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Clinical and Neurophysiological Characteristics of Patients with Carpal Tunnel Syndrome Presenting at the Tertiary Rheumatology Out-Patient Clinic

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Abstract

Background: Carpal tunnel syndrome (CTS) is the most commonly-encountered entrapment neuropathy. The classic symptoms of CTS are numbness and paraesthesia in the first three fingers of the hand, which is commonly exacerbated at night. The diagnostic signs include sensory loss along the lateral aspect of the hand, motor weakness and wasting of abductor pollicis brevis muscle. Tinel's and Phalen's signs are elicited at the wrist. Methods: This is a prospective analysis of clinical and electrophyisologic study performed on patients that attended the rheumatology outpatient clinic of a tertiary institution. The primary patients of the unit and those that were referred to the rheumatology clinic on account of clinical features of CTS were included in the study. Excluded from the study were pregnant women and those with previous history of CTS surgery. Nerve conduction study was carried out on all patients with features of nerve compression at the wrist. ***Results***: Sixty nine (69) patients out of 82 that presented with clinical features of CTS were diagnosed of CTS. Females constituted 84.1% (58) and males were 15 .9% (11). The most affected age group was (31-40) years. Diabetes patients had the highest presentation of CTS (42%). The classic history of CTS was reported in 33.3%, Paraethesia was observed in 46.4%, numbness in 44.9% while paraethesia and numbness together were reported in 40.6% of patients. Day pain and nocturnal pain was seen in 60.9% and only nocturnal pain was reported by 42.0%. Abductor policis brevis (APB) muscle weakness was found in 24.6% of patients while 11.65% had wasting of the muscle. ***Conclusion:*** CTS was fairly common among the rheumatology patients and diabetes patients were predominantly affected.

Keywords: Carpal tunnel syndrome, Entrapment neuropathy, Paraethesia, Canterbury scale.

INTRODUCTION

CTS is the most common entrapment known[1] and accounts for 90% of all entrapment neuropathies [1]. CTS is a neuropathy caused by entrapment of the median nerve at the level of the carpal tunnel [2]. It was first described by Paget in 1854 [3].

CTS remain an idiopathic syndrome. Certain risk factors that have been associated with this condition include prolonged postures in extremes of wrist flexion or extension, repetitive use of the flexor muscles, and exposure to vibration [4]. Pregnancy, menopause, obesity, renal failure, hypothyroidism, oral contraceptives, diabetes, alcoholism, vitamin toxicity or deficiencies are the medical risk factors identified [4].

Clinical features of CTS include pain in the hand, tingling in the fingers, pain or numbness in the distal distribution of the median nerve[5]. Some patients also complain of reduction of the grip strength and function of the affected hand[5]. Clumsiness is noticed during the day with activities requiring wrist flexion but Symptoms tend to be worse at night. Patients often describe a phenomenon termed the "flick sign", in which shaking or flicking their wrists relieves symptoms [5]. Patients suffering from CTS often report subjective feelings of swelling in their hands or wrists, but usually no apparent swelling is seen. Tinel's and Phalen's sign at the wrist are the useful physical signs [6].

CTS may be classified on the basis of symptoms and signs into three stages [7]:
Stage 1: Patients have frequent awakenings during the night with a sensation of a swollen, numb hand. They report severe pain that radiates from the wrist to the shoulder, and tingling sensation in their hand and fingers. Shaking their wrist relieves the symptoms.
Stage 2: The symptoms are present also during the day, mostly when patient performs repeated movements with their hand and wrist. With the appearance of motor deficit, the patient reports that objects often fall from his/her hands because they are unable to feel their fingers anymore.
Stage 3: Atrophy of the thenar eminence begins to be evident and sensory symptoms may diminish. There is also aching in the thenar eminence, and with severe compression, weakness and atrophy of the abductor pollicis brevis and opponens pollicis ensue.

Nerve conduction study (NCS) is considered the gold standard in the diagnosis of CTS [8]. Conservative and surgical interventions are the treatment modalities.

