

Perception of Dyspnea and Treatment Adherence in Asthmatic Patients

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OBJECTIVE: The majority of studies show that treatment adherence in chronic diseases such as asthma does not exceed 50%. Although the reasons may vary, it is clear that lack of treatment adherence is a determining factor in poor disease control. An association has also been observed between lack of perception of dyspnea and difficult-to-control asthma and with the occurrence of fatal or near-fatal asthma attacks. In this study we therefore attempted to demonstrate that one of the reasons that asthmatic patients do not adhere to treatment is a failure to perceive dyspnea associated with bronchial obstruction.

PATIENTS AND METHODS: We analyzed 2 groups of patients with moderate persistent asthma who had all been prescribed the same chronic treatment (a dose of inhaled drug administered with a dry powder inhaler every 12 hours). The first group comprised 24 patients (16 women and 8 men; mean [SD] age, 44 [15] years) who took the medication almost every day. The second group contained 24 patients (16 women and 8 men; mean [SD] age, 48 [14] years) who did not use the medication or only took it occasionally. There were no significant differences between the groups in terms of age, sex, percentage of smokers, socioeconomic and educational level, anxiety, depression, or spirometry variables. A histamine challenge test was carried out in all patients and the dyspnea perceived after each dose of the drug was measured on a modified Borg scale. The dose of histamine leading to a 20% reduction in forced expiratory volume in 1 second (FEV₁), perception of dyspnea associated with a 20% reduction in FEV₁ (PS₂₀), and the change in dyspnea measured on the Borg scale between baseline and 20% reduction in FEV₁ were analyzed. Patients were also classified as poor perceivers of dyspnea if the change in perception of dyspnea on the modified Borg scale was less than or equal to zero.

RESULTS: The group of patients with poor treatment compliance had a lower PS₂₀ (2.27 [1.9] vs 3.51 [1.8], $P=0.03$) and change in Borg score (1.64 [1.9] vs 2.7 [1.84], $P=0.057$), and they were more often poor perceivers of dyspnea (50% vs 21%, $P=0.034$).

CONCLUSIONS: There is a relationship between treatment adherence and dyspnea perception, such that poor perception is among the reasons for poor treatment adherence in patients with asthma.

Key words: *Dyspnea. Asthma. Perception. Treatment adherence.*

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Percepción de la disnea y cumplimiento terapéutico en pacientes con asma

OBJETIVO: El cumplimiento terapéutico en una enfermedad crónica como el asma no supera el 50% en la mayoría de las series. Aunque las razones sean de muy diversa índole, es evidente que el incumplimiento es un factor determinante en el mal control de la enfermedad. Por otra parte, la falta de percepción de la disnea se ha asociado con el asma de control difícil y con la aparición de crisis de asma fatal o casi fatal. Así pues, el objetivo del presente estudio ha sido intentar demostrar que una de las razones por las cuales los asmáticos no toman su medicación es que no tienen percepción de disnea cuando sus bronquios se obstruyen.

PACIENTES Y MÉTODOS: Hemos estudiado a 2 grupos de pacientes con asma persistente y moderada, a quienes se había prescrito el mismo tratamiento de forma continuada (una dosis de medicación inhalada en polvo seco cada 12 h). El primero estaba formado por 24 pacientes (16 mujeres y 8 varones; edad media \pm desviación estándar: 44 \pm 15 años) que tomaban casi todos los días la medicación, y el segundo, por otros 24 pacientes (16 mujeres y 8 varones; edad media: 48 \pm 14 años) que no tomaban la medicación o lo hacían sólo de vez en cuando. No había diferencias significativas entre los grupos en cuanto a edad, sexo, porcentaje de fumadores, niveles económico y educativo, ansiedad, depresión y parámetros espirométricos. A todos ellos se les realizó una prueba de broncoprovocación con histamina, y se midió la disnea experimentada tras cada dosis del fármaco en una escala modificada de Borg. Se determinaron la dosis de histamina con la que se alcanzó una caída del 20% en el volumen espiratorio forzado en el primer segundo (FEV₁), la percepción de disnea con una caída del FEV₁ del 20% (PS₂₀) y el cambio de disnea en la escala de Borg desde la situación inicial hasta la caída del 20% de FEV₁ (cambio en Borg). Además, se clasificó a los pacientes como hipoperceptores de disnea cuando su cambio en Borg fue igual o inferior a 0.

