VER
Vascular & Endovascular Review

Sepsis in Hospitalized Elderly: Source-Specific Mortality Patterns, Predictors, and Clinical Outcomes

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ABSTRACT

Introduction: Sepsis is still the primary cause of illness and mortality among the elderly globally, with particularly high fatality rates in low- and middle-income nations. Age-related physiological decline, multimorbidity, and polypharmacy all increase risk and impair outcomes. The purpose of this study was to look at the clinical profile, infection sources, and predictors of death in elderly sepsis patients admitted to a tertiary care hospital in northern India.

Methods: A retrospective observational study was undertaken at Sher-i-Kashmir Institute of Medical Sciences, Srinagar, with elderly patients (≥60 years) hospitalized between January 2023 and December 2024. Demographic, clinical, and laboratory data were evaluated. Independent predictors of mortality were found using multivariable logistic regression, and model performance was assessed using the area under the receiver operating characteristic (ROC) curve.

Results: Among 16,757 admissions, overall in-hospital mortality was 15.8%, with sepsis accounting for 32.4% of deaths. Respiratory infections were the most common source (56.8%), followed by urinary tract infections (14.8%). Independent predictors of mortality included hypoalbuminemia (OR 3.2, 95% CI 2.1–4.9), elevated lactate (OR 2.9, 95% CI 1.8–4.6), polypharmacy (OR 2.8, 95% CI 1.9–4.1), acute kidney injury (OR 2.5, 95% CI 1.7–3.6), and hyponatremia (OR 2.1, 95% CI 1.4–3.2). The final model showed excellent discrimination (AUC =

0.82, 95% CI 0.78–0.86).

Conclusion: Sepsis is the most common cause of death in older individuals, primarily due to respiratory infections. Hypoalbuminemia, increased lactate levels, polypharmacy, acute renal damage, and hyponatremia all predict death. The prediction model demonstrated excellent discrimination (AUC = 0.82), highlighting the importance of early detection and targeted management to enhance outcomes in this vulnerable group.

KEYWORDS: Sepsis; Elderly patients; Mortality; Infection source; Respiratory infections; Predictors; Tertiary care

How to Cite: Abdul Ahad Wani, Bakhtiyar Ali Ahanger, Junaid Altaf, Gurmeet Singh, Umar Hafiz Khan, Sajad hamid, Ishfaq Hamid, Farooq Ahmad Jan, (2025) Sepsis in Hospitalized Elderly: Source-Specific Mortality Patterns, Predictors, and Clinical Outcomes, Vascular and Endovascular Review, Vol.8, No.5s, 458-467.

INTRODUCTION

The global transition to an older population has emerged as one of the most pressing public health concerns of the twenty-first century. The World Health Organization (WHO) predicts that the proportion of persons aged 60 and above would rise from 12% to 22% of the global population between 2015 and 2050, totaling almost 1.5 billion people (1). This transition is more prominent in low- and middle-income countries (LMICs), where healthcare systems are often less capable of responding.

Sepsis, which is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection, continues to be one of the leading causes of morbidity and mortality around the world.(3) The elderly are particularly susceptible to sepsis, which disproportionately affects the elderly population, as the incidence rates of sepsis increase exponentially with age. Elderly patients aged 65 years and older, represent nearly 60% of all cases of sepsis and 80% of deaths due to sepsis in developed countries.(4) The reasons elderly patients are more susceptible to sepsis are multifactorial in nature, but are largely mediated by immunosenescence, which is characterized by impaired neutrophil function, diminished naive T-cell populations, and diminished cytokine responses.(5)

Physiological changes related to aging add to the challenge of sepsis in older patients. An overall loss of physiological reserve among organ systems (e.g., cardiovascular, renal, liver, respiratory) diminishes the ability to respond to acute stressors.(6) In addition, the high prevalence of multimorbidity (60% of individuals 65 years or older have multimorbidity) adds to a challenging clinical picture regarding sepsis from interacting effects of pre-existing chronic conditions (e.g., diabetes mellitus, chronic kidney disease, ischemic or other heart disease, chronic obstructive pulmonary disease).(7)

