Comparison of forced expiratory volume (FEV$_1$) and BODE index in the assessment of health-related quality of life in patients with chronic pulmonary disorder

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Abstract

Chronic obstructive pulmonary disease (COPD) can lead to major alterations in the patient's quality of life. Our objectives were to assess the quality of life in a population of COPD patients in stable condition and to analyse the correlations between quality of life expressed by the St George's respiratory questionnaire (SGRQ), forced expiratory volume in 1 second (FEV$_1$) and the BODE index. This study was a prospective study concerning 70 outpatients treated for COPD. Quality of life was assessed using the French version of the SGRQ. The study population was predominantly male (97%) with a mean age of 63 years. The average total SGRQ score was 2049 (SD 523). The difficulties expressed by our patients mainly concerned the domain of 'activity', followed by 'impact of the disease' and 'symptoms'. The correlation between FEV$_1$ (percentage of predicted value) and the total SGRQ score and its different domains revealed a significant relationship with all parameters, but this correlation was weak with a correlation coefficient (r) between -0.43 and -0.28. In contrast, the BODE index was more strongly correlated with the quality of life (r between 0.44 and 0.60). In conclusion, FEV$_1$ is correlated with health-related quality of life measured by the SGRQ, but the multidimensional BODE index is more reliable for assessing the impact of COPD on quality of life.

Introduction

Chronic obstructive pulmonary disease (COPD) is considered a systemic disease that starts in the lungs. Dyspnoea, resulting from bronchial obstruction and hyperinflation, leads to inactivity which reduces exercise capacity through muscle deconditioning. These phenomena lead to a major alteration of the quality of life; preserving the quality of life should be a key objective when managing patients with COPD.[1]

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Measures of health-related quality of life have undergone important developments in recent years. Their goal is to assess the health status of an individual in terms of physical, mental, and social parameters. This is a perceptual approach that takes into account the views of the patient and not only those of doctors or other health professionals. Assessing quality of life may be done by the use of either generic questionnaires that evaluate the overall state of the patient, regardless of their health status and regardless of the context, or by the use of specific questionnaires designed to assess for diseases such as COPD or asthma. The latter are more sensitive to clinical changes than generic questionnaires.[2]

The objectives of this work were to assess the quality of life in a population of COPD patients in a stable condition and to analyse the correlations between quality of life expressed by the St George's respiratory questionnaire (SGRQ), forced expiratory volume in 1 second (FEV$_1$), and the multi-dimensional BODE index.

Methods

We performed a prospective study of outpatients with COPD in a stable condition, followed in the pulmonology department at the Hedi Chaker hospital of Sfax (Tunisia) over 16 months.

The patients included in the study were aged 40 years and over, had smoked for more than 10 pack-years, were being followed for COPD and were stable during the study, and had not had any exacerbation at least 1 month prior to enrolment. Patients with pulmonary diseases other than COPD or severe disabling comorbidities (cardiovascular, neurological, or rheumatic) were excluded.

An information sheet containing patient demographics, smoking status, medical history, duration of disease and disease course, assessment of dyspnoea using the Medical Research Council (MRC) scale, and the number of exacerbations in the previous year was filled out by the attending physician during a regular outpatient clinic for patients meeting the inclusion criteria. Spirometry was performed before and after bronchodilatation; reference values taken were those of the European Respiratory Society (ERS).[3]

The 6-minute walk test was performed by a doctor trained according to the American Thoracic Society (ATS) recommendations.[4]

The BODE index[5] was calculated for each patient based

on the following variables: FEV_1, walking distance in 6 minutes, dyspnoea score according to the MRC scale, and body mass index. Depending on the score, four quartiles were defined: quartile 1 (score between 0 and 2), quartile 2 (score between 3 and 4), quartile 3 (score between 5 and 6), and quartile 4 (score between 7 and 10).

To investigate the quality of life of our patients, we relied on the SGRQ (French version).[6] The questionnaire consists of three domains (symptoms, activity, and impacts). The questions were asked by a trained physician in order to avoid cases of non-response or multiple responses. The responses were weighted and a score is calculated by dividing the sum for the patient by the maximum points available and expressing the result as a percentage. The score ranges from 0 to 100%; a score of 100% indicates a state of good health.

Data were entered and analysed using SPSS version 17.0 software. Numerical values were expressed as mean±standard deviation (SD). The study of correlations was made in bivariate analysis based on Pearson's correlation coefficient. A p-value of <0.05 was considered statistically significant.

Results

Our study involved 70 patients, predominantly male (97% male), with an average age of 63±10 years. All patients were current or past smokers; the average cumulative tobacco consumption was 46 pack-years. Nearly half of patients (52.8%) had been hospitalised one or more times for exacerbation of COPD. In the year before inclusion, 47 patients (67%) had at least one acute exacerbation of their disease.

