Published in final edited form as:

Retina. 2017 November ; 37(11): 2084–2094. doi:10.1097/IAE.0000000000001487.

Acute Posterior Multifocal Placoid Pigment Epitheliopathy on Optical Coherence Tomography Angiography

Michael J. Heiferman¹, Safa Rahmani², Lee M. Jampol¹, Peter L. Nesper¹, Dimitra Skondra¹, Leo A. Kim², and Amani A. Fawzi¹

¹Department of Ophthalmology, Northwestern University Feinberg School of Medicine, Chicago, Illinois, United States of America

²Department of Ophthalmology, Schepens Eye Research Institute/Massachusetts Eye and Ear, Harvard Medical School, Boston, Massachusetts, United States of America

Abstract

Purpose—To investigate choroidal involvement in acute posterior multifocal placoid pigment epitheliopathy (APMPPE).

Methods—A retrospective observational case series using multimodal imaging including optical coherence tomography angiography (OCTA).

Results—Five patients with APMPPE were included. In most acute lesions, OCTA revealed outer retinal and retinal pigment epithelium (RPE) hyper-reflective lesions with attenuated OCT signal in the underlying choroid, but careful examination allowed us to identify a single lesion with decreased choriocapillaris flow outside the signal attenuation. OCTA obtained after healing of lesions revealed areas of hypo-intense circular flow voids clustered in groups surrounded by either iso- or hyper-intense signal background. Point-by-point evaluation revealed these flow voids did not correspond to areas of RPE thickening or focal pigmentary changes. Larger hypo-intense lesions were observed and did correlate with pigmentary changes.

Conclusions—Our case series demonstrates choriocapillaris flow abnormalities in acute APMPPE extending beyond the OCT lesions, and distinct residual vascular abnormalities in healed APMPPE lesions on OCTA. Our findings support a primary ischemic insult to the photoreceptors and RPE, but choriocapillaris flow abnormalities could be secondary to (OCT invisible) retinal and RPE involvement. The lack of understanding of the etiology along with the inability to visualize most of the choroid in acute lesions preclude definite conclusions about the true pathogenesis of APMPPE.

Keywords

Acute Posterior Multifocal Placoid Pigment Epitheliopathy; APMPPE; Optical Coherence Tomography Angiography; OCTA; Retinal Pigment Epithelium; RPE; Choroid; Choriocapillaris

Corresponding Author: Amani A. Fawzi, Department of Ophthalmology, Northwestern University, 645 North Michigan Avenue, Suite 440, Chicago, IL 60611, USA; afawzim@gmail.com.

Proprietary interest: The authors have declared that they have no proprietary interest in the subject of this manuscript.

Introduction

Acute posterior multifocal placoid pigment epitheliopathy (APMPPE), first described by Gass in 1968,¹ is characterized by an acute decrease in visual acuity in young adults that can heal without treatment in weeks to months.² These patients develop multiple yellow-white deep placoid lesions that pigment over time, leaving well-demarcated alternating areas of focal retinal pigment epithelium (RPE) atrophy and proliferation, often with ultimate improvement in vision. Given the location of the acute lesions and residual changes in the RPE, primary inflammation of the RPE, as well as the underlying choroidal vasculature, have been postulated to explain these lesions.^{3, 4} The etiology of this inflammation remains unknown; however, an immune driven reaction preceding viral illness or vaccination has been suggested.⁵

On fluorescein angiography (FA), active lesions in APMPPE demonstrates early hypofluorescence with late hyperfluorescence due to leakage.⁶ In subacute and healed APMPPE lesions, the late fluorescein leakage disappears while RPE pigmentary changes lead to FA transmission defects. Similarly, indocyanine green angiography (ICGA) shows early hypocyanescence in active lesions with normalization of ICGA as APMPPE lesions heal.⁷ However, unlike FA, large choroidal vessels are visualized within active lesions during early ICGA and late hypercyanescence does not develop.⁸ While these ICGA findings have been interpreted as indicating a choroidal origin to the APMPPE lesions, the alternative hypothesis suggesting RPE origin (and potential ICGA signal attenuation by swollen RPE) remains viable.⁹

