ORIGINAL RESEARCH

Major affective disorders in chronic obstructive pulmonary disease compared with other chronic respiratory diseases

Chaicharn Pothirat
Warawut Chaiwong
Nittaya Phetsuk
Sangnual Pisalthanapuna
Nonglak Chetsadaphan
Juthamas Inchai

Division of Pulmonary, Critical Care and Allergy, Department of Internal Medicine, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand

Background: Chronic obstructive pulmonary disease (COPD) and other chronic respiratory diseases (CRDs) have significant impacts on quality of life including psychomotor domain.

Purpose: To evaluate three major affective disorders in subjects with COPD compared with other CRDs and nonill population.

Materials and methods: The Thai version of Mini International Neuropsychiatric Interview (MINI) was used as a diagnostic instrument for three major affective disorders (generalized anxiety disorder, major depressive disorder, and panic disorder) by face-to-face interview in assessing patients with CRDs [COPD, asthma, rhinasthma, all asthma (asthma and rhinasthma), and chronic rhinitis], and nonill subjects. Logistic regression analyses were used to determine the relation between major affective disorders and CRDs adjusting for age, sex, and disease severity.

Results: Major affective disorders were more prevalent in CRDs than nonill groups (adjusted OR =2.6 [95% CI, 1.8−3.9], $P<0.001$). COPD patients had significantly more generalized anxiety and panic disorder (adjusted OR =4.0 [95% CI, 1.4−11.9], $P=0.011$, and 4.4 [95% CI, 1.1−18.1], $P=0.038$, respectively) but not major depressive disorder (adjusted OR =2.7 [95% CI, 0.8−9.0, $P=0.105$]) than nonill group. Comparing with all asthma, COPD patients had lower occurrence of major depressive and panic disorders (adjusted OR =0.1 [95% CI, 0.0−0.4], $P=0.002$, and 0.1 [95% CI, 0.0−0.9], $P=0.043$, respectively). There was no difference in major mood disorders in COPD, rhinasthma, and chronic rhinitis patients. Major affective disorders were not increased by disease severity in COPD.

Conclusion: Major affective disorders were significantly higher in CRDs than nonill population. Generalized anxiety and panic disorders were significantly high in COPD patients. Moreover, major depressive and panic disorders in COPD were significantly lower than all asthma. The prevalence of major affective disorders may not be related to severity of COPD.

Keywords: respiration disorders, asthma, airway obstruction, rhinitis, mood disorders

Correspondence: Chaicharn Pothirat
Division of Pulmonary, Critical Care, and Allergy, Department of Internal Medicine, Faculty of Medicine, Chiang Mai University, 110 Inthavaroros Road, Sriphum, Maung Chiang Mai District, Chiang Mai 50200, Thailand
Tel +66 53 946228
Fax +66 53 895117
Email cpothira@med.cmu.ac.th/
chaicharn.p@cmu.ac.th

Introduction

Chronic respiratory diseases (CRDs) including chronic obstructive pulmonary disease (COPD), asthma, and chronic rhinitis have significant public health implications in terms of cost of care as well as in quality of life.[1–3] In addition to chronic airflow obstruction, COPD impacts of secondary skeletal muscle dysfunction on exercise capacity and survival are well established.[4,5] Affective disorders, generalized anxiety, and depressive symptoms are common in patients with even the mildest form of COPD.[6] These are major comorbidities in COPD[7–10] and are associated with poor prognosis.[9,11] Previous studies reported a high prevalence of mental illness in patients with other CRDs (asthma and rhinitis).[12–18] Each of these CRDs has a great impact on

psychological health.[18] However, the comparisons between psychological impairments associated with COPD and the other CRDs are rarely addressed. Psychological impairments and respiratory health status in Thai adult populations have never been systematically studied. We therefore conducted a study on the prevalence of the three major affective disorders in patients with COPD compared to the other CRDs (chronic rhinitis, asthma, all asthma, and rhinasthma) and the nonill population.

