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Hypersensitivity to Aeroallergens in Patients with Nasobronchial Allergy

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ABSTRACT

Background. Aeroallergens are the most common causes of allergy. **Aim.** The aim of this study was to determine hypersensitivity to aeroallergens in patients with nasobronchial allergy. **Methods.** This retrospective population study included 2254 patients with nasobronchial allergy, from late adolescents to adults. Their response to aeroallergens was assessed by skin prick tests. **Results.** More patients had rhinitis (72.7%), than asthma (27.6%). Although majority of patients were female, allergy is more common in men than in women ($p<0.05$). Both groups of patients had the greatest number of positive skin prick tests for *Dermatophagoides pteronyssinus* (27.5%) and weed pollens (21.9%), followed by grass (18.3%) and tree pollens (10.1%). Ragweed is the most common positive weed pollen in both groups, more in patients with rhinitis ($p=0.022$). The cocksfoot is the most common grass pollen in rhinitis group (15.3%), but meadow grass (12.6%) in asthma patients. Birch is the most common tree allergen in the both groups. **Conclusions.** More patients with nasobronchial allergy have rhinitis than asthma. Skin prick tests are usually positive for *Dermatophagoides pteronyssinus* and weed pollens, followed by grass and tree pollens, and they are more common positive in patients with rhinitis than asthma.
Key words: nasobronchial allergy, rhinitis, asthma, aeroallergens.

1. INTRODUCTION

Allergic diseases are amongst most common chronic disorders worldwide (1). Allergic rhinitis and asthma are both chronic heterogeneous disorders, with overlapping epidemiology of prevalence, health care costs and in quality of life (2). These two clinical entities are observed over time as separate diseases. Epidemiological and clinical evidence, as well as experimental observations have suggested a link between rhinitis and asthma leading to a definition of allergic rhino-bronchitis or united airways diseases and the concept of "one airway one disease". Both are inflammatory disorders with a similar pathophysiology and both share some treatment approaches.

Aeroallergens are the most common causes of nasobronchial allergy (3). Most important of them are pollens, dust mites, and animal products (4). Plant pollens are one of the most common outdoor allergens. House dust mites *Dermatophagoides pteronyssinus (Df p)* and *Dermatophagoides farinae* are the most common indoor aeroallergens all over the word. Other aeroallergens animal origin, which are often described as a cause of respiratory allergies are cockroach, feathers and animal hair (5).

Clinical epidemiological and pathophysiological studies suggest a strong functional and immunological relationship between the nose and bronchi and survey results report that pollens, especially grass pollens are the major cause of respiratory allergies worldwide (6, 7). The aim of this study was to determine hypersensitivity to the most common aeroallergens among our patients with nasobronchial allergy and to determine whether there are differences in hypersensitivity between rhinitis and asthma.

2. PATIENTS AND METHODS

The study is a retrospective, population analysis of the results of skin prick tests to aeroallergens in patients with nasobronchial allergy. The study included 2254 patients, aged from late adolescence (from 16 years of age) to adults, who were tested at the Department of Dermatovenerology, Clinical Centre of Banja Luka, during ten years period. Ambulatory patients, who were referred by family doctors, otolaryngologist, dermatologists, or pulmonologists were subjects of testing.

Patients were tested by skin prick test, which is used worldwide as an assured and rapid method for allergy screening. The results were interpreted by the standard method for test (3). We tested two series of allergens. In the first series there were seven allergens: *Df p*, weed pollen mixture, grass pollen mixture, tree pollen mixture, feathers, animal dander and cockroach (*Blatella germanica*). Second series contained 16 individual pollen allergens, that follow. Patients who tested positive for the grass pollen mixture, were further tested for: cocksfoot (*Dactilys glomerata*), meadow grass (*Poa pratensis*), rye-grass (*Lolium perenne*), timothy (*Phleum pratense*), cultivated

Allergens	All positive prick tests (%)	Sex		P-value	Allergic disease		P-value
		Male (%)	Female (%)		Rhinitis (%)	Asthma (%)	
Df p*	27.5	35.3	22.5	<0.001	28.9	23.9	0.020
Weed pollen mixture	21.9	28.6	17.6	<0.001	23.3	18.2	0.012
Grass pollen mixture	18.3	24.2	14.6	<0.001	19.8	14.5	0.005
Tree pollen mixture	10.1	12.2	8.8	0.011	11.1	7.6	0.018
Cockroach	3.3	2.4	1.2	0.056	3.3	3.3	1.000
Feather mixture	3.1	4.4	2.3	0.005	3.0	3.4	0.735
Animal hair mixture	1.7	5.7	1.9	0.001	1.7	1.6	1.000

Table 1. Positive skin prick tests in the total sample, by the sex of patients and type of allergic disease. *Dermatophagoides pteronyssinus

wheat (*Triticum aestivum*) and corn (*Zea mays*). Patients who tested positive for the weed pollen mixture, were further tested for: ragweed (*Ambrosia elatior*), mugwort (*Artemisia vulgaris*), sorrel (*Rumex acetosella*), plantain (*Plantago lanceolata*) and wall pellitory (*Parietaria officinalis*). Patients who tested positive for the tree pollen mixture were further tested for: birch (*Betula verrucosa*), hazel (*Corylus avellana*), elder (*Sambucus nigra*), linden (*Tilia cordata*) and ash (*Fraxinus americana*). According to the diagnosis, patients were divided in the two groups: Rhinitis and Asthma.

