Research Article

CORRELATION OF SERUM IMMUNOGLOBULIN 'E' LEVELS AND ABSOLUTE EOSINOPHIL COUNTS WITH SEVERITY OF BRONCHIAL ASTHMA

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ABSTRACT

Background: This present study is an observational clinical study which analysed the correlation of serum immunoglobulin E levels and absolute eosinophil count with the severity of bronchial asthma. **Aim of the Study:** To predict the prognosis and treatment outcome of bronchial asthma patients from absolute eosinophil count and serum IgE levels. **Material & Methods:** 50 patients who were diagnosed to have bronchial asthma were included in the study population. **Results:** Positive correlation was found between asthma severity and absolute eosinophil count in the severe persistent asthma group which was statistically significant. Serum IgE levels correlate with asthma severity and the mean IgE in mild was 271.50 IU/mL, moderate group was 916.48 IU/mL and severe group was 1662.59 IU/mL.

INTRODUCTION

Over the last few years, an increase in prevalence of allergic disease like asthma and allergic rhinitis is seen. Both are common chronic diseases that affect the quality of life of patients and have a significant economic impact. About 300 million people worldwide suffer from asthma and this figure is projected to rise to 400 million by year 2025[1].

In our country, there is a huge burden due to asthma though further data is required for finding out prevalence. Asthma epidemiology study group of Indian Council of Medical Research found the prevalence of bronchial asthma in Indian adults as 2.38%[2].

Presently, broncho dilators and anti-inflammatory drugs are providing relief in majority of patients, though they do not produce symptomatic relief to all patients. Despite the various treatment options available those in mild to severe group continue to have exacerbations with inhaled therapies, leading to large number of hospitalizations and visit to physicians[3].

As there exists many asthma mimics, diagnosis of asthma needs supporting evidences like family history, history of allergy etc., Asthma now considered as single airway disease and hence comprehensive diagnosis, treatment and follow up upper and lower respiratory tract is essential.

It has been observed in many studies that serum IgE level is elevated in asthmatic and tracks with the severity of asthma. Eosinophil infiltration is hallmark feature of pathogenesis of asthma which are the triggers for the chronic airway inflammation and are raised in acute exacerbations and hence assessing eosinophil count is evidence of serological markers for airway inflammation[4].

- In asthma patient, eosinophils are present in blood, sputum, bronchial lavage and bronchial biopsy specimens, and increase in number correlate with disease severity, airway obstruction and bronchial hyper reactivity.
- Atopy, the propensity to produce a higher amount of IgE in response to allergens appear to be greatest risk.
- Population studies have shown that majority of children and adults with asthma are atopic, though it may occur in few non atopic individuals with no positive skin tests or raised serum IgE levels.
- Population studies have also shown that prevalence of asthma increase with increasing levels of IgE and those with low levels of serum IgE have low prevalence of asthma.

Aim of the study

- To establish an association between airway inflammation as assessed by absolute eosinophil count and disease severity.
- To establish an association between atopy as demonstrated by serum Immunoglobulin E levels and disease severity.

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- To correlate the clinical presentation, serum IgE and absolute eosinophil count with severity of bronchial asthma as assessed by lung spirometry.
- To predict the prognosis and treatment outcome of bronchial asthma patients from absolute eosinophil count and serum IgE levels.

MATERIAL & METHODS

50 patients who were randomly selected from among outpatients and inpatients in Osmania General Hospital, Hyderabad Telangana State from March 2019 to February 2021 who presented initially with wheeze and breathlessness were included in the study.

Inclusion criteria

- Age group 18-60 years
- Clinical features of bronchial asthma as per GNA guidelines.
- All cases of bronchial asthma of age group 18-60 years having proven airflow reversibility by Spirometry
- Patients willing to give written
- Informed consent to participate in the study.

Exclusion criteria

- Patients having ongoing or past tuberculosis, chronic obstructive pulmonary disease or interstitial lung disease.
- Any history of haemoptysis.
- Those on oral corticosteroids prior to the study
- Congestive cardiac failure patients.
- Evidence of infective exacerbation like fever, purulent expectoration, raised leukocyte counts, specific growth of micro organism in sputum culture.
- Pregnant females with asthma.

