Encephalitis is inflammation of the brain parenchyma caused by either an infectious agent (viral, bacterial, fungal, protozoal, or helminthic) or through an autoimmune response, which may be postinfectious, paraneoplastic, or idiopathic. Diagnosis encompasses a comprehensive combination of laboratory, neuroimaging, and electrophysiologic findings. The majority of encephalitis cases are viral in etiology. Published data have shown that encephalitis is a rare but one of the most fatal manifestations of COVID-19 involving both adult and pediatric patients. In this case report, the authors from China presented a rare case of COVID-19-associated unilateral encephalitis, characterized by severe involvement of the left cerebral hemisphere.

Previous studies have described rare cases of unilateral encephalitis with anti-myelin oligodendrocyte glycoprotein (MOG) antibodies in cerebrospinal fluid and serum. Brain Sci. 2023, *13*(2), 283. https://doi.org/10.3390/brainsci13020283 Other viruses, such as herpes simplex types 1 and 2, can cause unilateral encephalitis, associated with high mortality and morbidity without adequate treatment.
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Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) affects the central nervous system (CNS). The exact mechanism of CNS invasion by SARS-CoV-2 is still being investigated, with possibilities including both direct viral invasion and indirect damages *via* inflammatory or autoimmune pathways. It seems that SARS-CoV-2 uses various neuroinvasive strategies and pathways to enter the CNS, such as the infection of the nasal olfactory epithelium and axonal transport along the olfactory nerve, retrograde axonal transport, the invasion through the impairment of the blood-brain barrier, and using infected hematopoietic cells as “Trojan horses” (haematogenic pathway). It is thought that the olfactory bulb serves as the main gateway for viruses to enter the brain.

About the case

A 47-year-old female patient with an acute SARS-CoV-2 infection presented with unconsciousness, rightward eye deviation, and seizures, characterized by involuntary twitching of the right arm and the right side of the face.

The authors conducted extensive cerebrospinal fluid and serum analysis to rule out the presence of various anti-neuronal antibodies, such as anti–*N*-methyl-d-aspartate (NMDA) receptor, anti–gamma-aminobutyric acid (GABA) B receptor, anti–α-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid (AMPA) receptor, anti–metabotropic glutamate receptor 5,

anti–leucine-rich glioma inactivated 1 (LGI1), anti–myelin oligodendrocyte glycoprotein (MOG), and anti-glutamic acid decarboxylase 65 kilodalton isoform (GAD65), as well as other potential causes of encephalitis or encephalopathy, including mitochondrial encephalomyelopathy and Creutzfeldt-Jakob disease. The patient underwent magnetic resonance imaging (MRI) which has a major role in the diagnosis and prediction of the possible cause.

