

Case of COVID-19-induced vestibular neuritis in a child

Sara Giannantonio , Alessandro Scorpecci, Berardo Montemurri, Pasquale Marsella

Audiology and Otorhinolaryngology Department, "Bambino Gesù" Children's Hospital, Rome, Lazio, Italy

Correspondence to

Dr Sara Giannantonio;
sara.giannantonio@opbg.net

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SUMMARY

Since the outbreak of the COVID-19 pandemic, there has been a growing need to fully understand all the possible clinical features of the epidemic, which often presents with unusual manifestations, especially in children. In this report, we describe the case of a child with a COVID-19 infection and suffering exclusively from vertigo and fever. Altogether, considering the clinical manifestation, laboratory tests and imaging, given the patient's positivity to SARS-CoV-2 infection and its neurotropic potential, we assumed that the child had COVID-19-induced vestibular neuritis, which, in consideration of the spontaneous improvement of symptoms, did not require any therapeutic adjustments, apart from the natural compensation of the central nervous system. This case suggests the importance of having an index of suspicion for a COVID-19 infection in patients with paediatrics presenting with vertigo and adds valuable information to the limited literature on COVID-19 presentation and management in children.

BACKGROUND

In December 2019, a new coronavirus, first called 2019-nCoV and then SARS-CoV-2 for severe acute respiratory syndrome-coronavirus-2, was identified in Wuhan, China.¹ SARS-CoV-2 has rapidly spread, causing the current COVID-19 pandemic, which as of 22 February 2021 has already killed 2.4 million people worldwide, with a recent further acceleration of new cases in the European region.²

Consequently, understanding the clinical manifestations of such pandemic has been a priority for the scientific world ever since. Pneumonia appears to be the most frequent and the most serious manifestation of a COVID-19 infection, presenting as fever, cough, dyspnoea and bilateral infiltrates on chest imaging.³ However, as in the case of other viral respiratory infections, COVID-19 may occur with other clinical features (such as conjunctivitis, fatigue, myalgia) and proved to have neurotropic properties, as some authors advocate that it may cause neurological manifestations, ranging from headache and loss of smell and taste, to confusion and disabling strokes.^{4,5}

Currently, little is known about the possible clinical implications of such infection on balance, and even less in the paediatric population.

In this report, we describe the case of a child with a COVID-19 infection and suffering exclusively from vertigo and fever.

CASE PRESENTATION

A 13-year-old boy, previously healthy, reported of sudden onset of fever, giddiness and repeated

vomiting on 20 October 2020. Due to the persistence and worsening of 'unsteadiness', his general practitioner referred him to the nearest emergency room the day after the onset of symptoms; in accordance with anti-COVID surveillance protocols, he immediately performed a nasopharynx swab, which tested positive for SARS-Cov-2 infection. Admitted to the COVID-19 ward with an initial diagnosis of dehydration, he then underwent further investigations: after 24 hours, the child had no longer fever, but continued to report of asthenia, extreme fatigue, mild photophobia, headache, nausea and dizziness. He described his vertigo as objective, lasting most of the day, present in rest conditions but mostly worsened by the movement of the head to the left side. He has never had breathing difficulties, no hearing loss or tinnitus, no disturbances of smell or taste. All the inflammatory markers, including erythrocyte sedimentation rate, C reactive protein and ferritin, were within normal limits and so were the coagulation parameters, including d-dimer, fibrinogen and platelet count. He had a blood pressure of 120/60 mm Hg, heart rate of 80/min, respiratory rate of 26/min, 100% oxygen saturation on room air. Vestibular examination, performed by the Ear-Nose-Throat specialist using Frenzel glasses, showed the presence of a spontaneous, horizontal-torsional grade III nystagmus with a rightward fast component, nonrhythmic, about 70 bpm, inexhaustible, visible even with visual fixation, although weaker. No further positioning manoeuvres were performed due to the finding of spontaneous nystagmus. Head impulse test (HIT) was performed as a reliable bedside differential diagnostic tool for peripheral vestibular deficiencies. The patient was clearly not able to generate the vestibuloocular reflex-driven fast contraversive eye movement and had to perform a corrective saccade to refixate the target when his head was turned horizontally and abruptly towards the left side. The remaining neurological evaluation demonstrated an intact cognition, intact fine finger movements and strength of upper limbs, except for the tendency to fall towards the left side, and, apart from the eighth, no other cranial nerve defects.

Transient-evoked acoustic otoemissions were bilaterally present, while it was not possible to perform pure tone audiometry due to problems of environmental disinfection. A brain MRI with contrast ruled out any acute findings: neither alterations of the brain parenchyma nor enhancements of the inner ear and/or IAC content was observed. Serology (IgG, IgM) and PCR for the main neurotropic viruses (herpes simplex virus (HSV)-1 and 2, Cytomegalovirus, Epstein Barr



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Case report

virus and adenovirus) gave negative results. During the 6 days of hospitalisation, the patient received an intravenous course of prednisone (20 mg for 5 days tapered over the following 5 days), administered according to clinical practice in our institution in the absence of high-level evidence⁶; his general conditions gradually improved, with a clear spontaneous reduction of the vertiginous symptoms. By day 6, the boy had spontaneous grade I-II nystagmus, a strong reduction of unsteadiness, no more nausea or vomiting. Therefore, the boy was discharged in good health, despite his persistent COVID positivity at molecular nasopharyngeal swab and serological testing, repeated every 48 hours throughout the patient's hospitalisation.

