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Local reaction of the nasal mucosa to an environmental factor, the allergen

Edyta Krzych-Fałta [1,*], *Adam J. Sybilski* [1,2], *Bolesław Samoliński* [1]

[1] *Department of Environmental Risk Prevention and Allergology, Faculty of Health Sciences at Medical University of Warsaw, Poland*

[2] *Department of Pediatrics and Neonatology, Central Clinical Hospital of the Ministry of Interior in Warsaw, Poland*

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ABSTRACT

The **Purpose** of the study was to assess the inflammatory response of the nasal mucosa based on nitric oxide concentration in exhaled breath and the level of inflammatory markers tryptase/eosinophil cation protein (ECP) in the nasal lavage fluid obtained via a nasal lavage collection device of our design. **Material:** The study group included 60 subjects: 30 patients diagnosed with an allergy to common environmental allergens (dust mites/grasses) and 30 healthy controls. The **Method** used in the study was NAPT, monitored via measuring nasal nitric oxide (nNO), and tryptase/ECP in nasal lavage fluid. **Results:** The early phase of the allergic reaction involved a drop in nNO with a simultaneous increase in nasal lavage tryptase levels (2.23 μg/L in the allergic rhinitis subgroup), which significantly differentiated between the allergic rhinitis and healthy groups. The late phase of reaction showed a significant increase in nNO and nasal lavage ECP levels (three-fold higher in the allergic rhinitis group than in healthy individuals). **Conclusion:** NAPT affects the nasal mucosa locally by initiating a series of symptoms characteristic for the early and late phases of the allergic reaction resulting from inflammatory marker secretion.

Introduction

Recent years have seen a growing incidence of allergies, defined as pathological, specific immune system response to allergens. Currently, allergy – in its various forms – is becoming an epidemic and is considered to be the disease of the 21st century [1]. The 2006–2008 Epidemiology of Allergic Diseases in Poland (ECAP) study in 18 617 respondents showed that nearly 40% of the general population of Poland (of 36 million) are affected by an allergic condition, including allergic rhinitis (AR) (>8 mil; 25%), diagnosed bronchial asthma (>1.5 mil; 5%), symptoms of asthma (>4 mil; 12%), atopic dermatitis (>1.5 mil; 4%) [2, 3]. Given the scale of the problem, we need to understand the exact pathophysiology of the reaction in order to introduce effective medical treatment or tertiary prophylaxis, to counteract adverse effects, and minimize the risk of

* *Corresponding author at*: Zakład Profilaktyki Zagrożeń Środowiskowych i Alergologii Warszawski Uniwersytet Medyczny, ul Banacha 1a, 02-097 Warszawa, Poland. Tel.: +48 22 599 20 39; fax: +48 22 599 20 42.
E-mail address: edyta.krzych-falta@wum.edu.pl (E. Krzych-Fałta).

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cross-reactivity. Nasal antigen provocation testing (NAPT) seems to be the optimal tool to assess the local nasal mucosal reaction defined as "the set of manifestations caused by IgE-mediated inflammatory reaction of the nasal mucosa to an allergen" [4]. Despite the fact that NAPT only partially imitates natural exposure to an allergen (single allergen dose), the test is a valuable source of information on the condition of those examined, and in case of large discrepancies in the history, skin-prick tests, or sIgE tests it is often decisive in qualifying patients for immunotherapy.

Experimental procedures

The aim of this study was to assess the inflammatory reaction within the nasal mucosa measured via nitric oxide in condensed air exhaled from the nose (nNO) and the level of markers; tryptase/ECP in nasal lavage fluid obtained with a nasal lavage collection device of our own design, which minimized the loss of sample material for an enzyme-linked immunosorbent assay (ELISA).

The study group comprised 60 subjects: 30 patients diagnosed with allergy to common environmental allergens: house dust mites *Dermatophagoides pteronyssinus, Dermatophagoides farinae*, grass pollens (14 females and 16 males; the mean age in the seasonal allergic rhinitis (SAR) group was 29.39 ± 6.001, in the perennial allergic rhinitis (PAR) group – 24.25 ± 3.415) and 30 healthy controls (HC; mean age 30.63 ± 6.037) with no allergic symptoms.

