Prevalence of Carpal Tunnel Syndrome in Subjects Complaining from Hand Pain

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ABSTRACT

This study was conducted to detect the prevalence of carpal tunnel syndrome (CTS) in 500 subjects (73 males and 423 females) and their ages ranged from 18 – 79 years. All subjects were evaluated for distal latency for the median nerve of both hands. The results of this study showed that there was 43.4 % of the subjects had bilateral affection, 38.6 % were complaining from right side affection, 14.6 % from left side affection and 3.4 % of the subjects were free from CTS. Studying of distal latency showed that 1.2% &1.2% of the subjects had the incidence of CTS, 27.4% & 37% mildly affected, 13.8% & 21.8% moderately affected, 15.8% & 22% severely affected, and 41.8% & 18% of the subjects were free from CTS for the left and eight side respectively. It was concluded that the population most vulnerable to be affected by CTS whose ages ranged from 30 – 49 years (54.6 %), the females more than the males, bilateral affection more common than unilateral affection, and right side affection most common than the left side affection.
Key words: *carpal tunnel syndrome - EMG - distal latency.*

INTRODUCTION

Carpal tunnel syndrome (CTS) is a clinical symptom complex caused by compression of the median nerve as it passes from the forearm to the palm beneath the transverse carpal ligament. It is characterized by numbness, paresthesias or pain in the part of the hand innervated by sensory fibers of the median nerve and weakness of the muscles innervated by the motor fibers of the median nerve. Carpal tunnel syndrome is the most well known nerve entrapment mononeuropathy. Signs associated with CTS include Tinel sign and Phalen sign in addition to hypoesthesia (Naeser et al, 2002; Kao, 2003).

Recent analysis of the National Health Interview Survey estimate that the prevalence of CTS among working adults population accounts for 2.8 cases per 1000 patients seen by healthcare practitioner. Variation in the reported prevalence rates may be caused by the lack of diagnostic gold standard for CTS. To this date, nerve conduction studies are considered the common diagnostic tool (Crossman et al, 2001).

The pathogenesis of CTS is related to decreased blood flow to the nerve and its sheath at the level of carpal tunnel. This process can be caused by a tenosynovitis, which results in increased pressure within the carpal tunnel. The tenosynovitis can act as a final common pathway for CTS development (Concannon, 1999). Most carpal tunnel syndromes are idiopathic. Other causes include intrinsic factors (which cause pressure within the tunnel), extrinsic factors (which cause pressure outside the tunnel) and overuse exertion factors (Pritsch et al, 2004).

The syndrome most commonly occurs in the fifth and sixth decades of life. The dominant hand is more often involved when the syndrome is unilateral and is usually involved longer and more severely when the syndrome is bilateral. Symptoms of CTS

usually begin as paresthesias, hypoalgesia and hypoesthesia of some portion of the median nerve sensory dermatome. The skin supplied by the recurrent palmar cutaneous branch of median nerve (i.e. skin on the medial aspect of the thenar eminence and the central depressed area of the palm) is characteristically spared (Kulick et al, 1986).

The carpal tunnel is about 3 centimeter long, posses a waist at 2-2.5 cm distal to its entrance. The cross sectional area of the carpal tunnel increases both proximal and distal to the region of the waist. Moreover, the carpal tunnel is roofed in this region, by the thickest portion of the transverse carpal ligament (Robbins, 1998). Compression of the median nerve within the carpal tunnel may be caused by an increase in the volume of the contents, whether, due to injury or disease or a decrease in the volume of the tunnel due to deformation of the bone (osteoarthritis or fracture), thickening of the transverse carpal ligament and anomalous structures within the tunnel (Joseph, 1988). This may be caused by; traumatic Lesions (as carpal dislocation, immobilization of a colles' fracture in the position of acute volar flexion and ulnar deviation, gross traumatic arthritis of the wrist, Hematoma due to hemorrhage in the palm) and non traumatic conditions (as tenosynovitis, (Abbott & Saunders, 1983) Anomalous structures; within the tunnel (Reimann, 1984) Idiopathic carpal stenosis (Dekel et al., 1980) Benign tumors, Amyloidosis, Congenital CTS (Michaud et al., 1990) Pregnancy (Lundbord, 1990) Diabetes Mellitus (Thomas et al., 1987) Hormonal changes (Wilkinson, 1990). Also median nerve compression can also be caused by tasks that require repeated stress at the base of the palm as in using screw drivers, paint brushes or buffers (Bleecker et al., 1985).

