Acta Scientific Otolaryngology (ISSN: 2582-5550)

Volume 7 Issue 2 February 2025

Research Article

Do High Blood Eosinophil Levels Predict Worse Quality of Life in Chronic Rhinosinusitis Patients?

Vera Miranda[1]*, Miguel Lopes[1], Luciana Rodrigues[1], Paulo Gonçalves[1], Tiago Soares Santos[1,2]

[1]ENT Department, Unidade Local de Saúde Entre o Douro e Vouga, Portugal

[2]Unit for Multidisciplinary Research in Biomedicine, Institute of Biomedical Sciences Abel Salazar, University of Porto, Porto, Portugal

***Corresponding Author:** Vera Miranda, ENT Department, Unidade Local de Saúde Entre o Douro e Vouga, Portugal.

DOI: 10.31080/ASOL.2025.07.0718

Received: December 31, 2024

Published: January 16, 2025

Abstract

Background: Chronic rhinosinusitis (CRS) is a clinical syndrome, characterized by persistent symptomatic inflammation of the nose and paranasal sinus mucosa for more than 12 weeks. Based on infiltration type, CRS can be classified as eosinophilic or non-eosinophilic. Recent evidence has shown that blood eosinophil count is a reasonable biomarker to predict eosinophilic CRS, which appear to be associated with severe and refractory disease. One of the validated tools to assess symptoms and quality of life in CRS patients is the SNOT-22 questionnaire. The purpose of this study was to evaluate if there was a correlation between blood eosinophil counts with clinical severity in CRS patients.

Material and Methods: We conducted a prospective study from September 2022 to January 2024. Eligible subjects were adults over 18 years old with CRS diagnosed according to EPOS2020 without medical therapy (antibiotics, systemic or topical corticosteroids, or other immunomodulatory drugs) for at least two months prior to medical appointment. Blood eosinophil counts and SNOT-22 questionnaire were requested for all included patients before starting medical therapy.

Results: Seventy-nine CRS patients (34 females, 45 males, mean age 49 years old) were included in this study. There was a positive correlation between blood eosinophil count and SNOT-22 score (r=0.123), without significant association (p=0.281).

Conclusion: Higher blood eosinophil counts showed a positive trend with increased symptom severity in CRS patients. Although not statistically significant, these findings highlight the potential clinical value of eosinophil- based stratification.

Keywords: Symptom Severity; Sino-Nasal Outcome Test; Quality of Life; Eosinophils; Chronic Rhinosinusitis

Introduction

Chronic rhinosinusitis (CRS) is a prevalent inflammatory condition of the nasal and paranasal sinus mucosa, persisting for more than 12 weeks and significantly impairing patients' quality of life [1]. CRS is typically classified into two distinct phenotypes: eosinophilic (eCRS) and non-eosinophilic (neCRS), based on the predominant type of inflammatory cell infiltration [2]. Eosinophilic inflammation in CRS is characterized by elevated levels of Type 2 cytokines, such as IL-4, IL-5, and IL-13, which drive tissue remodeling and mucosal damage [3].

Recent studies have highlighted the role of blood eosinophil count as a surrogate marker for eosinophilic chronic rhinosinusitis (eCRS), demonstrating a correlation with disease severity and prognosis [4]. Elevated blood eosinophil levels have been associated with higher scores on the Lund-Mackay CT and Lund–Kennedy endoscopic scales, reflecting more extensive sinus involvement [5]. A peripheral blood eosinophil count exceeding 250 cells/μL is frequently used as a cutoff linked to Type 2 inflammation and poor disease outcomes.[1] Patients with eCRS frequently present with a refractory disease course, including increased recurrence rates and reduced responsiveness to conventional therapies [6]. These findings underscore the clinical importance of incorporating blood eosinophil count as part of the diagnostic and prognostic framework for CRS management.

Assessing quality of life (QoL) is essential in evaluating the impact of CRS and guiding treatment decisions. The Sinonasal Out-

come Test-22 (SNOT-22) is a widely validated, disease-specific questionnaire that assesses symptom burden across multiple domains, including nasal, sleep, and psychological aspects.[1] However, SNOT-22 scores can be influenced by various factors, such as demographic variables and comorbidities like asthma, depression, and smoking, which can complicate the interpretation of its association with inflammatory markers like eosinophil counts [7].

The relationship between inflammatory markers and QoL in CRS patients has been studied, but findings remain inconsistent. While some studies report a correlation between tissue eosinophilia and worse QoL outcomes, others have found no significant association [8,9]. These discrepancies highlight the need for further investigation into the link between peripheral blood eosinophil counts and clinical severity, as measured by SNOT-22 scores.

Clarifying this relationship could establish blood eosinophil counts as a valuable, non-invasive biomarker for disease monitoring and prognostication in CRS. Additionally, it may support the development of personalized treatment strategies, particularly for identifying patients who could benefit from targeted therapies to reduce eosinophilic inflammation.

Objective

This study aims to explore the correlation between blood eosinophil counts and clinical severity in CRS patients, using SNOT-22 scores as a measure of disease impact. The findings aim to contribute to improved disease stratification and management in CRS.

