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Non-arteritic anterior ischemic optic neuropathy in COVID-19 infection – A case report

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ABSTRACT

Purpose: To report a case of a non-arteritic anterior ischemic optic neuropathy (NAION) in the setting of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).

Observations: A 60-year-old healthy female without any risk factors for vasculopathy, presented with an acute painless diminution of vision noticed in the lower half of the visual field in the left eye. She was diagnosed with NAION in the setting of a recent SARS-CoV-2 infection.

Conclusions and importance: The purpose of this case report is to supplement our knowledge about the neuro-ophthalmological complications of COVID-19 in the form of NAION which might occur even in the early stages of the infection.

1. Background

Non-arteritic ischemic optic neuropathy (NAION) is thought to be caused by the inadequate blood supply to the optic nerve leading to acute, unilateral, and painless loss of vision affecting older patients without any risk factors for vasculopathy and sleep apnea. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV2) has created a pandemic with more than 163 million cases of COVID-19 worldwide and resulted in more than 3.37 million deaths as of May 17, 2021.[1] A variety of neuro-ophthalmological complications of COVID-19 have been described in the literature. Herein, we describe a 60-year-old female without any other systemic risk factors presenting with NAION after a COVID-19 infection.

2. Case presentation

A 60-year-old lady from Kathmandu complained of acute painless diminution of vision in the left eye (LE) mainly involving the lower half of the visual field which was noticed upon awakening in the morning for the last 14 days. It was non-progressive and associated with floaters in LE. There was no ocular pain, headache, jaw claudication, weight loss, vomiting, and double vision. The patient had constitutional symptoms of fever, myalgia, dysgeusia, and cough for 5 days before testing positive for severe acute respiratory syndrome coronavirus 2 (SARS-CoV2). She developed ocular symptoms the next day. She did not have any anosmia, or dyspnea and had not been lying in the prone position. She had no vasculogenic risk factors like diabetes or hypertension. She had no history of smoking, snoring, or sleep apnea. She had a normal body mass index. She attributed her visual symptoms to weakness due to COVID infection and obtained ophthalmological consultation only after completing 14 days of home isolation.

The best-corrected visual acuities were 20/20 in the right eye (RE) and 20/200 in LE by Snellen's chart on the day of examination. The pupil showed a grade II relative afferent pupillary defect in the left eye. The ocular movements were full and free in all cardinal gazes. On slit-lamp examination, the anterior segment was normal. Dilated funduscopic examination revealed normal findings in the RE and sectoral disc pallor with retinal nerve fiber layer (RNFL) edema in the LE (Fig. 1). Intraocular pressure (IOP) was 20 mmHg in both eyes. The confrontational visual field demonstrated an inferior hemifield defect LE. The color vision in RE was normal but LE showed red and green color deficiency. The contrast sensitivity was RE 2.25 log units and LE 1.85 log units. Optical coherence tomography (OCT) was normal in RE whereas LE showed increased Retinal nerve fiber layer (RNFL) thickness more marked in the superior quadrant with thinning of the ganglion cell complex in the superior field (Fig. 2). The Humphrey 30-2 visual field showed a normal visual field in RE and inferior altitudinal field defect in

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Abbreviations

COVID-19	Coronavirus disease 2019
ESR	Erythrocyte Sedimentation Rate
IOP	Intraocular Pressure
LE	Left Eye
MOG	Myelin Oligodendrocyte Glycoprotein
NAION	Nonarteritic anterior ischemic optic neuropathy
NMO	Neuromyelitis Optica
OCT	Optical Coherence Tomography
RE	Right Eye
RNFL	Retinal Nerve Fiber Layer
SARS-CoV-2	severe acute respiratory syndrome coronavirus 2

neuro-ophthalmic complications of COVID-19 have been reported in literature varying from optic neuritis,[2–5] cranial nerve palsies including the Miller Fischer syndrome,[2,3,5] Oscillopsia in the context of encephalopathy,[5] posterior ischemic optic neuropathy[6] and visual field defects due to stroke involving the posterior circulation and occipital lobes.[3,5,7]

Although the mechanism of optic disc ischemia in NAION is not clearly understood, it is believed to occur due to circulatory insufficiency within the short posterior ciliary arteries (SPCA), but the specific location of the vasculopathy and its causes are still unclear.[8,9] Several articles in the literature suggest that since COVID-19 can target vascular pericytes expressing ACE-2, the viral infection could lead to complement-mediated endothelial cell dysfunction, and microvascular damage, and thus may compromise ocular circulation.[2,10] Other factors which may negatively influence the ocular perfusion could be related to hypoxia in the COVID-19 patients which might be profound without proportional symptoms of respiratory distress termed as happy hypox-

