

# A STUDY ON PROFILE OF ALLERGENS SENSITIVITY AND ASSOCIATED FACTORS IN NASO-BRONCHIAL ALLERGIC PATIENTS

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## ABSTRACT

**Background:** Prevalence of nasobronchial allergy is increasing globally. Several genetic, environmental and other associated factors are responsible for this increase. This study is designed to investigate profile of different allergens sensitivities and associated factors involved in the prevalence of naso-bronchial allergy.

**Methods:** 4312 skin prick tests with 77 allergens in 56 patients of nasobronchial allergy were studied using parameters like age, temporal association between asthma and allergic rhinitis, most common type of allergens, age of onset, sex, residence and family history of atopy.

**Results:** It was found that the age groups 12-40 years are more prone to nasobronchial allergy. 75% patients have shown temporal association between asthma and allergic rhinitis. Most common offending allergens were insects (33.3%), followed by pollens (30.3%), fungi (13.6%), dust (8.3%), non-juicy foods (6.8%), juicy foods (4.16%) and dander (3.03%). Males have shown more prevalence of nasobronchial allergy than that of the females. 32% patients have shown genetic disposition.

**Conclusions:** Overall, this study unravels different associated factors and profile of allergens in patients' of nasobronchial allergy which will be helpful in diagnosis, management and treatment of asthma.

**Keywords:** Allergy, Nasobronchial asthma, Rhinitis, Insects

## INTRODUCTION

The definitive diagnosis of allergy requires three criteria identification of allergen, establishment of causal relationship between exposure to allergens and occurrence of symptoms. Allergic disorders manifest in different body organs as allergic rhinitis, bronchial asthma, allergic conjunctivitis and atopic eczema. Allergic reactions can be antibody or cell mediated. In the majority of cases antibody typically responsible for an allergic reaction belongs to the IgE isotype. It is estimated that over 20% of the world's population suffer from IgE mediated allergic disorders such as allergic rhinitis, bronchial asthma, allergic conjunctivitis, food allergy, atopic eczema and anaphylaxis.<sup>1</sup> Respiratory allergy accounts for substantial part of burden of allergic disorders worldwide. The general pathogenic view of respiratory allergy has considerably changed over last 15 years. The prevalence of allergic rhinitis and bronchial asthma is continuously increasing, placing an enormous strain on

health resources in many countries and is a major cause of hospitalization especially among children. Airway allergy is now considered to be a disease not confined to a specific target organ but rather a disorder of the whole respiratory tract. Epidemiological evidences and clinical as well as experimental observation have suggested a link between rhinitis and asthma leading to a definitive rhino bronchitis or united airway disease (UAD) and the concept of one airway disease.<sup>2,3</sup> Thus, nasal and bronchial allergies are not distinct and separate entities but rather a continuum of inflammation involving one airway. Studies of temporal relationship between the onset of rhinitis and asthma have also shown that rhinitis frequently precedes the development of asthma.<sup>4</sup> Common allergens such as house dust mites, animal dander, pollen; aspirin can affect both the nose and bronchi and lead to allergic rhinitis and bronchial asthma. Both the disorders bronchial asthma and allergic rhinitis are common chronic diseases imposing a substantial social burden

worldwide among both children and adults and their prevalence is only increasing with time. The prevalence of asthma has risen steadily in this century. According to World Health Organization, India has an estimated 15-20 million asthmatics and prevalence of 10-15% in 5-11 years old children. Allergic disease is preventable if the allergen can be avoided. Identification of responsible allergen is only possible by careful history and diagnostic investigations. Several studies have been reported regarding the allergens profile and several associated factors related to nasobronchial allergy but, a thorough study is still needed. As there is no permanent cure of nasobronchial allergy and precaution is best option in the control of this disease then, there is need of exhaustive studies on allergens profile and several associated factors.

In this study, we have tried to open a new dimension towards the enhancement of our understanding regarding profile of different allergens sensitivities and

other associated factors like temporal association between asthma and allergic rhinitis, age of onset, family history of atopy, sex and residence wise distribution of the cases in prevalence of nasobronchial allergy.

## METHODOLOGY

**The Study Population:** The present study was undertaken in the Department of Pulmonary Medicine, CSM Medical University, UP, Lucknow, India. A total of 194 patients of nasobronchial allergy were evaluated on the basis of complete clinical grounds and out of these 56 patients fitted the inclusion criteria were subjected to skin testing. Study period was June, 2008 to Aug, 2009. This study was comprised of patients of bronchial asthma attending the indoor/outdoor Department of Pulmonary Medicine for their illness during the study period.



