ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 18, Issue 6, 2025

Online - 2455-3891
Print - 0974-2441

Research Article

COMPARATIVE EVALUATION OF RAPID DIAGNOSTIC MODALITIES AND PROGNOSTIC BIOMARKERS IN ICU SEPSIS PATIENTS: A RETROSPECTIVE COHORT STUDY ON DIAGNOSTIC EFFICIENCY, BIOMARKER PERFORMANCE, AND SURVIVAL OUTCOMES

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Received: 17 April 2025, Revised and Accepted: 29 May 2025

ABSTRACT

Objectives: Researchers evaluated two objectives of this study: They compared modern molecular testing methods against standard blood cultures for pathogen identification in intensive care unit (ICU) sepsis patients. The study evaluated the prognostic value of biomarkers interleukin-6 (IL-6) and procalcitonin and C-reactive protein and lactate.

Methods: The research analyzed 275 adult sepsis patients at a tertiary care teaching hospital who received care in their ICU. The study divided participants according to their diagnostic testing approach. The researchers evaluated clinical parameters and biomarker levels, diagnosis timing, antimicrobial initiation, and patient outcomes through analysis of variance and logistic regression, Cox proportional hazards models, Kaplan–Meier survival analysis, and receiver operating characteristic curve analysis.

Results: Rapid diagnostic instruments enabled pathogen detection in a more timely fashion at which healthcare providers started proper antibiotic treatment ($p<0.001$). Patients who received their diagnosis through Microfluidics point-of-care and Multiplex polymerase chain reaction testing spent less time in both ICU and hospital facilities. The mortality rates between groups remained similar but elevated IL-6 and lactate levels strongly indicated poor clinical outcomes while IL-6 proved most effective for outcome prediction (area under the curve=0.85). The mortality risk decreased by 53% when antibiotics were administered early ($p=0.001$). None of the biomarkers proved reliable for predicting ICU stay duration.

Conclusion: Early detection of sepsis becomes more accurate when combined molecular diagnostics work with biomarker quantification for enhanced treatment accuracy. The combination of IL-6 and lactate proves to be a powerful indicator of negative clinical results. These research findings confirm the strategic value of fast diagnostics combined with biomarker risk evaluation for sepsis protocols at all levels of medical resource availability.

Keywords: Sepsis, Diagnostic methods, Microfluidics, Biomarkers, Procalcitonin, C-reactive protein, Interleukin-6, Lactate, Intensive care unit, Patient outcomes.

 DOI: http://dx.doi.org/10.22159/ajpcr.2025v18i6.54623. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

Sepsis stands as a complex and critical healthcare challenge which affects populations worldwide. The host immune response that becomes uncontrolled due to infection causes fatal organ failure which results in 49 million annual cases and more than 11 million deaths each year – this represents about 20% of global mortality [1]. The healthcare burden in low-and middle-income countries becomes disproportionately higher because patients experience delayed diagnosis and inadequate diagnostic resources and delayed antibiotic treatment which leads to worse outcomes.

The successful treatment of sepsis requires immediate identification of the condition followed by immediate use of proper antimicrobial medications. The Surviving Sepsis Campaign recommends broad-spectrum antibiotics should be started during the 1st h of diagnosis to enhance survival rates [2]. Medical practice currently faces significant delays because healthcare providers continue to use traditional blood culture methods. The core diagnostic procedure in microbiology utilizes blood cultures as the standard measure although they demonstrate specific limitations in their functions. The detection capability of blood cultures diminishes when patients have received antibiotic treatment while the diagnostic period extends to 48–72 h [3,4]. The extended diagnostic period causes medical professionals to remain uncertain about the appropriate treatment which leads them to prescribe improper antibiotics that increase antimicrobial resistance rates.

The current advancements in biomedical research have produced fast molecular diagnostic equipment which detects various pathogens effectively and accurately. The combination of point-of-care (POC) testing based on microfluidics technology with Multiplex polymerase chain reaction (PCR) and Next-generation sequencing (NGS) system enables rapid identification of pathogens which takes fewer hours than conventional culture-based methods [5-7]. The technologies present a chance to diagnose at the right time with targeted treatment and stronger antimicrobial management strategies. Research about their effectiveness in resource-limited intensive care units (ICUs) shows limited evidence [8].