Additional characterization of the structural changes seen in APMPPE is needed in order to delineate the pathogenesis of this disease. Optical coherence tomography angiography (OCTA) is a noninvasive imaging modality that visualizes the retinal vasculature by detecting signal decorrelation between successive OCT B-scans due to blood flow motion. OCTA offers advantages over other angiographic modalities in that it is dye-less and can resolve fine detail of the retinal vasculature in three dimensions. OCTA has been used to evaluate numerous retinal diseases leading to better understanding of the pathogenesis of these diseases including diabetic retinopathy,¹⁰ age-related macular degeneration,¹¹ retinal vessel occlusion¹² and central serous chorioretinopathy.¹³ Additionally, OCTA offers a promising noninvasive tool to detect and monitor retinal diseases safer and faster than other angiographic modalities. In the present study, we set out to further elucidate choroidal involvement during acute and healed APMPPE to explore choroidal findings on OCTA.

Methods

Study sample

This was a retrospective observational case series of consecutive patients with APMPPE seen between June 2015 and June 2016 at two institutions: Feinberg School of Medicine at Northwestern University in Chicago, IL and Massachusetts Eye and Ear at Harvard University in Boston, MA. Patients underwent complete ophthalmologic examination during acute presentation and after the acute phase of the disease had healed. Complete ophthalmologic examination included high quality color fundus photos (Topcon Medical

Systems Inc., Oakland, NJ, USA), infrared reflectance (IR) and fundus autofluorescence (FAF, 488nm excitation, Spectralis HRA+OCT, Heidelberg Engineering Inc, Dossenheim, Germany). The study protocol was approved by the Institutional Review Boards of Northwestern University and Massachusetts Eye and Ear. This research followed the tenets of the Declaration of Helsinki.

Image acquisition

OCTA images were obtained using the RTVue-XR Avanti system (Optovue Inc., Femont, California) with split-spectrum amplitude-decorrelation angiography (SSADA) software. An A-scan rate of 70,000 scans per second was used with a light source centered on 840 nm and a bandwidth of 45 nm. Both 3×3 -mm and 6×6 -mm scanning areas, centered on the fovea were obtained. Two consecutive B-scans (M-B frames), each containing 304 A-scans were captured at each sampling location and SSADA was used to extract OCTA information. *En face* OCT angiograms were segmented using the built-in software algorithm to define superficial and deep capillary plexus, choriocapillaris and the outer retina.

Results

Case 1

A 21-year-old male presented with “white dots” in the central vision of both eyes over three days. One week prior to presentation, the patient developed a headache described as a general dull aching pain all over his head. Five days prior to presentation, the patient was diagnosed with sinusitis and was started on Augmentin. He denied blurred vision, eye pain, or floaters. Review of systems was negative for fevers, rash, joint pain, and insect bites. He had no family history of ocular or autoimmune disease.

On examination he was 20/25 OU. There was mild anterior chamber reaction in both eyes, but no vitritis. Ophthalmoscopy showed multiple hypo-pigmented yellow subretinal lesions in the posterior pole. At initial presentation, OCT revealed ellipsoid zone disruptions in the macula bilaterally with overlying hyper-reflectivity in the outer retina, corresponding to the lesions seen clinically. An infectious and autoimmune workup was negative. Due to his headaches, MRI and MRA were obtained and were normal. Two months after initial presentation, OCTA segmented at the level of the choriocapillaris revealed areas of hypo-intense circular flow voids clustered in groups surrounded by either iso- or hyper-intense signal background. These flow voids correlated with areas of healed episodes of APMPE seen on IR (Figure 1).