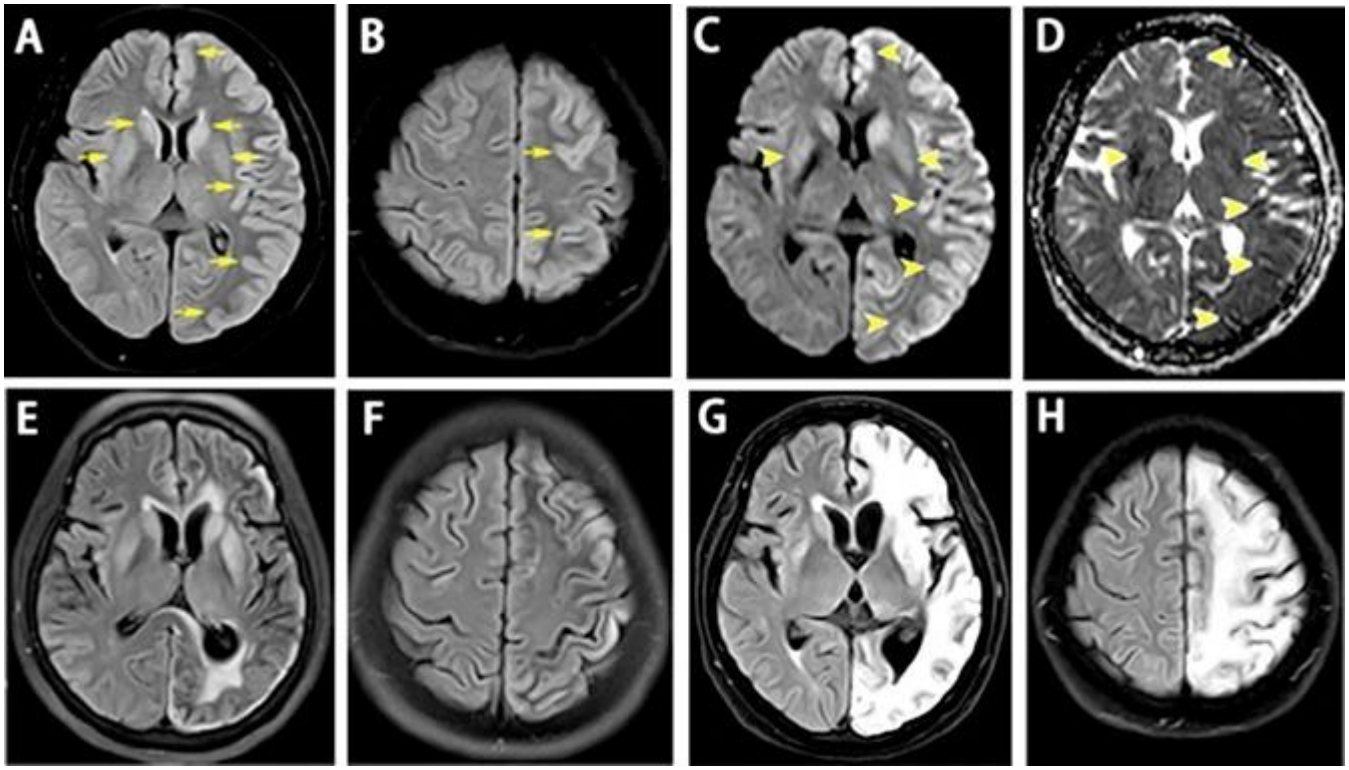
MRI findings

The MRI scans revealed encephalitis with a profound unilateral involvement of the left hemisphere. Axial T2-weighted fluid-attenuated inversion-recovery MRI scans showed dominantly cortical hyperintense lesions localized in the left cerebral hemisphere, bilateral insular cortex, and basal ganglia.

The patient was treated with high-dose methylprednisolone and intravenous immunoglobulin, and her condition gradually improved.

A month after treatment, a follow-up brain MRI scan revealed mild to moderate global and subcortical brain atrophy in the left cerebral hemisphere, accompanied by persistent hyperintensity in the bilateral basal ganglia regions.

Four months after treatment, an MRI examination demonstrated severe atrophy of the left hemisphere and mild involvement of the right caudate and lentiform nucleus.



The original illustration from the article of Wang, W., and Yin, S. Radiology 2024. (A, B) Axial T2-weighted fluid-attenuated inversion-recovery MRI scans show hyperintensity in the left fronto-parietal-occipital cortex and temporal lobe and bilateral basal ganglia regions (arrows), (C) diffusion-weighted source image shows hyperintensity (arrowheads) and (D) apparent diffusion coefficient map shows decreased signal (arrowheads). (E, F) Axial T2-weighted fluid-attenuated inversion-recovery images obtained one month after the initial presentation demonstrate mild to moderate global and subcortical region brain atrophy in the left cerebral hemisphere associated with ex vacuo dilatation of the left lateral ventricle. (G, H) Axial MRI scans obtained 4 months after treatment demonstrate discrete unilaterality, with severe atrophy of the left hemisphere and mild involvement of the right basal ganglia region.

Conclusion

According to the authors, this case is characterized by marked unilaterality, with severe involvement of the left cerebral hemisphere and the right-sided clinical presentation. Notably, an MRI examination demonstrated severe atrophy of the left hemisphere four months after treatment.

The authors emphasized that this asymmetric presentation contributes to the complexity of COVID-19-associated encephalitis. They concluded that further studies should investigate the underlying mechanisms of this rare form of COVID-19-associated encephalitis and its

possible long-term consequences.

Journal Reference

Wang W and Yin S. COVID-19 Hemiencephalitis: A Unique Manifestation. Radiology 2024; 310:e231716. https://doi.org/10.1148/radiol.231716