

Short communication

Can mite-specific IgE be used as a surrogate for mite exposure?

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Several epidemiologic studies suggest that in mite-sensitive patients symptoms are dependent upon mite-exposure level. However, in clinical practice, it is not easy to measure major mite allergens. In contrast, assay of specific IgE antibodies can be done routinely. Thus, we wanted to compare, in a group of 40 mite-sensitive patients, the levels of mite-specific IgE (measured by RAST grade 0–6) and the level of mite group I allergen in mattresses (measured in $\mu\text{g/g}$ house dust). The correlation coefficient between both variables was highly significant ($P = 0.001$). Subjects with a RAST grade of 3 or more had a 77% probability of being exposed to high (i.e., $> 10 \mu\text{g/g}$ dust) mite allergen level. In contrast, subjects with RAST grades 0, 1, or 2 had a 77% probability of not being exposed to such high levels. Thus, measurement of serum mite-specific IgE level could be used in routine prediction of mite exposure.

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The clinical diagnosis of house-dust-mite (HDM) allergy is difficult. A suggestive history of HDM allergy is represented by occurrence of symptoms during domestic activity (vacuuming, dusting, making beds, or shaking out blankets) (8). Specific bronchial challenge with mite extracts is correlated with mite sensitivity (10), but it does not actually mimic real exposure to house dust (13). A body of epidemiologic data has proved that high exposure to HDM governs expression of the disease in HDM-sensitive asthma (12–14, 17). Unfortunately, collection and processing of house dust cannot be part of the routine evaluation of asthmatic patients. In this paper, we investigated whether measurement of serum-specific HDM-IgE could be used as a surrogate of HDM-exposure by comparing both factors in asthmatic patients allergic to HDM.

Material and methods

The study population consisted of 43 subjects, comprising 32 asthmatic subjects and 11 nonasthmatic subjects, parents, siblings, or children of the asthmatic subjects. The criterion for inclusion in the study was a positive skin test for *Dermatophagoides pteronyssinus*. Skin tests were performed with Phazet

(Pharmalgen, Pharmacia Diagnostics AB, Uppsala, Sweden) for *D. pteronyssinus* (RF 43009). Phazet is a puncture test involving needles coated with standardized allergens. The validity of this test has been previously evaluated (2). A mean wheal diameter equal to or larger than half the positive test (1% histamine hydrochloride) and larger than the negative control (saline) was considered to be positive.

Dust samples from bedding were collected by vacuuming according to the recommendations of the First International Workshop on Asthma and Mites, i.e., 2 min/m^2 . Samples were prepared by extracting 100 mg sieved dust in 2 ml of borate-buffered saline. Extracts were stored at -80°C until testing. Samples containing less than 100 mg house dust were discarded. A quantitative, two-site monoclonal antibody (Mab) ELISA for two mite-allergens, *Der p* I and *Der f* I was performed. Each sample was assayed at two different dilutions, and, for each dilution, assays were performed twice. Thus, each result is the mean of four measurements. HDM exposure was considered to be the sum of *Der p* I and *Der f* I, namely, group I allergen level, expressed in $\mu\text{g/g}$ dust. The monoclonal antibodies were kindly provided by M. D. Chapman and T. A. E. Platts-Mills. Their production and characterization have been

Table 1. Sensitivity, specificity, and positive and negative predictive value (PPV and NPV, respectively) of RAST grades 0–2 and RAST grades 3–6, relative to a high (i.e., > 10 µg/g dust) mite-allergen exposure in mattresses

RAST grades	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
0–2 (<i>n</i> =22)	26.3	19.0	22.7	77.2
3–6 (<i>n</i> =18)	73.7	81.0	77.7	22.2

previously described (11, 14). Overall, 37 homes were investigated.

HDM serum-specific IgE was measured by the CAP system (Pharmacia Diagnostics AB, Uppsala, Sweden). The CAP system is a more sensitive method than the usual RAST, but both methods provide highly correlated results (1). Results are expressed quantitatively (kU/l) and qualitatively (grades 0–6). As an index of specific sensitization to mites, we also used the diameter of the wheal induced by prick testing with mite extracts.

For statistical analysis, using HDM exposure, on one hand, and specific IgE and diameter of the wheal, on the other hand, as continuous variables, we computed correlation coefficients. Grouping together RAST grades 0, 1, and 2, on one hand, and RAST grades 3, 4, 5, and 6, on the other hand, we also compared mean group I allergen levels by analysis of variance.

Using 10 µg/g dust as a threshold for a high mite-allergen exposure, we computed sensitivity, specificity, and positive and negative predictive values of RAST grades relative to predicting a mite-allergen level larger than 10 µg/g dust (12).