Case 2

A 28-year-old woman presented with bright shimmering that interfered with her vision for three weeks, left greater than right. She also noticed a central scotoma in her left eye that developed at the same time as the bright shimmering. Visual acuity was 20/25 in the right and 20/200 in the left eye. Slit-lamp examination showed no signs of inflammation.

One year after initial presentation, IR showed pigmentary changes in both eyes. FAF revealed mostly hypo-autofluorescence in a speckled pattern with focal spots of hyper-

autofluorescence, suggesting healed lesions in both eyes. OCT in the right eye showed residual damage to the ellipsoid zone and outer retinal elements. OCTA of the choriocapillaris showed hypo-intense flow voids surrounded by either iso- or hyper-intense background (Figure 2). Larger hypo-intense lesions were observed in the left eye that correlated with zones of healed APMPE seen on IR. Point-by-point evaluation revealed no pattern of alignment between the smaller OCTA flow void lesions and RPE thickening or focal pigmentary changes, suggesting these observed OCTA changes were not related to shadow artifact (Figure 3).

Case 3

A 46-year-old woman presented with redness and photophobia. Three months prior to presentation, the patient reported an episode of blurry vision with left metamorphopsia. One month later, the patient developed pain, redness and photophobia in the same eye. Best corrected visual acuity was 20/25 in the right eye and 20/50 in the left eye.

Slit-lamp examination from the initial presentation revealed mild cells in the anterior chamber and trace vitreous cells in the left eye. OCTA of acute APMPE lesions showed significant signal attenuation underlying outer retinal and RPE hyper-reflectivity, precluding unbiased assessment of choroidal and choriocapillaris flow in these areas of low signal (Figure 4A). Eight months after initial presentation, fundus photos showed healed APMPE lesions with pigmentary changes in both eyes. OCT showed residual damage to the ellipsoid and outer retinal elements with some irregularity in the RPE. OCTA of the choriocapillaris showed hypo-intense flow voids surrounded by either iso- or hyper-intense background (Figure 5).

Case 4

A 36-year-old woman with a history of APMPE presented with a blind spot in her right eye for 10 days. Her past ocular history was consistent with APMPE in her left eye, which was diagnosed 9 years prior. At that time, she had extensive work up including a lumbar puncture and brain MRI, which were normal. She denied any recent illness or sick contacts. She was a veterinarian by profession but denied any contact with sick animals for the past two months. She denied any headaches or neurological symptoms.

On examination, visual acuity was 20/20 in her right and 20/150 in her left eye. Biomicroscopy exam revealed a normal anterior segment and vitreous in both eyes. A white-gray placoid lesion was seen nasal to the fovea with some pigmentary change temporal to the fovea. Left eye funduscopy revealed pigmentary changes with hypopigmentation in the macula. At initial presentation, OCT of the right eye revealed ellipsoid zone disruption nasal and temporal to the fovea with overlying hyper-reflectivity in the outer retina, corresponding to the lesion seen clinically. OCT in the left eye revealed diffuse disruption of the ellipsoid zone. FA revealed hypofluorescence over the lesion nasal to the fovea with late staining in addition to patchy areas of hyperfluorescence corresponding to old lesions that were not apparent on clinical exam in the right eye. There were window defects on FA corresponding to old lesions in the left eye. OCTA of the choriocapillaris at the initial visit revealed minimal choroidal signal attenuation, with the appearance of absent flow signal in the

choriocapillaris both underlying the outer retinal lesion and extending beyond the OCT lesion, suggesting that choriocapillaris involvement may extend beyond the OCT outer retinal involvement (Figure 4B).

An infectious and autoimmune workup was negative. Three months later, her vision was unchanged and on examination, the acute lesion nasal to the fovea had healed. OCT in the right eye revealed improvement in the ellipsoid zone disruption with overlying hyper-reflectivity. OCTA of the choriocapillaris revealed hypo-intense flow voids surrounded by either iso- or hyper-intense background (Figure 6).

