

Agreement in Asthmatics' Perception of Dyspnea During Acute and Chronic Obstruction

E. Martínez-Moragón,^a M. Perpiñá,^b A. Belloch,^c A. de Diego,^b and M.E. Martínez-Francés^b

^aServicio de Neumología, Hospital de Sagunto, Port de Sagunt, Valencia, Spain.

^bServicio de Neumología, Hospital Universitario La Fe, Valencia, Spain.

^cDepartamento de Personalidad, Evaluación y Tratamientos Psicológicos, Facultad de Psicología, Universidad de Valencia, Valencia, Spain.

OBJECTIVE: Three types of asthmatic patients can be identified during periods of clinical stability: "poor perceivers," "normal perceivers," and "over perceivers." When asthmatics undergo bronchial challenge in the laboratory, the same distinctions in type of perception can be observed. The aim of the present study was to determine the level of agreement between the 2 situations.

PATIENTS AND METHODS: A total of 93 patients with persistent moderate asthma (36 men and 57 women; mean age 40 years) were studied. We asked them to assess their dyspnea on a modified Borg scale when stable and after each histamine dose in a bronchial provocation test. When a patient's Borg scale assessment in stable situation was below the 25th percentile, that patient was classified as a poor perceiver. Patients were considered over perceivers if their score in stable situation was in the 75th percentile. Others were labeled normal perceivers. Type of perception during acute bronchoconstriction was defined in function of the change in Borg assessment once forced expiratory volume in the first second had decreased 20%: poor perceivers were those whose change in Borg assessment was in the 25th percentile, over perceivers were in the 75th percentile, and normal perceivers in the middle percentiles.

RESULTS: In stable situation, 23 patients were poor perceivers, 58 were normal perceivers, and 12 were over perceivers. During bronchoconstriction, there were 23 poor perceivers, 47 normal perceivers, and 23 over perceivers. Agreement was estimated by a kappa index of 0.0574 for poor perception, 0.1521 for over perception, and 0.3980 for normal perception.

CONCLUSIONS: Asthmatics' perception of dyspnea during periods of stability and during acute bronchoconstriction are independent phenomena. It is therefore not possible to infer how a patient will perceive an asthmatic attack by evaluating only how he or she perceives breathlessness during stable periods.

Key words: *Dyspnea. Asthma. Perception. Borg scale.*

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Correspondence: Dra. E. Martínez-Moragón.
Servicio de Neumología (Medicina Interna), Hospital de Sagunto.
Avda. Ramón y Cajal, s/n. 46520 Port de Sagunt. Valencia. España.
E-mail: emm01v@saludalia.com

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Concordancia entre la percepción de disnea del asmático durante la obstrucción aguda y crónica

OBJETIVO: Durante la estabilidad clínica se pueden distinguir 3 tipos de asmáticos: hipoperceptores, normoperceptores e hiperperceptores. Cuando a esos mismos pacientes se les provoca una broncoconstricción aguda, también existen hipo, normo e hiperperceptores de disnea. El objetivo del presente trabajo ha sido comprobar la concordancia entre ambas situaciones.

PACIENTES Y MÉTODOS: Se ha estudiado a 93 pacientes con asma persistente moderada (36 varones y 57 mujeres; edad media de 40 años). Se les pidió que estimaran su disnea (escala modificada de Borg) en situación de estabilidad y después de cada dosis de histamina en una prueba de broncoprovocación. Cuando la puntuación de Borg en situación estable era menor del percentil 25, se consideró hipoperceptor; si era superior al percentil 75, hiperperceptor, y normoperceptor al grupo restante. En función del cambio de disnea al descender un 20% el volumen espiratorio forzado en el primer segundo se distinguieron los perceptores agudos: hipoperceptores (cambio en Borg inferior al percentil 25), hiperperceptores (cambio superior al percentil 75) y normoperceptores (cambio entre los percentiles 25 y 75).

