



The Relationship of Haemoglobin Levels and Leukocyte Numbers against Erythrocyte sedimentation rate (ESR) in Systemic Lupus Erythematosus (SLE) Patients

Gela Setya Ayu Putri¹, Siti Linda Purnamasari², Andri Sukeksi³

^{1,2,3}Universitas Muhammadiyah Semarang, Semarang, Central Java 50273, Indonesia
gela@unimus.ac.id

Abstract. Systemic Lupus Erythematosus (SLE) is a systemic disease with a wide range of clinical manifestations. SLE clinical manifestations include hematological symptoms such as anemia (low hemoglobin levels) and leukopenia. Anemia in SLE occurs by suppressed erythropoiesis caused by chronic inflammation, whereas leukopenia is caused by systemic infection. To evaluate hematological abnormalities in SLE, additional tests, such as complete blood count and erythrocyte sedimentation rate (ESR), are required. ESR values can be affected by hemoglobin levels and leukocyte counts. The aim of this study was to determine the relationship between hemoglobin levels and leukocyte counts against ESR values. This study is an analytical observational, cross-sectional design with retrospective data collection. The research uses secondary data from medical records data measurement of hemoglobin levels, leukocyte counts, and ESR values in 20 SLE patients at RSU Hermina Purwokerto. The result of this research showed the average hemoglobin level in 20 SLE patients was 9.3 gr/dL, the average leukocyte count was 8.5×10^3 cells/ μ L, and the average ESR value was 43 mm/hour. The Pearson correlation test showed that the variable Hb value and ESR value were significant ($p > 0.05$), whereas the variable number of leukocytes and LED value were not significant ($p > 0.05$). The final conclusion there is a relationship between hemoglobin levels and ESR values, but not between leukocyte counts and ESR values.

Keywords: Systemic Lupus Erythematosus (SLE), Hemoglobin Level, Leukocyte Count, ESR.

1. Introduction

SLE (Systemic Lupus Erythematosus) is an autoimmune disease affecting multiple organs [1]. According to the World Health Organization (WHO), the number of SLE patients has risen to five million, with the majority of them consisting of reproductive-age women, and more than 100,000 new cases are diagnosed each year. Lupus affects approximately 1,250,000 people in Indonesia [2].

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SLE can cause mild to severe symptoms in human organs and tissues. Symptoms may appear abruptly or gradually [3]. SLE has a wide range of clinical manifestations, including hematological manifestations such as anemia and leukopenia. The presence of autoantibodies, chronic inflammation, immunosuppressive drugs, and bone marrow suppression may all contribute to cytopenia in SLE [4].

Another factor that plays a role in blood abnormalities in SLE is continuous inflammation. Complete blood count is required to assess hematological abnormalities in SLE patients, as is an Erythrocyte Sedimentation Rate (ESR) examination to assess inflammatory markers [5].

Hematological abnormalities are found in 83-85% of SLE patients, with anemia being the most common [6]. SLE causes tissue inflammation and severe blood vessel problems, resulting in anemia due to a decrease in the number of red and white blood cells. The most common type of anemia in SLE is chronic disease anemia, which is caused by suppressed erythropoiesis as a result of chronic inflammation [7]. ESR values rise in SLE patients with hematological disorders such as anemia caused by low hemoglobin levels, resulting in a lower ratio of red blood cell volume to plasma volume and a lower plasma viscosity, which speeds up the sedimentation process [8].

Leukocytes play an important role in the body's defense system, a decrease in leukocyte count (leukopenia) can be caused by systemic diseases such as SLE. Leukopenia is a significant marker for acute SLE, occurring in approximately 50% of SLE patients. Neutropenia and lymphopenia are two types of leukopenia that occur in SLE [4]. A decrease in the number of leukocytes is associated with disease activity as measured by ESR [9].

There were 68 patients diagnosed with SLE at Hermina Purwokerto Hospital for the period October 2022 to March 2023, with 20 inpatients and 48 outpatients. Complete blood count examination and ESR values are carried out routinely or periodically in SLE patients. The goal is to monitor SLE patients to ensure that the disease does not worsen or damage the affected organs, as SLE is a lifelong disease that cannot be cured [10].

Based on previous research by Ratnadi [7], it shows that there is a relationship between hemoglobin and the severity of SLE. There has been no research on the relationship between hemoglobin levels and leukocyte counts with ESR values in SLE patients, so researchers are interested in conducting this study.

2. Methods

This study is a cross-sectional, analytical observational study with retrospective data collection. Data type of research uses secondary data from medical record measurements of hemoglobin levels, leukocyte counts, and ESR values in SLE patients at RSU Hermina Purwokerto from October 2022 to March 2023, totaling 20 patients.

The SPSS 24 application was used to analyze research data. The Kolmogorov-Smirnov test was used to determine normality, followed by the Pearson correlation test.

3. Result

3.1. Characteristics Respondents

Samples were collected from 20 SLE inpatients at Hermina Hospital in Purwokerto. The characteristics of the respondents are shown in Table 1.

Table 1. Distribution of research respondents

Characteristics	Frequency (n)	Percentage (%)
Gender		
Male	0	0
Female	20	100
Age (years)		
20-45	17	85
46-50	3	15

Table 1 shows that there were 20 female patients (100%), 17 adult patients (85%), 3 elderly patients (15%), and no male patients.

