Acta Scientific Ophthalmology (ISSN: 2582-3191)

Volume 5 Issue 6 June 2022

Case Report

Incomplete Third Cranial Nerve Palsy Presenting with Binocular Diplopia and Strabismus in a Patient with COVID-19

Júlia N Widmer-Pintos[1]*, Sofía del-Pozo-Lérida[1], Consuelo Arnaldos-López[1], Noelia Barriga-Barrios[1], Laura Sararols-Ramsay[1], Hugo Gonzalez-Valdivia[2] and Mercè Guarro-Miralles[1]

[1]Ophthalmology Department, Hospital General de Granollers, Barcelona, Spain

[2]Ophthalmic Plastic and Reconstructive Surgery Unit, Hospital Sant Joan de Déu, Barcelona, Spain

***Corresponding Author:** Júlia N Widmer-Pintos, Ophthalmology Department, Hospital General de Granollers, Barcelona, Spain.

Received: April 27, 2022

Published: May 18, 2022

Abstract

Purpose: This paper aims to raise suspicion in clinicians for COVID-19 infection in the setting of a third nerve palsy of unknown origin.

Case Report: We report the case of a previously healthy 46-year-old male presenting with an acute onset of binocular diplopia, right eye strabismus, and right eye ptosis 1 day before being tested positive on an antigen test for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).

Outcome: The patient successfully recovered 1 week after oral corticosteroid treatment.

Conclusion: Our patient's case, together with other reported cases, adds evidence suggesting a correlation between SARS-CoV-2 infection and III cranial nerve palsy.

Keywords: COVID-19; SARS-CoV-2; Diplopia; III Cranial Nerve Palsy; Strabismus

Introduction

The III cranial nerve is responsible for the innervation of the inferior oblique, the inferior rectus, the medial rectus, the superior rectus, and the levator palpebrae superioris. Depending on whether all or only some functions are affected, the paralysis can be complete or incomplete. The extracranial portion of the nerve is supplied by the ophthalmic artery. Its position exiting the brainstem makes it susceptible to aneurysms pressing on it. The most common causes for this paralysis are brain aneurysms, microvascular and demyelinating diseases, brain tumors, and head injuries [1].

Since the SARS-CoV-2 outbreak in 2019, there has been an increasing number of neurologic manifestations that are thought to be caused by the neurotropism of the virus. Here we present the case of a III nerve incomplete paralysis possibly derived from Coronavirus Disease 2019 (COVID-19) [2,3].

Case Report

We present the case of a 46-year-old male presenting with an acute onset of horizontal binocular diplopia and right eye strabismus for 2 days. The patient had no allergies, no prior medical history, and was taking no medication. He had tested positive for SARS-CoV-2 one day before admission. His pupils were symmetric under room light at examination, being the right one non-reactive to light. He presented right eye exotropia in primary position, a limited adduction of the right eye, and right eye ptosis (Figure 1).

Besides this, the patient had no other symptoms. Given that the patient had no risk factors for microvascular diseases, a cranial computed tomography (CT) scan was performed to rule out an aneurysm. The CT scan found no signs of acute lesions nor signs of aneurysmatic dilations. Further imaging with magnetic resonance imaging (MRI) ruled out a demyelinating disease (Figures 2 and 3) and angiography confirmed the absence of aneurysms (Figure 4). After ruling out aneurysms as the cause of the nerve paralysis on the day of admission, corticosteroids were prescribed (1 g/day of methylprednisolone p.o. for 3 days). After two weeks the patient showed full recovery of the paralysis (Figure 5) and tested negative on the SARS-CoV-2 antigen test.

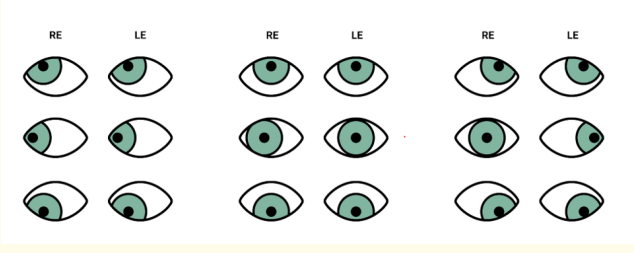


Figure 1: Schematic representation of patient's positions of gaze at presentation showing right eye exotropia in primary position and limited adduction of the right eye. RE: Right Eye; LE: Left Eye.

