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Research Article

**PREVALENCE OF CARPAL TUNNEL SYNDROME AND IT'S
ASSOCIATED RISK FACTORS AMONG DIABETIC
POPULATION OF AL-JOUF REGION, KSA**

Abdullah Saud Alsaqry¹, Sager Holy Alruwalili², Kholoud Hamdan Alruwaili¹, Osama Saud Alsaqry³, Tayf Muhammad Alhamad¹, Kholoud Khulaif Alruwaili¹, Ibrahim Mohammed Alshitwee¹, Ayman Khalil Alrushaydan¹, Doaa M. Abdel-Salam², Mohammed Ali Alruwili⁴

¹Medical Student at Jouf College Of Medicine, ²Assistance Professor, Collage Of Medicine, Jouf University, ³Medical Student At Unaizah College Of Medicine, ⁴Consultant Endocrinologist At Endocrine And Diabetic Centre At King Abdelaziz Specialty Hospital

Abstract:

Background: Carpal tunnel syndrome (CTS) is a group of symptoms and signs which resulting from the local compression of the median nerve at the wrist. Thenar muscles atrophy can be occur in patients with advanced disease and this can be irreversible

Objective: This study has been conducted to determine the prevalence of CTS among diabetic patients of Aljouf region in KSA (kingdom of Saudi Arabia), and to identify their associated risk factors.

Method: This cross-sectional study was conducted in KASH. The study randomly included all patients with diabetes mellitus were collected with their demographic data such as age, gender, BMI, occupation and educational level. diabetic history, medical history, diagnosis of CTS depends on validated questionnaire previously used to diagnosis patients with CTS .

Results: Out of 408 included, 41.7% had CTS. 76.5% of the study subjects had unilateral CT. More common in female than male. An association was found between age, occupation, duration of DM, retinopathy, dyslipidemia and the development of CTS

Conclusion: High prevalence of unilateral CTS was found among diabetic patients in Al-Jouf rejoin. Development of CTS was associated with increase age, increase duration of DM, retinopathy and dyslipidemia.

Key word: Carpal tunnel syndrome (CTS); diabetes mellitus; prevalence; severity; risk factor; Saudi Arabia.

Corresponding author:

Abdullah Saud Alsaqry,
Medical Student at Jouf College Of Medicine

QR code



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INTRODUCTION:

Carpal tunnel syndrome (CTS) is a group of symptoms and signs resulting from the local compression of the median nerve at the wrist. Increased pressure in the carpal tunnel is the most significant factor in the aetiology of the disease. Actually, this high pressure in the carpal tunnel interrupts the blood flow in the median nerve which leading to harmful effects on the nerve [1].

CTS is characterized by the presence of sensory symptoms in the form of numbness, tingling, pain, and feeling of heaviness of one or both hands. Pain may travel up the arm toward the shoulder [2]. Motor contribution and functional diminishing of the hand functions can occur in more severe cases if the CTS release surgery is not done within realistic time [3]. Majority of cases with CTS are idiopathic, while the risk of its development appears partly to be associated with different local and systemic factors, including genetic, female gender, medical, social, vocational, and demographic, inflammatory diseases, for example, rheumatoid arthritis, and systemic conditions, such as diabetes mellitus, hypothyroidism, obesity, and pregnancy. Occupational risk factors in the form of repetitive, powerful flexion and extension of the fingers and wrist may also related to CTS clinical presentation [4,5]. CTS diagnosis is built on characteristic clinical presentation and positive different challenging stress tests such as Phalen's test, Tinel's test, or hand elevation test on physical examination. It is confirmed by electrodiagnostic studies [6]. Nerve conduction studies alone do not offer spatial information regarding the nerve or its attendant abnormalities [7]. Ultrasonography (US) has emerged as simple, low cost, non-invasive imaging, rapid accurate method for assessing the median nerve in the carpal tunnel syndrome [8]. US have high sensitivity and specificity in CTS diagnosis which can detect the median nerve compression features, give anatomical images of the median nerve, adjacent structures and space occupying lesions such as ganglia neural tumors [9,10]. Also, the US can be used in clinical assessment of CTS in diabetic neuropathy [11]. The prognosis and therapeutic measures are extremely related to severity assessment of CTS by using different nerve conduction studies [12]. The prevalence of CTS varies in different studies; however it is reported to be more prevalent in DM patients compared to the normal population [13,14,15]. Some research found that the incidence rate of CTS ranges from 5% to 16% depending upon clinical diagnosis of CTS [16]. The incidence rate among adult ranges from 2.7% to 5.8% [17]. Also, high incidence rates among certain occupations as it considered an occupational disease [18]. Atrophy of

