Section: Internal Medicine

Original Research Article

PREVALENCE AND CLINICAL OUTCOME OF METABOLIC SYNDROME AMONG CHRONIC OBSTRUCTIVE PULMONARY DISEASE PATIENTS ATTENDING A TERTIARY CARE CENTRE IN KERALA

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Received : 05/04/2026
Received in revised form : 21/05/2026
Accepted : 06/06/2026

Keywords:
Chronic obstructive pulmonary disease; metabolic syndrome; systemic inflammation; C-reactive protein; GOLD staging; comorbidities.

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DOI: 10.47009/jamp.2026.8.3.166

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2026; 8 (3); 923-928

ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is increasingly recognized as a systemic inflammatory disorder associated with several comorbidities, including metabolic syndrome (MetS). Metabolic syndrome contributes significantly to morbidity, prolonged hospitalization, and reduced quality of life among COPD patients. Previous studies have reported varying prevalence rates and associations between MetS and COPD severity across different populations. **Objectives:** To determine the prevalence of metabolic syndrome among patients with COPD and to evaluate its association with disease severity, systemic inflammation, and clinical outcomes. **Materials and Methods:** This hospital-based observational study included patients diagnosed with COPD. Patients were evaluated for the presence of metabolic syndrome using standard diagnostic criteria. Clinical assessment included GOLD staging, spirometry, anthropometric measurements, blood pressure, fasting blood glucose, lipid profile, and serum C-reactive protein (CRP) levels. Duration of hospital stay and associated comorbidities were also analyzed. **Results:** The prevalence of metabolic syndrome among COPD patients in the present study was 26%. Patients with metabolic syndrome were more likely to have severe COPD (GOLD stages III–IV), and the association between metabolic syndrome and disease severity was statistically significant. Elevated CRP levels among metabolic syndrome-positive patients suggested an association between systemic inflammation and metabolic dysfunction. Metabolic syndrome-positive patients also had significantly longer hospital stays, indicating increased morbidity. A higher prevalence of type 2 diabetes mellitus and hypertension was observed among these patients. Although spirometric parameters were not significantly different, metabolic syndrome-positive patients tended to have more severe airflow obstruction. **Conclusion:** Metabolic syndrome is a common and clinically significant comorbidity among COPD patients and is associated with systemic inflammation, metabolic abnormalities, increased disease severity, and prolonged hospitalization. Early identification and management of metabolic syndrome components through lifestyle modification and appropriate medical intervention may help reduce morbidity and improve clinical outcomes in COPD patients.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a prevalent respiratory condition that impedes airflow and leads to difficulties in breathing. It is an inflammatory disease that affects the airways, lung tissue, and pulmonary vasculature. It comprises chronic bronchitis, emphysema, and small airway disease.

COPD is not strictly a lung condition; it has extensive extrapulmonary manifestations. Smoking, physical inactivity, systemic inflammation, hypoxemia, and steroid use are important risk factors for the development of metabolic syndrome among COPD patients (Fekete et al., 2022,[1] Küpeli et al., 2010.[2]).

ISSN (O): 2687-5365; ISSN (P): 2753-6556

In India, it is projected that 16.3 million individuals in rural regions and 5.9 million persons in urban areas had COPD in 2016. About 20–25% of Indian adults have metabolic syndrome. The frequency of metabolic syndrome is reported to be nearly twice as high in people with COPD as in the general population (Hariprasath et al., 2022,[3] Baniya et al., 2023.[4]. Numerous studies carried out globally indicate that the prevalence of metabolic syndrome among COPD patients varies between 25.6% and 60.9% (Sahoo et al., 2022,[5] Varma et al., 2024.[6]).

BACKGROUND AND RATIONALE OF THE STUDY

Chronic obstructive pulmonary disease and metabolic syndrome are frequently associated, which results in poorer clinical outcomes. Understanding the clinical significance and prevalence of metabolic syndrome in individuals with COPD can help improve early diagnosis, treatment, and patient outcomes.

