



PROFILE OF METABOLIC ACIDOSIS IN PATIENTS WITH SEPSIS IN AN INTENSIVE CARE UNIT: A PROSPECTIVE OBSERVATIONAL STUDY

Medical Science

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ABSTRACT

Background: Metabolic acidosis is a frequent complication of sepsis in critically ill patients and is associated with worse outcomes. Identifying its profile and prognostic relevance can aid in clinical management. **Objectives:** 1) To analyse the profile of metabolic acidosis in patients with sepsis on ICU admission. 2) To assess changes in metabolic acidosis during ICU stay and its relationship with outcomes. **Methods:** A prospective observational study was conducted over 18 months in the ICUs of JJM Medical College-affiliated hospitals, including 70 adult patients meeting Sepsis-3 criteria. Arterial blood gas (ABG) analysis and serum electrolytes were measured on admission and during the first five ICU days or until discharge/death. pH, bicarbonate, lactate, and anion gap (AG) were analysed. Clinical outcomes included mortality, ICU stay, and organ support. **Results:** Mean age was 55.7 ± 19.5 years; 54.3% were male. On admission, mean pH was 7.26, bicarbonate 14.1 mmol/L, lactate 3.5 mmol/L, and AG 21.0 mmol/L. Non-survivors had significantly lower pH (7.22 vs 7.30 , $p < 0.001$), higher lactate (4.1 vs 3.0 mmol/L, $p < 0.001$), and higher AG (22.7 vs 19.4 mmol/L, $p = 0.012$) than survivors. Mortality was 48.6%; mean ICU stay was 8.0 ± 3.2 days. **Conclusion:** Metabolic acidosis in sepsis, particularly with elevated lactate and AG, is associated with poor outcomes. Regular ABG monitoring can guide prognostication and management in ICU sepsis patients.

KEYWORDS

Sepsis, metabolic acidosis, lactate, anion gap, ICU mortality

INTRODUCTION

Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection, contributing to nearly 20% of global mortality. Despite advances in critical care, sepsis continues to carry high morbidity and mortality, particularly when complicated by metabolic acidosis.

Metabolic acidosis in sepsis results primarily from tissue hypoperfusion and anaerobic metabolism, leading to lactate accumulation. Additional contributors include renal dysfunction, impaired acid clearance, and accumulation of unmeasured anions. Previous studies have shown that the severity of acidosis correlates with mortality, making its assessment a crucial prognostic tool.

The present study aims to evaluate the profile of metabolic acidosis in ICU patients with sepsis and explore its relationship with patient outcomes.

Methodology

Study design: Prospective observational study conducted in the ICUs of Chigateri General Hospital and Bapuji Hospital, affiliated to JJM Medical College, Davanagere, India, over 1.5 years.

Inclusion criteria: Adults ≥ 18 years meeting Sepsis-3 criteria.

Exclusion Criteria: Diabetic ketoacidosis, toxin-induced acidosis, chronic kidney disease, renal tubular acidosis.

Sample Size: 70 patients (35 survivors, 35 non-survivors) based on statistical calculation.

Data Collection: ABG analysis, serum electrolytes, renal and liver function tests, and SOFA scores on admission and during ICU stay (up to day 5 or until discharge/death).

Statistical Analysis: SPSS v20, with $p < 0.05$ considered significant.

Ethics: Approved by the Institutional Ethics Committee of JJM Medical College.

RESULTS

Baseline characteristics: Mean age 55.7 ± 19.5 years; 54.3% male. Most common infection source was skin (30%), followed by urinary tract (18.6%) and lung (18.6%). Mean SOFA score was 7.4 ± 2.4 .

Key Metabolic Acidosis Parameters On Admission:

- pH: 7.26 ± 0.08
- HCO_3^- : 14.1 ± 3.7 mmol/L

- Lactate: 3.5 ± 1.3 mmol/L
- Anion Gap: 21.0 ± 6.5 mmol/L

Comparison Between Survivors And Non-survivors:

Parameter	Survivors	Non-survivors	p-value
pH	7.30 ± 0.06	7.22 ± 0.07	< 0.001
Lactate (mmol/L)	3.0 ± 1.0	4.1 ± 1.3	< 0.001
Anion Gap (mmol/L)	19.4 ± 6.0	22.7 ± 6.7	0.012
SOFA score	6.2 ± 1.9	8.5 ± 2.1	0.001

Outcomes: Mortality 48.6%, mean ICU stay 8.0 ± 3.2 days, renal replacement therapy 21.4%, mechanical ventilation 32.9%, vasopressors 17.1%, both supports 31.4%.

DISCUSSION

This study confirms that metabolic acidosis is highly prevalent in ICU patients with sepsis and that its severity correlates with mortality. Elevated lactate and AG were more common in non-survivors, reflecting greater tissue hypoperfusion and accumulation of unmeasured anions. These findings are consistent with earlier studies highlighting lactate clearance as a prognostic marker.

Our results emphasise the importance of early and serial ABG monitoring in septic patients. Management should prioritise source control, haemodynamic optimisation, and addressing the underlying cause of acidosis rather than routine bicarbonate therapy.

CONCLUSION

Metabolic acidosis in ICU sepsis patients is common and associated with poor prognosis. Elevated lactate and anion gap on admission predict higher mortality. Early recognition and targeted interventions can improve patient outcomes.

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