

Affect status and perception of exacerbation in patients with asthma

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ABSTRACT

Exacerbations occur commonly in patients with asthma but factors affecting perception of dyspnea during exacerbation are not well known. This investigation was designed to determine the effects of negative mood on perception of dyspnea during exacerbation. A total of 47 patient aged 28–78 years (mean age, 52.5 years) admitted with acute asthma had recordings of blood gas pressure, negative mood score, forced expiratory volume in 1 second (FEV₁), and dyspnea score at admission and at the 72nd hour. Perceived intensity of dyspnea was estimated using a modified Borg scale. The negative mood was assessed with an overall of six mood adjectives (nervous–anxious, sad–blue, and tired–drowsy). High negative mood score was defined as the score above the cutoff point (median score, >7). Borg score of patients with a high negative mood score was higher than that of patients with a low negative mood score (6.3 ± 2.5 versus 4.4 ± 2.4 ; $p = 0.01$). The high Borg score of asthmatic patients with high negative mood persisted even at the 72nd hour (1.6 ± 0.9 versus 1.0 ± 0.7 ; $p = 0.01$). FEV₁ values of both groups at admission were similar. The negative mood score ($\beta = 0.68$; $p = 0.0001$) and initial FEV₁ ($\beta = -0.42$; $p = 0.01$) were the important determinants of Borg score at admission in all patients with multivariate analysis but not arterial oxygen pressure, arterial carbon dioxide pressure, asthma duration, and female sex. This study indicated that emotional factors, as well as the level of airways obstruction, predicted the magnitude of dyspnea at exacerbation of asthmatic patients. Thus, the emotional factors should be taken into account in the treatment of dyspnea at exacerbation.

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The Center for Disease Control and Prevention has reported that the overall prevalence of lifetime asthma is 10.5%.¹ The perception of bronchoconstriction varies among patients with asthma and this perception may be related to the covariation of sensory and affective aspects of dyspnea.² Accurate recognition of asthma symptoms is essential for prompting individuals with acute severe asthma to increase medication or seek medical assistance.^{3,4} The ability to perceive accurately the onset and intensity of asthma symptoms is a cornerstone of effective asthma management.^{5,6}

Psychological factors can influence the perception of asthmatic symptoms such as dyspnea.^{7,8} Dyspnea is a debilitating and distressing symptom that is reflected in different verbal descriptors.⁹ Reduced perception of dyspnea may predispose patients to a life-threatening attack.^{10–12} Provided that psychological disturbances are recognized and treated in these patients, the asthma-related morbidity might be significantly reduced.^{13–15} It may be considered that negative mood at the time of questionnaire may affect perception of dyspnea during exacerbation in asthmatic patients. This

investigation was designed to determine the effects of negative mood at the time of questionnaire and other contributory factors on perception of dyspnea during exacerbation.

METHODS

Patients

This study included asthmatic patients who had been followed up regularly in the Respiratory Disease Clinics of Kirikkale University Hospital for a long time (1–11 years).¹⁶ Asthma diagnosis was made according to the American Thoracic Society criteria with symptoms of episodic wheezing, cough, and shortness of breath responding to bronchodilators and reversible airflow obstruction documented in at least one previous pulmonary function study.¹⁷ The patients fulfilling the exacerbation criteria were admitted to the hospital. The local Ethics Committee approved the study and all subjects who were enrolled in the study gave their written informed consent. All were lifelong nonsmokers.

All asthmatic patients included in the study were assessed on repeated occasions once admitted to the hospital: soon after admission (0 hours), and then at 72 hours.¹⁸ Dyspnea, defined as the perception of difficult or labored breathing, may be ideally quantified, using a Borg scale. Perceived intensity of dyspnea was estimated using a modified Borg scale labeled from 0 (no symptom) to 10 (maximum bearable).^{19,20} On each occasion the patients were asked to score how dyspneic

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they felt using the Borg scale. At the same time, after measuring the height, a clinician performed spirometry on each subject with a portable dry rolling spirometer (MIR Spirobank, Rome, Italy) according to the recommendations of the American Thoracic Society and calculated the results based on predicted values.^{21,22}

Blood gas monitor (Labora, Easy Stat) was calibrated according to the manufacturer's recommendations. Radial arterial blood (while breathing room air) was aspirated with a heparinized syringe, placed on ice, and taken to a blood gas laboratory for analysis. The analysis was completed within 10 minutes.

Assessment of Mood

We assessed negative mood in all participants by a questionnaire described previously for three categories of mood each measured by two subscales as follows: (1) active–unpleasant mood (nervous/anxious), (2) unpleasant mood (sad/blue), and (3) passive–unpleasant mood (tired/drowsy).^{23,24} Each subscale was rated for its extent in the past 30 minutes (0, not at all; 2, slightly; 4, moderately; and 6, very much). Negative mood score was defined as the overall score of three categories of mood. The median of negative mood score was accepted as the cutoff point. High negative mood score was defined as the score above the cutoff point (median score, 7).

