Turk Thorac J 2020; 21(1): 49-53 DOI: 10.5152/TurkThoracJ.2019.180194

Original Article

Does Nutritional Risk Screening 2002 Correlate with the Dyspnea Status of Patients with GOLD Stage C-D Chronic Obstructive Pulmonary Disease?

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Cite this article as: Ogan N, Yıldırım F, Süzen B, et al. Does Nutritional Risk Screening 2002 Correlate with Dyspnea Status of Patients with GOLD Stage C-D Chronic Obstructive Pulmonary Disease? Turk Thorac J 2020; 21(1): 49-53.

Abstract

OBJECTIVES: Dyspnea is a prominent symptom of chronic obstructive pulmonary disease (COPD). Patients with Global Initiative for Obstructive Lung Disease (GOLD) Stage C-D often complain of dyspnea, but the relationship between their level of dyspnea and their nutritional status has not yet been established. The aim of this study was to evaluate the dyspnea levels and nutritional status ofstable COPD patients in the out patient clinic.

MATERIALS AND METHODS: Medical records including the Modified Medical Research Council (mMRC) Dyspnea Scale and the nutritional status of 41 patients were investigated in the study. The meanage of patients was 71.7±9.2 years. The Nutritional Risk Screening 2002 (NRS-2002) tool, body mass index (BMI), and mid-upper arm circumference were used to evaluate their nutritional status. We used correlation analysis to display the relationship between NRS-2002 score and MRC, COPD stage, and biochemical and anthropometric parameters indicating the nutritional status of patients.

RESULTS: Out of the 41 COPD patients 87.8% (36) enrolled in the study were men and 12.2% (5) were women.The GOLD stages of the patients were 29.3% of patients with stage C and 70.7% with stage D.The risk of malnutrition (NRS ≥3) was detected in 48.8% of the patients, whereas 51.2% of patients (NRS<3) were risk-free. The mid-upper arm circumference of at risk patients was lower (25.6±3.2 vs 29.9±2.7 cm, p=0.032). The NRS-2002 score had a positive correlation with mMRC records (r=0.351, p=0.024). There was a statistically significant negative correlation between the NRS-2002 score and the mid-upper arm circumference (r=0.604, p<0.0001). Also, there was a negative correlation between BMI and mid-upper arm circumference (r=0.699, p<0.0001).

CONCLUSION: The risk of malnutrition was common in stable COPD patients at the outpatient clinic, which seemed to adversely affect their dyspnea level. Therefore, while planning the treatment of COPD patients, evaluating their nutritional status and taking precautions accordingly contribute to the shortness of breath which is one of the most significant symptoms of the disease.

KEYWORDS: COPD, malnutrition, mMRC, nutritional risk screening, nutritional status

Received: *03.12.2018* ***Accepted:*** *18.01.2019*

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is an important preventable cause of morbidity and mortality among all diseases worldwide. In our country, the prevalence of COPD is estimated to be 19.1% according to the Turkey-BOLD Study [1] and the mortality rate of COPD is about 7.1%. This prevalence is close to the European countries [2-4]. Malnutrition co-exists in a significant proportion of COPD patients, where 1/5th of patients have at least one of the following: weight loss, protein deficiency, or caloric malnutrition. It was also commonly seen in COPD patients followed in outpatient clinics [5]. Its prevalence is increasing as the disease stage progresses. The nutritional status of COPD patients has been mostly investigated in hospitalized patients. Also, the prevalence of malnutrition in COPD outpatients is reported to be high, with up to 45% of outpatients said to be at risk [6]. However, this is usually overlooked during the management of COPD patients in outpatient clinics.

Patients with Global Initiative for Obstructive Lung Disease (GOLD) Stage C-D COPD often complain of dyspnea, but malnutrition is also often seen in COPD patients who have progressive chronic inflammation and frequent exacerbation. Detection of malnutrition in COPD patients can be difficult because there is no gold standard method or questionnaire that accurately presents this data. Although the prevalence of malnutrition has been studied frequently in patients with COPD, its relation with the patients' dyspnea levels has not been investigated to a large extent.

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In this study, we assessed the nutritional status of outpatients with stable COPD by investigating various anthropometric and biochemical parameters and aimed to reveal whether there is a relationship between dyspnea levels and nutritional status markers in patients with stable COPD.

