ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 10, Issue 1, 2017

Online - 2455-3891
Print - 0974-2441

Research Article

A CLINICOPATHOLOGICAL STUDY OF ALLERGIC RHINITIS

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Received: 12 August 2016, Revised and Accepted: 13 October 2016

ABSTRACT

Objectives: Allergic rhinitis (AR) is on the rise in our society for various reasons. It is said that allergy might represent a primary or secondary factor in up to half the patients encountered in an otolaryngology practice. Thus, the management of AR constitutes a large proportion of the day-to-day practice. In addition to its primary effect, inhalant allergy of the upper respiratory tract might affect the development and clinical course of other disease states such as sinusitis, otitis media, and asthma due to the mucosal continuity. Hence, this study was conducted to know the comorbid associations of AR and also the pathology in inferior turbinate hypertrophy (ITH).

Methods: A time-bound, descriptive cross-sectional study was conducted in ENT OPD. Patients were selected for the study after proper history taking, clinical examination, laboratory investigations such as absolute eosinophil count (AEC) and diagnostic nasal endoscopy, and consent for biopsy from inferior turbinate and histopathological examination using predefined inclusion and exclusion criteria. Nasal symptoms of sneezing, rhinorrhea, nasal pruritus, nasal obstruction, anosmia and non-nasal symptoms of eye itching, watering, foreign body sensation, and pharyngeal itching were recorded.

Results: The mean age of the patients was 27.08 years with a standard deviation of 6.1. Patients were clinically evaluated regarding symptoms in ear, nose, throat, eyes, and respiratory system. All patients had nasal symptoms whereas 53.34% patients had ophthalmic and pharyngeal symptoms. Aural comorbidity was most common with complaints in 68.33% followed by respiratory symptoms in 30% patients. About 40% patients complained of sleep disturbances. Nearly 31.67% patients had a positive family history. The pale nasal mucosa was seen in 63.33% patients. Almost 70% patients had intermittent AR, of which 43.33% had a mild degree. About 55% cases had AEC <350 cells/cumm. Almost 51.67% patients had more than five eosinophils per high power field in the biopsy of their inferior turbinates.

Conclusion: Although most patients presented with nasal symptoms, ophthalmic and pharyngeal symptoms were commonly presented. ITH with pale nasal mucosa were the most common examination findings. Although AEC was not raised in most of the patients, more than half patients had a raised eosinophil count in the inferior turbinate biopsy. Thus, in a patient with AR, special attention has to be given to the ear, throat, eye, and asthmatic aspect. Eosinophil count in inferior turbinate biopsy is fairly reliable indicator in allergic turbinates.

Keywords: Allegic rhinitis, Asthma, Absolute eosinophil count, Eosinophil count, Inferior turbinate biopsy.

 DOI: http://dx.doi.org/10.22159/ajpcr.2017.v10i1.14655

INTRODUCTION

Allergic rhinitis (AR) is a heterogeneous disorder that despite its high prevalence is often undiagnosed [1]. It is a very common disorder that affects people of all ages. Although AR is not a serious illness, it is clinically relevant because it underlies many complications, is a major risk factor for poor asthma control, and affects quality of life and productivity at work or school [2].

There are many different causes of rhinitis. Approximately 50% of all cases of rhinitis are caused by allergy. In the case of rhinitis caused by allergens, symptoms arise as a result of inflammation induced by a gamma globulin E (IgE)-mediated immune response to specific allergens. AR is characterized by one or more of sneezing, itching, rhinorrhea, and/or nasal congestion. Sneezing is the most common symptom of allergy and is synonymous with it [1].

An association between AR and conditions including asthma, sinusitis, otitis media, nasal polyposis, sleep disturbances, respiratory infections, food allergy, and even orthodontic malocclusions has been observed. Research has identified shared pathogenic mechanisms, epidemiologic correlations, and findings from allergy testing to indicate that these conditions represent long-term physical consequences in allergic individuals [3].

