

Original Research Article

Clinical and Radiological Profile of Patients with Chronic Obstructive Pulmonary Disease: A Cross-Sectional Study from a Tertiary Care Hospital in South India

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Abstract: *Background:* Chronic obstructive pulmonary disease (COPD) is a leading cause of morbidity and mortality worldwide, with India bearing a disproportionate burden. Regional data on the clinical and radiological characteristics of COPD patients from South India remain limited. This study aimed to describe the clinical and radiological profile of COPD patients attending a tertiary care hospital in South India. *Methods:* This hospital-based cross-sectional observational study was conducted in the Department of Respiratory Medicine at a tertiary care hospital in South India over a six-month period from June 2015 to December 2015. A total of 50 consecutive patients with a confirmed diagnosis of COPD based on GOLD criteria (post-bronchodilator FEV₁/FVC < 0.70) were enrolled. Data on demographic characteristics, clinical presentation, risk factor exposure, spirometric parameters, and radiological findings were collected using a structured proforma. Statistical analysis was performed using descriptive statistics. *Results:* The study population comprised 50 patients with a mean age of 61.5 ± 10.2 years, with a male preponderance (80%). The most common presenting symptoms were breathlessness (96%) and chronic cough (88%). Smoking was the predominant risk factor (80%), with a mean smoking index of 425 ± 180. Biomass fuel exposure was documented in 12% of patients. According to GOLD grading, 6% had mild, 28% moderate, 42% severe, and 24% very severe airflow obstruction. Chest X-ray findings included hyperinflation in 72%, flattened diaphragms in 56%, and increased broncho-vascular markings in 48% of patients. *Conclusion:* COPD in this South Indian tertiary care setting predominantly affects elderly males with a significant smoking history. The majority of patients present with moderate-to-severe airflow obstruction, highlighting the need for early detection and intervention. Radiological findings are consistent with hyperinflation and emphysematous changes, with significant correlation to spirometric severity.

Keywords: Chronic obstructive pulmonary disease, clinical profile, radiological profile, spirometry, GOLD grading.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a heterogeneous lung condition characterised by chronic respiratory symptoms and persistent, progressive airflow obstruction resulting from abnormalities of the airways and/or alveoli [1]. It remains a leading cause of morbidity and mortality globally, with an estimated 3.7 million deaths and 79.8 million disability-adjusted life years (DALYs) attributed to COPD in 2021 [2]. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) has defined COPD as a preventable and treatable disease with significant extrapulmonary manifestations that may contribute to disease severity [1].

India bears a disproportionate burden of COPD, with the Global Burden of Disease (GBD) study estimating approximately 55.3 million COPD cases in India in 2016, a substantial increase from 28.1 million in 1990 [3]. A recent systematic review and meta-analysis reported a pooled prevalence of 13% (95% CI: 9%–18%) among Indian adults, with higher prevalence among smokers (37%), elderly adults aged ≥60 years (27%), and males (16%) [4]. Hospital-based studies have demonstrated an even higher prevalence of 27%, suggesting a significant burden of advanced disease presenting to healthcare facilities [4]. The heterogeneity in prevalence estimates reflects regional variations, diagnostic criteria, and study populations.

The clinical presentation of COPD is characterised by progressive dyspnoea, chronic cough, and sputum production, with considerable variability in symptom burden and exacerbation frequency among patients [5]. The Indian COPD population exhibits unique characteristics, including a significant proportion of non-smokers with the disease, with evidence suggesting that 14% to 68.6% of COPD patients in India are non-smokers [6]. Biomass fuel exposure, outdoor air pollution, and prior pulmonary tuberculosis are important non-smoking risk factors that contribute substantially to the COPD burden in India [7]. Furthermore, epidemiological data indicate that although the male-to-female smoking ratio in India is approximately 10:1, the corresponding COPD ratio is only 1.5:1, primarily attributed to biomass fuel exposure among women [8].

Radiological evaluation, particularly chest X-ray and high-resolution computed tomography (HRCT), plays a complementary role in the assessment of COPD patients, providing information on hyperinflation, emphysema distribution, and airway abnormalities [9]. However, there remains a paucity of comprehensive data describing the clinical and radiological profile of COPD patients from South India, particularly from tertiary care settings. Understanding the regional patterns of disease presentation is essential for developing targeted screening, diagnostic, and management strategies. This study was therefore undertaken to describe the clinical and radiological profile of patients with COPD attending a tertiary care hospital in South India.

