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Original Article

Internal Medicine Section

Pattern of Allergen Sensitivity among Patients with Bronchial Asthma and/or Allergic Rhinosinusitis in a Tertiary Care Centre of Southern India

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ABSTRACT

Introduction: The distribution of aeroallergens varies among various geographical areas of India and the knowledge of allergen sensitivity pattern in this part of Southern Indian (Karnataka) is limited. This data can provide clinically useful information and better understanding of common allergies prevalent in this area.

Aim: To study the pattern of allergen sensitivity among patients with bronchial asthma and/or allergic rhinosinusitis.

Materials and Methods: In this retrospective study, patients diagnosed with bronchial asthma and/or allergic rhinitis who underwent skin prick testing, were included in the study. Patients who had taken drugs that could affect the test results, within one week prior to testing were excluded. Also, patients on long-acting oral antihistamines within four weeks of testing and pregnant women were excluded. A total of 64 antigens were used which included eight types of pollens, eight types of dusts, six types of fungi, eight types of insects, two types of danders, wool and 31 types of food items. Skin prick testing was done as per standard protocol.

Results: Out of 2219 patients, 1193 (53.8%) were males and 1026 (46.2%) were females. The mean age of the subjects was 41.47 (±14) years. There were 740 (33.3%) patients diagnosed with bronchial asthma, 357 (16.1%) allergic rhinitis and 1122 (50.6%) had both bronchial asthma and allergic rhinitis. Overall the highest percentage of skin-prick test positivity was found among insect allergens (24.45%) followed by dust (24.21%), grass and tree pollen (20.57%), fungus (13.92%) and food allergens (9.28%), in that order. Among the individual allergens, the highest percentage of skin-prick test positivity was present in rice grain dust allergen (33.30%) and the least common was chicken allergen (4.40%).

Conclusion: Among the allergen groups, insects and dusts elicited the highest percentage of skin-prick test positive results. Whereas, among all the individual allergens rice grain dust elicited highest percentage of positives.

Keywords: Aeroallergen, House dust mite, Skin prick test

INTRODUCTION

Respiratory allergy is a major form of allergy and change in environment may be the reason for increased prevalence of nasobronchial allergy throughout the world as well as in India [1]. Airway allergy is now thought of as a disorder affecting the respiratory tract in its entirety, there being a well-recognized link between asthma and rhinitis and this has led to the description of an entity called allergic rhinobronchitis [1].

It is estimated that rhino conjunctivitis, asthma, eczema or anaphylaxis, all of which are mediated via Immunoglobulin E (IgE), affects nearly 20% of global population [2]. Allergic rhinitis and bronchial asthma affect 20% and 15% of the Indian population respectively [2]. Many factors, like inhaled, ingested and contact allergens can trigger off nasobronchial allergy. Skin prick testing may be useful in identifying the antigens responsible in such cases [3].

Types of aeroallergens differ variedly depending upon the geographic region and climate. India, due to its huge size and varied climatic conditions, has a wide range of allergens in different regions [1]. There is very limited data available regarding allergen sensitivity in Southern India. This study was aimed at identifying the pattern of allergen sensitivity among patients with bronchial asthma and/or allergic rhinosinusitis in a cohort of patients from 10 districts of Karnataka and two districts of Kerala.

MATERIALS AND METHODS

This retrospective study was conducted after obtaining permission from the Institutional Ethical Committee. Our centre is located in the Udupi district of the state Karnataka. The patients visiting our centre are mostly drawn from neighbouring districts of Karnataka as well as Kerala. A total of 2219 consecutive patients, who underwent skin prick testing, between January 2011 to June 2014, as out patients or in patients in the Department of Pulmonary Medicine, were included in the study. The inclusion criteria included age between 15 and 75 years and established diagnosis of bronchial asthma and/or allergic rhinitis [4,5]. Children, less than 14 years of age were not included as they might develop automatic remission beyond this age [6]. Patients who had taken short-acting oral antihistaminics, beta-blockers, steroids, tricyclic antidepressants or any other drug that could affect the test within one week prior to testing were excluded. Also, patients on long-acting oral antihistaminics within four weeks of testing and pregnant women were excluded [1,3,7].

A total of 64 antigens were used which included eight types of pollens, eight types of dusts, six types of fungi, eight types of insects, two types of danders, wool and 31 types of food items.

During the skin prick testing the skin was punctured on the volar aspect of the forearm, at 2 to 2.5 cm interval, with a calibrated lancet (1 mm) held vertically and lifted slightly to allow adequate entry of antigen beneath stratum corneum [8]. A positive histamine control and a negative buffered saline control were kept for every patient. At the histamine puncture site a wheal developed within 10 minutes. Evaluation of skin reactivity was done by calculating the mean diameter as (D + d)/2; where D = longest diameter and d = perpendicular diameter at the largest width of D after 15 minutes. If the mean wheal diameter was ≥3 mm than negative control (buffered

saline), it was considered to indicate sensitisation to the allergen and, hence, a positive response. To rule out dermographism, which makes the test results difficult to interpret, the use of the negative control is required [9].