AR has always been subdivided, based on the time of occurrence during the year, into seasonal and perennial disease. Seasonal AR is related to a wide variety of outdoor allergens such as pollens or molds. Perennial AR is most frequently caused by indoor allergens such as house dust mites, molds, cockroaches, and animal danders.

A new classification has been proposed by the AR and its impact on Asthma workgroup. It includes a measurement of the frequency and duration of the symptoms. Intermittent AR is defined as experiencing symptoms for <4 days/week or <4 consecutive weeks. Persistent AR is termed as symptoms occurring for more than 4 days/week and more than 4 consecutive weeks [3].

Most AR patients can be diagnosed by a combination of history, clinical examination, skin prick test, radioallergosorbent test for specific IgE with other nonspecific allergy tests such as absolute eosinophil count (AEC), total serum IgE level, and nasal secretion for eosinophils. Nasal biopsy can also be taken for determining the local changes and the number of eosinophils in the biopsy.

The management of AR is best when directed by guidelines. It includes allergen avoidance, education, pharmacotherapy, and possibly immunotherapy. Antihistamines control the symptoms of itching, sneezing, rhinorrhea, and eye irritation but not nasal congestion. Hence, an antihistamine decongestant combination may provide greater overall symptom relief than either agent alone. Intranasal administration of steroids minimizes systemic side effects, reduce inflammation and consequent hyperreactivity. It inhibits various components of early and

late phase reactions and reduces the associated cellular events. Surgery is rarely indicated as in cases of nasal obstruction most commonly caused due to inferior turbinate hypertrophy (ITH).

Thus, the study is being taken up to know the prevalence of AR, its classification, and its associated conditions.

Aims and objectives

1. To study the demographic pattern of AR
2. To study the incidence of intermittent and persistent types of AR
3. To study the incidence of various comorbidities associated with AR
4. To study the association between the degree of AR, AEC, and the eosinophil count in inferior turbinate.

MATERIALS AND METHODS

Materials

Source of data

Data for the present study were collected from the patients attending the outpatient Department of ENT, with nasal and associated symptoms of AR at Karnataka Institute of Medical Sciences, Hubli, between January 2012 and December 2012 with symptoms of AR.

Type of study

This study is a time-bound, descriptive cross-sectional study.

Method of data collection

Patients presenting to the outpatient Department of ENT with symptoms of AR were carefully evaluated by means of proper history taking with the help of proforma, clinical examination, and laboratory investigations such as AEC. A total of 60 patients were recruited over 1 year and then subjected to evaluation for inclusion into the study after fulfillment of both inclusion and exclusion criteria.

Inclusion criteria

1. Patients presenting with history suggestive of AR such as rhinorrhea, sneezing, itching, and nasal obstruction
2. Patients with clinical evidence of AR such as bilateral pale ITH or AEC >350.

Exclusion criteria

1. Patients with rhinitis of infectious origin
2. Patients with non-AR such as vasomotor rhinitis, rhinitis medicamentosa
3. Patients refusing consent for nasal biopsy
4. Atrophic rhinitis.

Methodology

The present study was conducted for 1 year from January 2012 to December 2012 in the Department of Otorhinolaryngology, KIMS, Hubli. This study was conducted to know the demographic pattern of AR, incidence of various comorbidities associated with it, and the pathological changes that occur in the inferior turbinate in AR. The consent was obtained from all the patients recruited to the study. Before the study, ethical clearance was taken from the institution.

Patients were selected for the study after proper history taking, clinical examination, laboratory investigations such as AEC and diagnostic nasal endoscopy, and consent for biopsy from inferior turbinate and histopathological examination using predefined inclusion and exclusion criteria. Nasal symptoms of sneezing, rhinorrhea, nasal pruritus, nasal obstruction, anosmia and non-nasal symptoms of eye itching, watering, foreign body sensation, and pharyngeal itching were recorded.

AEC was done by Direct method. The principle is that blood drawn from the patient is diluted 10 times in a WBC pipette with special diluting fluid called Dunger solution, which removes the red cells and stains the eosinophils. The diluted blood specimen is then charged in a Neubauer's counting chamber, and eosinophils are counted under a high power objective.

