Development of a Predictive Model for Patient Compliance in Enhanced Recovery After Surgery (ERAS) Programs for Colorectal Surgery

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Abstract

Background: Enhanced Recovery After Surgery (ERAS) programs optimize perioperative care to reduce surgical stress and improve recovery. Compliance with ERAS pathways is essential for achieving favorable outcomes, yet predictors of adherence remain poorly understood. Using demographic, clinical, and procedural factors, this study aims to develop and validate a predictive model for perioperative compliance within ERAS protocols for colorectal surgery.

Methods: A retrospective analysis was performed, including all patients who were managed under the ERAS framework. The compliance model was built based on feature engineering which involved scaling, polynomial interaction expansion, and Lasso-based variable selection. Three regression algorithms (CatBoost, XGBoost, and Histogram-based Gradient Boosting) were compared using ten-fold cross-validation. Predictive performance was evaluated by root mean squared error (RMSE) and mean absolute error (MAE).

Results: Analysis was done on 1,119 patients who had colorectal surgery under ERAS pathways. The sample's average age was 66.5 years, and its average BMI was 26.5 kg/m². The average hospital stay was 9.2 days, and the average operating time was 221.5 minutes. The ERAS compliance rate was 78% overall, with minimally invasive procedures having a higher compliance rate (83%) than open surgery (67%). The strongest predictors of compliance, according to feature importance analysis, were surgical approach, ASA class, and operative duration. These were followed by BMI, age, and ERAS process measures like PONV prophylaxis.

Conclusion: The newly developed compliance model will enable early identification of patients at risk of low adherence, hence, supporting personalized perioperative management and improved recovery outcomes

Keywords

ERAS, colorectal surgery, compliance, predictive model, perioperative care, machine learning.