Window to the Brain: Using Retinal Biomarkers to Diagnose Alzheimer’s Disease

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Alzheimer’s disease (AD) affects millions, but diagnostic methods are inadequate and expensive. The connection between the brain and retina suggests that retinal biomarkers may exist for AD. Three biomarkers were identified to detect AD in the retina of the eye: retinal nerve fiber layer thinning, choroid thickening, and retinal vein thinning. To enable off-site analysis of retinal biomarkers in optical coherence tomography (OCT) scans, software was developed that was as accurate as the commercial Heidelberg Eye Explorer software that is available only with onsite scanning equipment ($r2 = 0.998$). This software was used to analyze 163 eye scans. Results showed the retinal nerve fiber layer was significantly thinner ($p = 0.0004$), the choroid was significantly thicker ($p = 0.0171$), and the retinal vein was significantly thinner ($p < 0.0001$) in the AD group than in the control group. An online statistical confidence interval calculator was used to establish normal ranges for each retinal biomarker, against which retinal biomarkers were compared to predict AD, and the normal ranges were coded into the software for diagnostic purposes. Results showed that the diagnostic software is 97% accurate with 100% positive and 93% negative predictive values in identifying patients who have diagnoses of AD but no other ocular afflictions, as other ocular afflictions have been shown to have similar effect on the choroid and retinal vein in the same way that AD does. Finally, code was written to enable ophthalmologists and/or ophthalmology technicians to use the software to evaluate OCT retinal scans.

Awards Won:

Second Award of $2,000