



A Case of Atypical Unilateral Optic Neuritis Following BNT162b2 mRNA COVID-19 Vaccination

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Abstract

Background: We report a case of atypical unilateral optic neuritis after receiving BNT162b2 mRNA-based COVID-19 vaccine.

Case Report: An 86-year-old man complained of blurred vision and decreased visual acuity in the right eye 8 days after receiving the second BNT162b2 mRNA-based COVID-19 vaccine, and was referred to our hospital. He also had pain with eye movement. Best Corrected Visual Acuity (BCVA) in the right eye was 20/200 and critical flicker frequency dropped to 16 Hz. Relative afferent pupillary defects was positive, and cecocentral scotoma were observed. Fundus examination and SD-OCT revealed optic disc swelling and apparent thickening of the retinal nerve fiber layer around the optic disc in the right eye. However, since either increase in CRP or ESR on laboratory tests, demyelinating lesion on MRI, or positive of anti-MOG antibodies or anti-AQP4 antibodies were not observed, we diagnosed atypical optic neuritis developed after SARS-CoV-2 mRNA-based vaccination.

Conclusion: Ophthalmologists and physicians should be aware about the risk of atypical optic neuritis after COVID-19 vaccination.

Keywords: COVID-19; Optic neuritis; mRNA vaccine; Vaccination

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Abbreviations

COVID-19: Coronavirus Disease 2019; SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2; mRNA: Messenger Ribonucleic Acid; BCVA: Best-Corrected Visual Acuity; OD: Right Eye; OS: Left eye; IOP: Intraocular Pressure; CFF: Critical Flicker Frequency; RAPD: Relative Afferent Pupillary Defect; SD-OCT: Spectral Domain Optical Coherence Tomography; ESR: Erythrocyte Sedimentation Rate; CRP: C-Reactive Protein; MOG: Myelin Oligodendrocyte Glycoprotein; AQP4: Aquaporin 4; MRI: Magnetic Resonance Imaging

Background

Coronavirus Disease 2019 (COVID-19) remains rampant worldwide, and development of vaccines against the causative virus Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has progressed rapidly as an urgent demand. Several vaccines have been approved for emergency use for the prevention of COVID-19. Vaccination is being promoted with priority given to older people and adults at risk of severe COVID-19. However, immunological adverse events of COVID-19 vaccines have not been fully investigated. BNT162b2 is a nucleoside-modified mRNA vaccine that encodes the SARS-CoV-2 spike glycoprotein [1]. We report a case of atypical unilateral optic neuritis after receiving BNT162b2 mRNA-based COVID-19 vaccine.

Case Presentation

An 86-year-old man complained of blurred vision and decreased visual acuity in the right eye 8 days after receiving the second BNT162b2 mRNA-based COVID-19 vaccine, and visited a local eye clinic. Since the patient was also aware of pain with eye movement, he was referred to our hospital on suspicion of optic neuritis. He had a history of arrhythmia. At presentation, the best-corrected visual acuity (BCVA) was 20/200 in the Right Eye (OD) and 20/20 in the Left Eye (OS), and Intraocular Pressure (IOP) was 14 mmHg OD and 15 mmHg OS. Critical Flicker Frequency (CFF) was 16 Hz OD and 47 Hz OS. Examination of the right eye showed Relative Afferent Pupillary Defect (RAPD) and cecocentral scotoma. Fundus examination and Spectral Domain Optical Coherence Tomography (SD-OCT) revealed optic disc swelling and apparent thickening of the retinal nerve fiber layer around the optic disc in the right eye. However, fluorescein angiography

showed only hyperfluorescence of the right optic disc, and no findings such as papillary deficiency and choroidal delay that would suggest ischemic optic neuropathy. Alternatively, laboratory tests including Erythrocyte Sedimentation Rate (ESR) and C-Reactive Protein (CRP) showed no abnormal values. Anti-Myelin Oligodendrocyte Glycoprotein (MOG) antibody or anti-Aquaporin 4 (AQP4) antibody test was also negative. Intracranial MRI indicated neither contrast-enhanced effect of gadolinium on the optic nerve nor abnormalities such as demyelinating lesions. Since neither idiopathic optic neuritis nor ischemic optic neuropathy could be diagnosed, we considered the side effects of BNT162b2 mRNA-based COVID-19 vaccine. Since slight reduction of optic disc swelling in the right eye was observed on SD-OCT during a week, the patient was followed-up without any medication. One month later, optic disc swelling and the difference between right and left thickening of the retinal nerve fiber layer around the optic disc were completely resolved, and BCVA recovered to 20/100 OD. However, no further improvement was obtained. There was no inflammation in the left eye during these events.

Discussion and Conclusion

The risk of developing CNS demyelinating diseases including optic neuritis after vaccination has been reported to be 0.1% [2]. Regarding COVID-19 vaccination, acute disseminated encephalomyelitis and acute transverse myelitis have been reported [3-5]. Leber reported a case of acute thyroiditis and binocular optic neuritis after COVID-19 vaccination [6]. Hence, it is possible that optic neuritis in this case may be induced by BNT162b2 mRNA-based COVID-19 vaccination. In this case, although there were eye movement pain and cecentral scotoma suggestive of optic neuritis, either increase in CRP or ESR on laboratory tests, demyelinating lesion on MRI, or positive of anti-MOG antibodies or anti-AQP4 antibodies were not observed, which was atypical for optic neuritis. The mechanism by which vaccines cause optic neuropathy has not been elucidated, but molecular mimicry of viral proteins and immunological involvement of adjuvants have been suggested [2]. As such, inflammation based on the immune responses induced by COVID-19 vaccines may occur in any ocular region. In fact, onset of several types of uveitis following BNT162b2 mRNA COVID-19 vaccination has been reported [7,8]. Although further accumulation of cases is required to examine the conceivable relationship and mechanism, optic neuritis reported here may have been induced by BNT162b2 mRNA COVID-19 vaccination. Further caution should be taken as vaccination, including the use of

other types of COVID-19 vaccines, will become more widespread worldwide in the future.

In conclusion, we encountered a case of unilateral atypical optic neuritis occurring after the second BNT162b2 mRNA-based COVID-19 vaccination. Warning should be given to ophthalmologists and physicians about the risk of atypical optic neuritis after COVID-19 vaccination.

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