Herpes Encephalitis

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The Herpes viridae are a group of neurotropic viruses that tend to remain latent within cells until reactivated by several causes including emotional stress, immunocompromise and trauma. Of greatest concern in the central nervous system is the Herpes simplex virus, which is the most common cause of acute, fatal encephalitis. HSV type 1 accounts for more than 90% of cases, and HSV-2 the remainder.

HSV encephalitis has high morbidity and mortality – 97.5% of patients who survive the infection have persistent abnormal neurologic function, and the mortality rate is >70% for inadequately or untreated patients. Therefore, a high index of suspicion is required in evaluating brain imaging, especially in the setting of progressive, nonspecific neurologic signs and symptoms, fever, and altered mental status.

Neuroimaging, especially MRI, is a useful adjunct for diagnosis of HSV encephalitis because of the characteristic distribution of disease within the brain. Though classically brain biopsy was the most sensitive and specific study available for diagnosis of HSV, the morbidity and risk involved usually outweigh the benefit. Currently, PCR technique of the CSF plus adjuvant neuroimaging, specifically MRI, is considered “the most rapid, noninvasive, specific, and highly sensitive”

way to establishing (or exclude) the diagnosis.

Imaging Features

Findings typically begin in the anterior and medial temporal lobes and progress along the limbic system to the inferior temporal lobes and insular cortex. Involvement is typically more pronounced along the CSF-contacting areas of the brain, spreading inward to the deeper brain parenchyma. The basal ganglia are spared, which distinguishes this infectious encephalitis from MCA infarct. HSV encephalitis also tends to hemorrhage, with severity ranging from petechial to frank hematoma associated with necrosis. The following imaging findings reflect inflammation and cytotoxic and vasogenic edema:

- CT:
  - 25% of initial CT studies are normal. MRI is more sensitive.
  - Typical findings include hypodense edema in the involved cortex and white matter of the anteromedial temporal lobe, inferior frontal lobe, and insular cortex.
  - Hemorrhage presents as intraparenchymal hyperdensity.
- MRI:
  - FLAIR (and T2): Hyperintense signal of the involved cortex and white matter.
  - DWI/ADC: Often see true restricted diffusion

(hyperintense DWI signal, hypointense ADC signal)

- T1 Pre-contrast: If hemorrhage is present then subacute blood products will be inherently T1 hyperintense.
- T1 Post-contrast: Absent early. Variable later – patchy, gyral, diffuse, or ring.
- Spectroscopy: Decreased NAA. Increased Lipid and Lactate.