RESULTS

Out of 2219 patients, 1193 (53.8%) were males and 1026 (46.2%) were females. The mean age of the subjects was 41.47 (± 14) years. There were 740 (33.3%) patients diagnosed with bronchial asthma, 357 (16.1%) allergic rhinitis and 1122 (50.6%) had both bronchial asthma and allergic rhinitis. Majority (95.4%) of the patients were from state of Karnataka and the rest from Kannur and Calicut districts of Kerala. The district wise distribution of patients is shown in [Table/Fig-1]. In our study a total of 64 antigens were used per patient and; hence, a total of 142016 skin prick tests were done. The results of the skin prick test are shown in [Table/Fig-2,3].

District	Total Number of Patients (N)	Percentage of Patients (%)
Shivamogga	324	14.60
Davangere	515	23.20
Haveri	163	7.30
Uttar Kannada	170	7.70
Chikkamagaluru	127	5.70
Udupi	575	25.90
Chitradurga	139	6.30
Dakshina Kannada	26	1.20
Ballari	63	2.80
Bengaluru	14	0.60
Kannur*	78	3.50
Calicut*	25	1.10
Total	2219	100

[Table/Fig-1]: District-wise distribution of the patients.
*Districts of Kerala state

Food	Number of Positive Skin Pricks (%)	Food	Number of Positive Skin Pricks (%)
Split red gram	280(12.60)	Walnut	204(9.20)
Split green gram	277(12.50)	Mutton	202(9.10)
Glycine max	259(11.70)	Citrus Lemon	201(9.10)
Coriander	253(11.40)	Mustard	200(9.00)
Pearl millet	251(11.30)	Bengal Gram	198(8.90)
Red kidney beans	242(10.90)	Cashewnut	181(8.20)
Coffe Bean	238(10.70)	Sorghum	182(8.20)
Groundnut	238(10.70)	Black gram	178(8.00)
Pistachios	233(10.50)	Blackpepper	173(7.80)
Chickpea	226(10.20)	Rice	173(7.80)
Tomato	222(10.0)	Chocolate	171(7.70)
Potato	219(9.90)	Egg White	153(6.90)
Milk	216(9.70)	Fish	142(6.40)
Wheat	214(9.60)	Gum Acacia	137(6.20)
Red lentils	208(9.40)	Chicken	98(4.40)
Coconut	209(9.40)	Total	6378 (9.29)

[Table/Fig-3]: Results of the skin prick test to food antigens.
Percentage (%) in the table is calculated as: Number of positive skin pricks ÷ (Total number of individuals tested × No. of antigens tested) × 100
Total number of patients tested for each individual antigen was 2219.

DISCUSSION

Bronchial asthma and allergic rhinitis can coexist in the same patient or can develop one after the other [10]. Genetic, environmental and geographical conditions influence allergic sensitization, and subsequent development of symptoms [11,12]. Atopy is a very important risk factor for bronchial responsiveness and allergens can be precipitating factors even for sudden respiratory arrest [13,14]. Hence, identification of specific allergens which are most prevalent in the region is valuable for diagnosis and treatment of bronchial asthma and allergy rhinitis. Skin prick test is a commonly used method for detecting the implicated allergens and provides faster results when compared Radio Allegro Sorbent Testing (RAST) [9].

In our study, overall the most common offending allergen-group was insects followed by dust, grass and tree pollens, fungus and food allergens. Various studies have reported insects to be the most common offending antigens, with percentage ranging from 17.5% to 43.9% of the antigens studied [1-3]. Somewhat different results were reported, from a study done in Allahabad, Uttar Pradesh, on a relatively smaller cohort (50 patients), which showed dust mite (78%) followed by dust (66%) and insects (44%) as the implicated antigens [8].

Among the individual allergens, in our study, most common offending allergen was rice grain dust and the least common was chicken. In contrast, Kumar R et al., observed, in a study on aeroallergens, that the most common allergen was moth (33%); whereas, the least common was *Ehretia* (0.54%) [3]. Prasad R et al., in a study done in a medical college in Lucknow, found the pollen of *Amaranthus spinosus* to be the most common allergen (39.58%) [2]. This

