

Children's Atopy and Mastocytosis in the Nasal Smear

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Nasal secretion samples from 473 children aged 0–15 years were studied in order to evaluate the role of mast cells in the nasal smear in different types of atopy and food allergy. The occurrence of eosinophils in the nasal secretion and in the blood, and susceptibility to upper respiratory infection were recorded. A mast cell count of more than 20 cells per slide was indicative of atopy and there was a clear correlation between eosinophilia and mastocytosis in the nasal smear. No type of allergy seemed to be significantly predominant in the total material, but in young children aged 0–3 years mastocytosis was clearly related to food allergy. The examination of nasal smears for mast cells is a valuable test in diagnosing atopy in children and especially food allergy among young children. However, the test is not reliable enough to be used as a single screening test.

Key words: food allergy; mast cell; nasal smear; small children.

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The diagnosis of food allergy is difficult and time-consuming since there is no single reliable test to confirm the diagnosis (1). Attempts have been made to utilize the examination of the cellular population in nasal secretions, and especially the demonstration of mast cells as a means to diagnose food allergy. Results which indicate that there is a correlation between increased numbers of mast cells in the nasal smear and food allergy have been reported by Bryan & Bryan (3) and by Schioda & Mishima (15). On the other hand, Johnson (8) found no significant difference in the mast cell count when comparing patients who had a history of food allergy and those who did not. Okuda & Otsuka (12) demonstrated a relationship between the occurrence of mast cells and inhalant allergy. They also noted an increase in the mast cell count during the pollen season and after pollen provocation. In an epidemiological study on students and children a correlation between mastocytosis and allergic rhinitis was revealed in the students but not in the children (10).

In a preliminary study we found a correlation between the mast cell count and allergy to food, animal dander or a combination of the two (2). The purpose of this study was to evaluate whether examination of the nasal smear for mast cells is a useful screening test for food allergy.

MATERIAL AND METHODS

Nasal secretion samples, taken in the years 1976–78 from 2,934 children with a history of atopy or recurrent upper respiratory infections were studied. The children, who were mainly from Southern Finland, were patients at the Children's Hospital in Helsinki. The sample for the nasal smear was taken under visual control by wiping the nasal mucosa with a cotton-tipped applicator. The sample was rolled on to a glass slide, fixed by air-drying and stained using eosin, Wright's and Papanicolaou's stains. The basophilic cells are best visualized by Wright's stain. The cells were counted and the

Table 1
Occurrence of mast cells in 473 children with atopy or recurrent upper airways infection, by age and sex

Mast cells	No. of children	Boys	Girls	Years				
				< 3	3-5	6-8	9-11	> 12
++	142	94 (66 %)	48 (34 %)	23 (16 %)	38 (27 %)	38 (27 %)	35 (25 %)	8 (6 %)
+	170	108 (64 %)	62 (36 %)	32 (19 %)	57 (34 %)	30 (18 %)	22 (13 %)	29 (17 %)
+-	161	100 (62 %)	61 (38 %)	41 (25 %)	44 (27 %)	39 (24 %)	26 (16 %)	11 (7 %)
Total	473	302* (64 %)	171* (36 %)					

* The sex difference was highly significant: $P < 0.0001$.

results recorded as the number of cells per microscopical slide. The investigator had no information about the patients. In the mast cell count the criterion for mastocytosis was 10 mast cells per slide. A number below this was regarded as a negative finding. The positive findings were divided into three categories: a mast cell count of 10 to 19 cells per slide was labelled +-, a mast cell count of 20 to 49 cells +, and a finding of more than 50 mast cells per slide was referred to the ++ category.

In addition to the basophilic cells, the entire cellular population in the nasal smear was recorded. Eosinophil findings were classified according to Hansel's (5) criteria.

Blood eosinophilic cells were counted per mm³ and the criterion for eosinophilia was 600 cells/mm³ (9).

In this retrospective study, the 473 children (see Table 1) whose nasal smears had revealed more than 10 mast cells per slide were selected for a more careful study of correlations between the occurrence of mast cells in the smear and the clinical condition of the children. The analysis was focused on history of food allergy and history of allergy to pollen or animal danders, eosinophils in the nasal secretion and in the blood. Moreover, the state of skin was defined clinically and occurrence of atopic dermatitis recorded. The statistical analysis of the results was made by the chi-square test.

RESULTS

The distribution of mastocytosis in 473 children is presented according to age and sex in Table

1. Mastocytosis was significantly more common in boys than in girls (64% as compared with 36%, $P < 0.0001$).

Symptoms of atopy clinically defined as atopic dermatitis, seasonal or perennial rhinitis and bronchial asthma were found in 391 children. The symptoms were attributable to one or several allergens.