Material and Methods

Study design and inclusion criteria

A prospective study was conducted in our department from September 2022 to January 2024. Adult patients (≥18 years old) diagnosed with chronic rhinosinusitis (CRS) according to the European Position Paper on Rhinosinusitis and Nasal Polyps (EPOS2020)[1] were eligible for inclusion. To ensure accurate baseline data, patients were required to have discontinued all medical therapy, including antibiotics, systemic or topical corticosteroids, and other immunomodulatory drugs, for at least two months prior to their medical appointment.

For all included patients, peripheral blood eosinophil counts and SNOT-22 questionnaires were completed prior to initiating any CRS-specific treatment. Exclusion criteria included a history of autoimmune disease, monoclonal antibody therapy, cystic fibrosis, or corticosteroid dependency.

The study adhered to the ethical standards outlined by the Local Ethics Committees of Unidade Local de Saúde Entre o Douro e Vouga and complied with the principles of the Helsinki Declaration. Written informed consent was obtained from all participants prior to enrollment.

Sinonasal outcome test-22

The Sinonasal Outcome Test-22 (SNOT-22) is a validated tool widely recommended by the EPOS2020 for assessing symptom severity and quality of life in chronic rhinosinusitis (CRS) patients.[1] The SNOT-22 has also been translated and culturally adapted for the Portuguese population, with validation confirming its reliability and applicability for clinical and research use in Portugal [10].

Patients rate each of the 22 items on a 0–5 Likert scale, resulting in a total score ranging from 0 to 110, with higher scores indicating more severe symptoms [11,12].

In this study, all patients completed the SNOT-22 questionnaire prior to initiating any CRS-specific therapy, ensuring an accurate baseline assessment of symptoms.

Statistical analysis

Statistical analysis was performed with Statistical Package for the Social Sciences (SPSS) software version 25.0 (IBM, Armonk, New York, USA). Categorical variables are presented as frequencies and percentages, and continuous variables as means and standard deviations, or medians and interquartile ranges for variables with skewed distributions. In order to identify the correlation between blood eosinophils count and SNOT-22, we used a nonparametric Spearman correlation, because a variable of interest (blood eosinophils count) was not normally distributed. The alpha level for significance was set at 0.05.

Results

Sample characteristics

A total of 79 patients with chronic rhinosinusitis (CRS) were included in the study. The mean age of the cohort was 49 years (standard deviation [SD] = 15.2 years), ranging from 18 to 80 years (Table 1). The sample consisted of 45 males (57%) and 34 females (43%). Regarding smoking habits, 16 patients (20.3%) were smokers, while 63 (79.7%) were non-smokers. Asthma was present in 20 patients (25.3%), and intolerance to acetylsalicylic acid was reported in 4 patients (5.1%).

Blood eosinophil levels and SNOT-22 scores

Blood eosinophil counts showed a non-normal distribution, with a median value of 230 cells/μL (interquartile range [IQR] = 230 cells/μL). The mean SNOT-22 score was 49.8 (SD = 21.4), with a minimum score of 9 and a maximum of 100. This indicates a wide variation in symptom burden and quality of life among the study population (Table 1).

Demographic/Clinical variable		
Age (years)	Mean: 49.0 ± 15.2	Range: 18–80
Sex	Male: 45 (57%)	Female: 34 (43%)
Smoking Status	Smoker: 16 (20.3%)	Non-smoker: 63 (79.7%)
Asthma	Present: 20 (25.3%)	Absent: 59 (74.7%)
Aspirin Intolerance (AAS)	Present: 4 (5.1%)	Absent: 75 (94.9%)
SNOT-22 Score	Mean: 49.8 ± 21.4	Range: 9–100
Blood Eosinophil Count (cells/μL)	Median: 230	IQR: 230

Table 1: Demographic and Clinical Characteristics of the Study Population.

Correlation analysis

Spearman's rank correlation coefficient was used to assess the relationship between blood eosinophil counts and SNOT-22 scores (Table 2). A positive correlation was observed (r = 0.123), but this was not statistically significant (p = 0.281) (Figure 1).

Variable	Correlation Coefficient (r)	p-value
Blood Eosinophil Count vs. SNOT-22 Score	0.123	0.281

Table 2: Correlation Between Blood Eosinophil Count and SNOT-22 Scores.

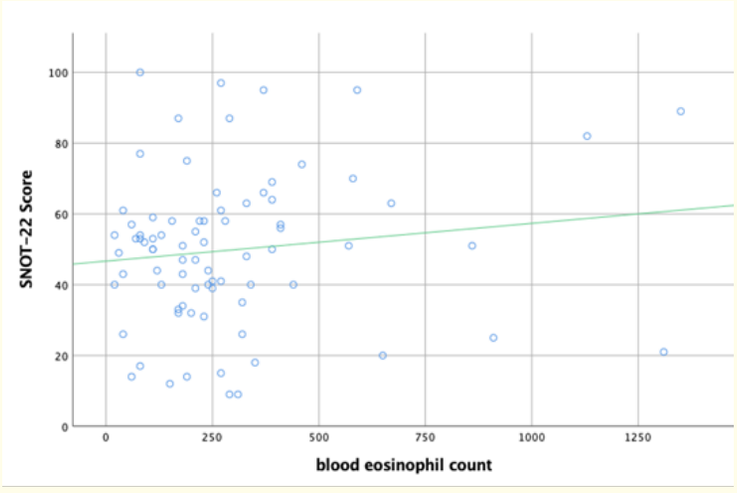

Figure 1: Relationship between blood eosinophil count and SNOT-22 ccore - scatter plot.

