THE FREQUENCY OF IGE ANTIBODIES SPECIFIC TO INHALANT AND FOOD ALLERGENS IN ADULT ASTHMATIC PATIENTS IN RIYADH, SAUDI ARABIA

Mohammed O. GadElRab, MBBS, MD, FACAAI

The number of studies examining the influence of allergies on the natural history of asthma in adults is relatively few. Most of these patients are thought to have intrinsic asthma and, therefore, allergy evaluation is not performed as a routine investigation. However, recent studies have provided some evidence that allergy may play a role in adults with asthma. It has been shown that the frequency of immediate skin test reactivity in these patients was high, ranging from 58% to 80%.[1,2] A recent study by Lin et al. demonstrated that 48.1% of adult asthmatic patients have immediate skin test reactivity to at least one of the 25 common allergens tested.[3] On the other hand, Inouye et al. showed that the intensity of skin test reactivity in adults was not associated with increased severity of asthma.[4] However, Pollart et al. have demonstrated that the presence of specific IgE antibodies to allergens was an important risk factor for acute asthma in adults.[5] Many other reports have also shown a correlation of atopic status with asthma severity in young adults.[6-11]

The aim of this study was to determine the frequency of sensitization to inhalant and food allergens in adult asthmatic patients with a history of allergy in Riyadh. Such information has never been reported before in this region. The types of allergens to which the patients reacted and the optimal number that can be used as a screening panel for allergy evaluation were presented and discussed.

Patients and Methods

The study group included 100 consecutive adult asthmatic patients referred to the Allergy Clinic at King Khalid University Hospital for evaluation of possible allergic factors. Since not all the patients with asthma in the hospital have allergy evaluation routinely, this referral was based on a suggestive medical history. This included patients who suspect an association between exposure to certain provoking factors or ingestion of certain foods and precipitation or aggravation of their symptoms. Their ages ranged between 19 to 65 years and the male to female ratio was 2:1. The diagnosis of asthma was based on a compatible clinical history and the presence of variable airflow obstruction as demonstrated by an improvement in FEV1 of greater than 15% after bronchodilator.

CAP RAST Assay

Blood samples were obtained from the patients and the serum separated and stored at –70°C until assayed. The samples were tested for the presence of specific IgE antibodies to inhalant and food allergens by the new Pharmacia CAP System RAST FEIA (Uppsala, Sweden), which has already been shown to be very sensitive. The panel of inhalant and food allergens included in the test appear in Tables 1 and 2. The patient's serum was added to the allergen of interest, which was covalently coupled to immunoCAP. After washing away nonspecific IgE, enzyme-labelled antibodies against IgE were added to form a complex. After incubation, unbound enzyme anti-IgE was washed away and the bound complex was then incubated with a developing agent. After stopping the reaction, the fluorescence of the eluate was measured in fluorocount 96. The higher the fluorescence value, the more specific IgE was present in the specimen.

Results

Interpretation of Results

The values are expressed as Ku/L. Values under 0.35 Ku/L are considered to be negative, those between 0.36 and 0.70 to be borderline (Class I) and those above 0.70 to be positive. Values between 0.70 and 3.5 Ku/L are attributed to Class 2, 3.5 Ku/L to 17.5 Ku/L to Class 3, 17.5 to 50 Ku/L to Class 4, and 50 to 100 Ku/L to Class 5.

Of the 100 adult asthmatic patients in the series, 58% gave a positive CAP RAST reaction (≥ Class 2) to at least one of the 24 allergens tested. Twenty-three (39.7%) of the patients reacted to one allergen and 16 (27.6%) reacted to two allergens. Fewer patients reacted to three or more allergens. More reactions were due to inhalant allergens, giving a total of 104 positive RAST reactions. The distribution and CAP RAST Class for the 12 inhalant allergens tested appear in Table 1.

From the College of Medicine, Immunology Division and Allergy Clinic, King Khalid University Hospital, Riyadh, Saudi Arabia.