Materials and methods
Study population and design

A cross-sectional survey study was setup to evaluate and compare the prevalence of the three major affective disorders in patients with COPD and other CRDs (asthma, rhinasthma, all asthma, chronic rhinitis) and nonill population. This study was one part of a cross-sectional population-based study setup to identify the prevalence of CRDs in adults older than 40 years living in municipal areas of Chiang Mai province (Chiang Mai Lung Health Study). The sample size was calculated using Slovin's formula.[19] A minimal sample size of 398 was determined with 30% of patients expected to deny the participation; consequently, we planned to enroll ~517 subjects. Selection of the community areas was performed by random-route methodology. The chosen areas were then divided into several blocks based on the geographical area and number of streets, and systematic sampling of households within these randomized blocks was conducted. The subjects who resided in detached houses were randomly selected from every third house within each block, and only one patient was interviewed per household.

The subjects were interviewed face-to-face via a standardized respiratory health questionnaire administered by trained interviewers. The respiratory questionnaire was adapted from the European Community Respiratory Health Survey (ECRHS),[20] and included questions on general health, chronic respiratory symptoms, and physician-diagnosed respiratory diseases. All relevant data including age, sex, smoking history, family history of atopic diseases, respiratory symptoms, previous medical history, diagnoses of respiratory diseases, and asthma medication use were reviewed. The subjects were invited to the pulmonary administrative office at Chiang Mai University Hospital to confirm the information by face-to-face interview and physical evaluation by pulmonologists in the study team. Each participant underwent a standard chest radiograph and post-bronchodilator (BD) pulmonary function test according to standard American Thoracic Society (ATS)/European Respiratory Society (ERS)

post-BD spirometry.[21] Results were reviewed and interpreted by a radiologist and pulmonologists. The spirometric values as % predicted were calculated using National Health and Nutrition Examination Survey (NHANES) III reference equations.[22] However, for Asians, a correction factor of 0.88 was applied to the forced vital capacity (FVC) and forced expiratory in first second (FEV_1) was predicted.[23]

Assessment of major affective disorders

The Mini International Neuropsychiatric Interview (MINI) is a standardized clinical diagnostic interview schedule for DSM-IV Axis-I disorders.[24] It can be reliably administered by lay interviewers who have appropriate training. The Thai version of MINI (translated from the English version of the MINI, Version 5)[25] was used as the "gold standard" diagnostic tool for identifying the presence of three major affective disorders (generalized anxiety disorder, major depressive disorder, and panic disorder) by face-to-face interview in assessing patients with CRDs and the nonill population in this study.

Inclusion and exclusion criteria

Randomly selected subjects who had completed the Thai version of MINI questionnaires were included. Subjects excluded from the study were those with complicated acute respiratory disorders; those with other associated significant physical illnesses such as ischemic heart disease, diabetes mellitus, uncontrolled hypertension, renal failure, hepatic failure, congestive heart failure or carcinoma; and those with a previous history of psychiatric illness. Informed consent was obtained from all participants, and the study was approved by the Ethics Committee of the Faculty of Medicine, Chiang Mai University.

Clinical definitions

Nonill subjects includes subjects with no history of chronic respiratory symptoms, no previous diagnosis of any CRD, normal general physical examination, and a normal chest radiograph. Chronic rhinitis subjects were with recurrent or chronic symptoms of nose blockage, posterior nasal drip, sneezing, or runny nose off and on without fever in the past year. Asthma was defined by a positive history of wheezing in the past year (current wheezer) and receiving asthma medication, post-BD $FEV_1/FVC > 0.7$ (for a chronic smoker >5 pack-years) or <0.7 (for a nonsmoker or smokers <5 pack-years), with no pulmonary infiltration, pleural effusion, bronchiectasis, or mass on chest radiographs. Rhinasthma was defined by diagnoses of chronic rhinitis combined with asthma. All asthma population were

asthma and rhinasthma subjects. COPD was defined by detection of airflow obstruction based on fixed threshold criterion (a ratio of post-BD forced expiratory volume in the first second to FVC [FEV_1/FVC] less than 0.7)[1] in chronic smokers >5 pack-years with normal or abnormal chest radiographs compatible with the disease (presence of diffuse pulmonary hyperinflation with flattened diaphragms). The severity of chronic rhinitis, asthma, and COPD was determined using Allergic Rhinitis and Its Impact on Asthma (ARIA),[26] Global Initiative for Asthma (GINA),[2] and Global Initiative for Chronic Obstructive Lung Disease (GOLD)[1] criteria, respectively.