Figure 1: Protocol of skin prick test.

**Detailed Clinical History, Clinical Examination and Nvestigation:** Name, age, sex, residence, profession, education, socioeconomic status, date of birth, age of onset of symptoms, history of smoking, breast feeding, respiratory illness in childhood, allergy disorders, BCG immunization, eczema, past and present medications and their responses, urticaria or allergic conjunctivitis, general ear nose throat (ENT) examination, chest examination, systemic examination,

total leukocytes count (TLC), differential leukocyte count (DLC), absolute eosinophil count (AEC), x-ray chest, spirometry, stool for ova/cyst, Montaux test, nasal smear for eosinophils (in patients of allergic rhinitis) have been performed before the Skin Prick Test (SPT).

**Patients' Inclusion Criteria:** Patients were informed about the study and study protocol. An ethical permission, patients' informed consent was obtained.

After first visit in the department the patient was enrolled in the study. For next one week patient got investigations done and after review of clinical history and physical examination along with all investigations, patient was finally included or excluded in the study. The diagnosis of allergic rhinitis was done based on detailed history and diagnosis of bronchial asthma was done detailed history and spirometric confirmation. Skin prick test was not used for the diagnosis but, performed following diagnosis of allergic rhinitis and bronchial asthma.

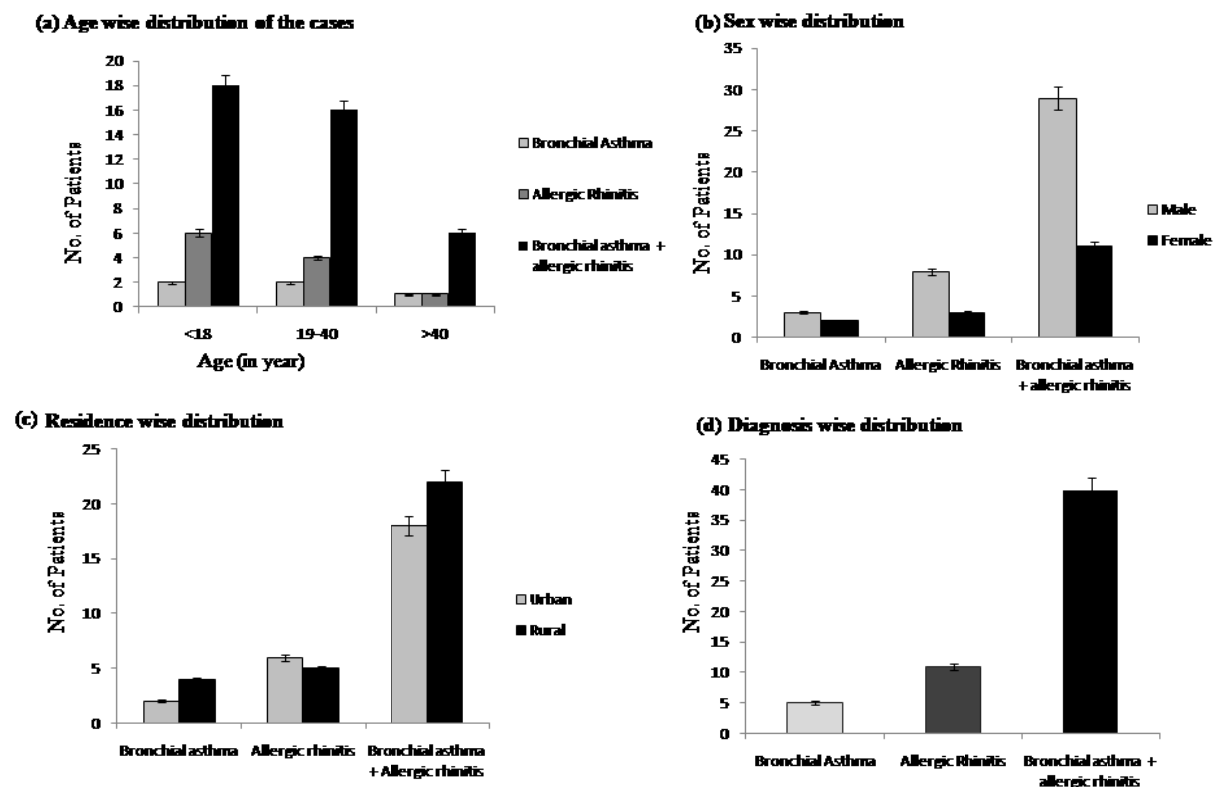
**Patients' Exclusion Criteria:** Patients less than 12 years and more than 55 years of age were not taken in this study. Pregnant and lactating females were omitted from this study. Patients having other associated significant broncho-pulmonary disease other than bronchial asthma, like pulmonary tuberculosis, Chronic Obstructive Pulmonary Diseases (COPD), bronchiectasis or other systemic disorder like diabetes mellitus, tuberculosis, hypertension, malignancy and other immunodeficiency syndrome are also excluded.

