Tumor Lysis Syndrome in Hematological Malignancies: Profiling Predictors of ICU Burden and Healthcare Utilization to Improve Operational Efficacy

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Introduction

Tumor lysis syndrome (TLS) is a well-recognized and extensively studied oncologic emergency commonly associated with hematologic malignancies. It can result in life-threatening metabolic abnormalities and organ dysfunction, often requiring intensive care. The impact of its complications and racial disparities on ICU admissions and healthcare resource utilization remains incompletely understood. This study aims to identify predictors of ICU admission, prolonged hospitalization, and increased healthcare costs among TLS-related hospitalizations.

Significance and Innovation

This study is among the first to evaluate national-level predictors of ICU admission and cost burden in TLS patients with hematologic malignancies. It uniquely examines racial disparities in resource utilization. By identifying high-risk features and complications, the findings can guide clinical decision-making, optimize ICU triage, and inform equitable resource allocation.

Methods

A retrospective cohort study was done using the National Inpatient Sample (2016-2020) to identify adult TLS hospitalizations (age > 18 years). Racial demographics and common in-hospital complications of TLS like acute kidney injury [AKI], hyperkalemia, hypocalcemia, arrhythmia and acute heart failure [HF] were analysed using multivariate logistic regression analysis to assess their independent impact on ICU admissions and resource utilization.

Results

Among 67, 450 TLS hospitalizations, the following in-hospital complications were associated with higher odds of ICU admissions:

- **AKI** (Adjusted Odds Ratio [aOR]: 3.24, 95% Confidence Interval [CI]: 3.17-3.31, p<0.001)
- **Arrhythmia** (aOR: 1.87, CI: 1.83-1.91, p<0.001)
- **HF** (aOR: 1.60, CI: 1.56-1.63, p<0.001)
- **Hyperkalemia** (aOR: 1.54, CI: 1.50-1.59, p<0.001)
- **Hypocalcemia** (aOR: 1.91, CI: 1.83-2.00, p<0.001)

Higher odds for increased LOS was found to be associated with:

- **AKI** (aOR: 1.56, CI: 1.54-1.58, p<0.001)
- **Arrhythmia** (aOR: 1.07, CI: 1.06-1.08, p<0.001)
- **HF** (aOR: 1.30, CI: 1.29-1.31, p<0.001)
- **Hypocalcemia** (aOR: 1.89, CI: 1.82- 1.96, p< 0.001)

Higher total hospital charges were associated with AKI (adjusted beta coefficient [β]: $28,296, p<0.001), Arrhythmia (β: $13,316, p<0.001), HF (β: $6,608, p<0.001), hyperkalemia (β: $13,121, p<0.001) and hypocalcemia (β: 39,213, p<0.001).

Compared to Whites, African Americans and Hispanics had higher odds of ICU admission and total hospital charges, but lower odds of prolonged length of stay (all p<0.001).

Impact of TLS Associated Complications on Hospital Stay

Complication	ICU aOR (95% CI)	LOS aOR (95% CI)	Hospital Charges β (USD)
AKI	3.24 (3.17-3.31)	1.56 (1.54-1.58)	28296
Arrhythmia	1.87 (1.83-1.91)	1.07 (1.06-1.08)	13316
HF	1.60 (1.56-1.63)	1.30 (1.29-1.31)	6608
Hyperkalemia	1.54 (1.50-1.59)	-	13121
Hypocalcemia	1.91 (1.83-2.00)	1.89 (1.82-1.96)	39213

Discussion

Racial disparities and development of in-hospital complications such as AKI, arrhythmia, HF, hyperkalemia, and hypocalcemia significantly affect the likelihood of ICU admissions, prolonged hospital stays, and higher healthcare costs among TLS hospitalizations. These findings highlight the need for early identification and management of complications to reduce resource utilization and improve patient outcomes.

References

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SOHO ANNUAL MEETING 2025