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Prevalence of metabolic syndrome in COPD patients attending a tertiary care centre

R Remya*, B Jayaprakash**, D Rajan***, K Anitha Kumari****

*Junior Resident, **Additional Professor, ***Assistant Professor****Professor and Head Department of Pulmonary

Medicine, Government Medical College, Trivandrum.

Correspondence Author: Dr. Jayaprakash. B, Additional Professor, Department of Pulmonary Medicine,Govt.Medical college,Trivandrum,Kerala, India.

Conflicts of Interest: Nil.

Abstract

Background: COPD is a growing epidemic with several extra pulmonary manifestations. Several etiopathogenic mechanisms have been proposed as link between COPD and Metabolic Syndrome.

Aim of the study

 To study the period prevalence of Metabolic Syndrome (MS) in all COPD patients attending the Pulmonary Medicine Department, Government medical college, Trivandrum.

2) To assess the severity of airflow limitation in COPD patients with and without metabolic syndrome.

Materials and methods :Hospital based Cross Sectional study conducted in the department of Pulmonary Medicine , Government Medical college, Trivandrum for a period of one and half years. 287 patients were enrolled. Diagnosis of COPD was made based on GOLD guidelines 2014. Diagnosis of Metabolic Syndrome was made based on new IDF (International Diabetes Federation) definition.

Results: The prevalence of metabolic syndrome among COPD patients in our study was 37.6% with 95% CI 32.2-43.2%. The number of COPD patients with metabolic syndrome (MS) were more among GOLD stage 2 and 3. **Conclusion:** The period prevalence of Metabolic Syndrome in our study was 37.6%. The prevalence was more among patients with GOLD stage 2 and 3. COPD

patients with MS has higher FEV1% (\geq 50%) as compared to those without MS.

Keywords: Metabolic syndrome, COPD, Prevalence, FEV1

Introduction

COPD is a growing epidemic and a major public health problem. COPD is defined as a common preventable and treatable disease, characterised by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and lung to noxious particles or gases. Exacerbations and comorbidities contribute to overall severity in individual patients. ^[1]

The overall prevalence of COPD is estimated to be in the vicinity of 4-5% in our country ^{[2][3]}. COPD is as a major cause of morbidity worldwide and is likely to be the third leading cause of death by year 2020^[4]. COPD is associated with several extra pulmonary systemic manifestations including Diabetes Mellitus, Ischemic Heart Disease, Metabolic Syndrome (MS), Osteoporosis, Anxiety, Depression etc. Hence COPD is considered as a systemic disease. The metabolic syndrome represents a cluster of risk factors (abdominal obesity, atherogenic dyslipidemia, hypertension, and insulin resistance) that predispose affected individuals to systemic inflammation, cardiovascular disease, and physical inactivity. It is associated with a 2-fold risk of cardiovascular diseases

and a 5-fold risk of diabetes. Individuals with metabolic syndrome have a 30%-40% probability of developing diabetes and/or cardiovascular disease within 20 years, depending on the number of components present. In the United States, the prevalence of the metabolic syndrome in the adult population was estimated to be more than 25%. It was estimated that 20%-25% of South Asians have developed metabolic syndrome and many are prone to it^[5]. The prevalence in Indians varies according to the region, the extent of urbanization, lifestyle patterns, and socioeconomic/cultural factors. Chow et al found a prevalence of MS of 26.9% in males and 18.4% in females in southern India^[6]. Deepa et al in CURES 43 (Chennai Urban Rural Epidemiology Study) study showed a prevalence of 18.3%^[7]. The development of obesity, or more specifically an increase in abdominal fat, is thought to be the major event in the progression of metabolic syndrome. A tendency to gain fat in the abdominal area, as opposed to the hip, buttock, and limb areas, is linked to a rise in fatty acids in the blood, which is thought to lead to insulin resistance, high blood pressure, abdominal blood and eventually diabetes. There are several lipids. definitions put forward for metabolic syndrome. The WHO definition (1998) was the first to tie together the key components of insulin resistance, obesity, dyslipidemia hypertension. The new International Diabetes and Federation (IDF) has put forward a new definition (Table1). Metabolic syndrome is found to be twice more common in COPD when compared to the general population. Several etiopathogenic mechanisms have been proposed as a possible link between COPD and Metabolic Syndrome that include systemic inflammation, adipose tissue inflammation and physical inactivity.

Studies to determine the prevalence of metabolic syndrome in COPD are low in our settings.

Aim of the Study

1.To find out the period prevalence of metabolic syndrome in COPD patients attending the Pulmonary Medicine Department, Government Medical College, Trivandrum

2. To assess the severity of airflow limitation in COPD patients with and without metabolic syndrome

Materials and Methods

Study Design

Hospital Based Cross Sectional Study

Study Setting

Department of Pulmonary Medicine, Government Medical College, Trivandrum

Study Period

February 2015 to August 2016

Study Population

All COPD patients attending Pulmonary medicine department during time period of February 2015 to August 2016

Inclusion Criteria

All COPD patients based on GOLD guidelines 2014

Exclusion Criteria

Asthma patients, Asthma COPD overlap Syndrome, Smear positive pulmonary TB, patients not willing for the study

Data Collection

Informed consent was taken from all patients. Data were collected using a structured questionnaire. Diagnosis of COPD made based on GOLD guidelines.

