



Study Of Correlation Between Severity Of Airflow Obstruction And Serum C-Reactive Protein In Copd Patients

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Abstract

Chronic Obstructive Pulmonary Disease (COPD)¹ is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation. GOLD guidelines have categorised the COPD patients according to their post bronchodilator level of airflow obstruction. Systemic inflammation & oxidative stress are the most important features of COPD. Stable COPD patients have a proinflammatory state with increased circulating levels of many inflammatory cytokines and acute phase reactants. Hence the purpose to conduct this study was to determine the correlation between severity of airflow obstruction and serum C-reactive protein in COPD patients. we have selected stable COPD patients for this study and did their Spirometry and serum CRP levels. And finally we came to a conclusion that there is a positive correlation between the severity of the disease and serum CRP levels. so these correlation can be utilised for assessing the severity of disease in a COPD patients without Spirometry.

Keywords: Airflow obstruction, COPD, GOLD guidelines, Smoking, Serum C-reactive protein

Introduction

Chronic Obstructive Pulmonary Disease (COPD)¹ is 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. Chronic Obstructive Pulmonary Disease (COPD) is currently the fourth leading cause of death in the world². Systemic inflammation & oxidative stress are the most important features of COPD. It is clearly established that some inflammatory markers (blood based biomarkers) in systemic circulation are increased in COPD. C-Reactive Protein has shown the greatest promise. In COPD patients increased serum CRP levels are associated with poor lung function, reduced exercise capacity & worsened

quality of life as well as being a significant predictor of all cause mortality. Aim of this study was to determine the correlation between severity of airflow obstruction and serum C-reactive protein in COPD patients. So we have done this study in the Department of respiratory medicine JLNH&RC Bhilai from march 2020 to February 2021.

Materials & Methods

Study Area: Department of Respiratory Medicine, Jawaharlal Nehru Hospital & Research Centre, Bhilai, Chhattisgarh.

Study Population: Patients diagnosed to have COPD in stable condition in the Department of Respiratory Medicine, JLNH &RC

Study Period: March 2020 to February 2021 (One year)

Sample Size: $SAMPLE\ SIZE\ (N) = [(Z_{\alpha} + Z_{\beta})/C]^2 + 3$

Formula for correlational study

1.645 = Z_{α} value for 10% Type I error

0.842 = Z_{β} value for 20% Type II error

r = correlation coefficient = 0.300⁷ for GOLD

$C = 0.5 \times \ln [(1+r)/(1-r)] = 0.310$

$N = [(1.645 + 0.842)/0.310]^2 + 3 = 68$

Minimum sample size was found to be 68, taking 10% loss to follow-up total 75 patients needed for the study.

Study Design: Institution based Correlational Study

Parameters To Be Studied

1. Relevant History & Clinical Examination
2. Spirometry
3. Serum C- reactive Protein

Study Tools

1. Relevant history & Clinical Examination
2. Laboratory tools & chemicals for estimation of Serum C-reactive Protein
3. Spirometer

Inclusion Criteria

1. Patients diagnosed to have COPD according to GOLD criteria¹
2. Patients clinically stable without baseline O₂ desaturation
3. Total duration of illness- 1 to 30 years
4. Patient giving informed consent to undergo study related testing

Exclusion Criteria

1. Patients with present Chest X ray showing pleural or parenchymal disease like lung mass, pleural effusion, pneumothorax, consolidation, fibrosis etc.
2. Patients refusing to give informed consent regarding participation in the study.
3. COPD patients with history of exacerbation within last 3 months.

Study Technique

1. Patients attending the Chest OPD were selected as given in the inclusion criteria and were recruited in this study after getting an informed consent in writing in accordance with the provisions of the Code of Ethics for research on human beings.
2. Relevant history was taken & thorough clinical examination of patients was done. Diagnosis of COPD & severity of airway obstruction was confirmed by Spirometry with bronchodilator reversibility testing (as per GOLD guideline 2019).
3. A detailed history regarding symptoms and smoking history was taken.

Spirometry

Spirometry was performed in Spirometry laboratory in the Department of Respiratory Medicine JLNH & RC, Bhilai.

Spirometry procedure was informed and demonstrated to all participants before doing.

Spirometry was repeated three times and the best value was taken for study.

