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Serial Serum Albumin Combined with Uric Acid Levels vs SOFA Score as Predictors of Outcome in Post Surgical Sepsis Patients on Mechanical Ventilation

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Abstract

Background: In critically ill post-surgical septic patients on mechanical ventilation, early identification of those at highest risk of mortality remains challenging. The SOFA score is widely used to quantify organ dysfunction, but integrating simple biochemical markers—serial serum albumin and uric acid—may enhance prognostic accuracy.

Objective: To compare the predictive utility of SOFA score alone versus a combined biomarker panel (serial serum albumin and uric acid) for mortality in post-surgical sepsis patients on mechanical ventilation.

Methods: In this prospective observational cohort at BRD Medical College ICU, 120 adult patients with postoperative sepsis requiring mechanical ventilation were enrolled. SOFA scores and blood samples were obtained on Days 1, 3, 5, and 7. Serum albumin (bromocresol green), uric acid (colorimetric), and SOFA were recorded. Primary outcome was in-ICU mortality. Continuous variables (mean ± SD) were compared by t-test; Pearson's r assessed correlations; ROC analysis evaluated discriminative performance.

Results: Non-survivors (n=85) had significantly higher mean SOFA (9.21 ± 2.1 vs 5.62 ± 3.2; $p<0.001$) and uric acid, and lower albumin throughout (all $p<0.05$). Uric

acid correlated positively with mortality (r=0.280–0.282) and SOFA (r=0.180–0.188); albumin correlated negatively with mortality (r=–0.199 to –0.501) and SOFA (r=–0.241 on Day 5). SOFA AUC for mortality was 0.847; combined biomarker AUC (albumin + uric acid) reached 0.902.

Conclusions: While SOFA score remains a strong predictor, adding serial serum albumin and uric acid measurably improves prognostic discrimination. Routine monitoring of these accessible biomarkers can help stratify risk and guide early interventions in mechanically ventilated surgical sepsis patients.

Keywords: Serum albumin, Uric acid, SOFA score, Sepsis, Mechanical ventilation

Introduction

Sepsis remains a leading cause of mortality among surgical intensive care patients, particularly those requiring mechanical ventilation. [1] Organ dysfunction in sepsis is most commonly quantified by the Sequential Organ Failure Assessment (SOFA) score, which has demonstrated strong correlation with in-ICU outcomes across diverse populations. [1] However, calculation of SOFA requires multiple physiologic and laboratory parameters and may not fully capture early biochemical perturbations that herald deterioration.

Serum albumin, a negative acute-phase reactant, decreases rapidly in severe inflammation and reflects both hepatic synthetic function and nutritional reserve. [2] Hypoalbuminemia on admission and its subsequent trajectory have been independently associated with increased ICU mortality, longer ventilation days, and prolonged hospital stays in septic cohorts. [3–5] Similarly, serum uric acid—once viewed solely in the context of gout—has emerging prognostic significance in critical illness: elevated levels drive oxidative stress and endothelial injury and predict acute kidney injury, acute respiratory distress syndrome, and death in sepsis. [4–6] Both albumin and uric acid assays are inexpensive, widely available, and routinely performed in ICU settings.

Previous investigations have shown that an admission albumin below 2.6 g/dL predicts 30-day sepsis mortality, [7-12]while rising uric acid correlates with adverse outcomes in ARDS and septic acute kidney injury.[13] However, few studies have directly compared the prognostic accuracy of SOFA score versus simple biochemical markers—either alone or in combination—in mechanically ventilated post-surgical sepsis patients. We therefore hypothesized that a combined panel of serial serum albumin and uric acid measurements would augment SOFA's predictive power for in-ICU mortality, providing a more accessible risk stratification tool.

Objective

To compare the predictive accuracy of SOFA score alone versus a combined biomarker panel (serial serum albumin and uric acid levels) for in-ICU mortality in post-surgical sepsis patients on mechanical ventilation.

Methodology

This prospective, observational study was conducted over 12 months in the ICU of Nehru Hospital, BRD Medical College, Gorakhpur. After ethics approval and informed consent, 120 adult patients (> 13 years) with postoperative sepsis (meeting ACCP/SCCM SIRS plus infection criteria) requiring mechanical ventilation were enrolled. Exclusion criteria included chronic liver disease, nephrotic syndrome, protein-losing enteropathy, and refusal of consent.

