Prevalence of Depression and Anxiety in Outpatients with Chronic Airway Lung Disease

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Background/Aims: Patients with chronic airway lung diseases often experience depression and anxiety, but little information is available regarding Koreans with these conditions. We thus assessed depression and anxiety in Korean patients with chronic airway lung diseases.

Methods: The degree of depression and anxiety in 84 outpatients with chronic obstructive pulmonary disease (COPD), 37 with asthma, 33 with bronchiectasis, and 73 healthy controls were evaluated by the Beck Depression Inventory (BDI) and the State-Trait Anxiety Inventory (STAI).

Results: The patients with COPD and bronchiectasis had higher BDI scores and were more likely than controls to experience depression ([COPD, 17; range, 0 to 42; prevalence, 55%], [bronchiectasis, 16; range, 3 to 51; prevalence, 55%], [controls, 13; range, 0 to 31; prevalence, 30%], $p < 0.05$). The state-anxiety scores of the patients were higher than those of the controls, but only the bronchiectasis group demonstrated a higher frequency of state-anxiety compared with the controls (39 vs. 16%, patients vs. controls, $p = 0.015$). Among all patients, 22% presented with concomitant depression and state-anxiety, and 25% demonstrated depression and trait-anxiety. Depression was positively correlated with both state-anxiety ($r = 0.644$) and trait-anxiety ($r = 0.597$, $p < 0.0001$). Irrespective of individual diagnosis, post-bronchodilator FEV_1 (odds ratio [OR], 0.972; $p = 0.027$) and smoking history (OR, 3.894; $p = 0.018$) were independent risk factors for depression in patients with chronic airway lung diseases.

Conclusions: Chronic airway lung diseases are associated with depression and/or anxiety, particularly in those with a higher airflow limitation and/or history of smoking. **(Korean J Intern Med 2010;25:51-57)**

Keywords: Depression; Anxiety; Pulmonary disease, chronic obstructive; Asthma; Bronchiectasis

INTRODUCTION

Chronic respiratory conditions are being recognized with increasing frequency in both Korea and worldwide [1-3] and are associated with an increased risk for mood and anxiety disorders [4-7]. Activities of daily living may be severely impaired in patients with chronic airway lung diseases owing to chronic psychological stress and somatic pain, frequent admission to the hospital, and dependence on medical and nursing personnel. Depression and anxiety cause deterioration in social functioning and quality of life and are correlated with levels of subjective dyspnea and disease progression [8-11]. Thus, detecting depression or anxiety in patients with chronic airway lung diseases is of great importance. Although the close correlation between anxiety and depression is well known, few studies have examined their simultaneous occurrence in patients with chronic respiratory conditions. Moreover, studies assessing and comparing anxiety and depression levels among patients with different chronic airway lung diseases such

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as chronic obstructive pulmonary disease (COPD), bronchial asthma, and bronchiectasis have been scarce in Korea.

The present cross-sectional study compared the levels and frequency of anxiety and depression among outpatients presenting at our pulmonary department with COPD, bronchial asthma, or bronchiectasis. In addition, we evaluated the clinical variables associated with depression in patients with chronic airway lung diseases.

METHODS

Subjects

We recruited 73 healthy control participants with no underlying lung disease or respiratory symptoms and 154 outpatients, 45 years of age and older, with chronic airway lung diseases who presented at the pulmonary department of our hospital. Of the 154 patients, 84 were diagnosed with COPD, 37 had bronchial asthma, and 33 had bronchiectasis. All patients received prior clinical evaluations and pulmonary function tests. This report presents the results of a cross-sectional assessment of depression and anxiety in these outpatients.

