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Original Research Article

Comparative Evaluation of Pulmonary Function, Symptom Burden, and Quality of Life in Asthma and Chronic Obstructive Pulmonary Disease in Central India

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Abstract

Background: Asthma and chronic obstructive pulmonary disease (COPD) are common obstructive airway diseases with overlapping clinical features. Despite similar symptomatology, they differ in pathophysiology, reversibility of airflow obstruction, and systemic involvement. Differentiating these entities and quantifying disease burden is crucial for appropriate management.

Objectives: To compare pulmonary function, symptom burden, exercise capacity, and health-related quality of life between asthma and COPD patients using spirometry, COPD Assessment Test (CAT), dyspnea grading, functional indices, and quality-of-life measures.

Methods: A case–control study was conducted in 180 participants including COPD patients and asthma subjects. Spirometry (FVC, FEV1, FEV1/FVC), CAT score, modified Medical Research Council (mMRC) dyspnea scale, six-minute walk distance (6MWD), Body Mass Index (BMI), BODE index, and St. George's Respiratory Questionnaire (SGRQ) were evaluated. Group comparisons were performed and significance was assessed using p-values.

Results: Mean FVC and FEV1 were lower in COPD than asthma, though not statistically significant (p=0.136 and p=0.073, respectively). However, the FEV1/FVC ratio was significantly lower in COPD compared with asthma (62.04 ± 20.01 vs 72.59 ± 11.30; p=0.011), confirming more severe and irreversible airflow limitation. COPD patients exhibited higher CAT, mMRC, BODE, and SGRQ scores and reduced exercise capacity, indicating greater symptom burden and poorer quality of life.

Conclusion: Although asthma and COPD share clinical manifestations, COPD is associated with significantly greater airflow limitation, functional impairment, and quality-of-life deterioration. Integration of spirometry with symptom-based and multidimensional tools such as CAT, BODE index, and SGRQ enhances differentiation and comprehensive disease assessment.

Keywords: Asthma, COPD, Spirometry, CAT score, Quality of Life, Central India.

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Introduction

Asthma and chronic obstructive pulmonary disease (COPD) are two of the most prevalent chronic respiratory disorders worldwide and contribute substantially to morbidity, mortality, and healthcare utilization [1]. Both conditions are characterized by airflow limitation, cough, wheeze, and dyspnea, leading to considerable overlap in clinical presentation, particularly among older adults and smokers. Despite these similarities, asthma and COPD are distinct disease entities with differing pathophysiological mechanisms, disease progression, and response to therapy [2]. Asthma is typically characterized by variable and largely reversible airflow obstruction, airway hyperresponsiveness, and inflammation predominantly involving eosinophils and Th2-mediated immune pathways [3]. In contrast, COPD is a progressive disease marked by persistent, largely irreversible airflow limitation due to chronic inflammation, airway remodeling, small

airway disease, and destruction of lung parenchyma (emphysema) [4]. Cigarette smoking, biomass fuel exposure, occupational pollutants, and environmental air pollution are key etiological factors in COPD, whereas asthma is influenced by genetic predisposition, allergens, and environmental triggers [5,6].

The global burden of COPD and asthma is substantial. The Global Burden of Disease study ranks COPD among the leading causes of death worldwide [7], while asthma affects more than 300 million individuals globally and is a major cause of disability [8]. In India, both diseases contribute significantly to respiratory morbidity, particularly in rural populations exposed to biomass fuel and ambient pollution [9,10]. The coexistence of asthma and COPD features in some individuals further complicates diagnosis and management, leading to the recognition of asthma–COPD overlap phenotypes [11].

Spirometry is the cornerstone for diagnosing and differentiating obstructive airway diseases. The forced expiratory volume in one second (FEV1), forced vital capacity (FVC), and FEV1/FVC ratio provide objective measures of airflow obstruction [12]. In asthma, airflow limitation is typically reversible with bronchodilators, whereas in COPD, obstruction persists and progressively worsens [13]. However, spirometric indices alone do not fully capture symptom burden, functional limitation, or quality-of-life impairment. Patients with similar lung function may report markedly different levels of dyspnea, fatigue, and activity restriction [14].

