Body mass index as predictor of carpal tunnel syndrome among garment workers

Lie T Merijanti S.*

ABSTRACT

*Department of Occupational
Medicine, Medical Faculty,
Trisakti University

Correspondence
dr. Lie T Merijanti S., MKK
Department of Occupational
Medicine, Medical Faculty,
Trisakti University
Jl Kyai Tapa No. 260,
Grogol - Jakarta 11440
Phone: 021-5672731 ext.2802
Email: lie_mery@hotmail.com

Of the nerve entrapment syndromes the most well-known is the carpal tunnel syndrome (CTS) involving the median nerve. In the field of occupational medicine this condition is categorized as an occupational disease, for which industrial workers may claim compensation if the CTS occurs as a consequence of their job. However, although several occupational risk factors have been suggested as causing the development of CTS, a definitive role of work activities as the central cause of CTS is unclear. The aim of the present study was to evaluate both non-occupational and occupational factors associated with CTS in garment home-industry workers. A cross-sectional study was performed from April to June 2008 in the garment home industry in North Jakarta. A total of 99 workers, consisting of 45 males and 54 females were included in this study. Historical data were obtained from a self-administered detailed questionnaire, while anthropometric and provocative median nerve test variables were measured directly. The results showed that body mass index (BMI) was a significant predictor of CTS in male workers (p=0.031), while the risk of CTS was three-fold higher in female workers using hormonal contraceptives (Prevalence Ratio/PR = 3.3 ; 95% Confidence of Interval/CI = 1.0 – 10.5). In conclusion it appears that BMI and hormonal contraceptive use were CTS predictors.

Keywords: Carpal tunnel syndrome, garment home industry, body mass index, hormonal contraceptive

INTRODUCTION

Carpal tunnel syndrome (CTS) is the most well known nerve entrapment syndrome involving the median nerve. However, its

symptoms are such that they are often overlooked by patients or misdiagnosed by their primary care physicians, leading to progression of the condition so severe that sometimes even surgical options will be of little benefit. The prevalence

of CTS is approximately 3.8% of the general population, women are 3 to 4 times more likely to develop the condition, and it effects both wrists in 50% cases.[1] CTS is often described as an occupational disease and claimed as a basis for worker's compensation.[2] Work related CTS is a complex and costly condition.[3] In Alberta, there were 7294 disabling injury claims (requiring time away from work or job modification) and 2849 compensated lost time claims for injuries to the hand and wrist excluding fingers, although the proportion of these that were due to CTS was not reported.[4] The number and frequency of worker's compensation CTS claims increased by more than 500%, despite increased regulations and monitoring, and presumably improved workplace conditions. Currently, CTS leads to more lost workdays than any other workplace injury.[2]

According to a review of occupational populations a wide range is found in the prevalence of CTS (0.6-61%), with the lowest prevalence occurring in industrial workers and the highest in grinders, butchers, grocery store workers, and frozen food factory workers, as in all of these occupations the workers use high force, high repetitive gripping.[5] However, the pathology of CTS remained unclear until Phalen reported on his experience in treating 439 patients at the Cleveland Clinic during the 1950s and 1960s. However, because the majority of the patients were middle aged women and thus not employed in industrial occupations, Phalen concluded that CTS was not an occupational disease but was "idiopathic". One important observation made by Phalen was that repeated, forceful grasping hand movements seemed to aggravate the symptoms.[6]

It has been reported that CTS is associated with certain diseases and conditions such as diabetes, hypothyroidism, pregnancy, rheumatoid arthritis, and work related factors. In some cases, two or more of these risk factors may coexist, placing the individual at a higher risk of developing CTS. Although less than half of all cases of CTS are identified as work related in medical claims, a definitive role of work activities as the central cause of CTS is unclear. In most cases, individual factors are not the potentially important independent causal factors that they appear to be, but frequently rather obscure an underlying relation between workplace factors and CTS. Hormone related disorders and/or hormone supplementation have been implicated as potential risk factors for CTS, while obesity may also contribute to risk for CTS.[7] The purpose of this study was to evaluate the predictors of CTS among garment home industry workers.

METHODS

Study design

From April to June 2008 a cross-sectional study was carried out among garment home industry workers, North Jakarta.