3. STATISTICAL ANALYSIS

In order to perform the necessary statistical tests we used the statistical software package SPSS for Windows (version 13). For the analysis of the data, descriptive and inferential statistics methods where used. From descriptive statistical parameters the mean value and measures of variation were used, which describe the main characteristics of the data in a quantitative sense. From inferential statistical methods Student's t-test, Person $\chi 2$ test were used. The limit value of the existence of a statistically significant difference was set at $p<0.05$.

4. RESULTS

The total sample of our study included 2254 patients with nasobronhial allergy, 1376 (61%) women, and 848(39%) men. The difference between number of female and male patients was statistically significant (*t* test; $p<0.01$). Rhinitis had 1634, and asthma 620 patients. Almost three times more patients, had allergic rhinitis than asthma (*t* test; $p<0.01$). In the Rhinitis group were 957 (58.6%) were female and 677 (41.4%) were male patients, mean age was 45.72±16.1. In the Asthma group 419 (67.6%) were women and 201 (32.4%) were men, mean age 45.68±16.0. In both group there were more male patients (*t* test; $p<0.01$).

Of all the patients, highest recorded number of positive prick tests was *Df p* (27.5%) and weed pollens (21.9%), followed by grass (18.3%) and tree pollens (10.1%). Although there were more female than male patients in our total sample ($p<0.001$), results show that the number of positive prick tests, according to all allergens was larger in male patients ($\chi 2$ test, $p<0.05$). The patients with allergic rhinitis have a higher number of positive skin prick tests to *Df p*, and all pollen mixtures, than patients with asthma ($\chi 2$ test, $p<0.05$). For cockroaches, feathers and animal hair, determined by a small number of positive skin prick

Weed pollens	All positive prick tests (%)	Positive prick tests by disease group		P-value
		Rhinitis n (%)	Asthma n (%)	
Ragweed (Ambrosia elatior)	28.9	30.9	23.2	0.022
Mugwort (Artemisia vulgaris)	11.3	11.6	10.5	0.719
Sheep sorrel (Parietaria officinalis)	3.2	4.0	1.2	0.049
Wall pellitory (Parietaria officinalis)	0.6	0.7	0.4	0.096
Plantain (Plantago lanceolata)	8.1	8.5	6.6	0.405

Table 2. Positive skin prick tests to weed pollens

Grass pollens	All positive prick tests (%)	Positive prick tests by group disease		P-value
		Rhinitis n (%)	Asthma n (%)	
Cocksfoot (Dactilys glomerata)	14.4	15.3	11.7	0.209
Rue-grass (Lolium perenne)	12.0	13.0	9.2	0.155
Timothy (Phleum pratense)	7.5	8.7	4.2	0.032
Meadow grass (Poa pratensis)	14.3	14.9	12.6	0.439
Wheat (Triticum aestivum)	10.2	10.8	8.4	0.337
Corn, Maize (Zea mays)	6.5	7.2	4.6	0.209

Table 3. Positive skin prick tests to grass pollens

Tree pollens	All positive prick tests (%)	Positive prick tests by group disease		***P-value***
		Rhinitis n (%)	**Asthma n (%)**	
Hazel (*Corylus avellana*)	5.7	6.2	4.4	0.406
Birch (*Betula verrucosa*)	7.3	7.6	6.6	0.730
Elder (*Sambucus nigra*)	0.9	1.1	0,4	0.620
Linden (*Tilia cordata*)	1.0	1.4	0.0	*
Ash (*Fraxinus americana*)	2.4	2.8	1.3	0.302

Table 4. Positive skin prick tests to tree pollens. *not applicable

tests, there were no statistically significant differences between patients with rhinitis and asthma (Table 1).

Results of skin prick test for individual weed pollens in the total sample and by group of disease show that they were mostly positive to ragweed (28.9%), then followed by mugwort (11%) and plantain (8.1%). The lowest number of positive tests were sheep sorrel and parietaria. More patients with allergic rhinitis than with asthma had positive skin prick test to ragweed and sheep sorrel ($\chi 2$ test, $p<0.05$). Other weed pollens showed no statistically significant difference between the two groups of patients (Table 2).