Health-related quality of life has therefore become an essential outcome in chronic respiratory disease assessment. Instruments such as the St. George's Respiratory Questionnaire (SGRQ) provide disease-specific evaluation of symptoms, activity limitation, and psychosocial impact [15]. Although widely validated, SGRQ is lengthy and complex, limiting its routine clinical use. To overcome this limitation, the COPD Assessment Test (CAT) was developed as a simple, eight-item questionnaire that quantifies the overall impact of respiratory disease on daily life [16]. CAT has demonstrated strong reliability and validity in COPD populations and has been correlated with spirometry, dyspnea scales, and quality-of-life indices [17–19].

Beyond symptom scales, multidimensional indices such as the BODE index (Body mass index, airflow Obstruction, Dyspnea, and Exercise capacity) integrate physiological, functional, and symptomatic parameters to predict morbidity and mortality in COPD [20]. Exercise capacity assessed by the six-minute walk test (6MWT) is another important indicator of functional limitation and prognosis in chronic respiratory disease [21]. Dyspnea severity, commonly graded using the modified Medical Research Council (mMRC) scale, is a key determinant of activity limitation and health status [22]. While numerous studies have evaluated these parameters in COPD, comparative data between asthma and COPD—particularly in the Indian context—remain limited.

Differentiating these conditions is clinically important, as treatment strategies, disease monitoring, and prognostic implications differ substantially. Moreover, understanding differences in quality-of-life impairment and functional limitation may help tailor management strategies and improve patient outcomes.

Therefore, the present study was undertaken to compare pulmonary function, symptom burden, exercise capacity, multidimensional disease severity, and health-related quality of life between asthma and COPD patients in Central India using spirometry, CAT score, mMRC dyspnea grading, BODE index, 6MWD, and SGRQ.

Materials and Methods

This hospital-based case–control study was conducted in the Departments of Physiology and Respiratory Medicine at a tertiary care teaching hospital in Central India.

Study Population and Sample Size

A total of 180 participants were enrolled. Subjects were categorized into:

COPD group: Diagnosed patients fulfilling GOLD criteria

Asthma group: Patients with physician-diagnosed asthma based on clinical features and spirometric reversibility

Sample size was calculated using standard statistical formulae with $\alpha = 5\%$, $\beta = 20\%$ (power = 80%), and adjustment for data loss.

Inclusion Criteria

1. Adults aged ≥35 years
2. Confirmed diagnosis of asthma or COPD
3. Clinically stable (no acute exacerbation in the preceding 6 weeks)
4. Ability to perform spirometry and six-minute walk test
5. Willingness to participate with informed consent

Exclusion Criteria

1. Oxygen saturation <90% during 6MWT
2. Patients on long-term oxygen therapy
3. Inability to perform spirometry or walk test
4. Presence of severe comorbid conditions limiting exercise performance

Study Tools and Measurements

- Pulmonary Function Tests (PFT):
- Standard spirometry to measure FVC, FEV1, and FEV1/FVC ratio.
- Symptom Assessment:
- COPD Assessment Test (CAT) questionnaire.
- Dyspnea Grading:
- Modified Medical Research Council (mMRC) dyspnea scale.
- Exercise Capacity:
- Six-minute walk test (6MWT) performed according to American Thoracic Society guidelines.
- Nutritional Status:
- Body Mass Index (BMI).
- Multidimensional Disease Severity:
- BODE index.
- Quality of Life:
- St. George's Respiratory Questionnaire (SGRQ).

Statistical Analysis: Data were analyzed using statistical software. Continuous variables were expressed as mean ± standard deviation and categorical variables as percentages. Differences between asthma and COPD groups were assessed using appropriate statistical tests. A p-value <0.05 was considered statistically significant.

Results

Pulmonary function testing demonstrated that both asthma and COPD patients had impaired lung function; however, the degree of airflow limitation differed between the two groups.

The mean FVC was lower in COPD patients (55.24 ± 23.97) compared to asthma patients (64.58 ± 35.64), though this difference did not reach statistical significance (p = 0.136). Similarly, mean FEV1 was reduced in the COPD group (43.03 ± 15.60) compared with the asthma group (50.37 ± 23.34), but this difference was also not statistically significant (p = 0.073).