Statistical analysis

Results for numerical values were expressed as mean ± standard deviation (SD) and those for categorical data were expressed as absolute frequencies and percentages. Independent sample *t*-tests and Fisher's exact test were used to compare differences between groups with and without respiratory diseases for continuous and categorical data, respectively. The prevalence of three major affective disorders (generalized anxiety disorder, major depressive disorder, and panic disorder) was compared between those with and without respiratory disease using Fisher's exact test. Logistic regression analyses were used to determine the relation between major affective disorders and CRDs adjusting for age, sex, and disease severity. Results were displayed as adjusted odds ratio (OR) together with 95% confidence interval (CI). *P*-value <0.05 was considered as statistically significant. All analyses were carried out with the SPSS statistical package, version 16 for Windows (SPSS Inc., Chicago, IL, USA).

Results

The demographic data of all patients are shown in Table 1. A total of 571 participants were interviewed using MINI. Of those, 343 were subjects with CRDs, and 228 were nonill subjects as controls. The mean age and age group >60 years old in CRDs were significantly higher than the nonill group (*P*=0.002 and 0.005, respectively). Major affective disorder (at least one) was significantly higher in the CRDs group than the nonill group (adjusted OR =2.7, 95% CI, 1.8−3.9). Generalized anxiety disorder was the most common major affective disorder detected in patients with CRDs (17.8%) followed by major depressive (10.8%) and panic (6.7%) disorders.

The demographic profile of CRDs subgroups is presented in Table 2. COPD patients were older, predominantly male and had a lower BMI than nonill subjects. All CRD subgroups

Table 1 Demographic data and major affective disorders from a total of 571 subjects

Characteristics	Respiratory disease		*P*-value	Risk assessment
	Yes (n=343)	No (n=228)		
Age (years)	54.9±12.1	52.1±9.5	0.002	
Age >60 years	216 (63)	45 (19.7)	0.005	
Male sex	127 (37.0)	90 (39.5)	0.555	
BMI (kg/m²)	23.7±5.1	24.9±3.7	0.002	
Percentage of predicted FEV_1	75.8±22.2	87.4±12.4	<0.001	
Ratio of FEV_1/FVC (%)	74.3±14.5	83.4±4.5	<0.001	
At least one major mood disorder	132 (38.5)	90 (19.3)	<0.001	Relative risk =2.6 (95% CI [1.8–3.9, *P*<0.001]) Adjusted odds ratio =2.7 (95% CI [1.8–3.9, *P*<0.001])
Generalized anxiety	61 (17.8)	11 (4.8)	0.002	Relative risk =4.3 (95% CI [2.2–8.3, *P*<0.001]) Adjusted odds ratio =4.3 (95% CI [2.2–8.5, *P*=0.005])
Major depressive disorder	37 (10.8)	8 (3.5)	<0.001	Relative risk =3.3 (95% CI [1.5–7.3, *P*=0.002]) Adjusted odds ratio =3.1 (95% CI [1.4–6.8, *P*<0.001])
Panic disorder	23 (6.7)	6 (2.6)	0.030	Relative risk =2.7 (95% CI [1.1–6.6, *P*=0.030]) Adjusted odds ratio =2.7 (95% CI [1.0–6.6, *P*=0.041])

Note: Results are expressed as mean ± SD or n (%), adjusted odds ratio controlling for age and sex.
Abbreviations: BMI, body mass index; FEV_1, forced expiratory volume in first second; FVC, forced vital capacity; CI, confidence interval; SD, standard deviation.

