Original Article

The role of blood eosinophil level in acute exacerbation of Chronic Obstructive Pulmonary Disease

Nizam S, Yogi KN, Bam N, Das SK

Department of Pulmonology and Critical Care Medicine, Tribhuvan University Teaching Hospital, Institute of Medicine

Correspondence to: Dr Salman Nizam

E-mail: calmannixam@hotmail.com

Abstract

Introduction: Chronic Obstructive Pulmonary Disease (COPD) has great implications on global health accounting for significant morbidity and mortality. The aim of this study was to assess blood eosinophil level in patients presenting with acute exacerbation of COPD and to check whether pre-treatment blood eosinophil level ≥2% has better improvement with the standard therapy (oxygen, corticosteroids IV/ Oral and inhaled corticosteroids/ inhaled beta 2 agonist/ inhaled muscarinic antagonists along with antibiotics and diuretics) as well as shorten the duration of hospital stay.

Methods: Blood eosinophil level was measured in 106 eligible patients on admission with the diagnosis of AECOPD,under the Department of Pulmonology and Critical Care Medicine, TUTH from December 2016 to August 2017 were included in this observational study. Clinical information was obtained and PFTs were done.

Results: A total 106 patients were enrolled. The mean age of the patients was 67±12 years with smoking history of mean pack year 24± 10.7. Among this population, 46.22% patients had blood eosinophil level ≥2% which had better improvement in general physical examination (edema and cyanosis/ P= 0.05 and 0.01), vital signs (tachycardia P=0.05) including (SPO2 P=0.01) and chest findings (crackles P= 0.01) with standard therapy compared to blood eosinophil level <2%. Similarly, significant shorter duration of hospital stay was observed in patients with blood eosinophil level ≥2% with standard therapy in comparison with blood eosinophil <2% (p=0.01).

Conclusion: Blood eosinophil level represents a potentially important biomarker that could aid treatment decision making as well as gives us a predictive idea regarding the duration of hospital stay upon admission with AECOPD.

Introduction

Chronic Obstructive Pulmonary Disease (COPD) has great implications on global health accounting for significant morbidity and mortality and is one of the most common preventable respiratory disease in clinical practice[1]. COPD is currently the fourth leading cause of death in the world and according to WHO by year 2030 COPD would become the third leading cause of death worldwide[2].

COPD is defined as a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases[3]. It includes emphysema, chronic bronchitis and small airway disease[4].

COPD is a slowly progressive disorder that begins many years before the onset of clinical symptoms[5]. The most important risk factor for COPD is cigarette smoking[6]. Other exposures including passive smoke[7] and use of biomass fuel, also plays a role[8]. The amount and duration of smoking contribute to disease severity.

The genetic risk factors that is best documented is a severe hereditary deficiency of alpha-1 antitrypsin[9].

Diagnosis of COPD should be suspected in any patient over age of 40 years presenting with chronic cough, chronic sputum production, dyspnea at rest or exertion or history of inhalational exposure to tobacco smoke, occupational dust or occupational chemicals[10]. Clinical diagnosis needs to be confirmed by standardized spirometric tests in the presence of not- fully reversible airflow limitation[11].

There are various causes of blood eosinophilia and there is a link between eosinophil level with COPD[12,13]. Studies have shown the correlation between blood eosinophil level and COPD with exacerbation. Therefore, it is important to know the role of eosinophil level in COPD for many purposes. This dissertation makes an effort to know the role of blood eosinophil level in acute exacerbation of COPD and to establish correlation of pre-treatment blood eosinophil level with AECOPD as well as its relation with the standard therapy and the duration of hospital stay.

Methods

In this observational study, blood eosinophil level was measured in 106 eligible patients above 40 years of age of both sexes upon admission with the diagnosis of AECOPD, under the Department of Pulmonology and Critical Care Medicine TUTH from December 2016 to August 2017. They were enrolled after carefully applying the inclusion and exclusion criteria and informed consent was taken.

Diagnosis of COPD was considered on the basis of history, clinical examination & radiographical findings and confirmed by pulmonary function test (spirometry) and in case of cases under domiciliary oxygen it was solely clinical diagnosis with exclusion of other causes and presence of typical features and risk factors.

Subjects with prior diagnosis of COPD by a respiratory physician (with typical presentation, risk factors and exclusion of other lung pathology like Pulmonary Tuberculosis, Post TB fibrosis/bronchiectasis, Interstitial Lung Disease, Bronchogenic Carcinoma) under domiciliary oxygen are also taken as COPD cases.

