Journal of Society Medicine
Research & Review Articles on Diseases
Journal of Society Medicine. 2025; 4 (3)

Analysis of Blood Eosinophil Levels as an Indicator of Controlled Asthma Classification at the University of Sumatra Utara Hospital

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ARTICLE INFO

Article history:
Received
18 January 2025

Revised
26 March 2025

Accepted
31 March 2025

Manuscript ID:
JSOCMED-180125-43-5

Checked for Plagiarism: Yes

Language Editor: Rebecca

Editor-Chief:
Prof. AznanLelo, PhD

ABSTRACT

Introduction: Asthma is a chronic inflammatory disease of the airways characterized by variable airflow obstruction. Eosinophils play a crucial role in airway inflammation and may serve as a biomarker for asthma control classification. This study aims to analyze the relationship between blood eosinophil levels and asthma control classification in patients at the University of Sumatra Utara Hospital.

Methods: This was an analytical observational study with a retrospective cohort approach based on medical records. A total of 25 stable asthma patients who had been receiving inhaled corticosteroid-long-acting beta-agonist (ICS-LABA) therapy for at least one year were included. Data were analyzed using SPSS version 26, and the Kruskal-Walli's test was performed to assess the relationship between eosinophil levels and asthma control classification.

Results: The majority of patients were aged 26-50 years (44%) and female (80%). Most patients had eosinophil levels <100 (84%), while 8% had levels between 100-300 and another 8% had levels >300. Regarding asthma control, 46.7% of patients were fully controlled, 43.3% were partially controlled, and 10% were uncontrolled. Statistical analysis showed a significant relationship between eosinophil levels and asthma control classification ($p = 0.009$), indicating that lower eosinophil levels are associated with better asthma control.

Conclusion: The study found that lower eosinophil levels were associated with better asthma control. These findings suggest that blood eosinophil levels may serve as an indicator for assessing asthma control, though further research is needed to confirm this relationship.

Keywords

Asthma, Eosinophil level, Asthma control, Inflammation, Biomarker

How to cite: Damanik RA, Pradana A, Pandia P. Analysis of Blood Eosinophil Levels as an Indicator of Controlled Asthma Classification at the University of Sumatra Utara Hospital. *Journal of Society Medicine*. 2025; 4 (3): 100-105. **DOI: https://doi.org/10.71197/jsocmed.v4i3.198**

INTRODUCTION

Asthma is a heterogeneous disease that is typically characterized by chronic inflammation of the airways. Chronic inflammation is marked by symptoms such as wheezing, shortness of breath, and coughing, which vary in intensity and frequency over time and are accompanied by expiratory airflow limitation [1]. Asthma is characterized by reversible bronchial narrowing and increased bronchial responsiveness to inhaled stimuli. Pathologically, asthma is characterized by bronchial mucosal remodeling with collagen deposition beneath the epithelial reticularis layer, along with hyperplasia of cells throughout the lung structures, blood vessels, smooth muscles, and secretory and goblet cells [1].

Asthma can occur at any age, from childhood to adulthood, with varying degrees of severity, from mild to severe, and in some cases, can even lead to death. According to the 2018 Basic Health Research (Riskesdas) data, the prevalence of asthma in Central Java was 1.8%, with 132,565 cases. The prevalence of asthma among

children aged 1-4 years is 1.6%, and among children aged 5-14 years, it is 1.9%. The recurrence rate of asthma in the past 12 months for children aged 1-4 years and 68.2%, and for children aged 5-14 years, it is 53.9% [2].

Various factors contribute to poorly controlled asthma, including age, sex, education level, smoking habits, severe asthma, incorrect use of corticosteroid medications, genetics, comorbid conditions, poor medication adherence, lack of asthma knowledge, and obesity. Asthma can manifest at any age, with symptoms that vary significantly between individuals [3].

The inflammation associated with asthma is characteristic and accompanied by eosinophil infiltration, distinguishing asthma from other airway inflammatory disorders. Eosinophils play a central role in asthma inflammation, as evidenced by an increase in eosinophils in bronchoalveolar lavage fluid after allergen inhalation during the late-phase asthmatic response, accompanied by inflammation [3].

Given the role of eosinophils in asthma pathogenesis, they may serve as important indicators of asthma control classification. This study aimed to evaluate the role of eosinophil levels as a potential indicator of asthma control classification at the University of Sumatera Utara Hospital. By understanding the relationship between eosinophil count and asthma control, healthcare providers can better assess asthma management strategies and improve patient outcomes in the future.

