

Is Serum Total IgE levels a good predictor of Allergies in Children?

Hema Satwani, Arshalooz Rehman, Sohail Ashraf, Anwar Hassan
Department of Pediatric Medicine, Liaquat National Hospital, Karachi, Pakistan.

Abstract

Objective: To study the role of Serum Total IgE levels as a marker of allergy and to see its association with different host and environmental factors, its association with different systemic allergies and with the increased allergic systemic involvement.

Methods: A cross sectional comparative study was conducted at Liaquat National Hospital Paediatric Medicine Unit and Outpatient Clinic, from December 2007 to October 2008. Two hundred and fifty eight children in the age group 6 months to 12 years meeting the inclusion criteria, were enrolled for the study. Complete blood count and serum total IgE levels were done in all patients. Data was collected and tabulated. Chi-square was applied to test the association of serum Total IgE levels with different variables using SPSS and p-value of <0.05 was taken as statistically significant.

Results: Out of 258 patients 166(64.37%) had raised serum total IgE levels (108males and 92 females). Among host factors there was no significant association of serum total IgE levels with age, sex, height of the patient, positive family history of allergy or age at which symptoms developed ($p > 0.05$), though the correlation of serum total IgE levels was seen with weight of the patient ($p < 0.049$), early weaning ($p < 0.01$) and bottle feeding ($p < 0.01$) in children.

Among environmental factors serum total IgE levels had a strong association with exposure to passive smoking ($p < 0.01$), pollen ($p < 0.01$), cold ($p < 0.01$), and pets ($p < 0.01$).

Blood eosinophilia was another factor that had positive association with allergy and raised serum total IgE levels ($p < 0.01$). However association of serum IgE levels was not statistically significant for any systemic allergies, skin allergy (0.608), food allergy ($p < 0.210$), allergic sinusitis ($p < 0.113$), allergic rhinitis ($p < 0.358$), allergic conjunctivitis ($p < 0.507$) except for bronchial asthma ($p < 0.01$) where serum total IgE levels was also associated with severity of bronchial asthma ($p < 0.01$).

Interestingly there was no significant relationship of increased number of systemic allergies with serum IgE levels.

Conclusion: Serum total IgE level is a good predictor of allergy in children. It is influenced by early weaning, early bottle feeding, exposure to passive smoking, pollen, cold, and pets and is associated with blood eosinophilia. Also serum total IgE level is a strong predictor of allergy in asthmatic children (JPMA 59:698; 2009).

Introduction

Allergic diseases such as reactive airway disease, allergic rhinitis, atopic dermatitis and food allergy are common illness that have been increasing in prevalence during the past 30 years¹ and more so in our surroundings which could be due to increased environmental exposure to allergens or genetic predisposition.

Studies of allergy and respiratory diseases have traditionally used allergy skin test reactivity, serum IgE levels or peripheral blood eosinophilia to identify atopic subjects.²

Although the diagnostic value of specific IgE levels against definite allergens is well accepted, there are conflicting results about predictive value of total serum IgE levels. Further, an association of total serum IgE levels with specific serum IgE levels has been described.³

Interestingly an association of total IgE levels with environmental and host factors have been indicated.³ Population studies have shown an association between prevalence of different allergies and serum total IgE levels independent of specific reactivity to common allergies or symptoms of allergy.^{4,5}

This study was undertaken to estimate the predictive value of total serum IgE levels in children with various allergic disorders, to see how useful a tool it is to indicate allergy, which can be later followed by specific IgE levels for specific allergens, and to see its association with different host and environmental risk factors and also with the severity of allergy,

Patients and Methods

All patients of 6 months to 12 years presenting to the paediatric outpatient clinic or at the emergency department of Liaquat National Hospital Karachi with various complaints of suspected allergic problems were included in the study. A written consent was signed by the parents. The study was conducted for a duration of 10 months from December 2007 to October 2008. Age, sex, anthropometry of each child was noted. Detailed history was taken from parents regarding weaning age, bottle feeding, age of development of allergic symptoms, aggravation of or development of allergic symptoms on exposure to pollen, cold, smoke, on exposure to passive smoking, pets and family history of allergy. Symptoms and signs consistent with allergic conjunctivitis, rhinitis, sinusitis, bronchial asthma, skin allergies and history of food allergies on exposure to certain foods, were documented. Each patient was examined by the physician and the Performa was filled accordingly.

