



THE ROLE OF CAT SCORE AND CRP LEVEL IN THERAPY ASSESSMENT OF COPD PATIENTS IN WESTERN UTTAR PRADESH

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Abstract: Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory disorder characterized by persistent airflow limitation, chronic respiratory symptoms, and systemic inflammation, leading to significant morbidity and impaired quality of life. The present prospective observational study was conducted to evaluate the role of the COPD Assessment Test (CAT) score and serum C-reactive protein (CRP) level in assessing therapeutic response among COPD patients in Western Uttar Pradesh. A total of 40 patients diagnosed with COPD according to the GOLD 2023 guidelines were enrolled from the Department of Respiratory Medicine, Krishna Mohan Medical College and Hospital, Mathura, between March 2024 and April 2025. Baseline and six-week follow-up assessments included CAT score, serum CRP estimation, and spirometric evaluation. The majority of patients were males and belonged to the 60–69 years age group, with smoking identified as the predominant risk factor. Following six weeks of standard therapy, a statistically significant reduction was observed in the mean CAT score and serum CRP level, along with significant improvement in pulmonary function parameters, including FEV₁ and FEV₁/FVC ratio ($p < 0.001$). Furthermore, a significant positive correlation was observed between CAT score and serum CRP level, whereas both parameters showed significant negative correlations with FEV₁, indicating that greater symptom burden and systemic inflammation were associated with poorer lung function. The findings of the study suggest that the CAT score and serum CRP level are valuable, simple, and complementary tools for evaluating therapeutic response in patients with COPD. When used together with spirometry, they provide a more comprehensive assessment of disease severity, systemic inflammation, and treatment outcomes, thereby supporting their routine use in the clinical management and follow-up of COPD patients.

Keywords: OPD, CAT score, C-reactive protein, Systemic inflammation, Disease severity, Treatment response, Exacerbation risk.

1. Introduction

Chronic obstructive pulmonary disease (COPD) is a heterogeneous lung condition characterized by chronic respiratory symptoms (dyspnea, cough, expectoration and/or exacerbations) due to abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema) that cause persistent, often progressive airflow obstruction. [1] COPD represents a spectrum of pathological changes that involve both small airway disease and emphysematous destruction of lung tissue. These pathological changes produce airflow limitation that is not fully reversible and tends to worsen over



time, particularly in individuals with continued exposure to tobacco smoke or environmental pollutants. In addition to pulmonary impairment, COPD is also associated with multiple extrapulmonary manifestations including skeletal muscle dysfunction, cardiovascular disease, metabolic syndrome, and systemic inflammation, which significantly contribute to morbidity and mortality. [2]

The modern concept of COPD emphasizes that the disease should be viewed not only as a disorder of airflow limitation but also as a multidimensional systemic

Table 1: GOLD classification of COPD Severity

GOLD Stage	Severity	Post-Bronchodilator FEV1 (% Predicted)
GOLD 1	Mild	FEV1 $\geq$ 80% predicted
GOLD 2	Moderate	50% $\leq$ FEV1 < 80% predicted
GOLD 3	Severe	30% $\leq$ FEV1 < 50% predicted
GOLD 4	Very Severe	FEV1 < 30% predicted

This classification provides an objective measurement of lung function impairment and correlates with disease progression and mortality risk. However, spirometric severity alone does not adequately reflect the clinical impact of COPD. Therefore, modern COPD management integrates spirometric classification with symptom burden and exacerbation history to guide therapeutic strategies.

