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Original Research Article

A COMPARISON OF SEQUENTIAL ORGAN FAILURE ASSESMENT(SOFA) AND QUICK SOFA SCORES AND SIRS IN PREDICTING HOSPITAL MORTALITY IN CRITICALLY ILL PATIENTS AND CORRELATION WITH LACTATE ALBUMIN RATIO IN A TERTIARY CARE

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ABSTRACT

Background: Sepsis is a life-threatening syndrome characterized by a dysregulated host response to infection leading to organ dysfunction and high mortality. Early risk stratification is crucial for prompt management and improved outcomes. The Sequential Organ Failure Assessment (SOFA), quick Sequential Organ Failure Assessment (qSOFA), and Systemic Inflammatory Response Syndrome (SIRS) scores are commonly used for prognostication, but their comparative predictive value remains uncertain. The objective is to compare the predictive accuracy of SOFA, qSOFA, and SIRS scores for hospital mortality among critically ill patients with severe sepsis and septic shock.

Materials and Methods: This prospective observational study was conducted in the Department of General Medicine and Intensive Care Unit of Basaveshwara Medical College and Hospital, Chitradurga. A total of 125 adult patients diagnosed with severe sepsis or septic shock were enrolled. Demographic details, clinical characteristics, laboratory parameters, and comorbidities were recorded at admission. SOFA, qSOFA, and SIRS scores were calculated on admission, and patients were followed until discharge or death. Predictive performance was evaluated using receiver operating characteristic (ROC) curve analysis.

Results: The mean age of participants was 60.78 ± 16.09 years. Pulmonary tuberculosis was significantly associated with mortality (p=0.001). Lower oxygen saturation (p=0.016), reduced platelet count (p=0.003), elevated blood urea levels (p=0.023), and requirement of mechanical ventilation (p<0.001) were significantly associated with mortality. Higher qSOFA scores were associated with mortality (p=0.036), whereas SIRS scores were not (p=0.171). SOFA scores were significantly higher among non-survivors (p<0.001). ROC analysis showed superior predictive accuracy for SOFA (AUC=0.678), followed by qSOFA (AUC=0.613) and SIRS (AUC=0.605). Mechanical ventilation (AOR=17.35, p<0.001) and SOFA score (AOR=1.34, p=0.001) independently predicted mortality.

Conclusion: SOFA demonstrated the highest predictive accuracy for hospital mortality and may serve as the preferred prognostic tool in critically ill septic patients. Its use may facilitate early identification of high-risk patients and guide timely clinical interventions.

Keywords: Sepsis, Septic shock, SOFA, qSOFA, SIRS, Mortality prediction, Intensive care unit.

INTRODUCTION

Sepsis remains one of the leading causes of morbidity and mortality among critically ill patients worldwide despite substantial advances in antimicrobial therapy, organ support, and intensive care management.[1] It is currently defined as a life-threatening organ dysfunction caused by a dysregulated host response to infection. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) emphasized organ dysfunction as the central feature of sepsis and recommended the use of the Sequential Organ Failure Assessment (SOFA) score for its identification.[2] This shift from inflammation-based criteria to organ dysfunction-based assessment has significantly influenced the diagnosis, prognostication, and management of septic patients. Globally, sepsis accounts for millions of hospital admissions annually and remains a major contributor to healthcare burden, particularly in low- and middle-income countries.[3]

For many years, the diagnosis of sepsis was based on the Systemic Inflammatory Response Syndrome (SIRS) criteria, which include abnormalities in body temperature, heart rate, respiratory rate, and white blood cell count. Although SIRS is simple and highly sensitive, it lacks specificity because similar physiological responses may occur in several non-infectious conditions such as trauma, burns, pancreatitis, and postoperative states. Furthermore, some patients with severe sepsis and significant organ dysfunction may not fulfill SIRS criteria at presentation, limiting its reliability as a prognostic tool.[4]

The Sequential Organ Failure Assessment (SOFA) score was developed to quantify the extent of organ dysfunction in critically ill patients. It evaluates six major organ systems—respiratory, cardiovascular, hepatic, coagulation, renal, and neurological functions—and provides an objective measure of disease severity.[5] Numerous studies have demonstrated a strong association between increasing SOFA scores and mortality, making it a valuable tool for risk stratification and outcome prediction in intensive care settings.[4,5,6] However, the requirement for laboratory investigations may limit its immediate applicability in emergency situations and resource-constrained environments.

