

# Low serum calcium levels are associated with a worse clinical outcome in ICH

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*Low serum calcium levels have been previously associated with larger hematoma volumes and hematoma expansion. The pathophysiology behind this is still unclear. The aim of this study was to identify an association between hypocalcemia and clinical outcome at discharge after controlling for baseline characteristics and serum Mg levels.*

## Background

- Low serum calcium levels have been previously associated with larger hematoma volumes, hematoma expansion and worse outcomes.
- The pathophysiological mechanisms are still not well understood
- A confounding effect among serum calcium and magnesium levels has been previously considered.

## Objectives

1. To identify rates of hypocalcemia and hypomagnesemia after ICH.
2. To compare outcome at discharge (Glasgow Outcome Scale: GOS) between hypocalcemic and normocalcemic subjects.
3. To assess the relationship among hypocalcemia and discharge disposition.

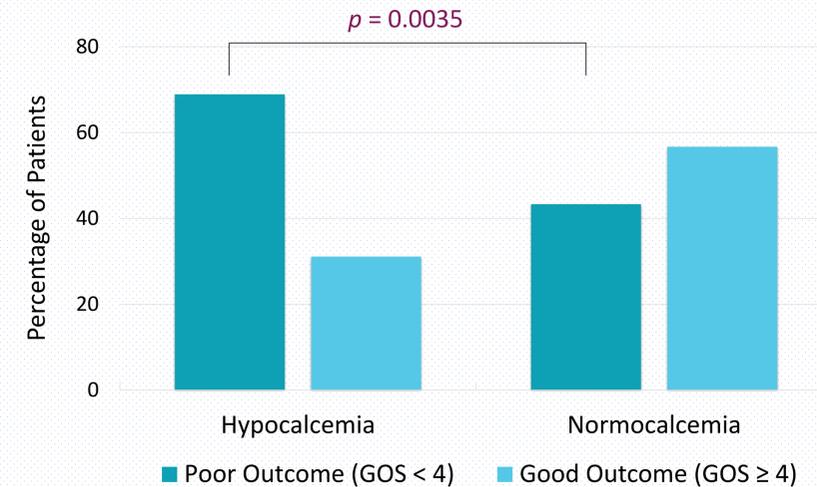
**Table 1.** Patient demographics and clinical outcome comparison among hypocalcemic and normocalcemic patients.

	Hypocalcemia (%)	Normocalcemia (%)	p-value
Female	46.9	56.7	0.1054
Age (mean ± SD)	63.3 ± 14.9	63.9 ± 15.9	0.7432
Good Outcome	31.1	56.7	<b>0.0035</b>
Poor Outcome	68.9	43.3	
Favorable Disposition	30.1	58.2	<b>0.0016</b>
Unfavorable Disposition	69.6	41.8	

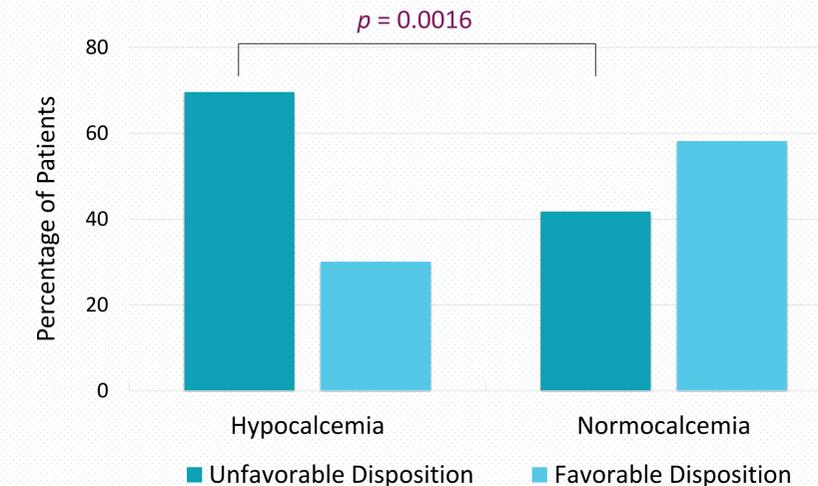
## Methods

- Retrospective review of consecutive patients with ICH admitted to the Baylor-St. Luke's Medical Center Neuroscience Critical Care Unit (NCCU) (January 2008 – December 2012).
- Demographics, hypocalcemia (serum Ca < 8.4 mg/dL), hypomagnesemia (serum Mg < 1.5 mg/dL), admission GCS, admission NIHSS, admission mRS and GOS were collected.
- Patients divided in a hypocalcemic and normocalcemic group.
- Associations between serum Ca levels and clinical outcome at discharge (GOS and discharge disposition) were investigated using a multivariate logistic regression model.

**Figure 1.** Clinical outcome: GOS compared between hypocalcemic and normocalcemic groups.



**Figure 2.** Discharge disposition compared between hypocalcemic and normocalcemic groups.



**Table 2.** Multivariate logistic regression analysis of maximum likelihood estimates.

Parameter <sup>a</sup>	Estimate	S.E. <sup>b</sup>	Wald $\chi^2$	p-value
Hypocalcemia	1.1755	0.4026	8.5256	<b>0.0035</b>
Hypomagnesemia	0.1298	0.6520	0.0396	0.8422
Gender	0.5653	0.2829	3.9939	0.0457
Ethnicity	-0.0460	0.1228	0.1401	0.7082
Admission GCS	-0.0219	0.0181	1.4603	0.2269
Admission NIHSS	0.0824	0.0149	30.3796	<b>&lt; 0.0001</b>
Admission mRS	0.6607	0.2070	10.1854	<b>0.0014</b>

<sup>a</sup> DF = 1; <sup>b</sup> Standard error



## Results

- 510 patients with ICH were included (55.2% female).
- Hypocalcemia was identified in 82 patients (16.1%) (Table 1).
- Clinical outcome was significantly worse (GOS < 4) in the hypocalcemic group compared to the normocalcemic group, poor outcome was found in 68.9% and 43.3%, respectively ( $p = 0.0035$ ) (Figure 1).
- This increased risk was significant after controlling for gender, ethnicity, serum Mg, admission GCS, admission NIHSS and admission mRS (Table 2).
- Unfavorable discharge disposition (LTAC, SNF, hospice, death) was also higher in the hypocalcemic group compared to the normocalcemic group, 69.6% and 41.8%, respectively ( $p = 0.0016$ ) (Figure 2).

## Conclusions

- Our study shows a significant association between hypocalcemia and poor clinical outcome after controlling for baseline characteristics and serum Mg levels.
- Hypocalcemia have been previously associated with hematoma expansion which can be related to a poor clinical outcome.
- A probable confounding effect among hypocalcemia and hypomagnesemia has been previously proposed, however we controlled for Mg levels in our study.
- Further large prospective studies might be needed to clarify this association.

*Our findings imply a possible relation between hypocalcemia and clinical outcome.*