

Clinical Characteristics and Outcomes of Sepsis in Adult Patients Admitted Through the Emergency Department: A Prospective Observational Study.

Hayat Muhammad Khan¹, Jehan Hussan², Jalwa Nargis³

¹-Associate Professor, Community Medicine Department, Khyber Medical College, Peshawar

²-Assistant Professor, Community Medicine, KMC Peshawar

³-WMO FCPS Obs/Gynae Peshawar



© 2026 The Author(s)

Article Metadata

Article History

Received: 12 January 2026

Revised: 22 February 2026

Accepted: 21 March 2026

Published: 10 April 2026

Corresponding Author

Jehan Hussan

Assistant Professor, Community
Medicine, KMC Peshawar.

Email: Jehanhusan@hotmail.com

ORCID ID: 0009-0008-9805-4934



This article may be cited as:

Khan HM, Hussan J, Nargis J. Clinical Characteristics and Outcomes of Sepsis in Adult Patients Admitted Through the Emergency Department: A Prospective Observational Study. J Pak Int Med Coll. 2026;3(2):40-45.

INTRODUCTION

Sepsis is a life-threatening syndrome characterized by a dysregulated host response to infection that results in acute organ dysfunction and remains one of the leading causes of morbidity and mortality worldwide. Despite advances in antimicrobial therapy, critical care, and organ support, sepsis continues to impose a substantial burden on healthcare systems because of prolonged hospital stays, increased

ABSTRACT

Background: Sepsis is a life-threatening syndrome characterized by an abnormal host response to infection and is a significant cause of morbidity and mortality worldwide. Early recognition and intervention in the emergency department (ED) are vital. This research compared clinical parameters and outcomes at presentation among adult patients with sepsis presenting to the ED.

Objectives: To determine the demographic characteristics, clinical presentation, sources of infection, management strategies, and hospital outcomes among adult patients presenting with sepsis to the ED, and to identify clinical factors associated with in-hospital mortality.

Methods: This prospective observational study of 8 months' duration included 100 adult patients with a Sepsis-3 diagnosis in the ED of a tertiary care hospital. Collected data included demographic information, comorbidities, clinical and laboratory parameters, SOFA scores, source of infection, treatment measures, and hospital outcomes. All data were analyzed using SPSS version 27.0. Continuous data were presented as mean $\pm$ SD, categorical data as frequencies and percentages, and a p-value < 0.05 was considered significant.

Results: Of the 100 patients, 61% were male, with a mean age of 59.4 ± 15.8 years. Pneumonia (38%) and urinary tract infection (27%) were the leading infection sources. The mean SOFA score was 7.72 ± 2.26 . ICU admission and mechanical ventilation were required in 32% and 24% of patients, respectively, while septic shock occurred in 26%. In-hospital mortality was 18%. Non-survivors had significantly higher serum lactate levels (4.45 ± 1.16 vs. 2.28 ± 1.2 mmol/L; $p = 0.002$) and SOFA scores (9.3 ± 2.24 vs. 6.6 ± 2.1 ; $p < 0.001$). Delayed antibiotic administration beyond one hour was associated with increased mortality ($p = 0.018$).

Conclusion: Significant morbidity and mortality were observed among adult patients with sepsis admitted to the ED. Results indicated that higher SOFA scores, higher serum lactate levels, and later antibiotic treatment were associated with lower survival, suggesting that early diagnosis, early antibiotic treatment, and active supportive care were important.

Keywords: Sepsis; Emergency department; SOFA score; Mortality

intensive care unit (ICU) admissions, and high treatment costs. The burden is particularly pronounced in low- and middle-income countries, where delayed diagnosis, limited healthcare resources, and restricted access to critical care contribute to poorer clinical outcomes [1,2]. The emergency department (ED) is the primary point of contact for most patients presenting with suspected sepsis. Early recognition and timely initiation of evidence-based management, including prompt administration of broad-spectrum

