

Significant Hypophosphatemia is Predictive of Brain Death in Severe Traumatic Brain Injury

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Background

- Traumatic brain injury (TBI) is one of the most common causes of death and disability worldwide¹
- It poses a burden on health-care systems and economies through lost productivity and high health-care costs¹
- Severe TBI (sTBI) carries the highest risk of developing brain death²
- There are currently no laboratory markers that predict the progression to brain death³
- However, certain electrolyte derangements have been observed⁴
 - Notably, hypophosphatemia
- The aim of the study is to evaluate prognostic significance of hypophosphatemia in relation to brain death progression from severe TBI



Patient cohort

- Total of 336 patients, ages 15-89, who had a GCS of 8 or less and were admitted to the ICU between 1/1/2018 and 12/31/2021

Results

- Multivariate analysis showed that HP was the only correlation with a p value less than 0.0001, while no other measured physiologic or metabolic derangements demonstrated significant correlation with progressing to brain death

Table 1: Patient Demographics and Group Comparison

Demographics	Confirmed Brain Death (n=57)	No Brain Death (n=279)	Significance
Age	44.44 ± 21.23	44.22 ± 20.51	N/A
Sex	16 Female, 41 Male (28%,72%)	71 Female, 208 Male (25%,75%)	N/A
GCS on Admission	4 ± 1.8	4 ± 1.8	NS
Total Vent Days	3.68 ± 2.20	8.27 ± 10.77	5.8614E-10
Total ICU Days	3.67 ± 2.20	10.34 ± 11.22	8.98204E-18
Phosphate Mean (mEq/L)	1.67 ± 0.79	2.16 ± 0.92	0.00004
Phosphate Median (mEq/L)	1.5 (1.2-1.7)	2 (1.6-2.6)	N/A
Lowest Phosphate Value (mEq/L)	0.9	0.9	N/A

Conclusion

- In patients with severe traumatic brain injury, significant hypophosphatemia is associated with progression to brain death
- Patients with sTBI demonstrate complex derangement in physiology leading to cytokine storm and biochemical imbalances such as hypophosphatemia that can interfere with neuromuscular exam
- The time required to correct significant electrolyte imbalances can potentially delay a diagnosis of brain death
- Early and aggressive correction is recommended

References

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