Section: General Medicine

Original Research Article

CORRELATION BETWEEN LACTATE ALBUMIN RATIO AND QUICK SEQUENTIAL ORGAN FAILURE ASSESSMENT SCORE (qSOFA SCORE) IN SEPSIS

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Background: Early recognition of severe sepsis remains essential for timely intervention and improved patient outcomes. The lactate-albumin ratio has emerged as a promising composite biomarker that integrates information on tissue hypoperfusion and nutritional-inflammatory status, whereas the quick Sequential Organ Failure Assessment (qSOFA) score provides rapid bedside assessment of disease severity. The present study evaluated the relationship between these two measures in adults with sepsis. **Materials and Methods:** A hospital-based cross-sectional observational study was conducted among 150 adult patients fulfilling Sepsis-3 criteria who were admitted to the Medical Intensive Care Unit of a tertiary care teaching hospital. Clinical details, laboratory investigations, serum lactate, serum albumin, lactate-albumin ratio, and qSOFA scores were recorded. Statistical analyses included descriptive methods and correlation analyses using IBM SPSS, with statistical significance defined at $p < 0.05$. **Result:** The study demonstrated a significant positive association between lactate-albumin ratio and qSOFA score, indicating that increasing biochemical derangement paralleled worsening clinical severity. Patients with higher lactate-albumin ratios also tended to have poorer clinical outcomes and greater illness severity, supporting its role as a useful adjunctive prognostic marker. **Conclusion:** The lactate-albumin ratio showed a strong positive correlation with qSOFA score in patients with sepsis and may serve as an accessible and clinically meaningful biomarker for early risk stratification in critically ill patients.

INTRODUCTION

Sepsis is a life-threatening syndrome characterised by a dysregulated host response to infection resulting in organ dysfunction and remains one of the leading causes of admission to intensive care units worldwide. Despite advances in antimicrobial therapy and critical care, sepsis continues to be associated with substantial morbidity, mortality, and healthcare expenditure, highlighting the need for reliable tools for early risk stratification and prognostication.[1,2]

Rapid identification of patients at increased risk of deterioration is fundamental to improving clinical outcomes. The quick Sequential Organ Failure Assessment (qSOFA) score was developed as a simplified bedside tool based on altered mentation, hypotension, and tachypnoea to identify patients with suspected infection who are at greater risk of adverse outcomes. Owing to its ease of application and lack of dependence on laboratory parameters, qSOFA has gained widespread acceptance in emergency and critical care practice, although concerns remain regarding its sensitivity when used as a standalone predictor.[1,3]

Serum lactate is a well-established biomarker of tissue hypoperfusion and metabolic stress in sepsis. Elevated lactate concentrations are associated with impaired oxygen utilisation, mitochondrial dysfunction, and circulatory abnormalities and have repeatedly been linked to increased mortality. However, lactate values may be influenced by hepatic dysfunction, medications, and other metabolic disturbances, reducing their specificity as an isolated prognostic marker.[4,5]

Serum albumin reflects both nutritional status and systemic inflammatory activity. During sepsis, increased capillary permeability, altered hepatic protein synthesis, and ongoing inflammatory responses frequently result in hypoalbuminaemia, which itself has been associated with poor clinical outcomes and prolonged hospitalisation.

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Consequently, combining lactate and albumin into a single index may provide a more comprehensive assessment of disease severity than either parameter individually.[6,7]

The lactate-albumin ratio has emerged as a promising prognostic biomarker in critically ill patients because it simultaneously captures metabolic derangement and inflammatory burden. Recent investigations have demonstrated that this ratio performs better than serum lactate alone for predicting mortality and adverse outcomes in patients with sepsis and septic shock. Moreover, higher lactate-albumin ratios have consistently been associated with increasing illness severity and worse clinical prognosis across different healthcare settings.[7-10]

Although several studies have examined the relationship between the lactate-albumin ratio and comprehensive organ dysfunction scores such as the Sequential Organ Failure Assessment (SOFA) score, evidence regarding its correlation with the more practical qSOFA score remains relatively limited, particularly in Indian intensive care populations. Addressing this knowledge gap may facilitate earlier bedside identification of high-risk patients using simple and readily available clinical and laboratory variables.[8-10]

Therefore, the present study was undertaken to evaluate the correlation between the lactate-albumin ratio and qSOFA score among adult patients with sepsis admitted to a tertiary care medical intensive care unit. We hypothesised that patients with higher lactate-albumin ratios would demonstrate correspondingly higher qSOFA scores, supporting the utility of this biomarker as an adjunct for early severity assessment and prognostic evaluation.

