

MRI Appearances in Multi-Faceted Spectrum of Encephalopathy

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Abstract: *Encephalopathy represents a complex array of neurological disorders with diverse etiologies and clinical presentations. Magnetic Resonance Imaging (MRI) plays a pivotal role in characterizing the spectrum of structural and functional abnormalities associated with encephalopathy. This review aims to provide a concise overview of the diverse MRI appearances encountered in encephalopathy, spanning from subtle to profound changes in brain morphology, signal intensity, and perfusion patterns. We outline the key imaging findings observed across various etiologies, including metabolic, infectious, toxic, and inflammatory causes. Understanding the multi-faceted MRI spectrum in encephalopathy is essential for accurate diagnosis, prognostication, and guiding appropriate management strategies.*

Keywords: Encephalopathy, brain dysfunction, MRI imaging, diverse etiologies, diagnosis

1. Introduction

Patient usually present with altered sensorium associated with seizures, focal neurological deficits and extra-pyramidal movement disorder.

Along with the clinical evaluation, imaging is used to confirm the clinical suspicion and provide prognostic information.

In this publication we will discuss a brief outlook on some of these conditions. Encephalopathy refers to a clinical scenario of diffuse or multifocal brain dysfunction which encompass a wide range of etiologies including intoxications, infections, autoimmune disorders, severe hypertension and metabolic imbalances.

They are important to recognize as they can lead to catastrophic outcomes if not rapidly and properly managed.

Aim and Objectives

- Identify the imaging appearances of various encephalopathies.
- Describe the imaging finding that are highly specific for the diagnosis of the particular encephalopathy.

- To get a better understanding of its varied spectrum of clinical presentation.
- In turn, influencing the further management.

2. Methods and Materials

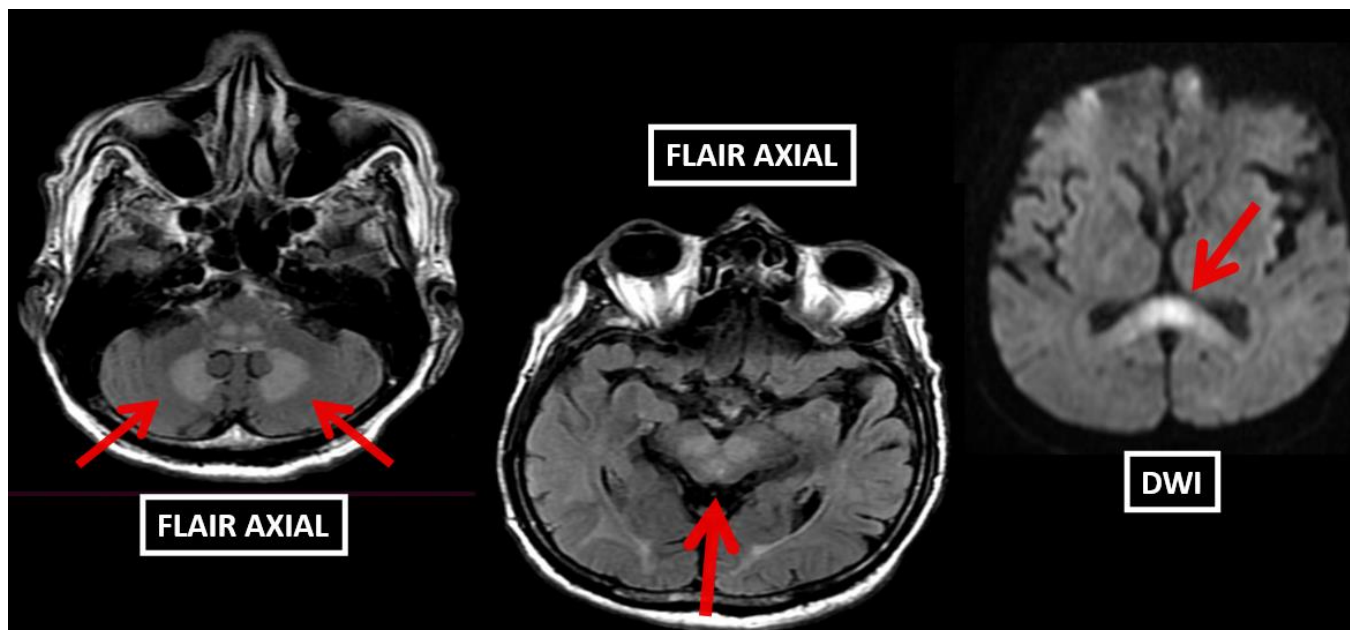
- Here we discuss the 6 characteristic cases presented to our institute who underwent MRI of the brain and were diagnosed with various encephalopathies.
- MRI scans of the brain were done on GE optima 1.5 Tesla machine with SOS gadolinium contrast administration.

