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INPLASY

Artificial Intelligence Predicting Treatment Response in Neovascular Age Macular Degeneration with anti-VEGF: A Systematic Review and Meta-Analysis

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ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 25 December 2025 and was last updated on 25 December 2025.

INTRODUCTION

Review question / Objective To evaluate the predictive accuracy of artificial intelligence (AI) and machine learning (ML) models for predicting treatment response in neovascular age-related macular degeneration (nAMD) using optical coherence tomography (OCT)–derived information. P (Population): Patients with nAMD treated with anti-VEGF therapy. I (Index Test): AI or ML models using baseline/pre-treatment OCT images. C (Comparator): Reference standard clinical outcomes (anatomical or functional response). O (Outcome): Diagnostic accuracy metrics (Sensitivity and Specificity). S (Study Design): Cohort studies and model development/validation studies.

Condition being studied Neovascular age-related macular degeneration (nAMD), specifically focusing on the prediction of anatomical or functional response to anti-vascular endothelial growth factor (anti-VEGF) therapy.

METHODS

Participant or population Patients diagnosed with neovascular age-related macular degeneration (nAMD) receiving treatment with approved anti-VEGF agents (e.g., ranibizumab, aflibercept, bevacizumab, brolucizumab, or faricimab).

Intervention Artificial intelligence or machine learning models (including deep learning and radiomics) that utilize optical coherence tomography (OCT) imaging (alone or combined with clinical data) to predict post-treatment outcomes.

Comparator The reference standard for treatment response as defined by the individual studies, typically involving expert human grading of anatomical resolution (dry macula) or standardized visual acuity measurement (e.g., gain of lines or letters) at a specified follow-up point.

Study designs to be included Prospective or retrospective cohort studies, and prediction model

development or validation studies that report sufficient data to reconstruct a confusion matrix (TP, FP, FN, TN).

Eligibility criteria Eigibility criteria Inclusion:Studies utilizing AI/ML for prediction of nAMD treatment response.Use of OCT as an input modality.Reporting of threshold-based performance metrics (sensitivity, specificity) or confusion matrices.Analysis at eye-level or patient-level.Exclusion:Studies focused solely on detection/diagnosis without response prediction.Non-AI statistical models.Lesion-level analysis only.Reviews, editorials, case reports, and conference abstracts without full text.Han et al. (2024) [25] excluded due to publication venue.Studies utilizing AI/ML for prediction of nAMD treatment response.Use of OCT as an input modality.Reporting of threshold-based performance metrics (sensitivity, specificity) or confusion matrices.Analysis at eye-level or patient-level.

Information sources Electronic databases: PubMed, Embase, Web of Science, IEEE.

Main outcome(s) Pooled Sensitivity and Specificity of AI models for predicting treatment response.

Quality assessment / Risk of bias analysis Risk of bias is assessed using the PROBAST-AI (Prediction model Risk Of Bias Assessment Tool – AI extension) framework, evaluating four domains: participants, predictors, outcome, and analysis.

Strategy of data synthesis We will perform a quantitative meta-analysis using a bivariate random-effects model to estimate pooled sensitivity and specificity. We will generate forest plots and SROC curves. Heterogeneity will be assessed visually and statistically.

Subgroup analysis Subgroup analyses will be performed based on:

Model Type: Deep Learning vs. Radiomics.

Prediction Target: Functional (Visual Acuity) vs. Anatomical (Fluid).

Prediction Horizon: Short-term vs. Long-term.

Study Size: 500 eyes.

Sensitivity analysis Sensitivity analysis will be conducted by sequentially excluding individual studies to test the robustness of the pooled estimates and the impact of single studies on overall heterogeneity.Sensitivity analysis will be conducted by sequentially excluding individual studies to test the robustness of the pooled estimates and the impact of single studies on overall heterogeneity.Sensitivity analysis will be conducted by sequentially excluding individual studies to test the robustness of the pooled estimates and the impact of single studies on overall heterogeneity.Sensitivity analysis will be conducted by sequentially excluding individual studies to test the robustness of the pooled estimates and the impact of single studies on overall heterogeneity.Sensitivity analysis will be conducted by sequentially excluding individual studies to test the robustness of the pooled estimates and the impact of single studies on overall heterogeneity.Sensitivity analysis will be conducted by sequentially excluding individual studies to test the robustness of the pooled estimates and the impact of single studies on overall heterogeneity.

Language restriction XXXXXXXXXX.
==Country(ies) involved Taiwan.

Other relevant information

Keywords Artificial Intelligence; Machine Learning; Neovascular Age-Related Macular Degeneration; Optical Coherence Tomography; Anti-VEGF; Treatment Response; Meta-analysis..

Contributions of each author
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