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Integrating CT-Derived Optic Nerve Sheath Diameter Metrics with Clinical Scales to Predict Outcomes After Aneurysmal Subarachnoid Hemorrhage

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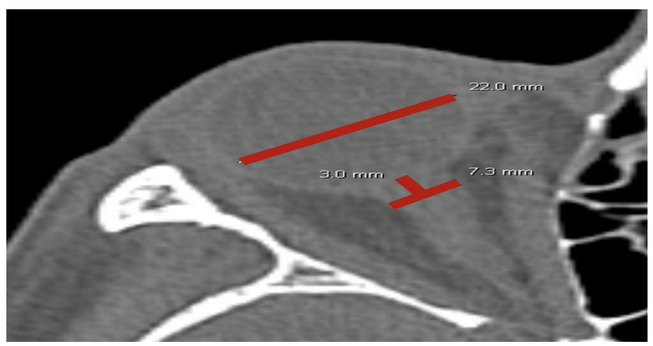
Introduction

- Aneurysmal subarachnoid hemorrhage (aSAH) is a neurologic emergency with high mortality and disability.
- Optic Nerve Sheath Diameter (ONSD) and ONSD/Eyeball Transverse Diameter (ETD) ratio (OER) are non-invasive markers of intracranial pressure.
- Their prognostic role in aSAH remains unclear.
- The objective of this study is to assess whether CT-based OER predicts neurological outcomes after aSAH, measured by:Modified Rankin Scale (mRS) at discharge

Methods

- Retrospective study of 290 aSAH patients (2013–2024).
- ONSD measured 3 mm posterior to globe; ETD as maximal eyeball diameter.
- Patients stratified into favorable (mRS 0–2) vs. unfavorable (mRS ≥3).
- Logistic regression models tested:
  Base model: OER only
  Arbitrary model: OER + severity scales (WFNS, Hunt-Hess, modified Fisher)
  Full model: OER + demographic, clinical, imaging variables
- Model performance evaluated with ROC curves.



Results

- Cohort: 290 patients (119 favorable, 171 unfavorable).
- ONSD/ETD ratio alone showed no significant association with outcomes (Base model, AUC = 0.56).
- When combined with severity scales (WFNS, Hunt-Hess, modified Fisher), OER became statistically significant (p = 0.03) and improved prediction (Arbitrary model, AUC = 0.80).
- The Full model achieved the highest discriminatory accuracy (AUC = 0.86) but OER itself lost significance.
- Independent predictors of poor outcome included age, atrial fibrillation, seizures, WFNS grade, pulmonary edema, and shunt placement.

ROC curve and AUC

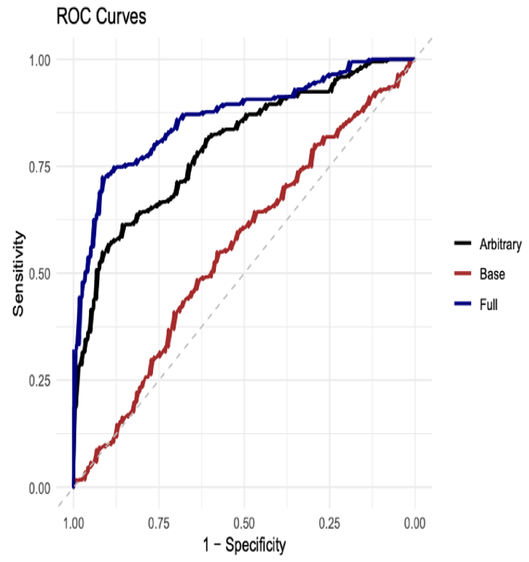


Figure 2: ROC curves for logistic regressions

Conclusions

- OER alone is not predictive (AUC = 0.56).
- Improves accuracy when combined with WFNS, Hunt-Hess, and Fisher scales (AUC = 0.80).
- Best results with full multivariable models (AUC = 0.86).
- OER is an adjunct marker, not a standalone tool.

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