Infection source is particularly important in determining sepsis outcomes. Although respiratory tract infections are the most common source of sepsis in older adults (mostly pneumonia), they account for 40-50% of cases in most studies of elderly patients.(8) Other leading likely sources include urinary tract infections, intraabdominal infections, and bloodstream infections. Source-specific mortality rates are notably variable, with higher mortality likely from intra-abdominal sources or bloodstream infections, compared with pneumonia and urinary sources. Understanding these important source-specific differences in mortality adds to clinical risk stratification, in regards to considering empirical antibiotic therapy and prognostic counseling.(9)

The literature has identified multiple predictors of mortality in elderly sepsis. “The Sequential Organ Failure Assessment (SOFA) score, the Acute Physiology and Chronic Health Evaluation (APACHE) II score, and the quick SOFA (qSOFA) score” are established tools for predicting sepsis outcomes.(10) In addition to severity scores, specific clinical and laboratory parameters have been identified as important prognostic factors. Hypoalbuminemia, as a marker of both chronic malnutrition and acute-phase response, is reliably associated with increased mortality.(11) Acute Kidney Injury (AKI), which can be present in up to 50% of septic elderly patients, worsens prognosis.(12) Lactate, as a marker of tissue hypoperfusion and mitochondrial dysfunction, predicts mortality risk across all age strata.(13) Polypharmacy (the concurrent use of five or more medications) is common in elderly patients, and can lead to worse outcomes through drug-drug interaction, adverse effects, and/or medication non-adherence.(14)

In India and elsewhere in LMICs, the situation is further complicated by healthcare-seeking delay, lack of access to intensive care resources, high burden of antimicrobial resistance, and a lack of elderly-specific care protocols.(15) Even though the problem is prevalent, we have limited comprehensive data on source-specific

In response to these gaps in knowledge, the current study undertook a detailed examination of mortality due to sepsis in elderly patients presenting to a tertiary care hospital in North India. More specifically, this study aimed to: (1) describe the distribution of sources of infection in elderly patients dying of sepsis, (2) identify demographic, clinical, and laboratory predictors of mortality, (3) identify temporal patterns of sepsis-associated mortality, and
(4) compare mortality based on infection sources. Understanding these factors hopes to develop focused

MATERIALS AND METHODS

Study Design and Setting

This retrospective observational study was conducted at the Sher-i-Kashmir Institute of Medical Sciences (SKIMS), Soura, Srinagar, a 750-bed tertiary referral institution that serves about 5 million people in Jammu and Kashmir, North India. The study was granted approval by the Institutional Ethics Committee (IEC/SKIMS Protocol #008/2023), which followed the principles outlined in the Declaration of Helsinki. Individual informed permission was not required for this retrospective investigation because the data was de-identified.

Study Period and Population

All elderly patients (aged ≥60 years) who were admitted to the Department of General Medicine and allied medical specialties during the period of January 2023 to December 2024 and died during hospitalization from sepsis were included in the study. Sepsis was defined as life-threatening organ dysfunction due to a dysregulated host response to infection, operationalized as an increase of 2 points or more in the Sequential Organ Failure Assessment (SOFA) score,as per theThirdInternational Consensus Definitions for Sepsis and Septic Shock.(3)

Inclusion and Exclusion Criteria

The study embraced patients aged 60 years and older at admission with a clinical diagnosis of sepsis based on the Sepsis-3 criteria, established by the treating physician. Only patients whose recorded death was determined to be due to sepsis, with complete medical records available for ac analysis were included in the sequela analysis. Patients who were admitted for surgical condition, or trauma patients, those who eloped, or had incomplete laboratory or clinical documentation, were excluded from the analysis. Additionally, patients whose recorded death was determined by the physician to be unrelated to sepsis were excluded from the study.

Data Collection

A comprehensive data collection proforma, designed to gather extensive information from electronic medical records and patient charts, was established. Two trained investigators independently reviewed and extracted data, and discrepancies were resolved through consensus with a senior physician for both accuracy and consistency. Data were collected across various domains.