Altogether, considering the clinical manifestation, laboratory tests and imaging, the most likely diagnostic hypothesis was a left vestibular neuritis probably caused by SARS-CoV-2 infection, which, in consideration of the spontaneous improvement of symptoms, did not require any therapeutic adjustments, apart from the natural compensation of the central nervous system.

OUTCOME AND FOLLOW-UP

At 1-month reassessment (after having confirmed the negativity of the nasopharyngeal swab), the patient had completely recovered: he no longer had spontaneous nystagmus, the HIT was negative, and it was possible to perform a pure tone audiometry, which confirmed bilateral normal hearing.

DISCUSSION

Although not rare in absolute terms, the prevalence of balance disorders in children is low, ranging between 0.7% and 15% in general paediatric population.^{7,8} Vestibular neuritis (VN), defined as benign, self-limited vestibular imbalance, represents one of the most common causes of vertigo in children, especially among adolescents, accounting for about 16% of overall paediatric dizziness.⁹ The clinical findings in these patients are consistent with sudden, severe rotatory vertigo, lasting from few hours to few days, associated with nausea and vomiting, without hearing loss. On examination, they would demonstrate hypofunction of the affected labyrinthine canal, typically with a spontaneous horizontal-torsional nystagmus beating away from the lesion side, associated with unsteadiness characterised by a falling tendency towards the lesion side. In adults, abnormal HIT for the involved semicircular canals, ipsilesional caloric paresis, decreased responses of vestibular-evoked myogenic potentials during stimulation of the affected ear can also be detected.^{10,11} Despite a faster and better recovery with respect to the adults affected children often represent a diagnostic challenge, due to their inability to explain the characteristics of the experienced symptoms and the scarce reliability of vestibular tests in younger patients. A diagnosis of VN is largely based on the clinical presentation of an acute, sustained vestibular syndrome, since there are no specific diagnostic tests. Yet, even in the patient with the typical pattern of spontaneous nystagmus observed in VN, brain imaging is indicated when the patient has unprecedented headache, negative HIT, severe unsteadiness or no recovery within 1–2 days. With respect to the therapeutic aspect, although a role of steroids and vestibular rehabilitation has been advocated, VN often has a spontaneous resolution in children and their overall prognosis seems to be better than that in adults.¹² Recovery from VN is generally due to a combination of peripheral restoration of labyrinthine function, somatosensory and visual substitution, and central compensation.¹³

With respect to the etiopathogenesis, VN occurs most of the times subsequently or concurrently to a viral upper respiratory

infection resulting in a postviral inflammatory disorder affecting predominantly the superior vestibular portion of the eighth cranial nerve.¹² Many authors advocate the role of type 1 HSV-1 as the main cause of VN,^{13,14} either through a reactivation of a latent infection of the vestibular ganglia or through autoimmune and microvascular ischaemic insults to the vestibular labyrinth.¹⁵

Also SARS-CoV-2 is proved to invade the central nervous system, causing neurological disorders such as headache, dizziness and impaired consciousness, acute cardio-vascular disease, meningitis/encephalitis, acute necrotising haemorrhagic encephalopathy and acute Guillain-Barré syndrome.¹⁶ Though the underlying neurotropic mechanisms of the new coronavirus are yet to be fully established, it has been hypothesised that SARS-CoV-2 may affect the central nervous system through two direct mechanisms, that is, haematogenous dissemination or neuronal retrograde dissemination.⁵

Since serology and PCR have both ruled out a current or previous infection by one of the neurotropic viruses known to be responsible for VN, given the patient's positivity to SARS-CoV-2 infection and its neurotropic potential, we assumed that the child had COVID-19-induced VN.

Cases of SARS-CoV-2-related VN are reported in the literature: in adults,^{17–19} they generally appear to be associated with the typical systemic manifestations of the disease. Instead, in the only paediatric case published so far,²⁰ VN was the only symptom, consistent with the case report described here.

In conclusion, this case suggests the importance of having an index of suspicion for a COVID-19 infection in patients with paediatrics presenting with vertigo and no other SARS-CoV-2-associated symptoms and adds valuable information to the limited literature on COVID-19 presentation and management in children.

Learning points

- ▶ Although balance disorders are relatively rare in children, vestibular neuritis must be taken into account, as it represents one of the most common causes of paediatric dizziness.
- ▶ A diagnosis of vestibular neuritis is largely based on the clinical presentation of an acute, sustained vestibular syndrome; however, affected children often represent a diagnostic challenge, due to their inability to explain the characteristics of the experienced symptoms and the scarce reliability of vestibular tests.
- ▶ Since vestibular neuritis occurs as a postviral inflammatory disorder, it is currently critical to suspect a COVID-19 infection in patients with paediatrics presenting with vertigo, even in the absence of the hallmark symptoms of COVID-19 infection (fever, respiratory symptoms, hyposmia).

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ORCID iD

Sara Giannantonio <http://orcid.org/0000-0002-5982-2581>

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