En face optical coherence tomography for diagnosis of unexplained snowflake scotoma

Ocular conditions with transitory examination findings can be challenging to diagnose, particularly when significant time has elapsed since the acute insult. One such example is paracentral acute middle maculopathy (PAMM), which may present initially with faint gray macular lesions. These lesions fade over time, leaving behind an unrevealing fundus examination and a pattern of inner nuclear layer (INL) thinning that may be difficult to appreciate with typical imaging modalities.[1] In this correspondence, we highlight the use of en face optical coherence tomography (OCT) to diagnose a case of perivenular PAMM 6 months after symptom onset, when fundoscopic examination was normal and the patient had already undergone an extensive work-up without a clear diagnosis.

A 72-year-old female with a history of hyperlipidemia and migraine was referred for evaluation of a scotoma involving the left eye. Six months prior, she awoke with a discrete snowflake-shaped white central scotoma OS (**Supplementary Fig. 1**, available online). The snowflake gradually faded over 2 months, leaving behind persistent blurry vision and dyschromatopsia in the left eye.

A few weeks after symptom onset, evaluation by her local ophthalmologist was notable for decreased visual acuity OS without apparent ocular structural abnormalities. Magnetic resonance imaging of the brain showed no acute pathology. The patient was referred for neuro-ophthalmologic evaluation, which revealed dyschromatopsia OS (3/11 Ishihara plates) with no afferent pupillary defect. Humphrey visual field 24-2 testing and OCT of the retinal nerve fibre layer were unremarkable OU. The cause of vision loss was unexplained, but given suspicion for a subtle maculopathy, the patient was referred to us for retinal evaluation.

Our evaluation 6 months after symptom onset disclosed a best-corrected visual acuity of 20/20 OD and 20/40-2 OS. Fundus biomicroscopy and autofluorescence imaging were unremarkable in both eyes. OCT angiography showed normal perfusion of macular vessels OU. Structural OCT imaging showed subtle heterogeneous thinning of the middle retinal layers OS, with preserved outer retinal architecture and thickness (**Supplementary Fig. 2**, available online). To better characterize the pathology, an en face OCT was obtained. This demonstrated patchy middle-layer retinal thinning in a vascular pattern, highly suggestive of chronic PAMM lesions (**Fig. 1**).

Our patient reported that around the time of symptom onset, she was found to be on an excessive dose of her migraine medication phenelzine, an irreversible nonselective monoamine oxidase inhibitor that can have vasoconstrictive effects.[2] Other than hyperlipidemia, our patient had no other known cardiovascular risk factors. She was evaluated by the outpatient Stroke Clinic and started on aspirin 81 mg daily. Her vision remains stable.

Originally described by Sarraf et al.[3] in 2013, PAMM is a finding on spectral-domain OCT that is characterized in the acute phase by placoid, hyperreflective bands in the INL, with subsequent INL atrophy associated with persistent paracentral scotomas.[4] It develops as a result of ischemia involving the deep vascular complex.[1] In the acute phase, there may be corresponding gray-white retinal lesions on examination, but these may be subtle[4]. Sarraf et al.[1] demonstrated that with milder degrees of ischemia, retinal damage occurs preferentially around venules, creating a distinct fernlike (or snowflake-like) pattern of pathology initially. With worsening degrees of ischemia, the pathology may appear confluent across the middle and even inner retina[1].

PAMM was initially thought to be a subset of acute macular neuroretinopathy (AMN); however, despite some similarities, it has since been determined to be a distinct entity. While PAMM spares the outer retina, AMN lesions occur at the junction of the outer plexiform layer and the outer nuclear layer. PAMM is also more prevalent and more often associated with retinal vascular diseases and cardiovascular risk factors than AMN.[4]

Common causes of PAMM include retinal vein occlusion, partial retinal artery occlusion, and Purtscher and Purtscher-like retinopathies, as well as diabetic and hypertensive retinopathy.[1] PAMM also may occur in ocular ischemic syndrome, sickle cell disease, and hypercoagulable states and has been described as a complication of certain intraocular surgeries.[1] An association with migraines has been reported, and certain medications also may be associated with PAMM (e.g., caffeine, oral contraceptives, amphetamines, and other vasoactive agents).[1] We evaluated our patient 6 months after symptom onset, when the fundus examination, autofluorescence imaging, and OCT angiography studies were all entirely unremarkable. However, based on the widespread and patchy pattern of middle-layer retinal thinning, we believe that the mechanism of perivenular PAMM in our patient was incomplete central retinal artery occlusion associated with migraine and excessive doses of the vasoactive agent phenelzine.

Although there is no known treatment for PAMM, it is critical to identify and manage underlying risk factors[4]. Patients with PAMM lesions resulting from partial central retinal artery occlusion merit systemic work-up for stroke risk factors as well as for giant cell arteritis in the appropriate clinical context.[1] PAMM is therefore an important diagnosis not to miss.

While PAMM was described initially using spectral-domain OCT, en face OCT imaging more clearly demonstrates the patchy or perivenular pattern of early, subtle, or chronic or resolved PAMM lesions. In our patient, en face OCT at the deep vascular complex level clearly highlighted

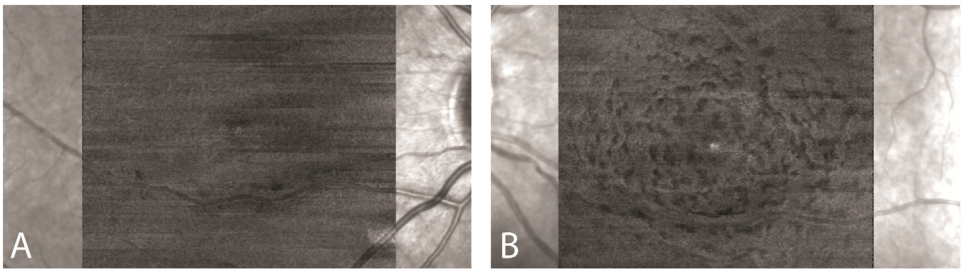

Fig. 1—En face optical coherence tomography with minimum projection of the deep vascular complex OD (A) and OS (B) reveals a distinct pattern of patchy middle retinal thinning exclusively OS.

the patchy pattern of middle retinal thinning that persisted 6 months after the acute PAMM lesions had faded. As illustrated by Zhao et al.,[5] the striking configuration of acute perivenular PAMM perfectly matches our patient's description of her highly specific, complex snowflake scotoma, which had faded along the acute lesions. For patients with old PAMM lesions, use of en face OCT when the fundus examination and even standard spectral-domain OCT appear grossly normal can quickly confirm the diagnosis, saving the patient from unnecessary testing (including magnetic resonance imaging in this case) and prompting appropriate referral for stroke work-up.

Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.jcjo.2022.07.016.

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Originally received Apr. 3, 2022. Final revision Jun. 26, 2022. Accepted Jul. 30, 2022.

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Footnotes and Disclosure

The authors have no proprietary or commercial interest in any materials discussed in this correspondence article.