Seidler A, Bolm-Audorff U, et al. Work-related lesions of the supraspinatus tendon: a case–control study. Int Arch Occup Environ Health 2011;84:425–433.

Design: Case-control study

Study question: Are work factors associated with the occurrence of rotator cuff tears?

Population/sample size/setting:

- 743 men, mean age 50, drawn from two regions of Hesse, Germany: Frankfurt/Main and Wiesbaden
- Cases (n=443, mean age 53.5) were identified by radiologists in 14 radiology practices located in those two regions
    - Participating radiologists were asked to identify all male patients between 25 and 65 with partial or total supraspinatus tendon tears diagnosed by MRI which was done due to shoulder pain
    - Eligible patients were those whose MRI diagnoses occurred between January 2003 and June 2008 in Frankfurt region
    - Cases and controls both needed to speak German or Turkish to be included in the study
- Controls (n=300, mean age 45) were recruited from a one percent random sample of male residents age 25 to 65 in the same regions from the population registration office; 551 were invited to participate and 300 consented

Assessment of exposure:

- A detailed computer-assisted personal interview was used to elicit information about work exposures
    - These included time working above shoulder level, work time physical workload including lifting and carrying, psychosocial workload, leisure activities, life events, and medical complaints
    - "Abstract" questions were not asked concerning the weight, frequency, or duration of the physical loads
    - Instead, participants were asked to describe specific objects that had to be carried or lifted frequently, followed by questions about the weight, frequency, and duration directly related to these objects
- Additional factors were also elicited in these interviews: age, education, smoking, height, weight, and cumulative hours spent in a variety of sports entailing exercise of the upper extremity (throwing, body building, weight training)
    - Questions were also asked concerning non-upper extremity sports such as cycling, soccer, jogging

- Cumulative exposure to work above shoulder level or to lifting/carrying was calculated up to the year of diagnosis (in cases) or to the year of interview (in controls)
    - Cumulative exposure to lifting/carrying heavy loads (>20 kg) was calculated by multiplying by 2.5 seconds (assumed to be the duration for a single lifting act), and summing up the frequencies of these loads

Analysis of exposure/outcome association:

- A first logistic regression model was fitted with symptomatic supraspinatus tendon tears as the outcome variable
    - Three exposure variables were entered into the model: cumulative lifting and carrying of loads >20 kg, cumulative work above shoulder level, and cumulative years of handheld vibration
        - Each exposure variable had a reference level (no exposure) and three higher levels of exposure
        - These three levels of exposure were based on tertiles of the control subjects
        - For example, lifting/carrying had 185 controls with no exposure, and three equal levels of some lifting/carrying with 35,36, and 35 subjects respectively
        - This led to unequal distribution of the case subjects among the tertiles of some exposure; for example, lifting/carrying had 202 cases with no exposure, and the three higher levels of exposure had 52,77, and 141 subjects respectively
    - Because the cases were older than the controls, age was entered as a polynomial variable: age, age squared, and age cubed
    - Region (place of residence) was also in the first model
- A second logistic regression model was fitted with the same variables as the first model, and with additional variables considered as confounders
    - Each of the exposure variables was entered as a confounder of the others
        - For example, cumulative work above shoulder level and years of handheld vibration were entered as confounders of the cumulative lifting and carrying of loads variable
    - The second logistic regression model also entered some of the recreational exposure variables (throwing, wrestling, and tennis)
- The first regression model estimated significant odds ratios for the three work exposures, and dose-response relationships appeared to be present, since the odds ratios increased with increasing levels of exposure (the odds ratio for zero exposure was always 1.0)

    - For cumulative lifting/carrying, the odds ratios at the three increasing levels of exposure were 1.4, 2.0, and 3.3
    - For cumulative work above shoulder level, the three ORs were 1.7, 2.6, and 4.1
    - For handheld vibration, the three ORs were 2.5, 3.8, and 4.6
- The second regression model, which entered the three exposures as if they were confounders of one another, also had increasing odds ratios in a dose-response pattern, but with smaller values
    - For cumulative lifting/carrying, the odds ratios at the three increasing levels of exposure were 0.9, 1.2, and 1.8
    - For cumulative work above shoulder level, the three ORs were 1.0, 1.4, and 2.0
    - For handheld vibration, the three ORs were 2.7, 3.1, and 3.2

Authors' conclusions:

- Supraspinatus lesions are independently related to work above shoulder level as well as lifting/carrying of heavy loads and handheld vibration
- The estimates of exposure depended on self-report, and the effect of recall bias on the risk estimates cannot be estimated reliably
- An analysis of job categories, though only exploratory in nature, showed increased odds ratios in construction workers and interior workers, and this is consistent with increased odds ratios in the measured exposures
- The controls, who did not have MRI of the shoulder, may have had a significant number of asymptomatic rotator cuff tears, and the odds ratios tent do slightly underestimate potential risk factors for supraspinatus tendon tears

Comments:

- The major liability of the study, as with most studies of work-related musculoskeletal conditions, is the reliance on self-report for measurement of exposure
- The categories of exposure depended on the tertiles of exposure in the exposed controls, with increasing numbers of cases in each increasing level of exposure, in contrast to the equal numbers of control subjects in the successive tertiles of exposure; although very crudely defined, a dose-response relationship is apparent with higher exposures leading to increasing numbers of cases of supraspinatus tears
- The second logistic regression model illustrates the degree to which the three exposures are correlated with one another; the odds ratios are considerably lower in this model due to the fact that carrying and working above shoulder level often go together in a particular job
- The controls were selected from the source population of the cases, and appear to have been selected in a manner which is parallel to the selection of the cases; this

means that the odds ratios estimated by the logistic regression model do not require the “rare disease” assumption of some case-control studies

- A 20 kg load equals 44 pounds, and is a fairly heavy load; this is an amount of lifting that is likely to be present in a small proportion of all physically active jobs
- The outcome of supraspinatus tears was confirmed by MRI, which is one advantage of this study over other studies which may not have a confirmation of the diagnosis

Assessment: adequate for some evidence that jobs requiring heavy lifting, heavy carrying, above-shoulder work, and handheld vibration, are likely to be associated with an increased risk of symptomatic supraspinatus tendon lesions, either partial or full thickness tears