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Original Research Article

COMPARATIVE EVALUATION OF THE SYSTEMIC IMMUNE-INFLAMMATION INDEX AND NEUTROPHIL-TO LYMPHOCYTE RATIO AS PREDICTORS OF ADVERSE OUTCOMES IN HOSPITALIZED PATIENTS WITH SEPSIS

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ABSTRACT

Background: Sepsis is a life-threatening condition associated with systemic inflammation, organ dysfunction, and increased mortality. Early identification of patients at risk of adverse outcomes is essential for effective clinical management. The Systemic Immune-Inflammation Index (SII) and Neutrophil-to-Lymphocyte Ratio (NLR) are inexpensive inflammatory markers with potential prognostic significance in sepsis. The aim is to compare the prognostic performance of SII and NLR in predicting adverse clinical outcomes among hospitalized patients with sepsis.

Materials and Methods: This hospital-based, prospective observational comparative study included 102 adult patients diagnosed with sepsis at a tertiary care hospital. Baseline clinical characteristics, hematological parameters, SII, NLR, SOFA scores, inflammatory markers, and adverse clinical outcomes were evaluated. Patients were categorized into survivors and non-survivors. Statistical analysis was performed using IBM SPSS Statistics version 28.0. ROC curve analysis and logistic regression were used to assess mortality prediction.

Results: Among 102 patients, 75 (73.53%) survived and 27 (26.47%) died during hospitalization. Median SII was significantly higher among non-survivors than survivors (2817.67 versus 2172.56; $p<0.001$). Similarly, median NLR was significantly elevated among non-survivors (12.42 versus 8.77; $p<0.001$). Both indices demonstrated significant positive correlations with SOFA scores and serum lactate levels. ROC analysis demonstrated AUC values of 0.725 for SII and 0.744 for NLR. NLR showed higher specificity (77.33%) than SII (68.00%).

Conclusion: Both SII and NLR demonstrated potential utility in predicting adverse outcomes among hospitalized patients with sepsis. NLR showed slightly better mortality discrimination than SII. Both markers may complement established clinical severity scores for early risk stratification.

Keywords: Sepsis; Systemic Immune-Inflammation Index; Neutrophil-to-Lymphocyte Ratio; In-Hospital Mortality; SOFA Score.

INTRODUCTION

Sepsis remains a major cause of deterioration and death among hospitalized adults worldwide. It represents a syndrome in which infection provokes a dysregulated host response, leading to potentially life-threatening organ dysfunction. Patients may initially present with nonspecific symptoms yet progress rapidly to circulatory failure, respiratory dysfunction, acute kidney injury, or multiorgan failure. Its burden extends beyond mortality to prolonged hospitalization, intensive care utilization, increased expenditure, and functional impairment among survivors. Differences in infectious

etiologies, underlying diseases, access to critical care, and delays in recognition make early risk assessment particularly important in tertiary care hospitals.[1] Early identification of patients likely to deteriorate is fundamental to sepsis management. Contemporary care requires prompt recognition of infection, assessment of organ dysfunction, antimicrobial therapy, source control, and individualized hemodynamic support. The Sequential Organ Failure Assessment (SOFA) score evaluates respiratory, cardiovascular, renal, hepatic, neurological, and coagulation abnormalities. However, calculating severity scores requires several clinical and laboratory variables and may not capture the evolving immune response. Conventional measurements such as C-reactive protein, procalcitonin, and serum lactate assist evaluation, but their interpretation is influenced by disease stage, comorbidities, and treatment. Accessible supplementary prognostic indicators are therefore desirable.[2] Sepsis involves interactions between innate immune activation, adaptive immune dysregulation, endothelial injury, coagulation abnormalities, and metabolic disturbances. Neutrophils participate in pathogen clearance but may also contribute to tissue damage through excessive inflammatory signaling. Lymphocytes support coordinated immune responses, whereas lymphopenia can accompany physiological stress and immune dysfunction. Platelets influence hemostasis, microvascular circulation, and inflammatory signaling. The Systemic Immune-Inflammation Index (SII), calculated by multiplying platelet and neutrophil counts and dividing by lymphocyte count, incorporates these cellular pathways into a single measurement. Because its components arise from routine complete blood counts, SII requires no specialized investigations and may help characterize inflammatory-immune imbalance in sepsis.[3] The Neutrophil-to-Lymphocyte Ratio (NLR) is calculated by dividing the absolute neutrophil count by the absolute lymphocyte count. It reflects the balance between innate inflammatory activity and lymphocyte-associated immune regulation. Unlike isolated leukocyte counts, NLR captures changes in two immune cell populations and may provide information when patients develop neutrophilia or lymphopenia. Its advantages include low cost, rapid availability, straightforward calculation, and feasibility across emergency departments, medical wards, and intensive care settings. Nevertheless, NLR may be influenced by corticosteroid exposure, physiological stress, hematological conditions, and coexisting inflammatory disorders, requiring interpretation within the broader clinical picture.[4] A major challenge in hospitalized sepsis is anticipating adverse events before irreversible organ damage occurs. Septic shock, acute kidney injury, respiratory failure requiring mechanical ventilation, renal replacement therapy, and in-hospital death are meaningful endpoints for risk stratification. Renal dysfunction is especially important because inflammatory injury, altered microcirculation, and hemodynamic instability may occur simultaneously. The inclusion of platelets in SII offers a theoretical advantage over NLR by incorporating an additional component linked to endothelial activation and coagulation. However, additional complexity does not guarantee superior prognostic performance. Evaluating both markers against organ dysfunction and complications is necessary to determine whether either adds useful clinical information.[5]

