

# A Rare Case of COVID-19-Associated Acute Hemorrhagic Necrotizing Encephalopathy in a Young Patient

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## ABSTRACT

Coronavirus disease-19 is an infectious disease caused by severe acute respiratory syndrome coronavirus 2, a strain of coronavirus. It can also present with neurological sequelae. It has been related to intracranial cytokine storm. Here, we present a case of acute hemorrhagic necrotizing encephalopathy in a young patient who presented with the characteristic magnetic resonance imaging findings. As the pandemic continues, we can expect that the spectrum of neurological presentations will widen. Knowledge of these neuroimaging features may assist in the detection and early management of neurological complications.

**Keywords:** Acute hemorrhagic necrotizing encephalopathy, Coronavirus disease, cytokine storm

*Asian Pac. J. Health Sci.*, (2022); DOI: 10.21276/apjhs.2022.9.1.18

## INTRODUCTION

Coronavirus disease-19 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), a strain of coronavirus. The first case was seen in Wuhan, China, in December 2019 before it spreads globally.<sup>[1]</sup> The typical presentation of SARS-CoV-2 is with fever and respiratory symptoms, but they can also present with neurologic sequelae. Few studies had demonstrated symptoms of encephalopathy and symptoms such as confusion, headaches, and altered mental status in 36% of COVID-19 patients.<sup>[2]</sup>

Acute necrotizing encephalitis (ANE) is commonly seen in the pediatric population as a parainfectious disease after acute viral respiratory infections, most commonly with influenza A (H1N1) and influenza B, parainfluenza, varicella, and enterovirus.<sup>[3]</sup> It has been related to intracranial cytokine storm, which results in blood-brain barrier breakdown, but without direct viral invasion or parainfectious demyelination.<sup>[4]</sup> It is characterized by multifocal symmetric involvement of bilateral thalami, brainstem tegmentum, internal and external capsules, and the cerebral and cerebellar white matter which can be detected on magnetic resonance imaging (MRI).<sup>[5]</sup>

## CASE REPORT

A 36-year-old woman with no known medical history presented with aphasia, headache, and altered mental status for 1 day and with a 7-day history of fever. On presentation, the patient was hemodynamically stable with a SpO<sub>2</sub> of 98% on RA. At the time of admission, as per our present hospital guidelines, computed tomography (CT) chest was performed which revealed bilateral multiple subpleural patchy ground-glass opacities suggestive of a very high level of suspicion for pulmonary involvement of COVID-19 with a CT severity score of 10/40, and, subsequently, was found to be positive for COVID-19 on reverse transcriptase-polymerase chain reaction nasal swab test.

Non-contrast CT of the head was performed, which demonstrated bilateral symmetric hypodense areas within the thalami, pons, and cerebellar hemispheres. On the following day, MRI of the brain was done, which revealed bilateral symmetrical T2 and fluid-attenuated inversion recovery hyperintensities in

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**How to cite this article:** Ahmed MS, Sulthana SR, Marupaka SK, Naveed A. A Rare Case of COVID-19-Associated Acute Hemorrhagic Necrotizing Encephalopathy in a Young Patient. *Asian Pac. J. Health Sci.*, 2022;9(1):88-90.

**Source of support:** Nil

**Conflicts of interest:** None.

**Received:** 12/08/21

**Revised:** 22/08/21

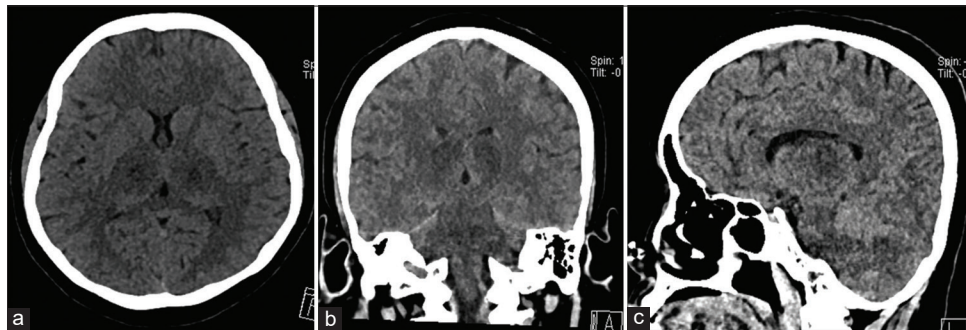
**Accepted:** 22/10/21

thalami, pons, and cerebellar hemispheres with ring-shaped restricted diffusion and areas of blooming on SWI in thalami and pons. These findings were consistent with the diagnosis of acute hemorrhagic necrotizing encephalopathy secondary to SARS-Cov-2 infection.