**Medications to Be Avoided before Skin Testing:** It has been suggested to patients to avoid some medicine so that occurrence of false positive results of SPT could be minimized. H1 & H2 blockers to be discontinued for >72 hours, Fexofenadine for 5-7 days, Loratidine for 7 days, Cetirizine for 7-10 days, Tricyclic antidepressants for 7 days, Beta blockers for >24 hours have been implicated in all the patients'. Emergency drugs were kept ready eg: Inj. Adrenaline, Inj. hydrocortisone, Inj. Chlorphenaramine, I V fluids

and oxygen gas cylinder for managing allergic anaphylactic reaction that may occur.

**Method of Skin Prick Test:** Skin Prick Test was performed according to guidelines in the USA with slight modifications.<sup>5</sup> In brief, SPT was done with purified extracts of various allergens like pollens, fungi, insects, animal dander, juicy and non-juicy foods obtained from Alcit India Pvt Ltd, New Delhi, India. Assessment of skin reactivity was done according to positive control (histamine acid phosphatase in glycerinated buffer saline 1mg/ml). Glycerinated buffer saline was taken as the negative control. Skin was cleansed with 70% alcohol and then allowed to dry. The skin prick test was performed by placing a small drop of each extract and control solution on the volar aspect of the forearm at a minimum distance of 2 cms. A disposable hypodermic needle (26-G) is passed through the drop and inserted in to the epidermal surface at a low angle with the bevel facing up. The needle tip is then gently lifted upward to elevate a small portion of the epidermis with out inducing bleeding. The needle tip is then withdrawn and the solution gently wiped away with a paper tissue. The skin test was performed for following 77 antigens (Figure 1).

**Time of Reading Test Result:** The immediate skin test induces a response that is read after 20 minutes. The size of the each reaction is measured with a millimeter ruler. Grading of the skin prick test was as 1+, erythema <21 mm, 2+ erythema >20 mm, 3+ wheal >3mm, 4+ wheal with pseudopodia.<sup>6</sup>



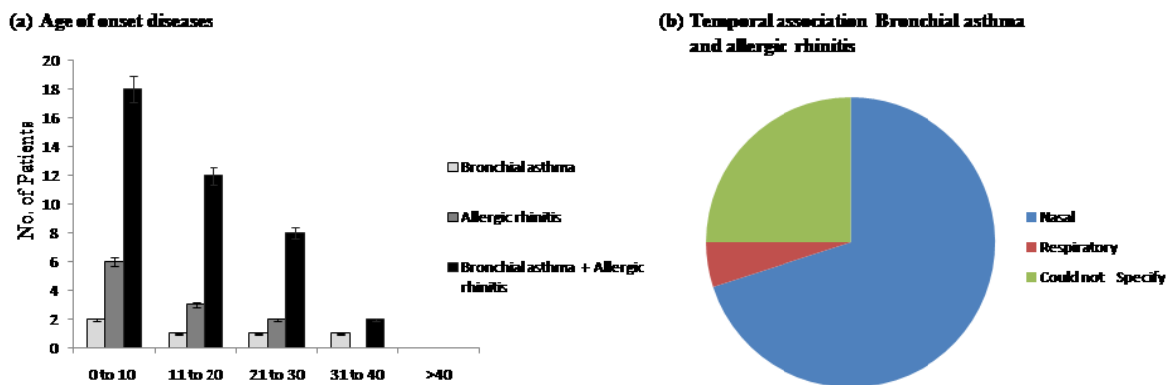
**Figure 2:** (a) Age wise distribution of the cases (b) Sex wise distribution of the cases (c) Distribution according to Diagnosis (d) Shows residence wise distribution of the cases. Probability values <5% were considered statistically significant (N=56).