ANTHROPOMETRY: Body weight, Height, BMI = weight in kg/height in metre square.Waist circumference (WC) measured using an inelastic tape at the midpoint between lowest rib and iliac crest.

BLOOD PRESSURE: Atleast two readings taken, with one minute interval between them and the average of the measurements recorded. **Demographic Variants**: Age, sex, h/o smoking, alcoholism, h/o Diabetes Mellitus, Hypertension, Coronary Artery disease

Blood Sample: Fasting blood sample for FBS, Lipid profile

Spirometry: Pre and Post bronchodilator spirometry was done

The Diagnosis of Metabolic syndrome made based on new IDF criteria.

Data Analysis

Quantitative variables were represented as arithmetic mean and standard deviation. Categorical variables were grouped and represented as percentage. Data were entered in excel sheet and analysed using SPSS V 16 software.

Results:

290 patients were enrolled in the study. 220 were males and 70 females. The mean age of the study population was 64+/-8.46 years. 218 were smokers and 72 nonsmokers. Among the 218 smokers, 43 were current smokers (14.8%). The smokers were further classified into mild, moderate and heavy smokers based on smoking index (<100, 100-300, >300). 185 (84.9%) patients had smoking index more than 300. Firewood smoke exposure was present in 89 (30.7%). The mean BMI of the study population was 22.39 +/- 4.03. Overall prevalence of Diabetes in the study was 42% (including already physician diagnosed diabetes and newly detected). An FBS value of >100 was present in 216 patients (74.5%). Prevalence of systemic hypertension was 39.6%. 32, 128, 99, 31 patients in GOLD stage 1,2,3,4 respectively. COPD combined assessment group A, B, C, D were 12,77,47 and 154 patients. Among 290 patients, MS was present in 109 patients. The period prevalence of Metabolic syndrome among COPD patients in our study was 37.6% with 95% CI 32.2- 43.2%(fig:1).The mean age among those with MS was 62.66 years while those without MS was 64.91

(48.6%). Among the 218 smokers, 72 had MS. Among those with MS, 98.2% of the population had FBS>100. About 67.9% of patients with MS had BP \geq 130/85. The mean value of triglycerides in those with and without MS was 104.09 and 88.27 respectively. On total 34 patients had low HDL cholesterol (<40 in males / <50 in females) and of this 34, 24 has MS. Among 109 patients with MS, 3.7%, 60.6%, 35.8% were in GOLD stage 1, 2, 3 respectively with maximum among GOLD stage 2 and 3 and the result was statistically significant.(p value <0.001). The total population was subdivided into 2 groups based on FEV1 (\geq 50, <50). Among the 290, 160 had FEV1250. 70 out of 109 patients with MS had FEV1>50. MS was present more among COPD patients with FEV1 >50 and the result was statistically significant with a p value of 0.016(fig 2).

years. Among 109 patients with MS, 75 were male and 34

females. Out of total 70 female patients, 34 had MS

Discussion

290 COPD patients were recruited in the study. The mean age of the study population was 64.06 +/- 8.46 years. The mean age among COPD patients with metabolic syndrome was 62.66 +/- 7.56 years and in those without metabolic syndrome was 64.91 +/- 8.87 years. Metabolic syndrome tends to occur at a slightly early age group. In a previous study conducted by Watz et al the mean age was 64.0 +/- 6.5 years which was comparable to our study.^[8], while another study by Diez et al the mean age was 73.7 +/- 8.9 years, which was higher than our study^[9]. In a study by Funakoshi et al the mean age group was 55+/- 7.9 which was lower than our study^[10].

Out of the 290 patients of our study 220 (75.9%) were males and 70 (24.1%) were females. The results were comparable with a study by Watz et al, in which 76% of populations were males and 24 % females. While study by Diez et al had 89% males and 11% females. In our study

the metabolic syndrome was present in 75 males (68.8%) and 34 females (31.2%). In a study by Marquis et al, 60.9% of male patients and 26.7% female patients with COPD had Metabolic Syndrome as defined by NCEP ATP III criteria ^[11]. Among 290 patients, 218 were smokers (75.2 %) and 72 were nonsmokers (24.8%). Among the 218 smokers, 43 were current smokers (14.8%). The mean smoking index of our study was 603.03 +/- 313.66. Study by Funakoshi et al showed 66.7% smokers (27% were current smokers) and 33.3% were nonsmokers ^[10]. Compared to our study the percentage of smokers were low in this study may be because the study was a general population based study where the data was collected from population who underwent medical screening whereas in our study all were COPD patients and majority had history of smoking. In our study among the patients with metabolic syndrome, 72 were smokers (66.1%) and 37 were nonsmokers (33.9%).