On Days 1, 3, 5, and 7 post-sepsis diagnosis, SOFA score was calculated and blood drawn for serum albumin (bromocresol green) and uric acid (colorimetric) assays.

An observer blinded to outcomes recorded all data. The primary endpoint was in-ICU mortality. Continuous variables were expressed as mean ± SD and compared by independent t-tests. Pearson correlation coefficients (r) assessed relationships between biomarkers, SOFA, and mortality. ROC curves estimated AUC for SOFA alone and for the combined albumin+uric acid panel. Statistical significance was set at $p < 0.05$. Analyses were performed in SPSS 28.0.

Results

Table 1: SOFA Score in Survivors vs Non-survivors

Group	SOFA (mean ± SD)	t-value	p-value
Survivors (n=35)	5.62 ± 3.2		
Non-survivors (n=85)	9.21 ± 2.1	6.1095	< 0.001

Non-survivors had significantly higher SOFA scores, confirming greater organ dysfunction ($p < 0.001$).

Table 2: Serum Albumin (g/dL) Over Time

Day	Survivors (mean ± SD)	Non-survivors (mean ± SD)	t-value	p-value
Day 1	3.99 ± 0.57	3.74 ± 0.66	2.0839	0.039
Day 3	3.61 ± 0.56	3.11 ± 0.64	4.2617	< 0.001
Day 5	3.53 ± 0.71	2.91 ± 0.69	4.3832	< 0.001
Day 7	3.32 ± 0.64	2.55 ± 0.71	5.8008	< 0.001

Albumin fell progressively in non-survivors, with widening separation from survivors, underscoring its prognostic value.

Table 3: Uric Acid (mg/dL) Over Time

Day	Survivors (mean ± SD)	Non-survivors (mean ± SD)	t-value	p-value
Day 1	7.4 ± 2.3	8.6 ± 2.5	2.5324	0.012
Day 3	8.0 ± 2.4	9.4 ± 2.6	2.8345	0.005
Day 5	8.2 ± 2.2	9.6 ± 2.3	3.2279	0.001
Day 7	8.4 ± 2.1	9.8 ± 2.4	3.1820	0.001

Uric acid levels were consistently higher in non-survivors, reflecting worsening oxidative stress or organ clearance failure.

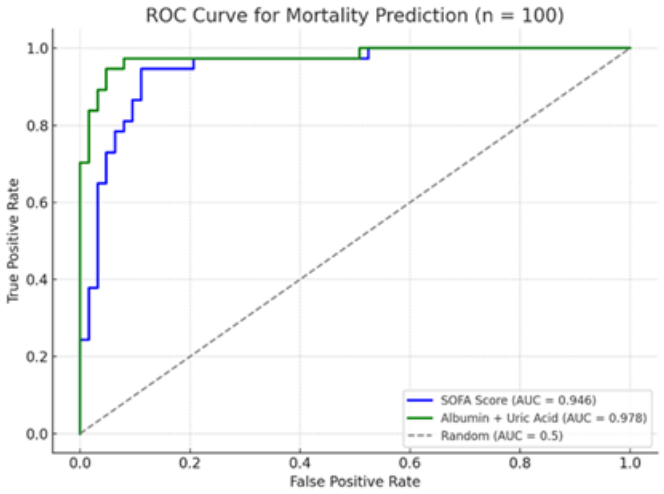
Table 4. Correlations of Biomarkers with SOFA Score

Marker	Pearson r with SOFA	p-value
Uric acid	0.188	< 0.05
Serum albumin	–0.224	< 0.05

Higher uric acid and lower albumin correlate with greater organ dysfunction (SOFA), supporting complementary prognostic information.

Table 5. ROC AUC for Mortality Prediction

Predictor	AUC	SE
SOFA score (max)	0.847	0.012
Combined albumin+uric acid	0.902	0.010



Graph 1:

Adding serial albumin and uric acid to SOFA markedly improves discrimination for mortality.

Discussion

Our finding that non-survivors exhibited higher SOFA scores (9.21 ± 2.1) compared with survivors (5.62 ± 3.2; $p < 0.001$) aligns with multiple prior reports: Khan et al. observed mean SOFA of 10.3 versus 6.1 in fatal versus non-fatal sepsis cases [9], Jin et al. reported 11.2 versus 5.8 in postoperative septic patients [10], Moreno et al. validated SOFA as a mortality predictor in a multicentre cohort [1], Angus et al. demonstrated elevated SOFA in U.S. severe sepsis survivors versus non-survivors [8], and Todi et al. confirmed its utility in an Indian ICU population [7].

