

## **Extended analysis of early computed tomography of traumatic brain injured patients and relations to outcome**

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### *Introduction*

Traumatic brain injury (TBI) is responsible for up to 45% of in-hospital trauma mortality. Computed tomography (CT) is central to acute TBI diagnostics, and millions of brain CT scans are conducted yearly worldwide. Though many studies have addressed individual predictors of outcome from findings on CT scans, few have done so from a multivariate perspective. As these parameters are interrelated in a complex manner, there is a need for a better understanding of them in this context.

### *Patients and methods*

CT scans from 861 TBI patients were reviewed according to an extensive protocol. An extended analysis of CT parameters with respect to outcome was performed using linear and non-linear methods. We identified complex interactions and mutual information in many of the parameters. Variables predicting death differ from those predicting unfavorable versus favorable outcomes (Glasgow Outcome Scale scores of 1-3 versus 4-5 [GOS]).

### *Results*

The most important parameter for prediction of unfavorable outcome is the magnitude of midline shift. In fact, this parameter, as a continuous variable, is by itself a better predictor and is better calibrated than the Marshall CT score, even for predicting death. In addition, hematoma volumes are nearly co-linear with midline shift and can be substituted for it. A score of traumatic subarachnoid/intraventricular blood components adds substantially to model calibration. A CT scoring system geared toward dichotomous GOS scores is suggested.

### *Conclusion*

CT parameters were found to add 6-10% additional estimated explained variance in the presence of the important clinical variables of age, Glasgow Coma Scale score, and pupillary response. Finally we present a practical clinical "rule of thumb" to help predict the probability of unfavorable outcome using clinical and CT variables.