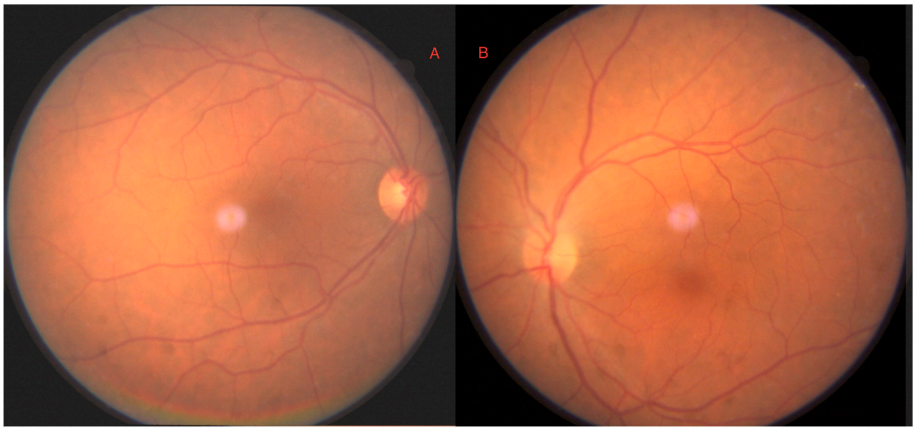

Fig. 1. Color fundus photograph of the right(A) and left(B) eye. Right eye shows a normal optic disc, whereas left eye optic nerve shows superior sectoral edema. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

LE (Fig. 3).

The routine laboratory tests done two weeks before the visit to our out patient department (during the isolation period), showed a normal complete blood count but the erythrocyte sedimentation rate (ESR) was raised (64mm in 1st hour). Other investigations like Random Blood sugar, renal function tests, and liver function tests were normal. The coagulation profile including the D-dimer assay was within normal range.

The patient was asked to follow up the next day with further investigation reports. Complete blood count, blood sugar, renal function tests, liver function tests, and coagulation profile were all normal. ESR had decreased to 24 mmHg and C-reactive protein was negative. Serology for HIV, HBsAg, Rheumatoid arthritis factor, and Treponema pallidum hemagglutination were all non-reactive. Magnetic resonance imaging of the brain and orbits with contrast, echocardiography, serum NMO and MOG antibodies and Thyroid function tests were all normal. She was then started on oral Aspirin 150mg per day and asked to follow up in 1 month. Her visual acuity in the left eye had improved to 20/32 at 1 month follow up but she still had inferior hemifield defect on confrontation test. HVF could not be done at the follow up visit because the machine was not functioning at the time.

3. Discussion

The first case in Nepal was confirmed on January 23, 2020 when the first wave of COVID-19 initially hit the nation. Now as the second wave of the pandemic hits the country with a rapid surge of COVID-19 cases, the number of ophthalmic complications is also on the rise. A variety of emia.[11] In addition, the prone positioning in COVID-19 patients increases venous pressure and IOP thereby critically reducing ocular perfusion pressure which may cause acute ischemic optic neuropathy.[2,12] All these factors may predispose the occurrence of NAION in COVID-19 patients.

Our patient is a classic case of NAION with acute monocular altitudinal loss of vision. There were no other identifiable classic risk factors of NAION in our patient apart from the concomitant COVID-19 infection. The exact cause of NAION in our case is debatable since the patient did not have any symptoms of hypoxia and the coagulation profile was also normal although the ESR was raised earlier. We believe that the inflammation associated with the recent COVID-19 infection and the resulting endothelial damage in the ocular microvasculature led to compromised circulation in the short posterior ciliary arteries, resulting in NAION in our case. The decrease in ESR was associated with a marked improvement of visual symptoms and visual acuity without any treatment.

Table 1 shows some of the published case reports of cases of NAION following SARS-CoV2 infection.

The causal relationship between NAION and COVID-19 can only be speculated and future observation and research may help us to understand the pathophysiology of NAION and its relationship with COVID-19 infection.

4. Conclusion

This is the first case report of a female patient with sequential COVID-19 infection and NAION in the absence of vasculogenic risk