RESULTADOS: En situación estable 23 pacientes fueron hipoperceptores, 58 normoperceptores y 12 hiperperceptores, mientras que durante la broncoconstricción hubo 23 hipoperceptores, 47 normoperceptores y 23 hiperperceptores. El análisis de concordancia mostró un índice kappa de 0,0574 para la hipopercepción, de 0,1521 para la hiperpercepción y de 0,3980 para la normopercepción.

CONCLUSIONES: Las percepciones de disnea de los asmáticos en situación estable y durante una broncoconstricción aguda son fenómenos independientes. Por ello, no es posible inferir cómo un paciente va a percibir una crisis de asma valorando únicamente cómo percibe su enfermedad durante la estabilidad clínica.

Palabras clave: *Disnea. Asma. Percepción. Escala de Borg.*

Introduction

Individual difference between the way asthmatics perceive dyspnea has been known for some time to be a factor to take into consideration.¹ Most studies have demonstrated the existence of at least 2 forms of anomalous perception of dyspnea in relation to bronchial obstruction: hypo- or "poor" perception and hyper- or "over" perception.²⁻⁴ These dyspnea perception patterns are detected both in stable situation and after provocation of acute bronchial obstruction.⁵ The pioneering study by Rubinfeld and Pain⁵ clearly revealed 2 components: inability to recognize acute bronchoconstriction and failure to perceive chronic bronchial obstruction.

However, even though various studies have been designed to clarify the problem of anomalous perception of dyspnea by asthmatics, much is disputed.^{6,7} One issue is our lack of information about whether a patient with asthma perceives dyspnea the same way in both situations (stable condition and under induced bronchoconstriction) or if each is independent of the other.

The present study was designed to determine exactly that. After evaluating how a series of stable asthmatics perceive their airway status in stable condition, we determined the perception of those same patients during acute bronchoconstriction. The aim of the study was to determine whether dyspnea perception in the 2 situations were or were not the same.

Patients and Methods

Ninety-three patients with persistent moderate asthma were studied in the outpatient pneumology department of our hospital. The inclusion criteria were that *a*) the patient was diagnosed with asthma according to the guidelines of the American Thoracic Society⁸; *b*) the patient was in clinically stable condition defined as absence of change in symptoms or treatment for at least the last 4 weeks; *c*) disease had been in course at least 1 year; *d*) the patient was older than 15 years of age and younger than 70; *e*) no other disease able to cause dyspnea was present (heart, neuromuscular, or other pulmonary diseases); and *f*) the level of asthma severity was "persistent moderate" according to the Spanish guidelines for the management of asthma (GEMA),⁹ which are the Spanish version of the Global Initiative for Asthma (GINA) guidelines.¹⁰ Lack of cooperation or inability to perform test maneuvers was considered an exclusion criterion.

The study was carried out prospectively in 2 sessions separated by an interval of 2 to 3 days, after informed consent of the patient had been obtained. In the first visit we recorded the patient's personal characteristics (age, sex, educational level on a scale of 1 to 5, where 1 represented "no formal education" and 5 indicated "higher education"). We also gathered information related to the history of asthma: age of onset of disease, use of health care services in the last year (visits to the emergency department and hospitalizations), and symptoms in the last month (cough, wheezing, chest tightness, and nighttime symptoms) on a scale in which 1 represented absence of the symptom and 4 the most severe level of the symptom. After dyspnea was assessed in stable situation on a modified Borg scale,¹¹ health-related quality of life (Asthma Quality of Life questionnaire of Marks^{12,13}), anxiety (State-

Trait Anxiety Inventory¹⁴), and depression (Beck Depression Inventory¹⁵) were also evaluated. In the same visit we then carried out a stable-situation lung function test that included recording of forced spirometry and a flow-volume curve as well as determination of lung volumes by the helium dilution technique, following recommendations of the Spanish Society of Pulmonology and Thoracic Surgery (SEPAR).¹⁶ Based on information collected, we confirmed that the patient had persistent moderate disease according to the GEMA criteria.⁹

