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Case Report

Bilateral Sequential Non-Arteritic Anterior Ischemic Optic Neuropathy Following COVID-19 Infection: A Rare Case Report

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Abstract

To report a patient with bilateral sequential non-arteritic anterior ischemic optic neuropathy (NA-AION) following severe COVID-19 infection. A 50-year-old male patient reported a 1-week history of painless vision loss in the right eye in adition to complaining of blurred vision in the left eye 4 weeks earlier. He had tested COVID-19 positive 4 weeks before the onset of symptoms in his left eye. Further investigations revealed that the most possible cause of vision loss was NA-AION associated with COVID-19. COVID-19 infection may be responsible for NA-AION. Therefore, ophthalmologists should keep this infection in mind when systemic investigation for the underlying etiology of NA-AION.

Keywords: COVID-19, ischemic optic neuropathy, optic disc edema, vision loss

Introduction

Coronavirus disease 2019 (COVID-19), which is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is responsible for an ongoing pandemic that started in 2020 (1). Ocular manifestations of the disease are not common and various signs and symptoms including anterior (epiphora, conjunctivitis, episcleritis, etc.) and/or posterior eye segments (central retinal and arterial occlusion, ophthalmic artery occlusion, acute macular neuroretinopathy, and paracentral acute middle maculopathy, etc.) have been reported (2-4). Besides involvement of anterior and/or the posterior segment of the eye, neuro-ophthalmic manifestations such as papillophlebitis, optic neuritis, Adie's tonic pupil, Miller Fisher Syndrome, cranial nerve palsies (oculomotor, abducens and facial nerve), and neurogenic ptosis have been described with isolated case reports occuring in severe infections (4,5). In this report, we present a male patient with non-arteritic anterior ischemic optic neuropathy (NA-AION) in both eyes following severe COVID-19 infection.

Case Report

A 50-year-old male patient presented with a 1-week history of painless vision loss in the right eye. 4 weeks earlier, he had been admitted to another clinic complaining of blurred vision in the left eye. When the patient' epicrisis report was examined, it was determined that he was treated with

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pulse methylprednisolone (1 g/day for 3 consecutive days) followed by oral predisolone (1 mg/kg/day) therapy and concurrent use of oral antiplatelet agent (acetylsalicylic acid 300 mg/day) with the diagnosis of NA-AION. In the epicrisis report, it was noticed that there was no change in the visual acuity with this therapy. Although his past medical history did not reveal any preexisting systemic or ophthalmologic diseases, he had tested positive for COVID-19 4 weeks before the onset of symptoms in his left eye. His symptoms had started as fever, cough, and fatigue; however, his reaction to COVID-19 had been severe and severe systemic symptoms, including worsening of cough, tachypnea, shortness of breath, and serious degree of fatigue had lasted 40 days. During a comprehensive examination in our clinic, best-corrected visual acuity was detected 8/10 and 3/10 with a Snellen chart, and color vision was 12/15 and 6/15 with the Ishihara plates in the right eye and left eye, respectively. Direct and indirect pupil reflexes were present bilaterally and no relative afferent pupil defect was observed. Slit-lamp biomicroscopy of the anterior segment showed no abnormalities and intraocular pressure with Goldmann applanation tonometer were 13 and 14 mmHg in the right and left eyes, respectively.

A fundus examination revealed optic disc edema in the right eye and temporal rim pallor in the left eye (Fig. 1). Visual field tests demonstrated enlargement of blind spot in the right eye and an altitudinal defect in the left eye (Fig. 2). Fluorescein angiography showed fluorescein leakage in the right optic disc and late staining of optic disc in the left one (Fig. 3). An optic nerve head optical coherence tomography (OCT) showed an increase in the peripapillary retinal nerve fiber layer's thickness bilaterally, and a ganglion cell complex analysis, revealed ganglion cell layer loss in the left eye (Fig. 4). Both macula were detected as normal with OCT.

