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Total Serum IgE and Skin Tests in Children with Respiratory Allergy

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ABSTRACT

Background: *Total serum IgE measurement and skin prick tests are the most common tools for allergy diagnosis. This investigation was conducted to evaluate total serum IgE and skin prick test relationship in Iranian atopic children with respiratory manifestations.*

Materials and Methods: *A history of allergic rhinitis, bronchial asthma and atopic dermatitis was obtained in 232 children (aged 1 to 15 years). Skin prick testing was performed using commercial preparation of the common allergens. The patients' sera were also analyzed for determining total IgE.*

Results: *More than 95% (n=221) of the patients had positive skin prick test (mean wheal diameter ≥3mm) to one allergen or more. Among the patients 46% (n=107) had elevated total serum IgE levels (≥150 IU/ml).*

Conclusion: *The study showed close relationship of skin test positivity with reported allergic symptoms, but no correlation was found between total IgE and skin prick test. This study revealed that skin testing and total serum IgE measurement may be considered complementary to one another in diagnosing allergic respiratory disorders.* ***(Tanaffos 2005; 4(15): 27-31)***

Key words: *Total IgE, Skin prick test, Allergy, Children*

INTRODUCTION

Asthma and other allergic conditions such as allergic rhinitis are major public health problems in Iran and other countries. The incidence of these allergies has been increasing worldwide over the recent years (1).

Total serum IgE measuring and skin prick testing are the simple and available tools for evaluation of allergic patients and determination of the diseases frequency in communities (2-6).

Although various epidemiologic studies have shown strong association among total serum IgE levels, skin test reactivity to different allergens, and allergy prevalence, (7-13) the details of these associations is still not well determined. However, elevated total serum IgE levels have sometimes considered as the basis of allergy diagnosis, many clinically proven allergic patients may have normal total IgE level, or present with increased IgE levels resulted from nonallergic conditions such as parasitic infections (14, 15, 16).

In the current study, the objective was to determine the relationship between total serum IgE

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level and skin prick test (SPT) in Iranian children who referred to our clinic with different allergic respiratory symptoms, and to show if each one of these two variables can be a predictor of the other.

MATERIALS AND METHODS

This investigation was carried out from March 1999 to May 2002 among 232 children aged between 1 and 15 years, who were referred to the authors' allergy clinic in Tehran with symptoms related to atopic dermatitis, allergic rhinitis or bronchial asthma. The authors interviewed each child's parents using a structured interview and a standardized questionnaire. No refusals to the interview were seen. The field survey was entirely conducted by the same physicians.

Skin prick tests (SPT) positivity. SPT were performed, using standardized allergenic extracts (Stallergen, Paris, France), and a sterile lancet. Ten allergens were used for the patients with respiratory symptoms including: *Dermatophagoides Pteronyssinus*, cat dander, house dust, feather, cockroach mixed allergens, trees, weeds, grasses, moulds and flowers, as well as negative and a positive (histamin hydrochloride) control. Also, for the patients with atopic dermatitis, egg whole, tomato, wheat, cow's milk, nuts and some other common food allergenic extracts were used. Reactions were measured 20 minutes after the pricks. Regarding the previous studies, positivity was defined as a mean wheal diameter of at least 3 mm to at least one of the allergens and greater than the negative control.

Total serum IgE analysis. Venous blood samples were taken and total serum IgE levels were measured by enzyme-linked immunosorbent assay (ELISA) method using commercially available kits (Radim, Rome, Italy), with an assay threshold of 0.1 IU/ml.

Statistical analysis. All data were analysed by SPSS software, and correlation analysis used for determining the relationship between total serum IgE and the skin prick test (Spearman procedure).

RESULTS

There were 94 girls and 138 boys who met the inclusion criteria. Table 1 shows descriptive statistics for these children. The number of asthmatics was higher than those with allergic rhinitis symptoms. The result of measuring total serum IgE among the 232 allergic subjects revealed a very wide spread of values, which ranged from 1 to 2500 IU/ml, and had a mean of 261.8. Regarding these results it was shown that children with different allergic respiratory symptoms exhibited total serum IgE responses of varying magnitudes, and the most increasing mean IgE levels was related to the allergic rhinitis condition. Also the most prevalence of increased IgE concentration was seen in the children with allergic rhinitis symptoms, slightly more increased than its amount in eczematous patients.

