

CORRELATION OF TOTAL LEUCOCYTE COUNT, EOSINOPHIL, NEUTROPHIL AND LYMPHOCYTE COUNTS WITH PEAK EXPIRATORY FLOW RATE (PEFR) IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) PATIENTS

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ABSTRACT

BACKGROUND

Chronic obstructive pulmonary disease (COPD) is the fourth leading cause of death in India. In COPD, there is an increased number of leucocytes suggesting a role for the inflammatory response in the clinical progression of the disease. The aim of the study is to correlate leucocyte counts with peak expiratory flow rate (PEFR) in COPD patients.

MATERIALS AND METHODS

This observational study was carried out among 30 COPD patients, volunteers referred from Pulmonology Department of Saveetha Hospital. The pulmonary function test was done by using a computerised spirometer and complete blood cell count was also made for all the subjects. PEFR recorded was correlated with blood parameters (TLC, neutrophils, eosinophils, lymphocytes).

RESULTS

There was strong negative significant correlation (-0.80) between PEFR and TLC ($p < 0.05$), between PEFR and absolute neutrophil count ($p < 0.05$), between PEFR and absolute eosinophil count ($p < 0.05$) and between PEFR and absolute lymphocyte count ($p < 0.05$).

CONCLUSION

The findings indicated that whenever the blood parameters (TLC, neutrophils, eosinophils and lymphocytes) increased, there was a decrease in the PEFR in COPD patients.

KEYWORDS

COPD, Computerised Spirometer, PEFR.

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BACKGROUND

Chronic obstructive pulmonary disease (COPD) is the fourth leading cause of death in India and a major worldwide healthcare problem. Chronic obstructive pulmonary disease (COPD) is characterised by the progressive, partially reversible air flow limitation which occurs in association with a chronic inflammatory reaction triggered by smoking or other inhalation in predisposed subjects.¹ Leucocytes are important cells, which mediate various inflammatory responses. Inflammation has been identified as an important factor for disease exacerbation in obstructive lung disease. In this study, we used neutrophil and eosinophil counts as biomarkers for exacerbation in obstructive lung disease.²

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It has been suggested that with severe COPD, there is an increased number of leucocytes, which is correlated with PFT suggesting a role for this inflammatory response in the clinical progression of the disease.³

Pulmonary Function Tests (PFTs) are very important in the medical evaluation of patients suffering from "shortness of breath," and they are effectively used for the diagnosis of pulmonary diseases such as COPD (i.e. chronic obstructive pulmonary diseases). Measurement of peak expiratory flow rate (PEFR) is very important for assessing the treatment of COPD.⁴

A number of studies have demonstrated the association between the reversibility of obstructive pulmonary function impairments and the number of leucocytes in peripheral blood. These earlier studies have identified environmental irritants are associated with COPD, but the relationship between markers of allergy and airway inflammation and pulmonary function results have not been extensively studied.⁵ So this study has been designed to correlate total leucocyte count, eosinophil (anti-allergy), neutrophil (anti-inflammatory) and lymphocyte counts with PEFR in COPD patients.

MATERIALS AND METHODS

Study Design

Observational study.

Methodology

The present analytical study was carried out among 30 COPD patients' volunteers referred from Pulmonology Department of Saveetha Hospital. Sample size was taken on convenience.

Inclusion Criteria

- Patients with COPD only.
- Age between 20 - 60 yrs.
- Both gender.
- Chronic bronchitis.
- Emphysema.
- Bronchiectasis.
- Bronchial asthma (with attack and follow-up).

Exclusion Criteria

Subjects with the following diseases were excluded

- Epilepsy.
- Infective diseases.
- Cardiac diseases.
- Mentally retarded subjects.

Procurement of Permissions

The protocol and the benefits of the study were explained to the subjects and written consent was also obtained from subjects before carrying out the study on the subjects.

Ethical Clearance

The study proposal with the informed consent and the questionnaire were submitted to the ethical committee of our institution and was approved by the ethical committee.

Pulmonary Function Test

Instrument used for measuring PEFR, Computerised Spirometer, (RMS Helios 401, Recorders and Medicare Systems (P) Ltd.).

Blood Analysis

- Total leucocyte count was done by manual method using haemocytometer.
- Differential leucocyte count was done by standard procedure of eosin and haematoxylin staining method.

Procedure

PFT Recording

- During recording, the patient was made to sit in high sitting position and asked to relax for 5 mins.
- Soft nose clips were used to prevent air escaping through the nose.
- Sterile filter mouthpieces were used to prevent the spread of microorganisms.
- The test was preceded by a period of quiet breathing in and out into the sensor through the mouth (tidal volume) or the rapid breath in (forced inspiratory part), which would come before the forced exhalation.

- The patient was asked to take a deep breath as forcefully as they can and then exhale into the sensor as hard as possible, preferably at least for 6 seconds.
- The manoeuvre is highly dependent on patient's cooperation and effort.
- After the patients were educated about the procedure, the tests were carried out three times and best of the three was selected for analysis.
- The values obtained by the sensor were recorded.

Pulmonary Parameters

PEFR values were taken from computerised spirometric chart.

