

# COVID encephalitis resulting in focal seizures with subsequent changes on MRI Imaging

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## INTRODUCTION

The neurologic manifestations associated with COVID-19 infection have been demonstrating increased clinical prevalence, with a presumed route of entry through the olfactory bulb leading to inflammation and demyelination<sup>Narula, Zombori</sup>. Of the common neurologic sequelae, seizures associated with SARS-COV have rarely been reported, and are hypothesized to occur as a result of acute systemic illness<sup>Zombori</sup>. Seizures with associated diffusion weight imaging (DWI) restriction on MRI are an accepted consequence after a single seizure episode<sup>Hübers</sup>. The associated DWI restrictions often appear as a hyperintense signal involving the cerebral cortex or hippocampi with corresponding hypointensity on apparent diffusion coefficient (ADC) images<sup>Pai</sup>. The pattern typically resembles a ribbon alongside the cortical band or around the border of a defined lesion<sup>Asadi-Pooya</sup>. Restriction is also often associated with gyral/cortical swelling and T2/FLAIR hyperintensity<sup>Pai</sup>. It is believed that these peri-ictal DWI and T2/FLAIR abnormalities likely reflect cytotoxic and vasogenic edema as a result of the increased blood flow and metabolic rate induced by seizure activity in the brain<sup>Pai</sup>. We present a rare case of COVID-19 encephalitis that resulted in focal seizures with associated post-ictal changes on MRI imaging, which to our knowledge has rarely been reported in the literature.

## HOSPITAL COURSE

We present a 52-year-old, right-handed Caucasian female, with a past medical history significant for relapsing remitting multiple sclerosis (RRMS), chronic bilateral lower extremity paraparesis, who presented secondary to focal seizure activity involving her left upper extremity and face with associated left sided gaze preference with associated changes in mentation for approximately 3 weeks prior to admission. Patient was diagnosed with RRMS in 2010, had been on several disease modifying medications including Glatiramer Acetate initially, followed by Fingolimod, which she did not tolerate. She has just been prescribed Ocrelizumab prior to admission but was not able to start prior to this admission.

Upon evaluation by the neurology service, patient was noted to be obtunded and unresponsive. She had an initial CT head without contrast performed which demonstrated a large wedge-shaped area of low attenuation in the right frontal lobe initially concerning for possible subacute infarct. Patient has also been found to be COVID-19 positive at this time, for which she was treated in the ICU. Initial MRI Brain with and without contrast revealed right frontal restricted diffusion, diffuse brain degenerative changes, bilateral white matter T2/FLAIR hyperintense foci without abnormal enhancement post IV contrast administration, no intracranial abnormal enhancement (Image 1). Further imaging studies including MRA head without contrast, MRV head without contrast, Carotid ultrasound, CTA of the head and neck with and without contrast were all unremarkable. MRI Cervical and Thoracic spine were performed, showing multilevel cord signal abnormalities compatible with patient's history of RRMS, no enhancing lesions were noted. She had an extensive workup including a lumbar puncture which was unremarkable except for a lymphocyte predominant pleocytosis, CSF studies for COVID-19 were not available in our facility.

Several initial EEGs were negative for epileptiform discharges, but significant for mild to moderate bihemispheric slowing. After several days of hospitalization, EEG was notable for epileptiform discharges originating from the right frontal lobe. Patient was treated with multiple antiseizure medications with eventual resolution of epileptiform discharges and seizure activity. MRI Brain with and without contrast was repeated 21 days after the initial MRI and it demonstrated resolution of previously seen restricted diffusion and T2 hyperintensity in the right frontal cortex (Image 2). Patient's clinical state significantly improved and patient was discharged home with close follow up.

## CONCLUSION

Since the onset of COVID-19, the neurologic sequelae of this primarily presumed respiratory illness are beginning to unfold, and are becoming more prevalent<sup>Narula</sup>. Neurologic manifestations of COVID-19 have been reported to be present in about 25% of patients, with a wide spectrum of symptoms ranging from dizziness, seizures, strokes to impaired consciousness<sup>Asadi-Pooya</sup>. Seizures in association with COVID-19 encephalitis have become more accepted, and are thought to be related to acute systemic illness<sup>Asadi-Pooya</sup>. Numerous case studies have reported electroencephalogram (EEG) findings in patients with COVID-19 encephalitis that are consistent with focal areas of status epilepticus especially in the temporal, fronto-temporal, and centro-parietal regions<sup>Narula</sup>. It is an accepted consequence that epileptiform discharges especially status epilepticus have associated DWI alterations on MRI imaging<sup>Hübers</sup>.