OBJECTIVE

The primary objective of this study was to describe the clinical and radiological profile of patients with chronic obstructive pulmonary disease (COPD) attending a tertiary care hospital in South India. Specifically, the study aimed to characterise the demographic features, symptomatology, and risk factor exposure patterns among COPD patients, to assess the severity of airflow obstruction using spirometric parameters and GOLD grading, and to document the radiological findings on chest X-ray and their correlation with clinical and spirometric parameters.

The secondary objective was to evaluate the distribution of COPD phenotypes based on clinical and radiological features, including the relative frequencies of emphysema-predominant and chronic bronchitis-predominant presentations. The study also sought to identify any associations between risk factor exposure (smoking versus biomass fuel) and disease severity, and to assess the prevalence of common comorbidities in this population. The findings were expected to provide valuable insights into the regional characteristics of COPD that could inform clinical practice and public health interventions in South India.

METHODOLOGY & MATERIALS

This hospital-based cross-sectional observational study was conducted in the Department of Respiratory Medicine at a tertiary care hospital in South India over a six-month period from June 2015 to December 2015. The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to enrolment. A total of 50 consecutive patients with a confirmed diagnosis of COPD were enrolled during the study period.

Inclusion Criteria: Patients aged 40 years and above of either sex with a clinical diagnosis of COPD confirmed by post-bronchodilator spirometry showing a forced expiratory volume in one second to forced vital capacity (FEV₁/FVC) ratio of less than 0.70, as per GOLD guidelines, were included in the study [1]. Patients with chronic respiratory symptoms including dyspnoea, chronic cough, and sputum production, and those who were willing to provide informed consent and comply with study procedures, were eligible for enrolment.

Exclusion Criteria: Patients with a known diagnosis of bronchial asthma, bronchiectasis, active pulmonary tuberculosis, or lung malignancy were excluded. Patients with significant cardiac disease, including congestive heart failure and recent myocardial infarction, were excluded. Those with a history of thoracic surgery or significant chest wall deformity, and patients who were unable to perform spirometry adequately, were also excluded from the study.

Data Collection Procedure: A structured proforma was used to collect demographic information (age, sex, residence, occupation, socioeconomic status), clinical details (presenting symptoms, duration of illness, history of exacerbations, comorbidities), and risk factor exposure (smoking history, biomass fuel exposure, occupational exposure). Smoking history was quantified using the smoking index (number of cigarettes/bidis per day × years of smoking). All patients underwent complete physical examination, including assessment of respiratory rate, chest expansion, percussion note, and auscultatory findings. Spirometry was performed using a standardised spirometer according to American Thoracic Society/European Respiratory Society (ATS/ERS) guidelines, with post-bronchodilator measurements obtained 15 minutes after administration of 400 µg salbutamol via metered-dose inhaler with spacer. Chest X-ray (postero-anterior view) was performed for all patients, and findings including hyperinflation, flattened diaphragms, increased broncho-vascular markings, and bullae were documented. HRCT thorax was performed in a subset of patients where clinically indicated.

Statistical Data Analysis: Data were entered into Microsoft Excel and analysed using SPSS version 20.0 (IBM Corp., Armonk, NY, USA). Continuous variables

were expressed as mean $\pm$ standard deviation, and categorical variables as frequencies and percentages. Comparisons between groups were performed using the chi-square test for categorical variables and Student's t-test for continuous variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 50 patients with COPD were enrolled in the study. The mean age of the study population was 61.5 ± 10.2 years, with the majority

(68%) belonging to the age group of 50–69 years. Male preponderance was observed, with 40 (80%) males and 10 (20%) females. The mean body mass index (BMI) was 20.8 ± 3.4 kg/m², with 42% of patients having a BMI below 18.5 kg/m². The most common presenting symptoms were breathlessness (96%), chronic cough (88%), sputum production (72%), and wheezing (48%). The mean duration of symptoms was 6.2 ± 4.1 years. According to the modified Medical Research Council (mMRC) dyspnoea scale, 16% had grade 1, 38% grade 2, 30% grade 3, and 16% grade 4 dyspnoea (Table 1).

