Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/t3bw8p80

STUDY OF EOSINOPHIL COUNT IN NASAL AND BLOOD SMEARS IN ALLERGIC RESPIRATORY DISORDERS IN CHILDREN

Dr. S. Subramanian[1*], Dr M.A.Mohamed Yaseen Sait[2]

[1*]MBBS., MD (Paediatrics) Assistant professor - Sri Sathya Sai Medical college & Research Institute. dr.subbu.s@gmail.com
[2]MBBS MD PAEDIATRICS, Sri Venkateshwaraa Medical College Hospital and Research Institute, Chennai yas_een2000@yahoo.co.in

***Corresponding Author:** Dr. S. Subramanian
[*]MBBS., MD (Paediatrics) Assistant professor - Sri Sathya Sai Medical college & Research Institute. dr.subbu.s@gmail.com

ABSTRACT

Background: Allergic respiratory problems are typical among children and are sometimes mistaken for repeated infections. Doing advanced tests like serum IgE and RAST is not possible in most primary care clinics, so simpler and less expensive tools are needed. Allergic inflammation is often marked by eosinophils which are simple to spot on both nasal and peripheral blood smears.

Aim: To evaluate the diagnostic role of eosinophil counts in nasal and blood smears in children presenting with allergic respiratory disorders.

Methods: A cross-sectional study was done on 50 children who were 12 years old or younger and had symptoms of allergic rhinitis and breathing difficulties, if present. Nasal samples were colored with Hansel's stain and peripheral blood samples were colored with Leishman stain. A nasal smear with >5 eosinophils on a microscope and an absolute eosinophil count >440 cells/cumm was taken as a positive result.

Results: Nasal eosinophilia was reported in 72% of the samples while blood eosinophilia was found in 62% of the cases. Of children with asthma and allergic rhinitis, 78% tested positive for both parasites. The most common signs were sneezing, nasal discharge and obstruction of the nasal passages.

Conclusion: In primary and rural settings, using mild, reliable and economic tests such as nasal and blood eosinophil counts helps identify allergic respiratory disorders in children.

Keywords: Nasal Cytogram, Eosinophil Count, Allergic Rhinitis, Bronchial Asthma, Pediatrics

INTRODUCTION

Allergy refers to an overactive response when a person is exposed to an allergen (often referred to as an antigen). Children are often hypersensitive and this usually appears as respiratory problems such as allergy-related rhinitis and asthma. Conditions like these severely reduce health, lower the quality of life and interfere with normal school and development for children[1,2]. The number of young people with allergic respiratory disorders is increasing worldwide because of factors such as genes, environment and their immune system[3,4]. Hay fever, another term for allergic rhinitis, affects

children commonly and it often appears with bronchial asthma, making them part of a single unified airway disease complex[5,6]. Although most cases are not dangerous, they might cause excessive breathing difficulties, repeated use of antibiotics and secondary problems, so they must be properly diagnosed[7,8]. Of all the immune cells that participate in allergy, eosinophils are especially essential. Seeing Eosinophils in nasal and peripheral blood is an easy way to signal allergic inflammation[9,10]. These large white blood cells release dangerous proteins and pro-inflammatory agents to cause allergies. In allergic rhinitis, the number of these cells found in the noses helps with diagnosis and shows direct links to how severe the condition is[11]. Even though there are advanced serum IgE titration and RAST tests, they are usually not affordable or reachable for most healthcare facilities in remote and resource-strapped areas.

On the other hand, looking for eosinophils in nasal secretions and doing an absolute eosinophil count (AEC) in blood is simple, affordable and requires little equipment[12,13]. Early 20th-century research suggested using nasal cytology for diagnosis and since then, many others have confirmed its usefulness. Hansel[14] pointed out the cellular characteristics seen in allergic patients and Walsh and Lindsay[15] described its usefulness for common ear, nose and throat cases in practice. Various tests confirm that it is a reliable way to diagnose colitis in children. These studies by Crobach et al.[16], Menstell et al.[17] and Malmberg & Holopainen[18] have clearly shown that nasal eosinophil count is a reliable way to determine allergic rhinitis in children. For these reasons, the current study wants to examine the use of eosinophil counts as a way to diagnose respiratory allergies in children. This study matters the most when it is difficult to use advanced testing of immune responses. The aim of our study is to establish how well eosinophil tests can be used as a help in screening for allergies in children.

