

A study of serum IgE in Allergic Diseases

J.K. Mishra¹, Usha², Ashish Deb¹, Deepak Sehgal¹

1. Dept of TB and Chest Diseases, 2. Dept of Pathology, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India

Abstract

Allergy poses a public health problem to large segments of population. About 15 to 20 per cent of the population is estimated to suffer from allergic disorders in India. The present study was carried out in 100 patients of respiratory allergy (66 patients of allergic rhinitis, 16 patients of bronchial asthma, 18 patients of allergic rhinitis with bronchial asthma) selected after a detailed history and clinical examination. Serum total IgE was estimated in all patients and, 20 healthy subjects. Majority of patients (65%) were from urban area and rest (35%) of them were from rural area, may be due to higher incidence of naso-bronchial allergy in urban area. The mean $\pm$ S.D. value of serum IgE level in the controls was 43.15 ± 19.75 IU/ml. In respiratory allergy patients, the mean $\pm$ S.D. value of serum IgE was 315.7 ± 151.17 , which was raised significantly.

Key words: Serum IgE, Allergic diseases, Allergic rhinitis, Bronchial asthma.

INTRODUCTION

Allergic diseases like bronchial asthma and allergic rhinitis are showing upward trend worldwide¹⁻⁶. In India, 15-20% population is suffering from respiratory allergy diseases.

According to reports from the Centres for Disease Control (CDC), the incidence of asthma and asthma-related mortality and morbidity in the US increased significantly during the period from 1980-1998. During this time, the number of work and school days lost to asthma-related events rose by 50%⁷. The yearly cost of asthma on the US healthcare system in

1990 was estimated at 6.2 billion dollars⁸ and by 2000, the estimated cost had doubled⁹.

Allergy, in human beings manifests in various ways depending upon the site and nature of organ involved. Though almost any tissue in the body may be affected, there seems to be a predilection for the respiratory system. The usual manifestations are in the form of bronchial asthma, allergic rhinitis, bronchial asthma with allergic rhinitis and hay fever.

Bronchial asthma, involves multifactorial aetiology. We are still unable to understand what asthma is and even less able to define it. That is why bronchial asthma is a subject of complete revision from time to time. Two very important features of this disease have been mentioned by all authors: hyper reactivity of tracheo-bronchial tree to various stimuli and resultant general obstruction to airway which changes

Address for correspondence: Dr. J.K. Mishra, Associate Professor, Dept. of TB and Chest Diseases, Room No. 1352, Institute of Medical Sciences, Banaras Hindu University, Varanasi, UP 221005 *E-mail:* jkmishra.imsbhu@gmail.com
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in intensity either spontaneously or as a result of treatment. Since the hyper reactivity is triggered by multiple factors, asthma is considered at present a syndrome rather than a disease.

Allergic rhinitis is the most common of all allergic disorders. In India, allergic rhinitis is commonest allergy and constitutes more than 50% of all allergies seen. One in every six persons¹⁰ suffers from rhinitis. Development of allergic rhinitis requires two conditions: atopic familial predisposition and exposure of the sensitized patient to the allergen. Atopy is an important factor in the development of asthma. Critical to atopy is the production of allergen-specific cells.

IgE plays a central role in allergic reaction of the respiratory tract. Serum total IgE is considered important in the clinical evaluation of allergic manifestations^{11,12}. In genetically predisposed individuals, IgE specific for allergens are synthesized and released into the circulation by plasma cells^{13,14}. IgE then binds to specific cell surface receptors located on mast cells, basophils and other immune effector cells. On subsequent allergen exposure, allergen binds to the Fab portion of the IgE molecule on the surface of mast cells and basophils, forming crosslinks and stimulating degranulation of these cells. The degranulation results in the release of mediators and cytokines that ultimately results in the pathophysiologic consequences and symptoms of allergic diseases, such as rhinitis and asthma^{14,15}.

Elevated IgE levels have been identified as a risk factor even in non-allergic asthma. In patients IgE levels correlate with asthma severity and BHR. The concept that IgE plays a critical role in asthma pathogenesis has driven the development of IgE blocker, which is currently being introduced into clinical use¹⁶⁻¹⁸.

