ALLERGEN SENSITIZATION PROFILE IN PATIENTS OF NASO-BRONCHIAL ALLERGY FROM RURAL AND URBAN AREA OF RESIDENCE IN CENTRAL RAJASTHAN

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ABSTRACT

BACKGROUND

Allergic diseases are important contributors of the overall disease burden worldwide. There is tremendous increase in the prevalence of allergic diseases in India in the last 30 years. India is country of diversity in climate, culture, vegetation and regional practices.

The aim of this study was to find out the difference in allergen sensitization profile of patients with nasobronchial allergy between urban and rural area of residence.

MATERIALS AND METHODS

Study included 100 patients of nasobronchial allergy from central Rajasthan who were subjected to skin prick test with a battery of 127 allergen solutions. The pattern of positive prick test was recorded and analysed. The study was conducted over a period of one year.

RESULTS

The most common allergens in rural population were Insect (25.19%) and Dust allergen (17%) while in urban population it was House Dust Mite (30%). Apart from these, sensitization to animal dander (6%) and fungal allergen (3%) was more common in rural population while pollens (7.99%), feather (4.29%), kapok cotton (4.29%) and silk (4.29%) was more common in urban population.

CONCLUSION

Our study concludes that a knowledge of prevalent allergens in a particular geographical area may help in education of general precautions in patients with nasobronchial allergies. Although allergen profile between rural and urban population does not differ significantly, yet it was observed that in rural population 20.16% of SPT were positive in contrast to 7.48% in urban population. It clearly indicates that rural population suffers from multiple allergies and need more hygienic precautions than urban populations.

KEYWORDS

Urban, Rural, Skin Prick Test, Allergen Profile.

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BACKGROUND

Over 20% of world population suffers from immunoglobulin E mediated allergy diseases such as allergic rhinitis, bronchial asthma, Rhino-sinusitis, rhino conjunctivitis, food allergy, atopic eczema, anaphylaxis etc.[1] Asthma is a problem worldwide, with an estimated 300 million affected individuals. The global prevalence of asthma ranges from 1% to 18% of the population in different countries.[2-3] The World Health Organisation has estimated that 15 million disability-adjusted life years (Dalys) are lost annually due to asthma, representing 1% of the global disease burden.[2] In India alone approximately 20% of population suffer from allergic rhinitis, 15% from bronchial asthma.[4] The overall burden of asthma in India is estimated at more than 15 million patients.[5] There is tremendous increase in allergic diseases in India as compared 30 years ago. Reasons attributed to the rising trend are urbanisation and lifestyle changes such as changes in dietary habits, indoor allergen exposure, vehicular pollution, crowding, environmental tobacco smoke exposure and pets at home. A number of allergens associated with various forms of allergy have been

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reported from all over the world.[6-7] The concentration of allergens in the environment varies, depending on various factors including climate, vegetation, and air quality. Allergens responsible for causing allergy differ from region to region with the variations in eco-geographic and climatic conditions.[8-9] This study was conducted to explore differences in the allergen profile of patients with nasobronchial allergy coming from rural and urban background but living in the same region (Central Rajasthan) having similar eco-geographic and climatic conditions.

MATERIALS AND METHODS

This was a non-randomized, prospective observational study. Study was done on 100 patients attending the Allergy Clinic in Outpatient Department, Department of Respiratory Medicine, Jawaharlal Nehru Medical College, Ajmer, over a period of one year. Patients having bronchial asthma and/or allergic rhinitis (according to the GINA.[10] and ARIA.[11] guidelines respectively) in age group of 14-70 years were included in the study. All the patients were subjected to Skin Prick Test as per standard protocol. The results were noted and analysed.

