



Clinical impact of chronic obstructive pulmonary disease (COPD) verified by the COPD Assessment Test (CAT) can be associated with functional capacity?

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ABSTRACT. The aim of this study was to investigate the impact of the different degrees of severity of 'CAT' in the functional capacity evaluated by the 6-minute walk test (6MWT). This is a cross-sectional study, which included spirometrically defined COPD patients, out of exacerbation period and with motor and cognitive skills necessary to perform the spirometry and the 6MWT and reply to the 'CAT' questionnaire. We sorted groups according to the clinical impact proposed by 'CAT': mild, moderate, severe and very severe. We included 66 COPD patients, with FEV1 (% pred) averages of 53.1 ± 21.9 , 51.4 ± 14.1 , 50.6 ± 12.8 and 46.4 ± 13.0 , which corresponded to the clinical impact of 'CAT', respectively ($p > 0.05$). The highest 'CAT' score, observed on mild, moderate and severe clinical impact did not determine the shortest walking distance in the 6MWT ($p < 0.05$). However, 'CAT' score > 30 (very severe clinical impact) was associated with shorter walking distance in the 6MWT ($p < 0.05$). We found no negative correlation between 'CAT' and 6MWT ($p = 0.0707$ and $r = -0.2479$). 'CAT' was not associated to 6MWT.

Keywords: chronic obstructive pulmonary disease; sickness impact profile; stress test.

O impacto clínico da doença pulmonar obstrutiva crônica (DPOC) verificado pelo COPD Assessment Test (CAT) pode associar-se com capacidade funcional?

RESUMO. O objetivo do presente estudo foi investigar o impacto dos diferentes graus de gravidade do 'CAT' na capacidade funcional avaliada pelo teste de caminhada de 6 minutos (TC6). Trata-se de um estudo transversal, que incluiu pacientes com DPOC, classificados espirometricamente, fora de um período de exacerbação e com habilidades cognitivas e motoras, necessárias para fazer a espirometria, responder ao questionário 'CAT' e executar o TC6. A divisão dos grupos foi de acordo com o impacto clínico proposto pelo 'CAT': leve, moderado, grave e muito grave. Foram incluídos 66 pacientes com DPOC, com médias de VEF1(% pred) de $53,1 \pm 21,9$, $51,4 \pm 14,1$, $50,6 \pm 12,8$ e $46,4 \pm 13,0$, que corresponderam aos impactos clínicos do 'CAT', respectivamente ($p > 0,05$). A maior pontuação do 'CAT', observada nos impactos clínicos leve, moderado e grave não determinaram menor distância caminhada no TC6 ($p < 0,05$). Entretanto, pontuação CAT > 30 (impacto clínico muito grave) se associou com menor distância caminhada no TC6 ($p < 0,05$). Não foi encontrada correlação negativa entre o 'CAT' e o TC6 ($p = 0,0707$ e $r = -0,2479$). O 'CAT' não se associou ao TC6.

Palavras-chave: doença pulmonar obstrutiva crônica; perfil de impacto da doença; teste de esforço.

Introduction

Clinical impact on patients with chronic obstructive pulmonary disease (COPD) has been measured by multidimensional instruments that seek to establish functionality or incapacity (Athayde, Britto, & Parreira, 2010). Through specific parameters, pulmonary function, functional capacity, dyspnea during activities and anthropometric data comprise the 'BODE' index (body mass index, airway obstruction, dyspnea, exercise capacity), which is a predictor of

death (Celli et al., 2004). Variation in the behavior of the clinical impact of these patients regarding the assessment tools used led to the adoption of other elements to determine them. Among them, the risk of exacerbations *per* year and the symptoms by the 'modified medical research council' (mMRC) or 'chronic obstructive pulmonary disease' (COPD Assessment Test – CAT) (Jones, Harding, Berry, Wiklund, Chen, & Kline Leidy, 2009; Silva, Morano, Viana, Magalhães, & Pereira, 2013; Kim et al. (2013)

questionnaires, classifying them in A, B, C or D (Vogelmeier et al., 2017). Previous investigations (Tsiligianni et al., 2012; Jones, 2012; Gianjeppe-Santos, Nyssen, Pessoa, Basso-Vanelli, Jamam, & Di Lorenzo, 2013) evaluated the relationship between CAT and parameters that make up the BODE index. Some studies found no significant correlation between BODE, CAT and the 6MWT, which would prevent CAT from reproducing objective measures of functional capacity, pulmonary function or as a predictor of death (Tsiligianni et al., 2012; Jones, 2012; Gianjeppe-Santos, Nyssen, Pessoa, Basso-Vanelli, Jamam, & Di Lorenzo, 2013). In another study (Gibellino, Mammana, L., iancio, & Di Maria, 2013), the calculation of BODE index, traditionally made with the 6MWT, was similar to a model that used CAT (BOD-CAT) (Gibellino et al., 2013). Investigations are necessary to define the association between the different clinical impacts of CAT and the functional capacity verified by TC6 (Jones, 2009; Puhan et al., 2009; The Global Initiative for Chronic Obstructive Lung Disease [GOLD], 2017). Despite having been validated for Brazil (Silva, 2013), Brazilian COPD patients were not investigated to clarify whether the use of CAT may be associated with 6MWT.