Spirometry was done after resolution of acute exacerbation episode near the time of discharge. The test was done with Spirolab III software and care was taken to involve same technician for the test as much as possible and suspected reports were repeated using same technician for confirmation.

Blood eosinophil level was measured in TUTH central laboratory on the day of admission and if the patient was admitted through ER, then, the following day blood eosinophil was done from the central laboratory. For blood eosinophils, a cut off level of 2% was used as previous publications identified this shows high sensitivity for the presence of raised eosinophil count[14].

All the data regarding the patients were recorded in a structured manner that include patients' demographic, clinical and laboratory data. In clinical evaluation, detailed information regarding the history of cough, sputum production and dyspnea was obtained. Physical examination including vital signs, general physical examination and chest findings was also obtained. Risk factors in the form of smoking was included and cases were grouped according to the blood eosinophil level ≥2% and <2%. Prescribed medication/standard therapy (oxygen, corticosteroids IV/Oral and inhaled corticosteroids/ inhaled beta 2 agonist/ inhaled muscarinic antagonists along with antibiotics and diuretics) was written on the proforma.

Patients were evaluated on 4th day of admission (including vital signs, general physical examination and chest findings) or one day prior to discharge with ongoing prescribed medication/standard therapy and the duration of hospital stay was noted.

Statistical analysis was carried out on various clinical features comparing both groups (blood eosinophil level ≥2% and <2%). All statistical analyses were 2 tailed and p-value of <0.05 was considered to be statistically significant.

Results

Out of total 106 cases, the study population comprised of 57.54% female (n=61) and 42.45% male (n=41) and mean age of the patients was 67±12, ranging from minimum of 42 years to maximum of 94 years with the mean age of male patients was 68±11 years and female was 67±13 years. All patients had history of smoking and among them 13 (12.26%) patients had the history of exposure to biomass fuel and outdoor air pollution in addition to smoking. There were 49 (46.22%) patients with blood eosinophil level ≥2% and 57 (53.77%) patients with blood eosinophil level <2% (figure1).

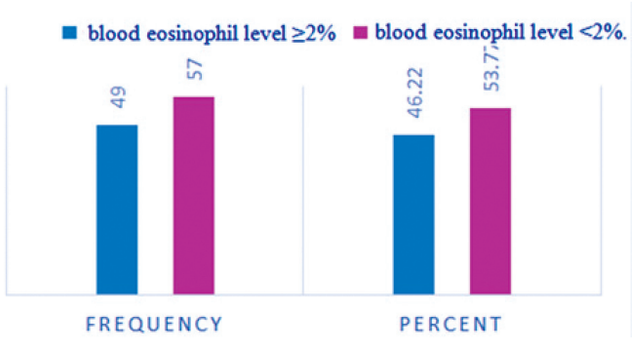

Figure1: Grouping the patients on the basis of blood eosinophil level upon admission.

Correlation between blood eosinophil level and standard therapy

General physical examination and vital signs

There was significant improvement mainly edema and cyanosis on blood eosinophil level ≥2% group with the standard therapy (P= 0.05 and 0.01). Similarly, tachycardia was improved on the group (P=0.05). There was improvement on both groups in terms of SPO_2 with the standard therapy but it was more significantly seen in the group blood eosinophil level ≥2% (correlation is significant at the 0.01 level).

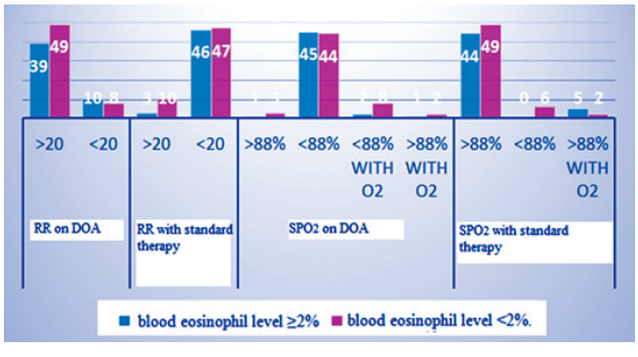

Figure2: Respiratory rate and SPO_2 in correlation with blood eosinophil level on the day of admission and at discharge.