The patient's history often is more important than the physical examination in making the diagnosis of CTS. Numbness and tingling of the hand are the most common complaints of those patients with loss of grip and dropping things; as well as; numbness and tingling. Symptoms are usually intermittent and are associated with certain activities (e.g. driving, reading the newspaper, crocheting and painting).

Nighttime symptoms that wake the individual are more specific of CTS, especially if the patient relieves symptoms by shaking the hand/wrist. Bilateral CTS is common, although the dominant hand is usually affected first and more severely than the other hand. Complaints should be localized to the sensory distribution of the median nerve at the wrist (Kulick et al., 1986; Treaster and Burr, 2004).

Pain is accompanied by an aching sensation over the ventral aspect of the wrist. This pain can radiate distally to the palm and fingers or, more commonly, extend proximally along the ventral forearm. More proximal pain should prompt a careful search for other neurological diagnosis (e.g. cervical radiculopathy). Autonomic symptoms are not infrequently, patients report symptoms in the whole hand. Many patients with CTS also complain of a tight or swollen feeling in the hands and/or temperature changes (e.g. hands being cold/hot all the time). Many patients also report sensitivity to changes in temperature (particularly cold) and a difference in skin color. In rare cases, there are complaints of changes in sweating. In all likelihood, these symptoms are due to autonomic nerve fiber involvement (the median nerve carries most autonomic fibers to the whole hand). Weakness/clumsiness in the hand (particularly for precision grips involving the thumb) does occur; however, in practice, loss of sensory feedback and pain is often a more important cause of weakness and clumsiness than loss of motor power (Crossman, 2001).

Although CTS has been described as the most common peripheral mononeuropathy, little is known about its prevalence in the general population. In the United States: Incidence is 1-3 cases per 1000 subjects per year; prevalence is approximately 50 cases per 1000 subjects in the general population. Incidence may rise as high as 150 cases per 1000 subjects per year, with prevalence rate greater than 500 cases per 1000 subjects in certain high-risk groups (Ashworth et al., 2005).

SUBJECTS, MATERIALS AND METHODS

Subjects

This study was conducted on 500 subjects complaining from hand pain (73 males and 423 females) and their ages ranged from 18-79 years.

Procedures

All subjects were evaluated for distal latency and conduction velocity for the median nerve of both hands (affected and non-affected hands) conducted by the following procedures:

The negative recording electrode (surface electrode) was placed over the muscle belly of abductor pollicis brevis, and the positive electrode was placed over the muscle tendon at the proximal phalanx of the thumb. Ground electrode was strapped around the wrist. Stimulating electrode: At level of the wrist, on palmer aspect midway between the tendon of flexor carpiradialis (laterally) and palmaris longus (medially). At level of the elbow: just medial to tendon of the biceps brachii muscle (Seror 2000).

RESULTS

The results showed the following:

1) Regarding sex:

The results showed that females are affected more than males 82.6 % against 14 %. Females are affected more than males by about 5.9 times. The number and percentage of males affected and not affected and females affected and not affected in the study is represented in table (1) and figure (1).

Table (1): The number and percentage of males affected and not affected and females affected and not affected in the study.

	Male		Female	
	Affected	Not affected	Affected	Not affected
Number	70	3	413	14
Percent	14	0. 6	82.6	2.8
Number	73		427	
Percent	14.6		85.4	

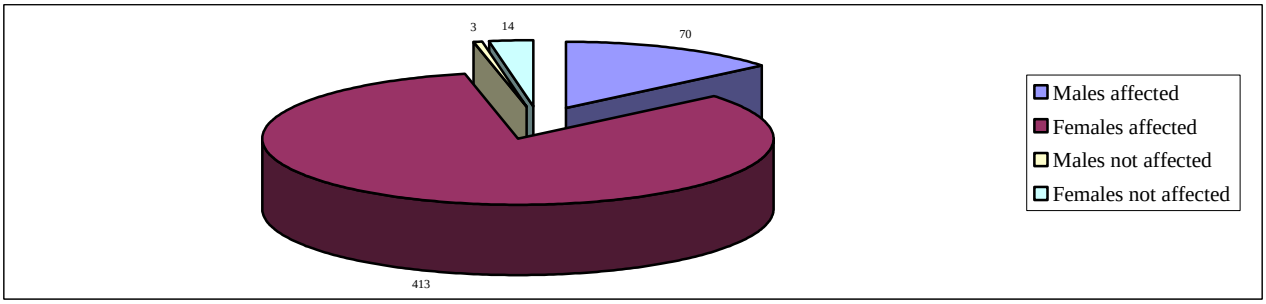

Fig. (1): The number and percentage of males affected & not affected and females affected & not affected in the study.

