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Seasonal variation of nasal surface basophilic cells and eosinophils in Japanese cedar pollinosis

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SUMMARY

Nasal pollinosis is caused by pollens of trees and grasses as allergen floating in the air during the seasons of blossom. In Japan, cedar pollinosis is the most prevalent of seasonal allergic rhinitis.

We studied the seasonal variation of nasal mucosal basophilic cells (cells with basophilic and metachromatic granules) and eosinophils by nasal scraping of cedar pollinosis patients from June 1986 to May 1987, and found that during the season basophilic cells and eosinophils increased significantly, decreased but still remained for two or three monts after the season, and finally disappeared.

The variation of eosinophils was more prominent than basophilic cells. The increase of both cells had close correlation with each other.

INTRODUCTION

Formerly, cells with basophilic and metachromatic granules (BC) were found in nasal secretions by Bryan and Bryan (1959). Their clinical significance, however, has not been well understood. Previously, we have revealed that basophil leukocytes increase in nasal secretions during the season of pollinosis correlating with the severity of nasal symptoms (Okuda et al., 1977) and mast cells similar to rat intestine mucosal mast cells migrate in the nasal surface (nasal secretion and epithelial layer) (Okuda et al., 1978, 1985) and play an important role in producing nasal symptoms in patients with nasal allergy (Ohtsuka and Okuda, 1981). Recently, Enerback et al. (1986 a, b) and Davies et al. (1987) have also revealed the marked increase in the intraepithelial migration of nasal mucosal mast cells in hay fever.

To develop the above studies, we have carried out the investigation of the yearly change in the numbers of nasal surface BCs together with those of eosinophil leukocytes (Eo) in patients with the Japanese cedar pollinosis between June 1986 and May 1987.

MATERIALS AND METHODS

The study involved 17 Japanese cedar pollinosis patients (four males and 13 females), who had moderate to severe symptoms only during the season of

Japanese cedar pollinosis before entry to the present study and were judged to be sensitive only to cedar pollen on the basis of skin test, nasal provocation test, determination of serum level of IgE and IgE antibody to the cedar pollen, nasal smear test for eosinophilia and peripheral eosinophil count. The age of patients ranged from 16 to 61 years (mean 39.2 years). The duration of illness ranged from one to 12 years (mean 6.4 years) and the duration of immunotherapy was from one to seven years (mean 2.6 years). In the intracutaneous test with 12 kinds of allergen common in nasal allergy in Japan (house dust, house dust mite, candida, alternaria, aspergilleus, penicilleum, pollen of Japanese cedar, timothy, orchard grass, common mugwort, Japanese hop, ragweed), five patients had concomitant allergen reation (one with house dust, three with mite, one with alternaria). All the patients but one were positive to provocation with Japanese cedar pollen and only one was positive to house dust.

In 14 patients who were examined serum levels of IgE antibody by radioallergosorbent test, 12 were positive to Japanese cedar pollen and all negative to other allergens tested.

Nasal symptoms were examined by the records of allergy diary during the period of study.

The patients were followed up repeatedly at least once in-season and off-season (mean 5.2 times a year) in total 89 times during the period from June 1986 to May 1987.

The number of BCs and Eos in the nasal surface layer was counted as follows. Scraping, approximately 4 mm^2 x 40 μm in volume, were taken from the mucosal surface of the bilateral inferior turbinates, and thinned on slide glasses, stained with Hansel's solution for light microscopy. The numbers of BCs and Eos from each side of the nose were counted separately on whole slide, and total number on the both sides was considered as the cell number of the patient.

The grading for BCs was slight (≤ 20), moderate (≤ 200), severe ($\leq 2{,}000$); and for Eos was ≤ 100, $\leq 1{,}000$, and $\leq 3{,}000$ respectively.

Pollen count was performed near our hospital every day through the years in both 1986 and 1987 using Durham pollen collector, and Japanese cedar pollen was found only between the middle of February and the end of March in 1986 and 1987.