Decreasing total serum IgE in atopic patients should decrease the available amounts of antigen-specific IgE to bind to and sensitize tissue mast cells and basophils. This reduction of available IgE should lead to a decrease in IgE-mediated symptoms and improve control of allergic diseases. Indeed, in allergic rhinitis studies, the reduction in total serum IgE levels caused by an anti-IgE monoclonal antibody correlated with improvement in symptom scores and rescue medication use¹⁸⁻²⁴.

The aim of the present study is to estimate the total serum IgE in different patients of respiratory allergy and to find out relationship between different groups of the patients, if any.

MATERIAL AND METHODS

Selection of patients for the present study was done from the chest ward, chest out patient department, of Sir Sundar Lal Hospital, Banaras Hindu University, Varanasi. Patients (n=100) of different age and sex suffering from respiratory allergy (viz. Bronchial asthma, rhinitis, rhinitis with bronchial asthma) and 20 control (healthy individual) were also taken with the aim to study the level of immunoglobulin (IgE) in the serum in allergic respiratory diseases during the period of March 2001 to March 2002. These patients were divided into 3 groups following the criteria prescribed by Lal et al.²⁵:

Group A – Patients of allergic rhinitis.

Group B – Patients of bronchial asthma.

Group C – Patients of bronchial asthma with allergic rhinitis.

Diagnosis and Clinical Evaluation: Detailed history was recorded in each patient and proper clinical examination was done. Special emphasis was given to the following points in history.

Bronchial asthma (BA): History of recurrent attack of paroxysmal breathlessness, symptoms free interval between the attacks, family history of other allergic disorder, identifiable allergy to inhaled and ingested substances, whether the symptoms were seasonal, perennial or perennial with seasonal exacerbations, frequency and severity of attacks with duration, precipitating factors, if any suspected by the patients, history of drug intake specially corticosteroids and antihistamines, whether there was any relation of acute attack with infection or not and history of smoking.

Allergic rhinitis (AR): History of recurrent attack of sneezing with running nose with or without nasal block, watering and redness of eyes and headache, whether the symptoms were seasonal, perennial or perennial with seasonal exacerbations, frequency of attacks with severity and duration, precipitating factors

suspected by patients, history of drug intake particularly corticosteroids and antihistamines, family history of atopy or other manifestations and smoking history. All other causes of paroxymal dyspnea were excluded, like cardiac causes, infiltrative conditions of lung, tropical pulmonary eosinophilia and emphysema due to chronic obstructive pulmonary disease based on history, clinical examination and investigations.

All the patients were investigated for total and differential cell count, haemoglobin percentage, sputum for culture and sensitivity, sputum for acid fast bacilli, absolute eosinophil count, serum IgE level, stool for ova and cyst (to exclude parasitic infection), X-Ray Chest P.A. view and X-Ray paranasal sinuses.

Quantitative estimation of IgE level was done using ELISA Kit from OSB agencies. Total IgE value below 100 IU/mL was taken as negative and above 100 IU/mL was taken as positive for adult patients.

RESULTS

The present study comprise of 100 patients of respiratory allergy diagnosed clinically. There were 66 patients of allergic rhinitis, 16 patients of bronchial asthma and 18 patients of allergic rhinitis with bronchial asthma. All patients were estimated for serum immunoglobulin IgE. Serum IgE level was also estimated in 20 normal subjects, which served as controls in this study.

Out of 100 patients studied, most of the patients belonged to 15–34 years of age. The incidence of allergy seems to decrease after 35 years of age. Our sample showed that maximum patients (65.00%) belonged to urban area and rest (35.00%) were from rural area. Incidence of all respiratory allergies were more in urban area than rural area.

The mean $\pm$ SD value of IgE in allergic rhinitis with bronchial asthma was 359.89 ± 171.37 IU/mL, in bronchial asthma was 334.88 ± 152.42 IU/mL and in allergic rhinitis was 299.18 ± 141.51 IU/mL, respectively.

The serum IgE level in control subjects and in respiratory allergic patients (mean $\pm$ S.D.) was 43.15

± 19.75 IU/mL and 315.79 ± 151.17 IU/mL, respectively. On statistical analysis, it revealed that rise in total IgE in respiratory allergy cases was statistically significant than control.

