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Research Article

Predictors of Mortality among Patients Presenting with Sepsis in the Emergency Department: A Prospective Observational Study

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Abstract: ***Introduction:*** Sepsis is a time-sensitive emergency associated with substantial in-hospital mortality, particularly when shock, organ dysfunction, tissue hypoperfusion, and respiratory failure are present at admission.**Objectives:** To determine clinical and biochemical predictors of in-hospital mortality among patients presenting with sepsis in the Emergency Department.**Methods:** This prospective observational study was conducted in the Department of Emergency Medicine, KIMS Saveera Hospital, Anantapur, Andhra Pradesh, India, from February 2025 to January 2026. A total of 100 adult patients presenting with sepsis were enrolled by consecutive sampling. Demographic profile, comorbidities, source of sepsis, clinical severity, SOFA score, qSOFA score, serum lactate, renal dysfunction, antibiotic timing, vasopressor support, mechanical ventilation, and in-hospital outcome were recorded. Survivors and non-survivors were compared, and multivariate logistic regression was performed to identify independent predictors of mortality.**Results:** The mean age was 58.6 ± 15.2 years, and 60.0% were males. Respiratory infection was the most common source of sepsis. The overall in-hospital mortality rate was 28.0%. Mortality was higher among patients with age ≥60 years, chronic kidney disease, septic shock, SOFA score ≥8, qSOFA score ≥2, serum lactate >4 mmol/L, acute kidney injury, delayed antibiotics, vasopressor requirement, and mechanical ventilation. On multivariate analysis, septic shock, SOFA score ≥8, serum lactate >4 mmol/L, acute kidney injury, and mechanical ventilation were independent predictors of mortality.**Conclusion:** Mortality in Emergency Department sepsis was mainly associated with shock, high organ dysfunction burden, hyperlactatemia, renal dysfunction, and ventilatory requirement. Early recognition of these predictors can support risk stratification and timely intensive management.

Keywords: Sepsis; Septic shock; Emergency Department; Mortality; SOFA score; Serum lactate; Acute kidney injury.

INTRODUCTION

Sepsis remains one of the most serious clinical emergencies encountered in acute care practice. It represents life-threatening organ dysfunction caused by a dysregulated host response to infection, and its progression to septic shock reflects profound circulatory, cellular, and metabolic abnormalities [1,2]. The Emergency Department is often the first point of hospital contact for patients with sepsis. Decisions made during the initial hours, including recognition of severity, initiation of antimicrobial therapy, resuscitation, and escalation to critical care, strongly influence subsequent clinical trajectory [6,7]. Because sepsis is heterogeneous in presentation, structured assessment of mortality risk is essential for prioritizing treatment and allocating limited intensive care resources.

The global burden of sepsis is substantial. Large epidemiological analyses have shown that sepsis contributes heavily to hospital admission, health-system expenditure, and death across both high-income and resource-limited settings [3,4]. In hospital-treated sepsis, mortality remains clinically important despite advances in antimicrobial therapy, protocolized resuscitation, and organ support. This burden is especially relevant in Emergency Departments where patients present with varying degrees of physiological instability, comorbid disease, delayed referral, or partially treated infection.

Several clinical and laboratory variables have been studied as prognostic markers in sepsis. The Sequential Organ Failure Assessment score provides a structured measure of organ dysfunction and has shown meaningful prognostic value in critically ill patients [10,11]. The quick SOFA score was developed as a bedside tool to identify infected patients at increased risk of poor outcome outside intensive care settings [5,12]. Serum lactate is a marker of tissue hypoperfusion and metabolic stress, and elevated lactate levels are consistently associated with adverse outcomes even in the absence of overt shock [13]. Septic shock, acute kidney injury, vasopressor requirement, and need for mechanical ventilation further indicate advanced physiological compromise and are frequently linked to mortality [4,14].

