

Identification of Common Allergens by Skin Prick Test associated with Common Respiratory Allergic Disorders in the City of Jaipur, Rajasthan

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Abstract

One hundred patients who attended Jaipur allergy and asthma center from January 1, 2008 to December 31, 2008 and underwent SPT (Skin prick test) as a part of the diagnostic workup were included in the study. Fifty five common allergen extracts were used for SPT including 46 pollens, 4 danders, 2 insects, 2 fungi and 1 dust mite. Skin reactions were graded and analyzed. All 100 patients exhibited marked positive reaction (2+ to 4+) to one or the other pollen extract, whereas 75% of them showed positive skin reaction to dust mite. Sensitization to danders, insects and fungi was observed in 3-25% of patients. Among pollens *Prosopis juliflora*, *Ricinus Communis*, *Holoptelea integrifolia*, *Amaranthus spinosus*, *Cassia siamea*, *Cassia occidentalis*, *Albizia lebbek* and *Cynodon dactylon* elicited positive skin reactions in maximum number of patients. Similar to other studies, *Aspergillus fumigatus*, *Alternaria alternata* and cockroaches were identified as major sensitizer for respiratory allergy.

Key words: Allergens, Jaipur, Skin Pick Test, Allergic Disorders, India

INTRODUCTION

Incidence of allergic disorders such as allergic rhinitis and bronchial asthma is increasing to epidemic proportions (allergic rhinitis: 10-50%; and bronchial asthma: 5-15%), both in the developed and the developing world, with a reduced quality of life of the patients, lower productivity and increasing medical cost¹. The increasing evidence on the links between allergic rhinitis and asthma comes from epidemiological, immunological and clinical

studies². Epidemiologically, up to 40% of patients with allergic rhinitis also have asthma, and up to 80% of patients with asthma experience nasal symptoms. Furthermore, patients with allergic rhinitis are at three times increased risk of developing asthma compared with those without allergic rhinitis. In children who develop rhinitis within the first year of life, the chances of developing asthma are twice as high as in those who develop rhinitis later in life. Again, rhinitis frequently precedes asthma, and treating allergic rhinitis has beneficial effects on asthma, suggesting that an upper airway disorder is a risk factor for development of asthma^{3,4}.

Recent surveys carried out in India show that 20-30% of the population suffer from allergic rhinitis and

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that 15% develop asthma^{5,6}. However, a study carried over 30 years ago in Delhi reported the prevalence of allergic rhinitis and asthma to be 10% and 1%, respectively⁷.

Aeroallergens play a major role in the pathogenesis of respiratory allergic disorders, particularly asthma and rhinitis. Several allergens from pollen, fungi, animal danders, house dust mites, and insects are detected as important trigger factors⁸ for allergies and asthma.

The role of different pollen allergens varies with environmental conditions, such as climatic factors, pollution and degree of exposure. Because of changes in the climatic conditions, the study of variations in the diurnal and seasonal prevalence of different pollens becomes very important⁹. The management of allergic asthma and rhinitis requires identifying the offending allergens to develop avoidance or treatment strategies. Previously, pollen and spore allergens were recorded at Jaipur (1980-81) under a All India Co-ordinated project on Aerobiology¹⁰. In the present study, attempt has been to identify common aeroallergens by skin prick tests in patients of allergic rhinitis and asthma at Jaipur, Rajasthan.

MATERIAL AND METHODS

Study subjects

Hospital medical records of all subjects who attended Jaipur Allergy and Asthma center from January 1, 2008 to December 31, 2008 were considered for the present study. Subjects who underwent skin prick tests (SPT) as part of diagnostic workup were included in analysis. Out of 960 patients who attended the clinic in above mentioned period, SPT results were available for 100 patients (60 males and 40 females). Mean age was 30.03 years (SD $\pm$ 11.17) for males and 28.9 years (SD $\pm$ 8.40) for females. Among these patients, 50 had allergic rhinitis, 15 had bronchial asthma while 35 were with allergic rhinitis and bronchial asthma both. Sixteen of 100 patients had positive family history for different respiratory allergic disorders.