Perception of dyspnea was studied during acute bronchoconstriction in a second visit. Histamine phosphate was chosen as the provocation agent and the technique used was that described by Cockcroft et al.¹⁷ At the start of the test and after each administration of the agent the patient was asked to grade his or her level of dyspnea on a modified Borg scale. Patients were free to choose any score on the scale but had been carefully instructed beforehand to ignore any other type of sensation such as nasal irritation, unpleasant taste, cough, or throat irritation. The test ended when forced expiratory volume in the first second (FEV₁) decreased at least 20% below the level obtained when placebo was inhaled. Then, 600 µg of salbutamol was administered to reverse bronchoconstriction. Reversal was verified by spirometry 20 minutes later.

To analyze individual perception of acute bronchoconstriction we calculated the change in Borg (CB) rating: the difference between the perception score of dyspnea on the Borg scale when FEV₁ had fallen 20% and the Borg score after administration of placebo. CB was a parameter we had found to be useful for distinguishing types of dyspnea perception in a previous study, in which the method was described in detail.¹⁸ Thus, in function of CB, patients were classified in acute situation as poor perceivers (CB below the 25th percentile), normal perceivers (CB in the middle quartiles) or over perceivers (CB above the 75th percentile).

The Borg scale was also used to assess chronic dyspnea, given that we had previously confirmed that it gave information similar in quality to that provided by other dyspnea scales.¹⁹ Three levels of dyspnea perception were defined by cut points at the 25th and 75th percentiles of scores for the patient population: *a*) level 1, chronic poor perceivers (Borg rating below the 25th percentile); *b*) level 2, chronic normal perceivers (Borg score within the middle quartiles); and *c*) level 3, chronic over perceivers (Borg score over the 75th percentile). It should be remembered that all patients enrolled had the same level of disease severity. Thus, we were distinguishing between dyspnea reported by a group of patients who, based on symptoms and lung function, had been classified by the same physician to have a similar level of asthma: persistent moderate.

Once patients had been classified according to their manner of perceiving dyspnea in acute and chronic situations, we used the kappa statistic to study agreement between the 2 situations. Then, using analysis of variance, we determined whether there was a difference between patients whose manner of perception coincided and those whose perception was discrepant.

Results

We enrolled 93 patients with asthma (57 women and 36 men) with a mean (SD) age of 40 (18) years (range, 16-69). Mean age of onset was 24 (16) years and mean time since onset was 13 (11) years.

In the year before the study, 19 patients (20%) had been hospitalized for asthma and 42 (45%) had been treated in the emergency department of our hospital. Three percent had a history of near-fatal asthma attack, with admission to an intensive care unit.

Types of Perception of Dyspnea During Bronchial Challenge

Mean CB overall was 1.59 (1.69) whereas the mean CB was 0.14 for those below the 25th percentile and 2.95 for those above the 75th percentile. Following the procedure described, we found 23 poor perceivers (25%), 47 normal perceivers (50%), and 23 over perceivers (25%) of dyspnea.

Types of Dyspnea Perception in Stable Situation

The mean Borg scale rating was 1.34 (0.83) (range, 0-3). For patients below the 25th percentile the mean score was 0.75, and for those above the 75th percentile it was 2. Thus, 23 (25%) were classified as chronic poor perceivers, 58 (62%) as normal perceivers, and 12 (13%) as chronic over perceivers.

Agreement Between Acute and Chronic Obstruction

The kappa statistics for agreement were as follows: 0.1521 for over perceivers, 0.0574 for poor perceivers, and 0.3980 for normal perceivers. According to the criteria established by Landis and Koch²⁰ for interpreting the kappa statistic, agreement was insignificant for poor and over perceivers of dyspnea, whereas there was slight agreement between the 2 situations for normal perceivers.