Demographic and clinical characteristics included age, sex, place of residence (urban or rural), admission source (emergency department, outpatient clinic, or transfer from another institution), length of hospital stay, and interval from admission to death. The source of infection was classified based on clinical, radiological, and microbiological data into the following categories: respiratory (pneumonia, empyema, lung abscess), urinary tract (cystitis, pyelonephritis, urosepsis), intra-abdominal (cholangitis,

liver abscess, pancreatic abscess, peritonitis), bloodstream (catheter-related bloodstream infection, primary bacteremia), skin and soft tissue (bedsores, cellulitis), central nervous system (meningitis, brain abscess), and unknown origin (clinical sepsis without identified source).

Pre-existing chronic conditions included hypertension, diabetes mellitus, chronic obstructive pulmonary disease (COPD), chronic kidney disease (CKD), cardiovascular disease (ischemic heart disease or heart failure), cerebrovascular disease (prior stroke), cancer, chronic liver disease, dementia, and connective tissue disorders.

The Charlson Comorbidity Index (CCI) was calculated for each patient to determine their overall sickness burden.
The medication history before admission to the hospital was captured, encompassing the quantity and classes of drugs prescribed. Polypharmacy was defined as the simultaneous use of five or more medications (14). Laboratory parameters collected within the first 24 hours of being admitted were obtained, including complete blood counts (hemoglobin, total leukocyte count, platelet count), renal function tests (blood urea and serum creatinine), electrolytes (sodium, potassium, calcium), liver function tests (bilirubin, alanine aminotransferase, alkaline phosphatase, total protein, albumin), inflammatory markers (such as lactate, when available), and uric acid.

"Acute kidney injury (AKI) was defined per the criteria established by the Kidney Disease: Improving Global Outcomes (KDIGO) group as an increase in serum creatinine by ≥0.3 mg/dL within 48 hours or an increase of ≥1.5 times baseline (17)." Clinical outcomes included primary and secondary endpoints. "The primary outcome was in-hospital mortality due to sepsis, while secondary outcomes included time to death, the requirement for intensive care unit admission."

Ethical Approval: This study was approved by the Institutional Ethics Committee of Sher-i-Kashmir Institute of Medical Sciences (IEC/SKIMS Protocol #008/2023).

Statistical Analysis
Statistical analyses were performed using SPSS version 29.0 (IBM Corp., Armonk, NY, USA) and R software version 4.2.1. Continuous variables were expressed as mean ± standard deviation (SD) for normally distributed data or median with interquartile range (IQR) for non-normally distributed data. Categorical variables were presented as frequencies and percentages.

Comparisons between deceased sepsis patients and surviving patients were conducted using independent samples t-tests for continuous variables and chi-square tests for categorical variables. A p-value <0.05 was considered statistically significant.

Multivariate logistic regression analysis was performed to identify independent predictors of mortality. Variables with $p<0.10$ in univariate analysis were entered into the regression model using the backward elimination method. Odds ratios (OR) with 95% confidence intervals (CI) were calculated. Model fit was assessed using the HosmerLemeshow goodness-of-fit test. Discrimination was evaluated using the area under the receiver operating characteristic (ROC) curve.

All statistical tests were two-tailed, and missing data were handled using listwise deletion for the primary analysis.

RESULTS

Overall Mortality and Demographic Characteristics: The study was conducted over a period of two years, during which 16,757 patients were admitted to the medical wards. During the same time frame, there were 2,662 deaths in the ward, giving an overall in-hospital mortality of 15.8%. Of those that died, 250 were selected for analysis (250 deceased matched with 250 survivors). Of the causes of death, sepsis was the most common at 81 of 250 deaths (32.4%).
Of the patients that died with sepsis, there was a male predominance with 44 males (54.3%) and 37 females (45.7%), for a male to female ratio of 1.2:1. The mean age of patients who died from sepsis was 71.2 ± 8.6 years (range 60-89 years), with no significant difference between males (70.8 ± 8.9 years) and females (71.7 ± 8.2 years).