MATERIAL AND METHODS

We included patients with COPD Stage C-D who were admitted to the outpatient clinic of the Department of Pulmonary Diseases at Ufuk University School of Medicine Hospital, between December 2017 and June 2018. The prospectively collected and recorded data were retrospectively evaluated. Ufuk University School of Medicine ethical board for clinical research approved the study protocol (Decision no: 2018/106/6). Written informed consent was obtained from all the patients.

In the study population, the diagnosis of COPD was made according to the GOLD guidelines. COPD was diagnosed if the forced expiratory volume in 1 second/forced vital capacity (FEV_1)/(FVC) was <70% in the pulmonary function test (PFT). Also, in patients who had symptoms that were consistent with COPD, such as disease starting after 40 years of age, smoking history of at least 10 packs per year, exposure to irritant or toxic gases, or exposure to biomass were sought. By using the exacerbation history and the modified Medical Research Council (mMRC) dyspnea scale, the GOLD categories of the patients were determined in four groups with increasing severity (A, B, C, and D) [7]. Patients with stages C and D were included in study. All patients had stable COPD and had no episodes of COPD exacerbation for the last 6 months.

Nutritional screening and assessment were made using the three-component NRS-2002 Questionnaire [8]. The NRS-2002 was proposed by the European Society for Clinical Nutrition and Metabolism (ESPEN) and was developed for malnutrition risk screening in hospitalized patients within the first 48 hours following admission.This tool includes three components. The first component assesses the nutritional status across three separate items, i.e., BMI categories [20.5 kg/m^2], weight loss categories [>5% in 3 months, >5% in 2 months and >5% in 1 month (>15% in 3 months)], and food intake as a proportion of the normal requirement in the preceding week (0%-25%, 25%-50%, 50%-75%, and >75%). The second and third components assess disease severity and age, respectively, with all subjects over 70 years of age being given an additional weighing. The BMI cut-off value for diagnosing malnutrition was 18.5 kg/m^2 [8].

The dyspnea status of patients in daily life was evaluated by mMRC (Modified Medical Research Council) Dyspnea scale. This scoring system is a questionnaire scores the dyspnea level in the range of no dyspnea (Grade 0) to almost complete disability (Grade 4) [9].

The demographic data, smoking habits, pulmonary function tests, severity of COPD, anthropometric measurements [Body mass index (BMI), mid-arm circumference], blood biochemical indicators of nutrition, mMRC dyspnea scale, and NRS-2002 scores of patients recorded. We compared the patients with nutritional risk (≥3) to those without nutritional risk (<3).

Statistical Analysis

All statistical analyses were performed using Statistical Package for the Social Sciences for Windows version 21.0 (SPSS IBM Corp.; Armonk, NY, USA). We performed a power analysis to calculate sample size, and 41 patients were found to be necessary for evaluation to achieve a significance level of 0.05. All tests were interpreted using a significance level of $p<0.05$. Kolmogorov-Smirnov test was used to determine whether the data were distributed normally. Descriptive statistical methods (mean, standard deviation, median, frequency) and Student's t-test were used to compare percentage of groups. Chi-square test was used to determine the relationship between categorical variables and correlation analysis was used to assess the relationship between mMRC and nutritional status variables.

RESULTS

We included 41 patients with a mean age of 71.7±9.2 years, of which 87.8% (n=36) were male. About 75.6% of the patients were older than 65 years. Majority of our patients were at GOLD Stage 4 (70.7%). Patients with a risk of malnutrition (NRS ≥3) were 48.8%, whereas 51.2% of patients (NRS <3) were not. The mean mMRC score of patients was 2.0±0.7, while the mean NRS-2002 was 2.5±1.2. The findings regarding the patients' age, smoking status, exacerbation status, GOLD stages, mMRC, PFT, NRS scores, and anthropometricand biochemical parameters are given in Table 1.