RESULTADOS: El grupo de incumplidores tenía menor PS₂₀ (2,27 \pm 1,9 frente a 3,51 \pm 1,8 en el grupo de cumplidores; $p = 0,030$) y cambio en Borg (1,64 \pm 1,9 frente a 2,7 \pm 1,84; $p = 0,057$), y eran con mayor frecuencia hipoperceptores de disnea (el 50% frente al 21%; $p = 0,034$).

CONCLUSIONES: Existe relación entre el cumplimiento del tratamiento y la percepción de disnea, de forma que uno de los motivos del incumplimiento terapéutico en los pacientes con asma es la hipopercepción de disnea.

Palabras clave: *Disnea. Asma. Percepción. Cumplimiento terapéutico.*

Introduction

Epidemiologic studies have shown that, in practice, asthma is poorly controlled in most patients, even when apparently appropriate treatment regimens are used.^{1,2} This paradox is mainly attributable to the low rate of treatment adherence observed among patients with asthma.³ Although the percentages vary according to the population studied, less than 50% of asthmatic patients display adequate adherence to regular treatment prescribed by their physician.^{4,5} In their list of diseases that are significantly affected by poor treatment adherence, the World Health Organization includes asthma along with others such as AIDS, hypertension, epilepsy, tuberculosis, and depression. Identifying strategies and solutions that improve treatment adherence has become a priority in our health care system, since lack of adherence affects the number of exacerbations and the costs involved, which increase unnecessarily.⁶

The phenomenon of treatment adherence is multifactorial and, therefore, extraordinarily complex. Patients' understanding of their disease and its treatment is a very important factor in improving adherence,⁷ and as a consequence, educational programs have a fundamental role to play.⁸ Researchers agree that the relationship between health care professionals and patients is probably the most powerful tool available for encouraging patient adherence to prescribed medication. However, of the many other factors that ultimately affect treatment adherence, 2 are particularly noteworthy; they are *a*) factors related to the complexity of the treatment prescribed and *b*) factors that depend on the patient, including personality, beliefs and attitudes towards health, and of course, perception of the disease. Thus, in the specific case of asthmatic patients it is reasonable to assume that treatment adherence will be affected by the perception of the central symptom of the disease, namely dyspnea.

Limited or poor perception of dyspnea occurs in approximately 13% of asthmatic individuals (according to our own experience⁹). Reduced perception of dyspnea is critically important, since it has been found to be associated with fatal or near-fatal asthma attacks^{10,11} and with difficult-to-control asthma.¹² For a number of years, our research group has investigated a variety of factors related to the perception of dyspnea in asthma.¹³⁻¹⁶ As part of this line of research, we decided to analyze a previously unconsidered possibility, namely that there is a relationship between reduced perception of dyspnea and lack of treatment adherence.

We hypothesized that one of the reasons that asthmatic patients do not adhere to treatment is that they are unable to perceive bronchial obstruction. We therefore compared the perception of dyspnea in a group of patients with moderate persistent asthma and good treatment adherence with that of a second group of patients with similar disease characteristics and the same prescribed medication but in whom treatment adherence was poor.

Patients and Methods

Patients with moderate persistent asthma (according to Global Initiative for Asthma criteria¹⁷) were consecutively enrolled by

a single physician in an outpatient respiratory medicine clinic. All patients had been prescribed treatment with a dry powder inhaler every 12 hours. The treatment comprised a combination of inhaled corticosteroids and long-acting β -agonists delivered as a single combined dose with the same inhaler. All patients were asked about their adherence to the treatment using the questionnaire described by Chambers et al.¹⁸ In this questionnaire, patients report the frequency of use of maintenance treatment for asthma on a 4-point scale from "never" to "at least twice a day almost every day." According to their responses, the patients were assigned to 2 groups: *a*) those who adhered to treatment, in other words, who took the treatment almost every day, and *b*) those who did not adhere to treatment, that is, who rarely if ever took the treatment.

