Category : **Brain: Head trauma**

A246 - *Predictive data signatures in icu-stratum traumatic brain injury patients: computational approach*

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Introduction:

Traumatic Brain Injury (TBI) is a global health problem which constitutes a leading neurological cause of death and also results in life-long disability in many survivors. The aim of this study was to identify data signatures in TBI patients recorded in the first 24 hours of ICU admission. We tested the hypothesis that these signatures are associated with short term clinical outcomes.

Methods:

4,450 patients admitted to the ICU for management of TBI were selected from the multisite clinical database (eICU) and clinical, laboratory and physiological time series data were extracted. Outcomes were mortality and neurological outcome at discharge. The eICU developed machine learning algorithms were externally validated on an analogous TBI sample in an independent single-center ICU database (MIMIC-III). Model performance metrics were compared with reference International Mission for Prognosis and Analysis of Clinical Trials (IMPACT) and Corticoid Randomization After Significant Head injury (CRASH) logistic regression models.

Results:

The computational models performed well for both neurological outcome prediction and mortality prediction, with test metrics that compared favorably with reference IMPACT and CRASH scores (Table 1). External validation utilizing MIMIC III corroborated the results from eICU for both neurological outcome and mortality suggesting robust generalizability. Top predictive features included age, PTS derived variables, glucose, platelet count, white blood cell count, and Glasgow Coma subscores, all originating from the first 24 hours of ICU admission.

Conclusion:

Results indicate that computational models trained with data available in the first 24 hours after admission are predictive of short-term neurological outcome and mortality in ICU-stratum TBI patients. Timely characterization of severity and clinical trajectories could open a window for targeted interventions to ameliorate outcomes in patients with moderate and severe TBI.

Image :

Short-term Neurological Outcome			Reference Models	
	eICU model	MIMIC III validation	IMPACT	CRASH
AUROC	0.923 ± 0.015	0.924 ± 0.005	0.790	0.776
Sensitivity	0.866 ± 0.048	0.844 ± 0.044	0.773	0.790
Specificity	0.866 ± 0.017	0.849 ± 0.027	0.646	0.613
Short-term Mortality Outcome			Reference Models	
	eICU model	MIMIC III validation	IMPACT	CRASH
AUROC	0.900 ± 0.027	0.931 ± 0.011	0.879	0.867
Sensitivity	0.796 ± 0.058	0.880 ± 0.040	0.852	0.810
Specificity	0.835 ± 0.034	0.841 ± 0.062	0.727	0.755

Table 1. Summarized eICU development and MIMIC III external validation results for short-term neurological outcome and mortality prediction.