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Prevalence of Carpal Tunnel Syndrome and its Associated Risk Factors among Workers of Marble Industries of Abbottabad

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Abstract

Pain, tingling, and numbness at the median nerve distribution on fingers and hands are the symptoms of carpal tunnel syndrome (CTS), which mostly occurs in specific hand force workers. Thus, the objective of the present study was to find out the prevalence of CTS and its associated risk factors among workers in the Marble Industries of Abbottabad. This descriptive cross-sectional study's data was collected from 150 workers via convenience sampling. The inclusion criteria of this study were industrial workers of age between 20 and 60, and the exclusion criteria were female, chronic disease (diabetes, systemic disease), and those with peripheral nerve injury. A Boston carpal tunnel syndrome questionnaire was used for collecting samples from the Jadoon marble industry, Taj marble industry, Hazara marble industry, and Janzib marble industry. The data was analysed using SPSS version 20. Results showed that the mean age of workers was 36.52. Statistically, age, work experience, and types of work showed significant (P value > 0.05) associations, whereas type of activity showed a highly significant (P value > 0.01) association with CTS. Further, the study showed that the prevalence of CTS increased with increasing age, experience, and forceful activities. The study concluded that marble factory workers who work more than 6 hours per day, have a greater number of years of work experience, are older, and use repetitive movements or vibratory tools are at high risk of developing CTS. Hence, awareness campaigns and training were recommended for marble industry workers to increase awareness of hand posture and management.

Keywords Carpal Tunnel Syndrome, Compression, Phalen's Test.

1. Introduction

Carpal tunnel syndrome is caused by medium vein pressure and can result in numbness, pain, and tingling in the hand and arm (1). "The syndrome is caused by compression of the nerve in a narrow passageway called the carpal tunnel", If the compression of the median nerve is continuous, it can lead to damaging the nerve and also worsen the symptoms (2). CTS gets worse over time, and to relieve the symptoms, the patient is advised to avoid activities that impact the syndrome as well as wear a wrist splint. CTS is the most common of all the nerve compression syndromes and can affect one in ten people during their lifetime (3). Carpal tunnel syndrome affects 5% of people in the United States. The highest risk of CTS is found in Caucasians as compared to non-white South Africans. Increasing age as a risk factor the ratio of 3:1 shows that women suffer more from CTS than men (4). Carpal tunnel syndrome: signs and symptoms of carpal tunnel syndrome are pain, numbness, parenthesis, and motor weakness in the hands (5). The annual incidence estimated at 1.9 for 1000 manual workers highlighted that the majority of the workers are affected by CTS (6). Risk factors for carpal tunnel syndrome are age, pregnancy, obesity, and a lack of fitness (7, 8).

The risk of CTS can be increased by being exposed to physical job variables such as segmental and mechanical

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stress on the base of the palm, vigorous effort of the hands, and highly repetitive motions like flexion, extension, or ulnar deviation of the wrist (9). Causes of carpal tunnel syndrome: Non-occupational (10) and occupational risk factors are the causes of CTS. Repetitive and Vibratory Carpal Tunnel are the types of carpal tunnel syndrome related to occupation (11). Tinel's sign test, Phalen's sign test, two-point discrimination test, Durkan test, carpal compression test, and hand elevation test (12) are clinical diagnostic tests for CTS. Treatment of CTS includes lifestyle modification (13), oral medication (14), local injection (15), splinting (16), physical therapy, and surgical management in cases where non-operative management fails.

The aim of this survey was to determine the prevalence of CTS and its associated risk factors among workers at Marble Industries and create a predictive model of who is at risk for CTS. This study will provide significant information to the health care team and owners of factories about CTS so that preventive measures can be taken to avoid this significant problem among workers.

