



ISSN: 2319-9490

Available online at <http://www.ijcrs.com>

*International Journal of Current Research in Life Sciences*  
Vol. 07, No. 02, pp.1144-1147, February, 2018



## RESEARCH ARTICLE

### PREVALENCE OF METABOLIC SYNDROME IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE PATIENTS

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Received 19<sup>th</sup> December, 2017; Accepted 26<sup>th</sup> January, 2018; Published Online 28<sup>th</sup> February, 2018

#### ABSTRACT

**Introduction:** Chronic obstructive pulmonary disease is a common preventable and treatable respiratory disease which is one of the leading causes of morbidity and mortality world wide. Metabolic syndrome is one of the frequently seen comorbidities of COPD. Systemic inflammation is common component of both metabolic syndrome and COPD.

**Objective:** The aim of this study is to assess the prevalence of metabolic syndrome in COPD patients.

**Methods:** This observational study included 70 COPD patients. Metabolic syndrome was defined using criteria of WHO. COPD patients were selected after getting spirometry done; followed by staging according to the Global initiative for obstructive lung disease (GOLD) criteria.

**Results:** Metabolic syndrome was present in 15.7% of COPD patients. The frequencies of metabolic syndrome in patients with GOLD stages I, II, III, IV were 9.09%, 45.45%, 37.29% and 25.42% respectively.

**Conclusion:** Most of the COPD patients were from urban residence having metabolic syndrome as compared to rural, which is statistically significant ( $p < 0.001$ )

**Key words:** Chronic obstructive pulmonary disease, Metabolic syndrome, Prevalence

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**Citation:** Verma, S.K., Jamsheer, A.K., Surya Kant, Kushwaha, R.A.S., Rajiv Garg, Santosh Kumar, Anand Srivastava and Bajajand, D.K. 2018. "Prevalence of metabolic syndrome in chronic obstructive pulmonary disease patients" *International Journal of Current Research in Life Sciences*, 7, (02), 1144-1147.

#### INTRODUCTION

According to Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2016, Chronic obstructive pulmonary disease is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/ or alveolar abnormalities usually caused by significant exposure to noxious particles or gases (Global initiative for chronic Obstructive Lung disease, 2014). Currently COPD is the fourth leading cause of the death in the world but will be third leading cause of death by 2020 (Lozano et al., 2010). Metabolic syndrome is a disorder that arises from insulin resistance accompanying abnormal adipose deposition and function (Olufadi, 2008). Most people with this syndrome have insulin resistance, which confers increased risk for type 2 diabetes. When diabetes becomes clinically apparent, CVD risk rises sharply. Beyond CVD and type 2 diabetes, individuals with metabolic syndrome seemingly are susceptible to other conditions, notably polycystic ovary syndrome, fatty liver, cholesterol gallstones, asthma, sleep disturbances, and some forms of cancer.

Genetics, physical inactivity, ageing, a pro inflammatory state and hormonal changes may have a causal effect in metabolic syndrome but the role of these may vary depending on ethnic group. Regardless of your height or build, for most adults an increased waist circumference is an indicator of the level of internal fat deposits which coats the heart, kidneys, liver, digestive organs and pancreas. This can increase the risk of heart disease and stroke (Dukhanbandhu Naik et al., 2014).

#### Inclusion Criteria

All patients whose diagnosis of COPD was made through spirometry as per GOLD Guideline 2016. And / or on clinico-radiological basis in which spirometry was not be able to perform due to any reason.

#### Exclusion Criteria

All COPD patients who were already diagnosed with diabetes mellitus.

#### MATERIALS AND METHODS

This study was conducted in a tertiary care health center in north India from 1<sup>st</sup> August 2016 to 31<sup>st</sup> July 2017 on Monday

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OPD. 70 COPD patients attended during the study period in respiratory medicine department OPD, were subjected to prospective observational study. The detailed history of present illness was recorded with regards to symptoms, their onset and duration of illness. Then the risk factors leading to COPD, associated comorbidities (diabetes mellitus and hypertension) and family history of similar disease were asked to get complete history. Then the patient was subjected to general physical examination, respiratory and cardiovascular system. Blood pressure of all patients were checked by using sphygmomanometer in sitting position.