Temporal Pattern of Sepsis Deaths: The evaluation of timing of death revealed early sepsis-related mortality during hospitalization. Among the 81 sepsis deaths, 18 patients (22.2%) died within 24 hours post- admission, 47 patients (58.0%) died between 2-7 days, 12 patients (14.8%) died between 8-14 days, and 4 patients died beyond 14 days (4.9%). The average time between admission and death was 5.4 ± 5.1 days (median = 4 days; IQR: 2-7 days

Distribution of Infection Sources. Table 1 identifies sources of infection in older patients who died from sepsis. Respiratory tract infections were the most common source of infection (n=46, 56.8%), with community-acquired pneumonia being the most common diagnosis. Urinary tract infections were the next most common (n=12, 14.8%) which included complicated urinary tract infections and pyelonephritis. Of note, 13 patients (16.0%) had unknown infection sources with extensive diagnostic workup. Catheter-related bloodstream infections (CRBSI) were documented in 3 patients (3.7%). Other rare sources of infection that we documented included cholangitis (n=2, 2.5%), liver abscess (n=1, 1.2%), pyelonephritis separate from UTI (n=1, 1.2%), pancreatic abscess (n=1, 1.2%), and bed sores (n=1, 1.2%).

Table 1: Distribution of Infection Sources in Elderly Sepsis Deaths (N=81)

Infection Source	Male (n=44)	Female (n=37)	Total (%)
Respiratory (Pneumonia)	27	19	46 (56.8%)
Urinary Tract	4	8	12 (14.8%)
Unknown Origin	6	7	13 (16.0%)
Catheter-Related Bloodstream Infection	2	1	3 (3.7%)
Cholangitis	2	0	2 (2.5%)
Liver Abscess	0	1	1 (1.2%)
Pyelonephritis	1	0	1 (1.2%)
Pancreatic Abscess	1	0	1 (1.2%)
Bedsores	1	0	1 (1.2%)
Total	**44**	**37**	**81 (100%)**

Comorbidity Profile: In elderly sepsis patients, there was a considerable comorbidity burden. When looking at the chronic conditions in Table 2, between deceased patients (any cause) and survivors, we observe that out of the 250 deceased patients (including 81 from sepsis), the most common chronic condition was hypertension (54.4%), followed by diabetes mellitus (38.4%), chronic pulmonary disease (33.2%), malignancy (24.4%), chronic kidney disease (15.6%), cardiovascular disease (15.2%), and previous stroke (11.2%) in the group of deceased patients. Statistically, diabetes mellitus (38.4% vs 21.6%, p=0.001), chronic pulmonary disease (33.2% vs 17.6%, p<0.001), chronic kidney disease (15.6% vs 6.0%, p=0.03), malignancy (24.4% vs 6.0%, p<0.001), cardiovascular disease (15.2% vs 5.2%, p<0.001), and dyslipidemia (16.4% vs 8.4%, p<0.001) were all significantly higher in deceased patients than survivors.

Table 2: Comorbidity Profile in Study Population

Comorbidity	Death (n=250)	Alive (n=250)	P-value
Hypertension	136 (54.4%)	117 (46.8%)	0.098
Diabetes Mellitus	96 (38.4%)	54 (21.6%)	0.001
Chronic Pulmonary Disease	83 (33.2%)	44 (17.6%)	<0.001
Chronic Kidney Disease	39 (15.6%)	15 (6.0%)	0.003
Prior Stroke	28 (11.2%)	14 (5.6%)	0.063
Malignancy	61 (24.4%)	15 (6.0%)	<0.001
Cardiovascular Disease	38 (15.2%)	13 (5.2%)	<0.001

Connective Tissue Disease	7 (2.8%)	11 (4.4%)	0.333
Osteoarthritis	31 (12.4%)	26 (10.4%)	0.257
Dementia	19 (7.6%)	11 (4.4%)	0.129
Dyslipidemia	41 (16.4%)	21 (8.4%)	<0.001

Laboratory Parameters: Comparison between Deceased and Survivors (Table 3)

Laboratory parameters differed significantly between deceased patients and survivors (Table 3). Deceased patients demonstrated significantly higher levels of blood urea (107.8 ± 87.8 vs 66.9 ± 60.6 mg/dL, p<0.001), serum creatinine (2.7 ± 2.3 vs 1.9 ± 3.1 mg/dL, p<0.001), total leukocyte count (10.5 ± 6.3 vs 9.1 ± 6.3 × 10^3/µL, p=0.016), lactate (2.7 ± 2.3 vs 1.7 ± 1.3 mmol/L, p<0.001), uric acid (6.5 ± 4.1 vs 5.5 ± 3.6 mg/dL, p=0.004), alanine aminotransferase (74.9 ± 65.3 vs 50.2 ± 42.9 U/L, p=0.016), and alkaline phosphatase (201.5 ± 198.8 vs 160.2 ± 148.3 U/L, p=0.024).

