Analysis of Hematological Indices in Patients of Systemic Lupus Erythematosus and Its Correlation with SLEDAI-2K

Ved Prakash Meena1*, Prabhu Dayal Meena2, Radhe Shyam Chejara3, Chuttan Lal Nawal4, Aradhana Singh5, Govind Rankawat6

Received: 31 May 2023; Accepted: 28 June 2023

ABSTRACT

Background: Systemic lupus erythematosus (SLE) is an autoimmune disease which is characterized by chronic multisystem inflammation and end-organ damage. In recent times there has been a need for new hematological markers to assess disease activity in SLE patients specifically, which can be easily available like eosinophil, basophil, neutrophil, monocytes, and platelet to lymphocyte ratios (ELR, BLR, NLR, MLR, and PLR, respectively).

Materials and methods: The present investigation determines the use of a different peripheral hematological marker to assess SLE activity in 106 patients attended for medical care at Sawai Mansingh (SMS) Medical College and attached hospital, Jaipur. SLE disease activity index 2000 (SLEDAI-2K) was used to assess the disease activity in all patients. Erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) were assessed in each subject. The ratio of various hematological indices, like NLR, BLR, ELR, MLR, PLR, etc., were analyzed and correlated with CRP, ESR, and SLEDAI-2K.

Results: The present study revealed that the SLEDAI-2K score showed a significant positive correlation with ELR and MLR (p < 0.005). CRP showed a significant positive correlation with PLR (p < 0.005). ESR showed a significant positive correlation with ELR, MLR, PLR, and NLR (p < 0.005).

Conclusion: The final results demonstrate that in SLE patients, the ratio of hematological indices like ELR, MLR, and PLR can be employed as disease activity markers.

INTRODUCTION

Systemic lupus erythematosus (SLE), often known as SLE, is a chronic autoimmune illness that affects the body’s connective tissue and is distinguished by a predisposition for flares. The condition can vary in its severity and its duration. According to the many pieces of epidemiologic evidence available, the frequency of SLE ranges from 6.5 to 178.0 per 100,000 people worldwide. The prevalence of SLE in India is estimated to be 3.2 cases per 100,000 people. Patients with SLE in North and West India were more likely to have a malar rash, arthritis, renal, and hematological features than discoid lesions, serositis, and neurological signs. Malar rash, arthritis, renal, and hematological manifestations were recorded in larger proportions. Neutrophils have been identified as key effector cells in the pathogenesis of SLE. In more recent studies, it was shown that neutrophils, specifically the formation of neutrophil extracellular traps, have a role in the development of SLE. This is a process in which nuclear and cytosolic debris is extruded from neutrophils that are in the process of dying.

It is absolutely necessary for persons who have SLE and also have renal impairment to have frequent follow-up appointments. For the purpose of determining the severity of SLE disease activity, composite measures such as the SLE Disease Activity Index 2000 (SLEDAI-2K) are utilized. However, relying on these indices on a consistent basis is not something that is especially feasible. The search for uncomplicated laboratory indicators that can be acquired at almost any healthcare facility in order to evaluate disease activity and renal affection in SLE patients is an important challenge that needs to be addressed. This is a problem that has to be addressed since it is an essential issue. Indirect evidence of subclinical inflammation has been shown to be present in platelet-to-lymphocyte ratios (PLR), neutrophil-to-lymphocyte ratios (NLR), basophil-to-lymphocyte ratios (BLR), and eosinophil-to-lymphocyte ratios (ELR). In recent years, there has been a growing interest in the function that complete blood count (CBC) parameters play in evaluating disease activity in a variety of autoimmune disorders. This interest stems from the fact that CBC parameters may be found in blood tests. Several different things have contributed to the rise in interest. Various components of the CBC, such as NLR, monocyte-to-lymphocyte ratio (MLR), and PLR, have been used as efficient markers of inflammation in inflammatory and autoimmune disorders in recent reports. The PLR has recently come to be recognized as an informative measure that can identify changes in platelet and lymphocyte counts that are caused by acute inflammatory and prothrombotic states.

