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A study of skin prick test sensitivity to common allergens in patients of nasobronchial allergy

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Abstract

BACKGROUND: Nasobronchial allergy accounts for a significant burden of allergy all over the world. The prevalence of nasobronchial allergy is increasing, so we conducted an observational study of common allergens by skin prick test (SPT) method in this group of patients. **OBJECTIVE:** The objective is to study skin sensitivity to various allergens in patients of nasobronchial allergy, using SPT method. **MATERIALS AND METHODS:** A total of 6000 SPTs were done using 60 allergens on 100 patients of nasobronchial allergy. **RESULTS:** Males were the predominant group of patients, and nasobronchial allergy was most common in 21–30 years' age group in our study. Among various groups of allergens studied, insects (24%) were the most common offending allergens, followed by dust mite (20%), airborne dust (11.3%), pollens (7.75%), fungi (6%), dander (6%), silk (4%), juicy foods (2.4%), and nonjuicy foods (2.25%). Among insects, moth (30) was the common allergen. Among dust, grain dust (30) was the common allergen. Among pollens, *Cassia siamea* (20) was most common. *Aspergillus fumigatus* (16) was the most common fungus to which sensitivity was elicited. Among miscellaneous foods (juicy and nonjuicy), milk, almonds, and cashew nut (4 each) were the common allergens. **CONCLUSION:** Skin prick testing forms an essential part of a comprehensive approach for allergy remediation. Our study determined skin sensitivity to various allergens for avoidance therapy and immunotherapy in affected patients. Allergy to insects as found in our study to be most common is likely because of prevailing poor sanitation and overcrowded dwellings in the Indian milieu.

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Full Text

Introduction

Nasobronchial allergy is a common health problem in India.[1] It is now considered to be a disease not confined to a specific target organ but rather a disorder of the whole respiratory tract and leading to the united airway disease concept of "one airway one disease." [2] The prevalence of nasobronchial allergy is increasing globally as well as in India, possibly due to

change in environment.[3]

More than 20% of the world suffers from IgE-associated allergic diseases such as nasobronchial allergies, acute urticaria, and food allergies.[4] Skin prick test (SPT) is the most effective and cheapest diagnostic test to detect IgE-mediated allergic reactions.[5] SPT is the gold standard diagnostic method to detect allergen sensitization.[6] Positive SPT with a history suggestive of clinical sensitivity to identifiable allergen strongly incriminates the allergen as a contributor to nasobronchial allergy.

The types of aeroallergens differ variedly depending on the geographic region and climate, and India, due to its huge size and varied climatic conditions, has a wide range of allergens in different regions. India, being a populous country with diverse food habits due to sociocultural and communal differences, also afforded us an opportunity to study the sensitivity to common food allergens in patients of our region. The present study was carried out to identify the patterns of SPT to various types of allergens for avoidance therapy and immunotherapy in patients attending an allergy clinic.

Materials and Methods

Subjects

This is a prospective observational single-center study on 100 consecutive patients of nasobronchial allergy in an allergy clinic between July 01, 2017, and June 30, 2018.

After taking clinical history and physical examination of patients in Pulmonary Medicine outpatient department, diagnosis of allergic rhinitis was made on the basis of the Allergic Rhinitis and its Impact on Asthma guidelines (2016 revised) and bronchial asthma on the basis of the Global Strategy for Asthma Management and Prevention (GINA 2016 update).

Inclusion criteria

Consecutive patients of nasobronchial allergy attending the Pulmonary Medicine and Ear, Nose, Throat Outdoor and Indoor Patient departments. Patients between 12 and 65 years of age group Patients ready to give informed consent for inclusion in the study and SPT.

Exclusion criteria

Patients with ischemic heart disease and hypertension, patients receiving immunosuppressive medication, pregnant and lactating females, and patients on β -blocker and other immune disorders Patients of dermatographism Patients with chronic sinusitis, atrophic rhinitis, nasal polyposis, nasal tumors, or other known causes of nonallergic rhinitis (occupational rhinitis, aspirin sensitivity, endocrine disease, pregnancy, and drug-induced rhinitis) Patients of allergic bronchopulmonary aspergillosis, bronchiectasis, wheezy bronchitis, and exercise/occupational induced asthma were also excluded.

A total of 100 consecutive patients of nasobronchial allergy comprising 78 patients of bronchial asthma with allergic rhinitis, 14 patients of allergic rhinitis, and 8 patients of bronchial asthma were recruited.

Sample size calculation

The sample size was calculated on the basis of proportion of the most common allergen (house dust) using the formula:

$$n = Z\alpha^2 pq / L^2$$

Where proportion of the most common allergen is $p = 86.27\%$ and $q = 100 - p$.

Type I error $\alpha = 5\%$.

The sample size came out to be 100.

Clearance and approvals

Clearance was obtained from the Institutional Ethical Committee. Informed consent in their vernacular language was obtained from the patients.

