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### Original Work

## A study of eosinophil count in nasal and blood smear in allergic respiratory diseases in a rural setup

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**ABSTRACT:** Allergic respiratory disorders are fairly common visiting cases in pediatrics outpatient department (OPD). With an appropriate history and detailed examination, diagnosis may not be problematic. Routine investigation may not contribute much to the final diagnosis but may help in ruling out other possibilities. This study was done to evaluate sensitivity and specificity of blood or nasal eosinophilia in subjects suffering from allergic respiratory disorders and also to assess the feasibility of nasal cytogram which is a simple, economical and reliable investigation in allergic respiratory disorders. This is a prospective clinical correlation study of patients attending outpatient department. 100 subjects aged between 2-18 years of either sex were selected for the estimation of eosinophil count in nasal and peripheral smear in allergic respiratory disorders. All allergic respiratory cases based on eosinophilia. The nasal and blood eosinophilia were compared with each other and clinical findings of allergic rhinitis with or without asthma were studied. In this study peak age incidence was seen between 11-18 years and it was more common in males. Rhinorrhoea, pale mucosa and nasal obstruction were common findings in allergic rhinitis with bronchial asthma. Nasal eosinophilia was seen in 52.4% and 64.9% of cases of allergic rhinitis and allergic rhinitis with asthma respectively. Blood eosinophilia was seen in 54% and 56.8% of cases of allergic rhinitis with asthma respectively. Nasal cytogram which is a simple, economical and non-invasive procedure can be used as an alternative to invasive peripheral smear eosinophilia as both are equally efficacious in diagnosing allergic respiratory diseases.

**KEY WORDS:** *Eosinophilia; Allergic rhinitis; Bronchial asthma*

### INTRODUCTION

Hay fever (allergic rhinitis) and asthma are two very common allergic diseases of the respiratory tract<sup>1</sup>. The two have much in common as to age at onset, seasonal manifestations, and causation. Hay

fever involves the mucosa, or lining of the upper respiratory tract only, whereas asthma is confined to the bronchial tubes of the lower respiratory tract<sup>2</sup>.

There is mounting evidence that eosinophils are implicated in pathophysiology of allergic respiratory diseases, the direct and easy access of airborne allergens and irritants to the airways stimulate mast cells to produce IgE and cytokines which serves as enhancing factors for eosinophilic infiltration in allergic diseases<sup>3</sup>. Since allergic rhinitis and asthma are such prominent disorders

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of immediate hypersensitivity, it is not surprising that identification of eosinophil leukocytes within the nasal and bronchial mucosa and corresponding eosinophilia of the nasal secretion and sputum are common findings in atopic populations<sup>4</sup>.

In the geographical area where allergens are prevalent, their role as the etiological factor is higher in allergic respiratory disorders<sup>5</sup>. Confirmation of allergen as etiologic agent is difficult in a small setup, where IgE estimation and allergy tests are not accessible<sup>6</sup>.

This study was done to evaluate sensitivity and specificity of blood or nasal eosinophilia in subjects suffering from allergic respiratory disorders and also to assess the value of nasal cytogram as an alternative investigation.

## METHODOLOGY

This was a prospective clinical correlation study conducted from 2008 to 2010, of 100 children between 2 to 18 years of either sex, with typical history and clinical features of allergic respiratory diseases who attended the outpatient department of Pediatrics. Children with tuberculosis, recurrent and chronic pneumonia, malnutrition, malignancy, collagen vascular disorders and those who were on steroid therapy were excluded from the study. The history, clinical features and investigation were noted in a proforma specially designed for the study. The following investigations were done: blood studies, nasal discharge smear for eosinophil count, Mantoux test and chest X-ray in all children included in the study. Consents from the parents and institutional ethical committee clearance were obtained.

Nasal and peripheral smear examination was done as follows:

### Nasal Smear Preparation

Nasal secretion was collected by asking the child to blow his nose into a plastic wrap and then placed on a glass slide. If he was too young to do this or insufficient secretion was obtained, cotton tipped swab was inserted into a nostril and left for 60 seconds. The nasal secretion which was obtained was transferred onto a glass slide, teased out and allowed to air dry.

