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Original Article

The obesity paradox: does it affect COPD outcomes

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Abstract:
Background: Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity and mortality worldwide. Malnutrition and weight loss are common in COPD patients and are associated with poor prognosis .**Objectives:**To study the relationship between the severity of COPD and body mass index (BMI), and to ascertain the correlation between BMI and the FEV1 decline rate and severity of the disease.**Methods**: This cross-sectional study included 209 COPD patients. Patients were classified according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) staging system. BMI was calculated and patients were categorized as underweight, normal weight, overweight, or obese.
Results: The classification of patients according to the severity of airflow limitation revealed that 10 patients were classified as having mild airflow limitation, 89 patients had moderate airflow limitation, 102 patients had severe airflow limitation, and 8 patients had very severe airflow limitation. It was observed that the patients' BMI decreased asthe disease severity increased (GOLD), and this relationship was statistically significant ($P < 0.05$). In the study populations with greater post-FEV1% projected values, the BMI was better.
Conclusion: The findings support the concept of the "obesity paradox" in COPD patients, where obesity is associated with better outcomes. Low BMI was positively associated with the increased severity of obstruction in COPD patients. Malnutrition and weight loss are serious ailments, which ought to be taken carefully while addressing COPD patients. Active dietary supplements offer likelihood to increase body weight while also enhancing exercise tolerance and respiratory health, thereby decreasing morbidity and mortality.
Keywords: Chronic Obstructive Pulmonary Disease (COPD), Body Mass Index (BMI), Lung Function, FEV1, Severity of Airflow Limitation, Obesity Paradox, Nutritional Status, Malnutrition

Introduction

According to GOLD-2024[1] Chronic obstructive pulmonary disease (COPD) is now one of the top three causes of death worldwide. More than 3 million people died of COPD in 2012 accounting for 6% of all deaths globally. It is major cause of chronic morbidity and mortality throughout the world.It causes persistent, often progressive, airflow obstruction.The disease progression of COPD often results in manifestations of several important systemic extra-pulmonary effects and comorbidities [2,3] such as fatigue, nutritional abnormalities, weight loss, skeletal muscle dysfunction and other consequences of mainly systemic inflammation[4,5]and contribute to exacerbations and to the high burden of COPD. [6]

Sarcopenia and cachexia can adversely influence the natural course of COPD and lead to severe symptoms, poor lung function, rapid disease progression, frequent exacerbations and increased mortality of COPD. [7,8]

Nutritional and metabolic abnormalities are core features of COPD as a systemic disease [9,10].Several observational studies have shown that low BMI is an independent predictor of mortality in COPD.[11-14] But, overweight and obesity appear to have a protective effect on mortality, with the greatest effect in those with severe COPD. [11,12]This is in contrast to the general

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population, where obesity is associated with decreased life expectancy [15].

Observations form part of the so-called "obesity paradox" [16], but how this applies to other COPD outcomes is unclear.

The term "obesity paradox" was coined by Gruberg et al. [16], in 2002, following their observations on the higher risk of complications and mortality among patients who were underweight and with normal BMI compared with their overweight and obese counterparts in CHD. The obesity paradox, is based on a protective effect of adipose tissue against mortality, has been observed in various chronic diseases, including cardiovascular disease, [17] chronic heart failure,[18],stroke,[19]chronic kidney disease,[20]type2 diabetes mellitus,[21],pulmonary hypertension. [22] and in respiratory diseases [23]. However, the relationship between obesity and mortality of COPD is controversial.

Hence, the objective of our study was to ascertain the correlation between BMI and the FEV1 decline rate and severity of the disease.

Materials and Method

The present study was carriedamong209 COPDpatientsattheDepartmentofRespiratory Medicine,RamaMedicalCollegeHospital and Research Centre, Hapur. The study was carried out after theapproval of the institutional ethics committee. A well-informed written consent was takenfromall subjects beforeenrolment in the study.