Testing in the form of FEV₁, FVC, and FEV₁/FVC were recorded and their impression was drawn as in the GOLD classification for COPD i.e.

GOLD 1:	Mild	FEV ₁ ≥ 80% predicted
GOLD 2:	Moderate	50% ≤ FEV ₁ < 80% predicted
GOLD 3:	Severe	30% ≤ FEV ₁ < 50% predicted
GOLD 4:	Very Severe	FEV ₁ < 30% predicted

While doing spirometry, the method of doing spirometry was assessed by checking the effort of the patient, coughing during procedure, and was looked for any leak.

Chest x-ray, few blood tests which include complete hemogram, renal function test, liver function test & ECG were done.

Pulse Oxymeter was used to determine SpO₂ at rest.

Then 5 ml blood was drawn in a clot vial & estimated the Serum C-Reactive Protein.

CRP levels were mentioned in mg/L

Based on relevant history and clinical examination, Spirometry, Serum C-reactive protein, patient-data were analyzed statistically.

Finally, Results were analyzed to find out correlation between severity of airflow limitation and serum C-reactive protein.

Results

The present study was conducted in the Department of Respiratory Medicine, J.L.N. Hospital & Research Centre, Bhilai, Chhattisgarh. 75 patients who were diagnosed cases of COPD and who satisfied the inclusion criteria were included in this study.

The observations made during the course of study are presented here:

