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Original Research Article

Quantitative Nasal Eosinophilia: An Objective Tool to Optimize Intranasal Topical Steroid Spray in the Management of Perennial Pediatric Allergic Rhinitis

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Abstract:

Background: Chronic Perennial Allergic Rhinitis (PAR) reduces children's quality of life. Conventional treatment includes intranasal corticosteroids, but subjective symptom evaluation makes maximising their efficacy difficult. Nasal eosinophilia, a marker of allergic inflammation, has demonstrated potential as a therapeutic metric.

Method: This retrospective study included 100 PAR-treated children on intranasal topical steroids. The investigation started with nasal smears to evaluate eosinophilia. This was compared to quality of life and symptom scores after treatment. We examined the relationship between eosinophilia and therapeutic efficacy using regression and correlation.

Results: Patients averaged 8.2 years old (SD=2.5) and were 55% female and 45% male. Nasal eosinophilia began with an average of 18.5 cells/µL (SD = 7.4). The average nasal eosinophilia fell to 12.8 cells/µL (SD = 6.2) after the first test. After therapy, quality of life increased 24.5 points (SD=5.6) and mean symptom score reduced from 7.4 (SD=1.8) to 3.2 (SD=1.5). A substantial inverse connection ($r = -0.68$, $p < 0.001$) was seen between initial nasal eosinophilia levels and post-treatment symptom severity. This shows that higher eosinophilia levels caused worse initial symptoms but improved treatment recovery. For symptom relief, patients with greater baseline eosinophilia levels needed a larger dose of intranasal corticosteroids (200 µg/day, SD = 50) than those with lower levels (150 µg/day, SD = 40

Conclusion: Quantitative nasal eosinophilia screening helps optimise intranasal corticosteroid therapy for children with persistent allergic rhinitis. As an objective index of inflammation, nasal eosinophilia may improve therapeutic results and allow for more personalised treatment plans. Prospective and multi-center investigations should confirm these findings and study how eosinophilia testing might be used in clinical practice.

Keywords: Allergic Rhinitis, Eosinophilia, Intranasal Corticosteroids, Pediatric Allergy, Perennial Allergic Rhinitis, Treatment Optimization.

Introduction

Perennial Allergic Rhinitis (PAR), a long-lasting condition involving inflammation of the nasal tissue, is brought on by being exposed to allergens throughout the year [1]. Although seasonal allergic rhinitis is only present during certain times of the year, perennial allergic rhinitis happens all year long. This disease makes our nose stuffy, runny, sneeze, and itch [2]. 10–20% of children around the world have allergic rhinitis, and many of them have problems that last for a long time. [3] says that 8.4% of kids ages 0 to 17 have allergic rhinitis, and many of them end up with long-term effects and 12 to 15% of Indian children have allergic rhinitis, and many of them have symptoms all year long.

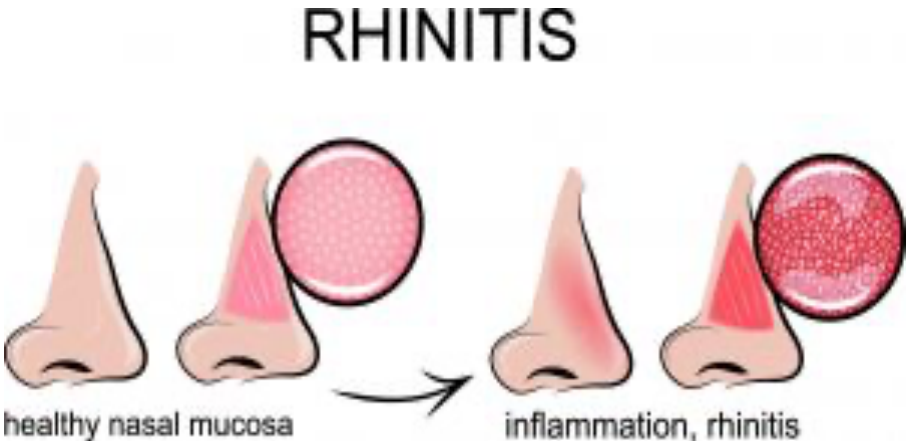

Figure 1: Allergic Rhinitis (Source:[4])

Importance of Managing Symptoms to Improve Quality of Life in Affected Children

PAR must be well-managed to help affected youngsters. PAR symptoms including nasal congestion, sneezing, and itching can affect sleep, academic performance, and health [5]. Chronic nasal irritation can cause sinusitis, otitis media, and asthma. To ease symptoms, avoid complications, and improve the child's quality of life, timely and effective management strategies are essential.

