

Van Rijn RM, Huisstede B et al. Associations between work-related factors and the carpal tunnel syndrome—a systematic review. *Scand J Work Environ Health* 2009;35(1):19-36.

Design: Systematic review of observational studies

Databases/selection and rating of articles:

- 44 observational studies of relationships between work-related physical/psychosocial factors and the occurrence of CTS
- Databases included MEDLINE from 1966-Sept 2007; EMBASE from 1984 to Sept 2007, and the Cochrane Central Register of Controlled Trials in Sept 2007
- Inclusion criteria required articles to report (1) the occurrence of CTS in occupational populations, (2) a quantitative description of measures of exposure or a description of an exposure pattern at job level, (3) a quantitative measure of the association between work-related risk factors and CTS, and (4) publication in English, German, French, or Dutch
- Quality scored by 2 reviewers based on 16 items related to description of study population, assessment of exposure & outcome, study design & analysis, and data presentation

Main outcome measures:

- 985 articles were screened, with 44 meeting inclusion criteria: 30 cross-sectional, 9 case control, and 5 cohort studies
- 22 articles compared CTS occurrence across occupational groups; 23 articles compared CTS across different physical risk factors, and 4 reported association between CTS and psychosocial risk factors
- 19 articles used both symptoms and median nerve conduction to define cases of CTS; the others used various combinations of symptoms and physical examination; 58% of the studies using nerve conduction for CTS diagnosis reported a significant relationship with work factors, while 64% of the studies with a less accurate diagnostic method reported a relationship with work
- Meta-analysis (statistical pooling of results) could not be done because of the heterogeneity of measures of both exposure and outcome
- Exposure to force was significant in 3 studies, and was not significant in 4 studies; force was variously defined (sometimes grip force, sometimes as heavy lifting)
- Repetition was significantly associated with CTS in 5 studies, and 5 articles reported no association between CTS and repetition; the strongest associations were seen with work cycle less than 10 seconds
- Vibration was significant in 3 articles and not significant in 2 articles; vibration was variously defined, sometimes as holding vibrating tools, sometimes as vibration transmitted to the hand
- Combinations of factors (repetition, force) were significant in 3 studies and were not significant in 1 study

- Posture (wrist flexion/extension, wrist deviation) was significant in 6 studies and non-significant in 2 studies
- Computer/mouse use was significant in 2 studies and non-significant in 5 studies
- Psychosocial risk factors (social support, task control, time pressure) were examined in 4 studies, and were non-significant in all 4 studies
- Quality scores of the articles were not associated with the reported exposure-CTS associations, and more recently published articles were not higher quality than earlier articles

Authors' conclusions:

- Frequent handling of loads, highly repetitive work with and without force requirements, hand-arm vibration, and activities with a flexed or extended wrist were associated with CTS
- Computer work was not associated with CTS
- The causality of the associations cannot be established due to the cross-sectional nature of most of the studies; cohort studies are rare
- Cohort studies are likely to be underpowered, due to the low incidence of CTS, unless very large populations are studied
- Different definitions of exposure in different studies creates a large heterogeneity among the study results
- Questionnaire and interview assessments of exposure, used in most studies, introduces substantial misclassification of exposure and attenuation of the true associations between exposure and CTS
- Strict case definitions of CTS (requiring median nerve conduction studies) reduces the measured prevalence of CTS, contributing to the lack of power to analyze the exposure-CTS associations
- The studies provide a consistent estimation that CTS is associated with average requirements of hand force > 4 kg, cycle time repetition <10 seconds, or > 50% of a cycle time during which the same movements are performed, and a daily 8-hour energy-equivalent frequency-weighted acceleration of 3.9 m/s²
- Prolonged flexion or extension is a risk factor, but there is not sufficient evidence to comment on the level of exposure

Comments:

- The authors' discussion section highlights some of the significant obstacles to a quantitative risk assessment for work factors and CTS
- Although the text of the article reports that psychosocial factors were not significant in any of the 4 studies that evaluated them, Table 4 shows that Nordstrom et al workers with higher levels of job control had a lower risk of CTS than workers with very little job control
- The quality scoring criteria may not capture all of the concepts needed to assess the evidence level of the articles
- For example, when combined exposure measures are discussed (p. 28), the case-control study of Cosgrove et al did not corroborate the three articles that

found a significant association; however, Cosgrove studied railroad workers who were all claiming to have work-related CTS; the “cases” were those confirmed by median-ulnar latency differences, and the “controls” were those claimants not so confirmed; this creates a control group that does not represent the population from which the cases arose, and which is expected to have elevated amounts of the work-related exposure; this attenuates the expected exposure-CTS relationship

- Questionnaire assessment of exposure does, as the authors discuss, introduce misclassification of exposure; however, it is not certain that this will attenuate the measure of association, since the misclassification may be non-random (e.g., CTS cases reporting more exposure than non-cases due to recall bias)
- The important authors’ suggestion that quantitative risk assessment is unlikely to be supported by the available literature is sound

Assessment: For a qualitative statement that high force, high repetition, vibrating tool use, and combinations of these contribute to CTS: adequate