Skin Prick Test Reactivity to Common Aeroallergens among Patients with Rhinitis

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ABSTRACT

Among the 89-rhinitis patients, the occurrence of skin prick test **(**SPT) positive was 76.4%. The most common positive SPT reaction occurred with house dust mite (69.7%), followed by cat fur (41.6%), mixed cockroach (25.8%), mixed grass (7.9%) and pollen (6.7%). A history of asthma was elicited in 24.7% of patients and out of that, more than three quarters (86.4%) have positive SPT. History of eczema was elicited in 20.2% and nearly all of them (88.9%) have positive SPT. Rhinitis patients with a history of asthma and eczema (triad) was elicited in 23.6% and out of which, 85.7% have positive SPT as compared with only 53.6% of patients with rhinitis alone having positive SPT ($p = 0.01$. In conclusion, more than three quarters of patient with rhinitis have positive SPT and more than 85% of patients suffering from rhinitis with coexisting allergic disease have positive SPT.

Keywords: Aeroallergens, Rhinitis, Skin Prick Test (SPT)

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INTRODUCTION

Rhinitis is characterized by chronic or recurrent sneezing or by runny or blocked nose. Allergic rhinitis implying the presence of an underlying IgE-mediated hypersensitivity response to environmental allergens, often includes itching among the symptoms [1]. The diagnosis of allergic rhinitis requires positive history, demonstration of IgE mediated response to inhalant allergens by skin or *in vitro* testing and correlation between history and test findings. Skin testing is recommended as the preferred diagnostic study and by confirming the diagnosis, it can help one to specify avoidance allergens measures. Avoidance of clinically

relevant allergens can lead to substantial reduction of symptoms and medication reliance, and this is the most important element of allergic rhinitis management [2].

Although allergic rhinitis is usually thought to be a minor irritating disease, it can cause significant morbidity. It was associated with missed school days and there are a number of atopic disorders that are associated with allergic rhinitis, including asthma, sinusitis and atopic dermatitis. Quality of life survey revealed that significant allergic rhinitis symptoms were just as debilitating as those of moderate to severe asthma [3]. Allergic rhinitis symptoms can have detrimental effects on the physical, psychological and social aspects of patients' life [4,5]. This study was undertaken to determine the prevalence of Skin Prick Test (SPT) reactivity to common aeroallergens associated with socio-demographic and environmental factors, among patients with rhinitis, at a Primary Care Clinic.

METHODOLOGY

The study was performed at Primary Care Clinic, HUKM, situated at Bandar Tasik Selatan, Kuala Lumpur. A total of 126 patients were identified to be recruited, based on the inclusion criteria whereby the patients has been diagnosed having rhinitis, of more than 5 years of age, and most importantly consented to be recruited for this study. Out of this number, 96 came for the appointment within the time frame given. Only 3 of them refused to be included in this study. Patients on oral corticosteroids (>20 mg/day) for systemic diseases such as severe asthma, or any immunosuppressive disease such as Systemic Lupus Erythematosus (SLE) or Rheumatoid Arthritis, on tricyclic antidepressants, on benzodiazepines, were mentally retarded suffering from dermatographism; and had a clinical history suggestive of greater risk of anaphylaxis from skin testing (eg. history of angioedema); or history of intubations for bronchiol asthma were not recruited.

Research Tools

Questionnaire

The questionnaire had been developed according to international recommendation for rhinitis based on the Diagnosis of Rhinitis and Allergic Rhinitis [6,7].

Allergy Skin Prick Test (SPT)

The basic pathophysiology behind skin testing is the interaction of the injected allergen with specific IgE antibodies on the surface of skin mast cells. This triggers release of histamine and

formation of a wheal (edema) and flare (erythema) at the site. Prick testing is used for diagnosis of clinically immediate (IgE- mediated) hypersensitivity induced by a wide variety of inhalant and food allergens. Prick tests are performed on the volar aspect of the forearm. Current recommendation calls for a 2 to 2.5cm space between each test site. In addition, the test is not performed within 5cm of the wrist or 3cm of the ante cubical fossa. A sterile lancet or 25 gauge (orange) needle is used to prick the skin (a separate needle is used for each allergen solution). A drop of allergen solution is placed on the skin of the forearm. The excess allergen solution is removed from the skin with an absorbent paper tissue. The reaction is evaluated after 15 minutes.

For specific allergens, a wheal-and-flare reaction 15 minutes after the prick indicates a positive response. Typically, the reaction is equal to or larger than that seen with a histamine control test. Although a large wheal-and-flare response typically indicates a more marked hypersensitivity, significant clinical allergic symptoms may be seen in patients who have only small wheal-and-flare reactions [8]. The SPT is easy to perform, does not hurt and is generally, not dangerous - the allergen extracts used are concentrated and thus stable.