Table 2 Demographic profile of chronic respiratory disease subgroups

Characteristics	Chronic rhinitis	Asthma	Rhinasthma	All asthma	COPD	Nonill
n (%)	160 (28.0)	46 (8.1)	55 (9.6)	101 (17.7)	82 (14.4)	228 (39.9)
Age (years)	50.5±8.9[a]	53.3±11.4[a]	49.2±8.2[a,b]	51.1±9.9[a]	68.1±10.4[b]	52.1±9.5[a]
Age >60 years	22 (13.8)[c,d]	10 (21.7)[d]	5 (9.1)[d]	15 (14.9)[d]	67 (81.7)[c]	45 (19.7)[d]
Male sex	46 (28.8)[d]	16 (34.8)[d]	16 (29.1)[d]	32 (31.7)[d]	49 (59.8)[c]	90 (39.5)[d]
BMI (kg/m^2)	24.2±3.5[a]	24.9±5.2[a]	25.1±4.6[a]	24.9±4.9[a]	21.1±7.0[b]	24.9±3.7[a]
Predicted FEV$_1$ (%)	87.3±14.0[a]	79.1±16.6[a,b]	78.7±15.6[a,b]	78.9±15.9[a,b]	49.9±20.7[b]	87.4±12.4[a]
Ratio of FEV$_1$/FVC (%)	82.2±6.2[a]	78.9±8.6[a,b]	79.4±7.3[a,b]	79.2±7.9[a,b]	52.8±10.5[b]	83.4±4.5[a]
Disease severity[e]						
Mild[f]	133 (83.2)	31 (67.4)	33 (60.0)	64 (63.4)	12 (14.6)	NA
Moderate	21 (13.1)	13 (28.3)	20 (36.4)	33 (32.7)	24 (29.3)	NA
Severe	6 (3.7)	2 (4.3)	2 (3.6)	4 (3.6)	34 (41.5)	NA
Very severe	NA	NA	NA	NA	12 (14.6)	NA

Notes: Results are expressed as means ± SD or n (%); [a]significantly different from COPD (independent-t-test); [b]significantly different from controls (independent-t-test); [c]significantly different from controls (Fisher's exact test); [d]significantly different from COPD (Fisher's exact test); [e]the severity classification of other chronic respiratory diseases was significantly different from COPD ($P<0.001$); [f]mild severity of disease includes mild intermittent and persistent severity in patients with chronic rhinitis and asthma.
Abbreviations: COPD, chronic obstructive pulmonary disease; BMI, body mass index; FEV$_1$, forced expiratory volume in first second; FVC, forced vital capacity; NA, not applicable; SD, standard devaition.

except chronic rhinitis had significantly lower lung function (percentage of predicted FEV$_1$ and ratio of FEV$_1$/FVC) than the nonill group.

The odds ratio of major affective disorders adjusted for age and sex in CRDs are presented in Table 3. Generalized anxiety disorder was significantly higher in all CRDs than the nonill group. Major depressive disorder was significantly higher in asthma ($P<0.001$), rhinasthma ($P=0.041$), and all asthma ($P<0.001$). Panic disorder was significantly higher in asthma ($P=0.014$), all asthma ($P=0.018$), and COPD

Table 3 Comparison of each respiratory disease with major mood disorders

Mood disorder	Subgroups	n (%)	Adjusted OR (95% CI)	P-value
Generalized anxiety	Nonill (n=228) (ref)	11 (4.8)		
	Chronic rhinitis (n=160)	22 (13.8)	2.8 (1.3–6.0)	0.008
	Asthma (n=46)	9 (19.6)	4.8 (1.8–12.3)	0.001
	Rhinasthma (n=55)	16 (29.1)	7.6 (3.3–17.9)	<0.001
	All asthma (n=101)	25 (24.8)	6.4 (2.9–13.6)	<0.001
	COPD (n=82)	14 (17.1)	4.0 (1.4–11.9)	0.011
Major depressive disorder	Nonill (n=228) (ref)	8 (3.5)		
	Chronic rhinitis (n=160)	7 (4.4)	1.2 (0.4–3.5)	0.709
	Asthma (n=46)	14 (30.4)	11.9 (4.6–30.8)	<0.001
	Rhinasthma (n=55)	6 (10.9)	3.3 (1.1–10.6)	0.041
	All asthma (n=101)	20 (19.8)	7.1 (2.9–17.0)	<0.001
	COPD (n=82)	10 (12.2)	2.7 (0.8–9.0)	0.105
Panic disorder	Nonill (n=228) (ref)	6 (2.6)		
	Chronic rhinitis (n=160)	6 (3.8)	1.3 (0.4–4.2)	0.628
	Asthma (n=46)	5 (10.9)	4.8 (1.4–16.7)	0.014
	Rhinasthma (n=55)	4 (7.3)	2.7 (0.7–9.9)	0.148
	All asthma (n=101)	9 (8.9)	3.6 (1.2–10.6)	0.018
	COPD (n=82)	8 (9.8)	4.4 (1.1–18.1)	0.038
At least one major mood disorder	Nonill (n=228) (ref)	44 (19.3)		
	Chronic rhinitis (n=160)	50 (31.2)	1.8 (1.1–2.9)	0.014
	Asthma (n=46)	30 (65.2)	7.8 (3.9–15.5)	<0.001
	Rhinasthma (n=55)	27 (49.1)	3.9 (2.1–7.3)	<0.001
	All asthma (n=101)	57 (56.4)	5.4 (3.2–8.9)	<0.001
	COPD (n=82)	25 (30.5)	1.7 (0.8–3.5)	0.140

Note: Adjusted odds ratio controlling for age and sex.
Abbreviations: OR, odds ratio; CI, confidence interval; COPD, chronic obstructive pulmonary disease.