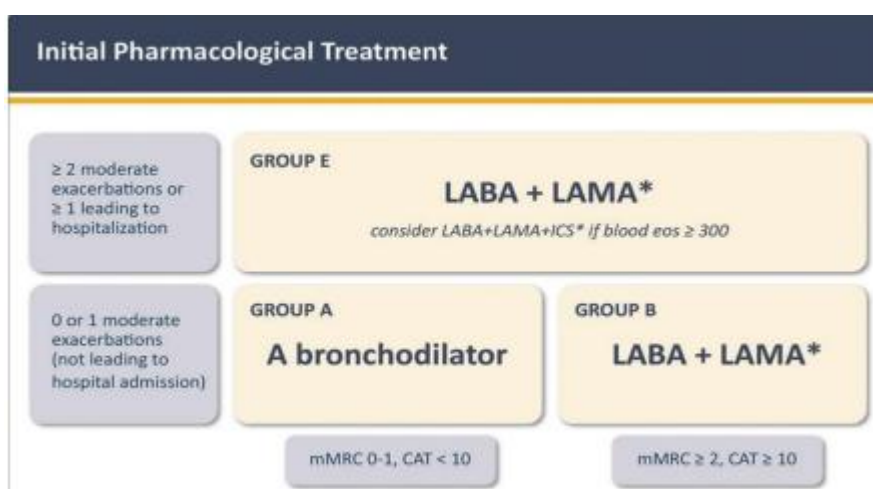


Figure 1: Gold Abe Classification Of Copd



Global Epidemiology and Disease Burden

COPD poses a major global public health challenge, contributing substantially to morbidity and mortality worldwide. In 2019, COPD was the third leading cause of death globally, responsible for an estimated 3.23 million deaths, ranking only behind ischemic heart disease and stroke. [3] This represents a dramatic rise from 1990, when COPD was the fourth leading cause of death, reflecting both aging populations and continued exposure to risk factors worldwide. [4] Prevalence estimates indicate that approximately 251 million people were living with COPD in 2016. A systematic review reported a global prevalence of COPD of about 10% in adults over 40 years, though rates vary by region and diagnostic criteria. [5] The disease burden of COPD is especially heavy in low- and middle-income countries, which account for about 90% of COPD deaths. Projections suggest that by 2030, COPD will remain among the top causes of death and disability worldwide, driven by ongoing tobacco use in many countries and aging populations.

Epidemiology and Burden of COPD in India and Western Uttar Pradesh

In India, COPD is a major contributor to respiratory disease burden. The Indian Study on Epidemiology of Asthma, Respiratory Symptoms and Chronic Bronchitis (INSEARCH) reported that COPD affects millions of individuals across the country, with higher prevalence among males and rural populations due to smoking and biomass fuel exposure. [6] COPD is a particularly pressing health problem in India, which now bears a disproportionate share of the global COPD burden. According to the Global Burden of Disease study, India accounted for approximately 32% of the world's COPD DALYs in 2016 – the highest of any country (India State-Level Disease Burden Initiative CRD Collaborators, 2018). The number of COPD cases in India was estimated at 55.3 million in 2016, making it one of the largest patient populations globally (India State-Level Disease Burden Initiative CRD Collaborators, 2018). COPD is now the second leading cause of death in India, responsible for an estimated 13% of all deaths nationally (Collaborators, 2018). This means COPD has emerged as the second-most common cause of death due to non-communicable disease in India, behind only ischemic heart disease. [7]

Etiology and Risk Factors of COPD

Smoking: Cigarette smoking is the single most important risk factor for COPD globally. Long-term tobacco smoking leads to chronic inflammation and narrowing of the airways, and approximately 20–30% of lifelong smokers develop COPD. [8] The duration and intensity of smoking (pack-years) correlate with COPD risk and severity; smokers have a markedly higher annual decline in FEV₁ and a greater risk of mortality than nonsmokers. [9]

Biomass Fuel and Indoor Pollution: Studies in India have demonstrated that lifelong biomass fuel exposure can nearly triple the risk of COPD in nonsmoking women. [10] In fact, most female COPD patients in India are lifelong nonsmokers with a history of indoor air pollution exposure.



