e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(6); 1368-1373

Original Research Article

Study of Prevalence of Hypertension, Dyslipidaemia, Diabetes and Abnormal Thyroid in Copd and Its Correlation with Severity

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Received: 01-03-2026 / Revised: 15-04-2026 / Accepted: 21-05-2026

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Conflict of interest: Nil

Abstract

Background: COPD is a major cause of morbidity and mortality around the world and is often complicated by other conditions like hypertension, diabetes mellitus, and dyslipidaemia and thyroid dysfunction. They co-exist owing to shared risk factors, such as smoking, systemic inflammation, obesity, and physical inactivity. It is crucial that these conditions are detected and managed early to achieve optimal outcomes for patients. The aim of this study was to look for the prevalence of hypertension, dyslipidaemia, diabetes and thyroid abnormalities in COPD patients and assess their association with the severity of the disease.

Method: A cross sectional observational study was conducted in the COPD population diagnosed as per GOLD criteria, at a tertiary care center. Demographic information, smoking history, and severity of COPD (using spirometry) were documented. Relevant clinical and laboratory investigations were carried out to evaluate the patient for hypertension, diabetes mellitus, and dyslipidaemia and thyroid dysfunction. Also, serum vitamin D level and inflammatory markers were evaluated, and their correlation with the severity of COPD was statistically evaluated.

Results: The mean age of COPD patients was 56.8 ± 11.2 years, and there was a significant male predominance (90%). Most patients had Stage II COPD (42%), followed by Stage I (24%), Stage III (22%), and Stage IV (12%). Abnormalities of thyroid function, diabetes mellitus, dyslipidaemia and hypertension were the most prevalent comorbidities (10%, 16%, 26% and 48%, respectively). Other comorbidities were not significantly associated with severity of COPD; this was the case for hypertension ($p = 0.002$). Patients with COPD also showed a significantly higher prevalence of vitamin D deficiency and an increase in inflammatory markers (CRP and ESR) than the controls ($p < 0.0001$). The most common patterns of comorbidities revealed were hypertension (28%) and hypertension with dyslipidaemia (13%).

Conclusion: Multiple comorbidities are highly associated with COPD, with hypertension being the most common and the only comorbidity significantly associated with the severity of the disease. Dyslipidaemia, diabetes mellitus and thyroid dysfunction, were also prevalent, but did not seem to be significantly associated with COPD severity. The research also shows that COPD patients are significantly deficient in Vitamin D and systemic inflammation. These results highlight the fact that COPD is a multisystem disease, and that, tooptimise the outcome of patients with COPD, attention should be paid to routine screening and treatment of cardiometabolic and endocrine comorbidities.

Keywords: COPD, Hypertension, smoking, Comorbidity, Vitamin D.

DOI: 10.25258/ijcpr.18.6.220

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a common and progressive respiratory disorder characterized by persistent airflow limitation and chronic airway inflammation. [1] Although primarily a pulmonary disease, COPD is increasingly recognized as a systemic disorder associated with several extrapulmonary manifestations including metabolic syndrome,

cardiovascular disease, anxiety, depression, and anemia, all of which contribute significantly to multimorbidity [2]. COPD is a major cause of morbidity and mortality worldwide and currently ranks among the top three causes of death globally. Approximately 300 million people are affected by COPD worldwide, accounting for nearly 3 million deaths annually. [3, 4] The global burden of COPD is expected to increase further by 2030, making it a major public health challenge. [5]

COPD frequently coexists with several comorbid conditions that adversely affect disease progression, quality of life, hospitalization rates, and mortality. [2] Several cross-sectional and longitudinal studies have demonstrated an association between COPD, diabetes mellitus, and hypertension. These comorbidities have been identified as independent risk factors for worsening respiratory symptoms, progressive decline in lung function, pulmonary hypertension, and asthma. [6]