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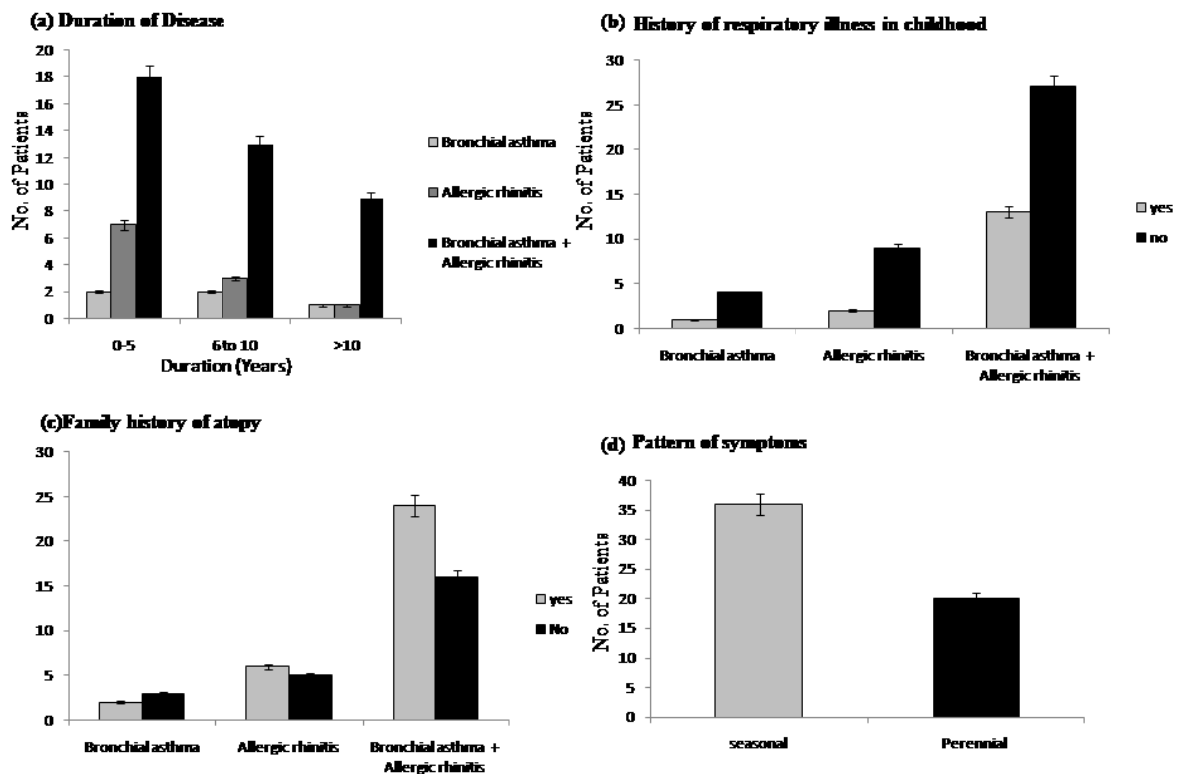
**Data Analysis:** The categorical variables were expressed as frequencies and percentages. Percentages were compared by chi-square test. Probability values <5% were considered statistically significant.

Majority of the patient (52) among 56 belong to age group of 12-20. Total 48 patients among 56 amounting to 85% belong to age group between 12-40 confirming the fact that asthma is more common in children and young adults (Figure 2a). Among 56 patients, 40 were males and 16 were females, the difference among two groups is likely to be correlated as males seeking medical help are more common than females (Figure 2b). In this study, 57.51% of patients were from rural area and 52.49% were from urban area (Figure 2c). The 56 patients included 40 patients of bronchial asthma and allergic rhinitis, 11 patients of only allergic rhinitis and 5 patients of only bronchial asthma (Figure 2d).

**RESULTS**



**Figure 3:** (a) Temporal association between asthma and allergic rhinitis (b) Distribution according to age of onset. Probability values <5% were considered statistically significant (N=56).



