



PHOTO ESSAY

## Facial and Abducens Nerve Palsies Following COVID-19 Vaccination: Report of Two Cases

Amirreza Veisi  <sup>a,b</sup>, Maryam Najafi <sup>a,b</sup>, Kiana Hassanpour <sup>a,b</sup>, and Abbas Bagheri <sup>a,b</sup>

<sup>a</sup>Ophthalmic Research Center, Research Institute for Ophthalmology and Vision Science, Shahid Beheshti University of Medical Sciences, Tehran, Iran; <sup>b</sup>Ophthalmic Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran

### ABSTRACT

A broad spectrum of neurological side effects has been reported after immunisation for COVID-19, including functional neurological disorders, cerebral vascular events, cerebral venous thrombosis, intracerebral haemorrhage, neuroleptic malignant syndrome, cranial nerve palsies, and otologic manifestations. Multiple cranial neuropathies have also been reported following vaccination in which involvement of VII nerve is the most prevalent, followed by the VI, III, and IV nerves. We describe two male patients, one with facial nerve palsy and the other with abducens nerve palsy following COVID-19 vaccination. The patient with facial nerve palsy received the AstraZeneca vaccine 2 days before the symptoms began. In contrast, the patient with the abducens palsy had received his first dose of the Sinopharm vaccine 7 days previously. Both patients demonstrated a gradual recovery within the next 2 months. Further studies are required to investigate the proper relationship between cranial nerve palsies and vaccinations.

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## Introduction

The rapid spread of SARS-CoV-2 infection throughout the world necessitated the fast development of vaccines. The World Health Organisation authorised the use of many COVID-19 vaccines before completing all phases of clinical trials. Therefore, the adverse effects of the COVID-19 vaccines are now being recognised and reported, particularly cranial neuropathies.<sup>1</sup> Commonly, they affect sense and movement in the face and eyes area.<sup>2</sup> The usual causes of cranial neuropathies mainly include diabetes mellitus, high blood pressure, trauma, viral infections, strokes, and brain tumours.<sup>3,4</sup> Abducens nerve palsy is the most common isolated ocular motor nerve palsy,<sup>5,6</sup> and results in inward ocular deviation and diplopia.

Facial nerve paralysis is a cranial neuropathy that is most widely idiopathic or related to infectious diseases, trauma, neoplasms, microvascular diseases, and congenital disorders. Bell's palsy is an isolated unilateral rapid onset facial paresis or paralysis.<sup>7</sup> It is more common in people aged 15 to 45 years. Hypertension, pre-eclampsia, pregnancy, diabetes

mellitus, immunocompromised state, obesity, and upper respiratory viral infection are identified risk factors for Bell's palsy.<sup>7</sup>

Though rare, vaccination is another proposed cause of cranial neuropathy.<sup>8</sup> Other than the VII nerve, vaccine-related palsies of cranial nerves most commonly involve the VI nerve followed by the III and IV nerves. Still, other cranial nerves could also be affected.<sup>8</sup> Similar to other vaccines, various reports have demonstrated the association between cranial nerve palsies and COVID-19 vaccination.<sup>9–12</sup> Herein, we report two patients, one with facial nerve palsy and the other with abducens nerve palsy shortly after COVID-19 vaccination.

## Case presentation

### Patient 1

A 65-year-old man went to the emergency room due to a feeling of weakness on the left side of his face, ocular foreign body sensation, and a decrease in the sense of taste. He had received the first dose of the AstraZeneca COVID-19 vaccine in his left 2 days previously. He had a past medical history of



**Figure 1.** Left facial nerve palsy in patient 1, 2 days after COVID-19 vaccination. (a) Partial loss of the nasolabial fold and an asymmetrical smile. (b) Incomplete eye closure and lack of ability to raise the forehead on the involved side.

hypertension, hyperlipidaemia, and ischaemic heart disease, for which he was taking aspirin, warfarin, atorvastatin, and losartan. He did not smoke or consume alcohol. He did not mention a history of oral or ocular herpes simplex virus (HSV1).

On examination he had a left-sided peripheral facial paresis (Figure 1) but the rest of the neurological examination was normal. He had no auricular pain and there were no lesions in his external ear canal. Slit-lamp examination revealed mild corneal epitheliopathy in the lower third of the left cornea. Bell's phenomenon was good.

Routine blood tests were unremarkable. He tested negative for COVID-19 on a polymerase chain reaction test. Systemic workup for sarcoidosis, tuberculosis, and human immunodeficiency revealed normal results. Since Iran is not endemic for Lyme disease, the test was not ordered. Magnetic resonance imaging (MRI) of the brain was unremarkable.

He was diagnosed with an isolated facial nerve palsy following vaccination. Frequent ocular lubricants were prescribed. His exposure keratopathy improved after starting ocular lubricant therapy and the facial nerve palsy spontaneously recovered over the next 2 months.

