

ORIGINAL ARTICLE

Evaluation of Serum Immunoglobulin E (IgE) Level in Newly Diagnosed Bronchial Asthma Patients in Rajshahi Medical College Hospital

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Abstract

Introduction: Frequent episodes of wheezing, dyspnoea, chest tightness, and coughing, especially at night or in the early morning, are hallmarks of bronchial asthma, a chronic inflammatory disease of the airways.

Aim of the study: The aim of the current study is to evaluate serum immunoglobulin E (IgE) level in newly diagnosed bronchial asthma patients in rajshahi medical college hospital.

Methods: This case-control study was conducted at the Department of Medicine, Rajshahi Medical College Hospital, Bangladesh. The study duration was 6 months which started from September 2021 to February 2022. Therefore, for this study 25 patients were included as cases, another 25 healthy individuals were included as control. That is, total 50 subjects were included in the study following the inclusion and exclusion criteria.

Result: The mean age of the newly diagnosed bronchial asthma cases was 31.16 ± 8.8 (SD) years. Among the case group, the majority of respondents were in the age group of 21-30 and 31-40 years. A majority of the study population were female in case groups (64%, n=16). It was well noted that the mean FEV1 values and the majority of the cases were having moderate (52%), severe (32%), and mild levels of bronchial asthma (16%) and dyspnoea (72%) was the most common symptom among cases. The mean serum immunoglobulin E (IgE) level of the cases was 735.8 ± 231.3 (SD) kU/L, and among the control group was 169.7 ± 23.2 (SD) kU/L. IgE level was significantly higher in severe bronchial asthma patients compared to moderate and mild bronchial asthma patients.

Conclusion: Serum IgE was significantly higher in patients with bronchial asthma (BA) in comparison to healthy control group. Moreover, a significant serum IgE was also significantly higher in patients with severe BA than the patients with moderate and mild BA.

Keywords: Immunoglobulin E (IgE), Bronchial Asthma, Immunocompromised

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Introduction

A chronic inflammatory disorder named Bronchial asthma is a disorder of the airways

characterized by recurrent episodes of breathlessness, wheezing, chest tightness, and cough, especially at night or in the early

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morning.¹ It causes considerable morbidity and mortality globally. It is one of the most common chronic, non-communicable diseases and affects around 334 million people around the world. The global prevalence of self-reported, doctor-diagnosed asthma in adults is 4.3%, with wide variation between countries.² The prevalence is lowest in poor nations like China (0.2%) and highest in wealthy nations like Australia (21%).³ By 2025, there might be an extra 100 million asthmatics, according to estimates.⁴ In the past, asthma has been linked to a substantial financial burden. In 2016, over 50% of children with asthma reported having one or more asthma attacks. If left untreated, asthma attacks can result in significant medical expenses and resource usage.⁵ On average, 11.6% of Bangladeshi secondary school students had bronchial asthma. Males were more likely than females to have bronchial asthma (15.6% vs. 7.4%).⁶ Most cases of asthma typically begin in childhood due to sensitization to common inhaled allergens, including pollens, cockroaches, mites from household dust, fungus, and animal dander. These inhaled allergens promote the growth of T helper type 2 (Th2) cells, which in turn stimulates the production and release of Th2 cytokines, interleukin (IL)-4, IL-5, and IL-13.⁷ It is a condition marked by frequent episodes of dyspnoea and wheezing, which differ in intensity and frequency among individuals. Hereditary allergic disorders, early exposure to protein antigens like cow's milk or egg white, recurrent respiratory tract infections, and indoor and outdoor environmental factors are some of the risk factors that contribute to the development of asthma. These risk factors can be further classified as allergic sensitization or exacerbation.⁸ Immunoglobulin (Ig) E-mediated allergies, also known as atopic allergies, account for most human allergies.⁹ The last of the five classes of human antibodies to be identified, immunoglobulin E (IgE) was designated in 1968 and is now frequently linked to the different symptoms of allergic illness.¹⁰ Its function in mammalian evolution seems to be to provide a defense mechanism against animal venoms and parasites, which necessitates the acquisition of a

