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Study of serum IgE levels in childhood asthma in Barabanki region, India

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ABSTRACT

Background: Elevated Serum Immunoglobulin E (IgE) levels are characteristic of most of the allergic diseases including asthma. Most of the asthma patients are allergic to inhaled antigens and chemical antigens, which lead to their sensitization and induce a state of hypersensitivity that is IgE mediated hypersensitivity reaction. The aim of this study was to estimate and compare serum IgE levels in childhood asthmatics and in normal subjects and to obtain the relationship between serum IgE levels and severity of asthma.

Methods: A stratified sample of 58 patients within the age group of 5-15 years including 36 male and 22 female asthmatic patients and 58 healthy controls within the same age group were included in this study and classified according to GINA classification 2016. Serum IgE levels were estimated by using ELISA kit.

Results: Mean IgE levels ranged from 163.82 IU/mL in normal subjects to 881.81 IU/mL in asthmatics. The mean values of Serum IgE levels in mild, moderate and severe asthmatic children were 625.25 IU/mL, 871.77 IU/mL, 1225.05 IU/mL respectively.

Conclusions: High Serum Immunoglobulin E levels were found in childhood asthmatics as compared to normal subjects. Serum IgE levels were found to increase as the severity of asthma increased. The variability in each grade of asthma was very large so we could not find any statistically significant correlation.

Keywords: Allergy, Bronchial asthma, Immunoglobulin E

INTRODUCTION

Asthma is a heterogeneous disease, usually characterized by chronic airway inflammation resulting in episodic airflow obstruction. All over the world, nearly 300 million individuals are affected by asthma. It affects all age groups and is increasing in prevalence in many developing countries. Although the etiology of childhood asthma has not been determined, a combination of

environmental exposures like air pollution and environmental tobacco smoke, urbanization and inherent biologic and genetic susceptibilities have been implicated. The prevalence of asthma in school- going children shows wide variation (4-19%) from different geographic areas in India. The prevalence of asthma in children below the age of 18 years was 29.5%, according to a recent study done in the city of Bangalore. Elevated Serum Immunoglobulin E (IgE) levels are characteristic

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of most of the allergic diseases including asthma.³⁻⁵ Most of the asthma patients are allergic to inhaled and chemical antigens which lead to their sensitization and a hyper-responsive airway.^{6,7} These antigens stimulate the induction of TH2 type T cells and other immune cells, which produce proallergic, proinflammatory cytokines (interleukin IL-4, IL-5, IL-13), and chemokines (eotaxins) which mediate the inflammatory process. Among these cytokines, IL-4 promotes IgE production by B cells while IL-5 increases the production and maturation of eosinophils. Subsequently, acute and late phase reaction occurs due to IgE mediated reaction to these inhaled allergens.⁸

Serum Immunoglobulin E (IgE) levels are age dependent and normally during infancy the levels remain below 10 IU/mL.⁹ Barbee et al and Kjellman et al provided the reference range age-specific total IgE concentration in human serum (Table 1).^{10,11}

Table 1: Age specific levels of serum IgE.

Age (years)	Serum IgE levels (IU/ml)
0-3	<10
3-4	<25
4-7	<50
7-14	<100
≥15	<150

Various studies have found an association between total serum IgE levels and the prevalence of asthma, independent of specific reactivity to common allergens or symptoms of allergy. 12,13

The present study was designed to estimate and compare serum IgE levels in childhood asthmatics and in normal subjects and to obtain the relationship between serum IgE levels and severity of asthma.

METHODS

The present study was conducted at Hind Institute of Medical Science, Safedabad, Barabanki, Uttar Pradesh from September 2017 to February 2018. Total 76 cases of asthma between 5-15-year age group attending the Pediatric Medicine Outpatient Department of the hospital were selected for the study.

After applying exclusion criteria, 9 children were excluded. Parents of 7 children refused to give consent to participate in the study, so finally 58 children were enrolled in the study out of which 36 were male and 22 were female patients. Another 58 healthy subjects within the age group 5-15 years were selected to serve as control group. Children who were clinically healthy and had no history of allergy were taken as control group.

Exclusion criteria

• children with any other allergic disorder,

- children who had taken any bronchodilator within last 24 hours.
- children with chronic respiratory diseases other than asthma
- immunocompromised children.

The purpose of the study was explained in detail to the parents of each subject, including the procedure of blood sampling. Asthma was diagnosed on the basis of variable respiratory symptoms and variable airflow limitation. Severity of asthma was assessed retrospectively from the level of treatment required to control symptoms and exacerbations based on GINA (Global Initiative for Asthma) guidelines 2016 update. The pulmonary function test was done using computerized spirometry - Spirobank G. For each of the patients the Forced Expiratory Volume 1 (FEV1) was measured.

Serum IgE levels were measured using ELISA kit. It is a solid phase enzyme linked immunosorbent assay based on the sandwich technique. Organon Teknika Microwell system was used to measure the concentration of Serum IgE at 450 nm. Two mL of venous blood was collected in vacutainers from the median cubital vein using the necessary aseptic precautions. After collecting the blood samples, they were left undisturbed for about half an hour for complete clot formation. The sample was then centrifuged to separate the serum from the clot. After centrifugation the serum was stored at -20°C in eppendorf tubes until the analysis was done.

