

RESEARCH ARTICLE

IgE Mediated Hypersensitivity to House Dust Mite in Causation of Exercise Induced Bronchospasm in Children

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Abstract

Study report of asthmatic children correlating exercise induced bronchospasm (EIB) with house dust mite (HDM) sensitivity, showing raised specific and total serum IgE. The cutaneous sensitivity to HDM in these children was detected in 60.8%, out of which 40% developed EIB.

Key words : House dust mite; EIB; Allergen specific IgE

INTRODUCTION

Asthma is a leading cause of acute and chronic respiratory illness in childhood, Hyper-responsiveness to various stimuli leads to bronchoconstriction and inflammation. Allergies to the most common species of house dust mites have been increasingly recognised by the allergologists worldwide as a major health problem (1) especially asthma (2) Incidence of asthma in general population is 4 to 7% (3) and of these 80% have exercise induced bronchospasm (4). Exercise induced asthma (EIA) has been reported in adults (5). However EIA is common in children (6). Recently it has been reported that unrecognised exercise induced bronchospasm (EIB) exists among high school athletes as a risk factor (7). It is possible that sensitivity to house dust mite (HDM) might be a contributory factor. Allergic reactions are mostly IgE mediated and currently there has been increasing

evidence of anti IgE therapy (8).

Pulmonary functions, particularly (PEFR) is a measure of bronchial muscle tone; however, most of the studies with regard to pulmonary functions were carried out in healthy children. Thus a prospective study was planned to determine the influence of HDM in causing EIB and role of immunoglobulin E (IgE).

MATERIALS AND METHODS

Two hundred and fifty children with history of asthma were included in the present study. One hundred and fifteen commercially available allergen extracts which were standardised using PNU and biological activity units were used for modified skin prick test (9). It was performed by introducing the tip of a microlancet through a drop of allergen solution into the epidermis. It was then elevated allowing a very small volume of allergen into the dermis. This was repeated for each drop of test solution selected for testing. The lancet was wiped with dry cotton or wool between the tests. The reactions were recorded

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after 15-20 minutes. The reactions appeared as a raised wheal surrounded erythema. To check the extent of reaction capacity of skin, histamine dihydrochloride (0.1w/v) was used as positive control. Wheal or flare produced by negative control (glycerinated saline) was subtracted from reaction produced by the other allergens before they were assessed.

Patients who were positive to one or more allergens were subjected for determination of serum IgE by ELISA method. Pulmonary functions were recorded using computerised electronic device. Selected cases above the age of 12 years, strongly sensitive to HDM were subjected to exercise test using a bicycle with speed ergometer to ascertain EIB based on Jones bronchial Lability Index (10).

RESULTS

Results showed that children at the age of even six months developed positive skin reactions which increased with age - 2.4% children < the age of one year, one to 5 years (7.05%), five to twelve (18.49%) and 58.88% above the age of twelve. Common allergens were house dust mite, dust, pollen, fungi, animal epithelia, insects and foods (Table 1).

Pulmonary functions (FVC, FEV₁, FEF 25-75% PEFR) except MVV were significantly lower in mite sensitive children compared to the other groups with negative skin reactions (Table 2). Forty percent of selected patients highly sensitive to HDM with raised total serum IgE levels developed exercise induced bronchospasm. (Table 3).

DISCUSSION

In this study, 86.46% children had skin test positive for one allergen or the other. Sensitization increased with age (11). Skin sensitivity at an early age group could be due to constant exposure to indoor allergens and humid climate of city of Mumbai.

Table 1 : Positive reactions to different allergens

Allergens	Mite Species	Dusts	Pollens	Fungi	Insects	Epithelia	Foods
No	152	148	123	103	105	70	162
%	60.8	59.2	49.2	41.2	42.0	28.0	64.8

Table 2 : Pulmonary Function Tests (Average of Predicted Values in Percentage)

Parameters	Positive to mite Antigen	Negative to mite antigen
FVC	55.50* ±13.0	86.21 ±19.50
FEV ₁	53.50* ±16.60	94.28 ±19.55
FEF	33.75 ±16.60	86.33 ±28.96
PEFR	33.75* ±13.60	86.33 ±25.34
MVV	125.00 ±20.10	128.36 ±37.00

*P < 0.001

Table 3 : Exercise Induced Bronchospasm in Mite Sensitive Children

Lability Index Average & S.D.	Percentage
12.50 4.20	60
42.25* 20.00	40

*P < 0.001

Skin testing which is an important tool in diagnosis of allergic manifestation is a sensitive and specific test for detecting allergen specific IgE(12). In the present study, 59.2% children showed raised value of allergen specific IgE for dust, 60.8% for house dust mites. These values were higher due to high concentration of mites in dust samples (13) compared to similar studies from Mumbai (14) showing cutaneous sensitivity to dust and HDM 46.6%, 28.8% respectively; however, higher incidence of HDM sensitivity (94%) has been reported from England (15) against ours 60.8%.