MATERIALS AND METHODS

Study Design and Setting

The study was a prospective, observational one carried out in the Department of Pediatrics at Rajah Muthiah Medical College and Hospital which is affiliated with Annamalai University in Tamil Nadu. The researchers studied if nasal and peripheral blood counts of eosinophils could be useful for detecting allergy disorders in children. Authority to conduct the study was given before any work began.

Study Population and Recruitment

Pediatric patients who had allergic rhinitis, with or without bronchial asthma, having not taken any steroids or antihistamines, were included in the study group from the outpatient department. Clinical consultation was the means used to select the population, using non-probability sampling. All these patients went through a set assessment and were enrolled in the study when they matched the inclusion criteria and gave their informed consent through their parents or guardians.

Inclusion Criteria

The inclusion criteria for children were having allergic rhinitis symptoms—sneezing, nasal blockage, runny nose and repetitive coughing—with or without any features of bronchial asthma and being 12 years old or younger. Having a clear history of possible allergy was required for the diagnosis. The child's guardian had to give their permission for the child to take part.

Exclusion Criteria

Eosinophil levels were not studied in children who had a chronic infectious or nutritional illness affecting the immune system. Specifically, children with pulmonary tuberculosis (Mantoux test or X-rays proved), repeated or serious pneumonia or malnutrition levels III or IV were not included. Also, people who had received corticosteroids or antihistamines in the previous two weeks were not allowed to participate.

Clinical Data Collection

A standard and pre-tested proforma was used to collect clinical data. Information gathered here was about the patient's age, symptoms, possible chemicals or animals around them, previous cases of allergy among family members and previous or current treatments. Each child was examined all over and looked at carefully through the various body systems. How often, how long and how intense each allergic symptom was noted exactly. An examination was done on the nose and lungs to determine the level of involvement in the airways.

Sample Collection Procedures

A sterile cotton swab was used to take samples from the front part of the inferior turbinate. Small samples of the material were gently placed on glass slides and then stained with Hansel's stain. Specimen evaluation with a high-powered microscope confirmed eosinophil counts exceeded 5 per HPF in more than 10 fields which was taken as a positive result of nasal eosinophilia.

In order to analyze peripheral blood smear, 2 milliliters (ml) of blood was taken from a vein using an EDTA vial. A smear of blood was made and Leishman stain was applied. An absolute eosinophil count (AEC) above 440 cells/cumm was considered to be high and it was determined manually.

Statistical Analysis

All the data was entered and organized so that it could be studied. To find out the frequencies and percentages, descriptive statistics were used. A comparison was done to check if there was a link between nasal smear eosinophil positivity and increased eosinophil blood counts. Connecting the two diagnostic tests was carried out and findings were formatted in the form of cross-tabulations and bar graphs.

Ethical Approval and Informed Consent

The research was previously reviewed and cleared by the Institutional Ethical Committee of Rajah Muthiah Medical College and Hospital. All parents or legal guardians of the kids provided written informed consent. Details about every participant's identity and medical records were kept hidden and there was no coercion, only voluntary involvement in the study.

RESULTS

Demographic Profile of the Study Population

The study accepted a total of 50 children who experienced symptoms of allergic respiratory diseases. Children between the ages of 0 and 12 were the only participants. Out of all the children, the most common age group was 3–6 and made up about half (25 children), 6–9 was the second most popular (12 children) and there were fewer children in the 9–12 years group (9) and the youngest group of ≤3 years (4). The highest number of cases in the 3–6 years category implies that kids are most likely to experience allergic rhinitis and related respiratory issues during early childhood after coming into contact with more allergens at school (Table 1).