Address reprint requests and correspondence to Dr. GadElRab: Immunology Division and Allergy Clinic, College of Medicine and KKUH, King Saud University, P.O. Box 2925, Riyadh 11461, Saudi Arabia.

Accepted for publication 20 June 1999. Received 17 March 1999.

The most prominent reactions were due to grass pollen allergens, namely Bermuda (*Cyndon dactylon*) 20% and ryegrass (*Lolium perenne*) 16%. These were followed by reactions to cockroach allergen (14%), cat allergen (12%), house dust 7%, and the house dust mite, *D. pteronyssinus* 8% and *D. farinae* 8%. The least reactions were from chenopodium (weed pollen), mesquite (tree pollen) and fungal allergens, alternaria, aspergillus and cladosporium.

RAST reactions to the 12 food allergens appear in Table 2. A total of 34 positive reactions were obtained. The most prevalent reaction was to peanut allergen (11%). Reactions to other foods were less prominent, ranging between one to three reactions for each food allergen.

The eight most common allergens to which the patients reacted are shown in Table 3. Approximately 96% reacted to these eight allergens, 89% reacted to seven allergens, 73% reacted to five allergens, and 36% of the patients reacted to two allergens. The optimum number of common allergens for screening patients for the presence of specific IgE antibodies appeared to be eight, with an identification rate of 96%.

Discussion

In this study, 58% of adult asthmatic patients gave a positive RAST reaction (≥ Class 2) to at least one of the 24 allergens tested. It was noticeable that most of the patients (39%) reacted to one allergen. This could help in the management of patients by advising on control measures for some allergens, and possibly immunotherapy in selected patients. In the whole series, a total of 138 positive RAST reactions were obtained. Of these, 104 (75.4%) were due to inhalant allergens and 34 (24.6%) to food allergens. The most prevalent reactivity was noted to pollen allergens, namely, Bermuda grass (*Cynodon dactylon*) and ryegrass (*Lolium perenne*). These were followed by sensitivity to indoor allergens, which included the house dust mites (16%), cockroach allergen (14%) and cat allergen (12%). It is interesting to note that these findings are consistent with a report by Pollart et al.[5] from a case control study in Virginia, where the relative risk of asthma was estimated to be 10-fold in the presence of elevated IgE to at least one of the following: ryegrass, ragweed, mite, cockroach or cat allergens. The same panel of allergens, which were reported by Pollart et al., were detected as significant in this study, except for ragweed, which was replaced by Bermuda grass.

Although sensitivity to the house dust mite is known to be an important indoor allergen in many parts of the world,[12,13] the prevalence rate in this study was 16% for mite sensitivity. This comparatively low rate could be explained by the striking regional variation of both species, *D. pteronyssinus* and *D. farinae*, in Saudi Arabia. This has been reported by Al-Frayh et al., who documented wide variations in mite concentrations in different regions of Saudi Arabia.[14] Most patients in this study were from Riyadh in the Central Region, with low mite concentrations. Nevertheless, detection of sensitivity to the house dust mites is important in the management of allergic patients. This is particularly so, since Gilbert et al. have shown that increased specific IgE to house dust mites, as well as cat and cockroach allergens, are associated with acute attacks in adult asthmatic patients.[15] Moreover, avoidance of exposure has been reported to be effective in the treatment of adult asthmatic patients.[16]

Positive RAST reactions to cockroach allergen were noted in 14% of patients. In an earlier study in our region,[17] skin test reactivity was recorded in 22.5% of asthmatic children. It was suggested that cockroach

TABLE 1. *The distribution of specific IgE antibodies (CAP RAST) to 12 inhaled antigens in adult asthmatic patients (n=58).*

	CAP RAST class					
Allergen	1*	2	3	4	5	Total class 2-class 5
House dust mix	8	4	3	–	–	7
Farinae	4	2	4	2	–	8
Pterronyssinus	1	4	2	2	–	8
Cockroach	7	7	6	–	1	14
Cat	3	6	6	–	–	12
Ryegrass	4	8	5	3	–	16
Bermuda	3	5	7	7	1	20
Chenopodium	1	3	3	–	–	6
Mesquite	1	3	2	–	–	5
Alternaria	2	1	–	2	–	3
Aspergillus	1	2	–	1	–	3
Cladosporium	2	2	–	–	–	2
Total positive reactions						104

Class 1 reactions were excluded, being borderline and of no clinical significance.

