

Study the Role of Nasal Scrap Cytology in Allergic Rhinitis Patients in Rural Population

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Abstract Allergic Rhinitis is one of the gift of modern era. Condition is involving wide range of age group starting from children to old age people. In spite of latest diagnostic facility and advanced treatment, it is still a great challenge for the otorhinolaryngologist. This study was done to perform simple and cost effective test to understand the severity of Allergic Rhinitis. To investigate the patients of allergic rhinitis with specific focus on nasal scrape cytology. After applying inclusion and exclusion criterion were found suitable and hence selected for the present study. 100 patients who were clinically diagnosed on history and examination as allergic rhinitis were included as cases while control group consisted of 100 subjects having no symptoms of allergic rhinitis. These patients were subjected to nasal scrape cytology for which Cytobrush Plus (Medscand Cell Sampling Kit), Malmo, Sweden, was employed. Mucosal specimens were acquired by scraping the surfaces of the middle thirds of inferior turbinates with Cytobrush Plus (Medscand Cell Sampling Kit), Malmo, Sweden. The samples thus obtained were transferred onto glass slides to be fixed in 95% ethyl alcohol and stained with May Gurwald Gimesa stain to study pattern and profile of different types of cells like eosinophils, goblet cells, mast cells. The nasal eosinophils were studied under 1000 × magnification of light microscope 10-well spread, high power epithelium fields were examined and the quantitative score of nasal eosinophils was rated according to a scale described by *Meltzer*. In study group all 100 patients underwent nasal scrape cytology. 25 (25%) patients in study group showed grade 1 + nasal

eosinophilia followed by grade ½ + in 24 (24%), grade 0 in 22 (22%) and grade 2 + in 21 (21%). In control group 80% of subjects had grade 0 nasal eosinophilia. Difference between nasal eosinophilia in the study and the control group were found to be statistically significant. In study group 54% showed grading > 0.5 + whereas 46% showed ≤ 0.5 + . The sensitivity and specificity were observed to be 54% and 100% respectively. The results thus found were statistically significant. Nasal scrape cytology which was an added dimension proved to be a more specific than sensitive test. The specificity of nasal scrape cytology in our study was 100%. Sensitivity was only 54%. 22% of the patients of allergic rhinitis showed an eosinophil count more than 300/cu mm.

Keywords Allergic rhinitis · Nasal scraping · Eosinophils

Introduction

Allergy has been found to affect 17% population at large [1]. The head and neck is the most commonly affected target organs of the allergic reaction. Effect of allergic reaction in producing nasal symptom was first reported by Derebery [2]. Allergic rhinitis is defined as an inflammation of the lining of the nose and is characterized by symptoms like nasal congestion, rhinorrhea, sneezing and itching. It is also defined as a state of hypersensitivity which is induced by exposure to particular allergen. It is a typical IgE mediated hypersensitivity. Allergens are inhalant, ingestants or contactants. They are also classified as major allergen or minor allergen.

The presenting symptoms of allergic rhinitis may also include nasal obstruction, paranasal pain or headache, pruritus, itchy or watery eyes, anosmia or dysosmia, chronic

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pharyngitis hoarseness and recurrent infection of nose and sinuses. These symptoms may be of seasonal or perennial nature. Due to its association with recurrent rhinosinusitis, otitis, bronchitis and asthma, it may also have an effect on quality of life and patients are likely to suffer from loss of sleep, reduced emotional well being, loss of concentration, and other associated symptoms such as headache. Thus though allergy has a low or no mortality, its presence has a significant negative impact on quality of life. The problem also has economic implications both direct and indirect. Mucus contains a number of different compounds able to neutralize antigen, either by innate or by adaptive immunological response. IgA and IgE are mainly present on the surface. IgE is a primarily involved in allergic reaction and produced mainly in lymphoid aggregates such as tonsils, adenoids and within the submucosa. IL-4 plays a pivotal role in directing specific IgE production by B lymphocytes, and IL-5 leads to clonal expansion of eosinophils. Newly produced IgE binds to high-affinity receptors on mast cells and basophils, resulting in sensitization of the nasal mucosa [3]. Within 4 to 10 h after allergen exposure, a second increase in mediators occurs, accompanied by cellular infiltration (particularly by eosinophils) of the nasal mucosa. Clinically, this late response correlates with increased nasal obstruction and nonspecific nasal hyper responsiveness [3]. This process is initiated by the presence of IL-8, eotaxin, and Regulated on Activation of Normal T cells Expressed and Secreted (RANTES), which provide a chemoattractant message for eosinophils toward the vascular endothelium [3]. In light of existing information about nasal allergy, we have undertaken this study wherein nasal scrap cytology was done for the eosinophils count in 100 clinically proven cases of Allergic Rhinitis and compare with 100 normal people.