Table 1. Age Distribution of Study Population

Age Group (Years)	Number of Children	Percentage (%)
≤3	4	8
3–6	25	50
6–9	12	24
9–12	9	18

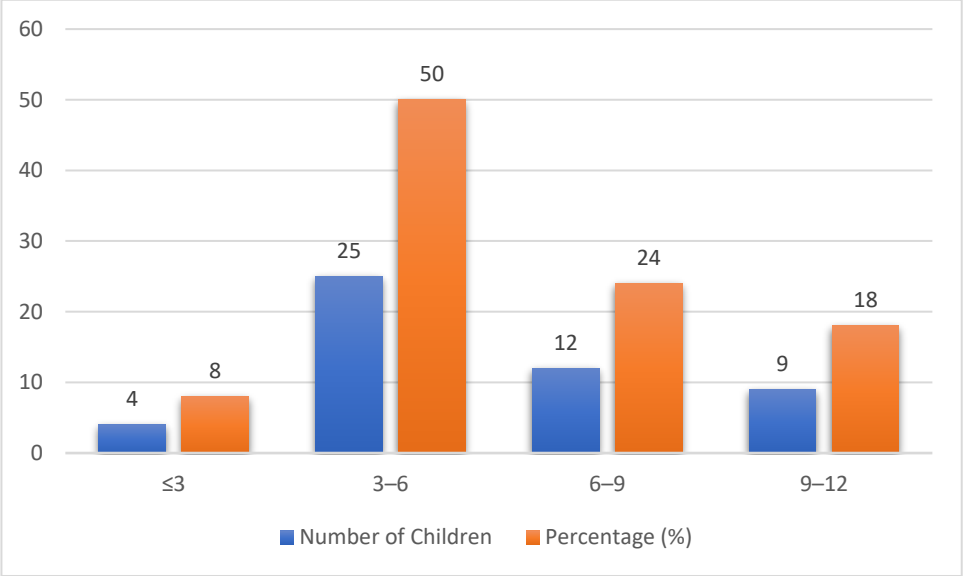

Figure 1. Age Distribution

The majority of children (n=31; 62%) were males in the sample, whereas females were 19 (38%). Some researchers find that boys are more likely than girls to have allergic responses to airborne substances early in life, as suggested by how many boys appear in pediatric allergy clinics (Table 2).

