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Research Article

Correlation Between Eosinophilia and Nasal Features in Allergic Rhinosinusitis: A Pilot Study

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Abstract: *A characteristic feature of nasal allergy is local accumulation of inflammatory cells, particularly mast cells and eosinophils, and their mediators, which have been implicated to be responsible for symptoms and signs of allergies. This prospective study tested the hypothesis that severity of nasal symptoms at presentation was related to the presence of nasal eosinophilia, using consecutive patients with allergic rhinitis attending the outpatient Department of Otorhinolaryngology, University College Hospital, Ibadan, Nigeria, between March and December 2008. Excluded were those who had commenced antihistamine and similar antiallergy drugs. Nasal eosinophilia, skin sensitivity, sinus radiograph, and clinical features were graded using standard classification. The study was composed of 49 subjects (28 males and 21 females). The subjects' age ranged from 7 to 53 years (mean ± SD: 28 ± 4 years). Nasal eosinophilia and abnormal skin sensitivity response were seen in 41 (83.8%) and 37 (75.5%) subjects, respectively. Rhinorrhoea, sneezing, and nasal obstruction constituted 42 (85.7%), 31 (63.3%), and 21 (42.9%), respectively, while inferior turbinate enlargement and radiological involvement were seen in 29 (59.2%) and 36 (73.5%) patients. The Spearman correlation test revealed a significant association between nasal smear eosinophilia and rhinorrhoea (P = .008) and sneezing (P = .04), although there was no significant association with other variables. The authors conclude that the degree of nasal eosinophilia may be useful in predicting the severity of rhinorrhoea and sneezing among the clinical features of nasal allergy.*

Keywords: allergic rhinosinusitis, symptoms, eosinophilia, correlation, examination, radiology

Allergic rhinitis is an IgE-mediated hypersensitivity disease of nasal mucosa characterized by sneezing, itching, watery nasal discharge, and a sensation of nasal obstruction. Worldwide, 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] The release of various mediators from these cells has been implicated to be responsible for the symptoms of allergic rhinitis, which can be divided into early or delayed (late) phase response.[2] Early-phase response is due to mediators released from degranulation of mast cells following exposure to an antigen. This antigen binds to mast cell–bound IgE. Major mediators released are histamine, prostaglandins, thromboxane A2, bradykinin, and platelet activation factor. This is followed by accumulation of additional inflammatory cells such as eosinophils and T cells through chemokine attraction. These cells then release additional mediators such as eosinophil cationic protein and major basic protein, which promote a second inflammatory effect approximately 36 hours after allergen exposure and is known as delayed allergic response.[3] These inflammatory cells can be easily identified in nasal mucosa and secretions, confirming the diagnosis of allergic rhinitis. Okano et al[4] reported that nasal eosinophilia may be a pointer toward the development of nasal symptoms and inferred that the test may be valuable in predicting prolonged or recurrent allergic rhinitis. Our hypothesis was that the severity of nasal symptoms at presentation is related to the presence of nasal eosinophilia. The aim of this study was to determine the correlation, if any, between the grade of nasal eosinophilia and the severity of clinical features in patients with confirmed nasal allergy.

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Table 1. Grading of Nasal Symptoms According to Okuda et al[5]

Nasal Symptom	Severe	Moderate	Mild	None
Nasal stuffiness	Predominant mouth breathing	Occasional mouth breathing	No mouth breathing	Sensation of blockage
Rhinorrhoea (blows per day)	10 blows	6-10	1-5	Nil
Sneezing (attacks per day)	10 sneezes	6-10 sneezes	1-5 sneezes	Nil

Table 2. Grading of Intranasal Findings According to Mackay and Lund[6]

Intranasal Findings	Severe	Moderate	Mild	None
Congestion of inferior turbinate	No visible sign of middle turbinate	Between severe and mild	Visible over half of middle turbinate	Nil
Nasal discharge	Filled in full	Between severe and mild	Only attached to turbinate	Nil