Discussion

The role of blood eosinophil count as a biomarker in CRS has been extensively studied, particularly in the context of eCRS. Elevated blood eosinophil levels are considered indicative of Type 2 inflammation, which is frequently associated with severe, refractory disease and nasal polyps [1,4].

Blood eosinophil levels are well-established markers of disease severity in CRSwNP, correlating with imaging scores like Lund-Mackay and endoscopic findings such as Lund-Kennedy [5,13]. Aslan., *et al.* demonstrated a significant association between elevated eosinophil counts, more extensive sinonasal involvement,

and poorer surgical outcomes [5]. Similarly, El-Anwar., *et al.* confirmed that blood eosinophil counts are reliable, cost-effective biomarkers for assessing disease severity and stratifying prognosis in CRSwNP.[13] These findings align with EPOS2020 guidelines, which recommend a blood eosinophil threshold of ≥250 cells/μL to identify patients with Type 2 inflammation, aiding in risk stratification and guiding personalized management [1].

However, the association between blood eosinophil counts and patient-reported symptom severity, as assessed by the SNOT-22, remains inconclusive. Some studies have identified a positive correlation between elevated eosinophil levels and higher SNOT-22 scores, suggesting that increased eosinophilia may correspond with greater symptom burden [12,14,15]. Conversely, other research has failed to demonstrate a significant relationship between these variables [1,16]. his discrepancy may stem from the inclusion of numerous non-nasal symptoms in the SNOT-22, such as sleep disturbances and emotional issues, which may not directly correlate with mucosal inflammation [11]. These factors could contribute to discrepancies between patient-reported outcomes and objective inflammatory markers.

In our study, we observed a positive correlation (r = 0.123) between blood eosinophil counts and SNOT-22 scores, which was not statistically significant (p = 0.281). These findings question the reliability of peripheral eosinophil counts as standalone predictors of patient-reported outcomes in CRS.

The lack of a statistically significant correlation in our study may be explained by several factors. First, the heterogeneity of CRS phenotypes within our sample likely diluted the observed relationship. Eosinophilic inflammation is a hallmark of CRSwNP, while phenotypes without nasal polyps are predominantly characterized by neutrophilic or mixed inflammation.[1,14] Our study did not stratify patients by CRS phenotype, potentially obscuring the impact of eosinophils within specific subpopulations.

Second, blood eosinophil levels may not reliably reflect local sinonasal inflammation. Tissue eosinophilia, rather than peripheral blood eosinophilia, has been shown to correlate more strongly with disease severity, polyp burden, and recurrence risk. For instance, Hauser., *et al.* demonstrated a significant association between tissue eosinophil counts and olfactory dysfunction in CRSwNP patients, independent of disease severity.[17] Similarly, Stevens., *et al.* reported that tissue eosinophilia is linked to mucosal remodeling and increased disease severity, highlighting its pivotal role in the pathogenesis of CRSwNP [18].

Lastly, confounding factors such as asthma, smoking, and aspirin-exacerbated respiratory disease (AERD) may influence the relationship between eosinophils and SNOT-22 scores. Patients with comorbid asthma or AERD tipically exhibit higher blood eosinophil levels and more severe symptoms [19]. However, SNOT-22 scores are also influenced by non-inflammatory factors, such as psychological comorbidities (e.g., anxiety, depression which could attenuate the association with inflammatory markers [20].

While blood eosinophil counts are accessible and cost-effective, their utility as a predictor of patient-reported symptom severity appears limited. Instead, a combination of biomarkers, including tissue eosinophil counts, IgE levels, and imaging findings, may provide a more comprehensive assessment of CRS severity [9].

This study has some limitations. The relatively small sample size may have reduced the statistical power to detect significant correlations. Future research should focus on larger, longitudinal studies with endotypic stratification to elucidate the role of eosinophils in CRS more effectively. Additionally, integrating other biomarkers and patient-reported outcomes could help refine disease assessment and improve management strategies.

Conclusion

This study found a positive correlation between peripheral eosinophil counts and symptom severity in CRS, not statistically significant. These findings highlight the complexity of CRS and the need for a multifactorial approach to disease assessment, incorporating both subjective symptom evaluation and objective biomarkers to guide diagnosis and management. Further research is warranted to refine the role of blood eosinophil counts in CRS stratification and prognosis.

Acknowledgements

There are no acknowledgements.

Conflict of Interest

There is no financial interest or any conflict of interest.

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