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27

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Rhinitis: A Risk Factor in Asthma Control?

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What is known on this subject?

Asthma is strongly linked to allergic rhinitis (AR). AR is a heterogeneous disorder that is characterized by a group of nasal symptoms. Some studies were conducted to show the worsening effect of rhinitis on asthma control, especially in children and in adult patients comparing the asthma control test (ACT) scores.

What this study adds?

We studied this aspect in adult patients with validated assessment tools and by separating the patients into groups defining AR severity according to visual analog scale and asthma control status according to ACT scores.

ABSTRACT

Objective: We studied the risk factor aspect of rhinitis in adult patients with asthma using validated assessment tools and separating the patients into groups defining rhinitis severity according to visual analog scale and asthma control status according to asthma control test (ACT) scores.

Material and Methods: Asthma is a disease that causes coughing, wheezing, and shortness of breath. It is characterized by variable and recurrent symptoms and reversible airflow obstruction. Allergic rhinitis (AR) is a disease characterized by symptoms like sneezing, itching, nasal congestion, and runny nose. Asthma is linked to AR. AR is diagnosed in 70-90% of the patients, and asthma symptoms are observed in 40-50% of the patients who are diagnosed with AR.

Results: Of 114 patients with asthma receiving treatment, 78.9% were female, and 64% had mild rhinitis symptoms. While 12.3% had diabetes mellitus (DM), 30.7% had hypertension (HT), and 14.9% had ischemic heart disease (IHD). Age, sex, DM, HT, IHD, exacerbation, and diagnosis time groups in the last year did not seem to cause a significant difference in ACT scores. The difference between the rhinitis groups in terms of ACT scores was statistically significant (F= 8.506, p=0.004, partial η^2=0.087). According to this result, 8.7% of the total variance asthma control could be explained by the severity of AR.

Conclusion: Severe symptoms of rhinitis are associated with asthma control. Therefore, the management of AR should be targeted in patients whose asthma control cannot be optimized.

Keywords: Asthma, allergic rhinitis, symptom control, quality of life

Introduction

Asthma is a chronic respiratory disease affecting children and adults that causes cough, wheezing, and shortness of breath. It presents with variable and recurrent symptoms and reversible airflow obstruction. Asthma is strongly linked to allergic rhinitis (AR) (1,2). AR is a heterogeneous disorder that is characterized by a group of nasal symptoms.

The "one airway, one disease" one airway, concept was first described by Grossman (3) in 1997. The upper respiratory tract consists of the nose, nasal cavity, pharynx, and larynx. The lower respiratory tract is composed of the trachea, bronchi, bronchioles, and alveoli. The embryological status of the lower and upper respiratory tract is the 4th anterior, which consists of a respiratory diverticulum formed in the ventral wall

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of the intestine. Histologically, the trachea is detailed and structurally similar.

It was found that 70-90% of asthma patients were diagnosed with AR, and 40-50% of patients with AR also had asthma symptoms (4,5). The AR and its impact on asthma (ARIA) guidelines recommend targeting the optimal control of asthma and AR simultaneously (6).

The asthma control test (ACT) is an assessment tool for the quality of life and symptom severity of patients with asthma patients (7). The visual analog scale (VAS) can also be used as an assessment tool for the symptom severity of patients with rhinitis (1,8).

Some studies have shown the worsening effect of AR on asthma control, especially in children (1) and in adult patients by comparing ACT scores (2). In this study, we studied this effect in adult patients with validated assessment tools and by separating the patients into groups defining AR severity according to VAS and asthma control status according to ACT scores.

Material and Methods

Patients

Our prospectively designed single-center study was performed in strong consistency with the ethical standards of the World Medical Association's Declaration of Helsinki and was approved by the Ethical Committee of Kirsehir Ahi Evran University Faculty of Medicine (date: 21.12.2021, approval number: 2021-21/205). An informed consent form was signed by each patient included in the study.

We included patients with asthma and rhinitis presenting to pulmonology outpatient clinics between 01.12.2021 and 01.06.2022. The symptoms of rhinitis were questioned for diagnosis. The prick test was not available in our clinics. The inclusion criteria were being diagnosed with asthma and rhinitis, being treated actively, and signing the informed consent form. Patients who did not agree to sign the informed consent form were excluded.

VAS and ACT scores were measured after treatment for 4 weeks the ARIA and Global Initiative for Asthma Strategy guidelines. The demographic data, ACT and VAS scores, asthma control status, and AR severity levels of the patients were recorded. According to ACT scores, 25 points are classified as complete control, 20-24 points are classified as partial control, and 19 or lower scores are classified as uncontrolled asthma. Then, considering the mean scores, the number of attacks in a year was divided into 2 categories, namely "never having an attack" and "having at least one attack".

