Original Article

The Nasal Smear for Eosinophils, It's Value, and It's Relation to Nasal Mucosal Eosinophilia in Allergic Rhinitis

Abstract

Introduction
There is no single test as a gold standard for the diagnosis of allergic rhinitis (AR). This study was to assess the usefulness and validity of nasal smear as a quick, easy and inexpensive diagnostic method for diagnosis of allergic rhinitis.

Materials and Methods
This study was conducted in a university hospital setting. Nasal smears were taken from 39 patients with a clinical history of nasal allergy and a positive skin prick test to at least one aeroallergen as well as 26 controls without any history and negative test. Biopsy specimens from the inferior turbinate as well as nasal smears of 19 cases including 9 patients and 10 controls with the same criteria were taken. Nasal smears and biopsy slides were stained with Giemsa and Hematoxilin-Eosin and were examined blindly by two separate pathologists.

Results
Fifty one percents of the patients and 11.5% of the controls showed eosinophilia in their nasal smear (≥10% eosinophils, *P*=0.001). The sensitivity of nasal eosinophil count as a diagnostic test for AR was 51.3% with a specificity of 88.5%, a positive predictive value of 87% and a negative predictive value of 54%. Eosinophilia in nasal biopsies was found in 44% and 30% of allergic patients and controls respectively. There was no significant correlation between symptoms or positive skin tests with either smear eosinophilia or tissue eosinophilia.

Conclusion
Evaluation of eosinophils in nasal smear is an insensitive but fairly specific test for the diagnosis of allergic rhinitis. It seems that the nasal secretions and nasal tissue represent two distinct cellular compartments.

Keywords
Eosinophilia, Nasal mucosa, Rhinitis

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Introduction

Allergic rhinitis is an IgE-mediated hypersensitivity reaction in nasal mucosa which is characterized by sneezing, itching, watery nasal discharge and a sensation of nasal obstruction. Depending on the part of the world, the rate of symptoms attributed to allergic rhinoconjunctivitis ranges from 1.4 to 39.7% of the population (1). A characteristic feature of allergic inflammation is local accumulation of inflammatory cells including T lymphocytes, mast cells, eosinophils, basophils and neutrophils (2). Release of various mediators from these cells is responsible for the symptoms of allergic rhinitis which can be divided into early or delayed (late) phase response (3).

Accumulation of additional inflammatory cells such as eosinophils and T cells occurs in response to various chemokines. These inflammatory cells can be easily identified in nasal mucosa or secretions by performing nasal biopsies and then, preparing nasal smears to confirm the diagnosis of allergic rhinitis. Moreover, these methods are simple, reproducible, easy to perform and cost-effective as compared to other tests e.g. skin prick test or radioallergosobent test (RAST), etc (3).

The present study was planned to evaluate the diagnostic value of nasal smear as a simple, noninvasive and inexpensive method for diagnosing allergic rhinitis and comparing it's validity to nasal tissue biopsy.

Materials and Methods

In a prospective, cross-sectional controlled and single-blinded study, we analyzed the value of nasal secretion and tissue eosinophilia in diagnosis of allergic rhinitis. The study was approved by Research Ethics Committee of Mashhad Medical School, Mashhad, Iran and was conducted in Imam Reza Hospital and Immunology Research Center, Mashhad, Iran. Participants were recruited through regional advertising from September 2006 to August 2007. Nasal smears were taken from 39 patients with a clinical history of perennial allergic rhinitis and a positive skin prick test to at least one aeroallergen as well as 26 controls without history of any allergic diseases and negative skin prick test to the same panel of aeroallergens as patients' group. Biopsy specimens were taken from the inferior turbinate of all patients as well as 10 controls. Complete allergic work up including history of special stress on allergic disorders, total serum IgE, allergic symptoms and physical examination was carried out for all cases. Participants taking local or systemic corticosteroids or those with chronic rhinosinusitis were excluded. Nasal smears and biopsy slides were stained with both Giemsa and Hematoxilin-Eosin method and were examined blindly by two separate pathologists. A smear was considered positive for eosinophilia when there was more than 10% eosinophils of total leukocytes and for mucosal eosinophilia (tissue biopsy) with at least more than three eosinophils in each high power field (X 40) of microscopic slide.

The data were analyzed using SPSS (PC version 11.5) software. Proportion equality test was used for two independent populations and chi–square test was done to compare those populations. $P<0.05$ were considered significant.

Results

In the control group, 10 were males and 16 were females, while in the study group, 20 and 19 were males and females respectively. The mean age was 22 and 24 years for patients and controls, respectively (range: 6-56 years). Table 1 shows the demographic characteristics of patients and controls.

51% and 11.5% of the patients and the controls demonstrated nasal smear eosinophilia respectively, and the difference was statistically significant ($P=0.001$) (Fig 1,2).

The sensitivity for nasal smear eosinophilia in the diagnosis of allergic rhinitis was 51.3% with a specificity of 88.5% and a positive and negative predictive value of 87% and 54%, respectively. The specificity of test was increased to 100% when the rate of eosinophilia was considered more than

50% but at the same time the sensitivity of the test declined (Fig 4).