METHODS

This study employed an analytic observational design with a retrospective cohort approach based on medical records and was conducted at the University of Sumatera Utara Hospital. The study population consisted of patients with stable asthma who were under control at the Pulmonary Polyclinic. The selection of participants was based on clinical criteria derived from anamnesis (patient history), physical examination, and supporting diagnostic tests to ensure accurate classification of asthma control status.

The sample size was determined using a hypothesis of different proportions, with the required number of participants being 25. The inclusion criteria for this study were as follows: (1) patients aged ≥ 18 years, (2) patients diagnosed with stable asthma, (3) patients who have been receiving inhaled corticosteroid (ICS)-LABA combination inhaler therapy for at least one year, and (4) patients who are able to provide informed consent. The exclusion criteria were as follows: (1) patients who were lost to follow-up; (2) patients with other chronic respiratory diseases, such as chronic obstructive pulmonary disease (COPD); (3) patients with severe comorbid conditions that could interfere with asthma control; and (4) patients who had used systemic corticosteroids within the past month.

Data were collected by reviewing the medical records of eligible patients. The variables of interest included demographic data (age and sex), clinical data (asthma control classification), and eosinophil counts. Asthma control was classified based on the Global Initiative for Asthma (GINA) guidelines and categorized into three groups: well-controlled, partially controlled, and uncontrolled asthma. Eosinophil counts were obtained from peripheral blood samples collected during routine clinical visits.

Statistical analyses were performed using SPSS version 26. Descriptive statistics were used to summarize the demographic and clinical characteristics, including the frequency distribution of asthma control status and eosinophil levels. The Kruskal-Wallis test was used to assess the relationship between eosinophil levels and asthma control classification. This non-parametric test was chosen because of the non-normal distribution of eosinophil data. Statistical significance was set at $p < 0.05$. Ethical approval for this study was obtained from the ethics committee of the University of Sumatera Utara Hospital, and all patient information was kept confidential per hospital policies and ethical guidelines for medical research.

RESULTS

Based on Table 1, it can be seen that the age of asthma patients is mainly in the age category 26-50 years, with as many as 11 patients (44%), followed by age> 50 years, with as many as eight people (32%), and the least is the age category 15-25 years as many as six people (24%). The majority of patients with asthma were female, with 20 (80%) and 5 (20 %) men.

Table 1. Demographic characteristics of Asthma Patients at University of Sumatra Utara Hospital

Demographic characteristics	n = 25
Gender, n (%)	
Male	20 (80)
Female	5 (20)
Age, n (%)	
15-25 years old	6 (24)
26-50 years old	11 (44)
>50 years old	8 (32)

Based on Table 2, it can be seen that patients with eosinophil levels <100 are the most patients, namely 21 people (84%), then patients with eosinophil levels 100-300 and patients with eosinophil levels >300 each as many as 2 people (8%).

Based on Table 3, it is known that asthma patients with controlled asthma classification were found to be partially controlled by as many as 13 people (43.3%), asthma patients with controlled asthma classification were found to be fully controlled by as many as 14 people (46.7%), and asthma patients with controlled asthma classification were found to be uncontrolled which was the least, namely 3 people (10%).

Table 2. Overview of Eosinophil Levels in Asthma Patients at the University of Sumatra Utara Hospital

Eosinophil Levels	Frequency (n=25)	Percentage (%)
<100	21	84
100-300	2	8
>300	2	8

Table 3. Overview Classification of Controlled Asthma Patients in the Pulmonary Polyclinic of the University of Sumatra Utara Hospital

Classification of Controlled Asthma	Frequency (n=25)	Percentage (%)
Uncontrolled	3	10
Partially Controlled	13	43,3
Fully Controlled	14	46,7

Based on Table 4, the P value was 0.009. Since the P value was less than 0.05, there was a relationship between eosinophil levels and the classification of controlled asthma in patients with asthma at the pulmonary polyclinic of the University of Sumatra Utara Hospital.

Table 4. Relationship Between Eosinophil Levels and Degree of Asthma Control in Asthma Patients at the Lung Clinic of the University of Sumatra Utara Hospital

Eosinophil	Classification of Controlled Asthma						P-value*
	Uncontrolled		Partially Controlled		Fully Controlled		
	n	%	n	%	n	%	
<100	0	0	13	48	14	52	0,009
100-300	2	100	0	0	0	0	
>300	1	100	0	0	0	0	

DISCUSSION

The findings of this study provide important insights into the demographic and clinical characteristics of patients with asthma at the Pulmonary Polyclinic of the University of Sumatera Utara (USU) Hospital, with a particular focus on the role of eosinophil levels in asthma control classification. The results show that the majority of patients with asthma were in the 26-50 age group, consistent with Lorensia's research, which also identified the highest prevalence of asthma in this age category [4]. This age group likely reflects the stage of life in which asthma symptoms become more pronounced and require management, although asthma can affect individuals at any age.