Inclusion Criteria for the study included: a) Age 40 and above, b) Stable disease for at least 3 months and c) Willingness of the patient to participate in study. Exclusion Criteria included: a) Use of systemic steroids in the past 3 months, b) Presence of present or past history of wheeze, chest tightness, eye allergy, nasal allergy or skin allergy, suggesting bronchial asthma and/or c) Presence of other illnesses like active pulmonary tuberculosis, Malignancy, Renal or Hepatic disease. A written informed consent was taken from all the patients after explaining the study protocol.All patients with clinical history consistent with COPD diagnosed so as per GOLD guidelines were enrolled.

CriteriafordiagnosisofCOPD

COPDwasdiagnosed based onthe GOLD guidelinesdescribedasbelow-

- Presenceofsymptomssuchasdyspnea,chroniccough or sputum production,and/orahistoryofexposuretoriskfactorssuchassmoking,occupation,andindoor/outdoorpollution.
- Thepresenceofpost-bronchodilatorforcedexpiratoryvolumeinonesecond (FEV1)/forcedvitalcapacity(FVC)oflessthan0.70.

ClassificationofairflowlimitationseverityinCOPD (basedonpost-bronchodilator FEV1)inpatients FEV1/FVC< 0.70:

1. GOLD1—mild:FEV1≥80%predicted
2. GOLD2—moderate:50%≤FEV1<80%predicted
3. GOLD3—severe:30%≤FEV1< 50%predicted
4. GOLD4—verysevere:FEV1<30%predicted

A detailed history and clinical examination were conducted for all patients. BMI was calculated for all patients by dividing their weight (in kg) by their height (in m) squared. Patients were then categorized based on the World Health Organization classifications as underweight (BMI < 18.5 kg/m2), normal weight (18.5-24.9 kg/m2), overweight (25.0-29.9 kg/m2), or obese (> 30.0 kg/m2).

Spirometry (pulmonary function test) was performed using a GANSHORN spirometer. Additional assessments included chest X-ray (PA view), routine blood investigations, and calculation of BMI.

The correlation between BMI and the FEV1 decline rate and severity of the disease was assessed. The variables collected were entered in Microsoft Excel (Office 2013) and was analyzed using SPSS (version 20). The data obtained at various stages of the study was compared using parametric and non-parametric tests and a possible correlation was attempted to establish the relationship between the various parameters studied taking into account the specific objectives of the study as well as the type of the data. P-value <0.05 was considered as a significant.

Results

Table 1: Distribution of patients according to Classification of airflow limitation severity in COPD

Classification according to severity of airflow	No. of patients
Mild	10
Moderate	89
Severe	102
Very severe	8

The classification of patients according to the severity of airflow limitation revealed that a total of 10 patients were classified as having mild airflow limitation, a significantly larger proportion of patients, numbering 89, were categorized as having moderate airflow limitation; the majority of patients, totaling 102, were classified as having severe airflow limitation and 8 patients were found to have very severe airflow

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limitation, indicating a significant impairment in lung function.

Table 2: Distribution of patients according to BMI

BMI criteria	No. of patients
Underweight	86
Normal	64
Over weight /obese	59

According to the Body Mass Index (BMI) criteria, the distribution of patients in the study revealed that 86 patients were categorized as underweight, with a BMI of less than 18.5 kg/m2. In contrast, 64 patients had a normal weight, with a BMI ranging from 18.5 to 24.9 kg/m2. 59 patients were classified as overweight or obese, with a BMI of 25 kg/m2 or higher (table 2).

Table 3: Correlation between BMI and the FEV1 decline rate and severity of the disease

SEVERITY	Mild (n=10)		Moderate (n=89)		Severe (n=102)		Very severe (n=8)	
	No.	%	No.	%	No.	%	No.	%
Underweight	0	0	30	33.70	50	49.01	6	75
Normal	10	100	39	43.82	13	12.74	2	25
Over weight /obese	0	0	20	22.48	39	38.23	0	0

The COPD patients were classified by their post-bronchodilator FEV1% predicted in four stages according to GOLD.Among 209 study population, 10 (5%) patients were in stage 1, 89 (44.5%) in stage 2, 102 (52%) in stage 3, and 8(5%) in stage 4. It was observed that the patients' BMI decreased as the disease severity increased (GOLD), and this relationship was statistically significant ($P < 0.05$). In the study populations with greater post-FEV1% projected values, the BMI was better.

