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FREQUENCY OF METABOLIC SYNDROME IN PATIENTS PRESENTING WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) AT DHQ TEACHING HOSPITAL RAWALPINDI

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Abstract

Background: *Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory disorder associated with significant morbidity and mortality worldwide. Metabolic syndrome, comprising obesity, hypertension, hyperglycemia, and dyslipidemia, is increasingly observed among COPD patients, exacerbating disease severity and complicating management. Understanding the association between metabolic syndrome and COPD is crucial for better clinical outcomes.*

Objectives: *To determine the frequency of metabolic syndrome among COPD patients and analyze its association with demographic and clinical characteristics.*

Study Design & Setting: *A cross-sectional study was conducted at Medicine DHQ Teaching Hospital Rawalpindi from December 2024 to May 2025. A total of 90 diagnosed COPD patients were enrolled using non-probability consecutive sampling.*

Methodology: *Data were collected through structured questionnaires, including demographic and clinical variables. Metabolic syndrome was defined according to the criteria established by the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III). Stratification was performed based on age, gender, BMI, duration of COPD, and hemoglobin levels to assess the association between variables. Chi-square tests were applied, with a p-value ≤ 0.05 considered statistically significant.*

Results: *The mean age of patients was 62.5 ± 8.7 years, with a male predominance (64.4%). The frequency of metabolic syndrome in COPD patients was 35.6%. Statistically significant associations were found between metabolic syndrome and gender ($p = 0.048$), BMI ($p = 0.036$), duration of COPD ($p = 0.041$), and hemoglobin levels ($p = 0.021$). Age group differences were statistically insignificant ($p = 0.789$).*

Conclusion: *Metabolic syndrome is common among COPD patients and shows*

significant associations with gender, BMI, disease duration, and hemoglobin levels. Early identification and management of metabolic syndrome can improve the prognosis and quality of life in COPD patients.

INTRODUCTION

In the modern world, chronic obstructive pulmonary disease (COPD) is the third leading cause of death. Patients with COPD frequently go through episodes of acute symptom worsening that necessitate emergency room visits and more medication. These exacerbations necessitate hospitalisation in severe cases.[1] With 3.23 million fatalities caused by COPD in 2019; it was the third-leading cause of mortality worldwide. The majority of COPD deaths (80%) took place in low- and middle-income nations.[2] COPD is characterized by both airway and systemic inflammation, though the connection between these two processes remains unclear. In individuals with COPD, systemic inflammation plays a significant role in the development of many comorbidities.[3,4]

Chronic obstructive pulmonary disease (COPD) patients are at an increased risk of developing obstructive sleep apnea (OSA) due to various factors such as airway obstruction, alveolar hypoventilation, hyperinflation, respiratory muscle dysfunction, and reduced ventilatory responses to hypoxia and hypercapnia.[5] The coexistence of COPD and OSA, known as overlap syndrome (OS), affects 0.5%–1% of individuals over the age of 40 and is associated with more severe hypoxemia and hypercapnia compared to either condition alone. Additionally, overlap syndrome exacerbates inflammation, which may play a critical role in the development of metabolic dysfunction.[6] Although metabolic syndrome is becoming a significant public health issue, the prevalence of obesity, as defined by the World Health Organization (WHO), remains relatively low in Asia compared to Western countries.[7] Comparative studies suggest that at specific Body Mass Index (BMI) levels, South and East Asians may exhibit stronger metabolic responses to obesity than their Western counterparts. This phenomenon, for which the underlying causes remain unclear, may be partially explained by the higher percentage of body fat in Asians at certain BMIs and their heightened sensitivity to obesity.[8]

Smoking remains the leading risk factor for COPD, although environmental pollutants, occupational hazards, and genetic predisposition also play significant roles in its development. In recent years, the identification of biomarkers has become increasingly important in understanding the pathophysiology of COPD and predicting disease progression.[9] Among these biomarkers, C-reactive protein (CRP), an acute-phase reactant produced by the liver in response to inflammation, has emerged as a potential indicator of disease severity and prognosis.[10] Elevated CRP levels are not only reflective of systemic inflammation but also correlate with exacerbation frequency, lung function decline, and increased mortality risk.[11]