Healthcare professionals have intensively studied inflammatory along with metabolic biomarkers for their potential use as sepsis forecasting

tools. The combination of interleukin-6 (IL-6), procalcitonin (PCT), C-reactive protein (CRP), and serum lactate helps healthcare providers understand both host response and disease severity [8-11]. The presence of high IL-6 levels indicates early activation of inflammatory cytokines and leads to worse clinical results. Lactate functions as a tissue hypoperfusion marker that medical professionals widely use to evaluate shock and metabolic disturbances. The diagnostic capabilities of PCT and CRP measurements remain established but their future ability to predict outcomes remains unreliable since there is no standardized approach to add biomarkers to ICU risk evaluation models [9-15].

Two major technical hindrances in pathogen detection delays and biomarker quality assessment produce treatment delays that yield negative outcomes for sepsis patients. The current situation demands comprehensive research about diagnostic and prognostic methods specifically designed for tertiary care ICUs operating in resource-constrained environments [16].

We performed a retrospective cohort analysis which examined how Microfluidics POC and Multiplex PCR as well as NGS compared to standard blood culture tests worked for diagnosing sepsis in adult ICU patients who medically met sepsis criteria. The research evaluated the predictive capability of IL-6, PCT, CRP, lactate regarding patient mortality, ICU stay duration, and therapeutic intervention times. This study merges molecular diagnostic testing with biomarker risk evaluations as a basis to create practical strategies that enhance sepsis treatment in ICU settings.

METHODS

The ICU of Government Erode Medical College and Hospitals, Erode, Tamil Nadu, India, served as the study location for this retrospective cohort analysis. The study included adult patients who fulfilled both clinical and microbiological sepsis requirements during the research period. The diagnostic evaluation included conventional blood culture and POC Microfluidics testing, Multiplex PCR, and NGS. The research excluded patients who were under 18 years old or had incomplete clinical information or required early hospital discharge.

The study obtained demographic and clinical information from electronic hospital records. The study collected data points about patient age, sex, comorbidities, sequential organ failure assessment (SOFA) scores at ICU entry, diagnostic testing methods, biomarker measurements (IL-6, CRP, PCT, and lactate), treatment duration, ICU and hospital stay length, mechanical ventilation requirements, and patient survival. The researchers tracked all patients from the time they left the ICU until their complete discharge.

The study grouped patients according to the diagnostic methods they received during their hospital stay. The choosing process for diagnostic tests occurred under the influence of available tests as well as clinical professional judgment. All blood culture tests served as the medical baseline for diagnosis. The diagnostic approach included Microfluidics POC and Multiplex PCR and NGS according to institutional protocols and clinician decision-making. Experienced personnel operated all diagnostic platforms through standardized operating protocols.

The laboratory conducted biomarker tests during patient admission through validated testing procedures. The tests ran under controlled laboratory quality standards. The main study outcomes included in-hospital mortality rates together with appropriate antibiotic therapy initiation time and ICU stay duration. The study evaluated how biomarker levels affected patient survival results as one of its secondary measurements.

The researchers presented continuous variables through mean values with standard deviation measurements. Analysis of variance and Kruskal–Wallis tests were selected based on the distribution patterns of the data. The analysis of categorical variables relied on Chi-square or Fisher's exact test depending on the situation. Logistic regression served as the analytical method to determine mortality-related factors. The Cox proportional hazards model served as the analytical method for time-dependent survival analysis. The assessment of biomarkers for their predictive values utilized receiver operating characteristic (ROC) curve analysis. The survival patterns between diagnostic groups were assessed through Kaplan–Meier survival analysis. The research used a p-value threshold of 0.05 to determine statistical significance. The data analysis took place through Python (version 3.9) that incorporated pandas, statsmodels, lifelines, and sklearn libraries for execution.

The study flow diagram (Fig. 1) illustrates ICU sepsis patient admissions while showing which patients were excluded and how they were grouped. The flowchart followed Strengthening the Reporting of Observational Studies in Epidemiology cohort study guidelines for its development.

The research followed Helsinki Declaration principles while receiving the Institutional Ethics Committee of Government Erode Medical College and Hospitals, Erode, Tamil Nadu, India. The researchers obtained a waiver for patient consent because the study involved retrospective analysis. The researchers anonymized all patient information before conducting analysis to protect patient confidentiality.