3. Cases and Discussion

Case 1: Metronidazole Induced Encephalopathy

- A 72 years male had chief complaints of generalized weakness since 10 days, slurred speech since 2 days, loss of appetite since 15 days, persistent abdominal pain since 1 month and 2 spike of fever since 2 days.
- Patient had past history of hepatic abscess and was on drug Metronidazole.
- MRI scan of the Brain was performed.

Imaging Features:



Axial FLAIR MR Image shows bilateral symmetrical hyperintense signal intensity areas noted along dorsal aspect of the brainstem and dentate nuclei.

DWI images of MRI Brain shows restricted Diffusion involving the splenium of the corpus callosum.

Discussion

- Metronidazole has been recently reported to cause CNS toxic effects, although very rarely.
- In nearly all reported cases of Metronidazole induced brain toxicity, MRI Brain showed bilateral symmetrical

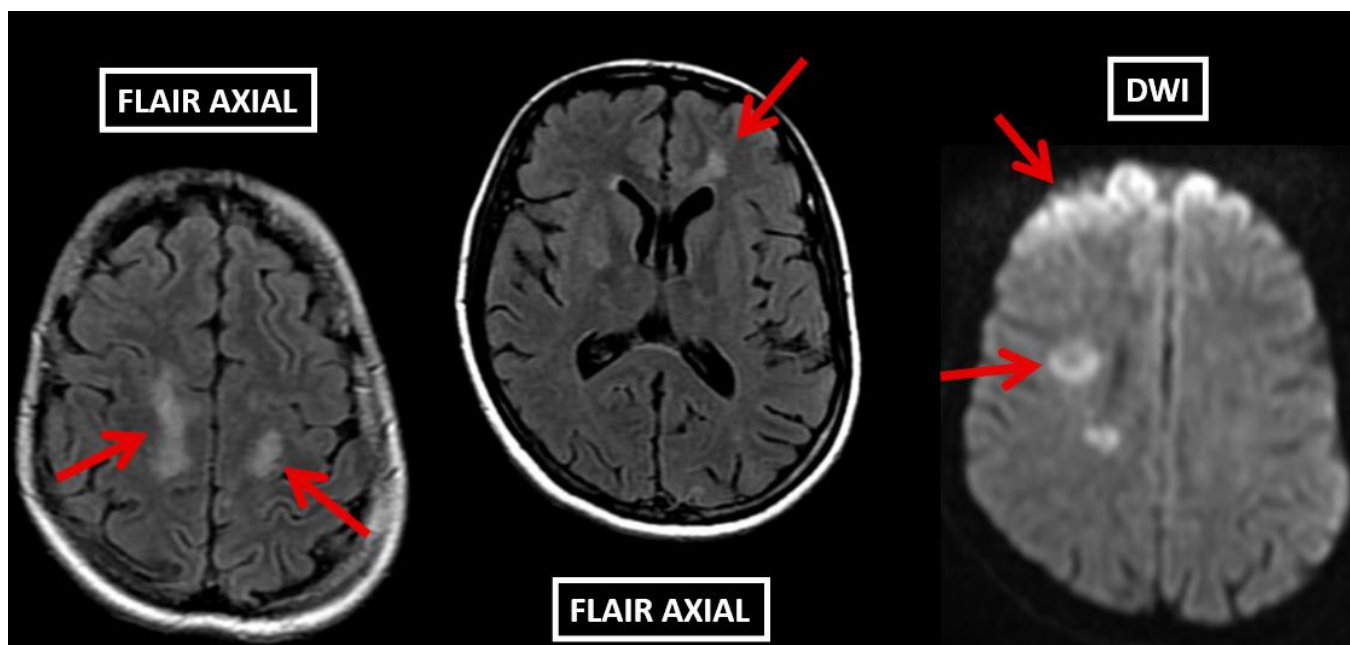
lesions in the cerebellum, predominantly in the dentate nuclei which appear T2W and FLAIR hyperintense.