Table 1: Demographics of Study Population

Characteristics	Study population (n = 75)
Age (years) (Mean ± SD)	57.53 ± 10.29

Figure 1: Mean ± SD of Age in study population

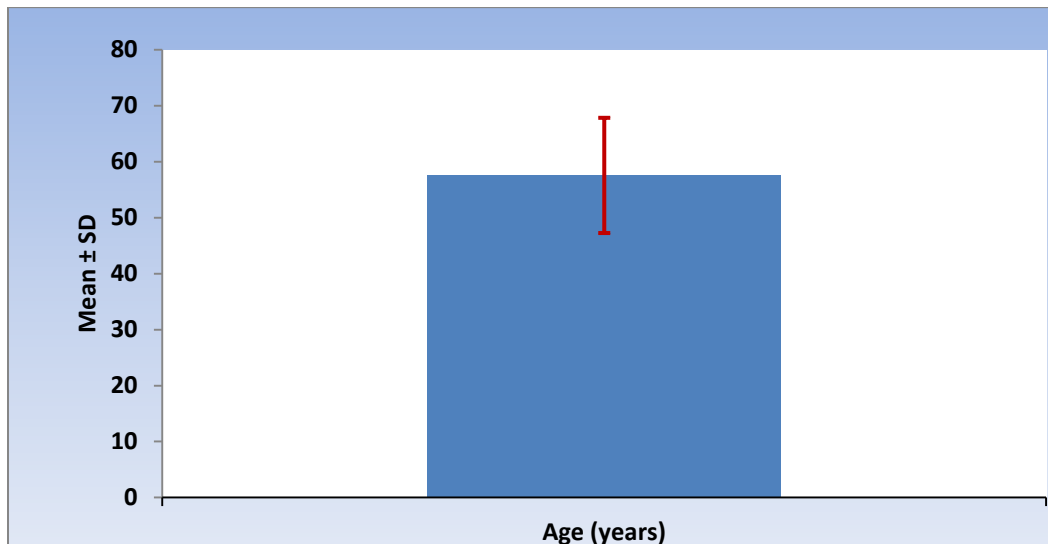


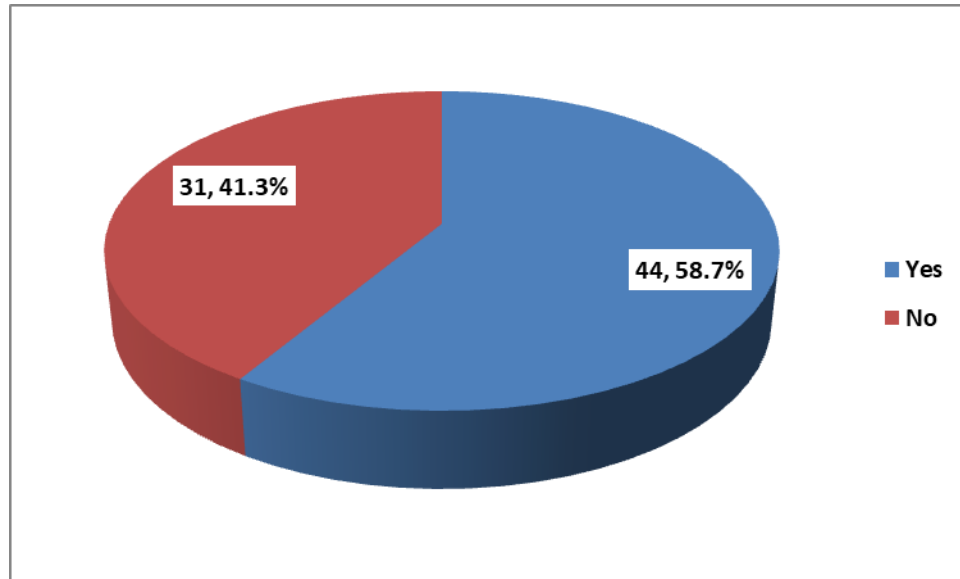
Figure 1: Distribution of age in the study population

In the present study, mean (SD) age of study population was 57.53 + 10.29 yrs.

Table 2: Distribution of Smoking status in the study population

Smoking history [n (%)]	
Yes	44 (58.7)
No	31 (41.3)

Figure 2: Distribution of Smoking status in study population

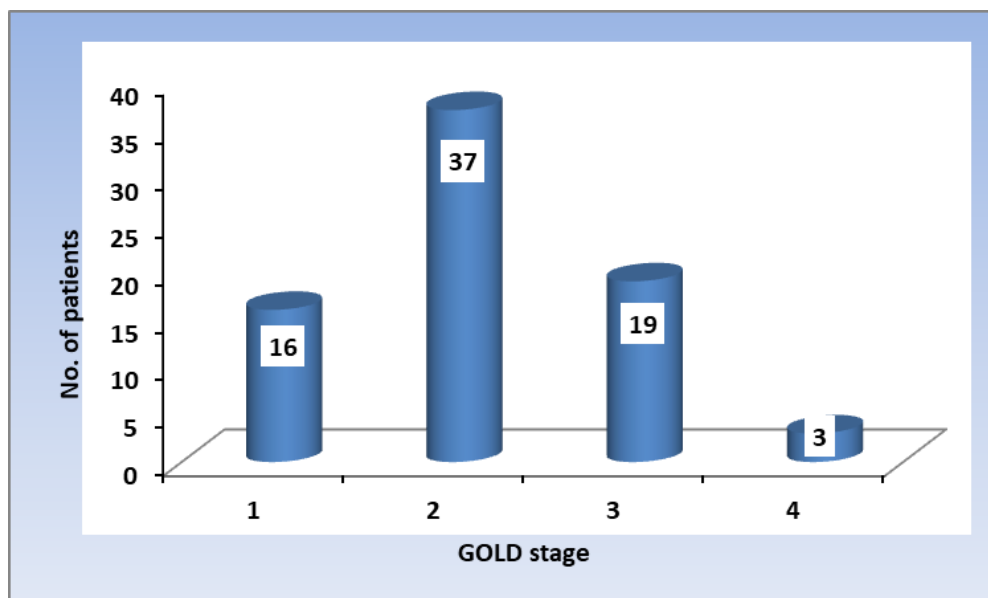


In the present study, there were 44(58.7%) patients having history of smoking & 31 (41.3%) patients were non smokers.

Table 3: Distribution of GOLD stage in the study population

GOLD stage [n (%)]	
1	16 (21.3)
2	37 (49.4)
3	19 (25.3)
4	3 (4.0)

