CAR-T and the Heartbeat: Arrhythmia Burden and Clinical Outcomes in CAR-T Cell Therapy Patients — A National Inpatient Sample Analysis (2017–2022)

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Introduction

Chimeric Antigen Receptor T-cell (CAR-T) therapy has transformed treatment for relapsed or refractory hematologic malignancies. However, concerns have emerged regarding cardiotoxicity, particularly arrhythmias. These may result from systemic inflammation, such as cytokine release syndrome (CRS), or unmask cardiac vulnerability. Despite increasing recognition, large-scale data on the burden and outcomes of arrhythmias in CAR-T recipients remain limited.[1]

Aim

To evaluate the burden and clinical impact of arrhythmias in patients hospitalized for chimeric antigen receptor T-cell (CAR-T) therapy, specifically:

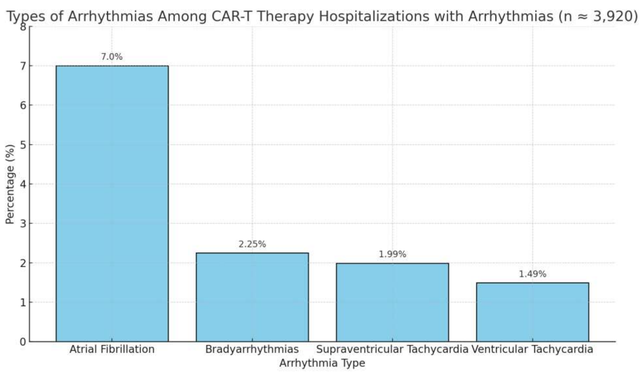
- To determine the prevalence of arrhythmias among CAR-T hospitalizations in a nationally representative cohort.
- To assess the association between arrhythmias and in-hospital mortality, healthcare resource utilization, and hemodynamic instability.
- To explore trends in severe cardiovascular outcomes such as cardiac arrest and shock.
- To emphasize the need for prospective studies and structured cardiac monitoring protocols in CAR-T recipients.

Objectives

With the growing use of CAR-T therapy in hematologic malignancies, understanding cardiovascular complications like arrhythmias is vital for improving outcomes and guiding strategies.

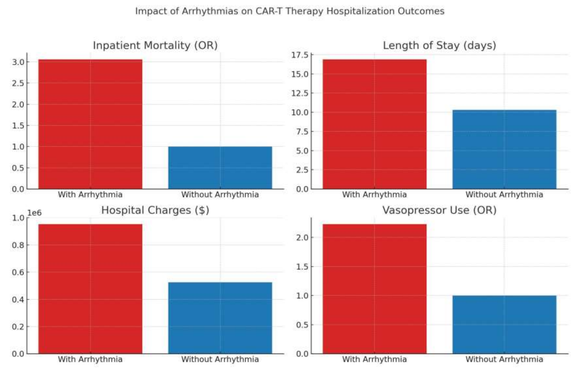
Methods

We conducted a retrospective cohort study using the National Inpatient Sample (2017–2022). Adult CAR-T hospitalizations were identified using ICD-10-PCS codes and stratified by arrhythmia presence, including atrial fibrillation, flutter, ventricular or supraventricular tachycardia, bradyarrhythmias, and conduction disorders. The primary outcome was in-hospital mortality. Secondary outcomes included length of stay (LOS), total charges, cardiogenic shock, vasopressor use, and cardiac arrest. Multivariable survey-weighted logistic and linear regression models were applied, adjusting for demographics and comorbidities.



Results

Among 32,640 CAR-T therapy hospitalizations in the U.S., 12% (n ≈ 3,920) had arrhythmias—most commonly atrial fibrillation (7%), followed by bradyarrhythmias (2.25%), supraventricular tachycardia (1.99%), and ventricular tachycardia (1.49%). Patients with arrhythmias were significantly older (mean age 63.1 vs. 43.7 years, $p < 0.001$), more often female (69.3% vs. 57.5%, $p < 0.001$), predominantly White (76.9% vs. 63.6%, $p < 0.001$), and had a higher comorbidity burden (Charlson category 3: 58.3% vs. 48.1%, $p < 0.001$). Arrhythmia was independently associated with higher inpatient mortality (OR 3.06, 95% CI: 1.84–5.10, $p < 0.001$), prolonged LOS (16.9 vs. 10.3 days; +4.79 days, $p < 0.001$), increased hospital charges ($953,632 vs. $525,958; +$268,230, $p < 0.001$), and greater vasopressor use (OR 2.23, $p = 0.001$). Associations with cardiogenic shock (OR 1.72, $p = 0.595$) and cardiac arrest (OR 3.05, $p = 0.103$) were not statistically significant.



Summary

Our study highlights the significant burden of arrhythmias among CAR-T therapy recipients, affecting approximately 12% of hospitalizations and correlating with markedly worse clinical outcomes. Patients with arrhythmias were older, had higher comorbidity burdens, and experienced increased in-hospital mortality, prolonged hospital stays, and greater healthcare costs. While associations with cardiac arrest and cardiogenic shock did not reach statistical significance, the observed trends point to potential hemodynamic instability. These findings emphasize the need for heightened cardiovascular monitoring and proactive management strategies during CAR-T therapy, as well as future prospective studies to better delineate pathophysiology and guide preventive care.

Discussion

In this nationally representative cohort, arrhythmia was associated with one in eight CAR-T hospitalizations and independently linked to increased in-hospital mortality, resource utilization, and hemodynamic compromise. Although associations with cardiac arrest and shock were nonsignificant, observed trends support vigilance. These findings underscore the need for prospective studies and structured cardiac surveillance to optimize safety in CAR-T recipients.[2,3]

References

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