2) Regarding age:

The results showed that population in the fifth decades of life are the most commonly population liable to CTS (30%) followed by those in the fourth decade (24.6 %) and then in sixth decade (23.4 %). On contrast, the results showed that the incidence of CTS is less common in population in the first decade (0 %), second decade (0.4 %), eighth decade (2.6 %) and third decade (7.8 %). The distribution of patients complaining from CTS according to age in the study is represented in table (2) and figure (2).

Table (2): The distribution of patients complaining from CTS according to their ages.

Age group	0 - 10	10-19	20-29	30-39	40-49	50-59	60-69	70-79
Number	0	1	36	117	147	113	56	13
Percent	0	0.2	7.4	24.22	30.43	23.39	11.2	2.6

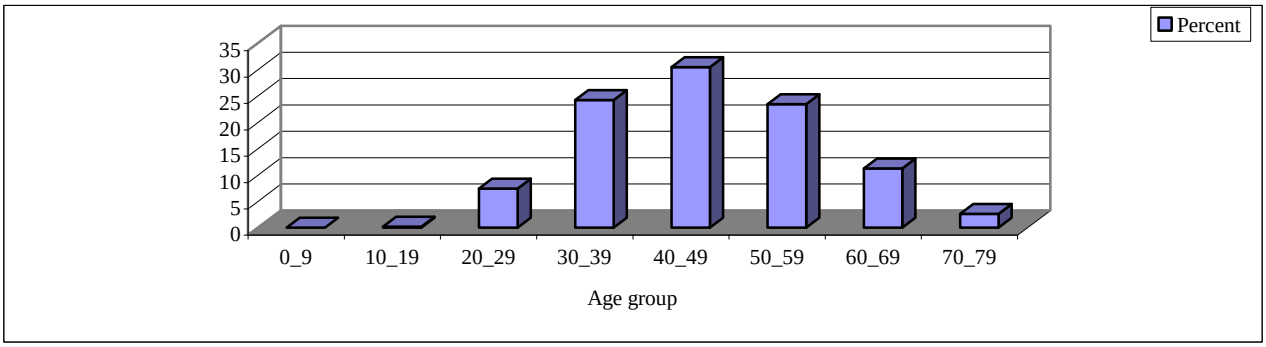

Fig. (2): The distribution of patients complaining from CTS according to their ages.

3) Regarding side affected:

The results showed that bilateral affection is more than right or left side affection and the affection of the right side is more than left one (43.4 % for bilateral affection, 38.6 for right side affection and 14.6 for left side affection). The distribution of subjects according to side affected in the study is represented in table (3) and figure (3).

Table (3): The distribution of subjects according to side affected.

	Right side	Left side	Both sides	Not affected
Number	193	73	217	17
Percent	38.6	14.6	43.4	3.4

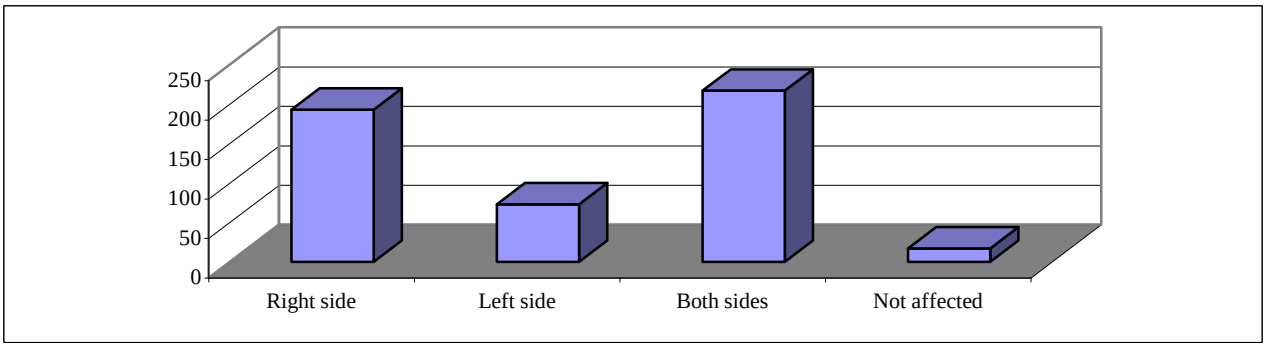

Fig. (3): The distribution of subjects according to side affected.