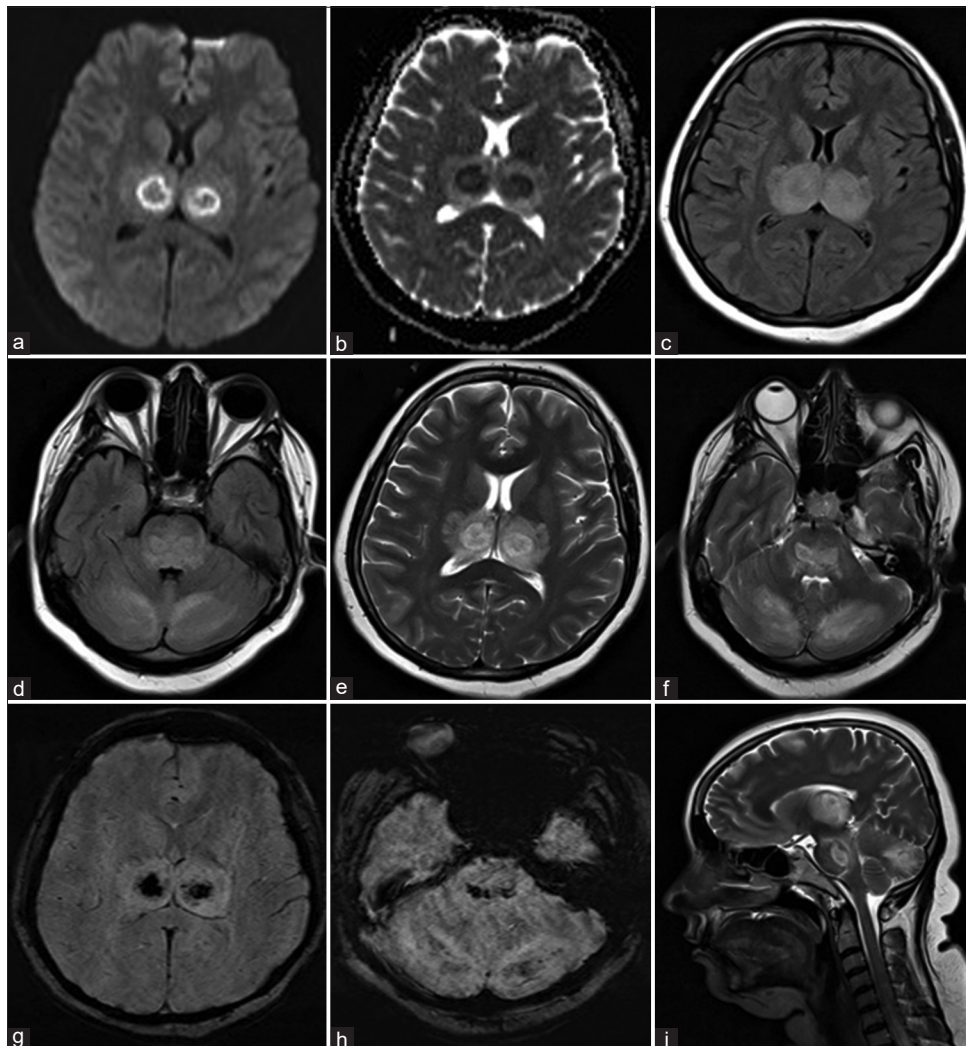
Laboratory tests revealed hemoglobin of 11.6 g/dl, lymphopenia, and adequate platelets on complete blood count. Liver function tests showed elevated liver enzymes. C-reactive protein and D-dimer were elevated. Interleukin-6 was elevated up to 16.97 pg/ml suggesting cytokine storm. We started the treatment with remdesivir, intravenous antibiotics, intravenous steroids, levetiracetam, acyclovir, and other supportive medications. The reverse transcriptase-polymerase chain reaction nasal swab test was negative after 5 days of admission. The patient made an uneventful recovery and was discharged home 10 days later in good condition.

