
Nutritional Status of COPD Patients with Acute Exacerbation

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SUMMARY

The prevalence and features of nutritional status in patients with chronic obstructive pulmonary disease (COPD) have been studied extensively in stable conditions, but are poorly defined in the presence of an acute exacerbation. The aim of this study is to evaluate the nutritional status of COPD patients with acute exacerbation and possible relationship between nutritional parameters and pulmonary functions. The study group consisted of 53 COPD patients acutely admitted to the hospital for standardized medical treatment. The nutritional status of patients were assessed by anthropometric measurements, biochemical analysis, and immunologic testing. The patients were divided into two groups as having severe ($FEV_1 < 50\%$) and mild to moderate ($FEV_1 \geq 50\%$) COPD and weight loss greater than 5% for the comparison of the study parameters. Ideal body weight (IBW%) was found as 104.42 ± 4.30 in severe COPD, where as it was 115.31 ± 7.28 in mild to moderate COPD group ($p = 0.07$). There was no relationship demonstrated between IBW% and FEV_1 . IBW% was correlated with DLCO for the total study population ($r = 0.353$, $p = 0.035$). Weight loss greater than 5% of body weight (BW) was observed in 54% of patients. Comparison of the patient's actual weight to their usual weight revealed statistically significant weight loss ($p < 0.01$). Mean values of serum albumin, transferrin were found in normal range. Delayed type hypersensitivity skin test revealed normal immune status. When the study parameters were compared, no any statistically significant differences in parameters related to nutritional status were detected, between severe and mild to moderate COPD groups. As a statistically significant weight loss was found between the actual and usual weights of the patients, monitoring of nutritional parameters and eventual dietetic treatment should also be included in the goals of the medical treatment of patients with COPD in acute exacerbation.

Key Words: Malnutrition, COPD, acute exacerbation.

ÖZET

KOAH Olan Akut Ataklı Olgularda Nutrisyonel Parametrelerin Değerlendirilmesi

Kronik obstrüktif akciğer hastalığı (KOAH)'nda nutrisyonel durumun değerlendirilmesi çoğunlukla stabil durumdaki hastalarda incelenmiştir. KOAH akut atak varlığında yapılan çalışmalar sınırlıdır. Bu çalışmanın amacı; KOAH akut atakta nutrisyonel durumun belirlenmesi ve nutrisyonel parametrelerle solunum fonksiyonları arasındaki olası ilişkinin saptanması-

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dur. Çalışmaya KOAH akut atak tanısıyla hospitalize edilen toplam 53 hasta alındı. Olgular FEV₁'lerine göre ağır (FEV₁ < %50) ve orta-hafif (FEV₁ ≥ %50) KOAH ve ağırlık kaybı %5'ten fazla olan-olmayan olarak iki gruba ayrılarak çalışma parametreleri karşılaştırıldı. Ağır KOAH'ta ideal vücut ağırlığı (İVA) yüzdesi 104.42 ± 4.30 iken, orta-hafif KOAH grubunda 115.31 ± 7.28 idi (p= 0.07). İVA yüzdesi ile FEV₁ arasında ilişki saptanmazken çalışmaya alınan hastaların ortalama DLCO değerleri ile İVA yüzdesi arasında istatistiksel anlamlı ilişki bulundu (r= 0.353, p= 0.035). Hastaların %54'ünde ağırlık kaybı yüzdesi %5'ten fazlaydı. Şimdiki ağırlıkla sürekli sahip olunan ağırlık karşılaştırıldığında istatistiksel anlamlı fark saptandı (p< 0.01). Serum albumin, transferrin ortalama değerleri normal sınırlardaydı. Geç tip aşırı duyarlılık testi sonucunda immün bozukluk saptanmadı. Hastalar ağır, orta-hafif KOAH olarak iki gruba ayrıldıklarında nütrisyonel parametrelerle solunum fonksiyonları arasında istatistiksel anlamlı fark saptanmadı. Çalışmamızın sonucunda, şimdiki ağırlıkla sürekli sahip olunan ağırlık arasında istatistiksel anlamlı kayıp olması, akut ataklı olgularda nütrisyonel parametrelerin değerlendirilerek nütrisyonel destek tedavisinin akut atak tedavisine eklenmesi gerektiğini düşündürmüştür.