4) Regarding distal latency:

A) Distal latency of left side:

The results of this study showed that 1.2 % of subjects have the incidence to be affected by CTS, 27.4 % of them are mildly affected, 13.8 % of them are moderately affected and 15.8 % of them are severely affected. While, 41.8 % are free. The distribution of subjects according to the affection of distal latency of left side in the study is represented in table (4) and figure (4).

Table (4): The affection of distal latency of left side.

Variable	Normal (> 4 msec.)	Have the incidence (4 msec.)	Mild (4-5 msec.)	Moderate (5-6 msec.)	Severe (< 6 msec.)
Number	209	6	137	69	79
Percent	41.8	1.2	27.4	13.8	15.8

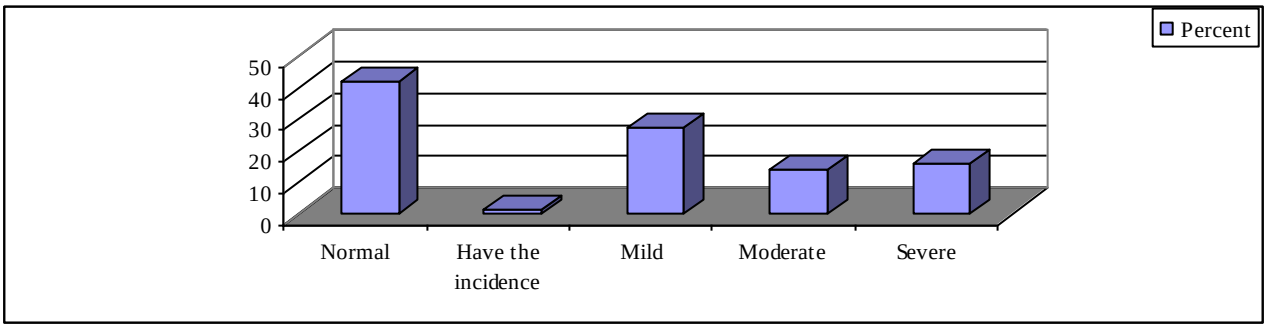

Fig. (4): The affection of distal latency of left side.

B) Distal latency of right side:

The results of this study showed that 1.2 % of subjects have the incidence to be affected by CTS, 37% of them are mildly affected, 21.8 % of them are moderately affected and 22 % of them are severely affected. While, 18 % are free. The distribution of subjects according to the affection of distal latency of right side in the study is represented in table (5) and figure (5).

Table (5): The distribution of subjects according to the affection of distal latency of right side.

	Normal (> 4 msec.)	Have the incidence (4 msec.)	Mild (4-5 msec.)	Moderate (5-6 msec.)	Severe (< 6 msec.)
Number	90	6	185	109	110
Percent	18	1.2	37	21.8	22

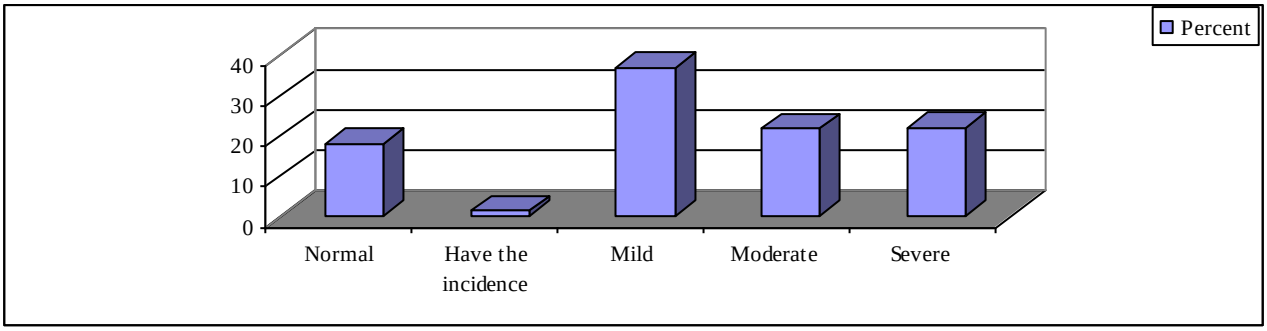

Fig. (5): The distribution of subjects according to the affection of distal latency of right side.

