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A study on reliable diagnosis of allergic respiratory diseases by using eosinophil count in nasal and blood smear: a prospective study in tertiary care centre

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ABSTRACT

Background: Allergic rhinitis and asthma are two very common allergic diseases of respiratory tract in pediatric patients. In this geographical area, where the prevalence of allergens exists, the role of allergens as the etiological factor is higher in allergic respiratory disorders. Confirmation of allergen as etiologic agent is cumbersome in a small setup, where IgE estimation and allergy tests are not accessible. In this study, the simple test of peripheral smear and nasal smear eosinophil count as a reliable diagnosis to solve the above problem and establishing allergy as etiological agent has been tried.

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Methods: A present study which was conducted over 2 years in children between 2 to 12 years who visited tertiary health care centre, Kurnool medical college and general hospital. The allergic respiratory cases based on typical history and clinical features were included in the study and investigated for nasal and blood eosinophilia. Children with TB, recurrent and chronic pneumonia, malnutrition, malignancy, collagen vascular disorders and those who are on steroid therapy were excluded from the study. The clinical profile of allergic rhinitis with or without asthma and nasal and blood eosinophils are studied.

Results: Out of 120 patients, there was male predominance and incidence was increasing as age increases. Dust is the most common risk factor for allergic rhinitis followed by weather changes, whereas in allergic rhinitis with bronchial asthma, weather change is common risk factor followed by dust and family history.

Conclusions: In children with allergic rhinitis with or without bronchial asthma, there is positive relation between nasal and peripheral smear eosinophil count.

Keywords: Allergens, Blood smear Eosinophils, Respiratory diseases

INTRODUCTION

Allergic respiratory diseases are very common in pediatric patients. Allergic rhinitis and asthma are two very common allergic diseases of respiratory tract. Clemens vonpirquet coined the term allergy from Greek "allos" meaning "others" and "ergon" meaning reaction to describe hypersensitivity reaction in 19061. Allergic

rhinitis is an IgE mediated hypersensitivity disease of mucous membrane of nasal airway characterized by sneezing, itching, watery nasal discharge and sensation of nasal obstruction. Asthma is a chronic condition characterized by recurrent bronchospasm resulting from a tendency to develop reversible narrowing of the airway Lumina in response to stimuli. Allergic rhinitis involves the mucosa of lining of upper respiratory tract only,

whereas asthma is confined to bronchial tubes of lower respiratory tractre is mounting evidence that eosinophils are implicated in the pathophysiology of allergic respiratory diseases. ¹⁻³ 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 disease.

Since allergic rhinitis and asthma are such prominent disorders 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 place findings in atopic populations.

In this geographical area, where the prevalence of allergens exists, the role of allergens as the etiological factor is higher in allergic respiratory disorders. Confirmation of allergen as etiologic agent is cumbersome in a small setup, where IgE estimation and allergy tests are not accessible.

In this study, the simple test of peripheral smear and nasal smear eosinophil count as a reliable diagnosis to solve the above problem and establishing allergy as etiological agent has been tried. This may enable the pediatricians in instituting proper therapy instead of resorting to antibiotics earlier than necessary.

The aim of the present study was to analyze the eosinophil count in the blood and nasal smears of children with allergic respiratory diseases especially allergic rhinitis with or without bronchial asthma.

METHODS

For the present study which was conducted during August 2015 to December 2016, children between 2 to 12 years who attended the outpatient and in-patient Department of Pediatrics, in tertiary health care centre, were selected on the random basis.

Inclusion criteria

 The allergic respiratory cases based on typical history and clinical features were included in the study.

Exclusion criteria

 Children with TB, recurrent and chronic pneumonia, malnutrition, malignancy, collagen vascular disorders and those who are on steroid therapy were excluded from the study.

Stastical analysis

Data was analyzed using statistical software. The following investigations were done on the blood studies,

nasal discharge smear for eosinophil count, Monteux test and chest X-ray in all the children taken for the study. The history, clinical features and investigation were noted in a proforma specially designed for the study.

Nasal and peripheral smear examination was done as follows: nasal smear preparation. Nasal secretion was collected by asking the child to blow his nose onto a plastic wrap and then placed on to a glass slide. If he was too young to do this or insufficient secretion was obtained, a cotton tipped swab was inserted into a nostril and left for 60 seconds. The nasal secretion which was obtained was transferred on to a glass slide, teased out and allowed it to air dry. Blood studies with strict aseptic precautions, blood sample was drawn by venepuncture and 3ml of blood was collected in EDTA anticoagulant.

