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Effectiveness of Sofa Score in Predicting the Outcomes in Cases of Sepsis in Acute Surgical Diseases

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ABSTRACT

Introduction: *Sepsis remains a major cause of morbidity and mortality worldwide, particularly among surgical patients where postoperative infections and inflammatory responses complicate recognition. Accurate prognostic tools are essential for timely intervention. The Sequential Organ Failure Assessment (SOFA) score has been recommended under Sepsis-3 criteria for predicting sepsis-related outcomes, but evidence in acute surgical cohorts remains limited. The objective of the study is to evaluate the effectiveness of the SOFA score in predicting outcomes among patients with sepsis admitted under General Surgery in a tertiary care teaching hospital.*

Materials and Methods: *This prospective observational study was conducted at Adichunchanagiri Institute of Medical Sciences, Adichunchanagiri University, Karnataka, from March 2023 to October 2024. A total of 100 adult patients with sepsis admitted under General Surgery were enrolled. SOFA scores were calculated at admission, and outcomes were recorded as discharge or mortality. Data were analyzed using SPSS v26, with diagnostic accuracy assessed via sensitivity, specificity, predictive values, and AUROC.*

Results: *The mean age was 60.37 ± 15.63 years, with males comprising 82% of participants. Overall mortality was 47%. Patients who died had significantly higher SOFA scores (mean 9.43 ± 3.16) compared to survivors (6.76 ± 5.13; p=0.001). A SOFA cut-off >14 predicted mortality with 94.3% sensitivity, 97.9% specificity, PPV of 98.0%, NPV of 93.9%, and AUROC of 0.996 (95% CI: 0.990–1.000).*

Conclusion: *The SOFA score demonstrated excellent predictive accuracy for mortality in surgical patients with sepsis, underscoring its value as a practical and reliable tool for early risk stratification and guiding timely clinical interventions.*

Keywords: *Sepsis, SOFA score, Surgical outcomes*

INTRODUCTION

Sepsis is a life-threatening syndrome characterized by organ dysfunction resulting from a dysregulated host response to infection [1]. Despite advances in therapeutic strategies, sepsis continues to be a major cause of mortality worldwide, with poor outcomes largely attributed to delays in recognition and initiation of appropriate treatment [2]. This has led to growing emphasis on the development of standardized criteria and tools for the early identification of sepsis, aimed at improving survival rates through timely intervention [3,4]. Historically, sepsis was defined as suspected or confirmed infection accompanied by two or more systemic inflammatory response syndrome (SIRS) criteria [5]. However, evolving insights into the underlying pathobiology have prompted refinements in its clinical definition.

In 2016, the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) redefined sepsis as life-threatening organ dysfunction caused by a dysregulated host response to infection, shifting away from SIRS-based criteria [1]. The consensus recommended the use of the Sequential Organ Failure Assessment (SOFA) score for identifying sepsis in intensive care unit (ICU) patients, while also

introducing the quick SOFA (qSOFA) score as a simple bedside tool for non-ICU settings [6,7]. The qSOFA score—based on altered mentation, systolic blood pressure <100 mmHg, and respiratory rate ≥22 breaths/min—demonstrated predictive value for mortality in patients outside the ICU [7]. Nonetheless, limitations remain, as neither SOFA nor qSOFA provides a diagnostic gold standard with both high sensitivity and specificity for sepsis [1].

Intermediate Care Units (IMCUs) occupy a transitional role between general wards and ICUs, catering to patients requiring closer monitoring and higher nursing intensity than ward care, but without the full resources of intensive care [8–10]. While IMCUs may provide continuous vital sign monitoring, their therapeutic capacities—such as mechanical ventilation, renal replacement therapy, and advanced vasopressor support—are limited compared to ICUs [11]. Evidence suggests that the presence of IMCUs contributes to improved hospital outcomes by reducing ICU burden and mortality [12–14]. Studies have further demonstrated that select patients, including those with septic shock, can be successfully managed in IMCUs, highlighting their role as a viable critical care environment [15].

