Original Article

Carpal tunnel syndrome in Iraqi paraplegic patients

Basim M. Alwan* **MBChB, MSc, PhD Neurophysiology**

Summary:

Background: The median nerve in paraplegic patients, who must rely on increased hand activities including transfer and wheel-chair propulsion, may be subjected to increased pressure, so that the incidence of carpal tunnel syndrome (CTS) may be higher than that in the normal population.

Objectives: To study the prevalence and the severity of carpal tunnel syndrome in Iraqi paraplegic patients and to identify the effect of duration of the injury as a possible factor related to its occurrence to avoid any chronic problems which interfere with the hand functions since these patients are greatly dependent on their hands for their daily activities.

Patients and Methods: Fifty paraplegic patients (100 hands), whose level of spinal cord injury was below D2, and fifty normal control subjects were included in this study. All patients studied in this work had complete spinal cord injury and were stabled medically and neurologically.

Clinical examination for the signs and symptoms of CTS as well as nerve conduction studies were carried out in both median and ulnar nerves for their sensory and motor components eliciting values for distal latencies for all patients and the control groups.

Results: Thirty percent of the paraplegic patients (15 patients) had signs and symptoms consistent with carpal tunnel syndrome (CTS), and all of them had electrodiagnostic confirmation of this injury.

Seventy percent of these paraplegic patients (35 patients) had no signs and symptoms suggestive of CTS, and only nearly about forty eight percent (17 patients) of them had only electrodiagnostic confirmation of CTS. Overall, 64% of the 50 paraplegic patients had CTS (32 patients). Nine paraplegic patients (18%) exhibiting bilateral CTS. Eight paraplegic patients (16%) had abnormal electrophysiological findings involving the ulnar nerve at the wrist and all of them had electrophysiological findings of CTS.

There was a sharp increase in incidence of occurrence of CTS from 6.3% in the group 1 to 5 years from injury to 13.7% in the group 6 to 10 years, and to 25% in the group 11 to 15 years, and again a very big increase to 50% in the group 16 years and over from injury.

Conclusion: Early testing of the median and ulnar nerve function, even in asymptomatic patients within the first 5 years of the injury, is recommended so for early detection, preventive and/or curative measures to be undertaken considering the fact that these patients are greatly dependent on their hands for their daily activities.

Keywords: Carpal tunnel syndrome, Paraplegics

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Introduction:

In the normal carpal tunnel there is barely room for all the flexor tendons of fingers with the median nerve, consequently in this tunnel the median nerve is liable to compression (1). The Carpal Tunnel Syndrome (CTS) was originally described by Sir James Paget in 1863. In 1913, Marie and Foix at the autopsy of a patient with advanced atrophy of the thenar muscles and no history of injury, demonstrated neuromata in both median nerves just proximal to the transverse carpal ligament. They were the first who recommend decompression of the median nerve by sectioning the transverse carpal ligament in order to prevent paralysis of the thenar muscles (2). Phalen (1950) published his 3years study in 22 cases of CTS, which involved 34 hands. He made an observation that a history of increased use of the hand was found in 14 cases prior to the onset of symptoms, then Phalen (1966) published his study of 17 years experience in 654 hands (3). Tanzer (1959) studied the pressure in the carpal tunnel in relation to wrist flexion and extension both in surgical and in post-mortem studies, since there seemed to be general agreement that symptoms of CTS were often produced or aggravated by a sudden increase in manual activity (4). A retrospective study done by Reinstein (1981) found that CTS occurred significantly more in the dominant hand (5). It was therefore, thought that in accordance to the above studies, median nerve compression at the wrist is associated with local trauma around the flexor retinaculum and repeated manual activity also exacerbates the disease severity (6) Paraplegic patients who must rely on increased hand activities, including transfer and wheel-chair propulsion, may be subjected to increased pressure on their median nerves, so that CTS incidence may be higher than that of the normal population as median nerve neuropathy could be purely mechanical which is produced by the increased pressure

**Department of Physiology, College of Medicine-Baghdad University.*

in the carpal tunnel (6). Individuals with lower extremity amputations, weakness or paralysis rely heavily on their upper extremities for activities of daily living and mobility. Both manual wheelchair propulsion and crutch ambulation have been implicated in upper limb repetitive strain injuries, including upper extremity nerve entrapment conditions, such as carpal tunnel syndrome (CTS). The prevalence of CTS among manual wheelchair users is between 49% and 73%. Gellman, in a study of 77 individuals with T2 or below paraplegia, found 49% had signs and symptoms of CTS (7). Sie interviewed 103 subjects with paraplegia and found historical or physical examination evidence of CTS in 66% (8). In these studies, wheelchair propulsion and crutch use have been implicated as contributing to injury. There is, however, limited data on the incidence of upper extremity nerve entrapments in the population of individuals with paraplegia in our country.

