Mortality Prediction Model for Traumatic Intracranial Hemorrhage: A National Trauma Data Bank Study

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Introduction
- Traumatic intracranial hemorrhage (tICH) is a leading cause of trauma morbidity and mortality
- Determination of prognosis is complex and relies on a multitude of patient, institutional, and clinical factors
- Identifying the most relevant mortality predictors in tICH can aid clinical reasoning and diagnostic ability

Patient Selection & Population
- National Trauma Data Bank (2012-2016)
- Diagnosis codes associated with tICH n=248,536
- Excluded for Missing Data n=35,870
- Final Study Population n=212,666

Breakdown by tICH
- Absent: 94%
- Present: 56%
- EDH: 43%
- SDH: 56%
- SAH: 50%
- IPH: 23%

Disposition
- Lived: 91%
- Death / Hospice: 9%

Mean age: 54.3 years
Male: 63.4%

Model Development & Results

Support Vector Machine (SVM)

Machine learning algorithm that classifies data into two subsets (e.g., alive vs. dead) via an optimal hyperplane in N-dimensions

Data Cleaning
- SVM trained using 19 selected variables on training data set (80%)

SVM Training
- Assessment of SVM initial performance

10-Fold Cross Validation
- Recursive identification of most important variables

Recursive Feature Elimination
- SVM trained using 8 selected variables on 80% of data

Final SVM Training
- SVM tested on hold-out testing set (20%)

Performance Assessment

Results: Selected Features & Association with Mortality in tICH

Eight features selected by SVM; magnitude of each feature’s coefficient is proportional to its importance in predicting mortality outcomes

- GCS
- SMM
- Blood Alcohol Level
- Injury Severity Score
- Age
- ISS

Comparison of model performance to previously developed prognostic models

Future Directions
- Development of risk stratification categories to aid in triage of patients
- Inclusion of additional variables for assessment in subsequent models

Conclusions
- The SVM identified eight predictors of mortality:
  - High ISS, advanced age, presence of subdural hemorrhage, and presence of subarachnoid hemorrhage were associated with increased mortality
  - High GCS, current smoker, blood alcohol level beyond the legal limit, and level 1 trauma center were associated with decreased mortality
- Accuracy, sensitivity, and specificity comparable to previous prognostic models

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