Aims and Objectives

1. To study demographic profile of patients of allergic rhinitis.
2. To investigate the patients of allergic rhinitis with specific focus on nasal scrape cytology.

Material and Method

A total of 200 subjects between the age group of 15–74 years attending E.N.T. outpatient department of Acharya Vinoba Bhave Rural Hospital and Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, after applying inclusion and exclusion criterion were found suitable and hence selected for the present study. 100 patients who were clinically diagnosed on history and examination as allergic rhinitis were included as cases

while control group consisted of 100 subjects having no symptoms of allergic rhinitis.

After the prior approval for the study by the ethical committee of Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, the purpose and design of study was explained to the subjects and their informed consent was obtained before all the investigations including nasal scrape cytology. Inclusion and exclusion criterion were as follows:

Inclusion Criteria

1. All the cases of clinically diagnosed allergic rhinitis.
2. All the cases of ethmoidal polyposis with underlying allergic rhinitis.

Exclusion Criteria

All the cases of non-allergic rhinitis.

Study Design

A prospective case control study was carried out from September 2009 to August 2011. The study consisted of 200 patients of whom 100 were cases having allergic rhinitis while balance were control. Cases having allergic rhinitis were evaluated by history and clinical examination. These patients were subjected to nasal scrape cytology for which Cytobrush Plus (Medscand Cell Sampling Kit), Malmo, Sweden, was employed (Fig. 1).

Methodology

After obtaining detailed and meticulous clinical history routine E.N.T. evaluation along with general systemic medical examination was done. Clinical evaluation included

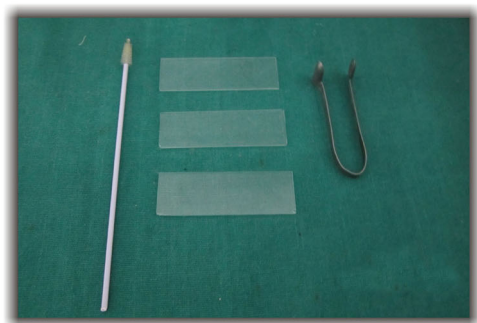
- External examination of nose.
- Examination of Vestibule.
- Anterior Rhinoscopy.
- Posterior Rhinoscopy.

For diagnosis of sinusitis and knowing finer details, structural abnormalities and anatomical variations, nasal endoscopic examination using 0 and 30 degree endoscope was done.

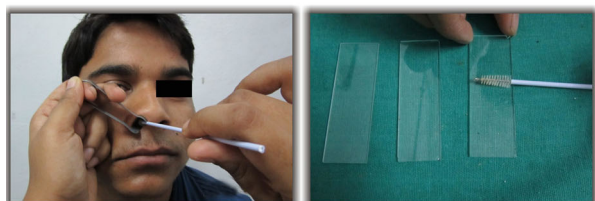
Nasal Scrape Cytology

Mucosal specimens were acquired by scraping the surfaces of the middle thirds of inferior turbinates with Cytobrush Plus (Medscand Cell Sampling Kit, Malmo, Sweden). The

PLATE I



Cytobrush, Glass Slide, Thudicum's Nasal Speculum were Employed for Taking Nasal Scrape



Photograph showing Nasal Scrape Cytology being taken from middle part of the inferior turbinate



4mm, 0° Endoscope Henke SASS, Wolf (Germany)

