

# Prevalence of self-reported symptoms compatible with Carpal Tunnel Syndrome (CTS) among employees at a neonatal intensive care unit: a cross-sectional study

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## KEY WORDS

Carpal Tunnel Syndrome; nurses; neonatal intensive care

## PAROLE CHIAVE

Sindrome del Tunnel Carpale; infermiere; terapia intensiva neonatale

## SUMMARY

**Background:** *Carpal Tunnel Syndrome is a significant work-related disease. Objective:* The aim of the study was to investigate the prevalence of symptoms possibly related to CTS in workers in a neonatal intensive care unit.

**Methods:** *The self-administered INRS questionnaire for musculoskeletal symptoms was distributed to all 41 employees of a neonatal intensive care unit and to an appropriate sample of 82 employees of a paediatric emergency department and an adult intensive care unit. Results:* Employees of the neonatal intensive care unit recorded a significantly higher prevalence of symptoms potentially related to CTS in comparison with the reference group (58.5% vs 8.3%, respectively;  $p < 0.001$ ). Logistic regression analysis indicated that work in the neonatal intensive care unit was independently associated with the risk of symptoms potentially related to CTS. **Conclusions:** The results provide some evidence for a higher prevalence of symptoms potentially related to CTS in nursing personnel of a neonatal intensive care unit. Further research work is needed to prove a causal association.

## RIASSUNTO

**«Prevalenza di sintomi compatibili con la Sindrome del Tunnel Carpale (STC) tra gli operatori di una unità di terapia intensiva neonatale: uno studio trasversale».** **Obiettivo:** Scopo dello studio è stato quello di valutare la prevalenza di sintomi potenzialmente correlati con la Sindrome del Tunnel Carpale (STC) in lavoratori di un'unità di terapia intensiva neonatale e della sua possibile associazione con fattori di rischio. **Metodo:** è stato somministrato un questionario per i sintomi muscolo-scheletrici a tutti i 41 operatori di una unità di terapia intensiva neonatale e ad un adeguato campione di 82 operatori del reparto di emergenza pediatrica e rianimazione adulti. **Risultati:** i lavoratori dell'unità di terapia intensiva neonatale hanno deposto una prevalenza significativamente maggiore di sintomi della sindrome del tunnel carpale in confronto al gruppo di riferimento (58,5% vs 8,3%,  $p < 0,001$ ). L'analisi di regressione logistica ha indicato che lavorare in un'unità di terapia intensiva neonatale è indipendentemente associato con il rischio di sintomi potenzialmente correlati con STC. I risultati depongono per l'evidenza di una maggiore prevalenza di sintomi potenzialmente correlati con STC tra i lavoratori di una unità di terapia intensiva neonatale. Ulteriori indagini sono necessarie per dimostrare l'esistenza di una associazione causale.

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## BACKGROUND

Carpal Tunnel Syndrome (CTS) is a clinical disorder resulting from the compression of the median nerve at the wrist. It has been considered as the most common of the entrapment neuropathies (3). In clinical terms CTS is characterized by sensory symptoms and signs in the area of the peripheral distribution of the median nerve. Known general medical conditions associated with CTS are diabetes, hypothyroidism, rheumatoid arthritis, pregnancy, obesity and trauma. Carpal Tunnel Syndrome represents one of the most significant problems of the working population both in terms of health and costs (4). However, there is some evidence of substantial underreporting of work-related cases of CTS (1). It has been suggested that 5-50% of CTS cases could be avoided in the entire population if effective interventions were implemented in the various workplaces. Despite the absence of a generally accepted case definition for CTS, Colombini et al proposed certain criteria for the classification of upper limb work-related musculoskeletal diseases, including CTS (3, 10). It has been pointed out that a substantial body of evidence suggests that prolonged and highly repetitive flexion or extension of the wrist increases the risk of CTS, in particular when accompanied by a forceful grip (9, 11). Nursing personnel of neonatal intensive care units are exposed to ergonomic hazards like repetitive and forceful movements, especially when working with incubators. To our knowledge there are no available data on the prevalence of symptoms potentially related to the Carpal Tunnel Syndrome among these workers. Consequently, the aim of the present cross-sectional study was to investigate the prevalence of symptoms potentially related to CTS as well as possible risk factors related to these symptoms among nurses working in a neonatal intensive care unit.

