Original article

Prevalence of Carpal Tunnel Syndrome Symptoms and its Associated Risk Factors in Hail Region

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Abstract

Background & Aims:
Early recognition and intervention will result in a better quality of life for patients with carpal tunnel syndrome (CTS). The aim of this study is to determine the prevalence of CTS symptoms and its associated risk factors in the Hail region.

Methods:
A cross-sectional study was conducted in Hail region, in 2020. A total of 584 subjects were selected and informed consent was obtained. A standardized and validated questionnaire was used to assess the symptoms of CTS if present and the functional status of the affected hand.

Results:
A total of 141(24.1%) were found to be symptomatic. Female gender, younger age group, and reported health problems were significantly associated with CTS symptoms development. The most reported symptomatic site was the right hand (40.6%) and the most reported symptom was tingling sensation (100%). Health problems were reported by 36% of the symptomatic subjects.

الملخص

الخلفية والأهداف:
تعتبر متلازمة النفق الرسغي واحدة من الاعتلالات العصبية المحيطية حيث يتم ضغط العصب المتوسط أثناء مروره خلال النفق الرسغي، مما يؤدي إلى مجموعة من العلامات والأعراض التي تزداد سوءًا بمرور الوقت عندما لا يتم تخفيف هذا الضغط. نتيجة لذلك، سيؤدي التشخيص والتدخل المبكرين إلى جودة حياة أفضل للمريض. تهدف هذه الدراسة إلى تحديد مدى انتشار أعراض متلازمة النفق الرسغي وعوامل الخطر المرتبطة بها في منطقة حائل.

طريقة البحث:
أجريت هذه الدراسة المقطعية في عام ٢٠٢٠ في منطقة حائل. تم اختيار ٥٨٤ شخص للمشاركة في البحث بعد أخذ الموافقة من كل شخص ووزّعت استبيانات موحدة ومصدّقة على المشاركين. تقوم هذه الاستبيانات بتقييم حدة الأعراض المتعلقة بمتلازمة النفق الرسغي إن وجدت وتحديد مدى تأثر الحالة الوظيفية في اليد المصابة.

النتائج:
أظهرت النتائج أن ١٤١ (٢٤.١٪) من المشاركين لديهم بعض أعراض متلازمة النفق الرسغي. وجدت الدراسة أن الإناث والأشخاص في الفئة العمرية الأصغر ومن لديهم مشاكل صحية مصاحبة كانوا أكثر عرضة من غيرهم بالإصابة بأعراض المتلازمة. بينت النتائج أن اليد اليمنى (٤٠.٦٪) أكثر موقع تظهر فيه الاعراض. كان الإحساس بالوخز أكثر عرض ذُكر من قبل المشاركين (١٠٠٪). وجد أن ٣٦٪

Conclusion:
Our study showed that the prevalence of CTS symptoms in Hail region is high. Multiple risk factors for developing CTS were recognized. We recommend further studies using clinical assessment and nerve conduction study.

Key words:
Carpal tunnel syndrome, Hail, Saudi Arabia.

من الأشخاص المصابين بالأعراض لديهم مشاكل صحية مصاحبة.

الخلاصة:
أظهرت الدراسة أن معدل انتشار أعراض متلازمة النفق الرسغي في منطقة حائل كان مرتفعاً. تم التعرف على العديد من عوامل الخطورة التي قد تسبب الإصابة بأعراض المتلازمة. نوصي بإجراء مزيد من الدراسات باستخدام التقييم السريري ودراسة التوصيل العصبي.

Introduction:

Carpal tunnel syndrome (CTS) is the most common nerve compression syndrome. It is a set of signs and symptoms caused by direct pressure on the median nerve as it passes across the carpal tunnel [1]. The etiology of CTS is usually unknown but may be linked with particular conditions, such as pregnancy, rheumatoid arthritis, acromegaly, hypothyroidism, obesity, and diabetes mellitus [2].