Method of collection of biopsy material

The collection of tissue samples from nose was done under local anesthesia.

Local anesthesia: Topical anesthesia of 4% lidocaine was used. Cottonoids soaked in 4% lidocaine were placed along the length of the inferior turbinate for 5 minutes. They were removed, and anterior end of the inferior turbinate was infiltrated with 1 ml of 2% lidocaine.

A diagnostic nasal endoscopy was done, and a sample of punch biopsy of nasal mucosa was obtained from medial part of inferior turbinate. The specimen was kept in formalin and sent for histopathological examination. Histopathological examination was done to confirm the diagnosis and to count the number of eosinophils/high power field (hpf).

RESULTS AND OBSERVATIONS

Sex distribution

The female patients were slightly more than the male patients with a female to male ratio of 1:0.935 in our study. There were 31 females and 29 males in our study.

Age distribution

In our study, the youngest patient was 16 years of age and the oldest being 45 years. The mean age of the study group was 27 years with a standard deviation of 6 years.

Presenting symptoms

All the patients who presented had nasal symptoms (100%) whereas another half patients (32, 53.34%) had associated ophthalmological symptoms and pharyngeal symptoms during presentation.

Nasal symptoms

The most common nasal symptom was nasal discharge (80%) followed by sneezing (78.34%) and nasal obstruction (70%). Seven patients (11.67%) had altered sense of smell and headache.

Ophthalmological symptoms

The most common ophthalmological symptom associated with AR is congestion in eyes in about 40% of patients followed by itching. Photophobia and foreign body sensation were seen in 1.67% patients, respectively.

Pharyngeal symptoms

The most common pharyngeal symptom associated with AR is postnasal drip seen in 30 (50%) patients, followed by throat itching in 7 patients and foreign body sensation in one patient.

Comorbid associations

Around 41 patients (68.33%) had aural symptoms whereas 18 (30%) had respiratory symptoms. Seven patients had skin problems and 5% had dental malformation.

Aural symptoms

Of the patients with aural symptoms, 21 (35%) had earache, 12 (20%) had itching in the ear, 8 (13.3%) had ear discharge, 5 (8.3%) had decreased hearing, and 2 (3.3%) had ear block.

Respiratory symptoms

The most common respiratory symptom was cough in 14 patients followed by wheezing in 4 (6.67%). Two patients had wheezing and tightness in chest and were diagnosed as bronchial asthma.

History of comorbidities

Around 24 (40%) patients complained of disturbance in sleep. A total of 19 (31.67%) patients had a positive family history of allergy. Two had history of food allergy - one patient to milk and other to peanut. One patient had drug hypersensitivity to aspirin.

Examination findings

Nasal findings

On examination of nose, 25 patients had bilateral ITH followed by right ITH in 21 (35%) patients and left ITH in 12 (20%) patients. Around 30% had deviated nasal septum.

Diagnostic nasal endoscopy

On diagnostic nasal endoscopy, 8 patients had adenoid hypertrophy and features of sinusitis each. Pus or mucopurulent discharge in middle meatus or nasopharynx was considered suggestive of sinusitis. Two patients (3.33%) had nasal polyps.

Types of nasal mucosa

Of all the patients, 38 had pale mucosa followed by 12 patients (20%) having normal nasal mucosa. Only 10 patients (16.67%) had congested nasal mucosa.

Aural signs

Of the 41 patients with aural symptoms, 12 had retracted tympanic membrane (TM), 10 had features of otitis media with effusion (OME), 6 had chronic suppurative otitis media, 4 had dull TM, and one patient had acute otitis media.

Diagnosis

Of total 60 patients, 42 (70%) were classified under intermittent AR and 18 (30%) as persistent AR. Of the 42 patients with intermittent AR, 26 had mild degree and 16 had moderate degree. Of the 18 patients, 14 had mild and 4 had moderate degree (Table 1).