2. Materials and Methods

This is a quantitative cross-sectional survey. Data is collected from workers working at the Jadoon marble industry, Taj marble industry, Jhanzaib marble industry, Abbottabad marble industry, and Hazara marble industries of Abbottabad. A total of 150 workers were recruited to collect the data through non probability convenience sampling as per inclusion criteria: includes only industrial workers of age between 20 and 60 years, Work-related carpal tunnel syndrome, only males were included. Participants who were available at the time of data collection and willing to participate were included, while participants with diabetic carpal tunnel syndrome, females, neoplasms, any systemic disease, and peripheral nerve injuries were excluded. Data was collected through a self-designed questionnaire, which includes demographics of participants, questions about working hours, working experience, type of work (e.g., drilling, cutting, vibratory, and carrying loads), high force activity and low force activity, and the Boston Carpal Tunnel Syndrome questionnaire, which was used to determine functional and symptom severity. Two questions were about Phalen's test and Tinnel's test (which were performed on participants). On the basis of these two tests, the diagnosis for CTs is determined. Participants who had a positive Tinnel's test will have an 88% chance of a positive Phalen's test (Table 2).

Ethical approval was obtained prior to the conduct of this study from the Women's Institute of Rehabilitation Sciences. Informed consent was taken from the subjects, questionnaires were distributed among workers, and questions in the questionnaire were asked verbally by workers who had difficulty understanding language. The collection of the questionnaire was done after 15 minutes. The data was analyzed using SPSS 20.0. Frequency was calculated to find out the prevalence of carpal tunnel syndrome in workers, and the chi-square test was used to find the association of carpal tunnel syndrome with age, work experience, type of activity (high force activity and low force activity), and work.

3. Results

Table 1 shows the minimum and maximum ages of the participants along with the mean and standard deviation. Minimum age was 21, maximum age was 56, and mean and standard deviation were 36.52 ± 9.27. The results of this survey revealed a prevalence of Carpal Tunnel Syndrome of 11.33%.

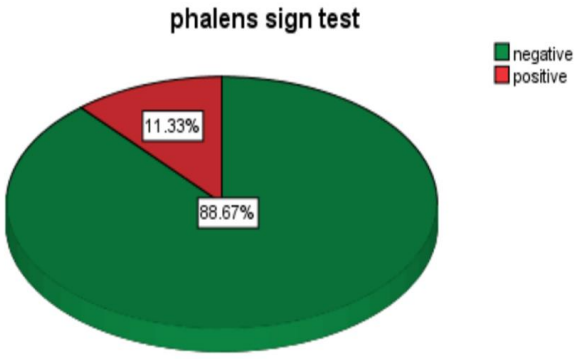

Figure 1: Prevalence of CTS in Male Marble Workers

Table 1: Distribution of Participants According to Age

	Frequency	Minimum	Maximum	Mean± Std. Deviation
Age of Laborers in Years	150	21	56	36.52 ± 9.27

Table 2: Tinnels and Phalen's Test of Agreement

		Phalen's Test		
		Negative	**Positive**	**Total**
Tinnel's Test	**Negative**	117	6	123
	Positive	16	11	27
Total		133	17	150

In table 2, the prevalence of CTS among 20–30-year-old workers was 1, among 30–40-year-old workers it was 4, and among >40-year-old workers it was 6. Statistical analysis showed a p-value < 0.05 (0.025), which shows a considerable association between age and CTS, meaning that workers will be more susceptible to developing CTS as their age increases. The prevalence of CTS in workers with 5 years of working experience was 0, workers with >5 years of working experience were 2, and those with >15 years of working experience were 9. Their p-value was 0.01, and a p-value less than 0.05 shows a statistically considerable association between working experience and CTS, meaning that a long duration of working experience can also contribute to the development of occupational CTS.

Workers dealing with work types like carrying loads had a prevalence of CTS of 2%, the use of vibratory tools was 6%, and workers dealing with drilling and cutting had a prevalence of 3%. Their chi-square (p-value) was 0.039, which is a statistically significant association between the type of work and CTS.

