Abstract: Neurologic manifestations of the 2019 novel coronavirus disease in children are varied. We present the case of a 9-month-old child with bulging anterior fontanelle caused by severe acute respiratory syndrome coronavirus-2.

Keywords: bulging anterior fontanelle; severe acute respiratory syndrome coronavirus-2; coronavirus disease 2019, children

CASE PRESENTATION

A 9-month-old Afro-Caribbean boy presented to the emergency department in April 2022 with a 1-day history of fever (maximum axillary temperature 39.6°C) and an episode of vacant staring lasting for a few seconds associated with labored breathing. He returned to his normal self within a few minutes. He had symptoms of rhinorrhea and cough for 1 day before fever. There was no diarrhea, vomiting, or rash.

The patient was born at term via normal vaginal delivery, and there were no concerns at birth. His mother was unvaccinated against severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Past medical history was noted of eczema and sickle cell trait. He has achieved age-appropriate milestones and has been immunized as per the UK schedule to date. There is no family history of febrile seizures.

On arrival at the emergency department, his axillary temperature was 39.4°C. He was tachycardic with a heart rate of 174/min. His other observations were respiratory rate 40/min, blood pressure 90/53 mm Hg, capillary refill time <2 seconds and oxygen saturation 97% in air.

He appeared tired but was responsive to commands. His cardiac, pulmonary, and abdominal examinations were normal. On neurologic examination, he was found to have a bulging and pulsatile anterior fontanelle (AF) while sleeping and in both supine and upright positions. There were no focal neurologic deficits.

The initial laboratory investigations included blood and urine samples. His total leukocyte count was 15 (reference range for age 6–17 × 10⁹ L) with 50% neutrophils and C-reactive protein of less than 1 mg/L (normal range 0–5 mg/L). His urea, creatinine, bilirubin, alanine aminotransferase, albumin and electrolyte levels were within normal limits. His urine dip urinalysis was negative.

In view of having a bulging fontanelle together with fever and an episode of vacant staring, the possibility of raised intracranial pressure secondary to meningitis/encephalitis was considered. Computed tomography of the brain performed before lumbar puncture showed bulging of the AF and widening of the major calvarial sutures, consistent with raised intracranial pressure, with no evidence of hydrocephalus. Lumbar puncture was unremarkable with clear cerebrospinal fluid (CSF), <1 WBC, glucose 3.5 mmol/L and protein 0.25 g/L (laboratory normal range 0.05–0.29 g/L). CSF culture for herpes simplex virus-1 and 2, varicella zoster virus and human herpes virus-6 were negative. His blood culture was sterile. Noncontrast magnetic resonance imaging (MRI) brain done after 3 days of admission showed no structural abnormality and reduction of bulging through AF; however, there was nonspecific finding of 3 tiny foci of increased signal intensity in the deep white matter of the right superior parietal region, right superior frontal lobe and left supramarginalis subcortical white matter. His nasopharyngeal aspirate was negative for influenza virus (A and B), rhinovirus, parainfluenza virus (1, 2, and 3), adenovirus, respiratory syncytial virus and enterovirus and positive for SARS-CoV-2 RNA (respiratory multiplex polymerase chain reaction) which was confirmed again with a nasopharyngeal swab (dedicated polymerase chain reaction). Further genome analysis showed omicron variant of SARS-CoV-2.

The child was treated with ceftriaxone, clarithromycin and acyclovir, which were discontinued after 4 days with negative CSF and blood cultures. He did not receive steroids, intravenous immunoglobulin, remdesivir or monoclonal antibodies. The patient improved clinically in the ward, and his AF was normal at discharge on day 5. He was reviewed after 3 weeks in clinic, at which time his AF remained normal and no other concerns had arisen.

DISCUSSION

In contrast to other respiratory viruses, children typically have less severe symptoms with SARS-CoV-2 infection, and the commonly proposed hypothesis behind this include age-related increased endothelial damage in adults, higher density and increased affinity of angiotensin converting enzyme 2 receptors in adults and high prevalence of pre-existing comorbidities in adults.

Neurologic manifestations in children with COVID-19 are varied. SARS-CoV-2 virus has neurotropic potential like other respiratory viruses, such as influenza and respiratory syncytial virus. Evidence of neurotropism with resultant astrocytic and neuronal injury is provided by studies demonstrating elevated serum levels of biomarkers such as glial fibrillary acidic protein and serum neurofilament light chain. Retrograde transmission through the olfactory neurons, disinhibition of renin angiotensin pathway and cytokine-induced neuroinflammation are some of the possible mechanisms behind the neurologic effects of COVID-19.2 The
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presentations commonly described in the literature include headaches overlapping with idiopathic intracranial hypertension,4 demyelinating disorders, stroke, encephalopathy and cerebral edema.5 Bulging of the AF in an infant is often a sign of raised intracranial pressure, and the differential diagnosis is wide, including infections, intracranial bleeds, space occupying lesions and trauma. With regard to infection, in a study done on 153 febrile children with bulging AF, 1 child had bacterial meningitis and the other etiologies were aseptic meningitis (26.7%), upper respiratory tract infection (18.3%), roseola infantum (8.5%), acute otitis media (6.5%) and pneumonia (4.5%).6 In our case with sterile CSF, blood, urine, negative human herpes virus-6 and negative nasopharyngeal aspirate for all respiratory viruses except for SARS-CoV-2, COVID-19 was the likely etiology. This is further supported by the finding of foci of increased signal intensity in the white matter in MRI which has been described as the most common radiological abnormality in children with COVID-19. In a multicenter and multinational study done looking at the neuroimaging manifestations of children with COVID-19, patchy or confluent areas of T2 hyperintensity in the gray and white matter with or without reduced diffusion or enhancement was the commonly reported one and found in 28 (74%) of 38 children.7 A similar presentation with fever and raised fontanelle because of SARS-CoV-2 in a 4-month-old has been recently published in the literature.8 Two years into the pandemic, SARS-CoV-2 has been associated with many different pathological presentations, and we suggest considering SARS-CoV-2 as a potential differential, and diagnosis of exclusion, in a child with a bulging fontanelle.

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