Practical Retina
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Use of Optical Coherence Tomography Angiography in Masqueraders of Wet Age-Related Macular Degeneration and Choroidal Neovascularization

by Sidney Schechet, MD; Asadolah Movahedan, MD; and Dimitra Skondra, MD, PhD

Optical coherence tomography angiography (OCTA) is a new and exciting imaging modality emerging in our field of retina. OCTA is a fast, noninvasive way to image chorioretinal vasculature providing volumetric data on both the structure and blood flow of the vascular networks with the ability to selectively visualize distinct chorioretinal vascular plexuses. There are many potential clinical applications for OCTA that are still being discovered.1-4

Fluorescein angiography (FA) has been considered the gold standard for assessing chorioretinal diseases since 1961, particularly choroidal neovascularization (CNV) in various disease processes like wet age-related macular degeneration (AMD) and myopic CNV. However, FA only provides a limited two-dimensional depth resolution of the retinal and choroidal vasculature and poorly visualizes vessels that may be obscured by fluid, hemorrhage, pigment, retinal pigment epithelium (RPE) detachments or other areas of hyper/hypofluorescence. Further, FA imaging is time-consuming and invasive, with potential systemic dye associated side effects.5,6

The role of optical coherence tomography angiography (OCTA) in the evaluation of the retinal and choroidal vasculature is much better understood today compared to its introduction in our clinics several years ago. Since 2015, we have seen numerous papers published comparing OCTA to conventional fluorescein angiography to evaluate various retinal disease states. Retina specialists are finally starting to process this flood of data.

I asked Dimitra Skondra, MD, PhD, Sidney Schechet, MD, and Asadolah Movahedan, MD, to provide us with an overview of how OCTA can help us in the clinical setting to evaluate various choroidal diseases. Their approach to demonstrate the utility of this technology is through a case series where each case highlights how OCTA changed management and improved patient outcomes compared to what would have been achieved with the use of traditional retinal imaging alone. Additionally, they provide us with an overview of OCTA technology — reviewing the merits and pitfalls of various retinal imaging techniques.

Obviously, OCTA is a very useful technology and its role will only increase as advances in processing algorithms continue. The insights and expertise that Drs. Skondra, Schechet, and Movahedan share with us will be very helpful as we apply OCTA into our clinical practices.

doi: 10.3928/23258160-20180129-01
In the past decade, optical coherence tomography (OCT) has established itself as an essential imaging modality in retinal diseases, including CNV, showing structural changes like intraretinal and subretinal fluid (SRF) and retinal pigment epithelial detachments (RPEDs). However, it does not provide direct visualization of the neovascular membrane itself, and often it can be difficult to distinguish CNV from subretinal fibrosis, blood, fibrotic pigment epithelial detachments, and drusenoid or vitelliform material.7

Often, even with the aid of OCT and FA, detecting CNV is difficult and unclear, yet accurately diagnosing CNV, or lack thereof, is crucial for the management plan. In cases of wet AMD, myopic CNV, or CNV secondary to central serous retinopathy (CSR), treatment with anti-vascular endothelial growth factor (VEGF) would be appropriately warranted. Conversely, if CNV can be ruled out in cases of AMD/CNV masqueraders, CSR, or myopic subretinal hemorrhages, it would be safe to observe the patient without unnecessary injections.

Recently, much interest has been directed to finding practical day-to-day uses for OCTA. Using OCTA to detect CNV has been described, particularly in eyes with AMD and myopic CNV.8-15 OCTA imaging can be a vital tool to quickly screen for CNV, and it is an easy and quick way to monitor these patients at follow-up visits. Thus, OCTA is an enticing option to diagnose and monitor patients with CNV and other chorioretinal vascular diseases due to its quick and non-invasive nature, its ability to directly visualize CNV, and its capability to be used frequently for close monitoring.

We propose that OCTA can be very useful in the diagnosis and management of wet AMD/CNV masqueraders helping to distinguish cases that need treatment for CNV from those that can be safely monitored. Using the AngioVue system (Optovue, Fremont, CA), we would like to share our case series that highlight the utility of OCTA in making an accurate diagnosis that greatly impacted management plans in these AMD/CNV masqueraders cases.
CASE 1

A 72-year-old male was seen for a second opinion regarding the diagnosis of wet AMD in his right eye that was being treated with bevacizumab (Avastin; Genentech, South San Francisco, CA). His vision in the right eye was stable at 20/25. Fundus photography (Figure 1A), FA (Figure 1B), and indocyanine green angiography (ICGA) (Figure 1C) showed posterior drusenoid deposits with RPE mottling, corresponding areas of hyperfluorescence, and areas of focal hypercyanescence, respectively. OCT showed a small RPED with hyperreflective material and small amount of SRF (Figure 1D), and corresponding OCTA of the outer retina clearly demonstrated no flow within the RPED indicative of absence of CNV (Figure 1E). Due to lack of CNV on OCTA and multimodal imaging, a diagnosis of CSR was made instead of wet AMD, and the patient was observed without further injections. This patient has been followed now with OCTA for 2 years without any injections, and he has remained 20/25.

