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A study of eosinophilia in nasal smear with severity and control of asthma in children

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Abstract
A 6-month cross-sectional study was conducted among 30 children, aged 6 to 18 years, who were visiting and had asthma. The study excluded children who were utilising nasal corticosteroid spray, systemic corticosteroids, and medications with a proven propensity to induce eosinophilia. In addition, children who had helminthic infections, a deviated nasal septum, or chronic rhinosinusitis were also excluded. All asthma cases were diagnosed based on the criteria established by the Global Initiative for Asthma (GINA), and the cases were categorised according to the severity and management of asthma. The allergic rhinitis (AR) that was linked to this case was categorised based on symptoms and signs, in accordance with the guidelines outlined by ARIA. A comparative analysis was conducted to assess the correlation between the amounts of eosinophils in the nasal passages and blood, and the clinical symptoms of asthma and allergic rhinitis.

Keywords: Peripheral eosinophilia, Nasal smear eosinophilia, Asthma and Allergic rhinitis

Introduction
The study evaluated significant groups of adults and children with varying degrees of asthma severity, and examined the correlation between eosinophilic and other cellular markers with disease outcomes. Individuals who had a high concentration of eosinophils in their sputum, sometimes accompanied by an increased amount of neutrophils, experienced more severe asthma. Significantly, these groups exhibited elevated medicine consumption and hospital admissions [1, 2]. Decreasing the amount of eosinophils in the blood and sputum is also associated with a decrease in asthma exacerbations and a reduction in the need for healthcare services [3, 4]. Nevertheless, in certain individuals with severe asthma, elevated levels of eosinophils may continue to exist even when high doses of controller drugs, such as corticosteroids, are employed. Crucially, eosinophilia serves as an indicator of a favourable reaction to corticosteroid treatment [5-7]. Hence, the detection of three individuals suffering from asthma and exhibiting notable eosinophilic inflammation is a crucial advancement in the implementation of personalised, or precision, therapy. Eosinophilia may be observed in the airway lumen, bronchial walls, and blood; however, the levels in these compartments may not necessarily exhibit a direct correlation. The enumeration of cells and analysis of gene expression patterns in the sputum can effectively distinguish individuals who respond to steroids. However, the process of collecting and measuring induced sputum is time-consuming, requires significant labour, and is not readily accessible for regular use [8-10]. The necessity of investigating the role of eosinophilia in asthma in tropical countries is a subject of controversy due to the existence of alternative causes of eosinophilia, such as parasitic infestation, fungal infection, and the use of certain drugs (such as penicillin, ibuprofen, aspirin, etc.). The association between sputum eosinophilia and the severity of asthma is widely recognised. Obtaining induced sputum from children poses a challenge. This study aims to determine if nasal smear eosinophilia can serve as an alternative for sputum eosinophilia in evaluating the severity of asthma in children, taking into account the idea of united airway. Numerous studies have been conducted on nasal smear eosinophilia in children diagnosed with allergic rhinitis. However, there is a scarcity of Indian studies that investigate the relationship between nasal smear and the severity and control of asthma in children. These few studies have produced mixed results. Therefore, the current investigation is being conducted.

Materials and Methods

Source of Data

Children aged between 6 years and 18 years of age diagnosed as asthma according to GINA guidelines

Method of Collection of Data

- Study Design: Cross sectional study
- Study Period: 6 months
- Sample Size: A minimum sample size of 266 asthmatic children was taken up for the study
- Sampling Method: Purposive sampling

Inclusion Criteria

Children between 6 years to 18 years of age diagnosed as asthma according to GINA guidelines 2020.118

Exclusion Criteria

- Children using nasal steroid spray.
- History of parasitic infestation.
- Use of oral steroids in past 2 weeks.
- Children who had coexisting/operated for deviated nasal septum 49
- Children who had chronic sinusitis, chronic tonsillitis, chronic suppurative otitis media.
- Usage of drugs known to cause eosinophilia like sulphonamides, penicillin, cephalosporins, NSAIDS (ibuprofen, naproxen), etc.