RESULTS

In all of patients but one, BCs increased in number during the season, but the degree of increase was different from patient to patient; slight 7, moderate 7, severe 2 (Figure 1).

Not only during the in-season but during the off-season, both types of cells sometimes increased; in April BCs increased in eight of nine patients examined in association with onset of nasal symptoms, and in June and July, in eight of 13 patients without nasal symptom. In addition, between August 1986 and January

1987, BCs occasionally and slightly increased in few patients with or without symptom. When the average number of BCs between August and January (the off-season) was compared with that of February and March (the in-season) in the same patient, there was a significant difference between the numbers of off-season and in-season ($P<0.05$) (Figure 2). One patient whose nasal BCs and Eos didn't increase during the season, had mild symptom, positive skin and provocation test to Japanese cedar pollen. She has been treated with immunotherapy for four years. Eos also increased in the season with different degree like BCs; slight 6, moderate 4, severe 6; and the variation between the in-season and off-season was more prominent than BCs ($p<0.01$) (Figures 3 and 4).
Eos increased together with BCs in the off-season. There was a significant correlation between the numbers of BCs and Eos in scraping during both in-season and off-season (correlation coefficient=0.799, p-value<0.005) (Figure 5).

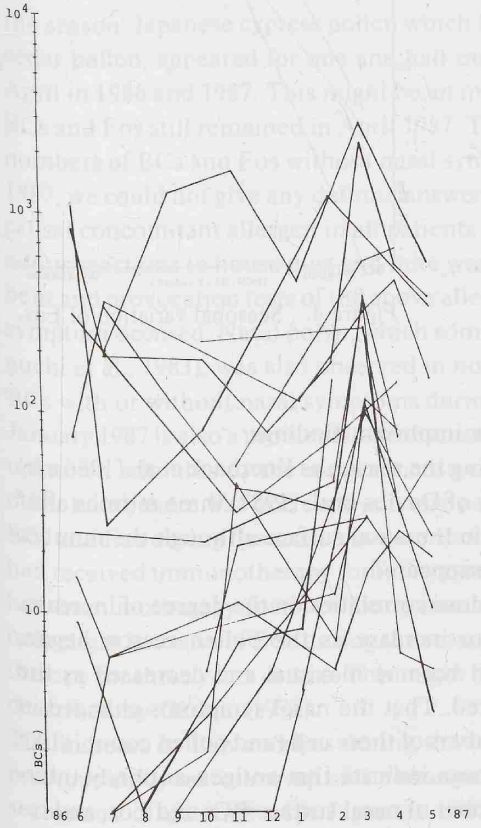

Figure 1. Variation of BCs from June '86 to May '87.

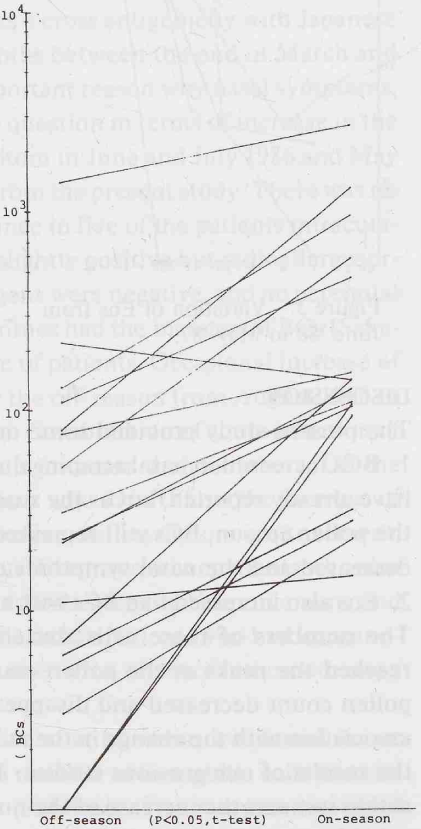

Figure 2. Seasonal variation of BCs.