the thenar muscles may occur in advanced cases, and this may be due to unobserved course or in compliance of the patient in the medication or persistent of the risk factor even after treatment, and this can be irreversible [19]. Diabetes mellitus (DM) is a chronic metabolic disorder, which is characterized by persistent hyperglycemia with subsequent morbidity and mortality in relation to its micro- and macrovascular complications. Diabetic hand" is a term used to define pathological hand manifestations that are more commonly found in diabetes. It represents the following musculoskeletal disorders; restricted joint mobility, Dupuytren's contracture, flexor tenosynovitis and carpal tunnel syndrome. Combined occurrence of diabetes and CTS has been approved for many years. Notably, DM is considered as a major risk factor with a higher incidence of CTS in patients with prediabetes. A relationship between HbA1c, duration of DM, micro vascular complications and CTS had been stated [20].

Hendriks et al [10] reported that type 2 diabetes was more frequently diagnosed among patients with carpal tunnel syndrome.

High prevalence of CTS among diabetic patients might be as a result of metabolic changes, repeated undetected trauma, accumulation of fluid or edema within the narrowed space of the carpal tunnel and /or diabetic cheiroarthropathy [21]. Hence, the aim of the present study was to estimate prevalence of CTS in diabetic patient in north region of Saudi Arabia and to determine risk factors associated with it among these patients.

Study objectives:

- 1) Prevalence of CTS among diabetic patients in Al-Jouf region of the KSA .
- 2) Determine the association between different risk factors and development of CTS among diabetic patients in Al-Jouf region of KSA.

METHODOLOGY:

This cross-sectional study was conducted in diabetic center in king Abdelaziz specialty hospital (KASH). The study randomly included All diabetic mellitus patients attending diabetic outpatient department (OPD) . The study Excluded patients having secondary diabetes and patient who diagnosed with DM less than 1 year. The sample size was calculated according to the following equation, based on previous research [22]

$$n = \frac{Z^2 P (1-P)}{d^2}, \text{ where the level of confidence interval was 95\%.}$$

The sample size was 236. We do a pre-test to evaluate the questionnaire was easy to

understand in about 50 patients. 408 Patients were interviewed at the outpatient clinic of the diabetic patients and after explanation of the study objectives and procedures a verbal consent was obtained from each of them.

Data collection tool:

The questionnaire consists of three section. The first section contains question regarding demographic characteristics: age, gender, height, weight, occupation, educational level.

Second section contains question regarding Medical history and laboratory data: history of diabetes mellitus (duration, and management), hemoglobin A1c (HbA1c) level. History of smoking, thyroid dysfunction, dyslipidemia, hypertension, retinopathy, heart disease where included in this section. Third section contains questions regarding Diagnosis proposes of CTS. The Questions was adapted and modified from a validated questionnaire previously used to diagnosis patients with CTS and it was showed a high sensitivity and specify as instrumental test. we had translated the questionnaire by forward and backward translation then we consult an expert to produce our final Arabic vision of the questionnaire.

This section composed of 9 questions, these questions:

1. Has pain in the wrist woken you up at night: Yes 1 No 0
2. Has tingling and numbness in your hand woken you during the night: Yes 1/ No 0
3. Has tingling and numbness in your hand been more pronounced first thing in the morning: Yes 1/ No 0
4. Do you have any trick movements to make the tingling, numbness go from your hands: Yes 1 /No 0

5. Do you have tingling and numbness in your little finger any time: Yes 0/ No 3
 6. Has tingling and numbness presented when you were reading a newspaper, steering a car or knitting: Yes 1/ No 0
 7. Do you have any neck pain: Yes 1/ No 0
 8. If applicable has the tingling and numbness in your hand been severe during pregnancy: Yes 1/ No 1
 9. Has it helped the tingling and numbness on wearing a splint on your wrist: Yes 2 / No 0
- 5 or more is suggested for use of the test as a diagnostic screening instrument to replace nerve conduction studies. we considered at least 5 points for establish the diagnosis [23].

Ethics

The present study was done after the approval of ethical board of Jouf University. Administrators of the hospital were informed about the study and its purposes. Confidentiality and privacy of data were assured.