AEC

The majority of patients (16, 26.67%) had AEC ranging between 301 and 400 followed by 15 (25%) patients in range of 400-500. The mean AEC was found to be 423.67 and standard deviation was 148.87 (Table 2).

The association between AEC and degree of AR is found to be statistically significant according to Chi-square test (Table 3).

Eosinophil count in inferior turbinate biopsy

The majority of patients (25, 41.67%) had around 6-10 eosinophils/hpf followed by 1-5 in 21 (35%) patients. The mean eosinophil count is 5.5 with a standard deviation of 4.35 (Table 4).

χ^2 - 4.351, $p<0.05$

The association between eosinophil count in inferior turbinate and the degree of AR is found to be statistically significant according to Chi-square test.

Correlation between AEC and eosinophil count in inferior turbinate biopsy

Table 5 shows that the relation between AEC and the eosinophil count in the inferior turbinate biopsy. After applying the Chi-square test, the association is found to be statistically significant. This means that patients who had an increased AEC in their blood had a higher chance of raised eosinophils in their inferior turbinates.

Table 1: Classification of allergic rhinitis

Diagnosis	Degree	Number	Total	Percentage
Intermittent	Mild	26	42	43.33
	Moderate	16		26.67
Persistent	Mild	14	18	23.33
	Moderate	4		6.67
Total		60	60	100

Table 2: Distribution of AEC among intermittent and persistent AR

Number	Intermittent	Persistent	Total (%)
100-200	5	-	5 (8.33)
201-300	11	1	12 (20)
301-400	11	5	16 (26.67)
401-500	9	6	15 (25)
501-600	2	3	5 (8.33)
601-700	2	2	4 (6.67)
701-800	2	1	3 (5)
Total	42	18	60 (100)

Mean AEC: 423.67, Standard deviation: 148.87. AR: Allergic rhinitis, AEC: Absolute eosinophil count

Table 3: Association between AEC and degree of AR

AEC	Intermittent	Persistent	Total
Normal AEC	27	6	33
Increased AEC	15	12	27
Total	42	18	60

χ^2-4.87, $P<0.05$. AR: Allergic rhinitis. AEC: Absolute eosinophil count

Table 4: Distribution of eosinophils in IT biopsy

Number	Intermittent	Persistent	Total (%)
0	8	-	8 (13.33)
1-5	16	5	21 (35)
6-10	16	9	25 (41.67)
11-15	1	3	4 (6.67)
16-20	1	1	2 (3.33)
Total	42	18	60 (100)

Mean count: 5.5, Standard deviation: 4.35

Table 5: Association between AEC and IT eosinophil count

IT eosinophil count	Normal AEC	Raised AEC	Total
Normal IT count	17	11	28
Raised IT count	5	27	32
Total	22	38	60

χ^2-13.07, $P<0.05$. AEC: Absolute eosinophil count

DISCUSSION

AR is the most common chronic disease experienced by humans which significantly affects the quality of life.

AR with its attendant complications is a common condition today, affecting all the age groups with more predilection in the younger generation. The mean age of the patients who entered our study was 27.04 years which is in accordance with the studies of Alsowaidi [4] (2010) 30 years, Viinanen [5] (2005) 30.2 years, and Valero [6] (2007) 32.3 years. One reason can be that AR affects early. In addition, the lifestyle and activity in this age group, who are more active compared to older age group, will increase the chances of bringing them into contact with a wide variety of allergens.

In this study, males constituted 48.33% and females constituted 51.67%. Sex incidence was as follows: According to the studies of Viinanen [5] (2005), 46.5% were males and 53.5% were females and Bauchau and Durham [7] (2005) 46% were men and 54% were women. It is observed that there is no significant difference in the sex ratio.

Typical symptoms of AR include sneezing, itching, clear rhinorrhea, and congestion. Patients may also complain of red, itchy eyes, along with itchy throat and ears. In this study, all the patients had nasal symptoms of AR whereas almost half of them had ophthalmic symptoms and pharyngeal symptoms.

