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The Correlation of Chronic Obstructive Pulmonary Disease Assessment Test With Other Healthy Life Quality Assessment Tests

Kronik Obstrüktif Akciğer Hastalığı Değerlendirme Testinin Diğer Sağlıklı Yaşam Kalitesi Değerlendirme Testleri ile İlişkisi

ABSTRACT

Objective:

To evaluate the effect of Chronic Obstructive Pulmonary Disease (COPD) on health and life with the Chronic Obstructive Pulmonary Disease Assessment Test (CAT) in stable COPD and to measure CAT's practical use.

Methods:

This is a single-center cross-sectional study of which participants were ≥ 40 years old patients with stable COPD and without any exacerbation in the last one month or reversibility in pulmonary function test (PFT). To evaluate the patients' health status and respiratory functions, we performed CAT, SGRQ, BODE index, PFT and six-minute walking tests (6 MWT). We analyzed the correlations of CAT with the pulmonary function tests, SGRQ score, and BODE index and assessed the internal consistency of CAT, and compared the time consumed for CAT and SGRQ.

Results:

A total of 100 stable COPD patients were enrolled in the study, 87 patients were male and the mean age was 63.68±7.73. The mean CAT score was 12.05±8.29, and there was no statistically significant difference between the test and re-test CAT score ($p>0.05$). The mean SGRQ score was 37.75 and the mean BODE index was 3.2 and CAT correlated positively with both SGRQ and BODE indexes and negatively with forced expiratory volume in one second (FEV1). CAT was significantly less time-consuming compared to SGRQ (respectively, 4.41±0.39 and 8.21±0.75 minutes, $p<0.05$).

Conclusions:

CAT can provide information about the stable COPD patient's healthy life quality and functional status similar to SGRQ and BODE index and consumes less time, thus seems more practical.

Key Words:

Quality of Life, COPD, CAT, SGRQ, BODE index

ÖZ

Amaç:

Stabil KOAH'ta Kronik Obstrüktif Akciğer Hastalığı (KOAH)'nın sağlık ve yaşam üzerindeki etkisini Kronik Obstrüktif Akciğer Hastalığı Değerlendirme Testi (CAT) ile değerlendirmek ve CAT'ın pratik kullanımını ölçmek.

Yöntemler:
Bu, son bir ayda alevlenme veya solunum fonksiyon testinde (SFT) reversibilite olmayan, ≥ 40 yaş stabil KOAH'lı hastaların katıldığı tek merkezli, kesitsel bir çalışmadır. Hastaların sağlık durumu ve solunum fonksiyonlarını değerlendirmek için CAT, SGRQ, BODE indeksi, PFT, altı dakikalık yürüme testleri (6 MWT) yaptık. CAT'ın solunum fonksiyon testleri, SGRQ skoru ve BODE indeksi ile korelasyonlarını analiz ettik ve CAT'nin iç tutarlılığını değerlendirdik ve CAT ve SGRQ için harcanan zamanı karşılaştırdık.

Bulgular:
Çalışmaya toplam 100 stabil KOAH hastası alındı, 87 hasta erkek ve ortalama yaş 63,68±7,73 idi. Ortalama CAT puanı 12,05±8,29 olup, test ve tekrar test CAT puanı arasında istatistiksel olarak anlamlı fark yoktu (p>0.05). Ortalama SGRQ skoru 37,75 ve ortalama BODE indeksi 3,2 idi ve CAT, hem SGRQ hem de BODE indeksi ile pozitif ve bir saniyedeki zorlu ekspiratuar hacim (FEV1) ile negatif korelasyon gösterdi. CAT, SGRQ'ya göre anlamlı olarak daha az zaman aldı (sırasıyla, 4,41±0,39 ve 8,21±0,75 dakika, p<0,05).

Sonuç:
CAT, stabil KOAH hastasının sağlıklı yaşam kalitesi ve fonksiyonel durumu hakkında SGRQ ve BODE indeksine benzer bilgi sağlayabilir ve daha az zaman harcar, bu nedenle daha pratik görünmektedir.

Anahtar Kelimeler:
Yaşam kalitesi, KOAH, CAT, SGRQ, BODE İndeksi

INTRODUCTION
Chronic obstructive pulmonary disease (COPD) is an important global health problem with a high prevalence and rising incidence. Approximately ten percent of the adult population is estimated to have COPD all around the world (1). It is a chronic lung disease that has a devastating effect on many aspects of a patient's life. A vicious cycle between progressive pulmonary function loss and a decrease in exercise capacity due to dyspnea cause deterioration in the quality of life.