The abdominal circumference was measured at level of iliac crest during normal expiration using a non-expandable measuring tape in standing position. Pulmonary Function Test (PFT) was done by using COSMED drum based spirometry in sitting position and chest X ray PA View was done at Respiratory Medicine Department. For early morning fasting plasma sugar and fasting plasma insulin blood sample (the patient with empty stomach for at least 8 hours) around 2ml of blood will be collected by venipuncture in flouride vial and plain vial respectively with proper aseptic precautions in Pathology department laboratory. To determine serum triglyceride and HDL levels and automated counts, 2 ml of blood will be collected in plain vial and another 2ml in EDTA vial respectively in same above mentioned department. Metabolic syndrome was assessed by WHO Clinical Criteria for Metabolic Syndrome. It consists of hyperinsulinemia (the upper fourth of the fasting insulin level among nondiabetic subjects) or hyperglycemia (fasting glucose  $\geq 110$ mg/dl) in addition to at least two of the following: Waist girth  $\geq 94$ cm in males and  $\geq 80$ cm in females; Dyslipidemia (triglycerides  $\geq 150$ mg/dl or HDL cholesterol  $< 40$ mg/dl in males and  $< 50$ mg/dl in females) and BP  $\geq 140/90$ mmHg or taking BP medication(5). Diagnosing and severity of airflow limitation is of COPD patients was assessed by Global Initiative of Obstructive Lung Disease criteria (GOLD) 2016(Global initiative for chronic Obstructive Lung disease, 2017)

**RESULTS**

The present study was carried out with an aim to study the prevalence of metabolic syndrome among COPD patients. Results are shown in Figure 1 to 4.

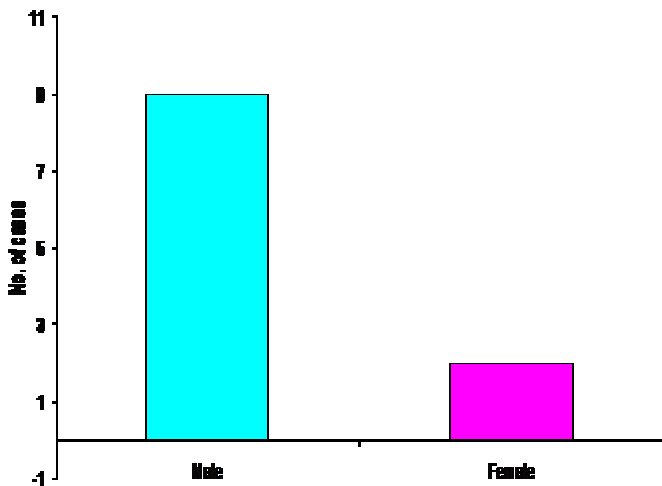


Figure 1. Gender wise distribution of metabolic syndrome patients with COPD

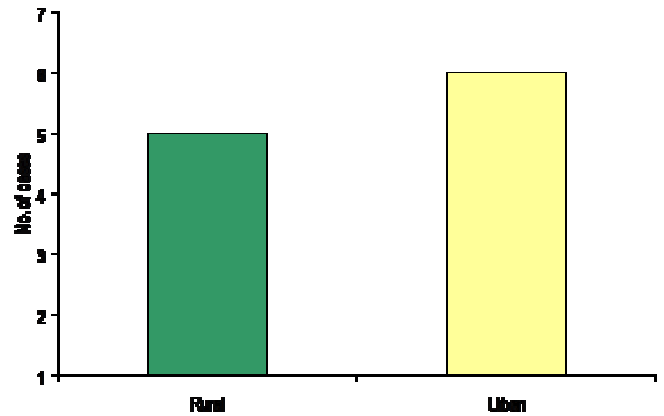


Figure 2. Distribution of metabolic syndrome patients according to place of residence