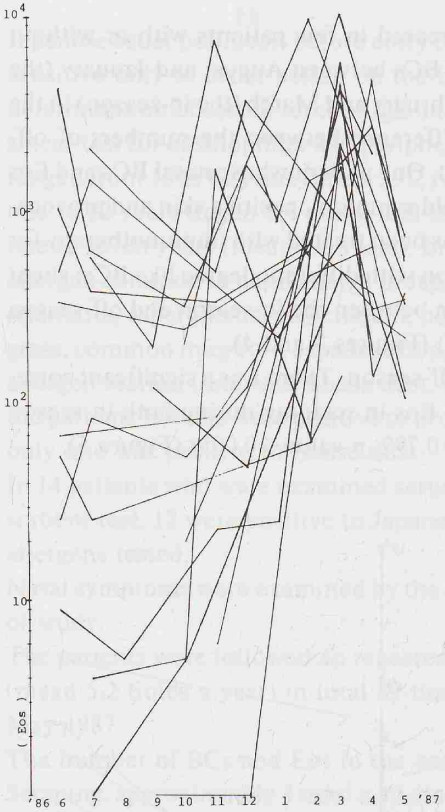

Figure 3. Variation of Eos from June '86 to May '87.

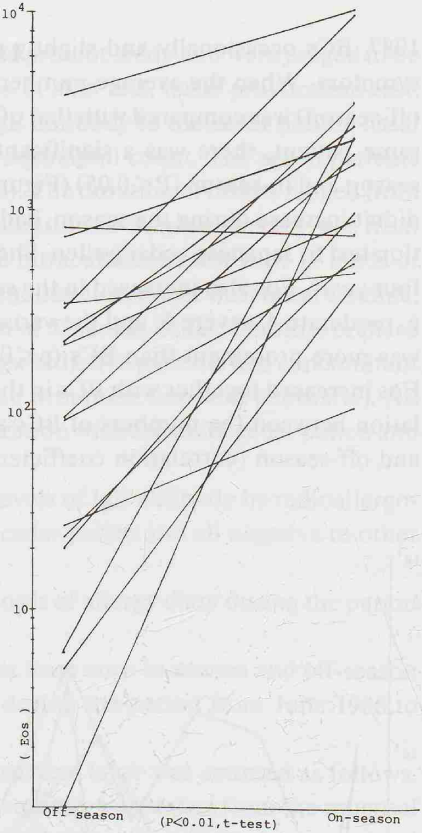

Figure 4. Seasonal variation of Eos.

DISCUSSION

The present study provided some new important findings:

1. BCs increased in nasal scraping during the season as Enerback et al. (1986 a,b) have already reported, but as the study of Davies et al. (1987) three months after the pollen season, BCs still remained in the nasal surface although the number decreased and the nasal symptoms disappeared.

2. Eos also increased like BCs with a close correlation in the degree of increase. The numbers of these cells started to increase as the pollen season began, reached the peaks as the pollen count became maximal and decreased as the pollen count decreased and disappeared. That the nasal symptoms changed in association with the change in the numbers of these cells and pollen count is like the results of our previous studies. These indicate that antigen-antibody interaction initiates the increase of the number of nasal surface BCs and Eos, and repeated allergic attacks induce more increase of BCs and Eos. Even if this is true, a question arises as to why BCs and Eos still remained in the mucosal surface after

