International Journal of Advanced Research in Medicine

E-ISSN: 2706-9575
P-ISSN: 2706-9567
IJARM 2020; 2(2): 307-310
Received: 05-10-2020
Accepted: 12-11-2020

Dr. Sathluri Tejaswi
Assistant Professor,
Department of TB &CD,
Dhanalakshmi Srinivasan Medical College, Trichy,
Tamil Nadu, India

Dr. Ramesh Dharavath
Assistant Professor,
Department of TB &CD,
Dhanalakshmi Srinivasan Medical College, Trichy,
Tamil Nadu, India

Corresponding Author:
Dr. Ramesh Dharavath
Assistant Professor,
Department of TB &CD,
Dhanalakshmi Srinivasan Medical College, Trichy,
Tamil Nadu, India

Biomarkers for the prediction of COPD exacerbations: Elevated blood eosinophils and serum IgE

Dr. Sathluri Tejaswi and Dr. Ramesh Dharavath

DOI: https://doi.org/10.22271/27069567.2020.v2.i2d.460

Abstract
Background: The presence of eosinophils in the airways, once thought to be unique to asthma, has been identified as an inflammatory characteristic in chronic obstructive pulmonary disease. The goal of this study is to determine whether or not higher blood eosinophils are connected with COPD exacerbations. Examining whether or if higher levels of blood eosinophils and serum IgE are associated with COPD exacerbation.
Methods: Patients with chronic obstructive pulmonary disease from Department of TB &CD, Dhanalakshmi Srinivasan Medical College, Trichy, Tamil Nadu, India, participated in the research. One-year, cross-sectional observational study conducted between January 2020 to November 2020. After receiving approval from a regional ethical review board and obtaining patients signed informed agreement, the study commenced. There were 120 patients with COPD; 101 were men and 19 were women, and their ages ranged from 44 to 76.
Results: There were 120 patients with COPD; 101 were men and 19 were women, and their ages ranged from 44 to 76. The proportions of the COPD population in each of the GOLD tiers (I, II, III, and IV) were as follows: 21, 40, 58, and 21. Fifty-three had stable COPD and 87 had COPD exacerbations. It was found that the AEC was present in both stable COPD and COPD exacerbation, while the Serum IgE was present only in the latter. Elevated levels of AEC and Serum IgE were found in current smokers compared to those seen in nonsmokers.
Conclusion: The AEC and serum IgE levels of a patient can be used as biomarkers of COPD exacerbations, which enables the patient to be identified as one who is most likely to respond to ICS treatment.

Keywords: Biomarkers, prediction of COPD, exacerbations, eosinophils, serum IgE

Introduction
At the global level, chronic obstructive pulmonary disease (COPD) is the fourth leading cause of death. By the year 2020, it is expected that chronic obstructive pulmonary disease would have surpassed both heart disease and cancer to become the third leading cause of death [1]. In patients with COPD, eosinophilic airway inflammation has been observed in 10%-40% of cases, regardless of the presence or absence of symptoms or when the condition is at its worst. Recent studies have indicated that counting the eosinophils that are found in the peripheral blood can help with the prediction of COPD flare-ups [2]. COPD encompasses both chronic bronchitis and emphysema as its component diseases. You must have a productive cough at least once a day for three months, and for more than two years, in order to be diagnosed with chronic bronchitis [3, 4].
In 1962, the American Thoracic Society provided a definition of emphysema as follows: "anatomic modification of the lung characterized by aberrant enlargement of the air spaces distal to the terminal, non-respiratory bronchiole, accompanied by destructive alterations of the alveolar walls." Emphysema is an anatomic modification of the lung [5].
According to the definition provided by the National Heart, Lung, and Blood Institute in 1984, emphysema is a lung disorder that can be identified by the abnormal and permanent expansion of airspaces that are distal to the terminal bronchiole [6]. This expansion is accompanied by the disintegration of the airspaces' walls and does not appear to be associated with fibrosis. This alteration was a result of inflammation and tissue damage in the tiny airways, as discovered by McDonough *et al*. The researchers found that permanent

enlargement of the distal airspaces may only function as a structural biomarker. This provides evidence that chronic obstructive pulmonary disease is characterized by anomalies in the airspace in addition to the airways [7, 8].

Estimates of the prevalence of chronic obstructive pulmonary disease are greatly reliant on the surrounding environment. The typical age at which COPD symptoms appear is 40 years or older. Increasing age is associated with an increased risk of developing chronic obstructive pulmonary disease. The graph that follows demonstrates how the incidence rate gets higher as one gets older [9].

Methods & Materials

Patients with chronic obstructive pulmonary disease from Department of TB &CD, Dhanalakshmi Srinivasan Medical College, Trichy, Tamil Nadu, India, participated in the research. One-year, cross-sectional observational study conducted between January 2020 to November 2020. After receiving approval from a regional ethical review board and obtaining patients signed informed agreement, the study commenced. There were 120 patients with COPD; 101 were men and 19 were women, and their ages ranged from 44 to 76.

Inclusion criteria

1. **Symptoms:** Wheezing, expectorant cough, and shortness of breath
2. Biomass exposure and other inhalation injuries
3. Dust and fume exposure at work
4. Smokers and non-smokers, fourth

Exclusion criteria

1. People with bronchial asthma
2. The asthma and COPD overlap syndrome
3. Chemical sensitivity

Inclusion and exclusion criteria were used to select patients for screening. Spirometry was performed on patients who fit the criteria and who had a clinical diagnosis of COPD. Spirometry was first performed in a seated position, when subjects recorded their maximum values for forced vital capacity and forced expiratory volume in 1 second. Each individual obtained at least two repeatable curves and three reliable values. Subsequently, nebulized salbutamol was administered. A second round of spirometry was performed 20 minutes following the salbutamol inhalation. COPD patient groups were analyzed to determine reversibility. These individuals were subjected to standard diagnostic procedures Diagnostics include a CBC, a urinalysis, a test of liver function, a test of kidney function, a sputum culture and sensitivity test for AFB, and a chest x-ray. In order to rule out other potential diagnoses, additional tests were performed, such as a computed tomography (CT) chest, a stool for ova cyst, and a peripheral smear. Radiology, spirometry, and other clinical findings ruled out ACOS.

