Scientific support programme on worker health protection (1999-2003)

OCCUPATIONAL ASTHMA IN BELGIUM

(SYNTHESIS)

Coordinator

Prof. B. Nemery
K.U.Leuven - Laboratorium voor Pneumologie
Herestraat 49, 3000 Leuven
tel 016.347121 - fax 016.347124
e-mail ben.nemery@med.kuleuven.ac.be

Other members of the network

Prof. R. Pauwels, UZ Gent, De Pintelaan 185, 9000 Gent
Prof. D. Piette, ESP-ULB, Route de Lennik 808, CP596, 1070 Bruxelles
Prof. O. Vandenplas, Cliniques Universitaires de Mont-Godinne, 5530 Yvoir

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Asthma, occupational asthma, epidemiology, experimental research, prevention

Introduction

Occupational asthma is the principal cause of respiratory disease caused by work in industrial countries. More than 200 biological and chemical agents that may be found in the workplace are capable of causing occupational asthma by immunological or toxic mechanisms. New technologies will probably lead to a further increase in the number of asthmogens.

A considerable number of important questions remain to be solved in relation to this modern occupational disease, such as the epidemiology, the socioeconomic consequences, the pathophysiology and the prevention.

a. Epidemiology of occupational asthma in Belgium.

There is no accurate information about the prevalence and incidence of occupational asthma in Belgium. A first aim of this project was, therefore, to assess the incidence of occupational asthma by organizing a national surveillance programme, based on voluntary reporting of new cases of occupational asthma by pulmonologists, allergologists and occupational physicians.

b. Individual socioeconomic consequences of occupational asthma.

Occupational asthma leads to substantial socioeconomic consequences for both the affected individual and for society. In Belgium, as in other countries, the compensation of the victims of occupational asthma is often insufficient. This is largely because the disease does not usually lead to major functional impairment,

which results in low financial compensation, although the social consequences may be huge (loss of employment). In addition, no compensation exists for self-employed workers, although some categories of self-employed have a high risk of occupational asthma (bakers, farmers and horticulturalists, woodworkers, spray-painters, hairdressers).
In this project the socioeconomic impact of occupational asthma was assessed in a group of victims of occupational asthma.

c. Pathophysiology of occupational asthma.

The mechanisms and risk factors leading to allergic sensitization, airway inflammation, and clinical manifestations of (occupational) asthma are still largely unknown. Relevant issues include the role of inhaled irritants, the identification of chemical respiratory sensitizers and the possible role of dermal sensitization. These questions were addressed by performing experimental studies in animal models.

d. Behaviour of youngsters at risk of occupational asthma.

Various social models and concepts were used to assess the possible influence of individual behavioural factors on the risk perception and adoption of a preventive behaviour among students from technical or vocational schools. Students at possible risk of occupational asthma were studied in their last year of education and in the next years, i.e. at the onset of their career.

Implementation of the project

The epidemiological studies (a/ epidemiology of occupational asthma and b/ socioeconomic consequences of occupational asthma) were conducted by the team of Prof. O. Vandenplas, Service de Pneumologie, Cliniques Universitaires de Mont-Godinne, Université Catholique de Louvain.

The experimental studies (c) were performed by the team of Prof. B. Nemery, Onderzoekseenheid voor Longtoxicologie, Laboratorium voor Pneumologie, Katholieke Universiteit Leuven, on the one hand, and by the team of Prof. J. Kips (until 2001) en Prof. R. Pauwels, Dienst Longziekten, Universiteit Gent, on the other. The former team concentrated on occupational asthma caused by low-molecular-weight chemicals, whereas the latter team concentrated on asthma caused by allergy to high-molecular-weight agents.

The study of risk perception in youngsters was conducted (d) was carried out by the team of Prof. D. Piette, Unité de Promotion et Education à la Santé, Ecole de Santé Publique, Université Libre de Bruxelles.

The overall coordination of the project was done by B. Nemery (K.U.Leuven).

a. Epidemiology of occupational asthma in Belgium (UCL)

Methods
Pulmonologists and occupational physicians were contacted through their respective professional associations to report (anonymously) all new cases of occupational asthma by means of standard form during the period of 2000 to 2002. Relevant personal, occupational and clinical data were collected. The incidence of occupational asthma was calculated based on the total active workforce in 1999, per gender, age category and region.