METHODOLOGY

A convenient non-probability sampling method was used for the study. The reference population of this study was all the patients seen at the rheumatology out-patient clinic of a tertiary health institution, who fulfilled the inclusion criteria. The inclusion criteria were patients that complained of pain in the wrist and the fingers with associated tingling sensation with clinical examination suggestive of CTS. Pregnant women and patients with previous hand surgery in one or both hands for CTS were excluded from the study.

Consecutive patients that met the inclusion criteria were recruited over a period of 6 months (from November 2018 to April 2019). A self-administered questionnaire was administered. Captured in the questionnaire were socio-demographic characteristics, work characteristics, psychosocial job factors, individual risk factors and co-morbid conditions. Socio-demographic data consisted of questions related to age, sex, race, marital status and education level.

The symptoms that were included in the questionnaire included day pain, pain at night, tingling sensation, reduced sensation (numbness), frequent dropping of objects, finger stiffness, loss of hand strength and morning swelling of the fingers.

Individual risk factors assessed included body mass index (BMI), history of taking hormone replacement drugs, chronic diseases (diabetes mellitus, renal impairment and rheumatoid arthritis) and involvement in and type of hand exercise.

Case definition of carpal tunnel syndrome for this study required that a clinician had suspected the diagnosis and that nerve conduction studies were positive at least grade 1 on the Canterbury scale in one or both hands.
Grade 0- normal
Grade 1 (very mild) - CTS demonstrable only with most sensitive tests
Grade 2 (mild)- sensory nerve conduction velocity slow on finger/wrist measurement, normal terminal motor latency
Grade 3 (moderate) - sensory potential preserved with motor slowing, distal motor latency to abductor pollicis brevis (APB) < 6.5 ms
Grade 4-(severe)- sensory potentials absent but motor response preserved, distal motor latency to APB < 6.5 ms
Grade 5 (very severe)- terminal latency to APB > 6.5 ms
Grade 6 (extremely severe)- sensory and motor potentials effectively unrecordable (surface motor potential from APB 0.2 mV amplitude.

Consent forms were served to respective patients prior to data collection. Statistical Analysis SPSS version 20 statistical software was used for data entry and analysis. Mean and standard deviation (SD) were calculated for each continuous variable and for categorical variables.

RESULTS

There were 82 patients that were seen in the rheumatology out-patient with features of CTS. Sixty nine of them were confirmed by NCS. The symptoms they presented with are shown in table 1. Females were found to predominate with a female to male ratio of 5.3:1 and the mean age of 38.4 ± 6.5 as shown in Table 2. The occupation distribution of the study population is as shown in table 3. Majority of the patients were manual workers, house wives and drivers. Figure 1 shows the relationship between handedness and whether the patient presents mainly with right, left, or bilateral median nerve impairment. The dominant hand was more affected in majority of the patients while only 10.1% presented with CTS in non-dominant hand. Figure 2 shows the associated morbid conditions of the patients.

Laterality and Severity of carpal tunnel syndrome

The dominant hand was the commonest hand affected. Females generally presented with milder disease than males patients. Grade 1 and grade 2 cases were mostly found in women. Where the 2 hands were involved, severity of symptoms was noticed with the dominant hand.

Table 1: Presentations of CTS among the patients

Symptoms	Frequency	Percent
Paraesthesia	32	46.4
Pain and paraesthesia	28	40.6
Day and night Pain	42	60.9
Nocturnal pain	29	42.0
Numbness	31	44.9
Hand weakness	17	24.6
Abductor pollicis brevis wasting	8	11.6

Table 2: Age group involvement among patients with carpal tunnel syndrome

Age (year)	Frequency	percentage
21-30	08	11.6
31-40	33	47.8
41-50	13	18.8
51-60	07	10.1
61-70	05	7.2
70 and above	03	4.3
Total	**69**	**100**

