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Abstract:

Objective: Surgical outcome prediction is challenging but necessary for postoperative management. Current machine learning models utilize pre- and post-op data, excluding intraoperative information in surgical notes. Current models also usually predict binary outcomes even when surgeries have multiple outcomes that require different postoperative management. This study addresses these gaps by incorporating intraoperative information into multimodal models for multiclass glaucoma surgery outcome prediction.

Materials and Methods: We developed and evaluated multimodal deep learning models for multiclass glaucoma trabeculectomy surgery outcomes using both structured EHR data and free-text operative notes. We compare those to baseline models that use structured EHR data exclusively, or neural network models that leverage only operative notes.

Results: The multimodal neural network had the highest performance with a macro AUROC of 0.750 and F1 score of 0.583. It outperformed the baseline machine learning model with structured EHR data alone (macro AUROC of 0.712 and F1 score of 0.486). Additionally, the multimodal model achieved the highest recall (0.692) for hypotony surgical failure, while the surgical success group had the highest precision (0.884) and F1 score (0.775).

Discussion: This study shows that operative notes are an important source of predictive information. The multimodal predictive model combining perioperative notes and structured pre-op and post-op EHR data outperformed other models. Multiclass surgical outcome prediction can provide valuable insights for clinical decision-making.

Conclusions: Our results show the potential of deep learning models to enhance clinical decision-making for postoperative management. They can be applied to other specialties to improve surgical outcome predictions.

Author	IC or Organization	Senior NEI Author	Corresponding Author	Author's Email
Chiang, Michael F.	National Eye Institute	Yes	No	michael.chiang@nih.gov
Hribar, Michelle	Oregon Health and Science University and National Eye Institute (NEI)		Yes	hribarm@ohsu.edu
Lin, Wei-Chun	Oregon Health and Science University		No	
Song, Xubo	Oregon Health and Science University		No	
Chen, Aiyin	Oregon Health and Science University		No	
Weiskopf, Nicole G.	Oregon Health and Science University		No	

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