Table 1: Demographic characteristic of patients and controls.

Group	Age (mean) / Range (year)	Sex (F/M)	Family history (Allergy)
Smear			
Patients (39)	21.67 / (6-56)	19/20	60%
Controls (26)	22.54 / (6-38)	9/17	46%
Tissue			
Patients (9)	21.78 / (17-56)	8/1	33-3%
Controls (10)	22.8 / (6-37)	7/3	60 %

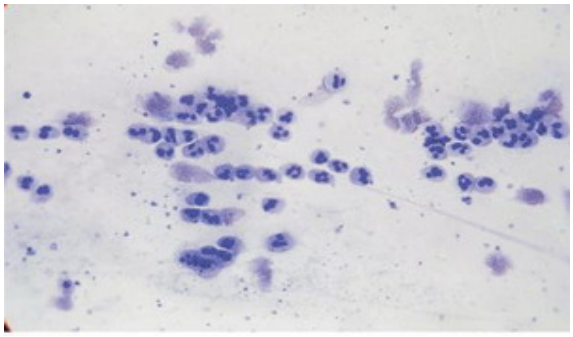

Fig 1: Infiltration of neutrophils in nasal smear. (May Granwald-Giemsa, 10×40)

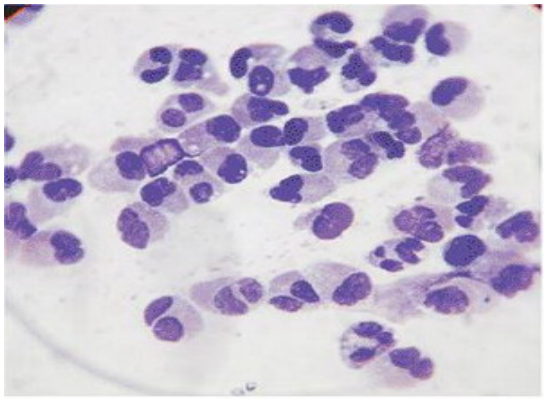

Fig 2: Infiltration of eosinophils in nasal smear. (May Granwald-Giemsa, 10×40)

For nasal biopsies, 44% of the patients and 30% of the controls had eosinophilia in turbinate specimens (Fig 5,6), but differences was not significant (*P*>0.05).

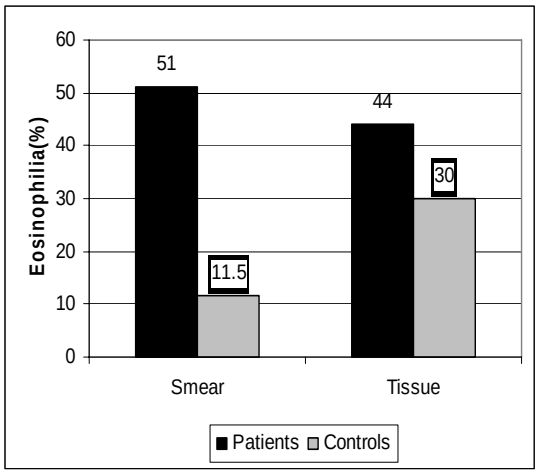

Fig 3: Comparison of eosinophilia in nasal smear and nasal tissue of patients and controls

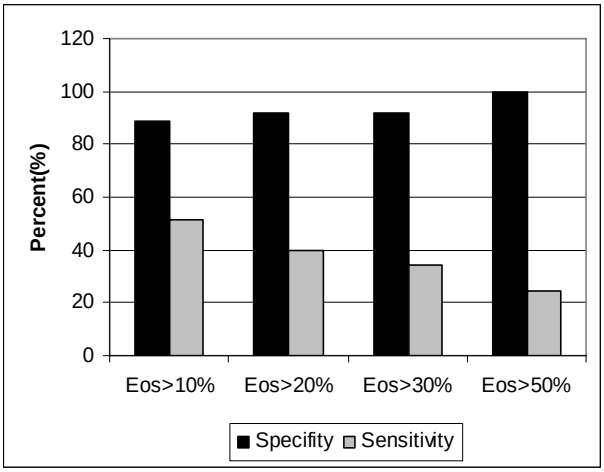

Fig 4: Specificity and sensitivity of eosinophilia in nasal smears with different cut off values

There was a positive significant correlation between smear eosinophilia and mean total serum IgE while for nasal biopsy we couldn't find such correlation between biopsy eosinophilia and total serum IgE (Table 2).

Table 2: The association between mean total IgE and eosinophilia in nasal smear and nasal tissue among allergic rhinitis patients.

Group		Mean IgE U/ml) / Range	*P*
Smear eosinophilia	Positive	199 (77-990)	0.018
	Negative	113 (52-620)	
Tissue eosinophilia	Positive	176 (84-880)	0.675
	Negative	107 (25-545)	

There was no significant correlation among symptoms or positive skin tests with neither smear eosinophilia nor mucosal eosinophilia (P>0.05).