Skin prick test procedure

The selected patients for SPT were discontinued on medications that interfere with test results, accentuate systemic allergic

reactions, or render patients less responsive to treatment with epinephrine. The allergens were obtained from All Cure Pharma Pvt. Ltd., New Delhi. The allergens included 27 pollens, 5 insects, 1 dust mite (*Dermatophagoides farinae*), 8 fungi, 2 animal dander, 8 nonjuicy foods, 5 juicy foods, 3 types of common dust, and 1 fabric fiber. The location of each allergen was marked with a pen and a test grid on the forearm to properly identify test results. Allergens were applied to the volar aspect of the forearm, 2–3 cm from the wrist up to the antecubital fossae.

The distance between allergens was kept up to 2 cm to avoid false-positive reactions due to direct contamination between them. A drop of each test solution was placed on the skin in identical order and immediately pricked at a 45° angle using a lancet.

Positive and negative controls were measured first. The histamine control was taken positively to make sure that it was applied correctly and to exclude negative SPT results due to potentially interfering medications taken by the patient. The wheal diameter was measured after 15–20 min and reported in “millimeter” and graded according to [Table 1]. A skin reaction of >3 mm than that produced by the negative control on the SPT was considered as a positive reaction. This is done to maintain objective assessments of the SPT responses.[Table 1]

The statistical analysis was done using SPSS (Statistical Package for the Social Sciences) Version 15.0 Statistical Analysis Software (PA SW Statistics for Windows SPSS Inc, Chicago, USA).

Results

Among the patients [Table 2], 32 (32%) were aged <20 years, 44 (44%) were between ages 21 and 30 years, 14 (14%) were between ages 31 and 40 years, 3 (3%) were between ages 41 and 50 years, and 2% were between ages 51 and 60 years. The age of patients ranged from 12 years to 58 years, with a mean age of 26 years. Male patients (58, 58%) were predominant gender compared to female (42, 42%) patients.[Table 2]

A total of 100 patients fulfilling the inclusion criteria were selected and subjected to SPT with 60 allergens in each patient; thus, a total of 6000 SPTs were done and response was tabulated [Table 3]. Due to high incidence of 1+ in the nonallergic normal persons, 2+, 3+, and 4+ reactions were labeled as markedly positive skin reactions and taken into analysis.[Table 3]

Discussion

The definitive diagnosis of allergy requires identification of allergen and establishment of causal relationship between exposure to allergens and occurrence of relevant symptoms. Identification of allergen is possible by careful history taking and diagnostic procedures such as SPT. SPT is a highly sensitive, specific, simple, inexpensive, and reproducible investigation for diagnosis of allergic diseases.[7]

The purpose of this study was to determine and characterize common allergens using SPT in patients of nasobronchial allergy in a tertiary care teaching hospital of Lucknow, India.

Out of 100 patients of nasobronchial allergy, 12 (12%) patients showed negative reactions to all allergens tested, whereas the remaining 88 (88%) showed positive reactions of varying grades. Markedly positive skin reactions (2+ to 4+) were quite common to the 60 allergens tested. The most common allergens found in our study were insects (24%), followed by dust mite (20%), airborne dust (11.3%), pollens (7.75%), fungi (6%), dander (6%), silk (4%), juicy foods (2.4%), and nonjuicy foods (2.25%).

Estimates suggest that insects comprise 80% of the world's species.[8] Dissemination of insects by air currents is significant in accounting for seasonal flare-ups of nasobronchial allergy.[9] Among the insects, moth (30) was the most common allergen, followed by cockroach (24), housefly (24), mosquito (24), and honeybee (18) in our study. A study of 48 patients of nasobronchial allergy by Prasad et al. using SPT had revealed the highest sensitivity to insects (21.8%).[4] An earlier study of 108 patients by Prasad et al. using intradermal testing also revealed the highest sensitivity to insects (17.5%).[10] Another study by Girdhar et al. in the same city also found insects to be the most common offending allergen (33.3%).[11] Chogtu et al. in the state of Karnataka found insects to be the most common overall group of allergens to which positivity was elicited.[12] Gupta et al. in a study in Central Rajasthan also found insects to be the most common allergens in the rural population.[13]

The next common allergen in our study was dust mite (20%). Asha'ari et al. in a study of allergic rhinitis patients had found dust mite to be the most common allergen.[14] Arbat et al. in a SPT study of 140 patients of nasobronchial allergy also found dust mite to be the most common allergen.[15] Rasool et al. in Kashmir and Gyandeo et al. in Maharashtra found dust mite to be the second most common allergen.[5],[16] Since the discovery of house dust mites in 1964, the association between dust mite allergy and asthma has been reported from many different parts of the world. There is evidence from avoidance studies,

population surveys, and allergen challenge that exposure of allergic patients to mite allergens is a major cause of nonspecific bronchial hyperreactivity.[17] The finding in our study of insects as most common and dust mite as the second common allergen is in accordance with the findings of Kumar et al. at a larger cohort of 4835 patients at Vallabhbhai Patel Chest Institute.[18]