- Some cases also demonstrate periventricular white matter involvement affecting the splenium.

Case 2: HIV Encephalopathy

- A 33 year old seropositive female presented to OPD with chief complaints of bilateral lower limb weakness and confusion. She was not on antiretroviral therapy.
- MRI scan of the Brain was performed.

Imaging Features:



Multiple small, discrete, ill defined areas of FLAIR hyperintense signal intensity are seen involving sub-cortical and deep periventricular white matter of bilateral fronto-parietal regions and gangliocapsular regions. Few of these appears bright on diffusion weighted images.

Discussion

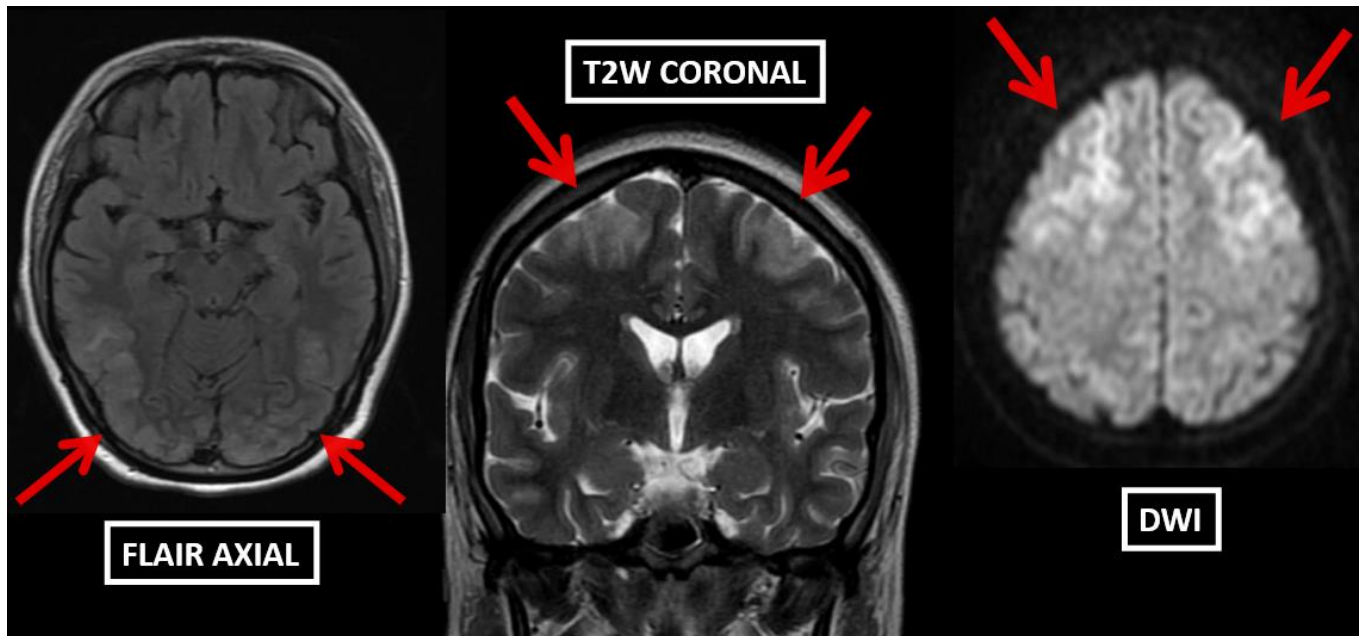
- HIV/AIDS is known to cause several CNS pathologies, one of them being HIV Encephalopathy.
- HIV Encephalopathy is a neurocognitive disorder caused by chronic inflammation in later stage of the disease.
- It is characterized by diffuse myelin and axonal degeneration.

- MR Imaging findings in early disease are usually unremarkable.
- T2W and FLAIR hyperintensities are noted in bilateral deep white matter and rarely in sub-cortical structures.

- 22 years old female, primigravida, had one episode of generalised tonic-clonic seizure post-partum. Shortly after resolution of seizures, while the patient was regaining consciousness, she started to report complaints of headache and bilateral diminution of vision.
- MRI of Brain was performed.