## MATERIAL AND METHODS

The self-administered questionnaire on musculoskeletal symptoms of INRS (Institut National de Recherche et de Sécurité; *Questionnaire sur les trou-*

*bles musculosquelettiques* version 2000) (5) was distributed to all 41 nursing personnel of a neonatal intensive care unit. All workers accepted to participate in the cross-sectional study. In addition, the same questionnaire was distributed to an matched sample of 41 workers of a pediatric emergency department, and to 41 health care workers of an adult emergency department. The questionnaire was distributed between May-July 2003. All participants gave their informed consent for participation in the study. Prior to the distribution of the questionnaire the employees were informed by two of the researchers about the aim of the study and the content of the questionnaire. The questionnaire consisted of five parts. The first part included questions related to personal and socio-demographic information (e.g. sex, age, duration of employment, weight, height). The second part included questions on musculoskeletal symptoms. Participants were asked to report sensory symptoms (in) along? the distribution of the median nerve during the last 12 months (yes, no). Then participants were asked about the frequency of CTS symptoms (never/almost never/rarely/sometimes/frequently/almost always). In addition, participants were asked to report nocturnal sensory symptoms in the area of the distribution of the median nerve. A subject was considered as positive for symptoms potentially related to CTS if he/she reported almost always/frequently/sometimes sensory symptoms in the area of the distribution of the median nerve during the last 12 months. The same criteria were used for nocturnal symptoms. The third part of the questionnaire included questions on psychosocial risk factors of the working environment (job demands, job control, supervisor, and co-worker support). A four-point scale was used with the ratings "never/seldom", "now and then", "often" and "always". A worker was considered to have high exposure to psychosocial hazards if she/he reported exposure to these hazards "often" or "always". The next part of the questionnaire included questions about the physical load and the repetitiveness of the work. Participants were asked to self-report their exposure to physical load and repetitiveness of their work by the use of a scale in which 0 was considered as the no exposure and 100 the highest expo-

sure. The same criteria was used for the definition of exposure to fine and precise movements during work.

### Statistical analysis

Qualitative data were presented as absolute (n) and relative frequencies (%) while continuous data were presented as mean (Standard deviation). The statistical analysis (univariate) of the qualitative data collected was conducted using the Chi-squared test, while the univariate analysis of continuous data was performed using Student's t-test. A logistic regression model was used for the multivariate analysis of CTS with selected risk factors. Odds Ratio (OR) and 95% Confidence Intervals (95% CI) were calculated. The level of statistical significance was set at 0.05. Statistical analysis was performed using Excel and SPSS software.

### RESULTS

The study population was predominantly female (92.7%) and the mean age was 36.39 years (SD=8.1). The mean duration of employment was 12.9 years (SD=1.67). Table 1 presents a comparison of the basic socio-demographic information between employees of the neonatal intensive care unit and their colleagues in the pediatric emergency department and adult intensive care unit. The two groups did not differ in terms of basic socio-demographic information. Symptoms poten-

tially related to CTS were reported by 30 participants (24.4%). In particular, of the 30 employees who reported symptoms 14 reported the symptoms "always" (11.4%), 9 "often" (7.3%) and 7 "sometimes" (5.7%). Of the seven employees who reported the presence of the symptoms "sometimes", 3 belonged to the control group and 4 to the group of the neonatal intensive care workers. Sixteen workers reported unilateral symptoms, and fourteen reported bilateral symptoms. Moreover, nurses in neonatal intensive care unit reported a higher level of task-related precise or fine movements of the upper extremities (91 vs.78, respectively;  $p < 0.001$ ). Further, the employees of the neonatal unit reported a higher though not significant level of repetitive movements of the upper extremities than the members of the control group. In terms of psychosocial risk factors the workers of the neonatal intensive care unit recorded a lower level of participation in the organization of their work procedures in comparison to the nursing personnel of the pediatric emergency department and adult intensive care unit (25% vs 3.7%, respectively  $< 0.001$ ). Table 2 illustrates all significant univariate associations of symptoms potentially related to CTS with possible risk factors. Workers in the neonatal intensive care unit did record a higher prevalence of CTS symptoms (unilateral and bilateral) in comparison to the control group. In particular, 24 workers of the neonatal intensive care unit had CTS symptoms in comparison with only 6 participants from the control group (58.5% vs 7.3%;  $p < 0.001$ ). Workers with high exposure to

