Chronic obstructive pulmonary disease (COPD) in elderly subjects: impact on functional status and quality of life

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Abstract

Chronic obstructive pulmonary disease (COPD) is an important cause of morbidity and disability. Many studies have investigated factors influencing quality of life (QoL) in middle-aged COPD sufferers, but little attention has been given to elderly COPD. The aim of the present study was to investigate the impact of COPD on QoL and functional status in the elderly. Sixty COPD patients and 58 healthy controls over 65 years old were administered Pulmonary Function Tests, 6 min Walking Test (6MWD) for exercise tolerance, the Barthel Index and Mini Mental State Examination (MMSE) for functional status, the Geriatric Depression Scale (GDS) for mood, and the Saint George Respiratory Questionnaire (SGRQ) for QoL. FEV_1 and PaO_2 were reduced in COPD patients. Also the distance walked during 6MWD was significantly shorter for patients than controls (282.5 ± 89.5 vs. 332.9 ± 95.2 m; $P < 0.01$). Moreover, COPD patients had significantly worse outcomes for the Barthel Index, GDS and SGRQ. The logistic regression model demonstrated that a decrease in FEV_1 is the factor most strictly related to the deterioration of QoL in COPD patients. Mood was also an independent factor influencing QoL. In conclusion, elderly COPD patients show a substantial impairment in QoL depending on the severity of airway obstruction; symptoms related to the disease may be exaggerated by mood deflection.

doi: 10.1053/rmed.2003.1488, available online at http://www.sciencedirect.com

Keywords COPD, elderly, functional status, quality of life.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity in old age, affecting approximately 16% of people over the age of 65 (1).

Progressive improvement in treatment, in particular the availability of long-term oxygen therapy, has increased the life-expectancy of COPD patients, extending the interval between onset of disability and death. Consequently, COPD patients can survive for a long time in spite of severe respiratory impairment and disability, both of which can be assessed by the degree of stable oxyhaemoglobin desaturation (2).

Elderly patients affected with COPD-related respiratory failure are frequently impaired in their social life, psychic function and activities of daily living (ADL) (3); therefore, it is of crucial importance to establish the relationship between COPD and quality of life (QoL) in this population.

Previous studies reported that respiratory symptoms, self-perceived health status, cognitive status and mood can influence QoL in COPD; (4–6) nevertheless, even though the role of these factors has been investigated in middle-aged patients, little attention has been given to its analysis in elderly subjects.

The evaluation of health status by separately investigating various physical, cognitive and affective domains is a common practice in geriatric assessment; more recently, however, a different approach based on the application of disease-specific questionnaires has been proposed. The Saint George Respiratory Questionnaire (SGRQ) is a standardized questionnaire designed to measured QoL in patients with chronic airflow limitation and to quantify the impact of chronic airway obstruction on health and well-being (7).

Having taken into account these considerations, we carried out a study aimed at understanding the

Received 12 Jun 2002; Accepted in revised form 18 Nov 2002
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impact of chronic airway obstruction on QoL, physical activity and functional status in elderly patients with COPD.

METHODS

Subjects

A total of 118 males over 65 years of age were studied. Sixty were affected with COPD diagnosed on the basis of respiratory functional impairment measured according to the European Respiratory Society criteria (8). COPD patients were recruited consecutively as outpatients at the geriatric day-hospital during a regular check-up visit when they met the inclusion criteria.

Fifty-eight healthy elderly subjects were evaluated as a control group and were recruited consecutively, from the subjects admitted to our department for a clinical routine examination.

Exclusion criteria for all subjects were the following: underweight condition (Body Mass Index (BMI) < 18.5) or obesity (BMI > 30); ischaemic heart disease; severe liver and renal failure and/or any other acute disease; changes in medication during the last 30 days and hospital admission in the previous 6 weeks. Subjects with cognitive, sensory and physical impairment relevant enough to preclude the execution of pulmonary function and/or exercise performance tests were also excluded. The study design was approved by the Ethical Committee of the University of Padua and the patients and controls gave their informed consent to participate in the study.