The pulmonary function test used to evaluate the diagnosis and severity of COPD is insufficient to evaluate the impact of COPD on quality of life because the pulmonary function test does not correlate well with symptoms (2). To define and manage patients with COPD, we should assess the effects of COPD on health and life quality more properly. Till now, many assessment tests and questionnaires have been developed to evaluate the impact of COPD on healthy life. COPD Assessment Test (CAT) is one of these tests and the Turkish version was validated recently (3). Apart from CAT, many scales have been developed previously to evaluate quality of life and functional status in COPD patients. However, in order for these tests to be used in practice, they must be easily applied and do not take much time.

We performed this study to evaluate the effect of COPD on health and life with CAT in patients with stable COPD and compare CAT with Saint George's Respiratory Questionnaire (SGRQ), "Body-mass index, airflow Obstruction, Dyspnea, and Exercise" (BODE) index and the pulmonary function tests.

SUBJECTS and METHODS
Study Population
Stable COPD patients over 40 years old, who applied to Akdeniz University Medical Faculty Chest Clinic between June 2010 and January 2011 was included in the study. The patients with FEV1/FVC >70% or ≥12% reversibility in FEV1 after a short-acting bronchodilator were not included in the study. The patients with major comorbidity, that can cause functional limitations and who experienced COPD exacerbation within the last one month were excluded from the study. Demographic characteristics, medical history, physical examination, and smoking history of all patients were recorded. For severity assessment, we used GOLD spirometric stages, ranging from 1 to 4 (4). On the same day, MRC dyspnea assessment, 6-minute walking test (6-MWT), BODE index measurement, CAT questionnaire, and SGRQ questionnaire were performed.

The questionnaires were filled in by the patients, and the researcher intervened if assistance was needed. CAT questionnaire was performed 15 days later in order to assess the internal consistency. Our study was approved by ethical committee of Akdeniz University Medical School and it was performed according to principles of Helsinki Declaration. A written inform consent was obtained from the participants. The study was supported by Akdeniz University Scientific Research Project Coordination Unit (project no: 2010.04.0103.017).

Assessment tools
Pulmonary function tests:

All pulmonary function tests (PFT) were performed at the Pulmonary Function test laboratory of our clinic by the same experienced technician using Jaeger Lab manager V5.50.0 pulmonary function test device. The test was performed by at least 3 technically acceptable maneuvers. Later, patients were asked to inhale 2 puffs (total 1000 mcg) of fast-acting bronchodilator, terbutaline, and PFT was repeated 15 minutes later for evaluating bronchodilator response. Patients with FEV1/FVC <70 after the bronchodilator were enrolled in the study. The patients who had an increase in FEV1 over 12% and 200 mL from the basal measurement were excluded. Upon the percentage of the predicted post-bronchodilator FEV1, patients were categorized according to the GOLD into subgroups of airflow limitation severity (i) mild obstruction (>80%), (ii) moderate obstruction (<80% and >50%), (iii) severe obstruction (<50% and >30%) and (iv) very severe obstruction (<30%) (5).

6-minute walk test (6MWT):

Patients were informed about the 6-MWT before the application. They walked between 2 landmarks placed 20 meters apart. Patients receiving continuous oxygen therapy walked with oxygen support. When an unwan- ted event occurred, we stopped the test for a while and continued after the patient rested adequately. We measured oxygen saturation (SpO2) and pulse before and after the test, recorded the changes in SaO2 and heart rate. We assessed the severity of dyspnea by BORG dyspnea

scale before and after the test. We used a chronometer to keep time and measured the distance after the test.