All the patients were subjected to skin prick-test (SPT). Most of the patients showed significant positive reactions (more than 2+) with one or more antigens. *Aspergillus fumigatus*, *Alternaria alternata*, *Dermatophagoides* species were common offending allergens (Table 1, 2, and 3). The controls were also tested but they did not show significant positive reactions; however, one plus reactions were observed in few subjects.

DISCUSSION

The present study was undertaken in 100 patients of respiratory allergy disease diagnosed clinically and all patients were investigated for total serum IgE level.

The incidence of respiratory allergy seems more prevalent in the age group of 25-34 years (48%), followed by 15-24 years (40%) and 35-50 years (12%). The mean age $\pm$ S.D. of males was 26.75 ± 6.52 , females 28.00 ± 7.18 and mean age $\pm$ S.D. of total 100 patients was 27.00 ± 6.67 , with 't' value 6.52 and 'P' value > 0.5 . The incidence declines with the advancing age. These findings were similar to that observed by Wig and Guleria²⁶ (1964) and Viswanathan²⁷ (1972).

In the present study, the percentage of cases from urban area and rural area were also noted. Maximum cases of respiratory allergy (65%) were from urban area while (35%) rest were from rural area. In allergic rhinitis, 44% cases were from urban area while 33.33% cases from rural area. In bronchial asthma, 68.75% cases were from urban area while 31.25% cases were from rural area. In allergic rhinitis with bronchial asthma, 55.56% cases were from urban area while 44.44% cases from rural area. The above findings are similar to that of Shaikh (1999)²⁸ who noticed 58% of allergic cases from urban area.

IgE level of 100 patients of respiratory allergy were estimated. Results revealed significantly raised levels of serum IgE levels as compared to controls. Mean value $\pm$ S.D. of IgE levels in respiratory allergic patients was 315.79 ± 159.17 IU/mL which was

Table 1. Allergic rhinitis*

Sl No	Patient ID	Age	Sex	SPT +ve	Total IgE (IU/mL)
1	P.ID. 1	18	M	Asp, Der, Curv	285
2	P.ID.2	22	F	Alt, Curv, Der	165
3	P.ID.3	31	M	Curv, Asp, Der	320
4	P.ID. 4	40	M	Pen, Der, Asp	340
5	P.ID. 5	17	F	Bra, Curv, der	180
6	P.ID. 6	24	M	Der, Asp, Curv	180
7	P.ID. 7	35	M	Alt, Bra, Der	240
8	P.ID. 8	43	F	Fus, Asp, Der	540
9	P.ID. 9	19	M	Asp, Der, Curv	660
10	P.ID. 10	20	M	Der, Curv, Alt	310
11	P.ID. 11	18	F	Arg, Der, Alt	190
12	P.ID. 12	16	M	Asp, Der, Alt	110
13	P.ID. 13	35	M	Fus, Alt, Der	520
14	P.ID. 14	25	M	Zea, Asp, Alt	210
15	P.ID. 15	36	F	Asp, Curv, Der	340
16	P.ID. 16	43	M	Der, Curv, Asp	430
17	P.ID. 17	45	M	Alt, Asp, Der	230
18	P.ID. 18	16	M	Xan, Asp, Der	410
19	P.ID. 19	27	F	Der, Alt, Xan	300
20	P.ID. 20	32	M	Asp, Curv, Alt	220
21	P.ID. 21	41	M	Fus, Der, Art	887
22	P.ID. 22	32	M	Curv, Art, Parth	540
23	P.ID. 23	28	F	Der, Parth, Asp	310
24	P.ID. 24	47	M	Asp, Curv, Der	670
25	P.ID. 25	28	M	Der, Alt, Curv	340
26	P.ID. 26	22	M	Xan, Asp, Der	220
27	P.ID. 27	31	F	Alt, Fus, Der	370
28	P.ID. 28	41	M	Der, Asp, Alt	240
29	P.ID. 29	49	M	Parth, Der, Asp	130
30	P.ID. 30	25	M	Curv, Fus, der	220
31	P.ID. 31	34	M	Der, Alt, Asp	200
32	P.ID. 32	21	F	Alt, Asp, Fus	280
33	P.ID. 33	28	M	Asp, Der, Alt	350
34	P.ID. 34	30	M	Der, Asp, Curv	410
35	P.ID. 35	32	M	Alt, Asp, Der	360
36	P.ID. 36	49	M	Der, Alt, Curv	340
37	P.ID. 37	16	M	Asp, Fus, Der	230
38	P.ID. 38	18	F	Curv, Asp, Der	250
39	P.ID. 39	24	M	Alt, Der, Asp	280
40	P.ID. 40	20	M	Asp, Alt, Curv	200

Contd...