Asthma Exacerbation

An exacerbation was defined as a combination of two of the following criteria, provided that at least one of the two was the first, second, or third criterion:

- Best forced expiratory volume in 1 second (FEV₁) test falls to (< 80% of the mean value on once admitted to the hospital).
- Bronchodilator use of more than four inhalations per day on 2 consecutive days.
- Nocturnal awakenings because of asthma on two consecutive nights.
- Increases in chest tightness, breathlessness, coughing, and wheezing on 2 consecutive days.
- Inability to go to school or work because of asthma for 2 consecutive days.
- Unscheduled physician visit because of asthma during the time period when the concomitant criterion/criteria started to be fulfilled.

Assessment of Symptoms

Symptom intensity from the previous 24 hours was used to create a score for each patient. The severity of asthma symptoms was defined as the following:

- "Nighttime asthma score" (0, no asthma; 1, slightly wheeze; 2, woke once because of asthma; 3, woke

several times because of asthma; 4, woke most of night because of asthma).

- "Daytime asthma score" (0, no asthma; 1, occasional wheezing or breathlessness; 2, frequent wheezing or breathlessness; 3, wheezing or breathlessness for most of the day that interfered with normal activities; 4, breathlessness so bad that it prevented the patient from attending work or school).
- "Cough score" (0, no cough; 1, occasional cough; 2, frequent coughing but with no interference with normal activity; 3, frequent coughing that interfered with normal activity; 4, cough so bad that it prevented normal activities).
- "Inhalation score" (0, no inhalation; 1, one or two inhalations per day; 2, three or four inhalations per day; 3, five or six inhalations per day; 4, more than six inhalations per day).

The asthma symptom score was calculated as the sum of all of these mean parameters (inhalation score, nighttime asthma score, daytime asthma score, and cough score).²⁵

Statistical Analysis

The differences between groups were assessed with Student's *t*-test and Mann-Whitney *U* test as appropriate. Multiple linear regression analysis was performed with symptom and Borg score at admission, as the dependent variables, negative mood score, FEV₁ percent, arterial oxygen pressure (Pao₂), arterial carbon dioxide pressure (Paco₂), asthma duration, gender, and age as predictor variables. Predictor variables were entered into the multivariate model using a stepwise procedure. Clinical data were expressed as mean ± SD. A value of *p* < 0.05 was considered statistically significant.

RESULTS

The study group consisted of 2 male and 45 female patients with a mean age of 52.5 years and a range of 28–78 years. The characteristics of the patients with asthma are shown in Table 1.

Borg score in patients with high negative mood score was higher than that of patients with low negative mood score. The FEV₁ percent values observed at admission in patients with high negative mood score also were similar to those in patients with low negative mood score. The symptom scores observed in patients with high negative mood during exacerbation was higher than those in patients with low negative mood.

The determinants of Borg value at admission according to multivariate analysis were negative mood score ($\beta = 0.68$; *p* = 0.0001) and initial FEV₁ ($\beta = -0.42$; *p* = 0.01) but not Pao₂, Paco₂, asthma duration, or female sex in all patients (Table 2). It was expected to determine dyspnea of Pao₂ and Paco₂, but there was no

Table 1 The characteristics of the patients with asthma

	HNM (n = 23)	LNM (n = 24)	p Value
Age (yr)	55.0 ± 14.6	50.2 ± 13.2	0.2
Female/male (n/n)	23/0	22/2	0.1
Asthma duration (yr)	8.2 ± 6.4	15.7 ± 9.7	0.004
FEV ₁ %	57.5 ± 17.9	55.5 ± 17.5	0.6
Symptom score	12.3 ± 2.4	9.0 ± 2.1	0.0001
Pao ₂	67.3 ± 13.1	67.2 ± 8.3	0.9
Paco ₂	37.5 ± 4.4	36.4 ± 3.5	0.5
Borg at admission	6.3 ± 2.5	4.4 ± 2.4	0.01
Borg at 72 hr	1.6 ± 0.9	1.0 ± 0.7	0.01

Data are given as mean ± SD unless otherwise indicated.

FEV₁% = forced expiratory volume in 1 s percent; HNM = patients with high negative mood; LNM = patients with low negative mood; Pao₂ = arterial oxygen pressure; Paco₂ = arterial carbon dioxide pressure.

