

ALLERGIC ALVEOLITIS IN WORKERS EXPOSED TO MOULDS

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The prevalence and incidence of allergic alveolitis were studied among farmers from the central (n = 500) and northern (n = 3000) part of Sweden. Acute attacks of fever and malaise as well as cough were found in 10—20 per cent of the population studied. Few persons had manifest clinical signs or symptoms of the disease. Precipitating antibodies against common antigen panel were found only in a few farmers. Farmers with the symptoms of allergic alveolitis had higher spore counts in the individual breathing zone than those without the symptoms. Possible causative mechanisms and preventive measures are discussed. The results from a group of persons exposed to mouldy wood chips are also described.

Inhalation of spores from mould can cause an allergic inflammation of the lung, known as exogenous allergic pneumonitis. Other commonly used names for this disease are farmer's lung or wood-trimmer's disease. Other mouldy material is found in sawmills where wood chips are used for heating purpose and in organic material from certain birds as in the case »pidgeon breeders' disease«.

Farmer's lung has been known as a disease since the early 1930 and was described by *Campbell* in England (1). The immunological mechanism of the disease was studied in England by *Pepy's* group who in 1962 identified precipitating antibodies in the serum against extract from mouldy hay in patients with farmer's lung (2).

Clinically, the disease can be classified into three forms: a) acute: 4—6 hours after exposure an influenza-like disease with fever, shivering, dry cough, dyspnea and malaise develops. Mostly the symptoms fade away in 24 hours. b) chronic: a disease which occurs after repeated exposure

to moulds. Clinically, the patient feels tired, dyspnoic and sometimes with a non-productive cough, nausea and weight loss. c) subacute: the symptoms mimic chronic bronchitis with cough and sometimes there is an acute attack with fever as described above.

The diagnosis of farmer's lung in its acute form is made on the basis of the medical history, lung function tests and lower oxygen tension as a sign of reduced gas exchange.

A positive reaction of precipitating antibodies against certain types of moulds (*Micropolyspora faeni*, *Thermoactinomyces vulgaris*) may occur. Spirometry mostly shows restrictive lung changes, but signs of obstruction (FEV_{1.0} decrease, closing volume increase) can also be present. X-ray of the lungs in the acute stage shows bilateral infiltrations. In severe cases of the disease, a lung biopsy shows granuloma with giant-cells and lymphocyte infiltration.

Epidemiological studies among farmers showed farmer's lung prevalence to be 2-8% in Scotland (3, 4) and 4% in Finland (5, 6). Other antigens in the »wood-trimmer's disease« were first described by *Wimander and Belin* (7). The mouldy material often contains *Aspergillus fumigatus*, *Paecilomyces species* and *Rhizopus*. In sawmills the disease often develops under poor wood drying conditions.

As a consequence of the rising oil price, in Sweden wood chips are increasingly used for heating purposes. There is no knowledge of a connection between the development of allergic alveolitis and this fact; hence a prospective study has been started in collaboration with one of the co-authors (Göran Blomqvist) and Leif Rosenhall MD, Lung Clinic, Region Hospital, Umea. Some preliminary data are presented here.

SUBJECTS AND METHODS

Postal questionnaires were sent to 512 farmers in Dalecarlia of whom 440 responded (86%). After stratification of samples, 92 farmers were interviewed by an industrial nurse or a doctor and blood samples were taken for estimating precipitating antibodies (IgG and IgE). Lung function tests, spirometry, gas exchange and exercise with blood gases estimated were performed in 56 persons. Spore and bacteria estimation was performed in 22 samples of mouldy hay and mouldy corn.

Postal questionnaires were sent to another group of 3000 farmers in northern Sweden (counties X, Y, Z) and answers were received from 70% of them. In a stratified sample, about 400 persons were clinically interviewed by doctors with a response frequency of 77%. From the same persons blood samples for precipitating antibodies were taken and prick tests to common allergens performed.

Postal questionnaires were sent also to 50 wood chip producers (sawmills and heat production plant). Blood samples for precipitating antibodies were taken from 20 of these persons.

For estimating moulds air samples from the workers' breathing zone were taken by sucking one litre of air per minute for 10 minutes through a Nucleopore filter. A method of direct counting of total number of spores was used. The spore material was coloured with a fluorescein dye.