Table 3: Occupation distribution of carpal tunnel syndrome patients

Occupation	Frequency	Percent
House wives	12	17.4
Manual workers	21	30.4
Drivers	09	13.0
Students	02	2.9
Retired	06	8.7
Teachers	10	14.5
Health workers	04	5.8
Military personnel	05	7.2
Total	**69**	**100**

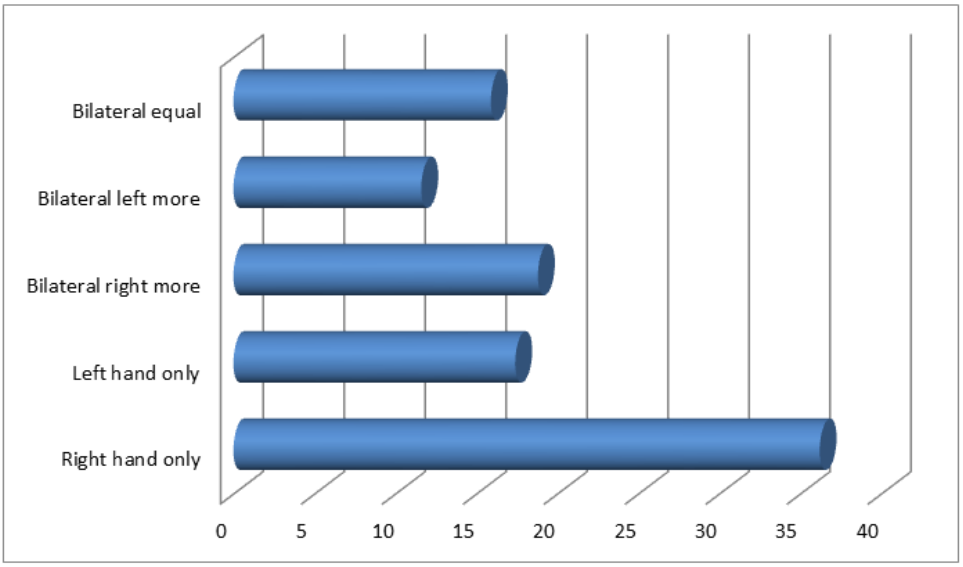

Figure 1: Bar chart showing hand involvement in patients with carpal tunnel syndrome

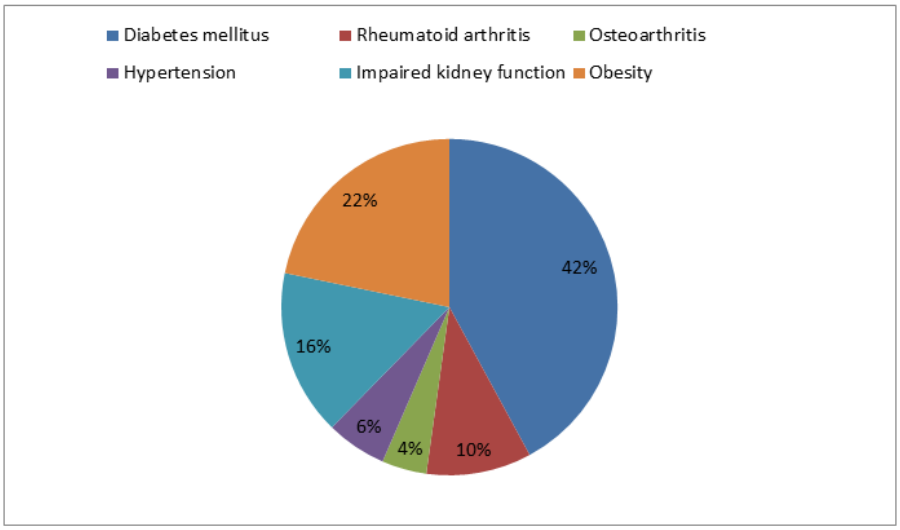

Figure 2: Co-morbid conditions among patients with carpal tunnel syndrome

DISCUSSION

After Phalen first drew the attention to the presence of carpal tunnel syndrome, many other investigators have described carpal tunnel syndrome in other populations [8]. A standardized method of grading the severity of the nerve conduction study findings in carpal tunnel syndrome was introduced in 1991 using a six point scale [9].

