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Pattern of allergen sensitization in children with asthma visiting Asthma and Allergy Clinic at Birat Medical College Teaching Hospital.

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ABSTRACT

Introduction: The allergic sensitization in childhood asthma plays a major role in pathogenesis and its patterns varies in different geographical areas. Predominant allergens of each region should be determined to guide clinicians on allergy avoidance.

Objectives: To determine the pattern of allergen sensitization with positive skin prick test in different age groups, gender, co-morbid allergic diseases, place of symptoms and family history of allergy in children with asthma.
Methodology: This was a cross-sectional study in which we included 75 asthmatic children between 2 and 18 years of age visiting Asthma and Allergy Clinic at the Pediatric Department of Birat Medical College Teaching Hospital in between December 2023 and June 2024. We used 60 common allergens in patients which included house dust mites (HDM), pollens, insects, fungi, danders, dusts, fabrics and food. The wheal size of ≥3mm was considered positive.

Results: The present study included a total of 75 children with asthma most of whom were from 5-10 years of age group (n=40, 53%) and male (n=55, 73%). Other associated allergic diseases were present in 44 (58%) and family history of allergic diseases was present in 46 (61%). Allergic rhinitis (AR) 30 (40%) was the most common comorbid allergic disease. Indoor and outdoor symptoms were found in 44 (58.7%) and 12 (16 %) cases. The most common sensitized allergens were Mites 38 (50.6%), Insects 35(46.6%) and Dusts 26 (34.6%). Among them House Dust Mite (D. Farinae) 37(49.3%), Cockroach 36(48%)and Grain dust mix 16(21.3%) were the common specific sensitized allergens found in asthmatic children. House Dust Mite (D. Farinae) was more common in male of 5-10 years of age group. Cockroach was common in more than 10 years of age. Common indoor allergens were mites 25(33.3%) and insects 19(25.3%) whereas pollens6(8%)and dust 5(6.6%) were more common outdoor allergen.

Conclusion: The common allergens sensitization in children with asthma were Mites, Insects and Dust. Mites and cockroaches were common in 5-10 years and more than 10 years old group respectively. Comorbid allergic disease and family history were present in the majority of children which indicates the importance of genetic predisposition in asthma.

INTRODUCTION

Asthma is one of the most common chronic diseases among children. It is a major cause of frequent admissions to hospital and emergency room visits among the pediatric population, leading to significant morbidity and mortality in children worldwide.[1] Globally, the prevalence of allergic diseases is rising rapidly in both developing and developed countries. Some studies demonstrate that, in developed

countries, allergy disorders are significantly more prevalent compared to developing countries.[2,3] A study from Nepal shows 20% positive SPT in normal school children between 5 and 15 years of age group living in the hills of Eastern Nepal.[4]

Asthma is caused by a complex interaction of genetic and environmental factors. One of the most important environmental factors is allergens which induce allergic reactions in sensitized a person and can cause various allergic diseases like asthma, allergic rhinitis and allergic conjunctivitis. Allergic sensitization is the development of Immunoglobulin E (IgE) antibodies to allergens that are ingested, absorbed or inhaled. Among important environmental triggers are aero and food allergens. Aeroallergens are airborne particles that induce allergic reactions in sensitized subjects and can cause asthma. Sensitization to either indoor or outdoor allergens is a major contributor to allergic asthma and should be taken into consideration while evaluating children with asthma.[5]

SPT is a reliable method to diagnose IgE-mediated allergic disease in patients It provides evidence for sensitization and can help to confirm the diagnosis of a suspected type I allergy.[6] It is minimally invasive, inexpensive and results are available within 15 to 20 minutes. Moreover, many different allergens can be tested simultaneously. It thus provides objective confirmation of sensitization to a specific allergen. Such sensitization to allergens should always be carefully interpreted to clinical history so that appropriate advice concerning avoidance measures can be given.

The rate of allergic disease increases as communities adopt western lifestyles and become urbanized. With the projected increase in the proportion of the world's population that is urban from 45% to 59% in 2025, there is likely to be a marked increase in the number of allergic diseases worldwide over the next two decades.[7] Similarly, urbanization of Nepal is also increasing from 23 % in 2014 to 66 % in 2017.[8] There are various environmental allergens responsible for the asthma. Avoidance of these allergens helps to decrease the severity as well as complete improvement of the disease. Various researches regarding the environmental allergens and allergy had been conducted in different parts of the world. In spite of being a common problem there is only few research works conducted to find out allergen sensitivity in children in Nepal. Hence, this study is planned to identify pattern of various allergens associated with allergic asthma in children and its association with their demographic profile, comorbid allergic disease, family history of allergy and place of symptoms with positive SPT.

