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Short Communication

Effect of pollen exposure on serum IgE and IgG antibody responses in Japanese cedar pollinosis patients

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ABSTRACT

We examined the IgE and IgG antibody responses in Japanese cedar pollinosis patients before and after the pollination season for 2 years. The sera from 90 patients in 1990 and 87 in 1991, living in five regions in the Tokyo area, were obtained before and after the pollination season. In all patients, changes (increase then decrease) in specific IgE levels were detected after natural pollen exposure. Total IgE and specific IgG concentrations also changed. However, the degree of change in specific IgE was greater than those in total IgE and specific IgG. Then, the geometric means of specific and total IgE levels were compared among the five regions. These levels were found to be highest in the region where the pollen count was the highest. These findings suggest that IgE antibody production is more stimulated after natural pollen exposure compared to IgG antibody production, and is dependent on the amount of allergens.

Key words: IgE, IgG, Japanese cedar pollinosis, seasonal change

INTRODUCTION

Japanese cedar (*Cryptomeria japonica*, Cj) pollinosis, one of the most common allergic diseases in Japan, was first reported in 1964[1] and the number of patients has been increasing recently.[2] The pollination season is usually from February to April and symptoms appear in the patients at this time. In birch or grass pollinosis, changes (both increase and decrease) in serum levels of specific IgE and total IgE due to the natural pollen exposure have been reported.[3,4] In Cj pollinosis, the seasonal changes in specific IgE and IgG levels have been investigated in a small number of patients.[5–7] In the present study, we measured the changes in both IgE and IgG antibody concentrations in about 90 Cj pollinosis patients and also compared the degree of the seasonal changes in 28 Cj pollinosis patients during 2 consecutive years.

METHODS

Sera were obtained from 90 and 87 Cj pollinosis patients in 1990 and 1991, respectively, before (January to February) and after (April to May) the pollination seasons. These patients were living in five regions (Chiyoda-ku, Ota-ku, Kita-ku, Hachioji-city and Chofu-city) in the great Tokyo area. Cry j I protein, a major allergen of Cj pollen,[8] was prepared according to the methods of Yasueda *et al.*[9] The specific IgE antibody was measured by an indirect enzyme-linked immunosorbent assay (ELISA). The second antibody in this ELISA was β-galactosidase-conjugated rabbit anti-human IgE antibody (RAST EIA reagent; Pharmacia, Uppsala, Sweden) and, as a fluorogenic enzyme substrate, 4-methylumbelliferyl-β-galactoside (4MUG) was used.[10] The specific IgG antibody was measured by a reverse-sandwich ELISA.[11] After absorption of total IgE with anti-IgE sepharose gel serum samples were incubated in a Cry j I coated microplate. After washing of the microplate, biotinylated Cry j I was allowed to react and then, after washing, streptavidin-conjugated β-galactosidase was added. After the final washing, 4MUG was added and then fluorescence of the reaction product was measured on a fluorometric microplate reader (Fluoroskan; Flow Laboratories, McLean, VA, USA). Biotinylation of Cry j I was carried out by the procedure as described by Miyazawa *et al.*[11] according to the methods of Nerurkar *et al.*[12] This reverse-sandwich ELISA detects mainly IgG antibody; in Sephacryl S-300 chromatography, the antibody activity eluted at the IgG and IgE+IgA fractions, and the activity at the latter fraction was abolished by pretreatment of the serum with the anti-IgE gel.[11] Relative IgE and IgG antibody units of serum samples were determined from standard curves obtained from a pooled serum. Total IgE was assayed by a sandwich ELISA using anti-human

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IgE (Tago, Camarillo, CA, USA) as capture antibody and β-galactosidase conjugated anti-human IgE antibody as detector. Total IgE concentration (ng/mL) was determined using human IgE standards (Phadezyme IgE PRIST reagent; Pharmacia, Uppsala, Sweden).

RESULTS

Figure 1 shows the anti-Cry j I antibody responses in 1990. Increases in specific IgE levels were detected in 87 of the 90 patients after natural exposure (Fig. 1a; Wilcoxon signed-rank test, P=0.0001). In 20 out of the 90 patients, specific IgG antibodies also increased (Fig. 1b; P=0.0001). However, the degree of increase was not as large as that in specific IgE. In 1991, similar findings were obtained (data not shown). These findings indicate that the specific IgE antibody, which plays the most important part in pollinosis, is preferentially produced by natural exposure to Cj pollen.

Next, we examined the changes in the antibody levels in Cj pollinosis patients for a period of 2 years. Sera from 28 patients were obtained for the two pollination seasons. The level of specific IgE increased after the pollination season in 1990 and decreased before the next season in 1991 to the pre-season level in 1990. Then, after the pollination season in 1991, the level increased again (Fig. 2a). Patterns of changes in the levels of total IgE and specific IgG were similar to that of specific IgE during the 2 observation years (Fig. 2). However, the degree of change (increase then decrease) in specific IgE was much greater than those in total IgE and specific IgG (Fig. 2).