CASE 2

This is a similar case of a 74-year-old male who presented with a VA of 20/50 in his left eye. An outside physician diagnosed his left eye with wet AMD and recommended anti-VEGF therapy. Fundus photography showed RPE mottling (Figure 2A), and FA did not reveal any definite CNV, but there were several areas of hyperfluorescence that could indicate an occult CNV (Figure 2B). OCT showed intraretinal fluid and SRF (Figure 2C), and corresponding OCTA did not show any CNV (Figure 2D). A diagnosis of chronic CSR was made. He has been observed now with OCTA for 1 year with no CNV formation and with improvement of the SRF and visual acuity (VA).
CASE 3

A 16-year-old female came for a second opinion of her recently diagnosed CSR in her left eye that was being observed for a few months without improvement. VA in her left eye was 20/125. Fundus photography (Figure 3A) showed a PED, and late-frame FA (Figure 3B) showed some blockage from the PED along with subtle hyperfluorescence in the central macula. OCT showed a large amount of SRF and a PED (Figure 3C), and corresponding OCTA of the outer retinal layer showed discrete flow within the PED indicative of a CNV membrane (Figure 3D). The patient underwent three bevacizumab injections with VA improving to 20/60+2. The latest OCTA showed persistent flow within PED but no SRF (Figures 3E and 3F). In this case, it was difficult to truly discern CNV in the FA under the slight blockage caused by the PED.

Figure 3. (A) Fundus photo of the left eye showing a retinal pigment epithelium detachment (PED) and subretinal fluid. (B) Late-frame fluorescein angiography image of the left eye shows blockage from the PED along with subtle hyperfluorescence. (C) An optical coherence tomography (OCT) B-scan with outer retina segmentation and OCT angiography (OCTA) decorrelation signal overlay show subretinal fluid with a PED that has increased flow signal indicative of choroidal neovascularization (CNV). (D) Corresponding en face OCTA of the outer retina shows a definite CNV membrane (arrow). (E) Follow-up OCT B-scan of the outer retina with resolution of subretinal fluid, and corresponding en face OCTA showing persistence of the CNV membrane (F, arrow).
whereas the OCTA very clearly demonstrated the presence of CNV and guided decision making for treatment with bevacizumab with resolution of SRF and visual improvement.

**CASE 4**

A 20-year-old male with −10D high myopia presented with new onset central scotoma and 20/100 VA in the left eye, and he was found to have macular subretinal hemorrhage on exam (Figure 4A). FA showed blockage from the hemorrhage (Figure 4B), and OCT showed a hyperreflective area in the outer retina concerning for myopic CNV (Figure 4C). Corresponding OCTA of the outer retinal layer did not show any flow within or under the OCT hyperreflectivity confirming lack of CNV (Figure 4D). He was monitored without injection with resolution of subretinal hemorrhage and visual improvement. OCTA in this case helped confidently show there was no myopic CNV beneath the blockage caused by the hemorrhage on FA and ensured safe monitoring, avoiding unnecessary intravitreal injections.

In conclusion, OCTA is an exciting new imaging tool in ophthalmology. As shown in our case series, OCTA can be very helpful in cases of AMD and CNV masqueraders helping make the correct diagnosis, while also enabling the practitioner to follow these patients efficiently at future follow up visits. OCTA has already made a huge impact in our field, and it will be very exciting to see where it takes us in the future.

**REFERENCES**


Sidney Schechet, MD, can be reached at the Department of Ophthalmology and Visual Science, University of Chicago, 5841 S. Maryland Avenue, MC2114, Chicago, IL; email: schechets@gmail.com.

Seenu M. Hariprasad, MD, can be reached at the Department of Ophthalmology and Visual Science, University of Chicago, 5841 S. Maryland Avenue, MC2114, Chicago, IL 60637; email: retina@uchicago.edu.

Asadolah Movahedan, MD, can be reached at the Department of Ophthalmology and Visual Science, University of Chicago, 5841 S. Maryland Avenue, MC2114, Chicago, IL; email: movahedan@gmail.com.

Dimitra Skondra, MD, PhD, can be reached at the Department of Ophthalmology and Visual Science, University of Chicago, 5841 S. Maryland Avenue, MC2114, Chicago, IL; email: dskondra@bsd.uchicago.edu.

Disclosures: Dr. Hariprasad is a consultant or on the speakers bureau for Alcon, Allergan, Bayer, OD-OS, Clearside Biomedical, Ocular Therapeutix, Alimera Sciences, Leica, Spark, and Regeneron. The remaining authors report no relevant financial disclosures.