antibiotics, adequate fluid resuscitation, source control, and hemodynamic stabilization, are essential to reduce organ dysfunction and mortality [3]. Delays in initiating appropriate treatment have consistently been associated with worse clinical outcomes and increased mortality. Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) define sepsis as life-threatening organ dysfunction caused by a dysregulated host response to infection, with organ dysfunction identified by an increase in the Sequential Organ Failure Assessment (SOFA) score of two points or more [4,5]. The SOFA score has become an established prognostic tool for assessing disease severity and predicting mortality in patients with sepsis. In addition, biomarkers such as serum lactate, C-reactive protein, and procalcitonin provide valuable information regarding tissue hypoperfusion, disease severity, and response to treatment. The clinical presentation and outcomes of sepsis vary according to patient age, underlying comorbidities, source of infection, causative microorganisms, and the timeliness of therapeutic interventions [6,7]. Respiratory tract infections, urinary tract infections, intra-abdominal infections, bloodstream infections, and skin and soft tissue infections remain the most frequent sources of sepsis among adults. Patients with diabetes mellitus, hypertension, chronic kidney disease, chronic liver disease, malignancy, and other immunocompromising conditions are at increased risk of severe disease and adverse outcomes. Although international guidelines provide standardized Recommendations for sepsis management, variations in healthcare infrastructure, patient characteristics, and regional epidemiology may influence treatment outcomes [8,9]. Therefore, evaluating local clinical characteristics and predictors of adverse outcomes is essential for improving early risk stratification, optimizing resource utilization, and strengthening institutional sepsis management protocols. This prospective observational study was conducted to determine the demographic and clinical characteristics, sources of infection, management strategies, and hospital outcomes among adult patients with sepsis presenting through the emergency department, and to identify factors associated with in-hospital mortality [10].

Study Objectives

To evaluate the demographic and clinical characteristics, sources of infection, management strategies, and hospital outcomes among adult

patients presenting with sepsis through the emergency department, and to identify predictors of in-hospital mortality.

MATERIALS AND METHODS

Study Design & Setting

This prospective observational study was conducted in the Department of Community Medicine, Khyber Medical College, Peshawar, over eight months from 1 January 2025 to 31 August 2025 using consecutive non-probability sampling. The study aimed to evaluate the demographic characteristics, clinical presentation, management strategies, and hospital outcomes of adult patients diagnosed with sepsis according to the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). All enrolled patients received standard treatment according to the institutional sepsis management protocol based on the Surviving Sepsis Campaign 2021 Guidelines, and no intervention beyond routine clinical care was performed.

Sample Size Calculation

The sample size was calculated using the World Health Organization (WHO) Sample Size Calculator for descriptive studies, assuming an anticipated prevalence of 50%, a 95% confidence level, and a 10% margin of error. The minimum required sample size was 96 patients. To compensate for possible incomplete records and attrition, 100 consecutive eligible patients were recruited.

INCLUSION CRITERIA

- Adults aged **18 years or older**
- Patients fulfilling the **Sepsis-3 diagnostic criteria**
- Admission through the Emergency Department
- Written informed consent provided by the patient or legally authorized representative
- Availability of complete clinical and laboratory data

EXCLUSION CRITERIA

- Patients younger than 18 years
- Pregnant women
- Trauma-related sepsis
- Patients receiving palliative or end-of-life care
- Patients transferred to another healthcare facility before completion of treatment
- Patients with incomplete clinical records or refusal to participate

Data Collection

Eligible patients were screened consecutively upon presentation to the Emergency Department and enrolled after fulfilling the eligibility criteria. Data were collected prospectively using a standardized, pre-tested data collection proforma by trained investigators under consultant supervision. Quality assurance was ensured through daily verification of completed proforma and periodic monitoring by the principal investigator. The collected information included demographic characteristics, comorbidities, presenting symptoms, vital signs, laboratory investigations, microbiological findings, SOFA score, source of infection, therapeutic interventions, and hospital outcomes. Laboratory investigations included complete blood count, renal and liver function tests, serum lactate concentration, blood culture results, and other clinically indicated investigations. Treatment variables included the timing of empirical antibiotic administration, intravenous fluid resuscitation, vasopressor therapy, mechanical ventilation, ICU admission, and source control procedures where indicated.