Table 3: Prevalence of CTS as per age of labor, Type of Work and Experience

	Prevalence of CTS (%)	**Chi Square (p-value)**
Age of Labour		
20-30 years	1	0.025
30-40 years	4	
>40 years	6	
Work Experience		
<5 years	0	0.01
>5 years	2	
>15 years	9	
Type of work		
Carrying Loads	2	0.039
Use of Vibratory tools	6	
Drilling Cutting	3	
Type of Activity		
None	0	<0.01
Low Force Activity	2.66	
High Force Activity	8.66	

The results of this study show that the prevalence of low-force activity was 2.66% and high-force activity done by workers was 8.66%. The chi-square (p-value) is less than 0.01. So, the results show that type of activity is also a contributing factor for carpal tunnel syndrome because as high-force receptive activity increases, there will be a greater chance of developing Occupational CTS.

4. Discussion

In this study, 150 subjects were recruited and studied. According to the present survey, the incidence of CTS in workers was found to be 11%, and the outcome of this study is similar to the survey that was conducted in 2008 among industrial workers, which showed an overall prevalence of 11.9% among workers (17). Many studies have shown that as age increases, the prevalence and severity of CTS also increase. The results of this study show that people of greater age (> 40 years) have a greater risk of carpal tunnel syndrome, and this study is supported by a study conducted among construction workers (2016) that found that workers' age is significantly associated with carpal tunnel syndrome (CTS) (18).

The result of this research revealed that more work experience or more duration of work can be risk factors for developing carpal tunnel syndrome, and this survey is supported by the study's conclusion that workplace and individual risk factors both contribute to the risk of CTS. If job exposure is high, forceful exertion can be a greater risk for CTS than obesity (19). In this study, the type of work that involves the use of vibratory tools, drilling or cutting, and carrying heavy loads can cause compression of the median nerve, which leads to CTS. This survey is favoured by a study conducted to find out the relationship between carpal tunnel syndrome and occupational ergonomic risk factors, and this study shows that CTS is associated with highly repetitive, forceful, and vibrational work (20).

The current study reveals that workers who work high-force repetitive activities are more likely to develop carpal tunnel syndrome, and the present survey results are favoured by the study of Silverstein and his colleagues, who found that workers who work high-force repetitive activities have an increased risk of suffering CTS (21).

In the result of this study, the risk factor for CTS is repetitive work activity, and the result of this research is favoured by the study of Frolund JT. and et al., who found that the overall prevalence of carpal tunnel syndrome was 1.6% on the dominant hand and 0.7% on

the other hand. With the increase of repetitive, non-forceful work on the working hand, there was a considerably increased risk of CTS every 10 hours (22). Another study by John C. and his colleagues is favoured in the results of a recent study; their study results showed that 8.2% and 9.2% were the prevalence of CTS among apprentices in sheet metal workers; BMI, age, and self-reported working overhead were prevalent factors in CTS (23).

The result of a recent study shows that more working years can cause CTS. The result of this recent research is favoured by the study conducted by Moustafa F. and his colleagues, whose study result shows that working years and precision grip are risk factors for CTS (24). Another study conducted by Frost P. and his colleagues concluded that daily manual work done with high velocity and force is a possible major factor that can cause carpal tunnel syndrome. Their conclusion supports a recent study (25).

5. Conclusion

The study concluded that the prevalence of carpal tunnel syndrome was 11% in workers in the marble industry. Participants who worked more than 6 hours or had a greater year of work experience, people with increased age, people who used useful repetitive movements, and people who used vibratory tools were at greater risk of developing carpal tunnel syndrome.

6. Recommendations

The following can be recommended:

- The effectiveness of management techniques can be found in their significant role in treating carpal tunnel syndrome.
- It is recommended that to prevent carpal tunnel syndrome, by correcting ergonomics and performing stretching exercises, ensuring correct wrist position and posture, and taking frequent rest breaks, jobs can be rotated among workers.
- Further studies must be conducted to find out about prevention strategies such as posture correction. Hence, awareness programmes, seminars, and workshops should be arranged at different industries about awareness of hands and management of carpal tunnel syndrome.

Conflict of Interest There is no conflict of interest.

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