DISCUSSION

The result of the present study showed that the most commonly population affected by carpal tunnel syndrome are those in the fifth decades of life (30%) followed by those in the fourth decade (24.6%) and then in sixth decade (23.4%). This is supported by the opinion of Kulick et al., 1986, who concluded that the syndrome most commonly occurs in fifth and sixth decades of life. While, it is less common in population in the first decade (0%), second decade (0.4%), eighth decade (2.6%) and third decade (7.8%). This might be explained as follows: population in the fourth to sixth decades are the most active group that are liable to forced grasp and twisting movements by their hands. On contrary, those populations in the first to third decades; as well as; eighth decade are less active than other decades so there is no need for forced grasps. This comes in agreement with the conclusion of Sternbach (1999). He concluded that Middle aged to older individuals are more likely to develop CTS than younger persons. Kao (2003) described carpal tunnel syndrome as an occupational disease and claimed as a basis for worker's compensation. Sternbach (1999) concluded that a common factor in developing carpal tunnel symptoms is increased hand use or activity.

Studies done by the National Institute for Occupational Safety and Health (NIOSH), indicated that job tasks involving highly repetitive manual acts or necessitating wrist bending or other stressful wrist postures were connected with incidents of CTS or related problems.

Regarding to sex, females are affected more than males 85.4 % against 14.6 %. This may due to the nature of their occupation (house hold operation). This comes in agreement with Sternbach (1999) and Treaster and Burr (2004) who concluded that, CTS is more common in women about three times than it is in men; perhaps; because the carpal tunnel itself may be smaller in women than in men.

Concerning the side of affection, bilateral affection is more than right or left side affection and the affection of the right side (dominant in most population) is more than left one (43.4 % for bilateral, 38.6 for right side and 14.6 for left side). This may be justified as those people who work hard (heavy occupation) use both hands in conducting this part or depending more on the dominant hand. This may be come in accordance with the opinion of Kulick et al., 1986, who reported that the dominant hand is more often involved when the syndrome is unilateral and is usually involved longer and more severely when the syndrome is bilateral. Also, Treaster and Burr (2004) concluded that, the dominant hand is usually affected first and produces the most severe pain.

The result of the present study concerning studies of distal latency of the left and right sides showed that 1.2 % (for both) have the incidence to be affected by CTS, 27.4 % & 37% (for left & right side respectively) of them are mildly affected, 13.8 % & 21.8 % (for left & right side respectively) of them are moderately affected and 15.8 % & 22 % (for left & right side respectively) of them are moderately affected. While, 41.8 % & 18 % (for left & right side respectively) of them are free. This means that, right side (dominant hand in most of population) is liable to affection more than the left side (nondominant hand in most of population) and when they are both affected the right hand is affected more than the left one. The may be explained as; the dominant hand is used more than the left one so there is liability for the carpal tunnel of the right side to be narrower causing CTS. These

results come in accordance with those of Kulick et al (1986).

It can be concluded that population that are mostly affected are those who are in 5th, 4th and 6th decade (most active population). Dominant hand is more affected than nondominant and in patients complaining from bilateral lesion the dominant hand is more severely affected than nondominant.

It is recommended that: subjects with hand pain specially those in the 5th, 4th and 6th decade should be examined to identify the cause of that pain to treat them in early stage to avoid aggravation of symptoms and to make any necessary job modifications. This is better to maximum efficiency of work.

