ORIGINAL ARTICLE

Effect of Asthma, Aeroallergen Category, and Gender on the Psychological Status of Patients With Allergic Rhinitis

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Abstract

Background: Despite increasing evidence for an association between allergy and psychological disorders in patients with allergic rhinitis (AR), the relationship between comorbid AR and asthma is not clear. The objective of this study was to investigate the effect of concomitant asthma, gender, and sensitization to a particular aeroallergen category on the psychological status of AR patients.
Methods: We analyzed 524 AR patients (311 males/213 females) aged 16 to 60 years using the Symptom Checklist-90 (SCL-90) and found that 34.2% had persistent AR and 65.8% intermittent AR. Overall, 61 patients (11.6%) had concomitant asthma.
Results: The SCL-90 scores of AR patients were significantly higher for the somatization, obsessive-compulsive, hostility, and psychoticism dimensions than those of the healthy controls. In contrast, the SCL-90 scores for persistent AR and intermittent AR patients were significantly different. Concomitant asthma significantly impacted the AR individuals' SCL-90 dimension scores for the obsessive-compulsive, interpersonal sensitivity, depression, and paranoid ideation subscales. Gender and sensitization to a particular aeroallergen category did not affect the SCL-90 scores of AR patients individually, but led to significant differences in SCL-90 scores for the phobic anxiety and psychoticism subscales when considered in combination.
Conclusion: Our results suggest that comorbid asthma exerts an independent main effect on the psychological status of AR patients.

Key words: Allergic rhinitis. Asthma. Aeroallergen. Gender. Psychological status.

Resumen

Introducción: A pesar de la evidencia de un aumento de la asociación entre alergia y enfermedades psicosociales en pacientes con rinitis alérgica (RA), la relación entre la comobilidad entre RA y asma no es clara. El objetivo de este estudio fue investigar el efecto del asma concomitante, género, y la sensibilización a una categoría particular de aeroalérgeno, sobre el estado psicológico de pacientes con AR.
Métodos: Analizamos 524 pacientes con RA (311 varones/213 mujeres) de 16 a 60 años de edad, aplicando un listado de síntomas (SCL-90) y encontramos que el 34,2% tenían RA persistente y el 65,8% RA intermitente. En total, 61 pacientes (11,6%) tenían asma concomitante.
Resultados: La puntuación de SCL-90 de pacientes con RA fue significativamente mayor para la somatización, compulsión, hostilidad, y subescalas de psicosis que aquellos de los controles sanos. En contraste, la puntuación del SCL-90 de pacientes con RA persistente y RA intermitente fue significativamente diferentes. El asma concomitante significativamente impactó la puntuación de la subescala SCL-90 de los individuos con RA respecto a la compulsión, sensibilidad interpersonal, depresión y subescalas de paranoia. El género y la sensibilización según categoría de aeroalérgeno no afectó la puntuación SCL-90 de pacientes con RA de manera individual, pero mostró diferencias significativas en la puntuación de SCL-90 para las subescalas de fobia y psicosis cuando éstas se consideraban agrupadamente.
Conclusión: Nuestros resultados sugieren que el asma comórbido ejerce un efecto independiente sobre el estatus psicológico de pacientes con RA.

Palabras clave: Rinitis alérgica, asma, aeroalérgeno, género, Estatus psicológico.

Introduction

Allergic rhinitis (AR) affects people the world over, and its already high prevalence is increasing rapidly, especially in industrialized countries [1]. Data from China show that the prevalence of self-reported AR in the center of several cities ranges from 8.7% to 24.1% [2]. Similarly, a more recent study, investigating a population-based cohort of children aged 6-13 years from 8 cities across China showed the prevalence of AR to range from 3.9% to 16.8% [3].