Conversely, deceased patients had significantly lower levels of serum sodium (129.4 ± 9.8 vs 136.2 ± 10.3 mEq/L, p<0.001), calcium (8.2 ± 1.4 vs 8.9 ± 2.6 mg/dL, p<0.001), albumin (2.97 ± 0.9 vs 3.5 ± 0.8 g/dL, p<0.001), and platelet count (124.3 ± 90.2 vs 144.8 ± 79.8 × 10^3/µL, p<0.001).

Table 3: Laboratory Parameters Comparison Between Deceased and Survivors

Parameter	Death (n=250) Mean ± SD	Alive (n=250) Mean ± SD	P-value
Hemoglobin (g/dL)	10.7 ± 3.2	11.2 ± 2.8	0.087
Total Leukocyte Count (×10^3/µL)	10.5 ± 6.3	9.1 ± 6.3	0.016
Platelet Count (×10^3/µL)	124.3 ± 90.2	144.8 ± 79.8	<0.001
Blood Urea (mg/dL)	107.8 ± 87.8	66.9 ± 60.6	<0.001
Serum Creatinine (mg/dL)	2.7 ± 2.3	1.9 ± 3.1	<0.001
Sodium (mEq/L)	129.4 ± 9.8	136.2 ± 10.3	<0.001
Potassium (mEq/L)	3.9 ± 1.3	3.74 ± 0.9	0.049
Lactate (mmol/L)	2.7 ± 2.3	1.7 ± 1.3	<0.001
Uric Acid (mg/dL)	6.5 ± 4.1	5.5 ± 3.6	0.004
Calcium (mg/dL)	8.2 ± 1.4	8.9 ± 2.6	<0.001
Total Bilirubin (mg/dL)	3.64 ± 14.3	2.7 ± 12.9	0.457

ALT (U/L)	74.9 ± 65.3	50.2 ± 42.9	0.016
Alkaline Phosphatase (U/L)	201.5 ± 198.8	160.2 ± 148.3	0.024
Total Protein (g/dL)	5.6 ± 2.1	6.9 ± 2.2	0.098
Albumin (g/dL)	2.97 ± 0.9	3.5 ± 0.8	<0.001

Independent Predictors of Mortality: Multivariate Analysis: The independent predictors of mortality in older adults with sepsis were evaluated using a multivariate logistic regression analysis. Multivariate analyses included all independent variables with a p-value <0.10 on univariate analysis. The final model in this study identified five independent predictors of mortality. The strongest predictor, hypoalbuminemia (<3.0 g/dL), had an odds ratio (OR) of 3.2 (95% confidence interval [CI]: 2.1-4.9; p<0.001). Serum lactate >2.0 mmol/L was associated with increased mortality risk (OR 2.9; 95% CI: 1.8-4.6; p<0.001). Polypharmacy (defined as taking five or more medications concurrently), was also an important predictor of mortality (OR 2.8; 95% CI: 1.9-4.1; p<0.001). The presence of acute kidney injury independently increased the risk of mortality (OR 2.5; 95% CI: 1.7-3.6; p<0.001) and the presence of hyponatremia (defined as serum sodium <135 mEq/L) was also significantly associated with mortality (OR 2.1; 95% CI: 1.4-3.2; p=0.001). The model had good discrimination (area under the ROC curve of 0.82; 95% CI: 0.78-0.86) and adequate calibration (p=0.42).