Ambient Air Pollution: Long-term exposure to high levels of ambient PM_{2.5} has been linked to decline in lung function and development of COPD, even in nonsmokers. [11]

Occupational Exposures: In rural North India, exposure to dust from agriculture (e.g., rice mill workers inhaling husk dust) and burning of fields can increase COPD risk. [12] In Western U.P., a significant portion of the workforce is engaged in agriculture and cottage industries that may involve organic or inorganic dust exposure, contributing to chronic lung damage over time.

Respiratory Infections and Early-Life Factors: Studies in India have found that a history of treated pulmonary TB is associated with significantly reduced lung function and higher odds of COPD. [13] Additionally, poor nutrition, low birth weight, and recurrent childhood respiratory infections can lead to suboptimal lung growth, leaving individuals with smaller airway reserves and greater susceptibility to COPD as they age. [14] One well-known genetic risk factor, though rare, is alpha-1 antitrypsin deficiency, an inherited disorder that can cause early-onset emphysema, especially in the presence of smoke exposure. [15]

2. Objectives

- To assess the CAT score and serum CRP level in COPD patients before and after therapy.
- To correlate CAT score and serum CRP level with spirometric parameters in COPD patients.

3. Research Methodology

3.1 Study Design and Study Population

The present study entitled "The Role of CAT Score and CRP Level in Therapy Assessment of COPD Patients in Western Uttar Pradesh" was conducted as a prospective observational study in the Department of Respiratory Medicine, Krishna Mohan Medical College and Hospital, Mathura, from March 2024 to April 2025. The study included patients aged 40 years and above who were diagnosed with Chronic Obstructive Pulmonary Disease (COPD) according to the GOLD 2023 Guidelines and attended the Respiratory Medicine Outpatient Department during the study period. Patients with diabetes mellitus, systemic hypertension, pulmonary hypertension, cor pulmonale, coronary artery disease, ischemic heart disease, active or previously treated pulmonary or extrapulmonary tuberculosis, neurological disorders, rheumatological disorders, peripheral vascular disease, inability to perform spirometry, or unwillingness to participate in the study were excluded. A total of 40 eligible patients fulfilling the inclusion criteria and providing written informed consent were enrolled using a convenience sampling technique.



3.2 Sample Size and Ethical Considerations

The study included a sample size of 40 patients, which was determined based on the feasibility of recruiting eligible COPD patients during the study period and the availability of resources at the study center. All eligible patients who fulfilled the inclusion criteria and consented to participate were consecutively enrolled until the required sample size was achieved. Prior to commencement of the study, approval was obtained from the Institutional Ethics Committee of Krishna Mohan Medical College and Hospital, Mathura. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Written informed consent was obtained from every participant after explaining the objectives and procedures of the study in their preferred language, and confidentiality of patient information was maintained throughout the study.

3.3 Data Collection Procedure

Following enrollment, demographic details, clinical history, smoking history, and relevant examination findings were recorded in a structured case record form. At baseline, each participant completed the COPD Assessment Test (CAT) questionnaire in either English or Hindi, and the total CAT score was calculated. Venous blood samples were collected under aseptic precautions for estimation of serum C-reactive protein (CRP) levels. Pulmonary function testing was performed using a calibrated spirometer, and baseline values of forced expiratory volume in one second (FEV₁), forced vital capacity (FVC), and the FEV₁/FVC ratio were recorded. Subsequently, 400 µg of inhaled salbutamol was administered through a metered-dose inhaler, and post-bronchodilator spirometry was repeated after 15 minutes according to standard guidelines. All patients received treatment as per standard COPD management protocols. At the end of six weeks of therapy, patients were reassessed using the CAT questionnaire, serum CRP estimation, and spirometry. Baseline and follow-up values of CAT score, CRP level, and spirometric indices were compared to evaluate the response to therapy.

3.4 Statistical Analysis

The collected data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics. Qualitative variables were expressed as frequencies and percentages, whereas quantitative variables were presented as mean $\pm$ standard deviation (SD). Baseline and six-week follow-up values of CAT score, serum CRP level, and spirometric parameters were compared using the paired t-test. The correlation between CAT score and serum CRP level was assessed using the Pearson correlation coefficient. A p-value of less than 0.05 was considered statistically significant for all statistical analyses.