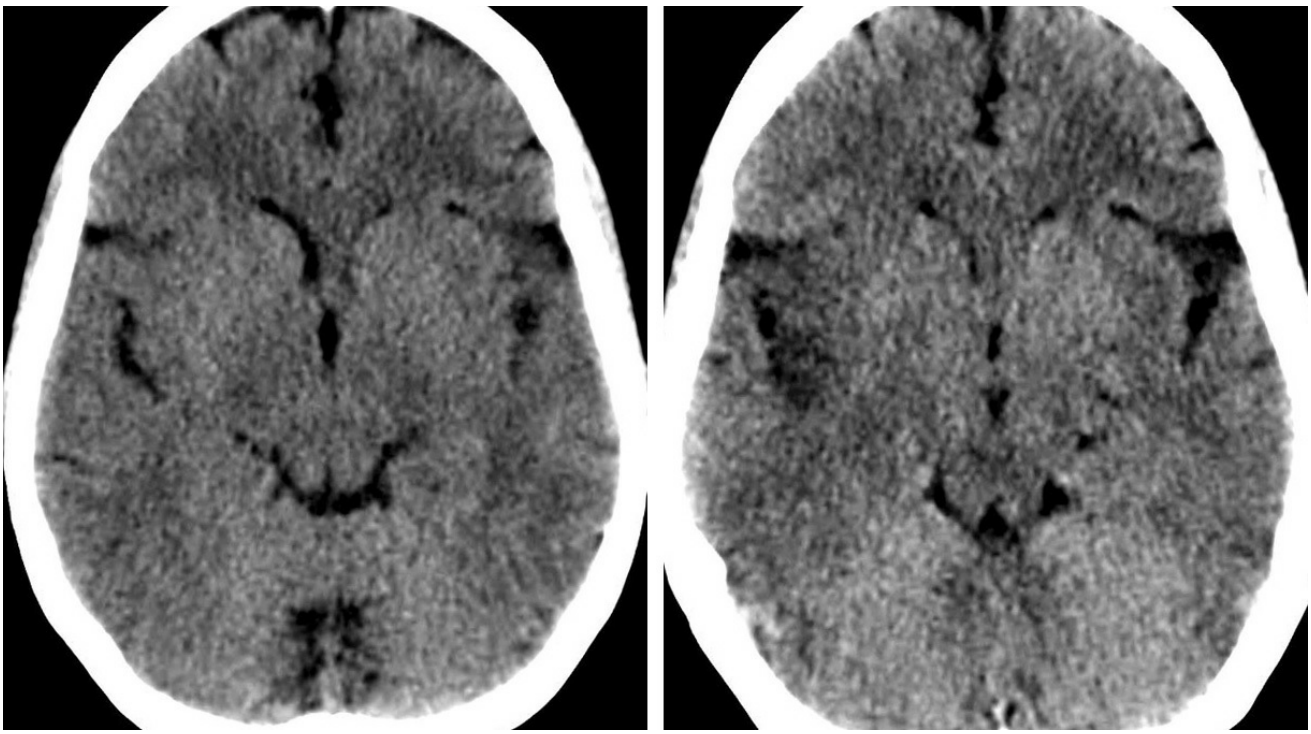

Figure 1: Noncontrast axial CT images of the head in this 70 year old patient with later confirmed herpes encephalitis. The left image shows a normal appearance of the brain. 3 days later (right), subtle hypodense edema has appeared in the right insular cortex.