Multiple factors contribute to the development of hypertension and diabetes mellitus in COPD patients. Smoking, systemic inflammation, obesity, and physical inactivity are associated. Literature review suggested that persistent systemic inflammation promotes insulin resistance, thereby increasing the risk of diabetes mellitus in COPD patients. [7] In addition, oxidative stress plays an important role in lung inflammation, insulin resistance, weight gain, and altered adipocyte metabolism, which further contribute to metabolic and cardiovascular abnormalities in COPD. [8]Metabolic Syndrome (MetS) is also prevalent in COPD patients.The prevalence of metabolic syndrome has been reported to be 20% to 50% in people with COPD.[9]

Thyroid dysfunction has also been increasingly reported in COPD patients. Chronic hypoxia, systemic inflammation, and altered hypothalamic–pituitary–thyroid axis activity may contribute to thyroid abnormalities, which can further aggravate metabolic imbalance, fatigue, and disease severity. [10] Although previous studies have evaluated the association of COPD with metabolic and cardiovascular disorders, limited data are available regarding the combined prevalence of hypertension, diabetes mellitus, dyslipidemia, and thyroid dysfunction and their correlation with COPD severity.[11]

Therefore, the present study was undertaken to determine the prevalence of hypertension, dyslipidemia, diabetes mellitus, and thyroid dysfunction in COPD patients and to assess their correlation with disease severity.

Methodology

This hospital-based observational cross-sectional study was conducted at tertiary care hospital over a period of 18 months A total of 90 COPD patients aged >18 years were enrolled in the study. Baseline demographic and clinical details including age, gender, smoking status, respiratory symptoms, dyspnea grading, exacerbation history, and associated comorbidities were recorded using a structured proforma.

COPD Diagnosis: All study participants underwent spirometry testing, and patients with a post-bronchodilator FEV_1/FVC ratio of <70% were diagnosed as having COPD. The severity of COPD was further classified into mild, moderate, severe, and very severe categories according to the GOLD guidelines. [12]

All participants were evaluated for hypertension, diabetes mellitus, dyslipidemia, and thyroid dysfunction. Hypertension was defined as blood pressure ≥140/90 mmHg or current use of antihypertensive medications. Diabetes mellitus was diagnosed based on fasting blood sugar >126 mg/dL or HbA1c >7%. Dyslipidemia was assessed using serum lipid profile parameters, while thyroid dysfunction was evaluated using serum TSH, T_3, and T_4 levels.

Statistical Analysis: Data were entered in Microsoft Excel and analyzed using EPI Info version 7.0 software. Statistical analysis was performed using Chi-square test, Student's t-test, and z-test, and a p-value <0.05 was considered statistically significant.

Results

Table 1: Baseline Demographic and Clinical Characteristics of the Study Population

Parameters	Value
Age (years) (Mean ± SD)	56.8 ± 11.2
Gender	
Male	90 (90.0%)
Female	10 (10.0%)
COPD Severity	
Stage I	24 (24.0%)
Stage II	42 (42.0%)
Stage III	22 (22.0%)
Stage IV	12 (12.0%)

Table No.1 presented the baseline demographic and clinical characteristics of the study population. The mean age of the patients was 56.8 ± 11.2 years. A clear male predominance was observed, with 90 patients (90.0%) being male and 10 patients (10.0%) female. Regarding disease severity, the majority of patients belonged to Stage II COPD (42.0%), followed by Stage I (24.0%), Stage III (22.0%), and Stage IV (12.0%). These findings indicated that most patients in the study had moderate disease severity with a predominantly male distribution.

Table 2: Prevalence of Comorbidities in COPD Patients

Comorbidity	No. of Cases	Percentage (%)
Hypertension	48	48.00%
Dyslipidaemia	26	26.00%
Diabetes Mellitus	16	16.00%
Thyroid Abnormalities	10	10.00%

Table No.2 showed the distribution of comorbidities among COPD patients.

Hypertension was the most common comorbidity, observed in 48 patients (48.0%), and followed by dyslipidaemia in 26 patients (26.0%). Diabetes mellitus was present in 16 patients (16.0%), while thyroid abnormalities were noted in 10 patients (10.0%).

Hypertension emerged as the predominant comorbidity in the study population.