Case 5

A 41-year-old man with a history of APMPE presented with a scotoma in his vision for one month. His best-corrected visual acuity was 20/20 in the right and 20/25 in the left eye. This patient had a history of recurrent APMPE initially presenting in 2002 with eleven documented previous recurrences and multiple additional scotomas for which he did not obtain care. Recurrences of APMPE beyond the first few weeks of disease onset are rare and this patient has been reported by us in detail.¹⁴

Slit-lamp examination showed no signs of inflammation. At initial presentation, IR in the right eye showed pigmentary changes with similar findings in the left eye. FAF in the right eye showed areas of speckled hypo-autofluorescence. OCT revealed irregularities of the retinal pigment epithelium and outer retinal elements in both eyes. One month after initial presentation, OCTA of the choriocapillaris revealed areas of hypo-intense circular flow voids clustered in groups surrounded by either iso- or hyper-intense signal background (Figure 7).

Discussion

In the present study, five cases of APMPE were evaluated with OCTA revealing choriocapillaris flow abnormalities underlying acute and healed APMPE lesions. In acute lesions, there was significant loss of choriocapillaris flow, while healed lesions showed distinct small vascular flow channels with intervening no-flow zones, which appeared different compared to surrounding unaffected zones of the choriocapillaris. There have been five previous single case studies and one case series of patients diagnosed with APMPE imaged on OCTA during acute presentation, but none of these studies commented on the recovery of blood flow on OCTA after lesions healed.^{15–20} Maier et al. describe a 32-year-old female with episodic photosensitivity, subsequently diagnosed with APMPE. OCTA images obtained in the acute period revealed dense low flow areas in the choriocapillaris that corresponded to ICGA findings. Follow up imaging revealed partial recovery of the choriocapillaris. However, OCTA imaging was only performed with 6 × 6-mm scanning area, which has a lower resolution with the potential to underestimate choriocapillaris changes. Park et al. describe a female in her mid to late 20s with blurry vision in her left eye after a viral prodrome. Patchy hypo-perfusion of the choriocapillaris and Sattler's layer was seen on phase-resolved OCT, corresponding to areas of photoreceptor and RPE irregularity on OCT. This group felt that the OCTA findings did not correspond to overlying RPE changes, though they did not provide supporting evidence.

In the five cases presented here, OCTA imaging was obtained acutely and after healing of acute APMPE lesions. Given the presence of RPE inflammation and intraretinal opacities at the level of the outer nuclear layer in most of the acute lesions, we found it was difficult to conclusively resolve the choroidal vasculature through overlying RPE thickening and inflammatory changes. Of the five cases, we identified only one APMPE lesion with choriocapillaris flow deficit extending outside the visible intraretinal lesion, not associated with overall signal attenuation (Figure 4B), similar to previous reports.^{19, 20} Using current OCTA analysis protocols, it is impossible to differentiate attenuated signal related to acute APMPE lesions (whether RPE thickening or outer retinal hyper-reflectivity) from primary choriocapillaris non-perfusion on OCTA. However, we did find evidence of a single acute lesion with choroidal flow deficits in the absence of overlying outer retina or RPE changes. The finding of OCTA choroidal flow attenuation beyond the visible retinal involvement has been described previously by Rosa Dolz-Marco et al. and Klufas et al.^{19, 20}

We observed projection artifacts and signal attenuation from chronic RPE thickening and pigmentary changes leading to hypo-intense lesions on *en face* OCT of the RPE of acute and subacute lesions. These outer retinal changes cast distinct shadow artifacts on the choriocapillaris (Figure 3). These cases illustrate the importance of considering information from *en face* OCT as well as the OCTA simultaneously, in order to differentiate between signal attenuation artifacts and true flow deficits on OCTA. Based on this information and given the attenuation of the signal in the setting of intraretinal opacities and the resulting difficulty of examining the choroid underneath these intense artifacts, we chose to carefully study eyes acutely as well as after healing of the acute APMPE lesions in order to better characterize the pathological findings in the underlying choroidal vasculature.