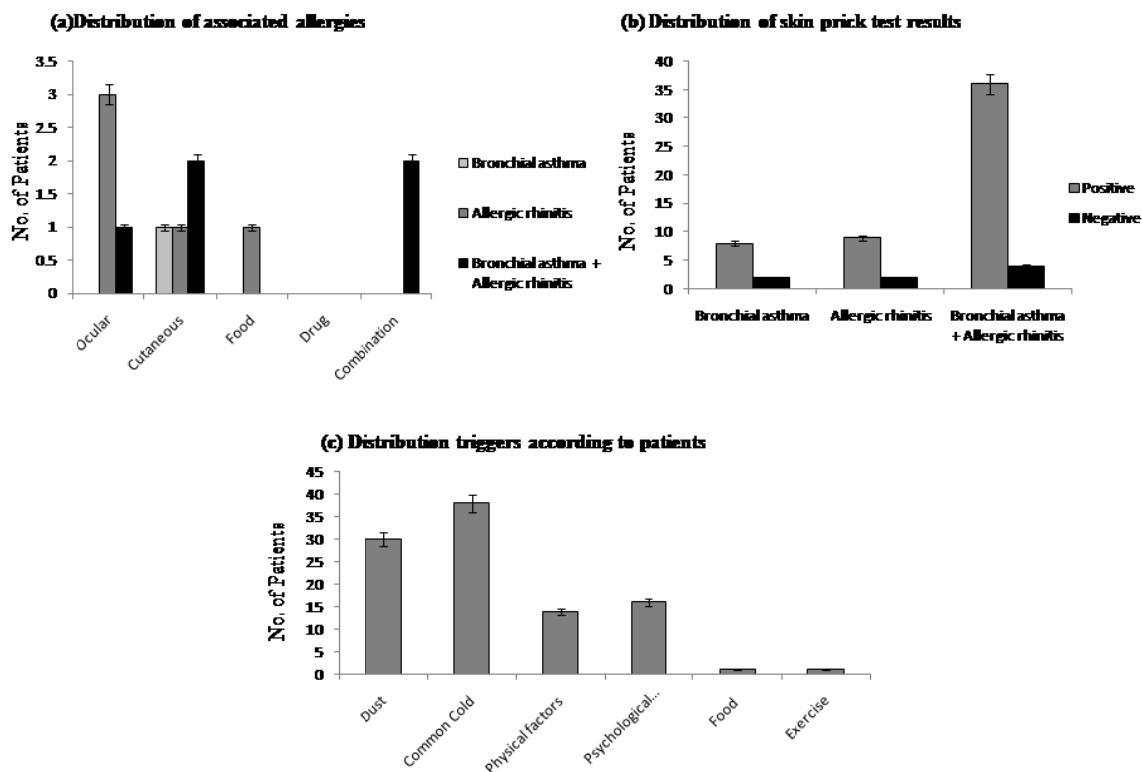
**Figure 4:** (a) Distribution according to duration of the disease (b) History of respiratory illness in childhood (c) family history of atopy (d) distribution according to pattern of symptoms. Probability values <5% were considered statistically significant (N= 56).

In our study maximum number of patients (75%) had the age of onset of disease in the first two decades of life i.e. between 0-20 years of age (Figure 3a). Temporal association between asthma and allergic rhinitis, in 70% of the patients nasal symptoms preceded the respiratory symptoms while 5% patients respiratory symptoms preceded nasal symptoms where as 25% could not specify (Figure 3b).

48.21% of the patients had less than five years of disease duration, 32.14% between 6-10 years of duration and 19.64% had more than 10 years of duration (Figure 4a). 28.57 % of patients show association with previous. One patient (20%) of bronchial asthma and two patients (18%) of allergic rhinitis had history of respiratory illness in childhood where as 13 patients (23%) of combined bronchial asthma and allergic rhinitis had history respiratory illness in child hood (Figure 4b). Family history of atopy was present in 32 (57.14%) patients among total 56 patients. Among those 32 patients 75% had both allergic rhinitis and bronchial asthma (Figure 4c). 36

(64.28%) patients among total 56 had seasonal symptoms largely seasonal during months of October – November and March and April, while 10 (17.85%) patients had perennial symptoms where as remaining 10 (17.85) had perennial symptoms with seasonal exacerbations (Figure 4d).

Four patients (7.14%) among 56 had ocular allergy and cutaneous allergy separately, two patients had combination of above allergies while one patient had food allergy (Figure 5a). Out of 56 patients 49 (87.5%) had SPT positive reaction to the antigens, while 7 patients did not show any sensitivity. Among 49 patients who reacted to antigen 4, (8.16%) were bronchial asthma patients, while 9 (18.36%) had allergic rhinitis patients and 36 (73.46%) had combined bronchial asthma and allergic rhinitis (Figure 5b). Most common trigger according to patient was common cold in 67%, followed by insects in 53.51%, psychological factors in 28.51%, and physical factors in 25% where as food and exercise in 1.78% of patients (Figure 5c).