MATERIALS AND METHODS

Study Design: Prospective Observational Study

Study Setting: Department of Internal Medicine, Government Medical College, Thiruvananthapuram, Kerala.

Study Population

All COPD patients admitted in the Department of Internal Medicine at Government Medical College in Thiruvananthapuram during the study period. Sample size is 117.

Diagnostic Criteria for COPD:

Post-bronchodilator FEV1/FVC < 0.7 as per GOLD 2023 guidelines.

Inclusion Criteria

- Patients aged ≥18 years with documented COPD.
- Not on oral corticosteroids for more than 6 months.
- Patients willing to participate in the study

Exclusion Criteria

- Patients unwilling to give consent.
- Patients with end-stage illness.

Study Duration

The duration of the study is 1 year from the Institutional Ethics Committee clearance.

Study Procedure

The Institutional Ethics Committee (IEC) will review and approve the study protocol.

A semi-structured proforma will be used to collect data following informed consent.

There will be a thorough physical examination and a detailed history taking.

Anthropometric parameters measured using standard procedure. All patients will undergo standard investigations at admission.

Data will be collected on: Age, gender, spirometry, ABG, CRP, blood investigations, lipid and glucose profile, and duration of hospitalization.

Patients will be followed till discharge, LAMA, or death, and outcomes recorded accordingly.

Data Collection Tool

A semi-structured proforma will be used for collecting all relevant clinical and investigation data**.**

Plan of Data Analysis

Microsoft Excel will be used to enter the data, and SPSS version 27 will be used for analysis.

RESULTS

The study participants ranged between 33-90 years with an average age of 63.59 years, majority were older individuals with 50 female and 67 male participants. Metabolic syndrome is significantly associated with elevated fasting blood sugar, increased triglyceride, reduced HDL, elevated systolic blood pressure and increased waist circumference.

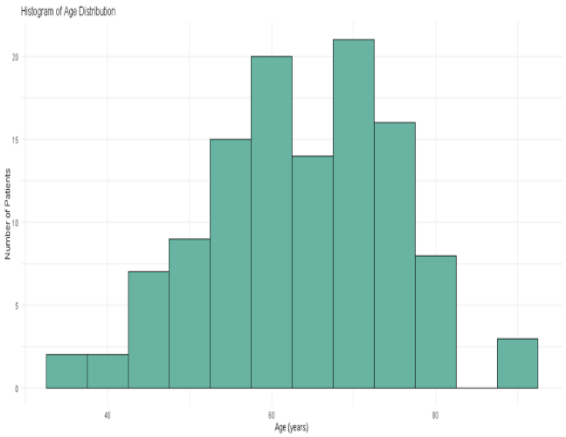

Figure 1: Age and sex distribution of patients

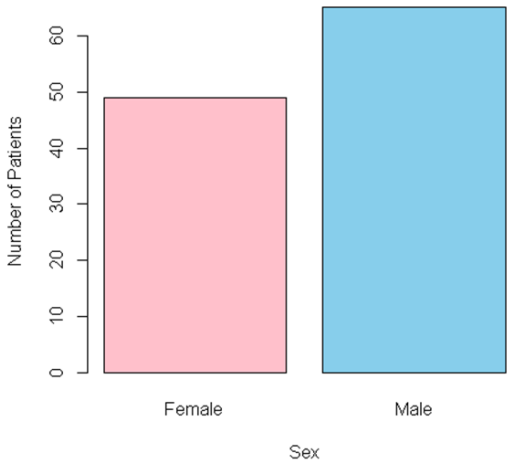

Figure 2: Sex distribution of patients

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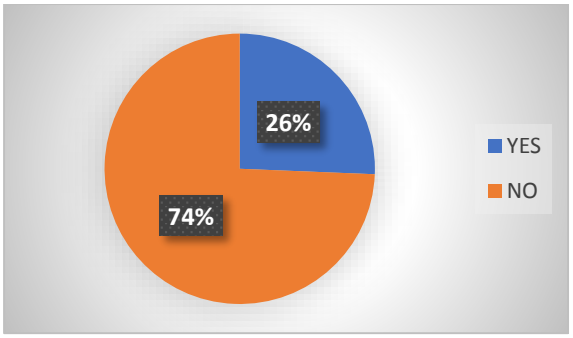

