Early Diagnostic Performance of S100B, GFAP and UCH-L1 Within the Timeframe Defined by the Scandinavian Traumatic Brain Injury Guidelines

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Abstract

Introduction: The Scandinavian NeuroTrauma Committee (SNC) guidelines recommend S100B as a screening tool for early detection of Traumatic brain injury (TBI) in patients presenting with an initial Glasgow coma scale (GCS) of 14-15. The objective of the current study was to compare S100B's diagnostic performance within the recommended 6-hour window after injury, compared to GFAP and UCH-L1. The secondary outcome of interest was the ability of these biomarkers in detecting traumatic intracranial pathology beyond the 6-hour mark.
Methods: The Center-TBI core database (2014-2017) was queried for data pertaining to all TBI patients with an initial GCS of 14-15 who had a blood sample taken within 6 hours of injury in which the levels of S100B, GFAP, and UCH-L1 were measured. As a subgroup analysis, data involving patients with blood samples taken within 6-9 hours, and 9-12 hours were analyzed separately for diagnostic ability. The diagnostic ability of these biomarkers for detecting any intracranial injury was evaluated based on the area under the receiver operating characteristic curve (AUC). Each biomarker's sensitivity, specificity, and accuracy were also reported at the cutoff that maximized Youden's index.
Results: A total of 531 TBI patients with GCS 14-15 on admission had a blood sample taken within 6 hours, of whom 24.9% (N = 132) had radiologically confirmed intracranial injury. The AUCs of GFAP (0.86, 95% confidence interval (CI): 0.82-0.90) and UCH-L1 (0.81, 95% CI: 0.76-0.85) were statistically significantly higher than that of S100B (0.74, 95% CI: 0.69-0.79) during this time. There was no statistically significant difference in the predictive ability of S100B when sampled within 6 hours, 6-9 hours, and 9-12 hours of injury, as the p-values were >0.05 when comparing the AUCs. Overlapping AUC 95% CI suggests no benefit of a combined GFAP and UCH-L1 screening tool over GFAP during the time periods studied [0.87 (0.83-0.90) vs 0.86 (0.82-0.90) when sampled within 6 hours of injury, 0.83 (0.78-0.88) vs 0.83 (0.78-0.89) within 6-to-9 hours and 0.81 (0.73-0.88) vs 0.79 (0.72-0.87) within 9-12 hours].
Conclusions: Targeted analysis of the CENTER-TBI core database, with focus on the patient category for which biomarker testing is recommended by the SNC guidelines, revealed that GFAP and UCH-L1 perform superior to S100B in predicting CT-positive intracranial lesions within 6 hours of injury. GFAP continued to exhibit superior predictive ability to S100B during the time periods studied. S100B displayed relatively unaltered screening performance beyond the diagnostic timeline provided by SNC guidelines. These findings suggest the need for a re-evaluation of the current SNC TBI guidelines.

Diagnostic ability of S100B, GFAP, and UCH-L1

Biomarker	AUC (95% CI)	Sensitivity (95% CI)	Specificity (95% CI)	Accuracy (95% CI)	P-value when comparing the AUCs
S100B	0.79 (0.75-0.82)	0.68 (0.57-0.73)	0.78 (0.70-0.82)	0.74 (0.71-0.77)	Reference
GFAP	0.89 (0.87-0.92)	0.81 (0.74-0.86)	0.85 (0.76-0.90)	0.84 (0.81-0.86)	<0.001
UCH-L1	0.86 (0.83-0.88)	0.80 (0.72-0.85)	0.79 (0.71-0.84)	0.80 (0.77-0.83)	<0.001