Skin Prick Test (SPT): Of the 55 common allergen extracts skin prick tested, 46 were from pollens, 4 danders, 2 insects, 2 fungi and 1 dust mite. Allergen

extracts for skin prick test were obtained from All Cure Pharma Ltd. A drop of allergen extract of 1:10 w/v was kept on the volar aspect of forearm and a prick was made through the extract using 26G hypodermic needle and then lifted slightly to allow entry of antigen beneath the stratum corneum epidermis. Glycerinated histamine di-phosphate (5 mg/ml) was used as positive control while glycerinated buffer saline was used as negative control.

The skin reactions were graded after 15 minutes according to Agarwal et al, 2003¹¹. Each patient was evaluated for sensitization to allergen, number of positive reaction and mean wheal size. The positive reactions were defined based on wheal size of negative control (wheal size less than 2mm), 1+ (wheal size up to 2mm), 2+ (wheal size equal to that of positive control i.e. histamine), 3+ (wheal size up to 2 mm more of control), 4+ (wheal size = more than 2 mm of control). Positive reaction of grade 2+, 3+, and 4+ were labeled as marked positive skin reaction.

RESULTS

A total of 100 patient's skin prick tests data with common aeroallergens were included for retrospective analysis in the present study. Of these, 60 (60%) were males and 40 (40%) females in the age group of 12-58 years. All of these patients exhibited marked positive skin reaction (2+ to 4+) to one or the other pollen extract. Seventy five patients were positive with dust mite, 16 with danders, 27 with insects and 8 were positive with fungal extracts.

Amongst pollens, *Prosopis juliflora* showed marked positive skin reaction in maximum patients (16%) followed by *Ricinus communis* (15%), *Holoptelea integrifolia* (14%), *Amaranthus spinosus* (13%), *Cassia siamea* (12%), *Cassia occidentalis* (11%), *Albizia lebbek* (10%), *Cynodon dactylon* (9%), *Ageratum conyzoides* (7%), *Xanthium strumarium* (7%), *Eucalyptus* (7%), and *Morus alba* (7%) (Table 1).

Amongst danders, buffalo dander (8%) and Cow dander's (8%) elicited marked positive reaction in few patients followed by Dog dander (3%) and Cat dander (2%) (Table 2).

Table 1. Results of skin prick tests with pollen extracts on respiratory allergy patients at Jaipur