**Figure 5:** (a) Distribution of associated allergies (b) distribution of skin prick test results (c) Distribution triggers according to patients. Probability values <5% were considered statistically significant (N= 56).

The 4312 skin prick tests with 77 allergens in 56 patients of nasobronchial allergy were studied. A total of 1792 skin tests with 32 pollen antigens were performed on 56 patients. Among pollens commonest was *Ailanthus* with 11.25%, followed by *Adhatoda vasica* 10%, *Prosopis julifera* 8.75%. *Cyanodon dactylon* and *Pennisetum* had 7.5% reactivity. Total of 336 skin tests were done with insects, among which cockroach male was positive in 31.4%, followed by cockroach female in 27.7%, and cricket in 20.45% and gross hopper 19.31% were reactive. A total of 224 skin tests were done with

dusts, house dust and wheat dust were 30%, paper dust were reactive in 25% and cotton meal dust was positive in 15% of the patients. A total of 280 skin tests were done with 5 dander allergens in 56 patients. Among them buffalo dander was commonest with 37.5% and followed by cow dander in 25%. A total of 392 skin tests were performed with non juicy foods, among them rice and mustard were commonest with 30%, followed by potato in 22.2%. A total of 504 skin tests were done with juicy foods commonest was milk

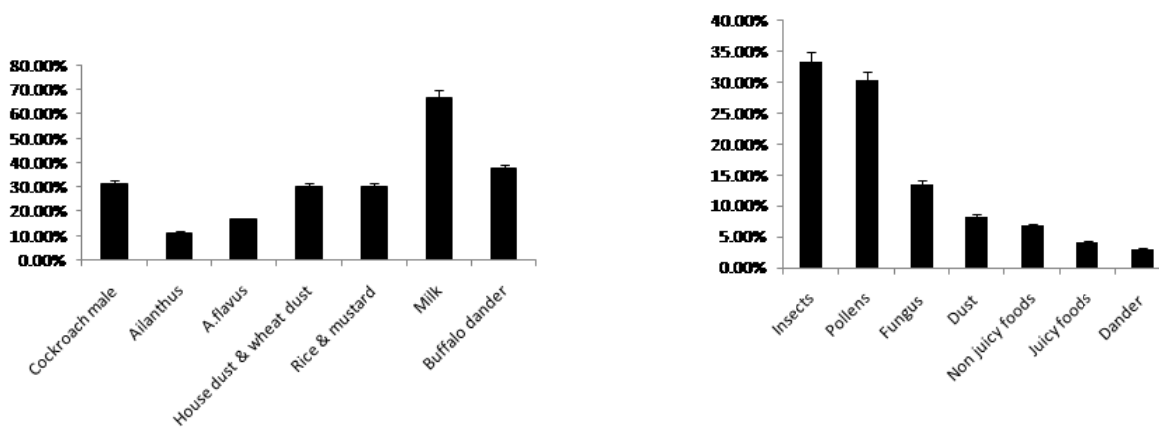
(66.6%) followed by apple and bean fresh (20.6%) (Fig 6a and 6b).

**DISCUSSION**

The use of skin testing as a diagnostic tool in nasobronchial allergy dates to the studies on hay fever since 1860's. Most investigators have found the prick test to be the most satisfactory of the epicutaneous tests commonly employed. In comparison, particularly with the scratch test the prick test has been reported to be more sensitive, less variable and better correlated with intradermal testing.<sup>7-10</sup> Because of the simplicity, speed and ease of performing on the forearm and back, it is possible to test with many allergens in one session. Allergen extracts are most stable when they are most concentrated. There is a good correlation between a strongly positive prick test and a positive RAST, and also between a negative prick test and a negative RAST. Prick tests with wheals less than 4-5mm in diameter are less frequently associated with a positive RAST, and intradermal tests with 1:1000w/v extracts are only exceptionally associated with a positive RAST.<sup>11-13</sup> Prick test wheals 3 mm or greater in diameter are often indicative of clinical sensitivity to some foods, particularly milk, eggs, peanuts, soybean, red gram, green gram and red kidney bean.<sup>14-17</sup> In our study, 87.5% patients had showed positive reaction to the different allergens. Among these patients who reacted to allergens bronchial asthma, allergic rhinitis or combined bronchial asthma and allergic rhinitis were quite evident.