Table 1 - Characteristics of workers under study by job title

Characteristic	Workers of a neonatal intensive care unit (No.= 41)	Workers of pediatric emergency department & adult intensive care unit (No.= 82)
Sex	No. %	No. %
Male	3 (7.3%)	6 (7%)
Female	38 (92.7%)	76 (93%)
Age <sup>a</sup> (years)	35.9. (8.2)	36.63 (8.08)
Duration of employment <sup>a</sup> (years)	13.1 (8.7)	12.3 (9.00)
Weight <sup>a</sup> (kg)	64.66 (12.15)	70.8 (55.3)
Height <sup>a</sup> (cm)	167 (7.35)	165.7 (8.0)

<sup>a</sup> mean, standard deviation

**Table 2** - Prevalence of symptoms potentially related to CTS in sub-groups of nursing personnel

Characteristic	Symptoms (+)	Symptoms (-)	P value
Job Title	No. (%)	No. (%)	
Pediatric emergency & adult intensive care	6 (7.3%)	76 (92.7%)	<0.001 <sup>b</sup>
Neonatal intensive care unit	24 (58.5%)	17 (41.5%)	
Precise movement score (Mean, SD)	90.03 (8.85)	79.89 (17.13)	<0.001 <sup>c</sup>
Fatigue reported			
No	15/85 (17.6%)	70/85 (82.4%)	0.013 <sup>b</sup>
Yes	15/38 (39.5%)	23/38 (60.5%)	
Participation			
No	6/13 (46.2%)	7/13 (53.8%)	0.045 <sup>b</sup>
Yes	23/109 (21.1%)	86/109 (78.9%)	
Repetitive work score (mean, SD)	65.4 (27.8)	61.1 (22.3)	NS <sup>c</sup>

<sup>b</sup>chi-squared test<sup>c</sup>Student's t-test

precise and fine movements recorded higher prevalence of CTS symptoms. Moreover, participants with CTS symptoms recorded higher exposure to precise and fine movements in comparison with those without symptoms (90.3 vs 79.8, respectively <0.001). Univariate analysis demonstrated that fatigue was significantly associated with the prevalence of CTS. In particular, employees who reported frequently a feeling of intense fatigue had a higher prevalence of CTS symptoms than employees who reported no feeling of fatigue (39.5% vs

17.6%; p=0.013). Univariate analysis also showed that low participation in decision making concerning working conditions was a risk factor of symptoms potentially related to CTS. In particular, workers with no/low participation in the definition of working conditions showed a prevalence of symptoms potentially related to CTS significantly higher than workers with high participation in decision making regarding working procedures (46.2% vs 21.1%, respectively=0.045). Table 3 presents the results of logistic regression analysis. Job

**Table 3** - Logistic regression analysis of symptoms potentially related to CTS

Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	P value
Fatigue reported			
No	1.00 (ref)		0.04
Yes	3.1	1.05-9.17	
Precise movements			
No	1.0 (ref)		NS
Yes	1.19	0.38-3.7	
Job Title			
Pediatric emergency & adult intensive care	1.0 (ref)		0.001
Neonatal intensive care	16.1	5.2-50.1	
Participation			
No	1.0 (ref)		NS
Yes	0.76	0.19-3.4	
Repetitive work			
No	1.0 (ref)		NS
Yes	1.72	0.52-5.01	

title and reported feeling of fatigue were variables independently associated with symptoms potentially related to CTS. In particular, nursing personnel of the neonatal intensive care unit recorded a 16.1% increased risk of reporting symptoms potentially related to CTS in comparison to the control group (OR=16.1; 95% CI=5.2-50.1). Furthermore, participants who reported fatigue recorded a 3-fold increase in risk of CTS (OR=3.1; 95%CI=1.05-9.17), nevertheless, the association was significant at a borderline level of significance.

