Austin Journal of Allergy

Austin Publishing Group

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Research Article

Study of Allergenicity Spectrum to Aero Allergens by Skin Prick Testing

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Received: June 09, 2014; **Accepted:** June 21, 2014; **Published:** June 23, 2014

Abstract

Background: Respiratory allergies are the most important public health issues in the world. Allergic diseases such as bronchial asthma, allergic rhinitis and atopic dermatitis are dramatically increasing all over the world including developing countries like India. They are caused by aeroallergens which play great role in pathogenesis of respiratory allergic diseases.

Aim: To study the skin sensitivity to various allergens by skin prick test in 102 randomly selected patients of nasobronchial allergy (allergic rhinitis) among patients attending Allergy & Asthma Clinic at Calcutta School of Tropical Medicine, Kolkata, India in the rainy season of 2013.

Methods: The current study was conducted to evaluate the pattern of positive skin test for various aeroallergens among allergic patients in Kolkata, India. 102 participants with allergic rhinitis (seasonal or perennial) with or without asthma were selected. Skin prick test using seven common allergen extracts was performed on all patients.

Results: The overall frequency of sensitization to any allergen was 100%. Overall the most common allergen was found to House dust (86.27%). The second most prevalent allergen was Azadirachta indica (55.68%), followed by Peltophorum pterocarpum (44.11%). No differences between genders were seen but slight decrease in positive reaction to mites with growing ages.

Conclusion: The results of the study revealed that prevalence of the skin prick reactivity to house dust and Azadirachta indica are significant in Kolkata and multiple sensitizations were common.

Keywords: Aeroallergen; Allergic Rhinitis; Asthma; Skin prick test

Introduction

Respiratory allergy is prevalent among all populations with increasing trend all over the world. Epidemiological studies carried out in different countries indicate the prevalence of respiratory allergy as 15–30% [1]. Aeroallergens play a major role in the pathogenesis of respiratory allergic diseases, particularly asthma and rhinitis. Pollen, fungi, animal danders, house dust mites, domestic pets, and insects are of particular importance as triggering factors. Therefore, it is essential to have the knowledge of locally prevalent aeroallergens for diagnosis and therapy of allergic patients. Allergic rhinitis is one of the most common chronic conditions, affecting 10% to 30% of adults and up to 40% of children [2]. A recent survey carried out in India shows that 20–30% of the population suffers from allergic rhinitis and that 15% develop asthma [3,4].

Sensitization to aeroallergens is the most important factor causing symptoms in allergic rhinitis [5]. Studies have shown that the distribution and pattern of aeroallergens is significantly different from one country to another [6]. Identification of the most common aeroallergens to which the patients are sensitized has an important role in the diagnosis and treatment of allergic rhinitis.

The objective of this study was to investigate the pattern of skin prick test reactivity to various aeroallergens among allergic rhinitis patients in eastern part of India.

Materials and Methods

Study population and design

A cross-sectional study was conducted in patients attending Allergy & Asthma Clinic at Calcutta School of Tropical Medicine, Kolkata, India. Institutional ethics committee approval was taken prior to start the study. Informed written consent was obtained from all participants who were than included in the study. We included only patients with physician-diagnosed allergic rhinitis with or without asthma who was willing to do skin prick test. We excluded subjects younger than 5 and older than 65 years (because of decreased reactivity of the skin to histamine, in infants and elderly patients), those with dermatographysm, any contraindications to the skin prick test, and patients was on antihistamines and corticosteroids as well as pregnant women.

The diagnosis of allergic rhinitis was confirmed using the score for allergic rhinitis (SFAR) [7] and clinical examination. Demographic data, clinical history (presence of allergic rhinitis, asthma, eczema & sinusitis), family history of atopy, smoking status (current smoker, passive smoker, never smoked or ex-smoker) and medication history were obtained.

Skin prick testing

Citation: Moitra S, Sen S, Datta A, Das S, Das P, et al. Study of Allergenicity Spectrum to Aero Allergens by Skin Prick Testing. Austin J Allergy. 2014;1(1): 4.

