpose we used difference in sensory peak latencies of median and ulnar nerve recorded at fourth digit.

Data was analyzed using SPSS 15. Frequencies and descriptive statistics were calculated for various variables. Descriptive statistics were used to calculate mean and SD for age. Frequency was calculated for gender, severity, common side involved and unilateral or bilateral disease. The data is presented as tables and figures.

## RESULTS

Our study included 150 hands of 96 patients, 110 (73.3%) from females and 40 (26.7%) from

males. Out of 96 patients, 70 (72.91%) were females and 26 (27.08%) were males. The average age in all patients was 47.33 ± 11.8 years (range: 25 to 80 years). Female: male ratio was 2.75 : 1. Bilateral disease was slightly more frequent in females that is 57.1% (n=40) as compared to 53.8% (n=14). While 42.8% (n=30) females had unilateral disease compared to 46.1% (n=12) males. Right hand was more frequently involved (n=91) compared to left (n=59) with ratio of 1.54:1. Among female 67 (60.9%) were right and 43 (39.1%) were left. While out of 40 hands from males 24 (60%) were right and 16 (40%) were left.

We divided severity in five grades as mentioned earlier. Percentages and number of hands placed in different grades of severity are shown in fig-1, while figure-2 showed same variables gender wise. Moderate CTS was the most frequent one (37.3%) followed by minimal (25.3%). Among males minimal variety is less frequent than milder one. There was a difference in frequency of minimal CTS among females compared to males (29% in females compared to 15% in males). However, moderate variety was more frequent in males (52.5% in males compared to 31.8% in females).

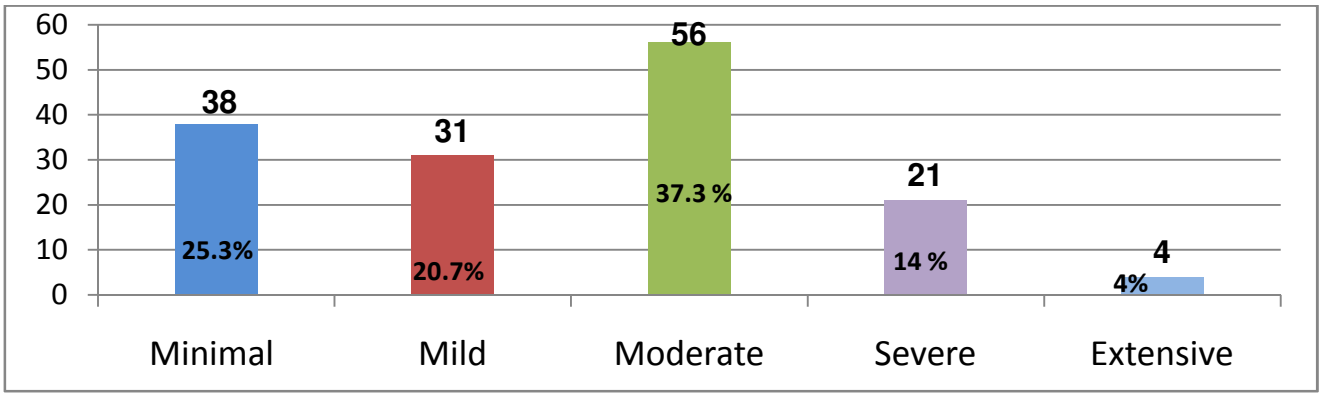


**Figure -1: Frequency of different grades of severity of carpal tunnel syndrome (CTS) in a mixed sample of female and male population.**