Data analysis

Cross-sectional data obtained from measures of pulmonary function, laboratory values, smoking behavior, nutrition, age, sex, and symptoms of depression and anxiety were analyzed for all subjects. The forced vital capacity (FVC) and forced expiratory volume one second (FEV1) before and 15 min after inhalation of 400 μg of salbutamol were determined in terms of pulmonary function units (SensorMedics, Yorba Linda, CA, USA). Based on the definition provided by the Global Initiative for Chronic Obstructive Lung Disease (GOLD) [12], COPD was defined by a chronic airflow limitation not fully reversible by bronchodilation. Obstruction was defined as a post-bronchodilator FEV1/FVC ratio < 0.70, and severity was classified into four categories according to the post-bronchodilator FEV1 value calculated as a percentage of the predicted value for normal subjects: mild obstruction, FEV1 > 80% of the predicted value; moderate, 50 to 79% of the predicted value; severe, 30 to 49% of the predicted value; and very severe, < 30% of the predicted value. Patients with a FEV1 reversibility of > 12% were excluded. Asthma was defined as an increase in FEV1 of ≥ 12% and ≥ 200 mL compared to pre-bronchodilator values [13] at the time of diagnosis. All patients received routine treatment with inhaled corticosteroids and/or long-acting bronchodilators. The patients with bronchiectasis were treated in our outpatient clinic for symptoms attributable to the bronchiectasis and were diagnosed by high-resolution computed tomography of the chest [14]. We excluded patients who had experienced acute exacerbations in their underlying chronic airway lung diseases within the past month.

Anxiety symptoms were evaluated with the State-Trait Anxiety Inventory (STAI) developed by Spielberger et al. [15] in 1970, which has been translated and standardized for use in the Korean population [16]. The STAI consists of two self-evaluation scales designed to assess state-anxiety anxiety and trait-anxiety separately. The state-anxiety anxiety scale evaluates a transitory state-anxiety in which unpleasant feelings, tension, and intensity vary according to the situation. The trait-anxiety scale assesses a longer-term personality characteristic. Each scale contains 20 items, each of which is rated from 1 to 4. Clinically significant levels of state-anxiety or trait-anxiety were defined as scores ≥ 50 on the state-anxiety or trait-anxiety subscale [5,17]. Depression was assessed with the Beck Depression Inventory (BDI) [18,19], which has been standardized for and used in the Korean population [20]. The BDI, a self-administered measurement of depression, has been translated into many languages and validated for use in several countries, including Korea. The questionnaire rates 21 items addressing emotional, cognitive, motivational, physiological, and other symptoms on a scale from 0 to 3; higher scores reflect more severe symptoms of depression. In accordance with Jo et al. [21], a threshold of 16 on the BDI was used to separate patients with mild or no depression (BDI < 16) from those with moderate to severe depression (BDI ≥ 16). All subjects completed the Korean versions of the STAI and BDI.

All participants were informed about the study, and all provided informed consent for their participation. Although we did not obtain approval from the institutional review board, this research was conducted according to the highest ethical standards and conformed to the 1995 Declaration of Helsinki (as revised in Edinburgh, 2000, and updated in Tokyo, 2004). This study used data collected from questionnaires, and the subjects understood that their refusal to participate would not affect the quality of their clinical care in any way. After BDI and STAI scores were determined, the patients were informed of the results.

Table 1. Baseline characteristics of the study population

Parameters	Healthy control (n = 73)	Chronic airway lung diseases		
		COPD (n = 84)	Bronchial asthma (n = 37)	Bronchiectasis (n = 33)
Age, yr	66 (51 - 89)	67 (45 - 88)	56 (45 - 80)[a,b]	62 (45 - 83)[a,b]
Male gender	33 (45)	80 (95)[a]	16 (43)[b]	15 (46)[b]
Body mass index, kg/m^2	23.8 ± 3.2	22.6 ± 3.0	24.9 ± 3.6[b]	21.3 ± 3.3[a]
Smoking habits				
Ex-smoker / Current smoker	14 / 1	59 / 25	7 / 3	9 / 1
Median pack-years	20 (1 - 40)	40 (15 - 100)[a]	20 (5 - 30)[b]	18 (2 - 70)[b]
Post-bronchodilator FVC, % predicted	98.8 ± 14.2	81.9 ± 17.8[a]	82.8 ± 18.7[a]	62.6 ± 18.2[a,b]
Post-bronchodilator FEV$_1$, % predicted	102.7 ± 16.7	59.5 ± 24.8[a]	71.7 ± 21.1[a,b]	55.0 ± 19.0[a]
Post-bronchodilator FEV$_1$/FVC ratio	84.9 ± 10.6	51.9 ± 13.3[a]	63.2 ± 10.2[a,b]	64.3 ± 16.6[a,b]
Hemoglobin, g/dL	13.1 ± 1.6	14.3 ± 1.7[a]	13.7 ± 1.8	13.2 ± 1.4[b]
Albumin, g/dL	4.1 ± 0.4	4.1 ± 0.5	4.3 ± 0.5	3.9 ± 0.5
PaO$_2$, mmHg (room air)	88.2 ± 3.6	79.1 ± 16.5	84.7 ± 13.2	77.9 ± 20.3
PaCO$_2$, mmHg (room air)	38.9 ± 3.5	40.8 ± 6.8	39.5 ± 4.7	42.8 ± 10.2[a]

Values are expressed as the mean ± SD, median (range), or number (%).
COPD, chronic obstructive pulmonary disease; FVC, forced vital capacity; FEV$_1$, forced expiratory volume one second.
[a] $p < 0.05$ compared to healthy controls.
[b] $p < 0.05$ compared to patients with COPD.