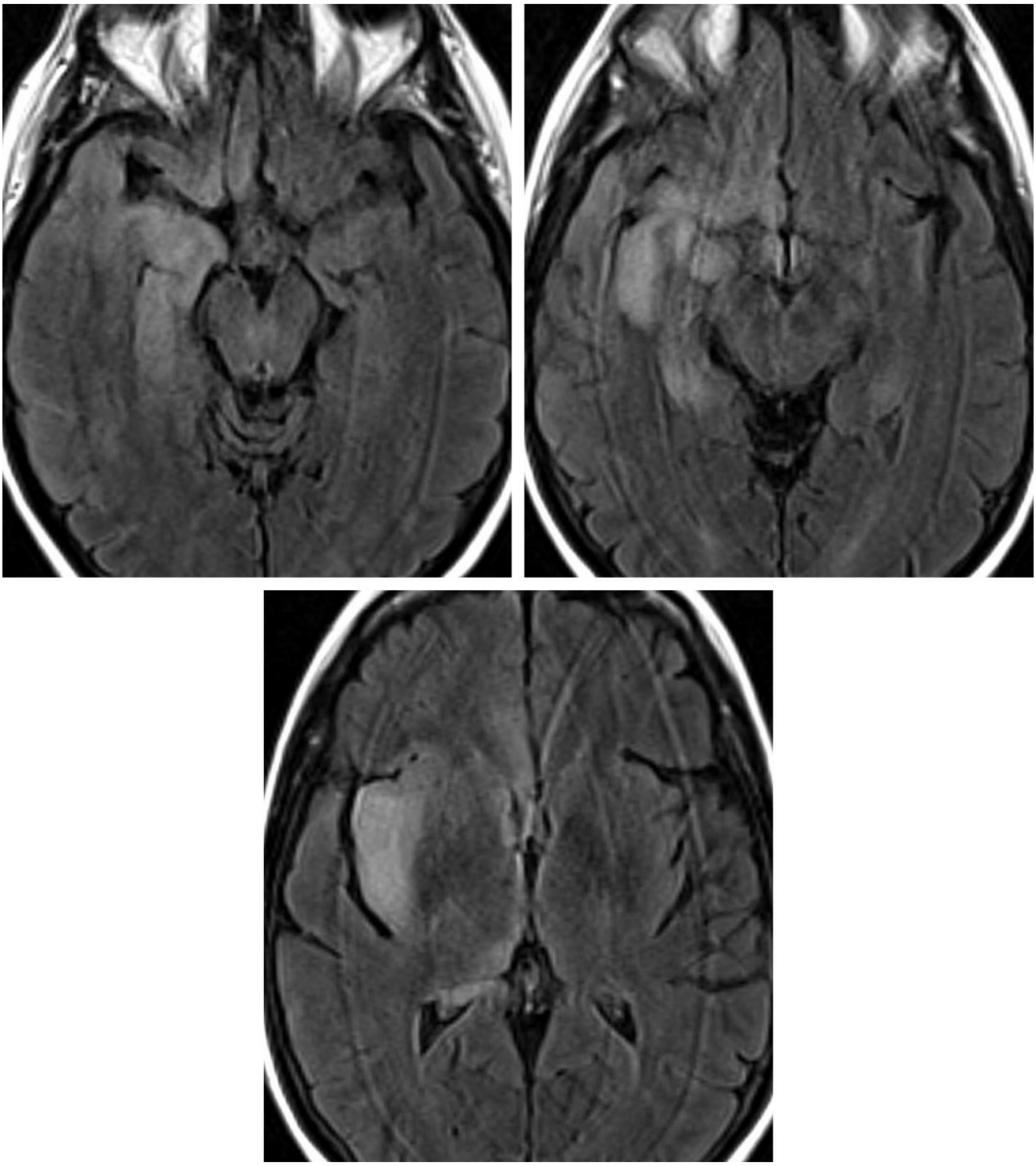

Figure 2: In the same patient as Figure 1, Axial FLAIR MR images demonstrate hyperintense edema involving the cortex and subcortical white matter of the medial anterior right temporal lobe, inferior right frontal lobe and right insular cortex with sparing of the basal ganglia.

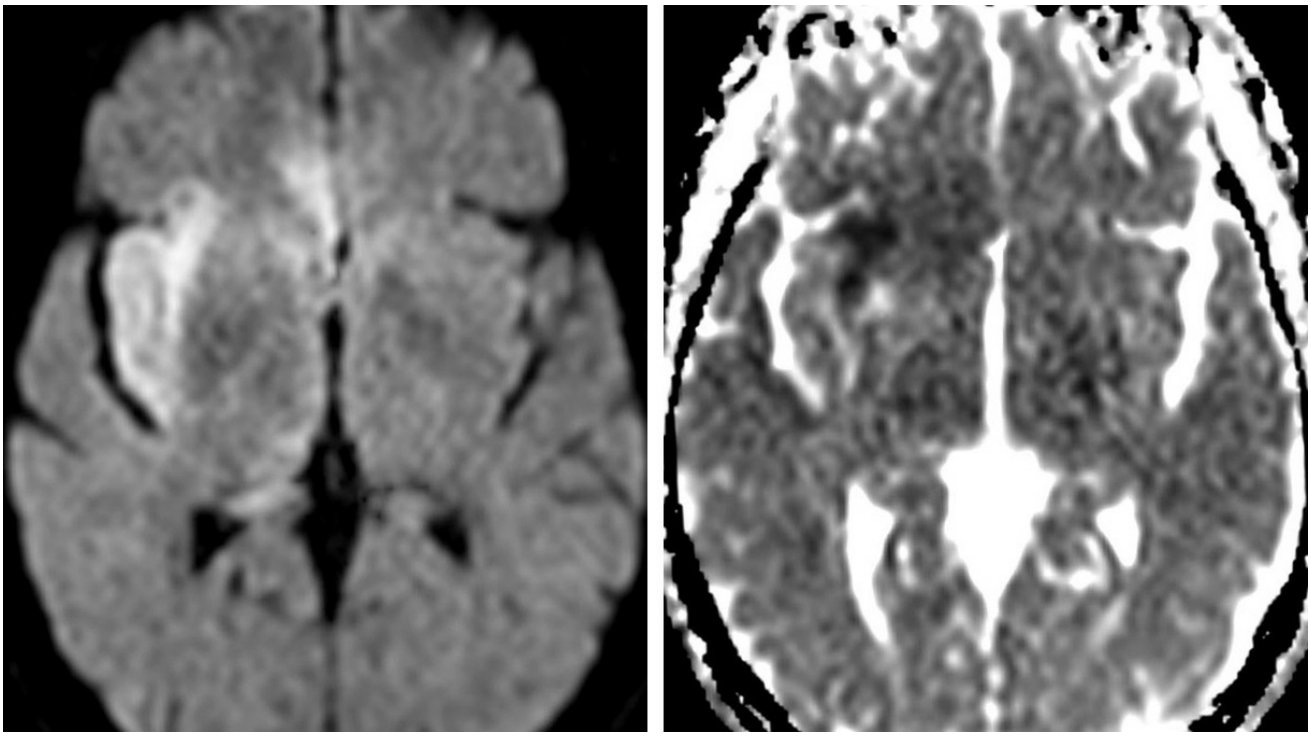

Figure 3: DWI (left) and ADC (right) images demonstrate restricted diffusion in the anterior right insular cortex reflecting cytotoxic edema (arrow). Vasogenic edema is also present as hyperintensity on DWI without ADC low signal intensity.