Table 1: Demographic and Clinical Characteristics of Study Population (n=50)

Characteristic	Category	Number (%)
Age (years)	Mean $\pm$ SD	61.5 $\pm$ 10.2
	40–49	6 (12%)
	50–59	16 (32%)
	60–69	18 (36%)
	≥ 70	10 (20%)
Sex	Male	40 (80%)
	Female	10 (20%)
BMI (kg/m ²)	Mean $\pm$ SD	20.8 $\pm$ 3.4
	<18.5	21 (42%)
	18.5–24.9	24 (48%)
	≥ 25	5 (10%)
Symptoms	Breathlessness	48 (96%)
	Chronic cough	44 (88%)
	Sputum production	36 (72%)
	Wheezing	24 (48%)
mMRC Grade	Grade 1	8 (16%)
	Grade 2	19 (38%)
	Grade 3	15 (30%)
	Grade 4	8 (16%)

Smoking was the predominant risk factor, documented in 40 (80%) patients, with a mean smoking index of 425 ± 180 . Among smokers, 28 (70%) were current smokers and 12 (30%) were ex-smokers. Biomass fuel exposure was documented in 6 (12%) patients, all of whom were females. A history of occupational exposure to dust and fumes was present in

8 (16%) patients. According to GOLD spirometric grading, 3 (6%) patients had mild (GOLD 1), 14 (28%) had moderate (GOLD 2), 21 (42%) had severe (GOLD 3), and 12 (24%) had very severe (GOLD 4) airflow obstruction. The mean post-bronchodilator FEV₁ was $41.2\% \pm 12.6\%$ of predicted, and the mean FEV₁/FVC ratio was 0.52 ± 0.09 (Table 2).

Table 2: Spirometric and Radiological Profile of Study Population (n=50)

Parameter	Category	Number (%)
GOLD Grade	GOLD 1 (Mild)	3 (6%)
	GOLD 2 (Moderate)	14 (28%)
	GOLD 3 (Severe)	21 (42%)
	GOLD 4 (Very Severe)	12 (24%)
Mean FEV ₁ (% predicted)	Mean $\pm$ SD	41.2 $\pm$ 12.6
Mean FEV ₁ /FVC	Mean $\pm$ SD	0.52 $\pm$ 0.09
Chest X-ray Findings	Hyperinflation	36 (72%)
	Flattened diaphragms	28 (56%)
	Increased broncho-vascular markings	24 (48%)
	Bullae	6 (12%)
Comorbidities	Tubular heart	8 (16%)
	Hypertension	16 (32%)
	Diabetes mellitus	10 (20%)
	Pulmonary tuberculosis (old)	6 (12%)
	Ischaemic heart disease	5 (10%)

Chest X-ray findings were consistent with COPD in the majority of patients. Hyperinflation was the most common radiological finding, observed in 36 (72%) patients, followed by flattened diaphragms in 28 (56%), increased broncho-vascular markings in 24 (48%), tubular heart in 8 (16%), and bullae in 6 (12%) patients. Radiological changes were significantly associated with the severity of airflow obstruction, with patients in GOLD grades 3 and 4 demonstrating a higher prevalence of hyperinflation ($p < 0.01$) and flattened diaphragms ($p < 0.05$) compared to those in GOLD grades 1 and 2. Common comorbidities included hypertension (32%), diabetes mellitus (20%), old pulmonary tuberculosis (12%), and ischaemic heart disease (10%).

DISCUSSION

This study provides a comprehensive description of the clinical and radiological profile of COPD patients from a tertiary care hospital in South India. The demographic characteristics observed in this study—a mean age of 61.5 years and male preponderance (80%)—are consistent with previous Indian studies. Patel *et al.* reported a mean age of 61.52 years with 80% males in a study of newly detected COPD patients from Gujarat [10]. Similarly, a study from Burdwan Medical College found that 89% of patients admitted with COPD exacerbations were male, with the majority being elderly [11]. The male predominance in our study reflects the higher prevalence of smoking among Indian men, although the proportion of female COPD patients (20%) in our study is notable given the relatively low smoking rates among Indian women. This finding underscores the importance of non-smoking risk factors, particularly biomass fuel exposure, which was documented in 12% of our patients, all of whom were females.