The most common nasal symptom was watery nasal discharge in 48 (80%) patients followed by sneezing in 47 (78.34%) patients and nasal obstruction/congestion in 42 (70%) patients. A total of

14 patients had itching in the nose and 7 patients each complained of loss of sense of smell and headache. The most common nasal symptom in studies of Meltzer *et al*. [8] (2012) was nasal congestion (42%), followed by repeated sneezing (39%), runny nose (37%), and nasal itching (31%). In addition, Hadley *et al.* [9] (2012) studied that the most frequently reported symptom was nasal congestion (56%), followed by repeated sneezing (45%) and nasal pruritus (31%).

The most common ophthalmic symptom in our study congestion in eyes (40%) followed by itching in 10% and 1.67% experienced photophobia and foreign body sensation, respectively. Photophobia was seen secondary to corneal involvement in a case of atopic keratoconjunctivitis who had persistent AR. This is similar to studies of Meltzer *et al.* (2012) 40% and Hadley *et al*. (38%) on watering/congestion of eyes. The most common pharyngeal symptom is postnasal drip, in which 30 (50%) patients complained of followed by throat itching in 7 (11.67%) patients and one patient had foreign body sensation. This is in agreement with studies of Meltzer *et al*. (2012) 46% and Hadley *et al.* (2012) 48% postnasal drip complaints.

For years, investigators have noted an association between AR and asthma, sinusitis, otitis media, nasal polyposis, recurrent respiratory infections, dental malformations in pediatric population, sleep disturbances, adenoid hypertrophy, eustachian cushion hypertrophy, food allergy, and drug hypersensitivity to name few.

Indeed AR can cause functional and physical impairment that can profoundly affect the quality of life in both adults and adolescents.

Allergen exposure in the nasopharynx with release of histamine and other mediators can cause eustachian tube obstruction, possibly leading to middle ear effusions. In our study, 41 patients (68.33%) had associated aural symptoms, of which most common aural symptom was ear pain in which 21 (35%) patients complained. Earache was the most common ear symptom in other studies of Meltzer *et al*. [8] and Hadley *et al.* [9] where the incidence is around 19% and 16%, respectively. Other symptoms are ear itching in 20% patients, ear discharge in 13.3% patients, decreased hearing in 8.3%, and ear block in 3.3% patients. The most common ear finding seen on examination was OME (36.67%), of which retracted TM was seen in 20% patients and features of serous otitis media were seen in 16.67% cases. Four patients had dull TM and 6 had chronic otitis media and one patient had features of acute otitis media. This is consistent with studies of Sheldon [3] where 21% of allergic children are found to have OME. The association between AR, recurrent otitis media, and OME is consistent with a unified airway model in atopic patients [10].

It has been proposed that AR and allergic asthma are manifestations of the same disease and that they represent a continuum, sharing common pathological and physiological characteristics. In this way, patients with less severe disease express only rhinitis while those with more severe disease express both rhinitis and asthma [11]. Epidemiologic studies worldwide have consistently shown that asthma and rhinitis often coexist in the same patient. Most studies on the association between rhinitis and asthma evaluate the prevalence of asthma in patients with AR [12]. In our study, 18 patients had respiratory symptoms. The most common respiratory symptom was cough in 14 (23.33%) cases followed by wheezing in 4 cases. Two patients (3.33%) had complaints of breathlessness and tightness in chest, respectively. This is comparatively lesser incidence than the study by Bugianib *et al.* [11] where 51% of patients with AR reported at least one asthma-like symptom, of which 31.1% cases had chronic cough, 26% had wheezing, and 8% patients had complaints of tightness in the chest. As many as 19-38% of patients with allergic rhinitis may have asthma, which is much more than the 3-5% prevalence among the general population. The reduced incidence in our study may be due to lower prevalence of asthma in the region and also due to distribution of patients to medicine department.

Only 7 (11.67%) patients complained of dermatological symptoms mainly limited to itching all over the body, especially flexor aspects. Infants and young children with atopic dermatitis are at great risk of developing respiratory allergy later in life with rhinitis, eye symptoms, and sometimes asthma than vice versa. The reported risks range between 50% and 75% [13]. However, patients of AR have fewer incidence of skin disease, especially atopic dermatitis.