Surgical patients frequently occupy IMCUs, as they are often extubated shortly after surgery and do not meet ICU admission criteria. However, postoperative infections are common in this population, and differentiating between surgical complications and infection-related inflammatory responses can be challenging [16,17]. This creates uncertainty about whether such patients should be stratified as ICU or non-ICU cases for the purpose of sepsis detection and monitoring. Consequently, there are no explicit guidelines on whether SOFA or qSOFA is more appropriate in this setting. Hence, the present study was aimed to evaluate the effectiveness of the SOFA score in predicting outcomes among surgical patients with acute sepsis admitted to a tertiary care teaching hospital.

MATERIALS AND METHODS

This hospital-based prospective observational study was conducted in the Department of General Surgery at Adichunchanagiri Institute of Medical Sciences, Adichunchanagiri University, B.G. Nagara. The study was carried out over a period of 18 months, from March 2023 to October 2024. All patients diagnosed with sepsis and admitted under General Surgery, either through casualty, wards, or the intensive care unit (ICU), were considered for inclusion. Records of patient outcomes were documented at the time of discharge or death.

Patients were enrolled based on predefined eligibility criteria. Inclusion criteria consisted of adult patients (≥18 years) admitted under General Surgery with a clinical diagnosis of sepsis who provided informed consent. Exclusion criteria included patients younger than 18 years, those discharged against medical advice, and patients in whom outcome documentation was incomplete due to early demise without sufficient clinical data.

Detailed clinical evaluation was performed for all eligible patients at the time of admission. This included a comprehensive history, physical examination, and relevant laboratory investigations. Data were recorded prospectively using a structured and pre-tested proforma designed for the study. The proforma included patient demographics, presenting complaints, vital parameters, systemic examination findings, clinical diagnosis, and laboratory values. While clinical stabilization and resuscitation were undertaken simultaneously, data collection was carried out systematically to ensure accuracy and completeness.

The Sequential Organ Failure Assessment (SOFA) score was employed to assess organ dysfunction and predict patient outcomes. The score was calculated based on standard parameters, including respiratory, cardiovascular, hepatic, renal, coagulation, and neurological systems. Outcomes of interest were classified as primary (comparison of observed mortality with SOFA-predicted mortality) and secondary (incidence and severity of organ dysfunction across study subjects).

Data were entered into Microsoft Excel and analyzed using SPSS software version 26 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD) and median with range, while categorical variables were summarized as frequencies and percentages. The Mann–Whitney U test was used for comparing continuous variables between outcome groups, and the Chi-square test was applied for categorical variables. Diagnostic performance of the SOFA score was evaluated using sensitivity, specificity, predictive values, likelihood ratios, and area under the receiver operating characteristic (AUROC) curve. A p-value <0.05 was considered statistically significant.

RESULTS

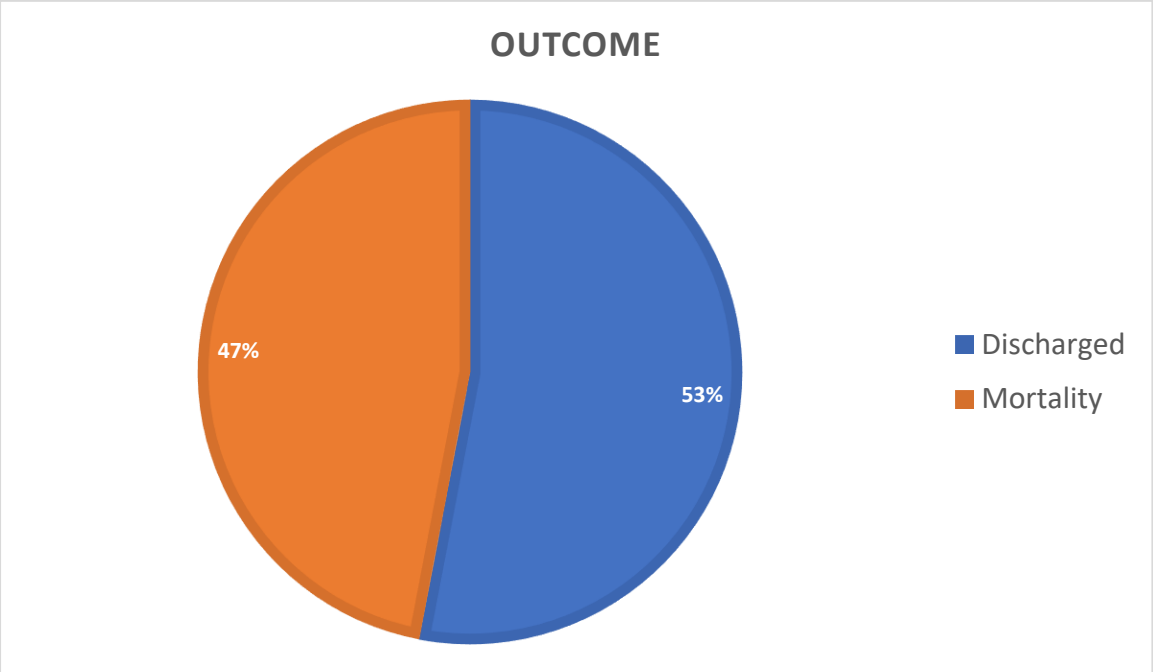
The mean age of the study cohort was 60.37 ± 15.63 years, with participants ranging from 24 to 92 years, and a median age of 63 years. Males constituted the majority of the study population (82%), while females accounted for only 18% (Table 1).