Patients who consented to inclusion in the study completed a standardized data collection form that included the following information: *a*) standard demographic data (age, sex, smoking habit); *b*) self-administered questionnaires for the State-Trait Anxiety Inventory¹⁹ and the Beck Depression Inventory²⁰; and *c*) data on level of education and socioeconomic status. The last 2 variables were categorized on scales of 1 to 5, where 1 indicated no formal education and low socioeconomic status and 5 indicated higher education and high socioeconomic status. The patients were then asked to subjectively assess the severity of their asthma on a linear scale of 0 to 10, where 0 and 10 indicated minimum and maximum severity, respectively. Next, spirometry was carried out according to the recommendations of the Spanish Society of Pulmonology and Thoracic Surgery (SEPAR),²¹ and then a bronchial challenge test was performed to analyze perception of dyspnea following acute bronchoconstriction, according to the method described by Boulet et al.²² The bronchoconstrictor used was histamine phosphate, administered according to the technique described by Cockcroft et al.²³ Once it had been ensured that forced expiratory volume in 1 second (FEV₁) changed by no more than 5% from baseline following inhalation of placebo, the patient was asked to inhale increasing concentrations of aerosolized histamine phosphate for 2 minutes at tidal volume, beginning with a dose of 0.03 mg/mL and reaching a maximum dose of 32 mg/mL. Following a 1-minute rest after each dose, the patient was asked to perform 2 forced expiratory maneuvers to check for change in FEV₁. At the start of the test and before each dose administered, the patient was asked to assess the dyspnea perceived at that moment on a modified Borg scale.²⁴ 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 FEV₁ had fallen by at least 20% of the baseline value obtained with inhalation of placebo. Then, 600 μ g of salbutamol was administered from a pressurized canister through a spacer chamber in order to reverse the effects of bronchoconstriction. Reversal was checked 20 minutes later by spirometry.

As described previously,⁹ individual perception of bronchoconstriction was measured through calculation of the following variables: *a*) PS₂₀ (perception score for dyspnea on the Borg scale when FEV₁ was reduced by 20%); PS₁₅ (perception of dyspnea when FEV₁ was reduced by 15%); PS₁₀ (perception of dyspnea when FEV₁ was reduced by 10%); and *d*) change in Borg score (mathematical difference between the dyspnea perceived at baseline and that perceived with a 20% reduction in FEV₁). Patients were classified as poor perceivers of dyspnea when the change in Borg score was 0 or less.

Statistical Analysis

Data for all variables were entered into a database to be managed with the SPSS statistical package (SPSS Inc, Chicago, Illinois, USA), version 11, for Windows. Analysis of variance

or a χ^2 test were used as appropriate to analyze differences between the 2 patient groups for each of the variables considered.

Results

The study included 48 patients: 24 who adhered to treatment and 24 who did not. The general characteristics of the 2 groups are shown in Table 1. Both groups were made up of individuals of an intermediate age (mean age, 45 years; range, 30-60 years). The groups had an identical sex distribution, similar asthma severity (moderate persistent), and comparable baseline FEV₁. The groups were also comparable in terms of the number of active smokers, level of education, and socioeconomic status. Scores on the anxiety and depression inventories were also equivalent in the 2 groups. The subjective severity of asthma and baseline dyspnea did not differ between the groups. The only difference observed was in the age at onset of asthma, such that in patients who adhered to treatment the disease had begun at an earlier age and they had therefore lived with asthma longer.

Analysis of the perception of dyspnea after provocation of acute bronchoconstriction in the laboratory, however, revealed marked differences between the 2 groups of patients. Whereas an absence of dyspnea when FEV₁ was reduced by 20% was reported by only 5 patients (21%) who adhered to treatment, 12 of the patients who did not adhere to treatment (50%) had a score of 0 on the modified Borg scale with this reduction in FEV₁ ($P=.034$) (Figure 1). Furthermore, the values of PS₁₀, PS₁₅, and PS₂₀ were significantly lower in patients who did not adhere to treatment compared to those who did. Thus, at all the levels of obstruction analyzed during the bronchial challenge test, the dyspnea perception scores of patients who did not adhere to treatment were notably lower than the scores of patients who did (Table 2). The dose of histamine that led to a 20% reduction in FEV₁ did not differ significantly between the groups. The curves for perception of dyspnea with acute bronchial obstruction thus differed between those patients who adhered to treatment and those who did not (Figure 2).