The COPD patients with a risk of malnutrition and patients without the risk were similar in terms of age, gender, and smoking habits. FEV_1 (% predicted) was lower in patients who were at risk of malnutrition than those without malnutrition (43.8±13.1 vs 45.2±15.6; p=0.041), but the FVC and the FEV_1/FVC ratio were similar (p>0.05).The NRS-2002 evaluation showed that the risk of malnutrition was greater in patients with stage D and lower in stage C according to the GOLD criteria (p=0.05). According to NRS-2002 components, the BMIs of patients with malnutrition risk were lower than patients without malnutrition risk (23.5 vs 28.7 kg/m^2,

MAIN POINTS

- Chronic obstructive pulmonary disease (COPD) is characterized by progressive chronic systemic inflammation with frequent exacerbations and is often accompanied by malnutrition.
- Several methods have been used to screen for the presence of malnutrition in COPD patients.
- In our study, a significant correlation was found between the ESPEN NRS-2002 malnutrition risk assessment score and mMRC dyspnea score in GOLD stage C and D patients with stable COPD.
- While clinicians plan the medical treatment of COPD patients in outpatient clinics, their evaluation of the nutritional status of patients and their consequent recommendation of precautions may contribute to areduction in the patients' shortness of breath, which is one of the most important symptoms of COPD.

Table 1. Basic characteristics, functional and nutritional status of patients

Variables	n=41 (%)	Mean±SD
Gender (Male/female)	36/5 (87.8/12.2)	-
Age (years)	-	71.7±9.2
58–64	10.0/24.4	-
65–74	17.0/41.5	-
≥75	14.0/34.1	-
Smoking habit		
Never smoked	4.0 (9.8)	-
Current smoker	34.0 (82.9)	-
Exsmoker	3.0 (7.3)	-
Smoking history (package/years)		39.9±20.3
Number of exacerbations (per year)		1.9±1.2
mMRC Score	-	2.0±0.7
1	10.0/24.4	
2	22.0/53.7	
3	8.0/19.5	
4	1.0/2.4	
Severity of COPD		
GOLD stage C	12.0/29.3	-
GOLD stage D	29.0/70.7	-
Pulmonary Function Tests		
FVC (%)	-	63.0±15.5
FVC (L)	-	2.3±0.8
FEV_1 (%)	-	44.5±14.3
FEV_1 (L)	-	1.3±0.6
FEV_1/FVC (%)	-	53.6±10.2
Nutritional Risk Score (NRS) 2002	-	2.5±1.2
NRS-2002 <3 (without risk)	20.0/48.8	
NRS-2002 ≥3 (with risk)	21.0/51.2	
NRS according to COPD severity		
GOLD stage C		1.7±1.4
GOLD stage D		2.8±1.1
Anthropometrics		
BMI (kg/m^2)		26.1±4.8
Mid-arm circumference (cm)		27.8±3.6
Blood biochemical indicators		
Folate (ng/mL)	-	3.7±0.7
Vit B12 (pg/mL)	-	260.7±87.2
Albumin (g/dL)	-	0.8±0.1
LDL (mg/dL)	-	3.4±0.6
HDL (mg/dL)	-	99.4±32.1
Phosphorus (mg/dL)	-	41.0±13.0
Systolic pulmonary arterial pressure (mmHg)	-	31.4±12.6

mMRC: Modified Medical Research Council; COPD: chronic obstructive pulmonary disease; GOLD: Global Initiative for Obstructive Lung Disease; FEV_1: forced expiratory volume in 1 second; FVC: forced vital capacity; NRS: nutritional risk screening; BMI: body mass index; LDL: low density lipoprotein; HDL: high density lipoprotein