Early antibiotic administration has also received major attention in sepsis care. The Surviving Sepsis Campaign recommends rapid recognition, timely antimicrobial therapy, hemodynamic resuscitation, lactate assessment, and vasopressor support when shock persists [6,7].

Observational evidence from large cohorts has reported an association between delay in treatment and increased mortality, although the strength of this relationship is influenced by baseline severity and clinical context [8,9].

The objective of this study was to evaluate predictors of in-hospital mortality among adult patients presenting with sepsis to the Emergency Department of KIMS Saveera Hospital, Anantapur. The study specifically assessed demographic characteristics, comorbid illnesses, source of sepsis, clinical severity indices, lactate elevation, renal dysfunction, antibiotic timing, vasopressor requirement, mechanical ventilation, and their association with survival outcome.

Methodology

Study design and setting: This prospective observational study was conducted in the Department of Emergency Medicine, KIMS Saveera Hospital, Anantapur, Andhra Pradesh, India. The study period extended from February 2025 to January 2026. The hospital is a tertiary care centre providing emergency, critical care, medical, surgical, laboratory, and imaging services. The Emergency Department receives acutely ill adult patients requiring initial stabilization, sepsis assessment, antimicrobial therapy, organ support, and intensive care referral.

Study population and sample size: Adult patients presenting to the Emergency Department with clinical suspicion of infection and features consistent with sepsis were screened. Sepsis and septic shock were defined using Sepsis-3 concepts [3,4]. Sample size was calculated using $n = Z^2pq/d^2$. With expected hospital-treated sepsis mortality of 27%, 95% confidence and 9% absolute precision, the minimum sample was 94; this was rounded to 100 [2]. Consecutive eligible patients were enrolled.

Eligibility criteria: Patients aged 18 years and above who presented with suspected or documented infection and sepsis-related organ dysfunction were included. Patients were excluded if they were brought dead, discharged against medical advice before outcome assessment, referred after prolonged inpatient treatment elsewhere without adequate baseline data, had incomplete records for key predictor variables, or declined consent through the patient or legally authorized representative.

Data collection procedure: After initial stabilization, demographic details, comorbidities, presenting symptoms, vital parameters, probable source of infection, laboratory investigations, serum lactate, platelet count, serum creatinine, SOFA score, qSOFA score, antibiotic timing, vasopressor use, mechanical ventilation, and clinical outcome were recorded in a structured proforma. SOFA scoring was used to quantify organ dysfunction [10]. qSOFA score was recorded as a bedside risk stratification variable in accordance with published emergency care evidence [5,12]. Antibiotic timing was grouped as administration within one hour or after one hour from Emergency Department recognition of sepsis.

Outcome variables: The primary outcome was in-hospital mortality. Patients were categorized as survivors and non-survivors. Predictor variables included age, sex, diabetes mellitus, hypertension, chronic kidney disease, chronic obstructive pulmonary disease, malignancy, source of sepsis, septic shock, SOFA score ≥8, qSOFA score ≥2, serum lactate >4 mmol/L, acute kidney injury, thrombocytopenia, serum creatinine >2 mg/dL, antibiotic administration after one hour, vasopressor requirement, and mechanical ventilation.

Statistical analysis: Data were entered into a spreadsheet and analyzed using standard statistical methods. Continuous variables were summarized as mean and standard deviation, while categorical variables were expressed as frequency and percentage. Survivors and non-survivors were compared using the chi-square test for categorical variables. Variables with clinical relevance and significant univariate association were entered into multivariate logistic regression analysis. Adjusted odds ratios with 95% confidence intervals were calculated. A p-value <0.05 was considered statistically significant.

Ethical considerations: The study was conducted after approval from the Institutional Ethics Committee of KIMS Saveera Hospital, Anantapur, Andhra Pradesh, India.Written informed consent was obtained from each participant or legally authorized representative. The study was observational and did not interfere with standard emergency care. Patient confidentiality was maintained by anonymizing data before analysis.