Skin test cannot be carried out on sites of active dermatitis or severe dermatographism. To properly interpret prick tests, both a positive and a negative control test are needed. The negative control should be the diluent used for the allergy extracts. These measures nonspecific reactivity induced by the diluent or by the force or technique of the tester. If this negative test causes a 3 mm or large wheal, the prick tests are difficult to interpret. Positive controls are used to detect the skin's reactivity to histamine. The usual positive control is histamine phosphate (2.7 mg/mL equivalent 1 mg/mL of histamine base).

Data Collection

All patients with diagnosis of rhinitis were identified from clinic's census. Based on inclusion criteria, patients were selected and called to the clinic by mail. Those agreed to participate in this study were registered and requested to fill-up questionnaires while waiting to be called to the consultation room. During the consultation, information given in the questionnaire was clarified and the patient was given an appointment for SPT at Allergy Centre, ENT Clinic - HUKM. After the SPT, the patient returned to the Primary Care Centre with the results of the

test. Consent from the patient and ethical approval were obtained from the Primary Care Clinic manager before the study was carried out.

Data Analysis

Data entry and analysis were computed using SPSS version 15. Descriptive statistics were used to describe socio-demographic data. Chi-square and Students' T-test were used to determine the association for categorical and continuous data respectively. It is stated significant if it is less than 0.05.

RESULTS

From the total of 93 patients, 4 dropped out of the study, 2 of which were unable to come on the SPT appointment date and time, one was hospitalised and another patient has shifted to another state (N = 89).

Result of SPT Reactivity among Rhinitis

Around three quarter (76.4%) of respondents were reported to have positive SPT to aeroallergens. Most of the respondents (69.7 %) were reactive to mixed mites and less than 7% were reactive to pollen. Half of the respondents have multiple allergens positively (two or more positive allergen) (Table I).

Table I: Showing status of SPT reactivity to common aeroallergen, and frequency of aeroallergens positively in rhinitis patients (N = 89)

Rhinitis		SPT Result to Aeroallergen	
		Positive (%)	Negative (%)
		68 (76.4 %)	21 (23.6 %)
Factors		SPT Reactivity	
		Positive (%)	Negative (%)
Aeroallergens	Mixed Mites	62 (69.7 %)	27 (30.3 %)
	Cat Fur	37 (41.6 %)	52 (58.4 %)
	Mixed Cockroach	23 (25.8 %)	66 (74.2 %)
	Mixed Grass	7 (7.9 %)	82 (92.1 %)
	Pollen	6 (6.7 %)	83 (93.3 %)
Number of allergens		Number of patients positive (n %)	
0		21 (23.6 %)	
1		23 (25.8 %)	
2		28 (31.5 %)	
3		14 (15.7 %)	
4		2 (2.2 %)	
5		1 (1.1 %)	

Status of SPT Reactivity among Respondents with Coexisting Allergic Disease

This study showed rhinitis patients with other coexisting allergic disease have a higher proportion of positive SPT: 88.9% (16 of 18) of rhinitis patients with eczema, 85.7% of rhinitis patients with asthma, and 86.4% rhinitis patients with eczema (triad), have positive SPT. 53.6% patients with positive SPT have rhinitis alone. Statistical calculation showed that there was significant association between positive SPT reactivity in the different groups of respondents with coexisting allergic disease (Table II).

Table II: Numbers of positive SPT to common aeroallergens in sub-group of rhinitis (*Significant)

	SPT Reactivity		Total	X^2 & p value
	Positive (n)	Negative (n)		
Rhinitis alone	15	13	28	$X^2 = 11.873$ df = 3 p = 0.01
Rhinitis + asthma	19	3	22	
Rhinitis + eczema	16	2	18	
Triad	18	3	21	
Total	68*	21	89	

SPT Reactivity with Socio-Demographic Characteristic of Respondents

Positive SPT reactivity was found to be almost equal between females -76.5% (36 of 47) and 76.1% (32 of 42) males. The Chinese gave the highest percentage of positive SPT reactivity - 82.4% (14 of 17). The mean age for positive SPT was younger than that for negative SPT. Statistically, none of the socio-demographic characteristics showed any significant result on the SPT reactivity ($p > 0.05$) (Table III).

SPT Reactivity with Common Environmental Factors in Rhinitis

More than 50% (61.8%) positive SPT patients have exposure to carpets, whereas 47.1% of positive SPT subjects have pets. 35.3% (32 of 68) of positive SPT patients have air-conditioner at home or office. Statistical calculation of data shows that none of the environmental factors has any significant association with SPT reactivity ($p > 0.05$) (Table IV).