Protocol of Skin Prick Test- Skin prick test was performed in Allergy Clinic in our outpatient department with purified extracts of a total of 127 allergens of various groups like pollen, fungus, insect, animal dander, dust and dust mite, feather, wool, kapok cotton and food allergen (ingestant). The pollen allergens were selected in agreement with the findings of the study of Dimple Singh et al[12] who in 2011 found out the common prevalent airborne pollens in the atmosphere of Jaipur city in Rajasthan. Other allergens were selected on the basis of locally prevalent vegetation, animals, birds and occupations in which the people of central Rajasthan are involved. All the emergency drugs for treatment of any anaphylactic reaction were kept ready. Allergens were applied in the form of a drop, on the volar surface of forearm. Allergens were placed at least 2 cm apart to avoid overlapping reactions and false-positive results.[13] Pricks were made through the drop of allergen extract by a Blood Lancet (26G) at 45 degree.[14] Skin was raised with the needle for proper exposure of allergen to mast cells. Reading was interpreted after 15-20 minutes. Grading of skin prick test reaction was done by comparing it with the reaction of negative control using Shivpuri's criteria.[15] of grading the result of skin prick test.

RESULTS

The study population consisted of 17% patients having only bronchial asthma, 49% patients having only allergic rhinitis and 34% patients having both allergic rhinitis and bronchial asthma. Of these 52% were females and 48% were males. 54% patients were not having a family history of allergy while it was present only in 46% of the study population. On the basis of the area of residence of the study population, 70% of the patients were from urban area while 30% were from rural area, a statistically significant finding with χ^2 = 16.0, p <0.001. Out of the total 100 patients in the study, 95% patients had clinically significant reaction to one or more of the tested allergens.

<table>
<tr><th colspan="2">Allergen Group</th><th colspan="2">Total Tests Performed</th><th colspan="2">Urban</th><th colspan="2">Rural</th></tr>
<tr><td rowspan="3">Pollen</td><td>Grass (G)</td><td rowspan="3" colspan="2">Urban
Total =2730, G=560, T=1050, W=1120
Rural
Total =1170, G=240, T=450, W=480</td><td rowspan="3">7.99
(n= 218)</td><td>G= 9.29
(n= 52)</td><td rowspan="3">7.26
(n= 85)</td><td>G= 7.50
(n= 18)</td></tr>
<tr><td>Tree (T)</td><td>T= 6.48
(n= 68)</td><td>T= 6.22
(n= 28)</td></tr>
<tr><td>Weed (W)</td><td>W= 8.75
(n= 98)</td><td>W= 8.13
(n= 39)</td></tr>
<tr><td colspan="2" rowspan="2">Fungus</td><td>Urban</td><td>Rural</td><td colspan="2" rowspan="2">2.71 (n= 19)</td><td colspan="2" rowspan="2">3.00 (n= 9)</td></tr>
<tr><td>700</td><td>300</td></tr>
<tr><td colspan="2">House Dust Mite</td><td>140</td><td>60</td><td colspan="2">30.00* (n= 42)</td><td colspan="2">20.00 (n= 12)</td></tr>
<tr><td colspan="2">Dust</td><td>700</td><td>300</td><td colspan="2">12.00 (n= 84)</td><td colspan="2">17.00# (n= 51)</td></tr>
<tr><td colspan="2">Insects</td><td>630</td><td>270</td><td colspan="2">24.60 (n= 155)</td><td colspan="2">25.19^ (n= 68)</td></tr>
<tr><td colspan="2">Animal Dander</td><td>350</td><td>150</td><td colspan="2">5.14 (n= 18)</td><td colspan="2">6.00 (n= 9)</td></tr>
<tr><td colspan="2">Feather</td><td>140</td><td>60</td><td colspan="2">4.29 (n= 6)</td><td colspan="2">0</td></tr>
<tr><td colspan="2">Ingestant</td><td>3150</td><td>1350</td><td colspan="2">3.56 (n= 112)</td><td colspan="2">3.93 (n= 53)</td></tr>
<tr><td colspan="2">Kapok Cotton</td><td>70</td><td>30</td><td colspan="2">4.29 (n= 3)</td><td colspan="2">3.33 (n= 1)</td></tr>
<tr><td colspan="2">Wool</td><td>140</td><td>60</td><td colspan="2">3.57 (n= 5)</td><td colspan="2">3.33 (n= 2)</td></tr>
<tr><td colspan="2">Silk</td><td>70</td><td>30</td><td colspan="2">4.29 (n= 3)</td><td colspan="2">3.33 (n= 1)</td></tr>
<tr><td colspan="2">Jute</td><td>70</td><td>30</td><td colspan="2">0</td><td colspan="2">0</td></tr>
</table>