Blood Parameters

i. Total Leucocyte Count:

- Using WBC pipette, Turk's fluid and Neubauer's counting chamber.
- $TLC \text{ (cells/mm}^3\text{)} = \text{cells counted} \times 50$.

ii. Differential Leucocyte Count

- Chart containing 100 counters were made.
- Type of leucocytes were registered in each counter.
- DLC was made by adding the registered counts.
- Percentage of DLC was made.
- Absolute count was made as follows:
 - Absolute neutrophil count = neutrophil % $\times$ TLC

Statistical Analysis

Data obtained were represented as Mean $\pm$ SD. Correlation coefficient was calculated between PEFR and blood examination results. Statistical analysis was performed using GraphPad Prism Software (GraphPad, San Diego, CA, USA) by unpaired 't' test. Pearson correlation was done for correlation analysis.

Result of the Study

In this study, 30 patients who were diagnosed as COPD from the Pulmonology Department of Saveetha Hospital participated voluntarily. Pulmonary parameters (PEFR) recorded was correlated with blood parameters (TLC, neutrophils, eosinophils, lymphocytes) and compared with "p-value."

PEFR values are correlated with blood parameters and the results are given below:

No. of Subjects	PEFR (L/min)	TLC (cells/mm ³)	Correlation Coefficient	'p' value
	Mean $\pm$ S.D.	Mean $\pm$ S.D.		
30	215 $\pm$ 49.39	12,800 $\pm$ 1301.9	-0.80	P < 0.05
Table 1. Correlation between PEFR and Total Leucocyte Count (TLC)				

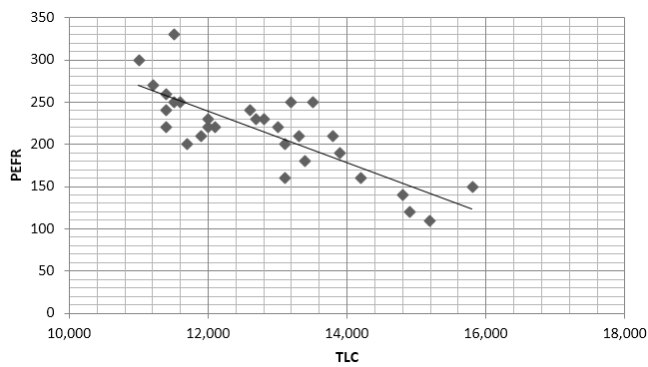


Figure 1

The mean value of PEFR were 215 ± 49.39 and the mean value of TLC was $12,800 \pm 1301.9$ (Table 7). When these two values were compared, the result showed that there was strong negative significant correlation (-0.80) between PEFR and TLC ($p < 0.05$) (Fig. 1), which means decrease in PEFR is associated with increase in TLC.

No. of Subjects	PEFR (L/min)	Abs. Neu. Cnt (cells/ mm ³)	Correlation Coefficient	'P' value
	Mean $\pm$ S.D	Mean $\pm$ S.D		
30	215 ± 49.39	7369.2 ± 952.01	-0.73	$P < 0.05$

Table 2. Correlation between PEFR and Absolute Neutrophil Count (ANC)

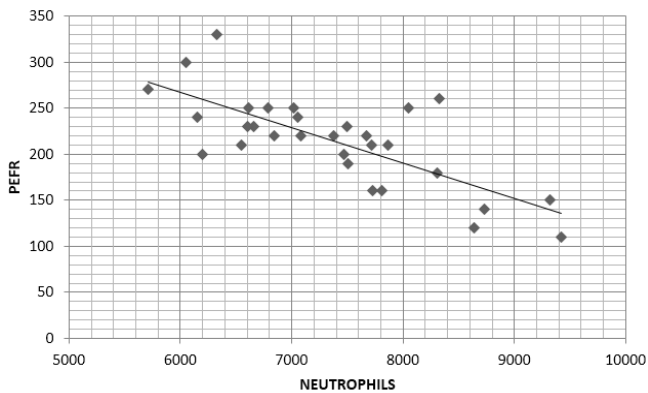


Figure 2

The mean PEFR value was 215 ± 49.39 and mean absolute neutrophil count value was 7369.2 ± 952.01 (Table 9). On comparing these two values the result showed that there was strong negative significant correlation (-0.73) existing between PEFR and absolute neutrophil count ($p < 0.05$) (Fig. 2), which means decrease in PEFR is associated with increase in ANC.

