

Symptoms of Chronic and Allergic Rhinitis and Occurrence of Nasal Secretion Granulocytes in University Students, School Children and Infants

H. MALMBERG

Department of Otolaryngology, Helsinki University Central Hospital, Helsinki, Finland

The prevalence of chronic and allergic rhinitis was studied in an unselected population sample consisting of 315 university students and 319 school children. History was taken by questionnaire, nasal appearance was examined by rhinoscopy, and a nasal smear was studied in all subjects. For comparison, nasal smears were also collected from 60 normal infants. Allergic rhinitis complaints were reported by 28% of the students and by 13% of the school children, with no significant difference in sex distribution. The cytological examination revealed secretion eosinophilia in 20% of the students, 28% of the school children, and 22% of the infants. Secretion eosinophilia correlated significantly with allergic rhinitis history, and with nasal mucosal swelling and nasal secretion seen on rhinoscopy. Nasal secretion neutrophilia, which occurred in 47% of the students, 79% of the school children and 97% of the infants, seemed to have an adverse effect on the reliability of secretion eosinophilia as an indicator of active nasal allergy. Possible reasons for the rising prevalence rates of allergic rhinitis are discussed.

Key words: allergic and chronic rhinitis prevalence; nasal secretion eosinophilia; nasal smear.

Accepted for publication 10 May 1979

Studies on the prevalence of allergic rhinitis in the general population have arrived at very different frequency values. In the earliest studies carried out in the United States, the prevalence rates were rather low, e.g. 3.3% in a report by Spain & Cooke in 1924 (23), and the rates were even lower in early reports from Finland and Sweden, e.g. 0.6% (20) and 2.5% (7). In later surveys, allergic rhinitis prevalence shows a strong upward tendency, recent figures being as high as 23.6% (10), and even 41% (15).

Most studies have made use of questionnaires, but the criteria for presence of allergic rhinitis applied in these studies show great variations. Some investigations concern only definite symptoms from pollens (20), some take

both seasonal and perennial immediate-type symptoms into account (7), and finally, some include all forms of nasal stuffiness and running except common cold symptoms (5). In order to achieve greater clarity, efforts have been made to employ more objective indicators of allergy. Skin reactivity is known to reflect the presence of immediate-type allergy (21) and in many surveys, skin tests have been added to history data to provide an objective criterion of allergy (5, 8, 9, 10).

Since the 1930's, the cytological examination of the nasal secretion has been widely used as an aid to differentiate nasal affections (4, 11). Eosinophils and mast cells are regarded as indicative of allergic rhinitis. In a study on nasal allergy in adult patients, 86% of

the allergies were detected on the evidence of either eosinophils or mast cells in the nasal smears (4). According to another report, eosinophils were invariably present in the nasal secretion samples from children with symptomatic hay fever (17). Neutrophils, again, are considered indicative of infectious rhinitis (4).

The aims of the present study were to assess the prevalence of allergic rhinitis and chronic rhinitis symptoms in school children and university students and to evaluate the occurrence of nasal secretion eosinophilia in this unselected population sample. For comparison, the occurrence of eosinophilia in the secretion samples from a group of normal infants was also studied.

MATERIAL AND METHODS

The material was collected during January and February, 1978, and comprises 694 subjects: 315 university students, 319 school children and 60 infants. The mean age of the students was 23.5 years (range 19–49 years), that of the school children 8.5 years (range 6–11 years) and the mean age of the infants 2.3 years (range 1–3 years). The students were seen at the University of Helsinki in connection with a yearly, compulsory chest X-ray examination, arranged by the Finnish Student Health Service. The school children were seen in three different comprehensive schools in Helsinki, entire classes attending the nasal examination during school hours. The infants were examined at the Department of Otolaryngology, Helsinki University Central Hospital, when attending a check-up because of corrected congenital septal subluxation. Repositioning of the septum had been performed manually within the first few days of life.

Data were obtained by means of a questionnaire which included questions about — chronic rhinitis (“Have you been troubled with recurrent, longer spells of a runny nose or stuffiness of the nose?”)