Results
During the three years of the scheme, 283 new cases of occupational asthma were reported, including 260 cases of allergic asthma and 23 cases of irritant-induced asthma.
Based on these data, the yearly incidence of occupational asthma was calculated to be 23.5 cases per million active workers. The incidence did not vary according to gender or age, but it did differ between Flanders (17.5 cases per million active workers) and Wallonia (38.6 cases per million active workers). The most frequently mentioned causes were isocyanates (17%), flour (13%) en natural latex (10%). The most frequently affected occupations were bakers (12%), health care workers (8.5%), painters (6%), cleaners (6%) and hairdressers (5%).

Discussion
The main limitation of such data relates tot o the voluntary reporting by pulmonologists and occupational physicians. This undoubtedly leads to a major bias. The obtained figure of 23.5 cases per million active workers is, therefore, likely an underestimate of the true yearly incidence of occupational asthma. Participation in the reporting scheme was incomplete and this probably largely explains the difference between Wallonia and Flanders. Moreover, because the diagnosis of occupational asthma is often overlooked, even by specialists, but even more so by general practitioners, many cases of occupational asthma were probably never reported. On the other hand, it should be acknowledged that not all reported cases were necessarily true cases of occupational asthma, since the diagnosis did not have to be documented by objective means.
Despite these limitations, the incidence figure obtained for Belgium is of similar magnitude as the incidence figures derived by the same methodology in other countries. However, the figure is higher than that derived from data from the Fund for Occupational Diseases, thus suggesting that not all cases of occupational asthma are reported to this Fund. One of the reasons for this is that occupational asthma may also affect self-employed workers.
This part of the project is being complemented by a study of all applications (> 2500) made for occupational asthma in the Fund for Occupational Diseases between 1987 and 1999.

Conclusion
Despite methodological limitations, this voluntary notification project has led to a better knowledge of the epidemiology of occupational asthma in Belgium. This should contribute an improved primary and secondary prevention of this important occupational disease.

b. Socioeconomic consequences of occupational asthma (UCL)

Methods
The socioeconomic consequences of occupational asthma were assessed in a group of 186 patients who had undergone a specific bronchial provocation test. A questionnaire was used to evaluate the job situation and earnings and determinants of unemployment and financial loss were assessed by logistic regression analysis.

Results
Out of the total group, 157 patients (87%) participated in the follow-up study with a median of 43 months after the diagnosis. Of these subjects, 86 (55%) had occupational asthma confirmed by a specific bronchial provocation test, whereas the other subject were considered to have "work-aggravated asthma".
In the group with proven occupational asthma, only 62% were still employed and in the other group the proportion was even lower (54%). The risk to be unemployed was mainly associated with age and low education and not the severity of the asthma. A substantial proportion of victims were still exposed to the causal agent. Only a small minority (5%) had benefited from an occupational rehabilitation.
Approximately two thirds of subjects in both groups reported a financial loss, this being substantial for half the patients, particularly in the case of job loss. The median loss of earning amounted to 22%. Compensation from the Fund for Occupational Diseases made up for the loss of earning in only a small minority of victims.

Conclusion
This study in a selected group of patients with occupational asthma demonstrates that the socioeconomic consequences of this disease are usually substantial. This has important implications for the recognition, compensation and rehabilitation of these victims.

c. Pathophysiology of occupational asthma (KULeuven & UGent)

Methods
This research was carried out in mice.
The KULeuven team developed a mouse model of occupational asthma, whereby the animals are first sensitized via the skin against a test chemical (mainly toluene diisocyanate, TDI) and then they receive the same agent via the airways. The endpoints studied include functional parameters (ventilatory function, non-specific airway responsiveness to methacholine) by means of non-invasive body plethysmography, on the one hand, and inflammatory parameters (inflammatory cells and mediators) in bronchoalveolar lavage, lung tissue and lymph nodes, on the other. The model was validated by testing various concentrations of TDI and various time intervals. The mechanisms were investigated by measuring relevant immunological parameters.
The UGent team used a validated ovalbumin asthma model in the mouse to study the interaction between exposure to cigarette smoke and the development or persistence of allergic airway inflammation.