## DISCUSSION

The cases of COVID-19 are on a rise in India, it can affect multiple organs including the central nervous system where the receptors are predominantly expressed by neurons. ANE is a rare encephalopathy frequently encountered in children and



**Figure 1:** Non-contrast computed tomography scan of the brain in axial (a), coronal (b), and sagittal (c) planes at the level of thalami showing symmetrical hypodensities in bilateral thalami



**Figure 2:** Magnetic resonance imaging brain on day 2 of admission. (a) Axial diffusion-weighted imaging and (b) apparent diffusion coefficient map at the level of thalami showing areas of ring-shaped diffusion restriction. (c and d) Axial fluid-attenuated inversion recovery (FLAIR) and T2 (e and f) and (i) sagittal T2 images showing bilateral symmetrical T2 and FLAIR hyperintensities in thalami, pons, and cerebellar hemispheres. (g and h) Axial susceptibility-weighted imaging images showing areas of blooming in thalami and pons

is characterized by symmetrical, multiple lesions in the thalami, brainstem, striatum, and cerebral white matter.<sup>[6]</sup> The exact etiology and pathophysiology of ANE are unclear. Respiratory virus-induced neuroimmunopathology due to a dysregulation of host immune response has been described, in particular for

ANE.<sup>[7]</sup> This can be induced by the cytokine storm secondary to viral infections.

In our case, there was symmetrical involvement of bilateral thalami, pons and cerebellar hemispheres, and the medulla. The inflammatory mediators were elevated along with IL-6 suggesting

cytokine storm. Because of the early administration of steroids, antibiotics, and antivirals, the patient responded very well. Overall clinical and imaging features supported a diffuse hemorrhagic ANE with involvement of the brain stem. Based on the history of upper respiratory tract infection, clinical presentations, the characteristic MRI findings, and the lack of other prominent etiologies, a diagnosis of coronavirus-associated ANE was made.

## CONCLUSION

This case demonstrates that early diagnosis and aggressive management are very much needed. This condition should be thought of in patients of COVID-19 with neurological symptoms. It is unclear whether these imaging appearances are the sequelae of direct infectious encephalitis, post-viral encephalitis, hypoxia, or simply critical illness-related encephalopathy. Hence, further studies are needed for further understanding of COVID-19-related CNS pathologies.

## ETHICAL APPROVAL

Written and signed informed consent was taken from the guardians for publishing the case report.

## REFERENCES

1. Coronavirus disease (COVID-19) Weekly Epidemiological Update and Weekly Operational Update; 2021. Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports> [Last accessed on 2021 Mar 29].
2. Weiss P, Murdoch DR. Clinical course and mortality risk of severe COVID-19. *Lancet* 2020;395:1014-5.
3. Abdelrahman HS, Safwat AM, Alsagheir MM. Acute necrotizing encephalopathy in an adult as a complication of H1N1 infection. *BJR Case Rep* 2019;5:20190028.
4. Rossi A. Imaging of acute disseminated encephalomyelitis. *Neuroimaging Clin N Am* 2008;18:149-61.
5. Wu X, Wu W, Pan W, Wu L, Liu K, Zhang HL. Acute necrotizing encephalopathy: An underrecognized clinicoradiologic disorder. *Mediators Inflamm* 2015;2015:792578.
6. Wong AM, Simon EM, Zimmerman RA, Wang HS, Toh CH, Ng SH. Acute necrotizing encephalopathy of childhood: Correlation of MR findings and clinical outcome. *AJNR Am J Neuroradiol* 2006;27:1919-23.
7. Mungaomklang A, Chomcheoy J, Wacharapluesadee S, Joyjinda Y, Jittmittraphap A, Rodpan A, *et al.* Influenza virus-associated fatal acute necrotizing encephalopathy: Role of nonpermissive viral infection? *Clin Med Insights Case Rep* 2016;9:99-102.