Study design

All subjects underwent anthropometric measurements, lung function tests, exercise tolerance evaluation and multidimensional assessment.

Anthropometric measurements

Body weight was measured on a balance beam platform scale to the nearest 0.1 kg. Height was taken by a stadiometer to the nearest centimetre with the subject standing barefoot, his feet together, at his head level. BMI was then calculated as body weight (kg) divided by the square of body height (m^2).

Pulmonary function tests

Lung function measurements were evaluated by a computerized water-sealed Stead-Wells spirometer (BAIRES System, Biomedin, Padua, Italy), which fulfils the 1994 ATS recommendations for diagnostic spirometry. The customized software assists the operator during the test and allows on-line control of compliance with ATS criteria by displaying all the parameters relevant to the start- and end-of-test, as well as those relevant to reproducibility of FEV_1 and FVC (9). An arterial blood sample was drawn from the radial artery for blood gas analysis of PaO_2 and $PaCO_2$ (ABL 300 blood gas analyzer, Radiometer, Copenhagen, Denmark).

Three days after the check-up, the patients' oxyhaemoglobin saturation (SaO_2) was recorded continuously during sleep for at least 8 consecutive hours at home, using a portable pulso-oximeter (8500 A, Nonin Medical Inc. Plymouth, USA). The desaturation index was defined as the time spent at $SaO_2 < 90\%$.

Exercise performance was evaluated by a 6 min Walking Test (6MWD) according to Guyatt *et al*. (10). Patients were asked to walk as far as possible in 6 min in a hospital corridor 100 m long. They could determine their own pace, even stop if necessary, and they were instructed that at the end they should feel as though they could not have walked any further. No encouragement during the test was given. As learning effects have been noticed to occur quickly with repeated walking tests, the patients performed one practice 6 min test (10). Both the distance walked and the minimum SaO_2 value during exercise were evaluated.

Multidimensional assessment

Each patient was asked to complete the following five questionnaires: the Barthel Index, the Mini Mental State Examination (MMSE), the Geriatric Depression Scale (GDS), the Medical Research Council (MRC) Dyspnoea Scale and the SGRQ. All the questionnaires were administered by trained investigators.

The Barthel Index is based upon an ordinal scale that evaluates feeding, bathing, grooming, dressing, bladder control, toileting, chair/bed transfer, mobility and stair climbing. Subjects are classified by a score ranging from 0 (complete dependence) to 100 (complete independence) (11).

The MMSE is a common test usually administered for screening dementia. It includes 30 items and yields a score ranging from 0 to 30; a score lower than 24 is suggestive of significant cognitive deterioration (12).

The GDS has 15 items with a score ranging from 0 to 15; a value > 5 indicates a significant mood disturbance (13).

The MRC Dyspnoea Scale concerns perceived breathlessness and consists of five degrees: 1, "shortness of breath with strenuous exercise"; 2, "shortness of breath when hurrying"; 3, "walking slower than people of same age"; 4, "needing to stop after walking 100 yards on level ground"; 5, "too breathless to leave the house" (14). An Italian translation of MRC Dyspnoea Scale was administered to the subjects.

The SGRQ is a questionnaire validated in order to measure QoL in subjects with chronic airway obstruction

(7,15). The SGRQ is composed of 76 items with three components: Symptoms, which measures frequency and severity of respiratory symptoms; Activity, which focuses on physical activities that either cause or are limited by dyspnoea; Impacts, which quantifies the impact of the respiratory disease on the daily life by assessing psychological problems, need of care, adverse drug reactions, expectations for health, and disturbances of daily life.

Each item of questionnaire has a weight that has been derived empirically. Because of weights of individual items, each section of the questionnaire is scored between 0 (no impairment) and 100 (maximal impairment); a cumulative score for the whole questionnaire is also computed and ranges between 0 and 100 (7,16). A translated version of questionnaire validated for Italy has been used (17).

