ORIGINAL ARTICLE

Seasonal Variation and Demographical Characteristics of Carpal Tunnel Syndrome in a Pakistani Population

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ABSTRACT

Objective: To determine the demographic characteristics of gender, age, involvement of hand/hands and seasonal distribution in patients with a neurophysiological diagnosis of carpal tunnel syndrome (CTS).

Study Design: An observational study.

Place and Duration of Study: Department of Neurology, Fauji Foundation Hospital, Rawalpindi and PIMS, Islamabad, during December 2006 to July 2009.

Methodology: Cases reported in the months of December and January (winter group) and those reported in the months of June and July (summer group), of any age and gender with electrophysiological confirmation of CTS were included. Those having median neuropathy in the region of elbow, brachial plexopathy and cervical radiculopathy (C6-7) or polyneuropathy were excluded. Nerve conduction study was done in Median nerve. Statistical significance between the two groups (summer and winter) was calculated.

Results: Among the 213 patients (320 hands) of CTS, 70 (105 hands) were in summer group and 143 (215 hands) were in winter group. There were 15 (21.43%) males and 55 (78.57%) females in summer group and 22 (15.38%) males and 121 (84.62%) females in winter group. The female hands were 83 (79.05%) and 182 (84.65%) and male hands were 22 (20.95%) and 33 (15.35%), respectively in summer and winter group. Mean age was 44.38 years and 45.16 years. The right hand was affected in 64 (60.95%) and 121 (56.28%); and the left hand was affected in 41 (39.05%) and 94 (43.72%) in summer and winter groups respectively. Half of the patients had bilateral involvement. The p-values for the NCS variables were not statistically significant.

Conclusion: Presentation with CTS was more common in winter at the study centre. Female gender and dominant hand was affected more frequently. There were no significant changes in NCS parameters among the two groups.

Key words: *Median nerve. Carpal tunnel syndrome. Nerve conduction study. Female. Dominant hand.*

INTRODUCTION

The term "carpal tunnel syndrome" was first used in 1939, although the condition was first noted in medical literature in the early 20th century. The median nerve (MN) enters the hand through the carpal tunnel, the floor and walls of which are formed by the carpal bones and the roof by the thick transverse carpal ligaments (flexor retinaculum).[1] Along with the median nerve the finger flexor tendons pass through the carpal tunnel surrounded by a complex synovial sheath.[2]

Compression of the nerve at the wrist carpal tunnel syndrome (CTS) is the most common disorder affecting the MN and it is the most frequent nerve entrapment syndrome.[3] CTS carry 10% life time risk and an overall prevalence of 2-3%.[4] CTS is frequently bilateral and the dominant hand is usually more often and more severely affected, especially in idiopathic cases.[5]

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CTS is characterized by bouts of paresthesias and pain in the wrist, hand and MN innervated fingers (thumb, index finger, middle finger and half of the ring finger). Often the pain radiated up the arm.[6,7] Symptoms are often nocturnal; on wakening the patient usually gets relief by shaking or rubbing the hands.[1,6,7] As the condition progresses, symptoms occur more frequently and also during the day. In severe cases, patient develops persistent numbness of lateral three and one half fingers and weakness and atrophy of thenar eminence.[1,8]

Other physical signs suggestive of the diagnosis include Tinel's sign (hand paresthesias from gentle percussion over the MN at the wrist) and Phalen's test (hand paresthesias after holding the wrist flexed for 30-60 seconds).[9-12] However, electro diagnostic testing (EDS) is most useful for confirming the diagnosis.[11] The most common neurophysiological abnormalities found in CTS are the increase of MN distal motor and sensory latencies and sensory conduction velocities.[1,5,13]

Marked increase in the number of patients being referred for EDS was observed in winter as compared to summer season. It is not known yet whether the increase in symptomatic CTS is because of changes in the nerve conduction parameters or it is the

environmental effect and/or other mechanism that decreases the threshold of pain. There were studies that showed aggravation of certain medical conditions like arthritis and Reynaud phenomenon (RP) in winter season; and CTS and RP can coexist.[14] This study was conducted to describe the demographic characteristics of gender, age, involvement of hand/hands and seasonal distribution in patients with a neurophysiological diagnosis of carpal tunnel syndrome in the local population.

METHODOLOGY

This observational study was conducted on patients with clinical and electrophysiological diagnosis of CTS presenting at the Outpatient Department of Neurology, Fauji Foundation Hospital (FFH), Rawalpindi and Pakistan Institute of Medical Sciences (PIMS), Islamabad, from December 2006 to July 2009.

Patients of any age and gender with clinical suspicion of CTS, referred for EDS were further evaluated through detailed history and clinical examination. CTS was confirmed by electrophysiological studies by demonstrating focal slowing or conduction block of median nerve (MN) fibers across carpal tunnel. The diagnosis of CTS was established following a pre-established protocol, with defined diagnostic criteria. Computer record was collected for all the cases with confirmed CTS reported to the study centres in the months of December and January (winter group) and in the months of June and July (summer group).