The sample collected was subjected to investigations like Hb%, TC, DC, ESR, absolute eosinophil count, and peripheral smear examination. Peripheral smear preparation a small drop of blood was placed about 1 or 2cm from one end of a pre-cleaned slide. Immediately another slide with a precleaned edge was placed at an angle of 25 degree and moved backwards to make contact with the drop. The drop of blood should spread quickly along the line of contact of spreader with the slide and allowed it to air dry. Peripheral blood smear was studied using Leishmans stain whereas nasal smear was studied by H and E stain.

RESULTS

A prospective clinical correlation study consisting of 120 children is undertaken to study the eosinophil count in nasal and blood smear in allergic respiratory diseases such as allergic rhinitis and bronchial asthma.

Table1: Age distribution.

Age (in years)	Frequency	percent
2-4	20	16.66
5-8	35	29.16
9-12	65	54.16
Total	120	100

In the above Table 1, 54.16% of the allergic respiratory cases were in the age group 9-12 years which is most common 29.16 % cases were in age group 5-8 years remaining 16.66% were in 2-4 years age group.

In this Table 2, the incidence of allergic disorder is more common in male (58.33%) compared to female (41.66%).

Table 2: Sex incidence.

Sex	Frequency	Per cent
Male	70	58.33
Female	50	41.66
Total	120	120

In this Table 3, dust is the most common risk factor for allergic rhinitis accounting for 86.25% followed by weather changes 56.25%, whereas in allergic rhinitis with bronchial asthma, weather change is common risk factor accounting for 87.5% followed by dust 80% and family history 75%.

Clinical findings in this Table 4, showed 100% of patients with allergic rhinitis had rhinorrhea, following that cough (60%).

In allergic rhinitis with asthma all patients had rhinorrhea, cough and wheezing. The incidence of fever is almost similar in both groups.

Table 3: Distribution of risk.

Risk factor	Allergic rhin (n=80)	nitis	Allergic rhinitis with bronchial	
KISK TACTOL	Frequency	(%)	asthma (n=40)	
	Frequency		Frequency	(%)
Dust	70	87.5	32	80
Weather change	45	56.25	35	87.5
Animal	20	25	12	30
Food	15	18.75	14	35
H/O family atopy	36	45	30	75

Table 4: Distribution of signs and symptoms.

Symptoma	Allergic rhinit	Allergic rhinitis (n=80)		Allergic rhinitis with bronchial asthma (n=40)	
Symptoms	Frequency	Percentage	Frequency	Percentage	
Rhinorrhea	80	100	40	100	
Nasal itching	36	45	16	40	
Nasal obstruction	48	65.25	28	70	
Sneezing	42	52.5	15	37.5	
Cough	48	60	40	100	
Wheezing	0	0	40	100	
Dyspnea	0	0	14	35	
Fever	10	12.5	08	20	

The incidence of fever is almost similar in both groups. In this Table 5, all 120 cases were investigated with both nasal and blood eosinophil count.

Table 5: Incidence of eosinophilia study.

Incidence site		Frequency	Percentage
Nasal	<10 cells	50	41.66
- 1000	>10 cells	70	58.33
eosinophil	Total	120	100.0
D1 1	<440 cells	37	30.83
Blood	>440 cells	83	69.16
eosinophil	Total	120	100

The positive nasal eosinophilia (>10cells) cases were 58.33%. Similarly, the positive blood eosinophilia (>440 cells/cc mm) were 69.16%. In Table 6, nasal eosinophilia is more common in allergic rhinitis with asthma compare to only allergic rhinitis (70.0 vs 52.5) but statistically not significant (p=0.103).

In the above Table 7, blood eosinophilia is more common in allergic rhinitis with asthma compare to only allergic rhinitis (65% vs 50) but statistically not significant (p=0.051).

Table 6: Distribution of nasal eosinophils according to the diagnosis.