Table 1. Descriptive statistics for subjects

Variables	Patients number (%)
Boys	138 (55%)
Girls	94 (45%)
Allergic condition	
Asthma	153 (66%)
Allergic rhinitis	79 (34%)
Total	232 (100%)
Total serum IgE (IU/ml)	
<150	125 (54%)
≥ 150	107 (46%)
Skin prick test	
Negative	11 (5%)
Positive	221 (95%)

Skin prick test results are shown in table 2. Among the patients, 221 and 11 subjects had positive and negative reactions, respectively. Children with

allergic rhinitis symptoms, also showed the most frequent positive SPT, as 98.7%.

Table 2. Frequency & severity of skin prick tests response of the patients.

Prick test response	Allergic conditions		Total no (%)
	Asthma	Allergic rhinitis	
Negative	10	1	11 (4.7)
1+	135	61	196 (84.5)
2+	4	4	8 (3.4)
3+	3	10	13 (5.6)
4+	1	3	4 (1.7)
Total	153	79	232 (100)

Data analysis by using spearman procedure showed non-significant correlation between the two variables among the total subjects, (r=0.180, p=0.001) and also in each different allergic conditions (Table 3). In the asthmatic children there was no correlation between total IgE levels and SPT results (r=0.228, p= 0.005). Likewise, in the children with allergic rhinitis symptoms, the relationship between the two variables was non-significant (r=0.235, p=0.037), and the lack of this correlation was also found in the children with eczema (r=-0.004, p=0.967).

Table 3. Correlation (Spearman) between total serum IgE and skin prick test.

Allergic conditions	R	P-value
Asthma	0.228	< 0.005
Allergic rhinitis	0.235	< 0.05
Total	0.18	0.001

* None of the above resulted relationships were significant.

DISCUSSION

For diagnosis of allergic diseases, the patient's history and physical examination are the most important factors. Paraclincal evaluation and different tests are useful for confirming the diagnosis and identifying potentially important environmental allergens (17).

Since increased total serum IgE can be in favor of atopy diagnosis, some physicians consider it as the first laboratory test and some others try to do more investigations like skin prick testing, only in cases whom the total IgE is increased.

In this study we tried to show: 1) the prevalence of increased total IgE and also positive skin prick test in children with respiratory allergy and 2) the relationship between these two variables, and determining if one of them can predict the other.

The study revealed that among the children with different allergic symptoms, 46% had increased total serum IgE (≥150 IU/ml) and most children (53.7%) showed lower IgE levels. The children with allergic rhinitis symptoms had higher prevalence of increased IgE. Our findings are similar to those of some other studies which showed increased total IgE from 35% to 74% among children with different allergic conditions (18-21).

This finding shows that total serum IgE is quite variable in allergic children and in some groups, it can be also within normal range. Thus, increased total IgE should not be expected in all allergic children and decision making for doing further investigation should not be based on the result of total IgE.

On the other hand, prick tests in our study showed 95% positivity which was comparable to similar investigations with positivity ranged from 73.2% to 96% (18, 20-24). Among our patients, again the children with allergic rhinitis symptoms showed the higher prevalence of SPT positivity with 98.7%. These findings mention that SPT is more conclusive in identifying atopic children and determining the potential environmental allergens, and thus is helpful for specific immunotherapy.

Statistical analysis revealed that correlation between total IgE and SPT was not significant in all three groups of allergic children. This means that

each one of these two variables is independent, and none of them can be a predictor for the other.

Barbera et al. found such a relationship in a small sample of 31 children with bronchial asthma, and suggested that IgE measurement should be considered as a complementary test investigation of allergy (21). Also in a group of allergic rhinitis patients with 2167 population sample, Droste et al. showed that total IgE and SPT may be considered complementary to one another in diagnosing the disease and both of the variables have close relationship with reported clinical symptoms (25). Khadadah et al. studied 101 asthmatic patients and revealed concomitant skin reactivity and elevated IgE in 62% of the cases (18). Interestingly, similar study was done recently by Niederberger et al. to determine the relationship between specific IgE and SPT which showed greatly varying magnitudes of IgE and that allergen sensitivity if SPT can not be predicted by quantitative IgE serology alone (26). Thus, our results seem to confirm the non- significant relationship between total IgE and SPT. Regarding the recent studies, SPT itself is one of the most effective measurements of atopy and correlates well with other more sensitive newer tests such as eosinophil cationic protein (ECP) measurement (18, 27).

In summary, we found that correlation between total IgE and SPT was not significant and none of them could be a predictor of the other. Furthermore, since total IgE showed a broad range of values and the variations among specific patients provided little information, along with the fact that many children with allergies can have total IgE level within the normal range, we suggest not to recommend its measurement for all allergic children as the routine evaluation.

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