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Selected Topics: Neurological Emergencies

ACUTE CEREBELLAR ATAXIA IN COVID-19 INFECTION: A CASE REPORT

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Abstract—Background: The outbreak of coronavirus disease 2019 (COVID-19) has been widely reported to cause symptoms such as fever, cough, sore throat, fatigue, and shortness of breath. Neurologic complications have not been widely reported without associated respiratory symptoms. These neurologic manifestations have been found mostly in the elderly. There has been no report of ataxia or COVID-19 cerebellitis in the young adult population without associated respiratory symptoms. **Case Report:** Here we report the case of a 30-year-old patient who presented with isolated cerebellar symptoms and was diagnosed with COVID-19 cerebellitis. **Why Should an Emergency Physician Be Aware of This?:** It is important for emergency physicians to know that COVID-19 can have many clinical manifestations and to have a high level of suspicion with acute neurologic symptoms. © 2020 Published by Elsevier Inc.

Keywords—COVID-19; coronavirus; COVID-19 infection; cerebellitis; cerebellar ataxia; acute cerebellar ataxia

Neurologic complications of COVID-19 have not been widely reported without associated respiratory symptoms. In Wuhan, China, 36.4% of COVID-19–positive patients were found to have neurologic manifestations, including acute cerebrovascular diseases and impaired consciousness (2). Elderly patients with comorbidities have been reported to have increased risk of altered mental status in acute COVID-19 infections, including acute encephalopathy and changes in level of consciousness (3).

There has been no report of ataxia or COVID-19 cerebellitis in the young adult, otherwise healthy patient population without respiratory symptoms. Here we report the case of a 30-year-old patient who presented with isolated cerebellar symptoms and was found to have COVID-19 cerebellitis.

CASE REPORT

INTRODUCTION

The outbreak of coronavirus disease 2019 (COVID-19) has severely affected the world, including the United States. Originating from Wuhan, China in December 2019, COVID-19's symptoms were initially described as fever, cough, sore throat, fatigue, and shortness of breath (1). The disease is mild in most but can progress to pneumonia, multi-organ dysfunction, and death in some.

A 30-year-old man with no medical history presented to the emergency department with onset of nausea, vomiting, slurred speech, and difficulty walking due to feeling off balance for 8 h prior to arrival. He reported some difficulty walking the day before, and then had difficulty speaking, which prompted him to come to the emergency department. He denied headache, unilateral weakness, vision changes, cough, congestion, fever, shortness of breath, chest pain, or neck pain. He denied any COVID-19 contacts but had traveled to Mexico the week before.

His initial vital signs were oral temperature of 98.1°F, blood pressure of 135/71 mm Hg, heart rate of 75 beats/min, respiratory rate of 16 breaths/min, and oxygen saturation of 99% on room air. The physical examination was significant for dysarthria, incoordination, trouble reaching for items, and imbalance. On examination, he was significantly ataxic with mild direction-changing nystagmus horizontally, dysidiadochokinesia, moderate appendicular ataxia, dysmetria with finger-nose testing, and was unable to stand unassisted. The patient was alert and oriented. He had 5/5 strength in upper and lower extremities with no pronator drift. No meningeal signs on examination. His heart sounds were normal and lungs were clear to auscultation.

Stroke was initially suspected due to his slurred speech and gait instability, so computed tomography angiograms (CTAs) of the head and neck were obtained immediately. The CTAs of the head and neck were negative for any brain or vascular abnormalities, but significant for the presence of partially visualized consolidations in the posterior, bilateral upper lungs, which was concerning for multifocal pneumonia (Figure 1).

The initial laboratory workup, including complete blood count (CBC), comprehensive metabolic panel, thyroid stimulating hormone, urinalysis, and urine drug screen, was obtained and all results were essentially normal. CBC was unremarkable, with white blood cell count (10.8×10^9 cells per liter) of 6.05 (absolute neutrophils 3.45, lymphocyte percentage 34.7, and absolute lymphocyte 2.10) and platelets 146. Results of a portable chest x-ray study appeared normal.

Neurology was consulted and the patient was admitted to the neurology service for magnetic resonance imaging (MRI) and further evaluation. Initial MRI brain with and

