Variation in body mass index in patients with chronic obstructive pulmonary disease

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ABSTRACT

Introduction: Chronic obstructive pulmonary disease (COPD) is associated with systemic inflammation. Weight loss seen in patients with COPD is a consequence of this inflammation. We hypothesized that higher grades of COPD are associated with greater degree of weight loss. **Materials and Methods:** In this cross-sectional study, we assessed the body mass index (BMI) of 34 patients with COPD proven by handheld spirometer. The difference in BMI among various grades of COPD was compared. **Results:** BMI was found to be inversely related to the grades of COPD in our study ($P = 0.001$). No significant difference was seen among the patients with regards to age and duration of symptoms before presentation. **Conclusion:** Advanced COPD is associated with greater degree of weight loss.

Keywords: Body mass index, inflammation, metabolism, nutrition, obstructive lung diseases

Introduction

Chronic obstructive pulmonary disease (COPD) is a disease of lung airways and parenchyma characterized by airflow limitation due to inflammatory response to noxious fumes and gases. Along with the inflammation present in the lungs of patients with COPD, there has been evidence to suggest that systemic inflammation exists in these patients.[1] This systemic inflammation is characterized by systemic oxidative stress, circulating inflammatory cells and increased plasma levels of proinflammatory cytokines.[2] Thus, COPD is associated with abnormalities in organs other than the lungs. These systemic abnormalities include weight loss, skeletal muscle dysfunction and cardiovascular diseases.[3] The state of marked under-nutrition seen in these patients is referred to as pulmonary cachexia.[4]

We hypothesized that patients with higher grades of COPD will have greater reduction in bodyweight.

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The objective of the study is to examine the variation in body mass index between the severity grades of chronic obstructive pulmonary disease.

Methods

This is a cross-sectional study conducted in Lumbini Medical College and Teaching Hospital, Palpa, Nepal. The study duration was three months and was carried out between February and April 2014. Study protocol was approved by the institute ethics committee. Informed written consent was taken from the participants. All patients unable to perform spirometry and those with lung conditions other than COPD, like pleural effusion, bronchiectasis, lung abscess and lung cancer, were excluded [Table 1].

All the patients visiting medicine outpatient department or admitted in ward with the diagnosis of COPD; during the study period were included in the study. All patients were interviewed regarding the smoking habits, exposure to biomass fuels and

family history of COPD. Height and weight of patients were measured. All patients underwent spirometry evaluation by hand held spirometer (Helios 401, Recorders and Medicare Systems) and the diagnosis of COPD was made when the post-bronchodilator ratio of forced expiratory volume at 1 second (FEV1) to forced vital capacity (FVC) was less than 70%. Patients diagnosed as COPD were sub classified on Global Initiative for Chronic Obstructive Lung Disease (GOLD) grades based on post bronchodilator FEV1.[5]

Statistical analysis

Results were analyzed using the SPSS 14 software. Continuous data were expressed as mean (SD), median and interquartile range (IQR), and a categorical variable as number (%). One way analysis of variance (ANOVA) was used to analyze the variation between means of the groups.

Results

Out of the 48 patients that were screened, 14 were excluded and 34 were included into the study [Figure 1].

The average age of patients included in the study was 66 years. 70% of patients were females. The most common presenting complain was dyspnea (n = 30, 88.2%) followed by cough (n = 26, 76.4%). Twenty five patients (73.5%) were current or former smokers and 21 (61.7%) had exposure to biomass fuels. Fifteen patients (44.1%) had a family history of COPD among the first degree relatives. 23% of the patients diagnosed as COPD also

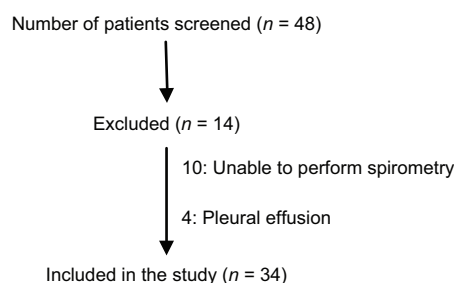### Table 1: Inclusion and exclusion criteria

Inclusion criteria
  Patients able to perform spirometry
    FEV1/FVC <70%
Exclusion Criteria
  Patients with pleural effusion, Lung abscess, lung cancer

FEV1: forced expiratory volume at 1 second, FVC: forced vital capacity.

Table 2: Characteristics of patients in the study

Variables	Results *n* (%) Total=34
Age (years)	66.35±10.09
Sex	Female=24 (70.58%)
Body mass index (kg/sq.m)	20.24
Duration of symptoms (months)	22.91±19.30
Presenting complains	
Cough	26 (76.47%)
Dyspnea	30 (88.23%)
Sputum	11 (32.35%)
Family history of COPD	15 (44.11%)
Smoker	25 (73.52%)
Biomass fuel exposure	21 (61.76%)
Associated Comorbidities	
DM	0
HTN	8 (23.52%)
CKD	0
Cancer	0

COPD: Chronic Obstructive Pulmonary Disease, DM: Diabetes Mellitus, HTN: Hypertension, CKD: Chronic Kidney Disease.

had hypertension. The average duration of symptoms of the patients was 23 months. The mean body mass index (BMI) of all patients was 20.2 kg/sq.m [Table 2].

