

Allergen Skin Test and Total IgE in Adults with Rhinitis in Singapore

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Allergic rhinitis is a common disorder although its true prevalence in many places is unknown. Studies have shown that up to 10% of children and 20% to 30% of adolescents have this problem.¹⁻³ Allergic rhinitis may be seasonal or perennial. The diagnosis of seasonal allergic rhinitis is generally easy since symptoms occur only during the pollinating season of the plants to which the patient is sensitive. Perennial allergic rhinitis presents a greater challenge in diagnosis as symptoms tend to persist throughout the year due to chronic antigen exposure.

Singapore has an equatorial climate with fairly uniform high daily average temperature and relative humidity. Rain falls throughout the year although more during the Northeast Monsoon. Allergic rhinitis in most patients is likely to be perennial. This study was carried out to assess the skin test positivity of patients with clinical features suggestive of allergic rhinitis. Serum total IgE was also measured to determine its value in the diagnosis of allergic rhinitis in our local patients.

SUMMARY The aim of this study was to determine the allergen skin test positivity and total serum IgE of adult patients in Singapore with clinical features suggestive of allergic rhinitis. The study was carried out prospectively from January to August 1990. All patients had one or more of three symptoms (1) rhinorrhoea or nasal congestion, (2) itching nose or throat and (3) sneezing, as well as pale edematous nasal mucosa. Twenty inhalant allergens (Greers Laboratory, USA) were used for skin prick test (SPT). Serum total IgE was measured using 3M FAST test. Eighty-five consecutive patients, 54 males and 31 females, were studied. Their mean age (SD) was 26.8 (6.1) years. More than half (55.3%) had severe symptoms affecting work. Twenty percent did not have any positive skin reaction compared with 44.9% of age-matched healthy controls; 62.4% had 2 or more positive reactions compared to only 37.2% of controls. These differences were statistically significant ($p < 0.002$). The two most commonly positive allergens were *Dermatophagoides farinae* (76.5%) and house dust (61.2%). No significant difference was found in the skin test positivity between males and females. Forty-three patients also had serum total IgE measurement and their geometric mean IgE was 240 IU/l which was significantly higher than the geometric mean IgE of healthy controls (88 IU/l, $p = 0.0005$).

MATERIALS AND METHODS

Subjects

The study was carried out prospectively from January to August 1990. Consecutive adult patients seen by ABJ at the Department of Otorhinolaryngology, Tan Tock Seng Hospital (TTSH) were included if they had the following clinical features: (1) at least one of these symptoms of rhinorrhoea or nasal congestion, itching nose or throat

and sneezing and (2) pale edematous nasal mucosa on speculum examination. A questionnaire was completed at the time of entry into the

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study. The following data were collected : age, sex, race, severity of rhinitis (mild, moderate, severe) and personal history of allergic conjunctivitis, asthma and atopic eczema. Healthy adult individuals without a personal history of rhinitis, asthma and atopic eczema were recruited from amongst medical personnel and medical students.

Skin prick test and serum IgE determination

As complete data on the local aeroallergens was not available then, a panel of 20 allergens (Greers Laboratory, USA) were selected after consultation with the Parks and Recreation Department, Singapore. The panel included pollens of grasses, weeds and trees, molds, animal danders, housedust mite (*Dermatophagoides farinae*) and house dust. Histamine base (1 mg/ml) was used as positive control and diluent (50% glycerine provided by Greers) as negative control. Skin prick test (SPT) was done on the flexor aspect of the forearms by either of two trained technicians at the Respiratory Function Laboratory, TTSH. The standard precautions for SPT including the appropriate avoidance of antihistamines were taken. A reaction was considered positive if the wheal was at least 3 mm or greater in mean diameter (compared to reaction in negative control) with surrounding erythema. Serum total IgE was done at the Pathology Laboratory, Singapore General Hospital using 3M FAST test.

Statistical methods

Statistical analysis was done using the SAS statistical package. Chi-square and *t*-test were used where appropriate.

RESULTS

Eighty-five patients fulfilled the clinical criteria (history and clinical examination) for allergic

rhinitis; all had at least 2 symptoms. There were 54 (63.5%) males and 31 (36.5%) females. Their age range was 18–40 years with a mean (SD) of 26.8 (6.1) years. Sixty-eight (80%) were Chinese, 2 (2.4%) Malay, 13 (15.3%) Indian and 2 (2.4%) of other race (Table 1). There were 78 normal controls who underwent SPT and their demographic profiles were as shown in Table 1.