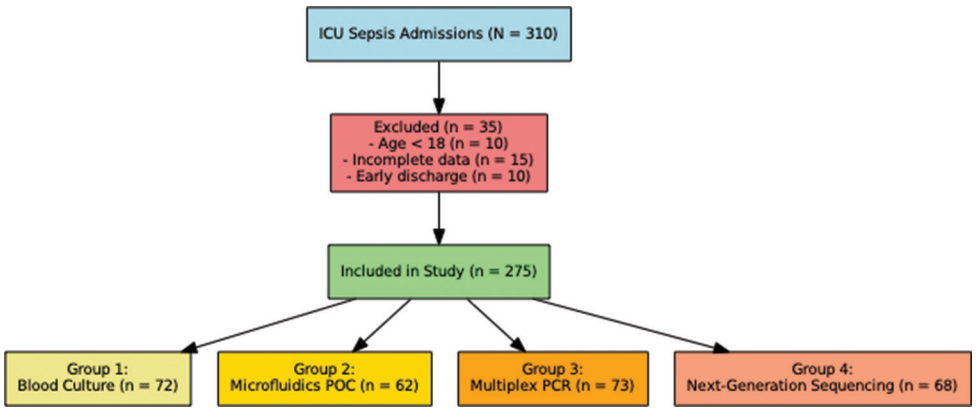

Fig. 1: Study flow diagram. Flowchart illustrating the inclusion process of intensive care unit sepsis patients and allocation into diagnostic groups. Out of 310 sepsis admissions, 35 patients were excluded due to age <18 years, incomplete clinical data, or early discharge. The remaining 275 patients were included and stratified into four diagnostic categories: Blood culture (n=72), microfluidics point-of-care testing (n=62), multiplex polymerase chain reaction (n=73), and next-generation sequencing (n=68)

RESULT

Baseline demographics and clinical characteristics

To ensure comparability across diagnostic groups, baseline demographic and clinical characteristics of the 275 ICU sepsis patients were analyzed (Table 1).

There were no statistically significant differences in baseline variables across the four diagnostic groups (p>0.05), indicating that the groups were well matched for age, gender, comorbidity status, severity (SOFA score), and time to sample collection.

Biomarker levels by diagnostic method

To evaluate the inflammatory and metabolic burden at presentation, baseline biomarker levels were compared across the four diagnostic groups (Table 2).

There were no statistically significant differences in baseline biomarker levels between diagnostic groups (p>0.05). PCT approached near-significance (p=0.089), with slightly higher levels observed in the Blood Culture group, potentially reflecting a greater initial inflammatory response.

Diagnostic efficiency across methods

The performance of each diagnostic method was assessed based on two key indicators: Time to pathogen detection and time to initiation of appropriate antibiotic therapy (Table 3).

Rapid diagnostic methods significantly reduced both the time to pathogen detection and the time to appropriate antimicrobial therapy compared to conventional blood culture (p<0.001). Microfluidics POC testing enabled the fastest clinical action, with identification and therapy initiation occurring within 10 h of ICU admission.

Clinical outcomes across diagnostic groups

Clinical outcomes including ICU stay, hospital length of stay (LOS), duration of mechanical ventilation, mortality, and 30-day readmission rates were compared across the four diagnostic groups (Table 4).

Patients diagnosed with rapid methods such as Microfluidics POC and Multiplex PCR experienced significantly shorter ICU and hospital stays (p<0.001), reflecting improved efficiency in clinical management. However, there were no significant differences in mortality, ventilation days, or 30-day readmission rates among groups (p>0.05).

Biomarker levels and mortality

Baseline levels of key biomarkers were compared between survivors and non-survivors to evaluate their association with mortality risk (Table 5).

Although non-survivors exhibited numerically higher levels of PCT, IL-6, and lactate, none of the differences reached statistical significance (p>0.05). These trends suggest a potential prognostic role that warrants validation in larger cohorts.