Table 1. Percentage of Clinically Significant Positive SPT Result in Study Population

* x^2= 104.23, p<0.0001; ^x^2= 126.84, p<0.0001 #x^2= 4.50, p<0.05

Table 1 shows that the most common and extremely significant allergen in urban patients was House Dust Mite (x^2= 104.23, p<0.0001) while in rural population Insect and Dust allergens were the most common and significant allergens (x^2= 126.84, p<0.0001, x^2= 4.50, p<0.05, respectively). A positive test was obtained in 20.16% of the total 3810 prick tests done in rural population while in urban population positive prick test was obtained in 7.48% of the 8890 tests done.

Table 2 shows the important difference in allergen profile among the patients of rural and urban area of residence.

Allergen	Tests Done			
	Urban	Rural	Urban	Rural
Pennisetum Typhoides (Grass Pollen)	70	30	5.71% (n= 4)	20% (n= 6)
Cenchrus Ciliaris (Grass Pollen)	70	30	20% (n= 14)	20% (n= 6)
Cassia Occidentalis (Tree Pollen)	70	30	4.29% (n= 3)	10.00% (n= 3)
Ricinus Communis (Tree Pollen)	70	30	17.14% (n= 12)	10.00% (n= 3)
Amaranthus Spinosus (Weed Pollen)	70	30	24.29% (n= 17)	16.67% (n= 5)
Chenopodium Album (Weed Pollen)	70	30	22.86% (n= 16)	23.33% (n= 7)
Curvularia Lunata (Fungal Allergen)	70	30	0	10.00% (n= 3)
Aspergillus Niger (Fungal Allergen)	70	30	5.71% (n= 4)	3.33% (n= 1)
Dermatophagoides Farina (House Dust Mite)	70	30	42.86% (n= 30)	26.67% (n= 8)
Grain Dust Bajra	70	30	22.86% (n= 16)	30.00% (n= 9)
Grain Dust Wheat	70	30	18.57% (n= 13)	20.00% (n= 6)
House Dust	70	30	15.71% (n= 11)	10.00% (n= 3)
Spider Web Dust	70	30	20.00% (n= 14)	16.67% (n= 5)
Cockroach (Female)	70	30	40.00% (n= 28)	46.67% (n= 14)
Cockroach (Male)	70	30	28.57% (n= 20)	36.67% (n= 11)
Honey Bee	70	30	10.00% (n= 7)	16.67% (n= 5)
House Fly	70	30	27.14 (n= 19)	36.67%^ (n= 11)
Mosquito	70	30	27.14 (n= 19)	30.00% (n= 9)
Buffalo Dander	70	30	7.14% (n= 5)	16.67% (n= 5)
Cat Epithelia	70	30	5.71% (n= 4)	3.33% (n= 1)
Dog Dander	70	30	2.86% (n= 2)	0
Cardamom (Small)	70	30	5.71% (n= 4)	13.33% (n= 4)
Egg (White)	70	30	10.00% (n= 7)	13.33% (n= 4)
Moth Daal	70	30	11.43% (n= 8)	6.67% (n= 2)
Soybean	70	30	2.86% (n= 2)	10.00% (n= 3)
Banana	70	30	7.14% (n= 5)	6.67% (n= 2)

Table 2. Difference in Positivity of Allergen Sensitisation by SPT in the Study Groups