potent effect or function.¹¹ An increase in serum Immunoglobulin E (IgE) levels is a characteristic of allergic disorders, including asthma. In allergic asthma, immunologic mechanisms mediated by IgE antibodies trigger a hypersensitivity reaction. IgE is essential for the start and spread of the inflammatory cascade and, consequently, the allergic reaction.^{12,13} Atopic disorders (asthma, allergic rhinitis, atopic dermatitis, urticaria), parasite diseases, cutaneous diseases, neoplastic diseases, and immunological deficits are additional ailments that raise blood IgE levels.¹⁴ Research revealed that persons with asthma had a noticeably higher serum total IgE level than those in good health.¹⁵ However, there is a lack of research in our nation on the IgE level in newly diagnosed asthma cases. Serum IgE levels in newly diagnosed instances of bronchial asthma will be assessed as part of the current study, and the relationship between IgE levels and the degree of airflow limitation will also be discussed. The aim of the current study is to evaluate serum immunoglobulin E (IgE) level in newly diagnosed bronchial asthma patients in Rajshahi medical college hospital.

Methods

This case-control study was conducted at the Department of Medicine, Rajshahi Medical College Hospital, Bangladesh. The study duration was 6 months which started from September 2021 to February 2022. Therefore, for this study 25 patients were included as cases, and another 25 healthy individuals were included as control. That is, total 50 subjects were included in the study. Age: >18 years, either gender, newly diagnosed bronchial asthma according to GINA guideline and willing to participate were included among inclusion Criteria for the cases. Previous criteria along with healthy individual were included among inclusion Criteria for the controls. However, patients with Other atopic sign and symptom, documented helminthic or parasitic infection, smoker, person with obesity, pregnant women, immunocompromised patients, chronic respiratory diseases other than asthma were excluded from the study.

Results

In Table 1 the mean age of the newly diagnosed bronchial asthma cases was 31.16 ± 8.8 (SD) years. Among the case group, the majority of respondents were in the age group of 21-30 and 31-40 years of which 36% respondents in each group, followed by in decreasing order 18-20 years and 41-50 years (12% respondents of each), and above 50 years of age group was 4% of respondents. The mean age and age distribution of the subjects were matched between two groups ($p=0.98$ and 0.61 respectively). This table represents the descriptive characteristics of the study population ($n=50$). Regarding educational status, the majority of respondents in the case group (36%) received primary education, only 12% had no formal education, the rest were

studied up to secondary school (28%), higher secondary school (8%), and graduated/above (16%). Both groups presented with a similar level of education ($p = 0.2$). In the terms of occupation, 36% of respondents in the case group were housewives while the others were day laborers, garment workers, housemaids, etc (32%), service holders (20%), Business (8%), and retired (4%). The distribution of the studied subjects by occupational level was also matched between the two groups ($p=0.98$). The majority of respondents in both groups hailed from rural areas (64% and 56% respectively) while 36% and 44% of respondents from both groups hailed from urban areas. No differences were found between the case and control groups concerning the latitude of residence ($p=0.6$).

Table-I
Socio-demographic profile of the study population (n=50)

Variables	Cases n(%) (n=25)	Controls n(%) (n=25)	p value*
Distribution of patients by Age group (Years) (n=50)			
18-20	3 (12)	2 (8)	0.98*
21-30	9 (36)	10 (40)	
31-40	9 (36)	8 (32)	
41-50	3 (12)	4 (16)	
>50	1 (4)	1 (4)	
Total	25 (100)	25 (100)	0.61**
Mean ± SD	31.16 ± 8.8	32.44 ± 8.9	
Distribution of patients by educational status (n=50)			
No formal education	3 (12)	2 (8)	0.2
Primary	9 (36)	4 (16)	
Secondary	7 (28)	10 (40)	
Higher Secondary	2 (8)	7 (28)	
Graduate/Above	4 (16)	2 (8)	
Distribution of patients by occupation (n=50)			
Housewife	9 (36)	8 (32)	0.98
Service	5 (20)	6 (24)	
Business	2 (8)	3 (12)	
Others	8 (32)	7 (28)	
Retired	1 (4)	1 (4)	
Distribution of patients by residence (n=50)			
Rural	16 (64)	14 (56)	0.6
Urban	9 (36)	11 (44)	

Chi-square test* and independent student t-test** was performed to compare between two groups

Cases: 25 newly diagnosed Bronchial Asthma patients.