Table 1. Baseline Demographic Characteristics of Study Participants (N = 100)

Variable	Sub-category	n (%) / Mean ± SD
Age	years	60.37 ± 15.63
Sex	Male	82 (82.0)
	Female	18 (18.0)

Clinical outcomes revealed that slightly more than half of the patients (53%) were discharged, while 47% experienced mortality, indicating a nearly equal distribution between the two groups (Figure 1).

Figure 1: Pie chart showing distribution of Clinical Outcome



When demographic characteristics were analyzed against outcome, no statistically significant difference was observed. The mean age was comparable between discharged patients (60.6 ± 16.67 years) and those who died (59.97 ± 14.56 years, p=0.661). Similarly, sex distribution did not differ significantly between the groups, with males predominating in both (p=0.200) (Table 2).

Table 2: Comparison of Demographic Characteristics by Outcome

Variable	Discharged (n=53)	Mortality (n=47)	p-value
Age (years)	60.6 ± 16.67 (27–92)	59.97 ± 14.56 (24–88)	0.661
Sex	Female: 12 (22.6%) Male: 41 (77.4%)	Female: 6 (12.8%) Male: 41 (87.2%)	0.200

Evaluation of laboratory and clinical parameters demonstrated significant differences between outcomes. Patients who died had markedly lower PaO_2/FiO_2 ratios and GCS scores, while bilirubin and creatinine levels were significantly elevated compared to those discharged. Platelet counts were also substantially reduced among non-survivors. All these parameters showed strong statistical significance ($p<0.001$), highlighting their prognostic relevance (Table 3).

Table 3: Comparison of Laboratory and Clinical Variables by Outcome

Variable	Discharged (n=53)	Mortality (n=47)	Total (N=100)	p-value
PaO_2/FiO_2	300.88 ± 95.93 (90–415)	120.99 ± 36.08 (90–250)	216.32 ± 116.55 (90–415)	<0.001

Bilirubin (mg/dL)	2.44 ± 1.56 (0.6–7.6)	10.29 ± 6.35 (1.1–20)	6.09 ± 5.92 (0.6–20)	<0.001
Creatinine (mg/dL)	2.83 ± 2.16 (0.6–8)	6.21 ± 2.55 (1.2–10)	4.43 ± 2.87 (0.6–10)	<0.001
Platelets (µL)	171,738 ± 118,174 (41,000–500,000)	34,500 ± 17,136 (17,000–96,000)	107,236 ± 110,502 (17,000–500,000)	<0.001
GCS	12.77 ± 2.68 (7–15)	5.94 ± 2.06 (4–13)	9.56 ± 4.18 (4–15)	<0.001

The SOFA score was found to be significantly higher in patients with mortality compared to survivors. Discharged patients had a mean SOFA score of 6.76 ± 5.13 (median 7), while those who died had a mean of 9.43 ± 3.16 (median 18), with p=0.001 indicating a strong association between higher SOFA scores and adverse outcomes (Table 4).

Table 4: Comparison of SOFA Score by Outcome

Outcome	Mean ± SD	Median (Min–Max)	p-value
Discharged (n=53)	6.76 ± 5.13	7 (0–16)	0.001
Mortality (n=47)	9.43 ± 3.16	18 (14–24)	
Total (N=100)	12.76 ± 7.70	14 (0–24)	

Diagnostic performance analysis of the SOFA score demonstrated excellent predictive accuracy for mortality. A cut-off value greater than 14 yielded a sensitivity of 94.34% and specificity of 97.87%, with a positive predictive value of 98.04% and a negative predictive value of 93.88%. The AUROC was exceptionally high at 0.996 (95% CI: 0.990–1.000), confirming its robust discriminatory ability (Table 5).

