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Original Research Article

Study on absolute eosinophil count correlation with severity of bronchial asthma

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ABSTRACT

Background: Bronchial asthma is defined as chronic inflammatory disease of the airways that is characterized by increased responsiveness of the tracheobronchial tree to a multiplicity of stimuli. Eosinophil infiltration is a characteristic feature of asthmatic airways. It presents as an obstructive type of ventilator defect usually diagnosed from a reduced FEV1% (Forced Expiratory Volume) or from a reduced peak expiratory flow (PEF) associated with reduced airway caliber during expiration. Allergen inhalation results in a marked increase in activated eosinophils in the airways. Correlation between the degree of bronchial hyperresponsiveness (a cardinal feature of asthma) and peripheral blood eosinophilia has been observed in patients with dual response following allergen challenge.
Methods: The study comprises a total number of 50 bronchial asthma patients of both sexes (male and female) between the age groups of 13-65 years. Based on severity, asthma patients were classified into mild, moderate and severe asthmatics, assessed by FEV1% computerized Spirometry Helios model number 701, recorders and medicare system. Peripheral blood sample was collected from each patient for absolute eosinophil count, the count was done on the same day.
Results: The mean±SD absolute eosinophil count of 50 patients is 330±88.64 which is slightly above normal (300 cells/mm^3). Author found that the mean±SD absolute eosinophil count of 405±83.16 in severe asthma patients is quite high, corresponding with a steep decline in the FEV1% 45.3±12.6.
Conclusions: Absolute eosinophil count and FEV1% are important indicators of bronchial asthma severity and can even be used to predict disease progression.

Keywords: Absolute eosinophil count, Bronchial asthma, FEV1%

INTRODUCTION

Bronchial asthma is manifested physiologically by a widespread narrowing of the air passages, which may be resolved spontaneously or as a result of therapy and clinically by paroxysms of dyspnea, cough and wheezing.[1] It is a condition with air flow limitation that varies over short periods of time, either spontaneously or in response to treatment and is associated with inflammation in the airways. It presents as an obstructive type of ventilatory defect which is usually diagnosed from a reduced FEV1% (FEV1/FVC) or from a reduced peak expiratory flow (PEF) associated with reduced airway caliber, hence the lower expiratory flow and also with premature closure of airways during expiration.[2]

Originally, asthma was thought to be the result of bronchospasm alone, but it is now recognized to be

primarily an inflammatory disorder with bronchospasm being secondary to the underlying inflammation.[3] It is one of the most common chronic diseases globally and currently affects approximately 300 million people worldwide.

Eosinophils are linked to the development of airway hyper responsiveness through the release of basic proteins and oxygen-derived free radicals. Eosinophil recruitment involves adhesion of eosinophils to vascular endothelial cells in the airway circulation due to interaction between adhesion molecules, migration into the sub mucosa under the direction of chemokines and their subsequent activation and prolonged survival.[4] Many cells play a role in inflammatory response in particular, lymphocytes, eosinophils, mast cells, macrophages, neutrophils and epithelial cells.[5]

Upon exposure to allergen, the eosinophils are actively recruited to the airways by chemokines such as eotaxin. Upon entry into the airways, eosinophils are able to release numerous mediators including granule proteins, leukotrienes (LTC4), prostaglandins and cytokines. Eosinophils can have up to four (4) types of granules but the most important are the primary and secondary granules. The primary granules contain Charcot-Leyden crystal proteins. The secondary granules contain up to four principal cationic proteins- MBP (Major Basic Protein), ECP (Eosinophil Cationic Protein), EDN (Eosinophil-Derived Neurotoxin) and EPO (Eosinophil Peroxidase). Peripheral blood eosinophilia is a prominent feature of asthma.[6]

Eosinophils and their products are known to play an important role in asthma, and the measurement of blood and sputum levels of such markers of inflammation may provide information reflecting the evolution and control of disease. However, the clinical usefulness of these trials is still uncertain.[7]

The aim and objectives of this study was to measure absolute eosinophil count in peripheral blood and correlate eosinophil count with the severity of airway obstruction in Bronchial asthma.

METHODS

This was a cross-sectional study which was carried out in the Department of Physiology and Department of Respiratory Medicine, Regional Institute of Medical Sciences (RIMS), Imphal, India. A written informed consent was taken from all the patients. Appropriate approval of the Ethics Committee was also taken.

A total number of 50 (fifty) patients were included in the study. Asthma Patients of both sexes (male and female) between the ages of 13 to 65 who were attending the Respiratory Medicine OPD (Out Patient Department) and Respiratory Medicine Ward of Regional Institute of Medical Sciences (RIMS), Imphal, India were included in the study. All asthma patients between ages 13 to 65 years were included in the study irrespective of their sex. Patients with associated diseases like worm infestations, atopic skin diseases and other allergic diseases, cardiac problems, renal failure, diabetes mellitus, hypertension, pulmonary fibrosis, neuromuscular diseases and ascites were excluded.

Based on severity, asthma patients were classified into mild, moderate and severe asthmatics, assessed by FEV1% computerized spirometry. FEV1% recorded by means of a Helios computerized spirometer model number 701 of the recorders and Medicare system, Chandigarh in the Respiratory Physiology Laboratory of Department of Physiology, RIMS, Imphal, India.

The procedure was explained to the patient followed by a demonstration. They were instructed to inhale completely and then exhale with maximum force for at least 2 seconds. Three consecutive tests were taken with a rest of 5 to 10 minutes, the best result among the three was considered.