In resource-limited healthcare settings, selecting an accurate and practical prognostic tool is crucial for effective triage and allocation of critical care resources. Therefore, the present study was undertaken to compare the predictive accuracy of SOFA, qSOFA, and SIRS scores in determining hospital mortality among critically ill patients with severe sepsis and septic shock admitted to a tertiary care center. The findings may help identify the most reliable scoring system for early risk stratification and clinical decision-making in septic patients.

MATERIALS AND METHODS

This hospital-based prospective observational study was conducted in the Department of General Medicine, including the Intensive Care Unit (ICU) and Emergency Department, at Basaveshwara Medical College and Hospital, Chitradurga, Karnataka, between February 2024 and August 2025. The study aimed to compare the predictive accuracy of Sequential Organ Failure Assessment (SOFA), quick Sequential Organ Failure Assessment (qSOFA), and Systemic Inflammatory Response Syndrome (SIRS) scores for predicting in-hospital mortality among critically ill patients with severe sepsis and septic shock.

A total of 125 consecutive adult patients (≥18 years) admitted with a clinical diagnosis of severe sepsis or septic shock were enrolled after obtaining written informed consent. Patients with advanced malignancy, chronic kidney disease, known HIV infection, transfer from another hospital after more than 48 hours of initial management, or refusal to participate were excluded. Institutional Ethics Committee approval was obtained before study initiation.

At admission, detailed clinical history, demographic data, comorbidities, vital parameters, and laboratory investigations were recorded using a structured proforma. Baseline investigations included complete blood count, renal and liver function tests, arterial blood gas analysis, chest radiography, urine examination, and blood cultures where indicated. Neurological status was assessed using the Glasgow Coma Scale (GCS).

SOFA, qSOFA, and SIRS scores were calculated at presentation. The SOFA score was derived from assessment of respiratory, cardiovascular, hepatic, coagulation, renal, and neurological systems. qSOFA was calculated using systolic blood pressure ≤100 mmHg, respiratory rate ≥22/min, and altered mentation (GCS <15). SIRS score was determined based on standard criteria including temperature, heart rate, respiratory rate, and total leukocyte count abnormalities.

Patients were followed throughout their hospital stay. Clinical outcomes, requirement for mechanical ventilation, vasopressor support, and in-hospital mortality were recorded. The primary outcome measure was in-hospital mortality.

Data were analyzed using SPSS version 16. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Comparisons between survivors and non-survivors were performed using independent t-test and Chi-square test as appropriate. Receiver operating characteristic (ROC) curve analysis was used to evaluate the predictive performance of SOFA, qSOFA, and SIRS scores. Area under the curve (AUC), sensitivity, specificity, and optimal cut-off values were calculated. Multivariate logistic

regression analysis was performed to identify independent predictors of mortality. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Baseline Characteristics of Study Population (n=125)

Variable	Discharge (n=64)	Death (n=61)	p-value
Age (years), Mean ± SD	60.10 ± 16.02	61.49 ± 16.23	0.611
Male, n (%)	31 (49.2)	40 (64.5)	0.118
Female, n (%)	32 (50.8)	22 (35.5)	

The mean age and sex distribution were comparable between survivors and non-survivors. Neither age nor sex showed a significant association with hospital mortality.

Table 2: Clinical Characteristics Associated with Hospital Mortality

Variable	Discharge	Death	p-value
Pulmonary Tuberculosis, n (%)	1 (1.6)	14 (23.0)	0.001
SpO□ (%), Mean ± SD	90.96 ± 9.66	83.41 ± 14.54	0.016
Platelet Count (cells/mm³), Mean ± SD	93,415 ± 150,078	215,410 ± 266,651	0.003
Blood Urea (mg/dL), Mean ± SD	58.30 ± 28.14	72.33 ± 38.63	0.023
Mechanical Ventilation, n (%)	10 (15.6)	48 (78.7)	<0.001

Observation: Pulmonary tuberculosis, lower oxygen saturation, abnormal platelet count, elevated blood urea, and requirement of mechanical ventilation were significantly associated with mortality.

Table 3: Distribution of qSOFA Scores and Hospital Outcome

SOFA Score	Discharge n (%)	Death n (%)
0	17 (26.6)	12 (19.7)
1	38 (59.4)	27 (44.3)
2	8 (12.5)	17 (27.9)
3	1 (1.6)	5 (8.2)

Observation: Higher qSOFA scores were significantly more common among non-survivors, indicating increasing mortality risk with rising qSOFA scores.

