CASE REPORT

Cerebral Necrotizing Encephalopathy in a 7-year-old Child after being Infected with COVID-19, A Case Report

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Abstract

New daily data on the COVID-19 pandemic are circulating globally. This disease usually appears with respiratory symptoms such as cough, shortness of breath, and fever. The neurological complications of the disease are somewhat known in adults but rarely reported in children. Acute necrotizing encephalopathy of childhood (ANEC) is one of the brain complications associated with Coronavirus disease that usually has a poor prognosis in children. In this case, we report a rare case of a 7-year-old boy who was referred to the hospital with symptoms of convulsions after contracting COVID-19 and developed cerebral necrotizing encephalopathy caused by COVID-19 infection. Although ANEC is a rare disease, clinical examination and MRI and CT scan findings play an essentialrole in diagnosing and treating the disease.

Keywords: COVID-19; Childhood; Encephalopathy; Seizure
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Introduction

A new Coronavirus (COVID-19) was recognized in Wuhan, China, in December 2019. The disease spread quickly, resulting in an epidemic in China, followed by an increase in several cases in other countries worldwide. The World Health Organization (WHO) identified the disease as COVID-19, standing for Coronavirus disease of 2019 (1).

Common manifestations of COVID-19 include fever, dry cough, shortness of breath, runny nose, headache, myalgia, fatigue, and hypovolemia. Pneumonia is evident on radiographs. Its complications include acute respiratory distress syndrome (ARDS), arrhythmia, shock, acute heart injury, secondary infection, acute kidney injury, and, in severe cases death (2-4). Research shows that many patients succumb to ARDS and damage to multiple organs, including the cardiovascular system. Additionally, the virus is linked to numerous central nervous system symptoms, such as loss of consciousness and headaches (5). According to studies, adults may experience ischemia and intracerebral hemorrhage (6). In contrast, children rarely report neurological disorders (7-9). A rare CNS complication of this virus is acute necrotizing encephalopathy (ANE), characterized by symmetric, usually hemorrhagic lesions invariably involving the thalami and other brain regions, including the brainstem and cerebellum (10).

In a study conducted by Leror et al. (2021) in the US, out of 1695 patients with a mean age of 9.1 years, 365 people (22%) from 52 centers had confirmed neurological involvement. Out of the total, 322 individuals (88%) experienced brief and non-fatal symptoms but recovered, while 34 individuals (12%) suffered severe health issues directly linked to COVID-19. These severe conditions included ANE (15 people), stroke (12 people), central nervous system infection (8 people), Guillain-Barré syndrome (4 people), and fulminant cerebral edema (4 people). Out of 43 COVID-19 patients associated with life-threatening neurological involvement, 17 (40%) had new neurological defects at the time of discharge from the hospital, and 11 (26%) died. The present report addressed a child with COVID-19 whose brain magnetic resonance imaging was characterized as ANE.

Case Report

The patient, a healthy 7-year-old boy with a full vaccination record, had no prior health issues or hospital stays aside from neonatal jaundice treated with phototherapy. He exhibited typical growth patterns. There was no family history of neurological disorders, and his parents were not consanguine.

He was brought to the Emergency Department of Hazrat Masoume Hospital in Qom due to convulsions and loss of consciousness. The patient's fever was 38.9°C at the time of hospitalization. According to