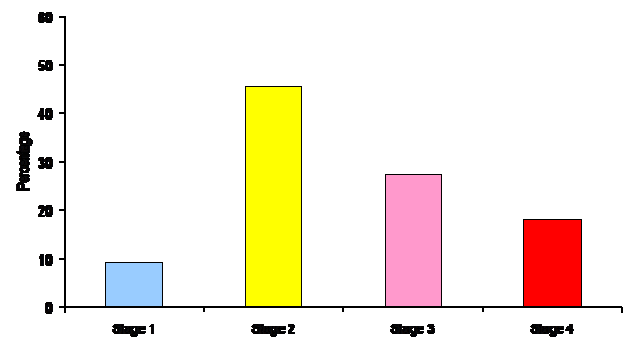


Figure 3. Association of Metabolic Syndrome patients with COPD according to GOLD Criteria

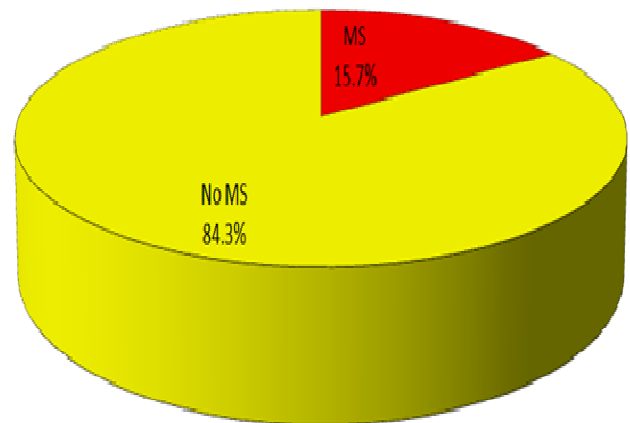


Figure 4. Prevalence of Metabolic Syndrome among COPD patients

Though the proportion of patients of Metabolic syndrome was higher as compared to with no metabolic syndrome among COPD Stage 1 (9.09 vs. 1.69%) and Stage 2 (45.45% vs. 35.59%) while proportion of patients with no metabolic syndrome was higher as compared to metabolic syndrome among Stage 3 (37.29% vs. 27.27%) and Stage 4 (25.42% vs. 18.18%). Difference in prevalence of metabolic syndrome among different stages of COPD was not found to be significant statistically (p=0.479). According to WHO criteria, metabolic syndrome was present in 11 (15.7%) cases. Thus prevalence of metabolic syndrome in study population was 15.7%.

## DISCUSSION

Over the last couple of decades, studies had shown significant relationship of Metabolic syndrome to COPD and several proposed pathogenic mechanisms explaining Metabolic syndrome in COPD are as follows (Naik *et al.*, 2014; Barnes, 2010)

**Systemic inflammation:** It is patho-physiological mechanism (spill over hypothesis) where is a spillover of peripheral lung inflammation into systemic circulation resulting in increased level of various inflammatory markers (IL-1 $\beta$ , IL-6, IL-8, and TNF- $\alpha$ ). Thus, these systemic inflammatory markers are reasons behind co-morbidities in COPD patients;

**Adipose tissue inflammation:** It is one of the major important factors for systematic inflammation. Insufficient oxygenation due to poor neovascularisation leads to relative tissue hypoxia and increased inflammatory response. Inflammation of adipose tissue is related to adverse effect on insulin signalling pathways;

**Physical inactivity:** As COPD progresses beyond the GOLD stages II, the physical activities decrease, and which can lead to weight gain and obesity. The relationship between physical inactivity and systemic inflammation has been observed, thus predisposing to develop Metabolic syndrome;

**Effect of steroid:** The use of steroid either in inhaled or oral form is frequent in COPD patients which is important contributing factor to produce different parameters of Metabolic syndrome;

