

Calcium Replacement Strategies in Critically Ill Patients Receiving Massive Transfusion

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Introduction

Hypocalcemia is a common complication associated with massive transfusion protocol (MTP). Citrate, contained in PRBCs and FFP, chelates with circulating calcium in the blood after being transfused and causes a decrease in the calcium free fraction. Hypocalcemia is associated with worse outcomes and mortality. Recommendations for calcium administration are limited and both proactive and reactive strategies are proposed. A proactive strategy is defined as calcium given before a low ionized calcium (iCa) based on number of blood products received. A reactive strategy is defined as calcium given in response to a low iCa.

Objectives

Primary

- Determine whether proactive versus reactive administration of calcium is associated with decreased hypocalcemia and related complications

Secondary

- Characterize calcium replacement practices at our institution
- Evaluate calcium requirements in relation to the number of citrate-containing products received
- Describe the frequency of serum iCa monitoring
- Determine the impact of calcium replacement strategy on patient outcomes.

Methods

Retrospective cohort study of patients who received MTP. Serum ionized calcium (iCa) values, calcium replacement, blood products and clinical outcomes were collected.

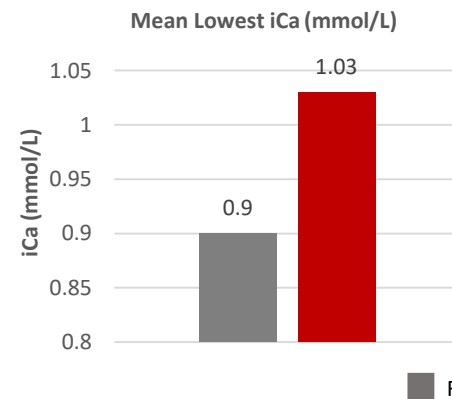
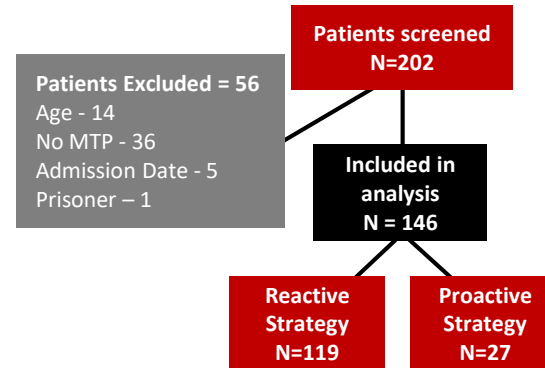
Inclusion Criteria

- 18-89 years of age
- MTP between January 1st, 2015 – September 1st, 2018

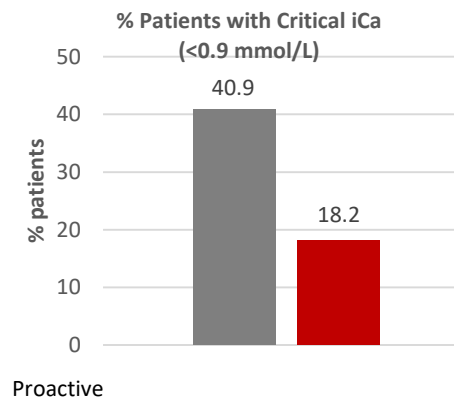
Exclusion Criteria

- Prisoners or wards of the state
- Pregnant women
- Inadequate documentation to confirm MTP

Results



Baseline Characteristics	Reactive N=119 (%)	Proactive N=27 (%)	P-value
Age - years (mean +/- SD)	48.0 ± 19.5	49.0 ± 20.6	0.83
Caucasian	82 (68.9)	13 (48.1)	0.0471
Male	81 (68.1)	17 (63.0)	0.65
Trauma	80 (67.2)	18 (66.7)	1.0
APACHE II Score (mean +/- SD)	19.7 ± 8.8	17.7 ± 8.4	0.29



Calcium Outcomes	Reactive N=119	Proactive N=27	P-value
Initial Calcium Dose (g)	1.25 ± 0.69	0.94 ± 0.47	0.037
Time to first iCa (hr)	1.19 ± 2.59	3.64 ± 6.14	0.003
Units PRBCs & FFP before iCa	1.94 ± 2.96	4.82 ± 4.36	0.0002

Clinical Outcomes	Reactive N=119 (%)	Proactive N=27 (%)	P-value
ICU Mortality	45 (37.8)	9 (33.3)	0.8257
Arrhythmia	36 (30.3)	10 (37.0)	0.4989
Recurrent Bleeding	5 (4.2)	0 (0)	0.5844
Mechanical Ventilation	104 (87.4)	19 (70.4)	0.0399

Conclusion

- In our institution, a reactive calcium replacement strategy was more common
- A proactive approach was associated with a higher average iCa
- There was a trend towards lower risk of critical iCa levels with proactive calcium replacement
- Fewer patients in the proactive replacement group required mechanical ventilation
- Proactive vs. reactive calcium replacement should be further investigated based on these findings.

Limitations

- Small sample size in the proactive group
- Potential for calcium replacement based on a low total calcium
- Low incidence of complications in both groups

Clinical Implications

Implementation of protocol-driven calcium replacement in massive transfusion may prevent critical iCa levels and associated complications

- iCa measure on admission
- Standard frequency of iCa measures
- Standard number of units where iCa measure should be done
- Calcium replacement based on number of blood product units

References

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