Thus, the aim of this study was to investigate the impact of the different degrees of severity of CAT on the functional capacity evaluated by the 6MWT.

Methods

This is a cross-sectional study representing a partnership between the University of Western São Paulo (Unoeste), in Presidente Prudente (SP – Brazil) and the São Paulo State University (Unesp – campus of Botucatu – SP – Brazil). Patients were selected at the Regional Hospital of Presidente Prudente (SP) and evaluated at the Chest Physiotherapy department in the School Clinic of the Physiotherapy course of Unoeste.

The study was approved by the research ethics committee of the Unoeste (CAAE 09051212.7.0000.5515).

A reduction in the FEV1/FVC ratio ($< 70\%$) associated with a reduction in FEV1 ($< 80\%$), both in the post-bronchodilator (post-BD) phase of spirometry, was required to include patients with COPD with a Global Initiative for Chronic Obstructive Lung Disease (GOLD, 2017) 2, 3 and 4 classification, with their corresponding parameters. In addition, all patients should be out of exacerbation period (Vogelmeier et al., 2017; GOLD, 2017), under medical follow-up, make use of COPD medication and have cognitive and motor

skills necessary to perform the spirometry and the 6MWT and reply to the CAT questionnaire.

The MK8[®] model micromedical spirometer was used in the test, which followed the norms of quality (Pereira, 2002). Height and weight measurements were used to obtain normal spirometry values, in addition to serving for the calculation of body mass index (BMI).

Through the implementation of the CAT, we sorted subjects into four groups according to the following score: (1) with COPD mild clinical impact (6 to 10 points), (2) moderate clinical impact (11 to 20 points), (3) severe clinical impact (21 to 30 points) and (4) very severe clinical impact (31 to 40 points).

We performed the TC6 on even ground (30 meters) to record the walking distance in 6 minutes (Holland, 2014).

Results were presented with average and standard deviation values. We verified the data normality using the Shapiro-Wilk test. The comparison between groups was performed by analysis of variance (ANOVA) with Bonferroni *post hoc* to perform the parametric distribution. We measured data correlation between 6MWT and CAT by Pearson correlation. We adopted $p \leq 0.05$ as significance level.

Results

We evaluated 66 patients with COPD, classified by GOLD (2017). Patients were sorted into four groups according to the clinical impact verified by CAT: mild (10 patients), moderate (26 patients), severe (20 patients) and very severe (10 patients).

Table 1 shows the anthropometric data of patients. There was no statistically significant difference regarding age, weight, height and BMI among groups ($p = 0.4992$, $p = 0.1348$, $p = 0.7414$ and $p = 0.2388$, respectively).

The FEV1(L), FEV1%(L), FVC(L), FVC(%) and FEV1/FVC(%) spirometry parameters showed no statistical difference between the groups assessed, despite the highest score of CAT, which determined the groups with mild, moderate, severe and very severe clinical impact (Table 2).

The 6MWT was similar between mild, moderate and severe clinical impacts. The CAT score > 30 , which determined COPD patients with very severe clinical impact, showed shorter walking distance in the 6MWT ($p < 0.05$), shown in Table 2.

Although patients of the very severe clinical impact group (CAT > 30) showed shortest walking distance in the 6MWT, the correlation analysis between 6MWT and CAT was not statistically significant, showing values of $p = 0.0707$ and $r = -0.2479$. There was no association between CAT and 6MWT.

Table 1. Parameters of patients with COPD, sorted according to the clinical impact determined by the CAT score, expressed as mean and standard deviation.

	Mild clinical impact 6 to 10 points / n = 10	Moderate clinical impact 11 to 20 points / n = 26	Severe clinical impact 21 to 30 points / n = 20	Very severe clinical impact 31 to 40 points / n = 10	p
Age (years)	63.2 ± 1.5	60.9 ± 9.3	58.8 ± 10.6	54.2 ± 9.2	n/s
Weight (kg)	106.8 ± 22.1	83.8 ± 12.7	85.7 ± 17.5	94.5 ± 13.2	n/s
Height (m)	1.65 ± 0.1	1.63 ± 0.1	1.61 ± 0.1	1.62 ± 0.1	n/s
BMI _i (kg m ⁻²)	39.1 ± 8	31.1 ± 4	32.9 ± 6	36.3 ± 7	n/s

BMI (body mass index), kg (kilogram), cm (centimeter), m² (square meter).

Table 2. Spirometric parameters; CAT and 6MWT scores of patients expressed as mean and standard deviation.