### Blood Studies

With strict aseptic precautions, blood sample was drawn by venepuncture and 3 ml of blood was collected in Ethylene Diamine Tetra Acetic Acid (EDTA) anticoagulant. The sample

collected was subjected to investigations like Hb%, Total Count (TC), Differential Count (DC), Erythrocyte Sedimentation Rate (ESR), Absolute eosinophil count (AEC), and peripheral smear examination.

### Peripheral smear preparation

A small drop of blood was placed about 1 or 2 cm from one end of a pre-cleaned slide and immediately another slide with a pre-cleaned edge was placed at an angle of 25 degrees and moved backwards to make contact with the drop. The drop of blood was spread quickly along the line of contact of spreader with the slide and allowed to air dry. Peripheral blood smear was studied using Leishman's stain whereas nasal smear was studied by Haematoxylin and Eosin (H & E) stain.

### Statistical Analysis

The following methods of statistical analysis have been used in this study, Chi-square test Student "t" test, Sensitivity, specificity positive predictive value, negative predictive value. Data analysis was carried out using Statistical Package for Social Science (SPSS Ver. 10.5).

## RESULTS

A total of 112 patients presented to outpatient department of paediatrics during the study period with history suggestive of allergic rhinitis. 12 of them were excluded from the study because of associated malnutrition, pneumonia, tuberculosis or steroid therapy. The results of analysis of data of 100 study cases were as follows.

35% of the allergic respiratory cases were in the age group >15 years, among this 63% of the cases were of adolescent group (aged between, 11-18 years). The incidence of allergic disorder was more common in males (62%) compared to females (38%). Female: Male Ratio= 1:1.6 (Table 1a & b).

**Table 1a: Age distribution**

Age (in yrs)	Frequency	Percent
2-5	19	19.0
6-10	18	18.0
11-15	28	28.0
>15	35	35.0
<b>Total</b>	<b>100</b>	<b>100.0</b>

**Table 1b: Sex incidence**

Sex	Frequency	Percent
Male	62	62.0
Female	38	38.0
<b>Total</b>	<b>100</b>	<b>100.0</b>

Female: Male Ratio = 1:1.6

In this study dust was the most common risk factor for allergic rhinitis accounting for 81% followed by weather changes 62%, whereas in allergic rhinitis with bronchial asthma, weather change is a common risk factor accounting for 94%, followed by dust (73%) and family history (64%) (Table 2). In this study the most common sign and symptom was rhinorrhoea (100%) in both the groups followed by nasal obstruction (81%) (Table 3) The mean nasal eosinophil in allergic rhinitis (20.10 cells) and bronchial asthma (20.19 cells) were almost similar, and the mean blood eosinophil count in allergic rhinitis with asthma (589) was

higher than in allergic rhinitis (506) but this was statistically not significant ( $p=0.270$ ) Table 4.

In this study all 100 cases were investigated for both nasal and blood eosinophil count. The positive nasal eosinophilia ( $>10$ cells) cases were 57%. Similarly, the positive blood eosinophilia ( $>440$  cells/cc mm) were 55%. Nasal eosinophilia is more common in allergic rhinitis with asthma compared to only allergic rhinitis (64.9 vs. 54.5) but this was statistically not significant ( $p>0.223$ ) Table 5a. Blood eosinophilia is almost similar in allergic rhinitis with asthma compared to only allergic rhinitis (56.8 vs. 54.0) but statistically not significantly ( $p>0.787$ ) (Table 5b).

In this study we compared the correlation between nasal smear and peripheral blood eosinophils in allergic rhinitis patients with or without asthma. There was a positive correlation between nasal and peripheral blood smear eosinophilia in allergic rhinitis patients with asthma (Table 6a). Children with only allergic rhinitis had significant nasal eosinophilia showing that nasal smear eosinophilia is more reliable in this group (Table 6b).