(Comparative Analysis of Pulmonary Function in COPD vs Asthma)

Table 1: Pulmonary Function Test Comparison between COPD and Asthma

Parameter	COPD (Mean ± SD)	Asthma (Mean ± SD)	P value
FVC	55.24 ± 23.97	64.58 ± 35.64	0.136
FEV1	43.03 ± 15.60	50.37 ± 23.34	0.073
FEV1/FVC	**62.04 ± 20.01**	**72.59 ± 11.30**	**0.011**

P < 0.05 = statistically significant

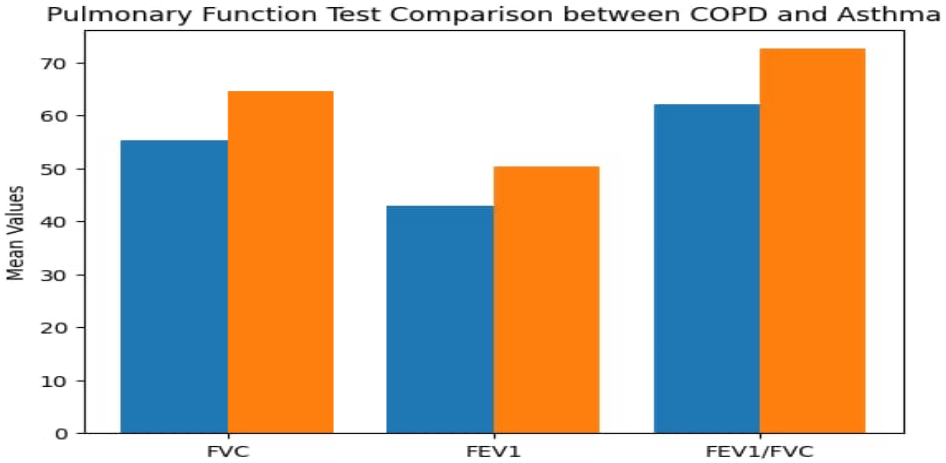
The comparison of spirometric parameters between COPD and asthma patients revealed varying degrees of statistical significance.

Forced Vital Capacity (FVC): The mean FVC was lower in COPD patients (55.24 ± 23.97) compared to asthma patients (64.58 ± 35.64). However, this difference was not statistically significant (p = 0.136).

This indicates that although COPD patients demonstrated reduced lung volumes, the observed difference could be due to random variation and does not conclusively differentiate the two groups based on FVC alone.

Forced Expiratory Volume in 1 second (FEV_1): Mean FEV_1 was also lower in the COPD group (43.03 ± 15.60) than in the asthma group (50.37 ± 23.34). The difference approached significance but remained statistically non-significant (p = 0.073).

This suggests a trend toward greater airflow limitation in COPD, but the difference was insufficient to reach the conventional level of statistical significance (p < 0.05).



Graph 2: Pulmonary Function Test Comparison between COPD and Asthma

Table 2: Summary of Symptom Burden, Functional Limitation and Quality of Life

Parameter	COPD	Asthma	Interpretation
CAT Score	Higher	Lower	Greater symptom burden in COPD
MMRC Dyspnea	Higher	Lower	More severe dyspnea in COPD
BODE Index	Higher	Lower	Greater multidimensional severity in COPD
SGRQ Score	Higher	Lower	Poorer quality of life in COPD
6-Min Walk Distance	Lower	Higher	Reduced exercise capacity in COPD

In contrast, the FEV1/FVC ratio showed a statistically significant difference between the two groups. COPD patients had a markedly lower mean FEV1/FVC ratio (62.04 ± 20.01) compared with asthma patients (72.59 ± 11.30; p = 0.011), indicating more severe and persistent airflow obstruction in COPD. This finding confirms the presence of irreversible airway limitation in COPD relative to the more reversible obstruction observed in asthma.

Assessment of symptom burden and functional status revealed greater disease impact among COPD patients. CAT scores were higher in the COPD group, reflecting increased symptom severity and daily activity limitation. Dyspnea severity measured by the mMRC scale was also greater in COPD, with a higher proportion of patients reporting moderate-to-severe breathlessness compared to asthma patients. Functional capacity assessed by the six-minute walk test was reduced in COPD, indicating impaired exercise tolerance and physical performance.

Quality-of-life assessment using SGRQ demonstrated significantly poorer health status among COPD patients. Higher total SGRQ scores in COPD indicated greater limitations in physical activity, increased symptom burden, and more pronounced psychosocial impact. The multidimensional BODE index was also higher in COPD, reflecting combined effects of airflow obstruction, dyspnea, nutritional status, and reduced exercise capacity. Overall, while both asthma and COPD patients experienced functional limitation and impaired quality of life, the magnitude of impairment was consistently greater in COPD.

