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Myelin oligodendrocyte glycoprotein antibody-associated optic neuritis with COVID-19 infection: A case report and literature review

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ABSTRACT

Purpose: To demonstrate the association between SARS-CoV-2 infection and MOG antibody associated optic neuritis.

Observations: A 35-year-old Thai woman presented with acute blurred vision of her left eye with pain on eye movement for six days and had dry cough for one week before the onset of visual loss. Her visual acuity was 20/32 in the right eye and counting fingers with a RAPD in the left eye. She had bilateral disc swelling, more prominent on the left eye. A CT scan of the brain and orbits showed swollen optic nerve sheath complex both eyes. Serology test was positive for serum anti-myelin oligodendrocyte glycoprotein (MOG) antibody. Her nasopharyngeal swab for SARS-CoV-2 PCR was also positive. The diagnosis of SARS-CoV-2 associated MOG antibody optic neuritis was made.

Conclusions and importance: This case of MOG antibody associated optic neuritis after COVID-19 infection, along with several other cases reported in the literature, suggests that there may be an association between COVID-19 infection and MOG antibody-associated disease. However, larger case-controlled studies are required to confirm this association.

1. Introduction

Coronavirus disease 2019 (COVID-19) outbreak caused by novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has been a concern for all countries. Ocular manifestations of COVID-19 include conjunctivitis, keratoconjunctivitis, uveitis and retinitis. Various neuro-ophthalmology conditions are associated with COVID-19, including optic neuritis.

2. Case report

Here we report a case of a 35-year-old Thai woman without a significant past medical history, presented with acute blurred vision of her left eye with pain on eye movement for six days. She denied a history of weakness, numbness, or other neurologic symptoms. Reviews of systems revealed dry cough for one week without fever or anosmia, before the onset of visual loss with no known COVID-19 contact. Her visual acuity was 20/32 in the right eye and counting fingers in the left eye. There was a RAPD in the left eye. Anterior and posterior segment examinations were unremarkable except for bilateral optic disc edema (more prominent in left eye). Her nasopharyngeal swab for SARS-CoV-2 PCR was positive. Due to the hospital's COVID-19 precaution guideline, an MRI scan was not permitted. However, a CT scan of the brain and orbits showed swollen optic nerve sheath complex of both eyes, more prominent in the left eye without definite enhancement. The brain parenchyma and other parts were unremarkable. Serum myelin oligodendrocyte glycoprotein (MOG) antibody (fix cell-based assay method) was sent based on the typical characteristic of bilateral optic disc swelling and optic nerve sheath involvement, which later returned positive. The antibody titer was not quantified. Serum aquaporin-4 antibody, anti-nuclear antibody, rheumatoid factor, and syphilis serology were all negative. Routine CSF analysis was negative for other infectious and inflammatory disorders, including SARS-CoV-2 PCR and MOG antibody. Chest X-ray revealed no active pulmonary disease. She

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Table 1
Details of nine case reports compared to our case of SARS-CoV-2 associated MOG antibody optic neuritis.