Eighty-two children were characterized as non-atopics and were examined because of a history of recurrent upper airways infections. In the atopic group, 167 children had a history of food allergy: 70 of them had only food allergy and 64 also suffered from symptoms caused by

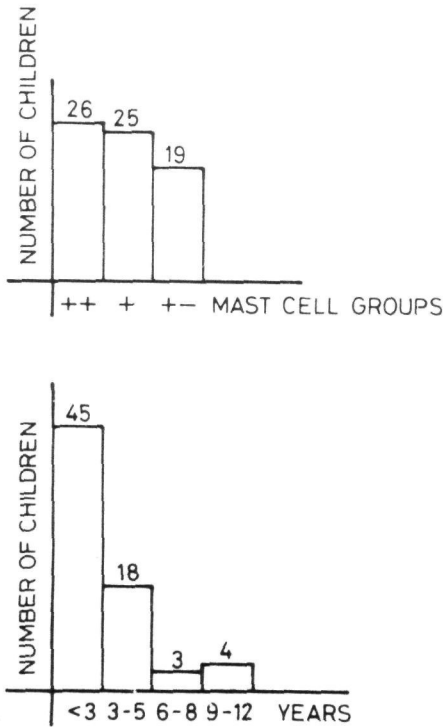


Fig. 1. Seventy children with a history of food allergy only.

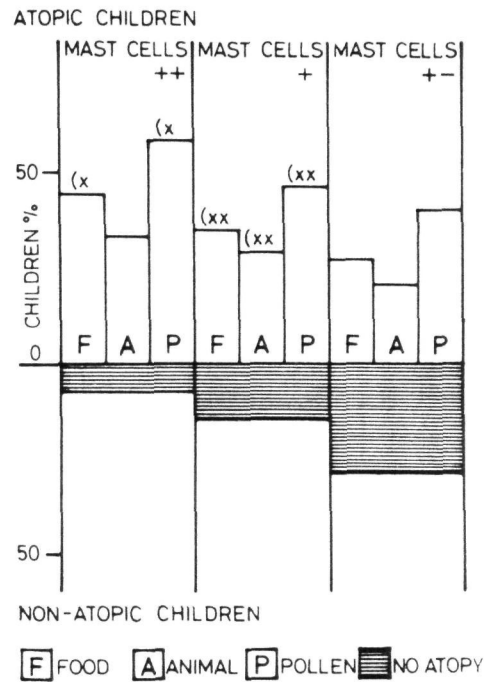


Fig. 2. Correlations between mastocytosis and allergy to food (F), animal danders (A) and pollen (P).

* $P < 0.05$ when compared with the + mast cell group.
** $P < 0.01$ when compared with the +- mast cell group.

Table 2

Correlations between occurrence of nasal secretion mast cells and eosinophils per microscopical slide (402 children) and between mast cell and blood eosinophil count (336 children)

Mast cells	No. of children	Eos Secr. - <i>n</i>	Eos Secr. + <i>n</i>	Blood Eos < 600 <i>n</i>	Blood Eos > 600 <i>n</i>
++	126	43	83**	55	48**
+	134	55	79**	74	46*
+-	142	93	49	90	23

* Difference between this group and the +- group is significant $P < 0.01$.
** Difference between this group and the +- group is highly significant $P < 0.0001$.

animal danders. In the total material of 473 children 129 had a history of allergy to animal danders. A history of pollen allergy was recorded in 224 children, often combined with allergy to food and/or animal danders. Sixty-four children who suffered from pollen allergy had no history of other allergies. Clinically defined atopic dermatitis without evidence of any special causative allergen was found in 19 children.

The 70 children with a history of food allergy alone are presented in Fig. 1. Slight mastocytosis (+-) was seen in 27%, moderate mastocytosis (+) in 36% and clear mastocytosis (++) in 37%. Sixty-four per cent of the children were under 3 years of age.

The ++ mast cell category included 131 atopic and 11 non-atopic children, the + category 145 atopic and 25 non-atopic children and the +- category 115 atopics and 46 non-atopics. The relationship between the mast cell categories and atopic symptoms is presented in Fig. 2. Mastocytosis was clearly associated with allergy to food, pollen or animal danders.

