

Prevalence of allergic rhinitis and nasal smear eosinophilia in 11- to 15 yr-old children in Shiraz

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Allergic rhinitis (AR) is a common condition among schoolchildren. The prevalence rate of AR differs among countries and even among regions within the same country. The objective of this study was to determine the prevalence of nasal symptoms and signs of AR and nasal smear eosinophilia in 11- to 15-yr-old children in Shiraz. A total of 4584 children aged 11–15 yr of both sexes were surveyed from May 1995 to April 1996, and nasal symptoms and signs of AR (sneezing, rhinorrhea, nasal blockage, itching, color change, mucosal swelling, nasal wetness, and nasal crease), based on questionnaire and ear, nose and throat (ENT) examination were recorded. In addition, smears were taken from nasal secretions and stained. The results compared with nasal smears related to 340 healthy children. 1008 (22%) schoolchildren had nasal symptoms of AR (based on the questionnaire), 445 (9.7%) were identified as having nasal symptoms and signs of AR (based on the questionnaire and ENT specialist examination), and 226 (5.8%) had nasal symptoms and signs of AR associated with nasal eosinophilia (based on the questionnaire, ENT specialist examination and positive nasal smear for eosinophilia). Nasal eosinophilia was present in 274 (62%) children with nasal symptoms and signs of AR. This survey showed that prevalence of nasal symptoms and signs of AR was high in schoolchildren in Shiraz. Nasal smear eosinophilia had a diagnostic specificity of 96% and sensitivity of 62% and seems to be a potentially valuable test for AR.

Allergic rhinitis (AR) is the commonest chronic disease (1). The incidence of AR is ever increasing because of industrialization and urbanization. The reported incidence of AR is 1.4–39.7% of the population in western countries (2). In UK there has been a fourfold increase in the incidence of AR in the last 30 yr (3). The cause of this increase is unknown; however, contributing factors may include higher concentrations of airborne pollution, rising dust mite populations, less ventilation in homes and offices, dietary factors, and the trend toward more sedentary lifestyles. AR symptoms typically begin in childhood and adolescence, and continue into adulthood. There is a significant trend for symptom improvement with younger age of onset of AR (4).

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In genetically susceptible individuals, airborne allergens sensitize the nasal mucosa and subsequent exposures lead to AR. It is an immunoglobulin-E (IgE)-mediated hypersensitivity disease characterized by a triad of intermittent clear rhinorrhea, sneezing, and nasal obstruction. Other features are itching of the nose, ears, eyes, and palate. There may be associated post nasal drip, eustachian tube obstruction and sinusitis.

Allergic rhinitis has a significant physical and economical impact on the patient. However, rhinorrhea, a prominent feature of AR, also has a social impact on the patient due to using handkerchief all the time (5).

One of the hallmarks of the allergic reaction is the eosinophilic infiltrate. Eosinophils actually

release various mediators such as basic proteins, arachidonic acid metabolites, oxygen derivatives, and cytokines, which contribute to mucosal inflammation. The presence of eosinophils in the nasal smear is particularly suggestive of an ongoing allergic reaction. In fact, only during AR is there an abundant eosinophil mucosal infiltrate. It is possible to demonstrate eosinophil activation by measuring mediator levels in nasal lavage fluid (6, 7). Elevated eosinophil counts are present in approximately 20% of the nasal smears of the general population; however, not everyone with eosinophilia has symptoms of rhinitis. A distinguishing feature of nonallergic rhinitis with eosinophilia syndrome (NARES) is the presence of eosinophils, usually between 10% and 20%, on nasal smears (8). Neutrophils remain, however, the principal inflammatory cells detectable in nasal cytology during allergic inflammation, although there is still no convincing evidence of their pathogenic role. It is worthy of note that inflammatory cell infiltrates occur with the clinical reaction as demonstrated by nasal allergen challenge studies (9, 10). During the early phase reaction, neutrophils predominate, while during the late phase eosinophils are more prominent (9). Further, the allergen challenge model demonstrates that repeated allergen provocations induce a more intense clinical and inflammatory response: the so-called 'priming effect' of specific hyperreactivity. It is a natural phenomenon occurring, for example, during the pollen season, when the previously sensitized subject is continuously exposed to the specific allergen. Recent studies indicate that if allergenic exposure persists allergic inflammation would be detectable even in the absence of symptoms, thus making clinical evaluation not a sufficient and reliable marker of allergic reaction (11). Eosinophilia in nasal mucosa is characteristic of AR (12). However, little is known about the prevalence of nasal eosinophilia (13).

The current study was designed to determine the prevalence of nasal symptoms and signs of AR and nasal smear eosinophilia among 11- to 15 yr-old children of both sexes in four seasons in Shiraz.