Case 3: Posterior Reversible Encephalopathy Syndrome (PRES)

Imaging Features:

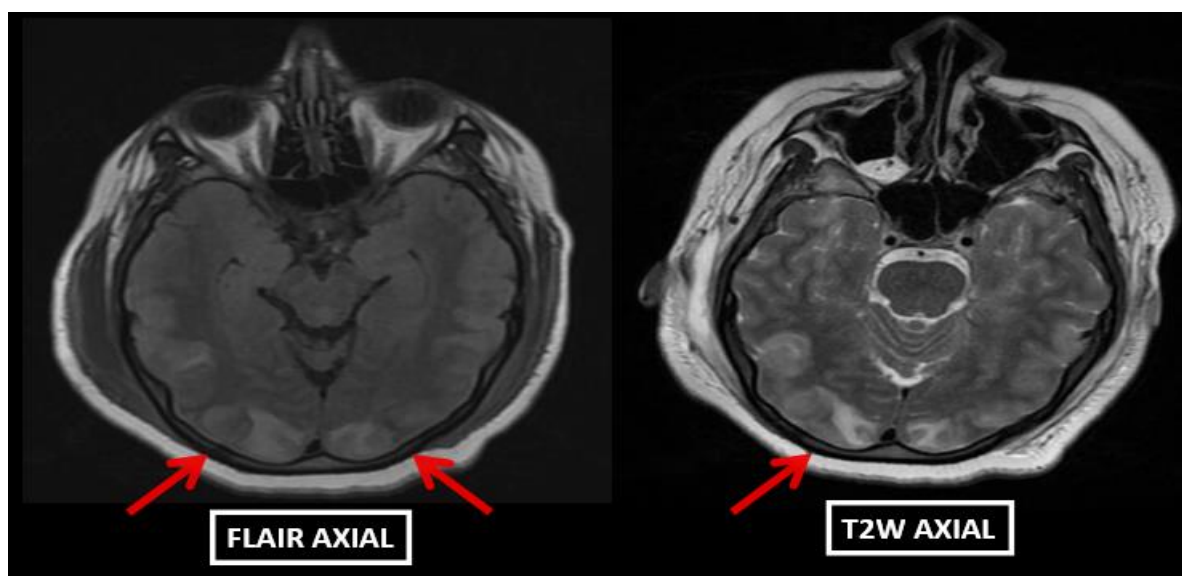


Multifocal areas of T2W and FLAIR hyperintense signal are seen involving the cortex and sub-cortical white matter of bilateral fronto-parietal, posterior temporal and occipital lobes. Few of these demonstrate hyperintense signal on Diffusion weighted images.

Case 4: Posterior Reversible Encephalopathy Syndrome (PRES)

- A 29-year-old woman, G3 P1 L1 A1 33 weeks by scan presented to the emergency department with chief complaints of 6 episodes of convulsions.
- She was a K/c/o hypertension and diabetes.
- MRI brain was performed.

Imaging Features:



Multifocal areas of T2W and FLAIR hyperintense signal intensities are seen involving the cortex, sub-cortical white

matter of bilateral posterior temporo-parietal and occipital lobes.

Discussion:

