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Prevalence of metabolic syndrome in COPD and its association with severity of disease

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Abstract

Introduction: COPD patients and metabolic syndrome often coexist which leads to increased risk for cardiovascular events. Aim of this study was to find the prevalence of metabolic syndrome in COPD patients and its association with severity of disease.

Materials and Method: We conducted this study At Sri Siddhartha Medical College; Tumakuru in Pulmonology OPD. It is a cross sectional study carried out on 129 diagnosed COPD patients comparing with control group. COPD cases are diagnosed based on GOLD criteria. All diagnosed patients were evaluated for presence of metabolic syndrome based on NCEP ATP III criteria and compared with severity of disease. Statistical analysis used: unpaired t-test and Fisher exact test. A p-value of <0.05 was considered significant.

Results: Among COPD patients 61(47.28%) patients were diagnosed with metabolic syndrome in comparison to control group 18(17.47%). We also noticed high prevalence of metabolic syndrome in Grade II COPD (64.28%) patients.

Conclusions: Our study concluded that prevalence of metabolic syndrome is more common in COPD patients and more prevalent in Grade II COPD subsets. Early recognition of metabolic syndrome in COPD patients and early intervention can prevent the mortality and morbidity related to cardiovascular complications.

Keywords: COPD; GOLD - Global initiative for Chronic Obstructive Lung Disease; Metabolic syndrome

Introduction

Chronic obstructive pulmonary disease (COPD) is characterized by persistent airflow limitation that is usually progressive and associated with chronic airway inflammation. Additionally, exacerbations and co-existing morbidities contribute to the overall severity in the individual patient. The overall prevalence of COPD is estimated to be 4-5% in our country [1]. It has been recognized as a major cause of morbidity worldwide and is likely to be the third leading cause of death by the year 2020 [2]. It is most commonly occurs in tobacco smokers and is characterized by an increase in the annual rate of decline of forced expiratory volume in 1 second (FEV1).

COPD has been associated with several extra-pulmonary systemic manifestations such of diabetes mellitus, osteoporosis, and metabolic syndrome, cardiovascular disease and lung cancer [3,4]. Metabolic syndrome, also called insulin resistance syndrome or syndrome X is a cluster of risk factors that is responsible for much of the excess cardiovascular disease morbidity among overweight and obese patients and those persons with type 2 diabetes mellitus [5].

The major characteristics of metabolic syndrome include insulin resistance, abdominal obesity, elevated blood pressure, and lipid abnormalities (i.e., elevated level of triglycerides and low levels of high-density lipoprotein cholesterol). Metabolic syndrome is age dependent and has been related to several other health conditions and an increased mortality risk. In addition, metabolic syndrome has clinically relevant negative effects on subjects exercise capacity as well as on health status. Several etio-pathogenic mechanisms have been proposed as a possible link between COPD and metabolic disorders that include systemic inflammation, adipose tissue inflammation, medications and physical inactivity [6,7].

In the present study we evaluated the prevalence of metabolic syndrome in COPD patients compared to healthy subjects, and also its association with severity of disease. We hypothesize that the prevalence of metabolic syndrome is higher in COPD patients compared to healthy subjects.

Materials and Method

The present study is carried out on 129 diagnosed COPD patients (GOLD criteria) as well as 103 apparently healthy non smoker volunteers (control group). All the patient were recruited from the department of pulmonary medicine, Sri Siddhartha medical college, Tumakuru, Karnataka, India during August 2016 to April 2017 (9 months) after taking written informed consent prior to participation in the study. An ethical committee approval was taken.

All patients and controls were analyzed for clinical and laboratory findings, including full history taking, clinical examination, routine laboratory investigations including complete blood picture with differential white cell count, erythrocyte sedimentation rate, complete liver and kidney functions test, serum uric acid, lipid profile including HDL-cholesterol, triglycerides, and ECG, 2D ECHO has also been done in all patients.