Patients and methods

In this study, we surveyed 4584 children aged 11–15 yr of both sexes from eight schools in Shiraz from May 1995 to April 1996. The selection was a cluster and simple random sampling, and about 150 children were studied in each school. We excluded children presenting clinical evidence of airway infection, as well as patients with pronounced deviated septum, nasal polyps, and other

nasal diseases that are identifiable through the use of anterior rhinoscopy. In addition, children diagnosed with moderate or severe asthma and children with severe comorbidities were excluded, as were patients who were being treated with antibiotics, nasal vasoconstrictors, antihistamines, or topic or systemic corticosteroids.

A questionnaire about symptoms of rhinitis (sneezing, rhinorrhea, nasal obstruction, itching) was completed by children with the help of two medical students (intern) or their parents. The nasal cavity was examined by an ENT specialist through the use of anterior rhinoscopy (nasal speculum). Color (bluish or whitish) and swelling of the mucosa, the presence of nasal wetness, and transverse crease of external nose were evaluated. Eosinophils in epithelium were obtained by gentle scraping with a blunt ear curette from the anterior part of the inferior turbinates of allergic patients, and Geimsa staining was carried out. The classification of nasal smears for eosinophils and neutrophils was according to the set zigzag method. Both smears were graded using the method of Shioda and Mishima (14). In smears for eosinophils and neutrophils, criteria adopted were 0: no cell, +: few eosinophils (or neutrophils) or small clumps, ++: moderate number or large clumps, +++: still larger clumps but did not cover the entire field, ++++: large clumps covering the entire field. When 10 or more cells (either eosinophils or neutrophils) were seen in any two separate high-power fields, the slide was graded as positive for these cells ($\geq 2+$). 340 nasal smears of age- and sex-matched healthy subjects with no evidence of AR acted as controls. The children were categorized into three groups: those with nasal symptoms of AR (based on the questionnaire), those with nasal symptoms and signs of AR (based on the questionnaire and ENT specialist examination), and those with nasal symptoms and signs associated with nasal eosinophilia (based on the questionnaire, ENT specialist examination and positive nasal smear for eosinophilia).

Statistical method

Data were analyzed for statistical significance by chi-squared test. $p \leq 0.05$ was considered significant.

Results

Of 4584 students, 2984 subjects (65%) were female and 1600 (35%) were male. The mean age was 12.9 yr. 1008 (22%) children had nasal symptoms of AR (based on the questionnaires),

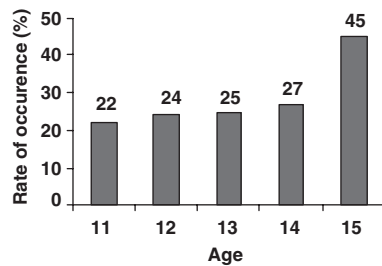


Fig. 1. Age distribution of allergic rhinitis in children.

445 (9.7%) had nasal symptoms and signs of AR (based on ENT specialist examination), and 226 (5.8%) had nasal symptoms and signs of AR associated with nasal eosinophilia (based on positive nasal smear for eosinophilia). In our study, AR occurred slightly more in males than in females. It was more common in older children (Fig. 1).

Rhinorrhea (55% and 85%) and nasal obstruction (56% and 65%) were the most common symptoms in those with nasal symptoms and in those with nasal symptoms and signs of AR, respectively. However, rhinorrhea (92%) and change in color of the nasal mucosa (88%) were the most common in those with nasal symptoms and signs of AR associated with nasal eosinophilia (Table 1).

There was no significant difference between these groups with respect to age, sex or season, and distribution of nasal symptoms or signs. Fifty-two percent of all children with nasal symptoms and signs of AR associated with nasal eosinophilia had pale mucosa, 36% had violaceous, and 12% had normal mucosal color. The results of nasal smear eosinophilia and neutrophilia for each of the three groups are summarized in Table 2.

Table 1. Nasal symptoms and signs of allergic rhinitis (AR) observed in three groups of schoolchildren

Nasal symptoms and signs of AR	With nasal symptoms, n (%)	With nasal symptoms and signs, n (%)	With nasal symptoms and signs associated with nasal eosinophilia, n (%)
Rhinorrhea	587 (55)	378 (85)	208 (92)
Nasal obstruction	598 (56)	289 (65)	190 (84)
Sneezing	438 (41)	240 (54)	151 (67)
Itching	363 (34)	191 (43)	101 (45)
Color change		221 (50)	199 (88)
Swollen turbinates		151 (34)	135 (60)
Nasal wetness		120 (27)	106 (47)
Nasal or allergic salute (horizontal crease in the skin of nose)		31 (7)	27 (12)

Table 2. Nasal smear eosinophilia and neutrophilia in three groups of schoolchildren

	With nasal symptoms, n (%)	With nasal symptoms and signs, n (%)	With nasal symptoms and signs associated with nasal eosinophilia, n (%)
Nasal eosinophilia	303 (28%)	274 (62%)	226 (100%) $p < 0.002$
Nasal neutrophilia	272 (25%)	191 (43%)	139 (62%) $p < 0.08$

Nasal eosinophilia in 274 (62%) children with nasal symptoms and signs of AR were significantly higher than that in the control group (4%) ($p < 0.002$). Among the symptoms and signs of AR, nose rubbing, sneezing, and swollen turbinate had significant relationship with eosinophils ($p < 0.01$). One hundred and forty (73%) of those with nasal symptoms and signs of AR had both nasal eosinophilia and neutrophilia. Nasal neutrophilia was not significantly associated with age, sex, season, or nasal symptoms and signs of AR except of swollen turbinates ($p < 0.05$).