STATISTICAL ANALYSIS

Data were entered, cleaned, and analyzed using IBM SPSS Statistics version 27.0 (IBM Corp., Armonk, NY, USA). Continuous variables were assessed for normality using the Shapiro–Wilk test. Normally distributed continuous variables are presented as mean $\pm$ standard deviation (SD), whereas non-normally distributed variables are expressed as median with interquartile range (IQR). Categorical variables are presented as frequencies and percentages. Comparisons between survivors and non-survivors were performed using the independent Student's *t*-test for normally distributed continuous variables and the Mann–Whitney *U* test for non-normally distributed variables where appropriate. Categorical variables were compared using the Chi-square test or Fisher's exact test as appropriate. Because of the limited number of mortality events (18 deaths), only univariate analyses were performed to identify factors associated with in-hospital mortality. Variables including age, SOFA score, serum lactate concentration, septic shock, ICU admission, mechanical

ventilation, and delayed antibiotic administration were analyzed individually. A two-tailed *p*-value <0.05 was considered statistically significant.

RESULTS

A total of 100 adult patients with sepsis were enrolled during the study period. There were 61 (61.0%) males and 39 (39.0%) females, with a mean age of 59.4 ± 15.8 years. The most common comorbidities were hypertension (48%), diabetes mellitus (44%), and chronic kidney disease (17%). Pneumonia was the leading source of infection (38%), followed by urinary tract infection (27%), intra-abdominal infection (16%), skin and soft tissue infection (11%), and bloodstream infection (8%). The mean SOFA score at admission was 7.2 ± 2.6 . In contrast, the mean serum lactate concentration was 3.1 ± 1.5 mmol/L. Overall, 32% of patients required ICU admission, 24% required mechanical ventilation, 28% required vasopressor support, and 26% developed septic shock. The mean duration of hospital stay was 8.9 ± 3.7 days. In-hospital mortality occurred in 18 patients (18.0%), whereas 82 patients (82%) were discharged alive. Compared with survivors, non-survivors had significantly higher mean SOFA scores (9.3 ± 2.4 vs. 6.6 ± 2.1 ; $p<0.001$) and higher serum lactate levels (4.5 ± 1.6 vs. 2.8 ± 1.2 mmol/L; $p=0.002$). Septic shock (61.1% vs. 18.3%; $p<0.001$), ICU admission (66.7% vs. 24.4%; $p=0.004$), and mechanical ventilation (55.6% vs. 17.1%; $p=0.001$) were significantly more frequent among non-survivors. Delayed administration of empirical antibiotics beyond one hour was also significantly associated with increased in-hospital mortality (44.4% vs. 23.2%; $p=0.018$).

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

Variable	n (%) / Mean $\pm$ SD
Age (years)	59.4 $\pm$ 15.8
Male	61 (61.0)
Female	39 (39.0)
Body Mass Index (kg/m ²)	27.1 $\pm$ 4.2
Current Smokers	29 (29.0)
Diabetes Mellitus	44 (44.0)
Hypertension	48 (48.0)
Chronic Kidney Disease	17 (17.0)
Chronic Liver Disease	9 (9.0)

Chronic Obstructive Pulmonary Disease	13 (13.0)
Malignancy	8 (8.0)
Mean SOFA Score	7.2 $\pm$ 2.6
Mean Serum Lactate (mmol/L)	3.1 $\pm$ 1.5

Values are presented as mean $\pm$ standard deviation (SD) or frequency (%). SOFA = Sequential Organ Failure Assessment.

Table 2. Clinical Presentation and Source of Infection among Patients with Sepsis (N = 100)

Variable	n (%)
Clinical Presentation	
Fever	84 (84.0)
Tachycardia	79 (79.0)
Tachypnea	74 (74.0)
Hypotension	41 (41.0)
Altered Mental Status	28 (28.0)
Hypoxemia	36 (36.0)
Primary Source of Infection	
Pneumonia	38 (38.0)
Urinary Tract Infection	27 (27.0)
Intra-abdominal Infection	16 (16.0)
Skin and Soft Tissue Infection	11 (11.0)
Bloodstream Infection	8 (8.0)

Pneumonia was the most common source of sepsis, followed by urinary tract infection and intra-abdominal infection.