Study subjects

The study sample consisted of garment home industry workers in North Jakarta meeting the inclusion criteria, i.e. workers who had been employed for more than two years and were willing to participate in the study by signing an informed consent form. Based on the CTS prevalance of the 3.8%,[1] at a confidence level of 95% and accuracy of 4%, using the survey study formula a sample size of 92 subjects was obtained.[8]

The exclusion criteria were workers with a history of wrist injuries, rheumatoid arthritis, diabetes mellitus and pregnancy of over three months, the history being obtained by interview. All of the workers have been invited to participate.

Data collection

All participants in the study filled out a questionnaire relating to gender, age, level of education, use of hormonal contraceptives, job characteristics including job duration, work hours and type of work, also the presence of relevant symptoms of CTS like tingling, numbness, or pain affecting areas innervated by the median nerve.

Assessments

Body weight was recorded to the nearest kilogram on barefoot subjects using Health Scale instruments, while body height was measured with a microtoise to the nearest centimeter without shoes. Body mass index (BMI) was calculated as the weight (kg) divided by the height squared (m^2), and defined by the following thresholds: underweight (<18.5 kg/m^2), normal ($18.5 - 22.9$ kg/m^2), overweight ($23.0 - 27.5$ kg/m^2), and obese (>27.6 kg/m^2).[9] Provocative tests used to isolate the median nerve included the Phalen test and the Tinel test. Phalen's sign is of use because it is considered a very good indicator for CTS with high sensitivity and specificity, as it localizes the median nerve at the carpal tunnel.[10-12] The Phalen test is performed by asking the respondent to hold his or her wrist in a flexed position at approximately 90 degrees. The test is considered a positive Phalen's sign if numbness or pain is felt by the patient within 30-60 seconds. Tinel's sign isolates the median nerve at the carpal tunnel by percussing it at the distal palmar crease. This also should elicit numbness or pain.[10] CTS was diagnosed according to the National Institute of Occupational Safety and Health (NIOSH) criteria, comprising one of the following symptoms, i.e. numbness, pain, tingling or paresthesia in the afected area, accompanied by positive Tinel's or Phalen's test and history of occupational work. Phalen's and Tinel's signs,

although they may assist in the diagnosis of CTS,[11] are not pathomnemonic for the disorder.

Statistical analysis

Data were analyzed using SPSS version 15.0. Comparison of the means of continuous variables was performed using the independent t-test, while the chi-square test was done to analyze the relationship between several categorical variables. Prevalence ratio was used to evaluate the strength of association between dependent and independent variables.

RESULTS

From a total of 105 garment home-industry workers, 99 participated in this study. Six subjects were excluded because they had been employed for less than two years. The subjects consisted of 99 garment workers with a mean

Table 1. Summary of the characteristics of the participating subjects

Characteristics	n = 99
Age (yrs)	29.8 ± 8.0
Job duration (yrs)	7.8 ± 5.9
Work hours (hrs)	10.4 ± 1.5
Education	
Primary education	91 (91.9%)
Secondary education	8 (8.1%)
BMI	
Overweight and obese	27 (27.3%)
Normal and underweight	72 (72.7%)
Hormonal contraceptive use	
Yes	19 (19.2%)
No	80 (80.8%)
Gender	
Male	45 (45.6%)
Female	54 (54.4%)
Work type	
Sewing	81 (81.8%)
Pressing and cutting	10 (10.1%)
Finishing	5 (5.1%)
Packing	3 (3.1%)

Table 2. Comparison of several continuous variables and CTS
in male garment home industry workers

Variables	CTS present n=19	CTS absent n=26	p
Age (years)	35.1 ± 6.7	30.2 ± 7.6	0.124
Job duration (years)	10.0 ± 5.6	9.0 ± 5.6	0.259
Work hours	10.5 ± 1.7	10.7 ± 1.3	0.173
Body mass index	20.5 ± 3.3	21.3 ± 2.7	0.031*

* Significant (p<0.05)

age of 29.8 ± 8.0 years and a mean job duration of 7.8 ± 5.9 years. The 99 workers comprised 45 males and 54 females, among whom eigthy one (81.8%) worked as seamster/seamstress and ninety one (91.9%) had only primary education. Of the 99 workers included in the study, 43 workers were diagnosed of CTS. So, the prevalence of CTS in our sample was 43.4% (Table 1).