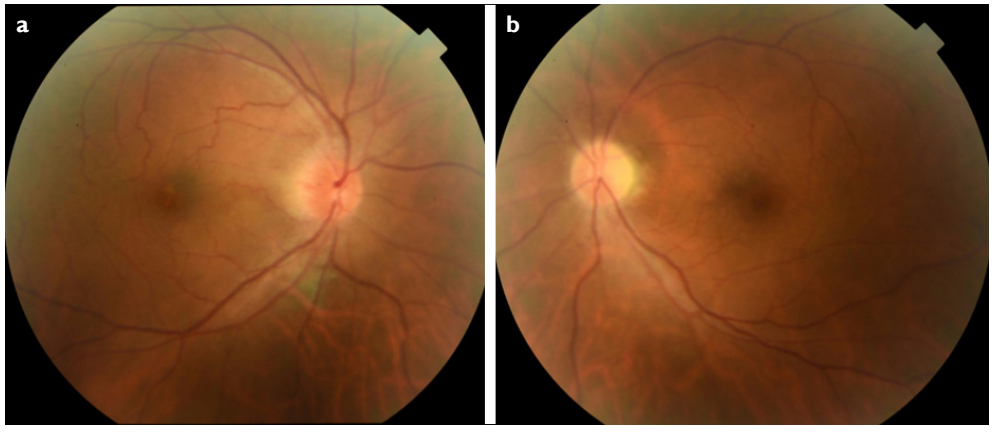

Figure 1. Color fundus photographs of the right eye **(a)** showing optic disc edema and left eye **(b)** depicting temporal rim pallor of optic disc.

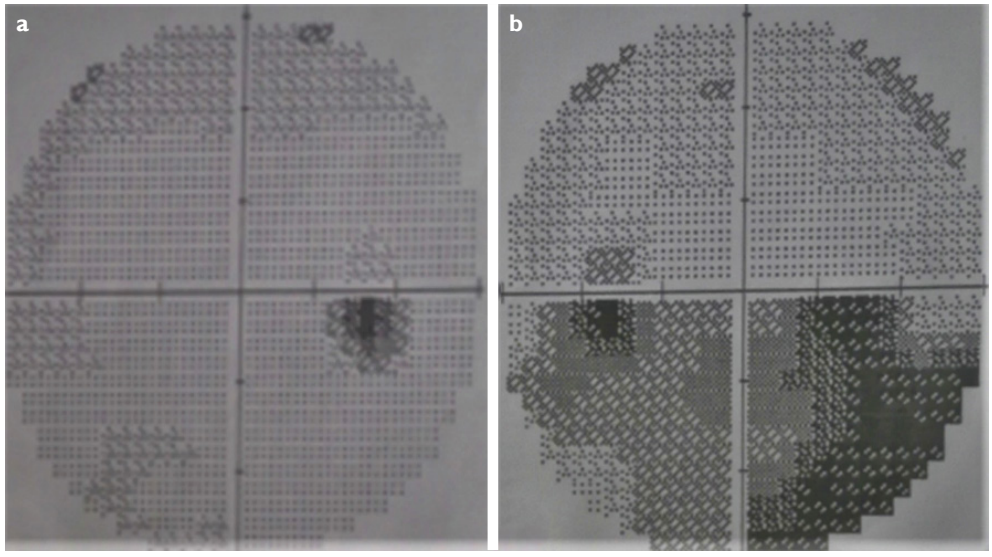

Figure 2. Visual field tests demonstrating enlargement of blind spot in the right eye **(a)** and an altitudinal defect in the left eye **(b)**.

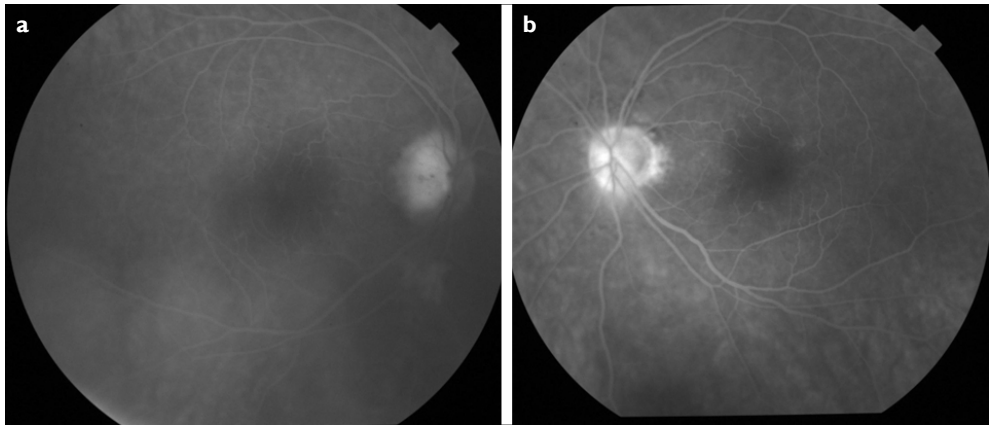

Figure 3. Fluorescein angiography showing fluorescein leakage in the right optic disc **(a)** and late staining of left optic disc **(b)**.