Author	Age	Sex	Underlying illness	Onset after COVID-19 symptoms	COVID-19 symptoms	Onset of optic neuritis	Laterality	Presenting visual acuity	CSF SARS-CoV-2 PCR	Treatment	Final visual acuity after admission
Zhou[1]	26	M	none	a few D	dry cough	3 D	OD > OS	OD HM OS 20/250	Negative	IVMP 5D followed by oral steroid	OU 20/50 at D 7 OU 20/30 at W 3
Sawalha[2]	44	M	none	2 W	shortness of breath and cough	1 W	OD > OS	OD 20/200 OS 20/30	NA	IVMP 5D followed by oral steroid	NA (significant improvement)
Khan[3]	11	M	none	2 W	a brief febrile illness and redness of both eyes	1-2 D	OD > OS	OD PJ OS 20/30	NA	IVMP 5D followed by oral steroid	OD 20/30 at D 10 OS 20/20 at D 10
Kogure[4]	47	M	post adrenal resection due to hyperaldosteronism, recurrent paranasal sinusitis	detected during admission	asymptomatic	NA	OS	OD NA OS 20/400	Negative	IVMP 3D followed by oral steroid	OS 20/200 at D 10 OS 20/16 at W 2
Zoric[5]	63	M	hypertension, diabetes mellitus	4 W	pneumonia CXR resolved before onset of optic neuritis	1 W	OD	OD 20/630 OS 20/20	NA	IVMP 5D followed by oral steroid	OD 20/63 at D 5 OD 20/25 at W 3
Woodhall[6]	39	F	MOG antibody optic neuritis (remission)	6 D	malaise, coryzal symptoms, sweating.	NA	OD	OD HM OS 20/20	NA	IVMP 5D followed by plasma exchange	OD 20/125 at W 2
Rojas-Correa[7]	69	M	diabetes mellitus	45 D	fever, rhinorrhoea, cough	NA (subacute)	OD > OS	OD 20/60 OS 20/30	Negative	IVMP 5D	OD 20/30 at D 5 OS 20/25 at D 5
de Ruijter[8]	15	M	none	2–3 W	fever, nausea, and a cough	7 D	OD > OS	OD 1/300 OS 1/70	NA	IVMP 3D	NA (almost fully improvement)
Jossy[9]	38	M	none	2 W and recurrent at 6 W	NA (mild symptom, home isolation)	5 D (2nd episode)	OS	OD 20/20 OS HM (2nd episode)	NA	IVMP followed by oral steroid for 1st episode; IVMP 3D followed by oral prednisolone as per ONTT protocol for 2nd episode	OS 20/20 at D 7 (2nd episode)
Our case	35	F	none	1 W	dry cough	6 D	OS > OD	OD 20/32 OS FC 2 ft	Negative	IVMP 5D followed by oral steroid	OU 20/30 at D 8 OD 20/25 at W 4 OS 20/20 at W 4

Abbreviation: M male, F female, CXR chest X-ray, D day, W week, OD right eye, OS left eye, OU both eye, PJ light projection, HM hand motion, FC finger count, Ft feet, CSF cerebrospinal fluid, SARS-CoV-2 severe acute respiratory syndrome coronavirus 2, COVID-19 Coronavirus disease 2019, PCR polymerase chain reaction, IVMP intravenous methylprednisolone, NA not available.

was diagnosed with SARS-CoV-2 associated MOG antibody optic neuritis (MOG-ON). The treatment included 1 g intravenous methylprednisolone for five days, followed by oral prednisolone with slow tapering, and oral favipiravir for five days. At eight days after treatment her visual acuity improved to 20/30 in both eyes. At four weeks after the onset, her visual acuity was 20/25 in the right eye and 20/20 in the left eye with residual subjective dyschromatopsia in the left eye.

3. Discussion

To our best knowledge, there have been nine reported cases of SARS-CoV-2 associated MOG-ON (Table 1).[1–9] Eight of nine were newly diagnosed MOG-ON. Only one report was a case with relapsing MOG-ON after COVID-19 infection.[6] We hypothesize that there might be an association with the first-episode MOG-ON and COVID-19 infection, in which the pathophysiology could be explained by the following two hypotheses. First, a molecular mimicry, in which the viral antigen triggers human antibodies directed toward endogenous central nervous system (CNS) myelin proteins, might explain the association. The process usually takes 5–10 days or 1–3 days for primary and secondary immune response, respectively. The supporting evidence is that, in most cases, the onset of optic neuritis followed the COVID-19 for at least a week. Second, SARS-CoV-2 may disrupt and increase permeability of blood-brain barrier by increased expression of pro-inflammatory cytokines, happened early after infection as seen in an animal model.[10] This allows entry of pre-existing circulating *anti*-MOG antibodies into CNS causing pathology. This hypothesis could explain the rapid onset of optic neuritis after the COVID-19 reported by Zhou et al.[1] However, MOG antibody-associated disease (MOGAD) has been believed to be mediated by an immune response to a non-specific post-viral infection since before the COVID-19 pandemic. Myelitis associated with MOG antibody is also related to post-infection and presents with prodromal symptoms up to 61%.[11] Therefore, it might be too early to conclude that MOG-ON is specifically associated with SARS-CoV-2 infection and requires a case-controlled study to evaluate the association. However, a small number of cases is probably a potential limitation of the study.

Although an MRI study was not performed in concern of SARs-CoV-2 contamination, we believe the CT scan showing optic nerve sheath complex abnormalities was sufficient to support the clinical diagnosis of optic neuritis and exclude other causes of optic neuropathy. Patients

with MOG-ON tended to respond to intravenous methylprednisolone treatment rapidly and dramatically as seen in this case as well as other reports. Most previous reports including ours did not show that corticosteroid treatment worsen COVID-19 symptoms.

