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Original Article

Association of Absolute Eosinophil Count and Post-Bronchodilator Reversibility in the Chronic Obstructive Pulmonary Disease Patients

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ABSTRACT

Objective: To look for the relationship between absolute eosinophil count and post-bronchodilator reversibility in chronic obstructive pulmonary disease patients at Pak Emirates Military Hospital, Rawalpindi Pakistan.

***Study Design*:** Cross sectional study.

***Place and During of Study*:** Pulmonology Department, Pak Emirates Military Hospital Rawalpindi (PEMH) from Jul to Dec 2019.

Methodology: The study was conducted on 150 patients suffering from chronic obstructive pulmonary disease admitted in the Medical Ward or reporting in the Outpatient Department. Lung function was assessed using spirometry pre- and post-bronchodilation. The presence and severity of chronic obstructive pulmonary disease were assessed using modified Global Obstructive Lung Disease (GOLD) criteria. The presence of significant bronchodilator responsiveness was taken as ≥12% improvement in the forced expiratory volume (FEV) (1) or the forced vital capacity.

Results: Of 150 patients in the final analysis, 95 (63.3%) were male, and 55(36.7%) were female. The mean duration of COPD in our target population was 9.13±1.23 years. 68 (45.3%) had >12% improvement after bronchodilator administration, while 82(54.7%) had <12% improvement. The absolute eosinophilic count was <2% in 49(32.7%), while it was raised in 101(67.3%) patients.

Conclusion: Raised eosinophilic count emerged as a predictor of good response after administering bronchodilators among patients suffering from chronic obstructive airway disease. Screening patients for this simple blood component may predict response to the initial treatment and help in the tailoring of the treatment plan by the treating physician.

Keywords: Chronic obstructive pulmonary disease, Eosinophils, Forced expiratory volume.

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INTRODUCTION

The chronic obstructive pulmonary disease has been a commonly encountered phenomenon by a pulmonologist, medical specialists and geriatric medicine specialists all around the world.[1,2] Situation is not different in our part of the world, and a huge number of patients have been suffering from this chronic airway condition.[3,4] Quality of life is severely affected once a patient suffers from COPD; sometimes, he may need hospital admissions and specialized care.[5]

Various treatment modalities have been involved in the management of this disease. Some target the acute phase, while others have a role in the prophylaxis to prevent future episodes of acute exacerbation.[6] Inhaled, oral and sometimes parenteral route has been used to manage these patients effectively.[7] Various drugs have also been used, including beta-agonists, steroids, mast cell stabilizers, etc. The inhalational route has been preferred in acute attack and illness prophylaxis.[8] There have been various studies on the effectiveness of inhaled medication and the factors affecting them. With the advancement in medical science, various disease and treatment markers have been studied to cater for management holistically. Eosinophil count has been an inflammatory marker studied regarding chronic airway illness treatment response.[9,10]

Being from a developing country and hospital which must provide free of cost treatment to the entitled patients, we need to sort out a cost-effective manage-ment plan for our patients. Unfortunately, limited data have been available to assess the use of eosinophil count as a marker for treatment response. If we can establish this fact, then this cost-effective routine investigation could be incorporated into the manage-ment plan to predict the response of bronchodilation therapy and separate the patients from the start who have the least chance to benefit from the standard therapy. Therefore, this study was

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planned to look for the relationship between absolute eosinophil count and post-bronchodilator reversibility in the COPD popu-lation at Pak Emirates Military Hospital, Rawalpinid Pakistan.

METHODOLOGY

The correlational study was conducted at the pulmonology unit of Pak Emirates Military hospital, Rawalpindi Pakistan, from July 2019 to December 2019. Ethical approval (A/124EC128) was taken from the Ethical Review Board Committee. The sample was gathered using the non-probability consecutive sampling technique. The sample size was calculated using the WHO sample size calculator using the population response to bronchodilators as 96.2%.[11]

Inclusion Criteria: All patients aged of 12 and 70 with acute exacerbation of COPD were included in the study.

Exclusion Criteria: Patients with unclear pulmonary symptom diagnoses or pregnant patients or diagnosed with pneumonia, lung cancer, interstitial pulmonary disease, asthma, bronchiectasis, and active pulmonary tuberculosis were excluded from the study. Patients with active substance abuse or delirium, or dementia, patients who have uncontrolled diabetes or any other metabolic disorder which was not fully managed, patients on any drug interfering with the eosinophil count or causing haematological derangement were also excluded.