Asthma Control Test

ACT was used as an assessment tool to evaluate asthma control after a 4-week treatment. Asthma control was evaluated by asking the following five questions that were answered on a scale of 1 to 5:

1) In the past 4 weeks, how frequently did your asthma keep you from getting as much done at work, school, and home?

2) During the past 4 weeks, how often have you had shortness of breath?

3) During the past 4 weeks, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness, or pain) wake you up at night, or earlier than usual in the morning?

4) During the past 4 weeks, how often have you used a rescue inhaler or nebulizer medication (such as albuterol)?

5) How would you rate your asthma control during the past 4 weeks?

The validity and reliability of ACT were demonstrated by Schatz et al. (7).

Visual Analog Scale

VAS was a tool for evaluate the severity of AR symptoms. AR symptoms were evaluated on a scale of 0 to 10. The validity and reliability of VAS were tested and confirmed by Ciprandi et al. (9) VAS scores of 0-3 indicate mild rhinitis, while scores of 4-7 indicate moderate rhinitis, and scores of 8-10 indicate severe rhinitis.

Statistical Analysis

The sample size required for the study was calculated using the G*Power 3.1.1 program. For this, based on a medium effect size defined by Cohen (1988), which was 0.25 in the analysis of variance, a type I error rate of 0.05, and 80% power, the number of patients to be included was calculated as. One hundred fourteen patients were included in our study.

We analyzed the collected data using the SPSS 25.0 program. Frequency, percentage, mean, standard deviation, and minimum-maximum values were calculated as descriptive statistics. In the study, by calculating the Cronbach's alpha internal consistency coefficient for the total ACT scores and the ACT scores related to AR, sex, age, number of attacks, the duration of diagnosis, and presence of other chronic diseases [diabetes mellitus (DM), hypertension (HT), ischemic heart disease (IHD)] with separate groups (2x2x6x2x2x2x2x2), eight-way comparisons were made with the mixed-factor analysis of variance (Ten-Way mixed-factor ANOVA) method. In addition,

the interaction effects of asthma control status with the other ten independent variables were examined.

Results

It was determined that 78.9% of the 114 asthma patients were female, and 64% had mild rhinitis. While 12.3% had DM, 30.7% had HT, and 14.9% had IHD. The average age of the patients was 45.55±14.79, the mean number of asthma attacks in the last year among the patients was 0.17±0.88, and the mean duration of diagnosis was 6.60±6.30 years (Table 1).

The internal consistency coefficient of ACT was found to be 0.929, while the mean ACT score of the patients was 21.57±3.76. Considering the GINA steps, which are used to evaluate the severity of asthma, it was seen that the mean asthma severity score of the patients was 2.99±0.36 on a scale of 1 to 5. The patients were asked to evaluate their complaints regarding rhinitis using VAS, and a score between 0 and 10 was used. Because of this evaluation, the mean VAS score of the patients was found to be 1.99±1.91 (Table 2).

In this study, in which the control of asthma was evaluated, First, the total ACT scores of the patients were categorized for the ANOVA as recommended in the literature. The duration of diagnosis was similarly classified as 5 years and shorter and 6 years or longer, which is considered the mean cut-off point. The patients were categorized based on their age groups as 18-24, 25-34, 35-44, 45-54, 55-64, and 65 or older. The Levene's test result was found as $p>0.05$ ($p=0.887$) after the conversion of the continuous variables into categorical variables. It was determined that the variances were homogeneously distributed, and the data were then analyzed.

There was a statistically significant difference in the ACT scores between the rhinitis severity groups ($F=8.506$, $p=0.004$, partial $\eta^2=0.087$). According to this result, 8.7% of the total variance in asthma control could be explained by the severity of AR. The groups formed based on age, sex, DM presence, HT presence, IHD presence, exacerbation in the last year, and the duration of diagnosis did cause a significant difference in the ACT scores of the patients (Table 3).

Table 1. **The demographic data**

Parameters		n
Gender	Female	90
	Male	24
Allergic rhinitis	Mild	73
	Moderate and severe	41
DM	Yes	14
	No	100
HT	Yes	35
	No	79
IHD	Yes	17
	No	97
Total		114
Age	$\bar{X}$ ± SD: 45.55±14.79	min-max: 18-79
Number of exacerbations in last year	$\bar{X}$ ± SD: 0.17±0.88	min-max: 0-6
The duration of diagnosis (years)	$\bar{X}$ ± SD: 6.60±6.30	min-max: 1-30

DM: Diabetes mellitus, HT: Hypertension, IHD: Ischemic heart disease, $\bar{X}$: Median, SD: Standard deviation, min: Minimum, max: Maximum

Table 2. **Descriptive features of measurement tools**

	Min-max	$\bar{X}$ ± SD	Cronbach alpha
ACT	5-25	21.57±3.76	0.929
GINA step	2-5	2.99±0.36	-
VAS	0-7	1.99±1.91	-

ACT: Asthma control test, GINA step: Global initiative for asthma step, VAS: Visual analog scale, $\bar{X}$: Median, SD: Standard deviation, min: Minimum, max: Maximum

Although there was a statistically significant difference between the ACT scores of the rhinitis severity groups, there was no interaction-common effect of rhinitis severity with other independent variables (Table 3).