Patients and methods:

This is a prospective cross sectional study to know the incidence of carpal tunnel syndrome (CTS) in Iraqi paraplegic patients who have used their hands extensively for daily activity. Fifty paraplegic patients (100 hands) whom level of complete spinal cord injury was below D2 were recruited either from Ibn-Kuff spinal cord rehabilitation center (inpatients and outpatients) or resident in Al-Shumouk or Al-Zura cities for the disabled. A group of fifty normal subjects of comparable age and sex distribution was used as control. All these fifty subjects had neither systemic disease nor clinical evidence of neuropathy and were not alcoholic. All paraplegic patients studied in this work were stable medically and neurologically and undergone full rehabilitation program, were considered independent for activity of daily living (ADL) and all of them have no systemic disease which might affect the nervous system. Electrophysiological studies were performed on all paraplegic patients using DISA-1500 digital EMG machine with four amplifier channels, provided with all requirements for nerve conduction assessments. Both median and ulnar nerves were examined bilaterally for motor and sensory component. Stimulation of the median nerve was performed at the second most distal wrist crease between the tendons of the Palmaris longus and flexor carpi radialis for both motor and sensory studies. Motor responses were recorded from the muscle belly of the abductor policies brevis (after supra-maximal stimulation) with self adhesive surface electrodes. While the sensory response were recorded using ring electrodes on digit II. Stimulation of the ulnar nerve was performed at the same distal crease just medial to the flexor carpi ulnaris. The ulnar nerve motor response was recorded from the muscle belly of the abductor digiti minimi using self adhesive surface electrodes and the sensory response using ring electrodes on digit V (9). Clinical criteria for the diagnosis of CTS required that the paraplegics to have two of the following subjective or objective findings: numbness/tingling or pain in the median distribution of the hand, nocturnal pain in the median distribution of the hand, decreased sensory exam in the median distribution of the hand, median hand weakness, a positive Tinnel>s sign or a positive Phalen>s test (10). The elctrophysiological criteria for CTS and ulnar nerve entrapment at wrist were based upon prolonged distal latency by more than 2 standard deviation of the median and ulnar nerves either the motor or sensory component (11).

Statistical Analysis:

Distributions of variables were examined and transformations were made where necessary. Paired t-tests were conducted to determine significant differences between the variables at two levels and X^2 (Chi squared test) for testing correlation were used. P-values of 0.05 were considered significant.

Results:

A total of 50 paraplegic aged 15-50 years (32 ± 4.45years) and 50 control subjects (30 ± 3.56 years) were included in this study. The time since the spinal cord injury in the paraplegic patients ranged from 1 to 25 years. The clinical diagnosis of CTS based on the presence of the specific signs and symptoms are recorded in table 1.

Table (1): Clinical signs and symptoms of CTS in the paraplegic patients

19	**Median nerve paresthesia**	**16**	**9**
10	**Ulnar nerve paresthesias**	**8**	**4**
7	**Median nerve sensory loss**	**5**	**3**
3	**Ulnar nerve sensory loss**	**3**	**1**
5	**Median nerve weakness**	**4**	**2**
2	**Ulnar nerve weakness**	**2**	**1**
8	**Positive Phalen>s test**	**6**	**3**
12	**Positive Tinel>s test**	**9**	**7**

Thirty percent of these paraplegic patients (15 patients) had signs and symptoms consistent with carpal tunnel syndrome (CTS), and all of them had electrodiagnostic confirmation of this injury. Seventy percent of these paraplegic patients (35 patients) had no signs and symptoms suggestive of CTS, and only nearly about forty eight percent (17 patients) of them had only electrodiagnostic confirmation of CTS. Of interest is the number of paraplegic without clinical signs and symptoms of CTS (17 paraplegic) who had electrophysiological finding supportive of this diagnosis, in other words 48 percent of paraplegics had subclinical CTS. Overall, 64% of the 50 paraplegic patients had CTS (32 patients). Nine paraplegic patients (18%) had bilateral CTS which indicate the high incidence of bilateral CTS in paraplegic patients. Concurrent ulnar neuropathy with CTS was observed since eight paraplegic patients (16%) had abnormal electrodiagnostic findings involving the ulnar nerve at the wrist and all of them had electrodiagnostic findings of CTS (Table 2).

