Alzheimer's disease and primary open-angle glaucoma associated with vascular health in patients of African descent

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Editor,

Patients of African descent are disproportionately affected by both primary open-angle glaucoma (POAG) (Racette et al. 2003) and Alzheimer's disease (AD) (Steenland et al. 2016) compared to their European counterparts. Importantly, both diseases represent chronic, age-related and multifactorial neurodegenerative disorders affecting ocular and brain tissue of similar embryological origin. As vascular risk factors have been implicated in the pathophysiology of both POAG and AD, it is possible that differences in vascular pathology may account for a portion of the shared increased risk for both POAG and AD in patients of African descent.

Specifically, patients with AD were reported to have a fivefold increase in glaucoma compared to matched controls, despite lower mean intraocular pressure, suggesting a nonpressure influence

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on the disease (Nucci et al. 2015). It has been suggested that POAG patients of African descent have a stronger vascular component in their disease process, including local and systemic vascular and metabolism biomarkers. Recently, a four-year prospective study identified reduced blood flow in the retrobulbar and retinal vasculature as predictors of glaucomatous structural progression in both the optic nerve head and macula, at significantly higher levels in persons of African compared to European descent (Siesky et al. 2016). Specific vascular changes have also been identified in AD including capillary dysfunction and regional capillary loss, both associated with cognitive deterioration (Nielsen et al. 2017). In addition, recent data suggest patients with AD may have changes in retinal oxygen metabolism (Stefánsson et al. 2017) as retinal oxygen saturation in arterioles and venules was shown to be significantly elevated in patients with moderate AD compared to healthy individuals (Einarsdottir et al. 2016).

Together these findings suggest that vascular insult may be implicated as a shared mechanistic pathway that accounts for the disease disparity seen in both AD and POAG in persons of African descent. The recent advancement of ocular imaging modalities that allow for the examination of the microvasculature of the optic nerve, specifically ocular coherence tomography angiography (OCTA), may provide a useful and noninvasive biomarker differential in not only glaucoma, but also AD, particularly in patients of African descent. We, herein, encourage more research to identify these shared vascular pathways in AD and POAG so we may improve outcomes for persons of African descent experiencing these disease disparities.

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References

Einarsdottir AB, Hardarson SH, Kristjansdottir JV, Bragason DT, Snaedal J & Stefánsson E. (2016): Retinal oximetry imaging in Alzheimer's disease. *J Alzheimers Dis* 49: 79–83.

Nielsen RB, Egefjord L, Angleys H, et al. (2017): Capillary dysfunction is associated with symptom severity and neurodegeneration in Alzheimer's disease. *Alzheimers Dement* 13: 1143–1153.

Nucci C, Martucci A, Cesareo M, et al. (2015): Links among glaucoma, neurodegenerative, and vascular diseases of the central nervous system. *Prog Brain Res* 221: 49–65.

Racette L, Wilson MR, Zangwill LM, Weinreb RN & Sample PA (2003): Primary open-angle glaucoma in blacks: a review. *Surv Ophthalmol* 48: 295–313.

Siesky B, Harris A, Carr J, et al. (2016): Reductions in retrobulbar and retinal capillary blood flow strongly correlate with changes in optic nerve head and retinal morphology over 4 years in open-angle glaucoma patients of African descent compared with patients of European descent. *J Glaucoma* 25: 750–757.

Steenland K, Goldstein FC, Levey A & Wharton W (2016): A Meta-Analysis of Alzheimer's disease incidence and prevalence comparing African-Americans and Caucasians. *J Alzheimers Dis* 50: 71–76.

Stefánsson E, Olafsdottir OB, Einarsdottir AB et al. (2017): Retinal oximetry discovers novel biomarkers in retinal and brain diseases. *Invest Ophthalmol Vis Sci* 58: BIO227–BIO233.