

# Prevalence of Metabolic Syndrome in Chronic Obstructive Pulmonary Disease (COPD) at a Tertiary Care Hospital

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DOI: [10.36348/sjimps.2022.v08i06.007](https://doi.org/10.36348/sjimps.2022.v08i06.007)

| Received: 03.02.2020 | Accepted: 11.02.2020 | Published: 27.06.2022

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## Abstract

Chronic obstructive pulmonary disease (COPD) is characterised by persistent airflow limitation that is usually progressive. Additionally, exacerbations and co-existing morbidities contribute to the overall severity in the individual patient [1, 3]. Metabolic syndrome is the name for a group of risk factors that raises the risk for heart disease and other health problems such as, diabetes and stroke. It is present in almost 57% of COPD patients [2]. This is a prospective observational study included 50 patients admitted in chest ward of Sri Ramachandra hospital with Chronic Obstructive Pulmonary Disease, According to guidelines from the national heart, lung, and blood pressure (NHLBI) and the American heart association(AHA), metabolic syndrome is diagnosed, COPD staging with PFT. Each patient was included only once in the study. On admission each patients history was taken regarding occupation, smoking, medication (Inhaled corticosteroids and bronchodilators), number of years of treatment, number of acute exacerbation and number of hospital admission in last year were recorded and tabulated. Height, Weight, BMI, Pulse rate, Respiratory rate and blood pressure, ABG, lipid profile, 6minute walk test, mid arm, mid-thigh and waist circumference were recorded and sent for statistical analysis. Result showed the prevalence of metabolic syndrome in our study was 62% and was associated with severe airflow obstruction and low 6 minute walk distance. Coexisting comorbidities also more frequent in these patients.

**Keywords:** Metabolic syndrome, comorbidities, Obstructive disease, Exacerbations, smoking, prospective study.

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## INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is characterised by persistent airflow limitation that is usually progressive. Additionally, exacerbations and co-existing morbidities contribute to the overall severity in the individual patient [1] and are associated with an increased mortality risk [3].

Metabolic syndrome is the name for a group of risk factors that raises the risk for heart disease and other health problems such as, diabetes and stroke. The term 'metabolic' refers to the biochemical processes involved in the body's normal functioning. Risk factors are traits, conditions, or habits that increase the chances of developing a disease [4]. Several etio-pathogenic mechanisms have been proposed as a possible link between COPD and metabolic disorders that include

systemic inflammation, adipose tissue inflammation, and physical inactivity.

### COPD and obesity

The relationship between COPD and obesity is being increasingly recognized. However, the association is still poorly understood. In a study conducted in Madrid which included 198,670 patients with age above 40 years, about 3.2% of the subjects were detected to have COPD among which 20% had diabetes, 25% were obese, and 34% had dyslipidemia [5]. Steuten *et al.* conducted a study to look at the association of severity of COPD and BMI among 317 subjects in the Netherlands. The overall prevalence of obesity was 18% with the highest prevalence being in subjects with mild to moderate COPD (stages 1 and 2). The prevalence was 23.5% in stage-2, 16.1% in stage-1, and 5.9% in stage 4. [6] Obesity is known to have a

significant impact on the respiratory function of subjects with or without COPD. The effects of abdominal obesity on lung functions are as follows:

(a) Abnormal ventilation/perfusion ratio, (b) Decreased chest wall and pulmonary compliance, (c) Increased work of breathing, (d) Reduction of ventilatory muscle strength and endurance, and (e) Small airway dysfunction and expiratory flow limitation.

#### **COPD and body composition**

Body composition has an important prognostic impact on the nutritional status of patients with COPD. Low BMI, particularly in the advanced stages is associated with an increase in all cause and COPD-related mortality [10]. Alteration in body composition can affect ventilatory function, exercise tolerance and skeletal muscle function.

#### **COPD and Lipoprotein metabolism**

Dyslipidemia was found in 48.3% of COPD patients and 31.7% among controls [11]. A study in a tertiary care hospital in South India revealed that the mean LDL among COPD patients was  $114.89 \pm 19.61$  (mg/dl) against the control group who had a mean LDL of  $96.22 \pm 19.96$  (mg/dl) which was statistically significant ( $P < 0.05$ ) [12].