Grass and Tree Pollen	Number of Positive Skin Pricks (%)	Dust	Number of Positive Skin Pricks (%)	Insects	Number of Positive Skin Pricks (%)	Fungi	Number of Positive Skin Pricks (%)	Misc	Number of Positive Skin Pricks (%)
Prosopis	662(29.80)	Rice Grain Dust	738(33.30)	Cockroach	571(25.70)	A. Fumigatus	316(14.20)	Dog Dander	218(9.8)
Argemone	510(23)	House Dust Mite	728(32.80)	Housefly	659(29.70)	Candida	315(14.20)	Human Dander	221(10)
Eucalyptus	499(22.50)	House Dust	690(31.10)	Rice Weevil	676(30.50)	Cladrosporium	283(12.80)	Wool	188(8.5)
Xanthium	467(21.00)	Cotton Dust	515(23.20)	Mosquito	495(22.30)	Rhizopus	312(14.10)	Total	627(9.4)
Parthenium	456(20.50)	Wheat Dust	459(20.70)	Grasshopper	676(30.50)	A. Niger	308(13.90)		
Zea Mays	376(16.90)	Paper Dust	415(18.70)	Ants	520(23.40)	A. Flavus	320(14.40)		
Cynodon	349(15.70)	Hay Dust	403(18.20)	Honey Bee	386(17.40)	Total	1854(13.92)		
Sorghum	334(15.10)	Wheat Thrashing Dust	351(15.80)	Cricket	358(16.10)				
Total	3653(20.57)	**Total**	4299(24.21)	**Total**	4341(24.45)				

[Table/Fig-2]: Results of the skin prick test with various antigens (grasses, dust, insects and fungi).
Percentage (%) in the table is calculated as: Number of positive skin pricks ÷ (Total number of individuals tested × No. of antigens tested) × 100

difference in various studies could be due to differences in study size and the geographical regions where they were conducted.

In our study, the highest percentage of skin positivity in the insects group was for rice weevil as well as grasshopper, followed by housefly and cockroach. Presence of protease allergens in the extracts obtained from the insects may also be the cause of allergy [15-17]. In contrast to our study, a study done by Kumar R et al., showed most common insect was moth followed by mosquito [3]. Patel A et al., from Gujarat has also reported moth as the most common insect allergen [1]. Agrawal RL et al., from Uttar Pradesh demonstrated cockroach as the most common offending insect [8]. Sarinho ECS et al., in a study from Brazil, conducted on adolescents, found cockroach as the most common allergen [18]. Also, in a study, done in Malaysia on 200 asthmatics, it was again noted that cockroach was the most common allergen demonstrating skin positivity, after house dust mites. Cockroach-derived allergens come from its saliva and faecal material [19]. It is obvious that different studies from different regions and countries are reporting varying results.

Rice grain dust, followed by house dust mite and house dust, were identified as the common dust allergens, in our study. Various studies have reported house dust while others have reported house dust mite as the most common dust allergen [8,20,21]. In general, house dust mite is a common cause of allergy worldwide [22].

Prosopis, argemone and eucalyptus were the three most common grass and tree pollen allergens observed in our study. A similar result was observed by Goyal M et al., in a study on 100 patients in Jaipur, Rajasthan, which revealed prosopis as the most common offending pollen [17]. In contrast, weed pollen, *Ageratum,* were observed as the most common pollen allergen among 918 patents of bronchial asthma and/or allergic rhinitis, in Delhi [3]. *Amaranthus spinosus* was the predominant offending pollen, reported in studies from Lucknow, Uttar Pradesh and Jalandhar, Punjab [2,23]. Varying distribution of pollen grains, among different regions of the country, may explain such different results [24].

The predominant fungus in our study were *Aspergillus flavus* followed by *Aspergillus fumigates* and *Candida*. Differing from our study, some studies have shown *Aspergillus fumigatus* as the most common fungus [2,8]. Study conducted in Jabalpur, on 180 poultry workers, showed predominance of *Aspergillus niger* sensitivity; whereas, study from Punjab reported *Cladosporium herbarum* allergen as the most common, again highlighting the regional variation in the results [23,25].

We observed that split red gram, split green gram, glycine max, coriander, pearl millet showed maximum percentage positivity to skin prick test, in the present study. A study testing for food intolerance, in patients with bronchial asthma in Delhi, by Kumar R et al., showed maximum intolerance to cow milk, casein, tiger nut and almond [26]. Further studies, testing various food allergens are required, in order to determine the sensitivity pattern predominant in different regions as per the food habits.

Our study will be useful in providing information on the pattern of allergen sensitization in this part of the country. The differences in skin positivity test results for various allergens in different regions of the country can be important for management of patients with allergies. Although, avoidance of the allergens may be difficult, it is one of the methods included in the management. Allergen-specific immunotherapy is other option, in selected cases, in addition to the standard treatment.

LIMITATION

The study was hospital based and hence, referral bias becomes a limitation. Moreover, the results cannot be extrapolated to other parts of Karnataka as it is a large state with varied geography.

CONCLUSION

Among the allergen groups, insects and dusts elicited the highest percentage of skin-prick test positive results. Whereas, among all the individual allergens rice grain dust and house dust mite elicited highest percentage of positives.

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