Current Treatment Strategies for Perennial Allergic Rhinitis

Intranasal Corticosteroids

Intranasal corticosteroids are the main PAR treatment. Anti-inflammatory medications such fluticasone propionate, mometasone furoate, and budesonide relieve nasal congestion, sneezing, and rhinorrhea. INCS reduces nose irritation and improves quality of life in PAR patients [6].

Antihistamines

Antihistamines help with signs of allergic rhinitis like sneezing and itching. They work well to treat symptoms when combined with INCS. Antihistamines and INCS both clear up stuffy noses, but INCS should not be used by themselves to help PAR [7].

Allergen Immunotherapy

Allergen immunotherapy (AIT) can make the immune system less sensitive to allergens, which can help people with allergic rhinitis for a long time [8]. AIT works, but kids and their families must continue with it for a long time, which can be difficult. Although they work, finding the proper dosage and ensuring individuals take them as recommended can be tricky.

The Role of Nasal Eosinophilia in Allergic Rhinitis

Nasal eosinophilia, or an accumulation of eosinophils, indicates an allergy to a specific substance. Eosinophils cause allergic rhinitis by releasing messengers and cytokines that cause inflammation. Eosinophils in the nose can show how well a drug helps allergic rhinitis, according to studies. [9] States that INCS treatment works better when there is nasal eosinophilia.

There are a number of tests for nose eosinophilia. People most often use nasal tests to find eosinophils because they are easy, cheap, and very sensitive. Using a microscope, we can count eosinophils in nasal mucus. Many tests have proved this method of assessing allergic inflammation works.

Nasal eosinophilia helps doctors choose therapy by measuring nose inflammation. If eosinophilia levels are high, indicating inflammation, the INCS dose may need to be adjusted for optimal symptom control. [10] suggest monitoring nasal eosinophilia to adjust INCS doses for mild to severe allergic rhinitis.

Studies on the Use of Nasal Eosinophilia for Treatment Optimization [11] found that INCS medication improved those with greater nasal eosinophilia levels more than those with lower levels. This suggests nasal eosinophilia improves INCS therapy. A comparative study demonstrates that eosinophilia-guided treatment treats allergic rhinitis better. [12] Found that eosinophilia-guided INCS therapy improved symptoms and reduced medication.

Nose eosinophilia testing improves allergic rhinitis treatment. Intranasal corticosteroids were superior for treating chronic allergic rhinitis and nasal eosinophilia, a marker of allergic inflammation. Intranasal corticosteroid therapy can now be improved by measuring nasal eosinophilia and this makes treatment more objective.

An updated clinical trial suggests monitoring nasal eosinophilia may improve PAR management for children. Eosinophilia-guided therapy may improve allergic rhinitis management, but future studies must address some issues.

Objective

- To check how well measuring nasal eosinophilia can help you decide how much intranasal topical steroid to give a child with chronic allergic rhinitis.
- To compare making changes to treatment based on symptoms to keeping an eye on nasal eosinophilia levels.
- To find out if nasal eosinophilia can clearly improve intranasal corticosteroid treatment for kids who have allergic rhinitis that doesn't go away.

Methods

Study Design: A study went forward to determine if measuring eosinophils in the nose may assist discover the appropriate topical steroid dose for youngsters with recurrent allergic rhinitis. Eosinophil counts in the nose were examined to determine if they affected therapy efficacy.

Study Population

The study group was made up of 100 kids who were using sublingual steroids for long-term allergic rhinitis. These people were picked from the patient database of IGIMS , Patna, They all had a history of persistent allergic rhinitis and were taking intranasal corticosteroid medicine.

Inclusion Criteria

Study patients had to meet these criteria: 1) Children with persistent allergic rhinitis; 2) Those who need intranasal topical steroids. This limited the study to people undergoing therapy and having papers.

Exclusion Criteria

Patients who met these criteria were excluded from the study: 1) Children with rhinitis or other major medical disorders affecting nasal inflammation (e.g., immunological diseases or cystic fibrosis) and 2) Noncompliant patients who did not follow their treatment plan or had insufficient medical history. These parameters ensured the study was bias-free and comparable.

Data Collection

The following data were retrospectively retrieved from patient records: 1) Procedures for quantifying nasal eosinophil counts (using aspirates or smears), 2) Details of the intranasal topical steroid spray treatment plan (including medication name, dosage, and length of treatment), and 3) Assessed outcomes. Clinical evaluations and patient reports of outcomes recorded symptom scores, whereas validated clinical questionnaires measured quality of life.