A large body of evidence suggests that the impact of AR symptoms is not limited to physical effects on the nose and eyes, but that it extends to marked impairment in the quality of life of patients with moderate-to-severe disease [4-6]. Symptoms can disrupt sleep, leading to fatigue, irritability, frustration, altered motivation or behavior, and reduced ability to concentrate [4,5]. Evidence suggests that poor sleep quality and sleep disorders may also significantly affect mental health and cause or increase the risk of depression, anxiety, and psychiatric diseases [6-9].

Although several studies have investigated the influence of psychosocial factors on atopic disorders and the effect of atopic disorders on mental health [10-13], a recent systematic review and meta-analysis revealed a significant bidirectional relationship between psychosocial factors and future atopic disorders, as well as between atopic disorders and future poor mental health [14]. Moreover, a subgroup meta-analysis of healthy populations and patients with atopic disorder demonstrated that psychosocial factors played a role in both etiology and prognosis. Evidence from population-based studies suggests that patients with AR have higher rates of depression, anxiety, sleep disturbance, and psychosocial problems than individuals without allergic disease [6,7,11,15,16]. Moreover, AR may even be a risk factor for suicide [13,17]. We recently demonstrated that psychological status scores for somatization, depression, anxiety, hostility, and psychosis were significantly higher in patients with seasonal AR than in healthy nonallergic individuals [18]. Moreover, women with moderate-to-severe persistent AR, especially single patients, showed significantly poorer psychological function than healthy nonallergic women [19].

As AR and asthma often manifest as comorbid conditions [20,21], they are increasingly considered to form part of a continuum of inflammatory disease involving a common airway [22], in which treatment of one condition may potentially decrease comorbidity of the other [23,24]. However, the way in which comorbid asthma influences the psychological status of AR patients remains unclear. The objective of the current study was to investigate the psychological profile of AR patients with and without comorbid asthma. The influence of aeroallergen category and gender on the psychological profiles of AR patients was also investigated.

Methods

Study Design

Patients with AR were recruited prospectively from the Rhinology Clinic of the Otolaryngology, Head and Neck Surgery Department of Beijing Tongren Hospital from February 2009 to November 2009. At an initial screening visit, we recorded demographic and clinical characteristics (gender, age, educational background, course of AR, AR type, association between AR and asthma or eczema, drug allergy, major life events in the past week, and overall general health). All eligible patients were asked to return to the clinic for a subsequent visit within 1 week, and the severity of their symptoms and their psychological status were further evaluated.

Prior to recruitment, written informed consent was obtained from all participants or their parents (if the participants were aged <18 years). The study protocol was approved by the Ethics Committee of Beijing Tongren Hospital and registered with ClinicalTrials.gov (NCT01295255).

Patients

Male and female patients aged 16-60 years with a history of intermittent AR (IAR) or persistent AR (PAR) diagnosed according to the ARIA guidelines [20] were eligible for participation in the study. All patients had a positive skin prick test (SPT) result to at least 1 of the allergens tested (*Dermatophagoides pteronyssinus* [Der p], *Dermatophagoides farinae* [Der f], animal hair, tree mix, grass mix, cereal mix, mugwort, dandelion, giant ragweed, *Chenopodium album*, *Humulus species*, locust bean, *Blatella germanica*, pine, plantain, *Curvularia lunata*, *Candida albicans*, *Penicillium notatum*, *Alternaria tenuis*, and *Aspergillus fumigatus*) (ALK-Abelló). The SPT result for each allergen was estimated as a skin index value (SI), namely, the ratio of allergen-induced wheal size (mm) to histamine-induced wheal size on a 4-point scale, as follows: ≤ 0.5 (+); $0.5 < SI \leq 1.0$ (++); $1.0 < SI \leq 2.0$ (+++); and $SI > 2.0$ (++++). A positive SPT was defined as an SI of 0.5-1.0 (++) and above. Similarly, patients with a diagnosis of comorbid asthma based on positive SPT responses to the common allergens listed above or physician-diagnosed asthma with wheezing according to the Global Initiative for Asthma (GINA) guidelines [25] were eligible to participate the study.

