Incidence of Cytokine Release Syndrome-Associated Coagulopathy and Disseminated Intravascular Coagulation Following CAR-T Therapy: A Systematic Review and Meta-Analysis

A. Sanjeevi, MBBS, MD[1], D.S. Pasnoor, MBBS [2], L.S.M. Kodali, MBBS, MPH [3] , M. Mylavarapu, MBBS, MPH [4], N. Ganatra, MBBS, MD [5], P. Jain, MBBS [6] , V. Kota, MD [7]

1. Department of Internal Medicine, Rochester General Hospital, Rochester, New York, USA
2. Kamineni Academy of Medical Sciences and Research Centre, Hyderabad, Telangana, India
3. Department of Public Health & Health Sciences, University of Michigan – Flint, Flint, Michigan, USA
4. Walker Baptist Medical Center, Jasper, Alabama, USA
5-6. Baptist Hospitals of Southeast Texas, Beaumont, Texas, USA
7. Associate Professor of Medicine, Department of Hematology/Oncology, Medical College of Georgia, Augusta, Georgia, USA

Introduction

Cytokine release syndrome (CRS) is a frequent complication following CAR-T therapy. CRS may be associated with coagulopathy, including disseminated intravascular coagulation (DIC). The true incidence and clinical impact of these events are yet to be clearly defined.

Objective

To determine the pooled incidence of CRS-associated coagulopathy and DIC and characterize transfusion support needs among patients receiving CAR-T therapy for hematologic malignancies through a systematic review and meta-analysis of clinical trials and retrospective studies.

Methods

- We conducted a comprehensive systematic search of PubMed, Embase, and Cochrane Library databases through May 2025.
- Our analysis included clinical trials and retrospective studies reporting the incidence of CRS-associated coagulopathy and/or DIC following CAR-T therapy.
- We also studied the frequency of blood product transfusion. We used a random-effects model for all pooled estimates.

Results

- 11 studies were included (8 adult or mixed, 3 pediatric).
- Among 758 total patients, 647 (85.4%) developed CRS.
- Of these, 456 were from adult/mixed cohorts that reported age; the weighted median age was 50 years.
- The pooled incidence of coagulopathy among CRS patients was 61% (95% CI, 48–73%; p<0.0001).
- We observed DIC in 22% (95% CI, 14–31%; p<0.0001) of CRS patients.
- Among studies reporting both endpoints, 39% (95% CI, 19–62%; p = 0.0002) of patients with coagulopathy progressed to DIC.
- Blood products (platelets/fresh frozen plasma/cryoprecipitate) were administered in 64% (95% CI, 38–87%) of CRS-associated coagulopathy cases and 98% (95% CI, 87–100%) of CRS-associated DIC cases.

