Correlates of incident hypocalcemia amongst trauma patients in the Western Cape of South Africa: a secondary analysis of the Epidemiology and Outcomes of Prolonged Trauma Care (EpiC) study

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INTRODUCTION

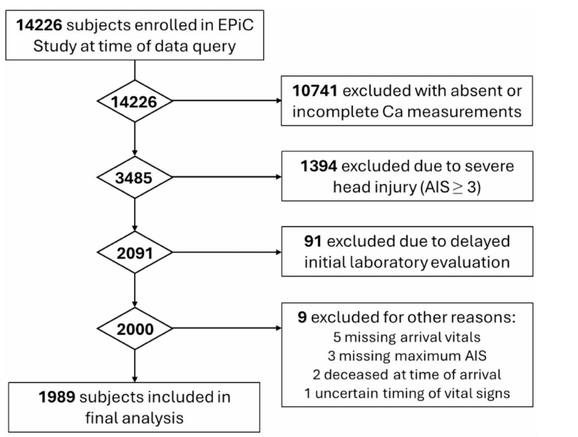
Internationally, traumatic injury is a leading cause of morbidity and mortality (1,2). Hypocalcemia is common following trauma, with research describing an association between calcium derangement and adverse outcomes such as mortality, coagulopathy severity, and transfusion requirement (3, 4, 5, 6). However, such studies have been limited in their assessment of *epidemiologic* factors in hypocalcemic trauma patients. These studies have also been limited to high-resource settings, with a notable lack data collected from health resource-limited populations. The assessment of predictive factors in hypocalcemia is crucial in establishing baseline protocols in the study of potentially life-saving pre-hospital calcium supplementation in trauma.

OBJECTIVE

Determine which, if any, epidemiologic and injury severity factors contribute to the prevalence of hypocalcemia in severely injured trauma patients in a resource-limited setting.

METHODS

Patients presenting to EDs throughout the Western Cape of South Africa following severe traumatic injury (excluding patients w/ severe traumatic brain injury) for whom an ionized calcium level was measured were included. Patients were stratified according to initial ionized calcium, and characteristics of the different strata were compared. Linear and quadratic regression was used to evaluate the relationship between initial ionized calcium and selected laboratory markers.

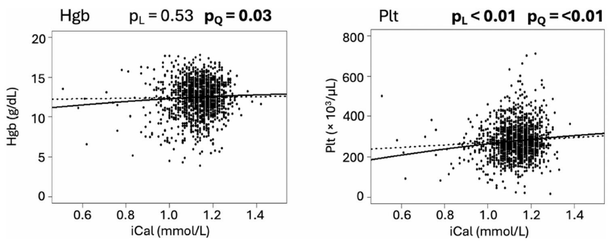


RESULTS

Table 1. **Selected composite data from epidemiologic characteristics analysis when calcium is treated as a categorical variable.**