The inflammatory response to sepsis is dynamic rather than uniform. Early hyperinflammation may coexist with immune suppression, and circulating cell counts can change substantially during hospitalization. Consequently, a biomarker measured at admission may carry a different clinical meaning from the same value later in the disease course. Relationships between composite inflammatory indices and prognosis may be nonlinear, making fixed thresholds difficult to generalize across populations. For SII, variations in platelet counts due to consumption, thrombocytopenia, or recovery may modify interpretation. These considerations underline the need to assess admission values carefully without assuming that increasingly high values invariably indicate greater risk.[6]

MATERIALS AND METHODS

The present study was designed as a hospital-based, prospective observational comparative study to evaluate and compare the prognostic significance of the Systemic Immune-Inflammation Index (SII) and Neutrophil-to-Lymphocyte Ratio (NLR) in predicting adverse clinical outcomes among hospitalized patients with sepsis. The study assessed the associations of these inflammatory indices with disease severity, organ dysfunction, septic shock, intensive care requirements, mechanical ventilation, length of hospital stay, and in-hospital mortality. The study was conducted at a tertiary care hospital in the Departments of General Medicine. Patients admitted to medical wards and intensive care units with a clinical diagnosis of sepsis were evaluated using standardized clinical and laboratory assessment protocols. A total of 102 adult patients diagnosed with sepsis were enrolled using a consecutive sampling technique. Patients fulfilling the eligibility criteria were included irrespective of sex, infection source, or disease severity. Based on clinical outcomes, patients were categorized into survivors and non-survivors. Additional comparisons were performed between patients with and without adverse clinical outcomes.

Inclusion Criteria

Patients aged 18 years and above who were hospitalized with suspected or confirmed infection and fulfilled the Sepsis-3 diagnostic criteria were included. Sepsis was defined as life-threatening organ dysfunction caused by a dysregulated host response to infection, characterized by an acute

increase of at least two points in the Sequential Organ Failure Assessment (SOFA) score. Patients with sepsis or septic shock and available baseline hematological investigations were eligible.

Exclusion Criteria

Patients below 18 years, pregnant women, and individuals with hematological malignancies, bone marrow disorders, or conditions significantly affecting leukocyte and platelet counts were excluded. Patients receiving cytotoxic chemotherapy, having major active bleeding or recent massive blood transfusion, and those with incomplete baseline hematological investigations or insufficient clinical information were also excluded.

Methodology: Detailed demographic and clinical information was collected using a structured proforma. Parameters included age, sex, body mass index, presenting symptoms, infection source, duration of illness before admission, and associated comorbidities such as diabetes mellitus, hypertension, chronic kidney disease, chronic liver disease, and cardiovascular disease. Vital parameters, including temperature, heart rate, respiratory rate, blood pressure, mean arterial pressure, oxygen saturation, and Glasgow Coma Scale score, were recorded at admission.

