

and have a poor prognosis [4]. In a case series of four children under 18 years of age who presented with severe COVID-19 infection, the neurological symptoms included encephalopathy, headache, brainstem, cerebellar signs, muscle weakness, and reduced reflexes. MRI brain had signal changes in the splenium of the corpus callosum in all four patients and T2-hyperintense lesions associated with restricted diffusion were seen in three children [6]. In a recent multi-centric retrospective study which analyzed the MRI findings in adults with severe COVID 19 infection, signal abnormalities located in the medial temporal lobe, non-confluent multifocal white matter hyperintense lesions on FLAIR and diffusion with variable enhancement, associated with hemorrhagic lesions, and (c) Extensive and isolated white matter microhemorrhages were the most common findings. The presence of hemorrhage was frequent, and the detection is of clinical importance as it was associated with worse respiratory, neurological, and biological status [7].

Internationally accepted case definitions for MIS-C are still evolving. In our case series, all were confirmed cases of COVID-19, of which the first two children had neurological manifestations of acute febrile encephalopathy and febrile seizure with features of MIS-C while the third child presented as febrile status epilepticus. One child with MIS-C had fulfilled the criteria for incomplete Kawasaki phenotype (fever >5 days, rash, bilateral non-purulent conjunctival congestion, cheilitis) according to AHA guidelines. Many MIS-C cases present as Kawasaki disease shock syndrome with Kawasaki-like clinical symptoms, cardiac impairment and shock [9].

There were a few limitations in our observations. Imaging studies and CSF analysis were not done in all. We speculate that COVID-19 being a respiratory virus, other systemic manifestations especially neurological presentations may go unrecognized. In this pandemic situation, any child with primary neurologic symptoms and fever, with mild or absent respiratory symptoms, it could either be a part of MIS-C or a self-limiting finding of pediatric COVID-19 infection.

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SARS-CoV- 2 Encephalitis in an Adolescent Girl

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus can affect both the central and peripheral nervous system, and SARS neurological manifestations have also been rarely reported in children. We herein report COVID-19 encephalitis in a 13-year-old girl, who presented with status epilepticus and altered sensorium and had complete resolution of neurological symptoms in 48 hours.

A 13-year-old girl presented with fever for 2 days associated with headache and an episode of generalized tonic clonic seizures on day 2 of fever lasting for more than 30

minutes. She was treated with intravenous lorazepam and phenytoin sodium and in view of persistence of seizures and altered sensorium, she was referred to our center for further care. There was no history of cough, vomiting, head trauma, rash or drug ingestion. She was first born to non-consanguineous parents and developmentally normal for age. There was no past or family history of seizures. On examination at admission, she was febrile (100°F), irritable and had altered sensorium. She had brisk deep tendon reflexes with an extensor plantar response. There were no signs of meningeal irritation. Her pupils were equal and reacting to light. There was no papilledema or focal neurological deficits. Cardiopulmonary and abdomen examination were normal. Her investigations revealed normal white cell counts and negative CRP. Her serum electrolytes including calcium and magnesium, liver function tests were normal. MRI

brain was normal. Cerebrospinal fluid (CSF) analysis showed 200 white blood cells/mm³ all lymphocytes with protein, 86 mg/dL, sugar, 77 mg/dL (corresponding blood sugar: 126 mg/dL). CSF gram stain, AFB stain, bacterial culture and Xpert gene TB were negative. CSF biofire film array multiplex PCR was negative for viruses (CMV, HSV, enterovirus and varicella). Nasopharyngeal aspirate for SARS-CoV-2 by qualitative RT-PCR was positive (cycle threshold: 27.26). Computed tomography (CT) chest showed patchy peripheral ground glass opacities involving the posterior segment of the right upper lobe and lateral segment of right middle lobe (COVID score 5/40). However, RT-PCR in CSF sample was negative for SARS-CoV-2 virus. Her EEG was normal. She was treated with levetiracetam and ceftriaxone. Within 48 hours of admission, she became afebrile, her sensorium improved and had no recurrence of seizures and ceftriaxone was stopped once CSF and blood cultures were reported sterile and was discharged home in a normal neurological state.

COVID-19 viral encephalitis was probably first reported by McAbee, *et al.* [1] in a 11-year-old male child whose nasopharyngeal swab was positive for COVID-19, whereas CSF was negative and the boy recovered without any specific treatment in six days. SARS-CoV-2 from the nose reaches CSF either by olfactory ensheathing cells, olfactory receptor neuron or by disrupting the respiratory epithelium then enters the blood stream and then enters brain through disrupted blood brain barrier, either caused by inflammation or by using angiotensin converting enzyme-2 (ACE-2) receptors present in the blood brain barrier endothelial cells, thereby resulting in viral proliferation, neuronal injury and damage [2]. Virus induced immunologic response also leads to swelling of the brain resulting in increasing cerebrospinal fluid pressure thereby resulting in alteration in consciousness. Abdel-Mannan, *et al.* [3] from UK had reported four children aged 8-15 years who had new onset encephalopathy and proximal muscle weakness. All of them were positive for SARS-CoV-2 virus in nasopharyngeal samples, and CSF (done only in 2 children) was negative for COVID-19 [3]. Neurologic improvement was seen in all of them. Acute splenial lesions were seen in four children [4] whereas, in our case, we could not identify any changes in the splenium of the corpus callosum. The neurological mani-

festations reported in COVID 19 are protean [4]. CSF pleocytosis (>5 WBC with predominant lymphocytes) that is characteristically seen in viral encephalitis, was seen in this girl. RT-PCR assays of the CSF samples being negative for SARS-CoV-2 in patients with neurological manifestations has not only been described in children [1,3] but even in adult patients and this depends on the severity of the systemic illness, the neurotropic properties of the virus, and immune-mediated inflammatory mechanisms [5,6]. It has been earlier reported that RT-PCR of nasopharyngeal specimen for SARS-CoV-2 appears to be a useful investigation for confirmation of COVID-19 even in children with neurological presentation and children have a favorable outcome [7], as seen in our cases.

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