None of the patients considered their rhinitis to be mild; 47 (55.3%) indicated their symptoms to be sufficiently severe as to interfere with work. Thirty-one (36.5%) also had

symptoms suggestive of allergic conjunctivitis while only 12 (14.1%) gave a history of bronchial asthma. We did not analyse data on personal history of atopic eczema as we found in the course of the study that many patients were either unable to describe their rashes clearly or unable to recall if they had such a complaint during childhood.

Seventeen (20%) of the patients did not have positive reaction to any of the 20 allergens compared to 35 (44.9%) of controls ($p < 0.002$) (Table 2). Fifty-three (62.4%) of the patients were positive to 2 or

Table 1. Demographic profile of patients and normal controls.

Demographic characteristics	Patients n=85	Normal controls n=78
<i>Ethnic group (%)</i>		
Chinese	68 (80.0)	54 (69.2)
Malay	2 (2.4)	14 (17.9)
Indian	13 (15.3)	9 (11.5)
Others	2 (2.4)	1 (1.3)
Male : female	54 : 31	27 : 51
Mean age (SD) years	26.8 (6.1)	26.4 (5.9)

Table 2. Skin prick test positivity of patients and normal controls.

Wheal diameter (mm)	Patients (%)	Normal (%)
0	17 (20.0)*	35 (44.9)
1	15 (17.6)	14 (17.9)
2	25 (29.4)	16 (20.5)
3	12 (14.1)	10 (12.8)
4	5 (5.9)	0
≥ 5	11 (12.9)	3 (3.9)

* $p < 0.002$

more of the allergens compared with only 29 (37.2%) of normal controls ($p < 0.002$). Amongst the patients with 2 or more positive reactions, 25 (47.2%) had 2 positive, 12 (22.6%) had 3 positive, 5 (9.4%) had 4 positive and 11 (20.8%) had more than 5 positive reactions.

The frequency of positivity for each of the allergens is as shown in Table 3. The most commonly positive allergen is *Dermatophagoides farinae* with 65 (76.5%) patients demonstrating positive reaction to it. The next common positive allergen is housedust ($n = 52$, 61.2%) and this is followed by *Acacia* species and common mugwort ($n = 10$ each, 11.8%), kapok ($n = 9$, 10.6%) and cat epithelium ($n = 8$, 9.4%).

Male patients had more positive reactions than females but this was not statistically significant. There was also no statistically significant difference in the number of positive reactions between those with and without a history of asthma as well as between those with moderate and severe rhinitis.

Forty-three of the patients, 34 males and 9 females, also had total IgE measurement. Their mean age (SD) was 25.3 years (5.7). Their geometric mean IgE was 240 IU/l and this was significantly higher than that of normal control ($n = 70$) who had geometric mean IgE of 88 IU/l ($p = 0.0005$). There was no significant difference in IgE level between patients with moderate and severe rhinitis, with positive and negative history of asthma and, between males and females. Although patients with a higher number of positive skin prick test reactions appeared to have higher IgE level but there was no significant difference.

DISCUSSION

We studied allergen skin prick positivity and serum total IgE levels in adult patients with clinical features

Table 3. Frequency of positive reactions to selected allergens.

Allergen (1:20 w/v)	Frequency of positive reaction	
	Patient (%)	Normal (%)
<i>D. farinae</i> †	65 (76.5)	36 (46.2)
Housedust*	52 (61.2)	25 (32.1)
Common mugwort	10 (11.8)	0
<i>Acacia</i> species	10 (11.8)	3 (3.8)
Kapok	9 (10.6)	7 (9.0)
Cat epithelium	8 (9.4)	5 (6.4)
Melaleuca	5 (5.9)	0
Black willow	5 (5.9)	0
Alternaria	5 (5.9)	0
Penicillium	4 (4.7)	0
Bermuda grass	4 (4.7)	4 (5.1)
Para grass	4 (4.7)	2 (2.6)
Red top grass	3 (3.5)	0
Pasture sage	3 (3.5)	0
Aspergillus	3 (3.5)	2 (2.6)
Dog epithelium	2 (2.4)	4 (5.1)
Hormodendrum	2 (2.4)	2 (2.6)
Annual wormwood	2 (2.4)	2 (2.6)
One seed juniper	1 (1.2)	2 (2.6)
Eucalyptus	0	2 (2.6)