Statistics: SPSS (Statistical Package for the Social Sciences) 21 software was used for statistical analysis. For categorical variables, frequencies and percentages were reported, and they were analyzed using pearson chi-square test or fisher's exact test for cell less than 5. *P values* ≤ 0.05 were considered statistically significant. The study was done after approval of ethical board of Al-Jouf university

RESULTS:

Demographic data: we invite 500 patients with DM on September 2018 to participate in the research , 408 were accept to join in ,and the response rate was 81.6%. The majority 270 (66 %) were in the age group between 31and 60 .130 (76.5 %) have unilateral CTS while the 40 (23.5%) have bilateral pain.

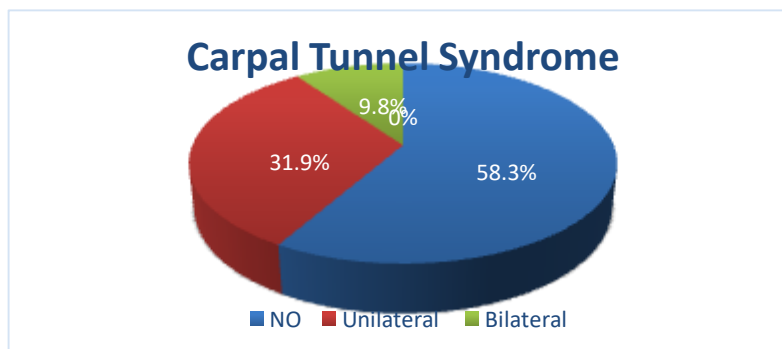


Figure 1: prevalence of carpal tunnel syndrome among diabetic patients.

Table 1: Relationship between CTS and socio-demographic characteristics of diabetic patients attending OPD at KASH.

Parameter		CTS			P value
		Yes N=170(41.7%)	NO N=238(58.3%)	Total N=408 (100%)	
Age	10-30 years	23(31.9%)	49(68.1%)	72	.014*
	31-60 years	119(44.1%)	151(55.9%)	270	
	>60 years	28(42.4%)	38(57.6%)	66	
Gender	Male	60(37%)	102(63%)	162	.124
	Female	110(44.7%)	136(55.3%)	246	
Occupation	Employed	52(30.1%)	121(69.9%)	173	.000*
	Unemployed	118(50.2%)	117(49.8%)	235	
Smoking	Yes	22(45.8%)	26(54.2%)	48	.534
	No	148 (41.1%)	212(58.9%)	360	

Table 2: Relationship between CTS and other Co-morbidities of diabetic patients attending OPD at KASH.

Parameter		CTS		Total N=408 (100%)	P value
		Yes N=170(41.7%)	NO N=238(58.3%)		
Duration of DM	1-5 years	41(33.6%)	81(66.4%)	122	.005*
	5-10 years	42(38.2%)	68(61.8%)	110	
	> 10 years	87(49.4%)	89(50.6%)	176	
Anti-diabetic drug	Insulin	67(46.9%)	76(53.1%)	143	.190
	Hypoglycaemic drug	71(33.3%)	142(66.7%)	213	
	Diet modification	2(66.7%)	1(33.3%)	3	
	Insulin + hypoglycaemic drug	30(61.2%)	19(38.8%)	49	
Body Mass index (BMI)	Underweight	3(33.3%)	6(66.7%)	9	.793
	Normal	38(38.8%)	60(61.2%)	98	

	Over weight	134(44.5%)	167(55.5%)	301	
Retinopathy		93(54.7%)	77(45.3%)	170	.002*
Thyroid dysfunction		36(21.2%)	134(78.8%)	170	.316
Hypertension		64(37.6%)	106(62.4%)	170	.309
Dyslipidaemia		86(50.6%)	84(49.4%)	170	.001*
Ischemic heart disease		13(7.6%)	157(92.4%)	170	.673

^ 170: number of diabetic patients with CTS

Fig (1) showed 41.7% of diabetic patients attending OPD at KASH had CTS; 31.9% unilateral and 9.8% bilateral. Table (1) revealed the relationship between CTS and sociodemographic characteristics of diabetic patients. Statistical significant differences were found between CTS on one hand and age and occupation on the other hand. CTS is significantly higher in the old age and employed patients. The relationship between CTS and comorbidities of diabetic patients attending OPD at KASH was depicted in Table (2). There was statistical significant difference between CTS and duration of DM as prevalence of CTS is significantly higher among patients with long duration of DM. Also, there were statistical significant differences between CTS and other comorbidities of diabetic patients as CTS was significantly higher among patients with retinopathy and dyslipidaemia.