Hematological and Biochemical Investigations: Venous blood samples were collected within 24 hours of admission for complete blood count and biochemical investigations. Hemoglobin, total leukocyte count, absolute neutrophil count, absolute lymphocyte count, and platelet count were measured using an automated hematology analyzer. Biochemical parameters included serum creatinine, blood urea, electrolytes, bilirubin, liver enzymes, serum albumin, blood glucose, and serum lactate. C-reactive protein and procalcitonin levels were recorded whenever available. Relevant blood, urine, sputum, and other microbiological cultures were performed according to the suspected infection source.

Calculation of Systemic Immune-Inflammation Index (SII): SII was calculated using the platelet count, absolute neutrophil count, and absolute lymphocyte count obtained from the same baseline complete blood count. The formula used was:

SII = (Platelet Count × Neutrophil Count) / Lymphocyte Count

Higher SII values were evaluated for their association with increased systemic inflammation, organ dysfunction, disease severity, and adverse clinical outcomes.

Calculation of Neutrophil-to-Lymphocyte Ratio (NLR): NLR was calculated by dividing the absolute neutrophil count by the absolute lymphocyte count obtained from the baseline complete blood count.

NLR = Absolute Neutrophil Count / Absolute Lymphocyte Count

NLR values were compared between survivors and non-survivors and evaluated in relation to sepsis severity, organ dysfunction, complications, and mortality.

Assessment of Sepsis Severity: Disease severity was assessed using the SOFA score, incorporating respiratory, cardiovascular, neurological, hepatic, renal, and coagulation parameters. The quick SOFA (qSOFA) score was also recorded. Septic shock was identified by vasopressor requirement to maintain mean arterial pressure of at least 65 mmHg and serum lactate greater than 2 mmol/L despite adequate fluid resuscitation. Associations between inflammatory indices, SOFA scores, serum lactate, and septic shock were examined.

Assessment of Adverse Clinical Outcomes: Patients were monitored throughout hospitalization for adverse clinical outcomes. The primary outcome was in-hospital mortality. Secondary outcomes included septic shock, acute kidney injury, requirement for mechanical ventilation, renal replacement therapy, intensive care admission, and prolonged hospitalization. Acute kidney injury was assessed using Kidney Disease: Improving Global Outcomes (KDIGO) criteria. SII and NLR values were compared across outcome categories to assess their prognostic significance.

Statistical Analysis: Data were analyzed using IBM SPSS Statistics version 28.0. Continuous variables were expressed as mean ± standard deviation or median (IQR), and categorical variables as frequencies and percentages. Student's t-test, Mann–Whitney U test, Chi-square test, and Spearman's correlation were applied as appropriate. ROC curve analysis assessed predictive accuracy, sensitivity, specificity, and AUC, while logistic regression identified predictors of adverse outcomes. A p-value less than 0.05 was considered statistically significant.

RESULTS

[Table 1] Baseline Demographic and Clinical Characteristics of the Study Population (N=102)

[Table 1] presents the baseline demographic and clinical characteristics of 102 patients with sepsis, comprising 75 survivors and 27 non-survivors. The mean age was significantly higher among non-survivors (59.84 ± 15.67 years) compared with survivors (52.81 ± 11.94 years; p=0.041). Male patients constituted 70.37% of non-survivors and 58.67% of survivors, although this difference was statistically insignificant (p=0.283). Chronic kidney disease was significantly more prevalent among non-survivors (40.74%) than survivors (16.00%; p=0.008). Hypertension was also more frequent among non-survivors (51.85% versus 33.33%), but the difference did not reach statistical significance (p=0.090). Respiratory tract infections were more common among non-survivors (59.26%), whereas urinary tract infections were more frequent among survivors (26.67%).

[Table 2] Comparison of Hematological, Inflammatory and Sepsis Severity Parameters Between Survivors and Non-survivors (N=102)

[Table 2] demonstrates significant differences in inflammatory biomarkers and sepsis severity parameters between survivors and non-survivors. The median absolute neutrophil count was significantly higher among non-survivors (11.69 × 10^3/μL) compared with survivors (9.11 × 10^3/μL; p<0.001), whereas lymphocyte and platelet counts showed no statistically significant differences. The median SII was substantially elevated among non-survivors (2817.67) compared with survivors (2172.56; p<0.001). Similarly, median NLR was significantly higher among non-survivors (12.42 versus 8.77; p<0.001), suggesting a stronger inflammatory response in patients with unfavorable outcomes. CRP and serum lactate levels were also significantly elevated among non-survivors, with median values of 165.67 mg/L and 3.48 mmol/L, respectively (both p<0.001). Furthermore, the median SOFA score was significantly higher among non-survivors (10.00 versus 6.00; p<0.001), indicating greater organ dysfunction and disease severity.