Regional differences in geometric mean levels of specific and total IgE among five regions were then compared. Figure 3 shows the specific and total IgE and total pollen count in 1990. Pollen was collected and counted during the pollination season, using the Durham's pollen slide shelter, by the Bureau of Public Health, Tokyo Metropolitan Government. Specific and total IgE levels increased in all five regions during the pollination season. In Hachioji-city, which is located near mountains with the highest pollen count, both pre- and post-seasonal levels of specific IgE and total IgE were higher than in the other four regions. The level of IgG also increased in all five regions; Hachioji-city being the highest (data not shown). Findings obtained in 1991 were similar to those obtained in 1990.

DISCUSSION

In this study, we examined the changes of specific IgE and IgG levels and confirmed that the degree of the change of specific IgE was higher than that of specific IgG as previously reported by Ogawa *et al.*[6] in four pollinosis patients who were followed for 3 years. It is not known why natural pollen exposure causes the preferential induction of specific IgE compared to IgG. It may be that the pollen is naturally a specific inducer for IgE class antibodies and/or that the IgE antibody producing cells, which are primed via the nasal mucosal route, may be preferentially

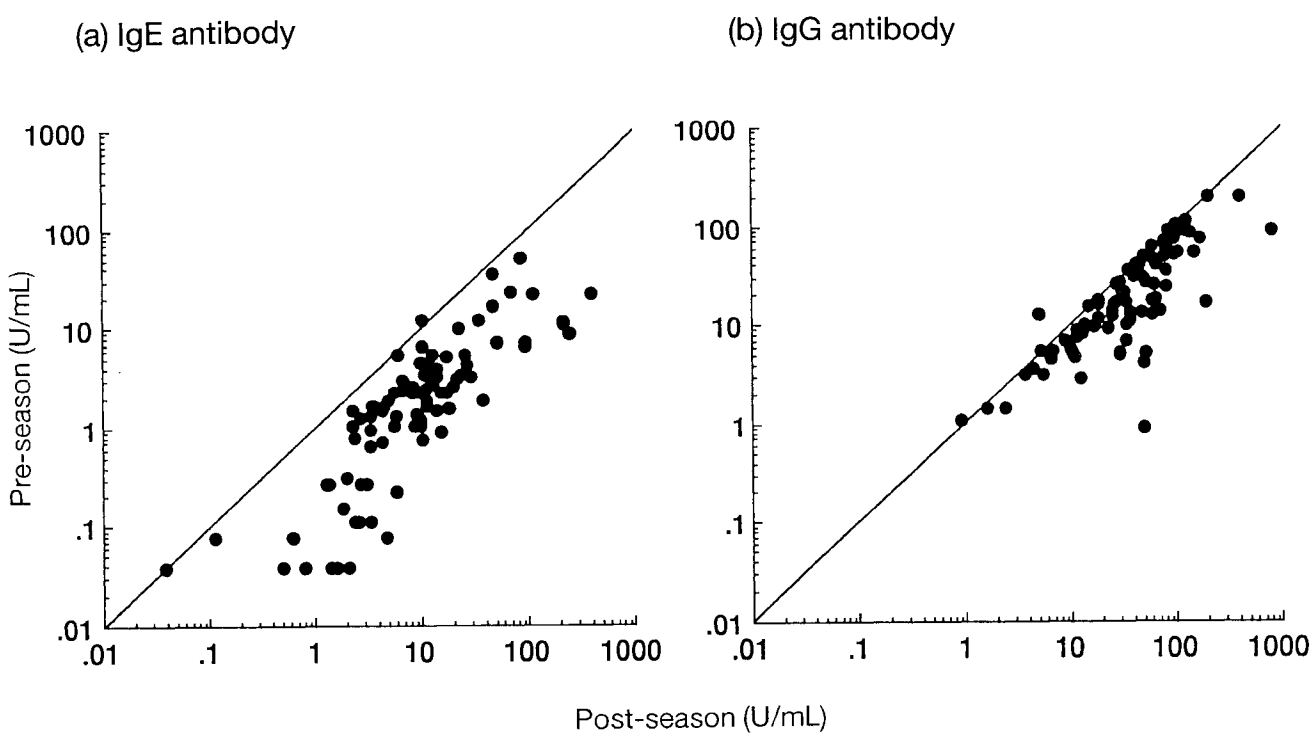

Fig. 1 Pre- and post-seasonal anti-Cry j I antibody responses in patients in 1990. Antibody concentrations are expressed as arbitrary units (U/mL).