Figure 3: Distribution of GOLD stage in the study population

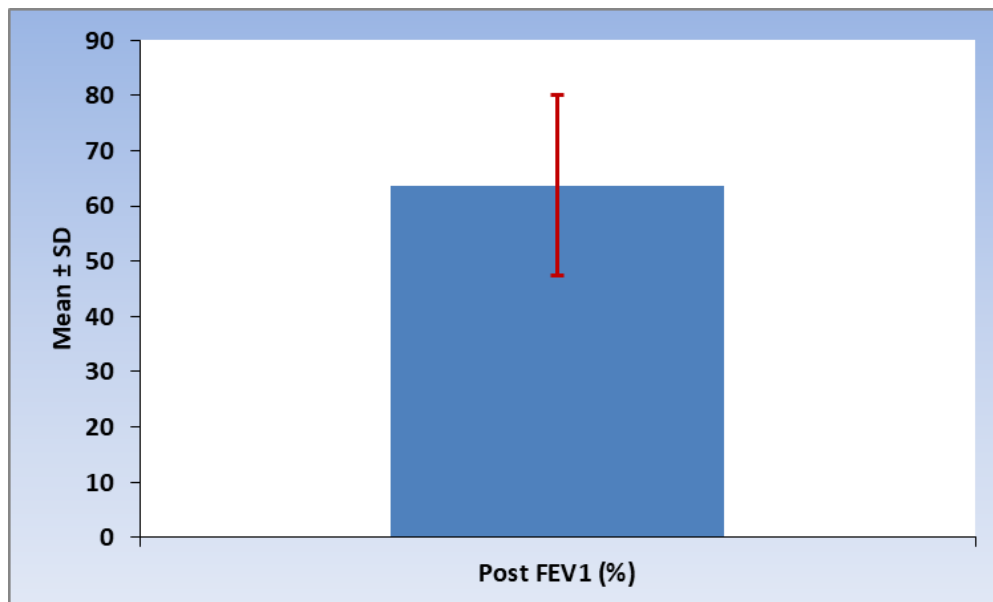


In the present study of total 75 stable COPD patients, more than 70% of the patients belongs to GOLD stage II & III; whereas less number (4%) of patients belongs to GOLD stage IV. Larger number (49.4%) of patients belongs to GOLD stage II

Table 4: Mean ± SD of FEV1 in the study population

Post FEV ₁ (%) (Mean ± SD)	63.69 ± 16.36
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Figure 4: Mean ± SD of FEV1 in the study population



In this study, mean value of post bronchodilator FEV1 was 63.69± 16.3

Table 5: Mean ± SD of CRP in the study population

CRP (mg/L) (Mean ± SD)	3.96 ± 2.73
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Figure 5: Mean \pm SD of CRP in the study population

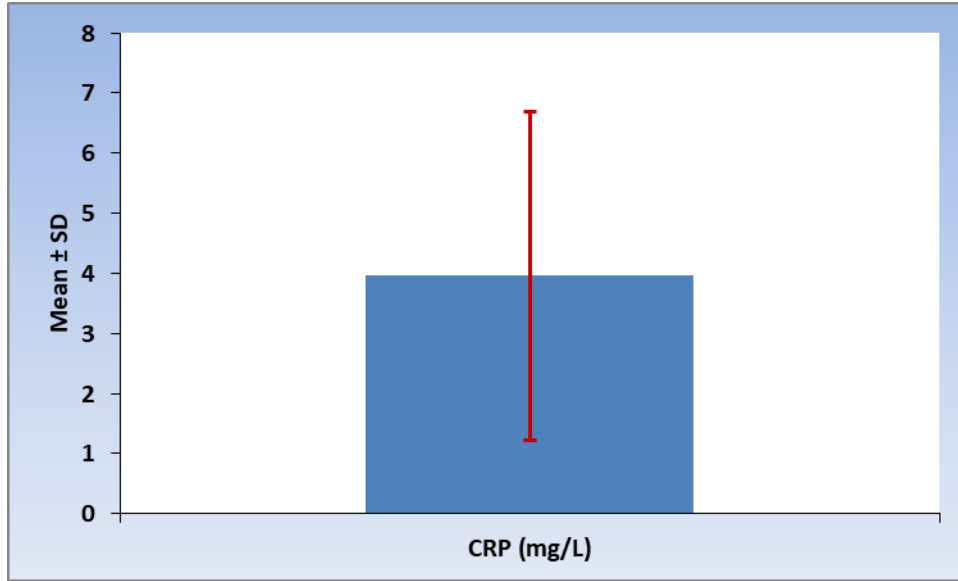
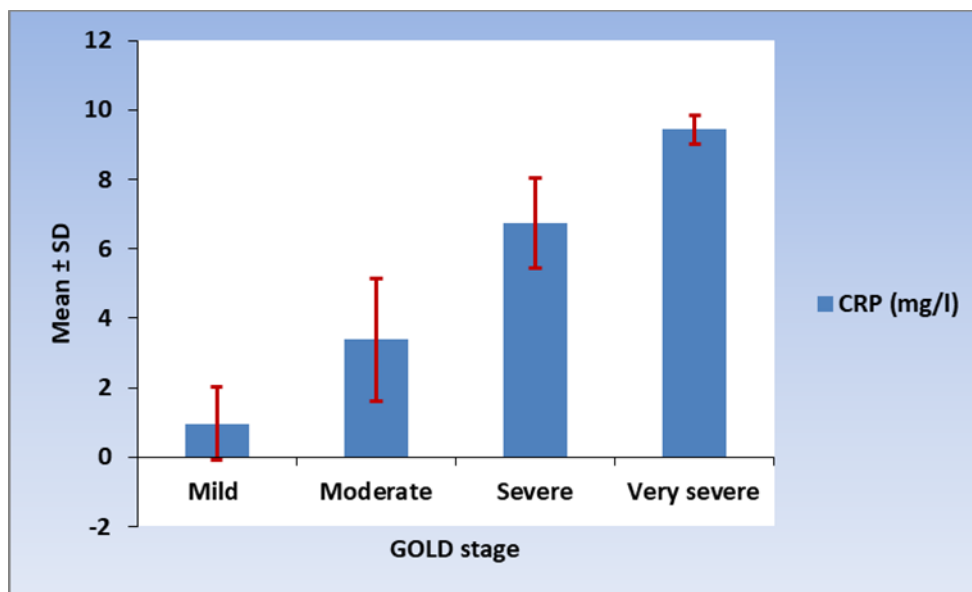