#### **COPD and Diabetes**

The prevalence of diabetes in COPD is approximately about 3-12% [13]. Systemic inflammation is probably an important contributory factor responsible for both COPD and diabetes mellitus. The nurses' healthy study: a prospective study over an 8-year period had showed that COPD patients have a 1.8% relative risk of developing diabetes. The markers of inflammation such as IL-6, TNF- $\alpha$ , and CRP are elevated in both COPD and diabetes and these markers are elevated to a greater extent in overweight and obese COPD patients [14]. A study by Engstrom *et al.* described that reduced lung function is an important risk factor for the development of diabetes in COPD [15]. Mannino *et al.* shows that subjects with stage 3-4 had a higher risk for developing diabetes with an odds ratio of 1.5 (CI: 1.1-1.9).

#### **COPD and hypertension**

A health survey conducted several years ago, 1992, from the USA, reported an incidence of hypertension 6.2% in COPD [16]. The incidence of hypertension can vary from 6-50% and depends upon the severity of airflow of obstruction [17]. A recent study (INDACO study) demonstrated a 53% incidence of hypertension [18]. The pathological mechanisms responsible for hypertension in COPD are hypoxia related vasoconstriction, free radical injury, endothelial dysfunction, and arterial stiffness [19]. Control of

hypertension in COPD subjects can improve the cardiovascular-related mortality [20].

## **MATERIALS AND METHODS**

It is a prospective observational study included 50 patients admitted in chest ward of Sri Ramachandra hospital with Chronic Obstructive Pulmonary Disease.

### **INCLUSION CRITERIA**

- Age should be less than 90 and more than 45.
- Diagnosis of COPD (ie. Post bronchodilator FEV<sub>1</sub> <70% predicted.)
- COPD grade I to IV
- Patient willing for the study.

### **EXCLUSION CRITERIA**

- Patient not willing for the study.
- Patients with severe LV dysfunction, secondary to Coronary Artery Disease.
- Patient with evidence of pulmonary thromboembolism.

According to guidelines from the national heart, lung, and blood pressure (NHLBI) and the American heart association (AHA), metabolic syndrome is diagnosed when a patient has atleast 3 of the following 5 conditions.

- Fasting glucose  $\geq 100$  mg/dl (or receiving drug therapy for hyperglycemia)
- Blood pressure  $\geq 130/85$  mmHg (or receiving drug therapy for hypertension)
- Triglycerides  $\geq 150$  mg/dL (or receiving drug therapy for hypertriglyceridemia)
- HDL cholesterol < 40mg/dL in men or <50 mg/Dl in women (or receiving drug therapy for reduced HDL cholesterol.
- Waist circumference  $\geq 90$  cm(35 inches) in Asian men or  $\geq 80$  cm(32 inches) in Asian women

Each patient was included only once in the study. On admission each patient's history was taken regarding occupation and smoking history. (number of cigarette/beedi per day and number of years of smoking). History regarding medication (Inhaled corticosteroids and bronchodilators) and number of years of treatment, number of acute exacerbation and number of hospital admission in last year were recorded and tabulated. Height, Weight, BMI, Pulse rate, Respiratory rate and blood pressure were recorded.

Oxygen saturation was recorded by using a pulse oxymeter. Arterial blood gas analysis was done in room air and values tabulated.

Fasting venous blood is taken for blood sugar and lipid profile. Results were tabulated. Six minute walk test was done when the patient is stable and the six minute walk distances were tabulated.

Mid arm, Mid-thigh and waist circumference were taken and tabulated. Modified Medical Research

Council (MMRC) Dyspnea Scale was recorded. These values are sent for statistical analysis.