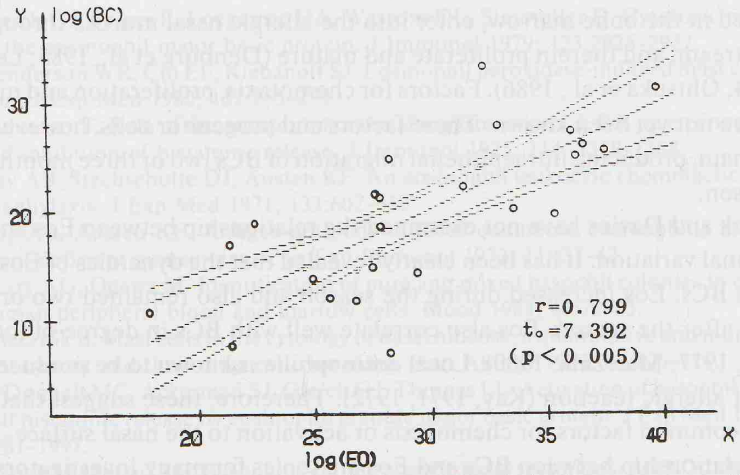

Figure 5. The correlation of increases of BCs and Eos during in-season and off-season.

the season. Japanese cypress pollen which has a cross antigenicity with Japanese cedar pollen, appeared for one and half months between the end of March and April in 1986 and 1987. This might be an important reason why nasal symptoms, BCs and Eos still remained in April 1987. To question in terms of increase in the numbers of BCs and Eos without nasal symptom in June and July 1986 and May 1987, we could not give any definite answer from the present study. There was no causal concomitant allergen in all patients since in five of the patients intracutaneous reactions to house dust and mite was slightly positive but radioallergosorbent and provocation tests of the above allergens were negative, and no perennial symptom occured. Nasal polyp, which sometimes had the increase of BCs (Sakaguchi et al., 1983), was also observed in none of patients. Occasional increase of BCs with or without nasal symptoms during the off-season from August 1986 to January 1987 is also a problem to be discussed. Combination of acute infection or unknown stimulus to the nasal mucosa could increase their numbers. On the other hand, there was one contradictory patient who didn't show the increase of BCs and Eos during the season as described before, with symptom improvement, had received immunotherapy for four years just like three other patients who also had immunotherapy for over four years had both symptom improvement and only slight increase of BCs during the season less than patients who had immunotherapy for three years or less. This might be due to the effect of immunotherapy described by Okuda (1977).

The increase in BCs and Eos during the off-season, however, was found in our previous study on follow-up of the change in number of basophilic cells in nasal secretions of patients with Japanese cedar pollinosis. The number increased during the season but still remained after the season (Ohtsuka and Okuda, 1980). Recent studies on ontogeneity of nasal BCs reveal that progenitor cells of BCs are

produced in the bone marrow, enter into the allergic nasal mucosa through the blood stream, and therein proliferate and mature (Denburg et al., 1985; Leary et al., 1984; Ohtsuka et al., 1986). Factors for chemotaxis, proliferation and maturation have not yet been known. These factors and progenitor cells, however, may still remain, producing intraepithelial migration of BCs two or three months after the season.

Enerback and Davies have not examined the relationship between Eos and BCs in seasonal variation. It has been clearly revealed that the dynamics of Eos is the same as BCs. Eos increased during the season and also remained two or three months after the season. Eos also correlate well with BCs in degree of increase (Okuda, 1977; Miecznik, 1980). Local eosinophilia is known to be produced as a result of allergic reaction (Kay, 1971, 1972). Therefore, these suggest that there may be common factors for chemotaxis or activation to the nasal surface. Functional relationship between BCs and Eos are topics for many investigators. BCs release chemotactic factor for Eos in allergy, and Eos may inactivate chemical mediators from BCs as regulatory cells (Wasserman et al., 1975; Hubscher, 1975; Zeiger et al., 1977) or activate BCs and damage tissues as effector cells (Gleich et al., 1979; Henderson et al., 1980; O'Donnell et al., 1983; Zheutlin et al., 1984).

CONCLUSION

BCs and Eos increase significantly during the season of Japanese cedar pollinosis and decrease during the off-season. The increase of both types of cells has close correlation with each other. There still remain BCs and Eos in the nasal mucosal surface even long after the season is over. Progenitor cells, chemotactic factors, concomitant allergens should deserve further study in nasal allergy.

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