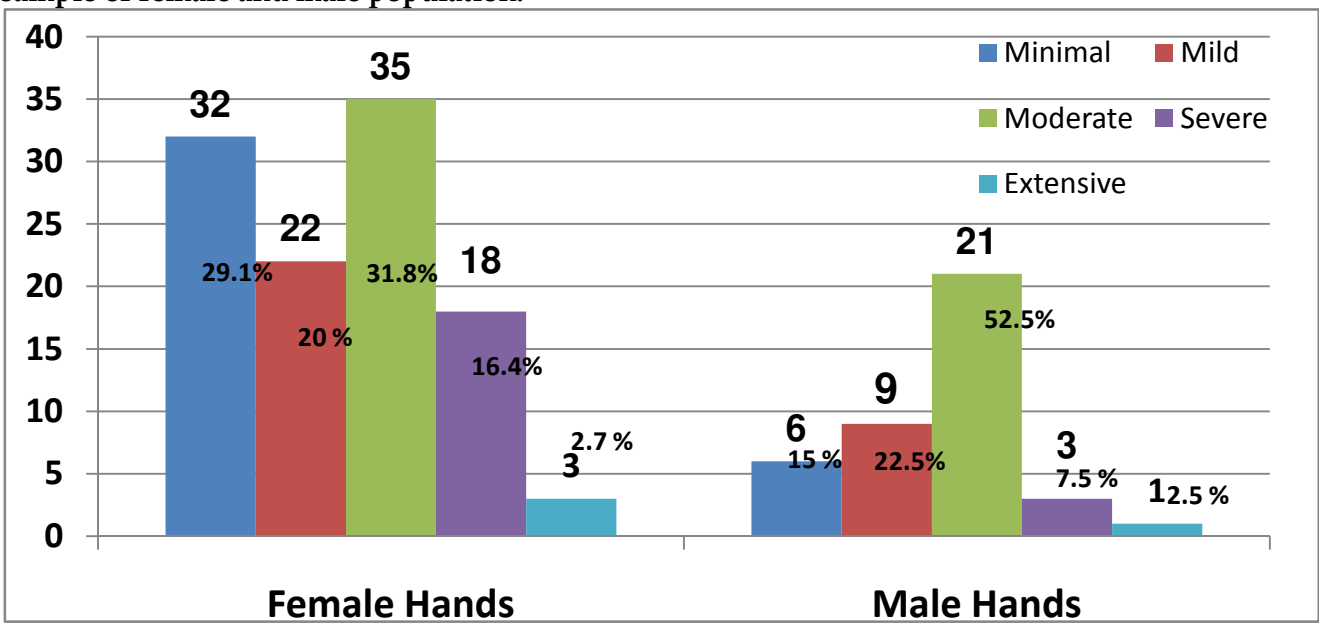


**Figure-2: Frequency of different grades of severity of carpal tunnel syndrome (CTS) in female and male hands.**

## DISCUSSION

There is very limited work done in Pakistan for measuring the frequency of this common health problem[11]. Although milder forms of disease may cause slight discomfort but advanced disease may have devastating effects on work and life. It can badly affect dexterity and grip[6]. The treatment of this disease depends upon the grade of severity, intensity of symptoms and its effect on one's day to day life. This study focuses on pattern of severity of CTS which was graded on the basis of electro-diagnostic studies. We also observed our findings separately in both genders. Treatment of CTS is different based on severity of syndrome. Conservative therapy of CTS consists of patient education, wrist splinting, vitamins, non-steroidal anti-inflammatory medication, steroid injections, and job changes or modification. Carpal tunnel decompression benefits patients with advanced thenar atrophy, and those with severe and extensive lesions[17].

Saeed et al[12] found that the disease is more common in females and dominant side is more involved. The same findings are confirmed in our study also. However frequency of bilateral lesion is more in our study that is 56.25% compared to 50.23%. Ninty one (60.6%) out of 150 hands were right compared to 185 (57.8%) out of 320 hands. Female to male ratio is 4.8 : 1 as compared to 2.75 : 1 in our study. This low female to male ratio in our study is different from previous study which may be due to the fact that less number of female patients reported to our electro diagnostic department as compared to the males, as the centre is a military hospital. However our result is comparatively nearer to 1:3 given by Randall et al[10]. As these results are based on single centre study, further multi-centered studies in this regard are suggested to find out actual prevalence and female to male ratio.

Yazdanpanah P et al[18] in their study conducted on both pregnant and non-pregnant females found that out of sixty-one non-pregnant women who had CTS, 73.6% had mild, 20.8% had moderate and 5.6% had severe CTS. When we compare it with results in our female population out of 110 female hands, 35 (31.8%) had moderate, 32 (29.1%) had minimal, 22 (20%) had mild and 18 (16.4%) had severe disease, while 3 patients (2.7%) were with extensive CTS as classified electro-physiologically. The high frequency of moderate and severe grade CTS might be due to the fact that we recruited our patients who were referred to out electro-diagnostic department for their symptoms, while in Iranian study the study sample was from general population. Moreover, in Iranian study, three grades of CTS were used as compared to five in our study. If we count both mild and minimal grades as one about 49.09% female hands had this type of disease and this grade would be the most frequent one similar to Iranian study.

Ali KM[19] et al performed a study on computer workers. Out of the 648 computer professionals, 85 had CTS (clinical diagnosis) with a prevalence of 13.1% (95% CI, 10.5–15.7%). The prevalence among males was 14.5% and among females was 6.8%. However they made diagnosis by clinical examination and not on electrophysiological findings.

We used the grading of severity modified from Pauda et al[16] following American Association of Electro-diagnostic Medicine (AAEM). They found that using this neurophysiologic classification, the CTS groups appeared distributed in extensive 3% of cases, severe 14%, moderate 36%, mild 24%, minimal 21%, and negative 3%. While our study showed this distribution as 2.7% extensive 2.7%, severe 14%, moderate 37.3%, mild 20.7% and minimal 25.3%.

Our study also has some limitations. It is a single centered study done in patients with confirmed electrophysiological findings of CTS. Multicentre based studies in general population are required to know about the prevalence of disease and health cost burden in Pakistan.

## CONCLUSION

The study showed that the most frequent grade at the time of presentation to electro

diagnostic clinic is "moderate" followed by minimal. Since in a large fraction of symptomatic population, especially in females standard tests were normal, the study highlights importance of comparison testing for early diagnosis which may in turn help to halt progression of disease by offering early non surgical interventions.

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