Patients also had to have moderate-to-severe nasal symptoms, including nasal itching, sneezing, nasal obstruction, and rhinorrhea. Each symptom was scored on a visual analog scale of 0 to 3 and (0, no symptoms; 1, mild symptoms; 2, habitual symptoms that are easily tolerated; and 3, habitual symptoms that are difficult to tolerate). Patients who had not received medication in the previous week and had pale edematous nasal mucosa, nasal discharge, and a swollen inferior turbinate (nasal endoscopy) were included in the study.

AR patients with eczema, any comorbid condition other than asthma, or tumor in the nasal cavity, as well as those who had experienced an acute infection in the previous week or were experiencing negative life events causing depression and anxiety were excluded from the study. Similarly, patients who failed to complete the study questionnaires were excluded.

Evaluation of Psychological Status

The psychological status of the study patients was evaluated using the Symptom Checklist-90 (SCL-90), a screening instrument comprising 9 symptom dimensions (somatization, obsessive-compulsive, interpersonal sensitivity, depression,

anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism) [26,27]. The checklist was self-administered and aimed to obtain information about patients' experience and perception of the previous week; the SCL-90 scores were recorded to determine the final scores.

In order to compare the psychological profiles of healthy nonallergic individuals, the SCL-90 scores obtained for the AR patients in the present study were compared with data from a cohort of 1388 healthy Chinese individuals (724 males and 664 females) aged 18-60 years [28].

Statistical Analysis

All data were analyzed using SPSS 15.0 (SPSS Inc.), with statistical significance set at $P<.05$. Independent sample *t* tests were used to compare the scores of the AR participants and healthy controls for the 9 SCL-90 dimensions, as well as the effects of age, gender, AR type, and concomitant asthma. In order to take account of the effect of the covariates including age and gender, an analysis of covariance (ANCOVA) was performed to examine the influence of aeroallergen categories and AR type on the 9 dimensions on the SCL-90. Multivariate analysis of variance (MANOVA) was used to evaluate interactions between the 3 dependent variables allergen type, asthma, and gender.

Results

Population Characteristics

The study population comprised 524 patients with AR (311 males and 213 females), of whom 34.2% were classified as PAR and the remaining 65.8% as IAR (Table 1). Comorbid asthma was recorded in 61 patients (11.6%). A general classification according to the SPT-based aeroallergen category showed that 293 patients (55.9%) were sensitized to house dust mite (Der p and Der f), 344 patients (65.6%) were sensitized to pollen (trees, grasses, cereals, mugwort, dandelion, giant ragweed, *C album*, *Humulus*, locust bean, pine, and plantain), and 180 patients (34.4%) were sensitized to other allergens (animal hair, *B germanica*, *C lunata*, *C albicans*, *P notatum*, *A tenuis*, and *A fumigatus*). We divided the combinations of aeroallergens into 7 categories; the frequency of each combination pattern is shown in Table 1.

Table 1. Demographic and Clinical Characteristics of the Study Population

Characteristic	AR Cases (N=524)
Mean (SD, range) age, y	31.5 (14.8, 16-60)
Sex (male/female), No. (%)	311 (59.4)/213 (40.6)
PAR/IAR, No. (%)	179 (34.2)/345 (65.8)
Allergen category, No. (%)	
House dust mites	96 (18.3)
Pollens	154 (29.4)
Other	36 (6.9)
House dust mite + pollen	94 (17.9)
House dust mite + other	48 (9.2)
Pollen + other	41 (7.8)
House dust mite + pollen + other	55 (10.5)
With asthma/without asthma, No. (%)	61 (11.6)/453 (88.4)

Abbreviations: IAR, intermittent allergic rhinitis; PAR, persistent allergic rhinitis.