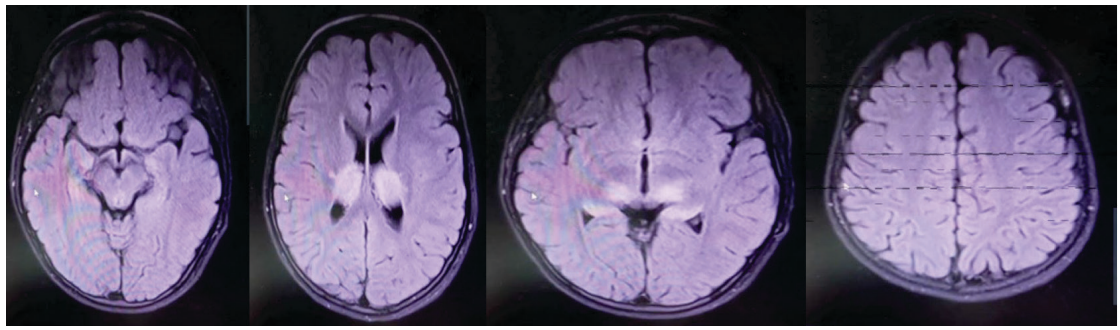

Figure 1. *involvement of the basal ganglia*

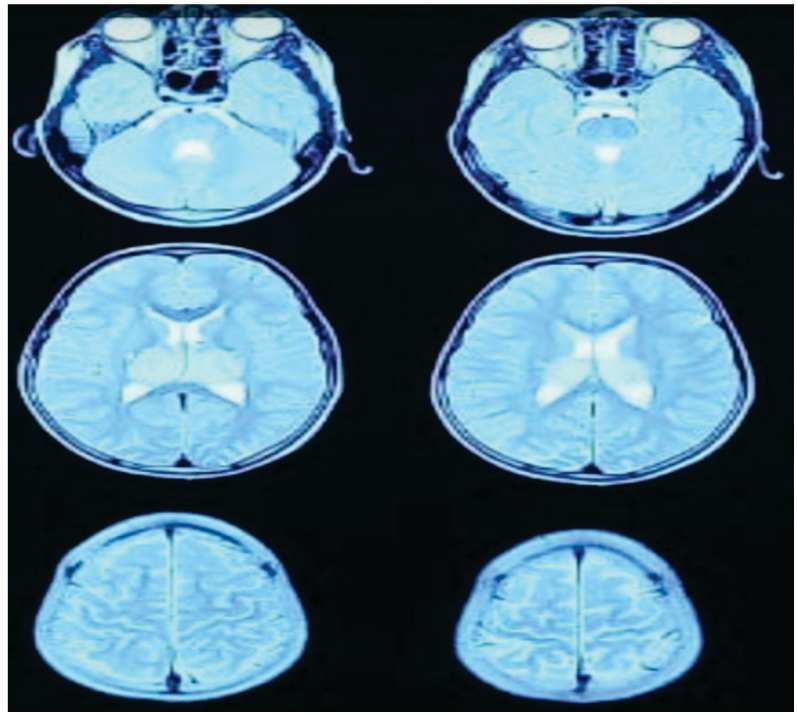

Figure 2. *bilateral involvement of the thalamus and hypertensive and heterogeneous changes with a necrotic appearance in the T2 and T1 sections*

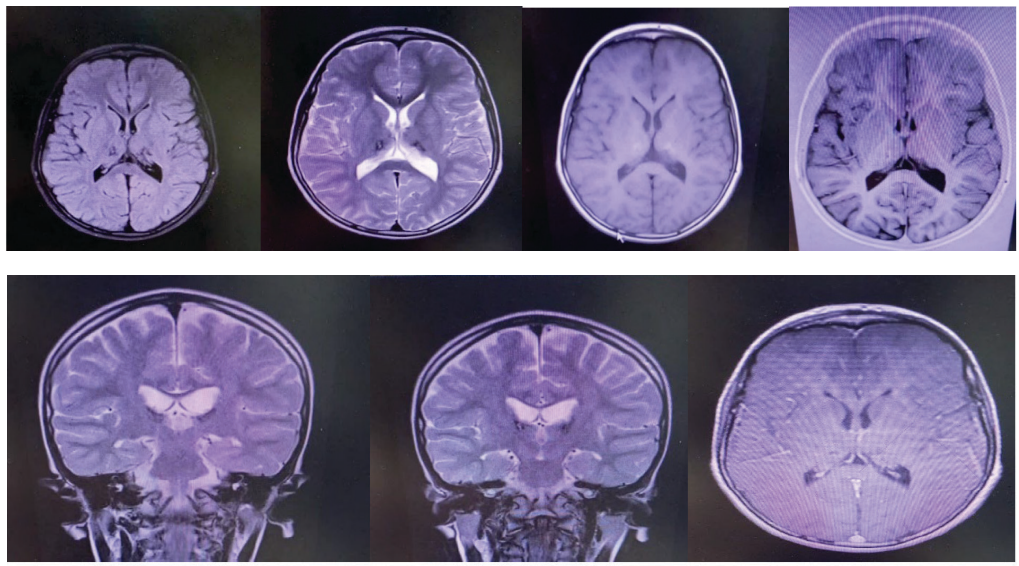

Figure 3. *Brain MRI (without and with Gd+ DWT))*

the parents, he had a fever, sore throat, and dizziness since the previous day, and on the day of the referral, he had a convulsion in the form of mouth-frothing and UWG eyes. The convulsion was atonic and lasted for about an hour. The patient did not have vomiting or digestive symptoms. Before referring to the center, the child had visited a doctor and received diphenhydramine and acetaminophen. The patient did not have lung involvement or respiratory symptoms. Parents had been infected with COVID-19 in the last two weeks. The patient's convulsion was controlled using Phenytoin and Levebel, but other examinations could not be performed in the Emergency room due to the patient's condition.