In case of suspected case of bronchial asthma,

patient's severity of disease was classified according to NAEPP Guidelines (National Asthma Education and Prevention Programme) for bronchial asthma.⁶

On the basis of history and clinical presentation and the number of systems involved each patient was clinically classified for severity of allergy. If a child had any single systemic allergy, it was classified as mild allergy, if there were 2-3 systemic involvement it was moderate allergy, and 4 or greater was classified as severe allergy. History of parasitic infestation was excluded in the children studied.

On the basis of history and clinical suspicion of different allergic conditions, complete blood picture and total serum IgE levels were tested in all children to screen allergy. Specific allergens in these children were not studied as the aim was to determine the utility of Total Serum IgE levels, as a predictor of allergy in children, suspected for allergy on clinical grounds.

As individual patients differ in their pattern of sensitization, an adequate diagnostic workup involves specific allergens, which is costly and time consuming. CBC & platelets were done in each child to look for eosinophil count which were compared with the standard ranges.⁷

Serum Total IgE levels were estimated in each child, by ELIZA using MEIA (micro particle enzyme immunoassay) and their levels were compared with the reference ranges for age and sex.⁸

Results were compiled, tabulated and analyzed using Pearson's chi-square test for association between serum total IgE levels and different host and environmental risk factors and with the severity of the disease. Differences were considered to be significant at p value < 0.05 . All calculations were done through SPSS (Statistical Package for Social Sciences).

Results

Of the 258 patients, 166 (64.3%) had raised serum total IgE levels. The association of different host factors with serum total IgE levels are shown in Table-1.

There was no significant association of the IgE level with any factor except the weight of children above the 10th centile for age and sex ($p < 0.049$), history of early weaning ($p < 0.01$) and bottle feeding ($p < 0.01$).

Table-2 shows association of different environmental factors, blood eosinophilia and systemic allergies with raised serum total IgE levels. Interestingly we found our results to be statistically significant for exposure to passive smoking ($p < 0.01$), pollen ($p < 0.01$), Cold ($p < 0.01$), exposure to pets

Table 1: Association of host factors with serum Total IgE levels.

Host Factors	(n=258)	Serum Total IgE levels raised(n=166)	P-value
Age			
1-5yrs	160	106(66.3%)	0.613
6-9yrs	80	50(62.5%)	
10yrs and above	18	10(55.6%)	
Sex			
Male	166	108(65.1%)	0.746
Female	92	58(63.0%)	
Weight			
>10 centile	116	78(67.2%)	<0.049*
5-10 centile	90	62(68.9%)	
<5th centile	52	26(50.0%)	
Height			
>10 centile	134	90(67.2%)	0.093
5-10 centile	80	54(67.5%)	
<5th centile	44	22(50.0%)	
Weaning Age			
Early(<6 months)	98	84(85.7%)	<0.01*
Normal(6 months)	138	70(50.7%)	
Delayed(>6months)	22	12(54.5%)	
Bottle feeding			
Yes	148	118(79.7%)	<0.01*
No	110	48(43.6%)	
Family history			
Yes	148	98(66.2%)	0.46
No	110	68(61.8%)	
Symptomatic age			
<1yr	94	68(72.3%)	0.119
1-5yrs	158	94(59.5%)	
6-9yrs	6	4(66.7%)	

P-value <0.05 were taken as statistically significant.

($p < 0.01$) and blood eosinophilia ($p < 0.01$).