Their levels shift depending on whether the overall inflammatory response in the body is becoming worse or getting better. A comprehensive blood count, which can be carried out at a wide range of medical facilities, may be used to estimate the total number of cells that are circulating in the body. On the other hand, there is a paucity of information addressing the use of NLR, MLR, and PLR in SLE patients. Within the context of this investigation, we investigated the possibility of a connection between NLR, MLR, ELR, BLR, and PLR levels and disease activity in SLE patients.

MATERIALS AND METHODS

A hospital-based retrospective study was conducted on 106 SLE patients at the internal medicine wards of Sawai Mansingh (SMS) Hospital, Jaipur. Patients diagnosed on the basis of Systemic Lupus International Collaborating Clinic (SLICC) and European League Against Rheumatism (EULAR)/American College of Rheumatology (ACR) criteria are included in this study. Participants were given a thorough explanation of the study, and after receiving their informed consent, the research was carried out. A routine blood investigation was done, and patients were evaluated for disease activity as per the SLEDAI-2K scale. The hematological markers (NLR, BLR, ELR, MLR, and PLR) were evaluated and subsequently correlated with disease activity parameters C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), and SLEDAI-2K score. Inclusion of patients with a diagnosis of illness according to SLICC classification criteria from 2012 or the criteria from the 2019 EULAR/ACR. Patients who had a current infection, overlap syndrome,
pregnancy, known cases of chronic liver disease (CLD), end-stage renal illness, or active cancer were excluded from this study.

**Statistical Analysis**

The presentation of the qualitative data included percentages and proportions. The mean and standard deviation (SD) were used to show the quantitative data. Analyzing nonparametric or categorical data was accomplished with the use of the Chi-squared test. The student’s t-test was applied to the examination of the data collected using ordinal scales. In order to examine the degree of connection between the variables, the Karl–Pearson correlation coefficient was computed. The level of significance was determined to be \( p = 0.05 \).

**RESULTS**

In our study, 106 patients with SLE were recruited. There is a female preponderance, with 103 (97.17%) females and three (2.83%) males. The mean age of cases is 26.74 years (26.74 ± 6.74), and the mean SLEDAI-2K is 9.71 (9.71 ± 5.82). Most of the patients in the study are indoor patients with high disease activity and relapse (Table 1).

In our study, 106 patients with SLE were included. There is a female preponderance, with 103 (97.17%) females and three (2.83%) males. The mean age of cases is 26.74 years (26.74 ± 6.74), and the mean SLEDAI-2K is 9.71 (9.71 ± 5.82). Most of the patients in the study are indoor patients with high disease activity and relapse (Table 1).

**DISCUSSION**

Here, in our study, NLR shows statistically significant correlation with ESR (\( r = 0.219; p = 0.0241 \)), ELR (\( r = 0.247; p = 0.0106 \)), MLR (\( r = 0.425; p = 0.0002 \)), and PLR (\( r = 0.425; p = 0.0002 \)) with ESR and PLR (\( r = 0.227; p = 0.0192 \)) with CRP show a statically significant correlation in SLE cases. Here, we find that ELR (\( r = 0.395; p = 0.0002 \)) and MLR (\( r = 0.253; p = 0.0088 \)) show a statistically significant correlation with SLEDAI-2K in SLE cases.

**Conclusion**

Other inflammatory indicators are more complicated, but hematological ratios may be easily determined from routine CBC tests performed in health clinics. Additionally, they are less expensive. In addition, these ratios are rather stable despite the fact that it is usual for circulating white blood cells to undergo relative alterations. These changes are often reflected by lymphopenia and neutrophilia, and they might explain elevated PLR in SLE patients, particularly when activity is present. In addition, lupus activity often results in a reduction in platelet counts; however, lymphocyte numbers drop more rapidly than platelet counts, which may help to explain why elevated PLR is associated with SLE activity. According to the results of our research, ELR and MLR are both high in patients who have a high SLEDAI-2K score; however, NLR and PLR do not exhibit any link with the SLEDAI-2K score. The CRP has a statistically significant connection with both the PLR. A substantial link may be shown between ESR and MLR, PLR, and NLR. There is a correlation between having a high SLEDAI-2K and CRP and having a high ESR and MLR. PLR has been found to have a substantial connection with both CRP and ESR. The research conducted by Suszek et al. demonstrates that there is a substantial link between SLEDAI-2K, ELR, and MLR. On the other hand, there is no relationship between NLR and PLR and the disease activity indicators. The NLR/MLR/PLR markers and the ESR/CRP readings all showed a substantial positive connection with one another.

