

Occupational allergic rhinitis in Finland

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Summary. Between 1980 and 1987 a total of 166 patients were diagnosed as having occupational (mostly allergic) rhinitis at the Institute of Occupational Health. This is about 20% of all the diagnosed cases in Finland. The most common causes were: flour (50 cases), wood dust (30 cases), animal epithelia (19 cases), and natural fibers, mainly cotton (19 cases). Between 1981 and 1987 the number of cases of occupational rhinitis in all of Finland more than doubled (from 61 to 128 cases per year), and in 1991 a total of 319 cases were detected. This was mainly due to the increase in rhinitis caused by animal epithelium and flour dust, which were then the most common causes of occupational rhinitis in Finland. This increase, in turn, was based on changes in the Finnish legislation, which in 1982 was extended to cover farmers. Other causes of the increase were probably the increased awareness of the public and health personnel, but a true increase in occupational rhinitis cannot be excluded.

Key words: Skin tests – Radioallergosorbent tests – Flour dust – Animal epithelium – Low-molecular-weight chemicals

Introduction

Very limited data exist on the statistics and epidemiology of occupational allergic rhinitis. In Finland, statistics on occupational diseases have been compiled by the Finnish Institute of Occupational Health (FIOH) since 1975. Statistics on new cases of occupational diseases are published annually [13]. The present report covers all the cases of occupational allergic rhinitis diagnosed at our Institute between 1980 and 1987 (about 20% of all cases in Finland) and all the cases reported to the Register in Finland during 5 selected years in the period 1981–1991.

Materials and methods

Patients investigated at the Institute of Occupational Health, Helsinki

Patients are sent to the clinic by otolaryngologists, specialists in industrial medicine and other disciplines, and insurance companies.

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All patients were investigated by the same otolaryngologist (E.V.).

In most cases a nasal provocation test was carried out prior to the diagnosis of occupational rhinitis (OR). Other laboratory tests were performed to confirm the diagnosis of OR (which was allergic in nature in most cases). These tests included skin prick tests, specific IgE (RAST) tests, and RAST inhibition tests; they were performed as previously described [7–10]. The diagnosis of OR has to be in accordance with the Finnish legislation, which mainly covers allergic rhinitis. However, in some cases in which the mechanism could not be verified, patients have nevertheless been compensated.

Nasal provocation tests. Provocation tests were performed either in a chamber as used for lung provocation [5, 9] or by applying the allergen to the nasal mucosa as follows: A small piece of cotton wool (diameter 1–2 mm) was impregnated with a small amount of the test material, together with physiological saline. The cotton wool was applied to the anterior opening of the inferior nasal meatus for 1 h. The simultaneous use of another piece of cotton wool with physiological saline alone served as a control. The nose was examined at 15-min intervals for 1 h. The test was interpreted as positive if at least two of the following signs were clearly present: (a) itching, (b) swelling of the mucosa, (c) watery discharge, and (d) sneezing, and if another provocation test with lactose and saline was negative.

Skin prick tests and scratch chamber tests. Skin sensitivity to 20 common standardized (ALK, Copenhagen, Denmark) allergens, including epithelia, pollen, and dust mite, was tested as previously described [3, 7–10]. Substances brought in by the patients were tested by the prick test method or by a scratch chamber method as previously described [3, 7–10] in an appropriate concentration. Low-molecular-weight chemicals [14, 15] were conjugated to human serum albumin (HSA) to form a complete allergen [5, 8, 14, 15]. Appropriate positive and negative controls were used for new allergens [3, 7–10]. A reaction was considered positive when the weal caused by the allergen (1 mg/ml or 10 mg/ml) was at least 3 mm and half the size of the weal induced by histamine hydrochloride (1 mg/ml or 10 mg/ml, respectively), or was at least 3 mm in diameter with nonstandardized substances.

Specific IgE tests (RASTs). Commercial RASTs (Pharmacia Diagnostic AB, Uppsala, Sweden) were used, if available. Otherwise RASTs were performed using the method of Ceska et al. [2] or Howe et al. [5] as previously described [8, 9]. RAST inhibition experiments and controls were performed as previously described [8, 9, 14, 15].

RASTs were scored in classes 0–4 according to the Phadebas-RAST scoring system. RAST class 1 or more was considered positive. A ratio of three or more of the (low-molecular-weight) hapten-HSA disk to the HSA control disk [for details, see 8] was defined as a positive RAST for low-molecular-weight chemicals.

Data collected from the Occupational Disease Register

Insurance companies provide the Register with data on every case reported to them irrespective of the final decision with regard to compensation. In general, the standard of the diagnoses is lower than is the case with patients diagnosed at our Institute, because fewer investigations have been undertaken and these investigations have not necessarily been performed by specialists.