**Table 2: Distribution of risk factors**

Risk Factor	Allergic Rhinitis (n=63)		Allergic Rhinitis with bronchial asthma (n=37)	
	Frequency	Percent (%)	Frequency	Percent (%)
Dust	51	81.0	27	73.0
Weather change	43	68.3	35	94.6
Animal	9	14.3	9	24.3
Food	10	15.9	17	45.9
H/o Family atopy	25	39.6	24	64.8

**Table 3: Distribution of signs and symptoms**

Symptoms and symptoms	Allergic Rhinitis (n=63)		Allergic Rhinitis with bronchial asthma (n=37)	
	Frequency	Percent	Frequency	Percent
Rhinorrhoea	63	100.0	37	100.0
Nasal itching	24	38.1	16	43.2
Nasal obstruction	51	80.9	24	64.8
Pale mucosa	53	84	30	81.0
Sneezing	32	50.8	12	32.4
Cough	23	36.5	37	100.0
Wheezing	1	1.6	37	100.0
Dyspnea	0	0	12	32.4
Fever	8	12.7	4	10.8

**Table 4: Distribution according to mean**

	Diagnosis	n	Mean	SD	Minimum	Maximum	't' value	'p' value
Nasal Eosinophils	Allergic Rhinitis	63	20.10	22.230	0	80	0.000	>0.983
	Allergic Rhinitis with Bronchial Asthma	37	20.19	18.017	0	80		
	Total	100	20.13	20.677	0	80		
Blood Eosinophils	Allergic Rhinitis	63	506.60	351.066	95	1888	1.232	>0.270
	Allergic Rhinitis with Bronchial Asthma	37	588.95	370.256	86	1650		
	Total	100	537.07	358.654	86	1888		

**Table 5a: Distribution of nasal eosinophils according to the diagnosis**

Nasal eosinophils	Allergic Rhinitis	Allergic Rhinitis with bronchial asthma	Total
<10	30 (47.6%)	13 (35.1%)	43(43.0%)
≥10	33 (52.4%)	24 (64.9%)	57 (57.0%)
Total	63 (100.0%)	37 (100.0%)	100 (100.0%)
	<b>Chi-Square Value</b>	<b>df</b>	<b>'p' value</b>
	1.482	1	.223

**Table 5b: Distribution of blood eosinophils according to the diagnosis**

Blood eosinophils	Allergic Rhinitis	Allergic Rhinitis with Bronchial Asthma	Total
≤440	29 (46.0%)	16 (43.2%)	45 (45.0%)
>440	34 (54.0%)	21 (56.8%)	55 (55.0%)
Total	63 (100.0%)	37 (100.0%)	100 (100.0%)
	<b>Chi-Square Value</b>	<b>df</b>	<b>'p' value</b>
	0.073	1	.0787

**Table 6a: Correlation between nasal and blood smear eosinophil counts in allergic rhinitis and allergic rhinitis with bronchial asthma**

Nasal eosinophil	Blood eosinophil			Sensitivity	Specificity	PPV	NPV	Accuracy
	>440	≤440	Total					
≥ 10	41(71.9)	16 (28.1)	57(100)	74.5	64.4	67.4	71.9	70
<10	14 (32.6)	29 (67.4)	43 (100)					
Total	55 (55)	45 (45)	100(100)					

Figures in parenthesis indicate percentage.

**Table 6b: Correlation between nasal and blood smear eosinophil counts in allergic rhinitis without bronchial asthma**

Nasal eosinophil	Blood eosinophil			Sensitivity	Specificity	PPV	NPV	Accuracy
	>440	≤440	Total					
≥ 10	25 (75.8)	8 (24.2)	33 (100)	73.5	72.4	70	75.8	73
<10	9 (30)	21 (70)	30 (100)					
Total	34 (54)	29 (46)	63 (100)					

Figures in parenthesis indicate percentage.

The sensitivity of nasal eosinophilia is higher in allergic rhinitis with bronchial asthma compared to other group (85.7 vs. 73.5) (Table 7).

**Table 7: Correlation of allergic rhinitis vs. allergic rhinitis with asthma**

	Allergic rhinitis (%)	Allergic rhinitis with asthma (%)
Sensitivity	73.5	85.7
Specificity	72.4	50
PPV	70	69.2
NPV	75.8	72.7
Accuracy	73	70.3

**DISCUSSION**

Allergic respiratory disorders are fairly common cases in pediatrics outpatient department (OPD). With an appropriate history and detailed examination the diagnosis is usually not

problematic. Routine investigations may not contribute much to the final diagnosis but may help in ruling out other possibilities. To confirm the allergic nature of the disease complicated tests like IgE, skin tests, (RAST) Radio Allergosorbent Test, (ELISA) Enzyme Linked Immuno Sorbent Assay etc, may not be possible in many hospital setups. Hence, a simple test for finding out allergy as an etiological agent by doing eosinophils count in nasal and peripheral blood smear and establishing it as a reliable and simple investigation has been tried.