Statistical analysis

SPSS version 13.0 (SPSS Inc., Chicago, IL, USA) was used for the statistical analysis. A p value of < 0.05 was considered significant. Group comparisons for categorical variables were performed using Pearson's chi-square test or Fisher's exact test. To compare groups of patients, we used ANOVAs for normally distributed data and the Kruskal-Wallis test for non-normally distributed data. For comparisons between two groups, Student's t-test and the Mann-Whitney U test were used for normally and non-normally distributed data, respectively. Pearson's correlation was used to assess the association between anxiety and depression. To evaluate the risk factors for depression, multivariate logistic regression analysis was performed incorporating all factors that obtained values of $p < 0.05$ in the bivariate analyses.

RESULTS

General characteristics of patients with chronic airway lung diseases

The demographic characteristics of the 73 healthy controls and the 154 patients with chronic airway lung diseases who completed the study are summarized in Table 1. The median age of all 227 subjects, 65 years (range, 45 to 89), was similar in the control and COPD groups. However, patients with bronchial asthma and bronchiectasis were slightly younger than were healthy controls or patients with COPD.

Prevalence of depression and anxiety in patients with chronic airway lung diseases

Table 2 shows the median scores on the BDI and both STAI subscales for patients with COPD, bronchial asthma, and bronchiectasis. Patients with COPD obtained the highest depression scores, followed by patients with bronchiectasis, and then by those with bronchial asthma, in decreasing order. The BDI scores and frequency of depression for the healthy controls and the patients with bronchial asthma did not differ significantly. Depression was identified in 55% of the patients with COPD (OR, 2.7; $p = 0.004$), 55% of those with bronchiectasis (OR, 3.0; $p = 0.016$), 41% of those with bronchial asthma (OR, 1.5; $p = 0.293$), and 30% of the healthy controls. In a subgroup analysis of patients with COPD, increased frequency of depression was correlated with increased disease severity according to the GOLD stages ($p = 0.004$); the frequency of depression among those with mild disease levels was 23% (5/22); with moderate, 54% (14/26); with severe, 72% (21/29); and with very severe, 71% (5/7). In terms of the severity categories, 40% (19/48) of the patients with

Table 2. Depression and anxiety status of the study population

Variables	Healthy control (n = 73)	Chronic airway lung diseases		
		COPD (n = 84)	Bronchial asthma (n = 37)	Bronchiectasis (n = 33)
BDI				
Total score	13 (0 - 31)	17 (0 - 42)[a]	14 (2 - 36)	16 (3 - 51)[a]
BDI score ≥ 16	22 (30)	46 (55)[a]	15 (41)	18 (55)[a]
STAI				
State-anxiety score	40 (23 - 67)	44 (20 - 67)[a]	44 (23 - 67)[a]	43 (23 - 72)[a]
Trait-anxiety score	44 (30 - 90)	47 (20 - 66)[a]	45 (32 - 58)	46 (28 - 64)

Values are expressed as the median (range) or number (%).
COPD, chronic obstructive pulmonary disease; BDI, Beck Depression Inventory; STAI, State-Trait Anxiety Inventory.
[a] $p < 0.05$ compared to healthy controls.

Table 3. Subgroup analysis of depression and anxiety status in patients with COPD, grouped according to GOLD staging

Variables	Healthy control (n = 73)	Chronic obstructive pulmonary disease	
		Mild to moderate (n = 48)	Severe to very severe (n = 36)
BDI			
Total score	13 (0 - 31)	14 (2 - 34)[a]	21 (0 - 42)[a,b]
BDI score ≥ 16	22 (30)	19 (40)	26 (72)[a,b]
STAI			
State-anxiety score	40 (23 - 67)	44 (21 - 63)	48 (20 - 67)[a,b]
Trait-anxiety score	44 (30 - 90)	46 (28 - 66)	50 (20 - 62)[a]

Values are expressed as the median (range) or number (%).
COPD, chronic obstructive pulmonary disease; GOLD, global initiative for chronic obstructive lung disease; BDI, Beck Depression Inventory; STAI, State-Trait Anxiety Inventory.
[a] $p < 0.05$ compared to healthy controls.
[b] $p < 0.05$ compared to mild to moderate COPD.

mild to moderate levels of severity experienced depression, whereas 72% (26/36) of the patients with severe to very severe levels of severity experienced this condition (Table 3).