Sr.No.	Allergen Extract	Patients tested (SPT) No	Marked positive reactions No	%
Grass pollen				
1	<i>Cynodon dactylon</i>	100	9	9
2	<i>Pennisetum typhoides</i>	100	6	6
3	<i>Imperata cylindrica</i>	100	5	5
4	<i>Zea mays</i>	100	4	4
5	<i>Cenchrus ciliaris</i>	100	3	3
6	<i>Sorghum vulgare</i>	100	1	1
Herbs/Shrubs pollen				
7	<i>Ricinus communis</i>	100	15	15
8	<i>Amaranthus spinosus</i>	100	13	13
9	<i>Cassia occidentalis</i>	100	11	11
10	<i>Ageratum conyzoides</i>	100	7	7
11	<i>Xanthium strumarium</i>	100	7	7
12	<i>Suaeda fruticosa</i>	100	6	6
13	<i>Gynandropsis gynandra</i>	100	6	6
14	<i>Brassica campestris</i>	100	6	6
15	<i>Adhatoda vasica</i>	100	5	5
16	<i>Maerua arenaria</i>	100	5	5
17	<i>Parthenium hysterophorus</i>	100	5	5
18	<i>Chenopodium murale</i>	100	4	4
19	<i>Asphodelus tenuifolius</i>	100	4	4
20	<i>Dodonea viscosa</i>	100	4	4
21	<i>Cannabis sativa</i>	100	3	3
22	<i>Chenopodium album</i>	100	3	3
23	<i>Ipomoea fistulosa</i>	100	3	3
24	<i>Rumex dentatus</i>	100	2	2
25	<i>Argemone mexicana</i>	100	2	2
26	<i>Lawsonia inermis</i>	100	1	1
27	<i>Typha angustata</i>	100	1	1
28	<i>Cyperus rotendus</i>	100	0	0
29	<i>Carica papaya</i>	100	0	0
Trees				
30	<i>Prosopis juliflora</i>	100	16	16
31	<i>Holoptelea integrifolia</i>	100	14	14
32	<i>Cassia siamea</i>	100	12	12
33	<i>Albizia lebbek</i>	100	10	10
34	<i>Eucalyptus</i>	100	7	7
35	<i>Morus alba</i>	100	7	7
36	<i>Broussonetia papyrifera</i>	100	4	4
37	<i>Crataeva nurvala</i>	100	4	4
38	<i>Salvadora persica</i>	100	4	4
39	<i>Ailanthus excelsa</i>	100	3	3
40	<i>Cassia fistula</i>	100	3	3
41	<i>Cocos nucifera</i>	100	3	3
42	<i>Melia azedarach</i>	100	3	3
43	<i>Putranjiva roxburghii</i>	100	3	3
44	<i>Azadirachta indica</i>	100	2	2
45	<i>Kigelia pinnata</i>	100	2	2
46	<i>Acacia arabica</i>	100	0	0

Table 2. Results of skin prick tests with non-pollen allergen extracts on respiratory allergy patients at Jaipur

Sr. No.	Allergen Extract	Patient tested No.	Marked positive reactions No.	%
Dander allergen extract				
1	Buffalo dander	100	8	8
2	Cow dander	100	8	8
3	Dog dander	100	3	3
4	Cat dander	100	2	2
Insect allergen extract				
1	Cockroach (Male)	100	23	23
2	Cockroach (Female)	100	25	25
House dust mite extract allergen				
1	<i>Dermatophagoides farinae</i>	100	75	75
Fungus Allergen Extract				
1	<i>Aspergillus fumigatus</i>	100	5	5
2	<i>Alternaria alternata</i>	100	3	3

The prevalence of marked positive reaction, amongst insects, was more with Cockroach female (25%) followed by Cockroach male (23%) (Table 2). Amongst fungi, *Aspergillus fumigatus* exhibited marked positive reaction in few patients (5%) followed by *Alternaria alternata* (3%) (Table 2). Dust Mite extract (*Dermatophagoides farinae*) showed marked positive reaction in many (75%) patients skin prick tested.

DISCUSSION

Pollens and other allergens play an important role in respiratory allergic disorders, hence it is essential to identify them for diagnosis and treatment of these disorders. In India, first atmospheric survey for airborne particles was initiated at Calcutta by Cunningham in 1873¹². After a long gap, Kasliwal and colleagues undertook such studies at Jaipur¹³. Shivpuri *et al.* did extensive studies in Delhi¹⁴. Since then a number of studies have been conducted on airborne pollen types and their concentration.

Aerobiological survey of pollen and spores was made at Jaipur in the years 1980-81 using Aeroscope¹⁰. The predominant pollen types were Poaceae (grass pollens), *Holoptelea*, *Amaranthus*, *Chenopodium*, *Azadirachta* / *Melia*, *Ailanthus*, Euphorbiaceae (*Ricinus* pollen) and *Morus*.