Differences by Perception of Dyspnea

Table 1 shows results of analysis of differences between patients whose perception of dyspnea coincided in acute and chronic phase (44 patients) and those whose perception did not coincide (49 patients). As shown, we found a significant difference only for number of visits to the emergency room for asthma attacks. The Figure shows the distribution of patients by manner of perceiving dyspnea in the 2 conditions—acute and chronic. Thus patients who were poor perceivers of dyspnea during the bronchial challenge test were largely normal perceivers when stable (61%), whereas 30% were poor perceivers and few (9%) were over perceivers. On the other hand, in the subgroup of over perceivers during acute obstruction, 52% were normal perceivers when stable, 26% were poor perceivers, and 22% were over perceivers. Thirty-two (34%) patients were normal perceivers in both situations; the only statistically significant difference between these patients and the others was in the number of attacks treated in emergency departments (Table 2).

Stable, Poor Perception	xxxxxx	xxxxxx xxxx	xxxxxxx
Stable, Normal Perception	xxxxxx xxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxx xxxxxx xx
Stable, Over Perception	xxxxxx	xxxxxx	xx
	Acute, Over Perception	Acute, Normal Perception	Acute, Poor Perception

Figure. Distribution of asthma cases in function of perception of dyspnea in stable situation and after acute bronchoconstriction. X indicates a case.

Discussion

In a previous study we found that 13% of asthmatics are poor perceivers of dyspnea when airway obstruction is provoked artificially during lung function testing.¹⁸ The pattern was that such patients usually self-report as having a low degree of disease severity, have little anxiety, good health-related quality of life, and place few demands on health care services. In the same situation, however, 24% of asthmatics are over perceivers of dyspnea, according to the same study, and these individuals have a high degree of anxiety and use medical services to a greater extent, exceeding the rate of use that would be truly consistent with the severity of their disease. However, there is also a group of patients who under- or overestimate airway caliber when stable. Perception of chronic dyspnea depends on such factors

TABLE 1
Characteristics of Patients With and Without Agreement Between Perception of Dyspnea in Stable Situation and During Acute Bronchial Obstruction*

	Agreement (n=44)	No Agreement (n=49)	P
Age, years	40 (17)	40 (18)	NS
Sex, % males	38	40	NS
Educational level	2.4 (1)	2.4 (0.9)	NS
Age of onset, years	26 (14)	27 (17)	NS
Years with asthma	2.4 (0.6)	2.4 (0.6)	NS
Emergencies, last year	0.4 (0.8)	0.9 (1.3)	.034
Hospitalizations	0.1 (0.4)	0.2 (0.5)	NS
Cough, last month	2 (1.2)	1.9 (1.1)	NS
Wheezing, last month	2.3 (1.2)	2.1 (1.1)	NS
Chest tightness	2.2 (1.1)	2.2 (1.1)	NS
Nighttime symptoms	1.8 (1.3)	1.7 (1.3)	NS
Chronic dyspnea (Borg)	1.3 (0.7)	1.3 (0.8)	NS
Chronic FEV ₁ , % predicted	78 (18)	77 (23)	NS
Depression (Beck)	10 (7)	11 (8)	NS
Anxiety (STAI-T)	23 (12)	24 (12)	NS
Quality of life	2.5 (1.8)	2.9 (1.8)	NS
PS ₂₀	2.7 (1.8)	2.8 (2)	NS

*Data are expressed as mean (SD), except for sex, for which percentage of males is shown. FEV₁ indicates forced expiratory volume in the first second; PS₂₀, dyspnea on the Borg scale when FEV₁ has decreased 20%; NS, not significant.