METHODOLOGY

- Patients who attended hospital with complaints of wheeze and breathlessness and associated symptoms like cough and nocturnal awakenings were included for the study.
- Symptomatology and duration was recorded for all.
- Spirometry was done and FEV1 and PEF was measured both before and twenty minutes.
- Asthma severity was analysed by both history and prebronchodilator FEV1% of predicted.
- According to latest GINA guidelines, severity was also assessed as follows;

1. Controlled asthma: No day time symptoms (less than twice / week), No limitation of activities, no nocturnal symptoms or asaekning. No need for rescue or reliever treatment (less than twice / week). Normal lung function tests, no exacerbations.
2. Partially controlled asthma – More than twice / week day time symptoms, any limitation of activities, any nocturnal awakenings, reliever or resuce treatment more than twice / week.
3. Uncontrolled asthma -3 or more features of partly controlled asthma present in any week, one in any week exacerbation.

Method of data collection

Serum Ig E

Venous clotted blood of 2 ml was used for measuring IgE levels using commercially available diagnostic ELISA kits. It is a solid phase enzyme immunosorbent assay based on sandwich technique.

Absolute eosinophil count

Venous EDTA blood will be subjected to automated analyser for AEC and confirmed by periopheral smear.

RESULTS

Table 1 Age distribution of study population

Age (Years)	Frequency	Percent
18-25	12	24
26-33	21	42
34-41	12	24
< 4.1	3	6

Table 2 Allergy and prevalence

| Allergy | Severity | | | P-Value |
	Mild	Moderate	Severe	
With allergy	10 (20%)	15 (30%)	15 (30%	< 0.01
Without allergy	1 (2%)	7 (14%)	3 (6%)	

Table 3 Family History and Severity of Asthma

| Severity | Family History | | P –value |
	No	Yes	
Mild	5	6	
Moderate	13	8	0.01
Severe	3	15	
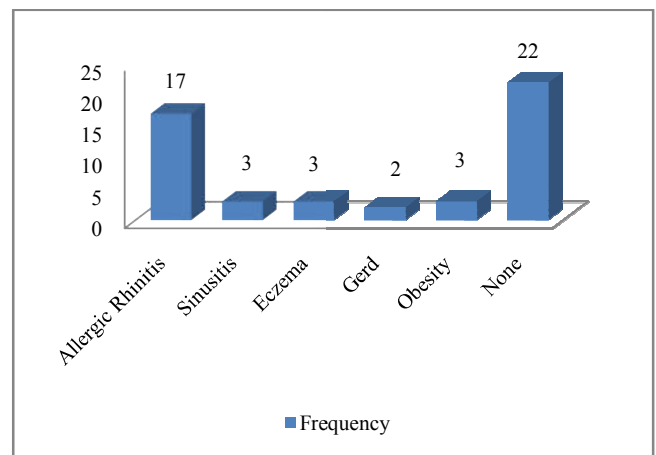
Graph 1 Association of Asthma with various Comorbid conditions

Table 4 Severity Assessed by Lung Spirometry

Severity	Frequency	Percent
Mild	11	22
Moderate	21	42
Severe	18	36

Table 5 Absolute Eosinophil count and severity of asthma

| Absolute eosinophil count (cells / cumm) | Severity | | | P-Value |
	Mild	Moderate	Severe	
Upto 440	11	19	6	< 0.01
> 440	0	2	12	
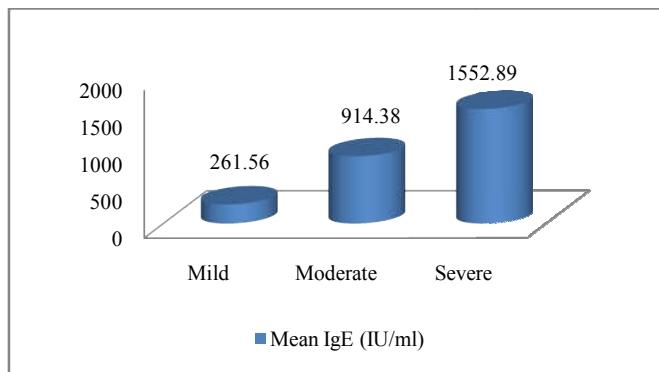
Graph 2 Mean Serum IgE and Severity

Mean IgE in the mild asthma patients was 251.56 IU/ml, in the moderate asthma group was 914.38 IU/ml, and in the severe group was 155.891 IU/ml.