Method of Study

This cross-sectional study comprised a cohort of 30 children, ranging in age from 6 to 18 years, who were diagnosed with asthma according to the GINA recommendations 2018. These children had been continuously observed for a minimum of 6 months. Before commencing the test, the participants and their parents were given a concise description of the study's goals, and written informed consent was obtained from them. A consistent template was employed to record the relevant information from each individual. Patients were disqualified if they had a parasite infection, long-term inflammation of the sinuses, long-term inflammation of the tonsils, long-term infection of the middle ear with pus, a deviated nasal septum that was either present at the same time or had been surgically corrected, or if they had taken oral steroids in the last 2 weeks or used nasal sprays or medications that are known to produce an increase in eosinophils. The pre-established template was utilised to document demographic data, chief complaints, symptom frequency, exacerbating factors, presence of allergic rhinitis and family history of asthma and atopy, previous hospital and intensive care unit admissions, adherence to medication, and comprehensive results from the clinical assessment. Anthropometric measurements, such as height, weight, and BMI, were performed on all registered participants. After obtaining appropriate consent, venous blood was collected to perform a thorough hemogram and ascertain the absolute eosinophil level. Furthermore, a nasal swab was collected for cytological analysis. The asthmatic children were categorised into four groups based on the intensity of their asthma: intermittent, mild persistent, moderate persistent, and severe persistent. The categorization is derived from the recommendations outlined in the Expert Panel Report of the National Asthma Education and Prevention Programme, which serves as a reference for diagnosing and treating asthma. The classification of asthma cases into well controlled, partly controlled, and badly controlled was determined based on the 3.44 GINA118 criteria. Allergic rhinitis was classified into four groups using the ARIA86 standards: mild intermittent, mild persistent, moderate to severe intermittent, and moderate to severe persistent.

Results

Table 1: Distribution of study participants based on their nasal eosinophil count

Nasal eosinophil	Number	Percentage
≤10	27	80
>10	03	20
Total	30	100

Table 2: Association AR with nasal eosinophilia in patients with asthma

	Nasal eosinophil count		P value
	≤10	>10	
Asthma without AR	12	3	0.954
Asthma with AR	14	1	

Table 3: Association of severity of AR in asthma with nasal eosinophilia

Severity of AR	Nasal eosinophil count		P value
	≤ 10	>10	
Mild	24	1	0.496
Moderate to severe	3	2	

Discussion

The prevalence of nasal eosinophilia varies between 18% and 80% in different investigations, using the same threshold of >10/hpf. The current investigation observed nasal eosinophilia in 20% of participants, a rate similar to that reported in previous studies conducted by Crobach *et al*., where the positive rates were 17.9% and 20% respectively. Like the current study, only a limited number of investigations, such as those carried out by Praglatha *et al*., Murayama *et al*., and Ramachandra Prabhu *et al*., have examined nasal eosinophilia in asthma. However, the majority of previous studies have focused on nasal eosinophilia in allergic rhinitis.

In their respective research, Ramachandra Prabhu *et al*., Ankireddy *et al*., and Sonawane *et al*. discovered that individuals with both allergic rhinitis (AR) and asthma had a notably higher presence of nasal eosinophilia compared to those with only AR. However, it is important to note that this link did not reach statistical significance.

The Severe Asthma Research Programme (SARP), supported by the National Institutes of Health, studied and evaluated significant groups of children with mild, moderate, and severe asthma. The programme examined eosinophilic and other cellular markers to determine their correlation with illness outcomes. Individuals with a notable presence of sputum eosinophilia experienced more severe asthma. Significantly, these individuals also exhibited elevated medication utilisation, episodes of systemic corticosteroid administration, and hospital admittance.

In contrast to our study, Ramachandra Prabhu *et al*. discovered that there was a negative correlation between nasal eosinophilia and asthma severity. However, this link was not statistically significant. The results of our current

investigation demonstrate a significant association between the presence of eosinophils in the nasal passages and the severity of asthma, with a p-value of less than 0.01. In a similar vein, Murayama et colleagues discovered in their research that the presence of eosinophils in nasal discharge, along with asthma symptoms, served as a reliable indicator of ongoing asthma. In their prospective cohort study on 130 asthmatic children, Kumar *et al*. discovered a correlation between poor asthma control and elevated levels of nasal eosinophilia (using a cutoff of > 5/hpf), which aligns with the findings of our own investigation.

Conclusion

The average count of eosinophils in the nasal passages of children with asthma, whether they have allergic rhinitis or not, shows a strong correlation with the severity and management of their asthma.

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