Body mass index and its relation to GOLD stage in chronic obstructive pulmonary disease patients

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Abstract  Background: Low body mass index (BMI) in patients with chronic obstructive pulmonary disease (COPD) was found to be more prevalent in severe stages and was associated with poor prognosis and poor survival.

Aim: To find out the relation between BMI and GOLD stage (Global Initiative for Chronic Obstructive Lung Disease) of COPD patients.

Methods: We conducted a cross-sectional, observational study among 154 patients of COPD, attending the chest medicine department in our medical college during the period from January 2014 to November 2015. We classify the severity of obstruction in COPD patients according to GOLD staging through spirometry. BMI of all the patients was measured. Correlation between BMI and severity of obstruction (post bronchodilator forced expiratory volume in 1st second (FEV1)% predicted) in COPD patients was determined.

Results: The mean age of all of the patients was 57.18 (SD ± 10.7) years. There were 115 (74.4%) males and 39 (25.3%) females. The COPD patients were classified by their post-bronchodilator FEV1% predicted in four stages according to GOLD staging. Among 154 study population, 3 (1.9%) patients were in stage 1, 54 (35.1%) in stage 2, 55 (35.7%) in stage 3, and 42 (27.3%) in stage 4. Applying the Pearson correlation test we found that BMI and post FEV1% predicted were positively correlated (R = 0.295, P < 0.05). By applying the same test on GOLD stage and BMI, they were found to be negatively correlated (R = –0.3, P < 0.05). Now by applying a one-way ANOVA, we found that BMI of the patients was decreasing with severity of the disease (GOLD) and it was statistically significant (F = 4.116, P < 0.05).

Conclusion: There was positive correlation between severity of airway obstruction and BMI in COPD patients.

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Introduction

Chronic obstructive pulmonary disease (COPD) is the fourth leading cause of death worldwide that causes more than 2.7
Malnutrition in COPD is due to increased metabolic demands caused by basal oxygen consumption, release of cachexia producing cytokines like tumor necrosis factor z, interleukin 6 [3,4]. The association between low body mass index (BMI) and poor prognosis of patients with COPD is a common clinical observation and it varies with different stages of COPD. Nutritional depletion and weight loss are features of COPD. Patients with low BMI are at an increased risk for developing severity of COPD [5]. Low BMI is also an independent negative determinant of survival in patients with COPD [6].

Materials and methods

This was a cross sectional, observational study. The study was conducted in Kasr Alainy Medical School on 154 COPD patients who attended our outpatient clinic or referred to our Chest Department for pulmonary function assessment in period from January 2014 to November 2015.

The subjects who were enrolled in the study were smokers and ≥40 years of age with symptoms of COPD (dyspnea, chronic cough or sputum production). Forced expiratory volume in 1st second/forced vital capacity ratio (FEV1/FVC) was less than 0.7 on spirometry, and without any significant post-bronchodilator FEV1 reversibility (that is, less than 12% and 200 ml).

All patients were subjected to full history taking and full clinical examination. BMI (weight in kg/height in m²) was measured in each patient. Pre and post-bronchodilator spirometry of all the patients was done. Patients with post-bronchodilator FEV1/FVC less than 0.7 and significant reversibility (improvement of 12% and 200 ml of FEV1) were excluded. Patients without significant reversibility were selected. They were classified according to GOLD (Global Initiative for Chronic Obstructive Lung Disease) staging in stage 1 (post bronchodilator FEV1 ≥ 80%), stage 2 (post bronchodilator FEV1 ≥ 50% and <80%), stage 3 (post bronchodilator FEV1 ≥ 30 and <50%), and stage 4 (post bronchodilator FEV1 < 30%). In our study we want to find out the correlation between BMI and severity of obstruction in COPD patients.

Statistical method

The data were coded and entered using the statistical package SPSS version 15. The data were summarized using descriptive statistics: mean, standard deviation, median, minimal and maximum values for quantitative variables and number and percentage for qualitative values. Statistical differences between groups were tested using chi square test for qualitative variables, ANOVA (analysis of variance) with postHoc test for quantitative normally distributed variables. Correlations were done to test for linear relations between variables. P-values less than or equal to 0.05 were considered statistically significant.

Results

All the patients of the study population were in age range of 40–80 years. The mean age of all of the patients was 57.18 (SD ± 10.7) years. Commonest age groups were 40–49 years and 60–69 years with 45 patients in each group (29.2%). Followed by 45 patients (29.9%) from 40 to 49 years and 22 pts (14.3%) from 70 to 79 years. There were 115 (74.4%) males and 39 (25.3%) females. The BMI ranged from 14.69 to 52.73 kg/m² with a mean of 26.64 (SD ± 7.58). The FEV1% predicted ranged from 15% to 83% with a mean of 43.48% (SD ± 16.99). The FEF 25–75% predicted ranged from 5% to 61% with a mean of 21.42% (SD ± 10.94).