RESULTS

A total of 100 patients presenting with sepsis in the Emergency Department were included in the study. The mean age of the study population was 58.6 ± 15.2 years. Most patients were aged ≥60 years, and males constituted 60.0% of the sample. Diabetes mellitus was the most common comorbidity, followed by chronic kidney disease and chronic obstructive pulmonary disease. The most frequent source of sepsis was respiratory tract infection, followed by urinary

tract infection and intra-abdominal infection. The overall in-hospital mortality rate was 28.0%, while 72.0% of patients survived. The baseline profile is shown in Table 1.

Table 1. Baseline demographic and clinical characteristics of the study population

Variable	Frequency / Mean	Percentage
Total patients	100	100.0
Mean age, years	58.6 ± 15.2	—
Age <60 years	45	45.0
Age ≥60 years	55	55.0
Male	60	60.0
Female	40	40.0
Diabetes mellitus	42	42.0
Hypertension	36	36.0
Chronic kidney disease	20	20.0
Chronic obstructive pulmonary disease	18	18.0
Malignancy	8	8.0
Respiratory source of sepsis	38	38.0
Urinary source of sepsis	24	24.0
Intra-abdominal source of sepsis	18	18.0
Skin and soft tissue source	12	12.0
Unknown source	8	8.0

On clinical assessment, fever, tachycardia, tachypnoea, and altered sensorium were commonly observed. Septic shock was present in 34.0% of patients at presentation. The mean SOFA score was 7.1 ± 3.2. Raised serum lactate level was frequent, with 30.0% of patients having serum lactate >4 mmol/L. Acute kidney injury was documented in 40.0% of patients. Vasopressor support was required in 32.0%, and mechanical ventilation was required in 25.0% of patients. Clinical severity and treatment-related variables are presented in Table 2.

Table 2. Clinical severity and treatment-related variables

Variable	Frequency / Mean	Percentage
Fever	78	78.0
Tachycardia	82	82.0
Tachypnoea	76	76.0
Altered sensorium	35	35.0
Septic shock at presentation	34	34.0
Mean SOFA score	7.1 ± 3.2	—
SOFA score ≥8	38	38.0
qSOFA score ≥2	62	62.0

Variable	Frequency / Mean	Percentage
Serum lactate >4 mmol/L	30	30.0
Acute kidney injury	40	40.0
Platelet count <100,000/mm³	26	26.0
Serum creatinine >2 mg/dL	34	34.0
Antibiotics administered within 1 hour	52	52.0
Antibiotics administered after 1 hour	48	48.0
Vasopressor support required	32	32.0
Mechanical ventilation required	25	25.0

Among the 100 patients, 28 patients died during hospital stay. Mortality was higher among patients aged ≥60 years, those with chronic kidney disease, septic shock, high SOFA score, qSOFA score ≥2, serum lactate >4 mmol/L, acute kidney injury, vasopressor requirement, and need for mechanical ventilation. Delayed administration of antibiotics beyond one hour was also associated with a higher proportion of mortality. The comparison of survivors and non-survivors is shown in Table 3.

Table 3. Comparison of survivors and non-survivors

Variable	Survivors (n=72)	Non-survivors (n=28)	p-value
Age ≥60 years	34	21	0.011
Male sex	42	18	0.557
Diabetes mellitus	26	16	0.071
Chronic kidney disease	10	10	0.018
Respiratory source of sepsis	26	12	0.530
Septic shock	14	20	<0.001
SOFA score ≥8	17	21	<0.001
qSOFA score ≥2	38	24	0.002
Serum lactate >4 mmol/L	12	18	<0.001
Acute kidney injury	20	20	<0.001
Antibiotics after 1 hour	30	18	0.041
Vasopressor support	12	20	<0.001
Mechanical ventilation	8	17	<0.001

On multivariate logistic regression analysis, septic shock, SOFA score ≥8, serum lactate >4 mmol/L, acute kidney injury, and requirement of mechanical ventilation were independent predictors of mortality. Septic shock showed the strongest association with mortality, followed by high serum lactate and mechanical ventilation requirement. The regression analysis is summarized in Table 4.

