Added Value of Intraoperative Data for Predicting Postoperative Complications

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Background: Models that predict postoperative complications often ignore important intraoperative events and physiological changes. This study tested the hypothesis that accuracy, discrimination, and precision in predicting postoperative complications would improve when using both preoperative and intraoperative data input features compared with preoperative data alone.

Methods: This retrospective cohort analysis included 43,943 adults undergoing 52,529 inpatient surgeries at a single institution during a five-year period. Random forest machine learning models in the validated *MySurgeryRisk* platform made patient-level predictions for seven postoperative complications and mortality occurring during hospital admission using electronic health record data and patient neighborhood characteristics. For each outcome, one model trained with preoperative data alone; one model trained with both preoperative and intraoperative data. Models were compared by accuracy, discrimination (expressed as AUROC: area under the receiver operating characteristic curve), precision (expressed as AUPRC: area under the precision-recall curve), and reclassification indices.

Results: Machine learning models incorporating both preoperative and intraoperative data had greater accuracy, discrimination, and precision than models using preoperative data alone for predicting all seven postoperative complications (intensive care unit length of stay >48 hours, mechanical ventilation >48 hours, neurological complications including delirium, cardiovascular complications, acute kidney injury, venous thromboembolism, and wound complications) and in-hospital mortality (accuracy: 88% vs. 77%, AUROC: 0.93 vs. 0.87, AUPRC: 0.21 vs. 0.15). Overall reclassification improvement was 2.4-10.0% for complications and 11.2% for in-hospital mortality.

Conclusions: Incorporating both preoperative and intraoperative data significantly increased the accuracy, discrimination, and precision of machine learning models predicting postoperative complications and mortality.