Table 3: Correlation of COPD Severity with Comorbidities

COPD Stage	Hypertension n (%)	Dyslipidaemia n (%)	Diabetes n (%)	Thyroid n (%)
Stage I	10 (41.7%)	7 (29.2%)	4 (16.7%)	3 (12.5%)
Stage II	22 (52.4%)	10 (23.8%)	7 (16.7%)	3 (7.1%)
Stage III	12 (54.5%)	5 (22.7%)	3 (13.6%)	2 (9.1%)
Stage IV	4 (33.3%)	4 (33.3%)	2 (16.7%)	2 (16.7%)
P-value	0.002	0.357	0.32	0.94

Table No.3 showed the distribution of comorbidities across different stages of COPD. Hypertension was the most common comorbidity across all stages and showed a statistically significant association with disease severity ($p = 0.002$), with higher proportions observed in Stage II and Stage III. Dyslipidaemia, diabetes mellitus, and thyroid abnormalities were variably distributed across stages but did not show statistically significant associations ($p > 0.05$). Overall, the findings indicated that hypertension was significantly associated with increasing severity of COPD, while other comorbidities did not demonstrate a significant correlation.

Table 4: Comparison of Comorbidities, Vitamin D Status and Inflammatory Markers between COPD Patients and Controls

Parameter	COPD Patients	Controls	P-value
Hypertension	48 (48%)	25 (25%)	0.007
Dyslipidaemia	26 (26%)	30 (30%)	0.592
Diabetes Mellitus	16 (16%)	10 (10%)	0.239
Thyroid Abnormalities	10 (10%)	5 (5%)	0.169
Vitamin D Deficient	27 (27%)	0 (0%)	<0.0001
Vitamin D Insufficient	70 (70%)	45 (45%)	0.019
Vitamin D Sufficient	3 (3%)	55 (55%)	<0.0001
CRP (Mean ± SD)	7.49 ± 12.2	1.28 ± 0.9	<0.0001
ESR (Mean ± SD)	28.4 ± 10.2	4.27 ± 4.5	<0.0001

Table No.4 compared the prevalence of comorbidities and laboratory parameters between COPD patients and controls. Hypertension was significantly higher in COPD patients (48%) compared to controls (25%) ($p = 0.007$). Dyslipidaemia, diabetes mellitus, and thyroid abnormalities were more frequent in COPD patients but did not show statistically significant differences ($p > 0.05$). Vitamin D deficiency and insufficiency were significantly more common in COPD patients, while sufficient levels were predominantly observed in controls ($p < 0.05$). Inflammatory markers, including CRP and ESR, were markedly elevated in COPD patients compared to controls, with highly significant differences ($p < 0.0001$). These findings indicated a higher burden of inflammation and vitamin D deficiency among COPD patients.

Table 5: Distribution of Comorbidity Patterns in COPD Patients

Comorbidity Pattern	No. of Cases	Percentage (%)
Hypertension only	28	28%
Dyslipidaemia only	6	6%
Diabetes only	6	6%
Thyroid only	1	1%
Hypertension + Dyslipidaemia	13	13%
Hypertension + Diabetes	3	3%
Hypertension + Thyroid	2	2%
Dyslipidaemia + Diabetes	1	1%
Dyslipidaemia + Thyroid	2	2%
Diabetes + Thyroid	1	1%
HTN + Dyslipidaemia + Thyroid	2	2%
DM + Dyslipidaemia + Thyroid	1	1%
All four	0	0%

Table No.5 showed the distribution of different comorbidity patterns among COPD patients. Hypertension alone was the most common pattern, observed in 28 patients (28%), and followed by the combination of hypertension and dyslipidaemia in 13 patients (13%). Isolated dyslipidaemia and diabetes mellitus were each seen in 6 patients (6%), while thyroid abnormality alone was rare (1%). Various combinations of two and three comorbidities were observed in smaller proportions. No patient had all four comorbidities simultaneously. These findings indicated that hypertension, either alone or in combination with other conditions, was the most frequent comorbidity pattern in the study population.