Table 2. Comparison of patients with or without nutritional risk

Characteristics	With nutrition risk (n=20) (Mean±SD)	Without nutritional risk (n=21) (Mean±SD)	p
Gender (Male/female) (N, %)	18/2 (90/10)	18/3 (85.7/14.3)	0.524
Age (years)	74.6±9.0	68.9±8.7	0.136
Age distribution (N, %)			
58–64	4.0/20.0	6.0/28.6	0.393
65–74	7.0/35.0	10.0/47.6	0.308
≥75	9.0/45.0	5.0/23.8	0.136
Smoking habit (N, %)			0.805
Never smoked	2.0/10.0	2.0/9.5	
Current smoker	16.0/80.0	18.0/85.7	
Exsmoker	2.0/10.0	1.0/4.8	
Smoking history (package/years)	42.2±23.0	35.7±17.2	0.343
Number of exacerbations (per year)	2.1±1.3	1.7±1.1	0.148
mMRC Score	2.3±0.7	1.8±0.7	0.033
Pulmonary functions			
FVC (%)	60.9±15.2	64.9±15.9	0.151
FVC (L)	2.3±0.8	2.3±0.8	0.06
FEV_1 (%)	43.8±13.1	45.2±15.6	0.041
FEV_1 (L)	1.3±0.7	1,3±0,6	0.046
FEV_1/FVC (%)	53.9±10.1	53.5±10.5	0.131
Severity of COPD (N, %)			0.05
GOLD stage C	3.0/15.0	9.0/42.6	
GOLD stage D	17.0/85.0	12.0/57.4	
Anthropometrics			
BMI (kg/m^2)	23.5±4.1	28.6±4.3	0.036
Mid-arm circumference (cm)	25.6±3.2	29.9±2.7	0.003
Blood biochemical indicators			
Folate (ng/mL)	3.8±0.8	3.6±0.6	0.02
Vit B12 (pg/mL)	274.6±78.8	247.5±94.4	0.06
Albumin (g/dL)	3.2±0.4	3.5±0.5	0.02
LDL (mg/dL)	96.4±37.1	102.2±27.1	0.03
HDL (mg/dL)	44.4±11.7	38.0±13.6	0.011
Phosphorus (mg/dL)	3.3±0.6	3.4±0.6	0.146
Systolic Pulmonary Arterial Pressure (mmHg)	33.3±11.6	29.5±13.4	0.139

mMRC: Modified Medical Research Council; FEV1: forced expiratory volume in 1 second; FVC: forced vital capacity; COPD: chronic obstructive pulmonary disease; GOLD: Global Initiative for Obstructive Lung Disease; BMI: body mass index; LDL: low density lipoprotein; HDL: high density lipoprotein

p=0.036). Also mid-arm circumferences and albumin and LDL levels were significantly lower in patients with the nutritional risk (p<0.05). The mMRC scores of patients with malnutrition risk were significantly higher (2.3±0.7 vs 1.8±0.7; p=0.033) (Table 2).

Table 3. Correlation coefficients (r) of NRS scores with anthropometric, biochemical parameters andpulmonary functions

Variables	r coefficient	p
Mid-arm circumferences	-0.595	<0.001
GOLD Stage	0.379	0.015
mMRC	0.351	0.024
FEV_1 (L)	0.847	0.031
Folate	0.276	0.080
Vit B12	0.588	0.087
Albumin	-0.147	0.358
Phosphorus	-0.071	0.661
Blood Urea Nitrogen	0.221	0.164
HDL	0.235	0.138
LDL	-0.081	0.615

BMI: body mass index; GOLD: Global Initiative for Chronic Obstructive Lung Disease; mMRC: The Modified Medical Research Council; HDL: high density lipoprotein; LDL: low density lipoprotein

The NRS-2002 had a positive correlation with mMRC (r=0.351, p=0.024) and GOLD stage (r=0.379, p=0.015). There was a statistically significant negative correlation between NRS-2002 and mid-upper arm circumference (r=0.699, p<0.001). However, the NRS-2002 score was not significantly correlated with blood biochemical indicators (Folate, albumin, vit B12, LDL, HDL, and phosphorus) (Table 3).

DISCUSSION

In our study, a significant correlation was found between the ESPEN NRS-2002 malnutrition risk assessment score and mMRC dyspnea score in GOLD stage C and D patients with stable COPD. Our data provided evidence of a relationship between the symptom level and the nutritional status of the patients with COPD.

Chronic obstructive pulmonary disease (COPD) is characterized by progressive chronic systemic inflammation with frequent exacerbations and is often accompanied by malnutrition. Many factors, especially cigarette smoking and systemic inflammation by TNF-α and neutrophils can cause malnutrition despite adequate food intake. Therefore, the presence of malnutrition in COPD patients may play an important role in disease progression and control of symptoms.

Several methods have been used to screen for the presence of malnutrition in COPD patients [10,11]. To the best of our knowledge, this is the first study from our country that examined NRS-2002 in COPD patients who were followed-up in outpatient clinics. Further, most of the previous studies investigating the nutritional status of COPD patients used other nutritional risk scales, whereas inour study, we evaluated the nutritional status of the patients using the NRS-2002 test.The NRS-2002 test is, to date, used for hospitalized patients. Arslan et al. [12] determined the relationship between quality of life and nutritional status in hospitalized COPD patients by using NRS-2002 and the Short Form-36 (SF-36) questionnaire. About 55.6% of their COPD patients were at risk of malnutrition, a ration that was very close to our result of 51.2%. In their study, the SF-16 values were found to be lower in patients with a risk of malnutrition than in patients with no malnutrition risk. Their patients differ from our patients in that they were all hospitalized. We used mMRC dyspnea scale instead of SF-16 questionnaire. There are further studies that show the association between the quality of life and mMRCscale, both in COPD patients and those with other lung diseases whose main pulmonary symptom is dyspnea [13,14].

