

Comparison of total serum immunoglobulin E and absolute eosinophil count levels among asthmatic and non-asthmatic children

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ABSTRACT

Background: Immunoglobulin E (IgE) and associated cellular responses such as absolute eosinophil count (AEC) are responsible for allergic airway diseases. A hypersensitivity reaction initiated by immunological mechanisms, mediated by IgE antibodies, and eosinophils occur in allergic asthma. **Objective:** To compare the total serum IgE level and AEC levels among asthmatic and non-asthmatic children. **Methods:** The present study was conducted in the department of pediatrics and TB and Chest of a Medical College of North India from October 2015 to November 2016. Children from 3 years to 18 years, 30 with bronchial asthma and 30 healthy children were included in this study randomly. **Results:** The mean total serum IgE level in children with bronchial asthma was significantly higher (700.97 ± 571.01 IU/ml) than that in healthy children (189.33 ± 14.29 IU/ml). The mean AEC was also significantly higher in cases (746.63 ± 492.02 cells/mm³) as compared to healthy children (220.23 ± 121.69 cells/mm³). In bronchial asthma group, mean AEC increased with the increasing severity of asthma. **Conclusion:** The elevated level of total serum IgE and AEC may demonstrate the allergic etiology of asthma and hence, estimation of serum IgE and AEC levels can be considered as laboratory investigations in diagnosing cases of bronchial asthma.

Key words: *Absolute eosinophil count, Childhood asthma, Serum immunoglobulin E*

Asthma is a chronic inflammatory condition of the lung airways resulting in episodic airflow obstruction. This chronic inflammation heightens the twitchiness of the airways - airways hyperresponsiveness to provocative exposures [1]. Worldwide, childhood asthma is increasing in prevalence despite considerable improvement in our management and pharmacopeia to treat asthma. Numerous studies conducted in different countries have reported an increase in asthma prevalence of approximately 50% per decade [1]. A study done in the city of Bengaluru showed a prevalence of 29.5% in children below the age group of 18 years [2]. Asthmatic patients have increased airway reactivity to a variety of stimuli such as allergens, irritants, exercise, cold air, and viruses. The allergic diseases including asthma and characterized by an increase of serum immunoglobulin E (IgE) levels by the process is called as atopy. Blood eosinophils are known to be an indirect marker of airway inflammation in asthma [3]. Hence, in clinical practice, peripheral blood absolute eosinophil count (AEC) is also widely used to demonstrate the allergic etiology of disease, to monitor its clinical spectrum and to address the choice of therapy.

The Global Initiative for Asthma (GINA) reported the proposed classification to rule out asthma severity. According to GINA guidelines 2015, asthma can be subdivided based on severity and into intermittent or persistent disease. A persistent disease can be further divided into mild, moderate, or severe. In

Indian context, a very limited approach has been addressed by the pediatricians, clinician, and researcher to evaluate the asthmatic patients with high sensitivity and specificity for the above diagnostic gap. Hence, in this denture, the present study provides information about the relation of AEC and serum IgE levels with the severity of bronchial asthma among children.

MATERIALS AND METHODS

This prospective study was conducted at Department of Pediatrics and TB and Chest of a Medical College of North India from November 2015 to October 2016. The registration of participants, data collection, and blood sample collection were done by the residents in the Outpatient Department (OPD) and In-PD of Pediatrics and TB and Chest. A total of 60 children from 3 years to 18 years of age were included in the study and were divided into two groups, group A or cases (30 children with bronchial asthma) and group B (30 healthy children serving as control). Ethical clearance was taken from Institutional ethics committee. Informed consent was taken. Children with pulmonary tuberculosis, bronchopneumonia, foreign body inhalation, parasitic infestation, congenital heart disease, and congenital anomalies were excluded from the study.

A detailed history was taken, and each patient was thoroughly examined and pro forma was filled accordingly. All the cases

have a diagnosis of bronchial asthma made as per the GINA 2015 guidelines [4]. Severity of asthma was assessed for both history and pre-bronchodilator. Peak expiry flow rate values in accordance with GINA guidelines. Controls were included in this study randomly by taking age- and sex-matched healthy participants coming to OPD with no history of respiratory disorder, other atopic signs and symptoms, helminthes, or parasitic infection. The method of randomization was computer-generated random numbers.

Serum IgE and AEC levels were done in all the study participants. Total serum IgE level was estimated by ImmunoCAP method (fluorescent enzyme immunoassay) and AEC was done by automated coulter counter technique. Chest X-ray, white blood cell count with differential counts, pulse oximetry, serum electrolytes, blood urea, and serum creatinine were also done in every case. Chi-square test and t-test had been used to find the significance of study parameters on categorical scale between the two groups. The final diagnosis was made by faculties of both departments (pediatrics and TB chest). Statistical analysis was performed using Statistical package for the social sciences (SPSS) software.

Normal values of total serum IgE level (Table 3) [5].

RESULTS

In our study, maximum cases (40%) were in the age group of 8-12 years, 33.33% were of age group 13-18 years, and 26.67% were of age group 3-7 years. The male to female sex ratio was 1.1:1. A family history of asthma was found to be an important risk factor in children with asthma and positive family history was found in 63.33% children. Exposure to passive smoking in their vicinity was present in 60% of the patients. In our study, 73.33% patients were resident of urban area. Of 30 asthmatic patients, maximum 10 (33.33%) were of mild intermittent severity, 9 (30%) of mild persistent, 7 (23.33%) of moderate persistent, and 4 (13.33%) of severe persistent severity.