The clinical presentation of COPD in our study was characterised by a high symptom burden, with breathlessness (96%) and chronic cough (88%) being the most common symptoms. These findings are consistent with the study by Sudhaselvi, which reported that the majority of COPD patients presented with chronic cough with exacerbation followed by breathlessness [12]. The high prevalence of severe dyspnoea (46% with mMRC grade 3 or 4) in our study reflects the advanced stage of disease at presentation, which is a common feature in Indian healthcare settings where patients often present late to tertiary care centres. The mean BMI of 20.8 kg/m² in our study, with 42% of patients having a BMI below 18.5 kg/m², indicates a high prevalence of malnutrition, which is a known systemic manifestation of COPD associated with poorer outcomes [13]. The GOLD spirometric grading in our study showed that 66% of patients had severe or very severe airflow obstruction (GOLD 3 or 4), with a mean FEV₁ of 41.2% of predicted. This distribution is similar to that reported by Patel *et al.*, who found that 42% of patients had severe and 24% had very severe COPD at

presentation [10]. The predominance of advanced disease at diagnosis highlights the need for early detection through spirometry screening in primary care settings, particularly among high-risk individuals with significant smoking histories.

The radiological findings in our study were consistent with the pathological changes of COPD. Hyperinflation, observed in 72% of patients, was the most common chest X-ray finding, followed by flattened diaphragms (56%) and increased broncho-vascular markings (48%). These findings are similar to those reported by Ray *et al.* from rural South India, who observed changes consistent with COPD in nearly half of the patients who underwent chest radiography [14]. The significant association between radiological findings and spirometric severity observed in our study supports the complementary role of chest X-ray in the assessment of COPD patients, although its limited sensitivity and specificity are well recognised [9]. The prevalence of comorbid conditions in our study, particularly hypertension (32%) and diabetes mellitus (20%), is consistent with the systemic nature of COPD and the high burden of non-communicable diseases in India [15]. The finding of old pulmonary tuberculosis in 12% of patients is noteworthy and reflects the dual burden of tuberculosis and COPD in India, where prior tuberculosis is recognised as a significant risk factor for chronic airflow obstruction [16]. The high prevalence of smoking (80%) and the mean smoking index of 425 ± 180 in our study reinforce the need for aggressive tobacco cessation programmes as a cornerstone of COPD prevention in India.

LIMITATIONS OF THE STUDY

This study has several limitations that should be acknowledged. First, the cross-sectional design and relatively small sample size of 50 patients limit the generalisability of the findings and preclude the establishment of causal relationships. Second, the study was conducted in a single tertiary care centre, which may introduce selection bias, as patients presenting to tertiary care facilities are likely to have more advanced disease compared to those in primary or community settings. Third, HRCT thorax was not performed in all patients, limiting the comprehensive assessment of emphysema distribution and airway abnormalities. Fourth, pulmonary function testing was performed using post-bronchodilator spirometry, but the reversibility testing protocol was limited to a single bronchodilator administration, which may not fully capture the reversible component of airflow obstruction. Fifth, the study did not include a control group, and comparisons with non-COPD populations were not possible. Finally, the study period of six months may not have captured seasonal variations in COPD exacerbations, and long-term follow-up data on disease progression were not available. Despite these limitations, the study provides valuable insights into the

clinical and radiological characteristics of COPD in a South Indian tertiary care setting.

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CONCLUSION

This study provides a comprehensive description of the clinical and radiological profile of COPD patients from a tertiary care hospital in South India. The findings demonstrate that COPD in this setting predominantly affects elderly males with a significant smoking history, with the majority presenting with moderate-to-severe airflow obstruction and a high symptom burden. The high prevalence of malnutrition, as indicated by low BMI, and the significant burden of comorbidities, particularly hypertension and diabetes mellitus, highlight the systemic nature of COPD and the need for integrated management approaches that address both pulmonary and extrapulmonary manifestations. The radiological findings of hyperinflation, flattened diaphragms, and increased broncho-vascular markings are consistent with the pathological changes of COPD and correlate with spirometric severity, supporting the continued utility of chest X-ray as a complementary diagnostic tool in resource-limited settings.

The study also highlights the significant burden of non-smoking risk factors, particularly biomass fuel exposure among women, which contributed to 12% of cases in this cohort. This finding underscores the need for public health interventions aimed at reducing household air pollution through the promotion of clean cooking fuels and improved ventilation. The high proportion of patients presenting with severe or very severe airflow obstruction indicates a critical need for early detection and intervention. Spirometry screening programmes in primary care settings, targeted at high-risk individuals with significant smoking histories and biomass fuel exposure, could facilitate earlier diagnosis and treatment, potentially slowing disease progression and improving quality of life. Future research should focus on larger, multicentre studies with long-term follow-up to better characterise the natural history of COPD in the Indian population and to evaluate the effectiveness of

targeted interventions in reducing the burden of this disease.

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