The gender distribution of patients with asthma in this study showed a predominance of female patients (80%), which is consistent with previous studies, including that of Lorensia, where a higher proportion of female patients with asthma were observed [5]. This gender disparity has been well documented in the literature, with women often experiencing more severe asthma after puberty owing to hormonal and biological factors, including menstruation, pregnancy, and menopause [6,7]. The UK Severe Asthma Registry also reported that 60.9% of severe asthma cases occur in women, reinforcing the higher prevalence of asthma severity in females [8,9].

Regarding eosinophil levels, the study found that most asthma patients (90%) had eosinophil levels below 100 cells/µL, which is consistent with Fachri's research, which identified a majority of asthma patients with eosinophil levels below 350 cells/µL [10]. Eosinophils play a central role in the pathogenesis of asthma, and elevated eosinophil levels often correlate with increased asthma severity and exacerbations. A study by Matsunaga et al. [11] demonstrated that higher eosinophil counts are associated with more frequent exacerbations and poorer asthma control, supporting the notion that eosinophil levels are important biomarkers in asthma management.

The classification of asthma control in this study found that 46.7% of patients had fully controlled asthma, 43.3% had partially controlled asthma, and only 10% had uncontrolled asthma. This distribution contrasts with that of Fitri et al., where uncontrolled asthma was more prevalent [11]. However, this difference may be attributed to regional variations in asthma management, patient adherence to treatment, and other local healthcare factors. The variation in asthma control classifications observed in this study aligns with global trends reported by the Global Initiative for Asthma (GINA), where the percentage of patients with well-controlled asthma ranges from 19% to 64.4%, and those with uncontrolled asthma ranges from 19.8% to 59% [12-16].

Statistical analysis revealed a significant relationship between eosinophil levels and asthma control classification ($P = 0.009$). Since the P-value was less than 0.05, this indicates a significant association between eosinophil levels and asthma control in patients at the USU Hospital Pulmonary Polyclinic. This finding contrasts with that of Fachri et al., who concluded that no relationship exists between eosinophil levels and asthma control classification [10]. This discrepancy may be due to differences in study populations or methodology; however, the present study suggests that eosinophil levels can be a useful marker for determining asthma control. High eosinophil levels are often linked to more severe asthma and exacerbations, which may contribute to poor asthma control [17,18]. Therefore, measuring eosinophil levels could help clinicians identify patients at a higher risk of uncontrolled asthma and tailor treatment strategies accordingly.

The results of this study indicate that patients with well-controlled asthma tend to have lower eosinophil levels, which is in line with the existing literature suggesting that lower eosinophil counts are associated with better asthma control [19]. This finding emphasizes the potential role of eosinophil levels as a useful biomarker for monitoring asthma severity and guiding treatment decisions, such as the use of corticosteroids, which are often prescribed to control eosinophilic inflammation in patients with asthma.

CONCLUSION

The study revealed that most patients with asthma at the University of North Sumatra Hospital were aged 26-50 years (44%), with females predominating (80%) over males (20%). The majority had eosinophil levels below 100 (84%), while 8% had levels of 100-300 or over 300. Regarding asthma control, 46.7% achieved full control, 43.3% achieved partial control, and 10% were uncontrolled. Analysis showed a significant correlation between eosinophil levels and asthma control ($p = 0.009$), with lower levels being associated with better control. These findings suggest that eosinophil levels may influence asthma control, although further research is required to confirm these results.

DECLARATIONS

Ethics approval and consent to participate were obtained. Permission for this study was obtained from the Ethics Committee of the Universitas Sumatera Utara and Haji Adam Malik General Hospital.

CONSENT FOR PUBLICATION
The Authors agree to publication in the Journal of Society Medicine.

FUNDING
None

COMPETING INTERESTS
The authors declare no conflicts of interest in this study.

AUTHORS' CONTRIBUTIONS
RAD was responsible for conducting follow-up and research on the patient's development. PP and AP provided essential guidance and were key discussion partners with RAD throughout the observation period. AP managed and processed the data, ensuring its accuracy and relevance to the study findings.

ACKNOWLEDGMENTS
None

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