TABLE 2. *The distribution of specific IgE antibodies (CAP RAST) to 12 food allergens in adult asthmatic patients (n=58).*

	CAP RAST class					
Allergen	1*	2	3	4	5	Total class 2-class 5
Egg white	2	1	1	1	–	3
Egg yolk	–	1	1	–	–	2
Milk	4	3	–	–	–	3
Fish	1	2	–	–	–	2
Peanut	3	6	3	2	–	11
Wheat	1	1	–	2	–	3
Tomato	–	2	–	–	–	2
Meat	1	1	–	–	–	1
Banana	–	1	1	1	–	3
Orange	–	1	–	–	–	1
Cocoa	–	1	–	–	–	1
Cheese	–	–	–	–	2	2
Total positive reactions						34

*Class 1 reactions were excluded, being borderline and of no clinical significance.

TABLE 3. *Sensitivity of the use of combination of allergens in detecting positive RAST reactions in adult asthmatic patients in Riyadh.*

		CAP RAST class						
Allergen	% positive	8*	7	6	5	4	3	2
Bermuda	20	†	†	†	†	†	†	†
Ryegrass	16	†	†	†	†	†	†	†
Cockroach	14	†	†	†	†	†	†	
Cat	12	†	†	†	†	†		
Peanut	11	†	†	†	†			
Pterronyssinus	8	†	†	†				
Farinae	8	†	†					
House dust (mix)	7	†						
% subjects identified		96%	89%	81%	73%	62%	50%	36%

*Optimal number, 8 allergens; †allergens used in test panel.

sensitivity could be an important cause of perennial symptoms in Saudi Arabia.

Three patients in the study group gave positive reactions to *Alternaria*. Skin test reactivity to *Alternaria* has been reported to be associated with almost 200-fold increase in the risk of respiratory arrest among asthmatics in the Midwestern United States.[18] This very dramatic association needs further attention in our region since it has never been noted before. It is relevant to mention that skin test reactivity to *Alternaria* was detected in almost 25% of asthmatic children in the Western region of Saudi Arabia.[17]

Reactivity to food allergens, on the other hand, was less notable. The most outstanding reaction was to peanut allergen, shown by 11% of patients. Reactions to the other food allergens were very low, ranging between 1%-3%. As the sole symptom of food allergy, asthma has been shown to be distinctly unusual. In an earlier study, Onorato et al.[19] reported that only six out of 300 patients (2%) had asthmatic reaction upon a double-blind food challenge. In another study, Novembre et al.[20] found that eight (5.7%) out of 140 asthmatic children had asthma symptoms on challenge. However, they put forward the possibility that foods may have a nonspecific role in the determination of asthma, or in the preparation of bronchi for the possible consequent stimulus. Food allergy may co-exist with an inhalant allergy. Moreover, cross-reactivity between pollen allergens, fruit and vegetable allergens may explain the association between pollen allergy and food allergy.[21] This observation needs further studies in our region, particularly with the high prevalence of pollen allergy observed in this study.

Although there is little information on the effect of the number of allergens used for testing on the adequacy of detecting sensitivity in our region, it appears from this study that the eight common allergens detected will identify 96% of patients by the CAP system FEIA. These common allergens could be used for screening allergic patients in future studies in this region.

In summary, 58% of adult asthmatic patients in this study could be considered atopic subjects. It seems important that allergy evaluation be included in the management of adult asthmatic patients. Since Saudi Arabia is a large country with variable climatic and geographic patterns, further studies will be needed in order to determine the frequency and pattern of sensitization in the different regions.