The ethical approval for the study was obtained from the Institute's Ethics Committee. The data collected was analyzed statistically with the help of SPSS software (version 17.0). Continuous variables are expressed as mean \pm SD and percentile. The comparison of the data was performed using appropriate statistical test. p value \leq 0.05 were considered significant.

RESULTS

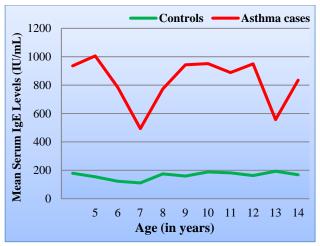
The mean Serum IgE levels in healthy controls and cases were found to be 163.82~IU/mL and 881.81~IU/mL respectively (Table 2) and statistically significant when the levels were compared between these two groups (p <0.001).

The patients in each group had similar demographic characters. Distribution of Mean serum IgE levels among controls and asthma cases according to age is shown graphically in Figure 1.

Table 2: Serum IgE levels in controls and asthma cases.

Groups	Number of Subjects	Mean Serum IgE Levels (IU/mL)
Controls*	58	163.82
Asthma cases*	58	881.81

^{*}Statistically significant (p <0.001); IgE: Immunoglobulin E



IgE: Immunoglobulin E

Figure 1: Distribution of Mean serum IgE levels among controls and asthma cases according to age.

In this study the asthmatics were diagnosed based on the GINA guidelines 2016 update. The mean values of Serum IgE levels in mild, moderate and severe asthmatic children was 625.25 IU/mL, 871.77 IU/mL, 1225.05 IU/mL respectively (Table 3) and statistically significant when the levels were compared between these three groups (p < 0.001).

Table 3: Mean serum IgE levels in mild, moderate and severe asthma cases.

Groups	No. of subjects	Mean Serum IgE Levels (IU/mL)
Mild asthma cases*	22	625.25
Moderate asthma cases*	19	871.77
Severe asthma cases*	17	1225.05

*statistically significant (p <0.001); IgE: Immunoglobulin E

DISCUSSION

Increased serum IgE levels in asthma may be due to increases in IgE-dependent processes and cellular components of the immune system. The secretion of IgE by lymphocytes defines the allergic state of an individual. The cellular events associated with IgE-dependent processes are very much important in asthma pathophysiology. ¹⁵ Higher IgE levels indicate some types of inherent susceptibility (atopy) and/or presence of a disease process involving airway inflammation. ^{16,17}

In our study, the mean serum IgE levels in healthy controls and cases were found to be 163.82~IU/mL and 881.81~IU/mL respectively (Table 2) and were found to be statistically significant when the levels were compared between these two groups (p <0.001). This is consistent with the body of evidence from a cross sectional study from Bangalore reporting mean IgE levels of children having asthma as 756.26~IU/mL, which was elevated as compared to the normal, nonatopic population levels of

151.95 IU/mL.¹⁸ Various other studies have showed Serum IgE levels were high in asthmatics as compared to normal subjects.^{5,19}

In the present study, the mean values of serum IgE levels in mild, moderate and severe asthmatic children was 625.25 IU/mL, 871.77 IU/mL, 1225.05 IU/mL respectively (Table 3) and were found to be statistically significant when the levels were compared between these three groups (p < 0.001). Present study was comparable to a longitudinal study done in Melbourne, Australia, of asthmatic children, which studied mean serum IgE level at 7, 10 and 14 years of age by grade of disease severity and results showed higher IgE levels in patients with more severe and persistent asthma compared with those with mild, episodic asthma. Various other studies showed Serum IgE levels increased as the severity of asthma increased. 18,21,22

Present study indicated that there is an increasing trend in serum IgE levels, which were lowest in normal control group and highest in asthmatic group. There was also an increasing trend as we progressed from mild asthmatic group to moderate asthmatic group and further increased in severe asthmatic group. This explains the important role that IgE plays in the severity of asthma; but it could not be ascertained whether this high level is a causative factor in severity of symptoms. IgE may not be the only possible root cause for asthma as the anti-IgE therapies developed are not 100% effective. 23,24

The exacerbation of symptoms in asthma may be due to viral infections, which lead to a generalized up-regulation of IgE production.²⁵ Several viral infections like Epstein Barr virus (EBV), Cytomegalo virus (CMV), Measles virus, vaccination with whole virion influenza vaccine and Rhinovirus lead to increase in systemic serum IgE levels.²⁶⁻²⁹

CONCLUSION

High Serum Immunoglobulin E levels were found in childhood asthmatics as compared to normal subjects. Serum Immunoglobulin E levels were found to increase progressively as the severity of asthma increased from mild to severe grade. However, there was no statistically significant correlation since the variability in each level of asthma was very large.

Recommendations

There is a need for further studies, using a larger sample size to be more representative of the society, to evaluate the Serum Immunoglobulin E levels for different age groups and to determine statistically significant correlation with the severity of asthma and other allergic disorders, which may prove to have prognostic significance.

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Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

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