Results

Patients from the Institute of Occupational Health

Between 1980 and 1987, 166 patients were diagnosed as having OR. Fifty patients had OR from flour (Table 1), 19 from animal epithelia (Table 2), 19 from natural fibers (Table 3), 30 from wood dusts (Table 4), and 48 from other chemicals or organic substances (Table 5).

Flour was the most common cause of OR and wheat was the most common flour (Table 1). There was a good

Table 1. The results of nasal challenge with flour compared to results of skin prick test (S) and RAST (R). Data on 50 cases of OR from the Institute of Occupational Health between 1980 and 1987

Flour	S+R+	S+R-	S-R+	S-R-
Wheat	30	5	1	0
Rye	13	8	4	5
Barley	7	5	0	1
Oat	0	5	1	0
All	50	23	6	6

S+R+: skin test and RAST positive; S+R-: skin test positive, RAST negative; S-R+: skin test negative, RAST positive; S-R-: skin test and RAST negative

Table 2. The results of nasal challenge with animal epithelia compared to results of skin testing. Data on 19 cases of OR from the Institute of Occupational Health between 1980 and 1987

Animal epithelium	No.	Skin prick test positive	Skin prick test negative
Cow	11	10	1
Fox	4	1	3
Mink	2	1	1
Other	2	1	1
All	19	13	6

Table 3. The results of nasal challenge with natural fibers compared to results of skin testing. Data on 19 cases of OR from the Institute of Occupational Health between 1980 and 1987

Natural fiber	No.	Skin prick test positive	Skin prick test negative
Cotton	13	11	2
Linen	3	2	1
Other	3	2	1
All	19	15	4

Table 4. The results of nasal challenge with wood dust compared to results of skin testing. Data on 30 cases of OR from the Institute of Occupational Health between 1980 and 1987

Wood dust	No.	Skin prick test positive	Skin prick test negative
Obeche	9	5	4
Oak	7	0	7
Birch	5	2	3
Other	9	6	3
All	30	13	17

Table 5. The results of nasal challenge with "other chemicals" compared to results of skin testing. Data on 48 cases of OR from the Institute of Occupational Health between 1980 and 1987

Chemical	No.	Skin test positive	Skin test negative
Persulfate	3	3	0
Pyrocatechol	2	1	1
Reactive dye	6	4	2
Phthalic anhydrides	1	1	0
Nickel sulfate	1	1	0
Green coffee bean	8	7	1
Castor bean	2	2	0
Guar gum	2	2	0
Paprika	5	5	0
Cardamom	4	2	2
Other spices	5	5	0
Paraphenylene diamine	1	0	1
Miscellaneous	8	6	2
All	48	39	9

correlation between skin prick tests, RASTs, and nasal provocation tests with flour (Table 1). Prick tests were more sensitive than RASTs in detecting flour allergy (Table 1).

Cow epithelium was by far the most common cause of rhinitis from animal epithelium (Table 2). The relatively high number of rhinitis cases caused by fox epithelium allergy reflects the high number of Finns involved in the fur industry during the investigation period.

Cotton was the most common cause of rhinitis from natural fibers and the prick tests revealed relatively well the natural fiber allergies (Table 3).

Obeche was the most common cause of rhinitis from wood dust (Table 4). Skin prick tests revealed only about one-third of the cases of rhinitis caused by wood dust (Table 4).

Table 5 shows other detected causative agents (low-molecular-weight chemicals and organic substances) of OR. Some of these cases have been reported in detail earlier (see Discussion).

Nationwide statistics

Statistics covering all of Finland (Tables 6, 7) showed that the same allergens were the main causes of OR as at

Table 6. Causes of allergic rhinitis in Finland between 1981 and 1987

Cause	1981	1982	1984	1987
Solvents		1		
Phthalic acids and anhydrides	1	1	3	1
Formaldehyde	2	1	3	5
Phenylene diamines				2
4,4'-Diphenylmethane diisocyanate (MDI)			2	
Insects and animals		1		
Plants		2		
Antimicrobials		1		
Leather products		1		
Hairdressers' products		1	2	3
Molds	1		3	
Cotton	2		5	2
Wool, wool alcohols	4	1		2
Synthetic fibers	3	2	2	2
Finnish trees			2	1
"Exotic" (foreign) trees			1	1
Tree dust	4	6		
Tree dust and formaldehyde		1		
Flour dust	23	35	39	39
Fur dust	2			3
Animal epithelium	2	7	38	38
Other organic dusts	5	2	6	6
Glues			1	1
Plastics	2	1	2	
Pyrolytic plastic products				1
Phenolformaldehyde resins			1	
Epoxy resin compounds		1	2	1
Colophony				1
Polyurethanes				1
Photocopy paper			1	
Leather and other dyes		1	1	2
Azo dyes	1			
Welding fumes			1	
Paint fumes			1	
Nickel			1	
Cement dust			1	
Foundry dust				1
Mineral rock wool				1
Other minerals				1
Causative agent not specified	9	1	4	13
Total	61	67	122	128

the FIOH. The most common causes were animal dander and flour. Storage mites have recently become an important cause of OR (Table 7). Other causes were more or less solitary.