Table 4: Distribution of SIRS Scores and Hospital Outcome

SIRS Score	Discharge n (%)	Death n (%)
1	4 (6.3)	2 (3.3)
2	18 (28.1)	9 (14.8)
3	28 (43.8)	29 (47.5)
4	14 (21.9)	21 (34.4)

Although higher SIRS scores were more frequent among non-survivors, the association with mortality was not statistically significant

Table 5: SOFA Score and Hospital Outcome

A. Categorical Analysis

SOFA Score	Discharge n (%)	Death n (%)
0–3	39 (60.9)	25 (41.0)
4–7	23 (35.9)	20 (32.8)
≥8	2 (3.1)	16 (26.2)

B. Continuous Analysis

Variable	Discharge (Mean ± SD)	Death (Mean ± SD)	p-value
SOFA Score	3.16 ± 2.41	5.11 ± 3.19	<0.001

SOFA scores were significantly higher among non-survivors. Patients with SOFA scores ≥8 had markedly increased mortality.

Table 6: Predictive Performance of SOFA, qSOFA and SIRS Scores

Score	AUC	Optimal Cut-off	Sensitivity (%)	Specificity (%)
SIRS	0.605	≥3	81.97	34.38
qSOFA	0.613	≥2	36.07	85.94
SOFA	0.678	≥7	36.07	92.19

SOFA demonstrated the highest overall discriminative ability (AUC 0.678) and specificity (92.19%). SIRS showed the highest sensitivity but poor specificity.

Table 7: Comparison of ROC Curves for Mortality Prediction

Comparison	AUC Difference	Z-value	p-value
SOFA vs SIRS	0.073	1.12	0.262
SOFA vs qSOFA	0.065	1.01	0.311
qSOFA vs SIRS	0.008	0.15	0.880

Although SOFA had the highest AUC, differences in predictive performance among SOFA, qSOFA, and SIRS were not statistically significant.

Table 8: Multivariate Logistic Regression Analysis for Hospital Mortality

Variable	Adjusted Odds Ratio	95% CI	p-value
Age	1.01	0.98–1.04	0.602
Male Sex	1.82	0.86–3.85	0.117
Mechanical Ventilation	17.35	6.45–46.68	<0.001
SOFA Score	1.34	1.12–1.60	0.001
qSOFA Score	1.29	0.85–1.96	0.230
SIRS Score	1.18	0.77–1.81	0.438

SIRS Score 1.18 0.77–1.81 0.438 Mechanical ventilation and SOFA score emerged as independent predictors of hospital mortality. qSOFA and SIRS did not independently predict mortality after adjustment.

Table 9. Hepatic and Metabolic Parameters and Association with Hospital Outcome. Sample size: n = 125

Parameter	Overall (Mean ± SD)	Discharge (Mean ± SD)	Death (Mean ± SD)	Test Used	Test Statistic	p-value
Serum Bilirubin (mg/dL)	1.08 ± 1.18	1.02 ± 1.05	1.14 ± 1.30	Independent t-test (Welch)	t = -0.561	0.576
Serum Lactate (mg/dL)	8.76 ± 8.75	8.09 ± 7.18	9.47 ± 10.16	Independent t-test (Welch)	t = -0.876	0.383
Serum Albumin (g/dL)	3.52 ± 3.21	3.92 ± 4.38	3.09 ± 0.76	Independent t-test (Welch)	t = 1.495	0.140
Lactate–Albumin Ratio (LA Ratio)	2.49	2.06	3.06	Derived Variable	—	—

Inference:

- Serum bilirubin levels were slightly higher among non-survivors but did not show a statistically significant association with mortality (p = 0.576).
- Serum lactate levels were higher among non-survivors; however, this difference was not statistically significant (p = 0.383).
- Serum albumin levels were lower among non-survivors (3.09 g/dL) compared to survivors (3.92 g/dL), but this difference did not reach statistical significance (p = 0.140).
- The Lactate–Albumin (LA) ratio was markedly higher among non-survivors (3.06) compared to survivors (2.06), suggesting worse metabolic and inflammatory status among patients who died. Although formal statistical testing of the derived ratio was not performed, the higher LA ratio among non-survivors may indicate poorer prognosis.

DISCUSSION

The present prospective observational study compared the prognostic performance of SOFA, qSOFA, and SIRS scores in predicting hospital mortality among critically ill patients with severe sepsis and septic shock. Of the 125 patients enrolled, mortality was observed in 61 (48.8%) patients. The study demonstrated that SOFA score had the best overall predictive performance, while qSOFA showed moderate prognostic utility and SIRS had the least discriminative ability.

The mean age of the study population was 60.78 ± 16.09 years, and neither age nor sex showed a significant association with hospital mortality. Similar findings have been reported in previous sepsis studies, suggesting that disease severity and organ dysfunction are stronger determinants of outcome than demographic factors alone.[7,8,9] Pulmonary infections were the most common source of sepsis in both survivors and non-survivors, reflecting the global epidemiological trend of

respiratory tract infections being the leading cause of severe sepsis. However, the source of infection was not significantly associated with mortality.