METHODOLOGY

A cross-sectional study was conducted between 2 and 18 years old children with a diagnosis of asthma visiting Asthma and Allergy Clinic at the Pediatric Department of Birat Medical College Teaching Hospital from December 2023 to June 2024. The subjects who were sampled by Non-Probability consecutive sampling technique who met the inclusion criteria. Written consent from parents was taken before including their children in this study. The study was started after approval by the Research Ethic Committee of Birat Medical College. All children between 2 and 18 years of age with asthma who had positive SPT for at least one allergen were included in this study. Global Initiative for Asthma (GINA) guidelines was used for the diagnosis of asthma. Uncooperative children, recurrent chest symptoms of infective origin, immunosuppressed patients, suffered from any extensive skin disease, denied to give consent, past history of a severe anaphylactic reaction, unstable asthma or recent history of severe exacerbation of asthma, widespread atopic dermatitis and history of previous severe reaction with SPT were excluded from the study. Demographic data like age, gender, associated other allergic diseases like allergic rhinitis (AR), allergic conjunctivitis (AC), and allergic dermatitis (AD), history of allergic disease in family and a detailed history of the location of symptoms (indoor/outdoor) were noted.

SPT test was performed using SPT Kit manufactured by AllVac Pharma, India by expert nursing staff dedicated to this task. We used 60 common allergens from different groups of allergens which included mites, pollens, insects, fungi, danders, dusts, fabrics and food. Control tests with normal saline (negative control) and histamine (positive control) were carried out to avoid false-negative results due to consumption of antihistamines, or false-positive results due to dermatographism. We discontinued drugs including antihistamines or any other drugs to affect SPT five days before performing SPT. SPT was conducted by putting a drop of antigen on the healthy skin over volar aspects of both forearms (2 to 3 cm away from the wrist and antecubital fossa) or on back with a dropper pipette at a gap of > 2 cm between the drops. A shallow prick was made using the tip of "lancet" through the drop of the test solution at 45° to 60° angle to the skin. Reading was interpreted after 15-20 minutes. Skin reactivity was assessed by calculating the longest diameter of wheal with a scale provided with the kit. To validate the test, the positive control needed to be at least 3mm more than the negative control. Any reaction with normal saline more than 3mm was considered invalid. A positive result to a specific antigen was indicated by a wheal diameter measuring ≥3mm.

Statistical program for Social Sciences (SPSS) 26.0 version was used for all statistical analysis. Data was summarized by using frequency and percentage for qualitative variables.

RESULTS

A total of 75 children with asthma between 2 and 14 years old children from December 2023 to June 2024 were included in this study. The most common sensitized allergens were mites 38 (50%), insects 35(46%) and dusts 26 (34%). [Table 1] Among them HDM (D. Farinae) (n=37), cockroach (n= 33) and grain dust mix (n=16) were the common particular sensitized allergens found in asthmatic children. The majority of them were from 5-10 years of age group (n=40, 53%) and male (n=55, 73%). Of all cases, comorbid allergic diseases were present in 44 (61%) and a family history of allergic diseases was present in 46 (58%). Pattern of allergen sensitization to age group, gender, co-morbid allergic disease, family history of allergy and place of symptoms is shown in Table 2. The most common associated allergic disease was allergic rhinitis 30 (40 %) [Fig 1]and 51 (68%) had two or more allergen sensitization.

Table 1: Distribution of sensitization to different groups of allergens in children with asthma

Allergen group	n (%)	Specific allergens
Mites	38 (50.6%)	1. House Dust Mite (D. Farinae) 37 (97%) 2. House Dust Mite (D. Pteronyssinus) 35 (92%)
Insects	35 (46.6%)	1. Cockroach 33 (94%) 2. Moth 18 (51%)
Dusts	26 (34.6%)	1. Grain dust mix 16 (61%) 2. Grain dust wheat 14 (54%)
Foods	20 (26.6%)	1. Bakers Yeast 7 (35%) 2. Ground nut (Peanut) 5 (25%)
Pollens	17 (22.6%)	1. Parthenium hysteroph 7 (41%) 2. Brassica campestris 5 (29%)
Fungi	15 (20%)	1. Alternaria tenuis 6 (40%) 2. Aspergillus flavus 5 (33%)
Danders	8 (10.6%)	1. Cow dander 6 (75%) 2. Buffalo dander 2 (25%)
Fabrics	8 (10.6%)	1. Wool mix 6 (75%) 2. Pigeon feathers 3 (37%)

Table 2: Pattern of allergen sensitization and demographic characteristics in children with asthma

Variable	Characteristics	n (%)	Mites	Pollens	Fungi	Insects	Dusts	Danders	Fabrics	Foods
Age	< 5 years	17(22.7%)	7	4	6	5	4	1	2	6
	5-10 years	40(53.3%)	23	10	5	18	17	4	4	10
	>10 years	18 (24%)	8	3	4	12	5	3	2	4
Gender	Male	55(73.3 %)	27	14	12	25	21	7	6	18
	Female	20(26.7%)	11	3	3	10	5	1	2	2
Co-morbid allergic disease	Yes	44(58.7%)	26	8	10	22	17	7	7	10
	No	31(41.3 %)	12	9	5	13	9	1	1	10
Family history of allergic disease	Yes	46(61.3 %)	24	11	11	21	16	7	6	13
	No	29(38.7 %)	14	6	4	14	11	1	2	7
Place of symptoms	Indoor	44 (58.7%)	25	5	12	19	10	2	4	6
	Outdoor	12 (16)	1	6	1	2	5			4
	Both	19 (25.3%)	12	6	2	14	10	6	2	10