Table 2 shows the relation between degree of mastocytosis and eosinophilia in the nasal smear and the blood. Secretion eosinophilia correlated with moderate (+) and high (++) degree of mastocytosis ($P < 0.0001$) and blood eosinophilia showed a correlation with ++ mastocytosis ($P < 0.0001$). The distribution of different types of allergy among the children grouped according to age and degree of mastocytosis is shown in Fig. 3. Food allergy and mastocytosis were a common combination in children under 3 years of age, 65% of the children with ++ mastocytosis had a history of food allergy, but this is not statistically significant since food allergy was well represented also in other mast cell groups (56% and 46%).

Among the children with a ++ mast cell finding, 88% were atopics (Fig. 4). Atopic disease was common in all age groups. The clearest correlation between atopy and mast cell count exceeding 20 cells/slide was seen in children under 3 years of age ($P < 0.0001$).

Table 3 reveals that susceptibility to upper airways infection bore no statistically significant relationship with the appearance of mast cells or eosinophils in the nasal smear.

DISCUSSION

Food allergies are said to be responsible for 25% of cases of childhood asthma, and they may also play a part in asthma in adults (14). The exact and relevant diagnosis and treatment of food allergy is therefore of great importance.

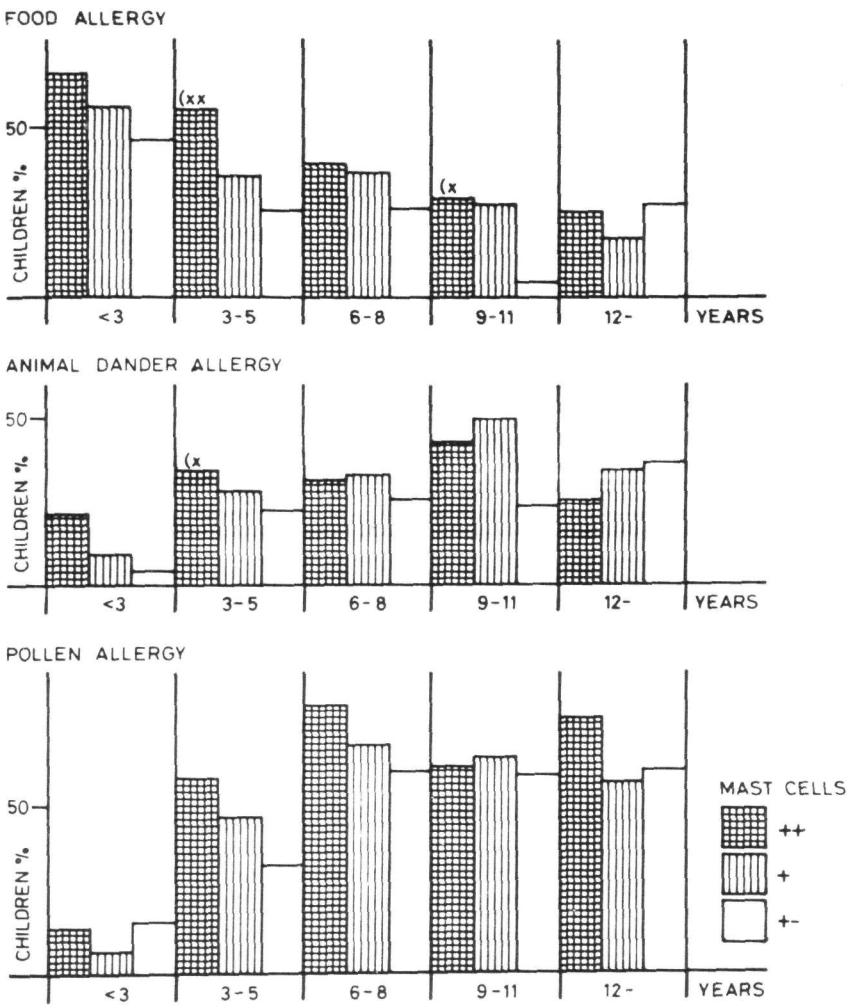


Fig. 3. Percentage distribution of food, animal dander and pollen allergy in different age and mast cell groups.
* $P < 0.05$ when compared with the +- mast cell group.
** $P < 0.001$ when compared with the +- mast cell group.

Table 3
Comparison of nasal smears in 180 atopic and non-atopic children with and without recurrent upper airways infections

Child groups	n	Mast cells		Secr. Eos	
		+-	+ or ++	-	+
No atopy No infections	23	13	10	15	8
No atopy infections	31	11	20	21	10
Atopy infections	14	3	11	6	8
Atopy No infections	112	40	72	57	55

The children in this series represent a wide age range: 0–15 years. The children were mainly from Helsinki and Southern Finland, and thus the results are perhaps not representative of the whole country. 2461 children with no or less than 10 mast cells per slide were excluded from the investigation.