All allergens used were at concentration of 1:20 weight/volume except

* Housedust 1:2

† *D. farinae* 10,000 AU/ml

suggestive of allergic rhinitis, at an Otorhinolaryngology Clinic in the General Hospital. We note that although there is no apparent ethnic variation in the incidence of allergic rhinitis⁴ yet we had a higher proportion of Indians and a lower proportion of Malays in our study population when compared to Singapore's ethnic distribution (where Chinese forms the majority followed by Malays and then Indians). Similarly, there were more males than females in the study group. Previous reports indicated that allergic rhinitis appears equally in males and females.^{2,3} One reason for our results would be a possible referral bias of Indians and male patients to the clinic. A

local epidemiologic study is needed to determine if there is a truly higher prevalence of allergic rhinitis in Indians and males. The results of the SPT and IgE measurement showed no significant difference between male and female patients.

All patients in the study had either moderate or severe symptoms. We were not surprised with this as patients with mild symptoms usually do not seek treatment. Whether the patients had moderate or severe symptoms, there is no significant difference in the number of positive skin reactions and total IgE level since other factors such as the load of the allergen in the patient's en-

vironment control the severity of symptoms.⁴ A positive SPT to an allergen merely indicates the presence of specific IgE and previous sensitisation to the particular allergen.

The clinical manifestations of atopy such as allergic rhinitis are determined by both genetic and environmental factors. Aeroallergens differ from region to region depending to a large extent on the local climate. Using a panel of aeroallergens presumed to be present in our local environment, we found housedust mite and housedust to be allergens to which many of our rhinitis patients have specific IgE antibodies (as shown by results of SPT). Previous studies using SPT had shown these two allergens to be the ones most commonly positive in bronchial asthma patients in Singapore.^{5,6} Amongst the pollens, only acacia and common mugwort had a frequency of positivity above 10%. The low positivity to the select panel of pollen allergens could be either because they are present in too low quantity to be of significance or the particular genus is not present in our environment or imported pollen extracts may have different antigens. Bermuda grass for example is certainly found in Singapore yet only 4.7% of the patients gave a positive reaction with the allergen produced by Greers (USA). Preliminary report from the first aerobiological survey in Singapore⁷ revealed that pollen counts are low while the majority of the spores sampled were from molds and ferns. We had low positive reactions to our select panel of mold allergens and this is in keeping with the recent data from this survey which showed that mold spores sampled were of different genus from the prepared mold allergens we obtained from overseas (personal communication). It is interesting to

note that cat epithelia, housedust and housedust mite were also found to be common allergens in rhinitis patients in studies carried out in Malaysia.^{8,9}

Twenty percent of the rhinitis patients did not show positive reaction to any of the 20 allergens. We propose two explanation, firstly, the panel of aeroallergen is incomplete particularly with regards to molds (in the light of results reported by Lee *et al.*⁷) and, secondly, the criteria we used for selection of patients with clinical diagnosis of allergic rhinitis did not completely exclude patients with other causes of perennial rhinitis such as NARES. Whether a patient can have negative skin test on the rare occasion that specific IgE antibodies are produced only locally in the nasal secretions is still debatable.

The total IgE of this group of patients is significantly higher than healthy controls. Thus in our local population, total IgE may be used as an aid in the diagnosis of allergic rhinitis. However, there is a wide range of IgE and it must be remembered that a normal level is not exclusive of an atopic or type I allergic disorder.

We conclude that in the approach to the diagnosis of allergic rhinitis in our local patients. The symptom complex of rhinorrhoea, nasal obstruction, sneezing and itch in the nose or throat and a pale edematous nasal mucosa are fairly reliable. Serum total IgE may be used as an adjunct to diagnosis. A smaller panel of aeroallergens comprising housedust mite, housedust, grass mix, acacia, common mugwort, mold mix, kapok, cat and dog epithelium would be useful both in the diagnosis as well as the management of the patient. In view of the fact that 55.1% of normal healthy people in our study

had reactions to one or more aeroallergens, results of SPT must be correlated with clinical history and findings.

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