

Allergic sensitization in nasobronchial allergy patients and its correlation with total immunoglobulin E level

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Abstract

INTRODUCTION: Bronchial asthma (BA) and allergic rhinitis (AR) are immunoglobulin (Ig) E-mediated hypersensitivity phenomena. The objective of the study is to assess the association between total serum IgE level and skin prick test (SPT) in Indian patients who presented with different nasobronchial allergy symptoms.

MATERIALS AND METHODS: This was an observational prospective study conducted in the Allergy and Asthma Clinic, Motihari, Bihar. A total of 183 patients diagnosed as BA and AR undergo SPT against different allergens between January 2017 and July 2018. Serum total IgE was measured in all patients. All statistical analyses were performed using statistical software SPSS version 20 (SPSS Inc., Chicago, IL, USA). $P < 0.05$ was considered statistically significant.

RESULTS: The study patients included 95 males and 88 females (total 183) with a mean age of 27.15 ± 12.64 years. SPT was positive in 99 out of 183 (54.09%) study patients. BA and AR were associated with skin sensitization in 30.60% and 15.30% of patients, respectively, while 54.09% of patients were associated with both AR and asthma. Forty-four out of 99 (44.44%) patients were sensitized to single allergen, while 40.40% and 15.15% of patients were sensitized to 2–5 allergens and >5 allergens, respectively. Except 11 patients, all the study patients had high total IgE level (>150 IU/ml). More than half of the study patients (51.36%) were associated with more than 1000 serum total IgE level. Total IgE level was not affected with the number of allergen sensitization. SPT-positive patients had higher IgE value than SPT-negative patients but statistically not significant ($P > 0.05$), and there was also poor correlation between SPT result and serum total IgE level ($r = 0.102$).

CONCLUSION: SPT should be performed in all clinical allergic patients irrespective of serum total IgE level.

Keywords: Asthma, serum total immunoglobulin E, skin prick test

Introduction

Allergy occur when immune substances reacts to a foreign substance, like pollen, pet dander or a food etc, that normally does not cause a harm in most person. In response to this, the immune system produces antibodies which bind to the allergen and protect our body.

Bronchial asthma (BA) and allergic rhinitis (AR) are immunoglobulin (IgE)E-mediated hypersensitivity phenomena often associated with sinusitis or other comorbidities such as conjunctivitis and atopic dermatitis.^{[1]·[2]·[3]} Total serum IgE estimation and skin prick testing are commonly available tools for the evaluation of allergic patients. There are various studies^{[4]·[5]·[6]} which show a strong association between total serum IgE levels, skin test reactivity to different allergens, and allergy prevalence. However elevated total IgE may be due to nonallergic condition such as parasitic infection. We also do not have a specific cutoff value for total IgE that really discriminates patients with allergic disease from those without, and there is considerable overlap.^{[7]·[8]·[9]}

IgE has been considered the most important biological target in the treatment of allergy and asthma, with many investigators trying to interfere with its production or its function in the immune system. This is supported by the success of the anti-IgE monoclonal antibody in the treatment of allergy and asthma. This study was conducted with hypothesis that patients with skin prick test (SPT) positivity have high total IgE and negative SPT patients should have a normal IgE.

Objective of the study

The objective was to assess the association between total serum IgE level and SPT in Indian patients who presented with different nasobronchial allergy symptoms.

Materials and Methods



This was an observational prospective study conducted in the Allergy and Asthma Clinic, Motihari, Bihar. A total of 183 patients diagnosed as BA and AR underwent SPT against different allergens between January 2017 and July 2018. The diagnosis of BA and AR was made according to the Global Initiative for Asthma and AR in Allergic rhinitis guideline respectively.

Inclusion criteria

1. Patients who have been diagnosed as AR, asthma or both and
2. Patients who have a history of atopy (Urticaria, eczema, rhinitis, early onset [<12 years]).

Exclusion criteria

1. Age > 45 years
2. Patients with a history of tuberculosis, diabetes mellitus, hypertension, endocrine disease, or coronary artery disease were excluded from the study
3. Pregnant patients were also excluded from the study.

All the sociodemographic and clinical details such as cough, cold, breathlessness, and wheeze were recorded in a specific proforma designed for the study. All the patients were subjected to complete blood count, serum total IgE level (measured by enzyme-linked immunosorbent assay method using commercially available kits), chest radiograph, and sputum test as required.

A written informed consent was obtained from the patients before performing SPT. Skin prick test performed with total 33 standardized allergen (Allergopharma) including (2 mites, 13 types of pollens, 5 types of fungi, 1 types of animal dander, and 12 food allergens) and two control of cold saline and histamine. Patients were counseled to stop drugs interfering with SPT according to the guidelines to achieve an appropriate diagnosis. Drop of each allergen was placed 3 cm apart and then was pricked with a lancet. Buffer saline will be used as a negative control, while histamine acid phosphate (1 mg/ml) as a positive control. The wheel diameter was measured after 15–20 min and reported in “mm.” A skin reaction of ≥ 3 mm than that produced by the negative control on the SPT was considered as a positive reaction.