4. Results

Table 2: Distribution of Patients According to Age (n = 40)

Age Group (Years)	Frequency (n)	Percentage (%)
40–49	6	15.0
50–59	11	27.5
60–69	15	37.5
≥70	8	20.0
Total	40	100.0

Table presents the age-wise distribution of the 40 COPD patients included in the study. The majority of the patients belonged to the 60–69 years age group, accounting for 37.5% of the study population, followed by 27.5% in the 50–59 years age group. Patients aged 70 years and above constituted 20.0%, whereas only 15.0% were between 40 and 49 years of age. The findings indicate that the prevalence of COPD was considerably higher among older individuals, particularly those above 60 years of age. This age distribution is consistent with the natural history of COPD, which is characterized by progressive airflow limitation developing over several decades due to prolonged exposure to risk factors such as tobacco smoking, biomass fuel exposure, environmental pollution, and occupational dust. Increasing age is therefore an important determinant of COPD occurrence, emphasizing the need for early identification and timely intervention among susceptible populations.

Table 3: Distribution of Patients According to Gender (n = 40)

Gender	Frequency (n)	Percentage (%)
Male	31	77.5
Female	9	22.5
Total	40	100.0

Table depicts the gender distribution of the study participants. Out of the total 40 patients, 31 (77.5%) were males while 9 (22.5%) were females, indicating a marked male predominance in the study population. The higher proportion of male patients may be attributed to the greater prevalence of smoking, occupational exposure to dust and fumes, and other environmental risk factors among men in the study region. Although COPD has traditionally been considered more common in males, the



disease burden among females is increasing due to rising smoking prevalence and continued exposure to biomass fuel smoke in rural households. Nevertheless, the present findings suggest that male gender continues to be a major demographic characteristic among COPD patients attending the study centre, reflecting the local epidemiological pattern of the disease in Western Uttar Pradesh.

Table 4: Distribution of Patients According to Smoking Status (n = 40)

Smoking Status	Frequency (n)	Percentage (%)
Current Smoker	21	52.5
Former Smoker	13	32.5
Never Smoker	6	15.0
Total	40	100.0

Table shows the smoking status of the enrolled COPD patients. More than half of the participants (52.5%) were current smokers, while 32.5% were former smokers and 15.0% had never smoked. These observations indicate that smoking remains the predominant risk factor associated with COPD in the present study. The considerable proportion of former smokers also reflects that many patients had discontinued smoking following the onset or progression of respiratory symptoms. The presence of COPD among never-smokers suggests that additional factors such as biomass fuel exposure, passive smoking, occupational hazards, and environmental pollution may also contribute to disease development. Overall, the findings reinforce the well-established role of tobacco smoking in the pathogenesis of COPD and highlight the importance of smoking cessation as an essential component of disease prevention and management.

Table 5: Distribution According to GOLD Stage (n = 40)

GOLD Stage	Frequency (n)	Percentage (%)
I	4	10.0
II	14	35.0
III	16	40.0
IV	6	15.0
Total	40	100.0



Table illustrates the severity of airflow limitation according to the GOLD classification. The largest proportion of patients (40.0%) belonged to GOLD Stage III, followed by 35.0% in Stage II, while 15.0% were classified as Stage IV and only 10.0% were in Stage I. These findings indicate that the majority of patients sought medical attention only after developing moderate to severe airflow obstruction. Delayed diagnosis may result from gradual disease progression, poor awareness regarding COPD symptoms, limited healthcare accessibility, and underutilization of spirometry in routine clinical practice. The predominance of Stage II and Stage III disease further suggests that a substantial proportion of patients experience significant impairment before seeking specialized respiratory care. This emphasizes the importance of early screening among high-risk individuals to facilitate timely diagnosis and initiation of appropriate therapy.