Table 2. Sex Distribution

Sex	Number of Children	Percentage (%)
Male	31	62
Female	19	38

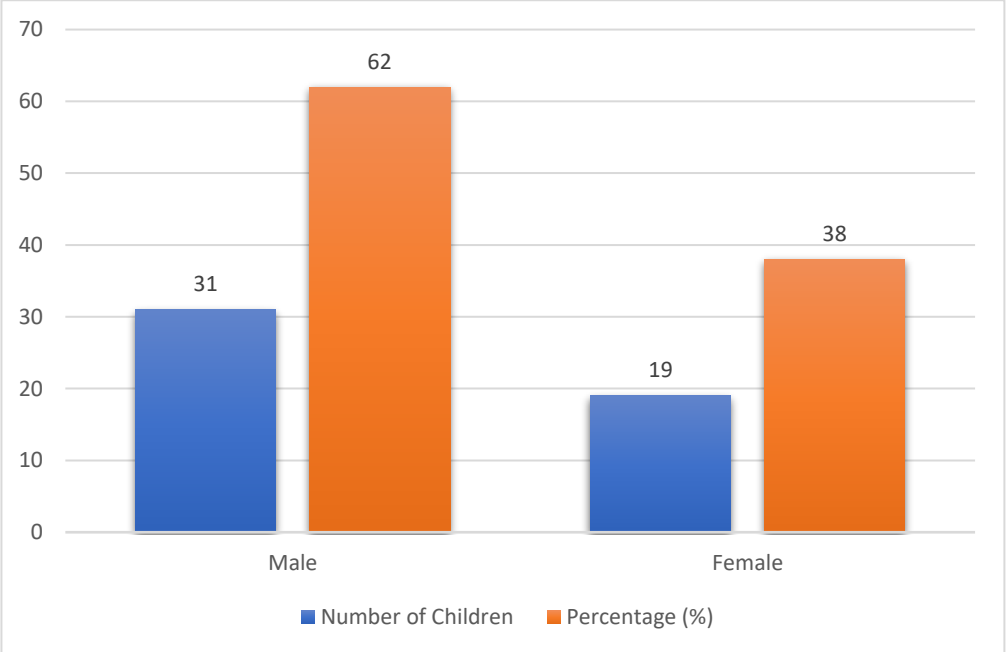

Figure 2. Sex Distribution

The majority of children in the study, 64% (or 32 students), came from lower socioeconomic backgrounds, 28% (14 students) from the middle-income group and 8% (4 students) from upper-income families. Since many cases in these studies come from economically disadvantaged families, having financial-first tools helps to serve these populations (Table 3).

Table 3. Socioeconomic Status

Socioeconomic Class	Number of Children	Percentage (%)
Upper	4	8
Middle	14	28
Lower	32	64

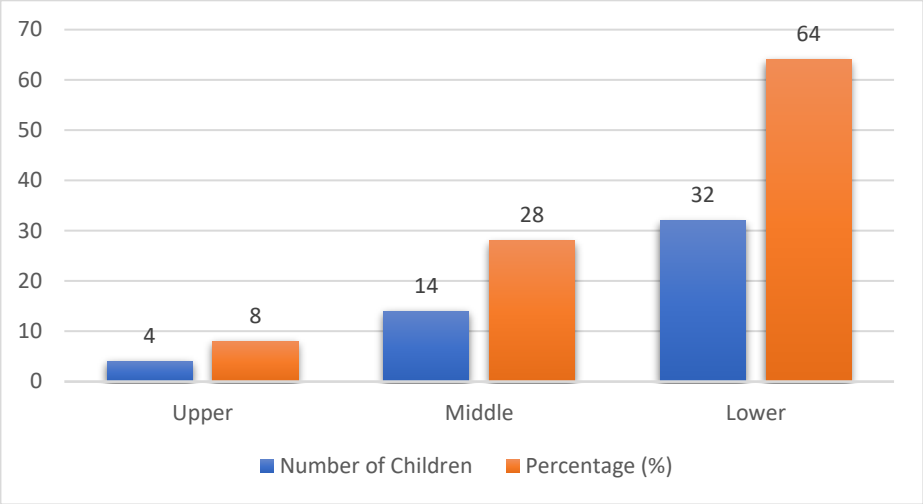

Figure 3. Socioeconomic Status

Clinical Symptomatology

Each patient in the research (100%) had allergic rhinitis symptoms which were confirmed by detailed medical history and by physical tests. Most participants (82% of them) found that their symptoms were worse during some seasons, suggesting an effect of environmental allergens. The most common symptoms seen were runny nose (84%), blocked nose (64%) and recurring cough (46%). All children (100%) in the study reported sneezing, so it was the symptom that showed up most often (Table 4).

Table 4. Clinical Symptom Prevalence

Symptom	Number of Children	Percentage (%)
Sneezing	50	100
Rhinorrhea	42	84
Nasal obstruction	32	64
Cough	23	46
Rhinitis (diagnosed)	50	100
Seasonal incidence	41	82

Based on these symptoms, it is clear that the child has pediatric allergic rhinitis and including eosinophil counts in the testing process becomes important.

Nasal Smear Eosinophil Findings

Hansel's stain of the nasal smears proved that 72% (36 out of 50) of the children showed >5 eosinophils in each high-power field which is considered eosinophilia. The 28% (n=14) who had ≤5 eosinophils/HPF were negative according to the criteria. It demonstrates once again that nasal cytology is a useful test, mainly where lab facilities are limited (Table 5).

Table 5. Nasal Smear Eosinophil Count

Eosinophils/HPF	Number of Children	Percentage (%)
>5 (Positive)	36	72
≤5 (Negative)	14	28

Peripheral Blood Eosinophil Count (AEC)

In the blood samples, it was found that 62% (n=31) of children had elevated levels of eosinophils (AEC >440 cells/cumm) and in 38% (n=19) of children, the levels were within the normal range. The findings are consistent with the results found on nasal smears and they point to the broader implications of allergic inflammation for the body (Table 6).