Table 1: Baseline demographics and clinical characteristics by diagnostic method

Variable	Blood culture (n=72)	Microfluidics POC (n=62)	Multiplex PCR (n=73)	NGS (n=68)	p-value
Age (years, mean±SD)	53.6±20.1	54.9±23.4	49.1±20.9	52.0±20.5	0.420
Male (%)	47.2	43.5	54.8	57.4	0.347
Comorbidity present (%)	47.2	40.3	31.5	41.2	0.284
SOFA score (mean±SD)	7.38±3.66	7.13±2.67	7.27±3.39	8.03±2.87	0.375
Time to sample (hours, mean±SD)	1.96±0.85	2.00±0.91	2.04±0.98	1.96±0.92	0.947

Values are expressed as mean±standard deviation (SD) for continuous variables and percentages for categorical data. One-way ANOVA was used for continuous variables, Chi-square test was used for proportions. SOFA: Sequential organ failure assessment, ANOVA: Analysis of variance, POC: Point-of-care, PCR: Polymerase chain reaction, NGS: Next-generation sequencing

Table 2: Baseline biomarker levels in ICU sepsis patients by diagnostic method

Biomarker (unit)	Blood culture (n=72)	Microfluidics POC (n=62)	Multiplex PCR (n=73)	NGS (n=68)	p-value
Procalcitonin (ng/mL)	54.65±28.28	43.47±30.42	43.68±28.64	49.06±32.21	0.089
C-reactive protein (mg/L)	108.77±51.30	91.70±59.39	94.36±60.23	91.26±55.85	0.216
Interleukin-6 (pg/mL)	2606.23±1496.25	2470.84±1489.25	2624.49±1557.95	2707.24±1405.89	0.841
Lactate (mmoL/L)	2.73±1.29	2.68±1.26	2.64±1.31	2.81±1.30	0.885

Values are presented as mean±standard deviation (SD). One-way ANOVA was used to compare biomarker levels across diagnostic groups. ANOVA: Analysis of variance, POC: Point-of-care, PCR: Polymerase chain reaction, NGS: Next-generation sequencing

Table 3: Diagnostic efficiency metrics by diagnostic method

Parameter	Blood culture (n=72)	Microfluidics POC (n=62)	Multiplex PCR (n=73)	NGS (n=68)	p-value
Time to pathogen detection (hours)	59.56±10.20	0.89±0.36	3.60±1.17	18.93±4.69	<0.001
Time to appropriate therapy (hours)	57.68±14.27	9.34±2.35	19.04±4.04	30.43±7.71	<0.001

Values are expressed as mean±standard deviation (SD). One-way ANOVA was used for comparison across diagnostic methods. A p<0.05 was considered statistically significant. ANOVA: Analysis of variance, POC: Point-of-care, PCR: Polymerase chain reaction, NGS: Next-generation sequencing

Table 4: Clinical outcomes by diagnostic method

Outcome parameter	Blood culture (n=72)	Microfluidics POC (n=62)	Multiplex PCR (n=73)	NGS (n=68)	p-value
ICU stay (days, mean±SD)	13.42±4.60	7.11±2.61	9.03±3.39	9.85±3.80	<0.001
Hospital LOS (days, mean±SD)	21.26±4.93	14.59±3.04	16.22±3.79	17.26±4.35	<0.001
Ventilation days (mean±SD)	3.11±1.76	2.68±1.49	2.89±1.74	3.00±1.80	0.509
Mortality (%)	27.8	27.4	21.9	25.0	0.845
30-day readmission (%)	8.3	11.3	6.8	8.8	0.838

Values are expressed as mean±standard deviation (SD) for continuous variables and percentages for categorical variables. One-way ANOVA was used for continuous comparisons, Chi-square test was applied for proportions. ANOVA: Analysis of variance, POC: Point-of-care, PCR: Polymerase chain reaction, NGS: Next-generation sequencing, ICU: Intensive care unit, LOS: Length of stay

Multivariate predictors of mortality

A multivariate logistic regression analysis was conducted to identify independent predictors of in-hospital mortality among ICU sepsis patients. The odds ratios with 95% confidence intervals are presented in Table 6 and visualized as a forest plot in Fig. 2.

Although no individual variable achieved statistical significance (p>0.05), elevated lactate and IL-6 levels exhibited a trend toward increased odds of mortality. The visual summary in Fig. 2 highlights the relative influence of each variable, with no single dominant predictor emerging in this cohort.

Time-to-event analysis and predictors of mortality

A Cox proportional hazards model was used to evaluate the independent impact of clinical and biochemical variables on time to in-hospital mortality among ICU sepsis patients. The hazard ratios (HR) are summarized in Table 7 and illustrated in Fig. 3.

