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ARVO Annual Meeting Abstract | June 2024

Associations between blood pressure, intraocular pressure, optic nerve and macular structure, and hemodynamics in patients with glaucoma

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Investigative Ophthalmology & Visual Science June 2024, Vol.65, 1228.
doi:

Abstract

Purpose : To investigate the relationship between blood pressure (BP), intraocular pressure (IOP), and optic nerve head (ONH) and macular structure and hemodynamics in open-angle glaucoma (OAG) patients and healthy controls.

Methods : A cross sectional study categorized 94 OAG patients and 110 healthy controls using levels of systolic BP (SBP) and diastolic BP (DBP). BP categories were based on the American College of Cardiology and American Heart Association guidelines including: normal BP (SBP<120; DBP<80), elevated BP (SBP=120–129; DBP<80), stage 1 hypertension (HTN) (SBP=130–139 or DBP=80-89), and stage 2 HTN (SBP≥140 or DBP≥90). IOP was assessed via Goldmann tonometry and optical coherence tomography angiography (Optovue) was used to quantify optic nerve parameters, retinal nerve fiber layer (RNFL) and macular thicknesses, and blood vessel densities (VD) (small vessels (SV) and all vessels (ALL)) at the global, hemispheric and quadrant levels. Pearson correlations were used with $p<0.05$ considered statistically significant.

Results : In OAG patients, ONH VD, RNFL, and macular thicknesses were all lower compared to healthy controls ($p < 0.05$) while IOP was significantly higher in OAG patients (15.7 ± 4.3) versus controls (14.7 ± 3.1 ; $p = 0.022$). In the normal BP category, the correlation between IOP and inside disc VD SV and ALL was negative in controls (SV: -0.45; ALL: -0.46) and positive in OAG patients (SV and ALL: 0.24). In the stage 1 HTN category, the correlations between IOP and peripapillary SV VD in the inferior hemisphere (IH), and RNFL thickness in the IH and inferior quadrant (IQ) were positive in OAG patients (SV IH: 0.58; RNFL IH: 0.47; RNFL IQ: 0.53) and negative in healthy controls (SV IH: -0.2; RNFL IH: -0.33; RNFL IQ: -0.33). In the stage 2 HTN category, the correlation between IOP and inside disc SV was positive in OAG patients (0.2) and negative in healthy subjects (-0.89) (all $p < 0.01$). At the level of the macula, no significant differences were found in correlations between patients with OAG and controls for any BP category (all $p > 0.01$).

Conclusions : The relationships between IOP, retinal and ONH structure, and hemodynamics are different in persons with OAG compared to healthy controls. In this cohort, these relationships were significantly affected by the level of BP at the ONH, but not within the macula region.

This abstract was presented at the 2024 ARVO Annual Meeting, held in Seattle, WA, May 5-9, 2024.

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