Discussion

We showed the worsening impact of rhinitis on asthma control. It can be concluded in general that rhinitis is a risk factor for poor asthma control. Our results were also consistent with the results of previous studies in the literature.

Several studies have shown the relationships between upper respiratory tract pathologies (10,11,12). Type 2 inflammation is a clinical key in pathological processes in asthma and rhinitis cases (13,14). The common inflammatory processes and histological structures lead to a strong link between these diseases, as well as the interaction of asthma control and rhinitis severity.

Emons et al. (1) conducted a study to validate an assessment tool named "CARATkids" in children with asthma and AR symptoms. One hundred and eleven patients were included in their study. Emons et al. (1) also recorded ACT and VAS scores in the next 3 visits of the patients, and they performed Spearman's correlation analyses. According to their results, it was concluded that AR was a risk factor for poor asthma control, and VAS and ACT scores were significantly correlated. In a prospectively designed observational study by Linhares et al. (15), similar results were found.

Our study differs from the aforementioned studies in terms of the age of the sample and data analysis methods. The abovementioned studies can contribute to our results on the strong link between asthma and rhinitis.

In a prospective multicenter study by Yasuo et al. (2), 157 patients with asthma were separated into two groups of patients with and those without rhinitis. The GINA steps of the patients in the group with rhinitis were significantly higher. In the group of patients with rhinitis, step 2 asthma rates were lower, and step 4 asthma rates were higher, while there was no statistically significant difference between.

The step 3 asthma rates of the two groups. The female sex was more prevalent than the male sex in both groups.

In this study, the severity of rhinitis was not recorded, but only the diagnosis was evaluated as a parameter and risk factor. Our results were consistent with the findings of Yasuo et al. (2). Furthermore, we separated the patients into groups based on the determination of their asthma control status and rhinitis using ACT and VAS scores. Most of our patients had GINA step 3 asthma, and most patients in our sample were female. The local epidemiological status of asthma and our patient profile were found to be similar. Yasuo et al. (2) also used VAS scores for asthma and found these scores higher in the rhinitis group, which was not a parameter in our study.

Table 3. Eight-way mixed factor analysis of variance in terms of ACT total score

Independent parameters	F	p	Partial η^2
Allergic rhinitis groups (2)	8.506	**0.004**	0.087
Gender groups (2)	0.372	0.543	0.004
Age groups (6)	0.810	0.546	0.044
DM groups (2)	0.125	0.725	0.001
HT groups (2)	0.006	0.938	0.000
IHD groups (2)	0.620	0.433	0.007
Number of exacerbations groups (2)	0.305	0.582	0.003
Duration of diagnosis groups (2)	0.788	0.377	0.009
Interactions			
Allergic rhinitis groups x gender groups (2x2)	1.157	0.285	0.013
Allergic rhinitis groups x age groups (2x6)	0.800	0.553	0.043
Allergic rhinitis groups x DM groups (2x2)	0.263	0.609	0.003
Allergic rhinitis groups x HT groups (2x2)	0.084	0.773	0.001
Allergic rhinitis groups x IHD groups (2x2)	1.212	0.274	0.013
Allergic rhinitis groups x number of exacerbations groups (2x2)	0.042	0.839	0.000
Allergic rhinitis groups x duration of diagnosis groups (2x2)	1.230	0.270	0.014

DM: Diabetes mellitus, HT: Hypertension, IHD: Ischemic heart disease

Study Limitations

Our results and sample size were consistent with those of the limited number of previous studies in the literature. Our study is remarkable with a better study design including methods such as the creation of patient groups according to asthma control and rhinitis severity.

Conclusion

There was a statistically significant difference in the ACT scores between the rhinitis groups. According to this result, 8.7% of the total variance in asthma control could be explained by the severity of AR. A higher severity of rhinitis was associated with poorer asthma control. Therefore, physicians should target the optimal control of asthma and rhinitis simultaneously.

Ethics

Ethics Committee Approval: Ethical Committee of Kirsehir Ahi Evran University Faculty of Medicine (date: 21.12.2021, approval number: 2021-21/205).

Informed Consent: An informed consent form was signed by each patient included in the study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: C.A., N.Z., Design: C.A., N.Z., Analysis or Interpretation: C.A., N.Z., Writing: C.A., N.Z.

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