Fig. 1 Photograph showing method and material of Nasal scrap cytology

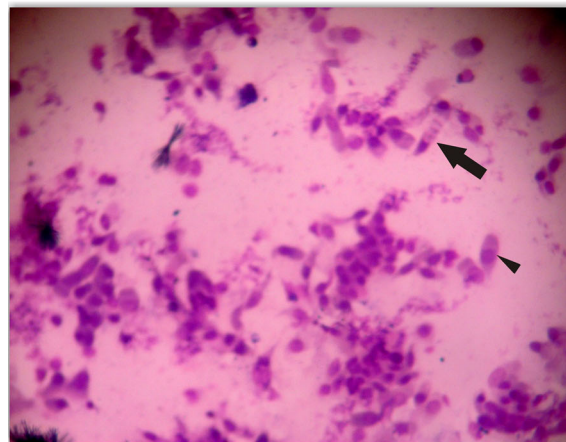
samples thus obtained were transferred onto glass slides to be fixed in 95% ethyl alcohol and stained with May Gurnwald Gimesa stain to study pattern and profile of different types of cells like eosinophils, goblet cells, mast cell. The nasal eosinophils were studied under $1000 \times$ magnification of light microscope 10-well spread, high power epithelium fields were examined and the quantitative score of nasal eosinophils was rated according to a scale described by Meltzer [4] (Table 1, Fig. 2).

Table 1 Semiquantitative nasal cytology grading score

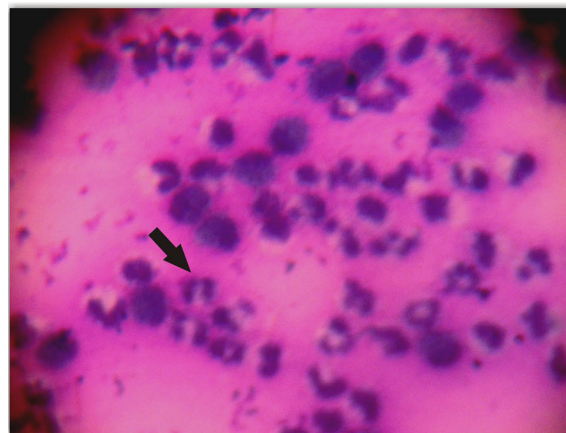
Grading of cells Eosinophils	Grade
0*	0
0.1–1.0*	$\frac{1}{2} +$
1.0–5.0*	1 +
6.0–15.0*	2 +
16.0–20.0*	3 +
> 20.0*	4 +

*Mean of cells per 10 high power field ($\times 1000$)

PLATE IV



Photomicrograph - Normal Nasal Scrape Cytology shows ciliated columnar Epithelial Cell placed in sheets (Arrow). These cell groups shows intermingled goblet cells with vacuolated cytoplasm (Arrow Head) (40x MGG)



Photomicrograph - Allergic Rhinitis shows Eosinophil Infiltrate (Arrow) amongst Epithelial Cells (40x MGG)

Fig. 2 Photograph showing microscopic picture of nasal scrap smear of allergic rhinitis patient

Observation and Results

Our study involved 100 cases of allergic rhinitis with as many controls. The findings emerging out of detailed history elaborate examination, endoscopic survey and pertinent investigations were noted and analyzed. Here are the observations.

Age Wise of Distribution of Patients

Age range in study group was 15–74 years with a mean age of 35.37 years. Most of the patients 42 (42%) were in age bracket of 31–40 years followed by 26 (26%) in 21–30 years, 15 (15%) in 41–50 years, 8 (8%) in 11–20 years.