Psychological Profiles of AR Patients and Nonallergic Healthy Controls

Significant differences were found between AR patients and nonallergic controls in the SCL-90 scores for somatization, obsession-compulsion, interpersonal sensitivity, hostility, and psychoticism (Table 2). We divided the patients into 9 age groups (<20; 20-24; 25-29; 30-34; 35-39; 40-44; 45-49; 50-54; and 55-60) in order to investigate the influence of age on mental status. ANOVA demonstrated that there was no correlation between age and mental status ($P>.05$, data not shown). When participants were analyzed by gender, men had a poorer psychological status than women, especially in somatization ($P=.01$), obsessive-compulsive ($P=.02$), interpersonal sensitivity ($P=.02$), depression ($P=.00$), phobic anxiety ($P=.01$), and paranoid ideation ($P=.01$) (Table 3).

However, analysis of the psychological profiles of AR patients according to AR classification (PAR and IAR) considering covariates after adjusting for age and gender

Table 2. System Checklist-90 Scores of Patients With Allergic Rhinitis

	Mean (SD)			
	Patient	Controls	T Value	*P* Value
Somatization	1.56 (0.53)	1.37 (0.48)	8.29	.00[a]
Obsessive-compulsive	1.71 (0.68)	1.62 (0.54)	3.16	.00[a]
Interpersonal sensitivity	1.56 (0.64)	1.65 (0.61)	3.19	.00[a]
Depression	1.52 (0.59)	1.50 (0.59)	0.87	.39
Anxiety	1.44 (0.54)	1.39 (0.43)	1.91	.06
Hostility	1.63 (0.66)	1.46 (0.55)	5.89	.00[a]
Phobic anxiety	1.24 (0.41)	1.23 (0.41)	0.82	.42
Paranoid ideation	1.45 (0.58)	1.43 (0.57)	0.77	.44
Psychoticism	1.46 (0.51)	1.29 (0.42)	7.59	.00[a]

[a]$P<.01$.

Table 3. Effect of Gender on System Checklist-90 Scores in Patients With Allergic Rhinitis

	Mean (SD)			
	Male	Female	T Value	*P* Value
Somatization	1.58 (0.55)	1.53 (0.51)	2.72	.01[a]
Obsessive-compulsive	1.78 (0.73)	1.62 (0.58)	2.33	.02[b]
Interpersonal sensitivity	1.61 (0.67)	1.49 (0.58)	2.44	.02[b]
Depression	1.57 (0.64)	1.45 (0.49)	2.84	.00[a]
Anxiety	1.49 (0.59)	1.36 (0.44)	1.31	.19
Hostility	1.66 (0.68)	1.58 (0.61)	1.21	.23
Phobic anxiety	1.26 (0.44)	1.21 (0.37)	2.57	.01[a]
Paranoid ideation	1.50 (0.64)	1.38 (0.47)	3.32	.01[a]
Psychoticism	1.52 (0.56)	1.38 (0.43)	1.18	.24

[a]*P*<.01.
[b]*P*<.05.

showed no significant differences in any SCL-90 dimension scores (*P*>.05, data not shown).

Effects of Aeroallergen Category and Asthma on the Psychological Status of AR Patients

Regarding the SCL-90 score as a dependent variable and the 7 combination patterns of the aeroallergen category as independent variables, ANOVA revealed no significant correlation between the scores for the 9 SCL-90 dimensions and aeroallergen types (*P*>.05, data not shown). Likewise, when we investigated whether or not comorbid asthma affected the AR patient's mental status, we found a significant effect only for phobic anxiety (*P*=.028). Furthermore, when age and gender were considered as 2 effect factors, ANCOVA of the SCL-90 scores adjusted for covariates, including age and gender, demonstrated that concomitant asthma significantly affected obsessive-compulsive (*P*=.011), interpersonal sensitivity (*P*=.008), depression (*P*=.021), and paranoid ideation (*P*=.003).