Statistical analysis

Numerical and categorical data were compared between groups using the Student's *t*-test and Chi-squared-test as appropriate. A point-biserial correlation was used to measure the strength and direction of the association that exists between one continuous variable and one dichotomous variable. All statistical analyses were performed using statistical software SPSS version 20 (SPSS Inc., Chicago, IL, USA). $P < 0.05$ was considered statistically significant.

Results



The study patients included 95 males and 88 females with a mean age of 27.15 ± 12.64 years. Among the 183 study patients, 99 (54.09%) patients were diagnosed as BA with AR, 56 (30.60%) with BA alone, and 28 (15.30%) with AR. SPT was positive in 99 (54.09) patients. More than half of the study patients (51.36%) were associated with more than 1000 serum total IgE level. The baseline characteristics of the study patients are summarized in [Table 1]. SPT was performed with five categories of allergens (mites, fungus, pollen, animal, and food). Among the 183 study patients, 66 (66.66%) patients were found sensitive to single allergen category, whereas sensitization to two or more than two categories of allergen was found in 19 (19.19%) and 14 (14.14%) patients, respectively. Sensitization with mold was associated with the highest total IgE level (1174.25 ± 665.75) followed by house dust mite, food, and pollen [Table 2]. The total number of allergen positivity per patients was found 3.31 for BA with AR, 2.97 for BA, and 1.63 for AR. Total IgE level did not significantly differ with the number of allergen [Table 3] and [Table 4]. There was no correlation between total IgE and SPT positivity ($P > 0.05$) ($r = 0.102$) [Table 5].

Characteristics	n (%)
Age	27.15±12.64
Male	95 (51.9)
Occupation	
Student	67 (36.61)
Homemaker	54 (29.50)
Shopkeeper	12 (6.55)
Agriculturer	14 (7.65)
Others	36 (19.67)
Symptoms	
Cough	146 (79.78)
Cold	117 (63.93)
SOB	155 (84.69)
Diagnosis	
Allergic rhinitis	28 (15.30)
Bronchial asthma	56 (30.60)
Allergic rhinitis with bronchial asthma	99 (54.09)
S-total IgE (IU/ml)	1061.21±595.25
<500	36 (19.67)
500-1000	53 (28.96)
>1000	94 (51.36)
SPT positivity	99 (54.09)

SPT=Skin prick test, IgE=Immunoglobulin E, SOB=Shortness of breath

Table 1: Baseline characteristics of the study patients (n=183)

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Type of Allergen	Total SPT positive (n=99)	Total allergen positivity (295) (100)	S-total IgE (IU/ml)	Table 2: Relation between total IgE and allergen sensitization in the study patients Click here to view
Single allergen category sensitization (n=66; 66.66)	n=66 (100)	121 (41.01)	1107.77	
House dust mite	35 (53.03)	55	1112.97	
Pollen	9 (13.63)	34	1058.80	
Mold	15 (22.72)	24	1267.68	
Animal	3 (4.54)	3	865.33	
Food	4 (6.06)	5	1174.25	
Two allergen sensitization (n=19; 19.19)		70 (23.72)	1174.57	
>2 allergen sensitization (n=14; 14.14)		104 (35.25)	1092.23	

SPT=Skin prick test, IgE=Immunoglobulin E

	Total study patients (n=183), n (%)	Bronchial asthma (n=56), n (%)	Allergic rhinitis (n=28), n (%)	Bronchial allergic rhinitis (n=28), n (%)	Table 3: Total allergen positivity in different nasobronchial disease and total immunoglobulin E
SPT positivity	99 (54.09)	29 (51.79)	11 (39.28)	60 (50.00)	
Total allergen positivity	295	78	18	159	
Allergen positivity per patient	2.79	2.97	1.63	1.63	
S-total IgE (mean±SD)	1061.21±595.25	1098.12±559.36	1004.66±500.01	1065.11±500.01	

SPT=Skin prick test, SD=Standard deviation, IgE=Immunoglobulin E

Total allergen positivity	SPT-positive patients (n=99), n (%)	Table 4: Serum total immunoglobulin E according to the number of allergen sensitization
1 allergen	44 (44.44)	
2-5 allergen	40 (40.40)	
>5 allergen positivity	15 (15.15)	

SPT=Skin prick test, IgE=Immunoglobulin E

Table 5: Comparison between skin prick test-positive and skin prick test-negative patients