The relationship between workplace factors, personal characteristics and CTS in male workers are shown in Table 2. There was a significant difference in body mass index (BMI) in male workers with CTS, compared with those without CTS (p=0.031).

Both in female workers with CTS and those without CTS, analysis revealed no significant difference in age, job duration, work hours, or BMI (Table 3).

Among female workers it was found that the risk of CTS was three-fold higher in workers using hormonal contraceptives (PR=3.3; 95% CI= 1.0 – 10.5) (Table 4).

DISCUSSION

This study did not find any significant relationship between occupational risk factors and CTS. However, among male workers BMI was a significant predictor of CTS and use of

Table 3. Comparison of several continuous variables and CTS
in female garment home industry workers

Variables	CTS present n=24	CTS absent n=30	p
Age (years)	28.3 ± 6.3	27.2 ± 8.8	0.447
Job duration (years)	7.1 ± 5.4	5.8 ± 6.1	0.768
Work hours	10.1 ± 1.5	10.2 ± 1.6	0.220
Body mass Index	21.6 ± 3.2	21.1 ± 2.8	0.190

Table 4. Hormonal contraceptive use and CTS in female garment home industry workers

Variables	CTS present n=24	CTS absent n=30	Prevalence Ratio (95% CI)
Non contraceptive	12	23	3.3 (1.0 – 10.5)
Hormonal contraceptive	12	7	

hormonal contraceptives was a predictor in females. The degree of work relatedness of CTS reported in the literature ranged from very high to very low.[7] CTS is accepted as a work related disorder by some authors.[11] Occupational hand uses that are considered ergonomic risk factors for developing CTS include those involving highly repetitive awkward wrist movements, high handgrip and pinch forces and those associated with high vibration.[2,14] However, this notion is controversial and many authors do not agree with it.[15] In the longest prospective longitudinal study by Nathan, occupation was not associated with CTS although being female and overweight was.[13] Gedizlioglu et al.[18] found that in manual steel industry workers, manual work was not a risk factor for development of clinical CTS.

In the present study, working conditions did not include ergonomic factors but only type of work, because garment home industry workers are classified as informal sector workers with uncertain job continuity. They mainly work when there is an order from clients and the types of garment they produce vary with each order. In addition, when there is no commission, the workers frequently return to their villages, with the result that they are not daily exposed to the same risk factors. The protective nature of informal employment is most likely attributable to decreased exposures to such risk factors and greater time for rest of the affected body areas.[19]

BMI and hormonal contraceptive use were found to be significant predictors of CTS in this study. The risk of CTS was three-fold higher in female workers on hormonal contraceptives (PR= 3.3; 95% CI= 1.0 – 10.5).

Obesity has been associated with CTS in previous studies.[20] A study conducted by Geoghegan et al.[21] in the community found that obesity was a significant risk factor to CTS. Obesity and wrist shape correlate with a higher prevalence of carpal tunnel syndrome. Weight

loss in obese patients, however, does not bring relief of the syndrome. Women who are pregnant, taking oral contraceptives or going through menopause also are at increased risk, most likely due to hormonal changes. Hormonal fluctuations in women play a role in CTS. Such fluctuations may cause fluid retention and other changes that cause swelling in the body. Fluid retention is one reason why CTS may develop during pregnancy. Fortunately, carpal tunnel syndrome related to pregnancy almost always improves after childbirth.[22,23] Estrogen receptors and progesteron receptors are present in transverse carpal ligament and flexor tendon synovitis, suggesting a role for sex steroid hormones in the pathogenesis of CTS disease.[24] However, the study by Maghsoudipour et al.[7] could not find any association between hormonal contraceptive use and CTS incidence.

One limitation of the present study is that working conditions did not include ergonomic factors but only type of work, because garment home-industry workers are informal workers with irregular work, making it difficult to perform a job analysis. Another limitation is that the diagnosis of CTS was established without being confirmed by a nerve conduction test, which is considered the most accurate single test for CTS. Therefore the CTS prevalence in this study has presumably been overestimated.

CONCLUSIONS

In this study BMI was found to be a significant predictor of CTS among males workers, whereas hormonal contraceptives increased the risk of CTS in females workers.

REFERENCES

1.   Burke FD, Ellis J, McKenna H, Bradley MJ. Primary care management of carpal tunnel syndrome. J Postgrad Med 2003;79:433-7.