Two major theories of the pathogenesis of APMPE have been debated. The first, proposed by Gass, suggests inflammation of the RPE and outer retina that manifests as placoid lesions during the acute phase.¹ The FA finding of hypofluorescence of these lesions is interpreted as masking of the underlying choroidal fluorescence. The second theory, proposed by Van Buskirk suggests that choroidal vasculitis leads to partial occlusion of the choriocapillaris in these eyes.^{3, 4} In turn, disruption of choroidal blood flow causes secondary ischemia of the overlying RPE and outer retina that manifests as placoid lesions. The ability to visualize large choroidal vessels on ICGA in areas of acute lesions make the possibility of blocked cyanescence by the RPE less likely and support the second theory. Subacute lesions with choroidal flow deficits on FA without structural OCT or autofluorescence findings have been previously identified, most recently by Mrejen et al.²¹ Furthermore, an incomplete overlap between acute lesions and areas of hypo-autofluorescence (and RPE changes) provides further evidence for a primarily choroidal disease. However, inconsistencies remain in the interpretation of the ICGA findings including the lack of correlation between the hypocyanescence and choroidal anatomy.⁹ Unfortunately, no histologic samples have been reported of active APMPE lesions leaving imaging to differentiate these theories.

Choriocapillaris non-perfusion has been noted in numerous diseases including hypertension, disseminated intravascular coagulation, amyloidosis and multiple vasculitides. OCTA has been used to observe choriocapillaris non-perfusion in other retinal diseases including age-related macular degeneration with geographic atrophy and reticular pseudodrusen,²²

choroideremia²³ and Stargardt disease.²⁴ We found that automated segmentation at the level of the choriocapillaris in regions of APMPE lesions revealed discrete black avascular zones. Our group has observed similar findings in age-related macular degeneration in areas with reticular pseudodrusen.²² These avascular zones with intervening distinct capillary networks suggest the visualization of a medium-diameter vessel network that we propose is Sattler's layer. These areas represent absent choriocapillaris flow with increased visibility of the underlying preserved Sattler's layer, normally not seen on OCTA. The preservation of the medium sized capillary network would be consistent with frequent recovery of RPE and photoreceptors that we have recently documented in APMPE.²⁵ These areas may be susceptible, with continued insult, to progress to complete choroidal vascular loss and subsequent RPE atrophy. However, in the setting of APMPE, a mild and potentially transient choroidal insult may not be sufficient to cause complete RPE and photoreceptor atrophy, instead leaving mild RPE irregularities and reversible photoreceptor changes.²⁵ It is possible that in APMPE, isolated disruption to the choriocapillaris leaves the choroid in a sufficiently functional state to largely maintain the RPE/photoreceptor integrity.

Limitations

This study has important limitations. As with any new imaging technology, the interpretation and utility of OCTA remains a subject of debate. OCTA is susceptible to numerous imaging artifacts that have the potential to affect clinical interpretation.²⁶ Given known changes in the RPE after resolution of active APMPE lesions, we took special care to consider shadowing and projection artifacts when interpreting changes in the underlying choroid (Figure 3). However, our group and others have observed similar choroidal changes in diseases that do not affect the RPE, making projection artifacts less likely to explain our findings. While there is ongoing research to develop software to minimize imaging artifacts; for now, interpretation of OCTA should be done with the understanding of the inherent potential for artifacts.