Pollens were more common allergen in urban population as compared to rural population, but it is not a significant finding. Among individual allergens in the different groups of allergens in the study the most common and significant grass pollen in Urban population was Cenchrus ciliaris (x^2= 10.90, p<0.01) while in rural population Cenchrus ciliaris and Pennisetum typhoides were most common and significant grass pollen allergens (x^2= 18.02, p<0.0001). Among Tree pollens there was no significant difference between the two groups, common in urban population were Cassia siamea and Ricinus communis. These were also common allergens in rural population but were more commonly reactive in the urban population group. Most common Weed Pollen allergen in urban population was Amaranthus spinosus (x^2=22.57, p<0.0001, extremely significant finding) while in rural population Chenopodium album was the most common and significant weed pollen allergen (x^2=9.92, p<0.01, significant finding).

Curvularia lunata was a significantly major fungal allergen in rural population (x^2=5.61, p<0.05) while in urban population Aspergillus niger was more common allergen.

House dust mites were the most common allergen group in urban population and among the two species of Dermatophagoides included in the study, Dermatophagoides farinae was the prominent house dust mite responsible for inhalational allergy.

Spider Web Dust was the most common and significant (x^2=4.71, p<0.05) dust allergen in urban population in our region. In rural population grain dust wheat and grain dust bajra were significantly common allergens (x^2=15.02, p<0.0001). House dust was more common allergen in urban population.

Insect allergens were more common allergens in rural population (25.19%), although they showed positive reaction in a good number of patients from urban population also (24.60%). Major insect allergens showing positivity in the study were: Cockroach (Female) (46.67%), Cockroach (Male) (36.67%), House Fly (36.67%), Mosquito (30%) and Rice weevil (26.67%) (in decreasing order of prevalence in rural population).

Buffalo dander (16.67%) was more commonly allergic in rural population while Cat (5.71%) and Dog (2.86%) dander were more commonly allergic in urban population. Among ingestants, Cardamom (small) (13.33%), Egg white (13.33%) and Soybean (10%) showed more positive reaction in rural population while Moth Daal (11.43%) and Banana (7.14%) showed more positive reaction in urban population.

DISCUSSION

Allergen exposure is the major factor involved in nasobronchial allergy. Different types of environmental allergens are known to play a role in triggering or exacerbating Bronchial Asthma and/or Allergic Rhinitis. Of the 100 patients in our study, 52% were female and 48% were male patients. There was no significant difference in the prevalence of the disease between the two genders. Danish Jamal et al[16] conducted a study in Delhi and found

that out of 207 patients, 141 (68.11%) were males and 66 (31.88%) were females. R.L. Agrawal et al[17] in their prospective study found that 66% patients were females and 34% were male. Giridhar BH et al[18] found in 2008-09 in Lucknow that 71.43% patients were male and 28.57% were female. Giriyanna Gowda et al[19] studied in 139 patients with bronchial asthma and found that 83 (59.71%) were females and 56 (40.29%) were males. Thus it can be concluded that there is no sex predilection for Nasobronchial allergy and the sex ratio may vary from region to region or may be due to sampling bias.

It has been postulated classically that in most of the patients of nasobronchial allergy, a positive family history of allergy is present, but in our study we found that in 54% of the patients a family history of allergic manifestations was not present and could be traced in only 46% of the cases, although this difference is not statistically significant (x^2 = 0.64, p>0.05). Some studies done in past have shown increased association with family history of allergy: Giridhar BH et al[18] studied that family history of atopy was present in more than 50% patient, E. O. Bandele et al[20] found that 63% of the patients with positive skin tests had a positive family history of asthma, Raja Rajeshwari et al[21] in their study found that a family history of allergy was obtained in 62.5% patients, R. L. Agrawal[17] found that 72% of the patients had a family history of asthma or allergic rhinitis; while other studies have shown a finding similar to our study- Giriyanna Gowda et al[19] found that family history of allergy was absent in 56.83% of the patients, D. J. Hendrick et al[22] conducted a study in 656 asthmatic patients and found that family history was not present in 61.43% of the cases, Erkan Ceylan et al[23] studied in 420 patients and found absence of family history in 63.8% of the cases, Bener A et al[24] found that family history of allergy was absent in 56% of the cases. Earlier studies on allergic inheritance, reported a positive family history in 40 to 80% of individuals with an allergic disease as compared to 20% or fewer in individuals without an allergic disease.[25-26] Thus it can be inferred that family history is not predictive of allergic disorder as it can be present in a large number of patients without a positive family history of allergy.