## DISCUSSION

The present cross-sectional study showed an increased prevalence of symptoms potentially related to CTS among nursing personnel of a neonatal intensive care unit, and logistic regression analysis confirmed an independent association between symptoms and this occupation. Regarding the observed prevalence of symptoms potentially related to CTS it is interesting to note that of the seven employees who reported the presence of symptoms "sometimes", 3 subjects belonged to the control group and 4 subjects to the group of the neonatal intensive care workers. We could suppose an overestimation of the prevalence of symptoms among neonatal intensive care nursing personnel, however the magnitude of the overestimation does not seem to be considerably high. Employees of the neonatal intensive care unit recorded higher levels of exposure to ergonomic hazards (e.g. fine movements, precision movements of the fingers) in comparison to the workers of the control group. It should be stressed that nursing work in the neonatal unit requires frequent work with incubators. Working with incubators requires strenuous wrist and finger movements (e.g. during the use of manometers or drug injection procedures) and supination-pronation movements of the hands (e.g. opening and closing the incubator door and handling bottled gas). Moreover, work with incubators is characterized by a high rate of repetitive work. According to our results work with incubators was considered – by the personnel of neonatal intensive care unit – as highly repetitive (repeti-

tiveness rate=68%). Multivariate analysis indicated that the job title (work with incubators) was the only variable strongly associated with the prevalence of self-reported symptoms (complaints) compatible with CTS. It is interesting to note that work repetitiveness and exposure to precise and fine movements of the upper hand were not found to be significant predictors of musculoskeletal complaints compatible with CTS. In particular, an elevated although non-significant Odds Ratio was recorded for work repetitiveness (OR=1.72) and for exposure to precise and fine movements of the upper extremities (OR=1.19). As mentioned above, two systematic reviews of the evidence showed that repetitive work is a risk factor for CTS. However, it should be mentioned that there are few studies which did not demonstrate a significant association between repetitive work and CTS (2, 8). Additionally, the relatively small sample of the study population resulted in a low power of the present study which probably prevented our results from reaching statistical significance. There are some limitations to our study which should be taken into account before interpreting the results. First, the cross-sectional design of the study did not permit attributing cause and effect. In addition, this study was based on a self-administered questionnaire (self-reports) and thus some information bias may have occurred. Viikari-Juntura and co-workers showed that the perception of musculoskeletal pain may bias the self-assessment of workload (12). Moreover, an additional limitation to the present study is the fact that we used self-reported complaints of the workers as a "proxy" for the evaluation of symptoms compatible with CTS given the absence of data based on clinical examination and symptoms anamnesis. It would have been an advantage if we had been able to integrate the use of the questionnaire with clinical examination data.

Another limitation of the present study is related to the low possibility of generalization of our results. In fact our results cannot be applied across the board to all nursing personnel of neonatal intensive care units. Lastly, we did not control for several disorders which are associated with an increased risk of CTS (e.g. diabetes mellitus, hy-



pothyroidism, rheumatoid arthritis). Nevertheless, there is no reason to expect that these disorders could have a significantly different distribution between workers at a neonatal intensive care and the control group. Furthermore, Barbieri *et al* in a study reporting information from a work-related carpal tunnel syndrome surveillance system found that the prevalence of diabetes between work-related cases of CTS was not higher than that of the general population. On the contrary, the prevalence of obesity was higher among subjects with work-related CTS (1). It is of note that in our study the workers in the neonatal intensive care unit had a lower BMI in comparison to the control group. Lastly, our results, which was based on self-reports, could be confounded by other hand symptoms reported by the participants. However, we believe that this effect was – in part – controlled by the use of additional questions about sensory and nocturnal symptoms.

## CONCLUSION

Despite the limitations mentioned, this study provides for the first time information on an increased prevalence of symptoms potentially related to CTS among nurses of a neonatal intensive care unit. This study is exploratory in nature; further research work is needed for the confirmation or rejection of our preliminary findings.

NO POTENTIAL CONFLICT OF INTEREST RELEVANT TO THIS ARTICLE WAS REPORTED

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