Table 3. Grading of Radiological Involvement

0	Normal	No sinus involvement
+	Mild	Sinus mucosal thickening (1 sinus involvement)
++	Moderate	>1 sinus involvement
+++	Severe	Polyp or fluid level in the sinuses

Table 4. Grading of Eosinophilia

+	Normal	<5% eosinophilia	Normal
+	Mild	>5% eosinophilia	Doubtful
++	Moderate	<50% eosinophilia	Pathological
+++	Severe	>50% eosinophilia	Pathological

Methods

Consecutive patients with allergic rhinitis attending the outpatient department of otorhinolaryngology, University College Hospital, Ibadan, Nigeria, between March and December 2008 were selected. The inclusion criteria were diagnosis using clinical presentation and confirmed by the presence of either nasal eosinophilia or skin sensitivity tests. Exclusion criteria included allergy patients who have commenced antihistamine or similar antiallergy drugs and patients with chronic illnesses and steroid/cancer chemotherapy. A detailed history was taken, emphasizing the frequency of rhinorrhea, nasal obstruction, and sneezing. These symptoms were graded according to Okuda et al[5] (Table 1). The nasal cavity was examined by anterior rhinoscopy using the head lamp. The sizes of the inferior and middle turbinates were assessed using the grading of Mackay and Lund[6] (Table 2).

The plain radiograph of the paranasal sinuses were graded as in Table 3. Mucosal thickening of the paranasal sinus greater than 2 mm was regarded as positive.

In examining for nasal eosinophilia, smears of the inferior turbinates were taken during anterior rhinoscopy using a thin swab stick, and the smears were immediately transferred onto clean slides and sent to the histopathologist. The smears were then stained with May-Grunwald and Giemsa stain and rinsed in a running tap. Discoloration with alcohol was done, and after the smears were allowed to dry, they were examined under oil immersion.

The criteria adopted was 0: <5% eosinophilia, +: >5% eosinophilia, ++: <50% eosinophilia of the entire field, and +++: >50% eosinophilia covering of the entire field (Table 4).

Skin sensitivity tests were undertaken on each patient for all of the allergens. The allergens included house dust, house dust mites, mold, cockroach, and poultry feathers. Particular points on the forearm of the subjects were marked for allergen application. The points were cleaned with a spirit swab and allowed to dry. Standardized concentrations of allergens and positive and negative controls at room temperature were inserted into the epidermis using a special lancet. The diameters of the weal and flare reaction were measured with a ruler after 20 minutes. The response was defined as positive when the diameter was more than 2 mL than the negative control and negative if no response was observed. To grade the severity of the response, the diameters were recorded for each allergen and compared with the controls.

The study received ethical approval from the University of Ibadan/University College Hospital Ibadan Joint Ethical Review Board (UI/IRC/07/0023).

The variables were scored as above and analyzed using SPSS version 15.

Statistical Analysis

The main outcome variable was the nasal eosinophilia score, while the variables were rhinorrhea, nasal obstruction, sneezing, turbinate size, skin sensitivity score, and the nasal sinus radiograph grading. The Spearman statistical test was used to find the correlation between nasal eosinophilia score and the dependent variables.

Table 5. Summary of Clinical Scores Based on Grading of Each Patient (N = 49)

Variable	Normal (0)	Mild (1)	Moderate (2)	Severe (3)
Nasal eosionophilia	8	17	14	10
Skin sensitivity test	12	15	12	10
Rhinorrhoea	7	16	11	15
Sneezing	18	13	8	10
Nasal obstruction	28	9	5	7
Inferior turbinate enlargement	20	12	8	9
Radiological involvement	13	6	6	4