The mean AEC was significantly higher asthmatic children (746.63 ± 492.02 cells/mm³) as compared to that of healthy children (220.23 ± 121.69 cells/mm³) ($p=0.00013$). In asthma group, mean AEC count increased with the increasing severity

of asthma. The mean AEC level was 297.60 ± 86.82 cells/mm³ for mild intermittent cases, 607.67 ± 182.97 cells/mm³ for mild persistent, 1107.00 ± 73.64 cells/mm³ for moderate persistent, and 1551.25 ± 566.67 cell/mm³ for severe persistent cases. The difference was statistically significant ($p=0.0003$ between mild intermittent and mild persistent, $p=0.0001$ between mild persistent and moderate persistent and $p=0.0092$ between moderate persistent and severe persistent).

The group of patients with positive family history had higher mean AEC level than that in children without family history (986.65 ± 324.43 vs. 412.13 ± 286.37 cells/mm³, respectively, $p=0.0341$) as shown in Table 1. The mean serum IgE levels asthmatic children was significantly higher (700.97 ± 571.01 IU/ml) than that in healthy children (189.33 ± 14.29 IU/ml). Statistically significant difference in mean serum IgE levels between cases and controls was found in each age group ($p<0.05$). Our study also showed a rising trend in total IgE levels as the severity of asthma has increased. Mean serum IgE level was 257.4 ± 57.26 IU/ml for mild intermittent cases, 481.89 ± 140.48 IU/ml for mild persistent, 1046.29 ± 221.0 IU/ml for moderate persistent, and 1698.5 ± 766.10 IU/ml for severe persistent cases. The difference was statistically significant ($p<0.05$) when all the groups were compared with each other (Table 2). Children with a positive family history had significantly higher IgE levels (941.36 ± 210.74 IU/ml) as compared to those with negative family history (459.68 ± 118.68 IU/ml).

DISCUSSION

The prevalence of asthma was almost 1.7 times among children with a family history of asthma compared to that of those without a family history and is in accordance with previous reports. Bijanzadeh et al. stated that family history of asthma was important determinants in the development of asthma in the offspring [6]. In our study, urban predominance was seen which was in accordance with the study by Srinivasa et al. in 2015 [7]. In the present work, it was found that mean AEC was significantly higher in asthmatic children than in healthy controls. This finding was in accordance with the finding of many previous studies done by El-Zohery et al. in 2012 [8] and Devi et al. in 2015 [9]. Devi et al. also found that AEC levels increase to the

Table 1: Mean AEC level in asthmatic children and controls in different age group

Age group	3-7 years		8-12 years		13-18 years	
	Cases	Controls	Cases	Controls	Cases	Controls
Mean AEC level	429.88±206.16	201.3±86.94	632.17±722.14	222.3±24.23	940.0±352.8	257.1±146.71
p value	0.0057		0.0376		0.0001	

AEC: Absolute eosinophil count

Table 2: Mean total serum IgE level in asthmatic children and controls in different age group

Age group	3-7 years		8-12 years		13-18 years	
	Cases	Controls	Cases	Controls	Cases	Controls
Mean IgE level	317.5±130.83	93.0±10.28	858.33±722.14	139.6±8.0	918.9±469.86	335.4±24.6
p value	0.0024		0.0001		0.00012	

IgE: Immunoglobulin E

Table 3: Normal serum IgE in children of different age groups

Age group	Reference intervals (IU/ml)
6-12 months	2-34
1-2 years	2-97
3 years	2-199
4-6 years	2-307
7-8 years	2-403
9-12 years	2-696
13-15 years	2-629
16-17 years	2-537
18 years and older	2-214

significant level ($p < 0.01$) with the severity of asthma. In our study, increase in AEC level was statistically significant ($p < 0.05$) as the severity of bronchial asthma increased. This finding was similar to previous studies done by Tran et al. [10] and Lonkvist et al. [11]. Similarly, Kamfar et al. in their study [12] found that total peripheral eosinophil count showed a very significant positive correlation with increased asthma severity.

In the present work, the total serum IgE levels in cases of bronchial asthma showed a significantly higher mean IgE level than that in the healthy children. Similar observations were noted when the levels were analyzed according to different age groups. The present study also showed a rising trend ($p < 0.05$) in total serum IgE level as the severity of asthma was increased. These observations were consistent with studies done by Ching et al. in 2013 [13] and Chandran et al. in 2015 [14]. Devi et al. in 2015 [9] done a study in which total 100 asthmatic children were considered for the study to correlate the serum IgE. The IgE levels were noted to increase the significant level ($p < 0.01$) with the severity of asthma. Limitation of our study was that total serum IgE level is a non-specific, costly, and time-consuming test.

CONCLUSION

High AECs and serum IgE levels were constantly associated with bronchial asthma as compared to non-asthmatics. The elevated level of total serum IgE and AEC may demonstrate the allergic etiology of asthma and hence, estimation of serum IgE level and AEC can be considered dependable laboratory investigations in diagnosing and categorizing cases of bronchial asthma.

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