MANOVA of the SCL-90 scores using the 7 aeroallergen category combinations, concomitant asthma, and gender as independent variables indicated that concomitant asthma had a significantly independent effect on psychological status, whereas aeroallergen category and gender had a combination effect on psychological status (Table 4). Furthermore, gender and aeroallergen category significantly influenced phobic anxiety (*P*=.015) and psychoticism (*P*=.009).

Table 4. Multivariate Analysis of Variance of Asthma, Aeroallergen Category, and Gender

Effect	Pillai Trace Value	*F* Value	*P* Value
Intercept	0.782	197.470[a]	.000[b]
With or without asthma + allergen category	0.116	1.090	.304
Allergen category + gender	0.161	1.530	.008[b]
With or without asthma + gender	0.012	0.680[a]	.728
With or without asthma	0.034	1.928[a]	.046[c]
Allergen category	0.104	0.974	.530
Gender	0.019	1.077[a]	.378

[a]Exact statistics
[b]*P*<.01.
[c]*P*<.05.

Discussion

Several authors have analyzed the association between atopic/allergic diseases and psychological disorders such as anxiety and depression [10-13,16,18,19], as well as the psychoneuroimmunologic mechanisms [26,29,30] underlying this association, thus leading us to a better understanding of the overall pathophysiology of AR. To our knowledge, this is the first study to explore the relationship between comorbid asthma, aeroallergens, and gender and its effect on the psychological status of AR patients. The findings of the present study are consistent with those of Bavbek et al [31], who also used the SCL-90 to study the psychological profiles of patients with perennial AR and seasonal AR and found significant differences in all the SCL-90 subscale scores. These differences were particularly pronounced for the somatization, depression, and general symptom index subscales. Moreover, in the AR patients, a positive correlation was observed between total symptom scores and SCL-90 scores for the subgroups of general symptom index, somatization, and difficulties in interpersonal relationships. The authors suggested that regardless of the type of rhinitis, patients with AR can develop a group of psychological complaints related to symptom severity [31]. Our study also demonstrated that although no significant differences were observed in the psychological profiles of Chinese adults with different AR

types, these were significantly worse for healthy nonallergic controls in somatization, obsessive-compulsive, interpersonal sensitivity, hostility, and psychoticism. Moreover, our study showed that the effect of AR on the psychological profile of patients was independent of age and gender, but significantly associated with comorbid asthma.

Several studies have reported high rates of abnormal psychological profiles in patients with asthma (approximately 50% of patients with AR had depression, anxiety, or both) [32-34]. An early study by Mancuso et al [29] demonstrated that 45% of the 230 asthmatic patients evaluated were positive for depressive symptoms and that these patients reported worse health-related quality of life than asthma patients with similar disease activity but fewer depressive symptoms. In a more recent study, using a historical primary care cohort and a nested case-control study design, Walters et al [35] demonstrated a significant association between asthma-related depression and increased mortality, despite being independent of asthma severity or corticosteroid use. Lv et al [18] found significant differences in somatization, obsessive-compulsive, depression, and anxiety among patients with a history of eczema or asthma compared with patients who did not have such a history [18]. Collectively, the findings of these studies and ours, namely, that asthma exerts an independent effect on the psychological status of patients with AR, show the importance of assessing and treating all AR patients for asthma and for other common chronic comorbid conditions.

Despite the limitations of investigating a relatively small number of individuals with and without concomitant asthma, our study provides useful information on the effect of comorbid asthma, gender, and allergen sensitization patterns on the psychological status of AR patients. The current study shows that comorbid asthma exerts a dependent main effect on the psychological status of AR patients and that the interactive effect of aeroallergen category and gender can affect psychological status in some cases. However, these findings need to be confirmed in larger cohorts. Moreover, future studies should investigate the mechanisms underlying the increased frequency of psychological disorders in AR patients with and without comorbid asthma in order to facilitate the design of novel therapies and frameworks leading to better overall management of such patients.

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