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COMPARATIVE ASSESSMENT OF EOSINOPHIL COUNTS IN PERIPHERAL BLOOD AND NASAL SMEAR IN NON-ALLERGIC AND ALLERGIC RHINITIS SUBJECTS

Dr. Prakash Shriniwas Kulkarni,[1] Dr. Pooja Pawaria,[2] Dr Bharti Saklani,[3] Dr Saket Gupta[4*]

[1]Ph.D. (Medical Physiology), Professor, Department of Physiology, Dr. N. Y. Tasgaonkar Institute of Medical Sciences, Karjat, Raigad, Maharashtra

[2]MD, Senior Resident, Department of Pathology, SHKM Government Medical College, Nalhar, Nuh, Haryana

[3]MD, Assistant Professor, Department of Pathology, Himalayan Institute of Medical Sciences, Dehradun, Uttarakhand

[4*]MS, Associate Professor, Department of ENT, Rajarshi Dashrath Autonomous State Medical College, Ayodhya, Uttar Pradesh

Address for correspondence

Dr Saket Gupta

Email id: saket.gupta58@gmail.com

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ABSTRACT

Background: Allergic rhinitis is an inflammatory disorder of the nasal membrane seen after allergen exposure and mediated by IgE type-1. It is characterized by one or more symptoms including rhinorrhea, nasal congestion, itching, and sneezing. Tissue eosinophilia is a characteristic feature of mucosal inflammation in allergic rhinitis.

Aim: The present study aimed to assess eosinophil counts in peripheral blood and nasal smear in non-allergic and allergic rhinitis subjects.

Methods: The present study assessed 180 subjects having allergic rhinitis against 180 gender and age-matched control subjects without allergic rhinitis. Smears were made from the nasal secretions and the peripheral blood of the study subjects. For both the groups, smears were fixed and staining was done to further study the samples under light microscopy.

Results: In allergic rhinitis and non-allergic rhinitis, negative predictive value, positive predictive value, specificity, and sensitivity were 79%, 86.23%, 87.75, and 76.64 respectively. The study results showed a significant difference in the eosinophil counts from peripheral blood smear and nasal smear in subjects having allergic rhinitis in comparison to age and gender-matched non-rhinitis subjects. These results showed that nasal eosinophilia is the first information tool of point of contact in provisional diagnosis of allergic rhinitis.

Conclusions: The present study concludes that nasal smear eosinophil cytology is a semi-invasive, economical, and simple procedure that can be used as a prognostic and diagnostic test in allergic rhinitis subjects.

Keywords: Allergic rhinitis, blood eosinophilia, cytology, eosinophil counts, nasal eosinophilia, nasal smear

INTRODUCTION

Originally known and called Allergies, the term allergy is a German term coined by two pediatricians and scientists in 1906. The term was coined by combining ergon meaning

activity to the Greek root allos meaning strange, different, or other. Allergic rhinitis is a global healthcare concern majorly seen in otolaryngologists having a prevalence rate of 10% to 30% in adults and nearly 40% in child subjects. Based on the National Health Portal 2016, nearly 20% to 30% of Indian subjects have one of the allergic diseases.[1] Allergic rhinitis is mediated by an IgE (immunoglobulin-E) type-1 inflammatory disorder of the nasal membrane resulting from allergen exposure and is characterized by one or more symptoms including rhinorrhea, nasal congestion, itching, and sneezing. It results in the exaggerated activation of a few cells in the human body that are triggered by eosinophils, basophils, mast cells, and IgE which has a vital role in inflammatory reactions.[2]

Inflammation in the mucosa of subjects with allergic rhinitis is characteristic of tissue eosinophilia which can be associated with comorbid conditions such as nasal polyps, atopic dermatitis, and asthma having significant effects on productivity at work workplace and quality of life. The first documentation of a conclusive and strong association between nasal eosinophil counts and allergic rhinitis dates back to 1972. Following this, extensive literature data supported and contradicted this association.[3]

In different geographical areas with a high prevalence of allergens, allergens have a major role in the etiology of allergic respiratory disorders. Confirming the allergen as an etiological factor is cumbersome in a small sample. The diagnosis of allergic rhinitis is confirmed using an array of investigation tools including serum IgE antibody levels, RAST (radio-allergo sorbent assay), ELISA, and skin prick test. These tests are expensive and available only in selected high-end healthcare settings. Eosinophil counts from nasal smears and peripheral blood smears are semi-invasive, economical, and simple tools for diagnosing allergic rhinitis.[4]

The present study aimed to assess the sensitivity and specificity of nasal smears for diagnosis of allergic rhinitis compared to gold-standard peripheral blood smears.

