Is there any correlation between the results of skin-prick test and the severity of symptoms in allergic rhinitis?

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ABSTRACT

Background: This study was designed to determine whether there is any correlation between results of the skin-prick test and the severity of symptoms in allergic rhinitis.

Methods: We retrospectively evaluated 150 patients with persistent or intermittent allergic rhinitis confirmed by positive skin tests and scaled from 1 to 4 according to the size of the wheal. The symptoms including sneezing, nasal obstruction, rhinorrhea, and nasal itching were ranked according to their severity (0 for no symptoms, 1 for mild, 2 for moderate, and 3 for severe). We investigated the correlation between the skin tests' positivity and symptoms score, rhinoconjunctivitis quality-of-life questionnaire (RQLQ), and visual analog scale (VAS) scores.

Results: Of the 150 patients, 98 had persistent and 52 had intermittent allergic rhinitis. Some patients had multiple allergen sensitivity. Each skin test group was compared with respect to symptom scores, RQLQ, or VAS scores. There was no statistically significant correlation between the size of the wheal and symptoms score, RQLQ, or VAS scores. There was also no correlation between the type of allergen and symptoms score.

Conclusion: The skin-prick test can be applied to support the diagnosis of allergic rhinitis, but one can not predict the severity of illness by stratifying the size of the skin-prick test result.

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Typical history of symptoms and confirmatory diagnostic tests are essential for the diagnosis of allergic rhinitis.¹ The most common symptoms of the disease are sneezing, nasal obstruction, rhinorrhea, and nasal itching. If the patients have two or more of these symptoms for more than an hour on most days, this is suggestive of allergic rhinitis.²

The diagnostic tests are divided into two groups as *in vitro* and *in vivo*. *In vitro* tests include serum-specific IgE measurements. *In vivo* tests are based on the demonstration of allergen-specific IgE in the skin (e.g., the skin-prick test, intradermal test, and patch test). Many subjects can have positive skin tests and/or detectable serum-specific IgE without allergic symptoms.³

In our study we assessed whether there is any correlation between the size of the skin-prick test reaction and the severity of symptoms of allergic rhinitis.

MATERIALS AND METHODS

In this study we evaluated 150 patients who had persistent or intermittent allergic rhinitis with positive skin-prick test. Ninety-six of the patients were women and 54 were men, with a mean age of 30.6 years (range, 17–53 years). The study was performed in out-of-pollen season. We have obtained informed consent from all patients.

We used the extracts that contained the most common pollens in Ankara, Turkey. In addition, we used house-dust mite, mold, epidermal mix, cereals, and cockroach extracts, and all allergen solutions were standardized extracts of Allermed. Multitest II applicator (AllerMed Laboratories, Inc., San Diego, CA) was used for 12 allergens, 1 negative control, and 1 positive control solutions. Each time,

the same physician applied and evaluated the test. The prick test was applied on the forearm skin and the size of a wheal was measured 20 minutes after application. We made measurements and used the larger diameter for comparison. The results were scaled from 1 to 4 according to the size of the wheal (+1, > negative control, <5 mm; +2, 5–7 mm; +3, 7–10 mm; +4, >10 mm, and/or pseudopods).

The allergic rhinitis symptoms were also scored based on the patients' expression of symptoms. Sneezing, nasal obstruction, rhinorrhea, and nasal itching were assessed, according to their severity from 0 to 3: "0" for no symptoms, "1" for mild, "2" for moderate, and "3" for severe. The validated rhinoconjunctivitis quality-of-life questionnaire (RQLQ)⁴ and visual analog scale (VAS) were also evaluated. The RQLQ has 28 questions in 7 domains (activity limitation, sleep problems, nose symptoms, eye symptoms, nonnose noneye symptoms, practical problems, and emotional function) and each question was scaled from 0 (not impaired at all) to 6 (severely impaired).⁴ VAS scores were also evaluated.

We investigated the correlation between the skin test results and symptom scores, RQLQ, and VAS scores. The correlation and regression analyses were used to assess the strength of the relationship between the RQLQ, VAS scores, total nasal symptom scores, and skin-prick test results. A two-tailed value of $p < 0.05$ was considered significant.

RESULTS

Of the 150 patients, 98 (65%) had persistent allergic rhinitis and 52 (35%) had intermittent allergic rhinitis. Multiple allergen sensitivity was observed in 124 of the patients (83%) and monoallergen sensitivity was observed in 26 of the patients (17%). The most common allergen sensitivity was house-dust mites (55%; Table 1) and the most frequent symptom was nasal obstruction (91% of patients had nasal obstruction; Table 2). Also, nasal obstruction had the highest symptom score (Table 2).

Each skin test result in terms of wheal size was compared with the symptom scores, RQLQ, and VAS scores. There was no statistically significant correlation between the size of the wheal and symptoms score (Table 3), RQLQ, or VAS scores (Table 4). There was also no correlation between the type of allergen and symptoms score. We have found a moderate correlation between RQLQ and nasal symptom scores ($0.28 < r = 0.43$).

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Table 1 The number of patients that are positive for each antigen

Allergen	Oat	Barley	Ryegrass	Clover	Wheat	Cockroach	House dust mite	Grass mix 1	Tree mix	Mold mix	Grass mix 2	Epider. mix
Patients (n)	40	38	41	25	38	31	83	60	22	14	15	22

Epider. = epidermals.

