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Research Article: Carpal tunnel syndrome at Jordan University Hospital

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ABSTRACT

Objective: To assess the age and sex distribution, risk factors, clinical, nerve conduction study findings and treatment of patients with carpal tunnel syndrome (CTS) seen at Jordan University Hospital (JUH) and compare the results with Western and Middle/Far Eastern studies.

Methods: This is a retrospective study of 150 patients with CTS seen at Jordan University Hospital (JUH) over a one-year-period (January 2019-January 2020).

Results: The mean age of the patients = 52 years (range 16-86), 121 females, 29 males. The most common predisposing factors were stressful manual work followed by diabetes mellitus and hypothyroidism. The most frequent symptoms were nocturnal hand paresthesiae.The respective sensitivities of Tinel and Phalen signs were 30 and 33%. The diagnostic yield of nerve conduction studies (NCS) ranged between 19 and 56% and the most sensitive NCS technique was the median palm-to-wrist (PW) technique with a yield of 56%. Fifty-two percent of the hands with electrophysiological CTS were moderate and severe. One hundred and thirty six patients received conservative treatment and 14 underwent surgical decompression.

Conclusion: Compared to other studies, there was a high proportion of young patients with, however, similar clinical symptoms and risk factors. The majority of the patients had moderate and severe CTS despite the absence of heavy manual industrial labour in Jordan.

1. Introduction:

Carpal tunnel syndrome (CTS) is due to an entrapment of the median nerve at the wrist [1]. It is the most common compression neuropathy [2-4] and the most common reason for referral to the EMG laboratory. CTS accounts for 90% of all entrapment neuropathies [1]. Its prevalence in the United States is estimated at 50 per 1000, with a cost of 30000 US Dollars per affected individual [5]. The incidence and prevalence varies between 0.125%-1% and 5-16% depending upon the criteria used for the diagnosis [6]. In a large Swedish general population study (aged 25-74 years), the overall prevalence was 2.1% among men and 3% among women [7]. Another study found a prevalence of 5% in the general population [8], but it is still unknown in the Middle East. It is a condition of middle-aged individuals and affects females more than males with a peak incidence of 55-60 years [5,6]. Only a few studies have been done in the Arab countries [9-12]. As CTS is a work-related disease and due to the lack of heavy industries in the Middle East compared with the West, therefore the present study is done with the purpose of assessing : (1) age and sex distribution; (2) predisposing factors; (3) clinical manifestations; (4) nerve conduction studies and (5) treatment.

The case notes of 150 patients with CTS seen at Jordan University Hospital (JUH) over a one-year-period were reviewed and results are compared with those in the Western and Middle/Far Eastern literatures.

2. Methods

The case notes of 150 consecutive patients with CTS (age range 16-86 years, mean=52 years; 121 females, 29 males) seen at JUH over a one-year- period (January 2019-January 2020) were studied retrospectively. JUH is a 600-bed tertiary care referral center serving a significant proportion of the middle class

Jordanian population. These were cases of CTS referred to the neurophysiology department at JUH by neurologists, neurosurgeons, rheumatologists or orthopedic surgeons between January 2019 and January 2020.

Nerve conduction studies (NCS) confirmed the presence of CTS in all the referred cases. All the patients had clinical symptoms indicative of CTS and many were examined for Tinel and Phalen signs as well as for hand weakness, atrophy or sensory loss. Risk factors were looked for and laboratory tests including serum B12, fasting blood sugar, Hb A1C, glucose tolerance test, thyroid function tests and rheumatoid factor were done when clinically indicated. For NCS, a Nihon Kohden machine was used at a room temperature of 25 degrees Celsius. The normal values of the median and ulnar distal motor latencies were established in our laboratory in 30 healthy controls. However, more recent highly sensitive and specific studies were introduced and their normal values were taken from Preston [13].

1. Motor study: median and ulnar studies at wrist and elbow. Prolonged distal motor latency (DML), from wrist to abductor pollicis brevis at a distance of 8 cm, if above 4.2 ms and prolonged ulnar DML from wrist to abductor digiti minimi at a distance of 8 cm, if above 3.2 ms.

2. Sensory studies: (a) Palm-to-wrist (PW) technique at a distance of 8 cm. Abnormal onset latency if above 1.8 cm and abnormal peak latency if above 2.4 ms; (b) Comparison median/ ulnar palm-to-wrist latency (CPW) at the same distance of 8 cm: abnormal if above 0.4 ms.

The procedure started with a sensory study (PW / CPW techniques) and a motor study. If both sensory studies were abnormal, with or without prolongation of median DML, the diagnosis of electrophysiological CTS was confirmed. NCS was done in both hands for all the patients.