MATERIALS AND METHODS

The present comparative prospective research study was aimed to assess the sensitivity and specificity of nasal smears for diagnosis of allergic rhinitis compared to gold-standard peripheral blood smears. The study was done after the clearance was given by the concerned institutional Ethical committee. The study subjects were from the Department of Physiology of the Institute. Verbal and written informed consent was taken from all the subjects before participation.

For the present study, the data were gathered from 360 subjects including 180 subjects with allergic rhinitis and 180 subjects from controls. The study subjects were in the age range of 18-55 years. Subjects that were diagnosed with positive skin prick tests and allergic rhinitis were included in the study. The study included another 180 age and gender-matched controls with no allergic rhinitis were taken as controls. The exclusion criteria for the study were subjects using intranasal or systemic steroid therapy in the past month, recent medical therapy for rhinitis, upper respiratory tract infection, and not willing to participate in the study.

Various opinions exist in the literature concerning the cut-off values of eosinophil counts in blood and nasal smears. Following the recommendations of IAP,[5] a cut-off value of 10 cells per high-power field has been accepted in the present study. Similarly, a blood eosinophil

count of >400 cells/cu mm has been accepted following the recommendations by Chowdhary et al[6] in 2003.

For nasal smear preparation, the smears were taken from the middle third of the inferior turbinate from both nostrils using the sterile cotton swab. These smears were then fixed using a slide having 95% ethyl alcohol and were stained using Wright-Giemsa solution. On examination under high power, the presence of a mean of 10 eosinophils per high power field was taken as positive.

For peripheral smear preparation, absolute eosinophil counts were assessed following the standard procedure. Peripheral blood smear was studied using the Leishman staining where a count of more than 440 cells per cu mm was considered as positive for absolute eosinophil count.

The data gathered were analyzed statistically using SPSS (Statistical Package for the Social Sciences) software version 16.0 (SPSS Inc., Chicago, USA) for assessment of descriptive measures and Mann Whitney U test. The results were expressed as mean and standard deviation and frequency and percentages. The p-value of <0.05 was considered statistically significant.

RESULTS

The present comparative prospective research study was aimed to assess the sensitivity and specificity of nasal smears for the diagnosis of allergic rhinitis compared to gold-standard peripheral blood smears. The present study assessed 180 subjects having allergic rhinitis against 180 gender and age-matched control subjects without allergic rhinitis. Smears were made from the nasal secretions and the peripheral blood of the study subjects. For both the groups, smears were fixed and staining was done to further study the samples under light microscopy. The study subjects were in the age range of 18-55 years with a mean age of 29.91±9.13 years. There were 104 males and 76 females in the study group, whereas, there were 92 males and 88 females in the control group with a mean age of 29.20±9.03 years. Eosinophil counts were highest in the nasal smear of subjects with allergic rhinitis with 19.14±1.2/hpf compared to non-allergic rhinitis subjects with 3.41±0.73/hpf depicting statistically significant inter-group difference with $p<0.05$. Mean blood eosinophil counts were also significantly higher in subjects with allergic rhinitis with 460.41/cu mm compared to subjects with no allergic rhinitis (controls) having a count of 185.21 cu mm with $p<0.05$.

In the study subjects, in the nasal smear eosinophil count, 136 subjects showed eosinophil counts, whereas, 24 subjects showed positive eosinophil counts. The negative counts were 23.31% and 87.75% in the study subjects and control group respectively. However, positive counts concerning absolute eosinophil counts were seen in 35.3% of allergic rhinitis subjects and 10% of subjects from the control group depicting negative results in 106 allergic rhinitis and 162 control subjects.

The study results showed that >10 nasal eosinophil cells/high power field were seen in 56 subjects with >440 cells/cu mm and in 80 subjects with <440 blood eosinophil cells/cu mm. <10 nasal eosinophil cells/high power field were seen in 20 subjects with >440 blood eosinophils cells/cu mm and 24 subjects with <440 blood eosinophil cells/cu mm. The

sensitivity, specificity, positive predictive value, and negative predictive value were respectively 73.66, 23.05, 41.15, and 54.52 (Table 1).

On comparison of blood and nasal smear eosinophil counts concerning negative predictive values, positive predictive values, accuracy, specificity, and sensitivity in two groups of study subjects. The accuracy of nasal and blood eosinophils was 82.27 and 32.43 respectively. Negative predictive values were 79.00 and 58.25 for nasal and blood eosinophils respectively. Positive predictive values for nasal and blood eosinophils were 86.23 and 78.02 respectively. Specificity was 87.75 and 90.00 for nasal and blood eosinophils respectively. Sensitivity for nasal and blood eosinophils was 76.64 and 35.53 respectively. All the parameters were significantly higher with nasal eosinophils with $p<0.05$ (Table 2).