Table 4 Comparison of major affective disorders in patients with COPD, other CRDs, and nonill

COPD vs asthma	COPD (n=82)	Asthma (n=46)	Relative risk (95% CI)	P-value	Adjusted OR (95% CI)	P-value
Generalized anxiety disorder	14 (17.1)	9 (19.6)	0.8 (0.3–2.1)	0.725	0.3 (0.1–1.3)	0.100
Major depressive disorder	10 (12.2)	14 (30.4)	0.3 (0.1–0.8)	0.011	0.1 (0.0–0.4)	0.001
Panic disorder	8 (9.8)	5 (10.9)	0.9 (0.3–2.9)	0.841	0.2 (0.0–1.2)	0.073
At least one major affective disorder	25 (30.5)	30 (65.2)	0.2 (0.1–0.5)	<0.001	0.1 (0.0–0.3)	<0.001
COPD vs rhinasthma	**COPD (n=82)**	**Rhinasthma (n=55)**	**Relative risk (95% CI)**	**P-value**	**Adjusted OR (95% CI)**	**P-value**
Generalized anxiety disorder	14 (17.1)	16 (29.1)	0.5 (0.2–1.1)	0.095	0.5 (0.1–1.8)	0.269
Major depressive disorder	10 (12.2)	6 (10.9)	1.1 (0.4–3.3)	0.818	0.1 (0.0–1.0)	0.055
Panic disorder	8 (9.8)	4 (7.3)	1.4 (0.4–4.8)	0.614	0.3 (0.0–3.4)	0.354
At least one major affective disorder	25 (30.5)	27 (49.1)	0.5 (0.2–0.9)	0.028	0.4 (0.1–1.2)	0.112
COPD vs all asthma	**COPD (n=82)**	**All asthma (n=101)**	**Relative risk (95% CI)**	**P-value**	**Adjusted OR (95% CI)**	**P-value**
Generalized anxiety disorder	14 (17.1)	25 (24.8)	0.6 (0.3–1.3)	0.276	0.3 (0.1–1.3)	0.131
Major depressive disorder	10 (12.2)	20 (19.8)	0.6 (0.2–1.3)	0.228	0.1 (0.0–0.4)	0.002
Panic disorder	8 (9.8)	9 (8.9)	1.1 (0.4–3.0)	0.845	0.1 (0.0–0.9)	0.043
At least one major affective disorder	25 (30.5)	57 (56.4)	0.3 (0.2–0.6)	0.001	0.2 (0.1–0.5)	<0.001
COPD vs chronic rhinitis	**COPD (n=82)**	**Chronic rhinitis (n=160)**	**Relative risk (95% CI)**	**P-value**	**Adjusted OR (95% CI)**	**P-value**
Generalized anxiety disorder	14 (17.1)	12 (13.8)	1.3 (0.6–2.7)	0.492	0.5 (0.2–3.7)	0.929
Major depressive disorder	10 (12.2)	7 (4.4)	3.0 (1.1–8.3)	0.024	0.4 (0.1–3.2)	0.418
Panic disorder	8 (9.8)	6 (3.8)	2.7 (0.9–8.3)	0.058	0.3 (0.2–10.4)	0.709
At least one major affective disorder	25 (30.5)	50 (31.2)	0.9 (0.5–1.7)	0.903	0.7 (0.3–2.1)	0.557
COPD vs nonill	**COPD (n=82)**	**Nonill (n=228)**	**Relative risk (95% CI)**	**P-value**	**Adjusted OR (95% CI)**	**P-value**
Generalized anxiety disorder	14 (17.1)	11 (4.8)	4.1 (1.8–9.4)	<0.001	4.0 (1.4–11.9)	0.011
Major depressive disorder	10 (12.2)	8 (3.5)	3.8 (1.5–10.0)	0.004	2.7 (0.8–9.1)	0.105
Panic disorder	8 (9.8)	6 (2.6)	4.0 (1.3–11.9)	0.008	4.4 (1.1–18.1)	0.038
At least one major affective disorder	25 (30.5)	44 (19.3)	1.8 (1.0–3.3)	0.037	1.7 (0.8–3.5)	0.140

