Retinal manifestations of ophthalmic artery occlusion with ischemic stroke in a young patient with COVID-19

Lagan Paul, Tanya Jain, Shalini Singh

COVID-19-associated coagulopathy (CAC) has led to an increase in the incidence of large vessel stroke and cryptogenic shock. We present a case of a 30-year-old COVID-19-positive patient who developed an internal carotid artery (ICA) thrombosis, which led to ischemic stroke, aphasia, and unilateral blindness. Ophthalmic artery occlusion (OAO) was found to be the cause of vision loss. We thereby aim to highlight the detailed ophthalmic manifestations of OAO with features of posterior ciliary artery occlusion (PCAO) in this patient with proven ICA thrombosis.

Key words: Case report, COVID-19-Coronavirus disease 2019, internal carotid artery, ophthalmic artery, posterior ciliary artery occlusion

Coronavirus disease 2019 (COVID-19) is caused by infection with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).[1] Large vessel occlusion occurs secondary to COVID-19 more so in younger age group patients.11-13 We report a case of a young Indian male patient who developed a deadly cerebrovascular stroke due to COVID-19 infection and severe vision loss due to its thrombotic complications.

Case Report

A 30-year-old male patient presented to our hospital with a history of diminution of vision in the left eye for 3 months. Ten months back during the pandemic, the patient had a fever for 2 weeks for which the patient was on symptomatic treatment at home. One night, he had an episode of vomiting and headache, and the next morning he was found unconscious. He was rushed to the hospital emergency department where he tested positive for COVID-19 through the Xpert test and was admitted. There was no known positive systemic history. On admission, his National Institute of Health Stroke score (NISS) was 19. He was mute with global aphasia. There was facial asymmetry with a deviation of the angle of the mouth to the left. Central Nervous System (CNS) examination...
showed reduced muscle tone and power of both limbs of the right side and reduced deep tendon reflexes. He was diagnosed with ischemic stroke with right hemiparesis, right upper motor neuron (UMN) facial palsy, and global aphasia. Non-contrast computed tomography (NCCT) scan of the brain revealed a middle cerebral artery (MCA) territory infarct [Fig. 1] with MCA hyperdense sign (arrow in Fig. 1). Extensive workup for stroke revealed lymphocytosis, neutrophilia, increased prothrombin time (13.6 s), hyper-homocysteinemia, and hyperlipidemia. CT-angiography of the head and neck revealed occlusion of the internal carotid artery (ICA) cut off from its origin. The carotid Doppler revealed a left ICA thrombosis. The patient was started on anti-hypertensive, anti-epileptic, dual anti-platelet therapy, and lipid-lowering agents.

After 3 months, he first noticed a diminution of vision in the left eye. On examination, he was now oriented to time, place, and person. He had a hemiplegic gait and unclear speech. His best-corrected visual acuity (BCVA) was 6/6, N6 in the right eye (RE) and 1/60, <N36 in the left eye (LE). The intraocular pressure was 12 and 13 mmHg in RE and LE, respectively. A grade 4 rapid afferent pupillary defect (RAPD) was present in the left eye. The left eye fundus examination revealed a pale disc with collaterals at the disc, severe arterial narrowing with sclerosed inferotemporal artery along with chorioretinal atrophy at the macula and in all the quadrants in the mid-periphery [Fig. 2]. Optical coherence tomography (OCT) of the macula revealed foveal thinning in the LE along with total loss of retinal architecture [Fig. 3]. Fundus fluorescein angiography (FFA) revealed a delayed arm to retina time (25 s) with a delayed patchy filling of the choroid, completed at 52 s. There was late arterial filling (50 s) and the cilioretinal artery also did not show filling until late phases. Areas of hyperfluorescence were noted in patches of chorioretinal atrophy s/o window defects [Fig. 4]. OCTA showed loss of superficial and deep vascular vessels with distorted choriocapillaris architecture [Fig. 5]. Hence, the diagnosis of LE old posterior ciliary artery occlusion (PCAO) along with Central Retinal Artery occlusion (CRAO) involving cilioretinal artery secondary to ICA thrombosis was made.

