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Original Research Article

Serum absolute eosinophil count: bridging diagnosis and severity assessment in allergic rhinitis among children

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ABSTRACT

Background: Allergic rhinitis (AR) is a non-infectious, IgE-mediated inflammatory disorder of the nasal mucosa characterized by nasal congestion, sneezing, itching, and rhinorrhoea. Diagnostic evaluation includes serum AEC, nasal smear eosinophilia, SPT, and IgE measurement. This study aimed to assess the diagnostic efficacy of serum absolute eosinophil count in identifying allergic rhinitis among children presenting with varying degrees of symptom severity.
Methods: A cross-sectional observational study was conducted involving 65 school going children diagnosed with allergic rhinitis aged 9-16 years. Disease severity was evaluated using TNSS. CBC and serum AEC were performed for all participants.
Results: The mean pediatric age group was 12.21 years, with 58.5% boys. Based on TNSS, 20% had mild, 47.7% moderate, and 32.3% severe disease. Elevated AEC was observed in 61.5% of children. Serum AEC showed significant positive correlation with TNSS severity (ρ=0.661, $p<0.001$) and excellent diagnostic accuracy (AUC=0.955).
Conclusions: Serum AEC is a simple, affordable, objective biomarker for early diagnosis and severity assessment in routine clinical practice.

Keywords: Allergic rhinitis, Absolute eosinophil count, Total nasal symptoms score

INTRODUCTION

Allergic rhinitis (AR) is a non-infectious, IgE-mediated inflammatory condition that affects the nasal mucosa, and is characterized by symptoms of nasal congestion, sneezing, itching, anterior or posterior rhinorrhea for a duration of two or more consecutive days for more than one hour on most days.[1] AR is a widespread condition, affecting between 0.8% and 39.7% of the global population. It affects 20-30% of adults and 40% of children in India suggesting that prevalence of allergic rhinitis is more among children.[2]

The severity of clinical symptoms in patients with allergic rhinitis is assessed using the four elements of the total nasal symptom score: sneezing, nasal congestion, running nose, and nasal itching.[3]

Allergic rhinitis is diagnosed by clinical evaluation supported by laboratory tests, including nasal smear for eosinophilia, skin prick testing, serum eosinophil count, and serum IgE levels. In-vitro tests such as RAST and ELISA help identify specific allergen sensitization.[4] This study aimed to assess the diagnostic efficacy of serum absolute eosinophil count in identifying allergic rhinitis among children presenting with varying degrees of symptom severity.

METHODS

Subjects

This was a cross-sectional observational study conducted on 65 consecutive children diagnosed with allergic rhinitis who attended the ENT outpatient department (OPD) of Akash Super Speciality Hospital in Devanahalli, Bengaluru, India, between June 2025 and December 2025. After obtaining a detailed clinical history and performing a thorough physical examination in the ENT outpatient setting, the diagnosis of allergic rhinitis was established according to the Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines (2016 revised).

Inclusion criteria

The study included consecutive patients diagnosed with allergic rhinitis who attended ENT outpatient department. Children aged 9-16 years were enrolled after obtaining informed written consent from their parents or legal guardians and assent from the participants.

Exclusion criteria

Children aged less than 9 years and more than 16 years. Those who had received systemic antihistamines, mast cell stabilizers, intranasal or systemic corticosteroids, or antileukotrienes within the last 7 days. Also, children with evidence of other nasal pathologies such as chronic rhinosinusitis with nasal polyposis or sinonasal tumors. Children with uncontrolled asthma. All these above children were excluded from the study.

Clinical evaluation

Symptom severity was assessed using the Total Nasal Symptom Score (TNSS), It includes four symptoms: nasal congestion, running nose, nasal itching, and sneezing. Each symptom is graded on a scale from 0 to 3, where 0 indicates no symptoms, 1 indicates mild symptoms that are not troublesome, 2 indicates symptoms that are troublesome but do not interfere with daily activities, and 3 indicates severe symptoms that are difficult to tolerate and interfere with daily activities. The total TNSS is calculated by summing the individual scores, with a possible range of 0 to 12. Based on the total score, disease severity is classified as mild (≤4), moderate (5-8), or severe (9-12).[3]

Laboratory assessment

Peripheral venous blood samples were collected under aseptic precautions for estimation of Absolute Eosinophil Count (AEC) using an automated hematology analyzer. AEC values were categorized as normal or elevated based on laboratory reference ranges (upto 444 cells/cu.mm).[8]

Statistical analysis

It was done using SPSS version 25.0 statistical Analysis Software. Continuous variables were summarized as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The relationship between absolute eosinophil count (AEC) and individual nasal symptoms as well as the Total Nasal Symptom Score (TNSS) was assessed using Spearman's correlation test. Differences in AEC across disease severity groups were compared using the Kruskal-Wallis test, and associations between categorical variables were examined using the chi-square test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The study comprised 65 pediatric age group, of whom 52 (80%) exhibited clinically significant allergic rhinitis (moderate to severe), while 13 (20%) presented with mild disease. The mean age of the pediatric participants in the study was 12.21 years, and 58.5% of them were boys indicating a slight boys predominance in our study, which is in line with what we know about how atopic disorders affect different groups of people (Table 1,2).

Table 1: Gender distribution in the study group.

Variables	Frequency	%
Boys	38	58.5
Girls	27	41.5
Total	65	100.0

Table 2: Distribution of nasal symptoms severity among the study participants.