	Mild clinical impact 6 to 10 points / n = 10	Moderate clinical impact 11 to 20 points / n = 26	Severe clinical impact 21 to 30 points / n = 20	Very severe clinical impact 31 to 40 points / n = 10	p
FEV ₁ (L)	1.41 ± 0.4	1.53 ± 0.5	1.41 ± 0.4	1.39 ± 0.6	n/s
FEV1 (%pred)	53.1 ± 21.9	51.4 ± 14.1	50.6 ± 12.8	46.4 ± 13.0	n/s
FVC (L)	2.25 ± 0.6	2.4 ± 0.8	2.21 ± 0.5	2.22 ± 0.5	n/s
FVC (%)	66.7 ± 27.5	63.9 ± 15.4	63.8 ± 11.2	61.2 ± 4.7	n/s
FEV ₁ /FVC (%)	64.0 ± 14.1	65.2 ± 15.6	63.6 ± 13.4	60.4 ± 16.1	n/s
CAT	8.5 ± 1.9	15.5 ± 2.6	24.1 ± 2.3	33.1 ± 2.1	-----
6MWT (m)	445.5 ± 122.4 ^a	447.7 ± 132.6 ^a	399.5 ± 122.2 ^a	280 ± 106 ^b	<0.05

FEV1 (forced expiratory volume in the first second), % pred (percentage of predicted), FVC (forced vital capacity) and m (meters). ^{a,b} same letters represent no statistical difference and different letters represent statistical difference (p < 0.05).

Discussion

There was no association between CAT and 6MWT, since there was no significant correlation. We found that the patients of the CAT group of severe clinical impact had the shortest walking distance in the 6MWT. In the mild, moderate and severe clinical impacts the walking distance in the 6MWT did not differ between the groups. However, the 6MWT average was 48.2 meters lower in the severe clinical impact group when compared with the moderate one.

This study aimed to verify whether the increase of the CAT score and the consequent change in clinical impact could be followed by the inverse behavior in the 6MWT walking distance.

CAT scores in mild, moderate and severe clinical impacts could not be associated with the functional capacity verified by the 6MWT. The highest score determined by the CAT did not find patients with the shortest walking distance in the 6MWT. In these three clinical impacts we included COPD patients who, on average, were considered moderate.

Inverse behavior was noted when patients were included in the very severe clinical impact (CAT between 31 and 40). Still, despite the shorter walking distance in the 6MWT, found among patients with severe clinical impact of CAT, there was no association between the CAT and the 6MWT. When assessing health conditions by CAT in a multidimensional way in the group with very severe clinical impact, we found individuals with more symptoms. Thereby, additional CAT information such as cough, expectoration and sleep were more frequent among patients of this group,

which may have influenced the findings concerning the shortest walking distance in the 6MWT.

This relationship between CAT and 6MWT was evaluated in other studies. Despite the significant increase in the walking distance in the 6MWT, after a period of pulmonary rehabilitation, Jones et al. (2012) found no negative correlation with CAT, in addition to the permanence of the score obtained in the same clinical impact (moderate). On the one hand, in this study, there was a similar behavior by the negative correlation, also not found. However, the decrease in the values of walking distance in 6 minutes was followed by a change in the clinical impact of CAT. It seems that CAT can be better associated with the 6MWT when the clinical impact is severe or very severe, since the study by Jones et al. (2009) and this one showed no significant changes between mild and moderate clinical impacts.

From the point of view of functional capacity measured by the 6MWT, we observed that increments longer than 35 meters or over 10% of the walking distance can predict an improvement in functional capacity in COPD patients (Rodrigues, Mendes, & Viegas, 2004; Dodd, 2011; Bautista, Ehsan, Normandin, Zuwallack, & Lahiri, 2011; Morales-Blanchir, Vidal, Romero, Castro, Villegas, & Zamboni, 2011; Agrawal & Awad, 2015). This study found that, on average, there was an increase of 48.2 meters in the walking distance when the clinical impact of CAT was severe, in comparison with moderate.

The study by Gibellino et al. (2013) proposed the replacement of 6MWT with CAT, for the calculation of the BODE index (Jones et al., 2012).

They included patients with moderate to severe COPD. The authors concluded that CAT can be a substitute for the 6MWT for the calculation of the BODE index.

In addition, CAT was an instrument that identified the answers to a pulmonary rehabilitation program in patients with more severe COPD (Gibellino et al., 2013). It can also be used as a substitute for long questionnaires because it is able to distinguish between different levels of response (Holland, 2014).

In another study (Gianjoppe-Santos, 2013) there was also no correlation between CAT and 6MWT when evaluating patients with moderate to very severe COPD.

BMI was similar between the groups of COPD patients. CAT indicates 'shortness of breath when climbing', 'limitation in activities at home' and 'energy (disposition)' in its questions. The heterogeneous BMI could be a confusing factor in the responses, which did not occur.

This study was limited to an analysis of the relationship between CAT and 6MWT by CAT category (mild, moderate, severe and very severe clinical impacts). By CAT < 10 (non-exacerbated COPD) and CAT > 10 (exacerbated COPD) criteria, the result could be different, since CAT is a multidimensional assessment instrument.

Conclusion

There was no association between CAT and 6MWT. The walking distance assessed by the 6MWT was shorter in COPD patients included in the very severe clinical impact CAT group. The study concluded that CAT should not be touted as a possible replacement for 6MWT, for not reproducing objective measures of functional capacity. Future research could include patients with COPD and divide them by exacerbation history and symptoms, sorting them into A, B, C, or D, to create a relationship with the functional capacity.

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