Body-mass index, airflow Obstruction, Dyspnea, and Exercise (BODE) index:
The patients who could walk 350 meters and more in 6MWT were scored as "0", those who could walk 250-349 meters were scored as "1", those who could walk 150-249 meters were scored as "2" and those who could walk less than 149 meters were scored as "3". The height and weight of each patient were measured and the Body Mass Index (BMI) of each patient was calculated. Patients who had BMI> 21 were scored as "0" and those who had BMI≤ 21 were scored as "1". In order to demonstrate airway obstruction, FEV1 (% of the expected value) of each patient was measured, those whose FEV1 were 65% or more were scored as "0", those whose FEV1 between 50 and 64% were scored as "1" and those whose FEV1 between 36-49% were scored as "2" and those whose FEV1 under 35% were scored as "3". Modified Medical Research Council (MMRC) scale was used for assessing the degree of dyspnea. According to this, those who were given 0-1 point were scored as "0", those with 2 points were scored as "1", those with 3 points were scored as "2" and those with 4 points were scored as "3". All scores were added together and a BODE index, between 0 to 10, was obtained.

COPD Assessment Test (CAT):
The patients were informed about the Turkish version of CAT by the researcher. Patients read 8 questions and filled in the answers themselves. The researcher explained the question to those who didn't understand it certainly. Total scores were calculated. Total scores ranged from 0 to 40. We performed CAT by phone or face to face, 15 days later to investigate internal consistency.

Saint George's Respiratory Questionnaire (SGRQ):
Patients were informed about the Turkish version of SGRQ, which consisted of 72 questions. Patients filled in the questionnaire at the outpatient clinic, they received assistance when needed. After the questionnaires were filled in, data were processed by the software, and SGRQ symptoms score, activity score, and overall scores were calculated.

Statistical Analysis

Descriptive statistics of investigation variables have been performed. Case number (n) and percent (%) were used for categorical variables and mean ± standard deviation values were used for continuous variables. Pearson or Spearman Correlation Analysis was used according to the type of variable to assess potential relations of variables with each other. For the evaluation of the statistical difference between the CAT score and the other tests, we used the paired-t-test. In order to find out the statistical difference of variables among more than 2 case groups, we used Kruskal Wallis Variance Analysis. For the evaluation of group pairwise comparison, we used Mann-Whitney U Test. The student's T-test was used for investigating the differences in CAT score related to gender. A significant level was accepted as $p<0.05$. SPSS (version 18.0) software was used for all statistical performances. Graphics were plotted using MS Office Excel 2010 software.

RESULTS

A total of 100 stable COPD patients were enrolled in the study, 87 patients were male (Table I). The mean age of patients was 63.68±7.73 years, mean disease duration was 6.72±5.5 years, mean cigarette smoking amount was 49.42±29.4 package/years. Nineteen patients were current smokers, while 79 patients had quitted, 2 patients had no history of smoking. Most of the patients (77%) had moderate to severe COPD. The mean FEV1 (%) value was 50.60±19.37 (Table I). There was significant negative correlation between CAT and FEV1 (%) (r: -0.595, p=0.024) and % FEV1/FVC (r: -0.516, p=0.043).

Table I: Demographical characteristics of patients and questionnaire results.

Characteristics	Mean±SD/n(%)	*Min-max*
Age (years)	63.68±7.73	45-80
Gender Female	13 (13%)	
BMI (kg/m^2)	25.39±4.70	16-42
COPD duration (years)	6.72±5.52	1-20
Cigarette smoking (package/year)	49.92±29.48	0-180
CAT score	12.05±8.29	1-40
SGRQ total score	37.75±21.59	5.71-91.31
FEV1 (Liter)	1.44±0.06	0.41-3.13
FEV1 (% of the expected value)	50.60±19.37	14-106
FVC (Liter)	2.43±0.08	0.73-4.89
FVC (% of the expected value)	67.38±2.13	20-119
FEV1/FVC (%)	56.35±1.05	31-70
PEF (Liter)	3.93±1.6	1.05-8.66
PEF (% of the expected value)	3.93±1.6	1.05-8.66
MMEF 25-75(Liter)	0.76±0.41	0.16-1.90
MMEF25-75 (% of the expected value)	23.79±11.74	6-56

BMI: Body–mass-index. COPD: Chronic Obstructive Pulmonary Disease. CAT: Chronic Obstructive Pulmonary Disease Assessment Test. SGRQ: St George's Respiratory Questionnaire. FEV1: Forced expiratory volume in one second FVC: Forced vital capacity. PEF: Peak Expiratory Flow. MMEF: Maximal (mid) expiratory flow.