Results

Table 1: Stage I, II, III, IV COPD prevalence and exacerbation

Sr. No.	Stage	COPD stable	COPD exacerbation
1.	Stage I	10	6
2.	Stage II	15	28
3.	Stage III	12	32
4.	Stage IV	2	15

Table 1 contains n=120 observations, the majority of which came from stages II and III.

Table 2: COPD exacerbation vs. steady COPD eosinophil count

Sr. No.	Cut Off AEC	Stable COPD	COPD Exacerbation
1.	<2%	141.8	200.6
2.	>2%	622.3	940.9

Table 2 shows that there was a prevalence of greater than 2%/300 in both stable COPD and COPD exacerbation; however, the prevalence was significantly higher in COPD exacerbation.

Table 3: Serum IGE in stable and exacerbating COPD

Sr. No.	Cut off S. IgE	Stable COPD	COPD exacerbation
1.	<150	64.2	00
2.	>150	1645.7	2289

Table 3 shows that there was a prevalence of over 150 IU/ml in both stable COPD and COPD exacerbation, although the prevalence was significantly higher in COPD exacerbation.

Table 4: AEC and S. IgE in stable and exacerbating COPD

Sr. No.	Variables	Stable COPD	COPD exacerbation
1.	AEC	457.8	882.6
2.	S. IgE	1198.2	2207

Table 4 shows that both stable COPD and COPD exacerbation are associated with greater mean absolute eosinophil counts and higher serum IgE levels.

Table 5: Variables compared between smokers and nonsmokers

Exposure to smoke	Duration of illness	No of hospitalization	No of exacerbation	FEV1	AEC	S. IgE
Smoker	2.9	3.58	1.12	52.1	738	2189
Non smoker	2.6	4.35	1.1	49.1	657	625.8

Table 5 shows that smokers had greater levels of absolute eosinophil count and serum IgE than nonsmokers did. Smokers also had longer illnesses, more hospitalizations, and longer durations of sickness.

Table 6: Population prevalence of radiological exposure

Sr. No.	CT Chest	No.
1.	Localized bullae	16
2.	Bronchial wall thickening	11
3.	Centriacinar	50
4.	Paraseptal	25
5.	Panacinar	14
6.	Irregular	4

Table 6 shows that the centriacinar and paraseptal pattern was the most frequently reported radiological finding. The irregular pattern was observed only sometimes.

Discussion

We made the discovery that a correlation exists between elevated levels of both blood eosinophils and serum IgE and the stability of COPD over the long term. In addition to this, we observed a connection between these two biomarkers and the progression of COPD symptoms. According to the

findings, the sample consisted primarily of individuals between the ages of 50 and 70, with men outnumbering women by a ratio of 119 to 21, and the majority of the participants were male [10, 11].

The patient's illness has progressed from stage I to stage II to stage III to stage IV during the course of the past year, and the number of exacerbations they have experienced has also increased during this time. However, as stage I progresses into stages II, III, and IV, the FEV1 decreases. There was hardly any discernible progress made during the patient's time spent in the hospital [12, 13].

Counts of absolute eosinophils in stages I–IV and levels of serum IgE in those same stages. In this particular case, the absolute eosinophil count as well as the serum IgE levels increased concurrently with the development of subsequent stages. Patients with COPD who were suffering exacerbation episodes were more likely to have risk factors such as occupational exposure to dust and fumes, exposure to biomass, and inadequate ventilation [14-16].

Patients diagnosed with COPD who were going through an exacerbation were more likely to make use of bronchodilators than patients who had COPD that was stable. There was consensus reached on a threshold value of 2% for the absolute eosinophil count and 150UI/ML for the serum IgE levels. The P value for this comparison shows that the levels of both biomarkers are considerably greater in COPD exacerbation than they are in COPD that is stable [17-19].

It has been demonstrated that smoking increases both the number of eosinophils in the blood as well as the amount of IgE serum that is present in the blood [20]. The COPD patient population that we evaluated revealed a rise in both the absolute eosinophil count and the serum IgE levels, therefore we decided to study why this was the case. We were able to establish an association between smoking cigarettes and increased levels of certain biomarkers. There was a correlation between current smokers and those who had smoked more than 10 packs of cigarettes in their lifetime, both of which were related with a more severe course of illness and more frequent exacerbations. There was also a correlation between current smokers and those who had smoked more than 10 packs of cigarettes in their lifetime [21-24].

Conclusion

Although elevated blood eosinophils and serum IgE levels were seen in both stable COPD and COPD exacerbation, they were more pronounced in the latter. So, eosinophil count in blood can be employed as a biomarker for the prognosis of COPD exacerbation. Patients who are most likely to benefit from ICS treatment can be selected using biomarkers. Longer illness duration, more frequent exacerbations, higher blood eosinophil and serum IgE levels are all associated with smoking. Chronic obstructive pulmonary disease exacerbations are thought to hasten the overall decline in lung function and disease severity. There has to be more research done to examine biomarkers in COPD and ACOS. Improved results could be expected from a study with a larger sample size.

Conflict of Interest

None

Funding Support

Nil

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