Association of Artificial Intelligence-Based Quantitative Fluorescein Angiography Measurements with Clinical Parameters in Patients with Diabetic Macular Edema

Ryan S. Huang[1], MSc MD(C), Andrew Mihalache[1], MD(C), Marko M. Popovic[2], MD MPH, David T. Wong[2], MD FRCSC, Rajeev H. Muni[2], MD MSc FRCSC,

[1]Temerty Faculty of Medicine, University of Toronto
[2]Deptartment of Ophthalmology and Vision Science, University of Toronto

Introduction: To investigate the association between baseline clinical characteristics of patients with diabetic macular edema (DME) and quantitative intravenous fluorescein angiography parameters, including blood-retinal barrier (BRB) permeability, retinal perfusion, and blood flow.

Methods: In this prospective, single-centre study in Toronto, Canada, we recruited consecutive patients with DME presenting with a central macular thickness (CMT) > 310 μm from 2017-2023. Patients with DME underwent fluorescein angiography using an ultra-widefield scanning laser ophthalmoscope. Fluorescein angiography images were processed using the artificial intelligence RETICAD FA assist system to extract quantitative BRB permeability, retinal perfusion, and blood flow measurements. Univariable and multivariable regression models were used to investigate associations between quantitative fluorescein angiography parameters and baseline characteristics, including best-corrected visual acuity (BCVA), CMT, and macular volume. This study was performed with approval from a local institutional review board and written informed consent was required for participation by eligible patients.

Results: The study population consisted of 56 eyes with DME and seven eyes from healthy controls. Among eyes with DME, 44 (78.6%) were male and 24 (42.9%) were Caucasian. The mean age of DME patients was 61.6 ± 11.6 years old. Central and peripheral BRB permeabilities were significantly higher in DME patients relative to healthy controls ($p<0.001$), whereas central and peripheral retinal perfusion was significantly lower in DME eyes ($p<0.001$ and 0.002, respectively). In our multivariable analysis, BRB permeability measured in the central and peripheral retina was significantly associated with BCVA ($p=0.003$ and 0.002, respectively) and macular volume ($p=0.025$ and 0.045, respectively). Blood flow measured centrally was also significantly associated with macular volume ($p=0.048$).

Conclusion: An increased BRB permeability in DME eyes was associated with a greater baseline macular volume and worse BCVA. Furthermore, DME eyes had a greater BRB permeability and lower retinal perfusion compared to control eyes. Future research should explore the clinical utility of quantitative fluorescein angiography measurements in diverse patient populations.