Anahtar Kelimeler: Malnütrisyon, KOAH, akut atak.

Malnutrition has been shown to influence adversely the functional performance and survival, independently of the impaired lung function (1-5). Infection further impairs the lung function and it is the most common cause of respiratory failure in chronic obstructive pulmonary disease (COPD) (6). When weight loss and infection occur concomitantly, nutritional status will deteriorate, and if the effect is severe enough, it can result with protein-calorie malnutrition (7,8). However, it is not certain whether this implies a causal relationship or whether low weight is a marker for more severely impaired lung function (7,9).

The objectives of this present study were as follows;

1. To prospectively assess the nutritional status of COPD patients with acute exacerbation, during the period of hospital admission,
2. To evaluate the relationships between the nutritional indices and the pulmonary function parameters.

MATERIALS and METHODS

Patients

We included 53 COPD patients, consecutively admitted to our department with acute exacerbation and free of any associated condition known to effect the nutritional status negatively (i.e; cancer, liver disease, chronic renal failure, surgery performed within six months, severe endocrine disorders, active gastrointestinal diseases). COPD was defined according to the criteria of GOLD. An acute exacerbation was defined as increased breathlessness, often accompanied by increased cough and sputum production, and may require medical attention outside of the hospital for mild to a recent increase in dyspnea,

cough and sputum production of sufficient severity to warrant hospital admission (10). All patients were current or ex-smokers. None of the patients had the evidence of significant reversibility (> 15% of predicted baseline) of air flow obstruction after inhalation of 500 µg of terbutaline. All measurements were performed within five days during the hospitalization period.

Nutritional Assessment

Anthropometric measurements: The patients body weight (BW) and height were measured with indoor clothing without shoes. The BW was compared to standard weights for height, age and sex, and this ratio was expressed as a percentage of ideal body weight (IBW%). Body mass index (BMI) was calculated as weight/(height)². Patients were asked to recall their present body weight, usual weight as indicated by the subject and body weight 12 months preceding the clinic visit. Weight loss was considered significant when > 5% decrease in body weight had occurred in the past year.

Biochemical analysis: A serum sample from each subject was obtained at hospital admission. Blood samples were analysed for albumin, transferrin, total lymphocyte count. Because the reference values for biochemical analysis were expressed within range, the lowest value of the range was used as the standart value of all other analysis of serum samples.

Serum albumin and transferrin were used as indexes of visceral protein. Serum albumin was measured with the ILAB 1800 Chemistry system using ILAB test reagent. Serum transferrin was measured with the Beckman-Array 360 nephelometer using Beckman array systems reagent.

Total lymphocyte count was used as an indicator of immunocompetence. Quantitation of total lymphocyte count was determined via differential for lymphocytes.

Tests for immunity: Delayed type hypersensitivity skin tests were performed on each subject within five days after admission. Intradermal injections of PPD were administered and interpreted at 72 hours. Erythema alone was not taken into account. A reaction was considered positive if the diameter of induration was equal to or above 5 mm in patients without BCG vaccine and 10 mm or above with/without BCG. Anergy was defined as a negative reaction for the tested antigen.

Lung function measurements: Spirometric and diffusing capacity examinations were performed with a V-max 229 SensorMedics pulmonary calculation system. DLCO was measured using standard procedures for the single breath method.