Table 6: Comparison of CAT Score Before and After Therapy

CAT Score	Baseline (Mean $\pm$ SD)	6 Weeks (Mean $\pm$ SD)	Paired t-value	p-value
CAT Score	24.85 $\pm$ 5.42	17.65 $\pm$ 4.91	12.84	<0.001

Table compares the COPD Assessment Test (CAT) scores before initiation of treatment and after six weeks of therapy. The mean CAT score decreased significantly from 24.85 $\pm$ 5.42 at baseline to 17.65 $\pm$ 4.91 following treatment. Statistical analysis using the paired t-test demonstrated that this reduction was highly significant ($t = 12.84$, $p < 0.001$). The marked improvement in CAT score indicates that patients experienced substantial relief in respiratory symptoms and enhancement in their health-related quality of life following standard COPD therapy. Since the CAT questionnaire evaluates multiple domains including cough, sputum production, breathlessness, chest tightness, sleep quality, activity limitation, confidence, and energy levels, the observed decline reflects an overall improvement in disease impact on daily living. These findings support the usefulness of the CAT score as a practical and sensitive tool for monitoring therapeutic response in COPD patients during follow-up.

Table 7: Comparison of Serum CRP Level Before and After Therapy

CRP (mg/L)	Baseline (Mean $\pm$ SD)	6 Weeks (Mean $\pm$ SD)	Paired t-value	p-value
Serum CRP	8.76 $\pm$ 2.85	4.91 $\pm$ 1.98	11.63	<0.001

Table presents the comparison of serum C-reactive protein (CRP) levels before and after six weeks of treatment. The mean CRP level decreased from 8.76 $\pm$ 2.85 mg/L at baseline to 4.91 $\pm$ 1.98 mg/L after therapy, and the reduction was found to be statistically highly significant ($t = 11.63$, $p < 0.001$).



CRP is a well-recognized marker of systemic inflammation, and elevated levels are commonly associated with increased inflammatory activity in COPD. The significant decline observed after treatment suggests effective control of systemic inflammation following standard medical management. This reduction parallels the clinical improvement observed in CAT scores and supports the hypothesis that successful COPD treatment is accompanied by a measurable decrease in inflammatory burden. Therefore, serum CRP may serve as an objective biomarker for assessing treatment response and disease activity during follow-up.

Table 8: Comparison of Spirometric Parameters

Parameter	Baseline (Mean $\pm$ SD)	6 Weeks (Mean $\pm$ SD)	Paired t-value	p-value
FEV ₁ (L)	1.31 $\pm$ 0.38	1.49 $\pm$ 0.36	4.32	<0.001
FEV ₁ (% Predicted)	47.20 $\pm$ 10.62	53.84 $\pm$ 10.41	5.04	<0.001
FEV ₁ /FVC Ratio (%)	54.41 $\pm$ 6.48	58.26 $\pm$ 5.97	3.86	0.001

Table compares the spirometric parameters measured at baseline and after six weeks of treatment. The mean FEV₁ increased from 1.31 $\pm$ 0.38 L to 1.49 $\pm$ 0.36 L, while the predicted FEV₁ improved from 47.20 $\pm$ 10.62% to 53.84 $\pm$ 10.41%. Similarly, the mean FEV₁/FVC ratio increased from 54.41 $\pm$ 6.48% to 58.26 $\pm$ 5.97%. All observed improvements were statistically significant ($p < 0.05$). These findings indicate that appropriate pharmacological therapy resulted in measurable improvement in airflow limitation and pulmonary function. Although spirometric changes over a relatively short period are generally modest in COPD because of its irreversible nature, the significant improvements observed in this study suggest better bronchodilation, reduction in airway inflammation, and improved respiratory mechanics. Spirometry therefore continues to play an important role in objectively assessing pulmonary function during treatment.