Table 6. Blood Smear Eosinophil Count (AEC)

AEC Count	Number of Children	Percentage (%)
>440 cells/cumm	31	62
≤440 cells/cumm	19	38

Correlation Between Nasal and Blood Eosinophilia in Rhinitis with Asthma

For the 23 kids diagnosed with both allergic rhinitis and bronchial asthma, there was a strong connection between eosinophil levels seen in the nose and the blood. Elevated eosinophils were found in both nasal and blood samples of 78% (n=18) of these children, whereas only 22% (n=5) did not test positive for eosinophils in either place. It means that smear results are more accurate when combined, especially in cases where allergies cause reactions in the upper and lower airways simultaneously (Table 7).

Table 7. Combined Nasal and Blood Eosinophilia in Rhinitis + Asthma

Smear Findings	Number of Children	Percentage (%)
Both Nasal & Blood Positive	18	78
Either One Positive or Both Negative	5	22

DISCUSSION

The primary goal of this study was to assess the ability of NSE and AEC tests to help diagnose allergic disorders affecting children's respiratory health. More than half of the children included in the study had either nasal or peripheral eosinophilia and this was common for those with allergic rhinitis and bronchial asthma combined. In the study, nasal eosinophilia affected 72% of subjects and blood eosinophilia affected 62% which suggests that they may be useful primary tests. Also, it is significant that the correlation rate (78%) between rhinitis and asthma is high in children. Unlike expensive and not always accessible tests such as total serum IgE and RAST testing, nasal smear cytology is simple, consistent and non-invasive for finding allergies. In places where resources and adequate lab facilities are in short supply, this approach is very helpful. As Hansel[14] and Bryan[5] noticed in their studies, the strong positive findings of NSE in this group indicate the significance of cytology in allergic rhinitis. It was concluded from the study that NSE can be reliably used in primary care as a substitute for IgE measurement. Results of this study are consistent with findings from studies done previously. According to Crobach et al. [15], using nasal smear tests to look for eosinophils can accurately tell the difference between allergic and non-allergic rhinitis in more than 70% of cases. According to Menstell and Enzmann,[17] nasal cytology is an important method used in ENT clinics. Early case identification in pediatric patients, according to Bryan and Bryan[5], can be made easier with nasal smear. Wakode and colleagues[6], in a study from India, noticed that NSE positivity was reported in 64% of allergic patients which matches our findings. Besides, Kay and others[7] pointed out the highly eosinophilic nature of airway inflammation in allergy-related diseases, confirming that these cells participate in systemic changes seen in allergic disease. The research presents outcomes that will shape the way pediatrics is practiced. The signs of allergic rhinitis, like sneezing, nasal discharge, stuffiness and cough, usually look like those seen in infections of the upper airways which leads to overuse of antibiotics. Doing NSE and AEC testing at the beginning can increase the accuracy of the diagnosis, help guide the use of antibiotics and allow specific treatments for allergy symptoms. Specifically in remote and underserved places, making these tests available is a useful and affordable way to improve results and cut back on drug misuse. How useful this study is lies in its methods which use methods that are quick and easy to use in clinic settings. Because both nasal and peripheral eosinophils are

examined together, the results can be understood and proven more clearly. Clearly set inclusion/exclusion rules, along with set ways to apply staining and inspect samples, add to the study's reliability. There are still a few weaknesses in the study. In the first place, with only 50 participants, the study cannot be relied upon for broad generalizations. The study only included patients in a certain area and time which may not show the same results in other areas. Third, because of difficulties in performing them and the related costs, there was limited ability to compare serum IgE or skin prick test results with the patients' cytological findings. Because nasal smear eosinophilia is often positive, it should be considered the first test in children with respiratory allergic symptoms. General practitioners and pediatricians working at peripheral health centers will find it most useful, since immunological testing is not available there. When given early on such tests can suggest how to plan referrals, prescribe medicines (such as antihistamines or leukotriene inhibitors) and make changes to the environment. Further studies should use bigger groups from different centers to test whether these findings are the same in other populations. Adding information about total IgE, specific IgE and eosinophilic cationic protein (ECP) to NSE may help achieve more precise diagnoses. Further studies should follow patients over time to find out how eosinophils and their control under therapy impact the disease.