Discussion

Our study was the first epidemiological survey of the prevalence of childhood nasal symptoms and signs of AR in Iran (Shiraz). No estimate of the actual percentage of the population suffering from AR, especially children, is available in our country. This study revealed that the prevalence of nasal symptoms of AR was 22%, which is in agreement with the study by Eder et al. in Salzburg (15). There is wide variability in the prevalence of AR between populations of different countries. For example, higher prevalence of AR was observed with 26.3% in Bangkok (16), 26.51% in Saudi Arabia (17), 30.0% vs. 31.1% in Beijing and Urumqi, respectively (18), 33.2% in South Africa (19), and 59.4% in Khon Kaen, north-east Thailand (20). Lower prevalence of AR was observed with 5.5% in Estonia (21) and 3.35% in Turkey (22).

In this study, the prevalence of nasal symptoms and signs associated with nasal eosinophilia was 5.8%, whereas it was 17.3% in the study performed by Okano et al. (13). In other study (6), clinically diagnosed cases of AR supported by nasal smears were positive in 80% of cases as also reported by Gobach et al. (23).

The total number of cases in this study was higher than in some other studies (13, 16, 24), and similar to another study (6), AR was more common in males than in females.

Similar to other studies, we used a clinical criterion for identification of subjects with AR (6). However, for confirmation, we assessed eosinophils in nasal smears (13). Nasal smear of 62% of students in the study group showed eosinophils that was higher in comparison with 28% of the schoolchildren in the study by Malmberg (25). However, some studies have shown higher positive rates of 81% and 69.2% (24, 26). In this study, the ratio of nasal eosinophilia in children with nasal symptoms and signs of AR to nasal eosinophilia in the healthy control group (62% to 4%) was higher in comparison with another study which showed it to be 47% to 8% (27). Mygrind et al. (28) and Murray and Anderson (29) reported increased eosinophils in 11% and 17% of their controls, respectively.

One of the aims of this study was to evaluate the utility of the nasal smear as a screening test for AR. Nasal smear eosinophilia was present in 62% of children with nasal symptoms and signs of AR (sensitivity) with a specificity of 96%. Jirapongsananuruk and Vichyanond (30) reported that nasal smear eosinophils have sensitivity of 91.7% and specificity of 100% in diagnosing AR. Another study showed that nasal smear for eosinophils is an insensitive but specific test for the diagnosis of AR (31).

There was a significant relationship between nasal eosinophilia and clinical symptoms and signs of AR which is not in agreement with the literature where a significant contribution of nasal smear eosinophilia to the diagnosis of AR was very small and considered clinically irrelevant (24). However, 38% of children with nasal symptoms and signs of AR did not have nasal eosinophilia. It may be related to the late appearance of eosinophils in secretions of mild cases of AR. The poor cooperation of children for smear sampling (4% of cases) and poor staining of a few slides may explain this limitation. The effects of drugs, foods, exercise, and emotion on the appearance or disappearance of the eosinophils in nasal secretions need further studies.

We observed positive nasal smears for neutrophils in 43% of cases with nasal symptoms and signs of AR, which does not agree with another study where a higher incidence of 79% was reported (25). Forty-seven (14%) normal children had significant nasal neutrophilia and 87 (38%) patients with nasal symptoms and signs of AR associated with nasal eosinophilia had no neutrophilia in nasal secretions. On the other hand, the absence or presence of neutrophils could not be a diagnostic tool for AR. There was

a high significant association between nasal eosinophilia and nasal neutrophilia in those with nasal symptoms and signs of AR ($p < 0.001$). Although superimposed infection may also occur (32). On the other hand, nasal secretion neutrophilia seemed to have an adverse effect on the reliability of nasal secretion eosinophilia as an indicator of active nasal allergy (25). Clinical criteria can detect mild or unnoticed AR. Although the skin prick test is needed for the detection of allergens, it is not always practical in children because of the adverse effects of the test (discomfort, anxiety, and cost). However, diagnostic tests like the studies of specific IgE are not readily available in most centers in Iran.

Similar to other studies which suggested that nasal smear examination may be a potentially valuable test to predict prolonged or recurrent AR (13), and the assessment of eosinophils in nasal smears should be given more relevance and be more commonly used in the diagnosis of nasal allergy (26), in this study, the nasal smear for eosinophils appears to be a reliable diagnostic test with moderately high sensitivity and high specificity in children with nasal symptoms of AR when the history and physical findings are equivocal. This highly valid test can be quickly and easily performed and read. Moreover, it can serve as a useful adjunct in the diagnosis of AR.

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