Case series

Neurological manifestations in pediatric patients with COVID-19: A case series

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ABSTRACT

In this case series of two male and one female patient with an age range of 2-12 years, only one patient had a
history of neurological disorder and underwent ventriculoperitoneal shunt for a medulloblastoma, which describes
coronavirus disease-associated neurological manifestations in pediatric patients, among which seizures and sensory
disturbances are noticeable. In order to describe the various clinical and neurological manifestations that appeared
earlier or developed over the course of illness, a series of cases of pediatric patients with coronavirus disease was
documented.

Keywords: COVID-19; SARS-CoV-2; neurological manifestations; pediatric patients; antibiotics.

INTRODUCTION

The causative agent of coronavirus disease (COVID-19) is severe acute respiratory
syndrome coronavirus 2 (SARS-CoV-2) (1). Due to the increased number of COVID-19 cases,
neurological manifestations have been reported more frequently. Neurological manifestations such as
headache, seizures, impaired consciousness, anosmia, and paresthesia (2, 3), which are common in the
advanced stages of the disease, are observed in pediatric patients with COVID-19 (4). A total of four
pediatric patients have reported new-onset neurologic COVID-19-associated symptoms, diagnosed with
multisystem inflammatory syndrome (5).

Data on the clinical characteristics and prognostic factors of pediatric patients with neurological
manifestations due to SARS-CoV-2 infection are limited. Herein, we present three clinical cases of
pediatric patients diagnosed with COVID-19 and treated at our hospital, along with a description of the
clinical and neurological manifestations that appeared earlier or developed over the course of illness.

Case 1

A one-year-old boy presented with fever and cough, eight days earlier. On admission, he presented with
severe cough, flaccid paralysis, and circumoral cyanosis, without fever or diarrhea. Both SARS-CoV-2
IgG/IgM rapid test and reverse-transcription polymerase chain reaction (RT-PCR) for the infant and his mother were positive; he was hospitalized for five days, as he presented with respiratory symptoms. He was readmitted three days after discharge, with episodes of involuntary movement-associated

Case 2

A nine-year-old boy who had undergone seeding of ventriculoperitoneal shunt for a medulloblastoma had
a two-day history of fever, irritability, and decreased consciousness. He was admitted to the intensive care
unit due to suspected ventriculoperitoneal shunt malfunction. Multi-slice spiral computed tomography
of the brain (without hydrocephalus) and cerebrospinal fluid analysis were performed; the results for both were negative. His mother's SARS-CoV-2 IgG/IgM rapid test was positive, while the patient tested negative, but RT-PCR results were positive for both. He was treated with ceftriaxone and amikacin. On day 4, the regimen was changed to meropenem, and vancomycin combined with
dexamethasone and acyclovir for 6 days, due to no symptom improvement. A cerebrospinal fluid analysis
was performed on the same day, showing a white blood cell count of ≤8,000/µl; therefore, viral
encephalitis secondary to COVID-19 was suspected. The patient showed complete remission and was
discharged after 12 days of treatment.

Case 3

A 12-year-old girl had a 2-week history of thigh pain that further radiated down her legs and into the feet,
along with paresthesia and difficulty walking for a week. She did not present with fever or respiratory
symptoms and denied contact with patients who tested positive for SARS-CoV-2.
Clinical examination revealed decreased muscle strength and diffused reduction of deep tendon reflexes, with no respiratory signs or symptoms, while Guillain Barré syndrome was suspected. The patient’s SARS-CoV-2 IgG/IgM rapid test result was positive and RT-PCR result was negative. She was treated with immunoglobulin (2g/kg) for 6 days. She was discharged on day 8, after experiencing less pain and improved muscle strength. Clinical characteristics and data from laboratory tests are shown in Table 1 and 2 respectively.

**DISCUSSION**

In this case series of two male and one female patients with an age range of 2-12 years, only one patient had a history of neurological disorder and underwent ventriculoperitoneal shunt for a medulloblastoma. Clinical manifestations included sensory disturbances (Case 2), involuntary movements (Case 1), muscle weakness, and hyporeflexia (Case 3).

In case 1, the patient experiencing seizures remained febrile over the course of the disease; the respiratory symptoms and seizures could be due to a coinfection (6). Recognition of coinfections is important for guidance on clinical evaluation and management of children with COVID-19.

In cases 2 and 3, no respiratory symptoms were present; however, in case 1, the patient did experience respiratory symptoms. It is noteworthy that none of the three pediatric patients experienced severe respiratory complications, unlike adults (7, 8). Likewise, none of the three cases presented with multisystemic inflammatory syndrome, which has been reported as one of the most severe complications in this age group, thereby suggesting that SARS-CoV-2 would exclusively affect the nervous system. Cases
with meningitis and Guillain-Barré syndrome are usually associated with critically ill adult patients (9); this does not occur in the pediatric population, as described in this report, where neurological manifestations occur without other systemic compromises.

Most pediatric patients tested positive due to household contacts (10). In this study, patients in cases 1 and 2 were positive due to household contact, which was confirmed by a rapid test. Information on SARS-CoV-2 penetration into the central and peripheral nervous systems remains unknown; one theory comprises the hematogenous spread of the virus from the systemic to the cerebral circulation, while another comprises dissemination through the cribiform plate into the olfactory bulb (11). Angiotensin-converting enzyme 2 receptors in endothelial cells (brain vasculature) act as entry points for SARS-CoV-2 (12). This report describes COVID-19-associated neurological manifestations in pediatric patients, among which seizures and sensory disturbances are noticeable.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

REFERENCES