

ASTHMA CONTROL

The influence of hospitalizations due to exacerbations or spontaneous pneumothoraxes on the quality of life, mental function and symptoms of depression and anxiety in patients with COPD or asthmaMarek Filipowski, MD, PhD¹, Andrzej Bozek, MD, PhD², Renata Kozłowska³, Damian Czyżewski, MD, PhD¹, and Jerzy Jarzab, MD, PhD²¹Clinical Department of Chest Surgery, Medical University of Silesia, Zabrze, Poland, ²Clinical Department of Internal Medicine, Dermatology and Allergology, Medical University of Silesia, Zabrze, Poland, and ³Hospital Zakonu Bonifratow, Zabrze, Poland**Abstract**

Background: Patients with bronchial asthma or chronic obstructive pulmonary disease (COPD) frequently have a low quality of life (QoL) in addition to depression symptoms. The aim of this study was to compare the QoL, depression symptoms, mental function and anxiety in patients with asthma or COPD exacerbations or spontaneous pneumothoraxes (SP) to patients with stable disease. **Materials and methods:** Patients with a confirmed diagnosis of severe (III degree) bronchial asthma or COPD were included in this study. Prospective observations of asthma or COPD exacerbations or SP were performed over a three-year period. QoL was assessed using St. George's Respiratory Questionnaire (SGRQ). In addition, the AQ20 questionnaire (AQ20), the Hospital Anxiety and Depression Scale (HADS) and the Mini-Mental State Examination (MMSE) were administered. **Results:** A total of 233 patients (112 with asthma and 121 with COPD; mean age 57.9 ± 11.9 years) were included in the study. Patients with COPD or asthma had a low QoL as estimated by the SGRQ (mean $\pm$ SD: 27.5 ± 12.9 and 25.1 ± 10.2 for asthma and COPD, respectively). Asthma exacerbations, COPD exacerbations or SP requiring hospitalization were associated with lower SGRQ scores over the three-year observation period (41.5 ± 11.7 , 57.9 ± 14.3 and 65.3 ± 11.4 , respectively). The mean MMSE score significantly decreased after an asthma exacerbation compared to the baseline (29.9 ± 2.1 versus 27.2 ± 3.1 ; $p < 0.05$). The mean MMSE score decreased after COPD exacerbations (28.5 ± 0.9 versus 26.9 ± 1.2 ; $p < 0.05$) and after COPD with an SP event (28.8 ± 1.2 versus 24.1 ± 2.2 ; $p < 0.05$). **Conclusion:** Low QoL and mental impairment were observed in patients with asthma and COPD. In addition, the QoL significantly decreased following hospitalizations due to exacerbations or SP.

Keywords

Asthma, COPD, diagnostics, quality of life

History

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Introduction

A few studies have confirmed that patients with chronic obstructive pulmonary disease (COPD) or asthma have a low quality of life (QoL). Although this observation has been well documented in the literature, there have only been a few comparisons of these two diseases [1–5]. There is still a deficiency in comprehensive analyses of QoL, depressive symptoms and mental function during and after COPD and asthma exacerbations. Additionally, there was no similar observations about patient with COPD after surgical intervention (e.g. in the case of pneumothorax). Some believe that the poor QoL in these patients is a result of chronic disease, but it has also been demonstrated that there is an additional negative impact on somatic disease [2,6]. This is because patients with a low QoL are less likely to cooperate with doctors, use their medication or exercise [2–5]. In addition,

depression is a significant comorbidity in patients with COPD and asthma, and it significantly reduces the QoL [7–9].

Chronic obstructive pulmonary disease and severe asthma are associated with recurrent exacerbations characterized by worsening cough, dyspnea and a significant decrease in exercise tolerance. In some patients with COPD, potentially life-threatening spontaneous pneumothoraxes (SP) with acute dyspnea may occur. Patients with SP require surgical intervention, which includes pneumothorax decompression and, in some cases, surgical opening of the chest. These cases are associated with increased mortality [4,10]. Moreover, exacerbations and hospitalizations contribute to the low quality of life and depression symptoms. The presence of depression, particularly in elderly patients, still goes undetected and untreated, although these symptoms have an impact on the underlying disease [11,12]. There is an opinion that low QoL after hospitalization promotes further worsening of COPD or asthma diseases [11]. However, further clinical studies are required to investigate this hypothesis.