Among the wood chip handlers mould estimation was done with a technique described by *Blomqvist and co-workers* (8), where viable spores were counted and cultivated for species estimation. IgG antibodies were determined by Lars Belin MD, Gothenburg, who used double diffusion gel technique by Ouchterlony.

RESULTS

Smoking frequency in the farming group was in both studies very low, around 20-30%. Among wood chip handlers it was 48%, a figure comparable to other male industrial populations in Sweden.

In the farmers most symptoms developed from handling mouldy barley, sometimes from contact with mouldy hay, and also from handling mouldy hay with mites.

The results from the 22 farms tested show that non-symptomatic farmers have very low spore counts. Spore counts up to 10^6 per litre air were found in persons with symptoms. The spore count was estimated as number of spores per litre air. The preliminary results from the study in the northern part of Sweden show sometimes a spore content as high as 10^9 spores per litre. In wood chip handling the results vary: 10^2 - 10^7 spores per m^3 or 10^3 - 10^6 viable colonies per m^3 .

The results from the Dalecarlia study with blood samples taken from 92 farmers only show a positive reaction in three cases and not with the conventionally used antigen panel of *Micropolyspora faeni* (*M faeni*) and *Thermoactinomyces vulgaris*. The three positive reactions occurred against *Aspergillus* and *Alternaria*: in a farmer with suspect lung fibrosis, in a wood chip handler with an acute fever reaction and in an asymptomatic person.

As other allergic mechanisms could occur we also estimated the IgE antibodies towards hay mites and got four positive antibody reactions towards hay mites from the 92 farmers from whom blood samples were drawn.

In one fifth of Dalecarlia farmers cough was a characteristic symptom, but chronic bronchitis as defined by the British Medical Research Council was found only in 5% of them and wheezing in every tenth farmer. One fifth of the farmers had attacks of fever, malaise and dry cough.

Of the farmers from the northern part of Sweden around 10% had had attacks of fever, and a similar percentage complained of both, fever and wheezing. By interviewing, cough was found in every fifth far-

mer, classical chronic bronchitis in 8% and clinical asthma in about 2% of the farmers. Half of the group had no symptoms and fewer than 1% were hospitalized due to a respiratory disease.

Exercise test, spirometry and diffusing capacity test showed work incapacity or signs of a chronic disease in only four patients out of 56 tested in the Dalecarlia study, thus a rather low figure.

The preliminary results from 50 wood chip handlers showed that positive precipitating IgG antibody test was extremely rare. The only positive precipitin antibody reaction was against *Penicillium*.

The results from a population of farmers from the very north of Sweden using wood chips for heating purposes sometimes show a reaction to *Aspergillus fumigatus*, *Cladosporium* and *Botrytis* as well as to *Penicillium*.

About 30% of wood chip handlers had had attacks of fever, nausea, non-productive cough and shivering. Wheeze was found in 10%. Morning cough of non-productive type was a very frequent finding. The rate of productive cough was 20%. Classical chronic bronchitis was found in 5% of the workers. The common frequency of chronic bronchitis in the general population in this region is 1.5%.

Finally, it must be pointed out that the heat production plants have been in operation for a rather short time, so that exposure for many of the workers does not exceed 1-2 years. Even if the frequency of febrile attacks in the questionnaire is reported to be about 30%, it is doubtful if these are really allergic reactions as the symptoms are known to occur immediately after exposure and not after a latency period of 4-8 hours.

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Sažetak

ALERGIJSKI ALVEOLITIS U RADNIKA IZVRGNUTIH PLIJESNIMA

Autori iznose neke podatke o incidenciji i prevalenciji alergijskog alveolitisa između 500 poljoprivrednika središnjeg dijela zemlje i između 3 000 poljoprivrednika iz sjevernih područja Švedske. Samo je po nekoliko ispitanika imalo manifestne znakove bolesti premda je 10—20% među svim ispitanicima imalo groznicu i loše se osjećalo u pojedinim razdobljima. Precipitirajuća antitijela na uobičajene alergene nađena su u malenom broju ispitanika. Oni radnici koji su imali znakove alergijskog alveolitisa imali su u zraku što su ga udisali veći broj spora od onih koji nisu imali znakova bolesti.

Autori također upozoravaju na rastući problem ekspozicije plijesnima u profesiji drvosječa, s obzirom na to da se zbog energetske krize sve više upotrebljavaju drveni otpaci i piljevina za loženje. Međutim, do danas ima malo podataka o ovom tipu ekspozicije jer je problem tek nedavno uočen.

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