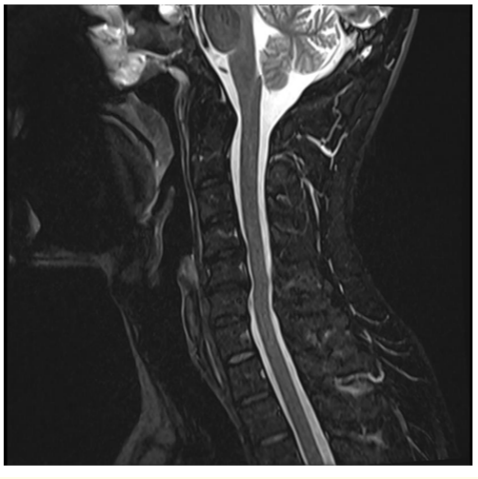
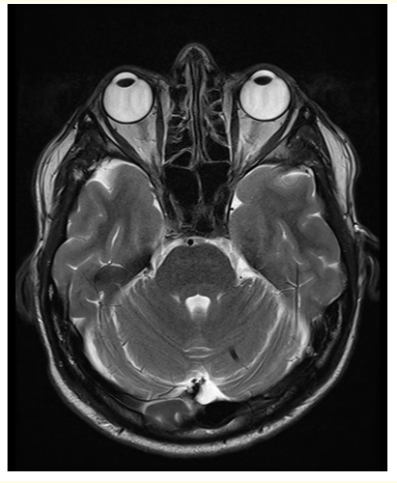


Figure 2: An MRI was performed to rule out demyelinating diseases. The analysis of the images showed no alterations.



Figures 3: An MRI was performed to rule out demyelinating diseases. The analysis of the images showed no alterations.

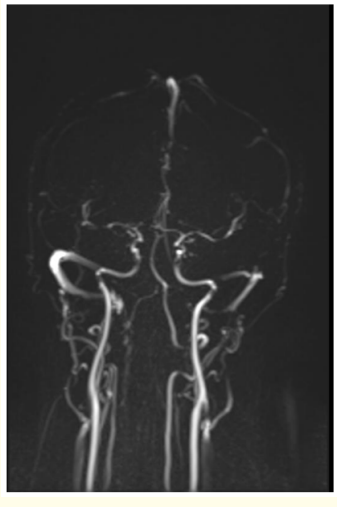


Figure 4: An angiography was performed to confirm the absence of aneurysms.

Discussion

Our patient received 1 g/day of methylprednisolone for 3 days, a treatment similar to others recommended in a comparable setting. Elenga., *et al*. used 2 mg/kg of prednisone per day for 10 days, calcium (500 mg once a day for 10 days), and vitamin D (440 UI once a day for 10 days) in a case of unilateral diplopia and ptosis

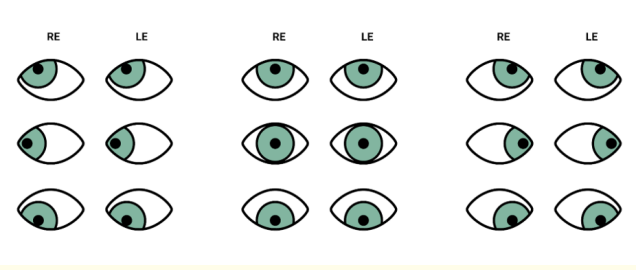


Figure 5: Schematic representation of patient's positions of gaze after two weeks showing full recovery. RE: Right Eye; LE: Left Eye.

in a child with COVID-19 [4]. Belghmaidi., *et al*. followed a regime of chloroquine (500 mg twice a day for 10 days) with azithromycin (500 mg once a day the first day, then 250 mg every day for 6 days), vitamin C (1g twice a day for 10 days) and zinc (90 mg twice a day for 10 days) [5] in a patient with a third cranial nerve palsy presenting with unilateral diplopia and strabismus, and Douedi., *et al*. chose to use a supportive treatment for COVID-19 and third cranial nerve palsy [6]. Full recovery was reached in all cases, which might suggest that a third cranial nerve palsy would resolve without specific treatment in cases of mild SARS-CoV-2 infection and a normal imaging study.