The basic demographic data of this study showed the excess of female over male patients. The ratio (5.3:1) is however more than that reported in Europe [10] and less than in Argentina (10:1) [11] or Korea (23:1) [12].

Many other studies have reproduced the demographic characteristics of carpal tunnel syndrome following the finding of Phalen which showed a marked female preponderance and a peak incidence at the age of about 55 to 60 years [8]. This present study agrees with Phalen on female preponderance but differs on the peak age of occurrence of carpal tunnel syndrome. The peak age of this study was 30 to 40 years as against 55 to 60 years by Phalen [8]. The reasons for this difference in age could be attributed to the location of the study. This study was done in Arab country where the majority of the work forces are young foreigners. This study did not find bimodial age distribution of carpal tunnel syndrome as in some other studies. Carpal tunnel decompression surgery from Ontario [13] showed a bimodal distribution of age in women. In contrast, the Italian study showed a unimodal age distribution in women but a bimodal one in men [14].

This study has revealed that patients that present with classic history of CTS also have higher neuro-physiologic grades. The conclusion from other studies that showed that intense repetitive motion, hand vibration and extreme postures of the hand and wrist during job performance may contribute to the development of CTS seems to be true for this study [15]. People that were involved in manual works, household works and driving were predominantly affected. Work related CTS was first discovered in 1947 that CTS was related to occupations, when Brain et al reported approximately 6 cases of work related CTS in repetitive work [16]. Broadly, there is support for substantially more than a doubling of risk when repetitive wrist movements occupy a major part of the working day.

There were 29 patients that presented with bilateral hand involvement and the dominant hand was mostly affected. This finding agrees with other studies where bilateral carpal tunnel syndrome was found to be a frequent finding [17]. Those with bilateral hand involvement had the dominant hand being involved first and also had the most severe pain. The explanation for this is likely because the dominant hand is the hand frequently used.

When the non-dominant hand is first affected with carpal tunnel syndrome, a review of the diagnosis should be made unless there is an obvious cause for median nerve entrapment on that side, such as a wrist fracture. There is a good agreement between the clinical assessment of which hand is worse affected and neurophysiological assessment of median nerve impairment, and thus neurophysiological abnormalities also tend to lateralise to the dominant hand.

Diabetes was reported in 42% of the subjects with clinically and electrophysiologically confirmed CTS. Also reported were obesity (22%), impaired kidney function (16%) and rheumatoid arthritis (10%). Others were hypertension (6%) and osteoarthritis (4%). Therefore, screening for predisposing conditions should be done in patients that are suspected with CTS.

Many studies have investigated the relationship between DM and CTS based on the assumption that DM makes peripheral nerves susceptible to entrapment [18]. A population based cohort study revealed that the prevalence of CTS was higher in patients with diabetes [19]. Also a meta-analysis found DM to be one of the risk factors for CTS [20]. It has therefore been proposed that the high prevalence of CTS among patients with diabetes might be due to repeated undetected trauma, metabolic changes, accumulation of fluid or edema within the confined space of the carpal tunnel and or diabetic cheiroarthropathy [21].

In contrast, after adjusting for sex, age, and BMI, a retrospective case–control study found that type-2 DM was not associated with CTS in multivariate analyses [22]. A similar case–control study suggested that DM was not significantly associated with CTS but being female, obese, and older were independent risk factors for CTS [23]. A Dutch study with matched age and sex groups also did not find a relationship between DM and CTS [24]. It therefore remains unclear whether DM is a real risk factor for CTS.

This study found people above 70 years of age to be minimally affected. Carpal tunnel syndrome in the elderly appears relatively neglected in most published series, perhaps because it is now widely believed to be a disorder of middle aged women and the diagnosis is therefore considered less readily in the elderly.

Symptoms of pain, numbness and tingling in the hands are common in the general population. High index of suspicion is therefore required to make a differential of CTS. Therefore, electrophysiological studies should be carried out in suspected cases.

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