The COPD patients were classified by their post-bronchodilator FEV1% predicted in four stages according to GOLD.

Among 154 study population, 3 (1.9%) patients were in stage 1, 54 (35.1%) in stage 2, 55 (35.7%) in stage 3, and 42 (27.3%) in stage 4.

Table 1 shows the age, BMI, FEV1% predicted and FEF (forced expiratory flow) 25–27% predicted of the COPD patients in their different GOLD stages.

| GOLD stage | Age | BMI | FEV1% predicted | FEF 25–27% predicted |
|------------|-----|-----|-----------------|----------------------|
| 1 Min–Max  | 56–71 | 24.49–38.57 | 80–83 | 5–61 |
| Mean (±SD) | 62.67 (±7.64) | 29.67 (±7.74) | 81 (±1.73) | 35.67 (±28.38) |
| 2 Min–Max  | 40–77 | 19.48–52.73 | 50–78 | 15–52 |
| Mean (±SD) | 56.69 (±9.57) | 28.73 (±7.95) | 61.15 (±7.99) | 31.93 (±7.31) |
| 3 Min–Max  | 41–80 | 14.69–47.8 | 30–49 | 12–31 |
| Mean (±SD) | 59.13 (±11.59) | 26.79 (±7.42) | 39.72 (±5.13) | 19.02 (±4.7) |
| 4 Min–Max  | 42–72 | 15.06–48.89 | 15–29 | 5–17 |
| Mean (±SD) | 54.88 (±8.19) | 23.54 (±6.42) | 23.6 (±4.14) | 10.05 (2.9) |
Body mass index and its relation to GOLD stage

Discussion

COPD is a common and progressive chronic inflammatory condition that is responsible for a large amount of morbidity and mortality worldwide. COPD is not only associated with airway inflammation but also with considerable systemic inflammation [7].

Evidence of systemic inflammation is measured either as increased circulating cytokines, chemokines and acute-phase proteins, or as abnormalities in circulating cells [8].

Effects of systemic inflammation include unintentional weight loss, skeletal muscle dysfunction, and increased risk of cardiovascular disease, osteoporosis, gastroesophageal reflux disorder, and depression, among others [9]. Nutritional depletion and weight loss are common features of COPD. The exact mechanisms are uncertain, [10] but decreased food intake and increased energy expenditure in breathing are the most important [11].

Several studies have demonstrated improved survival in COPD patients with a high BMI compared to COPD with low BMI.

Annemie et al. found that low BMI was significant independent predictor of increased mortality in 400 COPD patients [12].

Vestbo et al. followed 1898 COPD patients prospectively for 7 years and found that BMI and free fat mass index were significant predictors of mortality [13].

In the ANTADIR (Association Nationale pour le Traitement a Domicile de l´Insuffisance Respiratoire Chronique) network, the prognostic value of obesity in patients with COPD was clearly demonstrated. During the 7.5 years of follow-up, the highest survival and lowest hospitalization rates were observed in obese COPD patients [14].

In our study we found that BMI was positively correlated with both post-bronchodilator FEV1% predicted and FEF 25–75% ($R = 0.295$ and 0.27 respectively). Also BMI and GOLD stage were found to be negatively correlated ($R = -0.3$).

This was consistent with the findings of Mitra et al. who studied the relation between BMI and severity of obstruction in 101 male COPD patients and found that BMI of the patients were decreasing with increasing severity of the disease (GOLD) and it was statistically significant ($P < 0.05$) [15].

Regarding the age we did not find a significant relation between severity of obstruction and age in our study sample. In contrast Mitra et al. found that with increase severity of GOLD staging average age of the patient was also increasing [15].

In 2009, Qiu et al. [16] demonstrated that there was a positive correlation present between BMI and FEV1% predicted. Sahebjamii et al. [17] also demonstrated a correlation between BMI and pulmonary function tests and they recommended BMI as a criterion to evaluate the nutritional status of COPD patients.

In the Platino study, [18] a population-based epidemiologic study conducted in five Latin American cities (2008) showed that (GOLD) stages 3 and 4 was associated with lower BMI in 397 male patients.

Conclusion

In our study we found out that there was a positive correlation present in between BMI and severity of obstruction in COPD patients. With severity of the obstruction (GOLD staging) BMI of the patient decreases and it was statistically significant.

Conflict of interest

There is no conflict of interest.

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