In this study, majority of the allergic respiratory cases visiting paediatric OPD were of adolescent age group (11-18 years) accounting for 63% with male predominance. This finding was supported by Mirsaid Ghazi et al<sup>7</sup>, who showed in their study that the incidence of allergic rhinitis in children increases with age and there was male predominance.

The most common associated factor in patients with allergic rhinitis without bronchial asthma was dust exposure accounting for 81%, followed by weather change (62%); whereas in patients of allergic rhinitis with bronchial

asthma weather change was the most common associated factor accounting for 94% followed by dust in 73% and family history in 64% of patients. Among 100 children, 49 had a family history of allergic respiratory disorder out of which bronchial asthma cases were significantly more, accounting for 64.8% and this is comparatively more than the observation made by Chowdary et al (50%)<sup>8</sup>. Among other risk factors, food allergy and pet animal history was found in 27% and 18% of patients respectively. This observation was higher when compared to the study of Pokharel et al (6% and 12%)<sup>9</sup>.

In this study, all the children with allergic rhinitis had rhinorrhoea (100%) which is also high in other studies done by Akbari et al<sup>10</sup> and Mirsaid Ghaz et al<sup>7</sup> (92% and 73.4%). Pale mucosa is the next common clinical finding accounting for 84% which is similar to Akbari et al<sup>10</sup> accounting for 88%. Following this, nasal obstruction and sneezing were the next presenting finding. Among all clinical findings, symptoms contributed more than signs to the diagnosis.

Nasal eosinophil and blood eosinophil count was done in all (100) cases and nasal eosinophil count of >10 cells were considered as positive as per IAP text recommendation<sup>11</sup>. Many studies have taken different cut-off values. Sanil et al<sup>12</sup> and Crobach et al<sup>13</sup>, etc have considered >10 cells as significant similar to the present study. Similarly, blood eosinophil count >440 cell/cumm is considered as significant and this cut-off value is also considered by Chowdary et al<sup>8</sup>.

Various workers have found varying results for nasal smear eosinophilia, ranging from 18% to 81%. This study correlates well with Sanil et al (57%)<sup>12</sup>. The mean absolute number of blood eosinophils in both groups totaling 100 patients was 537.07/cu mm and the mean value for eosinophils in the nasal secretions was (20.13.) When compared with both the groups the children with allergic rhinitis with asthma showed slightly higher blood eosinophils (588.9/cumm) than those with allergic rhinitis alone (506.6), which was similar to Saracli et al<sup>14</sup>. However this difference was not statistically significant.

Correlation between nasal smear and peripheral blood eosinophils in allergic rhinitis patients with or without asthma showed that out of 45 cases with AEC counts less than 440/cu mm, 16 (28.1%) showed increased nasal eosinophils. Whereas 55 children with AEC counts more than 440/cu mm, 41(71.9%) showed increased nasal eosinophils. Thus, there is positive correlation between nasal and peripheral blood smear eosinophilia.

In children having only allergic rhinitis (63 cases), 33 showed significant nasal eosinophilia (>10/HPF), of which 25 (75.8%) showed increased peripheral smear eosinophils.

Out of 34(54%) cases which had blood eosinophilia >440/cu mm, of which 25 (73.5%) patients showed nasal smear eosinophilia >10 cells. In 63 children having allergic rhinitis with bronchial asthma, 26(70.3%) showed positive nasal eosinophilic count, of which 18 (69.2%) had peripheral smear eosinophilic count. Out of 21 (56.8%) cases with peripheral smear eosinophilia 18 (85.7%) showed nasal smear eosinophilia. Hence, nasal smear eosinophilia was more reliable in this group.

## CONCLUSION

We like to conclude that peripheral eosinophilia contributes equally in diagnosing allergic rhinitis and bronchial asthma, whereas nasal eosinophilia contributes more in diagnosing bronchial asthma than allergic rhinitis. In children with allergic rhinitis with or without bronchial asthma, there is positive correlation between nasal and peripheral smear eosinophilia.

Hence, nasal cytogram which is a simple, economical and non-invasive procedure can be used as an alternative to invasive peripheral smear eosinophilia as both are equally efficacious in diagnosing allergic respiratory diseases.

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