- allergic rhinitis (“Have you suffered from fits of nasal itching, sneezing, and running on exposure to pollens, animal danders or the like?”)
- possible seasonality of symptoms
- current symptoms
- the occurrence of asthmatic symptoms
- allergic skin and eye symptoms
- the occurrence of these symptoms in close relatives
- possible medication taken by the subjects for relevant symptoms during the past 2 days.

The students completed the questionnaire on the occasion of the nasal examination, while the children took the inquiry form home to their parents and returned it within the next few days. The division of the subjects into groups with chronic nasal symptoms, allergic rhinitis, and no rhinitis complaints was made on the basis of information from the questionnaires.

Nasal appearance was examined by anterior rhinoscopy, special consideration being given to colour and swelling of the mucosa, the occurrence of nasal secretion and septal deformities.

A sample of nasal secretion was taken from both nasal cavities with a cotton-tipped wiper. This sample was rolled on to two glass slides and air-dried. One of the slides was stained with eosin methylene blue to demonstrate eosinophilic and neutrophilic granulocytes, the other with Wright's stain for demonstration of mast cells (24). The slides were carefully examined under a light microscope. The case histories were not known to the microscopist. In the examination of the smears for eosinophils and neutrophils, the findings were classified according to Hansel's criteria of positivity (12), with some slight modifications. The mast cells were considered to be present in an increased number if at least 20 cells were found on a slide. This criterion for a ‘moderate’ number of mast cells is used by us in clinical work.

Two children and eight students refused to participate in the survey.

RESULTS

History

In the questionnaires, 28% (88/315) of the students and 13% (41/319) of the school children reported that they had had allergic rhinitis symptoms, i.e. 20% of all subjects. There were no significant differences in the sex distribution. Among the subjects with allergic rhinitis, there were 29 students (33%) and 15 children (37%) who had symptoms only in the summer (= the pollen season). The prevalence rate of seasonal allergic rhinitis was thus 7%.

Another 22% (70/315) of the students and 20% (83/319) of the school children complained of chronic rhinitis which they did not consider to be allergic. In this group there were more males than females, especially among the students ($P < 0.01$). Chronic or allergic rhinitis was thus found in 50% (158/315) of the students and in 33% (124/319) of the school children, i.e. in a total of 282 out of 634 subjects (44%).

According to the questionnaires, other symptoms of allergy were more common in the group of subjects with allergic rhinitis than in the other two groups, and allergic symptoms were also more frequent among relatives of this group (Table 1).

Table 1

The distribution of other symptoms of allergy and family history of allergy among subjects with allergic rhinitis history and among other subjects. (Students and school children)

Group	Asthmatic symptoms	Eye symptoms	Eczema	Allergy in relatives	All these negative
Allergic rhinitis $n = 129$	18	40	67	93	12
Other groups $n = 505$	7	17	122	205	215
χ^2 (df = 1) P	40.57 <0.001	92.60 <0.001	38.63 <0.001	39.67 <0.001	63.49 <0.001

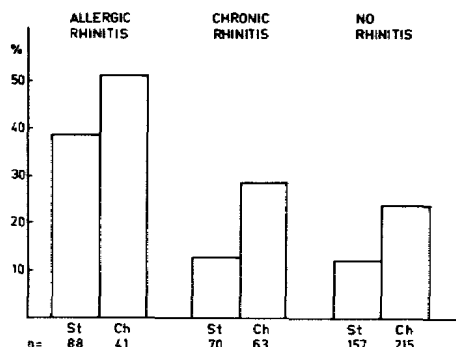


Fig. 1. Nasal secretion eosinophilia in 634 subjects grouped according to history. St=students; Ch=school children.

Nasal cytology and nasal appearance

On examination of the nasal smears for eosinophils, findings were positive in 20% of the students, in 28% of the school children and in 22% of the infants. Fig. 1 shows the distribution of all 152 positive smears among school children and students, grouped according to history. Nasal secretion eosinophilia was more frequent in the group of subjects with a history of allergic rhinitis than in the other two groups (St $P < 0.01$; Ch $P < 0.05$).

