Imaging Retinal Vascularization in Geographic Atrophy via OCT Angiography

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Abstract

Purpose.
- Prospective, observational pilot study
- Image retinal vasculature associated with geographic atrophy (GA) to understand the metabolic support of remaining retinal tissue

Methods.
- Five eyes of five patients with GA
  - Mean age 80.8 ± 7.1 years
- Used a spectral domain OCT with prototype angiography software (OCT-A, 10 x 10 degree field, Spectralis, Heidelberg Engineering)
- Areas of atrophy varied
  - Mean horizontal size 2410 ± 1314 um
  - Mean vertical size 2029 ± 959 um
- BCVA requirements: 20/50 or better
- Retinal layers were hand segmented

Results.
- Course and caliber of medium to large superficial vessels appears unchanged over areas of atrophy
- Both superficial and deep plexuses exhibit areas of reduced signal apparently respecting the larger areas of atrophy
- Foveal avascular zone was identifiable despite being within an area of atrophy

Conclusion.
- Area of decreased signal may indicate that fine vessels are not needed in areas of tissue loss

Introduction

- Research about tissue atrophy and its relation to blood supply in GA has been primarily aimed at understanding the choroid
  - Multiple studies show decreased flow of the choroid in and around an area of GA[1,2]
  - The order of tissue atrophy vs vascular atrophy occurring first depends on the stage of atrophy being studied[3]
- Research about outer retinal tubules (ORT) in areas of retinal atrophy raised questions about retinal vasculature[4]
- We aimed to investigate retinal vasculature in areas of retinal atrophy by answering questions such as:
  - Is the vasculature still present?
  - Is it present to the same degree as non-atrophied tissue?

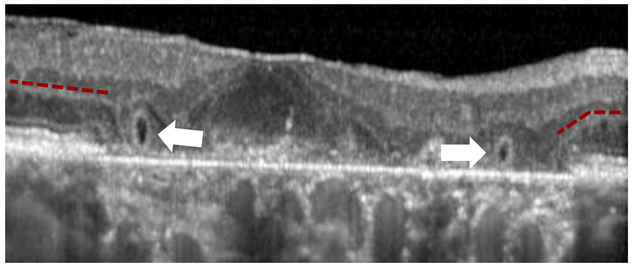

Figure 1: Patient 4 shows two Outer Retinal Tubules at the edge of GA (arrows). Dashed crimson lines separate inner and outer retina.

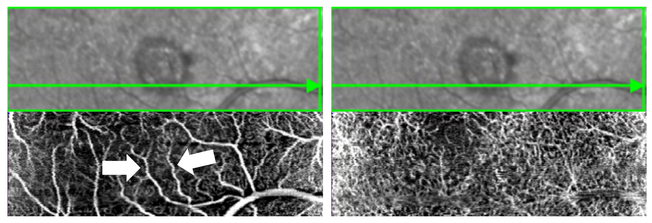

Figure 2: Patient 1 superficial plexus, deep plexus, IR image, respectively. Image depicts medium to large vessels maintaining course and caliber even as they travel over the area of atrophy (arrows).

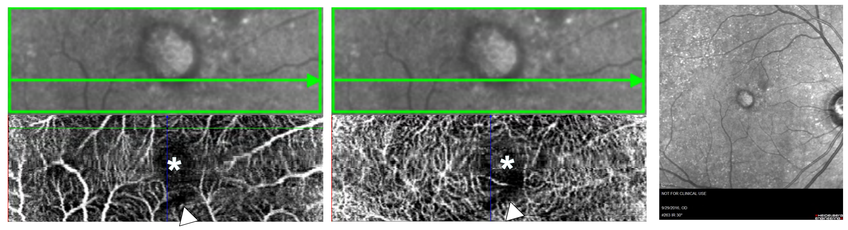

Figure 3: Patient 2 superficial plexus, deep plexus, IR image, respectively. Images depict an identifiable foveal avascular zone despite being within an area of geographic atrophy (asterisks). Images also show an area of reduced signal secondary to an unknown cause (arrowheads).

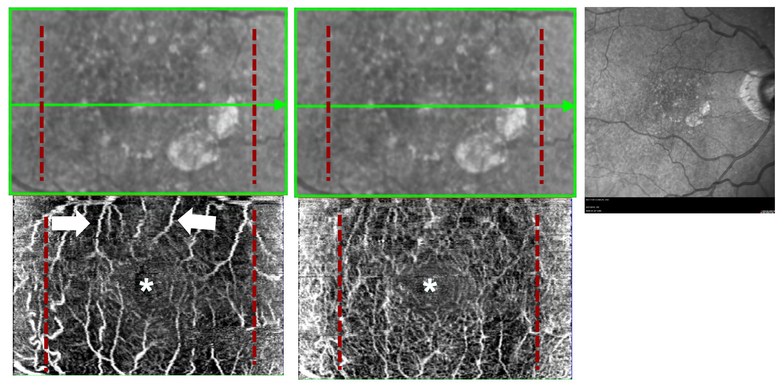

Figure 4: Patient 3 superficial plexus, deep plexus, IR image, respectively. Image shows medium to large vessels maintaining course and caliber even as they travel over the area of atrophy (arrows). It also shows an identifiable foveal avascular zone despite being in an area of geographic atrophy (asterisks). Both superficial and deep plexuses exhibit areas of reduced signal apparently respecting areas of atrophy (dashed crimson lines).