Table 3. Hospital Management and Clinical Outcomes (N = 100)

Variable	n (%) / Mean $\pm$ SD
ICU Admission	32 (32.0)
Mechanical Ventilation	24 (24.0)
Vasopressor Requirement	28 (28.0)
Septic Shock	26 (26.0)
Acute Kidney Injury	21 (21.0)
Positive Blood Culture	34 (34.0)
Mean Length of Hospital Stay (days)	8.9 $\pm$ 3.7
In-hospital Mortality	18 (18.0)
Survived to Discharge	82 (82.0)

ICU = Intensive Care Unit. Clinical outcomes represent the overall hospital course and final discharge status of enrolled patients.

Table 4. Factors Associated with In-Hospital Mortality

Variable	Survivors (n = 82)	Non-survivors (n = 18)	p-value
Age (years), Mean $\pm$ SD	57.6 $\pm$ 15.2	67.8 $\pm$ 13.7	0.013
SOFA Score, Mean $\pm$ SD	6.6 $\pm$ 2.1	9.3 $\pm$ 2.4	<0.001
Serum Lactate (mmol/L), Mean $\pm$ SD	2.8 $\pm$ 1.2	4.5 $\pm$ 1.6	0.002
Septic Shock, n (%)	15 (18.3)	11 (61.1)	<0.001
ICU Admission, n (%)	20 (24.4)	12 (66.7)	0.004
Mechanical Ventilation, n (%)	14 (17.1)	10 (55.6)	0.001
Delayed Antibiotic Administration (>1 hour), n (%)	19 (23.2)	8 (44.4)	0.018

Comparisons were performed using the independent Student's t-test for continuous variables and the Chi-square test for categorical variables. A p-value <0.05 was considered statistically significant. Higher SOFA score, elevated serum lactate, septic shock, delayed antibiotic administration, ICU admission, and mechanical ventilation were significantly associated with increased in-hospital mortality.

Discussion

This prospective observational study evaluated the clinical characteristics, management, and outcomes of adult patients with sepsis presenting through the emergency department. The study demonstrated that sepsis predominantly affected older adults with multiple comorbidities, particularly diabetes mellitus and hypertension, while pneumonia and urinary tract infection were the most frequent sources of infection [11,12]. The overall in-hospital mortality rate was 18%, reflecting the substantial clinical burden associated with sepsis despite contemporary management strategies. The demographic profile observed in this study is consistent with previous reports demonstrating a higher incidence of sepsis among elderly patients. Increasing age is associated with impaired immune function, multiple chronic illnesses, and reduced physiological reserve, all of which increase susceptibility to severe infection and adverse outcomes [13,14]. The predominance of male patients observed in this study is also comparable to findings from international observational studies. Pneumonia remained the leading source of infection, followed by urinary tract infection and intra-

abdominal infection. Similar findings have been reported in published studies where respiratory tract infections accounted for the majority of sepsis admissions. The high prevalence of diabetes mellitus and hypertension further supports existing evidence that chronic metabolic diseases significantly increase the risk of infection, organ dysfunction, and mortality among septic patients [15,16]. An important finding of this study was the strong association between higher SOFA scores and increased in-hospital mortality. Patients who died had significantly higher SOFA scores and serum lactate concentrations than survivors, confirming the prognostic value of these parameters in identifying high-risk patients. Elevated serum lactate reflects impaired tissue perfusion and has consistently been recognized as an independent predictor of mortality in patients with sepsis. Delayed administration of antibiotics beyond one hour after diagnosis was significantly associated with increased mortality [17,18]. This observation is consistent with current international sepsis guidelines, which strongly recommend early initiation of appropriate antimicrobial therapy to improve survival. Prompt recognition of sepsis, rapid implementation of sepsis bundles, and timely escalation of care remain essential components of emergency department management. Patients who developed septic shock, required mechanical ventilation, or required ICU admission experienced significantly poorer outcomes, indicating progressive organ dysfunction and greater disease severity [19,20]. These findings emphasize the importance of early Identification of patients at high risk of deterioration and timely referral to critical care services [21]. The prospective design, standardized data collection, and comprehensive assessment of clinical and laboratory variables strengthen the validity of the present study. However, its findings should be interpreted considering the single-center setting, relatively small sample size, and absence of long-term follow-up and antimicrobial resistance analysis. Future multicenter studies with larger populations are recommended to validate these findings and improve the generalizability of the results.