Controls: 25 healthy individuals.

Chi-square test* was performed to compare between two groups. Cases: 25 newly diagnosed Bronchial Asthma patients. Controls: 25 healthy individuals.

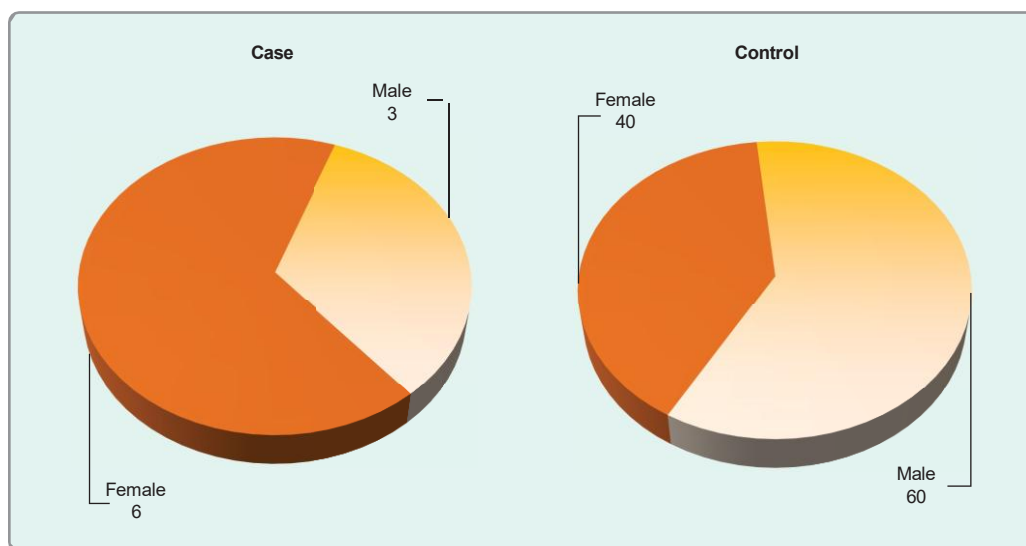


Figure 1: Pie chart showing sex distribution of patients (n=50)

Chi-square test* was performed to compare between two groups; Cases: 25 newly diagnosed Bronchial Asthma patients; Controls: 25 healthy individuals; p value* 0.1

Figure I shows a majority of the study population were female in case groups (64%, n=16) and a majority of the study population were male in the control group (60%, n=15). Both groups were statistically similar regarding gender distribution (p=0.1).

Table-II

Distribution of severity of bronchial asthma according to spirometry/PEF findings among the cases (n=25)

Severity of Bronchial Asthma	FEV1 or PEF	Cases (n)	Percentage
Mild	≥80%	4	16
Moderate	60-80%	13	52
Severe	≤60%	8	32

The distribution of severity of bronchial asthma is given in Table II. It was well noted that the mean FEV1 values and the majority of the cases were

having moderate (52%), severe (32%), and mild levels of bronchial asthma (16%).

Table-III

Distribution of clinical features among the cases (n=25)

Clinical Features*	Cases (n)	Percentage
Chest tightness	11	44
Dyspnoea	18	72
Cough	15	60
Wheeze	14	56
Runny nose	10	40

*Multiple response was considered

From Table III, it was noted that dyspnoea (72%) was the most common symptom among cases followed by cough (60%), wheeze (56%), chest tightness (44%), and runny nose (40%).