### Patient 2

A 55-year-old male patient presented to the clinic complaining of double vision and eye deviation 7 days after receiving the first dose of

the Sinopharm COVID-19 vaccine injection in his arm. His past medical history and past drug history were negative. He was not a smoker or alcohol user. His examination demonstrated a right face turn and 50% limitation in abduction from the midline with esotropia in his right eye, confirming the diagnosis of an abducens nerve paresis (Figure 2). On deviometry examination, he had an esotropia of 20 prism dioptres (PD) and 14 PD at distance and near, respectively. His diplopia and right esotropia increased on right gaze and was eliminated on left gaze. Other anterior and posterior ocular examinations were within normal limits. He underwent brain and orbital MRI, that was unremarkable. He was closely followed without treatment. His diplopia, right esotropia, and abduction deficiency completely improved within 2 months (Figure 2).

### Discussion

One year after the pandemic of COVID-19, a number of vaccines have been authorised for emergency use by many countries. Due to concern about the safety of SARS-CoV-2 immunisation, any adverse events associated with COVID-19 vaccines are being monitored for. Functional neurological disorders, cerebral vascular events, intracerebral haemorrhage, neuroleptic malignant syndrome, and otologic manifestations are among the reported



**Figure 2.** Abducens nerve palsy in patient 2, 7 days after COVID-19 vaccination. The top row demonstrates a small esotropia in the primary position and 50% limitation in abduction of the right eye. The esotropia and abduction deficiency had resolved 2 months later (bottom row).

events. We have described two patients with facial and abducens nerve palsies, respectively following recent vaccination against the SARS-CoV-2 virus.

Though the exact pathophysiology to explain the association between cranial nerve palsies and COVID-19 vaccination remains unknown, multiple hypothetical mechanisms exist. Since cranial nerve palsies have been reported both after COVID-19 infection<sup>13–15</sup> and vaccination,<sup>16</sup> an immune-mediated mechanism seems the most plausible. Alternatively, demyelination or localised vasculitis due to immune processes could damage the cranial nerves in their central or peripheral pathways. Regarding the well-known association between Bell's palsy and HSV1,<sup>17</sup> reactivation of HSV1 in the central nervous system is another possible mechanism to explain Bell's palsy. However, Brosh-Nissimov et al. could not find an HSV1 shedding in the oropharynx of patients receiving BNT162b2 mRNA vaccination.<sup>18</sup>

To date, cranial nerve palsies have been commonly reported following recent vaccination. Facial palsy is the most frequently involved cranial nerve, followed by the abducens nerve. Several vaccines, including measles-mumps-rubella, Hepatitis B, and influenza vaccine are associated with facial and abducens nerve palsies.<sup>19</sup> Different vaccines work by distinct methods to activate the body's immune response. Regardless of the method, cranial neuropathies have been commonly observed. Therefore, the pathophysiology of neuropathy might be unrelated to the type of vaccine and it seems more related to the patient's immune system common responses to antigens.

Bell's palsy has been consistently reported following COVID-19 vaccination. Wan et al. reported an increased risk of Bell's palsy through

a nested case-control study.<sup>20</sup> Of note, the analysis of a self-reporting database by Sato et al. confirmed the possible association between Bell's palsy and COVID-19 vaccination for another mRNA vaccine.<sup>21</sup> Regarding the possibility of increased risk of Bell's palsy, one case-control study challenged this finding. In their case-control study, Shermer et al. found no increased risk after matching among 37 cases with acute onset Bell's palsy and 74 matched controls who received the BNT162b2 vaccine.<sup>22</sup>

To the best of our knowledge, isolated abducens nerve palsy following COVID-19 vaccination has been rarely reported in the literature.<sup>10,12,23</sup> In the first study, Reyes-Capos et al. reported abducens nerve palsy 2 days after the Pfizer-BioNTech mRNA vaccine.<sup>10</sup> In contrast to the Reyes-Capos study, the type of vaccine used in our patient was based on inactivated virus. Therefore, ours is the first report of abducens nerve palsy following inactivated virus vaccine.

In conclusion, there is a possible association between cranial nerve palsies following COVID-19 vaccination. Further studies are needed to identify the possible mechanism.

#### Declaration of interest statement

No potential conflict of interest was reported by the authors.

#### Patient consent and ethics statement

The authors took the patients' permission to publish their information.

