Use of Optical Coherence Tomography Angiography to Assess Microvascular Health Among Persons with HIV: Employing the Retina as a Convenient Window

949

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BACKGROUND

- Mechanisms underlying the rising burden of aging-related non-AIDS comorbidities among persons with HIV (PWH) remain unclear
- Microvasculopathy may link HIV-related chronic inflammation and premature multimorbidity, similar to diabetes and other conditions characterized by inflammatory end-organ damage
- We used a novel retinovascular imaging tool, optical coherence tomography angiography (OCTA), to evaluate the retina as a convenient assessment of microvascular health among PWH

STUDY OBJECTIVE: To evaluate the utility of OCTA in detecting microvascular changes as a comorbidity risk assessment tool in the setting of HIV infection.

OCTA has been used to identify common retinovascular diseases and has shown promise in the early diagnosis of Alzheimer's disease. Its use among PWH remains limited.

Figure 1. Optical coherence tomography non-invasively obtains structural and functional images of the retina in a matter of seconds. Rapid imaging algorithms analyze angiograms and report specified quantitative metrics.

METHODS

- Data from 4 PWH who underwent OCTA (Zeiss CIRRUS™ HD-OCT 5000) at the Emory Eye Center from 2018-2020 were analyzed
- Demographics, HIV-specific indices and NACM were summarized at the time of OCTA
- Images were reviewed qualitatively and metrics of microvascular health – the foveal avascular zone (FAZ) area and vessel density from the superficial capillary plexus – were calculated by ImageJ

OCTA identified evidence of microvascular pathology in all eyes (n=7) of four PWH examined.

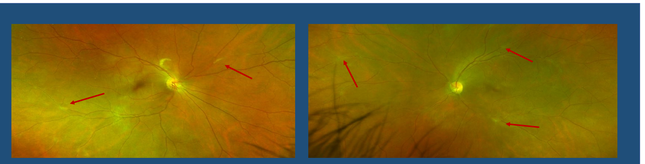

Figure 2. Fundoscopy of a patient with bilateral retinal vasculitis. Arrows designate areas of inflammatory deposition.

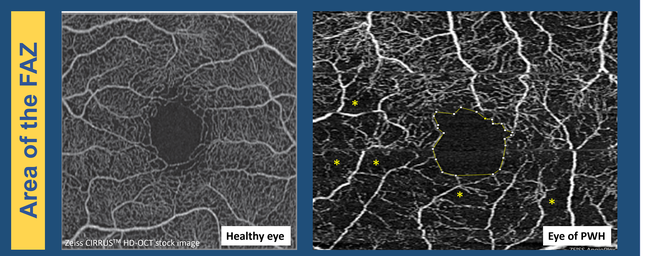

Figure 3. OCTA demonstrates the area of the foveal avascular zone (FAZ) as enlarged, irregular in contour, and associated with flow voids (*) in the eye of a PWH compared with a healthy eye.

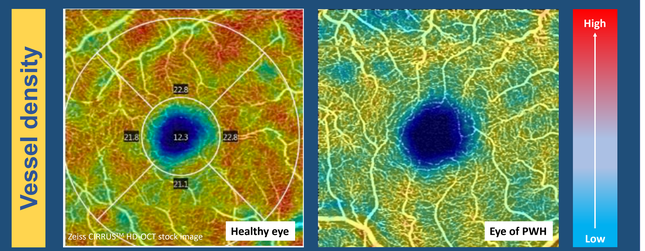

Figure 4. OCTA images analyzed by heat mapping of vessel density reveals areas of high (red) vs low (blue) density in the healthy eye vs eye of a PWH, respectively.

RESULTS – CLINICAL CHARACTERISTICS

Among 4 PWH:

- Median age was 39 years
- 100% were black
- 25% had ever smoked
- Median body mass index was 25.4 kg/m^2
- Prevalent non-AIDS comorbidities included (each n=1):
  - Hypertension
  - Dyslipidemia
  - Diabetes
  - Chronic kidney disease
  - Asthma

Table. HIV-specific indices among PWH at time of OCTA examination.

Median or % of patients	**N=4**
Time since HIV diagnosis	19 years
History of clinical AIDS	100%
Prior CMV retinitis	50%
Current CD4 count	84 cells/mm^3
Prescribed ART	100%
Current HIV-1 RNA <200 copies/ml	50%

RESULTS – OPHTHALMOLOGIC FINDINGS

- Qualitatively, all 7 of the eyes had evidence of microvascular pathology: 2 demonstrated diffuse capillary nonperfusion, while the remaining 5 eyes had focal areas of nonperfusion around the FAZ
- Mean FAZ area was 0.31 (SD±0.10) mm^2
- Mean vessel density was 43.9% (SD±10.9%)
- Retinovascular pathology identified by fundoscopy and OCTA is shown in Figures 2,3,4 to the left

LIMITATIONS

- Small sample size, lack of HIV-seronegative controls, inclusion of PWH lacking HIV suppression, males only

NEXT STEPS

- Perform OCTA among participants enrolled in the MACS/WIHS Combined Cohort Study (MWCCS) which includes male and female HIV-seropositive and HIV-seronegative individuals
- Evaluate the association of microvascular changes and HIV serostatus, along with biomarkers of inflammation and subclinical comorbidity measurements

CONCLUSIONS

- Among patients with longstanding HIV, OCTA identified microvascular abnormalities in all retinae examined
- Retinovascular evaluation by OCTA is a feasible, non-invasive technique for assessing microvascular health and findings support additional study in a larger, more diverse group of PWH
- Screening tools targeting microvasculopathy among PWH may aid in earlier detection of those at greatest risk of non-AIDS comorbidities and allow for aggressive risk-modification strategies

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