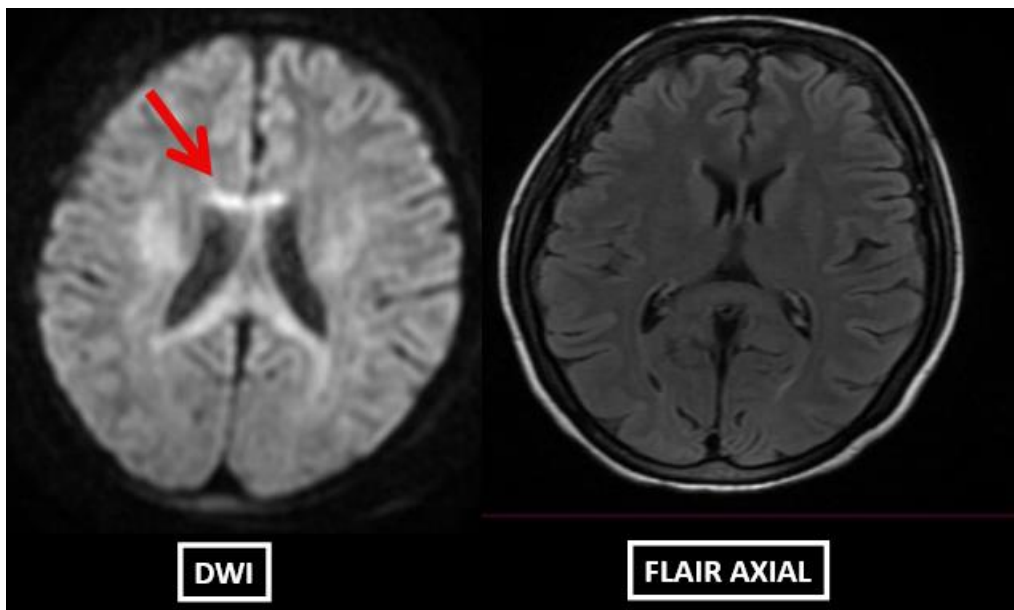
- Posterior Reversible Encephalopathy Syndrome (PRES) is a neurotoxic state most commonly associated with Eclampsia/Preeclampsia.
- Pathogenesis is injury to capillary bed secondary to hypertension, leading to hyper-perfusion and cerebral edema.
- Another hypothesis is vasoconstriction in response to hypertension.
- On imaging, cortical and sub-cortical white matter involvement is seen in occipital and parietal region which appear as T1 and T2 hyperintense and no

restricted diffusion in typical cases. Micro-hemorrhages can also be seen on gradient/ SWI Images as punctate areas of blooming.

Case 5: Hepatic Encephalopathy

- 30 years old female presented to the emergency department with chief complaints of altered mental status and yellowish discoloration of the eyes since 7 days associated with anorexia, nausea and vomiting.
- MRI scan of the brain was performed.

Imaging Features:

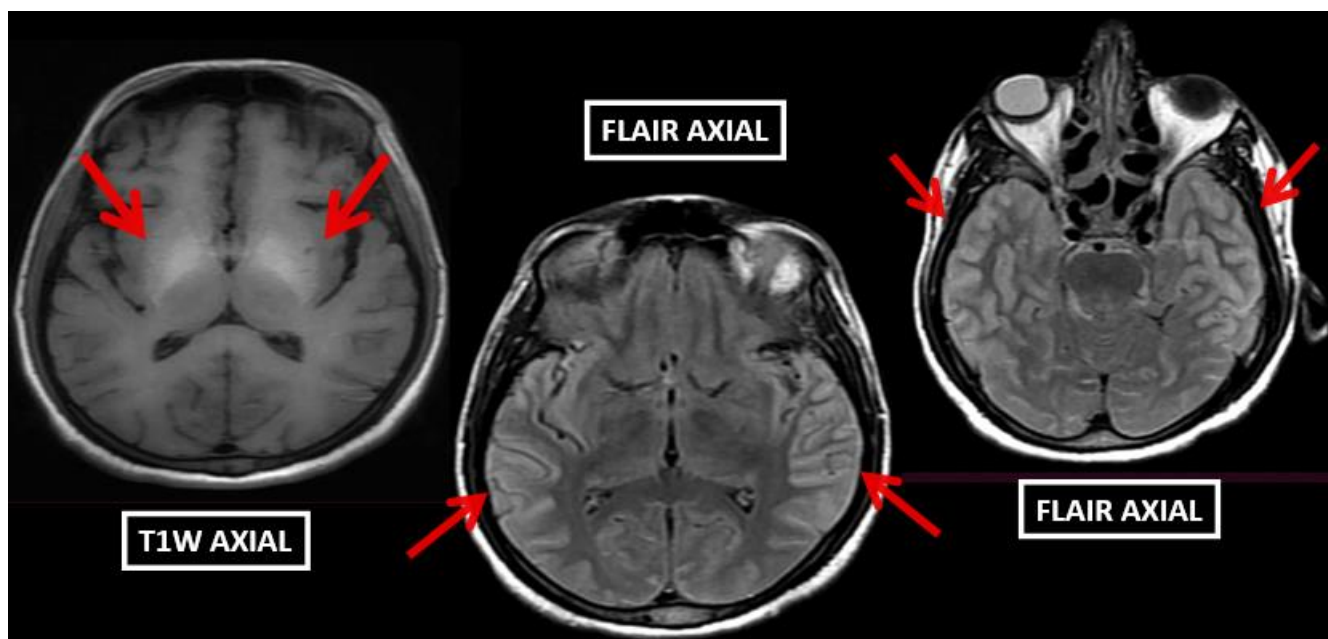


Areas of altered signal intensities which appear hyperintense on FLAR and Diffusion weighted images are seen involving Genu and Splenium of Corpus Callosum and Posterior limb of bilateral Internal Capsule.