In our study, 11.33% of the patients showed markedly positive skin reaction to various dust (grain dust, house dust, and paper dust). Grain dust (26) was the most common, followed by house dust (6%) and paper dust (2%). Chogtu et al. also found the grain dust to be the most common dust allergen individually.[12] Endotoxin is the principal component of grain dust responsible for the development of airway inflammation and airflow obstruction.[19] Holopainen et al. studied the distribution of allergens in patients of allergic rhinitis. Sensitivity to house dust was present in the majority of patients.[20] Donthi et al. and Acharya et al. found grain dust and house dust to be common allergens among various airborne dust in Andhra Pradesh.[21] Duc et al. found house dust to be the most common allergen in patients of nasobronchial allergy, but heterogeneous composition of house dust makes it difficult to determine potent allergenic factors.[22]

The common pollens to which allergy was seen were *Cassia siamea* (20%), followed by *Brassica campestris* (18%); *Ricinus communis* (14%); *Amaranthus spinosus* (12%); *Holoptelea integrifolia*, *Melia azedarach*, *Morus alba*, and *Parthenium hysterophorus* (10% each); *Prosopis juliflora*, *Cannabis sativa*, *Chenopodium album*, and *Cynodon dactylon* (8% each); *Acacia arabica*, *Eucalyptus tereticornis*, *Argemone mexicana*, *Ailanthus excelsa*, and *Gynandropsis gynandra* (6% each); and *Azadirachta indica*, *Ageratum conyzoides*, *Imperata cylindrica*, *Sorghum vulgare*, and *Xanthium strumarium* (4% each). *Adhatoda vasica* and *Cyperus rotundus* did not show any markedly positive reactions, indicating that they are not allergenic in our region. Aerobiological studies by Datta et al. show a dominance of pollen grains of *Morus* spp., *Ailanthus* spp., and *Holoptelea* spp. in Lucknow.[23] A study done by Agnihotri and Singh in Lucknow in 1969–1971 showed *Cynodon*, *Holoptelea*, *Prosopis*, *Amaranthus*, *Azadirachta*, and *Chenopodium* as eliciting markedly positive reactions.[24] Prasad et al. using intradermal testing in the same city found markedly positive reactions with *Cyperus*, *Cynodon*, *Lawsonia*, *Eucalyptus*, *Holoptelea*, *Brassica*, and *Melia* among pollens.[10] Prasad et al. in a latter study using SPT found *A. spinosus*, *A. mexicana*, *A. vasica*, *Ailanthus*, and *Cannabis* as the most common pollens to which sensitivity was elicited.[4] The composition of vegetation changes due to anthropogenic causes such as urbanization and natural causes such as climate variations, leading to alteration of pollen aerobiology, hence periodic studies are required to update knowledge regarding atmospheric pollens.

Among fungi, markedly positive reaction were elicited for *Aspergillus fumigatus* (16%); *Aspergillus niger* (12%); *Cladosporium herbarum* (6%); *Fusarium solani*, *Helminthosporium* sp., and *Alternaria tenuis* (4% each); and *Penicillium* sp. (2%). *Rhizopus nigricans* showed no markedly positive reaction. Singh et al. in 1978 investigated the prevalence of fungal spores in houses of patients of allergy and isolated *Aspergillus* spp., *Cladosporium* spp., *Penicillium* spp., *Alternaria* spp., *Curvularia* spp., *Fusarium* spp., and *Rhizopus oryzae* among other fungi in Lucknow.[25] Prasad et al. in their study by SPT in Lucknow found marked positivity to *Aspergillus* spp., *A. tenuis*, *F. solani*, and *R. nigricans*. In a previously done study by intradermal method, Prasad et al. found markedly positive reaction to *Fusarium*, *Penicillium*, *Aspergillus* spp., *Streptomyces*, *Candida albicans*, *Helminthosporium*, *Cladosporium*, *Mucor*, *Alternaria*, *Micromonospora*, *Curvularia*, *Rhizopus*, *Actinomyces*, and *Trichoderma*. Since *Rhizopus* species need high moisture for growth, positivity was not found in our study probably due to meteorological and topographical changes in the area.[26]

Grain dust contains a mixture of many organic materials such as seeds, pollens, insects, fungi (*Alternaria*, *Aspergillus* spp., *Penicillium*, and *Cladosporium*), and dust.[27] SPT positivity to grain dust was more common than house dust is in accordance with the findings of Patel et al., Chogtu et al., Raj et al., and Sharma et al.[4],[12],[28],[29] Buffalo dander was the most common dander to which positivity was elicited which in accordance with a study done by Gupta et al. is probably because most of the patients were from rural area.[13] Among juicy foods, prawn was the most common allergen identified which is in accordance with findings of Kunoor et al. and Mandal et al.[30],[31] Shellfish like prawn allergy in Asia is the most common food allergy in older children and adults.[32] Among nonjuicy foods, sensitivity to cashew and almond was the most common because Indians have a cultural habit of consuming dry fruits a lot.[33]

The knowledge gained will be invaluable for both the allergy practitioners and the atopic patients. Knowledge of the common sensitized allergens found among study population in a region could assist medical practitioners in narrowing down the panel of allergens tested in daily practice leading to more specificity and cost-effectiveness.

Conclusion

Skin Prick Test improves the quality of diagnosis and patient care in nasobronchial allergy. Insects were the most common allergens to which allergy was elicited in our study.

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Conflicts of interest

There are no conflicts of interest.

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