Rheumatology, hematology, pulmonology, and neurology consultations were requested. Detailed laboratory tests were performed. The complete blood cell count, erythrocyte sedimentation rate, and C-reactive protein values were within the normal limits. Among biochemistry tests, only total and low-density lipoprotein cholesterol were slightly elevated. All autoimmune screen (rheumatoid factor, antinuclear antibody, antineutrophil cytoplasmic antibodies, myelin oligodendrocyte glycoprotein, anti-aquaporin-4 antibody. etc.), infective serology (toxoplasma, syphilis, etc.), coagulation profile, and thrombophilia screen were negative. Comprehensive radiological imaging including torax computed tomography and magnetic resonance imaging of the brain and orbits with and without contrast were normal. The lumbar puncture results were within the normal limits with normal components.

The patient's vision loss occurred after severe COVID-19 infection, with no past history of visual complaints. His detailed medical history and neuro-ophthalmological examination, laboratory tests and radiological imaging results, and further consultations, revealed that the most possible cause of vision loss was NA-AION. In clinical follow-ups, the oral steroid dosage was gradually reduced, and discontinued, but the antiplatelet agent was continued. His visual acuity was 0.8 in the right eye and 0.6 in the left eye at the final visit.

Discussion

NA-AION is an important cause of vision loss in older patients (6). It is generally caused by loss of blood flow to the optic nerve and sometimes by the optic nerve's blood supplying arteries' embolization (6). In the presented report, bilateral sequential NA-AION was thought to be associated with prior severe COVID-19 infection due to the absence of a significant cardiovascular risk factor other than slightly high serum lipid values, very short interval between the two eyes involvement, and relatively young age to develop NA-AION.

It is not surprising that COVID-19 infection, which has been proven many times to cause hypercoagulability and hypoxemia resulting in ischemia, leads to NA-AION. COVID-19s main complications are generally linked to severe inflammation (7) and hypercoagulability tendency (8). In addition, the virus can bind itself to endothelial cells' angiotensin con-