The severity of electrophysiological CTS was categorized following the AAEM electrodiagnostic guidelines which led to the classification developed by Padua [14,15]: (1) Extreme CTS: absence of thenar responses; (2) Severe CTS: absence of sensory response and abnormal DML; (3) Moderate CTS: abnormal PW/CPW conduction and abnormal DML; (4) Mild : abnormal PW/CPW conduction and normal DML and (5) Minimal CTS: abnormal CPW technique with normal PW technique and DML. Treatment was either conservative i.e. wrist brace and correction of risk factors (diabetes mellitus, hypothyroidism and rheumatoid arthritis) or surgical decompression (endoscopic or open release).

3. Results

The age and sex distribution is shown in table 1. The mean age of the patient was 52 years. There was a predominance of females (F/M ratio=4.17/1). Eighty percent (120 out of 150) of our patients were in the age range 31-60 years, with a majority of females (101 females and 19 males), 17.3% (26 out of 150) of the patients were older than 60 years while only 2.6% (4 out of 150) were younger than 30 years. Ninety-five out of 150 of our patients (63%) were females above the age of 41 years.

The risk factors are shown in table 2 which demonstrates that the most common factor was idiopathic, mostly due to stressful manual work (71%) followed by diabetes mellitus / prediabetes and hypothyroidism.

The nerve conduction study (NCS) findings are shown in table 3. Among 150 patients, 118 (79%) had bilateral electrophysiological CTS and 32 (21%) unilateral electrophysiological CTS (24 in the right dominant hand and 8 in left hand). Among the 32 patients with unilateral electrophysiological CTS, 7 had minimal, 13 mild, 10 moderate and 2 severe CTS.

Among 118 patients (236 hands) with bilateral electro physiological CTS, 22 had minimal, 71 mild, 123 moderate and 20 severe electrophysiological CTS (118 hands had right CTS and the other 118 hands had left CTS). Thus in total , among 150 patients, 29 had minimal electrophysiological CTS, 84 mild, 133 moderate and 22 severe electrophysiological CTS.

The most frequent clinical manifestation were nocturnal hand numbness and paresthesiae in 99 out of 150 patients (66%), bilaterally in 45 patients and unilaterally in 54 patients (38 in the right dominant hand and 16 in the left hand). Tinel and Phalen signs were checked in 66 and 51 patients respectively and they were positive in 20 and 17 patients (30% and 33% respectively). Eighteen patients had associated neck pain, among whom four had neck pain referred to the upper limbs. MRI cervical spine in these patients showed disc bulges at one or multiple levels, between C4 and C7. However, needle EMG in the upper limbs was normal in these patients.

Carpal tunnel release was done in 14 patients while treatment in the remaining 136 patients was conservative.

4. Discussion

Several points emerge from this retrospective study of 150 patients with CTS observed at JUH over a one-year-period.

Concerning age, the mean age of our patients (52 years) is close to that in other Western studies [14,16] where the respective mean ages were 47.5 and 55 years, as well as to other Middle Eastern studies [9,10,12] where the respective mean ages were 52, 41 and 45 years. Lam [17] found more patients above the age of 55 years than occur in the general population.This is in disagreement with our study where 97 out of 150 (64%) of our patients were less than 55 years old.

Table 1 shows that the majority of our patients with CTS were middle-aged females (120 patients in the age-range of 31-60 years), with 95 patients (63%) being female above the age of 41 years. This is in full agreement with other reports [5, 6,18]. Wipperman [19] noted that women are 3 times more likely to have CTS and the prevalence and severity increase with age. According to Aroori [1], CTS affects 4-5% of the population, especially between the ages of 40-60 years and the prevalence rates are higher among females (9.2%) than among males (6%) between the ages of 45-60 years.

The marked predominance of females in our study (F/M ratio=4.17/1) is in accordance with all reports from the Western literature [15, 16, 18- 22]. In a recent surveillance study from Canterbury and Huddersfield, UK, Bland [23] reported an annual incidence of 139.4 cases per 100000 in females and 67.2 cases per 100000 in males with a female to male ratio of 2.07. Middle Eastern reports also agree with ours, since Awada [9] found 89 females and 57 males among 146 patients and Chacko [10] found a F/M ratio of 5.6/1 in a study of 100 Omani patients with CTS. A paper from Saudi Arabia [11] which assessed the prevalence of CTS among dentists in Riyadh, noted that female dentists had a significantly higher risk of having CTS symptoms than male patients. Our previous study from Jordan [12] found a female to male ratio of 5.4/1 among 185 patients with CTS. A female predominance was also mentioned in studies from the Far East [24-27]. This disagrees with the study done by Kuharic[28] who concluded that the risk for CTS was found in 38.5% of patients undergoing chronic hemodialysis without any significant difference in sex distribution.