[Table 3] Comparison of Adverse Clinical Outcomes Between Survivors and Non-survivors (N=102)

[Table 3] illustrates the distribution of adverse clinical outcomes among hospitalized patients with sepsis. Septic shock occurred in 33 patients (32.35%) and was significantly more frequent among non-survivors (62.96%) than survivors (21.33%; p<0.001). Acute kidney injury was observed in 39 patients (38.24%), with a significantly higher occurrence among non-survivors (62.96% versus 29.33%; p=0.002). Intensive care admission was required in 66.67% of patients and was significantly more common among non-survivors (88.89%) compared with survivors (58.67%; p=0.004). Mechanical ventilation was required in 51.85% of non-survivors compared with 17.33% of survivors (p<0.001). Similarly, renal replacement therapy was significantly more frequent among non-survivors (33.33% versus 5.33%; p<0.001). However, the median hospital stay was 10.00 days in both groups, with no statistically significant difference (p=0.567).

[Table 4] Correlation of SII and NLR with Clinical and Inflammatory Parameters (N=102)

[Table 4] presents the correlations of SII and NLR with clinical severity and inflammatory parameters among patients with sepsis. Both indices demonstrated strong positive correlations with SOFA score, with correlation coefficients of r=0.751 for SII and r=0.778 for NLR (both p<0.001), indicating an association with increasing organ dysfunction. Serum lactate showed moderate positive correlations with SII (r=0.537) and NLR (r=0.562), both statistically significant (p<0.001). Similarly, CRP demonstrated significant positive correlations with SII (r=0.480) and NLR (r=0.499), reflecting their association with systemic inflammation. Age showed weak but statistically significant positive correlations with both indices (r=0.231; p=0.019). Length of hospital stay demonstrated a weak positive correlation with NLR (r=0.197; p=0.048), whereas its correlation with SII was not statistically significant (r=0.185; p=0.063).

[Table 5] Comparative Predictive Performance of SII and NLR for In-Hospital Mortality (N=102)

[Table 5] compares the prognostic performance of SII and NLR in predicting in-hospital mortality among patients with sepsis. Receiver operating characteristic analysis demonstrated an AUC of 0.725 (95% CI: 0.611–0.831) for SII and 0.744 (95% CI: 0.637–0.842) for NLR, indicating moderate discriminatory ability for both markers. At an optimal cutoff of 2493.62, SII demonstrated 70.37% sensitivity and 68.00% specificity, whereas NLR showed 66.67% sensitivity and 77.33% specificity at a cutoff of 11.24. Both markers demonstrated statistically significant discrimination for mortality (p<0.001). Unadjusted logistic regression revealed significant associations of SII (OR=1.84, 95% CI: 1.23–2.75; p=0.003) and NLR (OR=2.06, 95% CI: 1.32–3.21; p=0.001) with mortality. However, after adjustment for relevant clinical factors, neither SII (adjusted OR=0.95; p=0.836) nor NLR (adjusted OR=0.81; p=0.506) remained statistically significant.

Table 1: Baseline Demographic and Clinical Characteristics of the Study Population (N=102)

Parameter	Survivors (n=75)	Non-survivors (n=27)	p-value
Age (years), mean ± SD	52.81 ± 11.94	59.84 ± 15.67	0.041
Male sex	44 (58.67%)	19 (70.37%)	0.283
BMI (kg/m²), mean ± SD	24.06 ± 3.96	23.84 ± 4.47	0.818
Diabetes mellitus	27 (36.00%)	9 (33.33%)	0.804
Hypertension	25 (33.33%)	14 (51.85%)	0.090
Chronic kidney disease	12 (16.00%)	11 (40.74%)	0.008
Respiratory tract infection	32 (42.67%)	16 (59.26%)	0.179
Urinary tract infection	20 (26.67%)	3 (11.11%)	0.114