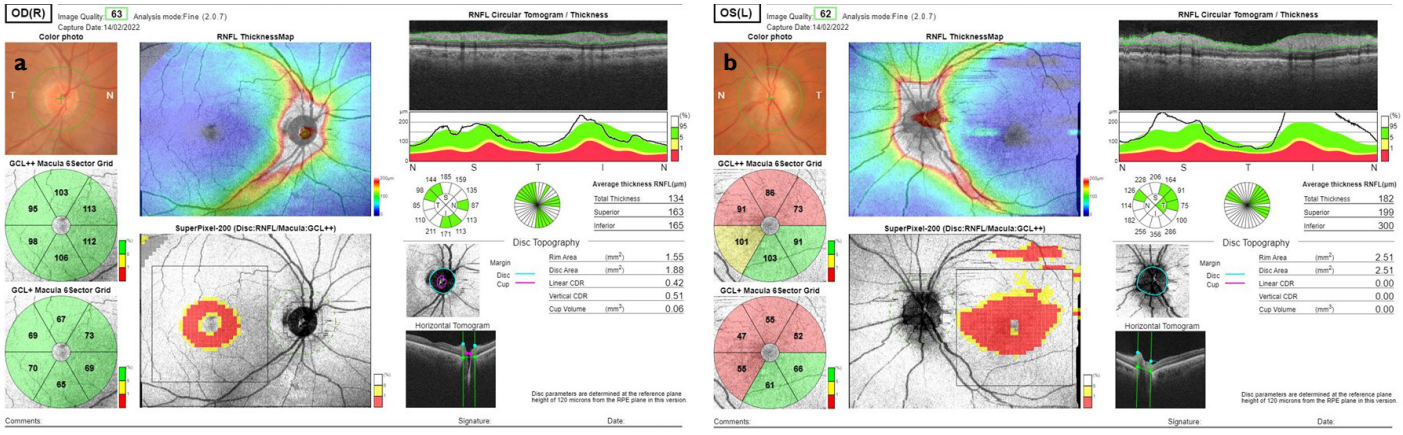

Figure 4. Optic nerve head optical coherence tomography (OCT) of the right eye **(a)** and left eye **(b)**. OCT analyses of both eyes **(a and b)** showing an increase in the peripapillary retinal nerve fiber layer's thickness. Ganglion cell complex analysis of the left eye **(b)** depicting ganglion cell layer loss

verting-enzyme 2 receptor and lead to endothelial dysfunction which can cause a tendency to a procoagulant state and result in ischemia (9). Severe inflammation can damage multiple organs and systems, while increased thrombin production and decreased fibrinolysis are the main factors responsible for the hypercoagulable state (10). Hypercoagulability and endothelial damage-associated hypoperfusion can result in ischemia in various organs and cause complications such as pulmonary embolism, strokes, or myocardial infarct (11). These pathogenetic factors can contribute to the reduction of the blood supply to the optic disc and result in NA-AION as in our patient.

Several cases of NA-AION associated with the COVID-19 vaccine have been described in the literature. However, these studies have suggested that it is uncertain whether the association of ischemic optic neuropathy and COVID-19 vaccination is coincidental or causal (12-15). On the other hand, post-COVID-19 infection-related NA-AION is uncommon, in three case reports the NA-AION are unilateral (10, 16, 17). The authors have suggested that COVID-19 infection-related significant hypercoagulability and hypoxemia may cause lack of perfusion to the optic nerve resulting in ischemic optic neuropathy (16,17). Furthermore, previous studies have indicated that high levels of circulating immune complex (viral antigen-antibodies) may be responsible for the pathogenesis of viral infection (hepatitis B and C infection, etc.,) related-optic neuropathy (18). In a recent case report by Sanoria et al., (19) a 45-year-old male was reported to have bilateral NA-AION following an episode of COVID-19, 1 month back like in our case. Furthermore, like our case, he noticed blurring in one eye first and 2 weeks later, he was reported to develop similar complaints in the other eye. The authors suggested that time lag of a month between acute infection and neuropathy manifestation could be explained by the immune-mediated mechanisms which could be the reason for perfusion compromise of the optic nerve.

To date there is no well-proven, accepted effective treatment for NAION. The efficiency of oral steroid treatment in NAION is still under debate and intravenous steroid treatment could potentially cause serious adverse effects. In a study by Rebolleda et al. (20) among patients diagnosed with NAION, it was reported that corticosteroids did not show a better visual acuity or visual field outcomes. Furthermore, they reported serious systemic complications including severe depression. They also reported that, in their study, patients treated with corticosteroids developed a NAION in their fellow eye more than the untreated group. They suggested that corticosteroid treatment could predispose to the development of NAION in fellow eyes with a disk "at risk."

Conclusion

Severe COVID-19 infection may be responsible for NA-AION, Therefore, ophthalmologists should be aware of the this rare neuro-ophthalmological complication related to severe COVID-19 infection. Furthermore, recent history of COVID-19 infection should be inquired in detail and other NA-AION causes should be excluded by the clinicians before a diagnosis of COVID-19-related NA-AION is made.

Disclosures

Informed consent: Written informed consent was obtained from the patient for the publication of the case report and the accompanying images.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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References