The majority of our patients who were at risk of malnutrition were classified under GOLD stage D. This shows that nutritional status deteriorates as the GOLD stage increases. Benedik et al. [15] used Mini Nutritional Assessment (MNA) questionnaire for 108 hospitalized patients. Similar to our study, 85% of their patients had severe or very severe COPD. About 55% of patients were at risk of malnutrition and MNA score decreased as the GOLD stage increased (p=0.02). The dyspnea levels of patients according to mMRC dyspnea scale was found to be high in patients with increased malnutrition risk (3.3±1.2 vs 3.1±0.9, p=0.037) [15].

Malnutrition is associated with poor prognosis and severe airway disease in COPD. In previous studies, FEV_1 was found to be lower in malnourished patients [16,17]. In our study, we found a positive correlation between the NRS-2002 test results and the FEV_1% values. Patients with a high malnutrition risk were found to have a lower FEV_1% value.

Scichilone et al. [16] researched the association between MNA scores and the dyspnea perception of COPD patients who were attending an outpatient clinic, as in our study. All of their patients were older than 60 years of age. They found that patients with an increased malnutrition risk had higher mMRC dyspnea scores, even though their BMIs were within the normal range. Their ordinal regression analysis revealed that MNA was the only independent factor that could predict mMRC p=0.01). About 75.6% of our patients were older than 65 years of age and the mMRC scores of patients with malnutrition risk were higher than the scores of the patients without risk (2.3±0.7 vs 1.8±7.0; p=0.033) [16]. Also, we found a positive correlation between the mMRC and NRS-2002 scores.

Benedik et al. [15] observed that malnourished COPD patients had low upper arm, middle arm, and shank circumference. In our study, the mid-arm circumferences of COPD patients at risk of malnutrition was lower than the measurements of patients without malnutrition risk. In accordance with the literature, as the nutritional status deteriorated, a fall was observed in the upper-middle arm circumference and the lowest values were found in patients with the highest malnutrition risk. In addition, a significant negative correlation was found between the NRS-2002 score and the upper-middle arm circumference in all the study groups.

Recently, Marco et al. [18] investigated COPD patients with ESPEN malnutrition. Similar to our study, their patient's population composed of COPD patients in the stable stage. They prospectively investigated 118 COPD patients free of

exacerbations and/or hospital admissions in the previous two months. In their study, they made a malnutrition nutritional evaluation according to the definition of ESPEN and included parameters such as, unintentional weight loss, BMI, and lean mass index (FFMI). They evaluated the body composition of the patients by bioimpedance analysis. They found the prevalence of malnutrition to be 24.6%. Malnutrition was found to be associated with an increased mortality risk (HR=3.9 [95% CI: 1.4-10.62]) in their study [18]. Our study showed a similar result, which suggested that the nutritional status of the COPD patients should be evaluated not only in hospitalized patients but also in those attending the outpatient clinics.

In conclusion, COPD patients were found to have a high risk of malnutrition that adversely affected their dyspnea. Nutrition is an important factor that affects the disease symptoms of COPD, and nutritional improvement is one of the most effective measures to relieve these symptoms. Therefore, while clinicians plan the medical treatment of COPD patients in outpatient clinics, their evaluation of the nutritional status of patients and their consequent recommendation of precautions may contribute to areduction in the patients' shortness of breath, which is one of the most important symptoms of COPD.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Ufuk University School of Medicine Ethical Board for Clinical Research (Decision no: 2018/106/6).

Informed Consent: Written informed consent was obtained from all patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - N.O., B.S., A.B.; Design - N.O., B.S.; Supervision - E.E.A., F.Y.; Materials - B.S., N.O.; Data Collection and/or Processing - A.B., F.Y.; Analysis and/or Interpretation - F.Y., N.O., E.E.A.; Literature Search - A.B., F.Y.; Writing Manuscript - F.Y., N.O.; Critical Review - E.E.A., A.B.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

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