References

1. Kalliel JN, Goldstein BM, Braman SS, Settipane GA. High frequency of atopic asthma in a pulmonary clinic population. Chest 1989;96: 1336-40.
2. Burrows B, Martinez F, Halonen M, et al. Association of asthma with serum IgE levels and skin test reactivity of allergens. N Eng J Med 1989;320:271-7.
3. Lin FJ, Wong D, Chan-Yeung M. Immediate skin test reactivity in adult asthmatic patients. Ann Allergy Asthma Immunol 1995;74:398-404.
4. Inouye T, Tarlo S, Broder I, et al. Severity of asthma in skin test-negative and skin test-positive patients. J Allergy Clin Immunol 1985; 75:313-9.
5. Pollart S, Chapman M, Fiocca G, et al. Epidemiology of acute asthma: IgE antibodies to common inhalant allergens as a risk factor for emergency room visits. J Allergy Clin Immunol 1989;83:875-82.
6. Kelly WJW, Hudson I, Phelan PD, et al. Childhood asthma in adult life: a further study at 28 years of age. BMJ 1987;294:1059-62.
7. Dodge RR, Burrow B. Prevalence and incidence of asthma and asthma-like symptoms in a general population sample. Am Rev Respir Dis 1980;122:567-75.
8. Shaw RA, Crane J, O'Donnell TV. Asthma symptoms, bronchial hyperresponsiveness and atopy in a Maori and European adolescent population. N Z Med J 1991;104:175-9.
9. Sears MR, Burrows B, Flannery EM, et al. Relation between airway responsiveness and serum IgE in children with asthma and in apparently normal children. N Engl J Med 1991;1325:1067-71.
10. Platts-Mills TA, Tovey ER, Mitchell EB, Moszaro H, Nock P, Wilkins SR. Reduction of bronchial hyperreactivity during prolonged allergen avoidance. Lancet 1982;2:675-8.
11. Bousquet J, Hejjaoui A, Michel FB. Specific immunotherapy in asthma. J Allergy Clin Immunol 1990;86:292-305.
12. Abramson M, Pearson L, Kutin J, et al. Allergies, upper respiratory tract infections and asthma. J Asthma 1994;31:367-74.
13. Platts-Mills TA, Thomas WR, Aalberse RC, et al. Dust mite allergens and asthma: report of a second international workshop. J Allergy Clin Immunol 1992;89:1046-60.
14. Al-Frayh AR, Hasnain SM, GadElRab MO, et al. House dust mite allergens in Saudi Arabia: regional variations and immune response. Ann Saudi Med 1997;17:156-60.
15. Gelber LE, Seltzer LH, Bouzoukis JKL, et al. Sensitization and exposure to indoor allergens as risk factors for asthma among patients presenting to hospital. Ann Rev Respir Dis 1993;147:573-8.
16. Dorward AJ, Colloff MJ, MacKay NS, et al. Effect of house dust mite avoidance measures on adult atopic asthma. Thorax 1988;43:98-102.
17. Al-Frayh AR, GadElRab MO, Al-Najjar A, et al. A comparative study of immediate skin test reactivity in asthmatic children of two different regions in Saudi Arabia. Ann Saudi Med 1992;12:468-71.
18. O'Hallaren MT, Yunginger TV, Offord KP, et al. Exposure to an aeroallergen as a possible precipitating factor in respiratory arrest in young patients with asthma. N Engl J Med 1991;324;359-63.
19. Onorato J, Merland N, Terral C, et al. Placebo-controlled double-blind food challenge in asthma. J Allergy Clin Immunol 1986;78:1139-46.
20. Novembre E, Martino M, Vierucci A. Foods and respiratory allergy. 1988;81:1059-65.
21. Boccafogli A, Vicentini L, Camerani A, et al. Adverse food reactions in patients with grass pollen allergic respiratory disease. Ann Allergy 1994;73:301-8.