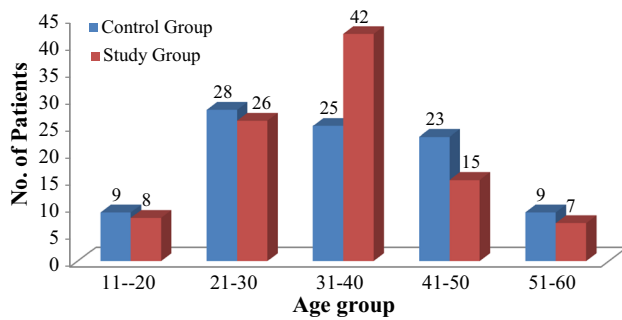


Fig. 3 Age wise distribution of patients

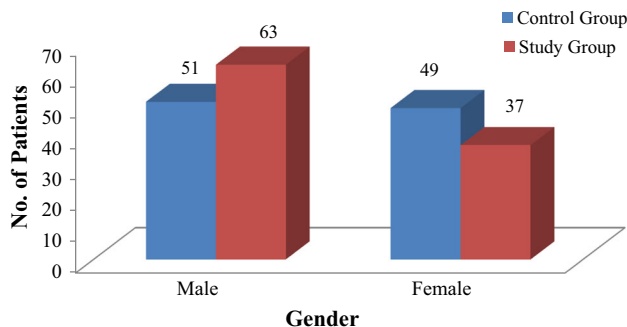


Fig. 4 Gender wise distribution of patients

Age range in control group was 17–75 years with mean age of 37.8 years. 28 (28%) were in the age group of 21–30 years followed by 25 (25%) in 31–40 years, 23 (23%) in 41–50 years and 9% in 11–20 years. Figure 3 depicts the age wise distribution of case and control group.

Gender Wise Distribution of Patients

Of the 100 patients of the study group, 63 (63%) were males and 37 (37%) were females. Thus the male to female ratio was 1.7:1. In control group 51 (51%) were male and 49 (49%) were females with male to female ratio of 1.04:1. Figure 4 shows gender wise distribution.

Symptom Wise Distribution of Patients of Allergic Rhinitis

Table 2 shows the frequency of symptoms in patients of allergic rhinitis. Most common symptom in our patients

Table 2 Symptom wise distribution of patients of allergic rhinitis

Symptoms	No. of patients	Percentage
Watery rhinorrhea	100	100
Sneezing	98	98
Nasal obstruction	87	87
Waterying of eyes	85	85
Nasal itching	83	83

was watery rhinorrhoea which was seen in all 100 patients followed by sneezing 98 (98%), nasal obstruction 87 (87%), watering of eye 85 (85%) and nasal itching 83 (83%).

Distribution of Patients According to Type of Allergic Rhinitis

Patients of allergic rhinitis were classified into seasonal and perennial allergic rhinitis. The criteria followed for this classification has been mentioned earlier in review of literature. Out of 100 patients, perennial allergic rhinitis in 62 (62%) and seasonal allergic rhinitis in 30 (30%) was predominantly present. Small minority of the patients i.e. 8 (8%) had features of both perennial and seasonal allergic type.

Family History in Patients of Allergic Rhinitis

In our study group, number of patients with positive family history of allergy were 83 (83%). In the remaining 17 (17%) of the patients the history could not be elicited.

Type of Allergens in Nasal Allergy

House dust to which patients are exposed while bed making, dusting, stove cooking was found to be the leading cause of allergy 26 (26%) in our patients. Dust, primarily environmental dust commonly seen in out door laborers, bike riders and sweepers was present in 16 (16%) of the patients. As agriculture is a major occupation of the people in the region where this study is carried out, we found 12 (12%) of the patients to be allergic to farm dust. 7 (7%) patients were sensitive to smoke and an equal number had allergic rhinitis during cold weather conditions. 6 (6%) patients were allergic to animal dander and 5 (5%) had allergic rhinitis during dry weather, which is also the major climatic feature of our geographical setting. 4 (4%) were susceptible to pollution followed by 3 (3%) to beedi smoke and 2 (2%) patients were allergic to hay. Of our total 100 patients 9 did not give any specific history of allergen (Table 3).