Table 6: Mean \pm SD of CRP with respect to GOLD stage

Characteristics	GOLD stage				p-value
	Mild (Stage 1) (n=16)	Moderate (Stage 2) (n=37)	Severe (Stage 3) (n=19)	Very severe (Stage 4) (n=3)	
CRP (mg/l)	0.96 \pm 1.05	3.39 \pm 1.77	6.74 \pm 1.29	9.43 \pm 0.40	0.0001*

Figure 6: Mean \pm SD of CRP with respect to GOLD stage



1. In this study there was a positive correlation between serum CRP value and GOLD stage.
2. Increase in severity of disease can be correlated with increase in serum CRP levels.
3. Patients who belong to very severe stage had higher serum CRP level.

Statistical Analysis: The data was entered into excel sheet. The descriptive data was analyzed using IBM SPSS software version 22. The categorical data is shown as number and percentage and the difference between the groups was analyzed by Chi square test. The continuous data is shown as mean and standard deviation and the difference between the groups was calculated using student's unpaired t-test. Correlation of CRP with Spirometry and other parameters of COPD patients was analyzed using Pearson Correlation analysis. P value <0.05 was considered to be statistically significant.

Discussion

The current study is a correlational study which included 75 patients diagnosed with COPD from March 2020 to February 2021

Aim of the study was to determine the correlation between serum CRP and severity of airflow obstruction. The serum CRP levels helps to monitor the response to therapy and to predict the morbidity and mortality of patients with COPD. Our study showed a significant association between serum CRP and severity of airflow obstruction.

Spirometry Findings And Gold Staging:

The spirometric findings were taken as post bronchodilator FEV1 values and classified into GOLD Staging. 16 (21.3%) patients were classified as GOLD Stage I having %predicted FEV1 \geq 80%; 37 (49.3%) patients were classified as GOLD Stage II with %predicted FEV1 between 50-79% and 19 (25.3%) patients were classified as GOLD Stage III with %predicted FEV1 between 30-49%. 3(4%) patients were classified as GOLD stage IV with %predicted FEV1 below 30

Study was comparable to:

1. Study conducted by **Dhanalakshmi D et al**³, had 14.81% patients as GOLD Stage I, 42.59% patients as GOLD Stage II, 27.77% patients as GOLD stage III and 14.81 % patients as GOLD Stage IV.
2. Study done by **Agrawal SR et al**⁴, had 11.6% patients as GOLD Stage I, 46.5% patients as

GOLD Stage II, 28.6% patients as GOLD Stage III and 13.3 % patients as GOLD Stage IV.

