

Short communication

Diagnostic value of the nasal provocation test with *Dermatophagoides pteronyssinus* in childhood asthma

Baki A, Uçar B. Diagnostic value of the nasal provocation test with *Dermatophagoides pteronyssinus* in childhood asthma. Allergy 1995; 50: 751–754. © Munksgaard 1995.

We aimed to determine whether the nasal provocation test (NPT) with allergen could be used as a diagnostic test in asthmatic children with or without allergic rhinitis, and whether it had any effects on pulmonary function tests and arterial oxygen saturation (SaO₂) values. Therefore, 25 asthmatic outpatients sensitive to *Dermatophagoides pteronyssinus* (Dp), aged 6–17 years, 12 having allergic rhinitis, and 10 nonatopic children as a control group were challenged intranasally with solution containing Dp extract by administration of a total dose of 800–1000 AU to both nasal cavities. Before the test and 10 min and 20 min after the administration of the allergen intranasally, the nasal expiratory peak flow (NEPF), pulmonary function tests, and SaO₂ were measured. In the NPT, a decrease of 20% or more in NEPF and occurrence of nasal symptoms were considered to be positive. NPT was positive in all the asthmatic patients with or without allergic rhinitis, while all the children in the control group had a negative test. Compared to values prior to the test, values of FEV₁ (forced expiratory volume in 1 s) and SaO₂ showed no statistically significant decrease, and no clinically significant asthmatic reaction was observed in any of the groups. Our study suggests that in asthmatic children with or without allergic rhinitis, the NPT with allergen is a simple, safe, and useful diagnostic test.

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Key words: allergic rhinitis; arterial oxygen saturation; asthma; child; *Dermatophagoides pteronyssinus*; nasal provocation; pulmonary functions.

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Accepted for publication 5 May 1995

Up to now, various provocation tests have been used in the diagnosis of asthma. Bronchial inhalation challenges with histamine, methacholine, or allergenic extracts have been used in epidemiologic studies involving children and as a tool to help in establishing the diagnosis of asthma, and to select allergens for inclusion in immunotherapy regimens (2). However, studies evaluating the diagnostic value of the nasal provocation test (NPT) with allergen in childhood asthma are very limited (4, 10). The aim of this study was to determine whether the NPT with allergen, which is a simple, safe, applicable, not time-consuming, and easily assessable test could be used as a diagnostic test in asthmatic patients with or without allergic rhinitis, and whether it had any effects on pulmonary function tests and arterial oxygen saturation (SaO₂) values.

Material and methods

Twenty-five asthmatic outpatients (14 girls and 11 boys) in the Farabi Hospital Department of Pediatrics (Turkey) were selected for this study. The study was carried out between February 1993 and August 1993. All of the patients showed a positive skin prick test and RAST to house-dust mites, but to no other allergens. Their ages ranged from 6 to 17 years (mean $\pm$ SD: 10 ± 3.6 years). Twelve of these patients also had allergic rhinitis. Ten nonatopic children (seven girls and three boys) between the ages of 6 and 15 years (mean $\pm$ SD: 11.8 ± 2 years) without a history of atopic disease, who had total serum IgE at normal levels and a negative skin prick test to house-dust mites, and who did not have eosinophilia or upper and lower airway problems within the

last three weeks were selected as a control group. Thus, our cases were divided into three groups, i.e., those with asthma having allergic rhinitis (group I), those with asthma only (group II), and the control group (group III).

None of the subjects had received immunotherapy or corticosteroid treatment previously. Patients were required to withhold antihistamine preparations for at least 3 days, and theophylline compounds and beta-agonists for 24 h prior to the study.

NPT were performed on all subjects between 8 and 12 a.m. to avoid possible circadian variations. Within the last 3 weeks and on the test day, the children had no asthma symptoms or upper respiratory tract infection. All subjects had not experienced any upper or lower respiratory tract viral infection for 6 weeks prior to the test day.

All children were first challenged with 0.9% saline solution and 10 min after that with solution containing *Dermatophagoides pteromyssinus* (Dp) house-dust mite intranasally. Each solution was delivered to both nasal cavities, as both nasal cavities would not respond equally to allergen challenge. An 0.9% saline solution was delivered into the nose with a hand-atomizer delivering one puff into each nostril. The allergen solution containing 10000 AU/ml of Dp extract (Hal Allergie Laboratory GmbH) was delivered through the nostril into the inferior turbinate region by a metered-dose pump-sprayer insufflating one puff (0.04–0.05 ml) into each nasal cavity (with a total dose of 800–1000 AU for both nostrils). During allergen insufflation, the patients held their breath and a nose-clip was applied immediately after insufflation to avoid inhalation of allergen into lower airways.

Before the test, 10 min after the administration of the 0.9% saline solution, and 10 min and 20 min after the administration of allergen, NEPF (1 min) was measured three times subsequently with a rhinomanometer (PN-Test, Hal Allergie GmbH, Düsseldorf, Germany). The mean value of three measurements was recorded. The same procedure was repeated for both nostrils.

The number of sneezes and symptoms such as rhinorrhea, nasal blockage, and itching of the nose which occurred during the 10-min period following allergen administration was recorded. The test was considered to be positive when a decrease of 20% or more in NEPF compared to the values prior to the test occurred in addition to an increase in nasal symptoms. The decrease in NEPF was calculated for each nostril separately, and then the decrease of the most reactive side was considered.