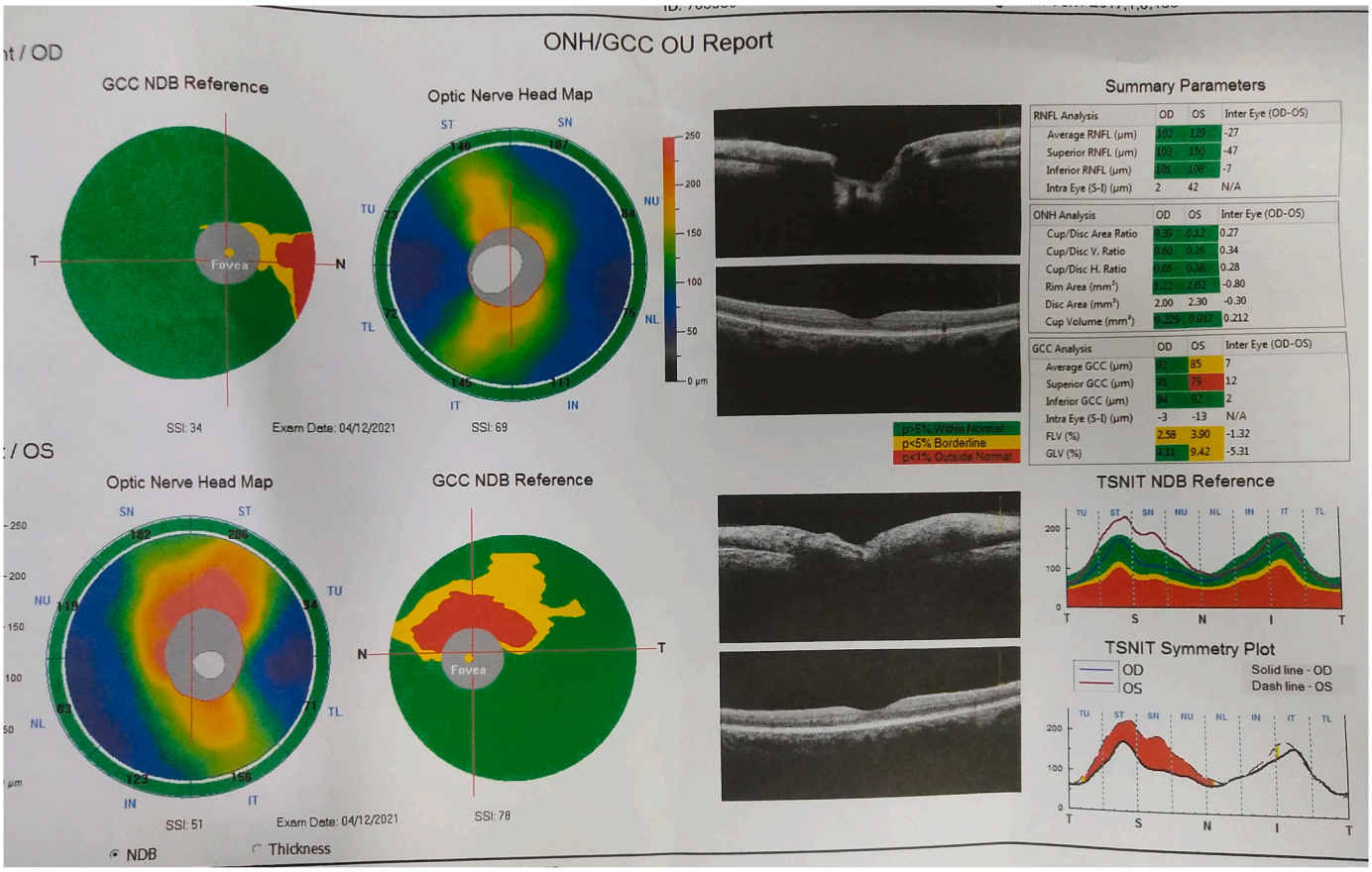

Fig. 2. Retinal nerve fibre layer (RNFL) analysis by SD-OCT (Optovue) showing superior RNFL thickening in the left eye measuring 150μm vs 103μm in the right eye due to superior sectoral optic disc edema. Macular ganglion cell – inner plexiform layer complex (GCC) analysis shows thinning of the Superior GCC in the left eye (79μm) when compared to the superior GCC of the right eye (91μm).