CONCLUSION

This study shows that eosinophil counts in nasal fluid and in blood samples are effective, practical and affordable ways to assess allergic disorders in children. Because almost all clinically confirmed cases of allergic rhinitis, whether alone or with asthma, have eosinophils in their smears, these exams are very useful for diagnosis. In particular, performing nasal cytology with Hansel's stain is a convenient, low-cost and simple method for catching diseases early, using it in primary care and rural pediatric health. Using these cytology methods together can help in quick diagnosis, cut down misdiagnosis rates, decrease unneeded use of antibiotics and help start allergy management earlier. In this regard, using blood eosinophil counts from the nose and from the peripheral blood is effective for the early diagnosis of allergies in children, so it ought to be practiced more widely.

REFERENCES

1. Repaport HG. Clemens von Pirquet and alerty. Anu Allergy. 1973;31:467–75.
2. Van Arsdel PP, Larson EB. Diagnostic tests for patients with suspected allergic disease. Ann Intern Med. 1989;110:304–312.
3. Eyerman CH. Nasal manifestations of allergy. Ann Otolaryngol. 1923;36:808–815.
4. Mahajan, N., Mishra, S., Warokar, A., More, S., & Pethe, A. (2024). Pharmacokinetics of niclosamide in rat plasma by RP-HPLC via intranasal and intraperitoneal route of administration. *Journal of Advanced Biotechnology and Experimental Therapeutics, 10*(2), 62–72. https://doi.org/10.53555/jab.v10i2.155
5. Bryan WTK, Bryan MP. Cytologic diagnosis in allergic disorders. Otolaryngol Clin N Am. 1984;7(3):637–666.
6. Wakode PT, Joshi PL, Mahore MN. Efficacy of nasal cytology. Indian J Otolaryngol. 1989;41(4):138–140.
7. Kay AB, Stech Schulte DJ, Austen KF. An eosinophil leukocyte chemotactic factor of anaphylaxis. J Exp Med. 1971;133:602–619.
8. Mullarkey MF, Hill JS. Allergic and non-allergic rhinitis: their characterization with attention to the meaning of eosinophilia. J Allergy Clin Immunol. 1980;65(2):122–126.
9. Losada Cosmes E, Garcia Canadillas F, Sainz Martin T, et al. Value of eosinophilia in blood and nasal exudates in the diagnosis of different types of rhinitis. Allergologia et Immuno Pathologia. 1984;12(4):283–288.
10. Rakesh Chanda et al. Comparative study of nasal smear and biopsy in patients of allergic rhinitis. Indian J Allergy Asthma Immunol. 2002;16(1):27–31.
11. Kemp A, Bryan L. Perennial rhinitis: a common children complaint. Med J Aust. 1984;141:640.

12. Van Arsdel PP, Motulsky AG. Frequency and heritability of asthma and allergic rhinitis in college students. Acta Genet. 1953;9:101.
13. Lubs–Edfors ML. Allergies in 7000 twin pairs. Acta Allergol. 1971;26:249.
14. Hansel FK. Observations on the cytology of the secretions in allergy of nose and PNS. J Allergy. 1934;5:357–366.
15. Walsh TE, Lindsay IR. Cytology of nasal polyp. Arch Otolaryngol. 1934;20:649–658.
16. Crobach M, Hermans I, Kaptein A, et al. Nasal smear eosinophilia for the diagnosis of allergic rhinitis and eosinophilic non-allergic rhinitis. Scand J Primary Health Care. 1996;14(2):116–121.
17. Menstell S, Enzmann H. Cytological assessment of the nasal smear: A valuable diagnostic method in routine ENT practice. 1990;38(1):16–19.
18. Malmberg H, Holopainen E. Nasal smear as a screening test for immediate-type nasal allergy. Allergy Eur J Allergy Clin Immunol. 1979; 34(5):331–337.