In present study 59 had baseline dyspnea of grade I mMRC (20.3%), 155 had grade II mMRC (53.4%), 76 had grade III mMRC (26.2%). 18.3% of patients with baseline dyspnea of grade I mMRC, 48.6% with grade II mMRC and 33% with grade III mMRC had metabolic syndrome. However the result was not statistically significant.In present study, 66.7% of patients with metabolic syndrome had 2 or more exacerbations in last year and the result was statistically significant. A prospective study by Kupeli E et al. of 106 patient observed that presence of MS was associated with an increase of acute exacerbations of COPD^[12]. This was comparable with our study result that patients with MS had more number of exacerbations. More and more severe comorbidities could explain that COPD patients with MS have more hospitalizations by any cause without an increase neither of admissions for COPD nor of exacerbations in the previous year. Patients with MS has

more chance of cardiac disease including hypertension and heart failure which may contribute for worsening breathlessness. Further. osteoporosis can modify respiratory mechanics and contribute to more breathlessness. The distribution of patients according to COPD combined assessment showed that majority of our population was in group D (154) and among them 78 had MS. The main reasons for such a result may be because our centre is a tertiary care centre. Most of our patients had exacerbations more than 2 or at least one hospital admission in last year. Now the latest GOLD guidelines 2017 have put forward to separate the spirometric assessment from symptoms evaluation. ABCD groups are now proposed to be derived exclusively from patient's symptoms and their history of exacerbations. The mean BMI of our study was 22.39 +/- 4.03. The mean BMI among those with MS (26.13) was higher than those without MS (20.13). This result was comparable to previous studies. In the study by Diez et al the mean BMI among those with and without MS were 29.8 and 24.9 respectively. Interestingly, 76.6% of the patients had BMI < 25 while only 23.4 % were overweight (BMI \geq 25). Among those overweight population 66% had MS. Considering BMI alone is not a good predictor of MS, because among 222 patients with BMI < 25, 39.4% had MS. Many patients with normal BMI also had MS, because they had central obesity as measured by waist circumference. It is the distribution of body fat an important determinant that total body weight.

In our study overall prevalence of Diabetes was 42% .The number of patients with $FBS \ge 100$ was 216 (74.5%). This showed almost three fourth of the population have impaired glucose tolerance. Among the 109 patients with MS , 107 had $FBS \ge 100$. The reason for a high prevalence of diabetes may be because Kerala State is the diabetic capital of India with its prevalence almost double as

nationwide prevalence, may be the reason for high prevalence of diabetes in our study. The prevalence of Systemic hypertension among the population was 39.6%. The number of patients with SBP/DBP \geq 130/85 were 106 patients. Among total 109 patients with MS, 74 (67.9%) had SBP/DBP \geq 130/85. The mean value of HDL among those with MS was 51.55. The mean value of LDL value of patients with and without MS was 108.73 and 97.28 respectively. A study by Niranjan et al showed that the mean LDL value of COPD patients in a tertiary care hospital in south India to be 114.89 +/- 19.61^[13]. The values of our study were almost comparable to this study.

The period prevalence of metabolic syndrome in our study was 37.6%. Among the total 290, 109 had MS. Several studies from different parts of world show that the prevalence varies from 25.6 to 60.9%. In the study by Watz et al the overall prevalence was 47.5% in German COPD and chronic bronchitis patients. Their results were higher as compared with our study, probably because they they included patients with stable COPD and 30 chronic bronchitis patients with normal spirometry. In the study by Diez et al, it was 42.9%, they used BMI instead of waist circumference as a criteria to diagnose Metabolic syndrome. In a systematic review by CerebronLipovec N et al. published in COPD 2016, 19 studies involving 4208 COPD patients, the pooled prevalence was 34%.^[14] The GOLD guidelines 2017 states the prevalence of MS in COPD patients is estimated to be more than 30%. The prevalence of metabolic syndrome was more among patients with GOLD stage 2 and 3 and on subgroup analysis of patients into two (FEV1 \geq 50 and < 50), MS were found more among those with FEV1 \geq 50. The study by Diez et al. also reported that MS was found more among those in GOLD stage 2 and those with higher FEV1. The study by Watz et al. also showed that MS prevalence was lower in patients with severe COPD

staging .The systematic review by CerebronLipovec N et al also showed that COPD patients with MS had higher FEV1 % predicted while compared to those without $MS^{[14]}$. The probable explanation would be as the COPD severity increases there will be more of muscle wasting, sarcopenia and cachexia.The overall period prevalence of MS in our study was 37.6 % and was more among those with FEV1 \geq 50.

Conclusion

The period prevalence of MS in our study was 37.6%. The prevalence was more among patients with GOLD stage 2 and 3. COPD patients with MS has higher FEV1% (\geq 50%) as compared to those without MS.

Table 1: The New International Diabetes Federation (IDF)definition.





Fig 1: Period prevalence of metabolic syndrome in COPD - 37.6%



Fig: 2: Relationship between FEV1 and Metabolic syndrome.

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