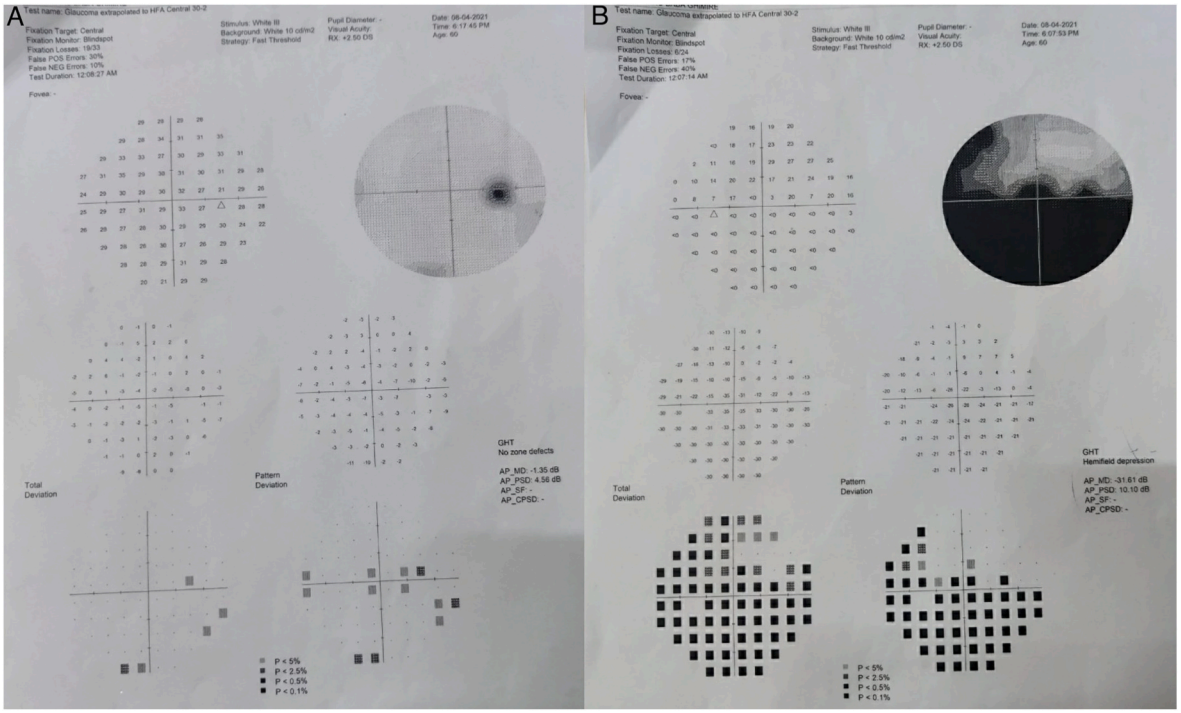

Fig. 3. Humphrey visual field analysis (30-2) of the RE(A) showing a normal pattern and the LE(B) showing an inferior altitudinal field defect suggesting the diagnosis of NAION.

Table 1
Summary of literature review of cases of NAION occurring in association with COVID-19 infection or vaccination.

	Authors	Patient description	Attributed mechanism of development of NAION
1	Rho J et al.[13]	43-year-old Hispanic male with a history of Diabetes and borderline hyperlipidemia.	Minimal cardiovascular risk factors and thrombophilia, most likely due to COVID-19.
2	Garcia B et al.[14]	55-year-old male with a history of high blood pressure, coronary stenting, and smoking bilateral NAION with left transverse sinus thrombosis with permanent vision loss	Endothelial damage in arteries and veins caused in situ inflammation and occlusion of the short posterior ciliary arteries resulting in bilateral simultaneous NAION.
3	Clarke KM et al.[15]	55 year old Afro-Caribbean male with severe, irreversible, visual impairment with bilateral NAION in a patient with COVID 19 pneumonitis and hypoxemic respiratory failure requiring prolonged sedation and eight episodes of prone mechanical ventilation	Prone positioning leading to alterations in IOP which precipitate nerve hypoperfusion
4	Tsukii R et al.[16]	55-year-old woman, who presented with a 4-day history of inferior visual field disturbance in the right eye 7 days after receiving the first dose of Pfizer-BioNTech COVID-19 vaccine.	COVID-19 vaccination-related vasculopathy on the microvascular network of the optic nerve head.[16]
5	Moschetta L et al.[17]	64 year old Caucasian male with no ocular or systemic risk factors for NAION who had SARS-CoV-2 pneumonia 4 weeks back.	SARS-CoV2 related endotheliopathy.[17]
6	Yuksel B et al.[18]	72-year-old male dentist, smoker, and a known case of Diabetes Mellitus, Hypertension, and Ulcerative Colitis, under medications, who was diagnosed as progressive NAION 13 days after testing positive for SARS CoV2.	Disturbances in endothelial cells that and reduced fibrinolysis leads to the hypercoagulability and thrombosis formation within the arterioles supplying the optic nerve leading to ischemia. Swollen axons in one ischaemic part may lead to secondary infarction in another part of the optic disc leading to progressive NAION.

factors reported from Nepal. This neuro-ophthalmological symptom manifested early in the course of her illness and resolved on its own with a good visual outcome. The purpose of this case report is to supplement our knowledge about the neuro-ophthalmological complications of COVID-19 which might occur even in the early stages of COVID-19 infection.

Patient consent

This report does not contain any personally identifying information.

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Intellectual property

We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, with respect to intellectual property. In so doing we confirm that we have followed the regulations of our institutions concerning intellectual property.

Research ethics

We further confirm that any aspect of the work covered in this manuscript that has involved human patients has been conducted with the ethical approval of all relevant bodies and that such approvals are acknowledged within the manuscript.

Authorship

All listed authors meet the ICMJE criteria. We attest that all authors contributed significantly to the creation of this manuscript, each having fulfilled criteria as established by the ICMJE.

We confirm that the manuscript has been read and approved by all named authors.

We confirm that the order of authors listed in the manuscript has been approved by all named authors.

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Declaration of competing interest

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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