Because the investigation was a retrospective one, the samples were taken of patients suspected of having atopy or having recurrent respiratory infection and we have focussed our interest only on patients with mastocytosis. In addition we concentrated on interpreting the correlation between mastocytosis and food allergy, and no attempts were made to find causes of food allergy or to identify the specific food

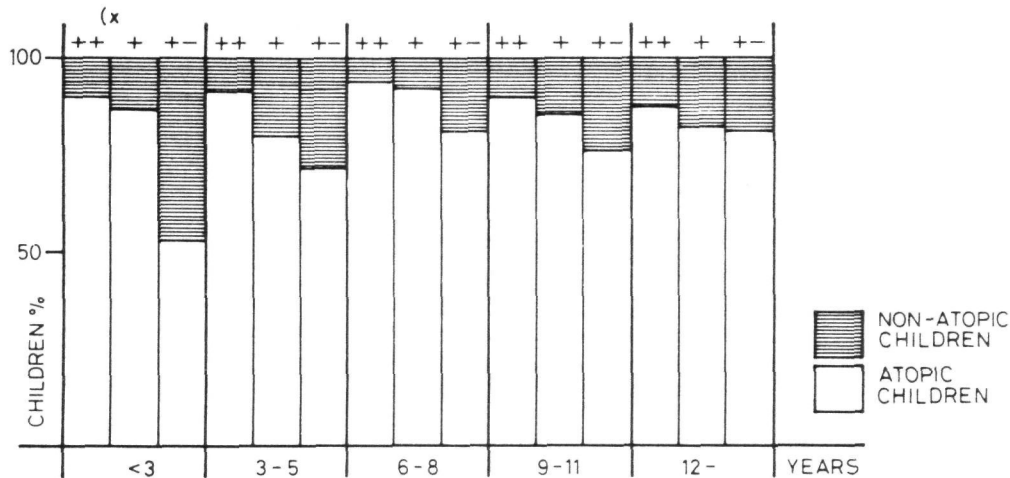


Fig. 4. Percentage distribution of atopic and non-atopic children according to age and mast cell findings.

* $P < 0.0001$ the ++ and + groups compared with the +- group.

allergens to which the presence of mast cells could be attributed.

As was expected, a high mast cell count correlated well with atopy. In all age groups, a marked increase in mast cells in the nasal smear was common in the children with clinical allergic symptoms to food, pollen or animal danders but rare in the non-atopic children. The correlation was particularly clear in the children in whom the nasal smear showed 20 mast cells or more per slide. However, in the total material, no type of allergy seemed to be significantly predominant (Fig. 2). Difficulties in diagnosing the specific type of allergy may also be due to the fact that one child often suffers from several types of allergy. An out-of-season period, e.g. the winter for children suffering from pollen allergy, may also affect the cell population in the nasal secretion and make the exact diagnosis more difficult.

The study of different age groups revealed that the frequency of food allergy and mastocytosis was highest in children under 3 years of age diminishing gradually with increasing age, while pollen and animal dander allergies became more predominant in older age groups. Similar observations have been reported by Morrison-Smith (11). Consequently, the child's age must be given consideration when evaluating the mast cell count and possible allergic manifestations. The significance of mast cells may escape detection since the frequency of mast cells is reported to be highest approxi-

mately 25 h after a positive provocation and their number decreases in a relatively short period of time (15).

Infections may cause a slight increase in the number of mast cells although opposite evidence has also been reported (6). The groups with known history of susceptibility to infections were perhaps too small to allow conclusions to be drawn. It has been reported that infection can affect the number of eosinophils in the smear (4, 10) as can an uneven distribution of cells in the nasal mucosa or in the secretion sample (5, 16). This may also apply to mast cells.

Blood eosinophilia seemed to have little diagnostic value in the evaluation of food allergy (Table 2). Studies on nasal allergy and blood eosinophilia have revealed similar trends (7, 13).

To sum up, mastocytosis in the nasal smear correlated well with atopy and secretion eosinophilia. Mastocytosis was suggestive of food allergy only in young children aged 0-3 years, while in older children mast cells may provide additional information for differentiating atopy and other conditions when symptoms are vague. The use of elimination and provocation tests in combination with examination of the nasal smear may give valuable information in the diagnosis of food allergy. However, a specific and sensitive test which involves no risk for the patient has yet to be developed.

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