The prevalence of CTS is differently reported in various studies. The general prevalence in the United States is 2.7%. The female/male ratio is between 3:1 and 10:1. Bilateral CTS is diagnosed in 78% of patients clinically. However, it is diagnosed in 50% by electrodiagnostic findings [3]. Moreover, CTS falls under the category of occupational diseases with high prevalence rates among certain occupations [4]. There is a wide variety of symptoms in CTS patients depending on the severity of the condition. Reported symptoms are numbness, tingling, pain, and burning sensation felt in the median nerve distribution, which are more apparent at night or during sleep [5]. Some patients will complain of pain being radiated up to the forearm, arm, shoulder, and neck [6]. The motor deficit is manifested with weakness and reduced grip strength. Muscle wasting over thenar muscles would also occur but later as the condition progresses. Almost 55-65% of patients complain of bilateral symptoms at first presentation [7].

The treatment of CTS mainly depends on the severity of the symptoms. It is categorized broadly into surgical and non-surgical treatment. Non-surgical treatments are recommended for patients with mild symptoms of CTS. Patients with moderate to severe symptoms are recommended for surgical evaluation [8]. There is not much work done investigating the prevalence of CTS in Saudi Arabia. However, a study conducted in Riyadh among the general

population has found that 50% of all participants had CTS symptoms ranging from moderate to severe [9]. Another study conducted in Al Majmaah city, Saudi Arabia has found the prevalence to be 14% among the adult population [10]. Other studies were conducted but are limited to high-risk groups [11,12]. Since there is no similar study conducted in Hail region, the aim of this study is to measure the prevalence of CTS symptoms and its associated risk factors in thepopulation.

Methods and Materials:

This descriptive cross-sectional study was conducted in Hail region, Saudi Arabia, in 2020. Ethical approval was obtained from the Ethical Committee of College of Medicine at University of Hail with an ethical approval number of HREC 00099/ CM-UOH.02/20. No personal data about identity was required. For the purpose of this study, a total of 584 subjects were selected and implied informed consent was obtained. A pre-designed standardized questionnaire known as "Boston Carpal Tunnel Syndrome Questionnaire" (BCTQ) which was established by Levine-Katz [13] was used. This questionnaire is valid, with good test-retest reliability and a high Cronbach's alpha (>0.9) for internal consistency [14]. It was translated and revised to Arabic by the researchers and distributed to participants in hard copies and online google forms. The questionnaire consists of two sections. The first section is called symptoms severity scale (SSS) and it is related to the assessment and grading of severity of symptoms. The second section which is related to function called function status scale (FSS). For the purpose of the study precision, all questions address the symptoms in a period of the last two weeks prior to answering the questionnaire. On the other hand, this questionnaire did not involve clinically diagnosed subjects with CTS as they were included in the prevalence directly. We also have included other questions related to demographic data, health conditions, body mass index (BMI), site of symptoms, and few additional questions related to CTS. Statistical Package for the Social Sciences (SPSS version 24) was used for the analysis of the data, where descriptive analysis such as frequency and percentage were applied for qualitative variables. The final score of SSS and FSS was calculated by measuring the mean and standard deviation of each applicable question. The Chi-square test was applied to find association between qualitative variables. Finally, independent t-test was used for the comparison between qualitative variables. A P value of less than .05 was considered statically significant.

Results:

Out of 584 subjects in this study, 258(44.2%) were male and 326(55.8%) were female. The study represents different age groups with 20-29 being the largest age group with 333(57%) subjects. The majority of them had finished higher education, 358(61.3%). A group of 8(1.4%) subjects have been already clinically diagnosed with CTS. (Table1)

Table 1. Demographic data of participants (N=584)

Characteristic		N (%)
Sex	Male	258(44.2)
	Female	326(55.8)
Age groups	14-19	86(14.4)
	20-29	333(57)
	30-39	98(16.8)
	40-49	36(6.2)
	50.above	31(5.3)
Education level	Illiterate	4(0.7)
	Elementary	5(0.9)
	Intermediate	22(3.8)
	High school	195(33.4)
	Higher education	358(61.3)
Nationality	Saudi	561(96.1)
	Non-Saudi	23(3.9)
Residence	Hail city	527(90.2)
	Rural areas	57(9.8)