3. Study done by **Kundu A et al**⁵, had 41(51.25%) patients in GOLD Stage II, 35 (43.75%) patients in GOLD Stage III and 4 (5.0%) patients in GOLD Stage IV.

Serum Crp

In our study after measuring the serum CRP levels and when compared with GOLD stages.

0.96 \pm 1.05 was mean value of CRP in GOLD stage I patients.

3.39 \pm 1.77 was mean value of CRP in GOLD stage II patients.

6.74 \pm 1.29 was mean value of CRP in GOLD stage III patients.

9.43 \pm 0.40 was mean value of CRP in GOLD stage IV patients.

Our study showed strong positive correlation between serum CRP and GOLD stage, and strong negative correlation between serum CRP and post bronchodilator FEV1.

Our study was comparable to

1. Study done by **Moayyedkazemi A et al**⁶ in which negative correlation was found between hsCRP and the predicted percentage of forced expiratory volume in one second (FEV1%) (P=0.03; r=0.32). There was also a positive correlation between hsCRP and the severity of COPD based on the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria (P=0.04;r=0.3).
2. Study done by **Pandey S et al**⁷ which showed that mean serum CRP levels was significantly higher in COPD group as compared to control group (p<0.0001) and the levels increased with the increasing severity of the disease.
3. Study done by **Prasad A et al**⁸ who concluded that a significant negative correlation was found between CRP and FEV1 (r=-0.284, p=0.004) and FEV1/FVC (r=-0.305, p=0.002). CRP levels were independent of FVC (r=-0.162, p=0.107)

1. Mean age of patients in our study was 57.53 ± 10.29 yrs.
2. 56 males and 19 females were included in the study.
3. 44 patients were smokers, 37 of them were male and 7 female.
4. Mean serum CRP levels are higher in smokers (4.72 ± 2.79) compared to non smokers (2.89 ± 2.29)
5. The spirometric findings were taken as post bronchodilator FEV1 values and classified into GOLD Staging. 16 (21.3%) patients were classified as GOLD Stage I having %predicted FEV1 $\geq 80\%$; 37 (49.3%) patients were classified as GOLD Stage II with %predicted FEV1 between 50-79% and 19 (25.3%) patients were classified as GOLD Stage III with %predicted FEV1 between 30-49%. 3 (4%) patients were classified as GOLD stage IV with %predicted FEV1 below 30%.
6. Serum CRP values were taken in mg/L
7. Mean value of serum CRP was
 0.96 ± 1.05 in GOLD stage 1;
 3.39 ± 1.77 in GOLD stage II
 6.74 ± 1.29 Observed in GOLD stage III
 9.43 ± 0.40 observed in GOLD stage IV
7. Serum CRP levels have Negative correlation with post bronchodilator FEV1.
8. There is positive correlation between serum CRP values and GOLD stage.
9. All patients with COPD should be followed up with Spirometry and Serum CRP levels
10. As assessment CRP allows one to determine the severity of the disease and its change with time and treatment, so we recommend that Serum CRP should be done in follow-up of patients.
11. In rural areas were the facility for spirometric evaluation is not possible ,we can use this simple blood test serum CRP as marker for evaluating prognosis , treatment response and severity of illness.
12. As our study showed significant correlation between smoking and disease severity, all patients should undergo counselling regarding smoking cessation.
13. In the current times of COVID-19 pandemic, Serum CRP is the best and simple test to look for prognosis and the control of the disease as it is non aerosol generating procedure, so it can be done on out-patient basis.

There is a Negative correlation between Post bronchodilator FEV1 and serum CRP levels.

There is a Positive correlation between serum CRP levels and GOLD stage.

Conclusion

1. Most of the COPD patients are male.
2. With increasing age COPD patients had more symptoms and higher serum CRP levels.
3. The most common risk factor was found to be history of smoking.
4. There is a Positive correlation between smoking history and GOLD stage
5. There is a Positive correlation between smoking history & serum CRP levels.
6. The patients who had more severe symptoms like dyspnea and cough with expectoration had lower post bronchodilator FEV1 values indicating the symptoms correlated with the spirometry findings.

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