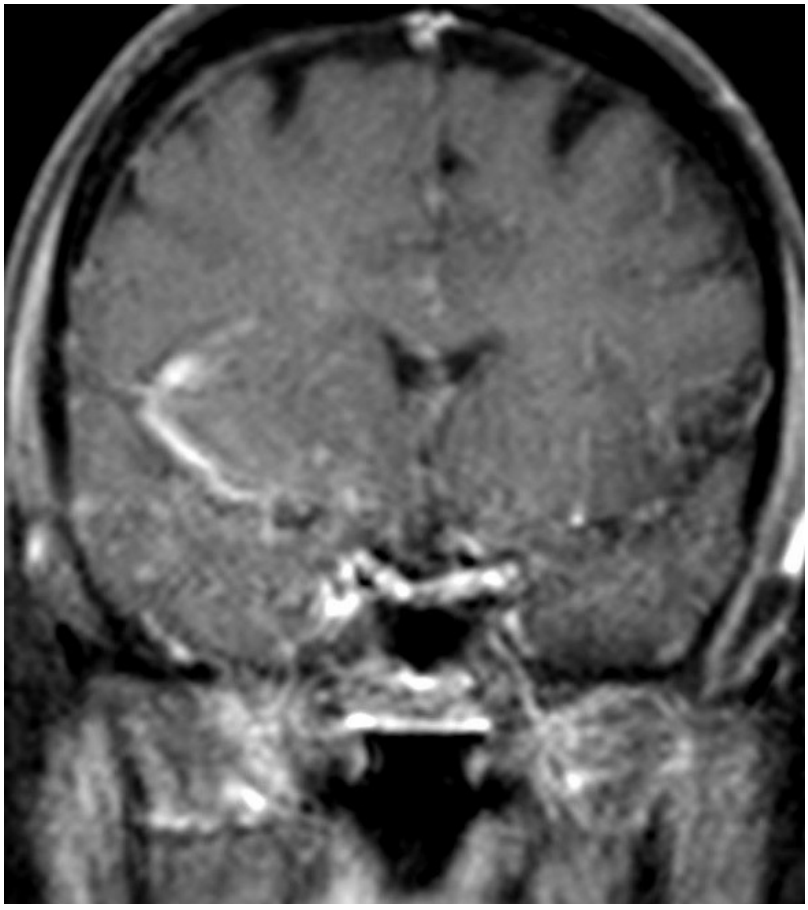

Figure 4: Contrast-enhanced T1-weighted coronal MR image shows a portion of the infected parenchyma as gyriform enhancement along the right insular cortex.