Table-IV

Comparison regarding Serum Immunoglobulin E (IgE) between two groups (n=50)

Variables	Cases (n=25) Mean ± SD	Controls (n=25) Mean ± SD	p value*
Serum IgE (kU/L)	735.8 ± 231.3	169.7 ± 23.2	<0.001

Independent student t-test* was performed to compare between two groups
Cases: 25 newly diagnosed Bronchial Asthma patients.
Controls: 25 healthy individuals.

Table-V
Association between serum immunoglobulin E (IgE) level with the severity of bronchial asthma (n=25)

Variable	Mild ($\geq 80\%$)	Moderate (60-80%)	Severe ($\leq 60\%$)	p value*
Serum IgE (kU/L)	404 $\pm$ 29.4	636.5 $\pm$ 55.9	1045 $\pm$ 14.4	<0.001

*p value was determined by one way ANOVA test. Post Hoc analysis by Bonferroni method was done.

In Table IV, the mean serum immunoglobulin E (IgE) level of the cases was 735.8 ± 231.3 (SD) kU/L, and among the control group was 169.7 ± 23.2 (SD) kU/L. Serum immunoglobulin E (IgE) level was statistically significantly higher in the case group than in the control group ($p < 0.001$).

Table V showing that the mean serum immunoglobulin E (IgE) level was statistically significantly associated with the severity of bronchial asthma ($p < 0.001$). IgE level was significantly higher in severe bronchial asthma patients compared to moderate and mild bronchial asthma patients. Besides, there was a significantly higher level of serum IgE present in the moderate group of bronchial asthma patients compared to a mild level of asthma patients. It was observed that the more the severity level of asthma, the higher the concentration level of serum IgE.

Discussion

In Table 1 the mean age of the newly diagnosed bronchial asthma cases was 31.16 ± 8.8 (SD) years. Among the case group, the majority of respondents were in the age group of 21-30 and 31-40 years of which 36% respondents in each group, followed by in decreasing order 18-20 years and 41-50 years (12% respondents of each), and above 50 years of age group was 4% of respondents. The mean age and age distribution of the subjects were matched between two groups ($p = 0.98$ and 0.61 respectively). Table 1 also represents the descriptive characteristics of the study population ($n = 50$). Regarding educational status, the majority of respondents in the case group (36%) received primary education, only 12% had no formal education, the rest were studied up to secondary school (28%), higher secondary school (8%), and graduated/above (16%). Both groups presented with a similar level of education ($p = 0.2$). In the terms of occupation, 36% of respondents in the

case group were housewives while the others were day laborers, garment workers, housemaids, etc (32%), service holders (20%), Business (8%), and retired (4%). The distribution of the studied subjects by occupational level was also matched between the two groups ($p = 0.98$). The majority of respondents in both groups hailed from rural areas (64% and 56% respectively) while 36% and 44% of respondents from both groups hailed from urban areas. No differences were found between the case and control groups concerning the latitude of residence ($p = 0.6$). In the present study, the incidence of bronchial asthma was higher in females (64%) than males (36%), being similar to previous reports.¹⁶ The higher prevalence of bronchial asthma in female patients corroborates with the earlier findings and this may be due to increased thoracic size in adult females after puberty when compared to males.^{17,18} Manohar S. et al. also observed that estimation of IgE level among females was 52%, which was higher than compared to males (48%).¹⁹ This was by our study results too. The distribution of severity of bronchial asthma is given in Table III. It was well noted that the mean FEV1 values and the majority of the cases were having moderate (52%), severe (32%), and mild levels of bronchial asthma (16%). In the present study, the most common clinical feature was dyspnoea as seen in 72% of patients followed by cough among 60% and wheeze in 56% of patients. This might be due to severe airway obstruction in many of our study subjects. In a study conducted on the prevalence of asthma in urban and rural children in Tamil Nadu, usual symptoms such as breathlessness (17.9%), wheezing (17.7%) and nocturnal dry cough (20.7%) were reported but without dyspnea.²⁰ In the current study, the mean serum IgE value of bronchial asthma patients was 735.8 ± 231.3 (SD) kU/L which was higher than the healthy control