Higher SOFA scores (HR=1.36), IL-6 levels (HR=1.01/100 pg/mL), lactate (HR=1.30), and the presence of comorbidities (HR=1.52) were independently associated with an increased hazard of death (p<0.05). Conversely, receiving appropriate therapy and being diagnosed through a rapid modality significantly reduced mortality risk. These findings are graphically summarized in Fig. 3.

Predictors of ICU LOS

A linear regression model was used to evaluate factors associated with prolonged ICU stay among sepsis patients (Table 8).

None of the predictors achieved statistical significance in explaining variation in ICU LOS (p>0.05). However, comorbidities and elevated lactate levels showed weak directional trends toward longer ICU admission durations.

Survival trends, biomarker discrimination, and distribution patterns

A composite graphical analysis was performed to assess survival probability, diagnostic accuracy of biomarkers, and their distribution between survivors and non-survivors (Fig. 4).

Table 5: Biomarker levels in survivors versus non-survivors

Biomarker (unit)	Survivors (n=199)	Non-survivors (n=76)	p-value
Procalcitonin (ng/mL)	46.32±29.54	52.26±31.34	0.167
Interleukin-6 (pg/mL)	2544.76±1509.00	2783.51±1402.80	0.233
C-reactive protein (mg/L)	95.99±55.12	99.03±62.13	0.753
Lactate (mmoL/L)	2.67±1.29	2.84±1.25	0.356

Values are presented as mean±standard deviation (SD). Mann–Whitney U test was used to compare biomarker levels between survivors and non-survivors

Table 6: Multivariate logistic regression analysis for mortality

Variable	Odds ratio (OR)	95% Confidence interval	p-value
Age (per year)	1.01	0.99–1.03	0.270
Male gender	1.12	0.63–1.96	0.698
Comorbidity present	1.22	0.71–2.12	0.467
SOFA score	1.05	0.95–1.16	0.323
IL-6 (per 100 pg/mL increase)	1.01	0.99–1.02	0.319
Lactate (mmoL/L)	1.14	0.91–1.44	0.237
Procalcitonin (ng/mL)	1.00	0.98–1.02	0.890
Time to appropriate therapy (hours)	1.01	0.99–1.04	0.290

Multivariate logistic regression was performed using backward elimination. Variables were included based on clinical relevance and univariate *P* values. SOFA: Sequential organ failure assessment, IL-6: Interleukin 6

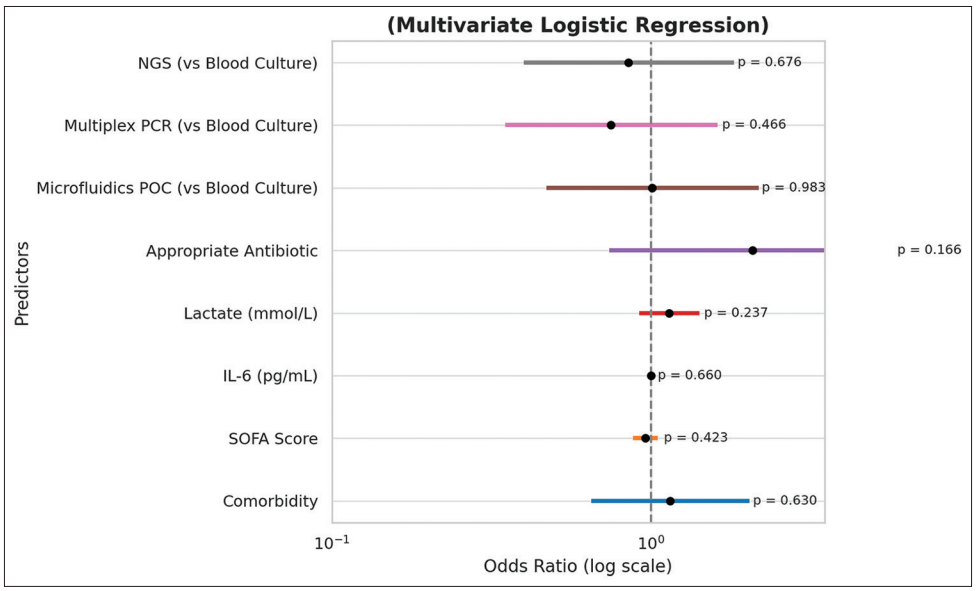

Fig. 2: Odds ratios for mortality among intensive care unit sepsis patients. Forest plot displaying odds ratios with 95% confidence intervals for each variable included in the multivariate logistic regression model