Statistical analysis

Data were analysed using Systat statistical software, version 8.01 for Windows (SPSS Inc. Chicago). Results were expressed as mean $\pm$ standard deviation. For anthropometric measures, range and percentiles 25th, 50th, and 75th were also shown. Differences between values of continuous variables were evaluated by Student's unpaired two-sided *t*-test. The level of statistical significance was set at $P < 0.05$.

Pearson's linear correlations was used to examine the relationship between lung function variables and test scores.

Logistic regression analysis was performed to define the role of independent factors on dependent dichotomous variables as MRC Dyspnoea Scale and QoL expressed by SGRQ "Total score", with a CI of 95%. The 50° percentile in the distribution of the MRC Dyspnoea Scale score and SGRQ "Total score" were selected as cut-off values to represent these dependent dicotomous variables.

RESULTS

Anthropometric characteristics of subjects are reported in Table 1; age and BMI were similar in COPD and controls. Spirometric and blood gas values of the COPD patients and normal subjects are reported in Table 2. As expected, spirometric values (FEV_1, FEV_1% pred, FEV_1/VC) were significantly lower for COPD patients than for the control group. COPD subjects were more hypoxaemic, and hypercapnic than controls.

The Desaturation Index was significantly higher among COPD patients than in controls (87.3 ± 134.4 *vs.* 32.1 ± 75.7 min; $P < 0.05$). Daytime PaO_2 inversely correlated with the Desaturation Index ($r -0.59$, $P < 0.001$).

Both the 6MWD distance (282.5 ± 89.5 *vs.* 332.9 ± 95.2 m; $P < 0.01$) and the minimum SaO_2 value during 6MWD (89.1 ± 5.2 *vs.* 94.1 ± 2.0 %; $P < 0.01$) were significantly lower for COPD patients than for healthy subjects.

The data reported in Table 2 also demonstrate that COPD patients have significantly worse outcomes concerning the Barthel Index and the GDS and MRC Dyspnoea scales; no significant difference was found concerning MMSE.

With regard to SGRQ, the total and single section scores were significantly higher among COPD patients, with the most severe impairments observed in the "Activity" and 'Symptom" sections (Figure 1).

Table 3 presents results of Pearsons' linear correlation between FEV_1 and multidimensional assessment tests. Among COPD patients, FEV_1 inversely correlated with the MRC Dyspnoea Scale, GDS and QoL expressed by

Table 1. Means values ($\pm$SD), range, and percentiles in anthropometric characteristics of COPD and controls

	COPD				Controls			
	Mean (SD) (range)	Percentile			Mean (SD) (range)	Percentile		
		25th	50th	75th		25th	50th	75th
Age	74.5 $\pm$ 5.8 (65–87)	69	74	77	76.8 $\pm$ 5.7 (65–90)	73	75	79
Height	167.0 $\pm$ 6.0 (158–177)	162	167	171	166.9 $\pm$ 6.1 (156–178)	165	168	170
Weight	69.2 $\pm$ 14.2 (47–94)	62	68	75	63.7 $\pm$ 10.2 (47–80)	59	65	72
BMI	25.1 $\pm$ 3.8 19.1–29.9	21	24	27	24.5 $\pm$ 3.8 (18.5–30)	22	24	27

Unpaired *t*-test. COPD *vs.* Controls: *P* not significant.