Patients found to have median neuropathy in the region of elbow, brachial plexopathy, and cervical radiculopathy (C6-7) or having polyneuropathy were excluded from the study. In addition all those patients with confirmed CTS who reported in the rest of the 8 months other than those mentioned above were also excluded from the study.

The diagnosis of CTS was confirmed by EDS, demonstrating prolongation of median distal motor and sensory latencies.[5] The median motor NCS was done by recording compound muscle action potential (CMAP) at Abductor Pollicis Brevis and stimulating the nerve at wrist and elbow. Distal Motor Latency (DML) i.e., recording latent period from wrist to onset of CMAP, amplitude and conduction velocity in the forearm were calculated.

As for Median sensory NCS comparison of wrist to palm Versus Palm to Digit-2 sensory Latencies technique was utilized to confirm CTS.[5] This technique compares the sensory conduction velocity along the MN at two segments of identical distance: the wrist to palm segment and the palm to the second digit segment. The MN is stimulated at the wrist at the fixed distance and at the palm at half that distance, recording the MN SNAP with ring electrodes over the second digit. The wrist to palm latency is computed by subtracting the palm to the second digit latency from the wrist to digit latency and then is compared with the palm to the second digit latency. In CTS there is relative slowing of the wrist to palm segment.

Only those patients were included in the study whose motor NCS in MN showed prolonged DML (> 4.2 m/sec) and sensory velocity at wrist was < 48 m/sec. Ulnar motor and sensory studies were done to exclude involvement of multiple nerves (polyneuropathy). In order to study the seasonal variation cases were collected during the months of December and January (winter group) and those reported in the months of June and July (summer group). These are the coldest and hottest months of Pakistan respectively.

Statistical package for social sciences (SPSS) version 10.0 was used to analyze the data in terms of inferential statistics. Independent sample t-test was used to determine the statistical significance between the two groups (summer and winter), regarding motor NCS DML, motor NCS velocities, sensory latencies and sensory velocities. A 'p-value' of 0.05 was considered statistically significant.

RESULTS

A total of 277 cases were reviewed out of which 213 were included in the study who matched the inclusion criteria. The total numbers of hands included in the study were 320. There were two groups in the study (Table I). In the summer group, total number of patients was 70 and the total number of hands was 105, in winter group; total number of patients was 143 and the total number of hands was 215.

Table I: Demographic comparison of summer and winter groups.

	Summer group	Winter group	Total
Number of patients	70	143	213
Number of hands included	105	215	320
Patients with hands involvement			
Unilateral	35	71	106
Bilateral	35	72	107
Gender			
Male (%)	15 (21.43)	22 (15.38)	37 (17.37)
Female (%)	55 (78.57)	121 (84.62)	176 (82.63)
Involvement of hands			
Male (%)	22 (20.95)	33 (15.35)	55 (17.19)
Female (%)	83 (79.05)	182 (84.65)	265 (82.81)
Side of hand involvement			
Right (%)	64 (60.95)	121 (56.28)	185 (57.81)
Left (%)	41 (39.05)	94 (43.72)	135 (42.19)
Age (years)			
Mean	44.38	45.16	44.90
Range	20-78	21-74	20-78

There were 15 (21.43%) males and 55 (78.57%) females in summer group and 22 (15.38%) males and 121 (84.62%) females in winter group. The female hands were 83 (79.05%) and 182 (84.65%) and the male hands were 22 (20.95%) and 33 (15.35%), respectively in the summer and winter group. Mean age

in summer group was 44.38 years (ranging from 20 to 78) and in winter group was 45.16 years (ranging from 21 to 74). Half of the patients had bilateral involvement in summer group 72 (50.35%) in the winter group patients. Right hand was affected in 64 (60.95%) and 121 (56.28%) and left hand was affected in 41 (39.05%) and 94 (43.72%)of the summer and winter groups respectively.

In the summer group DML ranged from 4.22 to 11.17 m/sec (mean 5.94) and SL ranged from 3.34 to 8.8 m/sec (mean 4.82). In the winter group, DML ranged from 4.22 to 12.89 m/sec (mean 5.89) and SL ranged from 3.28 to 9.72 m/sec (mean 5.03). There was no motor response in 4 and 3 hands; and no sensory response in 20 and 26 hands, in the two groups respectively.

The velocities of nerve conduction in both groups are shown in Figure 1. In the summer group the motor velocity ranged from 27.59 to 66.16 m/s (mean 53.24) and sensory velocity ranged from 8.29 to 41.24 m/s (mean 26.2). In the winter group the motor velocity ranged from 32.34 to 68.45 m/s (mean 54.48) and sensory velocity ranged from 11.31 to 40.7 m/s (mean 26.68). As shown in Table II the comparison of mean value of motor NCS DL in two groups showed p-value of 0.789 (95%, CI 0.35-0.45), motor NCS velocities in two groups showed p-value of 0.092 (95%, CI 2.74-0.25), sensory NCS DL in two groups showed p-value of 0.119 (95%, CI 0.46-5.36) and motor NCS velocities in two groups showed p-value of 0.587 (95%, CI was 2.23-1.29). The p-values calculated between the NCS variables in both groups were not statistically significant meaning that EDS parameter were similar in winter and summer groups.