Table 1. Contd....

Sl No	Patient ID	Age	Sex	SPT +ve	Total IgE (IU/mL)
41	P.ID. 41	40	M	Curv, Alt, Asp	280
42	P.ID. 42	25	F	Fus, Der, Alt	280
43	P.ID. 43	19	M	Asp, Alt, Der	140
44	P.ID. 44	42	M	Asp, Curv, Der	130
45	P.ID. 45	41	M	Alt, Asp, Der	230
46	P.ID. 46	36	F	Der, Curv, Alt	160
47	P.ID. 47	32	M	Xan, Alt, Der	180
48	P.ID. 48	29	M	Asp, Curv, Alt	205
49	P.ID. 49	25	M	Parth, Der, Asp	220
50	P.ID. 50	24	F	Der, Asp, Parth	240
51	P.ID. 51	20	M	Curv, Fus, Asp	180
52	P.ID. 52	19	M	Der, Alt, Asp	190
53	P.ID. 53	42	M	Der, Alt, Fus	320
54	P.ID. 54	46	M	Xan, Parth, Der	645
55	P.ID. 55	37	M	Alt, Der, Fus	450
56	P.ID. 56	30	M	Curv, Asp, Parth	115
57	P.ID. 57	28	F	Der, Curv, Asp	230
58	P.ID. 58	33	M	Der, Alt, Fus	360
59	P.ID. 59	48	M	Alt, Asp, Der	100
60	P.ID. 60	39	M	Der, Alt, Curv	200
61	P.ID. 61	42	M	Asp, Curv, Fus	300
62	P.ID. 62	45	M	Der, Asp, Alt	415
63	P.ID. 63	36	M	Parth, Asp, Der	375
64	P.ID. 64	18	M	Alt, Curv, Asp	230
65	P.ID. 65	24	M	Der, Alt, Asp	290
66	P.ID. 66	29	M	Curv, Asp, Der	270
				Mean $\pm$ SD	299.1 $\pm$ 148.1

Asp: *Aspergillus fumigatus*, Xan: *Xanthium strumarium*, Arg: *Argemone mexicana* Alt: *Alternaria alternata*, Fus: *Fusarium solani*, Der: *Dermatophagoides* sp., Curv: *Curvularia lunata*, Parth: *Parthenium hysterophorus*, Zea: *Zea mays*

*Range: 100-887; Mean $\pm$ SD: 299.18 $\pm$ 141.51; 't' value: 0.85 (A & B), 'P' value: >0.05

significantly higher as compared to 20 controls where the mean $\pm$ S.D. value was 43.15 $\pm$ 19.75 IU/mL. The present finding was in accord with the results of Johansson²⁹ (1967) who found significantly increased IgE level in respiratory allergy patients as compared to normal subjects.

SPT showed significant positive results in 80% patients of respiratory allergy with *Dermatophagoides* species and incidence was maximum (15/18) in patients of AR with bronchial asthma group. Second

commonest antigen was *Aspergillus fumigatus* and 72% revealed significant SPT reactions. The incidence was more in the patients of bronchial asthma (13/16) and AR with bronchial asthma group. Many other allergens were also tested in these patients and 55% of patients showed significant reaction with *Alternaria alternata* and result was pronounced in patients of bronchial asthma (10/16) and AR with bronchial asthma (10/18). Our observation has also been supported by studies of other workers like Das Gupta and Lal³⁰ (1974). Some recent studies³¹ have also

