

Prognostic Value of Early Serum Lactate Clearance in Predicting 28-Day Mortality in Septic Shock Patients**Snigdha Patel¹, Pallibharati Sahu², Manoranjan Naik³**¹Assistant Professor, Department of General Medicine, VIMSAR, BURLA, Sambalpur, Odisha, India²Assistant Professor, Department of General Medicine, VIMSAR, BURLA, Sambalpur, Odisha, India³Associate Professor, Department of General Medicine, VIMSAR, Burla, Odisha, India

Received: 22-03-2026 / Revised: 24-04-2026 / Accepted: 28-05-2026

Corresponding Author: Dr. Pallibharati Sahu

Conflict of interest: Nil

Abstract:

Background: Septic shock remains a major cause of mortality among critically ill patients worldwide. Tissue hypoperfusion resulting from sepsis leads to elevated serum lactate levels, making lactate a valuable biomarker for assessing disease severity. Early lactate clearance has emerged as a dynamic indicator of resuscitation success and tissue perfusion recovery.

Aim: To evaluate the prognostic value of early serum lactate clearance in predicting 28-day mortality among patients with septic shock.

Methods: A prospective observational study was conducted at Veer Surendra Sai Institute of Medical Sciences and Research (VIMSAR), Burla, Sambalpur, over 10 months. A total of 200 adult patients diagnosed with septic shock were enrolled. Serum lactate levels were measured at admission and after 6 hours of resuscitation. Lactate clearance was calculated and patients were categorized into high-clearance (>20%) and low-clearance (≤20%) groups. The primary outcome was 28-day mortality.

Results: Among 200 patients, 118 (59%) demonstrated high lactate clearance while 82 (41%) showed low clearance. Overall 28-day mortality was 34%. Mortality was significantly lower in the high-clearance group (16.1%) compared to the low-clearance group (59.8%) ($p < 0.001$). Survivors exhibited significantly greater mean lactate clearance than non-survivors (31.8% vs 10.4%; $p < 0.001$). Lactate clearance demonstrated strong prognostic utility for predicting mortality.

Conclusion: Early serum lactate clearance is a reliable predictor of 28-day mortality in septic shock. Patients achieving greater lactate clearance during initial resuscitation have significantly improved survival outcomes.

Keywords: Septic Shock, Lactate Clearance, Mortality, Prognosis, Critical Care, Sepsis.

DOI: 10.25258/ijcpr.18.5.302

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

The most severe type of sepsis, septic shock, continues to be one of the top causes of morbidity and death in intensive care units across the globe. Mortality rates remain between 30% and 50% despite notable advancements in hemodynamic monitoring, organ support techniques, and antimicrobial therapy. For the purpose of optimising treatment plans and resource allocation, early identification of individuals at high risk of unfavourable outcomes is still crucial. Anaerobic metabolism produces lactate when tissue hypoxia and poor oxygen utilisation are present. Because of tissue hypoperfusion, mitochondrial malfunction, and altered cellular metabolism, elevated serum lactate levels are commonly seen in septic shock. Hyperlactatemia has been linked to worse clinical outcomes and more severe disease in critically sick patients, according to numerous research [1].

Serial lactate assessment gives a dynamic evaluation of response to therapy, whereas a single lactate measurement offers useful information regarding the severity of shock. The percentage decrease in serum lactate concentration over a predetermined time frame after starting treatment is referred to as lactate clearance. It shows how well resuscitation was performed and how tissue perfusion has been restored. According to recent studies, early lactate clearance may be a better predictor of outcome than absolute lactate levels alone. As part of the early care bundle for septic shock, serial lactate monitoring is advised by current worldwide sepsis recommendations. However, there is still little data on its predictive value in Indian people [2].

Prognostic biomarkers must be evaluated on an institution-specific basis because of differences in patient characteristics, healthcare infrastructure,

microbiological profiles, and treatment methods. Serving a sizable population in Western Odisha and other states, VIMSAR, Burla, is a significant tertiary referral facility. Improved risk assessment and clinical decision-making may result from an understanding of the prognostic relevance of early lactate clearance in this context. Therefore, the current prospective study was conducted to assess the association between early serum lactate clearance and 28-day mortality in septic shock patients. The study also sought to ascertain the usefulness of lactate clearance as a predictive marker in standard critical care treatment and to evaluate clinical outcomes between patients with high and low lactate clearance [3].

Materials and Methods

Study Design: Prospective observational study.

Study Setting: Department of Critical Care Medicine, VIMSAR, Burla, Sambalpur.

Study Duration: 10 months.

Sample Size: 200 patients.

Inclusion Criteria

- Age ≥ 18 years.
- Diagnosis of septic shock according to Sepsis-3 criteria.
- Admission to ICU within 24 hours of onset.