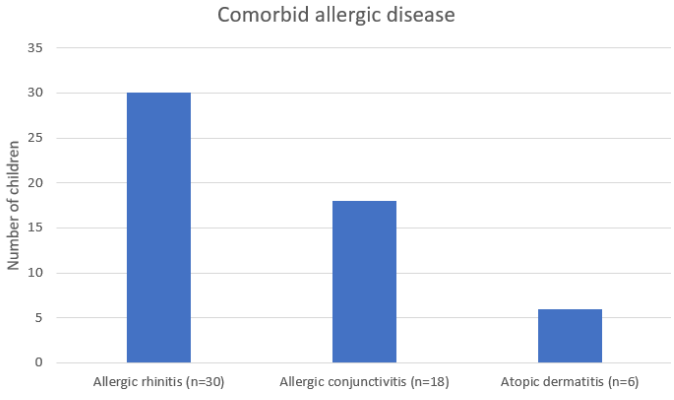

Figure 1: Pattern of comorbid allergic disease present in children with asthma

DISCUSSION

The allergen sensitization is more in the older age group in our study. Similar observations were found in other studies.[6,10] These findings might be attributable to the natural history of atopic disorders (atopic march) where exposure to outdoor allergens occurs in later childhood. The incidence of allergen sensitization is higher in boys (73.3%) with asthma in this study which was supported by other studies.[11,12] Most children with a positive SPT were sensitive to multiple allergens, similar to the findings in other reports.[13,14]

Comorbid allergic disease is common in asthma. In our study, more than half of asthmatic children were associated with other allergic disease like AR, AC, and AD. Among them, the most common was AR (40%). Surdu and Beck Af et al. reported the presence of comorbidities in 64.3% of cases and allergic rhinitis in 63.6% of their study respectively.[15,16] Similar finding was reported in another study.[17] These findings suggest an association of atopy to asthma in these children and also emphasize the importance of screening all children with bronchial asthma for other co-existing allergic diseases to determine the appropriate

treatment for both conditions for better control of symptoms. The children included in the present study with positive sensitization had a positive family history (61.3%) for one or more allergic conditions. Similarly, another study revealed that 68.8% of children with a family history of asthma reported a positive SPT.[6] Asthma is a multifactorial disease that can be influenced by environmental and genetic factors. These results indicate a genetic predisposition to asthma and atopy.[18] However, another report showed that family history of asthma was not predictive of skin test reactivity, which could be explained by the complexity of the interrelationship between the genetics and epigenetics of asthma.[19]

Most of the children in our study were sensitized to inhale allergens with only 26% with concurrent food sensitization. These observations are in line with results from various studies in school-aged children that have found inhalant sensitization to be strongly associated with asthma, possibly indicating the importance of a local immune reaction of the airway mucosa.[20, 21,22] Asthma is the most common respiratory symptom of food-induced anaphylaxis, but it is rarely an isolated symptom; it usually occurs in association with other clinical manifestations such as cutaneous or gastrointestinal symptoms.[23] Our findings showed that the most common allergen sensitization were HDM, cockroach and grain dust mix. A study done in India observed maximum sensitization against HDM (93%) followed by Candida (39%) and cockroach (36%).[11] A study by Pendino et al. found dust mite as the most common allergen followed by pollen, and mold.[24] However, a study by Meher et al found lower in the dust mite group but higher in the pollen and mold group.[10] D. farinae and D. pteronyssinus are the two predominant mites tested in the present study with a positivity rate of 50.6 % and 50 %, respectively. Luo et al. reported significantly high positivity in SPT for D. farinae similar to our study.[25] However, two other studies reported the most predominant mite to be D. pteronyssinus .[6,26]

CONCLUSION

Very few studies have been conducted in Nepal on the pattern of allergen sensitization in children with asthma. Most of the children were sensitized to multiple allergens. Mites, insects and dusts were the most common allergen. Among them, HDM (D. Farinae), cockroach and grain dust mix were the common specific sensitized allergens found in asthmatic children. Co-morbid allergic disease and family history were found in more than half of the patients. AR was the most common co-morbid allergic disease.

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RECOMMENDATION

This study provides information about the common allergens sensitization in asthmatic children which will guide clinicians for the initiation of avoidance of allergen in this region. This study also highlights the importance of co-morbid allergic disease and family history of allergic disease in asthma which can be used for the prediction of persistent asthma later part of life in children. This study also showed AR as the most common comorbid condition. Appropriate treatment of asthma as well as coexisting other allergic disease could significantly improve asthma control and thus the quality of life of these children.

LIMITATION OF THE STUDY

The study was conducted in a single center and only 60 selected reagents were tested as per the availability. The allergy test was performed by SPT which can't exclude non-IgE mediated allergy. The sample size is small. We need a large scale and multicenter study to adequately understand the common allergen responsible for asthma in the pediatric age group of specific geographical location.

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