Radiology

Images in Radiology

COVID-19–associated Acute Hemorrhagic Necrotizing Encephalopathy: CT and MRI Features

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Since its introduction to the human population in December 2019, the coronavirus disease 2019 (COVID-19) pandemic has spread across the world with over 330,000 reported cases in 190 countries (1). While patients typically present with fever, shortness of breath, and cough, neurologic manifestations have been reported, although to a much lesser extent (2). We report the first presumptive case of COVID-19–associated acute necrotizing hemorrhagic encephalopathy, a rare encephalopathy that has been associated with other viral infections but has yet to be demonstrated as a result of COVID-19 infection.

A female airline worker in her late fifties presented with a 3-day history of cough, fever, and altered mental status. Initial laboratory work-up was negative for influenza, with the diagnosis of COVID-19 made by detection of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) viral nucleic acid in a nasopharyngeal swab specimen using the U.S. Centers for Disease Control and Prevention (CDC) 2019-Novel Coronavirus (2019-nCoV) Real-Time Reverse Transcriptase-Polymerase Chain Reaction assay. The assay was performed on a Roche

thermocycler at our institution following “emergency use authorization” from the CDC. Cerebrospinal fluid (CSF) analysis was limited due to a traumatic lumbar puncture. However, CSF bacterial culture showed no growth after 3 days, and tests for herpes simplex virus 1 and 2, varicella zoster virus, and West Nile virus were negative. Testing for the presence of SARS-CoV-2 in the CSF was unable to be performed. Noncontrast head CT images demonstrated symmetric hypoattenuation within the bilateral medial thalami with a normal CT angiogram and CT venogram (Fig 1). Images from brain MRI demonstrated hemorrhagic rim enhancing lesions within the bilateral thalami, medial temporal lobes, and subinsular regions (Fig 2). The patient was started on intravenous immunoglobulin. High-dose steroids were not initiated due to concern for respiratory compromise.

Acute necrotizing encephalopathy (ANE) is a rare complication of influenza and other viral infections and has been related to intracranial cytokine storms, which result in blood-brain-barrier breakdown, but without direct viral invasion or parainfectious demyelination (3). Accumulating evidence suggests that a subgroup of patients with severe COVID-19 might have a cytokine storm syndrome (4). While predominantly described in the pediatric population, ANE is known to occur in adults as well. The most characteristic imaging feature includes symmetric, multifocal lesions with invariable thalamic involvement (5). Other commonly involved locations include the brain stem, cerebral white matter, and cerebellum (5). Lesions appear hypoattenuating on CT images and MRI demonstrates T2 FLAIR hyperintense signal with internal hemorrhage. Postcontrast images may demonstrate a ring of contrast enhancement (5).

This is the first reported case of COVID-19–associated acute necrotizing hemorrhagic encephalopathy. As the number of patients with COVID-19 increases worldwide, clinicians and radiologists should be watching for this presentation among patients presenting with COVID-19 and altered mental status.

References

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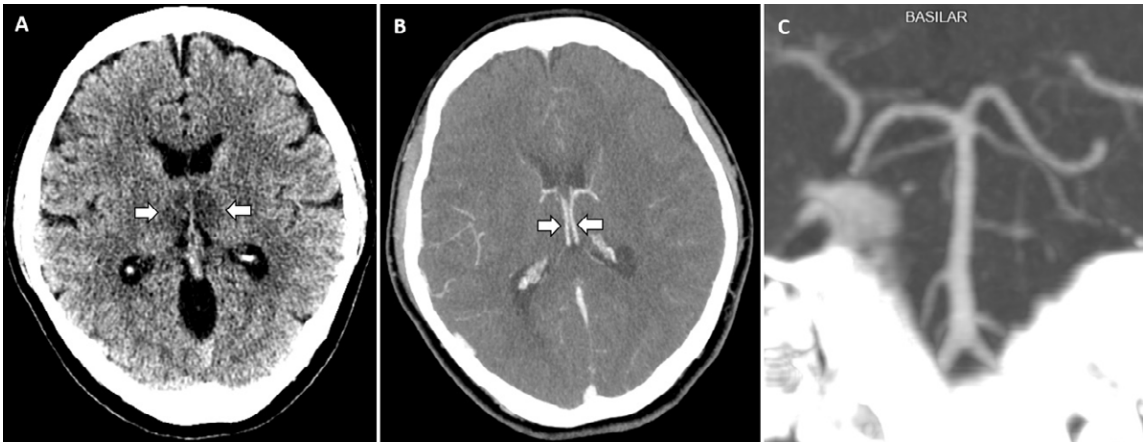