However association of raised serum IgE levels was found for bronchial asthma ($p < 0.01$) only, indicating

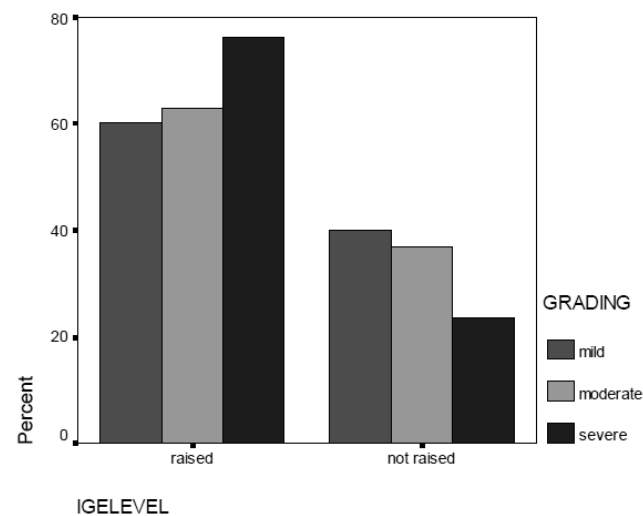


Figure: Association of raised serum Total IgE levels with number of systemic allergic involvement.

Table-2: Association of Environmental factors and Systemic allergies with raised Serum total IgE levels.

Environmental factors	Total no of Patients (n=258)	Raised serum IgE levels (n=166)	p-value
Passive smoking			
Yes	100	92(92.0%)	<0.01*
No	158	74(46.8%)	
Allergy to pollen			
Yes	84	76(90.5%)	<0.01*
No	174	90(51.7%)	
Allergy to cold			
Yes	170	128(75.3%)	<0.01*
No	88	38(43.2%)	
Exposure to pets			
Yes	50	42(84.0%)	<0.01*
No	208	124(59.6%)	
Blood Eosinophilia			
Raised	50	46(92.0%)	<0.01*
Normal	208	120(57.7%)	
Systemic Allergies			
Skin allergy			
Yes	78	52(66.7%)	0.608
No	180	114(63.3%)	
Food allergy			
Yes	68	48(70.6%)	0.21
No	190	118(62.1%)	
Allergic Sinusitis			
Yes	34	26(76.5%)	0.113
No	224	140 (62.5%)	
Allergic Rhinitis			
Yes	172	114(66.3%)	0.358
No	86	52(60.5%)	
Allergic conjunctivitis			
Yes	68	46(67.6%)	0.507
No	190	120(63.2%)	
Bronchial asthma			
Yes	239	166 (69.4%)	<0.01*
No	19	0	

P-value <0.05 were taken as statistically significant.

that IgE levels could be considered as a marker of allergy for asthma.

Interestingly 239 out of 258 patients had complaints consistent with bronchial asthma, with 30 children having mild intermittent asthma of which 12 (40%) had raised serum total IgE levels. Of 103 with mild persistent asthma, 62 (60.2%) had positive results. Similarly 68(82.9%) out of 82children with moderate persistent asthma and all 24 (100%) with severe persistent asthma had raised total IgE levels ($p < 0.01$) showing positive correlation of serum total IgE levels with the severity of asthma.

Figure shows association of grading of systemic allergies with Total Serum IgE levels.

Thirty-six (60%) out of 60 children with mild allergy, had raised IgE levels. Similarly 101 (63.1%) of the total 160 children with moderate allergy and 29

(76.3%) of 38 with severe allergy had raised serum total IgE levels ($p < 0.0226$), so there was no significant association of serum total IgE levels with the increased number of allergic systemic involvement.

Discussion

With allergic conditions on the rise, we need to seek laboratory parameters that are useful in diagnosing allergy other than making diagnosis on clinical grounds only. The discovery of serum IgE levels has led to an understanding of the mechanisms of allergy. It has also led to the development of diagnostic tools as well as analyses and standardization of allergen extracts.²

In our series of 258 patients, 166 (64.3%) had raised serum total IgE levels indicating that it can be taken as a good marker of allergy.