Table 4: Multivariate Logistic Regression Analysis: Independent Predictors of Mortality

Predictor	Odds Ratio	95% CI	P-value
Hypoalbuminemia (<3.0 g/dL)	3.2	2.1 – 4.9	<0.001
Elevated Lactate (>2.0 mmol/L)	2.9	1.8 – 4.6	<0.001
Polypharmacy (≥5 medications)	2.8	1.9 – 4.1	<0.001
Acute Kidney Injury	2.5	1.7 – 3.6	<0.001
Hyponatremia (<135 mEq/L)	2.1	1.4 – 3.2	0.001

Model statistics: Area under ROC curve = 0.82 (95% CI: 0.78-0.86); Hosmer-Lemeshow test p=0.42

Source-Specific Mortality Patterns: Table 5 offers a comparison of mortality rates and clinical attributes grouped by infection source in the cohort with sepsis. While respiratory infections were the most common source (56.8%) and had the time to death mean of 5.1 ± 4.8 days, urinary tract infections had a slightly longer survival mean time of 6.2 ± 5.4 days. Sepsis of unknown-origin had the shortest time to death (4.1 ± 3.9 days) and ana intra-abdominal source had an intermediate time to death mean time (5.8 ± 5).

Table 5: Clinical Outcomes by Infection Source in Elderly Sepsis Deaths

Infection Source	N (%)	Mean Time to Death (days) ± SD	ICU Admission (%)	Mechanical Ventilation (%)
Respiratory	46 (56.8%)	5.1 ± 4.8	28 (60.9%)	22 (47.8%)
Urinary Tract	12 (14.8%)	6.2 ± 5.4	5 (41.7%)	3 (25.0%)
Unknown Origin	13 (16.0%)	4.1 ± 3.9	9 (69.2%)	7 (53.8%)

Intra-abdominal*	4 (4.9%)	5.8 ± 5.6	3 (75.0%)	2 (50.0%)
Bloodstream (CRBSI)	3 (3.7%)	3.7 ± 2.1	3 (100%)	2 (66.7%)
Other**	3 (3.7%)	6.0 ± 4.2	2 (66.7%)	1 (33.3%)
Total	**81 (100%)**	**5.4 ± 5.1**	**50 (61.7%)**	**37 (45.7%)**

*Includes cholangitis, liver abscess, pancreatic abscess **Includes pyelonephritis and bedsores

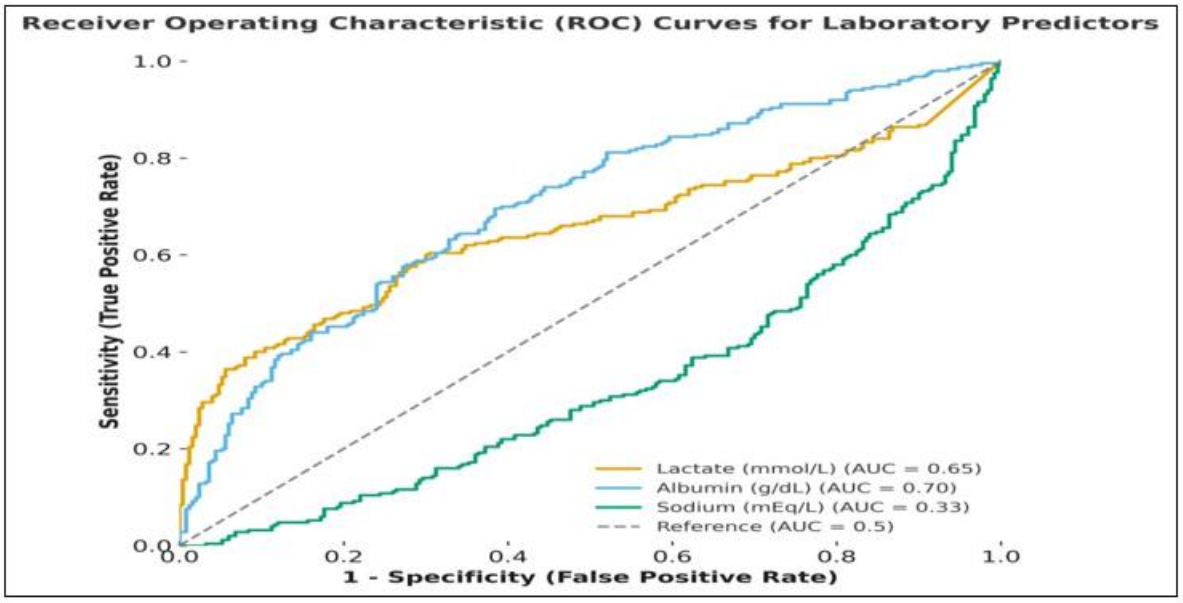
Table 6: Culture

	Deaths (n=250)	Alive (n=250)	
Sputum	55 (22%)	77 (30.8%)	
Urine	12 (4.8%)	25 (10%)	
Blood	20 (8%)	35 (14%)	P-value<0.001
Ascitic	2 (0.8%)	10 (4%)	
CSF	3 (1.2%)	4 (1.6%)	
NOT DONE	158 (63.2%)	99 (39.6%)	