Table 4. Multivariate logistic regression analysis of predictors of mortality

Predictor	Adjusted odds ratio	95% confidence interval	p-value
Age ≥60 years	1.84	0.72–4.69	0.201
Chronic kidney disease	2.41	0.86–6.78	0.094
Septic shock	5.62	2.01–15.69	0.001
SOFA score ≥8	4.38	1.61–11.92	0.004
Serum lactate >4 mmol/L	4.91	1.79–13.46	0.002
Acute kidney injury	3.26	1.20–8.83	0.020
Antibiotics after 1 hour	2.08	0.81–5.36	0.128
Mechanical ventilation	4.17	1.47–11.84	0.007

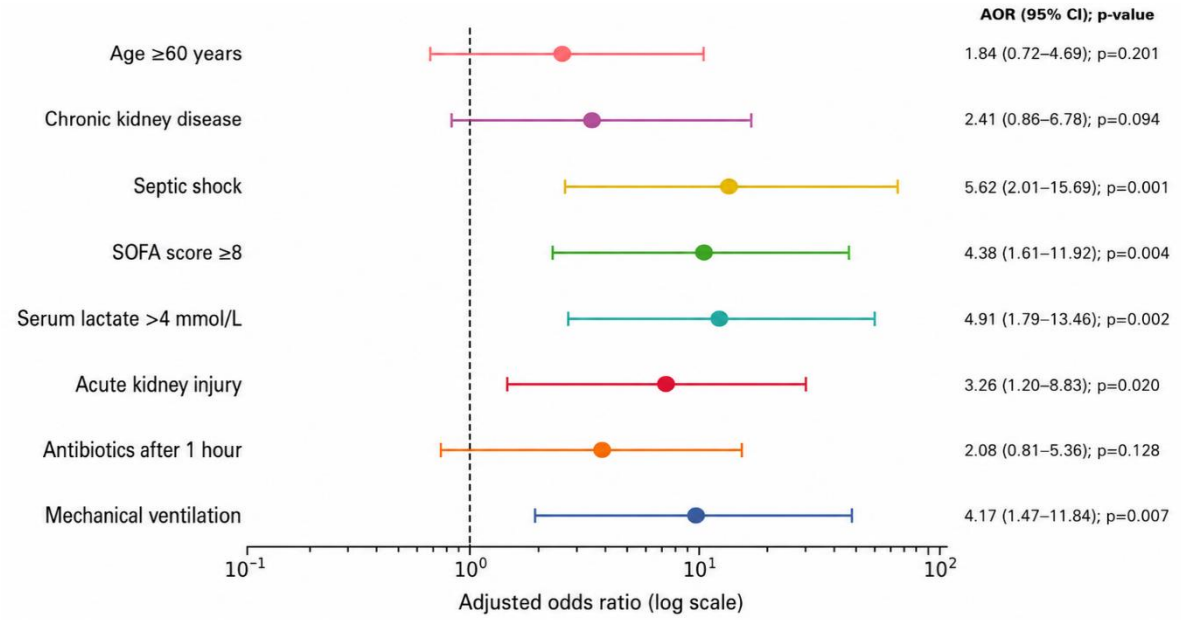

Figure 1: Multivariate logistic regression analysis of predictors of mortality

The findings indicate that mortality among patients presenting with sepsis in the Emergency Department was mainly driven by haemodynamic instability, higher organ dysfunction burden, tissue hypoperfusion, renal dysfunction, and respiratory failure requiring ventilatory support.