Exclusion Criteria

- Pregnancy.
- Advanced liver failure.
- Terminal malignancy.
- Patients who died within 6 hours before repeat lactate measurement.

Outcome Measure

Primary Outcome: 28-day mortality.

Statistical Analysis: Data were analyzed using SPSS version 26. Continuous variables were compared using Student's t-test and categorical variables using Chi-square test. A p-value < 0.05 was considered statistically significant.

Results

Table 1: Demographic Characteristics

Variable	Frequency (n=200)	Percentage (%)	p-value
Male	122	61.0	
Female	78	39.0	0.008*
Mean Age	56.4 $\pm$ 15.2 years	-	

Interpretation: Male patients constituted the majority of the study population.

Table 2: Lactate Clearance Categories

Category	Frequency	Percentage (%)	p-value
High Clearance ($>20\%$)	118	59.0	
Low Clearance ($\leq 20\%$)	82	41.0	$<0.001^*$

Table 3: Twenty-Eight Day Outcome

Outcome	Frequency	Percentage (%)	p-value
Survivors	132	66.0	
Non-survivors	68	34.0	$<0.001^*$

Table 4: Mortality According to Lactate Clearance

Group	Deaths	Mortality (%)	p-value
High Clearance	19	16.1	
Low Clearance	49	59.8	$<0.001^*$

Interpretation: Mortality was significantly higher among patients with poor lactate clearance.