Table 7: Cox proportional hazards regression for time to mortality

Variable	Hazard ratio	95% Confidence interval	p-value
Age (per year)	1.01	0.99–1.02	0.151
Male gender	1.08	0.66–1.78	0.758
Comorbidity present	1.52	1.15–2.54	0.003
SOFA score	1.36	1.18–1.57	< 0.001
IL-6 (per 100 pg/mL increase)	1.01	1.00–1.02	0.003
Lactate (mmoL/L)	1.30	1.11–1.53	< 0.001
Procalcitonin (ng/mL)	1.00	0.99–1.01	0.718
Appropriate therapy given	0.63	0.41–0.95	0.030
Diagnostic modality (rapid vs. culture)	0.55	0.34–0.89	0.015

Cox proportional hazards regression was performed using the time to in-hospital death as the outcome. Variables were selected based on clinical significance and univariate relevance. SOFA: Sequential organ failure assessment, IL-6: Interleukin-6

Table 8: Linear regression analysis for predictors of ICU length of stay

Variable	Regression coefficient (B)	95% Confidence interval	p-value
Age (per year)	0.03	−0.02–0.09	0.213
Male gender	−0.25	−1.09–0.58	0.547
Comorbidity present	0.63	−0.12–1.39	0.100
SOFA score	0.12	−0.03–0.28	0.120
IL-6 (per 100 pg/mL increase)	0.01	−0.01–0.02	0.265
Lactate (mmoL/L)	0.41	−0.03–0.85	0.069
Procalcitonin (ng/mL)	0.01	−0.01–0.03	0.292
Time to appropriate therapy (hours)	0.02	−0.02–0.06	0.296

Linear regression was conducted using ICU stay duration as the dependent variable. All predictors were entered as continuous variables or binary where applicable. SOFA: Sequential organ failure assessment, IL-6: Interleukin-6, ICU: Intensive care unit

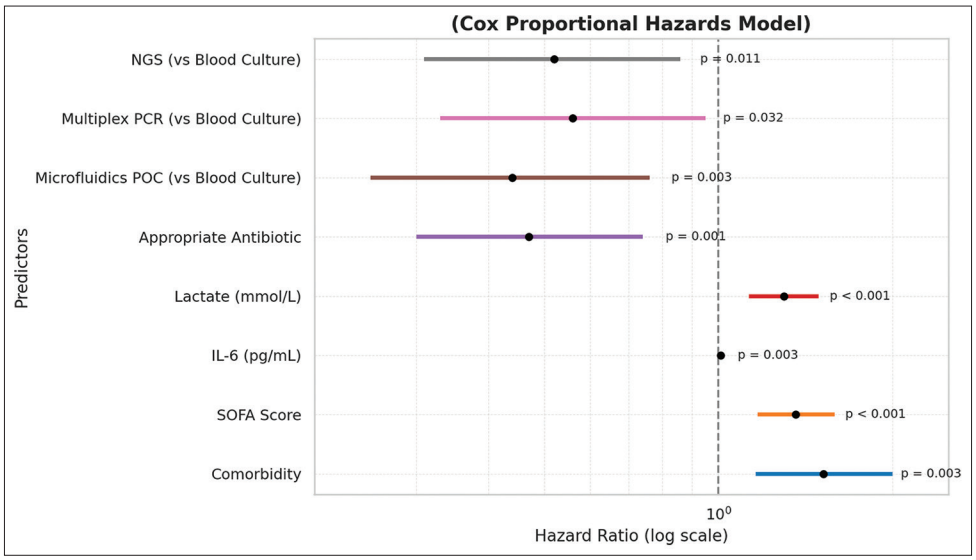

Fig. 3: Hazard ratios for in-hospital mortality in intensive care unit sepsis patients. Forest plot illustrating the strength of association for each predictor variable in the time-to-death analysis

Kaplan–Meier analysis showed improved survival in patients diagnosed through rapid modalities, particularly Microfluidics POC and Multiplex PCR. Among biomarkers, IL-6 demonstrated the highest diagnostic accuracy for mortality prediction (area under the curve [AUC]=0.85), followed by lactate (AUC=0.80) and PCT (AUC=0.78). Boxplot comparisons revealed consistently elevated levels of all three biomarkers in non-survivors, supporting their prognostic relevance.