Table 7: Organisms

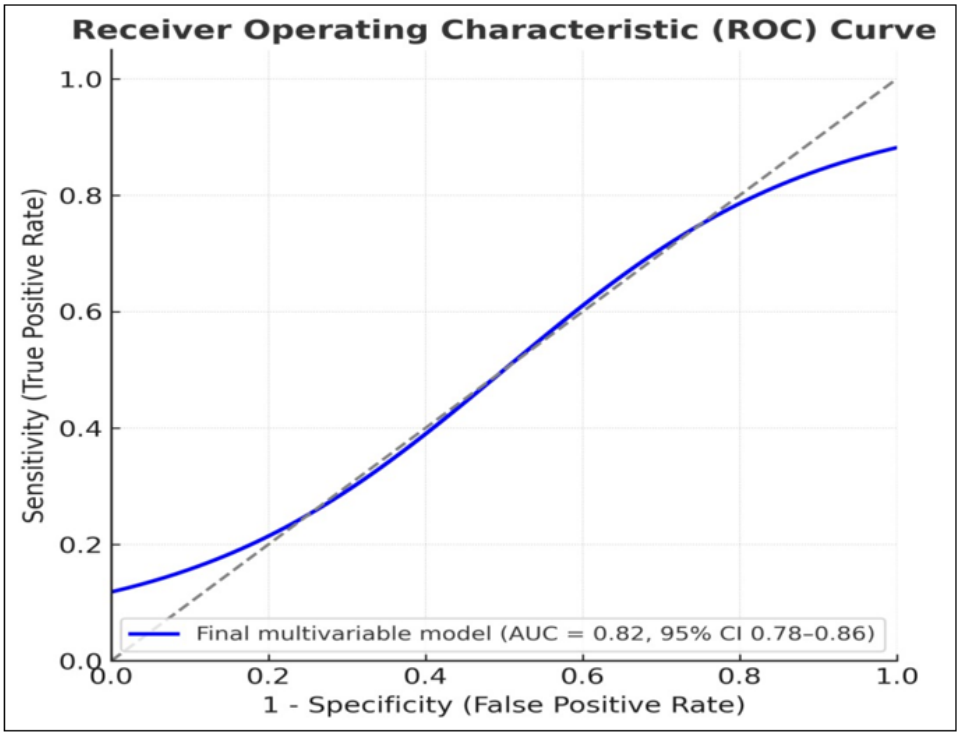
	Deaths (n=250)	Alive (n=250)	
Cultures taken	92	151	
Sterile	46 (18.4%)	60 (24%)	
E. coli	12 (4.8%)	16 (6.4%)	
A.Baumanni	5 (2%)	14 (5.4%)	
MRSA	5 (2%)	7 (2.8%)	
Klebsiella	2 (0.8%)	11 (4.4%)	P-value<0.001
Pseudomonas	5 (2%)	8 (3.2%)	
Enterococci	3 (1.2%)	5 (2%)	
Streptococcus	4 (1.6%)	7 (2.8%)	
CONS	7 (2.8%)	16 (6.4%)	
Others	5 (2%)	7 (2.8%)	

Figure 1. Receiver Operating Characteristic (ROC) curves for individual laboratory predictors of inhospital mortality in elderly sepsis patients.
(Lactate and hyponatremia showed moderate discriminative ability, while hypoalbuminemia demonstrated the highest AUC among single laboratory parameters.)