Table 6 Serum IgE levels and Severity

Serum IgE (IU/ml)	Severity			P-Value
	Mild	Moderate	Severe	
< 100	3	1	0	
> 100	8	21	17	< 0.01

DISCUSSION

In the section, we are comparing the results of our study with previous studies conducted and their results. The purpose of the study was to find out if there was any correlation between absolute eosinophil count, serum IgE levels and severity of bronchial asthma also evaluated the patients for symptoms, risk factors, family history and co morbid conditions to assess its relation with asthma severity.

B. leynaert et al[5] studies have shown that asthma was 20% more frequent in females than in males over the age of 35 years. Incidence of non-allergic asthma was higher in females than in men throughout all reproductive age group. Bapna et al[6] in 1998 reported that female sex show higher predilection than males.

Studies by de Marco R et al[7] also show severe asthma is more predominant in women. During childhood, girls had a significantly lower risk of developing asthma than boys (relateive risk (RR): 0.74 and 0.56 in the 0 to 55 yr and 5 to 10 yr age, respectively). Around puberty, the risk was almost equal in the two sexes (RR=0.84). After puberty the risk in women was always significantly higher than in men (RR: 1.38 to 5.91).

In our study population 56% had a positive family history. Among the 56% who had a positive family history 28% had severe, 16% had moderate and 12% had mild asthma.
P value was 0.01 showing high statistical significance.

Results of a study done by Parisa Davoodi P.A. Mahesh and Nallur B. Ramachandra indicated a positive association between having a family history of asthma and higher socio-economic status. Family history of asthma and a topy have been introduced as the strongest risk factors in adult asthma[8].
In our study, 56% had associated co morbidities of which allergic rhinitis constituted 34 cases, other were sinusitis, eczema, obesity and GERD. Co morbidities had positive correlation with severity of bronchial asthma as assessed by spirometry which were similar to studies by de Groot et al[9] and Andrea G Gershon[10].

Studies by Louis Philippe Boulet, Marie Eve Boulary, report that asthma in adults is most commonly associated with comorbidities such as rhinitis, sinusitis, obesity, obstructive sleep apnea and gastro-oesophageal reflux disease which is similar to co morbidities in our study population. In a study done by de Groot et al, the comorbidity associated with AR is high in adult age group and in children.

In a study done to assess the burden of co morbidities in asthma individuals by Andrea S Gershon, Teresa To, Jun Guan in Obtario Canada among 12 million residents, obesity, depression and allergic rhinitis were associated co morbidities. Soriano et al[11]. estimated the prevalence of comorbid diseases from an administrative data based study including 7931 patients with asthma and matched controls. The most prevalent associated condition in adult asthmatic patients was time-limited minor infections while others with a high impact and / or high prevalence were depression, hypertension, diabetes, ischemic heart disease, degenerative joint disease, cardiac arrhythmia and COPD. A total of 60% of adult asthma patients had at least on condition and 12% had three or more.

Comparing mean serum IgE and severity with other studies

Study	MEAN Ig E (IU/ml)			P Value
	Mild	Moderate	Severe	
Present study	271.50	916.48	1662.59	
Srikantaiah et al[13]	250	846	1045.32	0.000
Janeway et al[12]	304.6	882.4	1420.48	

Our present study shows that suggest that S.IgE levels increase with severity which is similar to studies by Juneway et al[12] and Kovac et al. In our study, mean serum IgE in mild, moderate and severe persistent cases, which is similar to the study by Srikantaiah et al[13].