Figure 1: *A*, Image from noncontrast head CT demonstrates symmetric hypoattenuation within the bilateral medial thalami (arrows). *B*, Axial CT venogram demonstrates patency of the cerebral venous vasculature, including the internal cerebral veins (arrows). *C*, Coronal reformat of aCT angiogram demonstrates normal appearance of the basilar artery and proximal posterior cerebral arteries.

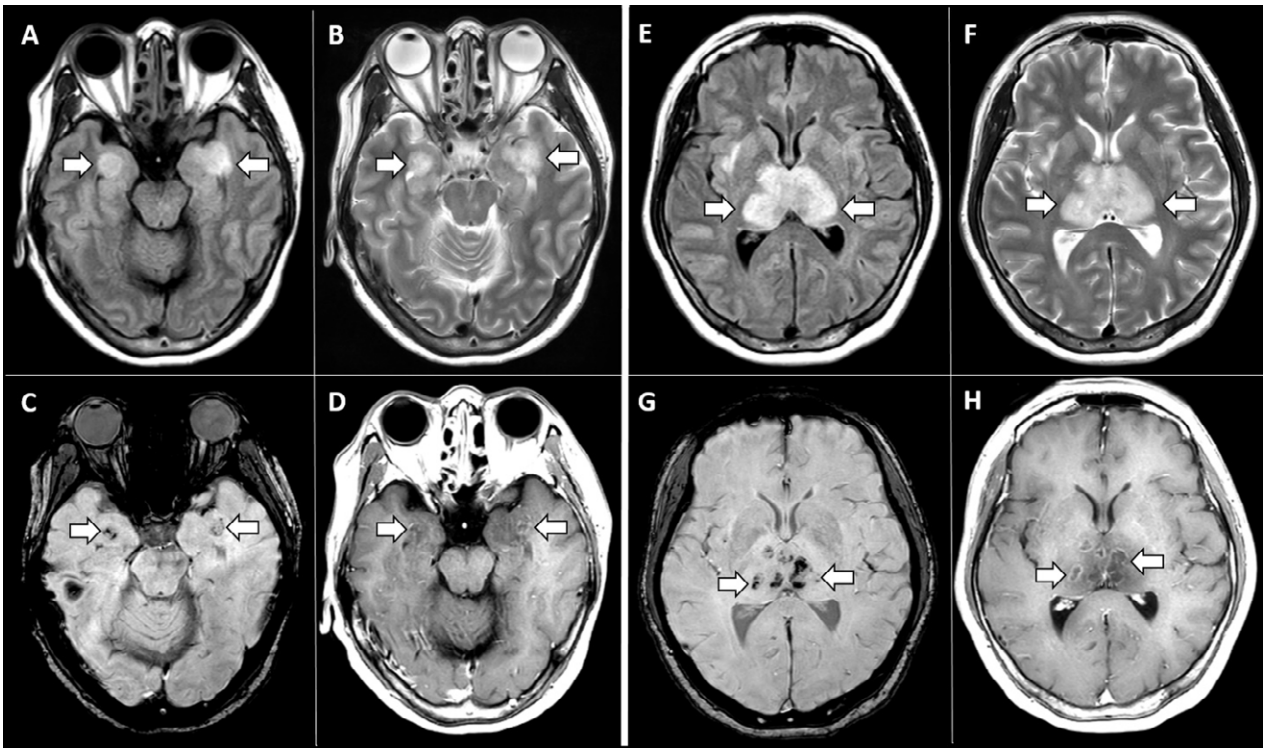

Figure 2: MRI images demonstrate T2 FLAIR hyperintensity within the bilateral medial temporal lobes and thalami (*A, B, E, F*) with evidence of hemorrhage indicated by hypointense signal intensity on susceptibility-weighted images (*C, G*) and rim enhancement on postcontrast images (*D, H*).