According to Qin et al., both NLR and PLR had a positive correlation with SLEDAI-2K (\( r = 0.471, p = 0.01 \)) and (\( r = 0.44, p = 0.01 \)), respectively. The PLR was shown to have a somewhat favorable association with the MEX-SLEDAI score, with a value of \( r = -0.366 \) and a \( p \)-value that was <0.001. This was discovered by Fikri et al. According to the results of our research, these hematological ratios are easily measurable and have the potential to serve as a useful marker for determining the progression of a disease and its subsequent treatment.

**Table 1:** Hematological profile of the study population

<table>
<thead>
<tr>
<th>Hematological indices</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemoglobin (gm/dL)</td>
<td>9.88</td>
<td>2.12</td>
</tr>
<tr>
<td>Total leukocyte count (cells per cumm)</td>
<td>7365.42</td>
<td>2837.74</td>
</tr>
<tr>
<td>MCV (fl)</td>
<td>87.91</td>
<td>10.08</td>
</tr>
<tr>
<td>PLT (Lakhs/cumm)</td>
<td>2.24</td>
<td>1.04</td>
</tr>
<tr>
<td>ESR (mm/hour)</td>
<td>47.62</td>
<td>24.92</td>
</tr>
<tr>
<td>NLR</td>
<td>5.35</td>
<td>3.52</td>
</tr>
<tr>
<td>ELR</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>MLR</td>
<td>0.21</td>
<td>0.20</td>
</tr>
<tr>
<td>BLR</td>
<td>0.00</td>
<td>0.01</td>
</tr>
<tr>
<td>PLR</td>
<td>219.42</td>
<td>147.91</td>
</tr>
</tbody>
</table>

**Table 2:** Pearson correlation between ESR, CRP, and different hematological ratios

<table>
<thead>
<tr>
<th>Ratio of blood cells</th>
<th>ESR</th>
<th>CRP</th>
<th>SLEDAI-2K</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r (p-value)</td>
<td>r (p-value)</td>
<td>r (p-value)</td>
</tr>
<tr>
<td>NLR</td>
<td>+0.219 (0.0241)</td>
<td>+0.141 (0.1493)</td>
<td>+0.170 (0.0814)</td>
</tr>
<tr>
<td>ELR</td>
<td>+0.247 (0.0106)</td>
<td>+0.119 (0.2243)</td>
<td>+0.395 (0.0002)</td>
</tr>
<tr>
<td>MLR</td>
<td>+0.425 (0.0001)</td>
<td>+0.112 (0.253)</td>
<td>+0.253 (0.0088)</td>
</tr>
<tr>
<td>PLR</td>
<td>+0.204 (0.0359)</td>
<td>+0.227 (0.0192)</td>
<td>+0.133 (0.1741)</td>
</tr>
</tbody>
</table>
each leukocyte count may be altered by dehydration, rehydration, and dilution of blood samples; hence, these hematological indicators may be utilized to evaluate the disease activity of SLE patients.

**Ethical Approval**
This study was approved by the ethical and research committee of SMS Medical College and Hospital, Jaipur, India.

**Author Contributions**
Prakash, Meena, and Chejara formulated the research questions, designed the study, developed the preliminary search strategy, and drafted the manuscript. Prakash, Singh, Nawal, and Rankawat collected and analyzed data for the study and wrote the manuscript. Nawal and Chejara conducted the quality assessment. All authors critically reviewed the manuscript for relevant intellectual content. All authors have read and approved the final version of the manuscript.

**Availability of Data and Materials**
Available from the corresponding author upon reasonable request.

**References**