**Hypogonadism:** Longitudinal studies have established that hypogonadism is a risk factor of Metabolic syndrome. Low testosterone level causes diminished energy level, muscle and bone mass. Hypoxia, hypercapnea and use of steroids are three possible causes of hypogonadism in COPD patients. Metabolic syndrome is present in a large proportion of patients with COPD may indicate that the risk of diabetes and its evolution and death related to premature cardiovascular diseases is likely to occur largely in a predominantly younger subset of COPD patients. Genetics, physical inactivity, ageing, a pro inflammatory state and hormonal changes may have a causal effect in metabolic syndrome but the role of these may vary depending on ethnic group. Regardless of your height or build, for most adults an increased waist circumference is an indicator of the level of internal fat deposits which coats the heart, kidneys, liver, digestive organs and pancreas. This can increase the risk of heart disease and stroke (Dukhanbandhu Naik, 2014). In our study among different metabolic syndrome factors, most prevalent is systemic hypertension in 25 (35.7%), which is followed by raised fasting insulin levels in 24 (34.3%) patients, high waist circumference in 15 (21.4%) patients, raised triglyceride in 24 (34.3%) and low HDL levels in 13 (18.6%) cases This is in accordance with study done by Cebren Lipovec *et al.* (2016) for prevalence of metabolic syndrome in COPD, where the three most prevalent components in both COPD and controls were arterial hypertension (56% and 51%), abdominal obesity (39% and 38%) and hyperglycemia (44% and 47%). In our study, frequency of metabolic syndrome in patients with GOLD Stages I, II, III, and IV were 2.9%, 37.1%, 35.7% and 24.3% is in accordance with cross-sectional study done by Vujic, Obradovic Nagomi *et al.* (2016) where frequencies of MetS in

patients with GOLD stages I, II, III, and IV were 3.3 %, 42 %, 31.6 %, and 23.1 %, respectively. In our study, the distribution of metabolic syndrome among COPD patients, according to sex (male: female) is 5:1 as compared to 6:1 in analytical study, conducted by Lokendra Dave *et al.* (2014) from November 2012 to December 2013. In our study prevalence of metabolic syndrome amongst COPD patients is 15.7% which is in accordance with study of Kamlesh Kumar Gupta *et al.* (2017) who demonstrated Metabolic Syndrome (MetS) in COPD according to NCEP ATP III and IDF criteria as 14 (15.56%) and 30 (33.33%) in North India. In another study from North India, the prevalence of MetS was 27% and Indian data on the prevalence of MetS or its components in COPD are sparse.

Acharya *et al.* (2016) report that MetS was found in 44%, 46%, and 31% of their COPD patients based on definitions by the NCEP ATP III, modified NCEP ATP III, and IDF criteria, respectively, against the statistics of 31%, 38%, and 32%, respectively, among non-COPD controls. These results suggest a trend toward a higher frequency of MetS in COPD cases. In a recent meta-analysis of 19 studies involving 4208 COPD patients, the pooled prevalence of MetS was 34%. Patients with MetS and COPD had higher body mass index (BMI), had higher forced expiratory volume in one second (FEV1%) predicted, and were more frequently females compared to controls.

Dave *et al.* (2014) reported MetS in 42% of their patients with COPD compared to 20% among age-matched controls. The frequency of its component such as abdominal obesity, systolic blood pressure, diastolic blood pressure, elevated triglyceride, reduced HDL-C and elevated fasting glucose respectively was 71 (78.89%), 25 (26.67%), 12 (13.33%), 18 (20%), 23 (25.56%) and 17 (18.78%) respectively. Dyslipidemia was found in 36 (40%) cases of COPD including 16 (17.78%) cases of elevated LDL cholesterol. Ethnicity-based regional differences in the prevalence of comorbidities in COPD may exist, as in Japanese patients, cardiovascular disease and MetS syndrome were found to be less prevalent while osteoporosis and malnutrition were more frequent.

## Conclusion

A total of 70 patients attended outdoor of department of respiratory medicine who were confirmed to have COPD were enrolled in our study.

- In our study, 60% of COPD patients from urban residence are having metabolic syndrome, which is statistically significant ( $p < 0.001$ )
- The prevalence of metabolic syndrome was linked with urban lifestyle and did not show a significant association with stage of disease.

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