Conclusions

In the present study, we provide further evidence of choriocapillaris flow abnormalities in acute and healed APMPE lesions using OCTA. Our findings support decreased blood flow consistent with choriocapillaris changes leading to a primary ischemic insult to the RPE rather than a primary RPE inflammatory etiology. However, we cannot rule out the choriocapillaris changes are secondary to subclinical overlying RPE and retinal damage, not visible with autofluorescence or other imaging modalities. Our study shows recovery of choroidal flow, with appearance of distinct small sized vascular channels with healing of the APMPE lesions. Overall, the inability to completely visualize the choroidal flow in most acute lesions, as well as the lack of clear understanding of the pathogenesis, leaves residual uncertainty about the true course of RPE, retinal and choroidal injury in APMPE. Further investigation of the pathogenesis of choriocapillaris injury in APMPE is warranted.

Acknowledgments

Funding: This work was funded by Research to Prevent Blindness, NY (Department of Ophthalmology, Northwestern University). Optovue Inc. provided support in the form of providing the optical coherence

tomography angiography instrument. The sponsor or funding organizations had no role in the design or conduct of this research.

References

1. Gass JD. Acute posterior multifocal placoid pigment epitheliopathy. *Arch Ophthalmol*. 1968; 80:177–185. [PubMed: 5661882]
2. Fiore T, Iaccheri B, Androudi S, et al. Acute posterior multifocal placoid pigment epitheliopathy: outcome and visual prognosis. *Retina*. 2009; 29:994–1001. [PubMed: 19491729]
3. Deutman AF, Oosterhuis JA, Boen-Tan TN, et al. Acute posterior multifocal placoid pigment epitheliopathy. Pigment epitheliopathy of choriocapillaritis? *Br J Ophthalmol*. 1972; 56:863–874. [PubMed: 4651978]
4. Van Buskirk EMLS, Frieman E. Pigment epitheliopathy and erythema nodosum. *Arch Ophthalmol*. 1971; 85:369–372. [PubMed: 5100807]
5. Mirza, RG., Jampol, LM. White Spot Syndrome and Related Diseases. In: Ryan, SJ., editor. *Retina*. Philadelphia: Elsevier Mosby; 2013.
6. Jones NP. Acute posterior multifocal placoid pigment epitheliopathy. *Br J Ophthalmol*. 1995; 79:384–389. [PubMed: 7742290]
7. Park D, Schatz H, McDonald HR, et al. Indocyanine green angiography of acute multifocal posterior placoid pigment epitheliopathy. *Ophthalmology*. 1995; 102:1877–1883. [PubMed: 9098291]
8. Hedges TR 3rd, Sinclair SH, Gragoudas ES. Evidence for vasculitis in acute posterior multifocal placoid pigment epitheliopathy. *Ann Ophthalmol*. 1979; 11:539–542. [PubMed: 453751]
9. Gass, JDM. Stereoscopic atlas of macular diseases : diagnosis and treatment. St. Louis: Mosby; 1987.
10. Ishibazawa A, Nagaoka T, Takahashi A, et al. Optical Coherence Tomography Angiography in Diabetic Retinopathy: A Prospective Pilot Study. *Am J Ophthalmol*. 2015; 160:35–44 e31. [PubMed: 25896459]
11. Coscas GJ, Lupidi M, Coscas F, et al. OPTICAL COHERENCE TOMOGRAPHY ANGIOGRAPHY VERSUS TRADITIONAL MULTIMODAL IMAGING IN ASSESSING THE ACTIVITY OF EXUDATIVE AGE-RELATED MACULAR DEGENERATION: A New Diagnostic Challenge. *Retina*. 2015; 35:2219–2228. [PubMed: 26398697]
12. Bonini Filho MA, Adhi M, de Carlo TE, et al. Optical Coherence Tomography Angiography in Retinal Artery Occlusion. *Retina*. 2015; 35:2339–2346. [PubMed: 26457398]
13. Quaranta-El Maftouhi M, El Maftouhi A, Eandi CM. Chronic central serous chorioretinopathy imaged by optical coherence tomographic angiography. *Am J Ophthalmol*. 2015; 160:581–587 e581. [PubMed: 26133250]
14. Cohen LM, Munk MR, Goldstein DA, et al. Acute, posterior multifocal placoid pigment epitheliopathy: a case of 11 recurrences over 15 years. *Retin Cases Brief Rep*. 2015; 9:226–230. [PubMed: 25741634]
15. Maier PDM, Wehrmann K, Lohmann C, et al. OCT-Angiographie-Befund bei akuter posteriorer multifokaler plakoider Pigment epitheliopathie (APMPPE). *Der Ophthalmologe*. 2016:1–5.
16. Park SS, Thinda S, Kim DY, et al. Phase-Variance Optical Coherence Tomographic Angiography Imaging of Choroidal Perfusion Changes Associated With Acute Posterior Multifocal Placoid Pigment Epitheliopathy. *JAMA Ophthalmol*. 2016
17. Kinouchi R, Nishikawa N, Ishibazawa A, et al. Vascular rarefaction at the choriocapillaris in acute posterior multifocal placoid pigment epitheliopathy viewed on OCT angiography. *Int Ophthalmol*. 2016
18. Salvatore S, Steeples LR, Ross AH, et al. Multimodal Imaging in Acute Posterior Multifocal Placoid Pigment Epitheliopathy Demonstrating Obstruction of the Choriocapillaris. *Ophthalmic Surg Lasers Imaging Retina*. 2016; 47:677–681. [PubMed: 27434902]
19. Dolz-Marco RSD, Giovannazzo V, Freund KB. OPTICAL COHERENCE TOMOGRAPHY ANGIOGRAPHY SHOWS INNER CHOROIDAL ISCHEMIA IN ACUTE POSTERIOR MULTIFOCAL PLACOID PIGMENT EPITHELIOPATHY. *Retin Cases Brief Rep*. 2016 Epub ahead of print.

