UNDERSTANDING AGE-RELATED NEURORETINAL ALTERATIONS IN NONGLAUCOMATOUS EYES

Declines in optic nerve and retinal parameters can mimic glaucomatous damage, leading to diagnostic inaccuracy and unnecessary treatment adjustments.

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Aging brings inevitable changes to the human body, including the neuroretinal structures of the eye. These changes are particularly relevant in the context of glaucoma management, where subtle alterations in optic nerve and retinal parameters are used to monitor disease progression. Age-related declines in these parameters can mimic glaucomatous damage, leading to diagnostic inaccuracy and unnecessary treatment adjustments.

AGE AND THE NEURORETINA: WHAT CHANGES?

The neuroretina undergoes structural and vascular changes with age, even in the absence of disease. The clinical implications of age-related changes in neuroretinal OCT and OCT angiography parameters were revealed by a 5-year prospective study of healthy individuals aged 50 years and older.[1] The study analyzed four key parameters used in glaucoma assessment: (1) peripapillary retinal nerve fiber layer (pRNFL) thickness, (2) macular ganglion cell complex (mGCC) thickness, (3) radial peripapillary capillary (RPC) density, and (4) superficial macular vessel density.

The investigators found that diffuse thinning of the pRNFL occurred with age and averaged -0.3 µm annually (-1.7 µm over 5 years). The superior nasal sector showed the fastest decline, whereas the temporal inferior sector was the most resilient. Compared to the pRNFL, the mGCC thinned at a slower rate, decreasing by -0.14 µm annually (-0.8 µm over 5 years). Age-related thinning was most pronounced in the superior parafoveal region. RPC density declined by 0.3% over 5 years, primarily in the temporal inferior sector, where nerve fiber density is lowest. The superficial macular vessel density parameter showed the most significant percentage loss (-2.4%) over 5 years, with diffuse reductions across macular sectors.

These findings highlight the diffuse yet sector-specific nature of age-related changes and underscore the need to distinguish normal aging patterns from disease progression.

CLINICAL REFLECTIONS: DIFFERENTIATING AGING FROM GLAUCOMA

The overlap between age-related neuroretinal changes and glaucomatous damage poses challenges in clinical practice. For example, pRNFL thinning of less than -1.7 µm over 5 years may reflect normal aging rather than glaucomatous progression. Similarly, changes in mGCC thickness, which occur more slowly than pRNFL thinning, may provide a more stable metric for disease assessment in older patients. However, superficial macular vessel density may be less reliable for long-term monitoring owing to diffuse loss and poor image quality in older populations. RPC density, often used to monitor early glaucomatous damage, also declines with age, particularly in regions with lower nerve fiber density.

Understanding these patterns can improve clinicians' ability to interpret OCT and OCT angiography results and avoid unnecessary treatment escalations when normal aging is the cause of observed changes.

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SYSTEMIC INFLUENCES ON NEURORETINAL AGING

Age-related neuroretinal changes are influenced by systemic factors. In the prospective study by Pang et al,[1] hyperlipidemia was negatively associated with mGCC thinning, suggesting that lipid metabolism might have accelerated retinal ganglion cell degeneration. RPC density changes were positively associated with pulse and systolic blood pressure, aligning with evidence linking vascular health to retinal microvasculature. These findings underscore the importance of incorporating systemic health considerations into assessments of age-related neuroretinal changes.

LOOKING AHEAD: NAVIGATING AGING AND DISEASE

Age-related neuroretinal changes can complicate glaucoma diagnosis and monitoring, particularly in patients older than 50 years of age. Clinicians must account for these normal aging patterns to improve diagnostic accuracy and optimize treatment strategies. By understanding the nuances of neuroretinal aging, they can better navigate the intersection of age and disease and ensure more accurate and effective patient care. ■

1. Pang R, Kolli A, Li R, et al. Age-related optic nerve OCT and OCTA changes in subjects without glaucoma: a five-year prospective study. *Am J Ophthalmol.* Published online November 22, 2025. doi:10.1016/j.ajo.2025.11.028

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