New-onset MOGAD after first-dose SARS-CoV-2 mRNA vaccination with relapse following SARS-CoV-2 mRNA booster

Myelin oligodendrocyte glycoprotein–associated disorder (MOGAD) is a rare cause of acute optic neuritis in the world of neuroimmunology and neuro-ophthalmology with an incidence of 0.16 per 100,000 people.[1] As an autoimmune disease, this particular entity is known to be triggered by stressors in the body, including infections, metabolic insults, and recent operative interventions.[2] Following the development of immunization of SARS-CoV-2, suspicion abounded regarding adverse reactions and long-term effects. We present the case of bilateral sequential optic neuritis due to MOGAD after the first dose mRNA vaccination in a patient who previously contracted COVID-19 and who developed a relapse after booster administration. To our knowledge, this is the first case of MOGAD following first-dose immunization with relapse following booster.

A 45-year-old white female with a history of asthma and dyslipidemia presented to the hospital for further evaluation of bilateral sequential progressive vision loss. She described gradual reduction in vision in her left eye that also involved loss of colour saturation and pain with eye movement. She was seen by outpatient ophthalmology, where outpatient brain magnetic resonance imaging was ordered. However, after 3 weeks, the patient noted worsening of her left eye vision and development of reduced vision in her right eye. This prompted her to present to the hospital for acute evaluation.

On further questioning, the patient denied any previous episodes of neurologic symptoms or reduced visual acuity. She relayed that she contracted COVID-19 in July 2020 and recovered without residual symptoms. In March 2021 she received her first dose of mRNA vaccine against COVID-19 and first noticed reduction in visual acuity in her left eye approximately 2 weeks thereafter. Reduction in right eye visual acuity began 2 weeks after her second dose.

On examination, the patient had no overt neurologic deficits aside from her vision. Best-corrected visual acuity was noted to be 20/200 OD and 20/70 OS. Colour saturation was reduced in the left eye as well. She continued to report pain with eye movement.

The patient underwent imaging of the brain and spine, which was unremarkable. Magnetic resonance imaging of the orbits revealed subtle enhancement involving the retrobulbar fat surrounding the optic nerves as well as bilateral optic nerve hyperintensity and enhancement predominantly involving the infraorbital and orbital apex segments with relative sparing of the prechiasmatic optic nerves, consistent with acute bilateral optic neuritis. Serologic testing for infectious, autoimmune, and inflammatory disorders was dispatched on presentation. The patient underwent a lumbar puncture with cerebrospinal fluid analysis that demonstrated elevated myelin basic protein but otherwise was unremarkable. Serologic examination for aquaporin-4 antibody was negative, whereas myelin oligodendrocyte glycoprotein antibody returned positive with a titer of 1:1000 (normal, 1:20), confirming the diagnosis of MOGAD.

The patient was started on intravenous corticosteroid therapy followed by plasmapheresis with good response. Her visual acuity improved to 20/40 OD and 20/40 OS. She did not develop any further symptoms throughout her hospital stay and was discharged in improved condition with outpatient neuro-ophthalmology follow-up. She was trialed on rituximab alongside prednisone doses but suffered numerous relapses on this regimen. Her vision OD eventually returned to baseline at 20/20 with intact colour vision on Ishihara colour plates. However, objectively and subjectively, her vision OS never fully recovered following her first attack. Throughout her course, the best visual acuity OS was 20/25 OS, and it would fluctuate during relapses, ranging from 20/30 to 20/40 with variable colour vision and visual field defects. Her subsequent relapses solely involved her vision, often involving OS only. She never developed other neurologic symptoms. She was subsequently transitioned to monthly infusions of intravenous immunoglobulin (IVIG) therapy in October 2021 in accordance with Chen et al.[3]

Her vision had remained stable on IVIG 1 g/kg every 4 weeks. Then, in February 2022, she reported subjective worsening of her vision bilaterally 3 weeks after receiving an mRNA booster. She did not alert our office and was seen routinely in March 2022. At that visit, her subjective symptoms had improved overall; visual acuity was 20/20 OD and 20/25 OS, but her colour vision was worse OS (1 of 14 versus 6 of 14 Ishihara colour plates at the previous visit in January 2022), and visual field testing showed a new, mild inferior central scotoma OS that was not present at her previous visit in January 2022. IVIG dosing was subsequently increased with improvement. On subsequent follow-ups, the patient denied further relapse. Her last visual acuity was 20/20 OD and 20/25 OS in August 2022, with improved visual field testing and colour plates (14/14 OD, 9/14 OS) and residual OS > OD optic atrophy Figure 1.