DISCUSSION

The present prospective observational study evaluated predictors of in-hospital mortality among 100 adult patients presenting with sepsis to the Emergency Department. The observed mortality rate was 28.0%, which is close to published estimates for hospital-treated sepsis and underlines the continuing lethality of this syndrome in acute care settings [1,2]. Respiratory tract infection was the most common source of sepsis, followed by urinary tract infection and intra-abdominal infection. This pattern is consistent with the frequent role of pneumonia and urinary infection as major drivers of emergency sepsis admissions.

Septic shock was the strongest independent predictor of mortality in this study. This finding is biologically plausible because septic shock reflects circulatory failure requiring vasopressors and is often accompanied by cellular metabolic dysfunction and hyperlactatemia [4]. In the present cohort, 20 of 34 patients with septic shock died, indicating that shock at presentation identifies a subgroup needing rapid hemodynamic optimization, lactate-guided reassessment, early source control, and intensive monitoring. The result supports the clinical relevance of early shock recognition in the Emergency Department.

Higher organ dysfunction burden also predicted mortality. A SOFA score ≥8 remained independently associated with death, while qSOFA score ≥2 showed significant association on survivor and non-survivor comparison. SOFA has been validated as a robust measure of organ dysfunction and has demonstrated strong prognostic correlation in critically ill patients [10,11]. In Emergency Department practice, qSOFA offers a rapid bedside signal, although its sensitivity varies across clinical settings [5,12]. These findings suggest that qSOFA can support early alerting, while formal organ dysfunction assessment through SOFA provides better severity characterization.

Serum lactate >4 mmol/L was another independent predictor. Lactate elevation reflects tissue hypoperfusion, adrenergic stress, impaired clearance, and cellular metabolic disturbance. Previous studies have shown that lactate is associated with mortality in severe sepsis independent of shock and organ failure [13]. The present study strengthens this observation because non-survivors had a markedly higher frequency of lactate >4 mmol/L. Acute kidney injury was also independently associated with mortality. Sepsis-associated AKI develops through inflammatory, microcirculatory, hemodynamic, and nephrotoxic mechanisms, and meta-analytic evidence confirms its strong relationship with adverse outcomes [14].

Delayed antibiotic administration beyond one hour was significantly associated with mortality on univariate comparison but lost independent significance after adjustment. This pattern indicates that antibiotic timing is clinically important, but its observed effect is intertwined with illness severity, shock, transfer delays, and treatment complexity. Large studies have shown that treatment delay is associated with increased mortality in sepsis, particularly when shock is present [8,9]. Requirement of mechanical ventilation independently predicted death, reflecting severe respiratory failure, altered sensorium, shock-related decompensation, or multi-organ dysfunction. Overall, this study highlights a practical mortality profile: septic shock, high SOFA score, hyperlactatemia, acute kidney injury, and mechanical ventilation identify the highest-risk sepsis patients at Emergency Department presentation.

Limitations

This single-centre study included 100 patients, limiting subgroup precision and external validity. Microbiological confirmation, serial lactate clearance, and long-term outcomes were not uniformly assessed. Some predictors, including antibiotic timing and ventilatory support, were influenced by disease severity, referral delay, and treatment decisions. The observational design identifies associations rather than causality, and residual confounding remains possible despite multivariate analysis in this limited cohort.

CONCLUSION

In this prospective observational study of 100 Emergency Department sepsis patients, in-hospital mortality was 28.0%. Septic shock, SOFA score ≥8, serum lactate >4 mmol/L, acute kidney injury, and mechanical ventilation were independent predictors of mortality. These variables represent circulatory failure, organ dysfunction, tissue hypoperfusion, renal injury, and respiratory compromise. Early identification of these high-risk features can support triage, closer monitoring, faster escalation to intensive care, and focused resuscitation. Incorporating structured severity assessment with lactate measurement and renal function evaluation in Emergency Department sepsis pathways can improve recognition of patients at greatest risk and guide timely clinical intervention. This approach supports timely decisions in busy emergency units at the earliest stage.

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