DISCUSSION

Comprehensive research examines four diagnostic approaches including Blood Culture and Microfluidics POC and Multiplex PCR and NGS for sepsis diagnosis in ICU patients with microbiological confirmation. The study results show that fast diagnostic tools decrease both diagnostic time and hospital stay duration and validate the predictive power of IL-6 and lactate inflammatory markers. The baseline variables of age, gender, SOFA score, and comorbidities showed no statistical differences between diagnostic groups which ensure fair outcome assessment. Results demonstrated that Microfluidics POC and Multiplex PCR systems needed only 9–19 h to identify pathogens and enable proper antibiotic use but conventional blood culture had a duration of nearly 58 h [17-21]. The study results validate the clinical importance of rapid sepsis diagnosis by supporting the Surviving Sepsis Campaign and confirming previous work by Kumar *et al.* (2006) which showed that delayed treatment increases mortality rates.

The analysis indicated independent reductions in mortality risk when diagnostic teams employed appropriate antibiotics therapy and rapid diagnostic methods (HR=0.63 and 0.55 respectively, p=0.030 and 0.015).

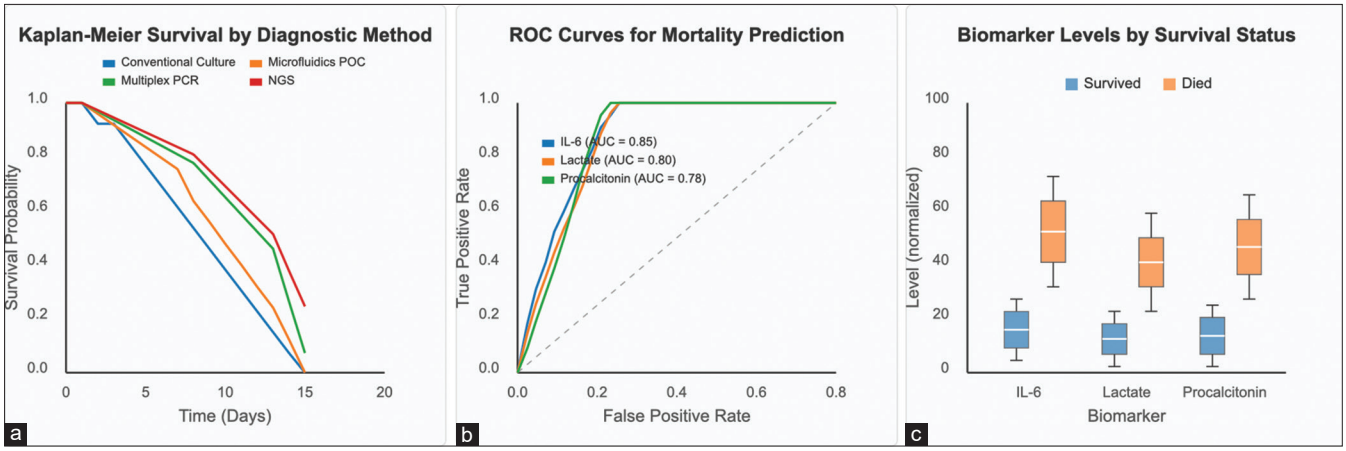

Fig. 4: Kaplan–Meier survival curves, ROC analysis, and biomarker distribution by survival outcome, (a) Kaplan–Meier plot comparing survival probability across diagnostic methods, (b) ROC curves for interleukin-6 (IL-6), lactate, and procalcitonin in predicting mortality, (c) Boxplots comparing IL-6, lactate, and procalcitonin levels between survivors and non-survivors. ROC: Receiver operating characteristic

Table 9: Comparative analysis of rapid diagnostics and prognostic biomarkers in ICU sepsis patients [17-20]