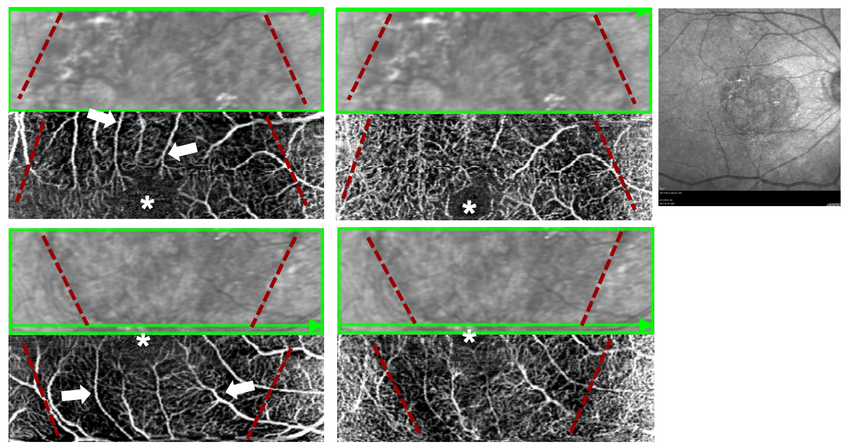

Figure 5: Patient 4 superficial plexus, deep plexus, IR image, respectively. Top column shows superior portion of atrophy and bottom column shows inferior portion of atrophy. Image shows medium to large vessels maintaining course and caliber even as they travel over the area of atrophy (arrows). It also shows an identifiable foveal avascular zone despite being in an area of geographic atrophy (asterisks). Both superficial and deep plexuses exhibit areas of reduced signal apparently respecting areas of atrophy (dashed crimson lines).

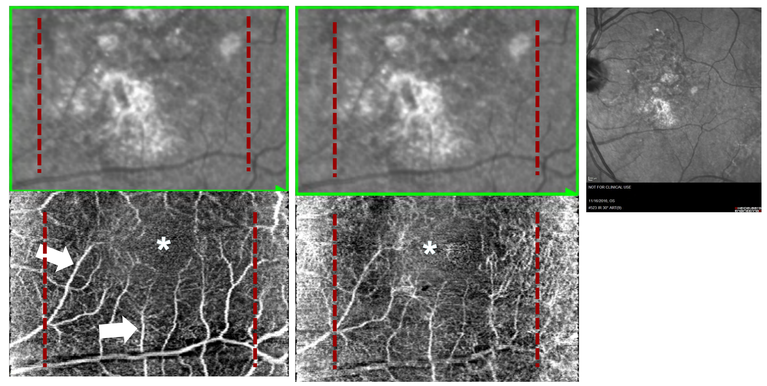

Figure 6: Patient 5 superficial plexus, deep plexus, IR image, respectively. Image shows medium to large vessels maintaining course and caliber even as they travel over the area of atrophy (arrows). It also shows an identifiable foveal avascular zone despite being in an area of geographic atrophy (asterisks). Both superficial and deep plexuses exhibit area of reduced signal apparently respecting areas of atrophy (dashed crimson lines).

Discussion

- Expected result
  - Medium to large superficial vessels did not change course and caliber over areas of atrophy
    - Superficial and deep retinal vasculature provide metabolic support to inner retina, not affected by geographic atrophy
- Unexpected results
  - Reduced signal which apparently respects the borders of large areas of atrophy
    - Hypotheses for this reduced signal:
      - Change of tissue position in areas of atrophy
        - Accounted for via hand segmentation
      - Atrophy has progressed enough to affect retinal tissue carrying vasculature, therefore diminished blood flow
      - Artifact of OCTA image
        - Area of reduced signal present in all figures
          - Figures 2 and 3 do not have geographic atrophy at this location
          - Figures 4 – 6 may be coincident that this area roughly aligns with borders of atrophy
  - Reduced signal inferior to the FAZ in figure 3
    - Present in both superficial and deep plexuses
      - Hypotheses for this reduced signal:
        - Segmentation error is not the cause
        - Media opacities and other OCTA artifacts
          - Unlikely because small blood vessel crosses over this area of reduced signal in the deep plexus
        - True absence of blood flow
        - Absence of detectable blood flow[6]
- Our results lead us to wonder if we might slow the progression of geographic atrophy by increasing retinal vascular perfusion without inducing CNVM

Acknowledgement

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References

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