20. Klufas MA, Phasukkijwatana N, Iafe NA, et al. Optical Coherence Tomography Angiography Reveals Choriocapillaris Flow Reduction in Placoid Chorioretinitis. *Ophthalmology Retina*. 2016 In Press.
21. Mrejen S, Sarraf D, Chexal S, et al. Choroidal Involvement in Acute Posterior Multifocal Placoid Pigment Epitheliopathy. *Ophthalmic Surg Lasers Imaging Retina*. 2016; 47:20–26. [PubMed: 26731205]
22. Nesper PL, Soetikno BT, Fawzi AA. Choriocapillaris Non-Perfusion is Associated with Poor Visual Acuity in Eyes with Reticular Pseudodrusen. *Am J Ophthalmol*. 2016
23. Jain N, Jia Y, Gao SS, et al. Optical Coherence Tomography Angiography in Choroideremia: Correlating Choriocapillaris Loss With Overlying Degeneration. *JAMA Ophthalmol*. 2016
24. Pellegrini M, Acquistapace A, Oldani M, et al. The dark atrophy: an optical coherence tomography angiography study. *Ophthalmology*. 2016
25. Scarinci F, Fawzi AA, Shaarawy A, et al. LONGITUDINAL QUANTITATIVE EVALUATION OF OUTER RETINAL LESIONS IN ACUTE POSTERIOR MULTIFOCAL PLACOID PIGMENT EPITHELIOPATHY USING OPTICAL COHERENCE TOMOGRAPHY. *Retina*. 2016 in revisions.
26. Spaide RF, Fujimoto JG, Waheed NK. Image Artifacts in Optical Coherence Tomography Angiography. *Retina*. 2015; 35:2163–2180. [PubMed: 26428607]

Figure 1.

Case 1.

IR: infrared reflectance with areas of healed APMPPE lesions and pigmentary changes.

OCTA CC: choriocapillaris OCTA shows vascular channels separated by circular areas of absent flow clustered in groups (representative areas circled in red) surrounded by normal choriocapillaris flow signal background (representative areas circled in white).

OCT RPE: *en face* OCT with irregularities of the retinal pigment epithelium, more prominent in the left eye.

Figure 2.

Case 2.