Note: Adjusted odds ratio for age, sex, and severity of disease.
Abbreviations: COPD, chronic obstructive pulmonary disease; CRDs, chronic respiratory diseases; OR, odds ratio; CI, confidence interval.

(P=0.038). Taken all together, the prevalence of at least one affective disorder was significantly increased in all subgroups of CRDs except COPD.

Comparison of major affective disorders in COPD with the other CRDs prior to and after adjustment for age, sex, and severity of disease is demonstrated in Table 4. COPD was associated with a higher prevalence of generalized anxiety, major depressive and panic disorders as compared with the nonill group prior to adjustment for age and sex. However, after adjustment major depressive disorder became insignificant. The prevalence of major depressive disorder in COPD was significantly less than asthma and all asthma (P=0.001 and P=0.002). The prevalence of panic disorders in COPD was significantly less than all asthma (P=0.043). Comparing COPD with rhinasthma and chronic rhinitis, there was no significant difference in prevalence of major affective disorders between them.

Table 5 presents a comparison of COPD severity to prevalence of major affective disorders. The prevalence of affective disorders in COPD stages II–IV including generalized anxiety, major depressive disorder, panic disorder, and at least one major mood disorder tended to be increased when compare to COPD stage I; however, they did not reach statistical significances after adjustment for age and sex.

Discussion

COPD was associated with high prevalence of generalized anxiety, major depressive and panic disorders as compared with nonill group, which was similar to previous studies.[15,16,18,27] Psychological distress may complicate the course of COPD.[28] The more severe the disease (dyspnea, related physical inactivity, and frequent exacerbation), the greater the social isolation, which leads to more fear and depression. Panic-driven responses to dyspnea, a characteristic feature of COPD, have been associated with increased psychopathology in respiratory disorders.[29] However, major depressive disorder prevalence was insignificantly different between the COPD and nonill groups after adjustment for age and sex. Due to a lack of in-depth Thai psychological studies to use for comparison, we could not fully explain the

Table 5 Comparison of COPD severity classification with major affective disorders

Mood disorder	GOLD Severity	COPD (n=82)		P-value
		n (%)	Adjusted OR (95% CI)	
Generalized anxiety	Mild (n=12) (ref)	1 (8.3)		
	Moderate (n=24)	3 (12.5)	2.5 (0.2–34.9)	0.502
	Severe (n=34)	9 (26.5)	0.8 (0.1–11.4)	0.833
	Very severe (n=12)	1 (8.3)	1.3 (0.6–26.9)	0.887
Major depressive disorder	Mild (n=12) (ref)	0 (0.0)		
	Moderate (n=24)	2 (8.3)	NA	0.303[a]
	Severe (n=34)	7 (20.6)	NA	0.088[a]
	Very severe (n=12)	1 (8.3)	NA	0.307[a]
Panic disorder	Mild (n=12) (ref)	0 (0.0)		
	Moderate (n=24)	0 (0.0)	NA	NA
	Severe (n=34)	6 (17.6)	NA	0.119[a]
	Very severe (n=12)	2 (16.7)	NA	0.140[a]
At least one major mood disorder	Mild (n=12) (ref)	1 (8.3)		
	Moderate (n=24)	7 (29.2)	5.3 (0.5–54.9)	0.160
	Severe (n=34)	13 (38.2)	2.8 (0.3–30.9)	0.406
	Very severe (n=12)	4 (33.3)	8.3 (0.7–104.7)	0.103

Notes: Adjusted odds ratio controlling for age and sex; [a]P-value using Fisher's exact test.
Abbreviations: COPD, chronic obstructive pulmonary disease; GOLD, Global initiative for chronic Obstructive Lung Disease; OR, odds ratio; CI, confidence interval; NA, not applicable; ref, reference.

reason that major depressive disorder in our COPD subjects was not increased.

