

RISK FACTORS

Looking at Allergens Increases Symptom Report in Patients with Allergic Asthma

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Objective. Accurate symptom perception is highly important for self-management and clinical treatment of asthma. Recent findings suggest that psychological factors can greatly impact asthma symptom perception. This study examined whether looking at allergens would lead to changes in perceived asthma symptoms. **Methods.** Allergic asthma patients and healthy controls viewed picture series containing either allergens or neutral material. Symptom reports and respiratory parameters were measured. **Results.** The present results demonstrate that looking at pictures with allergens increases subjective symptom reports in patients with allergic asthma in the absence of changes in objective respiratory parameters, but not in healthy controls. **Conclusions.** The results are suggestive of preceding learning processes during which patients have learned the association between visual representations of allergens and symptom-inducing effects of real contact with these allergens. This impacts asthma symptom perception without changes in respiratory status and might influence treatment decisions.

Keywords allergy, asthma, learning, perception, symptoms

INTRODUCTION

Asthma is a prevalent inflammatory airway disease with an estimated 300 million affected individuals worldwide which causes a considerable individual and socio-economic burden (1). Allergic asthma is among the most common phenotypes of pediatric and adult asthma (2). Prominent allergens include domestic mites, furred animals, and pollens, and contact with these allergens can elicit asthma symptoms such as dyspnea and cough, and also itch or urge to sneeze (1). Albeit usually experienced as unpleasant, the early and accurate perception of these symptoms is also important for successful self-management and clinical treatment of asthma because it motivates appropriate health behavior (3). Reduced symptom perception in patients with asthma can lead to increased morbidity due to delayed or inadequate medication use, delayed visits to the physician or emergency department, and might even result in near-fatal and fatal attacks (4, 5). In contrast, over-perception of respiratory symptoms can increase morbidity by leading to excessive use of medication or activity avoidance (5, 6). Previous studies demonstrated that psychological factors such as learning processes and affective states can strongly impact the perception of asthma symptoms independent from peripheral respiratory mechanisms (7, 8). However, popular lay theory assumes that merely looking at allergens can cause respective symptoms (9, 10) which—apart from anecdotal reports (11)—lack scientific proof. We formally tested this assumption by examining whether allergic asthma patients would show increased symptom reports

and respiratory responses to allergic versus nonallergic picture presentations when compared with healthy controls.

METHOD

After providing written informed consent, 19 patients with physician diagnosed asthma, based on the criteria of the Global Initiative for Asthma (1), were compared with 19 healthy controls being matched for age, weight, height, and gender (Table 1). Participants were recruited with notices at the University of Hamburg. Patients were included if they exhibited a previous allergy diagnosis (performed by pulmonologist or general practitioner with additional training as allergologist) based on a positive skin-prick test response to at least two out of three common allergens (house dust mite, cat fur, pollens) and agreed to refrain from taking their asthma/allergy medication (except inhaled corticosteroids) for 16 hours prior to the study. All participants were pre-screened with a diagnostic interview (12) to exclude significant psychological conditions and reported being nonsmokers and free of major respiratory symptoms in the preceding 4 weeks. In addition, the level of positive and negative affectivity of all participants prior to testing was controlled with the state version of the Positive And Negative Affect Schedule (PANAS) questionnaire (13). The study protocol was approved by the local medical ethics committee.

After standardized instructions and spirometric lung function testing, participants breathed room air via a mouthpiece and a breathing circuit. Respiratory parameters (airflow, $\dot{V}$; tidal volume, V_T ; breathing frequency, f ; inspiratory time, T_I ; and respiratory resistance, R_{OS}) were continuously recorded using a pneumotachograph and forced oscillation technique. After a

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TABLE 1.—Mean (SD) baseline characteristics of study groups.

	Patients with asthma	Healthy controls
Age (year)	32.2 (10.6)	31.7 (7.1)
Sex (female/male), No.	14/5	13/6
Weight (kg)	69.8 (11.0)	67.9 (16.3)
Height (cm)	172.7 (8.5)	173.5 (10.7)
FEV ₁ (L)	3.89 (0.99)	4.31 (0.89)
FEV ₁ (% predicted)*	108.12 (20.15)	117.92 (9.70)
Positive affectivity	30.1 (5.5)	30.3 (5.3)
Negative affectivity	12.7 (3.7)	11.7 (1.8)
Educational level ^a	19	17
Asthma severity (GINA criteria), No.		
Intermittent	6	—
Mild	8	—
Moderate	3	—
Severe	2	—
Asthma duration (year)	20.8 (9.1)	—

Note: FEV₁ = forced expiratory volume in 1 s.

* $p < .05$ for the comparison between patients with asthma and healthy controls.

^aNumber of individuals with university entrance diploma.

practice run, two picture series (each 3 min) were presented in randomized order on a monitor, separated by a 5-min rest period. The Allergy series consisted of 30 color-pictures depicting house dust, cat fur, and various plants with their pollens. The Neutral series consisted of 30 color-pictures from the International Affective Picture System (IAPS) depicting emotionally neutral scenes including household objects and neutral faces (14). All pictures within each series were presented for 6s without interstimulus interval. After each series, participants rated on separate visual analog scales (0 cm = not noticeable and 10 cm = maximally imaginable) the perceived intensity of the following, "not further described symptoms," presented in German language: difficult breathing, work of breathing, effort of breathing, air hunger, chest tightness, urge to cough, urge to sneeze, itching, watery eyes, and irritated mucosa. A mean symptom score was calculated by averaging the responses across the 10 symptoms for each participant (means for each individual symptom are presented in Table 2). Patients were unaware of the tested hypothesis, but were debriefed after the experiment.