All participants were subjected to SPT with test kit (Allergens for Prick Testing, Creative Drugs India); allergenic extracts included 4 groups of allergens: pollens, house dust mites, animal dander and moulds, along with positive control–histamine (1mg/ml) and negative–saline. Skin prick testing is a method for medical diagnosis of allergies that attempt to provoke a small, controlled, allergic response. In the prick test, a few drops of the purified allergen are gently pricked on to the skin surface, usually the forearm. This test is usually done to identify allergies to pet dander, dust, pollen, foods or dust mites. This test was done on both the arms of the patient. At first both the hands were carefully cleaned by a piece of cotton rinsed in ethyl alcohol. This was followed by attaching of the stickers containing names of various aero-allergens. Then the different samples of aero-allergens are put on the portion of the skin in front of the stickers. The allergenic extract was placed on to the volar surface of forearm and introduced into the epidermis (intradermal injections) with sterile lancet (1 mm depth), new for each allergen. 15 minutes later, for each subject, both diameters (the mean of the longest diameter and the diameter perpendicular to it) of skin reaction were recorded and SPT was considered positive if diameter were ≥3 mm compared with control. The order of skin prick testing was first histamine followed by negative control then allergen extracts. A drop from each extract was applied to the skin (7 different extracts on each arm) and then the skin was pricked through each drop using a sterile lancet. Skin prick tests were performed under physician's supervision. Equipment and emergency life saving medications were available to handle any anaphylactic reaction. Patients using drugs affecting skin test were excluded from the study. All the names of aero-allergens were noted in the case sheet of the patient and the resultant case sheet was shown to a physician who finally prescribes effective medication for the patient.

In addition, data like eosinophilic count and total IgE level were appended. Eosinophils were counted from peripheral blood sample stained with May Grünewald and Giemsa, and examined under light microscope (normal range 1-4%). Serum total IgE levels were determined by IRMA (Immunotech product, France) in laboratory Medicine, and values more than 100 IU/ml were considered raised.

Table 1: Demographic and clinical characteristics of study patients (*n* = 102).

Variable	Value
Age (years)	32.87 ± 18.17
Duration of allergic rhinitis (years)	5.97 ±4.1
M:F	62/40 (1/ 1.6)
Pattern of Allergic rhinitis: Seasonal Perennial	 Seasonal pattern 69/102 (67.64%), Perennial pattern 32.36%
Positive family history of allergy	41 (40.19%)
Types of patients	88 (86.27%) with rhinitis and 14 (13.72%) were both having allergic rhinitis and asthma
Disease presentation Sneezing Runny nose Itching and nasal congestion Rhinoconjuctivits	 89 (87.2%) 79 (77.4%) 63 (61.8%) 29 (28.4%)
Smoking history Current smoker Passive smoker Never smoked Ex-smoker	 17(16.7%) 21 (20.6%) 55 (53.9%) 9 (8.8%)

All data were presented in tables and analyzed with descriptive statistics, including percentage, mean and SD. Data were analyzed using SPSS, version 17.

Results and Discussion

This study included 102 allergic rhinitis patients with or without asthma. The mean duration of allergic rhinitis was 5.97 (±4.1) years. Traditionally, allergic rhinitis has been subdivided into seasonal and perennial types based on time and duration of symptom occurrence. Among patients with positive for SPT, seasonal pattern was seen in 69/102 (67.64%) of the patients, perennial pattern in 32.36%. In addition, 41 patients (40.19%) had positive family history of allergy. Concerning the genetic factor which represented by a family history of atopy is an established risk factor for the development of allergic rhinitis in most studies [8]. Among patients 88 (86.27%) with rhinitis and 14 (13.72%) were both having allergic rhinitis and asthma. M/F ratio was 62/40 = 1/ 1.6, with mean age 32.87 ± 18.17 (range 6- 69 years) (Table 1).

Patients with asthma and allergic rhinitis had eosinophil count more than 4%, comparing to only allergic rhinitis (85.7% vs. 67.04%) (Table 2). Elevated serum total IgE levels were measured in 11/14 78.6% of asthma associated with allergic rhinitis and 53/88 60.2% of only rhinitis. In this study the mean total IgE serum in men was significantly higher than women (188.34 vs. 139.28) ($p<0.01$) (Table 2). Elevated total IgE levels are usually associated to allergy, but it may be depend on various factors; such as parasitic infestations, pollution, smoking, local diet and different genetic background. [9]

After performing SPT to all participants, we found reaction to allergens in this manner: Cynodon dactylon 43.13%, Cocos nucifer 41.17%, House dust 86.27%, Azadirachta indica 55.68%, Caesalpinia pulcherrima12.74%, Peltophorum pterocarpum 44.11% and Areca catechu 3.92%.

Overall the most common allergen was found to House dust (86.27%). The second most prevalent allergen was Azadirachta indica (55.68%), followed by Peltophorum pterocarpum (44.11%) (Table 2). No differences between genders were seen but slight decrease in positive reaction to mites with growing ages.

The most of SPT positive patients 98 (96.1%) were reactive to two or more allergens. This is slightly higher than other similar international study reports [10-12].