The post bronchodilator FEV_1 was 1394±538 ml, or 46.4±15.7 (% predicted). The FEV_1/forced vital capacity (FVC) was less than 70% in all patients; the average value was 54.6±8.5% with a range from 36 to 64%. Referring to the GOLD (Global Initiative for Chronic Obstructive Lung Disease) classification, the majority (81.4%) of our patients had moderate to severe COPD. Only 2 patients had stage I COPD and 11 patients had reached a severe stage (Figure 1). The mean walking distance in 6 minutes was 430 m, with desaturation during exercise in 15 patients, and a fall of 6% on average.
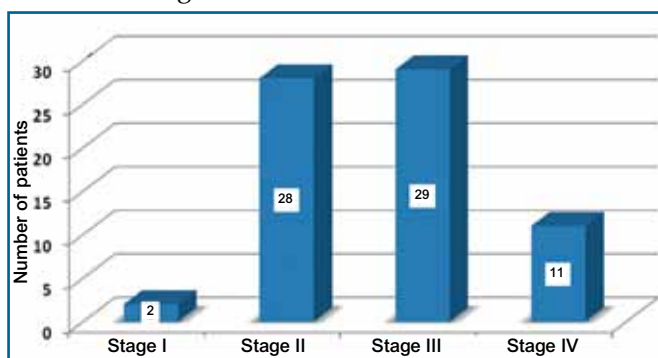

Figure 1: Distribution of patients according to the GOLD classification

Table 1 summarises the distribution of patients according to the limits of the various components of the BODE index. Based on the calculation of the BODE index and the division

Factor	Classification	Number of patients
Body mass index (kg/m²)	>21	41
	≤21	29
MRC scale	0-1	8
	2	31
	3	18
	4	13
6 minutes walk test (m)	≤149	2
	150-249	2
	250-349	16
	≥350	50
FEV_1 (%)	≤35	18
	36-49	22
	50-64	22
	≥65	8

Table 1: Distribution of patients according to the BODE index components

into four quartiles, the majority of our patients belonged to the second and third quartile (Figure 2). Assessing quality of life by the SGRQ total score gave an average value of 2048.9±523.3. The difficulties expressed by our patients mainly concerned the domain of 'activity', followed by 'impact of the disease' and 'symptoms' (Table 2).

The correlations of FEV_1 (% predicted) and the total score of SGRQ and its different domains (symptoms, activity, and impacts) were studied by bivariate analysis and showed significant relationships with all parameters, but correlations were weak with correlation coefficients (r) between -0.43 and -0.28 (Table 3). The BODE index correlated much better with the SGRQ total score and all its areas, with correlation coefficients between 0.44 and 0.60 (Table 3).
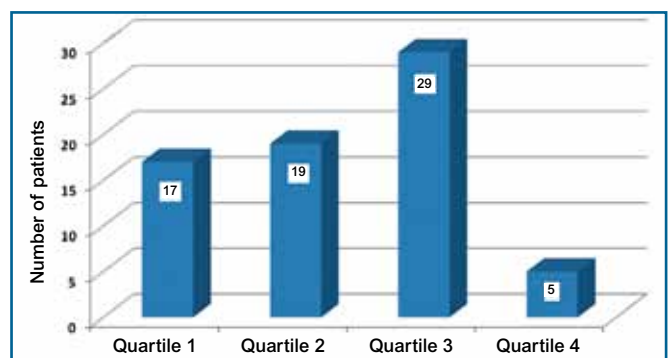

Figure 2: Distribution of patients according to quartiles of the BODE index

Discussion

The first concerns regarding the quality of life of COPD patients emerged in the 1970s. Stewart et al.[7] studied the role of long-term oxygen therapy in improving the daily activities of patients; the patients kept a diary which to indicated improvements in daily tasks. Since then, clinical

	Values	Percentage
Symptoms	177.1±90.1	26.7±13.6%
Activities	833.3±195.6	68.8±16.2%
Impacts	1038.5±303.3	49.0±14.4%
Total score	2048.9±523.3	50.8±14.0%

Table 2: Summary of the total SGRQ score and its domains

studies have followed and the results showed negative changes in mood and social behaviour of patients with COPD, similar to those found in studies of hypoxaemia.

Some generic scales of quality of life were assessed for COPD patients to study their validity for this type of pathology. The SGRQ was first developed in 1983 by Jones et al. and the final version contains 76 items divided into three domains: 'symptoms' (respiratory symptoms, their frequency and severity), 'activity' (activities that cause or are limited by breathlessness), and 'impacts' (these cover a wide range of aspects involved in the disruption of social functioning and psychological damage resulting from the respiratory tract disease).[8] However, specific questions designed to measure anxiety and depression were excluded. This questionnaire is designed specifically for patients with respiratory disease and all its items relate more or less directly to the symptoms of these disorders (shortness of breath, wheezing)[6] or their impact on daily life. For the evaluation of the effectiveness of a therapeutic action on the quality of life, a variation of 4 points in the total score or domain score is considered significant.