Discussion



A proper history and physical examination are most important factors for the diagnosis of allergic disorder. Preclinical evaluation and different tests are generally performed to confirm the diagnosis and identifying potentially important environmental allergens.^[10] Hence, out of 183 patients, 99 (54.09%) patients were diagnosed as BA with AR, 56 (30.60%) with BA alone, and 28 (15.30%) with AR. Other studies^{[11],[12]} have different prevalence of these three nasobronchial allergy disease. SPT was positive in 99 (54.09%) patients, which is lower in compare to previous studies^{[13],[14]} which showed 87.5 and 90.1% respectively and the region could be more standardized allergen used in this study. BA and AR were associated with allergen sensitization in 30.60% and 15.30%, respectively, while 54.09% in patients with both AR and asthma. Forty-four out of 99 (44.44%) patients were sensitized to single allergen, whereas 40.44% and 15.15% of the patients were sensitized to 2-5 allergens and <5 allergens, respectively. Atopy is defined as a genetic predisposition to produce IgE against common environmental aeroallergens and that about 80% of people with asthma are atopic, compared with 30% of the general population.^[15] Many physicians perform SPT only in patients with high total IgE, and so this study was basically designed to assess the correlation between allergen sensitization in nasobronchial allergy patients and their total IgE level. Except 11 patients, all the study patients had a high total IgE level (>150 IU/ml). More than half of the study patients (51.36%) were associated with more than 1000 serum total IgE level. The total IgE levels were not only elevated in allergic disorders such as atopic eczema, allergic asthma, and allergic bronchopulmonary aspergillosis, but also in parasitic diseases such as invasive helminthiasis. The high level of IgE in our study could be due to higher incidence of helmonthic infection and higher air pollution. Our hypothesis was that patients with positive SPT should have high total IgE value compared to negative SPT, but we found higher value in both SPT positive and negative patients although slightly higher level was observed in SPT-positive patients but statistically not significant ($P < 0.05$) [Figure 1]. We also compare it disease wise, which was not found statistically significant [Table 5]. We performed SPT with mainly five categories of allergen such as mites, fungus, animal, food, and pollen. Serum total IgE level was found highest in mold-sensitized individuals followed by individuals sensitized with food, mite, pollen, and least with those with animals. This study also shows that patients with multiple allergen (more than one category allergen) sensitization did not had higher total IgE value compared to those with single category allergen sensitization [Table 2]. This finding was different when compared to a older study, which shows higher IgE level as sensitization to number of allergen inceases.^{[16],[17]} Total 295 SPT reaction were found in 183 study patients. The number of allergen positivity per patients was found highest for patients with both AR and asthma patients (3.31), followed by BA (2.97) and AR (1.63), but, again here also, the total IgE was not significantly different in the three groups. We used biserial correlation statistical method to know any association between SPT result and serum total IgE level, and this study shows poor correlation ($r = 0.102$). Another study^{[18],[19]} also shows poor correlation between total IgE and SPT.

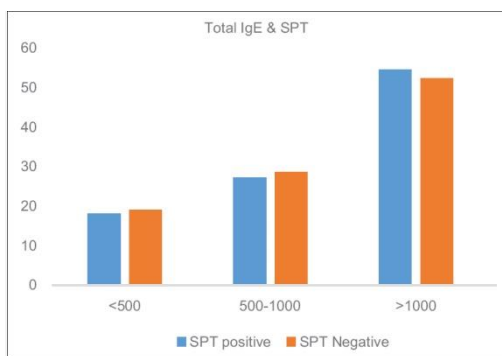


Figure 1: Relation variables of immunoglobulin E level and skin prick test positivity (higher proportion of skin prick test-negative patients with elevated serum total immunoglobulin E <500 (19.04% vs. 18.18%) and similarly for serum level of 500–1000 were higher in skin prick test-negative patients than skin prick test-positive patients (28.57% vs. 27.27%) while serum immunoglobulin E more than 1000 IU/ml were higher in skin prick test-positive patients than skin prick test-negative patients (54.44% vs. 52.38%). Number on Y-axis represents proportion

The study has certain limitations. We analyzed only 20% of asthma patients who agree for SPT or fulfil inclusion criteria, so generalizing the result may not be appropriate unless you take all consecutive patients. As the study center is a referral center, most of the patients had longer duration of disease and poor control of asthma; this could be a region for high total IgE. We have not assessed other factor such as parasitic infection, viral infection, or air pollution, which can lead to high IgE. As the study was performed in a private hospital located in the north of Bihar, the result cannot be generalized.

Conclusion



This study shows a poor correlation between SPT and serum total IgE level. Serum total IgE was not significantly different in patients with single or multiple allergen sensitization. SPT should be performed in all clinical allergic patients irrespective of serum total IgE level.

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Conflicts of interest

There are no conflicts of interest.

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