Acute Disseminated Encephalomyelitis in a 7-Year-Old

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A 7-year-old boy with no significant medical history presented to our emergency department (ED) with progressive mental status changes. The patient's symptoms had started 2 weeks prior to presentation with nonspecific headaches and daily vomiting.

Thirteen days prior to admission, the patient's primary care provider had diagnosed streptococcal pharyngitis via rapid strep test. Because the patient had a penicillin allergy, a 10-day course of cefdinir was prescribed. Over the following 2 weeks, the headaches and vomiting had persisted with intermittent, subjective fevers. The patient eventually began speaking less frequently, was intermittently unresponsive when being addressed, was answering questions inappropriately, and was laughing inappropriately, which were dismissed multiple times by his primary care provider.

One week prior to hospital admission (one week after the onset of symptoms), the patient had presented to the ED with symptoms of delirium. These symptoms were attributed to a febrile illness, and the patient was discharged home. Within the next day or 2, the patient followed up with his primary care provider, which resulted in prescription of ceftriaxone for unknown reasons. Then, on the day of hospital admission, the patient returned to the ED because of neck stiffness persisting for 4 days.

Physical examination

Results were remarkable for a nonverbal state, tongue fasciculations, shuffling gait, inappropriate laughter, and exaggerated deep tendon reflexes in the lower extremities. The patient's mother also reported these findings at home—the patient had become increasingly nonverbal and would spontaneously cry or laugh inappropriately. Findings from a detailed neurological examination performed by the patient's primary care team were normal.

Diagnostic testing

An initial complete blood cell count (CBC) conducted in the ED showed an elevated platelet count of 681 × 103/μL (reference range, 227-350 × 103/μL) but was otherwise unremarkable. The patient's C-reactive protein (CRP) level and complete metabolic panel were also within normal limits. A blood culture was also obtained, which did not have bacterial growth at the time, even at the end of the culture's lifespan. The physician in the ED gave the patient a bolus of normal saline, clindamycin, and dexamethasone for unknown reasons.

A computed tomography (CT) scan of the neck was obtained, which showed adenopathy in the anterior and posterior cervical chains, as well as enlarged tonsils. However, there was no evidence of any abscess. Results of a CT scan of the head showed no evidence of acute intracranial process or mass. Due to the patient's agitation, a lumbar puncture was deferred until he was sedated for the procedure.

Differential Diagnoses

When evaluating a pediatric patient presenting with fever, severe headaches, vomiting, neck stiffness, and neurologic deficits, there are life-threatening conditions that should be considered when approaching a diagnosis. Infectious meningitis and encephalitis are at the top of the list, both of which can present with fever, headache, change in mental status, and nuchal rigidity. Among other infectious diseases, brain abscesses can present similarly. However, our patient's head CT scan in the ED showed no evidence of abscesses.

Autoimmune encephalitis also has a similar presentation. Patients with specific types of autoimmune encephalitis, such as anti-N-Methyl-D-Aspartate receptor (NMDAR), present with hallmark symptoms of psychosis, language dysfunction, and abnormal movements, some of which were seen in our patient.[1]

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Many autoimmune causes of encephalitis are associated with cancers and more commonly affect adults, making this diagnosis less likely.[1]

Other important diagnoses to consider in new-onset neurological deficits are central nervous system (CNS) malignancies and demyelinating disorders. However, CNS malignancies are unlikely to explain our patient's febrile illness, acute presentation, and normal CT findings. Demyelinating disorders mostly cause neurologic dysfunction in sensory or motor domains rather than behavioral changes, as seen in our patient, making them less likely.

Because all of these diagnoses were ruled out, acute disseminated encephalomyelitis (ADEM) was diagnosed.

Discussion

ADEM is an inflammatory demyelinating disorder of the CNS with a post-infectious etiology. It presents with a variety of neurological features, with rapid onset, and may progress in hours to peak in days.[2,3] Deficits may include ataxia, tremors, dysarthria, hemiparesis, and bizarre behavior not proportional to environmental and situational stimuli, depending on the disease tropism of the brain.[2,3] There may be prodromal features such as fever, headache, and even meningismus, with prodromal viral illness.[2,3] Patients may even present neurologically intact on examination, but parental description of altered behavior at home should not be taken lightly. It actually should increase suspicion for encephalitis.[4] There is usually a delay in care for neurological cases. Fortunately, delay of care in patients with ADEM is not associated with poorer outcomes, but a prolonged course to return to baseline neurological status in patients have shown unfavorable cognitive and behavioral changes.[3,5,6]

Workup for ADEM is generally for ruling out other neurological diseases rather than ruling in ADEM. General characteristics of a common workup for ADEM would be a lymphocytosis in a CBC test, elevation of erythrocyte sedimentation rate (ESR) and CRP, lymphocytosis in cerebrospinal fluid (CSF) examination, and excess background slow wave activity without focal findings in an electroencephalogram.[2,3] Infectious etiology via antibody screening should be explored for encephalitis. However, tests will return negative results.[2,3] ADEM is diagnosed with magnetic resonance imaging (MRI), showing asymmetric supratentorial deep and subcortical white matter changes, which classically involve symmetric lesions of thalami and basal ganglia.[2,3]

Treatment and management

The use of high-dose intravenous corticosteroids is considered the standard of care.[2,3] If a patient's condition does not improve, intravenous immunoglobulin G (IVIg) treatment and/or high-dose oral corticosteroids are adjunctive therapies that may be used. However, they are not considered standards of care, since they are not well studied or supported by evidence.[2,3,7,8]

Patient outcome

A lumbar puncture was performed while the patient was sedated. However, after the procedure, the patient coincidentally had dysphagia to fluids with dyspnea and hypoxia resulting in the patient being transferred to the pediatric intensive care unit.

His CSF cell count showed an elevated white blood cell count at $14 \times 10^3/\mu L$ (reference range, $\leq 5 \times 10^3/\mu L$). A polymerase chain reaction assay of common sources of meningitis returned negative results. CSF anti-NMDAR antibody, CSF venereal disease research laboratory, CSF West Nile virus, and CSF oligoclonal bands testing also returned negative results.

Brain MRI scans with and without contrast showed increased T2 signal in the left hippocampus compared with the right, which raised concern for encephalitis, postictal change, or neoplasm. Pediatric neurology recommended starting the patient on intravenous methylprednisolone, 250 mg/d, for 5 days. The patient later developed tremors, therefore IVIg was started for 2 days. CSF culture showed no growth to date for 48 hours.

On hospital day 6, the patient was started on high-dose oral prednisone (2 mg/kg/d or 30.5 mg tablet twice daily) for an expected course of 3 months. The patient began opening his mouth, began to speak, and initiated small movements. At the end of his hospital stay of 15 days, the patient completely returned to baseline and was discharged with neurology follow-up and prednisone titration.

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