The health-related quality of life in COPD seems to vary according to the severity of deterioration in FEV_1. Stage I has little effect on the quality of life, whereas stages II and III are associated with a severe deterioration in quality of life.[9] Previous studies that have investigated the relationship between FEV_1 and health-related quality of life have had important limitations. Prigatano et al.[10], McSweeny et al.[11] and Alonso et al.[12] found no significant link between the quality of life and FEV_1 (% predicted). However, these authors used generic measures of quality of life that are less sensitive than specific questionnaires for the detection of certain changes in the quality of life.

Ketelaars et al.[13] studied the quality of life of 126 patients with COPD. Their study population had a post-bronchodilator FEV_1 of 39±18%. A significant relationship was found only with the 'activity' domain of the SGRQ (p<0.01 and r = -0.24). However, this study has some limitations including the inclusion of patients in advanced stages of their disease and the lack of staging based on the severity of their pathology.

The clinical significance of measuring quality of life in patients with stage I disease is difficult to assess, but it seems very important from a quantitative point of view, given the number of patients at this stage. On the other hand, the study of Ferrer et al.[14] found a difference in the quality of life score of 13% among patients with stage I disease and the reference group (those in a healthy condition), and this difference was clinically relevant. Similarly, the relationship between the stage of severity according to the ATS classification and the total score of the SGRQ and its different domains was significant with correlation coefficients ranging from 0.27 to 0.51.

Recent studies have demonstrated a significant relationship between disease severity and quality of life in COPD. The study of Ståhl et al.[15] involved 168 patients treated for COPD and showed a significant relationship between quality of life and FEV_1 (p<0.001) with a good correlation (r=-0.34); however, the correlation of FEV_1 with the different domains of the SGRQ has not been studied, and neither has the change in quality of life with the different stages of GOLD.

Antonelli-Incalzi et al.[16] studied 381 patients with COPD and found a significant relationship between the SGRQ score and FEV_1, with a correlation coefficient of r=-0.46. A dramatic worsening of health status was found with increasing GOLD stages (Wilk's λ 0.85, p<0.001). However, with an r^2 value of 0.21, it appeared that the severity of airway obstruction only explains a fifth of the variance observed in health status as evidenced by the total score of the SGRQ.

In our study, the link between FEV_1 and SGRQ was significant with a relatively high correlation (r=-0.28 to -0.43) according to the SGRQ domains. Progression through the stages of GOLD is associated with degradation of the quality of life related to health (Wilk's λ 0.81, p=0.004).

COPD is a complex disease with significant systemic manifestations that are not accounted for using only the measurement of lung function. Thus, several publications have concluded that FEV_1 is probably not the best marker of the severity and prognosis of COPD.[17-19] However, it is the basis for the classification in the different stages of severity mentioned by the majority of scientific societies.[20,21] The National Institute for Clinical Excellence (NICE)[21] was the first scientific society to insist that body mass index, dyspnea, and walking distance in 6 minutes were simple elements, which must be integrated in the evaluation of patients with

		Correlations coefficient (r)	Significance (p)
Total score	BODE	0.56	<0.001
	FEV_1	-0.37	0.001
Symptoms	BODE	0.44	<0.001
	FEV_1	-0.33	0.004
Activities	BODE	0.60	<0.001
	FEV_1	-0.43	<0.001
Impacts	BODE	0.47	<0.001
	FEV_1	-0.28	0.018

Table 3: Significance and correlation coefficients between BODE index, FEV_1 and SGRQ score

COPD and can provide a more reliable representation of the various extra-pulmonary manifestations. It is therefore no coincidence that all these factors have been combined since 2004 as a clinical score called the BODE index which has been evaluated as a prognostic factor in COPD.[5]

The attraction of the BODE index is that it provides additional information other than FEV_1, thus reflecting the systemic impact of COPD.[18,22,23] Studies have confirmed that the BODE index is highly correlated with the degree of systemic inflammation, especially oxidative stress.[23,24] In the current study, the multidimensional BODE index was more strongly correlated with the quality of life than lung function alone.

Ong et al.[24] observed an important evolutionary turning point in health status between patients with GOLD stages III and IV without significant changes in SGRQ total score marking the progression of COPD from stage I to stage III. This study also found, in agreement with the GOLD classification, significant differences in the quality of life related to health between higher quartiles (quartiles 3 and 4) of the BODE classification system. This difference was not found between quartiles of consecutive lower grades. This suggests that the health status of COPD patients may be relatively preserved until later stages. Therefore, efforts must be taken to prevent disease progression even in severe COPD to avoid a dramatic decline in health status.

Conclusion

FEV_1 is correlated with health-related quality of life measured by the SGRQ, but the multidimensional BODE index is more reliable for measuring the impact of COPD on quality of life. Thus, although the FEV_1 is a simple way of assessing the severity of COPD, it should not be used alone to appreciate the impact of COPD.

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