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PREVALENCE AND RISK FACTOR OF CARPAL TUNNEL SYNDROME AMONG WORKERS IN THE CONSTRUCTION INDUSTRY

By

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Abstract

Introduction: In terms of lost-work time, restricted workdays and rehabilitation, one of the most costly occupational musculoskeletal disorders is carpal tunnel syndrome (CTS). **Aim of work:** determination of CTS prevalence and evaluation of some personal and occupational risk factors among construction workers. **Materials and Methods:** In this descriptive cross-sectional study, 116 cases were enrolled. A questionnaire was used to assess socio-demographic data, and occupational history. CTS was assessed by symptoms on the Katz hand diagram and physical examination. Phalen's test was done for all participants. **Results:** According to this study, the prevalence of CTS was 27.6% among workers in construction industry. The rate of CTS was significantly higher among electricians than in other workers ($P < 0.05$). The risk of developing CTS increase with age ≥ 30 years and work duration ≥ 5 years. **Conclusion:** Our findings suggest that construction workers are at an increased risk of CTS, so awareness should be raised and interventions should specifically target this risk group.

Key words: Construction workers, Carpal tunnel syndrome, Risk factors, Katz hand diagram and Phalen's test.

Introduction

Carpal tunnel syndrome (CTS) is one of the most common non-traumatic peripheral nerve lesion and repetitive trauma disorder. It is one of the most expensive upper-extremity musculoskeletal disorders as an estimated cost of medical care, and surgical releases (Harris-Adamson et al., 2015). The non-medical costs are substantially greater. The median lost work-time from work-related CTS is 27 days, which is longer than any other work-related disorder except fractures. Furthermore, 18% of workers who develop CTS reported leaving their job within 18 months (Dale et al., 2013).

CTS arises from compression of the median nerve where it passes through the carpal tunnel in the wrist. It is characterized mainly by sensory and, to some extent, motor symptoms and signs in the peripheral distribution of the median nerve. Known causes include trauma, pregnancy, rheumatoid arthritis, diabetes, and hypothyroidism (Barcenilla et al., 2012). Since many of the individual risk factors of CTS are less modifiable than workplace factors, information about the occupations in which workers develop CTS is essential to target prevention strategies (Roquelaure et al., 2008).

Repetition of wrist flexion and extension is the greatest and the most accepted occupational risk factor. Forceful grip with the hand, and/or vibrations of the hand and arm, such as are induced by hand-held vibrating tools, can damage the median nerve and cause CTS. Frequency of the task and the percentage at the time spent on the repetitive task are important (Ghasemi et al, 2012). Moreover, repetitive wrist movements lasting more than 30 seconds and working more than 50% of total work time in repetitive movement patterns are considered significant (Silverstein et al., 1987).

Construction industry involves many types of activities aside from the building process, such as landscaping, painting, electrical supply, plastering, paving and telecommunications. Construction work involves a serious of occupational risks, such as work at heights (use of scaffolding, gangways and ladders), excavation work (use of earth-moving machines and explosives), materials lifting (use of cranes) and so

on (Adane et al., 2013). Occupational injuries and accidents among these workers are high due to illiteracy and lack of health safety training and information on health hazards and risks at the work place (Foley et al., 2007). Musculoskeletal disorders are a main cause of productivity loss at work, functional impairments and permanent disability (Boschman et al., 2015).

The estimate incidence and prevalence of CTS vary widely in the literature. The annual incidence rates were between 0.5 and 5.1 per 1,000 for CTS defined by electrophysiological criteria and 0.4 to 1.5 per 1,000 for CTS requiring surgical release of the median nerve (Roquelaure et al., 2008). Its incidence in the workplace has reached epidemic proportions as it comprise about 40.8% of all upper extremity repetitive motion disorders (Jagga et al, 2011). Prevalence estimates of CTS in the general adult population range from approximately 1% to 16% (Raman et al., 2012). In German, the prevalence of CTS in working populations (10.9%) was significantly higher than in the general population (8.2%) (Spahn et al., 2012).

The construction sector in Egypt is a major contributor to the country's economy and one of its fastest-growing sectors. Little work has been done on occupational health and safety aspects of building construction workers and there is lack of data about prevalence and determinant factors of CTS among these workers. Therefore, the present study attempted to contribute in determining magnitude and factors related to CTS among building construction workers in Ismailia city, Egypt.

Aim of work

Determination of CTS prevalence and evaluation of some personal and occupational risk factors among construction workers.

Materials and Methods

- **Study design:** It is a cross sectional study.
- **Place and duration of study:** This study was carried out on workers in the construction industry in Ismailia city during the period from February to April 2015.
- **Study sample:** the required sample size was determined by using EPI-INFO program version 7 (Dean et

al, 2001). For the calculation, 95% confidence level, 5% marginal error and 8.2% prevalence were taking from a previous study (Ghasemi et al, 2012).