LIMITATIONS

There are some limitations of this study. It was a descriptive study that was carried out in a single tertiary care center with a small

sample of 100 patients; the results might not be generalizable. There was no long-term follow-up after hospital discharge, and there was limited evaluation of microbiological resistance patterns and appropriateness of antimicrobial therapy.

Conclusion

Sepsis continues to be a leading cause of morbidity and mortality seen in the ED in adults. A high SOFA score, high lactate level, septic shock, and delayed antibiotic treatment were significant predictors of poor outcomes. Early diagnosis, prompt evidence-based treatment, and timely intensive care management are essential to improve survival and reduce sepsis-related complications.

Disclaimer: Nil

Conflict of Interest: Nil

Funding Disclosure: Nil

Ethical Approval

Ethical approval was obtained from the Institutional Research and Ethics Board, Khyber Medical College Peshawar (Approval No. 1452/08/KMC/IRB/2024) before the study commenced. The study was conducted in accordance with the Declaration of Helsinki (2013).

Disclaimer: Nil

Conflict of Interest: Nil

Funding Disclosure: Nil

Informed Consent

Written informed consent was obtained from all participants before enrollment in the study.

Authors' Contributions (ICMJE)

Hayat Muhammad Khan: Conceived and designed the study, supervised the research, interpreted the data, critically revised the manuscript for important intellectual content, approved the final version of the manuscript, and agrees to be accountable for all aspects of the work.

Jehan Hussan: Contributed to the study design, coordinated patient recruitment and data collection, performed data analysis and interpretation, drafted the manuscript, approved the final version of the manuscript, and agrees to be accountable for all aspects of the work.

Jalwa Nargis: Assisted in data collection, literature review, manuscript editing, and interpretation of the findings; critically reviewed the manuscript, approved the final version of the manuscript, and agrees to be accountable for all aspects of the work.

All authors made substantial contributions to the conception or design of the study, or the acquisition, analysis, or interpretation of data; participated in drafting or critically revising the manuscript;

approved the final version for publication; and agree to be accountable for all aspects of the work in accordance with the International Committee of Medical Journal Editors (ICMJE) authorship criteria.