TABLE 2
Characteristics of Normal Perceivers of Dyspnea in Acute and Stable Situation Compared to Other Asthmatics*

	Normal Perceivers (n=32)	Others (n=61)	P
Age, years	40 (18)	40 (18)	NS
Sex, % males	38	39	NS
Educational level	2.5 (0.9)	2.4 (1)	NS
Age of onset, years	27 (14)	27 (17)	NS
Years with asthma	2.5 (0.6)	2.4 (0.6)	NS
Emergencies, last year	0.3 (0.6)	0.9 (1.3)	.038
Hospitalizations	0.1 (0.3)	0.2 (0.5)	NS
Cough, last month	2 (1.1)	1.9 (1.2)	NS
Wheezing, last month	2.3 (1.2)	2.1 (1.1)	NS
Chest tightness	2.2 (1.1)	2.2 (1.1)	NS
Nighttime symptoms	1.8 (1.3)	1.7 (1.2)	NS
Chronic dyspnea (Borg)	1.3 (0.7)	1.3 (0.8)	NS
Chronic FEV ₁ (% predicted)	76 (18)	77 (23)	NS
Depression (Beck)	10 (7)	11 (7)	NS
Anxiety (STAI-T)	23 (12)	24 (12)	NS
Quality of life	2.4 (1.8)	2.9 (1.8)	NS
PS ₂₀	2.7 (0.7)	3 (2)	NS

*Data are expressed as mean (SD), except for sex, for which percentage of males is shown. FEV₁ indicates forced expiratory volume in the first second; PS₂₀, dyspnea on the Borg scale when FEV₁ has decreased 20%; NS, not significant.

as age, degree of airflow limitation, and emotional state of the patient.¹⁹

In the present study we have seen that perceptions of dyspnea in periods of stability and during induced acute bronchoconstriction are independent phenomena, especially for those whose perception is anomalous. In the group we might describe as having appropriate perception of dyspnea, agreement between acute and chronic perception is higher, although it remains weak. We studied patients with the same degree of asthma severity—an intermediate level—in order to assure the homogeneity of the population. The main conclusion is that there is no acceptable level of agreement between how airway caliber is perceived by a patient in chronic phase and the manner of perception during acute attack. This should not surprise us if we consider studies on the language of dyspnea carried out some time ago.²¹⁻²³ Those studies show that the descriptors of dyspnea used by patients with a variety of cardiovascular diseases vary. Similarly, in situations of asthma attack, the descriptors patients use as bronchoconstriction is relieved also differ from those used when asthma is stable.

For these reasons, although it is true that it is useful for a physician who treats asthma to ask about dyspnea, that symptom should not be evaluated only when the patient is stable, as perception then is not consistent with perception during acute asthma attacks. Moreover, we observed no differences that would allow us to distinguish beforehand which asthmatics will perceive dyspnea consistently in both situations and which will have inconsistent perceptions. However, our findings show that patients who do perceive dyspnea similarly in both situations will use emergency services less often. This observation seems logical, given that the patient who does not have abnormal perception of dyspnea will

be more accurate in monitoring symptoms in prescribed self-management plans. Most importantly, however, this finding has clinical implications, given that the patient whose dyspnea perception is inconsistent cannot follow self-treatment protocols based on symptoms. Such a patient should monitor lung function objectively with a peak flow meter. Moreover, objective monitoring is necessary because such a patient's disease is poorly controlled, as shown by the greater number of visits to the emergency department. It is also noteworthy that we found no association between consistent chronic and acute perception of dyspnea on the one hand and emotional balance of the patient (anxiety-depression) or health related quality of life on the other.

Perception of dyspnea—a multifactorial symptom—is complex and we think that the best way to investigate it in clinical practice, for the purpose of establishing therapeutic guidelines in cases of difficult-to-manage asthma, consists in carrying out a bronchial challenge test and asking the patient to assess dyspnea as airway caliber changes. The perceptions recorded during the challenge test will not necessarily correlate with perception when asthma is stable, however. The most unpredictable group consists of those who are either over perceivers or poor perceivers during acute attacks. Such asthmatics might perceive dyspnea in any manner at all during stable phase and they are precisely the individuals whose disease management usually presents more problems. These findings support the position that perception of dyspnea in both stable phase and during acute bronchoconstriction should be taken into consideration whenever establishing a self-management protocol for a patient whose asthma is difficult to control.

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