With the advent of the COVID-19 pandemic and the subsequent development of novel mRNA vaccines, anxieties and concerns abound regarding their respective ramifications.[4,5] This is further exacerbated when we consider demyelinating disorders, which in several respects are still being studied and further described. Among these, MOGAD has proven to be an often underdiagnosed and undertreated neuro-ophthalmologic disease. With proper evaluation and diagnostic considerations, MOGAD is known to be quite responsive to therapy. However, its heterogeneous presentations, coupled with underutilization of

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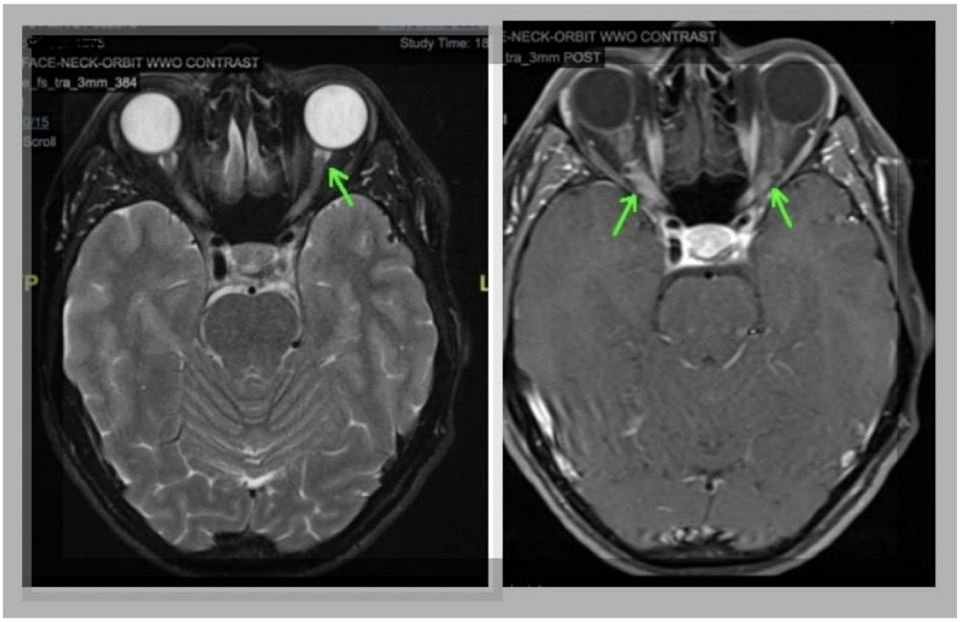

Fig. 1—A) T_2 sequence demonstrates increased signal of the optic nerves. (B) Gadolinium-enhanced magnetic resonance imaging sequence demonstrates enhancement of the bilateral optic nerves. Retrobulbar fat surrounding the optic nerves also demonstrates enhancement. Diffusion restriction (not pictured) was evident on diffusion-weighted imaging in the intraorbital and orbital apex segments of the optic nerves with relative sparing of the prechiasmatic optic nerves.

neurology and neuro-ophthalmology specialists to assist with work-up, have caused misdiagnoses and delays in treatment. Following the COVID-19 pandemic, a newfound appreciation for rare entities and rare presentations is beginning to take root.

Several cases of acute demyelinating processes have been detected in patients shortly after receiving COVID-19 mRNA vaccinations.[4,5] The age spectrum includes pediatric and adult cohorts. Given that MOGAD can precipitate all manner of acute neurologic deficits, symptomatology is often attributed to a form of multiple sclerosis. Worse yet, symptoms might be altogether written off as vague "adverse effects" of vaccination without seeking further evaluation. A few cases of acute focal neurologic deficits have prompted further evaluation, with eventual antibody testing confirming MOGAD. However, most of these reports have involved monophasic disease presentations. To our knowledge, our case demonstrates the classic symptom presentation of bilateral sequential optic neuritis in a diphasic manner. The importance of this specific presentation is paramount because it should clue in both neurologists and non-neurologists alike to the possibility of MOGAD. With the advent of COVID-19, physicians have become more aware of atypical presentations of numerous conditions in the setting of infection or inoculation. This case features a rare presentation of MOGAD following the administration of an mRNA vaccination with relapse following administration of a booster dose. MOGAD is known for relapses, but the temporal association of the patient's immunizations is not proof of causation. Thus clinicians should be aware of a potential association between MOGAD and COVID-19 immunizations.

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Footnotes and Disclosure

The authors have no proprietary or commercial interest in any materials discussed in this article.