Results
A protocol to reproduce the main characteristics of human asthma was successfully developed in the mouse. This mouse model involves the application of TDI (0.3%) on

the skin of the ears on days 1 and 7, and then the intranasal instillation of TDI (0.1%) on day 10. This leads to an early ventilatory response with characteristics of airway obstruction. The day after the instillation there is an enhanced response to methacholine and pulmonary inflammation, mainly by neutrophils. These reactions only occur in animals that have been previously sensitized by TDI on the skin and they do not occur in SCID mice, which are devoid of lymphocytes. The immunological studies have indicated that in the draining lymph nodes the pattern of activation of lymphocytes has characteristics of both T_{H1} and T_{H2} type activation. The experiments with cigarette smoke demonstrated that cigarette smoke stimulates both the sensitization process and the chronic airway inflammation. Simultaneous exposure to cigarettes and aerosolized allergen leads to sensitization and typical allergic airway inflammation even without the need for the use of adjuvant. Exposure to cigarette smoke after sensitization has an additive effect on the inflammation and the increase in bronchial hyperreactivity.

Conclusion
The research on experimental animals has led to the development of a satisfactory mouse model to investigate the pathophysiology of occupational asthma. The model still needs refinements, e.g. to reproduce the persistent character of the disease. The model offers the possibility of identifying potential asthmogens before their industrial use. This should contribute to a better prevention of chemical-induced occupational asthma.
The studies of the interaction between allergen exposure and smoking are also important in relation to the pathogenesis of occupational asthma because exposure to allergens and irritants or particles (for which cigarette smoke is a relevant model) is frequent in the workplace.

d. Attitudes of youngsters towards the risk of occupational asthma (ULB)

Methods
In this part of the project, young people were studied in the last year of their education in relation to their perception and attitudes towards occupational risks.
In a preliminary phase a qualitative study was performed by means of focus groups in vocational schools in Brussels. Eleven classes (115 students) from the penultimate year in the hairdressing, woodworking, bakery and sales sections took part.
Later a longitudinal study was started among students in the last year of these same sections (+ butchers). The participants received a self-administered questionnaire with questions on sociodemographic parameters, respiratory complaints and their perception of occupational risks, their perceived susceptibility for these risks, and their intention to adopt a preventive behaviour. The same questionnaire was administered again after leaving school, i.e. in the beginning of their career. A CD-ROM on occupational health risks for use in technical and vocational schools was also developed and evaluated.

Results
The preliminary study revealed that young people are regularly confronted with occupational risks but these risks are not always addressed sufficiently and adequately during their education.
Five hundred and thirty three students were included in the initial cross-sectional survey. This showed that students in jobs at high risk of occupational asthma are

slightly more aware of occupational risks than those without such risk (62% vs 52%), but the degree of their won risk perception and certainly their intention to adopt a preventive behaviour are low. It was also notable that a substantial proportion of students already report respiratory complaints, including asthma, before and during their education to become bakers or hairdressers.
Out of the initial cohort, 223 subjects could be evaluated again during their professional life. The analysis of these data is still ongoing, but it appears from this follow-up that the risk of reporting new respiratory symptoms is higher among those who already reported such symptoms in the baseline study. The risk perception and intention to adopt a preventive behaviour increase slightly in the high risk jobs.

Conclusion
From this sociological and epidemiological study it may be concluded that there is a need for education about occupational health risks during and after the technical and vocational education. The CD-ROM that was developed for this purpose appeared to be a useful learning tool.

General conclusion

So far, the studies that were done thanks to this project have led to the completion of two doctoral theses, a large number of scientific communications at national and international meetings, and numerous publications in the international scientific literature.

Through this multidisciplinary project significant progress has been made towards the epidemiology of occupational asthma and its socioeconomic consequences in Belgium, the pathophysiology of occupational asthma, and the sociological determinants of the prevention of this disease in high-risk jobs. Although the impact of this research for health policy is difficult to gauge, there is no doubt that the participants in this project are involved directly and indirectly in national and international initiatives in the fields of asthma, occupational asthma, prevention and health promotion.