Cognitive impairment during coronary disease might also be observed during asthma or COPD exacerbation [13].

Correspondence: Andrzej Bozek, Clinical Department of Internal Medicine, Dermatology and Allergy, Medical University of Silesia, M. Skłodowskiej Curie 10, 41-800 Zabrze, Poland. Tel: 004832 2713165. E-mail: andrzejbozek@o2.pl

Moreover, cognitive impairment could promote low QoL, but this needs to be confirmed.

The aim of this study was to track the QoL and depression symptoms over three years and to assess the impact of exacerbations on these measures as well as on mental function. An additional goal was to determine whether a low QoL and depression have potential implications for the increased risk of hospitalization in patients with acute asthma or COPD. The information obtained may allow for better prevention through the implementation of appropriate supervision and treatment (i.e. psychotherapy, antidepressant treatment, etc.).

Materials and methods

Patients included in this study qualified as having severe asthma, according to the Global Initiative for Asthma (GINA), Global Strategy for Asthma Management and Prevention criteria, or severe COPD, according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria [3,4]. All patients were recruited on the basis of a questionnaire that was prepared by their specialty physicians at outpatient pulmonology and allergy clinics. COPD patients were included in this study based on the following criteria: a post-bronchodilator FEV1/FVC ratio lower than 0.7, an FEV1 lower than 50% of the predicted value, an age over 45-years-old, a smoking history of 20 or more pack-years and no history of asthma. The asthma inclusion criteria were as follows: an FEV1 increase greater than 12% after 200 mcg of salbutamol, an age over 40 years, no smoking or <20 pack-years and severe asthma (IV degree) according to the GINA criteria. Patients over 40-years-old were selected to fit the age range for patients with COPD and allow for age-matching with asthma patients. Patients were excluded from the study if they had other chronic diseases (coronary disease, hypertension, diabetes). Patients with asthma/COPD overlap syndrome were also excluded.

Anxiety and depression were assessed using the Hospital Anxiety and Depression Scale (HADS). To determine the health-related quality of life (HRQoL), St. George's Respiratory Questionnaire (SGRQ) and the AQ20, a questionnaire that predicts the need for emergency intervention or hospitalization in patients with asthma and COPD, were used [5,6,14–17]. The Mini-Mental State Examination (MMSE) was used to examine mental function [18]. All patients were asked to complete questionnaires only during planned annual visits; the questionnaire was independent of hospitalization. This was a prospective, non-intervention cohort study with a three-year observation period. The study was conducted at the Clinical Department of Internal Disease, Dermatology and Allergology, Medical University of Silesia in Zabrze. The study was approved by the Local Ethics Committee. Written informed consent was obtained from all patients.

Questionnaires

The HADS is commonly used by doctors to determine patient anxiety and depression levels. The HADS is a 14-item scale that generates ordinal data. Seven of the items relate to anxiety, and seven relate to depression. Each item on the questionnaire is scored from 0 (best health) to

3 (worst health), with a score range between 0 and 21 for anxiety and depression [14].

The AQ20 is a specific questionnaire validated for patients with asthma and COPD. It includes 20 items in which “yes” responses are scored as 1 and “no” and “not applicable” responses are scored as 0. The summary score ranges from 1 (best health) to 20 (worst health). The AQ20 demonstrates good reliability and validity [6].

The SGRQ is a 50-item questionnaire specific to obstructive respiratory disease. It provides a total score and three component scores: Symptoms, Activity and Impact. Each category has a score range of 0 (best health) to 100 (worst health). This questionnaire has good reproducibility, is correlated with a range of established measures of disease activity, and responds to improvement and deterioration in the health of patients with chronic airflow limitations [6]. In this study, only the total score was analyzed.

