Abducens palsy and CRAO in COVID

**Embolic abducens palsy and central retinal artery occlusion in a patient with COVID-19**

Running Title: Abducens palsy and CRAO in COVID

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The morbidity and mortality of the COVID-19 pandemic is not limited to respiratory failure, but rather includes significant impacts on other organ systems. Vascular and neurologic complications have been extensively reported, including a wide variety of neuro-ophthalmic sequelae. To date, the literature comprises several cases of ophthalmoplegia and two cases of central retinal artery occlusion (CRAO). Herein we present the case of a COVID-19 patient who suffered multiple systemic embolic injuries including a cranial neuropathy, optic nerve ischemia, and a CRAO.

A 68-year-old Caucasian male with a history of untreated atrial fibrillation, hypertension, tobacco use, and cirrhosis status post transjugular intrahepatic portosystemic shunt (TIPS) presented to the emergency room with three days of cough, dyspnea, and malaise. He was hypoxic and required a non-rebreather mask on arrival.

Initial workup showed positive COVID-19 polymerase chain reaction, elevated lactate and D-dimer, acute kidney injury, non-myocardial infarction troponin elevation, diffuse ground glass pulmonary opacities, and atrial fibrillation with rapid ventricular response. Chest computed tomography (CT) showed extensive coronary atherosclerosis without pulmonary embolism. He was started on intravenous dexamethasone 6 mg daily and admitted to the Intensive Care Unit for treatment of acute hypoxic respiratory failure.

Ophthalmology was consulted the next day for eye movement abnormalities and profound, painless vision loss in the right eye which had reportedly begun 16 hours earlier. The patient had no prior ocular history and denied headache, jaw claudication, or scalp tenderness. His right eye demonstrated light perception vision and a 3+ relative afferent pupillary defect. Motility testing revealed a complete right abduction deficit and a -2 deficit of right supraduction. Fundus exam of the right eye showed optic disc pallor as well as diffuse macular whitening with
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a cherry red spot and macular edema (Fig. 1). The arterioles were attenuated with several visible plaques in the peripapillary region. Neurology was consulted and found no other neurologic defects at that time.

CT head without contrast showed no acute infarct. CT angiogram demonstrated complete occlusion of the right internal carotid artery (ICA) from the carotid bifurcation to the ICA terminus, with reconstitution of distal flow from collaterals. The proximal left ICA had moderate atherosclerotic stenosis. Transthoracic echocardiogram showed severely reduced systolic function with mild tricuspid regurgitation but no valvular vegetations. His C-reactive protein was 185, erythrocyte sedimentation rate 16, and platelets 235. He was placed on a heparin drip for his atrial fibrillation and presumed strokes and maintained on his home dose of aspirin and atorvastatin.

Contrast-enhanced brain MRI later revealed watershed regions of restricted diffusion between the anterior, middle, and posterior cerebral arterial territories and a right posterior optic nerve infarct extending to the chiasm (Fig. 2). No brainstem infarcts were found, but nonspecific enhancement of the cisternal segment of the right abducens nerve was noted.

Systemic imaging demonstrated bilateral wedge-shaped renal infarcts, an occluded TIPS, a right lower extremity deep femoral vein thrombosis, and acute left lower extremity ischemia requiring pharmacomechanical thrombolysis followed by balloon angioplasty.

The patient was intubated for his vascular procedures and hypoxic respiratory failure and was unable to be weaned off the ventilator in the ensuing days. Following palliative care discussions with his family, he was compassionately extubated on day 8 of his admission and passed away.
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While our patient succumbed to respiratory complications of COVID-19, the ancillary morbidity he suffered adds to our understanding of the vast effects of this illness. Although he had pre-existing and untreated atrial fibrillation, he sustained multiple systemic infarcts with atherosclerotic sources of emboli discovered in the carotid arteries and intra-abdominal aorta, but not the cardiac valves. His abducens palsy and CRAO are explained by the infarcts discovered on his MRI. His supraduction deficit may represent a partial third cranial nerve palsy or orbital muscular ischemia. While giant cell arteritis was briefly considered as a cause of CRAO, the presence of Hollenhorst plaques, absence of relevant history, and normal erythrocyte sedimentation rate and platelet count argued against this diagnosis.

Neurologic sequelae have been well documented since the beginning of the COVID-19 pandemic, with early reports showing neurologic symptoms in as many as 30%. An alarming 2.8% of patients have presented with an acute cerebrovascular infarct, typically ischemic in etiology, with several reported cases in young or previously healthy individuals with no known vascular risk factors.\(^1\)

At the start of the pandemic, Seah et al provided a useful framework of COVID-19 ocular involvement in animal models, demonstrating conjunctivitis, anterior uveitis, optic neuritis, and retinitis.\(^2\) Since that time, the ophthalmic literature has greatly expanded, including a study by Marinho et al finding hyperreflective OCT lesions at the level of the ganglion cell and inner plexiform layers in all 12 patients they studied with COVID-19.\(^3\)

The neuro-ophthalmology literature on COVID-19 includes several case reports of inflammatory optic neuropathies, ophthalmoplegia, and papillophlebitis. Ophthalmoplegia has been attributed to Miller Fisher Syndrome as well as isolated cases of cranial neuropathies which may represent more limited forms of the same entity.
Two prior cases of CRAO have been documented in COVID-19 patients. Acharya et al reported a case of a vasculopathy who developed a CRAO on his twelfth day of admission without any other neurologic or thromboembolic sequelae. Chandrakara et al described a 66-year-old male who experienced rash, polyarthritis, panuveitis, retinal vasculitis, and a CRAO as part of a post-COVID-19 inflammatory syndrome.

Our patient is one of the few cases of either cranial neuropathy or CRAO associated with COVID-19, and he presented with a unique constellation of embolic strokes affecting the eyes. This highlights the continued need for neurologic and ophthalmologic screening in COVID-19 patients and the importance of managing the hypercoagulable state of this illness.
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References


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FIGURES

Fig. 1. Color photograph in the COVID-19 Intensive Care Unit revealing central retinal artery occlusion in the right eye with a cherry red spot and peripapillary Hollenhorst plaques.
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Fig. 2. Diffusion-weighted MRI demonstrating right ischemic optic neuropathy.