Nasal eosinophils	Allergic rhinitis	Allergic rhinitis with bronchial asthma	Total
-10	38	12	50
<10	47.5%	30%	41.66%
> 10	42	28	70
>10	52.5%	70.0%	58.33%
Total	80 (100%)	40 (100%)	120 (100%)

In this Table 8, distribution of nasal smear and peripheral blood eosinophils in allergic rhinitis patients with or without asthma showed that out of 54 cases with AEC counts less than 440/cumm, 18(30%) showed increased nasal eosinophils. Of 66 children AEC counts more than 440/cumm, 42(70%) showed nasal eosinophilia. Thus, there is positive association between nasal and peripheral blood smear eosinophilia.

In this Table 9, children having only allergic rhinitis (80 cases), 43(53.75%) showed significant nasal eosinophilia (>10/HPF), of which 28 (65.11%) showed increased.

Peripheral smear eosinophils and in 40 (50%) cases with blood eosinophilia (>440/cumm), of which 28(65.11%) patients showed nasal smear eosinophilia. In this Table 10, children having allergic rhinitis with bronchial asthma (40 cases) of which 30 (75%) were nasal eosinophilia, of which 24 (80.0%) showed increased in peripheral smear eosinophilia. Out of 30 (68.4%) cases with peripheral smear eosinophilia 24 (80.0%) showed nasal smear eosinophilia. Thus, nasal smear eosinophilia is more reliable in this group. The sensitivity of nasal eosinophilia is higher in allergic rhinitis with bronchial asthma compared to another group (85.5 vs 75.2).

Table 7: Distribution of blood eosinophils according to the diagnosis.

Blood eosinophils	Allergic rhinitis	Allergic rhinitis with bronchial asthma	Total
<440	40 (50%)	14 (35%)	54 (45%)
>440	40 (50%)	26 (65%)	66 (55%)
Total	80 (100%)	40 (100%)	120 (100%)

Table 8: Distribution of nasal and blood smear eosinophil counts in allergic rhinitis and allergic rhinitis with bronchial asthma.

Nasal	Blood eosinophil			Consitivity	an a sifi aity	⊥ PPV	NPV
eosinophil	>440	<440	Total	Sensitivity	specificity	PPV	NEV
>10	42 (63.33)	18 (40)	60 (100)				
<10	24 (36.36)	36 (60%)	60 (100)	78.9	63.5	74.8	70.2
Total	66 (55.99)	54 (45)	120 (100)				

Table 9: Distribution of nasal and blood smear eosinophil counts in allergic rhinitis and allergic rhinitis without bronchial asthma.

Nasal	Blood eosinoph	Blood eosinophil			C	DDV	NIDV/
eosinophil	>440	<440	Total	Sensitivity	Specificity	PPV	NPV
>10	28 (65.11)	15 (34.88)	43 (120)				
<10	12 (32.43)	25 (67.56%)	37 (120)	75.2	65.5	68.8	72.4
Total	40(50.00)	40 (50.00)	80 (120)				

Table 10: Distribution of nasal and blood smear eosinophil counts in allergic rhinitis with bronchial asthma, its sensitivity and specificity.

Nasal	Blood eosine	ophil		. Canaitivity	. Crosificity	⊥ PPV	+ NPV
eosinophil	>440	<440	Total	Sensitivity	Specificity	PPV	NPV
>10	24 (80)	06 (20)	30 (120)				
<10	06 (60)	04 (40%)	10 (120)	85.6	55.3	82.5	65.6
Total	30 (75)	10 (25)	40 (120)				

Table 11: Comparison of allergic rhinitis vs allergic rhinitis with asthma.

	Allergic rhinitis (%)	Allergic rhinitis with asthma (%)
Sensitivity	75.2	85.5
Specificity	65.5	60.3
PPV	68.8	82.5
NPV	72.4	64.6

DISCUSSION

Allergic respiratory diseases are very common in pediatric patients. Allergic rhinitis and asthma are two very common allergic diseases of respiratory tract. They are usually diagnosed by appropriate history and detailed examination. Routine investigations may not contribute much for the final diagnosis but may help in ruling other

possibilities. There are many tests like skin tests, IgE, RAST, ELISA etc., to confirm disease as allergic but they are complicated and cumbersome and may not be possible in many hospital setups. Hence nasal and blood smear eosinophil count as a simple, non-invasive and reliable investigation for finding out allergy as an etiological agent has been tried. Hence, this study tries to find the efficacy of nasal and blood eosinophilia in

allergic respiratory disorders like allergic rhinitis and allergic rhinitis with bronchial asthma. The clinical profile, nasal smear eosinophilia, and peripheral smear eosinophilia is analyzed as follows. In this present study, majority of the allergic respiratory cases were of age group 8-12 years accounting 54.16%, this finding correlates with other studies like.²