Nasobronchial allergy has predilection for certain age groups. About 85% patients were belonging to age group between 12-40 confirming the fact that asthma is more common in children and young adults. Chaubey et al (1973) also reported maximum number of patients in age group of 13-48 years.<sup>18</sup> This is also supported by study done by Rajendra Prasad et al (2000) where maximum number of patients was in age group 12-30 years (63.6%) and more than 83% between 12-40 years of age.<sup>19</sup> Allergic rhinitis has showed no sex or age predilection.

The prevalence of nasobronchial allergy is higher in male but the susceptibility towards different allergens in male in females was different. In our study patients from rural area have shown dominance over patients from urban area for being nasobronchial allergic. This difference is considered to be due to more catering from rural area to the medical college setting also this is further justified considering the long distances from which patients arrived at out patient department. In this study, temporal associations between asthma and allergic rhinitis have been found significantly (70%). Pawankar (2006) studied that up to 80% of the bronchial asthma patients have co-existing allergic rhinitis, while up to 40% of allergic rhinitis will have asthma.<sup>20</sup> In this study maximum number of patients (75%) had the age of onset of disease in the first two decades of life. This is in concordance with the reported onset of atopy at a younger age. Majority of patients had duration of disease less than 10 years.



**Figure 6: (a)** Allergen sensitivity pattern **(b)** Most common type of antigen sensitivity pattern. Probability values <5% were considered statistically significant (N= 56).

Family history of atopy was present in more than fifty percent patients. Among those patients 75% had both allergic rhinitis and bronchial asthma. Chhabra et al (1999) also reported a strong association between a family history of atopic disorders and the prevalence of current asthma as well as total wheezing.<sup>21</sup> Several studies of twins have demonstrated that concordance rates for asthma, eczema and hay fever are all substantially higher for monozygotic twins than dizygotic twins, suggesting strong genetic contribution. In population based studies of twins, the estimated

effect of genetic factors is about 35-70% depending on the population and the design of the study.<sup>22-23</sup> In this study, the most common offending allergens were insects followed by pollens, fungi, dusts, non-juicy foods, juicy foods and danders. The common insect antigen were cockroach male (31.4%) followed by cockroach female (28.8%). Common pollen allergens were ailanthus (11.25%). Among fungi *Aspergillus flavus* (16.6%) was commonest. In dusts, wheat dust and house dust each with (30%) are commonest. Among non-juicy foods rice and mustard (each 20.8%) has highest sensitivity while milk (66.6%) is commonest in



juicy foods. Among danders buffalo dander (37.5%) was the commonest. P J Acharya found prevalence of skin reactivity with pollen (10.4%), fungi (7.4%), insects (29.4%) and dusts (24.5%) in this order among patients of nasobronchial allergy.<sup>24</sup> Duc J et al (1986) determined frequency of hyper sensitivity to allergens in patients of rhinitis and bronchial asthma and found total house dust (50%) followed by grass pollen (46%), house dust mite (38%) and animal dander (33%) as common allergens.<sup>25</sup> Rajendra Prasad et al (2001) found that insects (17.5%), dusts (15.4%), danders (13.8%), pollens (10.9%) and fungi (10.3%) were reactive in patients of nasobronchial allergy.<sup>26</sup> P J Acharya found prevalence of skin reactivity with pollen (10.4%), fungi (7.4%), insects (29.4%) and dusts (24.5%) in this order among patients of nasobronchial allergy.<sup>24</sup>

## CONCLUSIONS

This study unravels the fact that people of age range 12-40 are the most susceptible for being nasobronchial allergic. Males have been shown dominance over females in prevalence of nasobronchial allergy. The 70% temporal association between asthma and allergic rhinitis was highly evident and one can easily be prone for each other. Insects allergens are very dangerous allergens in the patients as they cause high prevalence of nasobronchial allergy. Several other factors like age of onset, place of residence and family history have shown significant role in the prevalence of disease. This study will improve our understanding regarding the nature and prevalence of asthma and will be useful in the nasobronchial allergy diagnosis, understanding the nature of disease and its management and therapy. Finally, the factors associated with asthma and their effects in exacerbation need to be addressed thoroughly using a bigger sample size.

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