REFERENCES

1- Abbott, L. and Saunders, J.: Injuries of median nerve in fractures of lower end radius. Surg Gynecol Obstet J. 57: 507-516, 1983.
2- Ashworth, N., Sucher, B. and Talavera, F.: Carpal tunnel syndrome. Medicine continuing education. 1-16, 2005.
3- Bleecker, M., Bohlman, M. and Morelan, R.: Carpal tunnel syndrome: Role of carpal canal size. Neurology. 35: 1566-1605, 1985.
4- Concannon, M.: Common hand problem in primary care. Hanley & Belfus, Pheladelphia. 133-137, 1999.
5- Crossman, M., Gilbert, C., Travlos, A., Craig, K. and Eisen, A.: Non-neurologic hand pain versus Carpal Tunnel Syndrome. Am J Phys Med. Rehabil. 80(2): 100-107, 2001.
6- Dekel, S., Papaioannou, T. and Rushworth, G.: Idiopathic carpal tunnel syndrome caused by carpal stenosis. Br Med J. 280: 1297-1299, 1980.
7- Joseph, G.: Carpal tunnel syndrome. A common but treatable cause of wrist pain. Wrist Pain. 84 (7): 34-43, 1988.
8- Kao, S.: Carpal tunnel syndrome as an occupational disease. Am Board Family Practice J. 16: 533-542, 2003.
9- Kulick, R., Cordillo, G. and Javidi, T.: Long term analysis of patients having surgical treatment for carpal tunnel syndrome. J Hand Sur Am. 11(1): 59-66, 1996.
10- Lundbord, G.: Ischemic nerve injury. Erlanders. Biktryckeri: Aetiobiology, Goteborg: 204, 1990.
11- Michaud, L., Hays, R. and Dudgeon, B.: Congenital carpal tunnel syndrome: a case report of autosomal dominant inheritance and review of the literature. Arch Phys Med Rehabil. 71: 430-432, 1990.
12- Naeser, M., Hahn, K., Lieberman, B. and Branco, K.: Carpal Tunnel Syndrome pain treated with low-level laser and micro amperes transcutaneous electric nerve stimulation: A controlled study. Arch Phys Med Rehabil. 83: 978-988, 2002.
13- Pritsch, T., Rosenblatt, Y. and Carmel, A.: Carpal Tunnel Syndrome. Harefuah. 143(10): 743-748, 2004.
14- Reimann, A., Daseler, F., Anson, B. and Beaton, L.: Palmaris longus muscle and tendone: study of 1600 extremities. Anat Rec. 11: 511-517, 1984.
15- Seror, P.: Comparative diagnostic sensitivities or ormuuiunnu ui antidromic sensory inching test in mild carpal tunnel syndrome. Arch Phys Med Rehabil. 81: 442-446, 2000.
16- Sternbach, G.: "The carpal tunnel syndrome". J Emerg Med. 17(3): 519-23, 1999.
17- Thomas, P., Lambert, E. and Csenz, K.: Electrodiagnostic aspects of carpal tunnel syndrome. Arch Neurology. 16: 653-641, 1987.
18- Treaster, D.E. and Burr, D.: "Gender differences in prevalence of upper extremity musculoskeletal disorders". Ergonomicdsvss. 47(5): 495-526, 2004.

الملخص العربي

مدي انتشار ضيق النفق الرسغي في الأشخاص الذين يعانون من آلام باليد

تم إجراء هذا البحث بهدف دراسة مدي انتشار ضيق النفق الرسغي في 00º حالة (73 ذكر و423 أنثى) من اللذين تتراوح أعمارهم ما بين 18 إلى 79 عاما ومتوسط أعمارهم45.95±11.98 سنة. وقد أشتمل التقييم على دراسة التأخر الأقصى لتوصيل العصب الأوسط لليدين. وقد أوضحت نتائج هذه الدراسة أن 43.4% من أفراد عينة البحث يعانون من ضيق النفق الرسغي على الجانبين وأن 38.6% يعانون من الضيق على الجانب الأيمن وأن 14.6% يعانون من الضيق على الجانب الأيسر و 3.4 % من الأفراد خاليين من ضيق النفق الرسغي. و قد أوضحت دراسة التأخر الأقصى لتوصيل العصب الأوسط أن 1.2% و 1.2 % من أفراد العينة لديهم الاستعداد للإصابة بضيق النفق الرسغي وأن 27.4 % و 37 % يعانون من إصابة بسيطة و 13.8 % و 21.8 % يعانون من إصابة متوسطة و 15.8 % و 22 % يعانون من إصابة شديدة وأن 41.8 % و18% عندهم درجه عادية للتأخر الأقصى لتوصيل العصب الأوسط وهذه النتائج للناحية اليسرى والناحية اليمنى على التوالي. وبناءا" على هذه النتائج يمكن استنتاج أن الأفراد الأكثر عرضة للإصابة بضيق النفق الرسغي هم الذين تتراوح أعمارهم ما بين 30 – 49 عاما"و الإناث أكثر عرضة للإصابة من الذكور . وأيضا يتضح أن التأثر على الجانبين أكثر حدوثا من التأثر على الجانب الواحد و أن الناحية اليمنى هي الأكثر عرضة للإصابة بضيق النفق الرسغي عن الناحية اليسرى .