Retinal Ganglion Cell Analysis Using High-Definition Optical Coherence Tomography in Patients with Mild Cognitive Impairment and Alzheimer’s Disease

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Abstract.

Background: Alzheimer’s disease (AD) is a neurodegenerative disorder with emerging evidence that it is associated with retinal ganglion cell loss; however, few data exist to establish this association.

Objective: To determine whether macular ganglion cell-inner plexiform layer (GC-IPL) and retinal nerve fiber layer (RNFL), as quantitatively measured by non-invasive in vivo spectral-domain optical coherence tomography (SD-OCT), are altered in patients with AD and mild cognitive impairment (MCI).

Methods: Patients with AD and MCI were recruited from dementia/memory clinics, and cognitively normal controls were selected from the Singapore Epidemiology of Eye Disease program. SD-OCT (Cirrus HD-OCT, software version 6.0.2, Carl Zeiss Meditec Inc, Dublin, CA) was used to measure the GC-IPL and RNFL thicknesses.

Results: Compared with cognitively normal controls (n = 123), patients with AD (n = 100) had significantly reduced GC-IPL thicknesses in all six (superior, superonasal, inferonasal, inferior, inferotemporal, and superotemporal) sectors (mean differences from −3.42 to −4.99 μm, all p < 0.05) and reduced RNFL thickness in superior quadrant (−6.04 μm, p = 0.039). Patients with MCI (n = 41) also had significantly reduced GC-IPL thicknesses compared with controls (mean differences from −3.62 to −5.83 μm, all p < 0.05). Area under receiver operating characteristic curves of GC-IPL were generally higher than that of RNFL to discriminate AD and MCI from the controls.

Conclusions: Our data strengthens the link between retinal ganglion cell neuronal and optic nerve axonal loss with AD, and suggest that assessment of macular GC-IPL can be a test to detect neuronal injury in early AD and MCI.

Keywords: Alzheimer’s disease, mild cognitive impairment, neurodegenerative disorder, optic nerve, retinal ganglion cell, spectral-domain optical coherence tomography

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