Mast cells were present in increased numbers in the nasal secretion samples from 37 subjects. Of the students with a positive mast cell finding, 83% complained of allergic rhinitis, while only 38% of the children with increased numbers of mast cells had a history of allergic rhinitis. In two instances, the secretion sample revealed an increase in the number of mast cells but no secretion eosinophilia.

Neutrophilia was a common finding in the secretion samples from the younger age groups. Smears with no or only few neutrophils, i.e. smears in which there was no sign of infection, were obtained in 53% of the students, and in 21% of the school children, but only in 3% of the infants. When the smears in which eosinophilia but no neutrophilia was present were analysed separately, correlation between history of allergic rhinitis and eosinophilia was good. This correlation with allergic rhinitis history was found to

become poorer with increasing neutrophilia. The effect of neutrophils on the correlation between rhinitis history and secretion eosinophilia in the 152 students and school children with secretion eosinophilia appears from Fig. 2.

Mucosal swelling and secretion in the nose, as seen by rhinoscopy, were highly significantly related to secretion eosinophilia (Table 2). Swollen but livid (not red) turbinates were observed in 52% of the subjects with eosinophilia.

In order to analyse the relationship between secretion eosinophilia and the presence of active symptoms of nasal allergy, all 129 students and school children with a history of allergic rhinitis were divided into two groups: the subjects who replied affirmatively to the question "Are you suffering from nasal symptoms at the present moment?" or in whom secretion was noted by rhinoscopy were classified as having active nasal allergy, while the subjects who satisfied neither criterion formed the other group. The correlation between active nasal allergy and secretion eosinophilia was highly significant (Table 3).

DISCUSSION

The material in this study is small and includes only certain age groups in an urban district, and thus the results are not representative of a total community.

By the anamnestic criteria used in this investigation, three different groups can be

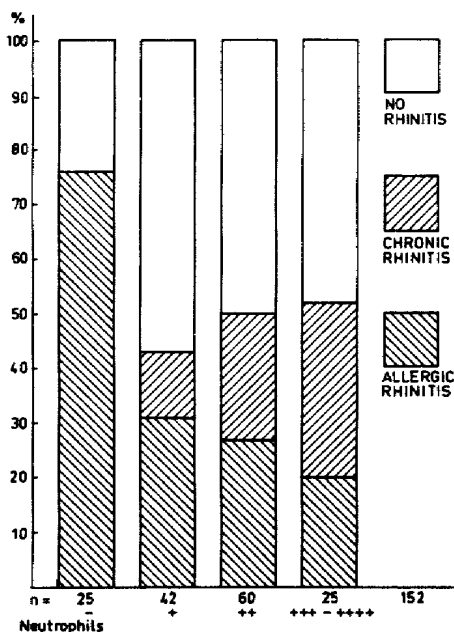


Fig. 2. School children and students (152) with secretion eosinophilia. Correlation between history of rhinitis and secretion eosinophilia in relation to secretion neutrophilia.

Table 2
Secretion eosinophilia correlated to presence of nasal secretion and swelling of the mucosa

Nasal smear	Secretion		Mucosal swelling	
	Visible	None	Visible	None
Eosinophilia	132	20	79	73
No eosinophilia	286	150	137	299
χ^2 (df = 1)	23.73		19.61	
P	<0.001		<0.001	

Table 3

Correlation between secretion eosinophilia and evidence of active allergic rhinitis in subjects with allergic rhinitis history. ($n = 129$)

Nasal smear	Symptoms of active nasal allergy	
	Present	Absent
Eosinophilia ($n = 54$)	50	4
No eosinophilia ($n = 61$)	13	48
χ^2 (df = 1)	55.89	
P	<0.001	

(Doubtful smear eosinophilia 14, not included)

distinguished: a group of subjects with allergic rhinitis symptoms only in the summer (7%), a group of subjects with perennial and/or seasonal allergic rhinitis (20%), and a group with chronic or allergic symptoms (44%). When data are analysed, not only criteria but also the age dependency of allergic rhinitis prevalence must be given consideration (3). A comparison between the present results and those reported in other studies, in which criteria and age groups are comparable, shows that similar prevalence rates have recently been obtained. Haahela (8, 9) found allergic rhinitis in 13.6% of 214 14-16-year-old school children, and Hagy & Settupane (10) reported a rate of 24% for college students. The 41% reported by Lebowitz et al. (15) may correspond to the total percentage of subjects with chronic/allergic rhinitis in this material.