The mean CAT score of the patients was 12.05±8.29, and there was no statistically significant difference between the baseline and control CAT score ($p>0.05$). CAT had a positive correlation with re-test CAT (r: 0.881, p= 0.01) (Figure 1A). The mean SGRQ score was 37.75 and there was a significant positive correlation between SGRQ and CAT (Figure 1B). There was a significant positive correlation between CAT and SGRQ (r:0.882, p=0.015). CAT was significantly less time-consuming compared to SGRQ (respectively, 4.41±0.39 and 8.21±0.75 minutes, $p<0.05$). But CAT correlated weakly with COPD duration, and there was a negative correlation between CAT and the distance in 6MWT.

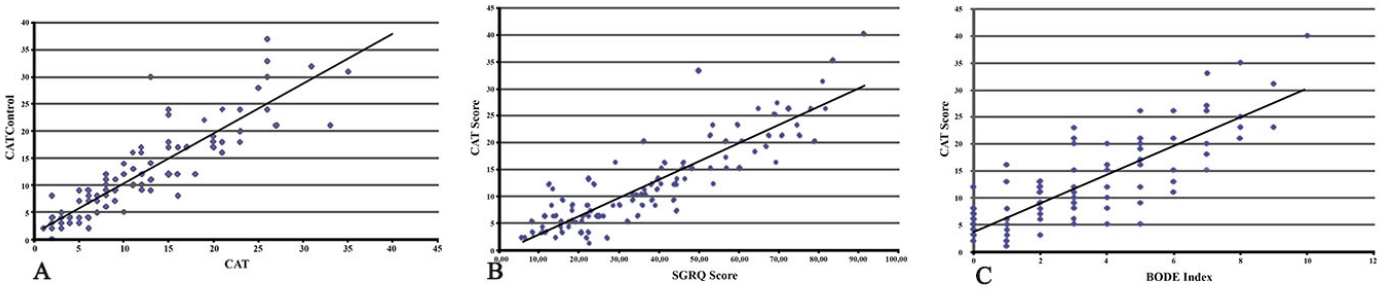

Figure 1: A. Correlation between CAT and CAT control (r: 0.881, p= 0.01). B: Correlation between CAT and SGRQ (r:0.882, p=0.015). C. Correlation between CAT and BODE index (r:0.824, p=0.02).

The mean BODE index was 3.2 and there was a significant positive correlation between the BODE index and CAT (r:0.824, p=0.02) (Figure 1C). BODE indexes in all stages were significantly different from each other. CAT and SGRQ in stage 2 were similar to those in stage 1, while the BODE index in stage 2 was significantly different from that in stage 1 (Table II).

Table II: Measurement results of the assessment tests according to stages.

	Stage I	Stage II	Stage III	Stage IV
FEV_1(%)	88.50 ±4.0	61.50±1.2*	41.46±0.93*+	21.20±0.98*+#
CAT	4.75±0.79	8.21±0.80	14.83±1.43*+	20.20±2.09 *+#
SGRQ total	18.30±3.10	28.17±2.34	44.02±3.48 *+	60.35±5.26*+#
BODE index	0.38±0.18	1.45±0.18*	4.43±0.30*+	6.73±0.41*+#

FEV1: Forced expiratory volume in one second CAT: Chronic Obstructive Pulmonary Disease Assessment Test. SGRQ: St George's Respiratory Questionnaire. BODE: Body-mass index, airflow Obstruction, Dyspnea, and Exercise.

* Difference from Stage I (p<0,05)
+Difference from Stage II (p<0,05)
#Difference from Stage III (p<0.05)

DISCUSSION

Our study demonstrated that CAT has a strong positive correlation with SGRQ and BODE index in patients with stable COPD. Moreover, it was less time-consuming than SGRQ. So, we suggest that CAT is a reliable, and less time-consuming tool for the assessment of COPD severity, exercise capacity, and the effect of COPD on life quality in patients with stable COPD.

CAT is a questionnaire made up of 8 questions about cough, phlegm, feeling of compression on the chest, dyspnea, daily indoor-outdoor activities, sleep, and energy. It was created by Jones et. al by extraction of the most proper 8 items from 21 candidate items identified in some well-structured studies (2). Turkish version of CAT has been proved to be valid and reliable at assessing COPD patients (3). We used this validated form of CAT and compared CAT with SGRQ and the time consumed for CAT and SGRQ. We found that there was a significant positive correlation between CAT and SGRQ. Recently, in an "SGRQ for COPD" validation study from Malaysia, it was reported that SGRQ for COPD had a higher correlation with CAT rather than the mMRC (6). Similarly, Flores et al reported a strong correlation between the total CAT score and the total SGRQ score (7). In our study, we also observed that CAT was less time-consuming than SGRQ. CAT had a time advantage against SGRQ as it could be filled in a few minutes and the total score can be calculated at an outpatient setting. Thus CAT seems to be more practical compared to SGRQ.