No. of Subjects	PEFR (L/min)	Abs. Eos. Cnt (cells/ mm ³)	Correlation Coefficient	'P' value
	Mean $\pm$ S.D	Mean $\pm$ S.D		
30	215 ± 49.39	811.03 ± 228.72	-0.60	$P < 0.05$

Table 3. Correlation between PEFR and Absolute Eosinophil Count

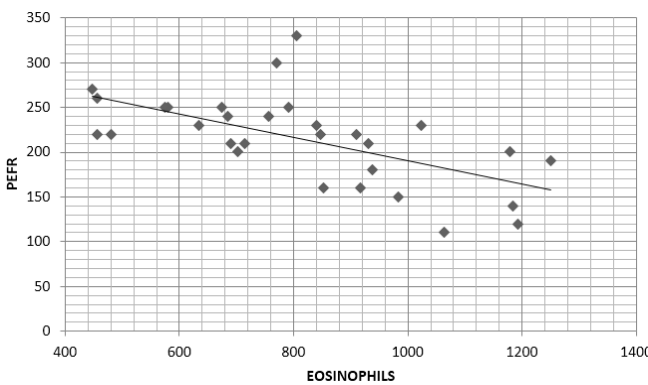


Figure 3

The mean PEFR value was 215 ± 49.39 and mean absolute eosinophil count value was 811.03 ± 228.72 (Table 9). On comparing these two values, the result showed that there was strong negative significant correlation (-0.60) existing between PEFR and absolute eosinophil count ($p < 0.05$) (Fig. 3), which means decrease in PEFR is associated with increase in AEC.

No. of Subjects	PEFR (L/min)	Abs. Lym. Cnt (cells/ mm ³)	Correlation Coefficient	'P' value
	Mean $\pm$ S.D	Mean $\pm$ S.D		
30	215 ± 49.39	3848 ± 516.03	-0.38	$P < 0.05$

Table 4. Correlation between PEFR and Absolute Lymphocyte Count

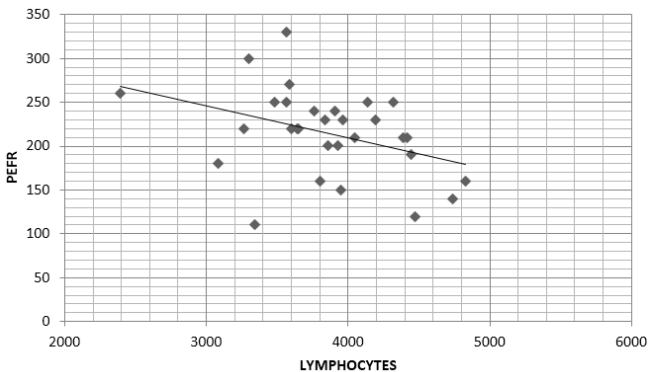


Figure 4

The mean value of PEFR were 215 ± 49.39 and mean value of absolute lymphocyte count was 3848 ± 516.03 (Table 10). These two values were compared and the result showed that there was strong negative significant correlation (-0.38) noted between PEFR and absolute lymphocyte count ($p < 0.05$) (Fig. 4), which means decrease in PEFR is associated with increase in absolute lymphocyte count.

DISCUSSION

COPD, the important disease which affect the respiratory system, is normally diagnosed by certain pulmonary function tests. Among that measurement, peak expiratory flow rate (PEFR) is very important for assessing the treatment of COPD.

It has been suggested that with severe COPD there is an increase in number of leucocytes, which is correlated with PFT suggesting a role for leucocytes in this inflammatory response in the clinical progression of the disease.³

Leucocytes are important haemocytic cells, which mediate various inflammatory responses. Inflammation has been identified as an important factor for disease exacerbation in obstructive lung disease.⁶

A significant increase in TLC with decrease in PEFr is noticed in the study. As the leucocyte have the important role in body's defense mechanism, it is natural that their number increase with the severity of COPD. The present result also supports the above mentioned fact.

Further, to find out the relative role of individual leucocytes, the PFTs were compared with different leucocytes. There was a significant increase in absolute neutrophil count observed with decrease in PEFr. Neutrophil has been implicated in the pathogenesis of COPD, being recruited into the lung in response to cigarette smoke inhalation and being responsible for the release of protease and oxidant-producing enzymes that cause bronchitis and emphysema.⁷

An increase in the white blood cells that may be produced during an allergic reaction (eosinophils) may indicate that a condition such as asthma is causing the symptoms. In our result also, there was significantly high increase in absolute eosinophil count with decrease in PEFr.

When the absolute lymphocyte count registered an increase, the PEFr showed a decrease. Lymphocytes are important effector and regulatory cells that participate actively in the inflammatory response of COPD, especially for subjects who develop COPD from smoking.⁸ The inflammatory response of lymphocyte in COPD patients may be the cause for reduction in PEFr.

Thus, our study concludes that both pulmonary and blood parameters are showing a negative correlation and signifying the inverse relationship between the blood and pulmonary parameters. This inverse relationship if established may help the family physician to understand the severity of COPD and direct them to the referral centre for early diagnosis and treatment.

In short, the findings of this study indicate that the severity of COPD diagnosed with pulmonary function tests have negative correlation with the blood parameters, i.e. whenever the blood parameters (TLC, neutrophils, eosinophils and lymphocytes) increases there was a decrease in the pulmonary test parameters in COPD patients.

CONCLUSION

The Result of our study showed that-

- There was strong negative significant correlation existing between PEFr and TLC, absolute neutrophil count, absolute eosinophil count and absolute lymphocyte count.
- Further study in this line is required to prove this inverse relationship of blood parameters and pulmonary parameters.
- This inverse relationship if established may help the family physician to gauge the severity of COPD and send them to the referral centre for early diagnosis and treatment.

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