Female gender was significantly associated with CTS symptoms development as 98(30%) of female subjects were symptomatic (P=.0001). CTS symptoms were more prevalent in obese subjects (28%) but this did not show any significance (P=.81). The younger age group was another significant predictor of CTS symptoms development as those with the age group of 14-19 reported symptoms more than others (30%) (P=.029). Similarly, subjects with health problems were more likely to complain of CTS symptoms (36%) than those with no health problems (21%) (P=.0002) (table 2)

Table 2. Characteristics of participants with and without symptoms of carpal tunnel syndrome

Characteristic		CTS symptoms		P value
		No (443) N (%)	Yes (141) N (%)	
Sex	Male	215(83)	43(17)	0.0001*
	Female	228(70)	98(30)	
BMI	Underweight	47(77)	14(23)	0.81
	Healthy Weight	199(76)	61(24)	
	Overweight	113(77)	34(23)	
	Obese	84(72)	32(28)	
Age group	14-19	56(65)	30(35)	0.029*
	20-29	268(80)	65(20)	
	30-39	72(73)	26(27)	
	40-49	25(69)	11(31)	
	50 and above	22(71)	9(29)	
Health problems	Yes	85(64)	48(36)	0.0002*
	No	358(79)	93(21)	
* statistically significant.				

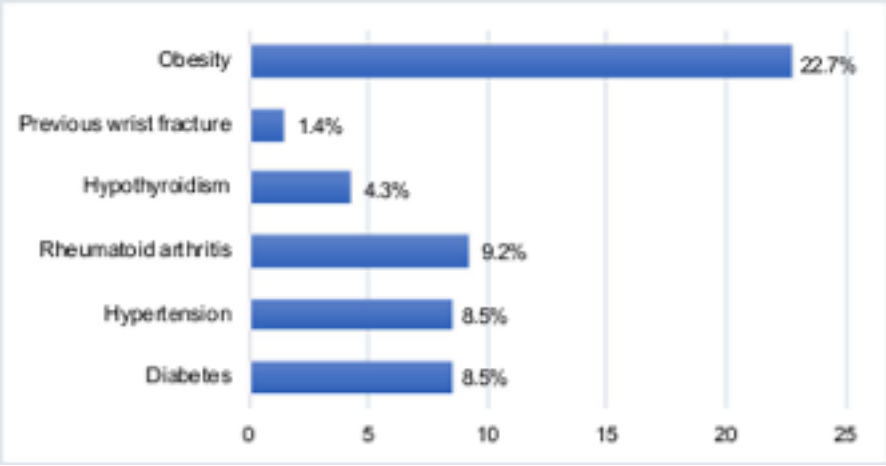
The site of symptoms was reported differently among participants with the palm of the hand being the most common, 63(47.4%) followed by the wrist, 47(35.3%), and thumb 36(27.1%). (table 3)

Table 3. Reported site of symptoms

Site	N	%
Thumb	36	27.1%
Index	14	10.5%
Middle finger	17	12.8%
Fourth finger	18	13.5%
Fifth finger	16	12.0%
The palm of the hand	63	47.4%
Wrist	47	35.3%

Health problems of symptomatic subjects were variable with obesity being the most reported, 32(22.7%). Other health problems such as rheumatoid arthritis 13(9.2%), diabetes 12(8.5%), and hypertension 12(8.5%) were also reported. (Fig.1)

Fig. 1. Health problems of symptomatic participants



The right hand was the most reported symptomatic hand, 54(40.6%) followed by bilateral symptoms, 50(37.6%), and left hand, 29(21.8%). The most frequently reported symptoms are as follows: tingling 133(100%), pain during daytime 93(69.9%), pain during night 75(56.4%), weakness 64(48.1%). 39(29.3%) have difficulty grasping and using small objects. A total of 17(12.8%) subjects have mentioned waking up at night due to pain and it shows that the mean value for SSS is significantly higher in those who reported waking up due to pain when compared to those who did not (p= <0.0001). Also, another 27(20.3%) subjects have reported waking up at night due to tingling sensation. Muscle wasting of the palm of the hand was reported in only 20(15%) of our subjects. With regards to SSS, our study revealed that out of total 576 subjects, 17.4% are mildly symptomatic, 5.4% are moderately symptomatic, 0.17% are severely symptomatic, and 0.17% are very severely affected.