Table 2. Bronchial asthma*

Sl No	Patient ID	Age	Sex	SPT +ve	Total IgE (IU/mL)
1	P.ID. 1	24	M	Asp, Curv, Der	230
2	P.ID.2	29	M	Curv, Alt, Der	104
3	P.ID.3	36	F	Der, Asp, Alt	470
4	P.ID. 4	39	M	Fus, Alt, Der	280
5	P.ID. 5	18	M	Arg, Asp, Der	264
6	P.ID. 6	20	M	Asp. Alt, Der	340
7	P.ID. 7	24	M	Alt, Fus, Asp	320
8	P.ID. 8	32	M	Curv, Alt, Asp	667
9	P.ID. 9	45	M	Der, Asp, Fus	250
10	P.ID. 10	49	F	Xan, Alt, Der	375
11	P.ID. 11	27	M	Asp, Curv, Alt	574
12	P.ID. 12	30	M	Der, Fus, Asp	368
13	P.ID. 13	45	M	Curv, Asp, Der	245
14	P.ID. 14	48	M	Alt, asp, Fus	265
15	P.ID. 15	29	M	Asp, Der, Alt	310
16	P.ID. 16	36	F	Der, Curv, Asp	295
				Mean $\pm$ SD	334.8 $\pm$ 137.5

Asp: *Aspergillus fumigatus*, Xan: *Xanthium strumarium*, Arg: *Argemone mexicana* Alt: *Alternaria alternata*, Fus: *Fusarium solani*, Der: *Dermatophagoides* sp., Curv: *Curvularia lunata*, Parth: *Parthenium hysterophorus*, Zea: *Zea mays*

*Range: 104 – 667; Mean $\pm$ SD: 334.88 $\pm$ 152.42; 't' value: (B & C) 0.45, 'P' value: >0.05

Table 3. Allergic rhinitis with bronchial asthma*

Sl No	Patient ID	Age	Sex	SPT +ve	Total IgE (IU/mL)
1	P.ID. 1	19	M	alt, Asp, Curv	285
2	P.ID.2	26	F	Der, Curv, Asp	240
3	P.ID.3	34	M	Asp, Der, Fus	480
4	P.ID. 4	42	M	Xan, Alt, Der	460
5	P.ID. 5	45	M	Asp, Curv, Alt	400
6	P.ID. 6	24	M	Alt, Der, Asp	640
7	P.ID. 7	29	F	Arg, Der, Alt	270
8	P.ID. 8	48	M	Der, Curv, Asp	270
9	P.ID. 9	31	M	Asp, Alt, Der	150
10	P.ID. 10	36	M	Curv, Der, Asp	342
11	P.ID. 11	48	M	Parth, Asp, Der	800
12	P.ID. 12	25	M	Alt, Fus, Asp	385
13	P.ID. 13	47	F	Der, Asp, Curv	620
14	P.ID. 14	38	M	Alt, Curv, Der	225
15	P.ID. 15	18	M	Asp, Der, Curv	210
16	P.ID. 16	33	M	Der, Alt, Asp	170
17	P.ID. 17	44	M	Xan, Asp, Der	245
18	P.ID. 18	28	M	Curv, Alt, Der	285
				Mean $\pm$ SD	359.8 $\pm$ 178.6

Asp: *Aspergillus fumigatus*, Xan: *Xanthium strumarium*, Arg: *Argemone mexicana* Alt: *Alternaria alternata*, Fus: *Fusarium solani*, Der: *Dermatophagoides* sp., Curv: *Curvularia lunata*, Parth: *Parthenium hysterophorus*, Zea: *Zea mays*

*Range: 125 – 800; Mean $\pm$ SD: 359.89 $\pm$ 171.37; 't' value: (A & C) 1.35, 'P' value: >0.05

found markedly high serum IgE in respiratory allergy patients as compared to healthy controls.

CONCLUSION

In conclusion, patients of respiratory allergy showed significantly raised levels of serum IgE as compared to controls. Mean value $\pm$ S.D. of IgE levels in respiratory allergy patients was 315.79 ± 159.17 IU/mL which was significantly higher as compared to controls where the mean $\pm$ S.D. value was 43.15 ± 19.75 IU/mL. The finding was in agreement with previous studies showing significantly increased IgE level in respiratory allergy patients. However, specific IgE estimation or SPT is suggested to prove the results. In the present study, a significant number of patients demonstrated high serum total IgE and a positive SPT.

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