DISCUSSION:

Carpal tunnel syndrome (CTS) is the commonest entrapment neuropathy and accounts for approximately 90% of all entrapment neuropathies with prevalence of approximately 3–6% of adults in the general population [24] The reason as to why CTS is more common in diabetes is unknown and an early diagnosis is essential to prevent permanent nerve damage and functional squeals [25].

Oktayoglu et al reported that some endocrine disorder can cause CTS like hypothyroidism and acromegaly but the diabetes is the most common risk factor for the CTS [26]. In the present study, the prevalence of CTS among diabetic patients attending OPD at KASH was 41.7% were suffering from CTS which is higher than the rate showed by **Pandey et al.** (14%) [27] and **Chammas et al.**(15% to 25%) [28]. The variation in the prevalence of CTS may be attributed to the chosen criteria to define the cases. Hagberg et al published a review of 21 studies including high quality information on occupational associations, and reported an increased risk of CTS in a number of jobs [29]. Our study demonstrated that there is a statistically significant relationship between age and

CTS, and that as age increases so does the CTS risk. This finding is compatible with some other research. The occurrence of CTS was observed in this study more in female than in male, this disagrees with findings of **Akulwar et al**, **Paranthakan and Govindarajan** which conduct the male more commonly to have CTS than the female [30,31]. Moreover, **deKromet al** reported that CTS is nearly ten times more common in women than in men [6]. The difference between the result may be due to the participants in which the female more than the male, and this what happen in our research. Because of the importance of occupation as a risk factor we found an association between the CTS and the occupation of the patients and this give another reason for the high prevalence of CTS in our study rather than the duration of DM and age.

It was claimed in the previous studies that this rate might positively correlate with the duration of diabetes millets, one of these studies was approved by **Akulwar et al** has observed an increased rate of CTS with longer duration of diabetes [30]. In contrast, **Paranthakan and Govindarajan**, they did not find any relation between the duration of the diabetes and occurrence of CTS [31]. So that the development of CTS is significantly higher among patients with long duration of DM as **p value = .015**. Additionally, **Alotaibi et al** was found the use of different antidiabetic drugs whether oral tablets or insulin did not show an association with CTS and this what we observed in our study based on p-value [22]. Patients with retinopathy have a high risk to develop the CTS, the risk was 1.9 more in patients with retinopathy than the patients who didn't have. This may be due to the development and progress of retinopathy indicate there was uncontrollable diabetes and the patients must be taking restricted attention to control the diabetes. Based on scientific date and many studies was approve the association between the hypothyroidism and CTS, hypothyroidism is considered as an important risk factor for CTS [32].

In the current study, no significant association was detected between hypothyroidism and the development of CTS. This study showed significant association between hyperlipidemia and CTS. As the risk for development of CTS is 2.02 higher than the patients who didn't have dyslipidemia. This result was approved by **Yurdakul et al**, which reported that CTS appears to be more severe in patients with metabolic syndrome including abdominal obesity, hypertension, dyslipidemia, and hyperglycemia compared to patients with diabetes alone [33]. Additionally, some component of lipid profile has an association with development of CTS like LDL, HDL, TG While the total cholesterol didn't have an association. This result was approved by **Alotaibi et al** [22].

Unfraternally in our study there a high percent of patient who did not know her/his HbA1C, because of that we can't estimate if controlled or uncontrolled diabetes and if it have an association with development of CTS. This idea was confirmed by **Paranthakan and Govindarajan** they found that uncontrolled diabetes is a risk factor for carpal tunnel syndrome where CTS was found more in uncontrolled diabetics [31].

CONCLUSION:

High incidence of CTS among diabetic patients is proved by various studies. This problem along with other complication also gives burden on the patients. It is the responsibility of the physician and the patient to control the diabetes to prevent the development of CTS. Also, high prevalence of unilateral CTS among diabetic patients. CTS was associated with age, occupation, duration of DM, dyslipidemia and retinopathy.

RECOMMENDATIONS:

Health care professionals should be aware of this high incidence of CTS in diabetic patients, and it will be useful to perform electrodiagnostic study in diabetic patients in whom CTS is suspected.

STUDY LIMITATION:

Perform electrodiagnostic study in diabetic patients to diagnose the CTS.

Assess the severity of CTS among diabetic patients.

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FINDING:

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COMPETING INTEREST:

Authors declare that there is no competing of conflict.

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