Discussion

Nutritional depletion and weight loss are the features of COPD. The exact mechanisms are uncertain, [24] but decreased food intake and increased energy expenditure in breathing are the most important. [25] Hypoxia has been shown to stimulate the production of inflammatory mediators and to contribute to the development of malnutrition in COPD patient. [2] There are several studies [26-28] which have documented the association between low body mass and poor prognosis and mortality in patients with established COPD.

The relationship between body mass index (BMI) and chronic obstructive pulmonary disease (COPD) has been a topic of interest in recent years. Our study found a significant correlation between BMI and the severity of COPD, as classified by the Global Initiative for Chronic Obstructive Lung Disease (GOLD) staging system. This finding is consistent with previous studies that have investigated the relationship between BMI and COPD.

Nemery et al. [29] observed that individuals susceptible to COPD may be leaner than those who are not susceptible, raising questions about whether low body weight is a risk factor for COPD or a consequence of established lung disease. Our study suggests that the latter may be the case, as we found that BMI decreased as the severity of COPD increased.The relationship between age and COPD severity has also been investigated in previous studies. Kohansal et al. [30] found that the severity of airflow obstruction increases with age, which is consistent with our finding that the average age of patients increased with increasing severity of GOLD staging.Furthermore, our study found a positive correlation between BMI and forced expiratory volume in one second (FEV1)% predicted, which is consistent with previous studies. Qiu et al. [31] demonstrated a positive correlation between BMI and FEV1/forced vital capacity (FVC), FEV1% predicted. Similarly, Sahebjami et al. [32] found a correlation between BMI and pulmonary function tests, and recommended using BMI as a criterion to evaluate the nutritional status of COPD patients. Our study supports these findings and highlights the importance of considering BMI as a prognostic factor in COPD management.

Another study that investigated this relationship is the Platino study, a population-based epidemiologic study conducted in five Latin American cities [33]. The study found that up to a normal BMI (i.e., BMI up to 25.00 kg/m2), forced expiratory volume in one second (FEV1)% predicted is positively and linearly correlated with BMI. This means that as FEV1% predicted increases, BMI also increases, and vice versa. However, in cases of pre-obese or obese patients, this correlation is not linear.

Our study's findings are consistent with the Platino study, as the mean BMI of our population was 20.5 ±

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2.39 kg/m2, which falls within the normal BMI range. This suggests that our study population's lung function, as measured by FEV1% predicted, is positively correlated with BMI, similar to the findings of the Platino study. This correlation highlights the importance of considering BMI as a factor in COPD management, particularly in patients with normal BMI.In contrast, other studies have found no correlation between BMI and lung function in COPD patients. For example, Vestbo et al. [34] found no correlation between BMI and post-bronchodilator spirometry (post FEV1/FVC, post %predicted) in their study of 1,898 patients. In the above study total number of population was 1,898 that was large scale study. But in our study total number of cases was 209.We need further studies involving larger sample size is required to confirm the correlation between BMI and severity of obstruction (GOLD) in COPD patients.

Similarly, Ischaki et al. [35] found no correlation between BMI and severity of obstruction (determined by spirometry) in COPD patients. Our study's findings differ from these studies, which may be due to differences in study design, population size, or other factors.Moreover, our study was cross-sectional study and we believe longitudinal study is also required to find out the correlation between BMI and severity of obstruction (GOLD) in COPD patients.

Conclusion

In conclusion, this study demonstrated a significant correlation between the severity of chronic obstructive pulmonary disease (COPD) and body mass index (BMI). The classification of COPD patients according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) staging system revealed a progressive decrease in BMI as the disease severity increased. Notably, patients with higher post-bronchodilator FEV1% predicted values had better BMI, indicating a positive association between lung function and nutritional status.

Malnutrition and weight loss are serious ailments which ought to be taken carefully while addressing COPD patients as they account to poor prognosis. Thus, obesity is seen associated with better outcomes in COPD patients which supports obesity paradox. Active dietary supplements offer a likelihood to increase body weight while also enhancing exercise tolerance and respiratory health, thereby decreasing morbidity and mortality.

Thus, findings of the present study highlight the importance of considering BMI as a prognostic factor in COPD management, and emphasize the need for early intervention to address malnutrition and improve outcomes in patients with advanced disease.

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