Table 2: Comparison of Hematological, Inflammatory and Sepsis Severity Parameters Between Survivors and Non-survivors (N=102)

Parameter	Survivors (n=75)	Non-survivors (n=27)	p-value
Absolute neutrophil count (×10^3/μL)	9.11 (7.19–11.76)	11.69 (10.09–13.99)	<0.001
Absolute lymphocyte count (×10^3/μL)	1.08 (0.89–1.32)	1.03 (0.86–1.12)	0.133
Platelet count (×10^3/μL), mean ± SD	246.63 ± 50.04	240.10 ± 37.98	0.486
SII, median (IQR)	2172.56 (1459.13–2821.10)	2817.67 (2244.38–3928.38)	<0.001
NLR, median (IQR)	8.77 (5.65–11.19)	12.42 (9.88–16.77)	<0.001
CRP (mg/L), median (IQR)	103.26 (70.39–144.73)	165.67 (116.22–189.16)	<0.001
Serum lactate (mmol/L), median (IQR)	2.32 (1.54–2.90)	3.48 (3.15–3.85)	<0.001
SOFA score, median (IQR)	6.00 (3.00–8.00)	10.00 (8.00–12.00)	<0.001

Table 3: Comparison of Adverse Clinical Outcomes Between Survivors and Non-survivors (N=102)

Clinical outcome	Total (N=102)	Survivors (n=75)	Non-survivors (n=27)	p-value
Septic shock	33 (32.35%)	16 (21.33%)	17 (62.96%)	<0.001
Acute kidney injury	39 (38.24%)	22 (29.33%)	17 (62.96%)	0.002
ICU admission	68 (66.67%)	44 (58.67%)	24 (88.89%)	0.004
Mechanical ventilation	27 (26.47%)	13 (17.33%)	14 (51.85%)	<0.001
Renal replacement therapy	13 (12.75%)	4 (5.33%)	9 (33.33%)	<0.001
Hospital stay (days), median (IQR)	10.00 (7.00–12.00)	10.00 (8.00–12.00)	10.00 (7.00–12.00)	0.567

Table 4: Correlation of SII and NLR with Clinical and Inflammatory Parameters (N=102)

Clinical parameter	SII (Spearman's r)	p-value	NLR (Spearman's r)	p-value
SOFA score	0.751	<0.001	0.778	<0.001
Serum lactate	0.537	<0.001	0.562	<0.001
C-reactive protein	0.480	<0.001	0.499	<0.001
Age	0.231	0.019	0.231	0.019
Length of hospital stay	0.185	0.063	0.197	0.048

Table 5: Comparative Predictive Performance of SII and NLR for In-Hospital Mortality (N=102)

Predictive parameter	SII	NLR
ROC AUC	0.725	0.744
95% confidence interval	0.611–0.831	0.637–0.842
Optimal cutoff	2493.62	11.24
Sensitivity	70.37%	66.67%
Specificity	68.00%	77.33%
ROC p-value	<0.001	<0.001
Unadjusted odds ratio (95% CI)	1.84 (1.23–2.75)	2.06 (1.32–3.21)
Unadjusted regression p-value	0.003	0.001
Adjusted odds ratio (95% CI)	0.95 (0.60–1.51)	0.81 (0.44–1.50)
Adjusted regression p-value	0.836	0.506