Statistical Analysis

The statistical analysis was performed using the Statistical Products and Service Solutions (SPSS; Chicago, IL, USA) for Windows package. Pearson correlation coefficients and Mann-Whitney U tests were used. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Fifty-three consecutive patients were studied. Characteristics of the total group were given in Table 1. Weight loss greater than 5% of body weight was observed in 54% of the patients. The mean IBW% (107.50 ± 26.59) and BMI (23.83 ± 5.2 kg/m²) for the total study group revealed that the group comprised of normal and obese patients, rather than malnourished ones. Patients were separated into two groups to assess the relationship between the nutritional indices and the severity of the respiratory failure. Nutritional assessment of the patients with severe (FEV₁/FVC < 70%, FEV₁ < 30% predicted or FEV₁ < 50% predicted plus respiratory failure or clinical signs of right heart failure) and moderate to mild COPD (30 ≤ FEV₁ < 80% predicted FEV₁ ≥ 50%), the mean values of the anthropometrics, biochemical and delayed hypersensitivity skin tests are summarized in Table 2. There was no significant difference in IBW% between the two groups. In

Table 1. Characteristics of the total study population.

Total study group (n= 53)	
Age (years)	62.75 ± 10.98
FEV ₁ (% predicted)	40.83 ± 21.26
FEV ₁ /FVC	74.20 ± 25.35
PaO ₂ (mmHg)	59.82 ± 15.89
PaCO ₂ (mmHg)	40.17 ± 9.66
DLCO (% predicted)	61.40 ± 25.44
BMI (kg/m ²)	23.83 ± 5.2
IBW%	107.50 ± 26.59
Actual weight (kg)	65.01 ± 13.56
Usual weight (kg)	68.75 ± 11.89
Ideal weight (kg)	61.89 ± 11.26
Albumin (g/dL)	4.03 ± 0.43
Transferrin (g/dL)	251.10 ± 84.40
Lymphocytes (/mm ³)	2110.63 ± 1101.23
PPD (mm)	11.43 ± 6.47
(Values are mean ± SD)	

both groups there was no significant difference between the actual weight and the ideal body weight. However the actual weight versus the usual weight was highly significant (p= 0.001 for patients with FEV₁ < 50%, and p= 0.006 for patients with FEV₁ ≥ 50%). The serum studies for visceral protein revealed normal values for each group of patients.

The mean value for the total lymphocyte count did not differ significantly. Delayed type hypersensitivity skin tests indicate intact immune function in patients with severe and moderate to mild COPD. IBW% was correlated with DLCO for the total study population (r= 0.353, p= 0.035). No correlation was found between mean predicted FEV₁ percent and nutritional parameters.

Weight loss of greater than 5% in the previous year was reported in 54% of the total study group. Characteristics of the patients with weight loss ≥ 5% and < 5% are given in Table 3. The differences in pulmonary function test and arterial blood gas levels were not reached statistically significant levels in two groups.

DISCUSSION

Malnutrition is common in patients with COPD (9). However it is still unclear whether weight

Table 2. Nutritional assessment of the patients with FEV₁ < 50% and FEV₁ ≥ 50%.

	Patients with FEV ₁ < 50% (n= 41)	Patients with FEV ₁ ≥ 50% (n= 12)
IBW%	104.42 ± 4.30	115.31 ± 7.28
Actual body weight (kg)	64.29 ± 2.24	69.36 ± 4.11
Usual weight (kg)	67.78 ± 1.79	73.90 ± 4.14
Ideal weight (kg)	63.14 ± 2.06	60.60 ± 1.83
Albumin (g/dL)	4.02 ± 0.42	4.20 ± 0.25
Transferrin (g/dL)	257.96 ± 81.14	242.62 ± 28.38
Lymphocytes (/mm ³)	2100.00 ± 1193.92	2010.00 ± 907.31
PPD (mm)	11.67 ± 6.89	10.63 ± 1.66

(Values are mean ± SD)

Table 3. Pulmonary functions in patients with weight loss < 5% and ≥ 5%.