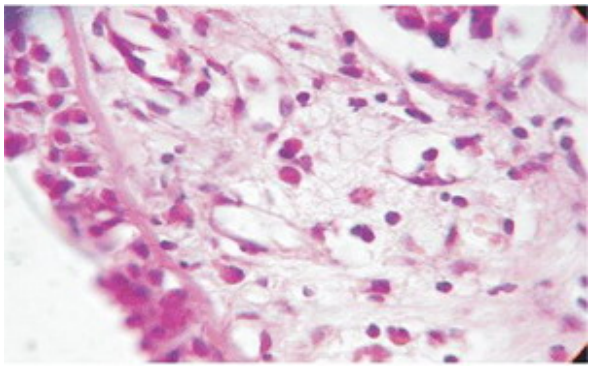

Fig 5: Infiltration of eosinophils in lamina propria. (H&E, 10×100)

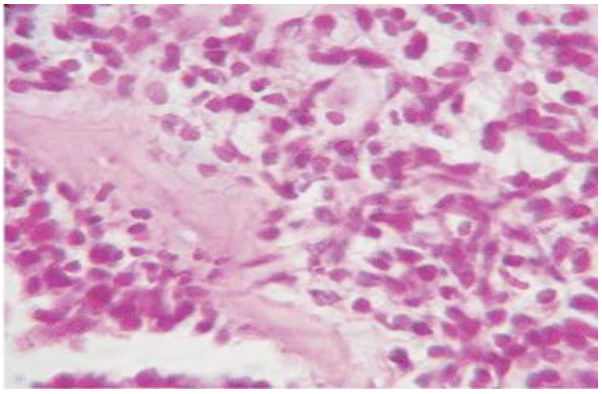

Fig 6: Infiltration of lymphocytes in lamina propria. (H&E, 10×100)

Discussion

Rhinitis is a heterogeneous disorder characterized by one or more of the following nasal symptoms: sneezing, itching, rhinorrhea, and/or nasal congestion. Studies reflect a more accurate prevalence of rhinitis but are likely to continue to underreport this disease (4,5).

There are many different causes of rhinitis in children and adults. Approximately 50% of all cases of rhinitis are caused by an IgE mediated reaction to allergens. In this case symptoms arise as a result of local inflammation induced by aeroallergens such as pollens, molds, animal dander and house dust mites. The immune response involves the release of inflammatory mediators and the activation and recruitment of different inflammatory cells to the nasal mucosa (6). Infiltration of inflammatory cells is evident in both seasonal and perennial form, although the magnitude of these cellular changes is somehow different in seasonal and perennial allergic rhinitis (7).

Although the type of infiltrating cells and pattern of inflammation is varied among different studies but generally accepted, allergic rhinitis (AR) is characterized the recruitment of eosinophils into the nasal mucous.

Increased numbers of eosinophils are reported within nasal lavage (8,9), secretions, smear, brush and biopsy samples in perennial AR compared with healthy nasal mucous (8-14). Inflammatory cellular infiltrates of eosinophils and basophilic metachromatic cells are the hallmark of the atopic nasal responses in allergic rhinitis. Nasal cytologic examination for these cells not only establishes the diagnosis of allergic rhinitis but is also useful in the follow up of patients and evaluation the efficacy of treatment (14). In general, numbers of eosinophils tend to be lower in perennial disease, in contrast to seasonal disease, with the proviso that this depends on the level of seasonal allergen exposure (15,16). Nasal biopsy samples reveal epithelial accumulation similar to that identified in seasonal disease as well as increases within the lamina propria (12). However, this finding is not invariable and may reflect both the degree of atopic sensitization and the level of perennial allergen exposure (17).

Miller et al claimed that the nasal smear for eosinophils appears to be a reliable diagnostic test with moderately high sensitivity and high specificity (18).

Allergic rhinitis is considered to be male predominant diseases, in our study there was a mild predominance for males. Although the onset of allergic rhinitis can occur at any time of life, 70% of these develop it before 30 years of age and in our study 60% patients were <30 years of age (19).

In our study three patients (11.5%) had increased number of eosinophils in control

Group. This is in agreement with Mygrind and Murray et al who reported increased eosinophils in 11% and 17% of their controls respectively (20,21).

In 51% of patients, eosinophilia was evident in their nasal smears, which is higher than the study by Chanda et al (3) and Lans et al (22). However some studies have shown higher positive rates of 81% and 69.2% (23, 24).

In spite of new techniques for allergic rhinitis diagnosis, still nasal smear specifically for eosinophilia has some role either in diagnosis or treatment evaluation (25-28).

The present study showed that smear eosiniphilia is more sensitive and specific than biopsies for the detection of allergic rhinitis and this is in agreement with finding of Mygrind et al (20). However results of another study has shown that biopsies are better than smears (3).

Conclusion

The result of this study showed that evaluation of eosinophils in nasal smear is an insensitive but fairly specific test for the diagnosis of allergic rhinitis. In addition, it sees that the nasal secretions and nasal tissue represent two distinct cellular compartments.

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