Nasal Scrape Cytology

Nasal Scrape Cytology Grading in Case and Control Group

Nasal scrape cytology was performed in all the patients of case group and subjects of control group. The technique has been described in material and methods. We followed semi quantitative nasal cytology grading score described

Table 3 Type of allergens in allergic rhinitis

Type of allergen	No. of patients	% of patients
House dust	26	26
Dust	16	16
Farm dust	12	12
Smoke	7	7
Cold weather	7	7
Animal dander	6	6
Dry weather	5	5
Pollution	4	4
Beedi smoke	3	3
Hay dust	2	2
Rainy weather	1	1
Chemical fumes	1	1
Chalk powder	1	1
No specific cause	9	9

Table 4 Comparison of eosinophils in nasal scrape cytology

Grading	Control group	%	Study group	%	2N-value	p value
Grade 0	80	80	22	22	87.34	$p < 0.0001$
Grade ½ +	20	20	24	24		$p < 0.05$
Grade 1 +	0	0	25	25		
Grade 2 +	0	0	21	21		
Grade 3 +	0	0	3	3		
Grade 4 +	0	0	5	5		
Total	100		100			

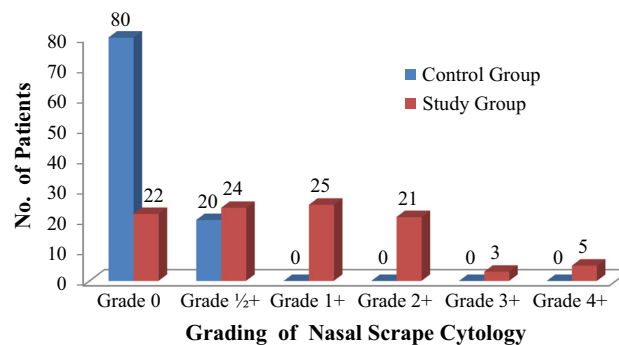
by Meltzer [4] for grading eosinophils and findings of nasal scrape cytology of case and control group were compared.

In study group all 100 patients underwent nasal scrape cytology 0.25 (25%) patients in study group showed grade 1 + nasal eosinophilia followed by grade ½ + in 24 (24%), grade 0 in 22 (22%) and grade 2 + in 21 (21%).

In control group 80% of subjects had grade 0 nasal eosinophilia. Difference between nasal eosinophilia in the study and the control group were found to be statistically significant. This is given in Table 4 and Fig. 5.

Sensitivity and Specificity of Nasal Scrape Cytology

In study group 54% showed grading $> 0.5 +$ whereas 46% showed $\leq 0.5 +$ (Table 5). The sensitivity and specificity were observed to be 54% and 100% respectively. The results thus found were statistically significant.

**Fig. 5** Comparison of eosinophils in nasal scrape cytology**Table 5** Sensitivity and specificity of eosinophils in nasal scrape cytology

	Study group	Control group	2N-value	p value
> 0.5	54	0	24.80	$p < 0.0001$
≤ 0.5	46	100		$S, p < 0.05$
Total	100	100		
	%		95% CI	
Sensitivity	54		43.74–64.02	
Specificity	100		96.38–100	
PPV	100		93.40–100	
NPV	68.49		60.29–75.92	
Accuracy	72			

CI confidence interval; PPV positive predictive value; NPV negative predictive value

Discussion

Allergic rhinitis has enormous impact on human life with huge socioeconomic implications. This socially crippling disease has gained importance in recent years owing to an increase in its prevalence which can mainly attributed to growing industrialization, urbanization and global warming. Hence it is rightly said to be a disease of the developing and developed nations both. With the plethora of options at our disposal, avoidance is still considered as the best remedy. This fact speaks volumes about the ineffectiveness of the present modalities of treatment. What makes the condition still hazardous is its association with other comorbid conditions like asthma, sinusitis and otitis media. Surgical space and scope in this condition is very less.

Age Wise Distribution of Patients

The mean age in our patients of allergic rhinitis in this study was found to be 35.37 years with age ranging from 15 to 74 years. Sood [5] found a mean age of 31.6 years. In yet another study involving 2267 patients of allergic

rhinitis, by Weiner et al. [6] mean age was reported to be 32 years. Similarly mean age 29 ± 9.8 years was observed by Varghese et al. [7] in 52 patients of allergic rhinitis Kirtsreesakul and Ruttanaphol [8], found a mean age of 33.4 years where the patients age ranged from 16–63 years in the 103 patients of AR. In the control group the mean age group of the patients was 37.80 years. All the observations regarding the mean age by various above workers nearly matches with our finding thus endorsing the fact that allergic rhinitis is more common in the fourth decade of life.

