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Wood dust exposure and risk of sinonasal cancer development

Alicja Ozga^{1a}, Aleksandra Obuchowska^{1b}, Justyna Wójcik^{1c},
Arkadiusz Standyło^{1d}, Karolina Obuchowska^{1e}

^a aozga1@gmail.com; <https://orcid.org/0000-0003-1291-905X>

^b aobuchowska12@gmail.com; <https://orcid.org/0000-0003-0464-2695>

^c justynawojcik455@gmail.com; <https://orcid.org/0000-0001-7163-6784>

^d a.standylo@gmail.com; <https://orcid.org/0000-0002-5154-4759>

^e karolinaobuchowska99@gmail.com; <https://orcid.org/0000-0003-4519-8236>

¹ Student research group by the Department of Otorhinolaryngology and Oncological Laryngology, Medical University of Lublin

Corresponding author:

Alicja Ozga

Student research group by the Department of Otorhinolaryngology and Oncological Laryngology, Medical University of Lublin

Jaczewskiego 8 Street

20-954 Lublin, Poland

e-mail: aozga1@gmail.com

Abstract

Introduction:

The incidence of sinonasal cancers (SNCs) is quite rare; they contribute to 0,16% of all malignant tumors and to 3% among head and neck cancers. The survival rate remains poor - it is 59.5% for 5 years. The two most common subtypes are squamous-cell carcinoma (SCC) and adenocarcinoma (ADC). Both subtypes of SNC are associated to occupational exposures. Main risk factors for SNC include chemical components, wood and textile dusts, nickel and chromium, welding fumes. Thus, people doing particular jobs are at higher risk of SNC.

Purpose:

Evaluation of the influence of wood dust on SNCs development.

Materials and methods:

We performed a database research using Pubmed, Google Scholar, Springer Link and ResearchGate and we made review and meta-analysis of relevant studies. We searched for studies analyzing the relationship between wood dust and sinonasal cancer incidence.

Results:

Studies have shown that the risks of SNCs were great for workers in wood-related jobs, especially cabinetmaking, carpentry or joinery. There was a strong correlation between ADC incidence and wood dust, however the morbidity for SCC was also high.

Conclusions:

SNCs development is related to the occupational exposures. People engaged in jobs associated with wood processing are at great risk. Proper ventilation and protection is necessary while doing wood-related jobs.

Key words: wood dust; nasal sinus carcinoma; occupational exposure; ADC

Introduction:

SNCs are sinonasal cancers affecting nasal cavity and sinuses (mostly maxillary and ethmoid). The incidence of sinonasal cancers (SNCs) is quite rare; they contribute to 0,16% of all malignant tumors and to 3% among head and neck cancers¹. The two most common subtypes are squamous-cell carcinoma and adenocarcinoma.

The course of the disease can be initially asymptomatic and symptoms are often shown in advanced disease. They can include obstruction of the nasal cavity, epistaxis, trismus, lacrimation, facial paresthesia, pain (for instance headaches) and many others. The initial asymptomatic course leads to diagnosis in advanced stages, where the prognosis is worst than at earlier stages². The overall prognosis is rather poor - 5-year survival rate is about 59.5%³.

The risk factors predisposing to SNCs development are various; they include chronic sinusitis, chemical substances, cigarette smoke, nickel, mineral oils, chromium, welding fumes, asbestos and also wood dust. It was stated that SNC have occupational etiology and is linked to specific jobs.

Wood belongs to the most important resources in the world that are renewable. Wood dust is a waste product arising during wood processing. Wood can be differentiated into two types, accordingly to the species of tree – hardwood (from deciduous trees) and softwood (from conifers). Both of them are used in wood industry. It was classified by the IARC (International Agency for Research on Cancer) as a definite human carcinogen in 1995, however the influence of wood dust on human health, besides cancer, includes allergy, dermatitis, chronic bronchitis⁴, rhinitis, conjunctivitis, allergic respiratory effects⁵. The exposure to wood dust varies among populations

The influence of wood dust on health is not only related to the dust itself, but also to chemical components of wood and chemical compounds used while wood processing. They involve phenols, flavonoids, alkaloids, glycosides; resins, essential oils, latex, rubber, turpentine; preservative substances, moulds or various bacteria.

Purpose:

Evaluation of the influence of wood dust on SNCs development.

Materials and methods:

We performed a database research using Pubmed, Springer Link and ResearchGate and we made review and meta-analysis of relevant studies. We searched for studies analyzing the relationship between wood dust exposure and incidence of sinonasal carcinomas.

