

Redefining Intracranial Pressure Targets in Elderly Patients with Traumatic Brain Injury: Evidence for a Lower ICP Threshold to Guide Prognosis

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Background:

Traumatic brain injury (TBI) is increasingly common among elderly patients and its incidence is expected to rise further with demographic aging. Despite their higher vulnerability due to comorbidities, favorable outcomes are achievable with modern neurointensive care, indicating that treatment limitations should not solely be based on age. Intracranial pressure (ICP) monitoring remains a cornerstone in TBI management, but current thresholds are largely derived from younger cohorts, leaving optimal targets for elderly patients uncertain.

Methods:

We retrospectively analyzed elderly TBI patients with hourly intracranial pressure (ICP) data for up to 72 hours after ICU admission. Logistic and segmented regression models were applied to examine the association between exposure to elevated ICP and outcomes at discharge (mortality, GOS <4). To this end, multiple logistic regression models were constructed across candidate ICP cut-offs, and segmented regression was used to identify breakpoints. Variability was assessed by deviations from patient-specific ICP means. Discriminatory performance of threshold-based metrics was evaluated using ROC analyses and compared with AUC-based burden measures.

Results:

The cohort included 67 patients. Mortality and poor outcome increased monotonically with ICP, including within the <20 mmHg range. Breakpoint analyses identified a threshold around 10.5 mmHg (10.76 mmHg for death; 10.61 mmHg for poor outcome). Greater variability in ICP was also associated with unfavorable outcomes. ROC analyses showed that the percentage of time above the identified threshold provided better discrimination than AUC-based metrics (AUC 0.67 vs. 0.65, $p < 0.001$).

Conclusion:

In elderly patients with TBI, ICP values previously considered safe (<20 mmHg) were associated with worse outcomes, with a prognostic threshold around 10.5 mmHg. Both absolute ICP levels and variability carried prognostic significance. These findings challenge the conventional 20 mmHg threshold and support the need for refined, individualized ICP targets in this population.