References

- Evans L, Rhodes A, Alazani W, Antonelli M, Coopersmith CM, French C, et al. Surviving Sepsis Campaign: International guidelines for management of sepsis and septic shock 2021. *Intensive Care Med.* 2021;47(11):1181-1247. doi:10.1007/s00134-021-06506-y.
- Oduncu AF, Kıyan GS, Yalçın S. Comparison of sofa, SIRS, and NEWS scoring systems for diagnosis, mortality, and morbidity of sepsis in the emergency department. *Am J Emerg Med.* 2021;48:54-59. doi:10.1016/j.ajem.2021.04.006.
- Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). *JAMA.* 2016;315(8):801-810. doi:10.1001/jama.2016.0287.
- Han X, Dou Q, Zhu Y, Ling P, Shen YH, Liu J, et al. Heparin-binding protein-enhanced quick SOFA score improves mortality prediction in sepsis patients. *Front Med (Lausanne).* 2022;9:926798. doi:10.3389/fmed.2022.926798.
- Abdullah SMOB, Sørensen RH, Nielsen FE. Prognostic accuracy of SOFA, SOFA, and SIRS for mortality among emergency department patients with infections. *Infect Drug Resist.* 2021;14:2763-2775. doi:10.2147/IDR.S304952.
- Yu B, Chen M, Zhang Y, Cao Y, Yang J, Wei B, et al. Diagnostic and prognostic value of interleukin-6 in emergency department sepsis patients. *Infect Drug Resist.* 2022;15:5557-5566. doi:10.2147/IDR.S384351.
- Song J, Cho H, Park DW, Moon S, Kim JY, Ahn S, et al. Vasoactive-inotropic score as an early predictor of mortality in adult patients with sepsis. *J Clin Med.* 2021;10(3):495. doi:10.3390/jcm10030495.
- Yin WP, Li JB, Zheng XF, An L, Shao H, Li CS. Effect of neutrophil CD64 for diagnosing sepsis in the emergency department. *World J Emerg Med.* 2020;11(2):79-86. doi:10.5847/wjem.j.1920-8642.2020.02.003.
- Zeng J, Ding H, Zhong W, Li X, Zeng H. Predictive value of sepsis-induced coagulopathy score on 30-day mortality in septic patients. *Zhonghua Wei Zhong Bing Ji Jiu Yi Xue.* 2022;34(12):1263-1267. doi:10.3760/cma.j.cn121430-20220830-00805.
- Arakawa M, Levy JH, Fujimori K, Kondo K, Iba T. A new SOFA score calculation to improve predictive performance for mortality in sepsis-associated disseminated intravascular coagulation patients. *J Crit Care.* 2021;64:108-113. doi:10.1016/j.jcrc.2021.03.008.
- Liu B, Li D, Cheng Y, Yu J, Jia Y, Zhang Q, et al. Development and internal validation of a simple prognostic score for early sepsis risk stratification in the emergency department. *BMJ Open.* 2021;11(7):e046009. doi:10.1136/bmjopen-2020-046009.
- Suttapanit K, Wisan M, Sanguanwit P, Prachanukool T. Prognostic accuracy of VqSOFA for predicting 28-day mortality in patients with suspected sepsis in the emergency department. *Shock.* 2021;56(3):368-373. doi:10.1097/SHK.0000000000001754.
- Zhao J, He Y, Xu P, Liu J, Ye S, Cao Y. Serum ammonia levels on admission for predicting 28-day mortality in sepsis patients in the emergency department: A two-center retrospective study. *Medicine (Baltimore).* 2020;99(11):e19477. doi:10.1097/MD.00000000000019477.
- Liu Z, Meng Z, Li Y, Zhao J, Wu S, Gou S, Wu H. Prognostic accuracy of the lactate-to-albumin ratio for predicting mortality in patients with sepsis: A systematic review and meta-analysis. *Front Med (Lausanne).* 2024;11:1358278. doi:10.3389/fmed.2024.1358278.
- Jee W, Jo S, Lee JB, Jin Y, Jeong T, Yoon JC, Park B. Mortality difference between early-identified sepsis and late-identified sepsis. *Clin Exp Emerg Med.* 2020;7(3):150-160. doi:10.15441/ceem.19.009.
- Li Y, Xie D, Chen X, Zhang Y, Wang H. Prognostic performance of Sequential Organ Failure Assessment (SOFA) score for predicting mortality in adult patients with sepsis: A systematic review and meta-analysis. *Front Med (Lausanne).* 2024;11:1360193. doi:10.3389/fmed.2024.1360193.
- Saoraya J, Wongsamita L, Srisawat N, Musikatavorn K. Plasma syndecan-1 is associated with fluid requirements and clinical outcomes in emergency department patients with sepsis. *Am J Emerg Med.* 2021;42:83-89. doi:10.1016/j.ajem.2021.01.019.
- Kilinc Tokar A, Kose S, Turken M. Comparison of SOFA score, SIRS, qSOFA, and qSOFA+L criteria in the diagnosis and prognosis of sepsis. *Eurasian J Med.* 2021;53(1):40-47. doi:10.5152/eurasianjmed.2021.20081.
- Kim KS, Suh GJ, Kwon WY, Kim K, Jo YH, Rhee JE, et al. Prognostic performance of qSOFA, SIRS, and NEWS for predicting mortality in patients with suspected sepsis presenting to the emergency department. *J Clin Med.* 2022;11(19):5755. doi:10.3390/jcm11195755.
- Rudd KE, Johnson SC, Agesa KM, Shackelford KA, Tsoi D, Kievlan DR, et al. Global, regional, and national sepsis incidence and mortality, 1990-2017: Analysis for the Global Burden of Disease Study. *Lancet.* 2020;395(10219):200-211. doi:10.1016/S0140-6736(19)32989-7.
- Evans L, Rhodes A, Alhazzani W, Antonelli M, Coopersmith CM, French C, et al. What is new in the Surviving Sepsis Campaign recommendations for management of sepsis and septic shock? *Intensive Care Med.* 2023;49(12):1457-1460. doi:10.1007/s00134-023-07199-1.