ROC analysis of individual laboratory variables showed that albumin, lactate, and sodium each had moderate predictive value for in-hospital mortality. Hypoalbuminemia exhibited the strongest discriminative ability (AUC = 0.70), followed by lactate (AUC = 0.65) and sodium (AUC = 0.33; inverse relationship indicating lower sodium associated with higher mortality). These findings suggest that albumin and lactate are useful early biochemical indicators of poor outcomes in elderly sepsis patients.

Figure 2. Receiver Operating Characteristic (ROC) curve of the final multivariable logistic regression model showing good discrimination for predicting in-hospital mortality.
(The area under the curve (AUC) was 0.82 (95% CI 0.78–0.86), indicating excellent model performance. The diagonal dashed line represents the line of no discrimination (AUC = 0.5).)



The discriminatory ability of the final multivariable model was evaluated using the area under the receiver operating characteristic (ROC) curve as shown in figure 1. The model demonstrated excellent discrimination for predicting mortality, with an AUC of 0.82 (95% CI 0.78–0.86). This indicates that there was an 82% probability that a randomly selected nonsurvivor would have a higher predicted probability of death than a randomly selected survivor.

CONCLUSION AND RECOMMENDATIONS

The study provides a strong indication that elderly hospitalized patients are at significant risk for sepsis-related mortality due to respiratory infections as the main source. The fact that a significant amount of mortality occurs within the first 24 hours of admission shows the importance of timely recognition and intervention. Important predictors of mortality such as hypoalbuminemia, elevated lactate, polypharmacy, acute renal injury, and hyponatremia provide valuable targets for ongoing risk stratification and clinical management. Improving early warning systems, enhancing infection-specific care, ensuring nutritional and renal support, and systematically reviewing medications can improve outcomes substantially. Creation of sepsis pathways relevant to geriatrics and better integration of patient-centered.

Public Health Campaigns: Promote early healthcare-seeking through awareness programs in local Languages, using community health workers (ASHA) and teleconsultation for remote areas. Symptom Recognition: Educate elderly and caregivers on early signs of critical conditions (sepsis, Stroke, cardiovascular events) using tools like FAST.

Chronic Disease Management: Implement screening and management for hypertension, diabetes, And multimorbidity with regular check-ups and integrated care models. Medication Optimization: Conduct medication reviews, train providers in geriatric pharmacology, And use EHRs to minimize polypharmacy and drug interactions.

Infection Control & Sepsis: Strengthen sepsis protocols (early antibiotics, fluids) and hospital Infection prevention (hand hygiene, catheter care). Stroke Care: Enhance stroke prevention (risk Factor control), establish stroke units with rapid imaging/thrombolytics, and promote FAST Awareness. Cardiovascular Health: Screen for risk factors (dyslipidemia, smoking), ensure Emergency cardiac care access, and promote lifestyle changes. Cancer Screening: Expand Community-based screening for high-risk cancers, improve oncology/palliative care access, and raise Symptom awareness.

CKD Management: Monitor renal function, promote dietary adherence, and expand dialysis access In peripheral hospitalsLab Monitoring: Use routine and point-of-care testing to manage critical laboratory abnormalities.

Geriatric Care Units: Establish specialized wards with multidisciplinary teams trained in frailty, Delirium, and palliative care. Hospital Stay & Discharge: Optimize stay duration and enhance discharge planning for better Outcomes.

Male-Targeted Interventions: Address male mortality predominance with risk factor programs (smoking cessation) and gender-specific campaigns.
Patient Education: Distribute local-language materials on chronic disease management and

Emergency recognition.
Policy Advocacy: Collaborate with authorities to improve primary healthcare infrastructure and Promote geriatric health research.

Research Priorities

- Prospective validation of GERI-Mortality Score - Microbiome studies in elderly sepsis
- Pharmacogenomic approaches to polypharmacy

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Acknowledgments: The authors acknowledge the medical records department staff at SKIMS for assistance with data retrieval.
Funding: No external funding was received for this study.
Conflicts of Interest: The authors declare no conflicts of interest.
Ethical Approval: This study was approved by the Institutional Ethics Committee of Sher-i-Kashmir Institute of Medical Sciences (IEC/SKIMS Protocol #008/2023).
Data Availability: De-identified data are available from the corresponding author upon reasonable request and with appropriate ethical approval.