Most of the patients of our study were from the urban area (70%), while those from the rural area comprised 30% of the study population. The difference is statistically significant. This difference is due to the fact that urban population has a more convenient approach to the health facilities, they are more vigilant towards their health status as compared to the rural population who tend to be more neglectant. The hygiene hypothesis suggests that with improving standards of living, decreased exposure to infective factors may facilitate development of sensitization in urban population. Several other factors present in urban environment including children exposure to diesel exhaust particles, treatment with antibiotics or even maternal supplements of progesterone might contribute to the increased allergen sensitisation.[27-30] R. L. Agrawal et al[17] found in their study that 60% of the patients were from urban area, Erkan Ceylan et al[23] found that 71% of their study population was living in urban region and 29% in rural region.

In this study it was found that the most common allergens in rural population were Insect (25.19%) and Dust allergen (17%) while in urban population it was House Dust Mite (30%). Apart from insects & dust, animal dander and fungal allergen were more significant allergens in the rural population while pollen, feather, kapok cotton and silk more significant allergens in the urban population. In rural population a positive Skin Prick test was obtained in 20.16% of the total skin pricks done while in urban population in only 7.48%. This prompts that the rural population is allergic and to a greater number of allergens as compared to the urban population. This may be due to the fact that in rural areas there are more animals, insects, dusty environment, more prevalence of microbiological flora and fauna and more of the trees and weeds; they are less aware of the healthy and hygienic practices and are more commonly involved in animal and plants/vegetation related occupation. This is supported by the observation in our study that the major contributors of allergy in the rural population were insects, dust, house dust mite, animal dander, pollens and fungal allergens.

Difference in the allergen sensitisation profile among patients of rural and urban area of residence has been an overlooked field as not many studies had been done in the past. A study was conducted by B. Majkowska–Wojciechowska et al[31] in central Poland among 404 children having been raised in rural and urban environment and found that there was considerable difference in allergen sensitisation between the two groups. They found that House Dust mite was the most commonly sensitising allergen among urban patients (a finding similar to our study). They also found that urban patients are more commonly sensitised to grass pollens and to banana (food allergen) as compared to patients living in rural environment. Similar findings were observed in our study.

CONCLUSION

There are subtle differences in the allergen profile of patients with nasobronchial allergy living in urban and rural area within the same geographical region. Most common allergen in urban population is house dust mite and these patients are more sensitized to Cenchrus ciliaris, Ricinus communis, Amaranthus spinosus, House Dust, Spider Web Dust, Cat Epithelia, Dog Dander, Moth Daal, Banana and Aspergillus niger. Most common allergens in rural population are Insects (specially Cockroach (Female), Cockroach (Male), Honey Bee, House Fly – & Mosquito) and Dust allergen mainly Grain Dust Bajra & Grain Dust Wheat, and are more allergic to Pennisetum typhoides, Cassia occidentalis, Chenopodium album, Curvularia lunata, Buffalo Dander, Cardamom (Small), Egg (White) and Soybean.

Knowledge of the difference in most prevalent allergens among patients of nasobronchial allergy living in an area but have a rural and urban dwelling is very essential in the management of these patients of respiratory allergies because we have seen in the study that the most commonly

sensitising allergens differ in these two groups of patients. A panel of these allergens in particular group of patients can be very helpful as universal precaution in management of allergies i.e. allergen avoidance, and in institution of immunotherapy to these patients.

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