Nasal symptoms	Frequency	%
Mild	13	20.0
Moderate	31	47.7
Severe	21	32.3
Total	65	100.0

Spearman correlation analysis revealed a statistically significant positive correlation between serum AEC and all individual nasal symptoms, including nasal obstruction (ρ=0.448, $p<0.001$), rhinorrhea (ρ=0.541, $p<0.001$), nasal itching (ρ=0.419, p=0.001), and sneezing (ρ=0.390, p=0.001).Of these, rhinorrhea had the strongest link to eosinophilia, which means that eosinophilic inflammation is a big part of how the mucosa secretes mucus in AR. Serum AEC had a strong positive relationship with TNSS, which measures the overall severity of the disease (ρ=0.661, $p<0.001$). This shows that as the number of eosinophils increases, the severity of symptoms gets worse. The strength of the correlation ($\rho>0.6$) indicates a biologically significant relationship rather than a mere statistical association (Table 3).

Table 3: Correlation between serum AEC and nasal symptoms.

Spearman's correlation	Nasal congestion	0.448**
	Running nose	0.541**
	Nasal itching	0.419**
	Sneezing	0.390**
	TNSS	0.661**

**Correlation is significant at the 0.01 level (2-tailed).

Figure 1 showed that 92.3% of mild cases had normal AEC, while most moderate and severe cases had high AEC. The chi-square association validated that elevated eosinophil counts were significantly correlated with the increasing severity of AR. This finding indicates that peripheral eosinophilia function as an objective laboratory marker of clinically relevant disease (Figure 1).

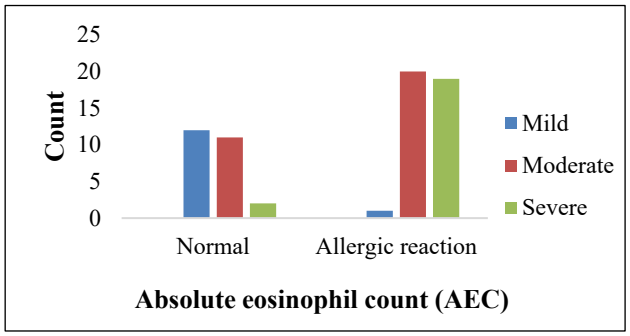

Figure 1: Bar diagram showing association between AEC and disease severity.

The Kruskal-Wallis test revealed a statistically significant difference in AEC among severity groups (H=37.449, p<0.001). The average rank of AEC steadily increased from mild (9.35) to moderate (31.44) and then to severe (49.95) disease. This slow rise shows that there is a connection between eosinophilic inflammation and the severity of the disease. This gradient strongly supports the idea that eosinophils are the cause of allergic rhinitis, not just a random rise (Table 4).

Table 4: Relationship between eosinophil and clinical severity.

	Grade	Number	Mean rank
Absolute eosinophil count (AEC)	Mild	13	9.35
	Moderate	31	31.44
	Severe	21	49.95
	Total	65	

DISCUSSION

Rhinitis is clinically characterized by the occurrence of two or more nasal symptoms, which includes nasal discharge, nasal obstruction, nasal itching, and sneezing. AR is an IgE-mediated inflammatory condition of nasal mucosa resulting from hypersensitivity reactions to environmental allergens. It begins with an early immune response driven by IgE antibodies and mast cell activation, resulting in vasodilation, leakage of fluid from blood vessels, and high glandular secretion. As the reaction progresses, inflammatory cells such as eosinophils and neutrophils get infiltrated in the nasal mucosa and maintain the inflammatory response. Eosinophils are particularly important in type I hypersensitivity reactions because they release several inflammatory proteins which is required in tissue irritation and symptom persistence. Multiple laboratory techniques are available to identify eosinophils and their mediators, helping clinicians evaluate the extent of allergic inflammation.[1,12]

Gopal et al documented elevated nasal eosinophilia in patients with persistent allergic rhinitis relative to those with intermittent disease, underscoring the significant role of eosinophils in maintaining chronic mucosal inflammation.[4] Bousquet et al documented that Serum AEC shows a relationship with how severe allergic rhinitis is in children.[5] It can be used as a simple and practical tool along with clinical evaluation. When considered together with ARIA guideline recommendations, AEC help doctors for better assessing the disease severity and make treatment decisions, especially in settings where advanced diagnostic tests are not easily available. Chen et al discovered that elevated eosinophil counts correlated with more severe AR symptoms in children, underscoring the significance of eosinophilic activity as a marker of persistent inflammation.[6] Similarly, Liu et al found that patients with persistent AR had more severe eosinophilic inflammatory profiles than those with intermittent disease, which further supports the connection between eosinophilic inflammation and persistent symptoms.[7] Kumar et al showed that eosinophil counts in both blood and nasal smears went up as allergic respiratory diseases got worse.[9] This supports the idea that eosinophil counts can be used as an objective way to measure disease activity.

CONCLUSION

This study shows that the serum absolute eosinophil count (AEC) is closely associated to severe nasal symptoms and to the overall burden of allergic rhinitis. Higher AEC levels were associated with higher TNSS scores, suggests that increase in eosinophil counts, symptoms tend to aggravate. The results also indicate that AEC helps in identifying children with clinically significant disease. Together with findings from previous studies, these results give the important role of eosinophils in allergic inflammation and support the use of AEC as a simple, objective, and affordable marker to help clinicians assess and grade the disease severity in allergic rhinitis.

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