without contrast was done with no acute abnormality. Sequences of MRI brain included T1, T2, fluid-attenuated inversion recovery (FLAIR), diffusion weighted imaging (DWI), apparent diffusion coefficient (ADC), and post contrast T1 and T2*. Five days later, MRI brain with and without contrast was repeated with no acute abnormality (Figure 2), as was an magnetic resonance angiography brain without contrast. A CT of the chest revealed bilateral patchy opacities concerning for multifocal pneumonia, but the patient continued to have no respiratory symptoms. A COVID-19 polymerase chain reaction (PCR) test obtained after admission was positive. The patient had extensive negative serology testing for autoimmune and alternative etiologies, and a lumbar puncture, which revealed normal protein with only 7 white blood cells, predominantly lymphocytes. A cerebrospinal fluid (CSF) meningitis/encephalitis (ME) PCR panel was negative (CSF was also negative on Venereal Disease Research Laboratory test, oligoclonal bands, acid-fast bacilli stain, and West Nile) as was a respiratory virus PCR panel and further serum studies (human immunodeficiency virus, viral hepatitis, galactomannan, coccidioidomycosis, histoplasmosis, brucella, West Nile, cryptococcosis, tissue transglutaminase, angiotensin converting enzyme (ACE), antineutrophil cytoplasmic antibody, antinuclear antibody, ganglioside antibodies, anti-glutamic acid decarboxylase, and Sjögren syndrome antigen A/Sjögren syndrome antigen B). The patient was diagnosed with viral cerebellitis secondary to COVID-19 infection. The CSF was not able to be tested for

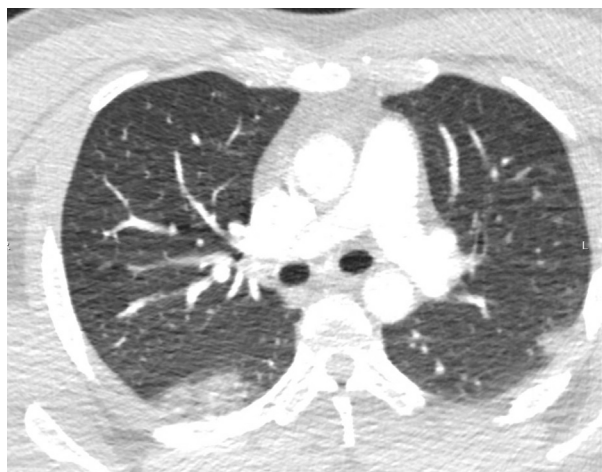


Figure 1. Computed tomography angiogram of head and neck demonstrating partially visualized consolidations in the posterior, bilateral upper lungs concerning for multifocal pneumonia.

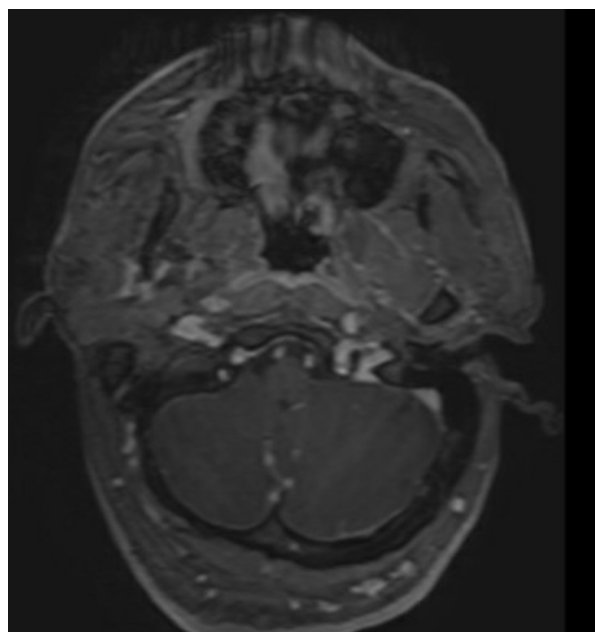


Figure 2. T1 post-gadolinium enhanced axial magnetic resonance image through the level of the cerebellum showing a normal appearance of the cerebellum.

COVID-19 and was not done because it would not change the management of patient after clinical cerebellitis was diagnosed. He remained hospitalized for 10 days with some improvement in his neurologic symptoms, although he still required a walker at discharge for ataxia and was scheduled to receive home health physical and occupational therapy.

DISCUSSION

Acute cerebellitis is a rare disease with symptoms of headache, nausea/vomiting, and ataxia. Acute viral cerebellitis is most commonly described in children (4). Viral pathogens known to cause acute cerebellitis include varicella-zoster, herpes simplex, Epstein-Barr, rotavirus, echovirus, coxsackie, mumps, measles, and rubella (5). COVID-19 has not yet been reported as a cause of acute viral cerebellitis without associated respiratory symptoms.

Respiratory coronavirus has been described as a cause of encephalomyelitis and encephalitis. The theory of the cause is that the coronavirus enters the central nervous system through the olfactory bulb, which then causes inflammation and demyelination. This leads to encephalitis and encephalomyelitis (6). This suggests a plausible causation of COVID-19 and neurologic manifestations.