Study inclusion criteria

- social history confirming an allergy to a given allergen (at least 3 years of symptoms, without medical treatment or specific immunotherapy)
- positive skin-prick test results
- computed tomography results of the paranasal and frontal sinuses excluding inflammation
- preserved patency in the osseous part of the nose

Study exclusion criteria

- a period of no less than 6 weeks from air-borne allergen season preventing the "sensitizing" phenomenon prior to NAPT
- nasal deformities, primary occlusion of the nares, septal perforation, significant septal deviation,
- nasal polyps,
- atrophic rhinitis,
- a less than 6-week interval from the end of symptoms of allergic rhinitis; the patients with SAR were examined in the period from March to May,
- vaccinations (according to immunization schedule, with vaccine formulations) administered within a week prior to testing,
- a less than 8-week interval from a nasal surgical procedure (especially corrective surgery on the inferior turbinate),

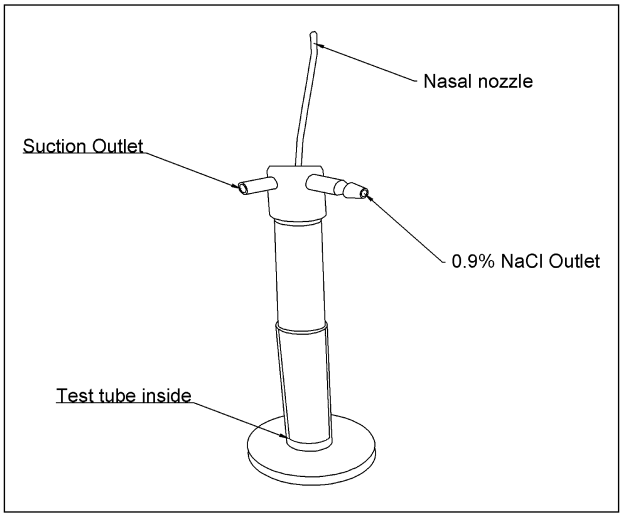

Fig. 1 – Nasal lavage collection device prototype (source on file)

- acute upper respiratory tract infection within 2–4 weeks before the study
- paranasal and frontal sinusitis
- bronchial asthma.

The test method used in the study was NAPT with a standardized allergen dose of 0.2 mL (5000 SBU/mL, Allergopharma) administered nasally with an atomizer. As usual, NAPT-evoked symptoms were assessed via a visual analog scale (VAS) (measured at 5, 10, 15, and 20 min, and at 4 h) and objective degree of inflammation (measured prior to, as well as 30 min and 4 h after): nNO, tryptase/ECP. Measurements of nNO (Hypair FeNO, Medisoft) in the exhaled air were conducted based on on-line nNO concentration analysis, with flow rates of 0.01–1 L/s and approximate pressure of 50 cm H_2O. Tryptase/ECP levels were assessed in the nasal lavage fluid obtained with a collection device made of stainless steel designed by Samoliński (Fig. 1). The device has a stand, which allows the patient to be seated comfortably, two outlets: one for saline influx into nasal cavities, the other connected to a suction tube, for efflux of the lavage fluid at a low pressure of 0.01–0.02 Pa into a test tube placed within the device stand. The tubing for saline influx into the nasal cavity was secured at the bottom with a rubber stopper to minimize loss of the collected material. The collected nasal lavage fluid was centrifuged (at the rate of 1000 rpm) and tested with ELISA (UniCAP, Pharmacia, Sweden, sensitivity threshold 1.0 μg/L). The study was conducted as part of a promotional grant by the Ministry of Science and Higher Education (N N402 520839) and was approved by the Ethical Committee of the Medical University of Warsaw (KB/79/2009). The Student *t* statistic and the Pearson's coefficient were calculated to determine the correlation between variables. Levene's test was used to estimate the homogeneity of variance. *P* value of <0.05 was considered to be statistically significant.