Pulmonary function tests are required for the diagnosis of COPD but may not be sensitive enough for the evaluation of disease impact over life. Ghobadi et al. found that in stable COPD patients, CAT was associated with airflow limitation and GOLD stage, and CAT worsened as airflow restriction increased (8). Similarly, Singh, et al., reported a significant association between the FEV1 and CAT (9). However, in the CAT validation study in Brazil, Flores et al reported that CAT did not correlate with spirometric values FVC, FEV1, and FEV1/FVC (7). In our study, we also observed that there was a negative correlation between CAT score and FEV1. We found that CAT scores increased by the increasing COPD stages. Moreover, there was an internal consistency between the baseline CAT score and the re-test CAT score. Similarly, a good correlation has been reported between test-retest measurements carried out with 53 patients in a previous study (10). So, CAT may predict pulmonary functions and the stage of the disease.

In practice, there are some problems in the use of SGRQ, that was accepted as the gold standard questionnaire for the assessment of health-related quality of life. The cut-off point for its scale is still controversial (11). Moreover, it has recently been suggested that the SGRQ may not be a suitable tool for measuring symptom severity or activity limitations in COPD patients (12). Besides, SGRQ can be filled in by the patient alone or with assistance at about 10 minutes, its application is a bit time-consuming (13). Also, scoring this test is time-consuming, requiring a calculator or software and it has a very complex scoring algorithm for routine use. The clinicians require more practical and less time consuming assessment tools for the evaluation of patients with stable COPD. So they may prefer using CAT in daily practice rather than using SGRQ.

BODE index is a multidimensional index that assesses the disease severity in COPD. It has been used to determine the progression, and treatment efficacy of COPD also (14). Previously, SGRQ symptom, activity, and overall scores had been found to be correlated well with the BODE index (15). CAT correlated positively with BODE index also (9). We also found that CAT correlated well with BODE index. But, for the assessment of BODE index we require the patient's FEV1 value, BMI, MMRC score, and the distance in 6 MWT. Thus, it is not practical. On the other hand, we observed that BODE scores varied significantly depending on all stages of the disease. CAT and MMRC could not distinguish stage 2 from stage 1, but the

BODE index did and increased significantly in all COPD stages. There are some limitations of this study. Firstly, most of our patients had moderate or severe COPD so the results can be generalized for moderate or severe COPD, not for mild or stage 4 very severe COPD patients. Secondly, we suppose that CAT scores will be higher in real life, because comorbidities interfere with the COPD symptoms, may result in increased CAT scores. Thirdly, this is a single-center study, conducted in a tertiary hospital, so the results may not be representative of all COPD patients with different educational and cultural backgrounds.

CONCLUSION

In conclusion, in our study, CAT showed a strong positive correlation with SGRQ and BODE index and a negative correlation with FEV1 and distance in 6MWT. There was an internal consistency between the baseline CAT score and the CAT score in the re-assessment. CAT was less time-consuming than SGRQ. Overall, CAT was a simple, reliable, less time-consuming practical tool for the assessment of COPD severity, exercise capacity, and the effect of COPD on life quality.

Ethics Committee Approval:
This research complies with all the relevant national regulations, institutional policies and is in accordance with the tenets of the Helsinki Declaration, and has been approved by the Akdeniz Medical Faculty Ethical Committee, Akdeniz University (approval number: 2010/07-31).

Informed Consent:
All the participants' rights were protected and written informed consents were obtained before the procedures according to the Helsinki Declaration.

Author Contributions:
Concept - A.T., H.D., C.Ö.; Design - A.T., H.D., C.Ö.; Supervision - A.T., H.D., C.Ö.; Resources - A.T.; Materials - A.T.; Data Collection and/or Processing - A.T.; Analysis and/ or Interpretation - A.T.; Literature Search - A.T., H.D., C.Ö.; Writing Manuscript - A.T., H.D., C.Ö.; Critical Review - A.T., H.D., C.Ö.

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

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