Discussion

The present study provides a comprehensive comparison of pulmonary function, symptom burden, functional capacity, and quality-of-life impairment between asthma and COPD patients in Central India. Although both conditions share common respiratory symptoms, our findings clearly demonstrate that COPD is associated with more severe and persistent airflow limitation, greater functional impairment, and poorer health-related quality of life. The significantly lower FEV1/FVC ratio observed in COPD patients compared with asthma patients (p = 0.011) is a key physiological distinction. This finding reflects the irreversible nature of airway obstruction in COPD due to airway remodeling, small airway disease, and emphysematous destruction, as described by Celli and Barnes [4]. In contrast, asthma is characterized by variable and largely reversible airflow obstruction, which explains the comparatively higher FEV1/FVC ratios in the asthma group [3]. Similar observations have been reported in previous comparative studies, emphasizing the diagnostic value of FEV1/FVC in differentiating these conditions [12,13].

Symptom burden assessed using CAT was consistently higher among COPD patients, indicating greater impact on daily activities and overall health status. Jones et al. [16] originally developed CAT as a measure of disease impact in COPD, and subsequent studies have shown strong associations between CAT scores and symptom severity, dyspnea, and functional limitation [17,18]. Our findings extend this evidence by demonstrating that CAT scores are also useful in distinguishing disease burden between COPD and asthma, with COPD patients experiencing more pronounced impairment.

Dyspnea, a hallmark symptom of chronic airway disease, was more severe in the COPD group as measured by mMRC. Nishimura et al. [22] reported that dyspnea is a strong predictor of survival in COPD, often exceeding spirometric indices in prognostic significance. The greater dyspnea burden observed in our COPD patients is therefore clinically relevant and highlights the systemic and functional consequences of persistent airflow limitation.

Exercise capacity, assessed by 6MWT, was reduced in COPD patients compared with asthma patients. Reduced exercise tolerance in COPD has been attributed to ventilatory limitation, dynamic hyperinflation, peripheral muscle dysfunction, and cardiovascular comorbidity [21]. In contrast, asthma patients—particularly in stable phases—often maintain better functional capacity. This difference reinforces the more extensive systemic involvement characteristic of COPD.

Quality-of-life impairment measured by SGRQ was also significantly greater in COPD. SGRQ has been widely used to quantify disease impact in chronic respiratory disorders [15]. Higher SGRQ scores in COPD reflect greater symptom frequency, activity

restriction, and psychosocial distress. Previous studies by Oga et al. [14] and Hwang et al. [19] have demonstrated that COPD patients report poorer health status than asthma patients, even at similar levels of airflow obstruction. Our results are consistent with these findings and highlight the need for comprehensive assessment beyond spirometry. The higher BODE index observed in COPD further underscores the multidimensional severity of the disease. Celli et al. [20] established BODE as a powerful predictor of mortality in COPD by integrating nutritional status, airflow obstruction, dyspnea, and exercise capacity. The greater BODE scores in COPD patients in our study reflect the combined physiological, functional, and systemic burden of the disease, which is less pronounced in asthma. From a clinical perspective, these findings have important implications. Although asthma and COPD may present with similar symptoms, reliance on symptom reporting alone can lead to misclassification. Integrating spirometry with patient-reported outcomes such as CAT, functional measures such as 6MWT, and quality-of-life instruments such as SGRQ provides a more comprehensive understanding of disease burden. This multidimensional approach is particularly valuable in resource-limited settings, where rapid and effective assessment tools are needed to guide management.

Moreover, the greater impairment observed in COPD emphasizes the need for early diagnosis, aggressive risk factor modification, pulmonary rehabilitation, and long-term monitoring. In asthma, where reversibility and response to therapy are more favorable, targeted anti-inflammatory treatment and trigger avoidance remain central. Differentiating these conditions accurately therefore has direct therapeutic and prognostic implications.

Conclusion

Although asthma and COPD share overlapping clinical features, COPD is characterized by significantly greater and irreversible airflow limitation, higher symptom burden, reduced exercise capacity, and poorer quality of life. The significantly lower FEV1/FVC ratio, higher CAT and mMRC scores, increased BODE index, and elevated SGRQ scores in COPD patients highlight the greater systemic and functional impact of the disease. Integrating spirometry with symptom-based and multidimensional assessment tools enhances differentiation and provides a more comprehensive evaluation of disease burden in chronic obstructive airway diseases.

Limitations

1. Single-center study limits generalizability.
2. Cross-sectional design prevents assessment of longitudinal outcomes.
3. Potential overlap between early asthma and COPD phenotypes.
4. Lack of advanced imaging and biomarker analysis.

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