3.2. Results of respondent test

Table 2. Distribution of Hemoglobin Levels, Leukocyte Counts, and ESR Values in SLE Patients

Variable	N	Min	Max	Mean
Hemoglobin level (g/dL)	20	6.2	12.4	9.3
leukocyte count ($10^3\text{sel}/\mu\text{L}$)	20	2.3	18.7	8.5

According to Table 2, the majority of SLE patients had low hemoglobin levels with a mean value of 9.3 gr/dL, a normal leukocyte count with a mean value of 8.5×10^3 cells/L, and a high ESR value with a mean value of 43 mm/hour.

Table 3. Hemoglobin Levels and Leukocyte Counts based on ESR Values

		ESR value		Total
		Normal	High	
Hemoglobin	Low	6 (30%)	14 (70%)	20 (100%)
	High	0 (0%)	0 (0%)	
Leukocyte	Low	0 (0%)	2 (10%)	20 (100%)
	Normal	3 (15%)	6 (30%)	
	High	3 (15%)	6 (30%)	

According to Table 3, the majority of SLE patients have high ESR values as well as low hemoglobin levels. Furthermore, the leukocyte count parameter shows an abundance of patterns, with some SLE patients having normal or high leukocyte values despite having high ESR values.

Based on statistical analysis, it is known that there is a relationship between hemoglobin levels and ESR values $p = 0.0010$ ($p < 0.05$) with a rho value of -0.703 , indicating there is a strong relationship in the negative direction, if the hemoglobin level is low then the ESR value is high. Furthermore, it was discovered that there was no relationship between the number of leukocytes and the ESR value $p = 0.692$ ($p > 0.05$).

4. Discussion

The characteristics of the research sample show that the majority of SLE patients were female, with 17 (85%) being female and 3 (15%) being elderly. The majority of SLE patients have low hemoglobin levels with a normal leukocyte count (8.5103 cells/L on average). The majority of ESR values in SLE patients were high, with a mean value of 43 mm/hour.

The results obtained are in line with research from Pradesta (2018), which found that more SLE patients are female. Based on the research results, there were 39 patients (90.7%) with SLE who were female and 4 patients (9.3%) with SLE who were male. Women suffer from SLE more often than men. The increasing prevalence of SLE disease before menstruation or during pregnancy lends credence to the theory that the hormone estrogen is a trigger for SLE disease [10].

Many SLE patients have low hemoglobin levels, which corresponds to one of the clinical manifestations of SLE, anemia. Inflammation, renal insufficiency, blood loss, insufficient intake, drugs, hemolysis, infection, hypersplenism, myelofibrosis, myelodysplasia, and the presence of autoimmune pathogenesis in aplastic anemia are all factors that contribute to anemia in SLE [11]. Anemia in SLE can be caused by the presence of IgG and IgM autoantibodies, which attack red blood cells and cause them to be damaged more quickly, resulting in a reduction in the number of red blood cells in circulation [10].

Leukopenia in SLE is caused by immune mechanisms, medication (cyclophosphamide or azathioprine, bone marrow dysfunction or hypersplenism), and steroid therapy. Leukocytosis can also occur in SLE as a result of infection or the use of high doses of glucocorticoids, resulting in disease exacerbation [12].

ESR testing is a sensitive indicator of inflammation and SLE activity, but it is not specific and takes time to reflect changes in disease activity [13]. The most cases reported in the involvement of the heart, kidney, or skin (with an ESR value of 80-90 mm/hour) and several cases in the involvement of the lungs, joints, and hematology (with a value LED around 60mm/hour) [14].

The ESR value is influenced by hemoglobin levels and the number of leukocytes, due to the presence of autoantibodies which damage erythrocyte cells so that the volume ratio of red blood cells is less than plasma which accelerates the process of rouleaux formation [15]. A decrease in the number of leukocytes is related to disease activity as assessed by ESR [10].

The ratio of red blood cell volume to plasma and plasma viscosity are two factors that influence the ESR value. Most SLE patients have low hemoglobin levels, which means that the protein that gives blood its red color is depleted. As a result, the volume of red blood cells is less than the volume of plasma. Because the process of erythrocyte deposition to form rouleaux occurs quickly [16], it can be concluded that there is a relationship between hemoglobin levels and ESR values in SLE patients.

Leukocytes play an important role in the body's defense system; a decrease in leukocyte count can be caused by systemic diseases such as SLE. A decrease in leukocyte count is related to disease activity as measured by ESR. White blood cell (leukocyte) abnormalities in SLE can be influenced by a variety of factors, including infection or the use of steroids, which can both increase and decrease the number of leukocytes in active disease conditions. As a result, there is no correlation between the number of leukocytes and the ESR value in SLE patients [17].

5. Conclusion

According to the results of this study, the average hemoglobin level in SLE patients is 9.3 gr/dL (low). In SLE patients, the average leukocyte level is 8.5103 cells/L (normal). In SLE patients, the average ESR is 43 mm/hour (high). There was a p value of 0.001 ($p < 0.05$) relationship between hemoglobin levels and ESR values in SLE patients, but no relationship between leukocyte counts and ESR values in SLE patients ($p > 0.05$).

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