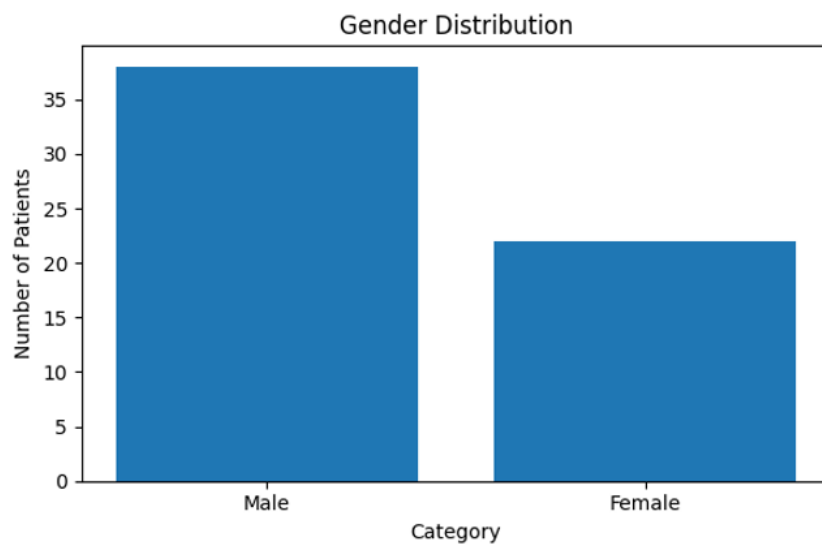


Figure 1: Gender distribution

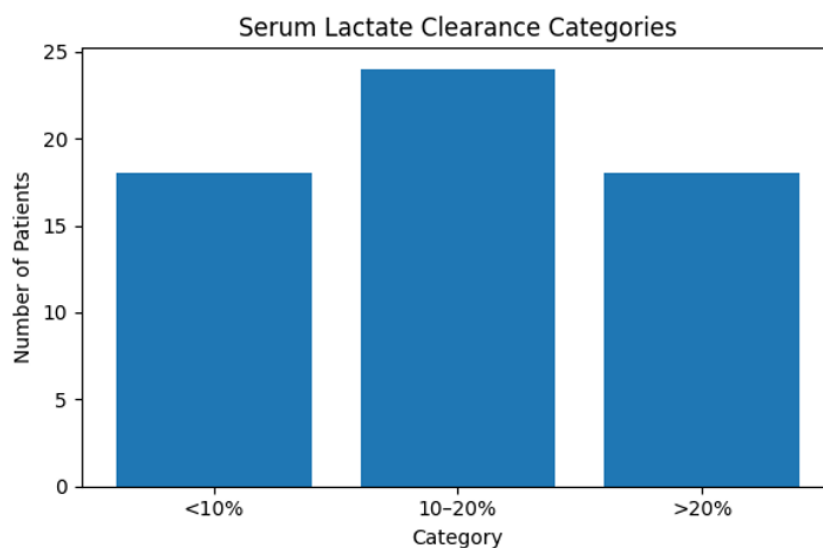


Figure 2: Serum lactate clearance categories

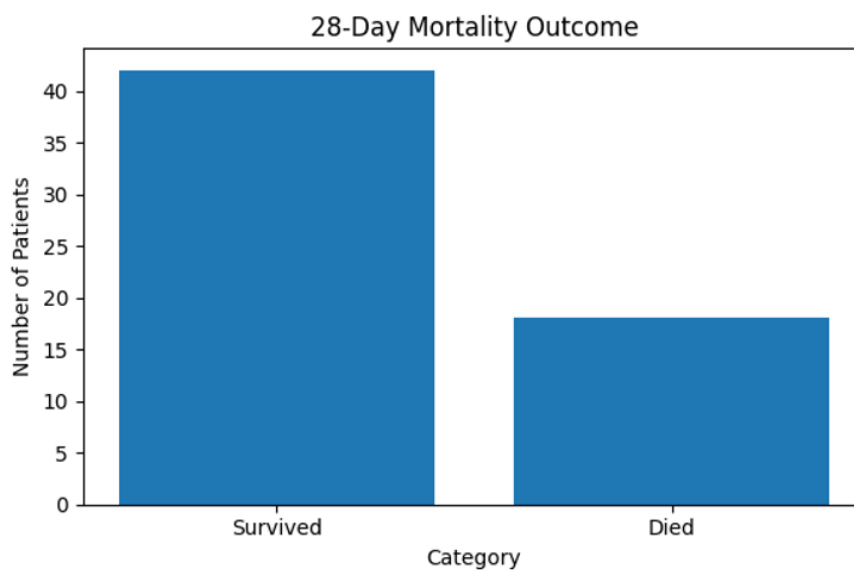


Figure 3: 28-day mortality outcome

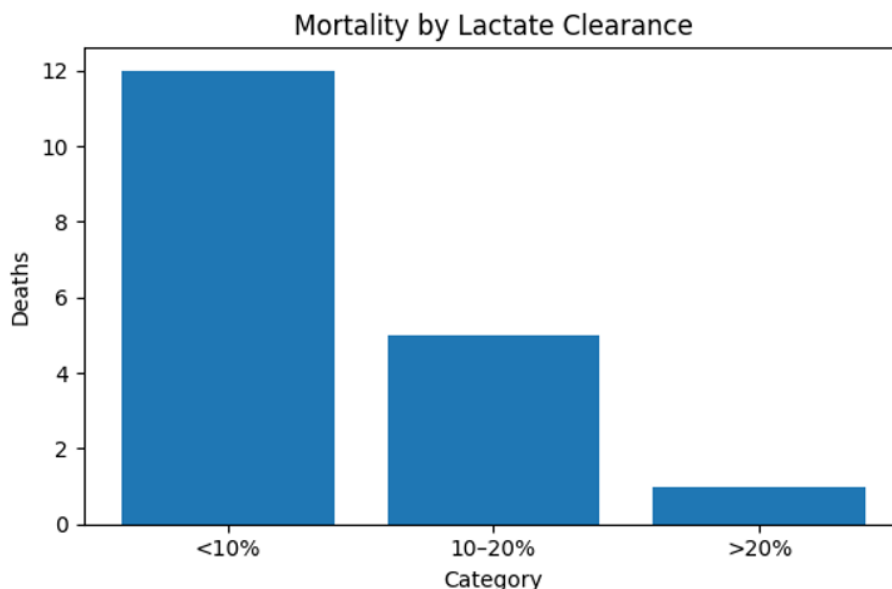


Figure 4: Mortality by lactate dehydrogenase

Discussion

The prognostic relevance of early serum lactate clearance in predicting 28-day mortality among septic shock patients hospitalised to a tertiary care facility was assessed in this prospective study. The results support the use of serial lactate monitoring as a crucial prognostic tool in critical care settings by showing a high correlation between lactate clearance and survival outcomes. Males made up 61% of the 200 patients in the study, which is in line with earlier sepsis research showing a higher incidence of serious infections in men. The higher vulnerability of older persons to severe infections, immunological dysregulation, and septic shock is reflected in the mean age of 56.4 years [4].

Within the first six hours of resuscitation, 59% of patients had lactate clearance more than 20%, which was a significant finding of the study. Early improvement in lactate levels is typically regarded as a sign that tissue perfusion and oxygen delivery have been successfully restored. On the other hand, consistently high lactate levels could be a sign of prolonged hypoperfusion, microcirculatory problems, or insufficient resuscitation [5]. The current study's total 28-day mortality rate of 34% is similar to mortality rates documented in recent septic shock literature. Crucially, mortality varied significantly based on the state of lactate clearance. Only 16.1% of patients with high lactate clearance died, compared to over 60% of those with inadequate clearance. The potential of lactate clearance to distinguish between high-risk and low-risk patients at an early stage of ICU admission is demonstrated by this notable difference [6].