Table 2. COPD staging by spirometry.	
COPD stage	Spirometry (postbronchodilator)
Mild	FEV <sub>1</sub> * ≥80% of predicted, FEV <sub>1</sub> /FVC <sup>†</sup> <0.7
Moderate	FEV <sub>1</sub> ≤50% to <80% of predicted, FEV <sub>1</sub> /FVC <0.7
Severe	FEV <sub>1</sub> ≤30% to <50% of predicted, FEV <sub>1</sub> /FVC <0.7
Very severe	FEV <sub>1</sub> <30% of predicted, FEV <sub>1</sub> /FVC <0.7

\*FEV<sub>1</sub>: forced expiratory volume in 1 second      †FVC: forced vital capacity  
Source: Adapted from Canadian Thoracic Society recommendations

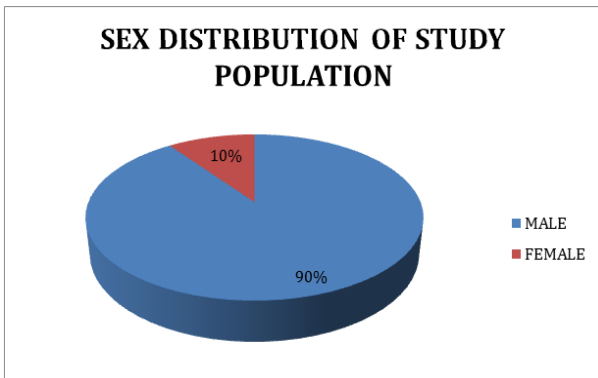
**RESULTS**

Total no of patients included in the study: 50 patients

**Table-1: Sex Distribution of Patients**

SEX	Patients
MALE	45
FEMALE	5
TOTAL	50

Total 50 COPD cases were studied in which 45 patients were males and 5 were females.

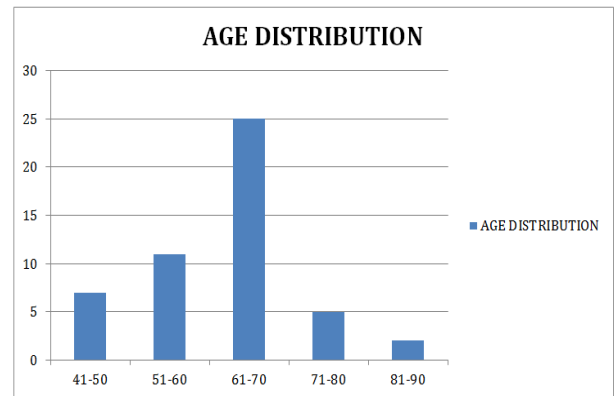


**Fig-1: Sex Distribution of Patients**

Age distribution of patients in the study

**Table-2: Age distribution of patients in the study**

AGE	NO OF PATIENTS
41- 50	7
51-60	11
61-70	25
71-80	5
81-90	2



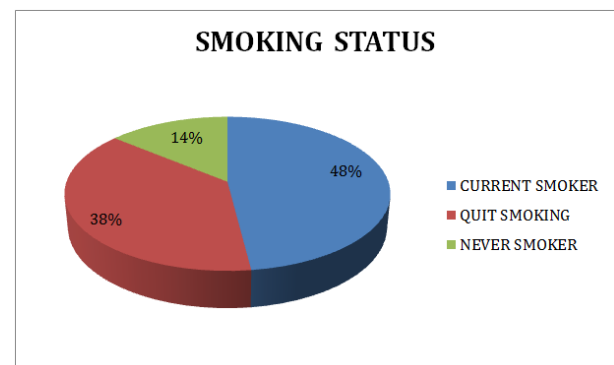
**Fig-2: Age distribution of patients in the study**

50% of the patients in the study are in the age group of 61-70.

**SMOKING HISTORY**

**Table-3: Smoking status**

CURRENT SMOKER	24(48%)
QUIT SMOKING	19(38%)
NEVER SMOKER	7(14%)



**Fig-3: Smoking status**

In our study group, 48% of the patients are current smokers, 38% of the patients are quit smoking and only 14% of the patients are never smokers.