Chest findings

Both groups were improving in terms of wheeze and crackles with the standard therapy. Patients with blood eosinophil level ≥2%, forty four patients had chest crackles on the day of admission and among them only one patient had chest crackles with standard therapy. On the other hand, all patients with blood eosinophil level <2% presented with chest crackles on the day of admission and among them 4 patients still had crackles with the therapy. There was significant improvement seen on crackles in patients with blood eosinophil level ≥2% and correlation is significant at the 0.01 level. Improvement was also seen in wheeze but it was not significant.

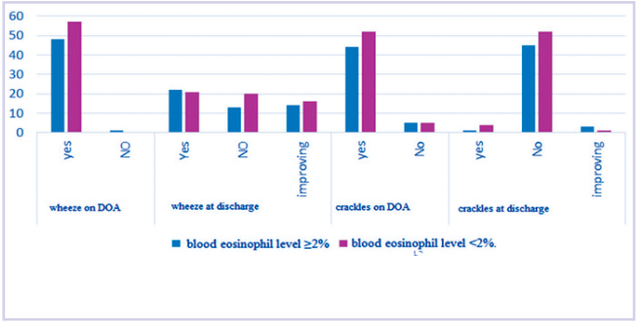

Figure 3: Chest findings in correlation with blood eosinophil level on the day of admission and at discharge with the standard therapy.

Duration of hospital stay with standard therapy

Among the population 14 (29%) patients had hospital stay of less than 5 days, 28 (57%) patients had 5-10 days and 7 (14%) patients had >10 days of hospital stay with standard therapy in the group blood eosinophil level ≥2% with correlation is significant at 0.01 level. Whereas in the group blood eosinophil level <2%, had 2 (4%) patients in hospital stay of less than 5 days, 28 (70%) patients had 5-10 days of hospital stay and 15 (26%) patients had more than 10 days of hospital stay with the standard therapy.

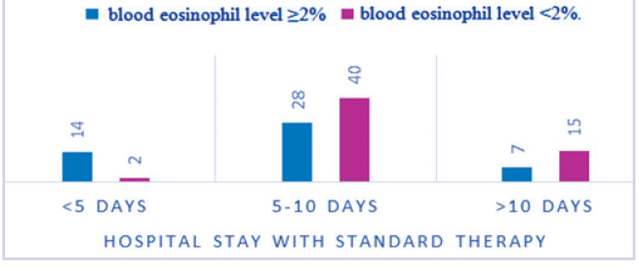

Figure4: Duration of hospital stay in correlation with blood eosinophil level with standard therapy.

Discussion

In this study, the most important risk factor for COPD was smoking and this correlates with other studies where cigarette smoking was the most common cause of COPD as shown in the study done by Burrows et al.[15]

In our study 46.22% patients had blood eosinophil level ≥2% and 53.77% patients (being the majority of

the population) had blood eosinophil level <2%. The study conducted by Bafadhel et.al. in 2016[16]among admitted patient, 25% were having blood eosinophilia prior to treatment but the study of INSPIRE, TRISTAN and SCO30002 have their blood eosinophil level ≥2% group; 57%, 75%, 61% respectively[17].

There was significant improvement seen on crackles in patients with blood eosinophil level ≥2% with significant correlation at the 0.01 level. Improvement was also seen in wheeze but not significant. Similarly in TRISTAN, blood eosinophil count ≥2% was associated with better response to inhaled corticosteroids vs placebo[18].

Patients in the group blood eosinophil level ≥2% had less hospital stay with standard therapy in comparison to the group blood eosinophil level <2 (P=0.01). Similar result was seen in Bafadhelet. al.[8] where length of hospital stay was shorter (in days) following treatment with corticosteroids in eosinophilic associated exacerbations compared with noneosinophilic exacerbations of COPD (mean [range], 5.0[1-19] vs 6.5 [1-33] P=0.015).

Therefore, this study shows the role of blood eosinophil level in acute exacerbation of COPD and patients with measured baseline (pretreatment) blood eosinophil levels ≥2% are associated with a greater response to standard therapy in patients admitted with exacerbation of COPD as well as to shorten the duration of hospital stay.

Conclusion

Our study suggests that an informative relationship exists between pre- treatment blood eosinophil level and acute exacerbation as nearly half of the patients presented with blood eosinophil level ≥2%. Blood eosinophil level represents a potentially important biomarker that could aid treatment decision making as well as gives us a predictive idea regarding the duration of hospital stay upon admission with acute exacerbation of COPD. However, large prospective studies are required to explore these findings further.

Conflict of interest: Not declared

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