Discussion:

In our study, we tried to enroll in a different age, social, and work categories. These included a total of 584 participants. The prevalence of CTS symptoms in this study was 24.1% (including those with confirmed diagnosis). In a similar study conducted in Al Majmaah city, the prevalence of symptoms of CTS was 14% [10]. On the contrary, a study among the general population of Riyadh city, Saudi Arabia revealed a prevalence of 50% of CTS symptoms considering the general prevalence of warning symptoms [9].

This research shows that gender is significantly associated with CTS symptoms development, as females tend to be more

affected than males. This is similar to what has been mentioned in other studies where female gender was considered a significant risk factor for CTS development [9,11,15]. Regarding BMI, CTS symptoms were more prevalent in obese subjects than others, but this did not show any significance in our analysis. Numerous studies have shown that BMI is considered as a significant risk factor for CTS development, as subjects with a BMI of 30 or more tend to be affected more [15,16,17]. On the other hand, a study conducted among medical laboratory staff showed no significant association between BMI and CTS symptoms development [12]. In our study, the younger age group was a significant predictor of CTS symptoms development. Likewise, a study conducted in Riyadh showed that the younger population reported symptoms more commonly than others [9]. Whereas a previous study in Brazil showed that the older age group (41-60 years) was a significant risk factor [15]. Few other studies reported no association between a specific age group and CTS development [11,12]. Furthermore, subjects with health problems were more commonly affected than others and this has shown to be significant. This is consistent with other studies as medical conditions were considered as a risk factor for CTS development [11,18].

Results of the current study found that the most frequently reported site of symptoms is the palm of the hand followed by wrist and thumb. One of the least affected was the little finger which was 12% and these results were somewhat similar to a study reported no single finger involvement [19]. Although the little finger has a different nerve supply, people may complain of little finger involvement. Various explanations suggested the reason behind the extraterritorial spread of symptoms (e.g. higher levels of pain and paresthesia) [20]. A previous study showed that increased severity of CTS symptoms was found to increase the time required to fall asleep and decreased total sleep time [21]. Similarly, as 12.8% of our subjects have mentioned waking up at night due to pain, it shows that the mean value for SSS was significantly higher in those who reported waking up due to pain when compared to those who did not ($p = <0.0001$). Another 20.3% of subjects have reported waking up at night due to tingling sensation.

Our results showed that among those subjects who reported the symptoms of CTS, 54(40.6%) perceived symptoms in the right hand, 29(21.8%) in the left hand, and 50(37.6%) in both hands. Our results were similar in comparison to a study conducted in Italy that aimed to evaluate the current management of CTS. They reported that 38% of cases manifested bilaterally, 41%

in the right, and 21% in the left [22]. On the other hand, a local study was conducted in the western area of Saudi Arabia showed that 55% of cases were bilateral, 30% in the right, and 15% in the left hand [23]. This slight difference could be due to a true difference between the two populations or to a bias in the answers of our subjects by not reporting the less affected hand.

Conclusion:

Our study showed that the prevalence of CTS symptoms in Hail region is high. Multiple risk factors for developing CTS were recognized. As female gender was significantly associated with CTS symptoms development. Likewise for the younger age group and those with associated health problems. We recommend further studies using clinical assessment and nerve conductionstudy.

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The questionnaire used in this study:

Carpal Tunnel Syndrome is a relatively common disorder. We are a group of medical students at UOH working on a study that aims to measure the prevalence of symptoms of this condition and its associated risk factors.

Thank you very much for agreeing to participate in this survey.

The information provided by you in this questionnaire will be used for research purposes only. It will not be used in a manner that would allow identification of your individual responses.