Figure 3: The distribution of patients based on presence of metabolic syndrome

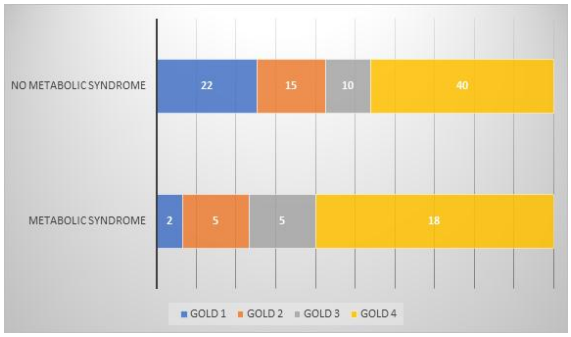

Figure 4: Gold Scoring and Metabolic Syndrome

Chi-square 4.06, p value=0.044

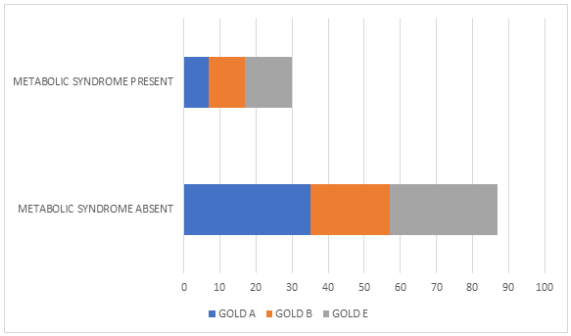

Figure 5: Gold ABE score and metabolic syndrome

- Chi-square ≈ 1.67
- Degrees of freedom = 2
- p-value ≈ 0.43

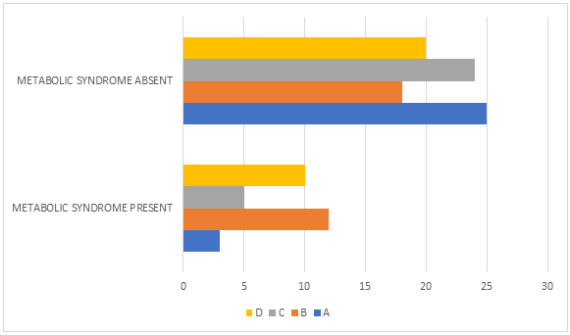

Figure 6: ABCD scoring and metabolic syndrome

- Chi-square (χ^2) ≈ 10.1
- Degrees of freedom = 3
- p-value ≈ 0.018

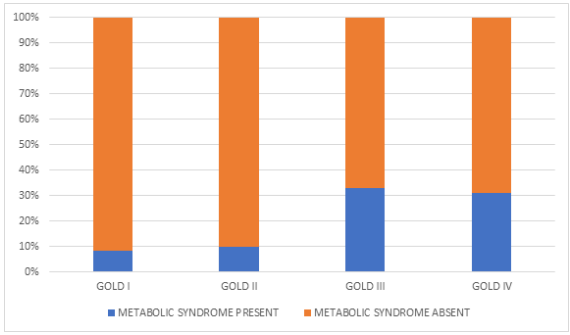

Figure 7: Prevalence of metabolic syndrome across various stages of COPD according to GOLD scoring

Severe COPD was associate with metabolic syndrome, more than mild or moderate GOLD stages.