Among comorbidities, pulmonary tuberculosis demonstrated a significant association with mortality, highlighting the adverse impact of chronic pulmonary disease on septic outcomes. Diabetes mellitus, hypertension, and cerebrovascular disease were not significantly associated with mortality. Patients with pulmonary tuberculosis may have impaired pulmonary reserve and altered immune responses, predisposing them to worse outcomes during severe sepsis.[10]

Evaluation of admission parameters revealed that oxygen saturation was significantly lower among non-survivors, indicating the importance of early respiratory compromise in predicting adverse outcomes. Similarly, elevated blood urea levels and abnormal platelet counts were significantly associated with mortality. Renal dysfunction and hematological abnormalities are well-recognized manifestations of organ failure in sepsis and have consistently been associated with poor prognosis.[11,12] In contrast, pulse rate, blood pressure, respiratory rate, leukocyte count, serum creatinine, bilirubin, lactate, and albumin levels did not independently discriminate between survivors and non-survivors.

Mechanical ventilation was strongly associated with mortality, with nearly four-fifths of non-survivors requiring ventilatory support. Multivariate analysis further confirmed mechanical ventilation as the strongest independent predictor of hospital mortality. This finding reflects the severity of respiratory failure and overall critical illness among patients requiring advanced organ support.[13]

Among the sepsis scoring systems evaluated, qSOFA demonstrated a significant association with mortality, with higher scores occurring more frequently among non-survivors. However, its predictive performance was moderate, with high specificity but limited sensitivity. These findings are consistent with previous studies reporting that qSOFA is useful as a bedside screening tool but may miss a substantial proportion of high-risk patients when used alone.[14,15]

In contrast, SIRS score was not significantly associated with mortality. Although SIRS ≥3 showed high sensitivity, its poor specificity limited its usefulness for risk stratification. This observation supports the growing recognition that inflammatory response criteria alone are insufficient for identifying patients at highest risk of death and explains the reduced emphasis placed on SIRS in contemporary sepsis definitions.

SOFA score demonstrated the strongest relationship with hospital mortality. Non-survivors had significantly higher mean SOFA scores than survivors, and mortality increased progressively with higher SOFA categories. ROC analysis showed that SOFA had the highest area under the curve (AUC 0.678), outperforming qSOFA (0.613) and SIRS (0.605). Furthermore, SOFA remained an independent predictor of mortality after multivariate adjustment, whereas qSOFA and SIRS did not. These findings emphasize the superiority of organ dysfunction–based assessment in predicting outcomes among critically ill septic patients.[13,14,15]

Overall, the present study supports the use of SOFA score as the most reliable prognostic tool among the three evaluated scoring systems for predicting hospital mortality in severe sepsis and septic shock. qSOFA may serve as a rapid bedside screening tool, whereas SIRS appears less useful for prognostication. Early identification of high-risk patients using organ dysfunction–based scoring systems may facilitate timely intervention and improve clinical outcomes.

Limitations

The study was conducted at a single tertiary care center with a relatively limited sample size, which may restrict the generalizability of the findings. Scoring systems were assessed only at admission, and serial measurements were not performed. Important biomarkers such as procalcitonin and C-reactive protein were not included in the analysis. Additionally, long-term outcomes beyond hospital discharge were not evaluated. Future multicentric studies with larger sample sizes, serial score assessments, and long-term follow-up are required to further validate these findings.

CONCLUSION

In this prospective observational study of 125 critically ill patients with severe sepsis and septic shock, SOFA score demonstrated the best overall performance for predicting in-hospital mortality among the three scoring systems evaluated. Higher SOFA scores were significantly associated with mortality and remained an independent predictor of death on multivariate analysis. qSOFA also showed a significant association with mortality but had lower predictive accuracy, whereas SIRS demonstrated limited prognostic utility.

Mechanical ventilation emerged as the strongest independent predictor of mortality, while pulmonary tuberculosis, lower oxygen saturation, abnormal platelet count, and elevated blood urea levels were significantly associated with adverse outcomes. These findings highlight the importance of early recognition of organ dysfunction and severity of illness in septic patients.

Overall, the results support the use of SOFA as the preferred prognostic tool for risk stratification in severe sepsis and septic shock. qSOFA may serve as a rapid bedside screening tool, particularly in resource-limited settings, whereas SIRS alone appears insufficient for mortality prediction. Incorporation of organ dysfunction–based scoring systems into routine clinical practice may facilitate early identification of high-risk patients and

improve clinical decision-making in critically ill septic patients.

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