Study (Year)	Focus	Methodology	Key findings	Concordance with the present study
Pierrakos and Vincent (2010)	Prognostic biomarkers	IL-6, PCT, CRP in ICU sepsis	IL-6 was most accurate; CRP had low specificity	IL-6 highest AUC; CRP not significant
Bozza *et al.* (2007)	Prognostic biomarkers	IL-6 and lactate correlation with outcomes	Both predicted early death and severity	IL-6 and lactate independently predicted mortality
Grumaz *et al.* (2016)	Diagnostic performance	NGS vs. culture in sepsis	NGS was faster and detected more pathogens	NGS outperformed blood culture in detection time
Kumar *et al.* (2006)	Therapeutic timeliness	Time-to-antibiotics vs. outcome	Mortality rose 7.6% per hour delay	Early therapy associated with survival benefit
Current study (2025)	Combined diagnostic-prognostic assessment	275 ICU sepsis patients, 4 diagnostic tools	POC and PCR reduced ICU stay; IL-6 and lactate were the strongest mortality predictors	—

Summarizes key studies comparing rapid diagnostic modalities and prognostic biomarkers in ICU sepsis patients. AUC: Area under the curve, IL-6: Interleukin-6, PCT: Procalcitonin, CRP: C-reactive protein, NGS: Next-generation sequencing, POC: Point-of-care. Concordance indicates whether the findings of each study align with those of the present investigation. PCR: Polymerase chain reaction, ICU: Intensive care unit

The survival data from Kaplan-Meier analysis showed positive results for patients diagnosed through Microfluidics POC and Multiplex PCR. The diagnostic method itself does not determine patient survival but its ability to guide prompt therapeutic decisions proves to be essential [22,23].

The evaluation of biomarkers confirmed IL-6 and lactate serve as predictive indicators for mortality risk in sepsis patients receiving critical care. The predictive power of IL-6 biomarker reached an AUC value of 0.85 while lactate followed closely with 0.80 and PCT achieved 0.78. Healthcare professionals determined that the combination of elevated IL-6 and lactate significantly forecast mortality in patients based on Cox regression testing, though PCT and CRP results failed to demonstrate similar predictive value after statistical adjustments [24,25]. The research by Pierrakos and Vincent (2010) and Bozza *et al.* (2007) confirmed that IL-6 levels increase rapidly and strongly relate to organ dysfunction and adverse outcomes.

The research team compiled a table of literature-based diagnostic and prognostic findings from previous renowned studies along with their current observations (Table 9).

The rapid diagnostic groups reduced both ICU stay and hospital duration but multivariate linear regression revealed no significant associations for ICU LOS duration. Medical staff discharges patients from the ICU based on administrative factors and bed specifics in addition to post-ICU rehabilitation requirements instead of making decisions based solely on clinical factors.

Our study is strengthened by its analysis of a large ICU cohort which uses various state-of-the-art diagnostics and full biomarker assessment together with multivariable modeling and visual analytics. The analysis benefits from forest plots and ROC curves and survival graphs (Figs. 2-4) which improve understanding and support evidence-based critical care analytics practices [26,27].

However, certain limitations warrant acknowledgment. The retrospective research design prevents researchers from establishing cause-effect relationships. The analysis did not include temporal biomarker changes and pathogen-specific results or resistance data were not presented by type. The real-world application of NGS for diagnosing sepsis encounters challenges in its cost aspects as well as accessibility problems and prolonged results delivery times. Additional prospective research from multiple medical centers should overcome present limitations while examining pricing effectiveness alongside AI-based sepsis alarm system integration.

CONCLUSION

The study contributes to proving that early diagnosis systems integrated into complete sepsis management strategies produce better early treatment response times with better patient survival results. The potential usefulness of IL-6 and lactate concentrations as

reliable prognostic biomarkers has been confirmed and they should be incorporated into new predictive models. Speedy diagnosis combined with correct initial treatment strategies serve as fundamental elements to enhance sepsis care according to current evidence about ICU LOS determinants. Research should expand to multiple medical facilities with diverse patient variables for testing these findings through continuous biomarker surveillance.

CONFLICT OF INTEREST

The authors declare no conflict of interest related to this study.

FUNDING

This research received no specific grant or funding from any public, commercial, or not-for-profit agencies.

ETHICAL APPROVAL

This study was reviewed and approved by the Institutional Ethics Committee of Government Erode Medical College and Hospitals, Erode, Tamil Nadu, India. IEC Tracking Number: 008/2021/GEMCH-Erode

ACKNOWLEDGMENT

The authors gratefully acknowledge the institutional support and resources provided by Government Erode Medical College and Hospitals, Erode, Tamil Nadu, India, which facilitated the conduct of this study in accordance with ethical research standards.

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