Gender Wise Distribution of Patients

Although men and women share kindred mechanisms that activate the immune system, there is a clinical preponderance of women affected with atopic disease [9]. Conversely there have been studies which show a male predominance in allergic rhinitis. In our study we found a male dominance. Of the total patients of allergic rhinitis 63% were males and 37% were females. This was in keeping with the findings of Varghese et al. [7] where AR was found in 61% males and 38% females. In yet another study comprising of 5900 patients of allergic rhinitis Gaur et al. [10] observed a male dominance (55.2%). Lasisi et al. [11] also found male predominance in their study with 57.1% and female 42.8%. Contradictory to the findings of most of the investigators Kirtsreesakul and Ruttanaphol [8], found female preponderance with 66.01% females and 33.9% males. Our findings of male predilection in allergic rhinitis agrees well with majority of studies. However our study was conducted in a rural area where poverty, lack of education and inadequate initiative on part of women to attend hospital may also be one of the reasons for male dominance.

Symptom Wise Distribution of Patients of Allergic Rhinitis

A detailed history of the patients revealed a variety of symptoms comprising of watery rhinorrhoea, which was the most common complaint found in all the 100 patients of our cases. Sneezing (98%), nasal obstruction (87%), watering of eyes (85%) and nasal itching in 83 (83%).

Kirtsreesakul and Ruttanaphol [8] found sneezing to be the most frequent presentation involving 94.2% of patients of AR. Rhinorrhoea in 88.3%, nasal blockage in 80.6% and nasal itching in 61.2%. Were the other symptoms reported by them.

Yadav et al. [12] observed rhinorrhoea in 90.3%, nasal obstruction and sneezing to be present in 90% each. Lasisi et al. [11] found rhinorrhoea in 85.7%, sneezing in 63.3% and nasal obstruction in 42%. Our findings regarding symptoms are in consonance with above studies.

Distribution of Patients According to Type of Allergic Rhinitis

Patients of allergic rhinitis were classified on the basis of seasonal bias or otherwise. In the present study, we found 62% of the patients to have perennial allergic rhinitis, 30% had seasonal AR. The remaining 8% showed seasonal exacerbation to an otherwise perennial AR. Our findings were analogous to the observations of Varghese et al. [7] where 63% of patients presented with perennial AR, 31% had seasonal AR and 6% had seasonal exacerbations in perennial AR.

In a prospective controlled clinical trial of 35 patients done by Jang [13] 22 patients were found to have seasonal AR and 13 patients had seasonal exacerbation of perennial AR. In yet another study Farhoudi et al. [14] found 29% patients to have perennial, 38% and 20% to have seasonal and seasonal exacerbation in perennial rhinitis respectively.

Family History in Patients of Allergic Rhinitis

There have been strong genetic links suggesting that a family history of allergic rhinitis predisposes to the development of the disease. In our study we found a strong family history of allergy among the parents, sibling and first degree relatives of the patient. In the present study 83 (83%) of the patients presented with a definitive history of familial allergic rhinitis. In a study conducted by Dold et al. [15] on genetic risk for atopic diseases, it was concluded that 47% of patients with atopic diseases showed a strong family history of atopy in at least one family member. In the study conducted by Varghese et al. [7] showed 76.92% of the patients to have a strong family history of allergic rhinitis. Farhoudi et al. [14] observed 72% of allergic rhinitis to have a family history of atopy. Our finding regarding positive family history in 83% patients in agreement with the studies by Varghese et al. [7] and Farhoudi et al. [14].

Allergen History in Patients of Allergic Rhinitis

A detailed history of the patient revealed exposure to variety of allergen precipitating symptoms of allergic rhinitis. Among the total cases in our study group we found house dust to be the most common allergen seen in 26 (26%). The patients gave history of exacerbation of rhinorrhoea and sneezing on dusting, bed making and stove cooking. 16 (16%) patients were found allergic to dust. These patients had increased allergic symptoms during travelling. The third most common allergen was found to be farm dust seen in 12 (12%).