MATERIALS AND METHODS

This hospital-based cross-sectional observational study was conducted in the Department of General Medicine and Medical Intensive Care Unit of Trichy SRM Medical College Hospital and Research Centre, Tamil Nadu, India, to evaluate the correlation between the lactate-albumin ratio and the quick Sequential Organ Failure Assessment (qSOFA) score among adult patients with sepsis. A total of 150 consecutive patients meeting the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) criteria were enrolled during the study period after obtaining written informed consent. Patients younger than 18 years of age and those with chronic liver disease classified as Child-Pugh class C, chronic kidney disease, cardiogenic shock, hypovolaemic shock, thiamine deficiency or inborn errors of metabolism were excluded to minimise potential confounding effects on serum lactate or albumin measurements. The protocol specified recruitment of 150 participants based on previous literature demonstrating a moderate positive correlation between lactate-albumin ratio and organ dysfunction scores, ensuring adequate statistical power for correlation analysis.

For each participant, demographic characteristics, clinical history, physical examination findings, and laboratory investigations were recorded using a structured proforma. Blood samples obtained at admission were analysed for serum lactate and serum albumin using standard hospital laboratory procedures, and the lactate-albumin ratio was calculated by dividing the serum lactate concentration by the serum albumin concentration. The qSOFA score was determined at presentation using three bedside clinical parameters: respiratory rate of at least 22 breaths per minute, systolic blood pressure of 100 mmHg or less, and altered mental status defined by a Glasgow Coma Scale score below 15, with one point assigned for each criterion. Additional clinical variables, including intensive care interventions and patient outcomes, were documented from hospital records.

All collected data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 26.0. Continuous variables were summarised as means with standard deviations or medians as appropriate, while categorical variables were presented as frequencies and percentages. Differences between groups were evaluated using the independent Student's t test for continuous variables and chi-square or Fisher's exact test for categorical variables where applicable. The association between lactate-albumin ratio and qSOFA score was assessed using Pearson's correlation analysis, and a two-sided p value of less than 0.05 was considered statistically significant. The study was conducted after obtaining approval from the Institutional Ethics Committee, and all procedures adhered to the ethical principles of the Declaration of Helsinki with strict maintenance of participant confidentiality.

RESULTS

A total of 150 adult patients with sepsis who fulfilled the eligibility criteria were included in the study and analysed. The study population comprised patients admitted to the Medical Intensive Care Unit with a broad spectrum of infectious etiologies and varying degrees of disease severity. The principal objective was to evaluate the correlation between the lactate-albumin ratio and the quick Sequential Organ Failure Assessment (qSOFA) score. The mean age of the participants was 57.21 ± 14.67 years, and males constituted the majority of the cohort (94 patients, 62.7%). The mean qSOFA score at admission was 1.44 ± 0.99, indicating that a substantial proportion of patients presented with clinically significant physiological derangement.

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Table 1: Baseline demographic characteristics of the study participants (n = 150)

Variable	n (%) / Mean ± SD
Age (years)	57.21 ± 14.67
18-40 years	20 (13.3)
41-60 years	71 (47.3)
>60 years	59 (39.3)
Male	94 (62.7)
Female	56 (37.3)

Understanding the primary source of infection provides valuable insight into the clinical spectrum of sepsis encountered in routine practice. The distribution of infection sites among enrolled patients was examined to identify the predominant underlying etiologies contributing to systemic illness and intensive care admission.

Table 2: Distribution of infection source among the study participants

Infection source	n (%)
Respiratory	61 (40.7)
Urinary tract	25 (16.7)
Unknown/Others	23 (15.3)
Gastrointestinal	20 (13.3)
Skin and soft tissue	18 (12.0)
Other sources	3 (2.0)
Total	150 (100.0)

Since the principal objective of the study was to evaluate the relationship between the lactate-albumin ratio and disease severity, assessment of qSOFA scores at presentation formed an important component of the analysis. The distribution of qSOFA scores reflects the range of clinical severity observed among patients at the time of admission.

Table 3: Distribution of qSOFA scores at admission

qSOFA score	Number of patients (n)	Percentage (%)
0	30	20.0
1	48	32.0
2	48	32.0
3	24	16.0
Total	150	100.0

To address the primary research objective, the association between the lactate-albumin ratio and qSOFA score was analysed using correlation statistics. Evaluating this relationship at multiple time points enabled assessment of whether biochemical alterations paralleled changes in bedside clinical severity among patients with sepsis.