Most earlier reports gave lower figures for the prevalence of allergic rhinitis (3, 7, 20). It is not easy to account for the marked rise in prevalence rates, but in addition to such factors as different criteria and age groups (5, 7, 15, 3), the circumstance that nasal symptoms have attracted more attention in recent years may explain the upward trend. This can clearly be seen in studies on allergic rhinitis in asthmatics. Earlier reports gave rather low frequency values, e.g. 29% (6) and 42% (14) in two child surveys, and 48% (1) in

a survey of adult subjects, whereas in a recent report the prevalence rate was found to be 96% (13). But the actual occurrence of allergic diseases may also be increasing (22).

A nasal secretion sample for studying granulocytes is easily obtained even from small children. The smears are dried in the air, and need not be stained immediately. Eosinophils and neutrophils are clearly visible under a light microscope. Eosinophils often appear in clumps and are not evenly distributed in the secretion sample, which makes it difficult to count individual cells. Hansel's method of recording and evaluating the cytologic finding in regard to eosinophils and neutrophils is not very accurate and only semi-quantitative, but it is simple and convenient in comparison with some other methods, in which occurrences of these cells are calculated as percentages (2, 19) or high power fields made use of (18).

In the present material, eosinophils in the secretion were a sign of active nasal allergy (Tables 2, 3). In a report on Vancouver school children, nasal secretion eosinophilia was highly significantly related to such evidence of allergy as nose rubbing, sneezing, sniffing and running of the nose, and wet and swollen turbinates (18). A significant correlation between secretion eosinophilia and active immediate-type allergy was also demonstrated in a clinical allergy evaluation of 115 subjects from the present survey material (16).

Infection and neutrophils affect the occurrence of eosinophils in the secretion sample (11), making the correlation between eosinophilia and allergy less reliable (Fig. 2). Neutrophilia was very often present, especially in the secretion samples from the children, and this may also explain, why "lividity" of the nasal mucosa was in the present material noted in only half of the subjects with nasal allergy, infection making the turbinates hyperemic and swollen.

Mast cells did not give any further information about allergy in this study. This may partly be due to the method of evaluating the findings.

In nasal allergy, the change from a normal

condition to an active manifestation of disease is gradual and continuous, and the occurrence of eosinophils in the secretion samples from subjects with no history of allergic rhinitis and those with a history of chronic, nonallergic rhinitis may be a sign of a mild, unnoticed nasal allergy. Moreover, slight rhinitis symptoms, especially in children, seem to be regarded as normal in winter time in Finland, and the possibility of allergy is not explored.

Still, from the present study and other recent surveys, it can be concluded that the prevalence rate of nasal allergy, particularly in children and infants, apparently is higher than the early field surveys indicated.

ACKNOWLEDGEMENTS

I am grateful to Miss Riitta Kärkkäinen for skilful technical assistance. This study was supported by a grant from Korvatautiin tutkimussäätiö r.y.

