



Vascular changes in age-related macular degeneration

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Age-related macular degeneration (AMD) is considered one of the principal causes of vision impairment among older individuals in developed countries. Assuming this, new technologies which may increment insights elucidating the morphological characteristics of this disorder are expected to improve the visual prognosis in AMD. The development of optical coherence tomography angiography (OCTA) has outstandingly extended our knowledge on the AMD pathophysiology.

Using swept source optical coherence tomography angiography (SS-OCTA), Arrigo and colleagues (1) nicely described retinal, choroidal, and optic nerve head microcirculation changes in 30 age-related macular degeneration (AMD) patients. These patients were affected by new-onset macular neovascularization (NV) in one eye and early/intermediate AMD in the fellow eye. Furthermore, an age-matched healthy control group was enrolled for comparison. In this study, the authors demonstrated that neovascular AMD eyes have an impairment of the retinal and choriocapillaris vessels. Another noteworthy observation was that even the fellow early/intermediate AMD eyes have retinal vascular alterations, this finding suggesting that retinal perfusion alterations might represent an early event in AMD pathogenesis. On contrary, the fellow early/intermediate AMD eyes did not display changes in choriocapillaris (CC) perfusion as compared to healthy eyes.

Previous OCTA studies have demonstrated that retinal and choroidal circulation is affected in AMD (2-4). In agreement with Arrigo *et al.*'s findings, our group previously showed that retinal perfusion is reduced in early/intermediate AMD eyes, especially in those eyes with OCT

signs of nascent geographic atrophy (GA) (2,3).

The introduction of OCTA has significantly broaden our capability to investigate the CC (4). Using spectral domain (SD)-OCTA, previous studies examined the CC perfusion alterations in AMD eyes (5-7). Since shadowing from overlying structures may disturb the assessment of the CC, these works evaluating the CC in early/intermediate AMD were restricted to measuring the CC perfusion outside of the drusen. These studies demonstrated that the CC not underlying drusen is principally impaired in those early/intermediate AMD eyes with NV in the fellow eyes, especially in those cases with type 3 NV in the fellow eyes (5,6). Assuming that patients with unilateral neovascular AMD are known to have an increased risk for progression to late AMD in their early/intermediate AMD eyes, these studies support the hypothesis that an ischemic choroidopathy might predispose to the formation of neovascularization. In addition, intermediate AMD eyes were described to be featured by an inverse correlation between post-photoreceptor function and CC hypoperfusion (7).

Using a longer wavelength, swept-source OCTA devices yield better drusen penetration, this allowing a superior proficiency in exploring the CC in AMD eyes. Subsequently, using SS-OCTA and employing an algorithm compensating the CC flow image by analyzing the structural information, the CC was studied topographically to estimate regional differences with and without drusen (8). In the latter study, the CC hypoperfusion characterizing intermediate AMD eyes was displayed to be principally circumscribed to the region underneath and surrounding drusen. Therefore, this study furnished imaging evidence to

corroborate the histopathologic observation that drusen co-localize to zones of CC impairment.

In conclusion, the study by Arrigo et al provided further evidence that AMD eyes have retinal and choroidal vascular alterations that are already present in the early/intermediate AMD form. The paper's novelty is that it displays that even the radial peripapillary capillaries (RPC) are decreased in AMD eyes. This finding suggests an extensive impairment of the ocular perfusion in AMD.

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