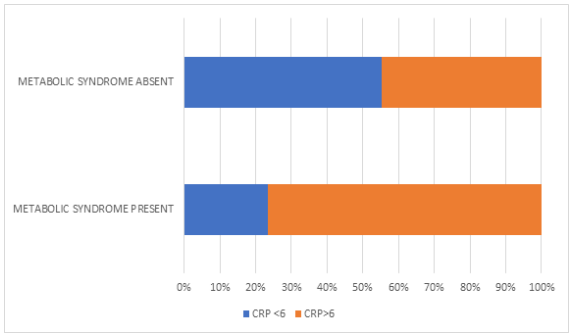

Figure 8: The prevalence of inflammation in COPD patients and its distribution according to the presence of metabolic syndrome

- Chi- square test: 6.63
- Degree of freedom: 1
- P value: <0.01

Table 1: The impact of metabolic syndrome on the clinical outcome

METABOLIC SYNDROME	SURVIVED	EXPIRED	TOTAL
PRESENT	24	6	30
ABSENT	74	13	87

Odds ratio 1.42

Two tailed P value= 0.17 (Fischer's Exact Test)

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Table 2: Showing the impact of metabolic syndrome on the type of ventilation required

METABOLIC SYNDROME	ROOM AIR	OXYGEN VIA FACE MASK	NIV	MECHANICAL VENTILATION	TOTAL
PRESENT	9	10	8	3	30
ABSENT	63	13	7	4	87

P value- 0.001 (Fischer- Freeman-Halton extract test)

Table 3: Impact of metabolic syndrome on the mean hospital stay

METABOLIC SYNDROME	Mean duration of hospital stay	T- statistic	Degrees of freedom	P value	95% CI
PRESENT	8.15 days	-2.4704	32.19	0.01898	-3.8245-0.3682)
ABSENT	6.06 days				

Correlation between cardiometabolic parameters and metabolic syndrome.

Table 4: Comparison of Fasting blood sugar levels in COPD patients with and without metabolic syndrome

Group	Mean FBS	t-statistic	Degrees of Freedom (df)	p-value	Confidence Interval (95%)
No MetS	72.55	-3.2234	25.16	0.00349	(-77.8172, -17.1563)
Yes MetS	120.04				

Table 5: Comparison of triglyceride levels in COPD patients with and without metabolic syndrome

Parameter	No MetS	Yes MetS	t-statistic	df	p-value	95% CI of Difference	Interpretation
Mean TG (mg/dL)	146.06	169.96	-4.7998	42.19	0.00002016	-33.95 to -13.85	Significant difference

Table 6: Comparison of HDLlevels in COPD patients with and without metabolic syndrome

Parameter	No MetS	Yes MetS	t-statistic	df	p-value	95% CI of Mean Difference	Interpretation
Mean HDL (mg/dL)	53.77	43.73	5.125	32.67	0.00001309	6.05 to 14.03	Significant difference

Table 7: Comparison of Waist circumference levels in COPD patients with and without metabolic syndrome

Parameter	No MetS	Yes MetS	t-statistic	df	p-value	95% CI of Mean Difference	Interpretation
Mean Waist (cm)	81.08	96.62	-5.527	42.22	0.000001867	-21.21 to -9.86	Significant difference

Table 8: Comparison of systolic blood pressure levels in COPD patients with and without metabolic syndrome

Parameter	No MetS	Yes MetS	t-statistic	df	p-value	95% CI of Mean Difference	Interpretation
Mean SBP (mmHg)	124.14	147.50	-5.690	57.32	0.0000004542	-31.58 to -15.14	Significant difference

Table 9: Comparison of Diastolic blood pressure levels in COPD patients with and without metabolic syndrome

Independent t-test Comparing DBP Between MetS Groups

Parameter	No MetS	Yes MetS	t-statistic	df	p-value	95% CI of Mean Difference	Interpretation
Mean DBP (mmHg)	81.47	84.46	-1.644	38.97	0.108	-6.67 to 0.69	Not statistically significant

ISSN (O): 2687-5365; ISSN (P): 2753-6556

DISCUSSION

This study investigated the prevalence of metabolic syndrome among patients with chronic obstructive pulmonary disease and evaluated its association with disease severity, systemic inflammation, and clinical outcomes.