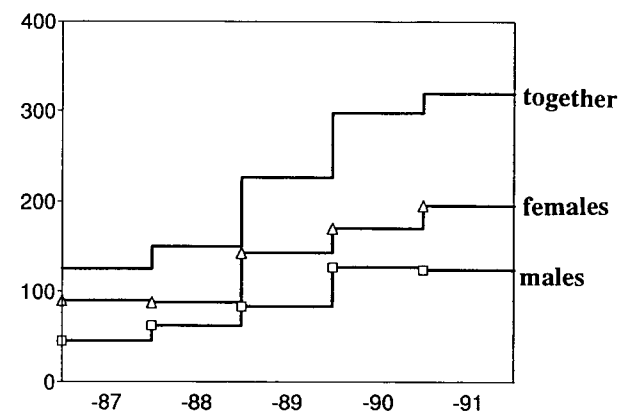
The number of cases of OR has increased very significantly, from 61 in 1981 to 319 in 1991 (Tables 6, 7; Fig. 1).

Discussion

Occupational respiratory allergy is a very complicated field. A large number of substances can provoke airway

Table 7. Causes of occupational allergic rhinitis in Finland in 1991

	Males	Females	Total
Cow epithelium	43	63	106
Wheat	5	21	26
Storage mites	11	12	23
Flour	9	11	20
Oat	9	6	15
Animal epithelium	2	8	10
Unknown	8	1	9
Rye	4	4	8
Textiles	0	7	7
Wood dust	3	3	6
Pine	3	1	4
Spices	1	3	4
Formaldehyde	1	2	3
Medicaments	1	2	3
Hairdresser's products	0	3	3
Cement	3	0	3
Ornamental plants	0	3	3
Pig epithelium	1	2	3
Other (less than 3 causes)	20	43	63
Total	124	195	319

number**Fig. 1.** Occupational allergic rhinitis by gender between 1987 and 1991

symptoms in factories and other workplaces. Only a minority of these (e.g., flour dust and animal epithelium) can be demonstrated by conventional allergy testing. Therefore an experienced otolaryngologist, nasal provocation tests, skin tests, and in vitro tests are usually needed before the diagnosis can be verified. A chemist is often needed to prepare substances for a non-commercial skin test, a provocation test, and an in vitro test from the patients' own products.

The number of patients investigated at the FIOH because of suspected OR has clearly increased during the last decade. This does not prove that the number of allergy cases has increased: it may simply reflect increased awareness of rhinitis as an occupational disease. This also holds true for Finland as a whole, where the number of cases of OR has increased markedly (Tables 6,

7; Fig. 1): the number more than doubled during the 1980s, and more than doubled from 1987 to 1991. The main reasons are probably the increased awareness of OR by the public and health personnel, the increased number of health personnel, and the changes in legislation. In July 1982 the legislation was extended to cover farmers, professional fishermen, and reindeer herders. Of these groups, farmers are very significant as regards OR, and this explains most of the increase in OR in Finland, cow epithelium allergy currently being the most common cause of OR in Finland.

The most common causes of OR at the FIOH are animal epithelia (mostly cow), flour and wood dust, and textile fibers. While animal epithelium dander and flour dust do cause allergy, a great number of patients exposed to textile and wood dusts have been investigated but only in rare cases has an allergic etiology been verified. In these cases the rhinitis may have been irritant.

The other causes of OR have mainly been detected when certain industries have been scrutinized in more detail, or have been occasional single cases. In the 1970s cases of OR caused by raw coffee beans, fodder yeast, peat, henna, senna, and electrocardiographic ink were detected. During the 1980s cases of OR caused by castor bean [6], reactive dyes [1, 3], anhydrides [8, 10], guar gum [9], latex [4], cellulolytic enzymes [11], and amylase [12] have been detected and reported. Interestingly, the number of patients with OR from low-molecular-weight chemicals [1, 3, 5, 7, 8, 10, 14, 15] is increasing, and better laboratory in vitro methods have now been developed to detect these cases [2, 3, 5, 10, 14, 15]. Better diagnostics enable prompt hygienic intervention at the workplace. As our experience is that occupational allergic rhinitis may proceed to bronchial asthma, an early diagnosis of OR is of great importance to prevent workers from developing a more severe occupational disease.

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