Body weight, height, and waist circumference were obtained in all participants. Waist circumference was measured by a single observer using an inelastic tape at the midpoint between the lowest rib and the iliac crest

Blood pressure was taken from both arms and the higher measurement was used for analysis. Participants were asked to fast for 12 h before blood sampling. Serum triglycerides were measured by Lipase-Glycerol kinase method. HDL-C was assessed by oxidase method.

Standard pulmonary function test was done for all COPD patients and control group. Based on the GOLD criteria (Table 1) all COPD patients were classified as mild, moderate, severe and very severe category. We used NCEP ATP III criteria to diagnose metabolic syndrome (Anneure 1).

Statistical Analysis: Data are reported as mean ± SD or proportions and 95% confidence intervals. Statistical analysis was performed by unpaired t test and Fisher exact test and p-value < 0.05 was considered statistically significant.

Table 1: Grading of COPD (GOLD criteria)

Grade	Severity	Spirometry
I	Mild	FEV1/FVC < 0.7 FEV1 ≥ 80% Predicted
II	Moderate	FEV1/FVC < 0.7 50% ≤ FEV1 < 80% Predicted
III	Severe	FEV1/FVC < 0.7 30% ≤ FEV1 < 50% Predicted
IV	Very Severe	FEV1/FVC < 0.7 FEV1 < 30% Predicted

Annexure-1

NCEP ATP III criteria

3 out of the following 5 criteria must be present for diagnosing metabolic syndrome.

1. Waist circumference (WC > 102 cm in men or > 88 cm in women)
2. Fasting blood glucose >100 mg/dl (5.6mmol/l) /previously diagnosed type II diabetes.
3. Serum triglyceride >150 mg/dl (1.7mmol/l) or specific treatment for this lipid abnormality.
4. Serum high density lipoprotein (HDL) ≤ 40 mg/dl (1.03mmol/l) in men or ≤ 50mg/dl (1.29mmol/l) in women or specific treatment for this lipid abnormality.
5. Systolic blood pressure ≥130 mmHg and/or diastolic blood pressure ≥ 85 mmHg or treatment of previously diagnosed hypertension.

Results

We tabulated Baseline characteristics of all the subjects participated in the study in Table 2. All COPD patients and control participants were matched for age and gender.

In our study we noted COPD patients of average age 56.5±7.7 yrs and male predominance (male: female = 77.5:22.4). We noted slightly higher BMI in COPD group (25.6 ± 4.4) compared to control group (23.3 ± 3.3) but not statistically significant. Among 129 COPD patients 86 were smoker (which include former and current smokers) and significantly high number 43(33.33%) were non-smokers. Their average pack year was 11.53 ± 4.75.

We also noted higher WC in COPD group (89.6 ± 8.8) compared to control group (86.8 ± 9.6). SBP (130.9 ± 14.6) and DBP (83.2 ± 12.1) were also higher in COPD group compared to control group which were 126.2 ± 13.3 and 81.2 ± 11.2 respectively.

TG concentration were higher in COPD (143.7 ± 14.9) compared to healthy groups (141.2 ± 11.2), but HDL value was higher in control group (44.2 ± 8.1) compared to COPD (42.5 ± 7.5) group. We noted more Diabetes among COPD group, as FBS value was higher in COPD group (106.5 ± 20.5) compared to control group (96.2 ± 13.2).

Our study revealed statistically significant differences between the two groups in various parameters like body mass index (p-value < 0.001) fasting blood glucose (p-value <0.0001) waist circumference (p-value=0.0216) and systolic blood pressure (p-value=0.0120) where as

Age (p-value=0.5264), DBP (p-value =0.2107) and triglyceride levels (P value=0.158) and high density lipoprotein cholesterol levels (p-value=0.099) among two groups were statistically insignificant.

During the study period, out of 129 COPD patients, 61(47.28%) patients were diagnosed to have metabolic syndrome as compared to control group in which 18(17.47%) were found to have metabolic syndrome.