DISCUSSION

The present study assessed 180 subjects having allergic rhinitis against 180 gender and age-matched control subjects without allergic rhinitis. Smears were made from the nasal secretions and the peripheral blood of the study subjects. For both the groups, smears were fixed and staining was done to further study the samples under light microscopy. The study subjects were in the age range of 18-55 years with a mean age of 29.91±9.13 years. There were 104 males and 76 females in the study group, whereas, there were 92 males and 88 females in the control group with a mean age of 29.20±9.03 years. Eosinophil counts were highest in the nasal smear of subjects with allergic rhinitis with 19.14±1.2/hpf compared to non-allergic rhinitis subjects with 3.41±0.73/hpf depicting statistically significant inter-group difference with $p<0.05$. Mean blood eosinophil counts were also significantly higher in subjects with allergic rhinitis with 460.41/cu mm compared to subjects with no allergic rhinitis (controls) having a count of 185.21 cu mm with $p<0.05$. These results were similar to the studies of Cameron L et al[7] in 2003 and Gelardi M et al[8] in 2011 where authors assessed subjects with demographic data comparable to the present study and with allergic rhinitis.

It was seen that in the study subjects, in the nasal smear eosinophil count, 136 subjects showed eosinophil counts, whereas, 24 subjects showed positive eosinophil counts. The negative counts were 23.31% and 87.75% in the study subjects and control group respectively. However, positive counts concerning absolute eosinophil counts were seen in 35.3% of allergic rhinitis subjects and 10% of subjects from the control group depicting negative results in 106 allergic rhinitis and 162 control subjects. These results were consistent with the findings of Miri S et al[9] in 2006 and Patel A.K et al[10] in 2014 where authors reported comparable eosinophil counts in nasal and blood smears of their study subjects with allergic rhinitis as seen in the present study.

The study results depicted that >10 nasal eosinophil cells/high power field were seen in 56 subjects with >440 cells/cu mm and in 80 subjects with <440 blood eosinophil cells/cu mm. <10 nasal eosinophil cells/high power field were seen in 20 subjects with >440 blood eosinophils cells/cu mm and 24 subjects with <440 blood eosinophil cells/cu mm. The sensitivity, specificity, positive predictive value, and negative predictive value were respectively 73.66, 23.05, 41.15, and 54.52. These findings were in agreement with the results of Meena C et al[11] in 2016 and Lee C.H et al[12] in 2008 where results comparable to the present study were reported by the authors in their respective studies.

Concerning the comparison of blood and nasal smear eosinophil counts negative predictive values, positive predictive values, accuracy, specificity, and sensitivity in two groups of study subjects. The accuracy of nasal and blood eosinophils was 82.27 and 32.43 respectively. Negative predictive values were 79.00 and 58.25 for nasal and blood eosinophils respectively. Positive predictive values for nasal and blood eosinophils were 86.23 and 78.02 respectively. Specificity was 87.75 and 90.00 for nasal and blood eosinophils respectively. Sensitivity for nasal and blood eosinophils was 76.64 and 35.53 respectively. All the parameters were significantly higher with nasal eosinophils with $p<0.05$. These results were in line with the findings of Corsico A.G et al[13] in 2017 and Bousquet J et al[14] in 2001 where sensitivity, specificity, accuracy, negative predictive values, and positive predictive values for blood and nasal smear for eosinophil counts reported by the authors in their studies was comparable to the results of the present study.

CONCLUSIONS

The present study, considering its limitations, concludes that nasal smear eosinophil cytology is a semi-invasive, economical, and simple procedure that can be used as a prognostic and diagnostic test in subjects having allergic rhinitis. However, further future multi-institutional prospective studies with larger sample sizes are warranted to reach a definitive conclusion.

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TABLES

S. No	Nasal eosinophils	Blood eosinophils		Total	
		>440 cells/cu mm	<440 cells/cu mm		
1.	**>10 cells/high power field**	56	80	136	**Sensitivity 73.66**
2.	**<10 cells/high power field**	20	24	44	**Specificity 23.05**
3.	**Total**	76	104	180	**PPV: 41.15 NPV: 54.52**

Table 1: Nasal and blood smear eosinophil counts in the study subjects

S. No	Parameter	Nasal eosinophils	Blood eosinophils
1.	**Accuracy**	82.27	32.43
2.	**Negative predictive value**	79.00	58.25
3.	**Positive predictive value**	86.23	78.02
4.	**Specificity**	87.75	90.00
5.	**Sensitivity**	76.64	35.53

Table 2: Comparison of blood and nasal smear eosinophil counts concerning negative predictive values, positive predictive values, accuracy, specificity, and sensitivity in two groups of study subjects