TABLE 2.—Mean (SD) ratings for the intensity of individual symptoms.

	Patients with asthma		Healthy controls	
	Neutral	Allergy	Neutral	Allergy
Difficult breathing	2.5 (2.6)	2.9 (2.5)	3.0 (2.5)	2.5 (2.5)
Effort of breathing	2.7 (2.6)	2.8 (2.6)	3.1 (2.4)	2.5 (2.4)
Air hunger	2.9 (2.8)	2.9 (2.8)	3.2 (2.9)	3.0 (2.7)
Chest tightness	1.8 (2.2)	1.7 (2.2)	1.4 (1.9)	1.3 (1.9)
Work of breathing	2.9 (3.0)	2.8 (2.4)	3.4 (2.5)	2.8 (2.4)
Irritated mucosa	1.7 (2.4)	2.2 (2.7)	1.9 (2.7)	1.8 (2.8)
Watery eyes	0.8 (1.7)	0.8 (1.7)	1.2 (2.2)	0.7 (1.1)
Itching	0.3 (0.4)	0.6 (1.1)	0.5 (1.1)	0.4 (0.8)
Urge to sneeze	0.2 (0.3)	1.1 (1.8)	0.1 (0.1)	0.2 (0.5)
Urge to cough	1.0 (2.3)	1.4 (2.1)	0.3 (1.0)	0.3 (0.6)

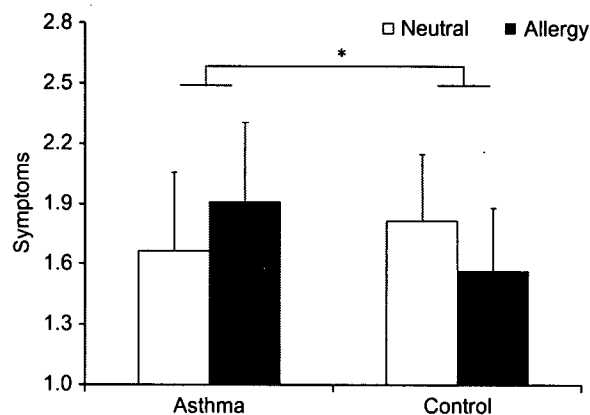


FIGURE 1.—Mean (SE) ratings for the intensity of subjective symptoms in patients with allergic asthma and healthy controls during looking at picture series depicting allergens or neutral scenes. * $p < .05$.

Baseline characteristics were analyzed with *t*-tests. Respiratory parameters and subjective reports were analyzed in separate repeated measures ANOVAs with a 2 (group: asthma, control) $\times$ 2 (picture condition: Allergy, Neutral) design. In addition, correlation analyses (Pearson's *r*) were performed.

RESULTS

No differences in baseline characteristics and affective state were observed between patients and controls, except lower lung function in patients (Table 1). As shown in Figure 1, a significant group $\times$ condition effect indicated greater increases in symptom intensity ratings from the Neutral to the Allergy condition in patients (1.66 ± 1.71 and 1.91 ± 1.71) compared to controls (1.81 ± 1.46 and 1.57 ± 1.37) ($F(1,36) = 2.74$, $p < .05$). Respiratory parameters showed no differences between conditions and groups (all p -values $> .16$) with the exception of breathing frequency which increased slightly more from the Neutral to the Allergy condition in patients (12.11 ± 3.17 and 12.82 ± 3.50) compared to controls (12.61 ± 3.29 and 12.64 ± 3.45) ($F(1,36) = 5.03$, $p < .05$). However, symptom intensity ratings in patients were not correlated with breathing frequency during the Allergy or the Neutral condition (for mean symptom score: all r -values < 0.20 , all p values $> .44$; for the 10 single symptoms: all r -values $< .34$, all p -values $> .16$).

DISCUSSION

The present results demonstrate that looking at pictures with allergens can increase subjective symptom reports in patients with allergic asthma in the absence of relevant changes in objective respiratory parameters, but not in healthy controls. This observation is most likely related to preceding learning processes during which patients have learned the association between visual representations of allergens and subsequent effects that contact with these allergens causes, that is, asthma symptoms due to changes in lung function. As a result of this associative

learning process, mere visual representations of these allergens might lead to increased symptom reports even without objective respiratory changes. This interpretation is in line with previous studies demonstrating that respiratory symptoms can experimentally be conditioned to harmless cues such as odors or colored inhalers (7, 15). These increases in asthma symptom perception caused by learning processes might lead to negative health consequences, for example, due to excessive use of medication. For example, asthma patients with high perception of resistive load-induced dyspnea demonstrated significantly greater beta-2 agonist consumption than those patients with normal or low perception of dyspnea (5). However, future studies are needed to examine whether increased symptom perception due to learning processes is related to an unfavorable course of disease by directly testing its impact on clinical outcomes such as medication use. In this regard, it will be interesting to test for individual differences that might facilitate such learning processes, including affective states (7).

CONCLUSIONS

Taken together, the present results underscore that subjective asthma symptom reports are not always closely related to objective lung function. Because subjective symptom perception provides the basis for patients' health behavior and for clinical treatment decisions, clinicians should be aware of this imperfect relation between subjective symptoms and objective lung function when planning respective treatments.

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DECLARATION OF INTEREST

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