



Single vs. Double Unit Red Blood Cell Transfusion in Stable, Non-Bleeding Anemic Trauma Patients



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Introduction

Red blood cell (RBC) transfusion is central to trauma care, yet the optimal dosing strategy for stable, non-bleeding patients remains uncertain. Contemporary patient blood management (PBM) frameworks favor restrictive transfusion thresholds (hemoglobin level typically 7–8 g/dL) and single-unit transfusion protocols to minimize unnecessary blood exposure and related risks [1]. However, trauma patients represent a unique population with complex surgical and physiologic considerations. Clinicians often default to double-unit transfusions, potentially exposing patients to unnecessary risks like transfusion-associated circulatory overload (TACO), transfusion-related acute lung injury (TRALI), and alloimmunization [2]. This project aimed to synthesize existing evidence and analyze institutional trauma data to determine whether single-unit RBC transfusions are safe and effective compared to double-unit transfusions in stable trauma patients.

Methods

- Literature Review:** Systematic search of PubMed and reference lists for randomized trials, cohort studies, and guidelines evaluating restrictive vs. liberal transfusion strategies, and trauma-specific outcomes.
- Single Center Retrospective Cohort Study:**
 - Population: 344 stable, non-bleeding trauma patients receiving RBC transfusion.
 - Groups: Single-unit (n=230) vs. double-unit (n=114) initial transfusion.
 - Statistical Analysis: Multivariable logistic regression for predictors of additional transfusions.

Objectives

- Primary Outcome: Change in hemoglobin and hematocrit post-transfusion.
- Secondary Outcomes: Additional transfusions, length of stay (LOS), infections, transfusion reactions, and mortality.

Results

Table 1: Baseline characteristics and outcomes by initial PRBC dose. Double-unit transfusions yielded modestly higher hemoglobin increments (+0.4 g/dL) without significant differences in clinical outcomes.

Metric	Single Unit (n=230) ¹	Double Unit (n=114) ¹	p-value ²
Age	45 (28, 62)	45 (27, 63)	> 0.9
Male (%)	84 (74%)	162 (70%)	0.5
Female (%)	30 (26%)	68 (30%)	
Injury Severity Score (ISS)	17 (11, 26)	20 (14, 27)	0.2
Admission Glasgow Coma Scale (GCS)	15 (12, 15)	15 (9, 15)	0.1
Pre-Transfusion Hb (g/dL)	6.7 (6.4 – 6.9)	6.3 (5.8 – 6.7)	<0.001
Post-Transfusion Hb (g/dL)	7.9 (7.5 – 8.6)	8.3 (7.9 – 8.8)	<0.01
Δ Hemoglobin (g/dL)	1.2	1.6	<0.01
Pre-Transfusion Hct (%)	20.6 (19.6 – 21.5)	19.2 (17.8 – 20.5)	<0.001
Post-Transfusion Hct (%)	24.2 (22.8 – 26.5)	25.3 (23.9 – 26.7)	0.003
Δ Hematocrit (%)	3.6	6.1	<0.01
Required Additional Transfusion	90 (39%)	48 (42%)	0.6
Median Total PRBC Units (IQR)	3 (1 – 6)	4 (2 – 7)	0.005
ICU Length of Stay (LOS) (days)	6 (3–16)	5 (2–11)	0.048
Hospital Length of Stay (LOS) (days)	17 (10–28)	14 (8–28)	0.2
Wound Infections (%)	36 (16%)	12 (11%)	0.2
Transfusion Reactions (%)	2 (0.9%)	1 (0.9%)	>0.9
30-Day Mortality (%)	27 (12%)	11 (9.6%)	0.6

¹n (%); Median (Q1, Q3)
²Pearson's Chi-squared test; Wilcoxon rank sum test; Fisher's exact test

Table 2: Unadjusted and adjusted odds ratios for factors associated with additional PRBC transfusion. Surgical interventions, including their frequency and intensity, were significant predictors, highlighting perioperative factors as key drivers of transfusion needs.

Predictor	Adjusted OR (95% CI)	p-value
Post-Transfusion Surgery	2.82 (1.47 – 5.36)	<0.01
Total Number of Operations	1.65 (1.25 – 2.31)	<0.01
PRBC Units in First 24 Hours	1.14 (1.03 – 1.26)	<0.05

Discussion

- Single-unit transfusions safely increased hemoglobin (from 6.7 to 7.9 g/dL) and hematocrit (from 20.6% to 24.2%) in stable trauma patients, whereas double-unit transfusions produced statistically significant differences without translating into improved clinical outcomes.
- Total RBC exposure was significantly higher with double-unit transfusions (median 4 vs. 3 units; p = 0.005), highlighting resource implications without clinical benefit.
- Rates of additional transfusions were similar (39% vs. 42%) between single- and double-unit groups, indicating that lower initial dosing did not increase the likelihood of subsequent transfusion need.
- Surgical interventions, not initial transfusion dose, were the strongest predictors of further transfusions, with post-transfusion surgery increasing odds nearly threefold (OR = 2.82).
- Clinical outcomes, including ICU/hospital stays, infections, and mortality did not differ significantly between groups, supporting single-unit strategies as safe, efficient, and consistent with patient blood management principles.

Conclusion

- Single-unit transfusions are safe, effective, and reduce cumulative RBC exposure in stable, non-bleeding anemic trauma patients.
- No significant difference in clinical outcomes or additional transfusion needs between single- and double-unit strategies.
- Adoption of single-unit protocols aligns with PBM principles, supporting patient safety and blood conservation.
- Further prospective studies are needed to refine transfusion thresholds and dosing in trauma care.

References

[1] Retter, A., Wyncoll, D., Pearse, R., Carson, D., McKechnie, S., Stanworth, S., Allard, S., Thomas, D., Walsh, T., & Haematology, B. C. for S. in. (2013). Guidelines on the management of anaemia and red cell transfusion in adult critically ill patients. *British Journal of Haematology*, 160(4), 445–464. <https://doi.org/10.1111/bjh.12143>
[2] Bowman, Z., Fei, N., Ahn, J., Wen, S., Cumpston, A., Shah, N., Craig, M., Perrotta, P. L., & Kanate, A. S. (2019). Single versus double-unit transfusion: Safety and efficacy for patients with hematologic malignancies. *European Journal of Haematology*, 102(5), 383–388. <https://doi.org/10.1111/ejh.13211>