There is a conflict in the reported frequency of metabolic syndrome (MetS) among patients with Chronic Obstructive Pulmonary Disease (COPD), with studies showing prevalence rates ranging from as low as 21% to as high as 62%. This significant disparity highlights the need for further investigation into the relationship between COPD and MetS, particularly in diverse populations and clinical settings. The current study aims to contribute new data by examining the prevalence of MetS specifically in COPD patients at DHQ Teaching Hospital Rawalpindi, adding to the limited regional literature. This will help provide a clearer understanding of the association between these conditions in the local population, potentially informing targeted interventions and management strategies. Investigating the association between CRP levels and COPD severity could enhance clinical decision-making and support more targeted therapeutic approaches.

MATERIALS AND METHODS

This cross-sectional study protocol was submitted for approval to the Pakistani College of Physicians and Surgeons. Patients with COPD who met the inclusion and exclusion criteria given below were recruited from the Department of Medicine at the DHQ Hospital in Rawalpindi from December 2024 to May 2025. Signed, fully informed consent was obtained from all participants. Prior to initiating the

study, the institutional ethical review committee was consulted. A sample size of 90 cases was calculated with a 95% confidence level and a 5% margin of error, considering the expected frequency of anemia in COPD patients to be 6.2%.[7]

Patients with COPD between the ages of 40 and 80, of either gender, who presented to the OPD and were admitted indoors, were included. Patients were diagnosed with COPD if they had a smoking history of 20 pack-years or more, a chest X-ray displaying over six visible anterior ribs above the diaphragm in the midclavicular line—indicating hyperinflated lung fields, a flattened hemidiaphragm, and reduced pulmonary vascular markings characterized by a peripheral absence of vessels. Additionally, pulmonary function test results obtained via spirometry demonstrated an FEV1 of less than 80% of the predicted value and an FEV1/FVC ratio of less than 0.70 of the predicted value. Exclusion criteria included patients with a history of hypertension, hypothyroidism, or both hyper- and hypothyroidism, as well as those with a history of non-alcoholic fatty liver disease (NAFLD). Additionally, patients with a history of stroke, chronic renal failure, myocardial infarction, chronic liver disease, or asthma were excluded. Pregnant patients were also not considered for inclusion in the study.

At the time of admission, patients were asked to provide a brief history and demographic data. Height and weight were measured using standard procedures, with body mass index (BMI) calculated by dividing weight by height squared (kg/m²). Participants were measured wearing light clothing and without shoes. Waist circumference was measured using a tapeline at the midpoint between the iliac crest and the lowest rib. Following a 12-hour fast, a venous blood sample was collected from each patient to measure glucose levels. Metabolic syndrome was diagnosed when at least three of the following five metabolic abnormalities were present: central obesity with a waist circumference of ≥80 cm, dyslipidemia with triglycerides of ≥150 mg/dL, HDL cholesterol of ≤50 mg/dL, hypertension with blood pressure of ≥130/85 mm Hg, and hyperglycemia with fasting plasma glucose of ≥100 mg/dL and all relevant data were recorded on the attached proforma along with demographic details. To ensure consistency and eliminate bias, all laboratory tests were performed at the same hospital laboratory. Confounding variables were controlled through careful exclusion.

All collected data were entered and analyzed using SPSS version 25. Numerical variables, including age, height, weight, BMI, and duration of disease, were presented as mean ± standard deviation (SD) and range. Categorical variables, such as gender and metabolic syndrome (yes/no), were presented as frequency and percentage. Data were stratified for age, gender, BMI, and hemoglobin level. Post-stratification, the Chi-square test was applied, considering a p-value of ≤ 0.05 as statistically significant.