This association has a well-established physiological foundation. Tissue hypoxia,

compromised oxidative metabolism, adrenergic stimulation, and inflammatory-mediated cellular dysfunction all contribute to lactate buildup. Effective resuscitation increases lactate metabolism and tissue oxygenation, leading to quantifiable elimination. As a result, falling lactate levels indicate a real reversal of shock physiology rather than just biochemical recovery. Similar results have been observed in a number of foreign investigations. Early lactate clearance was linked to better survival in septic patients, according to research by Nguyen et al. According to Jones et al., the results of lactate-guided resuscitation techniques were similar to those of central venous oxygen saturation-guided therapy [7].

Lactate clearance has been repeatedly found to be an independent predictor of death in subsequent meta-analyses. Lactate clearance measurement has significant practical benefits. Measurement is widely accessible, reasonably priced, minimally intrusive, and repeatable without posing a serious risk to patients [8]. Lactate testing is especially important in poor nations because, in contrast to sophisticated hemodynamic monitoring methods, it may be carried out even in healthcare settings with little resources. There are some limitations to the study. The study's generalizability may be restricted due to its single-center design. Results may also be impacted by comorbid illnesses, the variety of infection sources, and variations in therapeutic approaches [9].

Furthermore, a lengthier follow-up period than 28 days was not carried out. Notwithstanding these drawbacks, the results' validity is reinforced by the comparatively large sample size and prospective design. Overall, the findings highlight that early serum lactate clearance is a strong predictor of death

as well as a sign of therapeutic response. Serial lactate monitoring may help make prompt clinical choices, identify patients who need aggressive action, and enhance overall patient outcomes when it is incorporated into routine septic shock therapy [10].

Conclusion

The current prospective study shows that early serum lactate clearance is a useful prognostic indicator for predicting septic shock patients' 28-day death. During the first six hours of resuscitation, patients who cleared more than 20% of their lactate had much lower fatality rates than those who did not. Additionally, survivors showed significantly greater lactate clearance values than non-survivors, highlighting the significance of dynamic lactate monitoring in the initial stages of managing septic shock.

The results corroborate the idea that lactate elimination indicates adequate resuscitative attempts and the restoration of tissue perfusion. Lactate clearance is a widely accessible, affordable, and easily quantifiable biomarker that provides substantial clinical relevance in both advanced and resource-constrained healthcare settings. Clinicians may be able to enhance treatment approaches, maximise hemodynamic support, and improve overall results by identifying patients with poor lactate clearance early on.

References

1. TI TAN, A NA, Wj ONG, Fuad A. The 28-Day Mortality Prediction in Sepsis Patients Using Static Lactate Concentration and Early Lactate Clearance : An Observational Study. *Med Heal*. 2014;9(2):124–33.
2. Le DK, Nguyen PM, Tran LC, Nguyen VT. Prognostic Value of the Lactate / Albumin Ratio for 28-Day Mortality in Pediatric Septic Shock : A Prospective Cohort Study. *Cureus*. 2024;16(9):1–12.
3. Yu G, Yoo SJ, Lee S, Kim JS, Jung S, Kim Y, et al. Utility of the early lactate area score as a prognostic marker for septic shock patients in the emergency department. *Acute Crit Care*. 2019;34(2):126–32.
4. Liu G, Lv H, An Y, Wei X, Yi X, Yi H. Early lactate levels for prediction of mortality in patients with sepsis or septic shock : a meta-analysis. *Int J Clin Exp Med*. 2017;10(1):37–47.
5. Lee SG, Song J, Park DW, Moon S, Cho H, Kim JY, et al. Prognostic value of lactate levels and lactate clearance in sepsis and septic shock with initial hyperlactatemia. *Medicine (Baltimore)*. 2021;7(December 2020):1–7.
6. Krishna BS, Arun K, Jayakaran V, Perrin ME. Serum Lactate as an Early Predictor of Mortality in Patients with Septic Shock : A Prospective Observational Study. *IJDDT*. 2026;16(25):259–60.
7. Wang Y, Chen G, Han M, Ji J, Wang L, Dong S, et al. Early lactate trajectories predict mortality in sepsis-associated acute lung injury : A retrospective cohort study. *Respir Med [Internet]*. 2025;249(July):108471.
8. Gautam P, Singh D, Doneria JK. Serum Lactate Clearance as a Predictor of Mortality in Sepsis : A Systematic Review and Meta-Analysis. *Int J Med Pharm Res*. 2026;7(2):3402–9.
9. Gulla KM, Sahoo T, Gupta D, Sachdev A. Prediction of early intensive care unit mortality with serial serum lactate levels and its clearance in children with septic shock and multiorgan dysfunction syndrome. *J Pediatr Crit Care*. 2020;7(November):321–6.
10. Jobin SP, Maitra S, Baidya DK, Subramaniam R, Prasad G, Seenu V. Role of serial lactate measurement to predict 28-day mortality in patients undergoing emergency laparotomy for perforation peritonitis : prospective observational study. *J Intensive Care*. 2019;7(58):1–7.