- **Sex:**
  - ☐ male
  - ☐ female

- **Age:**
  - ☐ 14-19
  - ☐ 20-29
  - ☐ 30-39
  - ☐ 40-49

☐ ≥ 50

• Educational level:

☐ illiterate
☐ Elementary
☐ Intermediate
☐ High school
☐ Higher education

• Nationality:

☐ Saudi
☐ other

• City:

☐ Hail city
☐ Rural side

• Occupation:

• Height:

• Weight:

•Do you suffer from any of these conditions?

please write down any chronic disease you have that haven't been mentioned. You can choose more than one.

☐ Diabetes
☐ Hypertension
☐ Rheumatoid arthritis
☐ Hypothyroidism
☐ Kidney failure
☐ Previous wrist fracture
☐ Others:
Please mention .....

• Have you been diagnosed with carpal tunnel syndrome:

☐ Yes
☐ No

• Please circle the word that describes your condition for each question.

Symptom severity scale (11 items)

	1	2	3	4	5
1. How severe is the hand or wrist pain that you have at night?	Normal	Slight	Medium	Severe	Very serious
2. How often did hand or wrist pain wake you up during a typical night in the past two weeks?	Normal	Once	2 to 3 times	4 to 5 times	More than 5 times
3. Do you typically have pain in your hand or wrist during the daytime?	No pain	Slight	Medium	Severe	Very serious
4. How often do you have hand or wrist pain during daytime?	Normal	1-2 times / day	3-5 times / day	More than 5 times	Continued
5. How long on average does an episode of pain last during the daytime?	Normal	<10 minutes	10~60 Continued	>60 minutes	Continued
6. Do you have numbness (loss of sensation) in your hand?	Normal	Slight	Medium	Severe	Very serious
7. Do you have weakness in your hand or wrist?	Normal	Slight	Medium	Severe	Very serious
8. Do you have tingling sensations in your hand?	Normal	Slight	Medium	Severe	Very serious
9. How severe is numbness (loss of sensation) or tingling at night?	Normal	Slight	Medium	Severe	Very serious
10. How often did hand numbness or tingling wake you up during a typical night during the past two weeks?	Normal	Once	2 to 3 times	4 to 5 times	More than 5 times
11. Do you have difficulty with the grasping and use of small objects such as keys or pens?	Without difficulty	Little difficulty	Moderately difficulty	Very difficulty	Very difficult

• Where do you feel those symptoms:

You can choose more than one.

- ☐ Thumb
- ☐ Index
- ☐ Middle finger
- ☐ Fourth (ring) finger
- ☐ Little (pinky) finger
- ☐ The palm of the hand towards the thumb wrist

• Did you notice any dimpling in the muscles of the palm of hand?

- ☐ yes
- ☐ No

• Does the pain extend to the forearm sometimes?

- ☐ Yes
- ☐ No

- **Do you think that there are certain activities that make you more prone to any of the mentioned symptoms above**:
  - ☐ Yes
  - ☐ No

- **Do you suffer the symptoms mentioned above in:**
  - ☐ Right hand
  - ☐ Left hand
  - ☐ Both hands

- **Do you do any type of work that requires frequent hand and wrist movement?**
  - ☐ Yes
  - ☐ No

- **For married females with kids, have you experienced any of those symptomswhile you were pregnant?**
  - ☐ yes
  - ☐ no
  - ☐ Never been pregnant

How difficult is it for you to do the mentioned activities below? Please circle the number according to the level of difficulty:

Functional status scale (8 items)

	No difficulty	Little difficulty	Moderate difficulty	Intense difficulty	Cannot perform the activity at all due to hands and wrists symptoms
Writing	1	2	3	4	5
Buttoning of clothes	1	2	3	4	5
Holding a book while reading	1	2	3	4	5
Gripping of a telephone handle	1	2	3	4	5
Opening of jars	1	2	3	4	5
Household chores	1	2	3	4	5
Carrying of grocery basket	1	2	3	4	5
Bathing and dressing	1	2	3	4	5

Thank you for your time, you have completed the questionnaire.