Table 9: Correlation Between CAT Score and CRP at Baseline

Variables	Pearson's r	p-value
CAT Score vs CRP	0.69	<0.001



Table demonstrates the relationship between CAT score and serum CRP level at baseline. A strong positive correlation ($r = 0.69$, $p < 0.001$) was observed, indicating that patients with higher CAT scores also had higher CRP levels before treatment. This statistically significant association suggests that increased symptom burden and poorer health status were accompanied by greater systemic inflammation. Patients reporting severe respiratory symptoms therefore tended to exhibit elevated inflammatory marker levels. These findings support the concept that COPD is not only a pulmonary disease but also a systemic inflammatory disorder. The observed correlation highlights the complementary roles of CAT score and CRP level in evaluating disease severity and suggests that combining these parameters may provide a more comprehensive assessment of COPD than either measure alone.

Table 10: Correlation Between CAT Score and CRP After Therapy

Variables	Pearson's r	p-value
CAT Score vs CRP	0.56	<0.001

Table presents the correlation between CAT score and serum CRP level after six weeks of treatment. A moderate positive correlation ($r = 0.56$, $p < 0.001$) remained statistically significant following therapy. Although both CAT scores and CRP levels decreased after treatment, patients with relatively higher residual symptom scores continued to demonstrate higher CRP values. This finding indicates that improvements in clinical symptoms were accompanied by reductions in systemic inflammation, supporting the parallel behavior of these two parameters during therapeutic follow-up. The persistence of a positive correlation further emphasizes the usefulness of simultaneously assessing patient-reported outcomes and inflammatory biomarkers to evaluate treatment effectiveness and monitor disease progression.

Table 11: Correlation Between CAT Score and FEV₁

Variables	Pearson's r	p-value
CAT Score vs FEV ₁	-0.61	<0.001

Table demonstrates a statistically significant negative correlation between CAT score and FEV₁ ($r = -0.61$, $p < 0.001$). The negative correlation indicates that patients with lower pulmonary function had higher CAT scores, reflecting greater symptom burden and poorer health-related quality of life. As airflow limitation became more severe, patients experienced increased breathlessness, reduced exercise tolerance, greater activity limitation, and worsening daily functioning, resulting in higher



CAT scores. These findings support the inverse relationship between objective pulmonary function and subjective symptom assessment, emphasizing that CAT score effectively reflects the clinical impact of COPD while complementing spirometric evaluation during routine patient assessment.

Table 12: Correlation Between CRP and FEV₁

Variables	Pearson's r	p-value
CRP vs FEV ₁	-0.48	0.002

Table demonstrates a moderate negative correlation between serum CRP level and FEV₁ ($r = -0.48$, $p = 0.002$). The findings indicate that patients with lower lung function exhibited higher levels of systemic inflammation. This inverse relationship suggests that worsening airflow limitation is associated with increased inflammatory activity, supporting the role of inflammation in the pathogenesis and progression of COPD. Although CRP is a nonspecific inflammatory marker, its significant association with pulmonary function observed in the present study indicates that it may serve as a useful adjunctive biomarker for assessing disease severity and monitoring therapeutic response in COPD patients.

Table 13: Overall Change Following Therapy

Parameter	Baseline Mean $\pm$ SD	Follow-up Mean $\pm$ SD	Mean Difference	p-value
CAT Score	24.85 $\pm$ 5.42	17.65 $\pm$ 4.91	7.20	<0.001
CRP (mg/L)	8.76 $\pm$ 2.85	4.91 $\pm$ 1.98	3.85	<0.001
FEV ₁ (L)	1.31 $\pm$ 0.38	1.49 $\pm$ 0.36	0.18	<0.001
FEV ₁ /FVC Ratio (%)	54.41 $\pm$ 6.48	58.26 $\pm$ 5.97	3.85	0.001

Table summarizes the overall changes observed in CAT score, serum CRP level, and spirometric parameters following six weeks of treatment. There was a statistically significant reduction in both CAT score and serum CRP level, accompanied by significant improvement in FEV₁ and the FEV₁/FVC ratio. The decline in CAT score indicates improvement in patient-reported symptoms and quality of life, whereas the reduction in CRP reflects decreased systemic inflammation.

