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Inner retinal layer ischemia and vision loss after COVID-19 infection: A case report

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ABSTRACT

Introduction: COVID-19 infection may also occur with ocular manifestations. Paracentral acute middle maculopathy (PAMM) is a condition that causes ischemia in the inner retinal layers characterized by disruptions in capillary plexus flow. Also, ischemia in inner retinal layers secondary to COVID-19 infection has not yet been reported.

Case report: The case, presented with the complaint of gradually decreasing visual acuity in the right eye after COVID-19 infection. PAMM was suspected, however, ischemia was detected in all inner retinal layers with Optical coherence tomography angiography.

Discussion: We showed that it should be kept in mind that atypical retinal involvement of COVID-19 infection could present, with this case.

1. Introduction

While the blood supply of the outer retina layers is provided by the choriocapillaris, the blood supply of the inner layers is provided by the capillary plexus. The central macula has 3 main tri-laminar capillary plexuses. The superficial capillary plexus (SCP) supplies the area from the ganglion cell layer to the inner nuclear layer (INL), the intermediate capillary plexus (ICP) supplies the interior of the INL and the deep capillary plexus (DCP) supplies the part from the outer border of the INL to the outer plexiform layer [1]. Response of the ICP to hypoxia is much greater than the other two plexuses [2]. Paracentral acute middle maculopathy (PAMM) is a nomenclature based on optical coherence tomography (OCT) image characteristics. INL infarction caused by ICP and DCP hypoperfusion is seen as a hyperreflective band in this line. In the etiology of PAMM, reasons such as retinal artery and vein occlusions, hypercoagulability conditions, cataract and vitrectomy surgery and trauma have been implicated [1]. COVID-19 infection causes vascular occlusion by causing endothelial damage or increasing systemic thrombotic factors [3]. Retinal artery occlusion, PAMM and acute macular neuro-retinopathy cases associated with COVID-19 have also been reported in the literature [4–7].

In this case, we aimed to add a new perspective to the ophthalmological involvement of COVID-19 with an atypical PAMM case presenting with involvement of inner retinal layers associated with COVID-19.

2. Case report

A 41-year-old woman presented with the complaint of gradually decreasing visual acuity in the right eye for three weeks. She had no previous trauma or surgical history. A COVID-19 PCR nasopharyngeal swab test was positive 1 month ago. She described a paracentral scotoma that occurred when the vision decreased. However, she declared that the scotoma improved over time. In the ophthalmological examination, corrected visual acuity was 0.5 in the right eye with the Snellen decimal chart and no pathological appearance with slit lamp examination. In the indirect ophthalmoscopic examination, there was a parafoveal hyperpigmented round lesion in the right eye. Increased vascular tortuosity was observed in indirect ophthalmoscopic retinal examination, wide-field retinal imaging and fundus fluorescein angiography (FFA). Retinal vascular structures were symmetrical. OCT (Hiedelberg Spectralis OCT, Germany) images showed a hyperreflective lesion over the outer plexiform layer, including all parafoveal inner retinal layers next to the foveal pit [Fig. 1a]. No vascular occlusion finding was detected in FFA (Optos200Tx, Marlborough, MA, USA)[Fig. 1b]. There was no absolute scotoma, but decreased sensitivity was present in the visual field...
test consistent with the hyperreflective area (Octopus-900, HAAG-STREIT eyesuite static perimetry, V2.2.0). Two multifocal electroretinogram (mfERG) (MetrovisionMon2018F) tests were performed with the patient. At the first visit, there was no amplitude reduction compared to the normal population. However, after 5 weeks when the mfERG was repeated, “a waves” in the paracentral area were decreased compared to the first test but the statistical comparison to the healthy database did not reach the level of \( p < 0.05 \). To evaluate retinal capillary vascular density, OCT-A (6 × 6 mm) retinal angiography imaging was performed (RTVueXR AvantiOptovue Inc, Fremont CA, version 2017.1.0.151). When both eyes were compared in OCT-A en-face images covering the SCP, ICP and DCP, disruption was observed in the capillary network, suggesting decreased flow [Fig. 2]. The lesion was at the border of the foveal avascular zone and was seen as a mild hyperreflective reflection in OCT-A images. Arterial hypertension was not detected. The hematology department was consulted in terms of thrombophilia, and Protein C, Protein S, homocysteine and prothrombin time were normal in the examination. In genetic tests for methyltetrahydrofolate reductase

Fig. 1. OCT and fundus fluorescein angiography images of the right eye of the case. (a) OCT image shows a hyperreflective lesion over the outer plexiform layer, including the foveal pit and extending adjacent area. (b) No vascular occlusion on fundus fluorescein angiography.

Fig. 2. Superficial and deep capillary plexus imaging of the right eye with OCT-A. (a) Even the avascular zone in the deep capillary plexus cannot be detected due to the shadowing effect of the lesion that was initially observed in the superficial plexus. (b) On the superficial capillary plexus face images, a hyperreflective reflection and FAZ irregularity, which could be an artifact because of the lesion. (c) In the images repeated 1 month later, it is observed that the shadowing effect previously seen in the deep capillary plexus has disappeared and the borders can be defined more clearly. (d) In the images repeated 1 month later, it was observed that the hyperreflective image in the superficial capillary plexus extending into the avascular zone disappeared.
MTHFR A1298C was heterozygous. (MTHFR) gene polymorphism, MTHFR C677T was heterozygous and homocysteinemia was reported to be associated with diabetic MTHFR enzyme activity by heterozygous mutation. Hyperhomocysteinemia increases the risk of retinal vein occlusion, no relationship has been found between the MTHFR C677T polymorphism and retinal vein occlusion [11,12]. However, this is still a controversial topic. Although a typical PAMM appearance causes infarction in the ICP and DCP area, the location of the lesion and its failure to progress to the outer layers of the retina have distanced us from a diagnosis of type 2 acute macular neuroretinopathy [13].

In summary, in this report, a case of atypical PAMM with SCP, ICP and DCP involvement was considered that furthermore resolved spontaneously. Although not accompanied by hyperhomocysteinemia, the MTHFR C677T mutation and higher dimer levels led us to antithrombotic treatment. This case showed that it should be kept in mind that retinal involvement of COVID-19 infection could present in different ways.

### Declaration of Competing Interest

None.

### Funding

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