Discussion:

In the present study, 100 patients diagnosed with chronic obstructive pulmonary disease (COPD) were evaluated, with the majority belonging to the 60–70-year age group. The mean age of the study population was 56.8 ± 11.2 years, indicating that COPD predominantly affects older adults. These findings are consistent with previous reports by Patel HH et al.,[13] who observed a slightly higher mean age of 66.0 ± 5.4 years, with nearly half of their study population falling within the 60–69-year age group. Similarly, Buchardt ST et al., [14] reported a median age at diagnosis of 63 years, with patients being predominantly older, male, and having multiple comorbidities, which aligns well with the demographic characteristics observed in our study. Other studies, have also documented a higher prevalence of COPD among males, further supporting our findings. [15-17]

With regard to disease severity, the majority of patients in the current study were classified as having Stage II COPD (42.0%). Rabari et al., [18] who also found the highest proportion of patients in the moderate category (42%), followed by severe (28%), mild (18%), and very severe disease (12%). In present study Hypertension was the most prevalent comorbidity (48%), dyslipidemia (26%), DM (16%) and thyroid dysfunction in 10% cases. Present study shows strong association between COPD and cardiovascular as well as metabolic disorders. Our results align with previous Mourya J et al., [17] hypertension (18.8%) and diabetes mellitus (16.8%) as common comorbidities. another studies also reported hypertension, diabetes most frequent comorbidities. [15] While Kiani F.Z. et al., [19] identified dyslipidemia (70.2%) as the most prevalent comorbidity this reported the prevalence of comorbid diseases and COPD varies as per the duration, diagnosis and severity.

Patil et al., [13] found that hypertension was relatively uncommon in early COPD (4.05% in GOLD I and 14.86% in GOLD II) but became substantially more prevalent in advanced stages, rising to 37.83% in GOLD III and 43.24% in GOLD IV.

Mahishale et al., [20] similarly observed a high prevalence of systemic hypertension (37.25%) among COPD patients, with very severe COPD independently associated with an elevated risk (OR 1.6; 95% CI 1.4–1.9).

COPD severity with comorbid conditions found statistically significant correlation. Majority of cases with hypertension and DM were belong the stage II, followed by stage III, IV and I. This align with previous author Patil et al., [13] found that hypertension was relatively uncommon in early COPD (4.05% in GOLD I and 14.86% in GOLD II) but became substantially more prevalent in advanced stages, rising to 37.83% in GOLD III and 43.24% in GOLD IV. And author study showed a marked increase in diabetes from GOLD I (5.55%) to GOLD IV (44.44%). Mahishale et al., [20] similarly observed a high prevalence of systemic hypertension (37.25%) among COPD patients, with very severe COPD independently associated with an elevated risk (OR 1.6; 95% CI 1.4–1.9). Sikarwar, indicate that dyslipidemia becomes progressively more pronounced with advancing COPD severity.LDL and triglyceride levels

progressively increased from mild to very severe COPD, while HDL levels decreased across stages. A statistically significant negative correlation was observed between HDL and disease severity ($r = -0.275$, $p < 0.05$), whereas LDL, total cholesterol, and triglycerides demonstrated significant positive correlations with COPD severity ($r = 0.23$, 0.273, and 0.261, respectively; $p < 0.05$). Previous study found pooled prevalence of TGD in patients with COPD was 45% (95% CI: 25% to 65%). The most common form of TGD was hypothyroidism.

The study identified a lack of significant associations between TGD and COPD severity or various characteristics, highlighting the need for future prospective multi-center research, particularly with larger sample sizes to determine the clinical factors and biomarkers affecting the development of thyroid [11]

Conclusion:

COPD predominantly affects middle-aged and predominance among males. Most patients presented with mild to moderate COPD (GOLD I–II). Hypertension emerged as the most common comorbidity, followed by dyslipidemia, diabetes mellitus (16%), and thyroid abnormalities. Statically significant correlation observed among the comorbidity and disease severity particularly (hypertension $p<0.001$). These findings emphasize the importance of routine screening, early identification, and comprehensive management of cardiometabolic and endocrine comorbidities to reduce disease burden and improve clinical outcomes in COPD patients.

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