Simultaneously, the improvement in spirometric indices demonstrates better pulmonary function after therapy. Collectively, these findings suggest that standard COPD treatment produced meaningful clinical, biochemical, and physiological improvements. The results further support the combined use of CAT score and serum CRP level as practical, complementary tools for evaluating therapeutic response alongside conventional spirometric assessment in patients with COPD.

The present study conducted among 40 patients with Chronic Obstructive Pulmonary Disease (COPD) demonstrated that the disease was more common among older adults, with the majority of patients belonging to the 60–69 years age group, and showed a clear male predominance. Smoking was identified as the most common risk factor, and most patients were classified as GOLD Stage II or III, indicating moderate to severe airflow limitation. Following six weeks of standard therapy, there was a statistically significant reduction in the mean CAT score and serum CRP level, along with significant improvement in FEV₁, predicted FEV₁, and FEV₁/FVC ratio, reflecting improvement in both clinical symptoms and pulmonary function. A significant positive correlation was observed between CAT score and serum CRP level, while significant negative correlations were found between CAT score and FEV₁ and between CRP level and FEV₁, indicating that increased symptom burden and systemic inflammation were associated with poorer lung function. Overall, the findings suggest that the CAT score and serum CRP level are valuable, simple, and complementary tools for assessing therapeutic response in COPD patients, and when used together with spirometry, they provide a comprehensive evaluation of disease severity and treatment outcomes in routine clinical practice.

5. Discussion

The present prospective observational study evaluated the role of the COPD Assessment Test (CAT) score and serum C-reactive protein (CRP) level in assessing therapeutic response among 40 patients with Chronic Obstructive Pulmonary Disease (COPD) in Western Uttar Pradesh. The majority of the participants were older adults, predominantly males, with smoking being the most common risk factor, and most patients had moderate to severe airflow limitation according to GOLD staging. Following six weeks of standard therapy, a statistically significant reduction was observed in the mean CAT score and serum CRP level, accompanied by significant improvement in spirometric parameters, indicating improvement in both symptom burden and pulmonary function. [16] A significant positive correlation between CAT score and CRP level and significant negative correlations of both CAT score and CRP level with FEV₁ suggest that worsening symptoms and increased systemic inflammation are associated with greater airflow limitation. These findings support the concept that COPD is not only characterized by persistent airflow obstruction but also by systemic inflammation, and that assessment based solely on spirometry may not fully reflect disease activity. [17] Similar observations have been reported by Jones et al., who demonstrated that CAT is a reliable and responsive measure of health status in COPD,¹ while studies by Gan et al. and Celli et al. showed that elevated CRP levels are associated with increased systemic inflammation, disease severity, and poorer clinical outcomes in COPD.^{2,3} Therefore, the present study suggests that the



combined use of CAT score and serum CRP level, along with spirometry, provides a more comprehensive assessment of therapeutic response and disease monitoring than spirometry alone, making these tools valuable for routine clinical practice in the management of COPD patients.

6. Conclusion

The present study demonstrated that both the COPD Assessment Test (CAT) score and serum C-reactive protein (CRP) level are effective indicators for assessing therapeutic response in patients with Chronic Obstructive Pulmonary Disease. Following six weeks of standard treatment, significant improvement was observed in clinical symptoms, systemic inflammation, and pulmonary function, as evidenced by reduced CAT scores and CRP levels together with improved spirometric parameters. The significant positive correlation between CAT score and CRP level and the negative correlation of these parameters with FEV₁ indicate that increasing symptom burden and systemic inflammation are associated with worsening lung function. These findings suggest that CAT score and serum CRP level provide complementary information to spirometry and together offer a more comprehensive assessment of disease severity and treatment response. Therefore, incorporating CAT score and serum CRP estimation into routine clinical practice may facilitate better monitoring, individualized patient management, and improved therapeutic evaluation in patients with COPD.

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