group (169.7 ± 23.2 kU/L). One of the studies had reported that serum total IgE level was significantly higher ($P < 0.001$) in asthmatic adults compared to that of healthy subjects.¹⁵ An earlier study conducted in India, had recorded that the mean IgE levels ranged from 151.95 IU/ml in normal subjects to 1045.32 IU/ml in severe asthmatics.²¹ The mean total IgE level of the population was found to be 106.6 IU/ml whereas a higher mean total IgE level was observed patients with severe asthma have a higher mean IgE level (280.2 IU/ml).²² Our study was also in agreement with the study by Thirunavukkarasu et al., who investigated serum IgE level in 60 asthmatic patients between 18 and 60 years of age, classified according to the GINA classification (31 male and 29 female), and 13 healthy controls between 18 and 60 years of age. They found that the mean IgE level in the control group was 151 IU/ml and that in the asthmatic group ranged from 404 to 1045 IU/ml.²¹ Thus, the earlier studies cited above showed that serum IgE is higher in bronchial asthma patients that are similar to our study. When comparing the severity of asthma with serum IgE levels in bronchial asthma, the present data indicated that the more severity of asthma, the greater was the elevation in serum IgE. IgE level was significantly higher in severe bronchial asthma patients [1045 ± 14.4 (SD) kU/L] compared to moderate [636.5 ± 55.9 (SD) kU/L] and mild [440 ± 29.4 (SD) kU/L] bronchial asthma patients. This study was in agreement with the study by Davila et al., who investigated 383 patients with allergic asthma (129 mild, 82 moderate, and 172 severe; mean age: 38 ± 15 , 46 ± 16 , and 45 ± 15 years, respectively). They found that serum total IgE levels in adult patients with persistent allergic asthma were high (two-thirds with levels > 150 IU/ml) and extremely variable.²³ They did not find a significant association between serum total IgE levels and asthma severity or airflow limitation, except for a higher percentage of patients with IgE greater than 400 IU/ml in the severe subgroup. It was found that that serum IgE value increased with the increased severity of airway obstruction and it was to be statistically significant ($p < 0.05$) as observed in a study conducted within the age group of 18-60 years.²¹ This suggests that treatment of bronchial asthma patients warrants a necessary correlation between IgE levels and severity of obstruction.

Patients with severe asthma have a higher mean IgE level (280.2 IU/ml) than patients with moderate (145.8 IU/ml) or mild (137.8 IU/ml) asthma hence IgE levels increased as asthma severity increased.^{17,22} The same trend was reflected in both older and younger bronchial asthma patients.²⁴ The present study was in agreement with the study by Sandeep et al., who investigated serum IgE level in 60 asthma patients between 18 and 60 years of age (31 male and 29 female asthmatic patients), classified according to the GINA classification and 13 healthy controls between 18 and 60 years of age.²¹ They found that the mean IgE level in the control group was 151 IU/ml, and that in the asthmatic group was as follows: a mean of 404 IU/ml for patients with mild asthma ($n=19$), a mean of 404 IU/ml for patients with moderate asthma ($n=18$), and a mean of 1045.32 IU/ml for patients with severe asthma ($n=23$). IgE levels were highly significantly higher in severe exacerbated asthma, compared with moderate and mild exacerbated asthma ($P > 0.001$). In summary, the present data suggest that serum IgE levels increased significantly in bronchial asthma and reflect the severity of asthma.

Limitations of The Study

The study was conducted in a single centered hospital with a non- representative sample size. So, the results may not represent the whole community.

Conclusion

The present study findings indicate that serum IgE was significantly higher in patients with bronchial asthma (BA) in comparison to healthy control group. Moreover, a significant serum IgE was also significantly higher in patients with severe BA than the patients with moderate and mild BA. So, serum IgE could be a widely available, easy and convenient tool to screen the presence of BA and to predict the severity of disease. However, before drawing a final conclusion, further extensive studies should be conducted.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

Recommendation

Further larger cohort study is required to get the exact scenario. Government fund is required for a large scale study.

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