AR interferes with restful sleep in several ways: evidence has shown that both symptoms and the underlining pathology can disrupt sleep. AR is not associated with sleep-disordered breathing or daytime sleepiness unless nasal obstruction/congestion are present. Sleep disturbance is a very annoying symptom. A large survey involving 2355 individuals with AR focalized on the impact of nasal congestion on patient life. More than 80% of the respondents experienced nasal congestion at night, and 17% indicated that this is the most bothersome nocturnal symptom [14]. In the study by Meltzer *et al*. [8], around 22% patients had sleep disturbances and Hadley *et al*.'s [9] study had 29% patients with disturbed sleep. In our study, 40% complained of disturbance in their sleep. Not only AR, the first generation antihistamines also induce sleep, adversely affect awakening, reduce alertness, and prolong sleep.

There is a definite genetic component in AR and more so in asthma. The genetics of rhinitis has not been studied as much as that of asthma and atopy because there is difficulty in precise definition of the AR phenotype. A total of 19 patients (31.67%) gave a positive family history where one or both parents had complaints of AR or asthma. This is similar to the study by Dold *et al*. [15] where 40% patients had a positive family history including parents and siblings only.

Mouth breathing in the infant and child is frequently secondary to chronic nasal allergy. The allergic patients are characterized by deeper palatal height, retroclined mandibular incisors, increased total anterior facial height and lower facial height, a larger gonial angle, and greater SN, palatal, and occlusal planes to mandibular plane angles. Three patients had orthodontic malocclusion in our study. Two belonged to adolescent age group and had persistent AR whereas one patient aged 28 years and had intermittent type of AR. In a study by Vázquez Nava *et al.* [16], 37.2% youngsters had some kind of dental malocclusion. Of these, 42.3% had AR which was the highest contributor in the group [17]. After more than a century, the association between the obstruction of airways and dental malocclusion is still under discussion.

Two of our patients had history of food allergy, one to milk and other to peanut. The reaction to food was mild with itching and tingling sensation in throat. There were no breathing difficulties. This is in agreement with a study by Pénard-Morand [18] where 4.7% patients with AR complained of food allergy. In another study by Sampson *et al.* [19], three of the seven patients who had near fatal anaphylactic reaction to food had AR. Only one patient in our study was allergic to drugs and that was to aspirin. The patient complained of skin itching and urticarial on ingestion of the drug. In a study by Kurt *et al.* [20], they found significant association between drug hypersensitivity reactions and diagnosis of AR and eczema supporting other allergic conditions as risk factors.

Various mechanisms have been explained for the cause of ITH. On examination, 25 patients (41.6%) had bilateral ITH and 33 patients had unilateral ITH. This goes to tell that ITH is the most common nasal finding seen in AR. Eight patients (13.33%) had adenoid hypertrophy on diagnostic nasal endoscopy. In a study by Huang and Giannoni [21] on the risk of adenoid hypertrophy in children with AR, there was a significant association between the two. In addition, 8 patients (13.33%) had signs of sinusitis on endoscopy. According to Meltzer *et al.* [8], around 20% of patients complained of sinusitis symptoms such as facial pain and headache. Two patients had nasal polyposis (3.33%) which correlates well with the study of Hellings and Fokkens [22] where 0.5-4.5% of AR patients have been found to have nasal polyposis. The most common

type of nasal mucosa was pale mucosa which was seen in 38 patients followed by normal-looking mucosa and congested mucosa.

