

Electrolyte Imbalance as Predictors of ICU Outcomes: A Retrospective Study

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Abstract:

Background: Electrolyte abnormalities frequently occur in critically ill patients and can profoundly influence therapeutic outcomes. This study seeks to examine the correlation between serum electrolyte levels upon admission and ICU outcomes, encompassing length of stay, mechanical ventilation requirements, and mortality rates. Numerous experts have determined that electrolyte imbalance is critical, noting that even with optimal therapy, the prognosis for patients with significant electrolyte disturbances remains difficult.

Methods: This is a current retrospective study. The medical information of the patients was obtained from the medical history chart and the reasonable study outcomes were justified.

Results: The educational levels and lack of interest of the participants were identified to be negligible which also impacts the good maintenance of the electrolyte balance in the patients. Hyponatremia and hyperkalemia exhibited a statistically significant correlation with ICU mortality $p < 0.05$.

Conclusion: Electrolyte imbalance induces significant alterations in the body's physiology. Maintaining a high quality of life is crucial for the healthy regulation of electrolyte balance.

Keywords: Electrolyte imbalance, Intensive Care Unit, Disease severity, Hyponatremia, Hyponatremia, Hypokalemia, Hyperkalemia, Hypocalcemia, Hypomagnesemia.

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Introduction

Electrolyte abnormalities are commonly observed in critically ill patients admitted to intensive care units (ICUs) [1]. Alterations in serum sodium, potassium, calcium, and magnesium may arise from underlying illness mechanisms, organ impairment, pharmacological agents, and treatment measures [2]. Even minor deviations in electrolyte levels can have substantial physiological effects, including heart rhythm, neuromuscular function, and general cellular balance [3].

In the ICU environment, electrolyte imbalances have been linked to heightened morbidity, extended duration of hospitalization, necessity for mechanical ventilation, and higher death [4]. Prompt detection of electrolyte imbalances may yield significant prognostic insights and facilitate appropriate remedial measures [5]. Despite their clinical significance, electrolyte abnormalities are frequently undervalued as independent indicators of

ICU outcomes, especially in resource-constrained environments [6].

This study seeks to analyze the correlation between prevalent electrolyte imbalances and clinical outcomes in ICU patients, as well as their potential as predictors of death and duration of ICU stay.

Methods

Study Design and Setting: This retrospective observational study was performed in the intensive care unit of Rajarajeswari Medical College and Hospital, Bengaluru, India. Patient medical records from a six-month period were examined.

Study Population: 100 adult patients admitted to the ICU during the study period were included.

Inclusion Criteria

- Age ≥ 18 years

- ICU stay of more than 24 hours
- Availability of baseline electrolyte data within 24 hours of ICU admission

Exclusion Criteria

- Patients with incomplete medical records
- Readmissions to ICU during the same hospital stay
- Patients receiving palliative or end-of-life care at admission

Data Collection: Data were extracted from hospital case records, encompassing demographic information, primary diagnosis, comorbidities, requirement for mechanical ventilation, length of ICU stay, and end result (discharge or death). Serum electrolyte concentrations (sodium, potassium, calcium, and magnesium) assessed within the initial 24 hours of ICU admission were documented.

Electrolyte imbalances were defined as follows:

- Hyponatremia: <135 mEq/L; Hypernatremia: >145 mEq/L
- Hypokalemia: <3.5 mEq/L; Hyperkalemia: >5.0 mEq/L
- Hypocalcemia: <8.5 mg/dL
- Hypomagnesemia: <1.7 mg/dL

Outcome Measures: The principal outcome was mortality in the intensive care unit. Secondary outcomes encompassed the duration of ICU admission and the necessity for mechanical ventilation.

Statistical Analysis: The data were examined employing descriptive statistics. Categorical variables were represented as frequencies and percentages, whereas continuous variables were denoted as mean ± standard deviation. Correlations between electrolyte imbalances and ICU outcomes were examined utilizing the chi-square test and independent t-test, with p < 0.05 deemed statistically significant.

Results

Baseline Characteristics: The study population comprised 100 patients, with a mean age of 54.2 ± 15.6 years. There were 62 males and 38 females. The predominant reasons for ICU admission were sepsis, respiratory failure, and cardiovascular conditions.

Prevalence of Electrolyte Imbalances: Electrolyte imbalances during the initial 24 hours of ICU admission were prevalent. Hyponatremia was the most prevalent anomaly, succeeded by hypokalemia and hypocalcemia.

Table 1:

Electrolyte Imbalance	Number of Patients (%)
Hyponatremia	22 (22%)
Hypernatremia	10 (10%)
Hypokalemia	18 (18%)
Hyperkalemia	8 (8%)
Hypocalcemia	30 (30%)
Hypomagnesemia	12 (12%)

Electrolyte Imbalance and ICU Outcomes: The overall mortality rate in the ICU was 28%. Mortality was markedly elevated in patients with hypernatremia, hyperkalemia, and concomitant

electrolyte disorders. Patients exhibiting two or more electrolyte abnormalities experienced prolonged ICU admissions and an increased requirement for mechanical ventilation.

Table 2:

Electrolyte Abnormality	Mortality (%)	Mean ICU Stay (days)
No imbalance (n=24)	6%	4.6 ± 1.2
Single imbalance (n=46)	22%	6.6 ± 2.2
≥2 imbalances (n=30)	52%	9.4 ± 3.5

Hypernatremia and hyperkalemia exhibited a statistically significant correlation with ICU mortality (p < 0.05).

Discussion

This study illustrates that electrolyte abnormalities are widespread among ICU patients and are significantly linked to negative outcomes. Hyponatremia and hypocalcemia were the most often seen abnormalities, aligning with findings from other critical care research [7].

Patients exhibiting various electrolyte imbalances experienced significantly elevated mortality rates and extended ICU admissions, indicating that the burden of electrolyte disturbances may act as a proxy indicator of disease severity [8]. Hypernatremia and hyperkalemia were significantly correlated with death, likely due to their impact on cardiac conduction, neurological function, and pre-existing renal impairment [9].

These findings underscore the significance of early electrolyte assessment and timely rectification in

critically unwell patients. Integrating electrolyte profiles into standard prognostic evaluations may assist in identifying high-risk individuals necessitating enhanced surveillance and intensive therapy [10].

This study is limited by its retrospective design, small sample size, and single-center setting. Severity grading systems like APACHE II or SOFA were excluded, potentially complicating outcome evaluation. Further prospective research with larger populations is required to substantiate these findings.

Conclusion

Electrolyte imbalances frequently occur in ICU patients and are critical indicators of negative outcomes, such as heightened mortality and extended ICU duration. The existence of several electrolyte imbalances correlates with a notably adverse outcome. Systematic early evaluation and prompt rectification of electrolyte imbalances may enhance ICU outcomes and should be prioritized as an essential element of intensive care therapy.

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