Figure 1. Proportion of Coagulopathy in CRS Patients

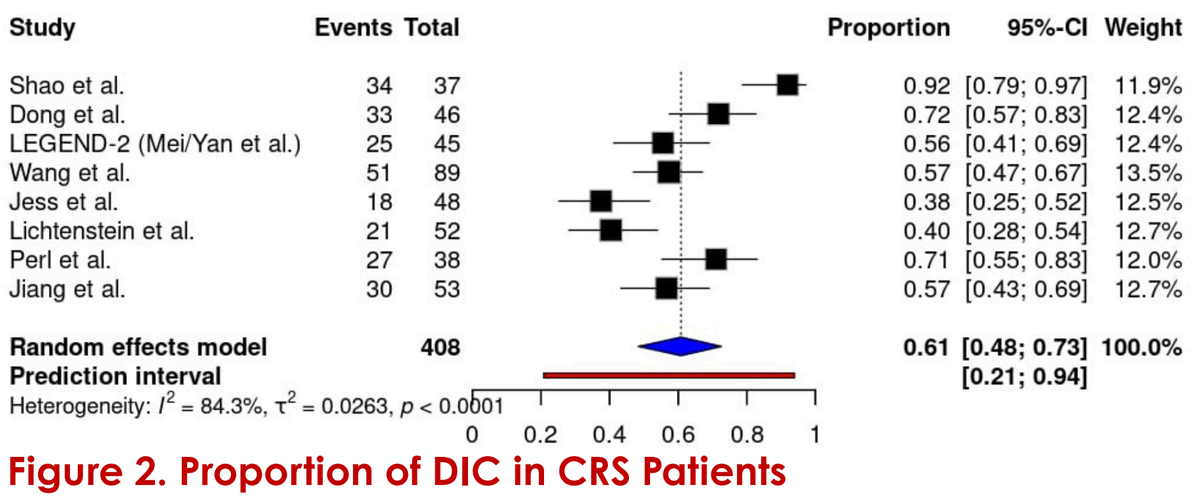


Figure 2. Proportion of DIC in CRS Patients

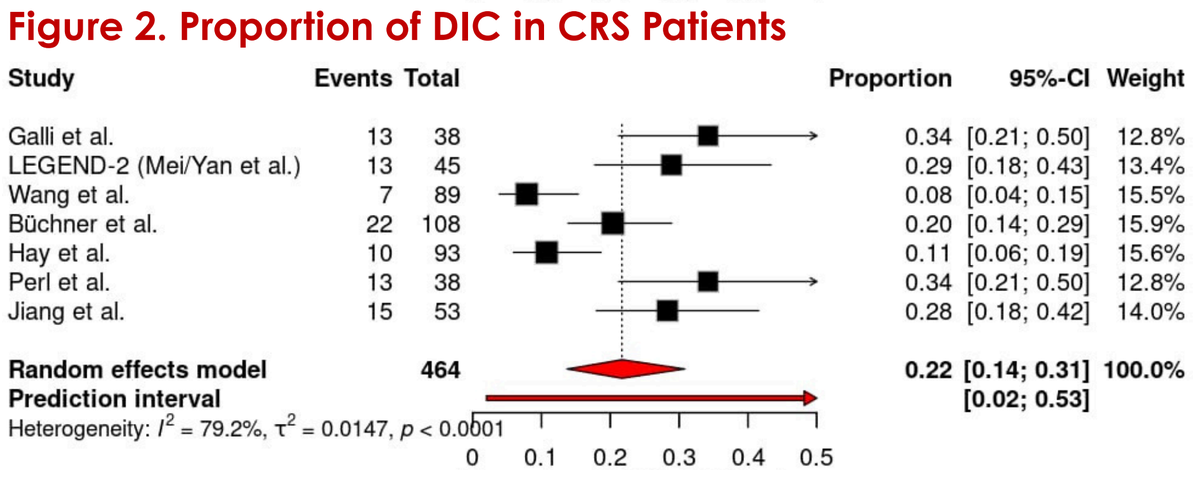


Figure 3. Proportion of Coagulopathy Patients with DIC

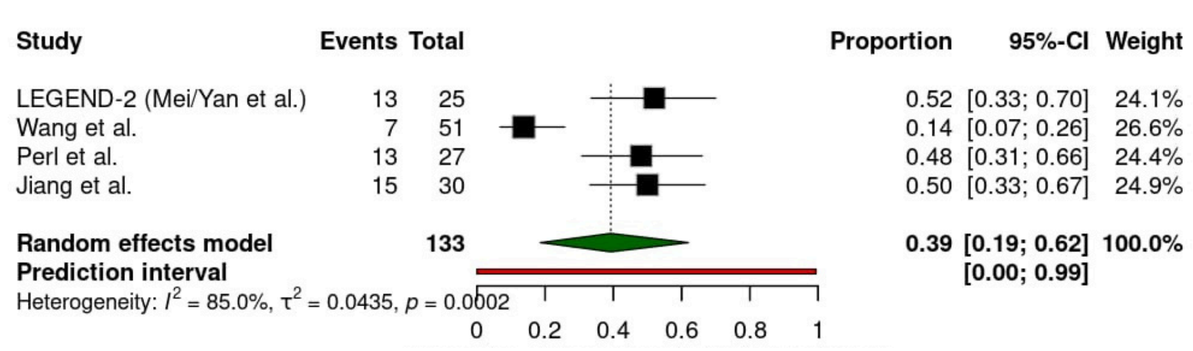


Figure 4. Transfusion Rate in CRS-Related Coagulopathy

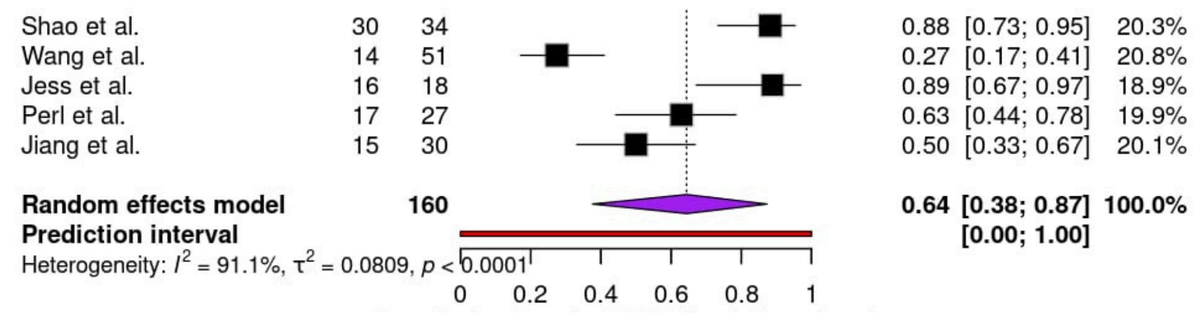
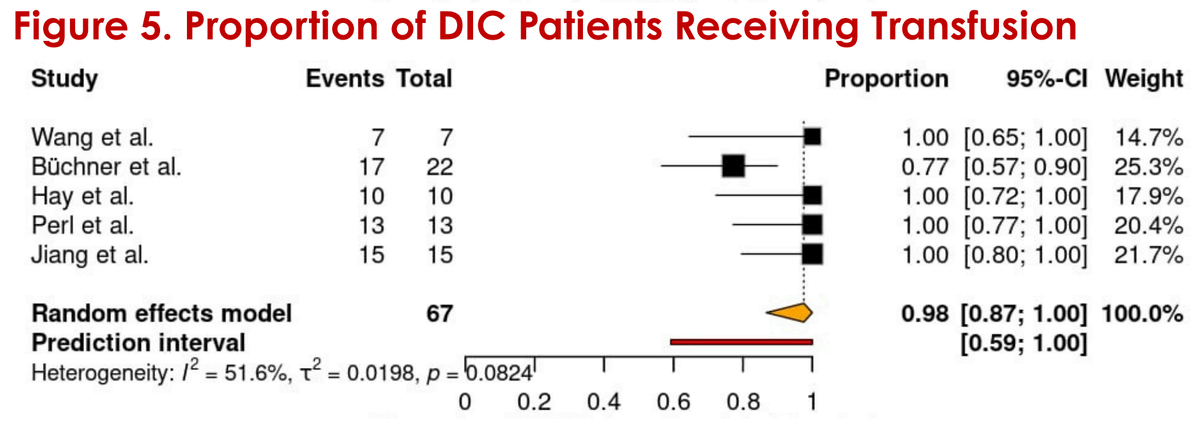


Figure 5. Proportion of DIC Patients Receiving Transfusion



Conclusions

- Coagulopathy and DIC are common in patients with CRS following CAR-T therapy and often necessitate transfusion support.
- Current data suggests coagulopathy has a variable impact on progression-free and overall survival; however, these findings are inconsistent across studies.
- Further prospective investigation is needed to clarify the prognostic implications of CRS-related coagulopathy and optimize supportive care strategies.