Effects of cold and hand-arm vibration on the peripheral neurosensory and vascular system

an occupational perspective

Daniel Carlsson

Akademisk avhandling

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Avhandlingen kommer att försvaras på engelska.

Fakultetsopponent: Docent, Tiina Ikäheimo,
Center for Environmental and Respiratory Health Research,
University of Oulu, Oulu, Finland.
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Abstract
Exposure to hand-arm vibration and cold are two common occupational health hazards. Health effects of hand-arm vibration has been thoroughly studied while the scientific support for effects of occupational cold exposure in terms of peripheral neurosensory and vascular function are limited. Common symptoms associated with exposure to hand-arm vibration and cold injuries are cold sensitivity and sensation of cold. The overall aim is to increase knowledge on health effects from cold and hand-arm vibration exposure on the peripheral neurosensory and vascular system with an occupational perspective.

A case series study on 15 military conscripts in cold winter military training was conducted to investigate the hypothesis that cold injuries can result in similar neurosensory and vascular impairments as is caused by hand-arm vibration. To assess health effects of cold exposure, a cohort study on 54 military conscripts was conducted. Health effects were assessed before and after 14 months of military training in cold climate. To investigate if sensation of cold hands is a predictor for the Raynaud’s phenomenon or paresthesia we investigated a cohort of 178 employees at a manufactory with considerable amount of exposure to hand-arm vibration. The cohort was followed during 21 years and both vibration exposure and health outcome were measured every fifth year. To identify risk factors for cold sensitivity a case-control study was conducted involving 997 participants from the general population in northern Sweden. The study focused on possible risk factors for cold sensitivity and different measures of cold sensitivity.

Cold injuries and cold exposure was independently shown to affect sensibility for temperature and vibration and increase severity and prevalence of neurosensory and vascular symptoms. The risk of developing Raynaud’s phenomenon when previously reported sensation of cold has an odds ratios between 6.0 and 6.3 (95% CI 2.2-17.0). There was no increased risk for paresthesia in relation to a sensation of cold hands. The identified risk factors for cold sensitivity for all participants were frostbite in the hands, rheumatic disease, nerve injury in upper extremities or neck, migraine and vascular disease. When analysing women and men separately, women’s risk factors were frostbite in the hands, rheumatic disease, migraine and cold exposure. Men’s risk factors were frostbite in the hands, vibration exposure and nerve injury in upper extremities or neck. BMI > 25 was a protective factor for both men and women.

Cold injury and cold exposure are independently associated to impairments in the neurosensory system. A sensation of cold hands is an independent risk factor for Raynaud’s phenomenon but not for paresthesia. Risk factors for cold sensitivity for both men and women are frostbite in the hands and nerve injury in upper extremities or neck. For women rheumatic disease, migraine and cold exposure are also independent significant risk factors and for men exposure to hand-arm vibration. Being overweight (BMI > 25) is a protective factor for both men and women.

Keywords
Occupational, cold, quantitative sensory testing, neurosensory, vascular, hand-arm vibration, cold sensitivity, Raynaud’s phenomenon, paresthesia, sensation of cold