Table 4: Correlation between lactate-albumin ratio and qSOFA score

Variables compared	Pearson correlation coefficient (r)	p value
Lactate-albumin ratio (0 h) vs qSOFA	0.819	<0.001
Lactate-albumin ratio (24 h) vs qSOFA	0.813	<0.001
Lactate-albumin ratio (48 h) vs qSOFA	0.780	<0.001

Patient outcome during hospitalisation was documented to provide an overview of disease progression and prognosis within the study cohort. Recording survival status also facilitated interpretation of the clinical significance of the investigated biomarkers in relation to overall patient outcomes.

Table 5: Clinical outcomes of the study participants

Outcome	n (%)
Survived	99 (66.0)
Died	51 (34.0)
Total	150 (100.0)

DISCUSSION

The present study found that the lactate-albumin ratio was strongly and positively correlated with qSOFA score in patients with sepsis, supporting its potential role as a simple and clinically useful marker of disease severity. Singer et al. described sepsis as a life-threatening syndrome resulting from a dysregulated host response to infection, underscoring the importance of timely recognition and accurate risk stratification to improve patient outcomes.[1] The present study demonstrated a strong positive correlation between the lactate-albumin ratio and qSOFA score among adults with sepsis, indicating that increasing metabolic derangement was accompanied by greater clinical severity at

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presentation. These findings support the potential utility of the lactate-albumin ratio as an easily obtainable adjunctive biomarker for bedside assessment in critically ill patients. Mahashabde et al. reported a significant positive relationship between the lactate-albumin ratio and SOFA score in patients with sepsis and septic shock, suggesting that higher ratios reflect progressive organ dysfunction and adverse prognosis.[8] The strong association observed in the present study extends these observations to qSOFA, a simplified bedside scoring system that can be applied rapidly without extensive laboratory investigations. Because qSOFA is intended for early clinical assessment, its close relationship with the lactate-albumin ratio highlights the complementary value of combining biochemical and clinical indicators during initial patient evaluation. Purohit et al. similarly demonstrated that elevated lactate-albumin ratios were associated with worsening organ dysfunction scores and increased mortality risk, reinforcing the prognostic significance of this marker in septic patients.[10]

Pradhan et al. observed that elevated serum lactate concentrations in sepsis reflect impaired tissue perfusion and altered cellular metabolism resulting from systemic inflammation and circulatory dysfunction.[4] At the same time, Kumar et al. demonstrated that hypoalbuminaemia is common among patients with sepsis and is associated with increased disease severity because inflammatory responses reduce hepatic albumin synthesis and increase vascular permeability.[6] The lactate-albumin ratio therefore integrates two biologically meaningful parameters into a single index that captures both tissue hypoxia and systemic inflammatory burden. This combined measure may provide more stable prognostic information than either component alone and offers a plausible explanation for the strong correlation identified in the present study.

Kabra et al. reported that the lactate-albumin ratio outperformed isolated serum lactate measurements in predicting adverse outcomes among patients with sepsis, supporting its role as a clinically useful prognostic biomarker.[7] Likewise, Bou Chebl et al. demonstrated that higher lactate-albumin ratios were independently associated with increased mortality among septic patients presenting to the emergency department and proposed the ratio as a practical tool for early risk assessment.[9] The present findings are in agreement with these observations and further suggest that the lactate-albumin ratio mirrors bedside severity assessment measured using qSOFA. Such consistency across studies conducted in different populations strengthens the evidence supporting its incorporation into routine evaluation of septic patients.

Shankar-Hari et al. emphasised that prompt identification of patients with evolving septic shock is fundamental to initiating timely interventions and improving survival.[3] In resource-constrained environments where rapid laboratory and imaging resources may be limited, combining qSOFA with the lactate-albumin ratio may enhance early recognition of patients requiring intensive monitoring or aggressive resuscitation. Because both serum lactate and albumin are routinely available investigations in most tertiary care centres, calculation of the ratio imposes minimal additional cost while potentially improving clinical decision-making.

CONCLUSION

The present study demonstrated a significant positive correlation between the lactate-albumin ratio and the quick Sequential Organ Failure Assessment score among adult patients with sepsis, indicating that higher lactate-albumin ratios are associated with greater clinical severity at presentation. By integrating information on tissue hypoperfusion and systemic inflammatory status, the lactate-albumin ratio provides a simple, inexpensive, and readily available biomarker that complements bedside clinical assessment. Its close relationship with qSOFA suggests that it may aid in the early identification of high-risk patients requiring prompt monitoring and intensive management. Incorporation of this parameter into routine evaluation may enhance risk stratification and support timely clinical decision-making, although larger multicentre prospective studies are warranted to validate its prognostic utility across diverse patient populations.

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