Russel (16) demonstrated HDM and mixed grass pollen sensitivity responsible for childhood asthma. Pollen sensitivity in our study was 49.2% against HDM 60.8% which might have contributed to asthma. We also observed sensitivity to fungi (41.2%), insects (42.0%) and epithelia (28.0%). Similar studies from Mumbai reported variable results (14, 17).

Pulmonary functions are generally reduced in asthma, one of the major cause of respiratory distress in infants and children (18). In the present study, pulmonary functions viz, FVC, EFV₁, PEF, FEF except MVV significantly reduced in mite sensitive asthmatic children. Reduced Peak expiratory flow (PEF) in these asthmatics suggests that HDM may be responsible for airflow obstruction (19). EFV₁ and FVC are important parameters in assessing severity of asthma (20), which have been reduced significantly in mite sensitive children.

The present study correlates PEF, EIB, with HDM sensitivity indicating that specific IgE for HDM and total serum IgE plays an important role in triggering EIB in asthmatic children which confirmed that allergic manifestation in IgE mediated hypersensitivity and suggests that anti IgE antibodies might play an important role in management of EIB.

REFERENCES

1. Voorhorst R, Spiekma FTHM, Varenkamp H, Leupin MJ, Lyklema AW. The house dust mite (*D. pteronyssinus*) and allergies it produces identity with the house dust allergen. *J Allergy and Clin Immunol.* 1967; **39** : 325-29.
2. Nelson HS. The atopic diseases. *Ann. allergy*; 1985; **55** : 441.
3. Weiler JM, Metzger WJ, Donnelly A *et al.* Prevalence of bronchial hyperresponsiveness in highly trained athletes. *Chest* 1986; **90** : 23-28.
4. Voy Ro. The US Olympic Committee experience with exercise-induced bronchospasm. *Med. Sci sports Exec.* 1986; **18** : 328-330.
5. Pargaonkar KA, Dhar HL. Evaluation of exercise induced asthma (EIA). Effects of various drugs, a double blind cross over study. *Advances in asthmology*, (Ed.) S. Kobayashi and JA Bellanti, 1990 : 569-575.
6. Schmidt SM, Ballke EH, Nuske F, Leistikow G, Wierbitzky SK. Effect of ambulatory sports therapy on bronchial asthma in children. *Pneumologic*, 1997; **51**(8) : 835-841.
7. Kukafka DS, Lang DM, Porter S, Roger SJ, Ciccolella D, Polansky M, D'Alonzo GE. Exercise induced bronchospasm in high school athletes via a free running test, 1998; **114**(6) : 1613-1622.
8. Chang TW. The pharmacological basis of anti IgE therapy. *Nature Biotechnology*. 2000; **18**(2) : 157-162.
9. Subcommittee on skin tests of European Academy of Allergology and Clinical Immunology. Skin test used in type I allergy testing. *Allergy* 1989; **44** (Suppl.10) : 1-59.
10. Jones RS. Exercise Tests and Respiratory Function. Edward Arnold publications, London 1976; 84-92.
11. Sly RM. Allergic disorders. In Behrman RE (ed) Nelson, Textbook of Paediatrics, 14th ed., Philadelphia, WB Saunders Co. 1992 : 570-610.
12. Ten RM, Klen JS, Frigas E. Allergy skin testing. *Mayo Clinic Proc.* 1995; **70** : 785-786.
13. Tripathi DM, Parikh KM. Mite fauna and other allergens present in the house dust in Bombay. *Lung India* 1983; **1**(4) : 1-5.
14. Bavdekar SB, Lahiri KR, Menon J. Childhood asthma, Allergen skin test Paediatric pulmonology Update - Bulletin of respiratory chapter of Indian academy of paediatrics, 1997; **9**(2) : 14-18.
15. Sporik R, Holgate ST, Platts Mills TAE, Cogswell JJ. Exposure to house dust mite allergen (Der pt.) and development of asthma in childhood : prospective study. *N. Engl. J. Med.* 1990; **323** : 502-507.
16. Russell G, Jones SP. Selection of skin tests in childhood asthma. *Br. J. Dis. Chest.* 1976; 70-104.
17. Agarwal M, Pagarkar WB, Bhat G, Khokar S. Allergen testing in children. Paediatric pulmonology update. *Bulletin of respiratory chapter of Indian academy of Paediatrics* 1997; **9**(2) : 14-18.
18. Wagh MG, Ghool RB, Shetty RS. Respiratory distress and asthma in infants and children. *Ind. Paediatrics*, 1985; **22** : 683-696.
19. James TC LI. Home peak expiratory flow rate monitoring in patients with asthma. *Mayo Clin. Proc.* 1995; **70** : 649-656.
20. Turcotte H, Boulet LP. Perception of breathlessness during early and late asthmatic responses. *Am. Rev. Respir Dis.* 1993; **148** : 514-518.