Results

The study was composed of 49 subjects with allergic rhinitis (28 males and 21 females). The age of the subjects ranged from 7 to 53 years (mean ± SD: 28 ± 4 years). Cytology revealed normal eosinophilia in 8 (16%) subjects and abnormal eosinophilia in 41 (83.8%) subjects, graded as mild in 17, moderate in 14, and severe in 10. Skin sensitivity response was normal in 12 (24.5%) subjects, abnormal in 37 (75.5%) subjects, graded as mild in 15, moderate in 12, and severe in 10. Rhinorrhoea was the most prevalent symptom found in 42 (85.7%) subjects, rated as mild in 16, moderate in 11, and severe in 15 subjects; sneezing was seen in 31 (63.3%) subjects, rated as mild in 13, moderate in 8, and severe in 10 subjects; and nasal obstruction was seen in 21 (42.9%) subjects, rated as mild in 9, moderate in 5, and severe in 7 subjects. Examination revealed inferior turbinate enlargement in 29 (59.2%) subjects, which was mild in 12, moderate in 8, and severe in 9 subjects. Radiological involvement was seen in 36 (73.5%) subjects, which was mild in 15, moderate in 8, and severe in 13 subjects, while the sinus radiograph was normal in 13 (26.5%) subjects (Table 5). The Spearman correlation test between other variables revealed a significant association between nasal smear eosinophilia and rhinorrhoea (P = .008) and sneezing (P = .04), whereas there was no significant association with skin sensitivity test (P = .69), nasal obstruction (P = .46), inferior turbinate enlargement (P = .47), or radiological involvement (P = .9; Table 6).

Table 6. Result of Spearman Correlation Test Between Nasal Smear Eosinophilia and Other Variables

Variable	*P* Value
Skin test	.69
Rhinorrhoea	.008[a]
Nasal obstruction	.46
Sneezing	.041[a]
Inferior turbinate enlargement	.47
Radiologic features	0.9

[AQ: 3]

Discussion

This study adds to the body of knowledge on nasal allergy by finding a positive correlation between nasal eosinophilia and the severity of rhinorrhoea and sneezing. This study has further confirmed nasal eosinophilia as a cardinal feature of nasal allergy found in 84% of the subjects, in agreement with previous reported figures of 40% to 95%.[7,10] [AQ: 1] Previous data showed that the extent of eosinophilic inflammation is related to the extent of sinonasal mucosal involvement, the severity of nasal disease, and size of nasal polyps.[11] However, we found rhinorrhoea and sneezing as the symptoms with statistical significance in relation to eosinophilia. In contrast, Lans et al[12] [AQ: 2] did not find a significant correlation between nasal eosinophilia and symptoms and signs. In earlier studies, Chanda et al[13] showed a trend toward direct proportion of eosinophilia and inverse proportion of mastiphilia with severity of nasal obstruction. They also found a higher incidence of eosinophils and mast cells in patients who had associated allergic symptoms of the eyes and respiratory system. However, in cases with associated symptoms of the skin and gastrointestinal system, higher incidences of only eosinophils and mast cells, respectively, were found. However, our study did not find a correlation between skin sensitivity and radiologic involvement. In contrast, Sood[14] reported that both the skin test and nasal eosinophilia were positive in 88% of patients. Our finding may be explained by the limitation in the array of allergens tested in the study. There might be a chance that we were not able to test the specific allergens to which the patients were sensitive. In addition, the onset of infections in our patients at presentation might also have contributed to this disparity in eosinophilia and skin sensitivity. Bryan and Bryan[15] reported that infections may cause the temporary disappearance of eosinophils from the secretions of allergic patients.

The age characteristics of our patient are comparable with the patients in the study by Chanda et al[12]; they reported that

60% patients were <30 years of age, whereas in our study, the mean age was 28 years. In addition, we found a male predominance similar to most findings in the literature, although this was in contrast to the report of Chanda et al[12] and Sood,[14] who reported female predominance. In this study, we used nasal smear in assessing eosinophilia. The 2 methods that have been employed by previous researchers were nasal smear and biopsy, and the findings were comparable. While Chanda et al[12] and others[16,17] reported biopsies to be better than smears for the detection of eosinophils, Mygind[18] showed smears to be better than biopsies. This appears to be the first report in the literature comparing radiologic features and nasal eosinophilia, and it is hoped that further studies will explore this area in future.

We conclude from this study that the degree of nasal eosinophilia may be useful in the prediction of the severity of rhinorrhoea and sneezing among the clinical features of nasal allergy.

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