Table 2 Multivariate model with Borg value as dependent variable and FEV₁%, Pao₂, Paco₂, and negative mood values at admission as independent variables

	Borg at Admission	
	β*	p Value
	R ² = 0.46	
Intercept		0.0001
Age (yr)	0.15	0.3
Gender (female)	-0.23	0.1
Asthma duration	0.13	0.4
FEV ₁ %	-0.35	0.03
Pao ₂	-0.27	0.08
Paco ₂	0.05	0.7
Negative mood score	0.66	0.0001

*β is the standardized regression coefficient.

FEV₁% = forced expiratory volume in 1 s percent; Pao₂ = arterial oxygen pressure; Paco₂ = arterial carbon dioxide pressure.

relationship between them. Multiple linear regression analysis also clarified that negative mood score (β = 0.55; *p* = 0.004) was a significant predictor for symptom score at admission after adjusting for possible confounding factors in asthma exacerbation (Table 3).

DISCUSSION

The present study indicated that the Borg scores of patients with high negative mood at the exacerbation time were higher than those of patients with low negative mood. The asthmatic patients with high negative mood had high Borg scores even at 72 hours. Furthermore, negative affective status in asthmatic patients was the major determinant of dyspnea at exacerbation

Table 3 Multivariate models with symptom score as dependent variable and negative mood values at admission as independent variables

	Symptom Score	
	β*	p Value
	R ² = 0.31	
Intercept		0.0001
Age (yr)	0.09	0.8
Gender(female)	0.11	0.5
Asthma duration	0.09	0.6
FEV ₁ %	-0.10	0.5
Pao ₂	-0.16	0.3
Paco ₂	0.12	0.4
Negative mood score	0.55	0.004

*β is the standardized regression coefficient.

FEV₁% = forced expiratory volume in 1 s percent; Pao₂ = arterial oxygen pressure; Paco₂ = arterial carbon dioxide pressure.

but airway caliber was also an independent determinant of dyspnea with multivariate analysis. FEV₁ values of both groups at the exacerbation time were similar.

Accordingly, exacerbation severity of both asthmatic groups was similar but patients with negative affectivity perceived exacerbation as more intense than that of patients with low negative mood. It is not well known whether negative emotional state predicts the magnitude of dyspnea at exacerbation. It may be possible that negative affective status precedes the poor health status outcomes. Furthermore, present results suggest that negative affective status, even in the absence of important psychopathology, predict and possibly promote magnitude of perceived dyspnea at exacerbation

time and at 72 hours in asthmatic patients. Previous studies evaluated the effect of long-term psychopathology on dyspnea in patients with asthma.^{26–29} However, the present study evaluated the effect of negative affective state on dyspnea of patients with asthma at the exacerbation time. A relevant study indicated that, in an outpatient sample of asthmatic subjects, anxious perceivers of histamine-induced airways obstruction manifested higher scores for both perceived breathlessness and level of anxiety at a 20% fall in FEV₁.³⁰ Similarly, psychological disturbances were associated with a higher degree of dyspnea in outpatients with stable asthma.²⁶ Furthermore, a significant correlation was found between psychological status and the report of asthma-related symptoms, such as attacks of breathlessness after activity and waking with attacks of breathlessness.²⁷ In contrast, anxious patients' perceptions of the added loads were significantly less sensitive than normal subjects.²⁸ In addition, the level of anxiety in asthmatic subjects did not influence perception of bronchoconstriction.²⁹ Discrepancies between studies may simply be caused by differences in the clinical characteristics of patients.

Another important finding of the present study was that the asthmatic patients with negative emotional state had higher symptom scores than those without. Accordingly, the negative affective status at exacerbation was associated with more symptoms and greater perceived dyspnea. According to this, several clinical reports suggest that various emotional and psychological factors can precipitate asthmatic symptoms.^{31–33} An experimental study inducing stress under laboratory conditions in adults with asthma revealed a rapid and significant increase in respiratory symptoms immediately after exposure to stressful stimuli eliciting negative emotions.³⁴ Furthermore, early intervention to negative affectivity may help to improve the health status outcomes.

It may be expected to determine dyspnea of Pao₂ but we could not find a relationship between dyspnea and Pao₂. However, presence of a relationship between dyspnea and FEV₁ is important. Accordingly, changes in airway caliber may partially determine changes in dyspnea.

Potential limitations of our study were that the data on bronchodilator use, nocturnal awakenings, and asthma symptoms was determined from self-report by subjects. Many factors may influence how a person responds to a question.

The negative emotional state at exacerbation of asthmatic patients predicts the magnitude of dyspnea at exacerbation and at 72 hours. Accordingly, greater negative emotional state was associated with greater perceived dyspnea and greater perceived asthma symptoms. In addition, negative affective status in patients with asthma may play a useful role in early to be

realized and early to be treated exacerbation. Furthermore, treatment of both symptoms and negative affective status in asthmatic patients may produce an aid improvement in perception of dyspnea.

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