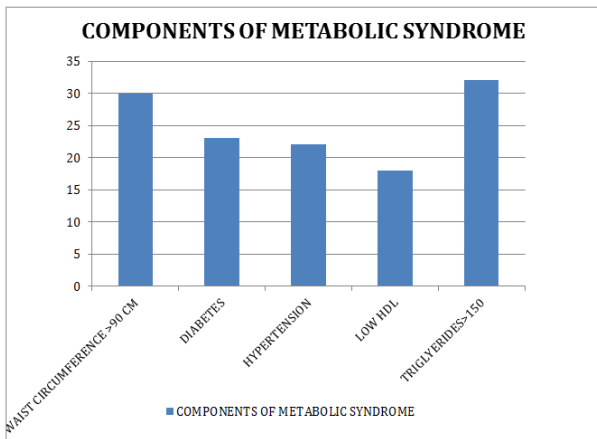
**Components of metabolic syndrome**

COMPONENTS	NO OF PATIENTS
Waist circumference > 90 cm in males / > 80 cm in women.	30(60%)
Fasting glucose > 110mg/dl	23(46%)
Blood pressure > 140/ 90 mmHg	22(44%)
HDL-C < 40 mg/dl	18(36%)
Triglycerides > 150 mg/dl	32(64%)

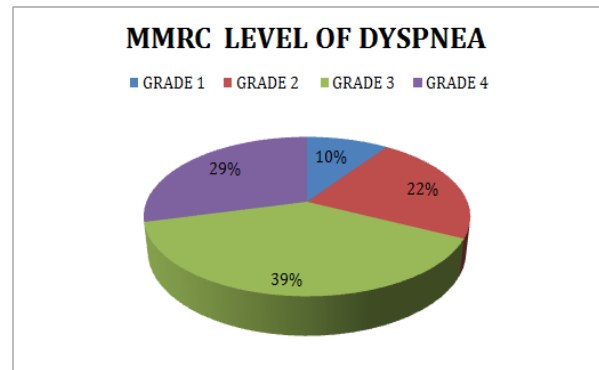
In our study 30 patients (60%) out of 50 having the waist circumference of more than 90 cm 23 patients (46%) out of 50 that is having diabetes mellitus 22 patients (44%) out of 50 having blood pressure, 18(36%) patients out of 50 having low HDL Cholesterol level, 32(64%) patients out of 50 having high triglyceride level

**Table-5: Metabolic Syndrome and MMRC grading of dyspnea**

MMRC grading of Dyspnea	No of Patients
Grade 1	3(9%)
Grade 2	7(22%)
Grade 3	12(38%)
Grade 4	9(29%)
Total	31



**Fig-4: Components of metabolic syndrome**



**Fig-6: Metabolic Syndrome and MMRC grading of dyspnea**

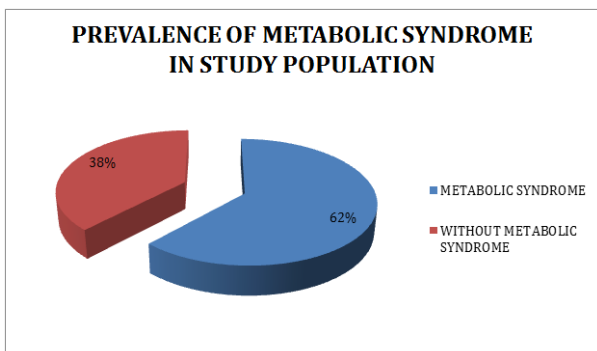
**Prevalence of metabolic syndrome**

Out of 50 patients 31 patients have metabolic syndrome. The Prevalence of metabolic syndrome was 62%

**Metabolic Syndrome and severity of airflow Obstruction (GOLD)**

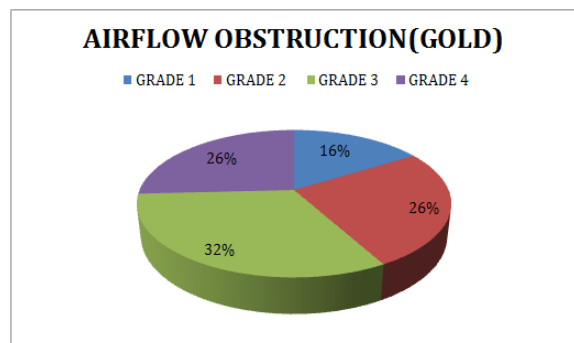
**Table-6: Metabolic Syndrome and severity of airflow Obstruction (GOLD)**

GOLD grading of Obstruction	No of patients
Grade 1	5(10%)
Grade 2	8(27%)
Grade 3	10(33%)
Grade 4	8(26%)
Total	31