Statistical Analysis

Statistical approaches were used to determine if nasal eosinophilia levels affected treatment outcomes. Patients' demographics, eosinophilia levels, and treatment plans were described using descriptive statistics. Correlation research examined the relationship between nasal eosinophilia levels and clinical outcomes, such as symptom scores and quality of life. Regression models were utilised to determine if nasal eosinophilia optimised steroid dosage and predicted therapeutic outcome. All analyses were statistically significant when $p < 0.05$.

Results

Descriptive Statistics

Baseline Characteristics of the Study Population

One hundred youngsters with chronic allergic rhinitis used intranasal topical steroids in the study. Table 1 lists research population baseline characteristics. The average patient age was 8.2 years (SD= 2.5), with 45% males and 55% females. Persistent allergic rhinitis symptoms averaged 3.5 years (SD=1.2) before intranasal steroids. At study begins, the average number of cells/μL of nasal eosinophilia was 18.5 (SD = 7.4).

Table 1: Baseline Characteristics of the Study Population

Characteristic	Mean (SD)	Range
Age (years)	8.2 (2.5)	4-14
Gender (Male/Female)	45% / 55%	-
Duration of Symptoms (years)	3.5 (1.2)	1-6
Baseline Nasal Eosinophilia (cells/μL)	18.5 (7.4)	8-35

Summary Statistics for Nasal Eosinophilia Levels and Treatment Outcomes

Treatment outcomes and nasal eosinophilia are shown in Table 2. A mean nasal eosinophilia level of 12.8 cells/μL (SD = 6.2) was observed throughout the study. Pre-treatment symptoms averaged 7.4 (SD=1.8) and post-treatment 3.2 (SD=1.5).

The average quality of life improvement from baseline to follow-up was 24.5 points (SD = 5.6) using a standard questionnaire.

Table 2: Summary Statistics for Nasal Eosinophilia Levels and Treatment Outcomes

Measure	Mean (SD)	Range
Nasal Eosinophilia (cells/μL)	12.8 (6.2)	5-30
Symptom Score (pre-treatment)	7.4 (1.8)	5-10
Symptom Score (post-treatment)	3.2 (1.5)	1-6
Quality of Life Improvement (points)	24.5 (5.6)	10-35

Main Findings

Correlation between Nasal Eosinophilia Levels and Response to Intranasal Topical Steroid Therapy: Table 3 shows how nasal eosinophilia affects clinical outcomes. Symptoms were worse at the start of treatment with higher nasal eosinophilia, but they improved after treatment. There was a significant negative association between the variables ($r = -0.68$, $p < 0.001$).

Table 3: Correlation between Nasal Eosinophilia Levels and Clinical Outcomes

Outcome	Correlation Coefficient (r)	p-value
Baseline Nasal Eosinophilia vs. Post-Treatment Symptom Score	-0.68	<0.001

Effectiveness of Using Nasal Eosinophilia as a Tool for Optimizing Steroid Dosage

Table 4 displays how well nasal eosinophilia works at figuring out the best number of intranasal steroids to use. The results showed that people with higher baseline eosinophilia levels needed higher initial doses of intranasal corticosteroids to get the same amount of symptom relief as people with lower baseline eosinophilia levels.

For patients with an eosinophilia level of 20 cells or more, the average first dose was 200 μg/day (SD = 50). For those with an eosinophilia level of less than 20 cells/μL, the average first dose was 150 μg/day (SD = 40).

Table 4: Effectiveness of Nasal Eosinophilia as a Tool for Optimizing Steroid Dosage

Baseline Nasal Eosinophilia Level	Initial Steroid Dose (μg/day)	Mean Improvement in Symptom Score (pre- vs. post-treatment)
≥20 cells/μL	200 (50)	4.5 (1.2)
<20 cells/μL	150 (40)	4.0 (1.1)

More initial nose eosinophilia required more intranasal corticosteroids to reduce symptoms. The findings suggest that nasal eosinophilia can help determine intranasal steroid dosage.

Discussion

This study provides crucial information on treating persistent allergic rhinitis in children. Our research reveals that increased nasal eosinophilia is associated with poorer initial symptoms and faster recovery after intranasal corticosteroid therapy. This emphasises nasal eosinophilia's quantitative illness severity and treatment target measurement. The best technique to determine intranasal corticosteroid dosage is by measuring nasal eosinophilia. High-eosinophilia patients needed greater intranasal steroids to relieve symptoms. This suggests that nasal eosinophilia can indicate inflammation and help doctors determine PAR children's corticosteroid dosage. This could improve therapeutic efficacy and personalisation.