IR: infrared reflectance shows patches of speckled reflectivity consistent with healed APMPE lesions and pigmentary changes. OCTA CC: choriocapillaris OCTA shows vascular channels separated by circular areas of absent flow clustered in groups (representative areas circled in red) interspersed with zones of normal choriocapillaris flow (representative areas circled in white). In addition, there are central larger zones of non-flow lesions observed in the left eye. OCT RPE: *en face* OCT of the retinal pigment epithelium shows focal hypo-intense lesions correlating with pigmentary changes seen on IR. These lesions are further characterized in figure 3.

Figure 3.

Choroidal shadows related to RPE pigmentary changes versus true choriocapillaris APMPPE OCTA lesions (Case 2).

OCT RPE: *en face* OCT of the RPE. Green lines are location of B-scan, while red line indicates exact location on B-scan. (A & B) cross-hairs are focused on APMPPE lesions without RPE pigmentary changes at the location indicated, as shown by lack of abnormalities on *en face* OCT or B-scan. (C & D) cross-hairs are focused on RPE hypo-intense lesions indicating RPE pigmentary changes. OCTA CC: choriocapillaris OCTA (A & B) small hypo-intense circular flow void that does not correlate with pigmentary changes. (C & D) larger hypo-intense lesions correlating with pigmentary changes seen on both OCT RPE and OCT B-scan.

Figure 4.

Acute choriocapillaris flow deficit with variable overlying RPE and outer retina reflectivity (A: Case 3 OD; B: Case 4 OS).

OCTA CC: choriocapillaris OCTA with areas of hypo-intense flow deficit in both images.

OCT B-scan: (A) RPE and outer retinal hyper-reflectivity completely overlying choriocapillaris flow deficit. The signal attenuating effect of the outer retinal changes is illustrated by “complete darkness and lack of structure” affecting the entire choroid underlying these changes in B-scan. (B) Central RPE and outer retina abnormalities with surrounding normal retina, with underlying choriocapillaris flow deficit extending beyond the outer retinal changes. OCTA B-scan: decreased flow signal in the choriocapillaris underlying, but extending beyond the borders of the overlying retinal abnormalities in (B).

Figure 5.

Case 3.

IR: infrared reflectance shows speckled areas corresponding to healed APMPPE lesions. OCTA CC: choriocapillaris OCTA with areas of abnormal/reduced choriocapillaris flow (representative areas circled in red) interspersed with zones of normal choriocapillaris flow (representative areas circled in white). OCT RPE: *en face* OCT with subtle irregularities of the retinal pigment epithelium seen as areas of hyper- and hypo-reflectivity.

Figure 6.

Case 4.

IR: infrared reflectance with areas of healed APMPE lesions. OCTA CC: choriocapillaris OCTA with areas of choriocapillaris flow defects clustered in groups surrounded by either iso- or hyper-intense signal background (representative areas circled in red) interspersed with zones of normal flow (representative areas circled in white). OCT RPE: *en face* OCT with hypo-reflective irregularities of the retinal pigment epithelium left greater than right eye.

Figure 7.

Case 5.

IR: infrared reflectance highlights areas of RPE changes following healed APMPE lesions.

OCTA CC: choriocapillaris OCTA with areas of hypo-intense well-defined flow abnormalities clustered in groups surrounded by flow signal in distinct interconnected vascular channels (representative areas circled in red) interspersed with zones of normal flow (representative areas circled in white). OCT RPE: *en face* OCT slab showing the subtle hypo-reflective irregularities of the retinal pigment epithelium from healed lesions.

Table 1

Clinical case information.

Case No.	Age	Gender	Eye affected	Time after disease onset	Follow up after acute episode	Recurrences
1	21	M	OU	2 months	2 months	0
2	28	F	OU	1 year	1 year	0
3	46	F	OU	8 months	8 months	0
4	36	F	OU	9 years	3 months	1
5	41	M	OU	16 years	2 month	11