The trait-anxiety scores of patients with chronic airway lung diseases did not differ significantly from those of healthy controls, with the exception of the patients with COPD, who had a median trait-anxiety score of 47 (vs. 44 for the controls, $p = 0.042$) and a median state-anxiety score of 44 (vs. 40 for the controls, $p = 0.029$). Despite their higher median trait-anxiety score, patients with COPD were not significantly more likely than healthy controls to report trait-anxiety ($p = 0.054$). State-anxiety was identified in 26% of the patients with COPD (vs. 16% of the controls, $p = 0.176$), 16% of the patients with bronchial asthma (vs. controls, $p = 1.000$), and 39% of the patients with bronchiectasis (vs. controls, $p = 0.015$) (Table 2).

Overall, 79 (51%) of the 154 patients with chronic airway lung diseases exhibited clinically significant levels of depression according to their BDI scores. Thirty-four patients (22%) presented with concomitant depression and state-anxiety anxiety, and 39 (25%) presented with both depression and trait-anxiety.

Determinants of depression in patients with chronic airway and lung diseases

A lower BMI, history of smoking, lower predicted values of post-bronchodilator FVC and FEV1, and higher PaCO2 levels were more common among chronic airway lung disease patients with depression than among those without depression. However, no significant difference between patients with and without depression was observed with respect to age, gender, degree of hypoxia, hemoglobin level,

Table 4. Predictive factors for depression in patients with chronic airway lung diseases

Factors	Odds ratio (95% CI)	p value
Age	1.017 (0.978 - 1.059)	0.395
Female gender	1.792 (0.579 - 5.547)	0.311
Body mass index	0.974 (0.865 - 1.095)	0.656
Current or ex-smoker	3.894 (1.269 - 11.952)	0.018
Post-bronchodilator FVC, % predicted	0.990 (0.961 - 1.020)	0.522
Post-bronchodilator FEV$_1$, % predicted	0.972 (0.947 - 0.997)	0.027

CI, confidence interval; FVC, forced vital capacity; FEV$_1$, forced expiratory volume one second.

or serum albumin level. Compared to patients without depression (BDI < 16), patients with depression (BDI ≥ 16) had significantly higher median scores for both subscales of the STAI ($p < 0.0001$), and their symptoms of depression were positively correlated with both state-anxiety ($r = 0.644$, $p < 0.0001$) and trait-anxiety ($r = 0.597$, $p < 0.0001$).

A bivariate analysis identified four variables related to increased risk for clinically relevant depression ($p < 0.05$): BMI (OR, 0.9; $p = 0.023$), history of smoking (current or ex-smoker; OR, 2.8; $p = 0.004$), predicted value of post-bronchodilator FVC (OR, 0.972; $p = 0.002$), and predicted value of post-bronchodilator FEV1 (OR, 0.966; $p < 0.0001$). Age and sex were added to these four factors in a multivariate logistic analysis, revealing that the predicted value of post-bronchodilator FEV1 (OR, 0.972; $p = 0.027$) and smoking (current or ex-smoker) (OR, 3.894; $p = 0.018$) were independently associated with the development of depression in patients with chronic airway lung diseases, irrespective of individual diagnosis (Table 4).

DISCUSSION

The present study found a higher prevalence of depression among patients with chronic airway lung diseases than among those in the healthy control group, but found no significant difference with respect to the frequency of anxiety, even though the scores for anxiety symptoms were higher among the patients with chronic airway lung diseases than among the controls. Clinically significant depression was strongly correlated with more severe airflow limitations and a history of smoking (current or ex-smokers), which were independent risk factors for depression in patients with chronic airway lung diseases.