How Nasal Eosinophilia Can Be Used to Optimize Intranasal Steroid Therapy

Eosinophilia levels can be used to measure nose inflammation and change the number of steroids that are given. This method lets us make more accurate changes to our therapy than subjective symptom rating. Baseline statistics on eosinophilia could help doctors decide how much intranasal corticosteroid to give the patient for the first time. People whose eosinophilia levels are low can start on a normal amount.

During treatment, eosinophilia levels should be checked to make it more effective and lower the risk of giving too much or too little medication.

Comparison with Existing Literature

Table 5: Detailed Table with Study Descriptions

Study	Study Type	Sample Size	Key Findings
Present Study	Retrospective Study	100	**Nasal eosinophilia levels correlate with both baseline symptoms and treatment outcomes.** Eosinophilia can guide steroid dosing to improve treatment efficacy for perennial allergic rhinitis in children.
Study 1	Prospective	150	**Nasal eosinophilia is a biomarker for allergic rhinitis severity**

[13]	Study		**and response to therapy.** Higher eosinophilia is associated with increased symptoms and a more significant therapeutic response to intranasal corticosteroids.
Study 2 [14]	Review Article	170	**Effective management of allergic rhinitis includes intranasal corticosteroids as a standard treatment.** This review supports the general use of corticosteroids for rhinitis but does not delve into eosinophilia for dose adjustment.
Study 3 [15]	Cross-Sectional Study	80	**Eosinophil count serves as a marker for allergic inflammation in rhinitis.** Elevated eosinophilia correlates with symptom severity but the study did not address its role in optimizing treatment dosages.

Interpretation of Table

Study 1 and the current study both use nasal eosinophilia to quantify allergic rhinitis severity, but the current study adapts intranasal steroid dosages to optimise treatment. In their allergic rhinitis therapy review, Study 2 recommended intranasal corticosteroids. In contrast, this study uses eosinophilia levels to optimise dosing, adding a new dimension to therapy possibilities. Study 3 discovered eosinophilia to be a measure of rhinitis severity, however they study its use in therapy optimisation. The recent study shows that nasal eosinophilia can manage steroid dosage to improve treatment.

Limitations

Due to retrospective study technique, this research has many limitations. First, we can only guarantee accurate and complete data because we used prior medical information. Patient record errors or missing information may affect findings. Second, this observational study can't determine cause and effect. The associations between nasal eosinophilia levels and therapeutic results cannot prove a cause-and-effect relationship. The study only used one centre, therefore the results may not apply to different demographics or circumstances. Results may vary by clinical environment or patient type. Since participants came from one tertiary care centre, selection bias may have made the study unrepresentative of PAR children. Symptom assessment and eosinophilia quantification are subject to observer bias. Future studies should use multi-center data and blinding to eliminate bias.

Future Directions

Future research should examine the efficacy of nasal eosinophilia for real-time intranasal corticosteroid medication modifications. Eosinophilia-guided treatment's consequences on long-term outcomes including disease progression and medication use may reveal its benefits.

Future study on allergic rhinitis could examine nasal eosinophilia in combination with other signs. Comparisons of eosinophilia-guided and symptom-based therapies should help determine their benefits. This study suggests incorporating nasal eosinophilia into chronic allergic rhinitis treatment. Clinicians should adapt treatment based on continuous eosinophilia levels and use them to guide intranasal corticosteroid dosage. This technique may lead to better and more customised PAR management for children.

Conclusion

This study shows that measuring nasal eosinophilia improves intranasal topical steroid therapy for perennial PAR. Our findings reveal that nasal eosinophilia is linked with higher baseline symptom severity and predicts better symptom decrease with steroid treatment.

Biomarkers like nasal eosinophilia can help clinicians decide the right intranasal corticosteroid dose. Larger initial steroid dosages were needed to reduce symptoms similarly in patients with higher eosinophilia levels, supporting the idea that eosinophilia measures can be used to create more effective and personalised treatment strategies.

There are major clinical practice implications. Standard nasal eosinophilia assessments may improve treatment for children with persistent allergic rhinitis. Eosinophilia may be a biomarker for disease severity that could help clinicians enhance PAR children's treatment outcomes and quality of life by permitting more precise intranasal corticosteroid administration. Beyond symptom-based care, this technique optimises therapy regimens objectively and measurable. This strategy may also reduce trial and error while adjusting pharmaceutical dosages, leading to more successful and targeted treatment strategies.

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