Patients were classifieds into GOLD grades based on FEV1. None of the patients were in GOLD grade 4. The number of patients in Grade 1 was 8 (23.5%), in Grade 2 was 20 (58.82%) and in Grade 3 was 6 (17.6%). The average age of the patients in the three groups was 65 years, 65.3 years and 71.6 years, respectively. The difference in age of the patients in these groups was not significant ($P = 0.375$). The average duration of symptoms before presentation was 15.1 months, 20.9 months and 40 months, respectively. The difference in duration of presentation was not significantly different between the groups ($P = 0.103$). All of the patients in Grade 3 complained of cough and dyspnea. Family history of COPD was observed in 66% of patients with Grade 3, as compared to 45% of Grade 2, and 25% of Grade 1. Most of the patients in Grade 3 and Grade 2 were smokers; 83.3% and 80%, respectively, as compared to only 50% of patients with Grade 1. Patients also had exposure to biomass mass fuels in 75% of grade 1, 55% of grade 2 and 66.6% of grade 3. Hypertension was present in 66.8% of patients in grade 3 COPD. The body mass index of patients in grade 1 COPD was 21.6 kg/sqm, in grade 2 was 20.8 kg/sqm and in grade 3 was 16.3/sqm. The decline in body mass index observed in higher grades of COPD was statistically significant ($P = 0.001$) [Table 3].

Discussion

It is the first study done in the rural western region of Nepal where we have evaluated for the presence of poor nutrition in patients with COPD by calculating the body mass index of the patients. We found that patients with higher grades of COPD have lower BMI as compared to the lower grades of COPD. Most of the patients in our study were elderly with mean age of 66 years, although the difference in age in between the three groups of COPD patients in this study was not significant. The duration of symptoms before presentation was also not significantly different between the groups. Most of the patients in our study were females (70.5%), most were smokers (73.5%) and had exposure to biomass fuels (61.7%).

COPD is a disease associated with many co-morbidities and also with high mortality.[6] Advanced COPD is associated with weight loss.[7] Malnourished patients of COPD have increased

Number of patients screened (*n* = 48)

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Excluded (*n* = 14)

    10: Unable to perform spirometry

    4: Pleural effusion

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Included in the study (*n* = 34)

Figure 1: Details of patients in the study

Table 3: Characteristics of patients in various grades of COPD			
	Gold grade1 (*n*=8)	Gold grade2 (*n*=20)	Gold grade 3 (*n*=6)	*P*
Age (years)	65±5.90	65.3±12.34	71.66±1.86	*P*=0.375
Sex	Male=2 (25%)	Male=8 (40%)	Male=0	
	Female=6 (75%)	Female=12 (60%)	Female=6 (100%)	
Body mass Index (kg/sq.m)	21.61±1.46	20.86±0.44	16.36±0.52	*P*=0.001
Duration of symptoms (months)	15.12±13.82	20.9±16.21	40±27.01	*P*=0.103
Presenting Complains				
Cough	6 (75%)	14 (70%)	6 (100%)	
Dyspnea	6 (75%)	18 (90%)	6 (100%0	
Sputum	0	11 (55%)	0	
Family history of COPD	2 (25%)	9 (45%)	4 (66.6%)	
Smoker	4 (50%)	16 (80%)	5 (83.33%)	
Biomass fuel exposure	6 (75%)	11 (55%)	4 (66.66%)	
Associated comorbidities				
DM	0	0	0	
HTN	2 (25%)	2 (10%)	4 (66.66%)	
CKD	0	0	0	
Cancer	0	0	0	

COPD: Chronic Obstructive Pulmonary Disease, GOLD: Global Initiative for Chronic Obstructive Lung Disease, DM: Diabetes Mellitus, HTN: Hypertension, CKD: Chronic Kidney Disease.

risk of in-hospital deaths and of readmission.[8] The causes of weight loss in patients with COPD are multifactorial and include decreased oral intake, the effect of increased work of breathing due to abnormal respiratory mechanics and the effect of chronic systemic inflammation.[9] Measurement of body mass index is useful for quantifying the weight loss. In 1999, Landbo and colleagues conducted a prospective study in patients with COPD which concluded that low BMI is an independent risk factor for mortality in subjects with COPD, and that the association is strongest in subjects with severe COPD.[10] The body mass index (BMI), when combined with other variables like FEV1, modified medical research council dyspnea scale and distance walked in six minutes, is a predictor of the risk of death from any cause and from respiratory causes in patients with COPD.[11] Our observation of inverse relation between BMI and GOLD grades of COPD which is based on FEV1 is in accordance with these studies. In our study, age and duration of symptoms did not play a role in the severity of COPD.

Women are believed to be more susceptible to developing smoking-induced COPD than men for the same level of tobacco consumption.[12] Also, it has been shown that smoking women who are exposed to biomass fuels experience respiratory symptoms more often than nonsmokers.[13] Majority of the patients in our study were women, smokers and also were exposed to biomass fuels.

Hypertension is one of component of complex co-morbidities that are seen in patients with COPD and is probably the most common of all. [14,15] In a longitudinal study done in 2010, Terzano C, *et al.* found hypertension to occur in 64.2% of patients with COPD.[15] Hypertension was seen in 23% of our patients but 66% of patients with grade 3 COPD were found to be hypertensive.

Nutritional therapy in undernourished COPD patients may be beneficial to all COPD patients, not only for its potential pulmonary benefits, but also for other comorbidities like cardiovascular and metabolic diseases. In primary care, nutritional interventions along with exercise will probably be most effective in undernourished patients.[16]

This study has a few limitations. This is a single centre study and was not powered to study the effects of COPD on other comorbidities like hypertension, and ischemic heart disease.

Conclusion

This cross-sectional study provides data on the nutritional status of patients suffering with COPD in rural Nepal. It emphasizes the need to create awareness of good nutrition in the community. This study also provokes further studies in the area of nutritional intervention in patients of COPD.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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