Results

Many studies assessed the risk of SNC among woodworkers. A first study that reported high incidence of nasal cancers among woodworkers was conducted by Macbeth long time ago⁶. Since then, many other researches and cohort studies were performed to prove the relationship between SNCs and wood dust exposure, which was estimated as a carcinogen and finally classified in 1995 by the IARC (International Agency for Research on Cancer).

SNCs are known as "occupational tumours". It was stated that health causes depend on the amount and time of the exposure to wood dust. The highest exposures (5 mg/m³) were reported in cabinet manufacture and furniture industry⁷.

Studies have shown that wood dust increases the risk of SNCs, especially for adenocarcinoma. The occurrence of ADCs is firmly linked to the work done, especially in factories joinery and carpentry work as well as cabinet making and furniture factories⁸.

An Italian research displayed the relationship between ever exposure to wood dust and ADCs occurrence and assessed the risk as OR=58.6; the risk for ADC doubled every 5 years of cumulative exposure time, showing the association between dose and response⁹.

Also, a Swedish study of occupational groups showed that risk for adenocarcinoma was very high for woodworkers and depended on the exposure time, when there was a combination of softwood and hardwood¹⁰.

An increased risk for ADC was proven in a French study by Luce D et al. The risk of the tumor was the greatest for workers in wood-related jobs, as cabinetmakers (OR= 35.4, 95% CI= 18.1-69.3), wood-working machine operators (OR = 7.4, 95% CI = 3.4-15.8) and carpentry and joinery (OR = 25.2, 95% CI = 14.6-43.6), however the risk of SCC was also high (OR = 8.1, 95% CI = 1.3-50.3)¹¹.

A study from Finland proved that workers exposed to wood dust and other chemical substances (in this case formaldehyde) are at greater risk of SNC (SCC) - (RR = 1.98, 95% CI: 1.19-3.31)¹². Another cohort study, performed by EH Rang included 5371 men who had worked in furniture factories. In this study, a linkage between dustiness of work and cancer incidence was found¹³. Jobs were classified as “very dusty”, meaning cabinet and chair makers, wood machinists and sanders; “dusty” including polishers and maintenance men and “less dusty” for upholsterers and office workers. As a reference, they used the general population of Oxford. At the end of the research, they investigated 8 cases of adenocarcinomas, among which 7 cases affected workers in jobs classified as “very dusty”; there were no cases in “less dusty” jobs.

A research conducted by Emanuelli E compared 32 cases of adenocarcinoma with 21 cases of non-adenocarcinoma epithelial tumors for circumstances of exposure in wood and shoe industry¹⁴. Both non-occupational factors (sex, tobacco smoking, age, allergy) and occupational factors (like exposure intensity, wood type) were included. The reference group for all analyses consisted of patients never exposed. Results have shown that adjusted OR was higher (22.5) where the degree of protection against wood dust was low and lower (9.37) if the degree was high. The OR for hardwood was 33.8 and increased the risk of ADC.

Discussion

Sinonasal cancers are quite rare neoplasms in general population. They can occur initially as asymptomatic, displaying symptoms later; thus are usually diagnosed at advanced stages. There are many occupational risk factors predisposing to SNC; they include chemical substances, such as formaldehyde or nickel, smoking tobacco, welding fumes, wood and textile dusts.

Wood dust is a by-product arising while wood processing. The exposure to sawdust vary among populations, however the most exposed are workers in wood furniture, cabinetmaking, sawmills, joinery shops, carpentry, logging etc. High incidence of SNC was observed in wood-related jobs by many authors. Thus, many studies stated that SNCs development and incidence are related to exposures to wood dust and chemical substances arising during wood processing.

Researches show that there is a clear correlation between exposure to wood dust and SNC development. The data about relationship between histological subtype and type of wood/time of exposure/job type is limited, however we can state that ADC is strongly linked to wood dust exposure.

Wood dust was classified officially as a carcinogen in 1995 by IARC (International Agency for Research on Cancer). However, studies display a wide influence of sawdust on human health, except cancer development. Health causes of being exposed to wood dust include bronchitis, various allergy reactions, asthma, dermatitis and many others.

Conclusions

To conclude, wood dust is one of the carcinogens and working in industries processing wood is slightly related to the probability of SNC development¹⁵. There are differences in risk that depend on the intensity of exposure to the carcinogen and by type of wood dust, however it was presented that adenocarcinomas are strongly correlated with occupation to wood particles. Many studies have presented the relationship between sawdust exposure and woodworkers suffering from SNC. It seems that working in wood-related jobs requires proper ventilation and usage of relevant protective equipment in order to minimize the SNC risk.

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