The Use of Machine Learning Algorithms to Predict 30-day Readmission in Patients with Aneurysmal Subarachnoid Hemorrhage

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Disclosure

• The authors have no relevant financial or personal interests to disclose
Introduction

- Hospital readmissions are a major contributor to rising healthcare costs in the United States and they are frequently used as a quality metric for evaluating providers and hospitals.

- Logistic regression models have been used to predict the individual likelihood of readmission after aneurysmal subarachnoid hemorrhage (aSAH), but machine learning (ML) methods have not:
  - ML methods have shown to improve accuracy and fit in numerous neurosurgical outcome prediction models.
Methods

• The Nationwide Readmissions Database (NRD) was used to identify adults with aSAH between 2010 and 2014

• Outcome of interest was any readmission to the hospital within 30 days of discharge (30dRA) from the index admission

• Explanatory variables included demographic, comorbidity, and hospital data as well as hemorrhage severity, aneurysm treatment modality, vasospasm, hydrocephalus, length of stay, and discharge disposition
Results

• 13,623 patients met the inclusion criteria
• Median (± IQR) of cohort was 55 (46-64)
• Majority female (68.8%)
• There were 1,588 (11.7%) patients who experienced a 30dRA at a median (± IQR) of 9 days (4-19) after discharge from index admission
Results (cont.)

• Area under the curve (AUC) in the receiver operating characteristics (ROC) curve for binary logistic regression and each ML model is shown below:
  – Binary logistic regression: 0.633
  – Elastic net: 0.621
  – Gradient boosting: 0.632
  – Lasso: 0.621
  – Random forest: 0.607
  – Ridge regression: 0.635
Discussion

• Multiple ML algorithms failed to perform better than a standard logistic regression model for predicting 30dRA in patients with aSAH
  – None of the models had satisfactory discriminatory capacities for predicting 30dRA

• This suggests that covariates typically employed for predicting the likelihood of readmission in neurosurgical patients may not be applicable for those with aSAH
Summary points

• Incidence of 30dRA after aSAH is 11.7%
• Traditional binary logistic regression performed as well as ML models for predicting 30dRA, though overall discriminatory capacities were poor