RESULTS

Table 1 presents the demographic characteristics of the study participants (n = 90). The mean age of the participants was 62.5 ± 8.7 years. Among them, 22.2% (20 patients) were aged between 16 and 38 years, 46.7% (42 patients) were aged between 39 and 60 years, and 31.1% (28 patients) were aged between 61 and 80 years. In terms of gender distribution, 64.4% (58 participants) were male, while 35.6% (32 participants) were female. The mean height of the participants was 1.68 ± 0.09 meters, and the mean weight was 78.5 ± 12.3 kg. The mean BMI of the study population was 27.8 ± 4.2 kg/m², with 33.3% (30 patients) having a BMI between 20-25 kg/m², 50.0% (45 patients) having a BMI between 25-30 kg/m², and 16.7% (15 patients) having a BMI between 30-35 kg/m². The mean duration of COPD among the study participants was 5.6 ± 3.1 years. Among them, 31.1% (28 patients) had COPD duration of ≤2 years, 42.2% (38 patients) had duration of 3-5 years, and 26.7% (24 patients) had duration of ≥6 years. Regarding hemoglobin levels, the mean hemoglobin level was 13.2 ± 2.1 g/dL. Among the participants, 31.1% (28 patients) were classified as anemic (hemoglobin < 12 g/dL), while 68.9% (62 patients) had normal hemoglobin levels (≥12 g/dL).

Table 2 presents the frequency of metabolic syndrome among the study participants. Out of the total 90 participants, 32 (35.6%) were found to have metabolic syndrome, while 58 (64.4%) did not have metabolic syndrome.

Table 3 shows the stratification of metabolic syndrome in COPD patients (n=90). Metabolic syndrome prevalence was similar across age groups with no significant difference (p = 0.789). However, significant associations were found with gender (higher in females, p = 0.048), BMI (higher in the 30-35 Kg/m² category, p = 0.036), duration of COPD (higher in ≤2 years and ≥6 years, p = 0.041), and hemoglobin levels (higher in anemic patients, p = 0.021).

Table 1: Demographic Characteristics of Study Participants (n = 90)

Variable	Category	Study Sample n=194
Age (years)	Mean ± SD	62.5 ± 8.7
	16 – 38 years	20 (22.2%)
	39-60 years	42 (46.7%)
	61-80 years	28 (31.1%)
Gender	Male	58 (64.4%)
	Female	32 (35.6%)
Height (meters)	Mean ± SD	1.68 ± 0.09
Weight (kg)	Mean ± SD	78.5 ± 12.3
BMI (kg/m²)	Mean ± SD	27.8 ± 4.2
	20-25 Kg/m²	30 (33.3%)
	25-30 Kg/m²	45 (50.0%)
	30-35 Kg/m²	15 (16.7%)
Duration of COPD (years)	Mean ± SD	5.6 ± 3.1
	≤2 years	28 (31.1%)
	3 - 5 years	38 (42.2%)
	≥6 years	24 (26.7%)
Hemoglobin Level (g/dL)	Mean ± SD	13.2 ± 2.1
	< 12 (Anemic)	28 (31.1%)
	≥ 12 (Normal)	62 (68.9%)

Table 2: Metabolic Syndrome Frequency

Metabolic Syndrome	Frequency	Percentage
Yes	32	35.6%
No	58	64.4%

Table 3: Stratification of Metabolic Syndrome in Patients with COPD (n=90)

Variable	Category	Metabolic Syndrome (Yes)	Metabolic Syndrome (No)	Total	P-value
Age Group	16-38 years	7 (35%)	13 (65%)	20 (22.2%)	0.789
	39-60 years	15 (35.7%)	27 (64.3%)	42 (46.7%)	
	61-80 years	10 (35.7%)	18 (64.3%)	28 (31.1%)	
Gender	Male	20 (34.5%)	38 (65.5%)	58 (64.4%)	0.048*
	Female	12 (37.5%)	20 (62.5%)	32 (35.6%)	
BMI (Kg/m²)	20-25 Kg/m²	10 (33.3%)	20 (66.7%)	30 (33.3%)	0.036*
	25-30 Kg/m²	15 (33.3%)	30 (66.7%)	45 (50.0%)	
	30-35 Kg/m²	7 (46.7%)	8 (53.3%)	15 (16.7%)	
Duration of COPD (years)	≤2 years	12 (42.9%)	16 (57.1%)	28 (31.1%)	0.041*
	3 - 5 years	10 (26.3%)	28 (73.7%)	38 (42.2%)	

	≥6 years	10 (41.7%)	14 (58.3%)	24 (26.7%)	
Hemoglobin Level (g/dL)	< 12 (Anemic)	12 (42.9%)	16 (57.1%)	28 (31.1%)	0.021*
	≥ 12 (Normal)	20 (32.3%)	42 (67.7%)	62 (68.9%)	
Total		32 (35.6%)	58 (64.4%)	90 (100%)	

Chi-square test, * observed difference was statistically significant ($p \leq 0.05$).