Table 5: Diagnostic Accuracy of SOFA Score for Predicting Mortality

Parameter	Value (95% CI)
Cut-off	>14
Sensitivity	94.34% (84.34–98.82)
Specificity	97.87% (88.71–99.95)
Positive Predictive Value (PPV)	98.04% (89.51–99.60)
Negative Predictive Value (NPV)	93.88% (83.20–99.84)
LR+	44.34 (6.37–308.59)
LR–	0.06 (0.02–0.17)
AUROC	0.996 (0.990–1.000)
p-value	0.0043

DISCUSSION

The Sequential Organ Failure Assessment (SOFA) score remains one of the most widely validated prognostic tools in sepsis, consistently demonstrating strong predictive accuracy for mortality. Numerous studies have shown a direct correlation between higher SOFA scores and increased risk of death, with the prognostic value improving when assessed sequentially during the first 48–72 hours of admission [1,2]. Compared with other scoring systems, SOFA offers distinct advantages. While APACHE II and SAPS II provide comprehensive assessments, they require extensive data and incorporate chronic comorbidities, making them less practical for serial monitoring. By contrast, SOFA focuses on acute organ dysfunction and can be recalculated repeatedly at the bedside, offering a dynamic picture of patient trajectory. Furthermore, SOFA has shown greater predictive accuracy for in-hospital mortality than both qSOFA and SIRS criteria, particularly in critically ill populations [3–5].

Beyond ICU settings, SOFA has demonstrated relevance in intermediate and ward-level care, where early recognition of organ dysfunction remains vital. Patients presenting with septic shock show particularly strong correlations between elevated SOFA scores and mortality risk, underscoring its applicability in identifying high-risk groups [6]. Importantly, the score captures the severity of dysfunction across six organ systems, thereby guiding therapeutic decision-making. Serial assessments can inform clinicians about the progression or resolution of organ failure, enabling timely escalation of care such as mechanical

ventilation, vasopressor support, or renal replacement therapy. This adaptability strengthens its clinical utility across diverse care environments, from intensive to step-down units [7,8].

Despite its strengths, certain limitations constrain the SOFA score's universal applicability. It was originally designed to describe organ dysfunction rather than predict mortality, and its calculation requires laboratory and clinical data that may be difficult to obtain in low-resource settings [9]. Pre-existing chronic illnesses such as cirrhosis or renal disease may elevate baseline SOFA scores, complicating interpretation unless serial changes are emphasized over absolute values. Moreover, variability in the timing and frequency of assessments across institutions can influence its predictive accuracy. Research also highlights demographic influences, with performance differing by age, comorbidity burden, and infection source, suggesting that SOFA may underestimate risk in elderly populations while overestimating it in younger patients [10,11].

Nevertheless, the clinical significance of SOFA extends beyond mortality prediction. It has become integral to the Sepsis-3 definition, with a change of ≥2 points serving as a diagnostic marker of sepsis [1]. Its structured evaluation of six organ systems provides a systematic framework for clinicians to assess disease severity, stratify risk, and optimize resource allocation. Serial SOFA measurements also allow institutions to benchmark ICU performance and improve quality of care, while its widespread use in clinical research ensures consistency and comparability across studies. Thus, while limitations related to resource requirements, baseline comorbidities, and variability in application exist, the SOFA score remains a pragmatic, reliable, and clinically meaningful tool for evaluating sepsis severity and guiding patient management.

CONCLUSION

The present study reaffirms that the SOFA score is a reliable and practical tool for predicting mortality in patients with sepsis, demonstrating strong clinical value through its good predictive accuracy and ease of integration into standard care pathways. By enabling early identification of high-risk patients, the SOFA score can guide timely interventions and improve patient management, thereby contributing to better outcomes and reduced sepsis-related mortality. Continued efforts to address its limitations and optimize its application in diverse clinical settings will further enhance its effectiveness, ultimately helping to save more lives and reduce the global burden of sepsis.

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