It seems multi-allergen sensitization may be due to several factors, including cross-reactivity among allergens belonging to close reservoirs, which reflects the presence of common allergenic epitopes in different but botanically close plant species, long-term exposures to close phylogenic source of allergens, and interactions of genetic and environmental factors [13,14].

As the use of a panel of aero allergens belongs to closely related

Table 2: Levels of IgE and eosinophils in allergic rhinitis.

	Allergic Rhinitis (n=88)	Allergic Rhinitis with Asthma (n=14)
IgE level (IU/ml) < 100 IU/ml > 100 IU/ml	 53 (60.2%) 35 (39.8%)	 11 (78.6%) 3 (21.4%)
Eosinophils (%) < 4 % > 4 %	 59 (67.04%) 29 (32.95%)	 12 (85.7%) 2 (14.3%)

Table 3: Frequency of positive skin test positive responses among allergic rhinitis patients (n=102).

Cynodon dactylon	44 (43.13%)
Cocos nucifer	42 (41.17%)
House dust	88 (86.27%)
Azadirachta indica	49 (55.68%)
Caesalpinia pulcherrima	13 (12.74%)
Peltophorum pterocarpum	45 (44.11%)
Areca catechu	04 (3.92%)

species; it may be an explanation of the high rate of multi-sensitization in our study.

Previous study had shown that in West Bengal, 59 types pollen were revealed from air and their maximum concentration was recorded in May. Important dominant types are *Trema orientalis, Asteraceae* and *Chenopodiaceae, Pongamia, Areca catechu, Xanthium* and *Cocos.* At Guwahati, *Poaceae, Cheno/Amaranth, Asteraceae, Putranjiva, Mangifera* and *Eucalyptus,* are the dominant types of pollen [3,15].

In an earlier study, Mandal et al. showed the importance of *Peltophorum pterocarpum* as a dominant avenue tree in India and the purified protein is a clinically relevant allergen with a potential for diagnosis and therapy of patients susceptible to its pollen. Thus, substantial risks of allergic courses can get increased by management of green trees in the cities [16].

These results can be compared with an earlier study of airborne pollen in Calcutta where an attempt was made to design a pollen calendar in the city by a study over 2 years. The dominant pollen types were *Trema* (19%), Poaceae (12.98%), *Casuarina* (5.76%), *Cocos* (5.7%), *Azadirachta* (4.65%), *Peltophorum* (3.71%), *Cyperaceae* (3.68%), *Delonix* (3.18%) and *Areca* (2.56%). Total pollen concentration seems to have a significant positive correlation with temperature and wind speed whereas there was a negative correlation with humidity. Skin tests were most frequently found to be positive with the pollen of Poaceae (49%), *Azadirachta* (46%), *Cocos* (47%), Cyperaceae (35%), *Peltophorum* (33%), *Areca* (29%), *Phoenix* (26%), and *Borassus* (23%). Comparing with our results, it can be said that frequency of skin test positive responses has got diminished with *Cocos and almost same with Azadirachta,Peltophorum and Areca* [17].

An allergic response begins with sensitization to an antigen. In atopic individuals, allergen exposure results in binding to IgE, activation of mast cells and releasing of preformed and newly synthesized mediators [18,19]. These effects, along with neuronal parasympathetic reflexes result in the clinical syndrome of immediate and late phase allergic response, which includes well known symptoms of coughing, wheezing, nasal itching, sneezing and discharge [20].

Although, upper and lower, respiratory symptoms develop for other reasons, allergic etiologies are strongly related to inhaled allergens [21,22].

Conclusion

The results of skin prick test for common aeroallergens in allergic rhinitis patients indicated the high incidence of allergy to house dust mites & plant pollens and the most common was found to be house dust with 86.27%. These results certify that mites are the main cause of sensitization and pollens of polisensitization. Physical measures and changing lifestyle to reduce dust mite allergen levels may improve respiratory symptoms in our patients with respiratory allergies.

However, further studies are needed to identify components of dust particles and define association of this phenomenon with the prevalence or exacerbation of respiratory allergic diseases in local resident population.

Pollen causing allergy are quite variable in different eco-zones which makes it very important to identify pollinosis causing species from every region, and prepare extracts from them for diagnosis and immunotherapy for the benefit of allergy sufferers.

Authors' Contributions

SM, SB and PD carried out data collection. AD and SS collated and analyzed statistics. SS & SB drafted the manuscript. SD & AD finalized the manuscript. All authors read and approved the final manuscript.

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Austin J Allergy - Volume 1 Issue 1 - 2014
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Citation: Moitra S, Sen S, Datta A, Das S, Das P, et al. Study of Allergenicity Spectrum to Aero Allergens by Skin Prick Testing. Austin J Allergy. 2014;1(1): 4.