Table (2): Electrophysiological findings of normal and paraplegic groups

((Median nerve)) (DML) msec. (DSL) msec.	3 .2 ± 0.5 1.7 ± 0.2	4.8±0.83* 2.3±0.74*	3.7±0.6* 2.1±0.45*	4.7±0.9* 3.1±0.65*
No. of subjects with abnormal Median NCS	1 (2%)	32(64%)*	17 (48%)*	15(30%)*
((Ulnar nerve)) (DML) msec. (DSL) msec.	2.5 ± 0.7 1.75 ± 0.4	2.84± 0.623 2.26±0.53	2.6 ± 0.8 1.64±0.5	3.1±0.9* 1.9±0.75
No. of subjects with abnormal Ulnar NCS	0 (0%)	8 (16%)*	2(4%)*	6 (12%)*

*significant difference (P<0.05) than the control group

(DML) Distal motor latency, (DSL) Distal sensory latency

NCS Nerve conduction study

The incidence of CTS appears to be related to the duration of spinal cord injury so there is a direct relationship between length of injury and development of CTS. In our study, the patients were divided into four groups according to the duration of their spinal cord injury. We found that there is a sharp increase in incidence of occurrence of CTS from 6.3 % in the group1 to 5 years from injury to 13.7 % in the group 6 to 10 years, and to 25% in the group 11 to 15 years, and again a very big increase to 50% in the group 16 years and over from injury (Figure 1). A significant difference was found with the duration between the successive groups (Table 3).

Table (3): Incidence of CTS in the paraplegic groups according to durations of paraplegia

1	1- 5	4	2 (6.3%) (32)
2	6-10	10	6 (13.7%)*(32)
3	11-15	14	8 (25%)*(32)
4	16-25	22	16 (50%)*(32)

*significant difference (P<0.05) in between the different age groups

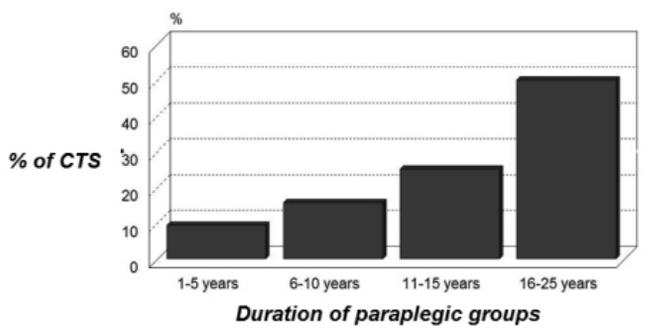

Figure (1): Duration of paraplegia and the percentage of CTS

Discussion:

There are limited data on the prevalence of upper extremity nerve entrapments in paraplegic as well as in patients with major limb amputations (12). Information on the incidence of upper extremity nerve entrapments is important for counseling and safety of patients, for training medical staff, and for preparing strategies for prophylaxis and treatment. From the data collected of our study and other studies, it appears that there is a definite trend for development of CTS and ulnar nerve neuropathy in the paraplegic population, which in our study is 64 per cent. Several studies have been done for the general paraplegic population regarding the prevalence of CTS in those patients (7, 13, and 14). Gellman et al. (7) examined 77 paraplegics and found 38 with clinical sign and symptoms of CTS. Only 18 of them agreed to electrodiagnostic testing, and the diagnosis of CTS was confirmed in 8 of those while the other 10 were asymptomatic and with normal studies. Aljure et al. (6) reported an Incidence of 64% of paraplegic patients having electrophysiological findings consistent with CTS, whereas only 40% (19 0f 47patients) had clinical symptoms of CTS. In addition, 21 of the 47 (45%) had both clinical and electrodiagnostic confirmation of ulnar neuropathy and of these only two had CTS as well. Also in this study, of the 24 patients who had no clinical evidences of CTS, eight (33%) had electrophysiological finding consistent with CTS. The study also indicated a relationship with length of injury and incidence of CTS. Davidoff et al (14) examined 31 paraplegics and found 17 (55%) to have CTS and 24%of these were bilateral in addition four patients had evidence of ulnar neuropathy. The clinical and electrophysiological findings in our study are comparable to those of previous studies of CTS in the paraplegic population in general, since the same clinical and electrophysiological criteria were applied in our and their studies (Table 4).

Table (4): Comparison of our study with prior studies.

1	Gelerman et al.	77	38/77 (49%)	8/18 (44%)
2	Aljure et al.	47	19/47 (40%)	30/47 (64%)
3	Davidoff et al.	31	10/31 (32%)	17/31 (55%)
4	Our study	50	15/50 (30%)	64%))32/50

Several studies have tried to explain the high incidence of CTS in paraplegic patients (13, 14, &15). Most authors agreed that repetitive trauma to the wrist, especially with wrist extension, is most probably the cause of CTS in paraplegic patients. Several other studies have indicated that increased pressure in the carpal tunnel is the most etiological factor for the development of nerve injury (16, 17, 18, 19 & 20). It is our belief that the high incidence of CTS in paraplegics is the result of excessive use of their hands to compensate for their disability so there is a direct relationship between length of injury and development of CTS in our study and even in some other studies (6).

Conclusion:

We recommend early testing of median and ulnar nerve function, even in asymptomatic patients within the first 5 years of the injury, and periodic re-evaluations as the clinical situation may dictate thereafter, so that with early detection, preventive and/or curative measures may be undertaken considering the fact that these patients are greatly dependent on their hands for their daily activities.

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