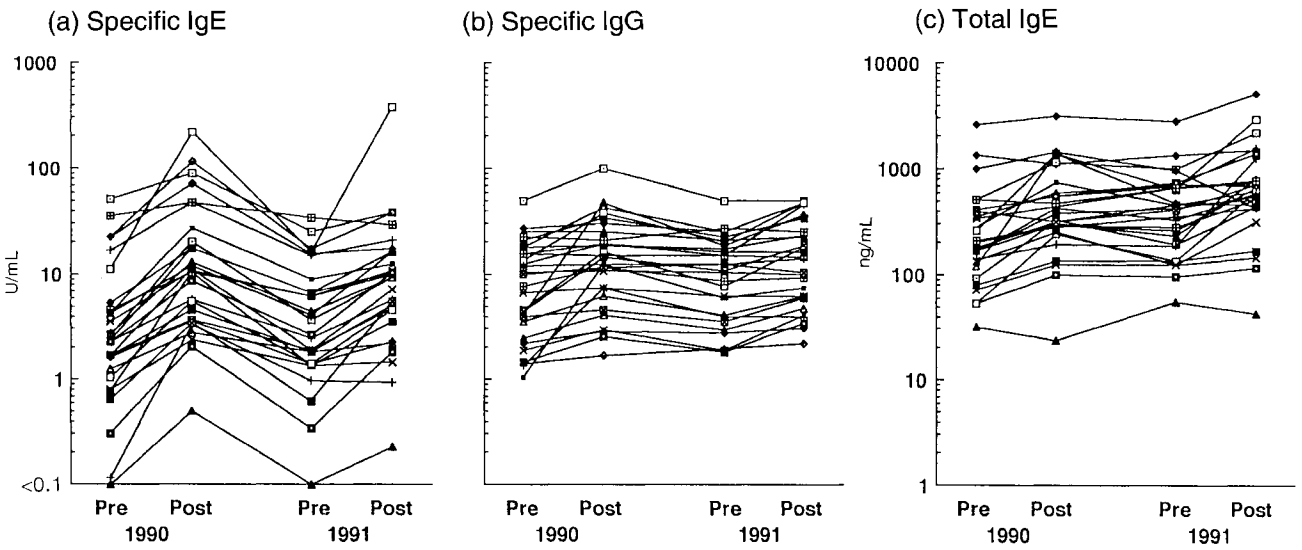

Fig. 2 Two seasonal anti-Cry j I and total IgE antibody responses in 28 patients. Specific IgE and IgG concentrations are expressed as arbitrary units (U/mL).

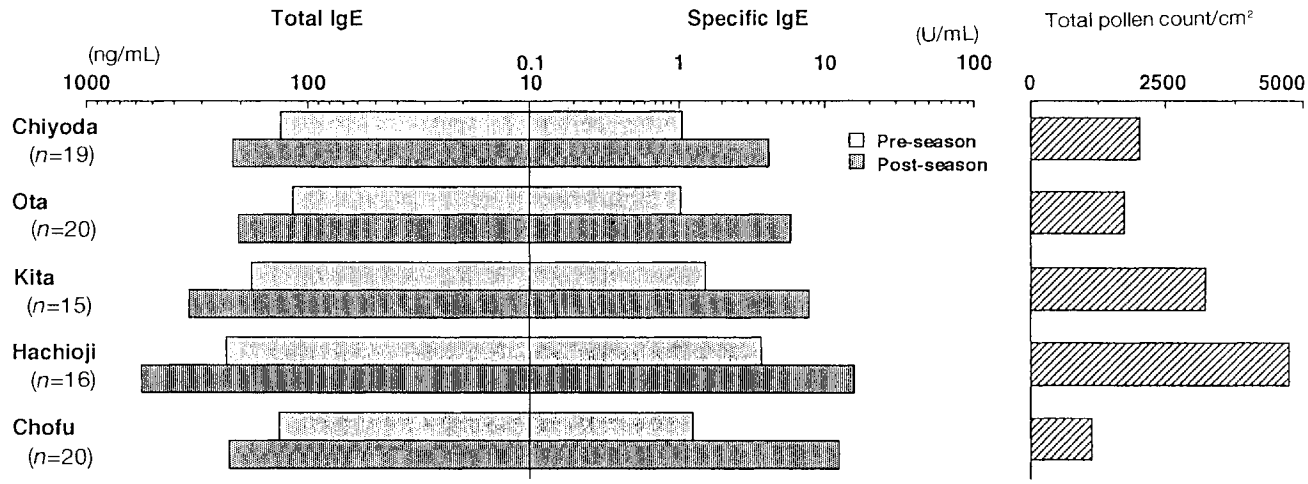

Fig. 3 IgE antibody responses and total pollen count in five regions during the pollination season in 1990. Antibody concentrations are shown as geometric means. *n*=number of patients. Specific IgE concentrations are expressed as arbitrary units (U/mL).

stimulated via the same route. In this study, we also found that patients living in areas with higher pollen counts tended to show higher IgE antibody levels, although some discrepancy was found in one region (Chofu; Fig. 3). Moreover, Ogawa *et al.*[6] reported that the four patients in their study showed higher IgE antibody levels in the years of higher pollen counts.[6] These results may reflect that the incidence of pollinosis appeared to be related to the amount of pollen to which the residents were exposed.[13]

In conclusion, these findings confirm that (i) natural allergen exposure causes the induction of both allergen-specific IgE and IgG, but (ii) it causes preferential induction of allergen-specific IgE to IgG antibody and suggest that (iii) the antibody production seems to be dependent on the amount of allergens to which the patients are exposed.

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