Before the NPT and 20 min after the administration of allergen, pulmonary function tests were performed on all subjects, except for a 6-year-old patient who was uncompliant in using a computer-

ized spirometer (System 2400, Computerized Pulmonary Function Laboratory, Sensor Medics). Forced expiratory volume in 1 s (FEV_1) as an indicator of bronchial response was recorded. None of the asthmatic patients had a pretest FEV_1 value under 70% of the predicted value. Arterial oxygen saturation (SpO_2) was also measured for all the subjects in the study and the control groups by Oxy Shuttle Pulse Oximeter (Sensor Medics Corporation, California, USA) before the test and after the test. The changes in FEV_1 , SpO_2 , and NEPF were compared to the values prior to the test in all cases.

The Wilcoxon sign rank test was used to compare the pre- and post-test values in each group, and the Mann-Whitney U test was used to compare the changes of various test parameters in the groups.

Results

There were no statistically significant decreases in NEPF in any of the study and control groups after the administration of 0.9% saline intranasally ($P > 0.05$). After the specific allergen administration intranasally, groups I and II showed a significant decrease from the pretest NEPF values ($P < 0.05$); however, there was no significant decrease in the control group ($P < 0.05$). Both groups I and II had a significantly greater decrease than the control group ($P < 0.05$). However, there was no statistically significant difference between groups I and II for these values ($P > 0.05$). All patients in groups I and II had a decrease of more than 20% in NEPF and showed clinical nasal symptoms (sneezing, rhinorrhea, congestion, itching) during the 10-min period following challenge with allergen. Among these, seven patients in group I and eight patients in group II had a decrease of 100%. Thus, NPT was positive in every patient in groups I and II. However, none of the children in the control group had a decrease of 20% or more in NEPF. Half of the control subjects showed statistically insignificant decreases ranging between 2% and 13% in NEPF, while the other half of them had no change in NEPF with allergen challenge. None of the children in the control group had any clinical nasal symptoms during or after the test. Hence, all the children in the control group had a negative NPT (Fig. 1).

Before the test, SpO_2 values of subjects in all the groups ranged from 95% to 99% ($97\% \pm 1.05\%$) and there was no statistically significant difference between the groups ($P > 0.05$). Compared to those prior to the test, values of SpO_2 showed no statistically significant decrease in any groups ($P > 0.05$).

Pretest FEV_1 values of groups I and II were significantly lower than those of the control group ($P < 0.05$). However, there was no significant difference between pretest FEV_1 values of groups I and

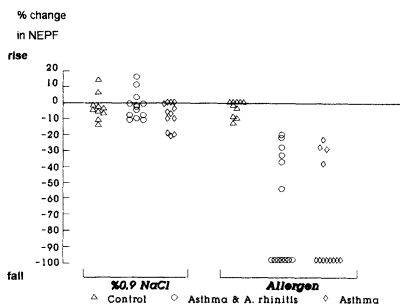


Fig. 1. Individual changes in NEPF after nasal provocation with 0.9% saline and specific allergen in controls, patients with asthma and allergic rhinitis, and patients with asthma only (positive values reflect rises, and negative values reflect falls in NEPF: -100% , fall demonstrates complete nasal obstruction).

II ($P > 0.05$). Twenty minutes after allergen challenge, no significant fall in FEV_1 occurred in any group ($P > 0.05$).

One patient in group I developed mild wheezing and another patient in group II developed mild cough during the 10-min period after the test, although no significant changes were observed in their FEV_1 and SAO_2 values; and they recovered in a few minutes without requiring any treatment.

Discussion

Skin tests, RAST, and provocation tests are useful methods for evaluating allergic states. Among provocation tests, the bronchial provocation test with allergen is one of the important tests which has been used for a long time. However, it has some difficulties in application, especially in children, since it requires a long time and special equipment and is often unpleasant for the patient (6, 9). In contrast to this, nasal provocation with allergen is a simple test, can be easily performed, does not cause any important complication, and is not time consuming.

Different ideas about whether nasal mucosal response reflects bronchial mucosal responsiveness and whether stimulation of nasal mucosa affects lower airway hyperreactivity have been reported in the literature. These studies were mostly for adults; only the studies of Jean et al. (4) and Ukai et al. (10) included a pediatric age group. Although these studies are similar to ours in some aspects, there are significant differences in the methods and the selection of the patients and control groups.

There are some studies confirming that the NPT is a safe and valuable diagnostic method for asthma (4, 5). Other studies indicate that bronchial allergen

provocation cannot be replaced by similar provocation of other organs, since the sensitivity of the mucosa in different organs of the same patients is unrelated (3, 6).

Our findings have shown that the NPT was positive in every asthmatic child with or without allergic rhinitis, while all the children in the control group had a negative test. None of the children had any significant response to normal saline administration intranasally. These findings demonstrate that NPT positivity in asthmatic children is not a nonspecific response.

In our present study, no statistically significant difference could be found between the group consisting of patients with asthma and allergic rhinitis and the group consisting of patients with asthma without allergic rhinitis in their NPT results. Therefore, it has been demonstrated that allergic rhinitis did not seem to affect the results of the nasal provocation tests, and that the NPT positivity with specific allergen in asthmatic patients is related to diffuse mucosal sensitivity. For this reason, this test may be used in the diagnosis of asthma. In addition to these findings, we demonstrated that the nasal provocation with allergen did not cause any change in pulmonary function tests and SAO_2 , and therefore that this test does not cause any significant pulmonary complications. Other authors support our findings, although their methods are different (1, 4, 7, 8).

In conclusion, our study suggests that the NPT with allergen is a simple and applicable diagnostic test in asthmatic children, and that it does not have any effect on pulmonary function tests and SAO_2 or any significant complications when carried out during the asymptomatic period.

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