	Weight loss < 5% (n= 23)	Weight loss ≥ 5% (n= 30)
FEV ₁ (% predicted)	36.48 ± 17.30	44.21 ± 23.65
FEV ₁ /FVC	70.42 ± 27.14	77.14 ± 23.98
PaO ₂ (mmHg)	56.90 ± 14.28	62.06 ± 16.91
PaCO ₂ (mmHg)	40.31 ± 9.7	40.07 ± 9.80
DLCO (% predicted)	69.71 ± 28.25	56.11 ± 22.57
DLCO/VA (% predicted)	97.21 ± 35.57	81.53 ± 31.69

loss progresses gradually in patients who are otherwise in stable clinical condition, or if it follows a stepwise pattern related to acute disease exacerbation. Most of the studies that have so far assessed the nutritional status of COPD patients were conducted in stable patients (9,11,12). In the present study, therefore, we assessed the nutritional status of COPD patients with acute exacerbation and possible relationship between nutritional parameters and pulmonary functions.

Laaban and colleagues reported that in patients diagnosed as COPD presenting with an acute respiratory failure, malnutrition was observed at a rate of 60%. Malnutrition has been observed more frequently in those patients who required mechanical ventilation (9). A high prevalence of malnutrition was also reported by Fiaccanlori et al in a group of 55 hypercapnic-hypoxemic COPD patients with acute respiratory failure (12). In our study, patients with COPD presenting with acute exacerbation were evaluated. The mean IBW% revealed that the group composed of normal and obese patients, rather than

the malnourished ones. When the patients were divided into two groups as severe (FEV₁ < 50%) and mild to moderate (FEV₁ ≥ 50%) COPD to compare the study parameters, IBW% were found not to differ significantly. Also no relationship could be demonstrated between IBW% and FEV₁. Similar results have been reported in stable and acutely ill COPD patients (9,12,13). On the other hand, in some studies, it was reported that body weight was a powerful predictor of diffusing capacity in patients with same FEV₁ (9,14). In subjects with emphysema, the degree of somatic nutritional depletion was also related significantly to decrease in DLCO. The reduction in diffusing capacity is thought to be due to the loss in vascular bed and gas exchange surface area, which results from destruction and dilatation of alveoli. While malnutrition has not been clearly implicated in the pathogenesis of emphysema, animal studies suggest that nutritional depletion leads to structural abnormalities in the lung (11,13,14). According to DLCO, 37% of our study group was diagnosed as emphysema. Among this population, only 13 patients had a body weight smaller than 90% of their ide-

al body weight. For the total study group there was a positive correlation between % IBW and DLCO, though no statistically significant correlation was found when patients were divided into two groups according to their FEV₁. Comparison of the patients' actual weight to their usual weight revealed statistically significant weight loss. This result is in consistence with the other studies but the cause of the weight loss is often considered as enigma (9). In the studies evaluating nutritional status of patients with COPD, body weight was found as a poor marker because malnutrition as defined by a multi-parameter nutritional index was observed in high percentages in patients with normal body weight (9,15).

In our study IBW% was not the only marker used for assessment of nutritional status. Serum albumin and transferrin levels were detected as an index of visceral protein status. The reason for the use of serum albumin as a nutritional indicator was based on the observation that prolonged starvation is associated with a discrete reduction in albumin concentration. In this present study, mean serum values of albumin were found in normal range. This result is consistent with the other studies (9,16,17). Serum transferrin level was either in normal range or moderately decreased in our patients. In agreement with the other studies, transferrin was also found as non-discriminative, since iron status in patients with COPD probably doesn't reflect iron store deficits, but rather an adjustment of the body hypoxemia (17).

With regard to the immunity testing, results of our patients showed that the observed total lymphocyte count was in normal range. Lymphopenia has been reported in COPD patients with acute respiratory failure, but the total lymphocyte count is usually in normal range in stable COPD patients (11,12). Delayed hypersensitivity skin tests showed that eight of the subjects were anergic, with no measurable inductions for PPD. Similar findings of intact total lymphocyte count but depressed reactivity to different antigens was reported in a group of marasmic patients, by Bistran and colleagues (18).

Although IBW%, biochemical nutritional parameters, and immunity status were found in normal range, patients with emphysema may be prone to nutritional depletion.

As a conclusion, monitoring of nutritional parameters and eventual dietetic treatment should also be included in the goals of the medical treatment of patients with COPD in acute exacerbation.

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