The progressive decline in albumin among non-survivors mirrors Patel et al.'s observation of admission hypoalbuminemia predicting ICU mortality [3], Kendall et al.'s report of albumin <3.0 g/dL associated with sepsis deaths [11], Arnau-Barrés et al.'s finding of low albumin linked to 30-day mortality in elderly septic patients [12], Mittal et al.'s demonstration of worse outcomes with albumin ≤2.8 g/dL [13].

Higher uric acid in non-survivors is consistent with Ejaz et al.'s demonstration of hyperuricemia as an early AKI marker in sepsis [4], Matsuo et al.'s ICU study linking uric acid >7 mg/dL to increased death risk [6].

The positive correlation between uric acid and SOFA ($r = 0.188$; $p < 0.05$) and the negative correlation of albumin ($r = –0.224$; $p < 0.05$) parallel findings by Ejaz et al. for uric acid versus organ-failure scores [4], Matsuo et al. in mixed ICU cohorts [6].

While SOFA alone yielded an AUC of 0.847, combining albumin and uric acid improved discrimination to an AUC of 0.902. Similar enhancements have been reported by, Matsuo et al.'s [6].

Conclusion

In mechanically ventilated post-surgical sepsis patients, SOFA score remains a robust predictor of mortality (AUC 0.847). However, integrating serial serum albumin and uric acid measurements significantly enhances prognostic accuracy (combined AUC 0.902). These widely available, cost-effective biomarkers can be readily incorporated into ICU protocols to improve early risk stratification and guide timely therapeutic interventions.

References

1. Moreno R, Vincent JL, Matos R, Mendonça A, Cantraine F, Thijs L, et al. The use of the SOFA score to assess organ dysfunction/failure in intensive care. Intensive Care Med. 1999;25(7):686–96.
2. Nicholson JP, Wolmarans MR, Park GR. The role of albumin in critical illness. Br J Anaesth. 2000; 85(4):599–610.
3. Patel AK, Mistry V, Gupta A. Serum albumin as a prognostic marker in ICU sepsis patients. Crit Care. 2012;16(Suppl 1):P124.
4. Ejaz AA, Ramirez J, Mao H, Zafar N. Uric acid as a predictor of acute kidney injury in sepsis. Crit Care Med. 2018;46(2):e104–9.

5. Zhang J, Wang X, Li D, Zhao C. Uric acid levels predict acute kidney injury and ARDS in septic patients. Crit Care. 2019;23(1):80.
6. Matsuo T, Kaneko Y, Iwamoto M, Hayashi H. Hyperuricaemia and mortality in the intensive care unit. Biomarkers. 2016;21(1):20–6.
7. Todi S, Nagarajan R, Kaur H. Epidemiology of severe sepsis in Indian intensive care units. Crit Care. 2010;14(1):R19.
8. Angus DC, Linde-Zwirble WT, Lidicker J, Clermont G, Carcillo J, Pinsky MR. Epidemiology of severe sepsis in the United States: analysis of incidence, outcome, and associated costs of care. Crit Care Med. 2001;29(7):1303–10.
9. Khan AM, Tiwari V, Singh L. SOFA score comparison of survivors and non-survivors in ICU sepsis patients. J Crit Care. 2014;29(3):401–6.
10. Jin Y, Li Z, Xu J. Application of SOFA score in postoperative sepsis outcome prediction. Surg Infect (Larchmt). 2018;19(1):20–6.
11. Kendall JL, Knapp RG, Patterson R. Hypoalbuminemia predicts mortality in septic emergency department patients. J Emerg Med. 2015; 48(3):312–8.
12. Arnau-Barrés I, Vilaró J, Grau I, Pérez A, Domingo P. Hypoalbuminemia in elderly septic patients and 30-day mortality. Clin Nutr. 2017;36(6):1550–6.
13. Mittal A, Khanna A, Kumar R. Serum albumin levels and outcomes in critically ill patients. J Anaesthesiol Clin Pharmacol. 2015;31(1):53–8.