REFERENCES

- Alanko, K.: Prevalence of asthma in a Finnish rural population. *Scand. J. Resp. Dis., Suppl.* 76, 1970.
- Andersen, H. C.: Studies on the clinical aspects, etiology and pathogenesis of nasal polyps and hyperplastic sinusitis with special reference to eosinophilia. Thesis. Thanning & Appel, Copenhagen, 1943.
- Broder, I., Barlow, P. P. & Horton, R. J. M.: The epidemiology of asthma and hay fever in a total community, Tecumseh, Michigan. I. Description of study and general findings. *J. Allergy* 33, 513-523, 1962.
- Bryan, W. T. K. & Bryan, M. P.: Cytologic diagnosis in otolaryngology. *Trans. Am. Acad. Ophthalmol. Otolaryngol.* 63, 597-612, 1959.
- Burrows, B., Lebowitz, M. D. & Barbee, R. A.: Respiratory disorders and allergy skin-test reactions. *Ann. Intern. Med.* 84, 134-139, 1976.
- Dawson, B., Horobin, G., Illsley, R. & Mitchell, R.: A survey of childhood asthma in Aberdeen. *Lancet* 827-830, 1969.
- Engström, I., Kraepelin, S. & Linneroth-Elzvik, K.: Occurrence of allergic rhinitis among school children. *Acta Allergol.* 15, 459-465, 1960.
- Haahtela, T.: Allergiaoireet ja ihoekotulokset teinikäisillä. *Duodecim* 94, 719-727, 1978.
- Haahtela, T. K. M.: The prevalence of allergic conditions and immediate skin test reactions among Finnish adolescents. *Clin. Allergy* 9, 53-60, 1979.
- Hagy, G. W., Settignano, G. A. & Providence, R. I.: Bronchial asthma, allergic rhinitis and allergy skin tests among college students. *J. Allergy* 44, 323-332, 1969.
- Hansel, F. K.: Observations on the cytology of the secretions in allergy of the nose and paranasal sinuses. *J. Allergy* 5, 357-366, 1934.
- Hansel, F. K.: The cytology of secretions in allergy. In Hansel, F. K.: *Clinical allergy*, pp. 408-419. Mosby, St. Louis, 1953.
- Järvinen, K. A. J.: Allerginen nuha liittyy kiinteästi astman taudinkuvaan. *Allergiatutkimussäätiön vsk.* 8, 37-40, 1977.
- Koivikko, A.: Childhood asthma in Finland. *Acta Allergol.* 29, 30-72, 1974.
- Lebowitz, M. D., Knudson, R. J. & Burrows, B.: Tucson epidemiologic study of obstructive lung diseases. I: Methodology and prevalence of disease. *Am. J. Epidemiol.* 102, 137-152, 1975.
- Malmberg, H. & Holopainen, E.: The nasal smear as a screening test for immediate-type nasal allergy. *Allergy* 34, 331-337, 1979.
- Murray, A. B.: Nasal secretion eosinophilia in children with grass pollen hay fever. *Can. Med. Assoc. J.* 104, 599-600, 1971.
- Murray, A. B. & Anderson, D. O.: The epidemiologic relationship of clinical nasal allergy to eosinophils and to goblet cells in the nasal smear. *J. Allergy* 43, 1-8, 1969.
- Mygind, N. & Thomsen, J.: Cytology of the nasal mucosa. A comparative study between a replica-method and a smear method. *Arch. Klin. Exp. Ohren. Nasen. Kehikopfeilkd.* 204, 123-129, 1973.
- Peltonen, M.-L., Kasanen, A. & Peltonen, T. E.: Occurrence of allergic conditions in school children. *Ann. Paediat. Fenn.* 1, 119-129, 1955.
- Pepys, J. & Davis, R. J.: Allergy. In Clark, T. J. H. & Godfrey, S. (eds.): *Asthma*, pp. 126-161. Chapman & Hall, London, 1977.
- Smith, J. M.: The prevalence of asthma and wheezing in children. *Br. J. Dis. Chest.* 70, 73-77, 1976.
- Spain, W. C. & Cooke, R. A.: Studies in specific hypersensitiveness. XI. The familial occurrence of hay fever and bronchial asthma. *J. Immunol.* 9, 521-535, 1924.
- Wright, J. H.: A rapid method for differential staining of blood films and malarial parasites. *J. Med. Res.* 7, 138-144, 1902.

Address:

Dr. Henrik Malmberg

Department of Otolaryngology

Meilahti Hospital

00290 Helsinki 29

Finland

This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.