DISCUSSION

The present study evaluated 102 hospitalized patients with sepsis, comprising 75 survivors (73.53%) and 27 non-survivors (26.47%), with an overall in-hospital mortality rate of 26.47%. The mean age of non-survivors was significantly higher than that of survivors (59.84 ± 15.67 versus 52.81 ± 11.94 years; p=0.041). Chronic kidney disease was significantly more prevalent among non-survivors (40.74%) than survivors (16.00%; p=0.008). Similar findings were reported by Kang et al. (2024), who conducted a nationwide cohort study involving 373,539 patients with sepsis in Korea. They observed that 13.70% of patients had chronic kidney disease, with an in-hospital mortality rate of 28.00% in this subgroup. In comparison, chronic kidney disease was present in 22.55% of patients in the present study, with a mortality rate of 47.83% among affected individuals. Their study also identified advanced age, male sex, and chronic kidney disease as factors associated with mortality.[7] Regarding the distribution of infection sources and associated comorbidities, respiratory tract infections were the most frequent infections in the present study, accounting for 47.06% of patients, followed by urinary tract infections in 22.55%. Respiratory infections were more common among non-survivors (59.26%) than survivors (42.67%). Diabetes mellitus was present in 35.29% of the total study population, while hypertension was more frequent among non-survivors (51.85% versus 33.33%; p=0.090). Comparable observations were reported by Nayak et al. (2025), who studied 100 patients with sepsis and identified pneumonia as the most frequent infection source (58.00%), followed by urinary tract infections (24.00%). Diabetes mellitus was the most common associated comorbidity (52.00%), followed by hypertension (36.00%) and chronic kidney disease (13.00%). Their findings were broadly consistent with the present study regarding the predominance of respiratory and urinary tract infections, although the proportions of underlying comorbidities differed.[8] The present study demonstrated significantly elevated Systemic Immune-Inflammation Index (SII) values among non-survivors compared with survivors, with median values of 2817.67 and 2172.56, respectively (p<0.001). Similarly, the median Neutrophil-to-Lymphocyte Ratio (NLR) was significantly higher among non-survivors (12.42 versus 8.77; p<0.001). These findings indicate an association between increased systemic inflammatory activity and mortality in patients with sepsis. Mangalesh et al. (2023) evaluated 267 patients with blood-culture-confirmed sepsis and reported 76 deaths, representing a mortality rate of 28.50%, which was comparable to the 26.47% observed in the present study. They identified SII and NLR as independent predictors of mortality, with adjusted odds ratios of 1.51 (95% CI: 1.24–1.84) and 1.67 (95% CI: 1.30–2.13), respectively. Their SII demonstrated an AUC of 0.848 at an optimal cutoff of 564, with 85.50% sensitivity and 71.20% specificity. In comparison, the present study demonstrated an SII AUC of 0.725, with 70.37% sensitivity and 68.00% specificity at a cutoff of 2493.62.[9] The association between elevated NLR and adverse clinical outcomes was another important finding of the present study. Non-survivors demonstrated significantly higher absolute neutrophil counts (11.69 versus 9.11 × 10^3/µL;