The MMSE is a brief, 30-point questionnaire used to screen for cognitive impairment. It is commonly used in medicine to screen for dementia [18]. It is also used to estimate the severity of cognitive impairment and to follow the course of cognitive changes in an individual over time; these features make the MMSE an effective measure for documenting the response to treatment. Any score greater than or equal to 25 points (out of 30) indicates normal cognition. Lower scores can indicate severe (≤ 9 points), moderate (10–20 points) or mild (21–24 points) cognitive impairment. The raw score may also need to be corrected for educational attainment and age. It is important to note that a maximum score of 30 points can never exclude dementia. Low to very low scores correlate closely with dementia; however, other mental disorders can also lead to abnormal MMSE findings. The presence of purely physical illnesses can also interfere with the interpretation if they are not properly analyzed; for example, a patient may be physically unable to hear or read instructions properly or may have a motor deficit that affects writing and drawing skills. The Polish versions of all questionnaires were used for all patients. The questionnaires were administered at baseline and each year afterward for a total of three administrations.

Statistical analysis

All results are presented as the mean $\pm$ SD or as the frequency and percentage. Differences between clinical, functional and psychological variables and in the scores on questionnaires between patients were tested using the Chi-square test. An analysis of variance for repeated questionnaire measures was performed with the Friedman test for non-parametric variables or an ANOVA for parametric variables. A value of $p < 0.05$ was considered significant for all analyses. Statistica 8.1 was used (StatPol, Cracow, Poland).

Results

A total of 233 patients (112 with asthma and 121 with COPD) were included in this study. Patient characteristics are presented in Table 1. At the start of the study, the HADS anxiety scores were 9.3 ± 2.4 (mean $\pm$ SD) for the asthma group and 10.8 ± 2.5 for the COPD group. There were no significant differences between these groups ($p > 0.05$).

There were also no significant differences in the HADS depression scores (6.2 ± 2.5 and 7.4 ± 1.1), the AQ20 scores (6.9 ± 1.4 and 7.2 ± 1.1) or the SGRQ scores (27.5 ± 12.9 and 25.1 ± 10.2). The repeated measures of HADS, AQ20 and SGRQ questionnaire scores for all time points are shown in Table 2. The total repeated measures of the SGRQ scores had acceptable reliability (Cronbach's $\alpha = 0.87, 0.7$). The HADS, AQ20 and MMSE reliability were also acceptable, with scores of $\alpha = 0.93$, $\alpha = 0.79$ and $\alpha = 0.59$, respectively. The correlation coefficient between all repeated total scores for suitable questionnaires were significant (0.788–0.932). After the three-year observation period, the analysis of repeated measurements for all questionnaires (Table 2) showed statistically significant ($p < 0.05$) decreases in QoL from baseline to the end of the observation period in the

following groups: asthma exacerbation, COPD exacerbation and COPD and SP. Additionally, the latter group had significantly worse score results on all questionnaires when compared to the other patients ($p < 0.05$). Over the observation period, patients with exacerbation episodes (asthma or COPD) had a worse QoL than patients without exacerbations. Similar trends were observed in cases of anxiety and depression symptoms as assessed by the HADS scale. Anxiety and depression symptoms were particularly increased in patients with episodes of acute exacerbations of COPD and SP ($p < 0.05$).

The mean MMSE score was significantly decreased after asthma exacerbations compared to the baseline (29.9 ± 2.1 to 27.2 ± 3.1 ; $p < 0.05$). Similar results were observed after COPD exacerbations (28.5 ± 0.9 to 26.9 ± 1.2 ; $p < 0.05$) and after COPD with SP (28.5 ± 0.9 to 24.1 ± 2.2 ; $p < 0.05$). The MMSE results in patients with asthma and COPD without exacerbations or SP were comparable over the observation period. Patients with COPD and SP had significantly lower MMSE scores compared to patients with asthma or COPD exacerbations (24.1 ± 2.2 versus 27.2 ± 3.1 versus 26.9 ± 1.2). Two patients with COPD had low MMSE scores (< 9), and severe mental impairment was confirmed.