Table III: Showing SPT reactivity with socio-demographic characteristic of respondents (N = 89)

Socio-demographic characteristic		SPT Reactivity		n = 89	X² & p value
		Positive (n = 68)	Negative (n = 21)		
Gender	Female	36	11	47	X² = 0.002
	Male	32	10	42	df = 1
					p = 0.964
Ethnic	Malay	51	17	68	X² = 1.014
	Chinese	14	3	17	df = 2
	Indian	3	1	4	p = 0.798
	5 – 14 yrs	27	7	34	X² = 4.630
Age	15 – 24 yrs	13	3	16	df = 5
Group	25 – 34 yrs	4	3	7	p = 0.462
	35 – 44 yrs	7	3	10	
	45 – 54 yrs	14	3	17	
	55 – 64 yrs	3	2	5	
Mean Age		26.19 ± 17.73	27.52 ± 17.76		t – test F = 0.301 (p = 0.764)

Table IV: Association between other environmental factors exposure with SPT results

Exposure to Environmental Factors		SPT Reactivity		n = 89	X² & p value
		Positive (n = 68)	Negative (n = 21)		
	Yes	42	14	56	X² = 0.165
Carpet	No	26	7	33	df = 1
					p = 0.684
	Yes	32	10	42	X² = 0.002
Air-Cond.	No	36	11	47	df = 1
					p = 0.964
	Yes	24	4	28	X² = 2.099
Pet	No	44	17	61	df = 1
					p = 0.147

DISCUSSION

This study revealed that the prevalence of atopy among patients with rhinitis is 76.4 %. On the other hand, the prevalence of atopy among rhinitis patients has been reported to range between 65 – 95 % in other series using SPT response to environmental inhaled allergens [9-12]. The atopy in this study, focused on the five common aeroallergens, and the house dust mites (*D. Pteronyssimus* and *D. Farinae)* proved to be the most common allergen here. This is in keeping with other four studies conducted in Malaysia [13-15].

Even though pollen is a common allergen in United Kingdom and South Africa [1], in this study it was found to be responsible in only 6.7 % of rhinitis respondents. This finding is similar with those of other local studies, which revealed a prevalence range of between 8-24 % for pollen as allergen. The presence of different seasons in temperate countries which provide continuous aeroallergens (pollens) load especially during flowering months has been implicated as the major cause of allergic rhinitis in those countries. Malaysia has no seasonal variations, therefore perennial rhinitis is less prevalent. Besides house dust allergy, this study demonstrated that cat fur and mixed cockroach were the next common aeroallergens. This finding is consistent with those of other local studies [5].

Rhinitis has been an increasing problem in the paediatric population and previous studies report its manifestations in 25% to 78 % of school children. Another study showed that the onset occurs early in childhood, with median age at presentation of 5 years with a range of 3 months to 15 years. Patients of 5 years of age and above were chosen in our study because they are usually more exposed to environmental factors after their enrolment in kindergarten or school [1]. Individuals with allergic rhinitis are frequently sensitive to more than one allergen. This study showed that 45 (50.6 %) of 89 rhinitis patients were sensitized to two or more allergens. This percentage is lower than that obtained from the study done at tertiary hospitals. Our study, however, obtained similar findings as other studies where 98 (51.0 %) of 192 atopic children were found to be sensitized to two or more allergens [16,17].

Rhinitis patients with coexisting disease have significantly higher proportion of positive SPT, more than 85 % of these subgroup of rhinitis patients have positive SPT as compared to patients with rhinitis alone, 53.6 % (15 of 28) as per Table I. The high percentage of positive SPT, i.e. 86.4%, corresponds to previous studies [15,18], which showed 85.6 % (95 of 111) asthmatic patients with rhinitis have positive SPT reaction, sensitization to aeroallergens is more frequent among patients with both rhinitis and asthma than in those with either condition alone. Asthma was three times more likely to occur in individuals with allergic rhinitis who had positive SPT to allergen [19]. The lack of a significant association between SPT reactivity and environmental factors in this study is an unexpected finding. However, further review of literature showed that exposure to allergens was related to specific sensitisation in a dose-dependant way. Janson et al. [20] showed that there was a significant relation between passive smoking and presence of asthma, and that there was no significant

relation between passive smoking and allergic rhinitis. Factors such as type, duration and severity of allergen exposure early in life, as well as allergens load, could possibly affect the clinical manifestation of allergic upper and lower airways diseases. Most studies on the effect of reducing house dust mite allergen exposure on symptoms of allergic rhinitis have reported benefits [21]. This was covered in this study.

In conclusion, the prevalence of positive SPT to common aeroallergens among patients with rhinitis is high, and was associated significantly with age, ethnic and gender of patients. The most common aeroallergens was mixed mites, followed by cat's fur, mixed cockroach, mixed grass and pollen, with more than 50% of the patients having positive reactivity towards two or more aeroallergens. The prevalence of positive SPT reactivity to common aeroallergen increases when there is coexistence with other allergic diseases and there is a significant association between SPT results with sub-groups of rhinitis. A mixed mite was the commonest aeroallergen.

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