**Fig-5: Prevalence of metabolic syndrome**

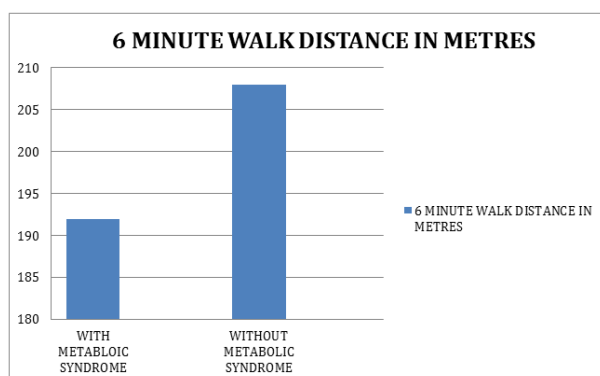
**Metabolic Syndrome and MMRC grading of dyspnea**



**Fig-7: Metabolic Syndrome and severity of airflow Obstruction (GOLD)**

**Table-7: Metabolic syndrome and 6minute walk distance**

Average walk distance in metabolic syndrome patients.	192 metres
Average walk distance in patients without metabolic syndrome.	208 metres

**Fig-8: Metabolic syndrome and 6minute walk distance**

## DISCUSSION

In our study 50 COPD cases were included; in which 45 patients (90%) were males and 5(10%) were females. In our study 14% of the patients are in the age group of 41-50. 22% of the patients are in the age group of 51-60. 50% of the patients are in the age group of 61-70. 10% of the patients are in the age group of 71-80. 4% of the patients are in the age group of 81-90.

In our study group, 48% of the patients are current smokers, 38% of the patients are quit smoking and only 14% of the patients are never smokers.

In our study 30 patients (60%) out of 50 having the waist circumference of more than 90 cm. 23 patients (46%) out of 50 having diabetes mellitus. 22 patients (44%) out of 50 having hypertension. 18(36%) patients out of 50 having low HDL Cholesterol level. 32 (64%) patients out of 50 having high triglyceride level.

In a study conducted in Madrid which included 198,670 patients with age above 40 years, about 3.2% of the subjects were detected to have COPD among which 20% had diabetes, 25% were obese, and 34% had dyslipidemia. A recent study (INDACO study) demonstrated a 53% incidence of hypertension.

In our study Out of 50 patients 31 patients have metabolic syndrome. The prevalence of metabolic syndrome in our study was 62%. Various studies showing prevalence of metabolic syndrome varying 40 to 65%

A study by Funakoshi *et al.* on 7189 Japanese males aged 45-88 years found that patients with GOLD staging II - IV have a high probability of having co-

existent metabolic syndrome with an Odds ratio (OR) of 1.33

Out of 31 patients, with metabolic syndrome 9% having dyspnea of grade 1 MMRC. 22% patients having dyspnea of grade 2 MMRC. 38% patients having dyspnea of grade 3 MMRC. 29% patients having dyspnea of grade 4 MMRC.

Out of 31 patients, with metabolic syndrome, 10% having grade 1 (GOLD) obstruction, 27% having grade 2 (GOLD) obstruction. 33% having graded 3 (GOLD) obstructions, 26% having graded 4 (GOLD) obstructions

In our study patients with metabolic syndrome predominantly having severe to very severe obstruction and lower six minute walk distance and exercise capacity, as it is associated with higher morbidity and mortality. Studies have shown that COPD patients with Metabolic Syndrome have more dyspnea and a greater risk of hospitalization either due to acute exacerbations, or other complications.

## CONCLUSION

The prevalence of metabolic syndrome in our study was 62%. Metabolic syndrome was associated with severe airflow obstruction and low 6 minute walk distance. Coexisting comorbidities also more frequent in these patients.

COPD patients with the Metabolic Syndrome have a more severe form of disease, more dyspnea, a lower FEV1 and require more inhaled glucocorticosteroids. The prevalence of MetS and its comorbidities increases with advancing age. Thus this group of COPD subjects can be further stratified into a higher risk phenotype which requires a closer follow-up.

Studies have shown that the presence of common underlying factors affects the natural history of both the diseases leading to significant morbidity and mortality. Thus, it is essential to focus on a comprehensive way of management of COPD and its comorbidities rather than primarily treating the pulmonary symptoms.

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