Comparing major affective disorders between COPD and other CRDs, a major depressive disorder was more prevalent in those with asthma than COPD. This could be due to the fact that symptoms of COPD and major depressive disorders are very similar and often overlap. Fatigue, decreased interest, lack of energy, sleep disturbance, appetite change, poor concentration, and loss of sexual interest are easily ascribed to COPD unless a formal evaluation is done to screen for affective disorders.[30] Psychological stress has been thought to play an important role in asthma as these patients tended to have higher levels of stress and negative emotions such as panic, fear, irritability, and depression.[31] Increased psychiatric morbidity in asthma is consistently reported in previous studies[32,33] and our study results are consistent with those findings. Asthma was previously thought to be a psychosomatic disease because of the episodic nature in which symptoms would suddenly appear without warning or apparent cause.[34] Patients with chronic rhinitis had significantly higher generalized anxiety disorder as compared with the nonill group. Previous studies reported sleep difficulties associated with allergic rhinitis leading to poor quality of life and emotional problems such as irritability, anxiety, and fatigue.[35,36] A similar finding of high prevalence of anxiety was reported in a study of allergic rhinitis with bronchial asthma.[18,37] Patients with both rhinitis and asthma had higher generalized anxiety disorder than chronic rhinitis or asthma patients. Having both

asthma and rhinitis may contribute to an increased likelihood of co-occurring anxiety as suggested by a previous study.[38] At least one major mood disorder was observed across all severity classes of COPD and prevalence increased with severity category. Generalized anxiety disorder was prevalent in all COPD severity stages, whereas major depressive and panic disorders were found only in severe to very severe stages. There was no significant difference of severity classification associated with major affective disorders which contrasted to a previous study showing that a higher airflow obstruction is associated with generalized anxiety.[16] The explainable reason would be the sample size for this study did not include enough COPD subjects, especially in stages I and IV.

Taken all together, high prevalence of affective disorders in COPD, as well as other CRDs, may be due to various confounding factors. Screening for symptoms of affective mood disorders by simple and quickly validated questionnaires such as MINI during out-patient visits will be helpful in early diagnosis and appropriate treatment or referral.[39] While clinical guidelines are well established to diagnose and treat COPD, practice guidelines target isolated diseases and do not encompass comorbidities, presenting a challenge in COPD care.[40] Like many chronic diseases, COPD affects multiple aspects of the patient and varies with each patient. Vigilant review of clinical practice guidelines is necessary to optimize evidence-based care. Providers should be alert to the high risk of psychological comorbidities and should screen patients for depression and anxiety upon initial

presentation.[10] Early recognition, supportive care, and treatment can ease the burden of psychological comorbidities in patients with COPD. A holistic, integrated treatment plan will serve to optimize patient outcomes, decrease the burden of symptoms, prevent/manage exacerbations, slow disease progression, reduce disease morbidity, and overall, improve the quality of life of the patient. In summary, psychological assessment should evolve as a priority in clinical assessment of COPD patients.

The strength of this study is that it was designed as a combination of epidemiological and clinical studies. The results therefore were more informative than either study alone. In our study, all CRDs were optimally investigated prior to diagnosis made by an experienced pulmonologist. The quite large sample size allowed us to examine different categories of CRDs and their affective disorders. However, some limitations of this study should be mentioned. First, the association between medications for CRDs and the further development of affective disorders was not investigated in our study, because the medications varied for each CRD. Further, a clinical study would be required to investigate this association. Second, this study did not provide some information, such as family history, personal life style, education level, socioeconomic status, and environmental factors. Without this information, we were unable to examine their influence of these confounding factors. Third, the quite small number of COPD patients prevented adequate statistical inference for relationships in disease severity and affective disorders.

Conclusion

Major affective disorders were significantly higher in CRDs patients than in nonill population. Generalized anxiety and panic disorders, but not major depressive disorder, were significantly high in COPD. Moreover, major depressive and panic disorders in COPD were significantly lower than the all asthma population. The prevalence of major affective disorders may not be related to severity of COPD.

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Author contributions

The first author developed study design and carried out acquisition and interpretation of data, statistical analysis, manuscript preparation, and critical revision of intellectual content. The remaining authors contributed to acquisition and interpretation of data, revision of the article for important intellectual content, and final approval of the version to be published. All authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Disclosure

The authors report no conflicts of interest in this work.

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