2.   Kao SY. Carpal tunnel syndrome as an occupational disease. J Am Board Fam Pract 2003;16:533-42.

3.   Sperka P, Cherry N, Burnham R, Beach J. Impact of compensation on work outcome of carpal tunnel syndrome. Occup Med 2008;58:490-95.

4.   Alberta Employment, Immigration and Industry. Occupational injuries and diseases in Alberta. Lost time claims, disabling injury claims and claim rates. Edmonton, Alberta: Government of Alberta;2007.

5.   Van Rijn RM, Huisstede BMA, Koes BW, Burdof A. Association between work related factors and the carpal tunnel syndrome - a systematic review. Scand J Work Environ Health 2009;35:19-36.

6.   Phalen GS. The carpal tunnel syndrome: 17 years experience in diagnosis and treatment of 654 hands. J Bone Joint Surg Am 1966;48:211-28. Cited by Kao SY. Carpal tunnel syndrome as an occupational disease. J Am Board Fam Pract 2003;16:533-42.

7.   Maghsoudipour M, Moghimi S, Dehghaan F, Rahimpanah A. Association of occupational and non occupational risk factors with the prevalence of work related carpal tunnel syndrome. J Occup Rehabil 2008;18:152-6.

8.   Sastroasmoro S. Dasar-dasar metodologi penelitian klinis. Edisi 2. Jakarta: CV Agung Seto;2002.

9.   World Health Organization. Appropriate body mass index for Asian populations and its implications for policy and intervention strategis. Lancet 2004;363; 157-63.

10. Katz JN, Simmons BP. Carpal tunnel syndrome. N Engl J Med 2002;346:1807-12.

11. Lajoie AS, McCabe SJ, Thomas B, Edgell SE. Determining the sensitivity and specificity of common diagnostic testa for carpal tunnel syndrome using latent class analysis. Plast Reconstr Surg 2005; 116:502-7.

12. Scanlon A, Maffei J. Carpal tunnel syndrome. J Neuroscience Nursing 2009;41:140-7.

13. Nathan PA, Isthvan JA, Meadows KD. A longitudinal study of predictors of research defined carpal tunnel syndrome in industrial workers: findings at 17 years. J Hand Surg 2005;30:593-8.

14. Wellman H, Davis L, Punnet L. Work related carpal tunnel syndrome (WR-CTS) in Massachusetts 1992-1997: source of WR-CTS, outcomes, and employer intervention practices. AM J Ind Med 2004;45:139-52.

15. Palmer KT, Harris C, Coggnon D. Carpal tunnel syndrome and its relation to occupation: a systematic literature review. Occup Med 2007;57: 57-66.

16. Stapleton MJ. Occupation and carpal tunnel syndrome. ANZ J Surg 2006;76:494-6.

17. Katz JN, Simmons BP. Carpal tunnel syndrome. N Engl J Med 2002;346:1807-11.

18. Gedizlioglu M, Arpaci E, Cevher D, Ce P, Kulan CA, Colak I, et al. Carpal tunnel syndrome in Turkish steel industry. Occup Med 2008;58:212-4.

19. Cole DC, Ibrahim S, Shannon HS. Predictors of work-related repetitive strain injuries in a population cohort. Am J Pub Health 2005;95;1233-7.

20. Werner RA, Franzblau A, Gell N, Ulin SS, Armstrong TJ. A longitudinal study of industrial and clerical workers: predictors of upper extremity tendonitis. J Occup Rehabil 2005;15:37-46.

21. Geoghegan JM, Clark DI, Bainbridge LC, Smith C, Hubbard R. Risk factors in carpal tunnel syndrome. J Hand Surg Eur Vol 2004;29:315-20.

22. Solomon DH, Katz JN, Bahn R, Mogun H, Avorn J. Nonoccupational risk factors for carpal tunnel syndrome. J Gen Intern Med 1999;14:310-4.

23. Ferry S, Hannafoed P, Warskyj M, Lewis M, Croft P. Carpal tunnel syndrome: A nested case-control study of risk factors in women. Am J Epidemiol 2000;151:566-74.

24. Toesca A, Pagnotta A, Zumbo A, Sadun R. Estrogen and progesterone receptors in carpal tunnel syndrome. Cell Biol Int 2008;32:75-9.