The study found that patients with metabolic syndrome had GOLD 3-4 COPD when compared to patients without metabolic syndrome, who had less severe COPD and the association was significant. However another Indian study by G Ramamoorthy,[6] et al did not find any significant association with severity and prevalence of metabolic syndrome. Baniya,[4] et al , (2023) reported that 38.3% s the prevalence of metabolic syndrome in COPD patients, with the majority being in GOLD stage 1 and Il unlike the results of our study. This may be due to the difference in genetics and ethnicity across various Asian populations.

In our study C-reactive protein (CRP) levels were significantly elevated in metabolic syndrome-positive patents, suggesting link between systemic inflammation and metabolic dysfunction in COPD, is consistent with the study of Kupeli,[2] et al. (2010).

Metabolic syndrome is frequent comorbidity in COPD, primarily linked to abdominal obesity and dyslipidemia is in line with the study of Park 7et al. (2012).

In our study, 26% of COPD patients had metabolic syndrome, which is lower than an Indian study by AK Verma,[8] et al in 2024.

In our study, patients with metabolic syndrome had significantly longer hospital stays, suggesting increased morbidity, this is consistent with the findings of Keeratichananon9 et al.

We also noted a higher incidence of type 2 diabetes mellitus and hypertension in the metabolic syndrome group these findings are consistent with those of Suresh Kumar,[10] et al (2022), who emphasized the burden of coexisting non-communicable diseases in COPD patients with metabolic syndrome.

From a spirometric perspective, although not statistically significant, patients with metabolic syndrome tended to have more severe airflow obstruction. Previous studies such as Fekete,[1] et al (2022) have demonstrated that the coexistence of metabolic syndrome in COPD can accelerate lung function decline, likely mediated by chronicsystemic inflammation and oxidative sires.

Hariprasath Vet,[3] al. (2022) reported an even higher prevalence of 62%, making it one of the highest among South Indian cohorts. The increased prevalence and adverse outcomes observed in Hariprasath's cohort could be attributed to differences in inclusion criteria, sample size (n-50), and possibly a higher burden of comorbidities like diabetes and hypertension conditions more prevalent in their metabolic syndrome-positive group.

While comparing with Sahoo,[5] et al 2022) both studies demonstrated that patients with metabolic syndrome had higher BMI, blood pressure, fasting glucose Triglycerides, and CRP levels. Furthermore, Sahoo e al. found an inverse correlation between FEV, and BODE index among metabolic syndrome-positive. patients mirroring our observation that metabolic abnormalities co-exist with decreased lung function and elevated systemic inflammation.

Funakoshi,[11] et al 2010) observed increased risk of metabolic syndrome with higher GOLD stages (I1-1V), whereas our study found metabolic syndrome clustered more in care sages (GOLD I & II), This discrepancy may stem from underlying differences in BMI distribution, ethnicity, early malnutrition, or sample selection. Both studies consistently identify central obesity and hypertension as the most predictive components of metabolic syndrome in association with airflow limitation, reinforcing the utility as early screening indicators in COPD patients. Our findings highlight the importance of early identification and management of metabolic syndrome in COPD patient. Lifestyle interventions, dietary modifications and management of individual metabolic syndrome components could potentially reduce hospital stay, improve quality of life, and mitigate long-term complications.

CONCLUSION

This study proves that metabolic syndrome is associated with elevated fasting blood sugar, increased triglyceride, reduced HDL level, elevated systolic blood pressure, increased waist circumference and longer duration of hospital stay. Hence early identification and management of metabolic syndrome components prevent long term complication .

Strengths and Limittations of the Study

Strengths

- Regional relevance: This is one of the few studies conducted in a tertiary care centre in South Kerala
- Well- defined criteria: The study employed standardised diagnostic criteria for identifying metabolic syndrome (NCEP ATP III criteria).
- Clinical correlation: The study not only analysed the prevalence of metabolic syndrome among COPD patients, but also its relation with the parameters like CRP, ventilatory requirement, duration of hospital stay and outcome.

Limitations

- Single- centre study design: The study was conducted in a single centre , which may limit its generalisability.
- Small sample size.
- Lack of long term follow up.

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