As seen in this case presentation, the patient was noted to have right frontal epileptiform discharges on her electroencephalogram (EEG), that correlated with the cortical ribboning and restriction of diffusion seen in the right frontal lobe on MRI imaging, DWI sequence. It is presumed that the focal seizures in our patient were provoked by COVID-19 encephalitis that eventually led to the presence of MRI changes consistent with post-ictal changes; a well-known and accepted sequela of focal seizures. We do also raise the possibility that the COVID-19 encephalitis may have led to cortical MRI changes that may have resulted in focal seizures with associated epileptiform discharges. There have been rare case reports that do demonstrate cortical changes that have then been associated with late-onset seizures<sup>Zombori</sup>. Though the latter seems less likely in our case presentation as the DWI changes in the right frontal region on MRI imaging resolved with the treatment of the continuous seizure activity. It is important to recognize seizure and associated MRI changes as a potential sequela of COVID-19 encephalitis since urgent treatment of seizures are known to improve morbidity and mortality. It is also important to consider post-ictal changes on the differential diagnosis for DWI changes on MRI imaging as there is a broad differential of diagnoses may restrict diffusion on MRI imaging and it is important to diagnose appropriately, correlate clinically in order to ensure the patient is treated appropriately.

## Imaging

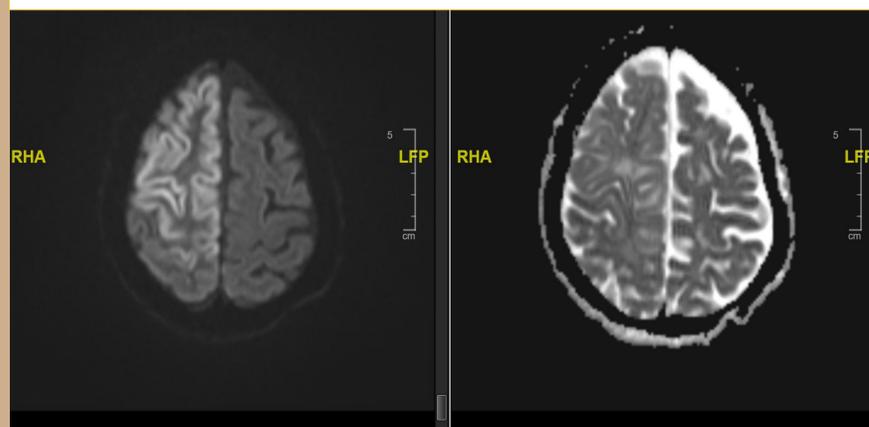


Image 1: Initial MRI Brain with and without contrast, demonstrating an axial DWI image (on the left) showing restriction of diffusion in the right frontal lobe, with the associated ADC image (on the right) that demonstrates drop-out.

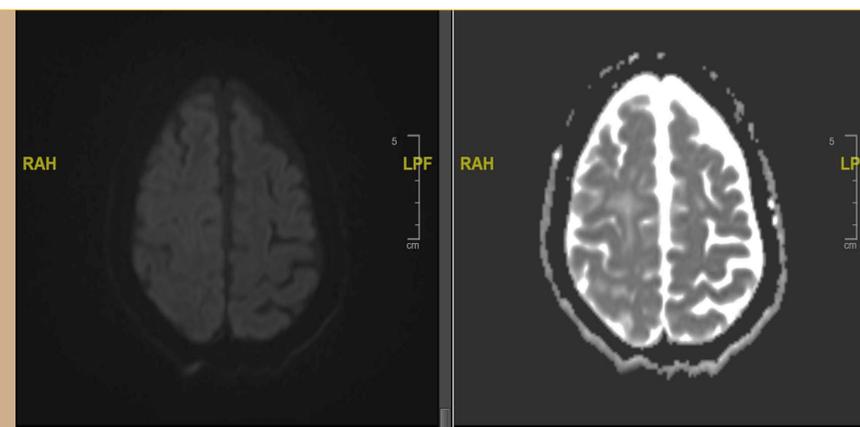


Image 2: This is the repeat MRI brain done 21 days after the initial MRI brain, after treatment of patient's focal seizures. demonstrated the resolution of the right frontal DWI restriction (on the left) with resolution of ADC (on the right) drop-out.

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