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## ORCID

Amirreza Veisi  <http://orcid.org/0000-0001-8304-3804>

## References

- Yuan P, Ai P, Liu Y, et al. Safety, tolerability, and immunogenicity of COVID-19 vaccines: a systematic review and meta-analysis. *medRxiv*. 2020. doi:10.1101/2020.11.03.20224998.
- Spies JM. Cranial and peripheral neuropathies. *Med J Aust.* 2001;174(11):598–604. doi:10.5694/j.1326-5377.2001.tb143451.x.
- Eviston TJ, Croxson GR, Kennedy PG, et al. Bell's palsy: aetiology, clinical features and multidisciplinary care. *J Neurol Neurosurg Psychiatry*. 2015;86(12):1356–1361. doi:10.1136/jnnp-2014-309563.
- Park UC, Kim SJ, Hwang JM, Yu YS. Clinical features and natural history of acquired third, fourth, and sixth cranial nerve palsies. *Eye (Lond)*. 2008;22(5):691–696. doi:10.1038/sj.eye.6702720.
- Elder C, Hainline C, Galetta SL, et al. Isolated abducens nerve palsy: update on evaluation and diagnosis. *Curr Neurol Neurosci Rep.* 2016;16(8):69. doi:10.1007/s11910-016-0671-4.
- Patel SV, Mutyal S, Leske DA, et al. Incidence, associations, and evaluation of sixth nerve palsy using a population-based method. *Ophthalmology*. 2004;111(2):369–375. doi:10.1016/j.ophtha.2003.05.024.
- Vakharia K, Vakharia K. Bell's palsy. *Facial Plast Surg Clin North Am.* 2016;24(1):1–10. doi:10.1016/j.fsc.2015.08.001.
- Woo EJ, Winiecki SK, Ou AC. Motor palsies of cranial nerves (excluding VII) after vaccination: reports to the US vaccine adverse event reporting system. *Hum Vaccin Immunother.* 2014;10(2):301–305. doi:10.4161/hv.27032.
- Repajic M, Lai XL, Xu P, Liu A. Bell's palsy after second dose of Pfizer COVID-19 vaccination in a patient with history of recurrent Bell's palsy. *Brain Behav Immun Health.* 2021;13:100217. doi:10.1016/j.bbih.2021.100217.
- Reyes-Capo DP, Stevens SM, Cavuoto KM. Acute abducens nerve palsy following COVID-19 vaccination. *JAAPOS*. 2021;25:302–303.
- Shemer A, Pras E, Hecht I. Peripheral facial nerve palsy following BNT162b2 (COVID-19) vaccination. *Isr Med Assoc J.* 2021;23:143–144.
- Pawar N, Ravindran M, Padmavathy S, Chakrabarty S. Acute abducens nerve palsy after COVID-19 vaccination in a young adult. *Indian J Ophthalmol.* 2021;69(12):3764–3766. doi:10.4103/ijo.IJO\_1968\_21.
- Dinkin M, Gao V, Kahan J, et al. COVID-19 presenting with ophthalmoparesis from cranial nerve palsies. *Neurology.* 2020 Aug 4;95(5):221–223. doi:10.1212/WNL.00000000000009700.
- Falcone MM, Rong AJ, Salazar H, et al. Acute abducens nerve palsy in a patient with the novel coronavirus disease (COVID-19). *JAAPOS*. 2020;24(4):216–217.
- Fitzpatrick JC, Comstock JM, Longmuir RA, et al. Cranial nerve III palsy in the setting of COVID-19 infection. *J Neuroophthalmol.* 2021;41(3):e286. doi:10.1097/WNO.0000000000001160.
- Elewa TK, Gaier ED, Haseeb A, et al. Adverse ocular events following COVID-19 vaccination. *Inflammation Res.* 2021;70:1–5. doi:10.1007/s00011-020-01419-w.
- Fu M X, Linda Tang M, Can Wang M, et al. A network meta-analysis to compare the efficacy of steroid and antiviral medications for facial paralysis from Bells palsy. *Pain Physician.* 2018;21:559–569.
- Brosh-Nissimov T, Sorek N, Yeshayahu M, et al. Oropharyngeal shedding of herpesviruses before and after BNT162b2 mRNA vaccination against COVID-19. *Vaccine.* 2021;39(40):5729–5731. doi:10.1016/j.vaccine.2021.08.088.
- Jeong N, Kim Y, Kim C, et al. Association between influenza vaccination and the risk of Bell's palsy in the Korean elderly. *Vaccines (Basel)*. 2021;9(7):746. doi:10.3390/vaccines9070746.
- Wan EYF, Chui CSL, and Lai FTT, et al. Bell's palsy following vaccination with mRNA (BNT162b2) and inactivated (CoronaVac) SARS-CoV-2 vaccines: a case series and nested case-control study. *Lancet Infect Dis.* 2022 Jan 1;22(1):64–72.
- Sato K, Mano T, Niimi Y, et al. Facial nerve palsy following the administration of COVID-19 mRNA vaccines: analysis of a self-reporting database. *Int J Infect Dis.* 2021;111:310–312. doi:10.1016/j.ijid.2021.08.071.
- Shemer A, Pras E, Einan-Lifshitz A, et al. Association of COVID-19 vaccination and facial nerve palsy: a case-control study. *JAMA Otolaryngol-Head Neck Surg.* 2021;147(8):739–743. doi:10.1001/jamaoto.2021.1259.
- Pereira A, Haslett RS. Acute abducens nerve palsy following the second dose of the AstraZeneca COVID-19 vaccine. *J Pediatric Ophthalmol Strabismus.* 2021 Nov 1;58(6):e49–50. doi:10.3928/01913913-20210920-01.