The patient was transferred to the ICU based on ABCD and a consciousness level of 6.15. In the laboratory examination, WBC=5380 (PMN 46%), lymphocyte=35%, PLT=87000, CRP=5.3, ESR=55, LDH=414, D-dimer=392, and Fibrinogen=255 without kidney and liver dysfunction and without electrolyte disorder. His blood sugar level was reported to be 110. Pleocytosis or evidence of blood or glucose drop was not seen in the CSF sample.

Due to fever, convulsion, and reduced consciousness, the patient was treated with Ceftriaxone, meningeal dose Vancomycin, and Acyclovir to cover viral encephalitis. An intranasal PCR sample was taken to check for COVID-19, and the result was positive. According to involving the basal ganglia after the brain CT scan, an acute necrotizing encephalopathy of childhood (ANEC) diagnosis was proposed for the patient (Figure 1). The patient underwent MRI brain imaging. Due to the bilateral involvement of the thalamus and hypertensive and heterogeneous changes with a necrotic appearance in the T2 and T1 sections, ANEC was confirmed (Figure 2). The patient was treated with pulse methylprednisolone and IVIG. The patient was admitted to the PICU for five days. On the sixth day, his condition stabilized, with steady vital signs and regained consciousness, allowing for his transfer to the ward. Throughout his hospital stay, the patient experienced a diminished swallowing reflex, along with reduced sensation and movement in all four limbs. The patient was discharged on the 16th day of hospitalization with the recommendation of physio- and speech therapy. He was fully alert at the time of discharge, followed orders, maintained proper eye contact, and partially improved his swallowing reflex. He was unable to communicate verbally, and his movement disorder, especially in the upper limbs, was partially improved and his nerve reflexes were also partially improved. He had the ability to sit unassisted but was not yet able to walk. Three months later, the patient underwent a non-contrast brain MRI during the follow-up. This imaging revealed necrosis and calcification within the ventricle, confirming a diagnosis of ANEC and distinguishing it from ADEM (Figure 3). The patient exhibited symptomatic improvement, regaining the ability to speak and move.

Discussion

ANEC is a sporadic disease primarily affecting children, caused by a "cytokine storm" Para or after an infectious disease, leading to the breakdown of the blood-brain barrier and subsequent damage to the central nervous system (10). The etiology and pathophysiology of this disease are not well known (11).

In this complication, common symptoms such as convulsion, vomiting, and loss of consciousness occur after 12-72 hours of viral infection, but these symptoms are not Exclusive (12). Brain imaging

plays an essential role in diagnosing the disease. In the CT, there is bilateral reduction distributed on the brain. The MRI shows typical T2WI/FLAIR hyperintensities in the cerebral cortex, around the ventricular white matter, thalamus, basal ganglia, brainstem, and cerebellar hemispheres. Limited dispersion can be detected on Diffusion Weighted Imaging (DWI), a sign of necrosis. Contrast-enhanced images may show peripheral rim enhancement. Furthermore, Susceptibility-Weight Imaging (SWI) can show whether there is a hemorrhagic lesion or not (13).

There is no particular treatment for COVID-associated ANEC. Currently, high-dose corticosteroids, multivalent immunoglobulin, or plasmapheresis can be utilized to treat this condition only if diagnosed and treated early (8, 12, 13).

Although ANE is rarely reported, as in this case, it is vital to take it as a possible complication in children with COVID-19. It is impossible to determine definitively whether our patient's initial improvement was due to corticosteroids, intravenous immunoglobulin, and other medications or the natural course of the disease. Further elucidation of effective treatments for this disease requires randomized, impractical trials due to their rarity. MRI is critical in the rapid diagnosis of this rare condition. This study offers the potential for supportive care and specialized treatments that may enhance neurological outcomes. This study was conducted in compliance with research ethics while obtaining consent from the patient's parents after obtaining an ethics code from the Research Ethics Committee of Qom University of Medical Sciences bearing ID No. IR.MUQ.REC.1401.104.

There is bilateral symmetrical involvement of thalami with enlargement and signal alteration which are heterogeneously hyperintense on T2 and low on TIWI with internal necrotic changes.

Signal alteration in tegmentum tectum, posterior aspect of midbrain and medial side of both temporal lobes are seen Restriction on DWI is heterogeneously visible. Minimal if any enhancement is seen on post contrast images.

In Conclusion

Acute-phase and delayed-phase Covid-19 related CNS abnormalities are seen in children. Disease and atypical neuroimaging manifestations can be found and should be recognized being as potentially due infection as an underlying a etiological factor.(3)

Studies of pediatrics specific cohorts are needed to better understand the effects of Covid-19 infection on the CNS at presentation and on long-term follow-up in children is necessary.

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Author's Contribution

M HA , MM, ZM was the attending doctor of the patient.

.BSH contributed to review medical reports of the patient, drafting, and revision of the article. All authors approved the final manuscript.

Conflict of Interest

There was no conflict of interest.

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