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Blood Eosinophil Count as a Predictor of Asthma Exacerbation

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ABSTRACT

Introduction: Asthma is a heterogeneous disease characterized by chronic airway inflammation, where eosinophils play a crucial role. Eosinophil levels are often considered a biomarker for asthma severity and treatment response. However, their relationship with asthma exacerbation severity remains unclear. This study aimed to evaluate the relationship between blood eosinophil levels and the severity of asthma exacerbations in patients at Prof. Dr. Chairuddin P. Lubis USU Hospital.

Method: This study employed an analytic observational design with a retrospective cohort approach. Data were collected from 25 asthma patients through medical records, including demographic characteristics, blood eosinophil levels, and asthma exacerbation severity. The relationship between eosinophil levels and exacerbation severity was analyzed using the Whitney test.

Results: The majority of asthma patients were in the 26-50 age group (44%) and predominantly female (80%). Most patients had blood eosinophil levels <100 (84%), and severe exacerbations were the most common (72%). Statistical analysis showed no significant relationship between blood eosinophil levels and asthma exacerbation severity ($p = 0.976$).

Conclusion: This study found no significant correlation between blood eosinophil levels and asthma exacerbation severity. Other factors, such as corticosteroid use, delayed immune response, and non-eosinophilic asthma, may influence exacerbation severity. These findings emphasize the importance of a multidimensional evaluation in asthma management, including the identification of different asthma phenotypes to guide more precise treatment strategies.

Keywords

Predictor of asthma exacerbation, Blood eosinophil count, Chronic airway inflammation.

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INTRODUCTION

Asthma is a heterogeneous disease characterised by chronic airway inflammation. This chronic inflammation is characterised by airway symptoms such as wheezing, shortness of breath, and cough that vary over time and intensity, accompanied by expiratory airflow limitation.[1]

According to the World Health Organization (WHO) and the Global Initiative for Asthma (GINA), the number of asthma sufferers globally reaches 300 million, and this figure is expected to grow to 400 million by 2025. Based on data from the Ministry of Health in 2020, Asthma is one of the most common diseases suffered by Indonesians; until the end of 2020, the number of asthma sufferers in Indonesia was 4.5 percent of the total population of Indonesia or more than 12 million.[1,2] In patients on medication for asthma, the severity of asthma is assessed based on the clinical features of asthma and the treatment regimen. According to the Global Initiative for Asthma (GINA), asthma management guidelines aim to achieve controlled asthma. However, in reality, the guidelines are not implemented effectively in daily practice, so there are still many uncontrolled asthma conditions.[1] Various factors play a role in causing uncontrolled asthma, including age, sex, education

level, smoking habits, severe asthma, incorrect use of corticosteroid drugs, genetics, comorbid diseases, poor treatment compliance, lack of knowledge about asthma, and excess weight. Asthma can occur at any age, with highly variable manifestations that vary from one individual to another (Global Initiative for Asthma (GINA).[3]

Inflammation in asthma is typical inflammation accompanied by eosinophil infiltration, which distinguishes asthma from other airway inflammatory disorders. Eosinophils are the main inflammation in asthma; it is proven that after inhalation with allergens, there is an increase in eosinophils in bronchoalveolar drain fluid during slow asthmatic reactions accompanied by inflammation.[3] Based on the background obtained, the formulation of this research problem is as follows: How is Blood Eosinophil Level a predictor of Asthma Exacerbation?

METHOD

This was an analytical observational study with a retrospective cohort design conducted by Prof. Dr. Chairuddin P. Lubis USU Hospital. The objective of this study was to evaluate the relationship between blood eosinophil counts and the severity of asthma exacerbations in patients with stable asthma. The study population consisted of patients who had been diagnosed with stable asthma and received regular inhaled corticosteroids (ICS) combined with long-acting beta-agonist (LABA) therapy for at least one year. These patients were regularly followed up at the pulmonary polyclinic based on clinical examinations and supporting diagnostic tests. The sample size was calculated to be 25 patients based on the hypothesis of different proportions.

Inclusion criteria for the study required patients to have received ICS-LABA therapy for at least one year, while exclusion criteria included patients who were lost to follow-up, had incomplete medical records, or had comorbid conditions that could interfere with the severity of asthma exacerbation. Retrospective data collection was performed using medical records, gathering information on demographic characteristics, eosinophil levels, and asthma exacerbation severity, as documented in the patient records.

Data were processed and analysed using SPSS version 26. Descriptive statistics were employed to assess the frequency distribution of patient characteristics, while the relationship between eosinophil levels and asthma exacerbation severity was analysed using the non-parametric Mann–Whitney test. Statistical significance was set at a p-value of less than 0.05. Ethical approval was obtained from the Institutional Review Board of Prof. Dr. Chairuddin P. Lubis USU Hospital, and patient consent was waived owing to the retrospective nature of the study.

The findings of this study are expected to contribute to a better understanding of the role of eosinophil levels in predicting asthma exacerbations, potentially guiding personalised asthma management strategies. However, the study acknowledges limitations, such as its retrospective design and the potential for incomplete data, which may affect the generalisability of the results.

RESULTS

Based on Table 1, it can be seen that the age of asthma patients is mostly in the age category 26-50 years, with as many as 11 patients (44%), followed by age> 50 years, with as many as 8 people (32%), and the least is the age category 15-25 years as many as 6 people (24%). Asthma patients were predominantly female, with as many as 20 people (80%), and men, as many as five people (20%).

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

Table 3 shows that 18 patients (72%) had severe exacerbation, and asthma patients with mild to moderate exacerbation (28%).

Based on Table 4, a P value of 0.976 was obtained. Since the P value was greater than 0.05, there was no relationship between eosinophil levels and the exacerbation level of asthma patients at the USU Hospital Polyclinic.