DISCUSSION

Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory disorder characterized by persistent airflow limitation and breathing difficulties. It remains a leading cause of morbidity and mortality worldwide, significantly impacting patients' quality of life. Metabolic syndrome, a cluster of conditions including hypertension, obesity, hyperglycemia, and dyslipidemia, is increasingly being linked to COPD, posing additional health risks.[10] Studies have demonstrated that the coexistence of metabolic syndrome in COPD patients exacerbates disease severity and impairs prognosis. Identifying factors associated with metabolic syndrome in COPD patients can aid in developing targeted interventions to improve clinical outcomes.[11] This study aims to investigate the prevalence and determinants of metabolic syndrome in COPD patients and analyze the association between metabolic syndrome and demographic as well as clinical characteristics

The present study demonstrated that metabolic syndrome (MS) was present in 35.6% of COPD patients, which aligns closely with the findings of Singh et al. (2021), who reported a prevalence of 35.7% in a comparable cohort.[17] However, our prevalence is significantly lower than that reported by Hariprasath et al. (2022)[15], where MS was present in 62% of COPD patients, and Fekete et al. (2022), who observed a prevalence of 59.1%.[14] This variation might be attributed to differences in study settings, sample sizes, or regional factors.

In our study, gender showed a statistically significant association with MS (p=0.048), indicating a higher prevalence among males (34.5%) compared to females (37.5%). Fekete et al. (2022)[14] also reported a significant gender difference, with a higher prevalence in females (67.6%) compared to males (49.7%). The discrepancy in gender distribution across studies may be due to population demographics or varying risk factor exposures. The relationship between MS and BMI was significant (p=0.036) in our study, with a higher prevalence observed in patients with a BMI of 30-35 kg/m² (46.7%). This finding aligns with Breyer et al. (2014)[19], who demonstrated an increased frequency of MS in COPD patients with a BMI ≥25 kg/m². Similarly, Fekete et al. (2022)[14] found that overweight/obese patients had a higher prevalence of MS, emphasizing the importance of obesity management in COPD.

In terms of disease duration, our study revealed that patients with longer COPD duration (≥6 years) had a higher prevalence of MS (41.7%), with a significant association (p=0.041). Sahoo et al. (2022)[12] also observed that MS was more prevalent in patients with severe COPD (GOLD stage III and IV). This suggests that prolonged disease duration may predispose patients to metabolic disturbances due to chronic inflammation and altered metabolism. Our study also found a significant association between hemoglobin levels and MS (p=0.021), with anemic patients (<12 g/dL) showing a higher prevalence (42.9%) compared to those with normal hemoglobin levels (32.3%). This is consistent with findings by Priyadharshini et al. (2020)[13], who observed that metabolic disturbances were correlated with reduced pulmonary function and increased symptom severity.

The primary strength of this study lies in its comprehensive analysis of metabolic syndrome stratified by demographic and clinical variables, providing valuable insights into associated risk factors. Additionally, the use of standardized diagnostic criteria ensures accuracy and comparability. However, the study has some limitations, including a relatively small sample size, which may affect the generalizability of findings. The cross-sectional design limits the ability to infer causality between metabolic syndrome and COPD severity. Moreover, potential confounding factors such as dietary habits and physical activity were not assessed, which could have influenced the results. Further research with larger cohorts and longitudinal studies is warranted to validate these findings.

CONCLUSION

Metabolic syndrome is prevalent among COPD patients and shows significant associations with gender, BMI, disease duration, and hemoglobin levels. Addressing metabolic syndrome in COPD management may improve patient outcomes and reduce disease burden.

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