Discussion

Reduced perception of dyspnea in patients with asthma leads to greater difficulty in controlling the disease and, in some cases, leads to severe asthma attacks due to a failure of the patient to recognize alarm symptoms and instigate self-management procedures. There have been no previous reports of a failure to perceive dyspnea being associated with lack of treatment adherence during the stable phase of the disease. In this study, we selected patients with moderate persistent asthma in whom inhaled maintenance treatment had been prescribed to control the disease and then we assessed differences in the perception of dyspnea between patients who adhered to treatment and those who did not. Given that adherence can be influenced by the complexity of the treatment regimen⁵ and the way it is administered, the patients included in the study had received the same prescription. In an effort to minimize the possibility that differences in treatment

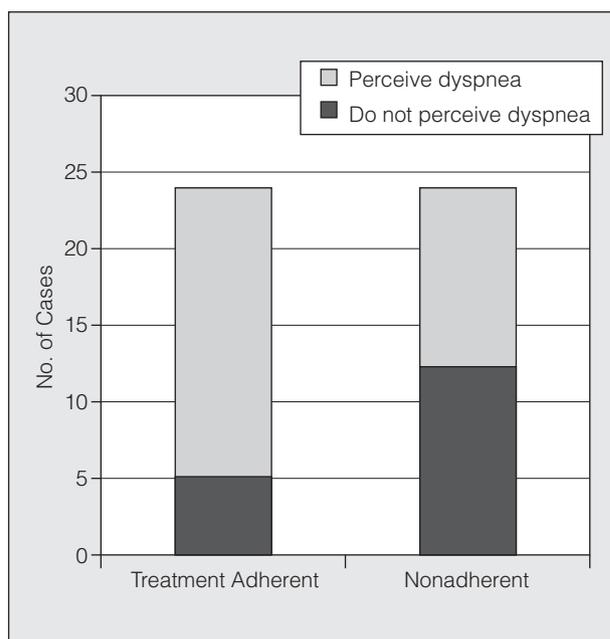


Figure 1. Bar chart showing the number of patients who perceived no change in dyspnea with acute bronchial obstruction of 20%.

TABLE 1
General Characteristics of the Study Group:
Treatment-Adherent Versus Nonadherent Patients^a

	Nonadherent (n=24)	Treatment-Adherent (n=24)	P
Age, y	48 (14)	44 (15)	NS
Sex, male/female	8/16	8/16	NS
FEV ₁ , % predicted	80 (12)	78 (15)	NS
Basal dyspnea, Borg score	0.56 (0.7)	0.71 (0.14)	NS
BDI score	28 (6)	26 (5)	NS
STAI score	19 (8)	20 (8)	NS
Education	3.1 (0.52)	3.2 (0.47)	NS
Socioeconomic status	3.01 (0.49)	3.17 (0.48)	NS
Subjective severity	3.65 (2.3)	4.91 (2.67)	NS
Smokers, yes/no	4/20	2/22	NS
Age at onset of asthma, y	32 (10)	22 (11)	.039

Abbreviations: BDI, Beck Depression Inventory; FEV₁, forced expiratory volume in 1 second; NS, not significant; STAI, State-Trait Anxiety Inventory.
^aData are shown as means (SD) or number of patients.

TABLE 2
Perception of Dyspnea in
Treatment-Adherent
and Nonadherent Patients^a

	Nonadherent (n=24)	Treatment-Adherent (n=24)	P
PD ₂₀ , mg/mL	0.26 (0.22)	0.59 (0.84)	.066
Change in Borg score	1.64 (1.9)	2.7 (1.84)	.057
PS ₂₀	2.27 (1.9)	3.51 (1.8)	.030
PS ₁₅	1.5 (1)	2.5 (1.1)	.002
PS ₁₀	1 (0.7)	1.4 (0.6)	.039

Abbreviations: PD₂₀, dose of histamine leading to a 20% reduction in forced expiratory volume in 1 second (FEV₁); PS₂₀, perception of dyspnea with a 20% reduction in FEV₁; PS₁₅, perception of dyspnea with a 15% reduction in FEV₁; PS₁₀, perception of dyspnea with a 10% reduction in FEV₁.
^aData are expressed as means (SD).

