Trauma Surgery & Acute Care Open

Balanced resuscitation: the role during nonmassive hemorrhage

Kent Garber, Lucy Kornblith 💿 , Joseph Cuschieri 💿

To cite: Garber K, Kornblith L, Cuschieri J. Balanced resuscitation: the role during non-massive hemorrhage. *Trauma Surg Acute Care Open* 2024;**9**:e001486. doi:10.1136/ tsaco-2024-001486



► http://dx.doi.org/10.1136/ tsaco-2023-001310

© Author(s) (or their employer(s)) 2024. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

Surgery at ZSFG, University of California San Francisco, San Francisco, California, USA

Correspondence to Dr Joseph Cuschieri; joseph. cuschieri@ucsf.edu

During the past two decades, balanced transfusion strategies for patients with traumatic hemorrhage have been increasingly adopted. Research has predominantly concentrated on the sickest trauma patients—those receiving "massive transfusion," classically defined as receiving over 10 units of red blood cells (RBCs) within 24 hours after injury. For this group, a higher ratio of plasma to RBCs has been associated with reduced early mortality due to hemorrhagic shock and improved outcomes.¹²

However, as highlighted by Jehan *et al*³ most civilian trauma patients receiving blood transfusion do not receive "massive transfusion." Data from the American College of Surgeons' Trauma Quality Improvement Program (TQIP) indicate that less than 3% of trauma patients receive more than 10 units of RBCs within 24 hours.⁴ Therefore, decision-making around transfusing plasma and platelets with RBCs in the majority of trauma patients suffers from a lack of comprehensive data to guide us.

To address this gap, Jehan and colleagues analyzed TQIP data from 2016 to 2019 for over 85 000 patients receiving "submassive transfusions" and explored whether there is a mortality benefit when plasma and platelets are administered with RBCs, and what the RBC threshold is where the addition of plasma and platelets becomes beneficial. Using backward stepwise logistic regression and propensity matching, they identified that the addition of plasma or platelets for patients receiving 1–3 units of RBCs was not associated with reduced mortality. However, for patients receiving more than 3 units of RBCs, the combined use of plasma or platelets significantly lowered the odds of death.

Although subject to the usual limitations of retrospective large database study designs, the findings are important. They contribute to the knowledge of beneficial resuscitation strategies for the *majority* of injured civilians, for which the traumatic hemorrhage transfusion trials have not well addressed potential coagulopathy.⁵

That said, there is much more to the story that needs to be unraveled. The study excluded patients who died within 24 hours, a crucial subgroup. Further, the design used the classical "massive transfusion" definition, which has been substantially challenged in modern resuscitation.⁶ This is important as it is possible patients analyzed in the "submassive transfusion" category may have been massively hemorrhaging by more modern definitions. Finally, the study also did not evaluate the effects of different plasma or platelet volumes or ratios, timing of administration, or coagulation profiles in patients receiving combined resuscitation versus RBCs alone. Future studies should examine these variables, but until then these results support consideration of early initiation of combined resuscitation for patients receiving 3 units of RBCs or more.

Contributors Each other contributed to the review, conclusions, and editing.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Commissioned; internally peer reviewed.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: http:// creativecommons.org/licenses/by-nc/4.0/.

ORCID iDs

Lucy Kornblith http://orcid.org/0000-0002-1861-9691 Joseph Cuschieri http://orcid.org/0000-0003-1456-6841

REFERENCES

- 1 Holcomb JB, Tilley BC, Baraniuk S, Fox EE, Wade CE, Podbielski JM, del Junco DJ, Brasel KJ, Bulger EM, Callcut RA, *et al*. Transfusion of plasma, platelets, and red blood cells in a 1:1:1 vs a 1:1:2 ratio and mortality in patients with severe trauma: the PROPPR randomized clinical trial. *JAMA* 2015;313:471–82.
- 2 Roquet F, Neuschwander A, Hamada S, Favé G, Follin A, Marrache D, Cholley B, Pirracchio R, Traumabase Group. Association of early, high plasma-to-red blood cell transfusion ratio with mortality in adults with severe bleeding after trauma. *JAMA Netw Open* 2019;2:e1912076.
- 3 Jehan F, Zangbar B. Rafieezadeh A, et alls there a need for fresh frozen plasma and platelet transfusion in trauma patients receiving Submassive Transfusion?Trauma surgery. Acute Care Open 2024;9:e001310.
- 4 Como JJ, Dutton RP, Scalea TM, Edelman BB, Hess JR. Blood transfusion rates in the care of acute trauma. *Transfusion* 2004;44:809–13.
- 5 Brohi K, Singh J, Heron M, Coats T. Acute traumatic coagulopathy. J Trauma: Injury Infect Crit Care 2003;54:1127–30.
- 6 Holcomb JB, del Junco DJ, Fox EE, Wade CE, Cohen MJ, Schreiber MA, Alarcon LH, Bai Y, Brasel KJ, Bulger EM, et al. The prospective, observational, multicenter, major trauma transfusion (PROMMTT) study: comparative effectiveness of a time-varying treatment with competing risks. JAMA Surg 2013;148:127–36.