Results

The concentration of group I allergen in dust samples collected from bedding showed large variations, from 0.9 to 103 µg/g dust. The mean (SD) value was 18.6 ± 21.3 µg/g dust. Fig. 1 illustrates the relationship between level of specific IgE, expressed in grades, and group I allergen level in mattresses. Correlation between both variables was highly significant ($r = 0.57$; $P = 0.0001$). The same relationship was obtained when level of specific IgE was used as a continuous variable ($r = 0.56$; $P = 0.0002$). Mean group I allergen level was equal to 7.6 ± 8.7 µg/g dust in patients with RAST grades 0, 1, or 2, but it was 29.5 ± 24.6 µg/g dust in patients with RAST grades 3–6, a difference which was statistically significant ($P < 0.001$). The positive predictive value of RAST grades 3–6, i.e., the probability that the mite-allergen level in the mattress would be higher than 10 µg/g dust, reached 77%. In contrast, the negative predicted value of RAST 0, 1, or 2, i.e., the probability that the mite-allergen level in the mattress would be lower than 10 µg, was equal to 77.2%. However,

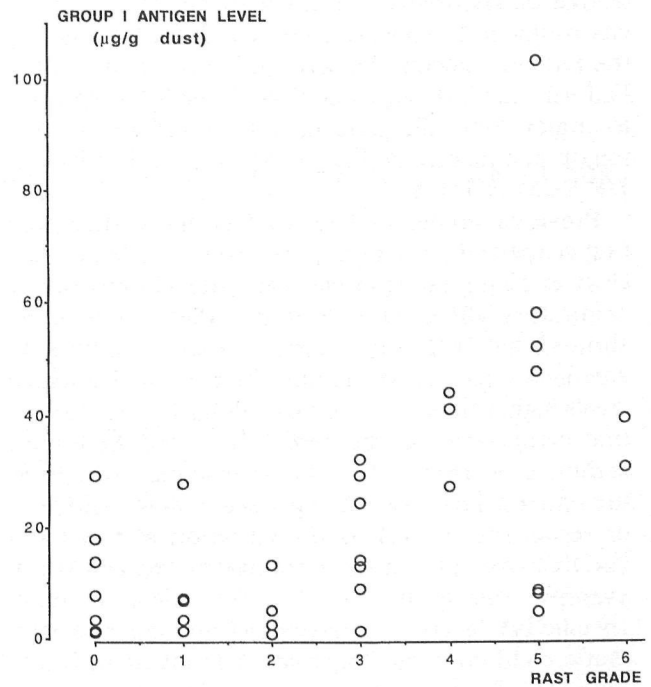


Fig. 1. Relationship between serum mite-allergen levels (expressed in grades) and group I allergen content in mattresses (expressed in µg/g dust).

five patients with RAST grades 0, 1, or 2 had high group I allergen levels (30, 28, 18, 14, and 12 µg/g dust, respectively). Mean wheal diameter in those patients was 3.9 mm, whereas it was 4.2 mm in patients with RAST grade 3 or higher. Moreover, two patients had a RAST grade 5 and low group I allergen levels (5.1 and 8.6 µg/g dust, respectively). The correlation between diameter of the wheal induced by skin test with mites and group I was not significant.

Discussion

This study shows that, in most cases, measurement of serum HDM-IgE level can be used as a surrogate for HDM exposure. This measurement can be performed routinely in outpatients. A positive result (RAST grade 3 or more) implied a 77% probability of a high mite exposure (group I allergen level > 10 µg/g dust), whereas a negative result (RAST grades 0, 1, or 2) implied a 77.2% probability of a low mite-allergen level. However, there were a few exceptions (Fig. 1). Subjects were included in this study by a positive skin test to mites. It is likely that, within this group of subjects, some have a moderate sensitivity to mites, whereas others have a very high sensitivity. In extreme cases, nonatopic subjects may be exposed to a very high mite-allergen level without being sensitized. This could explain why three subjects in our group had quite high mite-allergen exposure without showing serum mite-specific IgE. The

degree of sensitivity is known to be influenced by environmental exposure to mites (3, 9), but also by the patient's genetic background. For example, the Oxford team has suggested that atopic IgE responses to major mite allergens may be restricted by the major histocompatibility complex encoded by the DP locus of HLA (5).

Previous epidemiologic studies have suggested that sensitized persons exposed to mite allergen levels over 10 µg/g dust are at risk of developing severe respiratory allergy. For example, Platts-Mills et al. showed that 16/18 mite-allergic patients admitted to emergency rooms for asthma had group I allergen levels higher than 10 µg/g dust. Pollart et al. showed that serum-specific IgE level was a risk factor for asthma exacerbation (15). Other evidence to support the relationship between exposure to mites and level of serum-specific IgE is the variation of this latter variable over time after a change in exposure. For example, our group found a 50% drop in mite-specific IgE levels in a group of 42 mite-allergic asthmatic children during a prolonged stay at high altitude (18). Similar data have been obtained in grass-sensitive patients after the pollen season (4, 7).

The relationship between exposure to HDM allergen and sensitization to mites shown by presence of serum-specific IgE has been previously demonstrated. Rowntree et al. (16) have shown that all children with positive RAST for mites had group I allergen levels in bedroom floor dust higher than 2 µg/g dust. Similar results were obtained by Lau et al. with atopic children and young adults (6).

In conclusion, these data show that measurement of serum mite-specific IgE can usually serve as an index of current mite exposure. Thus, this variable can help to identify those patients for whom mite exposure is an important triggering factor.

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