In this study it also shows the incidence of allergic rhinitis in children increases with age. In this study out of 120 children, 58.33% were males and 41.66% were females. Female as to male ratio was 1.5:1. Male predominance was also observed by other previous studies.²⁻⁴ Dust is the most common risk factor for allergic rhinitis accounting for 87.5% followed by weather changes 56.25%, whereas in allergic rhinitis with bronchial asthma, weather change is common risk factor accounting for 87.5% followed by dust 80% and family history 75%. Among 120 children 36 have the family history of allergic respiratory disorder. There is no difference in family history between allergic rhinitis and bronchial asthma. And this is comparatively similar with the observation made by (47.9%), (50%), (52.3%) and (52%).²⁻⁶ Among other risk factors like food allergy and pet animal have less contribution for allergic respiratory disorder accounting for 25% and 30% respectively which is still higher when compared to other studies done by others revealed 6% and 12%.7 But allergy to pet animal is less as compared to study (35.4%).8 In this study, all children with allergic rhinitis and asthma had rhinorrhea (100%). It is high as compared to other studies, nasal obstruction, sneezing and cough had similar frequency in allergic rhinitis in this study while in bronchial asthma cough and wheezing were present in all patients followed by nasal obstruction and dyspnea.^{7,8} Among all the clinical findings, symptoms contribute more than signs for the diagnosis. Out of 120 cases and nasal eosinophil count of >10 cells were considered as positive as per IAP text recommendation. Many studies have taken different cut off value. Other previous studies have considered >10 cells as significant similar to the present study.⁹ Similarly, blood eosinophil count >440 cell/cumm is considered as significant and this cut off value is also considered in other previous studies. Various workers have found varying results for nasal smear eosinophilia, ranging from 18% to 81%. In this study nasal eosinophilia was 60% which correlates well with other studies. 9-12 Distribution of nasal smear and peripheral blood eosinophils in allergic rhinitis patients with or without asthma showed that out of 54 cases with AEC counts less than 440/cumm, 18 (30%) showed increased nasal eosinophils. Of 60 children AEC counts more than 440/ cumm, 42 (70.0%) showed nasal eosinophila. Thus, there is positive association between nasal and peripheral blood smear eosinophilia. Children having only allergic rhinitis (80 cases), 43 (53.75%) showed significant nasal eosinophilia (>10/HPF), of which 28 (65.11%) showed increased peripheral smear eosinophils and in 40 (50%) cases with blood eosinophilia (>440/cumm), of which 28 (65.11%) patients showed nasal smear eosinophilia >10

cells. Children having allergic rhinitis with bronchial asthma (40 cases) of which 30 (75.0%) were nasal eosinophilia, of which reliable in this group. 13,14

CONCLUSION

This clinical profile study of nasal and peripheral smear eosinophilia in 120 children between 2 to 12 years presenting with allergic rhinitis with or without bronchial asthma can be concluded as follows:

Peak age incidence is between 8-12 years and the disease occurs more commonly in males than in females. Rhinorrhea, cough, nasal obstruction was the most common presenting symptom in children with allergic rhinitis. Cough, wheezing, rhinorrhea were present in all the cases of allergic rhinitis with bronchial asthma. Dust and weather changes were the common triggering factors. Family history of atopy is seen more in allergic rhinitis with bronchial asthma than in allergic rhinitis. Blood eosinophil count contributes equally in diagnosing allergic rhinitis with bronchial asthma and allergic rhinitis, whereas nasal eosinophil count contributes more in allergic rhinitis with bronchial asthma than allergic rhinitis. In children with allergic rhinitis with or without bronchial asthma, there is positive relation between nasal and peripheral smear eosinophil count are equally efficacious.

So, nasal eosinophil count which is simple, non-invasive, economical and reliable can be used as an alternative to invasive peripheral smear eosinophil count as both are equally efficacious in diagnosing allergic respiratory diseases.

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