Regarding risk factors for CTS in our patients, table 2 shows that the majority of cases (71%) were idiopathic, mostly due to

stressful manual work, mainly domestic duties for housewives. This was followed by diabetes mellitus (DM)/ preDM (25%) and hypothyroidism (6%). This is in accordance with Western reports [1,29-32] which mentioned that CTS is idiopathic in 50% of patients and is a work-related condition. Lam [17] concluded that six times the number of females who worked in moderate manual work underwent carpal tunnel release compared with the general population of Newzealand. This is also in agreement with other Middle Eastern reports [10, 33] as well as with our previous study [12]. A recent study from Saudi Arabia [11] demonstrated a high prevalence of CTS (30.5%) among dentists in Riyadh, who are exposed to daily manual work. According to another report from China [26], sex, age, wrist working/ injury are all risk factors for CTS.

Diabetes mellitus (DM) and preDM were found in only 35 out of 150 (25%) of our patients with CTS. Although the prevalence of CTS is 2-3% of the general population [7], it is the most common entrapment neuropathy complicating diabetes, with an incidence several fold that in the general population [34]. Surprisingly, none of our diabetic patients with CTS had symptoms in the lower limbs indicating the presence of a diabetic polyneuropathy. A report by Perkins [35] mentioned that, in diabetic patients, the prevalence of CTS varies between 14% in subjects without diabetic neuropathy, and up to 30% in patients with diabetic neuropathy. Wengie [25] noted an odds ratio of 1.837 for DM in Chinese patients with CTS. Although other studies [25, 36-38] have shown a higher risk of CTS in hypothyroidism and rheumatoid arthritis, only 8 out 150 of our patients had hypothyroidism and none had rheumatoid arthritis.

The most common clinical symptoms in our patients were nocturnal hand numbness and paresthesiae noted in 99 out of 150 of our patients (66%), bilaterally in 45 patients (45%) and unilaterally in 54 patients (55%), mainly in the right dominant hand in 38 patients. This is in full accordance with other reports [2, 16, 18]. The percentage of patients with clinical symptoms of bilateral CTS (66%) is lower than the figure of 74.3% noted in a study from Poland [39].Unilateral clinical CTS was mainly in the right dominant hand (38 out of 54 of our patients), which is in contradistinction with the study from Saudi Arabia [11].

In our study, Tinel and Phalen signs were positive in 30 % and 33% respectively. This is much lower than the percentages found in our previous study [12] and those noted by Wipperman [19] who mentioned that the sensitivity of Tinel sign is 36% - 50% and that of Phalen sign 57% - 68%. However, another study [40] noted that the sensitivity of Tinel sign may be as low as 30% to 43% with specificity up to 65%, but the sensitivity of Phalen test is better but only around 50% to 67%.

About 79% (118 out of 150 patients) had bilateral electrophysiological CTS, which is in accordance with other reports [9,41]. However, this is much higher than the percentage of patients who had clinical symptoms in both hands (45 out of 150 patients, or 30%). This shows the value of doing NCS in both hands in patients with clinically overt unilateral CTS.

Among 150 patients (300 hands), moderate and severe electrophysiological CTS were present in 155 hands (52%) of our patients, which is similar to the figure of 53% noted by Padua [15], but less than the figure of 70% mentioned in our previous study [12]. Nevertheless, this did not have a straightforward correlation with the severity of clinical manifestations.

With regard to the sensitivity of the individual NCS tests, the diagnostic yields of the two tests which were performed in all patients were 52% for DML and 56% for PW (table 3). These percentages are similar to our previous study [12], but much less than in other reports [14, 42-44]. Aroori [1] concluded that NCS is not a perfect test, with sensitivities ranging from 49% to 84% and specificities from 95% to 99%. This is in agreement with Demino [42] (95.8% specificity for DML and 93.6% for distal sensory latency) and with Khosrawi [43] (100% specificity for DML and 91% for distal sensory latency).

In conclusion, our study shows: (1) nothing remarkable regarding age and sex distribution, with, however, a high proportion of relatively young patients; (2) same predisposing factors as in other series with, however, a lower proportion of diabetic patients; (3) same clinical presentation as in other studies, with a lower percentage of positivity of Tinel and Phalen signs; (4) that most of the patients had moderate to severe electrophysiological carpal tunnel syndrome despite the absence of heavy manual industrial labour in Jordan and (5) that surgical decompression was done in only a minority.

Table 1
Age and sex distribution

Age range (years)	Sex		Total
	Male	Female	
10-20		1	1
21-30		3	3
31-40	4	22	26
41-50	5	37	42
51-60	10	42	52
61-70	5	12	17
71-80	5	3	8
81-90		1	1
Total	29	121	150

Table 2
Predisposing factors

Factor	Number of patients	Percentage (%)
Idiopathic #	106	71
Diabetes mellitus (DM)	25	17
PreDM	10	8
Hypothyroidism	8	6
Wrist trauma	1	1

Some patients had more than one predisposing factor; # due to stressful manual work, among them 9 with professional risk: one painter, one hairdresser, one cleaner, one computer programmer, 5 teachers

Table 3
Results of nerve conduction studies
(n=150 patients, 300 hands)

Test	number of abnormal hands	diagnostic yield (%)
DML	155	52
PW	84	56
CPW	29	19

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