1. Javanian M, Bayani M, Shokri M, Sadeghi-Haddad-Zavareh M, Babazadeh A, Ghadimi R, et al. S. Risk factors for mortality of 557 adult patients with COVID 19 in Babol, Northern Iran: A retrospective cohort study. Bratisl Lek Listy 2021;122:34–8.
2. Wu P, Duan F, Luo C, Liu Q, Qu X, Liang L, et al. Characteristics of ocular findings of patients with Coronavirus disease 2019 (COVID-19) in Hubei Province, China. JAMA Ophthalmol 2020;138:575–8. [CrossRef]
3. Sharma A, Kudchadkar US, Shirodkar R, Usgaonkar UP, Naik A. Unilateral inferior altitudinal visual field defect related to COVID-19. Indian J Ophthalmol 2021;69:989–91. [CrossRef]
4. Sen M, Honavar SG, Sharma N, Sachdev MS. COVID-19 and eye: A review of ophthalmic manifestations of COVID-19. Indian J Ophthalmol 2021;69:488–509. [CrossRef]
5. Favas TT, Dev P, Chaurasia RN, Chakravarty K, Mishra R, Joshi D, et al. Neurological manifestations of COVID-19: A systematic review and meta-analysis of proportions. Neurol Sci 2020;41:3437–70. [CrossRef]
6. Babazadeh A, Barary M, Ebrahimpour S, Sio TT, Afshar ZM. Non-arteritic anterior ischemic optic neuropathy as an atypical feature of COVID-19: A case report. J Fr Ophtalmol 2022;45:e171–3. [CrossRef]
7. Choudhary S, Sharma K, Silakari O. The interplay between inflammatory pathways and COVID-19: A critical review on pathogenesis and therapeutic options. Microb Pathog 2021;150:104673. [CrossRef]
8. Becker RC. COVID-19 update: Covid-19-associated coagulopathy. J Thromb Thrombolysis 2020;50:54–67. [CrossRef]
9. Insausti-Garcia A, Reche-Sainz JA, Ruiz-Arranz C, Vazquez

AL, Ferro-Osuna M. Papillophlebitis in a COVID-19 patient: Inflammation and hypercoagulable state. Eur J Ophthalmol 2022;32:NP168–72. [CrossRef]
10. Golabchi K, Rezaee A, Aghadoost D, Hashemipour M. Anterior ischemic optic neuropathy as a rare manifestation of COVID-19: A case report. Future Virol 2021;17:71–6. [CrossRef]
11. Klok FA, Kruip MJ, van der Meer NJ, Arbous MS, Gommers DA, Kant KM, et al. Incidence of thrombotic complications in critically ill ICU patients with COVID-19. Thromb Res 2020;191:145–7. [CrossRef]
12. Chung SA, Yeo S, Sohn SY. Nonarteritic anterior ischemic optic neuropathy following COVID-19 Vaccination: A case report. Korean J Ophthalmol 2022;36:168–70. [CrossRef]
13. Nachbor KM, Naravane AV, Adams OE, Abel AS. Nonarteritic anterior ischemic optic neuropathy associated with COVID-19 vaccination. J Neuroophthalmol. 2021 Dec 16. doi: 10.1097/WNO.0000000000001423. [Epub ahead of print]. [CrossRef]
14. Elhusseiny AM, Sanders RN, Siddiqui MZ, Sallam AB. Nonarteritic anterior ischemic optic neuropathy with macular star following COVID-19 vaccination. Ocul Immunol Inflamm 2022;30:1274–7. [CrossRef]
15. Franco SV, Fonollosa A. Ischemic optic neuropathy after administration of a SARS-CoV-2 vaccine: A report of 2 cases. Am J Case Rep 2022;23:e935095. [CrossRef]
16. Yüksel B, Bıçak F, Gümüş F, Küsbeci T. Non-arteritic anterior ischaemic optic neuropathy with progressive macular ganglion cell atrophy due to COVID-19. Neuroophthalmology 2021;46:104–8. [CrossRef]
17. Rho J, Dryden SC, McGuffey CD, Fowler BT, Fleming J. A case of non-arteritic anterior ischemic optic neuropathy with COVID-19. Cureus 2020;12:e11950. [CrossRef]
18. Korkmaz A, Karti DT, Bilgin YO, Karti O, Celebisoy N. Bilateral optic neuropathy revealing chronic hepatitis B infection: A report of a rare case. Neuroophthalmology 2020;45:403–6.
19. Sanoria A, Jain P, Arora R, Bharti N. Bilateral sequential non-arteritic optic neuropathy post-COVID-19. Indian J Ophthalmol 2022;70:676–9. [CrossRef]
20. Rebolleda G, Pérez-López M, Casas-LLera P, Contreras I, Muñoz-Negrete FJ. Visual and anatomical outcomes of non-arteritic anterior ischemic optic neuropathy with high-dose systemic corticosteroids. Graefes Arch Clin Exp Ophthalmol 2013;251:255–60. [CrossRef]