Table 2. Means values (±SD), of spirometric and hemogas analitic parameters, Barthel Index, GDS, Dyspnoea Scale (MRC) and MMSE: comparison between COPD and controls (*$P<0.05$; **$P<0.01$)

	COPD patients (n=60)	Controls (n=58)
PaO_2 (mmHg)	74.5 ± 9.9**	88.7 ± 10.3
$PaCO_2$ (mmHg)	43.2 ± 4.6*	39.4 ± 4.2
pH	7.4 ± 0.04	7.4 ± 0.03
FEV_1 (l)	1.1 ± 0.5**	2.2 ± 0.7
FEV_1% pred	48.1 ± 18.3**	98.3 ± 24.2
FEV_1/VC %	47.2 ± 12.4**	74.1 ± 11.6
Barthel Index	89.7 ± 10.8**	94.2 ± 4.4
GDS	5.0 ± 3.9**	3.3 ± 2.3
MRC Dyspnoea	2.2 ± 1.4**	0.5 ± 0.7
MMSE	26.2 ± 4.2	26.0 ± 3.2

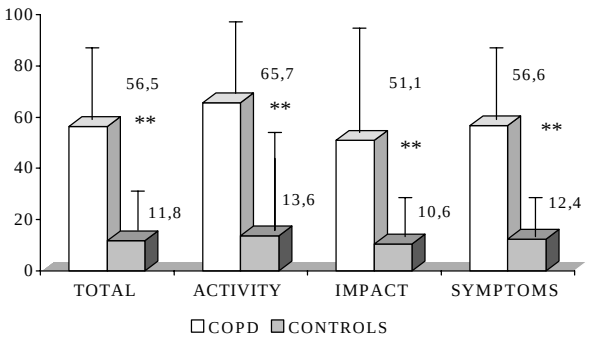

Fig 1. Saint George Respiratory Questionnaire (SGRQ) scores in COPD and healthy subjects. (COPD vs Controls: **$P<0.01$).

Table 3. Pearson's correlation coefficients (r) between FEV_1 (as dependent variable) and Barthel Index, MRC Dyspnoea Scale, GDS, SGRQ, 6MWD in COPD patients and controls (*$P<0.05$; **$P<0.01$).

FEV_1	CoPD (n=60)	Controls (n=58)
Barthel Index	0.37*	0.21
MRC Dyspnoea Scale	−0.47*	−0.21
GDS	−0.36**	−0.21
SGRQ (Total score)	−0.39**	−0.07
SGRQ (Activity)	−0.46**	−0.03
SGRQ (Impact)	−0.28*	−0.13
SGRQ (Symptoms)	−0.10	0.06
6MWD (m)	0.37*	0.17

the "Total score", and the "Activity" and "Impact" sections of the SGRQ. A direct relationship was found between FEV_1, the Barthel Index and 6MWD. No correlation was found in the control group.

Among COPD patients, the MRC Dyspnoea Scale inversely correlated with 6MWD distance (r: −0.51; $P<0.01$), the Barthel Index (r: −0.38; $P<0.01$) and FEV_1 (r: −0.47; $P<0.01$) and directly correlated with GDS (r: 0.47; $P<0.01$). Nevertheless, when the independent effect of single variables was tested by logistic regression analysis, only GDS strictly predicted the degree of dyspnoea (OR: 1.47; 1.0–2.0; $P<0.03$). 6MWD correlated with Barthel index (r: 0.55; $P<0.01$) in COPD patients but not in controls. No correlation was found between 6MWD and GDS in both the groups.

In COPD patients the "Total score" and scores from the "Impact" and "Activity" sections of the SGRQ significantly correlated with all multidimensional assessment tests; the "Symptom" section showed a significant relationship with the MRC Dyspnoea Scale and GDS (Table 4). In normal elderly subjects, a significant correlation was found only between SGRQ "Activity" section and MRC score and 6MWD (Table 4).

Finally, using the logistic regression model, FEV_1 was found to be the most important factor in predicting deterioration of QoL in COPD patients (OR: 14.0; 95% CI: 3.6–54.9); by this model, QoL was also slightly influenced by GDS (OR: 1.3) and Barthel Index (OR: 1.02) while Dyspnoea Scale and 6MWD resulted not significant.

DISCUSSION

Because elderly patients affected with COPD-related respiratory involvement are frequently impaired in their social life, psychological function and ADL, it is important to establish the relationship between COPD and QoL in this population. The aim of our study was to investigate the impact of COPD on QoL and functional status in the elderly.