p<0.001) and NLR values (12.42 versus 8.77; p<0.001). NLR demonstrated an AUC of 0.744 for predicting in-hospital mortality, with an optimal cutoff of 11.24, sensitivity of 66.67%, and specificity of 77.33%. Similar findings were reported by Wen et al. (2024), who retrospectively studied 606 patients with sepsis, including 421 survivors and 185 non-survivors. Their study demonstrated significantly higher NLR values among non-survivors, with a first-day NLR AUC of 0.880 and an optimal cutoff of 10.769 for predicting in-hospital mortality. The NLR AUC decreased to 0.770 on day 2, 0.784 on day 3, and 0.732 on day 7. Their reported first-day NLR cutoff was close to that of the present study, although their initial discriminatory performance was higher.[10] The present study also demonstrated a significant association between organ dysfunction and unfavorable outcomes. Acute kidney injury occurred in 39 patients (38.24%) and was significantly more frequent among non-survivors (62.96%) compared with survivors (29.33%; p=0.002). Renal replacement therapy was required in 12.75% of patients and was more frequent among non-survivors (33.33% versus 5.33%; p<0.001). Similarly, mechanical ventilation was required in 51.85% of non-survivors compared with 17.33% of survivors (p<0.001), indicating greater organ support requirements among patients with fatal outcomes. Nandagopal et al. (2020) evaluated 242 critically ill patients and reported acute kidney injury in 111 patients (45.80%). Among patients with acute kidney injury, 55.80% had sepsis. Mortality was significantly higher among patients with septic acute kidney injury (25.80%) than among those with sepsis without acute kidney injury (5.60%; p<0.01). Additionally, renal replacement therapy was required in 19.30% of patients with septic acute kidney injury compared with 6.10% of those with non-septic acute kidney injury (p=0.04).[11] Disease severity assessment in the present study revealed significantly higher median SOFA scores among non-survivors (10.00) compared with survivors (6.00; p<0.001). Serum lactate concentrations were also significantly elevated among non-survivors (3.48 versus 2.32 mmol/L; p<0.001), suggesting greater circulatory and metabolic dysfunction. Septic shock occurred in 32.35% of patients and was substantially more frequent among non-survivors (62.96% versus 21.33%; p<0.001). Park et al. (2023) conducted a nationwide prospective observational study involving 6,734 patients with sepsis to evaluate the prognostic significance of combining serum lactate measurements with SOFA scores. They reported that the initial lactate-adjusted SOFA (Lac-SOFA) score demonstrated an AUC of 0.679 for in-hospital mortality, compared with 0.656 for the conventional SOFA score. On the third ICU day, the corresponding AUC values increased to 0.797 and 0.781, respectively (p<0.001 for comparisons). Although the present study did not calculate a combined Lac-SOFA score, its findings similarly demonstrated that elevated serum lactate and higher SOFA scores were associated with mortality.[12] Correlation analysis in the present study demonstrated strong positive associations between inflammatory indices and sepsis severity. SII and NLR were significantly correlated with SOFA scores (r=0.751 and r=0.778, respectively; both p<0.001). Moderate positive correlations were observed between SII and serum lactate (r=0.537) and between NLR and serum lactate (r=0.562). Similarly, SII and NLR demonstrated significant positive correlations with CRP (r=0.480 and r=0.499, respectively; both p<0.001). Rehman et al. (2020) investigated NLR as an early marker of sepsis and reported a positive correlation between NLR and SOFA score (r=0.214; p=0.012). They also observed a significant correlation between NLR and CRP (r=0.292; p=0.023), while the correlation between NLR and procalcitonin was stronger (r=0.760; p<0.01). Although the correlation coefficients reported in their study were lower than those observed in the present study, both investigations demonstrated positive relationships between NLR and conventional inflammatory or severity indicators.[13] Receiver operating characteristic analysis in the present study demonstrated moderate predictive performance for both SII and NLR, with AUC values of 0.725 (95% CI: 0.611–0.831) and 0.744 (95% CI: 0.637–0.842), respectively. NLR demonstrated slightly higher specificity (77.33%) than SII (68.00%), whereas SII showed marginally higher sensitivity (70.37% versus 66.67%). Wang et al. (2025) conducted a retrospective cohort study using the MIMIC-IV database to compare the prognostic performance of different inflammatory indices among patients with sepsis. They reported AUC values of 0.640 for the Systemic Immune-Inflammatory Complex Index (SIICI), 0.622 for the Systemic Inflammation Response Index (SIRI), and 0.586 for log-transformed SII in predicting 30-day mortality. The corresponding AUC values for SOFA and SAPS II scores were 0.756 and 0.739, respectively. Their SII AUC was lower than the 0.725 observed in the present study, although the studies differed in mortality endpoints, patient populations, and index transformations.[14] The multivariable analysis in the present study demonstrated that both SII and NLR were significantly associated with mortality before adjustment, with unadjusted odds ratios of 1.84 (95% CI: 1.23–2.75; p=0.003) and 2.06 (95% CI: 1.32–3.21; p=0.001), respectively. However, after adjustment for relevant clinical factors, neither SII (adjusted OR=0.95; p=0.836) nor NLR (adjusted OR=0.81; p=0.506) remained statistically significant. Similar findings regarding the limited independent predictive performance of NLR were reported by Bou Chebl et al. (2022), who conducted a prospective study involving 865 patients with sepsis. They identified an optimal NLR cutoff of 14.20 for predicting in-hospital mortality, with sensitivity of 44.80%, specificity of 65.30%, and an AUC of 0.552 (95% CI: 0.504–0.599). However, after adjustment for confounding factors, NLR was not independently

associated with mortality (OR=1.451; 95% CI: 0.927–2.270; p=0.103).[15]

CONCLUSION

The present study concluded that both the Systemic Immune-Inflammation Index (SII) and Neutrophil-to-Lymphocyte Ratio (NLR) were significantly elevated among non-survivors with sepsis and were positively associated with disease severity and organ dysfunction. NLR demonstrated slightly better predictive accuracy for in-hospital mortality (AUC=0.744) compared with SII (AUC=0.725). However, neither marker remained an independent predictor of mortality after adjustment for clinical severity factors. Both indices may serve as simple, inexpensive, and readily available supplementary tools for early risk stratification, but should be interpreted alongside established clinical severity scores.

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