Previous studies have reported a tendency toward depression in patients with COPD [4-7], and our findings confirmed a higher frequency of depression in these patients. In the present study, 70% of patients with severe to very severe COPD exhibited depression. Higher percentages of patients with COPD and bronchiectasis than of controls reported symptoms of depression, although anxiety was not more common in the patients than in the controls. Previous studies have reported susceptibility to depression in patients with other chronic respiratory conditions [17,22]. Indeed, bronchiectasis manifests as a chronic and progressive disease with multiple exacerbations resulting in altered lung functioning, including irreversible airflow obstruction, progressive dyspnea, and greatly reduced quality of life [14]. Contrary to the results of previous studies [17,22], our data showed that the scores for and frequency of depression in patients with asthma did not differ significantly from those in members of the control group. However, irrespective of the specific pulmonary diagnosis, clinically significant levels of depression were more common in patients who were smokers and/or those with airflow limitations that altered lung functioning.

As established in previous studies [4,22], our results also showed a significant correlation between anxiety and depression. The state-anxiety scale evaluates a momentary condition in which the intensity of unpleasant feelings depends on the situation. Thus, because state-anxiety anxiety represents symptoms at the moment of evaluation, the groups with chronic airway lung diseases would be expected to have higher state-anxiety scores than would those in the control group [17]. The trait-anxiety scores of patients and healthy controls, however, did not differ significantly, and the frequency of trait-anxiety in patients and controls was similar. This finding can be attributed to the fact that the trait-anxiety scale measures a lasting personality trait-anxiety related to how an individual responds to potentially threatening situations over the course of a lifetime.

The dearth of studies with adequate sample sizes and the variability in the instruments and threshold scores used to measure depression and anxiety have been recognized as difficulties in developing strategies to manage Korean patients with chronic airway lung diseases. A BDI score of 21 has been suggested as the optimal cutoff score for the diagnosis of major depression because it is 1 standard deviation from the mean in a Korean cohort [20]. However, a recent study reported that a cutoff score

of 16 on the Korean version of the BDI was reliable in screening elderly patients for depression [21]. Based on a study by Jo et al. [21], the present study used a score of 16 as the optimal threshold for the diagnosis of clinically significant depression because our study group included elderly patients. Unfortunately, clinical cutoff scores for the STAI subscales have not been validated in the Korean population; therefore, we diagnosed anxiety according to previous work performed by Carvalho et al. [17].

Patients with a higher degree of airflow limitation, as determined by measuring the post-bronchodilator FEV1, reported more symptoms of depression, and pulmonary functioning was found to be a predictor of depression. Patients with severe airway obstruction have previously been shown to face increased risk for depression [7,23], and several studies have identified a history of smoking as a strong risk factor for depression [24,25]. Similarly, our results also demonstrated that a history of smoking was associated with increased risk for depression in patients with chronic airway lung diseases. The complex behaviors associated with nicotine addiction are often accompanied by comorbid depression or depressive symptoms [26,27], although the reasons for this association are not well understood. The present study showed no correlation between depression or anxiety and age, sex, nutritional status, or degree of hypoxia or hypercapnia. Our results underscore the importance of screening for and treating depression and anxiety in patients with chronic airway lung diseases so that they may retain their functional status, avoid unnecessary hospitalizations, and maintain their efforts at pulmonary rehabilitation [8-11]. Currently, depression is underdiagnosed in this patient population. Because depression is associated with deterioration in the underlying lung disease and increased mortality, it must be assessed in patients with chronic respiratory conditions.

Although this is, to date, the largest series evaluating the frequency and risk factors associated with depression and anxiety in Korean patients with chronic respiratory conditions, this study has certain limitations. We did not assess or measure functional status or health-related quality of life in our subjects and were therefore unable to examine correlations between these factors and psychological distress. Furthermore, we did not assess personal characteristics such as standard of living, educational level, economic conditions, and family issues, all of which have an influence on psychological distress. From a clinical perspective, these variables are difficult to measure in the outpatient setting of a pulmonary clinical practice.

In conclusion, patients with chronic respiratory diseases are at increased risk for depression and anxiety. Decreased lung function with airflow limitations and a history of smoking were independent risk factors for depression in patients with chronic airway lung diseases. Our findings show that the importance of screening for depression is underscored in patients with chronic airway lung diseases, particularly those with a high airflow limitation or history of smoking, to provide adequate patient care. Further studies are needed to elucidate the effectiveness of treating psychiatric distress in these patients as well as the efficacy of screening to identify those who might benefit from specific therapy.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

Acknowledgements

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