Occupational exposure to organic solvents as a cause of sleep apnoea

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Abstract

A high prevalence of sleep apnoea was found in a group of men occupationally exposed to organic solvents. Workers with long term exposure to organic solvents often report symptoms such as fatigue, forgetfulness, and concentration difficulties. These symptoms are strikingly similar to those reported by patients with obstructive sleep apnoea syndrome (OSAS). This is a frequently diagnosed disorder characterised by disturbed sleep causing psychic or somatic complications and daytime sleepiness. A study was undertaken to evaluate whether people with long term occupational exposure to organic solvents have a higher prevalence of sleep apnoea than the general population. Patients exposed to solvents (66 men) were invited to participate in a screening for sleep apnoea. A static charge sensitive bed was used for the monitoring of respiration movements and pulse oximetry during one night. A classical sleep apnoea was diagnosed if periodic respiration movement exceeded 45% of estimated sleep time and the oxygen desaturation index exceeded 6. The prevalence of sleep apnoea among the men exposed to solvents was compared with the prevalence in the general population (1-4%). The prevalence among the participating exposed men was 19.7% which gave a conservative relative risk estimate of 14.1 (95% confidence interval 7.5-24.2). The results indicate that exposure to organic solvents causes sleep apnoea. An alternative possibility is that people with sleep apnoea are misdiagnosed as cases of solvent induced toxic encephalopathy. The interpretation has importance for the caring of the patient.

Occupational exposure to organic solvents might cause acute and chronic effects on the central nervous system. Chronic effects, for instance, toxic encephalopathy, have been recognised for many years as an occupational disease in the Scandinavian countries. During recent years chronic effects have also been reported from other countries. Workers with long term exposure to organic solvents often report symptoms such as fatigue, forgetfulness, and concentration difficulties. These symptoms are strikingly similar to those reported by patients with sleep apnoea. The obstructive sleep apnoea syndrome (OSAS) is a frequently diagnosed disorder that is characterised by loud snoring and repeated upper airway obstructions during sleep that cause psychic or somatic complications. Patients with OSAS usually have disturbed sleep and complain of daytime sleepiness. Most patients with OSAS are obese, and sometimes there is a specific cause of OSAS predisposing to a narrowing of upper airways. Several studies have suggested a comorbidity between habitual snoring, OSAS, and vascular diseases. A high occurrence of sleep apnoea is reported in various diseases of the central nervous system, such as senile dementia of the Alzheimer type, brain stem disorders, as a sequel after encephalitis, and after head trauma, as well as diseases of the autonomic nervous system. There is also a slight increase in the number of sleep apnoeas with advancing age and among patients with hypothyroidism. In three studies exposure to organic solvents has been implicated as a possible cause of sleep apnoea. This study was undertaken to evaluate whether people with long term occupational exposure to organic solvents have a higher prevalence of sleep apnoea than the general population.

Material and methods

The study group comprised all patients from Koppárberg county occupationally exposed to solvents and referred to the Department of Occupational Medicine in Uppsala during 1984 to 1988; in total 66 men. We sent a questionnaire to

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their home addresses, regarding sleep problems and an invitation to participate in a sleep apnoea screening at the Department of Medicine, Avesta Hospital.

The medical history, body mass index (BMI), and blood pressure was recorded for each man. We used a static charge sensitive bed for the monitoring of respiration movements and pulse oximetry during one night. The respiration movements were recorded on paper, and the number of pathological recordings calculated. A pathological sleep recording was defined as more than five apnoeas a night. If periodic respiration movement exceeded 45% of estimated sleep time and the oxygen desaturation index exceeded 5 the recording was classified as a classical sleep apnoea.

The prevalence of sleep apnoea among the men exposed to solvent was compared with the prevalence in the general population, obtained from an epidemiological study of the prevalence of sleep apnoea syndrome among Swedish men in the age group 30 to 69.

Results
Of the 66 men, 59 (89%) answered the questionnaire and 34 (52%) took part in the screening study (fig 1). The mean age for the participants was 53 and mean exposure time to solvents was 24 years. Corresponding figures for the non-participants were 49 and 21 years respectively. Of the 34 men, 25 had pathological sleep recordings, and only nine (14%) were normal. Of those with pathological recordings, 13 had a classical sleep apnoea (fig 2). This gave a prevalence of 19.7% among the entire study group of 66 men, assuming the non-participants had normal sleep recordings. The apnoeas were of the obstructive type. The BMI was 26.0 among those with normal sleep recordings, 27.5...
among those with OSAS, and 25.5 among those with pathological sleep recordings but no OSAS. There was no difference in mean blood pressure between the three groups.

The prevalence in the general population of Swedish men of the same age group is 1.4%. As the prevalence among the exposed men was 19.7% the conservative relative risk estimate was 14.1 with a 95% confidence interval (95% CI) of 7.5–24.2 (fig 3).

Further analyses of exposure time showed a relative risk for sleep apnoea of 1.3 (95% CI 0.3–4.6) for those exposed for 20 years or more, compared with those with less than 20 years of exposure. No man with less than 10 years of exposure experienced sleep apnoea.

Discussion

A high prevalence of sleep apnoea was found in a group of men occupationally exposed to organic solvents. This might indicate that exposure to organic solvents causes sleep apnoea. An alternative possibility is that people with sleep apnoea are mis-diagnosed as cases of solvent induced toxic encephalopathy.

The study group comprised patients referred to the Department of Occupational Medicine in Uppsala, due to occupational exposure to organic solvents. This might have entailed a selection bias and decreased the internal validity of the study. Although most of the men were referred on the basis of symptoms such as fatigue, forgetfulness, and concentration difficulties, none of the patients were referred due to a suspicion of a sleep apnoea syndrome. It might be argued that if the doctor had diagnosed a possible sleep apnoea syndrome, the patient would have been referred to another department. This might actually lead to an underestimation of the true prevalence among the exposed people in our study.

The single factor most commonly associated with OSAS is obesity.5 The BMI in our study did not, however, show any statistically significant difference between the men with pathological sleep recordings and those with normal sleep pattern. Although there was a somewhat higher BMI in the group with OSAS, the difference was too small to explain the increased prevalence. Neither was there any difference between the groups for blood pressure; nor were there clinical signs of hypothyroidism. We therefore believe that the most common and recognised causes of OSAS can be ruled out as explanations for our results.

In evaluating exposure to organic solvents as a cause of OSAS, assessment of exposure must be accurate. In this study we had access to histories of

![Figure 3 Prevalence of sleep apnoea among Swedish men and the study group.](image-url)
Occupational exposure to organic solvents as a cause of sleep apnoea


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