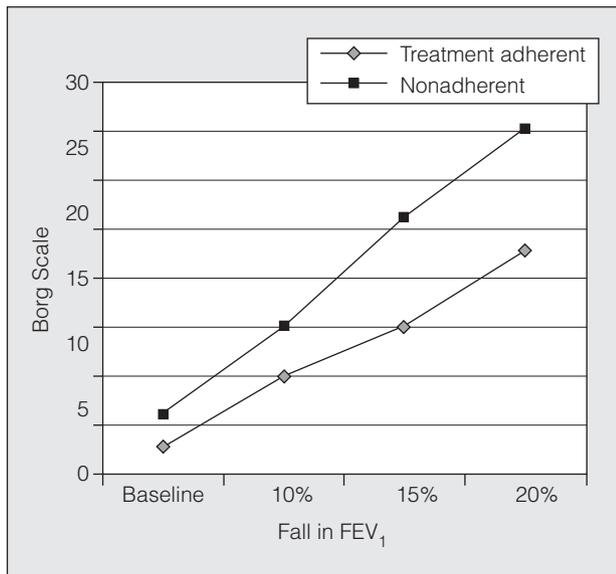


Figure 2. Perception of dyspnea on a modified Borg scale with acute bronchial obstruction in the laboratory. FEV₁ indicates forced expiratory volume in 1 second.

adherence were related to the treating physician (way of explaining the nature of the disease or the requirement for daily maintenance treatment), patients were selected from a single clinic in which patients were all seen by the same pulmonologist. It is noteworthy that the treatment-adherent patients corresponded to those in whom the disease had been present for longest and in whom asthma had appeared at a younger age; this observation may suggest that younger patients find it easier to understand the disease and the need for maintenance treatment, and that patients in this group were more familiar with the concept of chronic disease, given that they had lived with asthma longer.

Our results show that treatment adherence and perception of dyspnea are closely related in patients with asthma. Any reduction in FEV₁ was perceived to a lesser extent in patients who did not adhere to treatment. Furthermore, 50% of those patients were unable to perceive a 20% reduction during the nonspecific bronchial challenge test. There were no differences in socioeconomic status or emotional state (anxiety and depression) between the groups, indicating that these were not confounding factors for the results obtained.²⁵

One possible criticism of this study is the absence of an objective measure of treatment adherence.²⁶ Clearly, direct measures of adherence to treatment would add value to the results obtained but, due to the complexity of such measures, we opted for the simple procedure of obtaining information from the patients themselves through the use of validated questionnaires. It can be assumed that at least those patients who reported that they did not adhere to treatment were telling the truth. We therefore consider that the procedure used to classify patients as adherent and nonadherent does not undermine the results obtained and that, although treatment adherence in asthmatic patients depends on many different factors, one of them is perception of dyspnea.

Improving treatment adherence in asthma is the responsibility not only of physicians and their patients but also of health care institutions. Although there will be no single or straightforward solution, it is our opinion that the results of this study will play an important role in the efforts that need to be made on an ongoing basis by physicians. The conclusion that can be drawn is that many patients who do not adhere to prescribed treatment fail to do so because they are unable to adequately recognize dyspnea. Educational programs in asthma largely focus on symptoms but should also involve objective measures of improvement, since not all patients perceive the symptoms adequately. According to the study of Ohm and Aaronson,²⁷ who used a different method to ours but with a similar objective, adherence is more associated with variability of peak expiratory flow than with perception of symptoms. Taken together, these findings suggest that the inclusion of techniques for recognition of dyspnea should be considered in educational programs for asthma patients. Our results suggest that adequate instruction and training in the perception of dyspnea could be useful in patients with asthma, since it could improve treatment adherence. It should be remembered that improved treatment adherence will also reduce health care costs. Patients in whom the disease is poorly controlled not only place their lives at risk from potentially serious exacerbations but also consume more health care resources of all types, precisely as a result of this poor control of the disease. Without doubt, health care managers should take this factor into consideration.

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