Based on the GOLD criteria (Table 1) all COPD patients were classified as mild, moderate, severe and very severe category and NCEP ATP III criteria was used to diagnose metabolic syndrome. We noted 7 (43.75%) patients in Mild, 36(64.28%) patients in Moderate, 12 (34.28%) patients in Severe and 6 (27.27%) patients in very severe COPD group to have metabolic syndrome (Table 3). We noted more percentage 36/56 (64.28%) of patients in Moderate COPD group with co existed metabolic syndrome.

Table 2: Baseline characteristics of patients and controls

Parameters	COPD	Controls	p-value
Age (years)	56.5±7.7	55.8±9.1	0.5264
Gender(M:F)	100:29	81:22	
BMI (Kg/m^2)	25.6±4.4	23.3±3.3	<0.001
Smoking status		Non smoker	
Never smoker	43		
Former smoker	56		
Current smoker	30		
Pack years	11.53±4.75		
Waist Circumference (cm)	89.6±8.8	86.8±9.6	0.021
SBP (mm of Hg)	130.9±14.6	126.2±13.3	0.012
DBP (mm of Hg)	83.2±12.1	81.2±11.2	0.210

TG (mg/dl)	143.7±14.9	141.2±11.2	0.158
HDL (mg/dl)	42.5±7.5	44.2±8.1	0.099
FBG (mg/dl)	106.5±20.5	96.2±13.2	<0.001
Metabolic syndrome (%)	61(47.28%)	18(17.47%)	<0.001

Table 3: Prevalence of metabolic syndrome in relation to severity of COPD

Grade of COPD	Metabolic syndrome (present)	
	No.	Prevalence
Mild	7/16	43.75%
Moderate	36/56	64.28%
Severe	12/35	34.28%
Very severe	6/22	27.27%

Discussion

COPD is complex disease with multiple systemic co-morbidities and complications [8]. Systemic inflammation and physical inactivity have been identified as relevant extra pulmonary marker of the severity of COPD and they lead to exacerbations, hospitalizations, and mortality in this patient population [9,10]. When COPD and metabolic syndrome coexists cardiovascular complications are more common when compared to general population.

Our study showed high prevalence of metabolic syndrome in COPD patients (47.28%) compared to healthy group of patients (17.47%). Our study also showed presence of metabolic syndrome is more common in moderate group of COPD patients (64.3%).

Similar studies done by Hosny et al. [11], also reveals presence of metabolic syndrome more common in COPD group of patient compared to healthy group. One more study done by Marie-Kathrin et al. [12] showed similar observations.

Our study revealed statistically significant differences between the two groups in various parameters like body mass index (p-value < 0.001) fasting blood glucose (p-value <0.0001) waist circumference (p-value=0.0216) and systolic blood pressure (p-value=0.0120) and parameters like age (p-value=0.5264), diastolic blood pressure (p-value =0.2107) and triglycerides (P value=0.158) and high density lipoprotein cholesterol levels (p-value=0.099) did not show any statistical significance. Study done by Marie-Kathrin et al. [12] showed similar observations.

Our study also revealed that presence of diabetes is more common in Grade III and IV COPD patients. Possible explanation being as the diseases progress in severity, patients use more medications in the form of steroids and also presence of adipose tissues inflammation leading to body insulin resistance leading to development of diabetes [13].

It is important to emphasize that COPD result in sedentary lifestyle and physically inactive condition, which could explain the higher prevalence of the metabolic syndrome in COPD patients compared to the control participant. COPD is an important risk factor for cardiovascular disease, increasing the risk by two to three folds [14]. Thus in COPD patients the presence of metabolic syndrome might explain the increase in incidence of cardiovascular complications.

Conclusions

Our study concludes that prevalence of metabolic syndrome is more common in COPD patients compared to control group and more prevalent in Grade II COPD subsets. Hence components of metabolic syndrome being the most serious co-morbidities encountered with COPD amounting for severe disease and major cause of mortality. Early recognition of metabolic syndrome in COPD patients and early intervention can prevent the mortality and morbidity related to cardiovascular complications.

Conflicts of interest

None declared

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