Studies done by Kornelija Kovac et al[14] in children aged 5-15 years showed that asthmatic children have elevated S.IgE concentration. Asthmatic children with higher asthma severity have a higher concentration of both Total IgE (>288 IU/mL) and specific IgE to Dematophagoides pternyssinus (>44.1 IU/ml).

Comparing Absolute Eosinophil count (AEC) and severity of Asthma with other studies

Study	Mean AEC (cells/cumm)	Correlation with severity
Present study	423.08	P value 0.001 Positive
Milaat et al[15]	581.7	Positive
Koshak et al[16]	480.28	Positive

In our study among the 32 severe asthma patients, 20 had raised AEC with high statistical significance similar to the study by Koshak et al and Kamfar et al[17]. In a study done by Koshak et al, 60 asthmatics aged 15 to 70 years, of which 68.3% were female, were studied. Severity levels differed between the two assessment methods in 45% of the cases and showed a predominance of the moderate persistent type. Absolute eosinophil count ranged between 22 and 2470 cells/mm3 and eosinophilia was found in 50% of the cases. AEC showed a high positive correlation with increased asthma severity level assessed by history alone.

In a study by Kamfar HZ, Milaat et al, in asthma patients, the AEC for the groups ranged between 10 and 2100 cells/mm3 (mean=581.7 cells) and showed a very significant positive correlation with increased asthma severity (P<0.001). A high linear trend of AEC within each clinical group was found (P<0.0001), and the means among each group also shown a

significant increase as athma severity level increased (P<0.001). the study documents a significant positive correlation between the clinical severity of bronchial asthma and eosinophil count s. Authors advocate the use of this simple and sensitive laboratory test as significant adjunct objective technique in the assessment of asthma severity and management.

Summary

- It involved 50 patients who were randomly selected from among outpatients and inpatients presenting to Malla Reddy Institute of Medical Sciences, Hyderabad Telangana State.
- Relevant history and physical findings including symptoms were recorded.
- Routine haematological, biochemical investigations, Chest X ray were done.
- Spirometry was done in all patients and FEV1 and PEF was measured both before and 20 minutes after giving nebulised salbutalmol. Post bronchodilator reversibility of 12% or more was taken as criteria for diagnosis of asthma.
- Severity of asthma was assessed by both history and prebronchodilator FEV1% Predicted values.
- Absolute eosinophil count and serum IgE was assessed in all patients in each severity group.
- Among 50 patients, 27 were females and 23 were males.
- Most common age group in our study population was 26-32 years, Range 18-48 years
- 26 among 50 had positive family history and there was positive correlation with family history and asthma severity.
- Most common risk factor in the study population was atopy and the most common associated comorbid condition was allergic rhinitis.
- Other comorbidities in the study population were eczema, sinusitis, obesity and gastro esophageal reflex disease.
- Asthma comorbidity has a strong association with the severity of asthma in our study population (P Value < 0.01).
- Positive correlation between absolute eosinophil count and severity of asthma was statistically significant (P Value < 0.01)
- Serum immunoglobulin E levels also had positive correlation with severity of asthma which was statistically significant (P value < 0.01).

CONCLUSION

1. Family history a strong association with the disease and severity.
2. Asthma was also associated with comorbidities like allergic rhinitis, obesity, gastroesophageal reflex disease.
3. Comorbidity by the disease has adverse impact on people's health and health care system. Focusing to tackle such co morbidities is also crucial.
4. Asthma comorbidity has a strong association with the severity of asthma
5. Absolute eosinophil count has a definite positive correlation with asthma severity in the severe persistent asthma group.
6. Mean serum IgE in mild, moderate and sever persistent cases was 261.56, 914.38, 1552.89 IU/mL with positive correlation.

7. Our present study advocates the possible supplementation of absolute eosinophil count and serum immunoglobulin E levels as another objective parameter that can help in selecting the appropriate severity level in asthmatics.
8. Estimation of serum IgE in diagnosed case of asthma gains importance with increasing severity based on clinical grading.

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