In the total sample tested to six individual, grass pollens showed highest number of positive tests to cocksfoot (14.4%) and meadow grass (14.3%). This was followed by rue-grass (12%) and wheat (10.2%). The lowest number of positive tests was for timothy grass and maize. Patients with rhinitis had more positive tests for cocksfoot (15.3%), but the patients with asthma for meadow grass (12.6%). There was no statistically significant difference for grass pollens between the two groups of patients, except for timothy grass ($\chi 2$ test, $p<0.032$), in Rhinitis group. (Table 3).

In the total sample of patients, the highest number of positive tests, was to birch pollen (7.3%), then hazel (5.7%), while for the other tree pollens, there were a small number of positive skin reactions. Both groups of patient had the highest positive tests for birch, but without statistically significant difference, as for the other tree pollens (Table 4).

5. DISCUSSION

Main findings of this study are that our patients with nasobronchial allergy more often have allergic rhinitis than asthma, and that *Df p* is the most common cause of allergy. Although in the study there were more women than man, allergy was more often found in men.

It is consistent with the results of similar studies which included more women than men, and with a higher incidence of adult non-atopic rhinitis in women. However, there are studies that found no difference in the gender distribution (3). The fact that a significantly greater number of patients had allergic rhinitis rather than asthma coincides with epidemiological data on the incidence and prevalence of these diseases in adolescence and adulthood (1, 7). Finding that *Df p* is the common allergen in both groups of patients in our study, especially in the rhinitis group, is consistent with the results of a large number of similar studies (3, 8). When it comes to pollens, we found that the greatest number of positive skin prick tests was to weed pollens, followed by grass pollens and the smallest number for tree pollens. Aerobiological and allergic studies show that the pollen map of Europe is changing and that depends of cultural factors, major international moving and climate changes (9, 10). A number of studies provide data that grass pollens are the main source of respiratory allergies worldwide (11, 12, 13, 14). In the same studies, tree pollens are generally found as well as in our study, according to the frequency in second place behind the grass and weed pollens. However, in recent years, weed pollens allergy has been increasing in certain parts of France, Italy, Austria, Croatia and Bulgaria (15). Our research, as the majority of studies in Europe, shows that ragweed pollen is the leading weed pollen (6). In Hungary, at least 60% of the patients who have an allergy to pollen are allergic to ragweed pollen (16). In Croatia, which is a geographically close region, nearly half the patients with seasonal rhinitis and asthma have had sensitization to ragweed (17). In our study, after ragweed, the second most common weed pollen is mugwort. Ragweed and mugwort have nearly identical flowering season, and clinical and serological studies in Europe suggest that hypersensitivity to this two pollens are frequently associated (18). Plantain, third weed pollen in our study, is cited as a significant cause of pollinosis in temperate regions of North America, Australia, Europe as well as in Japan (19). The most common grass pollens in our study is cocksfoot and meadow grass. In similar studies meadow, cocksfoot and rye-grass are stated as the most common allergens (20, 21). Our result show that the birch is most usually allergenic tree pollen which is consistent with results from other studies that identified it as one of the most common causes of allergic rhinitis in Europe (5). In the literature, numbers of adults which are allergic to birch vary depending on geographic region (22). Authors from the United Kingdom were recommended that birch pollen is one of the seven allergens which are sufficient for identification of hypersensitive individuals in epidemiological studies (23). After the birch, hazel is the second allergenic tree pollen in our study. This pollen is often referred to the cause of pollen allergy in central and northern Europe (24, 25). Our results show that a small number of patients have positive skin prick tests for cockroach, animal hair and feathers. Distribution of these allergens varies depending on the geographic region, climate and housing conditions, and the literature data are different. In recent years, a number of studies have investigated that cockroach exposure is a major risk factor for the development of asthma (26, 27). However, the results for cockroach allergy are similar to ours, as was also confirmed by Croatian authors (28). Some studies show that one–third of patients with respiratory allergy have an allergy to cat allergens, while multicenter study from China noted significant number of respondents have dog hair allergy (29). Our study, like the others, showed a very low percentage allergy for animal hair (30).

6. CONCLUSION

More patients with nasobronchal allergy have rhinitis than asthma. Although majority of patients were female, allergy is more common in men, than in women. *Dermatophagoides pteronyssinus* and weed pollens are the most common aeroallergens for both groups of patients. They are followed by grass and tree pollens. Small number of patient have allergy for animal hair, feathers and cockroach. The rhinitis group of patients had the greatest number of positive skin prick tests for house dust mite and all pollens, than the asthma group. Ragweed is the most common weed pollen for both group of patients. Cocksfoot is the most common grass pollen in rhinitis group, and meadow and in asthma group of patients. Birch is the most common tree pollen for both groups of patients.

CONFLICT OF INTEREST: NONE DECLARED

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