The predictive model of hospitalizations or SP events during the first year of observation for COPD and asthma patients is shown in Table 3.

The frequency of previous hospitalizations was also an independent predictor for another hospitalization within two years for both asthma (OR: 2.12; $p = 0.012$) and COPD patients (OR: 2.96; $p = 0.003$) and of death for both asthma (OR: 1.09; $p = 0.05$) and COPD patients (OR: 2.23; $p = 0.01$). SP was an independent predictor for another hospitalization

Table 1. Characteristics of the study patients.

Characteristics	Asthma	COPD	<i>p</i> Value
Age, mean $\pm$ SD	57.4 ± 7.8	58.4 ± 6.6	NS
Female (%)	57%	48%	< 0.05
Current smokers (%)	32%	89%	< 0.05
Disease duration, mean (SD)	24.9 ± 14.6	26.1 ± 9.44	NS
FEV1 post-bronchodilation, % of predicted	48.7%	45.1%	NS
Education level (%)			
Primary school	23.1	34.5	< 0.05
Secondary school	46.7	47.2	NS
University	30.2	18.3	< 0.05
Place of residence (%)			
Rural	35.5	37.2	NS
Urban	64.5	62.8	NS
Single (divorced, widowed)	28.1	31.3	NS
Married or with partner	71.9	68.7	NS

Table 2. Baseline, 12 month and final questionnaire scores.

	Baseline	12 months	24 months	36 months	<i>p</i> Value
Asthma					
HADS anxiety	9.3 ± 2.4	9.1 ± 3.1	8.9 ± 2.2	8.5 ± 2.5	0.243
HADS depression	6.2 ± 2.5	5.9 ± 2.1	5.7 ± 3.2	5.6 ± 1.7	0.179
AQ20	6.9 ± 1.4	7.2 ± 1.1	6.7 ± 1.6	6.9 ± 1.8	0.430
SGRQ	27.5 ± 12.9	24.1 ± 13.1	20.7 ± 10.1	21.3 ± 12.6	0.051
Asthma_EX					
HADS anxiety	9.3 ± 2.4	10.9 ± 3.1	10.5 ± 2.5	11.8 ± 2.1	0.048
HADS depression	6.2 ± 2.5	7.9 ± 1.2	7.6 ± 1.7	8.1 ± 0.9	0.039
AQ20	6.9 ± 1.4	7.3 ± 1.3	6.9 ± 1.8	9.2 ± 3.1	0.021
SGRQ	27.5 ± 12.9	28.3 ± 14.1	34.3 ± 12.6	41.5 ± 11.7	0.007
COPD					
HADS anxiety	10.8 ± 2.5	9.9 ± 1.8	12.9 ± 2.5	13.8 ± 3.5	0.094
HADS depression	7.4 ± 1.1	8.1 ± 0.8	10.3 ± 0.9	10.7 ± 0.9	0.223
AQ20	7.2 ± 1.1	7.1 ± 0.9	8.0 ± 0.9	8.5 ± 1.2	0.103
SGRQ	25.1 ± 10.2	28.9 ± 12.5	32.5 ± 5.6	48.2 ± 11.6	0.023
COPD_EX					
HADS anxiety	10.8 ± 2.5	11.9 ± 2.7	14.9 ± 2.7	15.9 ± 2.7	0.005
HADS depression	7.4 ± 1.1	8.7 ± 0.4	12.4 ± 2.4	11.8 ± 1.5	0.017
AQ20	7.2 ± 1.1	10.2 ± 2.8	11.7 ± 3.2	10.9 ± 3.2	0.004
SGRQ	25.1 ± 10.2	54.2 ± 13.5	50 ± 12.1	57.9 ± 14.3	0.006
COPD_SP					
HADS anxiety	10.8 ± 2.5	13 ± 1.1	16.2 ± 1.9	17.2 ± 2.7	0.013
HADS depression	7.4 ± 1.1	9.7 ± 0.4	10.6 ± 1.1	12.9 ± 2.3	0.009
AQ20	7.2 ± 1.1	14.1 ± 5.6	14.8 ± 5.7	13.8 ± 2.9	0.012
SGRQ	25.1 ± 10.2	59.2 ± 11.4	68.9 ± 10.5	65.3 ± 11.4	0.001