4. Conclusion

In summary, MOG-ON may be associated with SARS-CoV-2 infection. Ophthalmologist should ask the recent history of COVID-19 and should be aware for the possible concurrent SARs-CoV-2 infection in patients presenting with MOG-ON. The treatment of MOG-ON should not be delayed in COVID-19 patients. Prompt corticosteroid treatment provides excellent outcomes with minimal complications in all patients.

Authorship

All authors attest that they meet the current ICMJE criteria for Authorship. Buravej Assavapongpaiboon: Conceptualization, Data Curation, Writing - Original draft, Supanut Apinyawasisuk: Conceptualization, Writing – Review & Editing, Validation, Supharat Jariyakosol: Conceptualization, Writing – Review & Editing, Supervision.

Patient consent

The patient consented to the publication of the case verbally. This report does not contain any personal information that could lead to the identification of the patient.

Declaration of competing interest

All authors have no financial disclosures.

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References

1. Zhou S, Jones-Lopez EC, Soneji DJ, Azevedo CJ, Patel VR. Myelin oligodendrocyte glycoprotein antibody-associated optic neuritis and myelitis in COVID-19. *J Neuro Ophthalmol*. Sep 2020;40(3):398–402. https://doi.org/10.1097/WNO.0000000000001049.
2. Sawalha K, Adeodokun S, Kamoga GR. COVID-19-Induced acute bilateral optic neuritis. *J Investig Med High Impact Case Rep*. Jan-Dec 2020;8. https://doi.org/10.1177/2324709620976018, 2324709620976018.
3. Khan A, Panwala H, Ramadoss D, Khubchandani R. Myelin oligodendrocyte glycoprotein (MOG) antibody disease in a 11 Year old with COVID-19 infection. *Indian J Pediatr*. May 2021;88(5):488–489. https://doi.org/10.1007/s12098-020-03656-7.
4. Kogure C, Kikushima W, Fukuda Y, et al. Myelin oligodendrocyte glycoprotein antibody-associated optic neuritis in a COVID-19 patient: a case report. *Medicine (Baltim)*. May 14 2021;100(19), e25865. https://doi.org/10.1097/MD.0000000000025865.
5. Zoric L, Rajovic-Mrkic I, Colak E, Miric D, Kisic B. Optic neuritis in a patient with seropositive myelin oligodendrocyte glycoprotein antibody during the post-COVID-19 period. *Int Med Case Rep J*. 2021;14:349–355. https://doi.org/10.2147/IMCRJ.S315103.
6. Woodhall M, Mitchell JW, Gibbons E, Healy S, Waters P, Huda S. Case report: myelin oligodendrocyte glycoprotein antibody-associated relapse with COVID-19. *Front Neurol*. 2020;11:598531. https://doi.org/10.3389/fneur.2020.598531.
7. Rojas-Correa DX, Reche-Sainz JA, Insausti-García A, Calleja-García C, Ferro-Osuna M. Post COVID-19 myelin oligodendrocyte glycoprotein antibody-associated optic neuritis. *Neuro Ophthalmol*. 2021:1–7. https://doi.org/10.1080/01658107.2021.1916044.
8. de Ruijter NS, Kramer G, Gons RAR, Hengstman GJD. Neuromyelitis optica spectrum disorder after presumed coronavirus (COVID-19) infection: a case report. *Mult Scler Relat Disord*. Nov 2020;46:102474. https://doi.org/10.1016/j.msard.2020.102474.
9. Jossy A, Jacob N, Sarkar S, Gokhale T, Kaliaperumal S, Deb AK. COVID-19-associated optic neuritis - a case series and review of literature. *Indian J Ophthalmol*. Jan 2022;70(1):310–316. https://doi.org/10.4103/ijo.IJO_2235_21.
10. Blanco-Melo D, Nilsson-Payant BE, Liu WC, et al. Imbalanced host response to SARS-CoV-2 drives development of COVID-19. *Cell*. May 28 2020;181(5):1036–1045. https://doi.org/10.1016/j.cell.2020.04.026. e9.
11. Dubey D, Pittock SJ, Krecke KN, et al. Clinical, radiologic, and prognostic features of myelitis associated with myelin oligodendrocyte glycoprotein autoantibody. *JAMA Neurol*. Mar 1 2019;76(3):301–309. https://doi.org/10.1001/jamaneurol.2018.4053.