Cline et al.⁹ reported the highest total IgE levels were seen in the age group 8-14 years. In the presented study no significant relationship of serum Total IgE levels with any age group was observed.

Interestingly no association was found with either sex, however many studies have reported males to have raised IgE levels.^{10,11} Raised IgE levels were observed in children with appropriate weights, in our study. This is against the presumption that allergic children are usually below the centile for age.

Early weaning of less than 6 months and introduction of formula feed at below 6 months age was found to have a strong correlation with raised serum total IgE levels in our study as also shown by Baldacci et al.² This stresses on that early weaning and formula feeds should not be initiated unnecessarily as they are strong risk factors for allergy in children.

Positive family history of atopy nor the age at which symptoms started, did not influence IgE levels as reported by Lopez et al.¹³

Environmental factors are known to contribute to allergy. We found our results to be significantly associated with passive smoking, exposure to pollen, cold, and exposure to household pets. Passive smoking is by far the best established risk factor, particularly in childhood.¹⁴ Rathore et al. reported exposure to cigarette smoke to be higher in wheezy children.¹²

Experimental, epidemiologic and clinical observations strongly support the concept that immune response to allergens is influenced by the conditions under which the primary encounter with an allergen occurs.¹⁵

Early contact with allergens like pollen, pet, house dust mites and early feeding with foreign proteins have been associated with increased risk of development of allergic diseases¹⁶ as also seen in our study. Pollen allergy is a common cause of seasonal allergies. In Norway subjects in summer had higher IgE levels than in other seasons of the year,¹⁷ probably due to pollen exposure during the summer season. Another study reported 45% patients of allergic rhinitis to be sensitive to tree pollens and 48.7% to grass pollens.¹⁸ Waheed et al. showed animal or pet exposure as 18.28% in their group of allergic children. Though only 50 of our children had history of exposure to pets in our study, among them 42 (84%) had raised serum total IgE levels. This indicates IgE levels to have a strong association with allergy.

Eosinophilia along with raised serum IgE levels was found as a significant allergic marker in our study. In clinical practice, peripheral blood eosinophil counts are widely used to demonstrate the allergic etiology of disease, to monitor its clinical course and to address the choice of therapy.²⁰ Therefore, peripheral blood eosinophil count can be useful for observing the association of host factors and environmental determinants as indicators of allergy prevalence.²

Other studies have shown a positive relationship of raised IgE levels with atopic dermatitis, conjunctivitis and allergic rhinitis.^{11,21} No such association was found in our study except for bronchial asthma, where the serum total IgE levels were not only raised but also correlated well with the severity of bronchial asthma. This study reinforces the evidence provided by other studies on asthma.^{4,5} It has been suggested that high total serum IgE level could itself be a marker of air way inflammation in asthmatic patients.²² In our study, serum IgE levels were not affected by the severity or the increased number of allergic systemic involvement, except for asthma.

The role IgE levels play in allergic conditions is well documented. Consequently serum IgE levels are estimated more frequently as part of routine allergy testing. They are easy to perform and new methods and equipments make them less expensive.

However sensitization to common allergens is usually assessed by measuring specific IgE levels in serum or by performing a skin test to find out the specific allergens. Adequate diagnostic workup may involve 10 or more allergens which is costly and time consuming. Thus a single measurement of serum total IgE levels would be useful as the initial step to identify allergy which can

followed by specific IgE levels to specific allergens.¹⁰

Conclusion

The study concluded that serum total IgE level is a good predictor of allergy in children. Serum total IgE levels are influenced by weaning, early bottle feeding, and environmental factors like exposure to passive smoking, pollen, cold, and pets. Blood eosinophilia and raised serum total IgE level are strong predictors of allergy in asthmatic children.

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