Under All India coordinated project on Aeroallergens and Human Health (2000), 43 types of pollen were recorded from Northern India⁵. The dominant types were *Holoptelea*, Poaceae, *Eucalyptus*, *Casuarina* and *Putranjiva*. *Holoptelea* contributed maximum (22.2%) pollens, followed by Poaceae (11.8%), Asteraceae, *Prosopis juliflora*, *Ricinus communis*, *Morus*, *Mallotus*, *Alnus*, *Argemone*, *Amaranthus* and *Chenopodium* of the total pollen airspora. In the present study, most of the above mentioned pollens were skin prick tested to evaluate sensitization in allergic asthma and rhinitis patients. The dominant pollen allergens identified were *Prosopis juliflora* (16%), *Ricinus communis* (15%), *Holoptelea integrifolia* (14%), *Amaranthus spinosus* (13%), *Cassia siamea* (12%), *Cassia occidentalis* (11%), *Albizia lebbek* (10%), *Cynodon dactylon* (9%), *Ageratum conyzoides* (7%), *Xanthium strumarium* (7%), *Eucalyptus* (7%), and *Morus alba* (7%). The pollen like *Quercus*, *Pinus*, *Alnus*, and *Cedrus* were not tested due to non availability of antigen extract. Moreover, these pollen types belong primarily to hill region of the country. *Casuarina* and *Mallotus* are not common in Jaipur and neighbourhood.

In Delhi, surveys have been conducted from time to time by Singh and Shivpuri¹⁵, Singh and Babu¹⁶ and Malik *et al.*¹⁷. The similarities between the

pollen allergens identified in present and former studies can be attributed to the geographical proximity of Delhi and Jaipur.

In Eastern India, Chanda and Co-workers initiated the work in 1970s to record the airborne pollen of Calcutta. Chanda and Sarkar¹⁸ observed that grass pollen were the major contributors (39%) to the total pollen load in air. The other dominant pollen¹⁹ types were *Azadirachta*, *Caesalpaenia*, *Carica papaya*, *Mangifera indica*, *Amaranthus*, *Chenopodium*, *Xanthium* and *Argemone*. These results show a marked variation from the present study which can be attributed to the difference in geographical distribution of various pollen allergens.

Similar to present study, Prasad et al at lucknow²⁰, (2001) reported *Cynodon*, *Cyperus*, *Lawsonia*, *Eucalyptus*, *Holoptelea*, *Brassica*, *Melia*, *Prosopis*, *Amaranthus*, *Azadirachta* and *Chenopodium* as common pollen allergens by skin tests. Pollens from Poaceae, Asteraceae, Apocynaceae *Rosa*, *Cicer*, *Ricinus*, *Ailanthus*, *Holoptelea*, *Chenopodium*, *Amaranthus* and *Cyperus* were dominant types at Gwalior, Bhopal, and Kolhapur, in central India²¹⁻²³.

Agarwal et al. at Allahabad²⁴ (2008) identified major pollen allergens as *Cynodon dactylon* (56%), *Gynandropsis gynandra* (54%), *Brassica campestris* (52%), and *Putranjiva roxburghii* (52%) by skin tests. Other important pollen allergens were *Albizia lebbek*, *Sorghum vulgare*, *Rumex dentatus*, *Pennisetum typhoides*, and *Ailanthus excelsa*.

In the present study, skin prick tests with house dust mite extract showed marked positive reaction in 75% of patients similar to study of Agrawal et al.²⁴ Amongst the fungi, *Aspergillus fumigatus* and *Alternaria alternata* have been identified as major fungal allergens. In a study conducted by Prasad et al²⁰ the major fungus sensitizer was *Aspergillus fumigatus*. Cockroaches and house dust mite allergens show sensitization in a large number of patients^{25,26} as observed in the present study. This may be attributed to presence of protease allergens in these extracts.^{27,28}

In conclusion, *Prosopis juliflora*, *Ricinus communis*, *Holoptelea integrifolia*, *Amaranthus spinosus*, *Cassia siamea*, *Cassia occidentalis*, *Albizia lebbek* and *Cynodon dactylon* were identified as

important allergens for respiratory allergy disorders by skin prick tests. However, this needs to be validated by specific IgE estimation. Also more such studies are required taking large cohort of patients

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