- **Study methods:**

Workers were recruited in the study according to the following inclusion criteria; working in the construction industry for at least 1 year, with no past history of chronic diseases or disability. Exclusion criteria included workers with a history of certain disorders such as rheumatoid arthritis, diabetes mellitus, cervical radiculopathy, hypothyroidism, thoracic outlet syndrome and medically diagnosed CTS prior to starting the current occupation.

A questionnaire was prepared in English and translated to Arabic (native language) and then back to English by different independent language experts to verify the consistency and content of translation. Detailed information about the socio-demographic, and occupational data as: age, marital status, education, residence, job category, duration of work in years and working hours were included.

The diagnosis of CTS was based on the NIOSH criteria for definition, namely the presence of: (i) one or more symptoms indicative of CTS, e.g. paraesthesiae, pain or numbness; and (ii) clinical signs that included a positive Tinel's sign or Phalen's sign or nerve conduction findings indicative of nerve dysfunction across the carpal tunnel as well as (iii) evidence of work relatedness or the development of symptoms proceeding after employment in a job involving one or more activities such as the use of hand force, repetitive motion, use of vibrating tools and awkward positions (Sluiter et al, 2011).

Data analysis:

The data were entered, cleaned and analyzed using SPSS software version 13.0. Descriptive statistics like frequency distribution and percentage calculation was made for most of the variables. Chi-Square test was used to examine the relationship between two qualitative variables, Fisher›s exact test was used to examine the relationship between two qualitative variables when there›s a cell with an expected frequency of less than 5. Bivariate analysis was carried out to identify risk factors in

terms of unadjusted odds ratios (OR) with their 95% confidence intervals (CIs). A P< 0.05 was considered statistically significant.

Consent

The study subjects were explained the purpose of study, assured privacy and a verbal consent was obtained from them.

Funding:

No funding sources for this research.

Ethical Approval:

Confidentiality and anonymity were maintained according to the regulations mandated by Research Ethics Committee of Faculty of Medicine Suez Canal University.

Results

This study was carried in Ismailia city on 116 of workers in construction industry.

Table 1. Distribution of the study group according to socio-demographic characteristics

Socio-demographic characteristics	No.	%
Age (yrs) < 20 20-40 > 40	20 51 45	17.2 44.0 38.8
mean ± SD	26.6 ± 8.6	
Residence Urban Rural	66 50	56.9 43.1
Marital status Single Married	61 55	52.6 47.4
Education Illiterate Primary & preparatory Secondary & technical	 23 38 55	 19.8 32.8 47.4
Smoking habits Non-smoker Smoker	60 56	51.7 48.3

Table (1) showed that the mean age ± standard deviation (SD) was 26.6 ± 8.6 years. The highest percentage of workers (44.0 %) was in the age group 20-40 years, while the lowest percentage (17.2%) was < 20 years. The majority of them was from urban areas (56.9%) and was single (52.6%). Those with basic education constituted (32.8%), while illiterates constituted 19.8%, and those graduated from secondary/technical schools constituted 47.1%. As regard smoking, 56 workers (48.3%) were current smokers.

Table 2. Distribution of the study group according to occupational history

Occupational history	No.	%
Job		
Electricians	11	9.5
Bricklayers& concrete finishers	33	28.4
Plumbers	14	12.1
Elevator constructors	24	20.7
Installers of floors	16	13.8
Painters	13	11.2
Carpenters	5	4.3
Duration of work (yrs)		
<5	42	36.2
5- 10	48	41.4
> 10	26	22.4
Working hours (h/d)		
< 8	16	13.8
≥ 8	100	86.2

Table 2 showed that the highest percentage of participants was bricklayers and concrete finishers workers (28.4%) and only (4.3%) were carpenters. The highest percentage of workers (41.4%) had duration of work 5- 10 years and 86.2% of workers were working for more than 8 hours/ day. All participants were daytime workers with no shift work.

Table 3. Prevalence of CTS among construction workers according job categories.

Job	Yes		X2	P-value
	N	%		
Electricians	7	63.3	14.86	0.02
Bricklayers, concrete finishers	8	24.2		
Plumbers	3	21.4		
Elevator constructors	2	8.3		
Installers of floors	5	31.2		
Painters	4	30.8		
Carpenters	3	60.0		
Overall	32	27.6		

Table 3 showed that the allover prevalence of CTS among construction workers was 27.6%. The highest prevalence of CTS was among electricians (63.3%), followed by carpenters (60.0%). The lowest prevalence was among elevator constructors (8.3%). The difference among different job categories was statistically significant ($P< 0.05$) .