Asthma_EX: patients with asthma exacerbations and hospitalizations during the observation period; COPD_EX: patients with COPD exacerbations and hospitalizations during the observation period; COPD_SP: patients with COPD and SP during the observation period.

Table 3. Logistic regression analysis predictions of hospitalizations or SP in the patient population during the first year of observation.

	OR	95% CI	p Value
Predictors of COPD hospitalizations (incl. SP)			
HADS	1.85	1.23–1.96	0.002
AQ20	1.03	0.97–1.21	0.0001
SGRQ	1.22	1.03–1.54	0.04
MMSE	1.89	1.43–1.98	0.005
Predictors of asthma hospitalizations			
HADS	1.72	1.21–1.87	0.002
AQ20	1.16	1.09–1.37	0.002
SGRQ	1.17	1.04–1.40	0.033
MMSE	1.77	1.29–1.89	0.002

(OR: 3.14; $p = 0.005$) and death (OR: 1.78; $p = 0.04$) within two years.

Discussion

The results of this study confirm that patients with chronic obstructive diseases have a low QoL. In addition, exacerbations that require hospitalization result in a significant decrease in the QoL, which was confirmed by an increase in the total SGRQ score. However, interpretation of this result is limited because there was no information as to which components (symptoms, activity or impact) were affected. The trend of decreased QoL continued throughout the observation period for patients with COPD exacerbations or SP events as well as for patients with asthma exacerbations, although to a lesser extent. A low QoL can be correlated with rehospitalization due to its impact on exacerbations in patients with COPD or asthma. This finding has been confirmed in other studies [6,11,12,15,19–21].

Similar to other observations, patients with severe COPD and severe asthma had substantially more intensive depression and anxiety symptoms [8–11]. Although it is known that anxiety and depression are related to exacerbations and QoL in both diseases [6], our study is the first to demonstrate a significant decrease of QoL associated with the symptoms of depression in patients after an SP episode. This event may be related to surgery-associated pain aggravation, longer hospital stays and overall reduced post-operative medical monitoring, as previously described in patients with SP [19]. These associations are particularly important in elderly patients, who should be specifically monitored for depression. Our results suggested that insufficient quality patient care and lack of pulmonary, psychological and psychiatric consultations affect low QoL after an SP episode. Surgical observation alone after surgery is insufficient [19]. The analysis of mental function revealed decreases in mental function after hospitalization for asthma or COPD exacerbations. Other studies have reported that this decrease is substantially greater in patients who experience an SP event; however, these are the only such observations to date [20–26]. Low MMSE scores after asthma and COPD exacerbations are evidence that elderly patients should receive psychiatric monitoring and may require treatment.

The limitation of this study is the fact that only one type of mental test was performed and it is not able to determine

the cause of mental impairment in some patients. The deterioration of mental function may exacerbate the symptoms of depression and vice versa [22,23]. These interactions contribute to a worsened course of asthma and COPD and increase the risk of further exacerbations [24,25].

Conclusion

A low QoL was observed in patients with asthma and COPD, and the QoL was significantly decreased after hospitalization due to exacerbations or episodes of SP.

A three-year observation period revealed a trend of decreasing QoL, increasing depression symptoms and decreasing mental function in patients after hospitalization, particularly in cases of SP. These patients should receive better medical care with a special emphasis on psychological and psychiatric treatment.

Declaration of interest

The authors report no conflicts of interest.

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