Differential Diagnosis

- Limbic encephalitis
- Diffuse glioma
- Status epilepticus

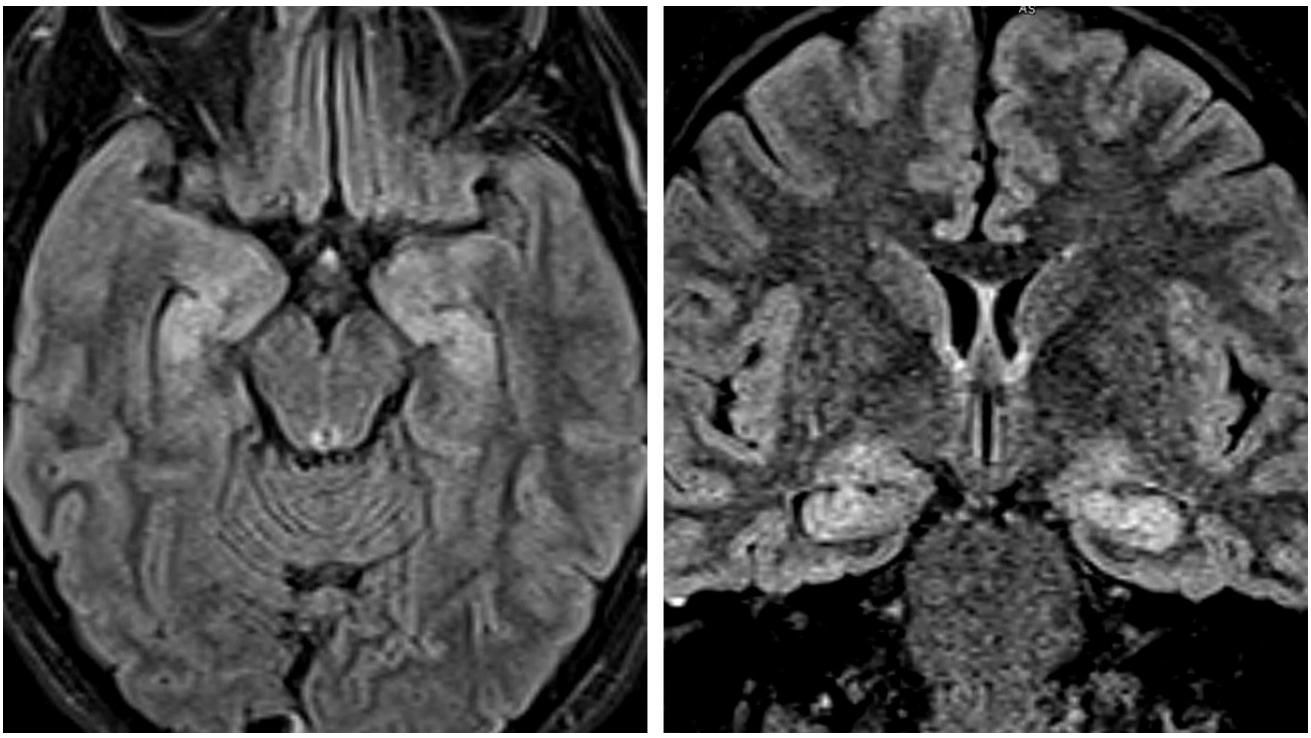

Figure 5: Axial (left) and coronal (right) FLAIR MR images demonstrate enlarged and hyperintense edematous hippocampi mimicking herpes encephalitis. In this patient, however, the findings were due to status epilepticus.

- MCA infarction (also involves the basal ganglia, which can help to distinguish it from HSV encephalitis)
- Trauma

- Neurosyphilis
- Other viral causes of encephalitis (Rabies, EBV, HHV-6, VZV, Influenza A)

For more information, please see the corresponding chapter in Radiopaedia.

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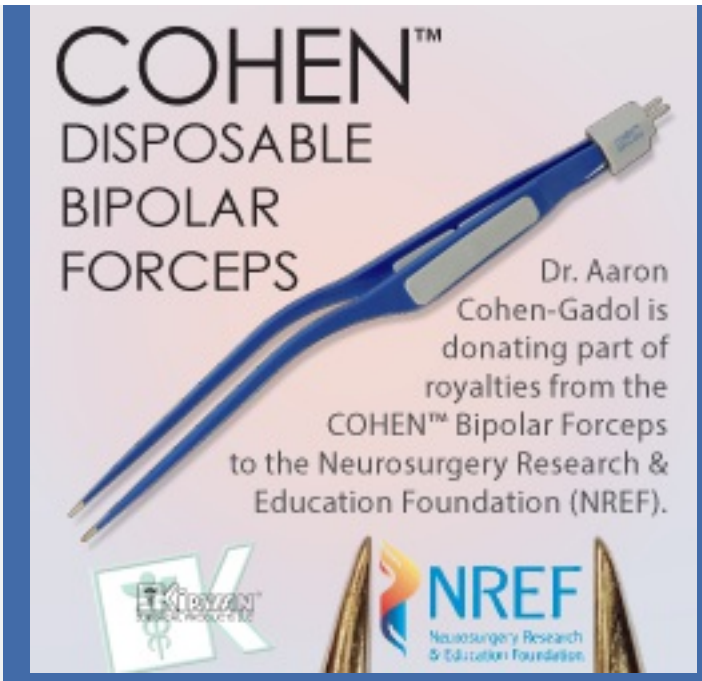
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