Table 1. Demographic Characteristics of Asthma Patients at RS Prof. Dr Chairuddin P Lubis USU

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)

Table 2 Overview of Eosinophil Levels in Asthma Patients at Prof. Dr. Chairuddin P Lubis USU Hospital

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

Table 3. Overview of the Exacerbation Level of Asthma Patients at Prof. Dr. Chairuddin P Lubis USU Hospital

Exacerbation Level	Frequency (n=25)	Percentage (%)
Mild to Moderate	7	28
Severe	18	72

Table 4. Relationship Between Eosinophil Levels and the Level of Exacerbation of Asthma Patients at the Lung Polyclinic of the USU Hospital

Eosinophil	Exacerbation				P-value
	mild to moderate		Severe		
	n	%	n	%	
<100	6	28	15	72	0,967
100-300	0	0	2	100	
>300	1	50	1	50	

DISCUSSION

Based on the results of the study, it can be seen that the age of most asthma patients is in the 26-50 age category, with 11 patients (44%), over 50 years of age with 8 people (32%), and the least is the 15-25 age category with 6 people (24%). This is in line with Lorensia's research which showed that patients aged 25-49 years were the most numerous, with 34 people (79%), and patients aged 20-24 years with 9 people (21%).

Asthma patients were predominantly female (n = 20, 80%) and male (n = 5, 20%). This is in line with Lorensia's research, that there are more female patients, 26 (60.47%), and male patients, 17 (39.53%).[4] After puberty, asthma is more common and severe in women than in men. This shift is associated with hormonal changes and other biological factors that occur during puberty and throughout a woman's life, such as menstruation, pregnancy, and menopause.[5,6] In the UK Severe Asthma Registry, 60.9% of severe asthma patients are women, highlighting the higher prevalence of severe asthma among women.[7,8]

Based on the results of the study, it can be seen that patients with eusinophil levels <100 were the most numerous, namely 21 people (84%), followed by patients with eusinophil levels of 100-300 and patients with eusinophil levels >300, 2 people each (8%). This is in line with Fachri's research which states that the highest level of eosinophils in asthma patients is <350 eosinophils in 60 people (57.1%), and >350 eosinophils in 45 people (42.9%).[9] The number of eosinophils was higher in the patients with more severe asthma. For example, one study found that the number of eosinophils was significantly higher in patients with severe asthma compared to mild and moderate cases, with a total of 658±72 eos/mm³ in severe cases versus 334±35 eos/mm³ in mild cases.[10] Eosinophil levels can vary significantly in individuals with asthma, thereby affecting treatment decisions. In a study of people with severe asthma, only 6% consistently had eosinophil levels above 300 cells/μL, indicating the need for repeated measures to guide therapy.[11]

Based on the results of the study, it was found that 18 patients (72 %) had asthma with a severe level of exacerbation, and 7 (28%) had asthma with a mild to moderate level of exacerbation. This is not in accordance with Muhammad's research which states that the highest level of exacerbation is moderate exacerbation with

38 people (71.7%), mild exacerbation with 12 people (22.6%), and severe exacerbation with 3 people (5.7%).[12] In the United States, the CHRONICLE study found that female, black, Hispanic, and younger adult patients experience higher rates of severe asthma exacerbations compared to their peers.[13]

A p-value of 0.976 was obtained based on the results of the study. Since the P Value is greater than 0.05, there is no relationship between eosinophil levels and the level of exacerbation of asthma patients at the USU Hospital Polyclinic. In the results of this study, low eosinophil levels in asthma patients were found due to several possibilities, including 1) decreased peripheral blood eosinophils, 2) the use of corticosteroids, both inhaled and systemic, 4-8 hours before the attack, 3) peripheral blood eosinophils did not increase during the attack because of the slow immune response phase that occurs 6-8 hours after bronchoconstriction, and 4) asthma does not go through a mechanism involving eosinophils, known as non-eosinophilic asthma, but is related to a neutrophil response. Eosinophil levels can predict clinical outcomes, such as the risk of acute exacerbation. In the Korean cohort, patients with eosinophil levels <100 cells/μL had a higher risk of severe exacerbation, while patients with levels ⩾300 cells/ μ L had a higher risk of moderate exacerbation.[14] Exposure to bacterial endotoxins, air pollution, and viral infections can trigger neutrophil infiltration in asthma. If the patient has non-eosinophilic asthma, then an examination of the peripheral blood will not show an increase in the number of eosinophils or eosinophilia, so there is no relationship between the level of eosinophils and the level of exacerbation.[15]

CONCLUSION

This study shows that most asthma patients are in the 26-50 age group (44%) and predominantly female (80%). Most patients had eosinophil levels <100 (84%), and severe exacerbations were the most common (72%). However, statistical analysis indicated no significant relationship between eosinophil counts and the severity of asthma exacerbations ($p = 0.976$).

This suggests that other factors, such as corticosteroid use, delayed immune response, and the possibility of non-eosinophilic asthma, may influence this relationship. These findings highlight the importance of multidimensional evaluation in asthma management, including the identification of different asthma phenotypes, for a more precise therapeutic approach.

DECLARATIONS

This study complied with the procedures and ethical guidelines established by the Health Research Ethics Committee of the Universitas Sumatera Utara.

CONSENT FOR PUBLICATION

The Authors agree to be published in Journal of Society Medicine.

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COMPETING INTERESTS

The authors declare that there are no conflicts of interest.

AUTHORS' CONTRIBUTIONS

All authors significantly contributed to the work reported on execution, acquisition of data, analysis, and interpretation, or in all these areas. Contribute to drafting, revising, or critically reviewing the article. Approved the final version to be published, agreed on the journal to be submitted, and agreed to be accountable for all aspects of this work.

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