Since the SARS-CoV-2 outbreak in China in December 2019, many investigations regarding the virus mechanism of action have been conducted. Some of them show its affinity for the angiotensin-converting enzyme 2 (ACE2) receptor. This receptor is widely known to be found in lung tissue cells, but also in nervous tissue. ACE2 is expressed on nervous tissue cells like neurons (both excitatory and inhibitory neurons) and some non-neuron cells (mainly astrocytes and oligodendrocytes) in the human middle temporal gyrus and posterior cingulate cortex [7]. There is growing evidence that shows that COVID-19 variably causes neurologic manifestations prior, during, and even after the onset of common COVID-19 symptomatology [2,3]. Suggested mechanisms are direct SARS-CoV-2 infection to the nervous system, neuroinflammation, post-viral triggered autoimmune response, hypercoagulability, and metabolic or hypoxic injury [8]. Direct infection is thought to be favored by slow blood flow within the microcirculation and the high viral load in the initial sites of infection. This may make the interaction of the SARS-CoV-2 virus spike protein (S-protein) with ACE2 expressed in the capillary endothelium possible [9]. Two theories have been postulated regarding the entry mechanism of SARS-CoV-2 into the nervous system. The main theory states that SARS-CoV-2 probably uses the olfactory nerve fibers as the main entry route into the CNS, and induces neuronal cell death [8,10]. The other theory postulates that the virus could spread to the CNS through neural dissemination, using anterograde axonal transport [8]. Coronaviruses may alternatively cross into the CNS through a blood-brain barrier compromised by endothelial injury or endotheliitis, inflammatory mediators, transmigration of macrophages carrying the virus, or direct infection of the endothelial cells themselves [11].

These findings show us that, although the mechanism might not be clear yet, the virus is able to reach the CNS. This knowledge offers biological plausibility to the theory that SARS-CoV-2's entry into the CNS might be responsible for causing a III cranial nerve palsy in some cases.

Adding our experience to that of other authors reporting similar cases [4-6,12], we aim to raise suspicion of a COVID-19 infection in patients presenting a unilateral III cranial nerve palsy with little to no imaging findings, even in the setting of mild COVID-19 symptoms.

Conclusion

Together with other reported cases, our patient's case adds to evidence suggesting a correlation between SARS-CoV-2 infection and III cranial nerve palsy. It meets not all but some Bradford-Hill criteria for causation (temporality, biological plausibility, and coherence), which supports the need for further investigation on the neurological complications of a SARS-CoV-2 infection to establish a causation relationship.

Funding

No funding or grant support.

Conflicts of Interest

The authors have no financial disclosures.

Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

Patient Consent

Informed consent was obtained from the patient for reporting this case.

Acknowledgments

We thank Dr. Pintos-Morell for useful discussions and Martí Serra for providing us with technical support.

Bibliography

1. Radia M., *et al*. "Examination of a Third Nerve Palsy". *British Journal of Hospital Medicine* 78.12 (2017): C188-C192.
2. Niazkar H R., *et al*. "The Neurological Manifestations of COVID-19: A Review Article". *Neurological Sciences* 41.7 (2020): 1667-1671.
3. Carod-Artal F J. "Neurological Complications of Coronavirus and COVID-19". *Revista de Neurología* 70.9 (2020): 311-322.
4. Elenga N., *et al*. "Unilateral Diplopia and Ptosis in a Child with COVID-19 Revealing Third Cranial Nerve Palsy". *Journal of Infection and Public Health* 14.9 (2021): 1198-1200.
5. Belghmaidi S., *et al*. "Third Cranial Nerve Palsy Presenting with Unilateral Diplopia and Strabismus in a 24-year-old Woman with COVID-19". *The American Journal of Case Reports* 21 (2020): e925897-1.
6. Douedi S., *et al*. "Third Cranial Nerve Palsy due to COVID-19 infection". *Cureus* 13.4 (2021).
7. Chen R., *et al*. "The Spatial and Cell-Type Distribution of SARS-CoV-2 Receptor ACE2 in the Human and Mouse Brains". *Frontiers in Neurology* 11 (2021): 1860.
8. Armocida D., *et al*. "How SARS-Cov-2 can involve the central nervous system. A Systematic Analysis of Literature of the Department of Human Neurosciences of Sapienza University, Italy". *Journal of Clinical Neuroscience* 79 (2020): 231-236.
9. Keyhanian K., *et al*. "SARS-CoV-2 and Nervous System: from Pathogenesis to Clinical Manifestation". *Journal of Neuroimmunology* 350 (2021): 577436.
10. Zubair AS., *et al*. "Neuropathogenesis and Neurologic Manifestations of the Coronaviruses in the age of Coronavirus Disease 2019: A Review". *JAMA Neurology* 77.8 (2020): 1018-1027.
11. Aghagoli G., *et al*. "Neurological Involvement in COVID-19 and Potential Mechanisms: A Review". *Neurocritical Care* 34.3 (2021): 1062-1071.
12. Fitzpatrick JC., *et al*. "Cranial Nerve III Palsy in the Setting of COVID-19 Infection". *Journal of Neuro-Ophthalmology* 41.3 (2021): e286.