Table 2 Symptom severity of the patients (n = no. of patients)

Symptoms Score	Sneezing (n)	Nasal Obstruction (n)	Rhinorrhea (n)	Itching (n)
0 = None	14	13	17	17
1 = Mild	20	20	18	16
2 = Moderate	36	16	20	23
3 = Severe	80	101	95	94

Table 3 Comparison of size of wheal for each allergen extract and symptom scores (p values)

Symptoms	House-Dust Mite	Grass Mix 1	Tree Mix	Mold Mix	Grass Mix 2	Epider. Mix	Oat	Barley	Ryegrass	Clover	Wheat	Cockroach
Sneezing (p)	0.350	0.090	0.232	0.785	0.649	0.188	0.240	0.166	0.183	0.374	0.262	0.328
Nasal obstruction (p)	0.079	0.861	0.098	0.548	0.251	0.242	0.375	0.807	0.678	0.251	0.461	0.172
Rhinorrhea (p)	0.067	0.431	0.284	0.537	0.320	0.669	0.677	0.651	0.200	0.884	0.769	0.504
Itching (p)	0.484	0.173	0.334	0.350	0.584	0.441	0.123	0.061	0.142	0.125	0.137	0.101

Epider. = epidermals.

Table 4 Comparison of size of wheal for each allergen extract and VAS scores (p values)

VAS	House-Dust Mite	Grass Mix 1	Tree Mix	Mold Mix	Grass Mix 2	Epider. Mix	Oat	Barley	Rye Grass	Clover	Wheat	Cockroach
p	0.420	0.100	0.060	0.847	0.368	0.199	0.063	0.107	0.077	0.230	0.094	0.674

Epider. = epidermals; VAS = visual analog scale.

DISCUSSION

Allergic rhinitis is one of the most common allergic diseases in the world that is defined as an allergen-induced, IgE-mediated inflammation of nasal mucosa. Although it is not a life-threatening illness, it significantly affects patients' quality of life.

Allergic rhinitis has characteristic symptoms of sneezing, nasal obstruction, rhinorrhea, and nasal itching. Similar symptoms can be caused by nonallergic rhinitis, which consists of a group of rhinitis caused by a diverse group of causes. The diagnosis of allergic rhinitis is based on the typical symptoms supported by several diagnostic tests.⁵ IgE is the main antibody increased in allergic diseases, so the diagnostic tests of *in vivo* and *in vitro* are based on detecting the free or bound IgE. The skin-prick test is a safe, cheap, and effective diagnostic tool used frequently in the diagnosis of the allergic rhinitis. A lancet, a Morrow-Brown needle, and a Duo-tip can be used for monoallergen application. For multiallergen application, a Quintest or a multitest II applicator can be used. They are reproducible and it is easy to use multiallergen applicators; thus, we used a multitest II applicator in our study.

Jung *et al.*, in a study, determined the serum IgE levels and skin-prick tests results for each patient using age-matched true allergens. They suggested that the serum IgE level measurement is the preferred method for detecting allergy to house-dust mites for patients >50 years old and skin-prick test for patients <30 years old as the first choice.⁶ In addition, Calabria *et al.* compared the measurement of serum-specific IgE level (immunoCAP, Phadia, Inc., Portage, MI) to

skin-prick test results and they showed that CAP should be considered complementary but not equivalent to the skin-prick test.⁷ Allergen solutions must be chosen according to the environmental characteristics. In our study, 83% of the patients had multiple allergen sensitivity and house-dust mite was the most common allergen.

Symptoms of allergic rhinitis affect patients' quality of life. Sneezing, nasal obstruction, rhinorrhea and itching are the main symptoms. Nasal obstruction was the most frequent symptom in our study and it had the highest symptom score. As a common behavioral belief, it is expected that the more the positive the skin test the more powerful the treatment. However, as we determined in this study, there is no statistically significant correlation between the severity of the skin-prick test results and symptom scores, RQLQ scores, or VAS scores. In another study a significant correlation was shown between the wheal size of the skin-prick test and symptom changes in the nasal provocation test, if the wheal from the skin-prick test was small.⁸ Radcliffe *et al.* explained that the skin tests correlate poorly with the patients' perception of disease severity because the skin is not an organ primarily involved in aeroallergen diseases.⁹ Graif *et al.* determined that self-reported symptoms severity by the patients with allergic rhinitis is apparently not related to the magnitude of skin-prick test response, but positively associated with psychological factors of hypochondriasis and somatic awareness.¹⁰

The RQLQ was developed to measure the functional problems (physical, emotional, social, and occupational) and those are the most

troublesome to adults with either seasonal or perennial rhinoconjunctivitis of either allergic or nonallergic origin.¹¹ Many studies were performed to develop, standardize, and validate questionnaires for uses in clinical trials.^{4,12–14} We used a Turkish version of the RQLQ in our study. In another study, only weak-to-moderate correlations between the RQLQ and nasal symptom scores have been found.¹⁵ We also found a moderate correlation between RQLQ and nasal symptom scores.

Recently, it has been shown that an important number of patients previously diagnosed as nonallergic rhinitis had local allergy with nasal production of specific IgE and a positive response to a nasal allergen provocation test.^{16–18} This entity has been suggested to be atopy¹⁶ or local allergic rhinitis.¹⁹ Patients with local allergic rhinitis do not have atopy so we detected negative skin-prick tests and normal serum-specific IgE levels, but these patients have similar symptoms of allergic rhinitis.

CONCLUSION

The skin-prick test can be used to determine if rhinitis is IgE mediated and thus supports the differentiation of allergic rhinitis versus nonallergic rhinitis. However, the size of the skin reaction can not be relied on to determine the disease severity in adult patients.

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