Table 4. Distribution of workers with CTS

Symptoms Experienced	(CTS (N=32	
	N	%
(Types (not mutually exclusive		
Parasthesia	6	18.8
Pain in hand/wrist	30	93.8
Numbness	21	65.6
Decrease of hand muscular power	9	28.1
Nocturnal exacerbations of symptoms	18	56.3
Frequency of symptoms		
Always	12	37.5
Occasionally	18	56.2
Rare	2	6.3
(Duration of symptoms (yrs		
1>	12	39.5
3 1-	1	44.9
3 <	5	15.6
Sick leave taking		
Yes	12	37.5
No	20	62.5
Treatment taking		
Yes	8	25
No	24	75

Table 4 showed that 93.8% of workers diagnosed with CTS had pain, 65.6% had numbness and 56.2% of them were occasionally experienced these symptoms. Twelve workers (37.5%) diagnosed with CTS take sick leave because of CTS symptoms and a small percentage (25%) was taking medical treatment for CTS.

Table 5. Bivariate analysis of risk factors of CTS among construction workers.

Variables	CTS				OR	95% CI	P-value
	No		Yes				
	N	%	N	%			
Age			13				
< 30	58	81.7	19	18.3		1.40-	
≥ 30	26	57.7		42.3	3.2	7.57	0.005
Current smokers							
No	43	76.8	13	23.2		0.67-	
Yes	41	68.3	19	31.7	1.53	3.49	0.31
Duration of employment							
< 5	37	88.1	5	11.9		1.49-	
≥ 5	47	63.3	27	36.4	4.25	12.11	0.002
Work hours/day							
< 5	11	68.8	5	31.3		0.26-	
≥ 5	73	73.0	27	27.0	0.81	2.56	0.72

Table 5 showed that CTS is more prevalent among those age ≥ 30 years and among those working for ≥ 5 years. The difference is significantly ($P< 0.05$). Also, the percentage of CTS was higher among current smokers (31.7%) than among non-smokers (23.2%), the difference was statistically insignificantly ($P> 0.05$).

Discussion

This study was carried on 116 of workers in construction industry. Our study results revealed that out of total participants, 27.6% of the construction workers experienced CTS. This is similar to the prevalence rate found in France (19.7%) (Roquelaure et al., 2009) and (21%) in Hungary (Rosecrance et al. 2001) . This high prevalence of CTS among construction workers can be due to the higher prevalence of repetitive movements of the hand or wrist, forceful handgrip and loads handling during works. Hunting et al., 1994 in a study of 308 electricians, reported a higher prevalence where 47% of them had wrist symptoms representative of cumulative trauma disorders.

The use of vibrating tools increases the risk of CTS development. Vibration of hand tools affects blood circulation and cause wrist and hand disorders (Barcenilla et al., 2012). It seems that when work rate increases, repetition of hand or wrist increases and as a result, the risk of CTS development increases (Shiri et al., 2009).

The prevalence of CTS in our study was higher than that in other industrial setting (6-15%) (Ghasemi et al., 2012). In Iran, 395 workers from automobile industry factories were assessed by interview and electrodiagnostic studies, 47 met the definition of CTS to yield a prevalence of 11.9% (Maghsoudipour et al., 2008). In German, the prevalence of CTS in working populations (10.9%) was significantly higher than in the general population (8.2%) (Spahn et al., 2012). This discrepancy in the prevalence may be linked to the difference between countries in level of development, and strengths of occupational health and safety services and the use of electrodiagnostic studies. It can be expected that the prevalence of CTS would decrease if clinical diagnosis and/or nerve conduction testing were used to validate the estimate (Lenderink, 2012 and Raman et al, 2012).

The most frequently reported CTS symptoms in our study were in the following order: hand/wrist pain in 93.8%, numbness in 65.6 %, nocturnal exacerbations in 56.3% of workers. When we compare these findings to those presented by Ahamed et al (2015) we find that they reported the same symptoms but with lesser percentages.

There are some personnel and occupations risk factor that predispose to CTS. In our study, the prevalence of CTS was higher in older age group ≥ 30 (table 5). In most literature reviews, the prevalence of CTS increased in patients 40-60 years old (Ghasemiet al., 2012 and Harris-Adamson et al., 2013). The difference in smoking habits was not statistically significant in the development of CTS (table 5). This finding is concoid with Armstrong et al (2008). Also, CTS is associated with longer duration of work (P< 0.05) but not with working hours (P> 0.05). This agree with the results of study conducted on 996 construction workers, where longer duration of work has been found as a risk factor for CTS (Merlino, et al., 2003).

Conclusion

Based on the results of our study, together with the documented high prevalence of factors associated with CTS may indicate that programs for the identification, prevention and intervention of musculoskeletal conditions such as CTS should specifically target this risk group.

Conflict of Interest:

Authors have declared that no conflict of interests exists.

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