	Overall[1] N = 1989	Severe HypoCa[2] (0.51 - 0.99) n = 99	Moderate HypoCa[2] (1.00 - 1.09) n = 442	Mild HypoCa[2] (1.10 - 1.14) n = 488	Normal Ca[2] (1.15 - 1.29) n = 939	Hyper Ca[2] (1.30 - 3.80) n = 21	*p*-value
Baseline Characteristics							
Age (years)	30 (18 - 90)	33 (27 - 37)	31 (26 - 39)	31 (26 - 38)	30 (25 - 36)	27 (22 - 35)	**0.009**[3]
Max AIS score							**0.03**[4]
Minor (1)	633 (32%)	28 (28%)	140 (32%)	168 (34%)	292 (31%)	5 (24%)	
Moderate (2)	459 (23%)	19 (19%)	94 (21%)	106 (22%)	234 (25%)	6 (29%)	
Serious (3)	659 (33%)	37 (37%)	158 (36%)	167 (34%)	293 (31%)	4 (19%)	
Severe (4)	139 (7%)	10 (10%)	30 (7%)	26 (5%)	69 (7%)	4 (19%)	
Critical (5)	94 (5%)	5 (5%)	18 (4%)	21 (4%)	49 (5%)	1 (5%)	
Maximal (6)	5 (0%)	0 (0%)	2 (0%)	0 (0%)	2 (0%)	1 (5%)	
Shock Index	0.78 (0.25-3.67)	0.83 (0.62-1.06)	0.79 (0.65-0.98)	0.80 (0.66-0.99)	0.77 (0.64-0.95)	0.89 (0.71-1.10)	**0.05**[3]
Items not found to be statistically significant: *Patient sex, injury type (blunt, penetrating, other), time from injury to hospital arrival, and time from injury to initial vital sign measurement*							
Objective Patient Data							
Ionized calcium (mmol/L)	1.14 (0.51-3.80)	0.95 (0.90-0.97)	1.06 (1.04-1.08)	1.12 (1.11-1.13)	1.19 (1.17-1.22)	1.32 (1.30-1.38)	**<0.001**[3]
pH	7.36 (6.73-7.56)	7.36 (7.27-7.41)	7.36 (7.31-7.40)	7.37 (7.31-7.41)	7.36 (7.31-7.40)	7.32 (7.20-7.42)	**0.03**[3]
Lactic acid (mmol/L)	2.5 (0.3-24.0)	3.3 (2.0-5.0)	2.9 (1.7-4.4)	2.4 (1.4-3.9)	2.3 (1.2-4.2)	3.9 (2.2-7.3)	**<0.001**[3]
Hemoglobin (g/dL)	12.7 (3.9-17.8)	11.8 (9.3-13.6)	12.9 (11.1-14.1)	12.6 (11.0-14.0)	12.7 (11.4-14.1)	11.6 (10.8-12.3)	**0.02**[3]
Platelets (x10^3/µL)	270 (17-1041)	252 (197-305)	265 (212-324)	269 (228-328)	277 (233-334)	300 (219-357)	**0.02**[3]
Items not found to be statistically significant: *heart rate, systolic blood pressure, serum creatinine, serum potassium*							
Measures of Injury Severity							
Kampala Trauma Score	9 (4-10)	9 (8-10)	9 (8-10)	9 (8-10)	9 (8-10)	8.5 (8-10)	**0.03**[4]
Trauma and Injury Severity Score	6.08 (-4.69-8.21)	5.93 (4.82-6.96)	6.08 (5.30-6.99)	6.16 (5.55-7.07)	5.33 (3.82-6.04)	6.08 (5.39-6.99)	**0.02**[3]
Triage Early Warning Score	4 (1-14)	5 (4-6)	5 (4-6)	4 (4-6)	4 (3-6)	5 (4-6)	**0.005**[4]
Items not found to be statistically significant: *NISS score and number of AIS scores*							
Patient Outcomes							
30-day mortality	58 (2.9%)	4 (4.0%)	14 (3.2%)	12 (2.5%)	24 (2.6%)	4 (19%)	**<0.001**
ICU Admission	129 (6.5%)	17 (17%)	31 (7.0%)	34 (7.0%)	46 (4.9%)	1 (4.8%)	**<0.001**
Received blood (any)	385 (19%)	35 (35%)	101 (23%)	89 (18%)	156 (17%)	4 (19%)	**<0.001**
Items not found to be statistically significant: *Hospital Length of Stay*							

Figure 2. and Table 2. **Regression analyses of selected laboratory values comparing serum calcium when treated as a continuous variable.**



Comparison	Linear[1]		Quadratic[2]		
	m	b	a	b	c
pH	-0.0243	7.37	0.0179	-0.0797	7.41
Creatinine	-9.36	98.4	12.6	-49.8	128
Platelets	***61.3***	***211***	***-47.7***	***217***	***96.0***
Lactate	-0.522	3.96	0.132	-0.932	4.25
Hemoglobin	0.360	12.1	***-0.964***	***3.50***	***9.76***

[1] Linear regression coefficients are included here in the format $y = mx + b$.[2] Quadratic regression coefficient are included here in the format $y = ax^2 + bx + c$

DISCUSSION

The average initial calcium level was 1.14 mmol/LR, with a hypocalcemia rate of 52% and hypercalcemia rate of 1.1%, consistent with similar studies on high-resource populations. Significant differences among calcium strata existed in regard to patient age, injury body region, maximum AIS, and shock index. pH, lactate, hemoglobin and platelets were all significantly different across strata. Ionized calcium was significantly associated with several injury severity scores, most notably TEWS, a physiologic-based trauma severity score. This may suggest that hypocalcemia is tied more closely to abnormal physiologic states rather than injury severity or type.

There was no statistically significant difference between calcium strata with regards to injury type, but blunt trauma was more common in the hypercalcemic group than other calcium strata. There is also a parabolic relationship between calcium and several laboratory values, suggesting a role of hypercalcemia as well as hypocalcemia in portending poor trauma outcomes.

CONCLUSIONS

Hypocalcemia is common in trauma patients and is present in low-resource populations at the same rate as high-resource studies. Epidemiologic variation exists amongst hypocalcemic trauma patients, and some trauma severity scores correlate well with hypocalcemia in trauma. There is evidence suggesting a unique relationship between hypercalcemia and laboratory derangements, which should be further studied.

REFERENCES

This poster is adapted from: Oudakker, J., et al. (2025). Correlates of incident hypocalcemia amongst trauma patients in the Western Cape of South Africa: a secondary analysis of the Epidemiology and Outcomes of Prolonged Trauma Care (EpiC) study. Scandinavian journal of trauma, resuscitation and emergency medicine, 33(1), 128.

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