The presence and severity of COPD were assessed using modified Global Obstructive Lung Disease (GOLD) criteria. The presence of significant bronchodilator responsiveness was taken as ≥12% improvement in the FEV (1), or the FVC.[12,13] Patients received 400 µg salbutamol via a large volume spacer (Volumatic) and spirometry tests were repeated after 30 minutes. Salbutamol is a beta two agonist routinely used as a bronchodilator worldwide.[14]

After written informed consent from the potential participants, patients diagnosed with COPD in the Pulmonology Unit of PEMH RWP. Investigations on these patients included all the baseline investigations (Complete Blood picture, liver function test, renal function test, C-reactive protein, tumour markers etc.). In addition, the eosinophilic count was done on the same analyzer by the same operator in all the enrolled patients in this study. As a result, COPD patients were divided into two groups according to their eosinophilic count status: Group-1, eosinophilic (>2%) and Group-2, non-eosinophilic (≤2%). Similarly, based on ≥12% improvement in the FEV (1) or the FVC, patients were divided into two groups, a significant improvement group and the group without significant improvement.

All statistical analysis was performed using the Statistics Package for Social Sciences version 24.0 (SPSS-24.0). First, the mean and standard deviation for the age of the study participants was calculated. Next, frequency and percentages for gender were calculated for patients with normal or raised eosinophilic count and patients with and without significant bronchodilator response.

Table: Characteristics of COPD Patients (n=150)

Characteristics	n(%)
Age (years)	
MeanSD	57.14±2.42
Range (min-max)	12 years-69 years
Mean duration of illness	9.13±1.231 years
Gender	
Male	95(63.3%)
Female	55(36.7%)
Eosinophilic Count	
<2%	49(32.7%)
>2%	101(67.3%)

RESULTS

A total of one hundred and fifty patients were selected out of all the patients reporting OPD during the study period. This selection was made after applying the inclusion and exclusion criteria set for this study. Of 150 patients in the final analysis, 95(63.3%) were male, and 55(36.7%) were female. Table shows the general characteristics of our target population. The mean duration of COPD in our target population was 9.13±1.23 years. 68(45.3%) had >12% improvement after bronchodilator administration, while 82(54.7%) had <12% improvement. The absolute eosinophilic count was <2% in 49(32.7%), while it was raised in 101 (67.3%) patients. Further analysis revealed a significant relationship between high eosinophilic count and good bronchodilator response in our sample population.

DISCUSSION

Bronchodilation and optimizing the airway has been the primary goal of managing COPD, especially acute management. Various factors predict the response for bronchodilator response. Candela *et al*. and Perng *et al.* and in their studies studied various factors which can influence the response of bronchodilator therapy in COPD patients.[6,15] Perng *et al*. especially highlighted the role of haematological and immunological markers associated with a bronchodilator response. In their study, IL -8, neutrophilia and eosinophilia merged as factors linked with good response to

the bronchodilator therapy. 15 Results of our study are similar to theirs. Chrou *et al*. concluded that FEV1 reversibility was weakly correlated with sputum eosinophil levels in COPD. Positive FEV1 reversibility (>0.4L and >15%) is moderately successful in predicting sputum eosinophilia (>3%).[11] A retrospective cohort study done in Turkey mentioned that acute presentations of COPD are mostly neutrophilic and less eosinophilic, but still, Non-eosinophilic patients with COPD exacerbations with high CRP values had worse outcomes than eosinophilic patients.[12]

Tsiligianni *et al*. discussed using eosinophils as biomarkers for treatment response in COPD. They had an opinion that this cost-effective marker, if reliable, can be used to set the management goals for the patient right from the start. They mainly discussed the response to inhaled corticosteroids in patients with raised eosinophilic counts.[16] Our study used salbutamol as bronchodilation, but the response to this bronchodilator was strongly linked with raised eosinophilic count among patients suffering from COPD. Tashkin *et al*. concluded that raised eosinophilic count predicts a good response to bronchodilation therapy, whether inhaled corticosteroids or beta-agonists.[17] Our results strengthen their findings and provide a way forward in our setup in managing COPD patients. Siddiqui *et al*. used beta-agonists as a bronchodilator, so this study was very near to ours as most of the other studies used inhaled corticosteroids for bronchodilatation. Results in the study of Siddiqui *et al*. were similar to our results, and raised eosinophilic count emerged as a strong predictor of good bronchodilator response.[18] Similar results across various populations make this phenomenon generalizable worldwide for COPD patients.

A review by Calvery *et al*. also recom-mended the same strategy in managing COPD.[19] The long duration of illness was another factor associated with poor response to bronchodilator treatment in our study. In their study, Donohue highlighted this fact and raised the issue of the development of tolerance for beta-agonist use as a bronchodilator among patients suffering from COPD.[20] This means that as the disease progress and repeatedly beta agonist are used, they lose their efficacy with time. That may be the reason for this finding in our stud as well.

CONCLUSION

Raised eosinophilic count emerged as a predictor of good response after administering bronchodilators among patients suffering from chronic obstructive airway disease. Screening patients for this simple blood component may predict response to the initial treatment and help in the tailoring of the treatment plan by the treating physician.

Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

MN: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

MNAK & SUS: Conception, study design, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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