As expected, our COPD patients showed a significant reduction in lung volume compared to healthy controls; they were nevertheless normoxaemic and normocapnic at rest. This observation can be explained by the fact that the inability to perform the 6MWD was an exclusion criterion.

During sleep, elderly COPD patients were significantly more hypoxaemic than controls. Given that blood gas exchange deterioration during night-time in adult patients with COPD is a well-known factor that worsens quality of sleep and daytime functional status (8, 18), we can argue that even in older subjects with chronic obstructive lung disease the deterioration of functional status may at least in part be related to nocturnal blood gas derangement and not only to age itself.

The distance walked during 6MWD by COPD patients was significantly shorter than the controls'; in addition, among COPD patients this distance inversely correlated

Table 4. Pearson's correlation coefficients (*r*) between SGRQ and Barthel Index, MRC Dyspnoea Scale, GDS, 6MWD in COPD patients and healthy subjects (*$P < 0.05$; **$P < 0.01$).

	Barthel Index		MRC Dyspnoea scale		GDS		6MWD	
	COPD	Controls	COPD	Controls	COPD	Controls	COPD	Controls
SGRQ (Total score)	−0.48**	0.03	0.41**	0.39	0.53**	0.07	−0.39**	0.25
SGRQ (Activity)	−0.43**	0.06	0.47**	0.44*	0.52**	0.16	−0.36**	−0.34*
SGRQ (Symptoms)	−0.12	0.14	0.34*	0.33	0.43**	0.001	−0.49	0.15
SGRQ (Impact)	−0.50**	−0.03	0.34*	0.32	0.48**	−0.07	−0.37**	−0.18

with the SGRQ "Total score" and its "Activity" and "Impact" components. According to other reports, these data confirm that COPD may reduce exercise tolerance and daily activities even in older patients (19, 20).

Dyspnoea is considered a reliable index of disability and the main factor influencing exercise tolerance and QoL in COPD patients (21, 22). Nevertheless, multivariate analysis of our elderly patients' data excluded a significant influence of dyspnoea, as expressed by MRC Dyspnoea Scale, on 6MWD and SGRQ. In addition, the degree of dyspnoea did not correlate with lung volume deterioration, thus confirming that the severity of this symptom is not strictly influenced by the degree of airway obstruction. In agreement with previous studies (23, 24), our results show that dyspnoea may be influenced by emotional and mood components. However, the relationship between this symptom and depression still remains unclear: in fact, although we could argue that older subjects with a depressed mood tend to emphasize dyspnoea, we could also conclude that a dyspnoeic patient tends to be more depressed due to his functional restriction.

An additional problem could rise by the observation that also in the control group there is a significant correlation between SGRQ "Activity" section, MRC Dyspnoea Scale and 6MWD: this may suggest that some items examined by SGRQ may be influenced not only by the degree of COPD but also by the coexistence of age-related functional impairment.

Previous studies aimed at investigating the impact of obstructive ventilatory impairment on QoL in the elderly yielded controversial results: some authors (25, 26) demonstrated an improvement of QoL with age in COPD patients, presumably related to the fact that older subjects usually tend to restrict their own daily activity and expectations. In contrast, others suggest a persisting disease-related deterioration of QoL in older COPD patients (27). In our study, SGRQ scores were significantly higher for subjects with COPD, thus confirming that the effect of the disease on QoL persists even at an advanced age; according to other studies (28) the impact of airway obstruction on QoL is demonstrated by the significant relationship between FEV_1 and SGRQ (Table 3) and confirmed by the logistic regression analysis. Nevertheless, mood seems to influence not only respiratory symptoms but also QoL, thus confirming previous observation (29).

In conclusion, our findings suggest that COPD is a main cause of severe deterioration of QoL, physical activity and functional status in elderly populations and that the degree of this impairment mainly depends on the severity of chronic airway obstruction, although it may be aggravated by mood deflection.

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