**Discussion**

COVID-19 has been reported to cause ischemic stroke and large vessel occlusion in young patients more than usual.\(^1\) Reported rates of arterial thrombosis range from 2.8% to 3.8%.\(^4\) Mechanisms involved include increased hypercoagulability from a pro-inflammatory state, infection-induced Disseminated Intravascular Coagulation (DIC), and embolus from the virus-related cardiac injury.\(^5\)\(^-\)\(^7\)

ICA is the main vessel trunk from which the ocular blood supply arises. The ophthalmic artery (OA) is a branch of the supra-clinoid segment of ICA, which gives central retinal artery (CRA), the short and long posterior ciliary arteries (PCA), and the anterior ciliary arteries. PCA supplies the optic nerve head, the outer 130 mm of the retina, and the retinal pigment epithelium (RPE).\(^5\) CRA supplies the inner retinal layers and contributes to the vision. Left MCA territory occlusion lead to right-sided hemiparesis and UMN facial nerve palsy, also due to Broca’s and Wernicke’s area supplied by the same lead to global aphasia. In the eye, OA occlusion leads to PCAO and CRAO and hence loss of vision.

Acute PCAO leads to optic disc edema and ischemic retina and later on leads to the development of optic atrophy and the white opacity of the fundus seen during the acute phase resolves in approximately 2 to 3 weeks, and the involved part of the fundus assumes a grayish, granular, and depigmented appearance.\(^7\) Cherry red spot is a feature of acute CRAO, which in old cases is seen as a loss of retinal architecture with gross thinning of retinal layers, thereby, explaining the fundus appearance in the present case.

Acharya et al.\(^9\) have reported the first isolated case of CRAO in a 60-year-old patient following COVID-19, owing to its hyper-coagulable nature; however, a known site of occlusion could not be demonstrated. In another report by Murchison et al.,\(^8\) they described a patient in his fifth decade with a CRAO secondary to COVID-19 due to luminal narrowing of the ICA.\(^8\) However, that patient did not develop any neurological...
Coagulation abnormalities and thrombosis in patients infected with SARS-CoV-2 and other pandemic viruses. ArteriosclerThrombVascBiol 2020;40:2033-44.

5. Oxley TJ, Mocco J, Majidi S, Kellner CP, Shoirah H, Singh IP, et al.
Large-vessel stroke as a presenting feature of Covid-19 in the young. N Engl J Med 2020;382:e60.

6. Engelmann B, Massberg S. Thrombosis as an intravascular effector of innate immunity. Nat Rev Immunol 2013;13:34-45.

7. Hayreh SS, Podhajsky PA, Zimmerman MB. Retinal artery occlusion: Associated systemic and ophthalmic abnormalities. Ophthalmology 2009;116:1928-36.

8. Acharya S, Diamond M, Anwar S, Glaser A, Tyagi P. Unique case of central retinal artery occlusion secondary to COVID-19 disease. IDCases2020;21:e00867.

9. Montesel A, Bucolo C, Mouvet V, Moret E, Eandi C. Case report: Central retinal artery occlusion in a COVID-19 patient. FrontPharmacol 2020;11:588384.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References
1. Zakeri A, Jadhav A, Sullenger B, Nimjee S. Ischemic stroke in COVID-19-positive patients: An overview of SARS-CoV-2 and thrombotic mechanisms for the neurointerventionalist. JNeuroIntervSurg 2020;13:202-6.

2. Cavallieri F, Marti A, Fasano A, DallaSalda A, Ghirarduzzi A, Moratti C, et al. Prothrombotic state induced by COVID-19 infection as trigger for stroke in young patients: A dangerous association. eNeurologicalSci. 2020;20:100247.

3. Majidi S, Fifi J, Ladner T, Lara-Reyna J, Yaeger K, Yim B, et al. Emergent large vessel occlusion stroke during New York City’s COVID-19 outbreak. Stroke 2020;51:2656-63.

4. Mackman N, Antoniak S, Wolberg AS, Kasthuri R, Key NS.