Absolute eosinophil count was done under a compound microscope in an Improved Neubauer's Chamber at the Hematology laboratory of the Department of Physiology, RIMS, Imphal, India. Two ml of venous blood were drawn from all 50 asthmatic patients, under aseptic conditions by venopuncture using a plastic sterile disposable syringe. The sample was collected in EDTA vials. The fluid used for counting was Dunger's Fluid which is a product of the Stanbio Company. The normal value of absolute eosinophil count by this method is 150-300 cells/mm^3.

RESULTS

Table 1 shows the classification of asthma according to the GINA guidelines updated 2008 into mild, moderate and severe asthma.

Table 1: Classification of asthma patients according to severity of asthma along with absolute eosinophil counts.

Severity	No. of cases	%	Mean±SD FEV1% predicted (test)	Mean±SD Absolute eosinophil count
Mild	28	56	101.43±12.43	285.71±69.19
Moderate	12	24	70.5±5.14	370.83±75.25
Severe	10	20	45.3±12.6	405±83.16
Total	50	100		

Author found that maximum number of cases are in the mild group i.e., 28 (56%) with FEV1% predicted 101.43±12.43 while moderate group has 12 cases (24%) with FEV1% predicted at 70.5±5.14 while the least number of cases was the severe group with 10 (20%) with

FEV1% predicted at 45.3±12.6. Their absolute eosinophil count also reflects a similar but decreasing pattern.

Table 2: Correlation between FEV1 % and absolute eosinophil count.

No. of cases	Mean eosinophil count±SD	FEV1 % predicted mean±SD	r value	t value	df	p value
50	330±88.64	82.784±25.36	-0.65	16.61	49	<0.001

Table 2 shows the results of a paired "t" test between the absolute eosinophil count of each participant against the FEV1% predicted. Author saw that there was an inverse correlation between the eosinophil count and FEV1% from the r value -0.65. There was a strong correlation between the two values as evident from the "t" value of 16.61. The statistical correlation was highly significant as p <0.001.

Table 3: Correlation between FEV1 % and absolute eosinophil count among mild asthma cases.

No. of cases	Mean eosinophil count ± std dev	FEV1% predicted mean ±SD	r value	t value	p value
28	285.71±69.19	101.43±12.43	-0.61	12.5	<0.001

Table 3 shows that there was an inverse correlation between the eosinophil count and FEV1 % from the r value -0.61. There was a strong correlation between the two values as evident from the "t" value of 12.5. The statistical correlation was highly significant as p <0.001.

Table 4 shows that there was direct correlation between the eosinophil count and FEV1% from the r value 0.018. There was a strong correlation between the two values as evident from the "t" value of 13.81. The statistical correlation was highly significant as p <0.001.

Table 4: Correlation between FEV1% and absolute eosinophil count among moderate asthma cases.

No. of cases	Mean eosinophil count±SD	FEV1% predicted mean±SD	r value	t value	p value
12	370.83±75.25	70.5±5.14	0.018	13.81	<0.001

Table 5: Correlation between FEV1% and absolute eosinophil count among severe asthma cases.

No. of cases	Mean eosinophil count±SD	FEV1% predicted mean±SD	r value	t value	p value
10	405 ± 83.16	45.3 ± 12.6	-.113	13.3	<0.001

Table 5 shows inverse correlation between the eosinophil count and FEV1% from the r value -0.113. There was a strong correlation between the two values as evident from the "t" value of 13.3. The statistical correlation was highly significant as p <0.001.

DISCUSSION

The present study classifies the asthmatic patients according to their FEV1% predicted into mild (>80%), moderate (60-80%) and severe (<60%) cases in line with GINA 2008 updated classification (Global Initiative for Asthma). Author found that there is marked difference in the FEV1% predicted between the severe and mild groups with the moderate group in between the two. The mild group has FEV1% predicted test value of 101.43±12.43 compared with the severe group having 45±12.6 while the moderate has 70.5±5.14 (Table 1). This is consistent with the findings of Bai TR et al.[8] Jatakanon A et al, classified asthmatics into mild, moderate and severe, in his study the FEV1% predicted in mild asthmatics was 91, for moderate it was 88 while for severe it was 61.[9] These values are in line with the findings of the present study.

Present study found a higher value of mean absolute eosinophil count which is consistent with the findings of Hussain MM et al, where the absolute eosinophil count in asthmatic patients was found to be 442±48.52.[10] In this study, the mean absolute eosinophil count is 330±88.64

(Table 2) which is more than the normal value of 150-300 cells/µl. Rytila P et al, also showed that eosinophil count of asthmatic patients was significantly higher as compared to healthy controls suggesting that eosinophilia is an important diagnostic feature of bronchial asthma.[11]

Eosinophils and FEV1% as markers of asthma severity revealed in this study is consistent with the findings of Roquet A et al, where a significantly higher eosinophil count ($p < 0.01$) was found among the bronchial hyperactive patients estimated by a bronchial challenge test.[12] Also there was an inverse relation ($r = -0.4$, $p < 0.001$) between the eosinophil count and the asthma severity as measured by histamine challenge (PD20). These findings are similar to the findings of the present study where there is a significantly higher ($p < 0.001$) eosinophil count with severe obstruction whose FEV1% predicted test value is only 45±12.6 compared to the patients with mild obstruction where the eosinophil count is 285.71±69.19 with FEV1% predicted test value of 101±12.43 (Table 3 and 5).

CONCLUSION

Eosinophils are important indicator of disease severity where a significant rise is often detected in the most severe cases of bronchial asthma. Absolute eosinophil count and FEV1% are important indicators of asthma severity and can even be used to predict disease progression.

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