Patients were classified into intermittent AR and persistent AR based on their symptoms. Intermittent AR is defined as experiencing symptoms for <4 days/week or <4 consecutive weeks. In our study, 42 patients had intermittent AR. Persistent allergic rhinitis is termed as symptoms occurring for more than 4 days/week and more than 4 consecutive weeks which was seen in 30% of our patients. They were further classified into mild and moderate depending on the degree of their symptoms. It is classified as mild if there is no disturbance in sleep or impairment of routine activities and work and school. If the patient has abnormal sleep or has impaired daily routine activities or impaired performance at work or school attributed to AR, he is said to be having a moderate to severe disease. Of the patients with intermittent AR, 61.9% had mild disease whereas 38.1% had moderate to severe disease. In patients with persistent disease, 77.78% had mild disease and moderate to severe disease was seen in 22.23% cases. Thus, the most common allergic patient is one having intermittent disease with mild degree. This correlates well with the study of Bauchau and Durham [7], in which 70.82% patients had intermittent disease and 29.18% had persistent disease.

At present, the eosinophil is recognized as a proinflammatory granulocyte implicated in protection and parasitic infections and is believed to play a major role in allergic diseases such as allergic asthma, AR, and atopic dermatitis. Eosinophils normally account for only 1-3% of peripheral blood leukocytes and the upper limit of normal range is 350 cells/mm^3 of blood. Eosinophilia occurs in a variety of disorders and is arbitrarily classified as mild (351-1500 cells/mm^3), moderate (>1500-5000 cells/mm^3), and severe (>5000 cells/mm^3). The most common cause of eosinophilia worldwide is helminthic infections, and the most common cause in industrialized nations is atopic disease. In AR, eosinophils are found both in peripheral blood and nasal tissue [23]. AEC was done in all cases. Normal AEC was found in 33 cases in 55% of cases and raised AEC was seen in only 45% of cases. As seen in the study, AEC was not raised in more than half the AR patients.

Eosinophil count in inferior turbinate biopsy was counted. Eosinophils were counted per hpf and the average was calculated. Eosinophil count below 5 was considered normal and above 5 was raised count. In our study, 48.34% cases had <5 eosinophils/hpf and 51.67% had raised eosinophil count in their inferior turbinate. In a study by Ingels *et al.* [24], the biopsy was considered hypereosinophilic when they contained more than one eosinophil in four fields. However, there were many false positives. Hence, biopsy was considered positive for eosinophils when at least four eosinophils are demonstrated in four microscopic fields. In their study, they found that 25% of non-allergic patients had hypereosinophilic mucosa. In another study by Minshall *et al.* [25], a significant reduction in the number of epithelial and submucosal eosinophils was observed in posttreatment sections compared with that in biopsy specimens obtained before treatment of AR. Thus, eosinophil count in the inferior turbinate appears to be a more reliable investigation in AR.

In addition, there seems to appear a significant correlation between raised AEC count and raised IT eosinophil count. In our study, 27 patients with raised AEC also had a raised IT eosinophil count whereas 17 patients who had normal AEC had normal eosinophil count in their IT biopsy. Remaining few patients had variations in their AEC and IT eosinophil count. This association between the AEC and the eosinophil count in the inferior turbinate is found to be statistically significant. Hence, patients with raised eosinophils in their blood are more liable to have increased eosinophils in their nasal mucosa and vice versa.

There are very few studies conducted about the comorbidities of AR and about the eosinophil count in inferior turbinate biopsy.

The drawback of this study was lack of control group and also the diagnostic criteria for AR was based only on history.

CONCLUSION

AR is a highly prevalent yet underappreciated inflammatory disorder which affects not only the nasal mucosa but also other contiguous mucosa.

- Although most patients presented with nasal symptoms, ophthalmic and pharyngeal symptoms were commonly presented
- A significant percentage of patients had aural and respiratory comorbidities
- Sleep disturbances were seen in a significant number of allergic patients
- ITH with pale nasal mucosa were the most common examination findings
- Majority of allergic patients were classified under intermittent type with mild degree
- Although AEC was not raised in most of the patients, more than half patients had a raised eosinophil count in the inferior turbinate biopsy
- Thus, in a patient with AR, special attention has to be given to the ear, throat, eye, and asthmatic aspect.

Eosinophil count in inferior turbinate biopsy is fairly reliable indicator in allergic turbinates.

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