Nasal Scrape Cytology

Eosinophils in Nasal Scrape Cytology

An added dimension to our study was nasal scrape cytology which was done in both the study as well as control group. They were then graded on the basis of eosinophil count. Grading technique has been discussed earlier in “[Materials and methods](#)” section. In the study group 25 (25%) patients showed a grade 1 +, 24 (24%) patients showed a grade 0.5 +, 22 (22%) patients showed grade 0 while grade 2 + was seen in 21 (21%) patient. Small number of patients i.e. 3 (3%) and 5 (5%) patients were seen in grade 3 + and grade 4 + respectively. In the control group we found 80 (80%) of the patients to have grade 0, 20 (20%) showed grade 0.5 +. None of the patients showed a grade of ≥ 1 +.

In a study on nasal scrape cytology done in 48 patients of allergic rhinitis by Jirapongsananuruk and Vichyanond [4] found grade 0 to be present in 4 (8.3%) grade 0.5 in 13 (27%) grade 1 +, 2 +, 3 +, 4 + were seen in 14 (29.1%), 12 (25%), 2 (4.1%) and 3 (6.2%) patients respectively. In their control group 38 of their 41 patients (92%) to have grade 0 and remaining 3 (7.3%) patients to have grade of 0.5 +.

The median eosinophil cell scores in the rhinitis group were 1 and 2 whereas the corresponding medians for the control group, regardless of age, were both 0. None of the control subjects had nasal eosinophil cell scores more than 0.5. Eosinophil scores > 0.5 + were therefore considered positive cut-off points for the diagnosis of allergic rhinitis.

Sensitivity and Specificity of Nasal Eosinophil Count

In our study we found the nasal scrape cytology to be more specific than sensitive i.e. its specificity was 100% and sensitivity was 54%. Jirapongsananuruk and Vichyanond [4] where he found the specificity to be 100% and sensitivity to be 64.58%. Jirapongsananuruk and Vichyanond [4] and Miller et al. [16] observed specificity to be 94% as compared to sensitivity of only 70%. Bakhshae et al. [17] in study on nasal smear for eosinophils, discovered the sensitivity of nasal eosinophil count to be 51.3% and specificity to be 88.5%. The findings regarding sensitivity and specificity of nasal scrape cytology reported by various previous workers are in consonance with our study.

In present study 54% patients were having positive eosinophilia on nasal scrape cytology Lans et al. [18] studied nasal scrape cytology in allergic and non allergic individuals. In their total 61 patients of allergic rhinitis they found 26 to have nasal eosinophilia i.e. 43%. In yet another study conducted by Yadav et al. [12] noted 53.3% patients

of AR to have positive nasal eosinophilia which is in relation to our study.

Conclusion

Allergic rhinitis is a global disease, the prevalence of which has been on a rise in the urban as well as rural population. The spectrum of allergen has widened with increased urbanization. The most common in our study being house dust, environmental dust, farm dust and smoke.

The disease poses a malady to the productive population in a country as the burden of its annoying symptoms fall in the mid age group commonly among the males. Based on the seasonal variation of the symptoms AR was rightly classified into seasonal AR, perennial AR and seasonal exacerbation of perennial AR. Majority of our patients showed perennial AR i.e. 62%.

Family history of allergic rhinitis has a strong co relation with the development of AR. In our study out of the 100 patients of AR we found 83% to have a definitive family history of allergy. This value is more than in any other study.

Another distinctive finding in our study is that 100% of our patients had watery rhinorrhoea and 98% showed sneezing as a major complain. Pale mucosa and inferior turbinate hypertrophy was a common finding in 89% and 82% respectively.

Nasal scrape cytology which was a non invasive procedure was performed in both the case as well as control group. The result of this study showed that evaluation of eosinophils in nasal smear is a less sensitive and but more specific test for the diagnosis of allergic rhinitis.

Allergic rhinitis is a thwarting disease affecting the young adults having a strong familial predilection. The disease not only is a predicament on its own but also has with it associated co morbid conditions viz bronchial asthma and sinusitis. Early diagnosis of allergic rhinitis may lead to timely detection of asthma and sinusitis which may help decrease the immensity of these diseases.

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