In past case studies, MRI has been used as the “gold standard” in the diagnosis of cerebellitis, but 20% of patient with clinical cerebellitis have been found to have normal MRI findings (when using sequences T1, T2, FLAIR, DWI, ADC, and post contrast T1 and T2*). Fifty-four percent of patients with cerebellitis were found to have abnormalities on MRI brain with T1 sequence only. To diagnose cerebellitis, MRI brain and lumbar puncture are used to rule out other differential diagnoses (4). Furthermore, although some authors have made a distinction between post-infectious cerebellar ataxia and acute cerebellitis based on the absence or presence of findings on MRI or mental status changes, other authors speculate that this might merely represent a spectrum of the same disease process (7–9).

Patients presenting with COVID-19 can have a wide variety of symptoms. Symptoms are no longer limited to cough, fever, and shortness of breath. Patients have been commonly presenting with gastrointestinal symptoms and now with neurologic symptoms as well. Previous reports of neurologic deficits were from those that were symptomatic and included confusion, dizziness, impaired consciousness, propensity to develop acute strokes, anosmia, hypogeusia, ataxia, epilepsy, and neuralgia (10). Physicians should maintain a level of suspicion for COVID-19 when encountering patients with neurologic manifestations, which might be due to an aberrant immune response to COVID-19. This remains to be characterized (11).

Unexpected findings of COVID-19 have been reported at the lung bases of abdominopelvic CT imaging. These patients were not previously suspected of having COVID-19 and underwent CT for abdominal pain and were subsequently found to have COVID-19 confirmed by PCR (12). As with our patient, COVID-19 was not suspected until a CT angiogram of the head and neck was noted incidentally to have peripheral lung opacities concerning for multifocal pneumonia. In past studies, CT chest was shown to be more sensitive than reverse transcription (RT) PCR, with a sensitivity of 97% when in reference to RT-PCR (13).

A diagnosis of acute viral cerebellitis secondary to COVID-19 was made in our patient based on the clinical findings of cerebellar dysfunction associated with a positive COVID-19 PCR, characteristic CT chest findings of COVID-19 infection, and no alternative explanation for his symptoms.

WHY SHOULD AN EMERGENCY PHYSICIAN BE AWARE OF THIS?

It is important for emergency physicians to know that COVID-19 can have many clinical manifestations. This case report describes a patient who presented to the ED with symptoms of acute viral cerebellitis, but without other systemic or respiratory symptoms typically associated with acute COVID-19 infection. It is important for an emergency physician to maintain a high level of suspicion for COVID-19 infection in patients presenting with acute neurologic symptoms at the onset. Characteristic findings of multifocal pneumonia on CT of the chest has high sensitivity and should prompt further investigation into the possibility of COVID-19 as the cause.

REFERENCES

1. Singhal T. A review of coronavirus disease-2019 (COVID-19). *Indian J Pediatr* 2020;87:281–6.
2. Mao L, Jin H, Wang M, et al. Neurologic manifestations of hospitalized patients with coronavirus disease 2019 in Wuhan, China. *JAMA Neurol* 2020;77:683–90.
3. Filatov A, Sharma P, Hindi F, Espinosa P. Neurological complications of coronavirus disease (COVID-19): encephalopathy. *Cureus* 2020;12:7352.
4. Samkar V, Poulsen MNF, Bienfait HP, Van Leeuwen. Acute cerebellitis in adults: a case report and review of the literature. *BMC Res Notes* 2017;10:610.
5. Sawaishi Y, Takada G. Acute cerebellitis. *Cerebellum* 2002;1:223–8.
6. Bohmwald K, Galvez B, Rios M, Kalergis A. Neurologic alterations due to respiratory virus infections. *Front Cell Neurosci* 2018;12:386.
7. Yildirim M, Gocmen R, Konuskan B, et al. Acute cerebellitis or postinfectious cerebellar ataxia? Clinical and imaging features in acute cerebellitis. *J Child Neurol* 2020;35:380–8.
8. Emelifeonwu J, Shetty J, Kaliaperumal C, et al. Acute cerebellitis in children: a variable clinical entity. *J Child Neurol* 2018;33:675–84.

9. Lancella L, Esposito S, Galli ML, et al. Acute cerebellitis in children: an eleven-year retrospective multicentric study in Italy. *Ital J Pediatr* 2017;43:54.
10. Shaikh AG, Mitoma H, Manto M. Cerebellar scholars' challenging time in COVID-19 pandemic. *Cerebellum* 2020;9:343–4.
11. Gutiérrez-Ortiz C, Méndez A, Rodrigo-Rey S, et al. Miller Fisher syndrome and polyneuritis cranialis in COVID-19. *Neurology* 2020;95:e601–5.
12. Dane B, Brusca-Augello G, Kim D, Katz DS. Unexpected findings of coronavirus disease (COVID-19) at the lung bases on abdominopelvic CT. *AJR Am J Roentgenol* 2020;215:603–6.
13. Ai T, Yang Z, Hou H, et al. Correlation of chest CT and RT-PCR testing in coronavirus disease 2019 (COVID-19) in China: a report of 1014 cases. *Radiology* 2020;296(2):E32–40.