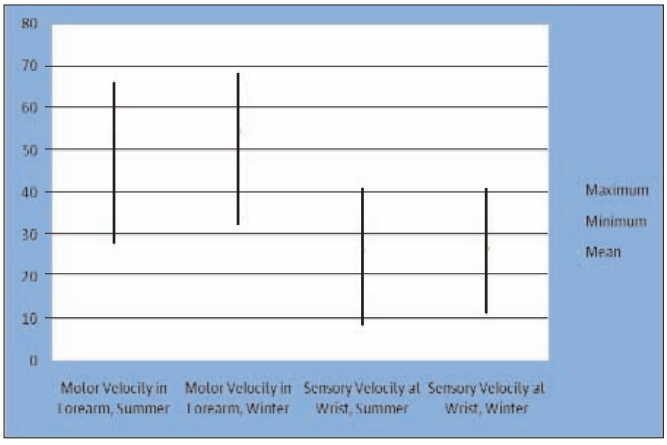

Figure 1: Nerve conduction studies - conduction velocities (CV) in m/sec.

Table II: Statistical comparison of summer and winter groups.

Group	Total patients	Mean	Standard deviation	p-value	Significance
Motor NCS (DML)					
Summer	101	5.94	1.75		
Winter	212	5.89	1.54	0.789	NS
Motor NCS velocity					
Summer	101	53.24	6.46		
Winter	212	54.48	5.90	0.092	NS
Sensory NCS latency					
Summer	85	4.82	1.00		
Winter	189	5.03	1.01	0.119	NS
Sensory NCS velocity at wrist					
Summer	85	26.20	6.95		
Winter	189	26.68	6.52	0.587	NS

NCS= nerve conduction studies; DML= distal motor latency; NS= not significant.

DISCUSSION

Carpal tunnel syndrome is an extremely common disorder caused by compression of the median nerve at the wrist within the unyielding space known as carpal tunnel.[15,16] It is one of the most frequent reasons for referral to ED laboratory. CTS is more common in women.[17] In this study also, the greatest frequency of CTS was observed in women (3.6:1 in summer and 5.5:1 in winter season) and overall ratio of female to male was 4.8:1 while it was 5.6:1 in the study reported by Gomes *et al.* which was conducted in Brazil.[17] Women on average have smaller carpal tunnels as compared to men; the difference explains in part the increased incidence of CTS.[2]

The mean age in this study was 44.78 and 45.16 years in summer and winter groups respectively, which is in accordance with the fact that CTS usually occurs in 40-60 years age group.[1]

Although CTS is usually bilateral both clinically and electrically, the dominant hand is usually involved first, often followed by the other hand.[1,5] In this study right hand is affected more (185 out of 320 hands) and overall 50.23% of patients had bilateral involvement both electrically as well as symptomatically.

There were significant (143 vs. 70) increase in the number of patients with CTS in winter as compared to summer group at this centre. This demonstrated a significant association with winter months.[8,15] However, no significant difference (p-value > 0.05) was found between the ED parameters in nerve conduction studies. Motor and sensory NCS were comparable in the two groups both in distal latencies as well as conduction velocities.

Considering the above mentioned insignificant changes in ED parameters in the two groups, the increase in symptomatic CTS in winter season can be attributed to environmental factors that adversely affect in this regard. Exposure to cold environment is a well known aggravating factor for arthritis and incidence of Raynaud's phenomenon (RP) also increases in winters. The CTS and RP can co-exist as reported in a Korean study by Chung *et al.*[14]

Further it could be the effect of overuse of hands in our population. The reason in female community could be the traditional hand knitting and cooking food items such

as *punjeere*, and various home-cooked winter foods that require hours of holding and stirring the *doi* (spoon with along handle) resulting in stress and strain to MN in an already compromised carpal tunnel, thus adding to the insult. In addition increased sweating in summer and a state of relative dehydration might be the reason for fewer symptoms even in prone CTS patients.

As this data is from one centre only, it will be of much interest to perform multicentre studies for further confirmation of seasonal variations in CTS, both in terms of symptomatic as well as in ED parameters. If the same increase in symptomatic CTS in winter season is proved then further studies to identify the causes and measures to control them would be of much help to the patients in order to decrease the agony of pain associated with routine activity.

CONCLUSION

Carpal tunnel syndrome was more common in winters as compared to summer season at the study centre. Females and the dominant hands were affected more frequently; however, 50% of the patients showed bilateral hand involvement. The EDS parameters did not show any significant changes in nerve conduction parameters among the summer and winter groups. So the increase in symptomatic CTS in winter season is likely to be influenced by environmental factors and cultural practices.

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