- 34 years old male presented to emergency department with chief complaints of altered sensorium. Patient was known C/O end stage liver disease with suspected hepatic encephalopathy.
- MRI scan of the Brain was performed.

Case 6: Hepatic Encephalopathy

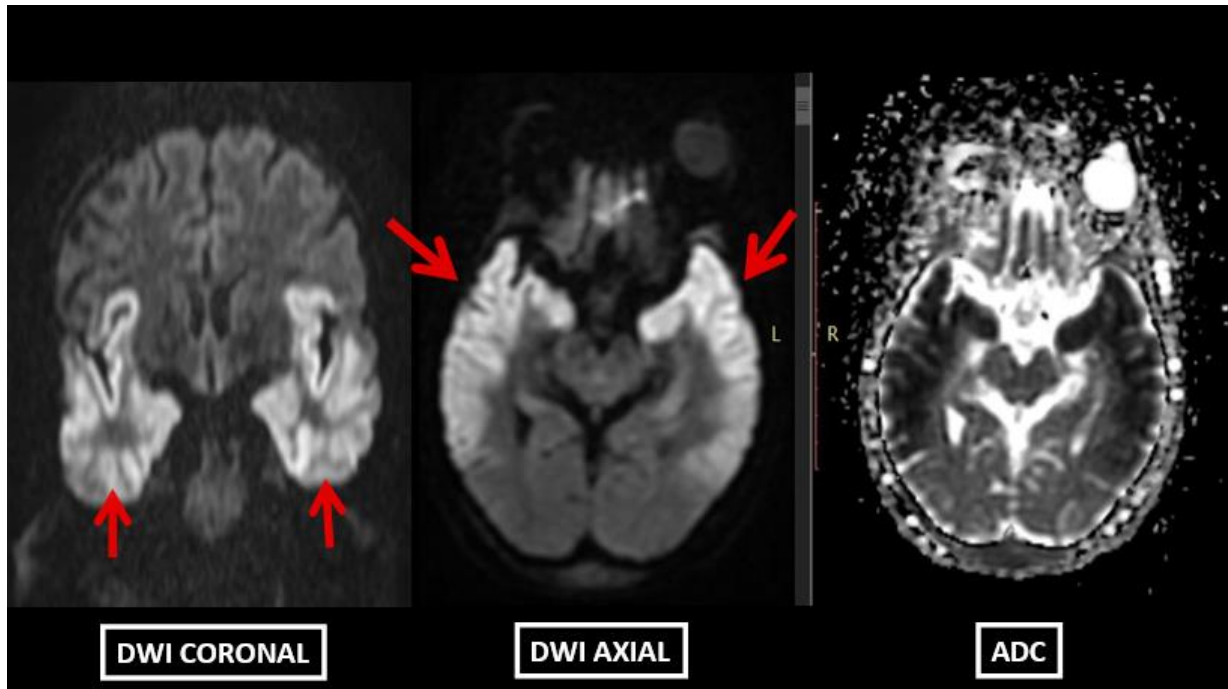
Imaging Features:



Bilateral symmetric areas of T1W hyperintense signal intensities seen involving the globus pallidus.

Bilateral symmetrical areas of FLAIR hyperintense signal intensities seen involving the both grey and white matter of bilateral temporo-parietal lobes.

Imaging Features:



Bilateral nearly symmetrical areas of restricted diffusion involving the both grey and white matter of bilateral temporo-parietal lobes.

- Ammonia is thought to be the main contributor along with inflammation, oxidative stress and neuro-steroids.
- MR imaging findings include bilateral basal ganglia T1W hyperintensities especially in globus pallidus (manganese deposition). FLAIR and DWI hyperintensities along the cortical spinal tract white matter.

Discussion

- Hepatic Encephalopathy is defined as a spectrum of neuropsychiatric disorder in patient with sever acute or chronic liver dysfunction.

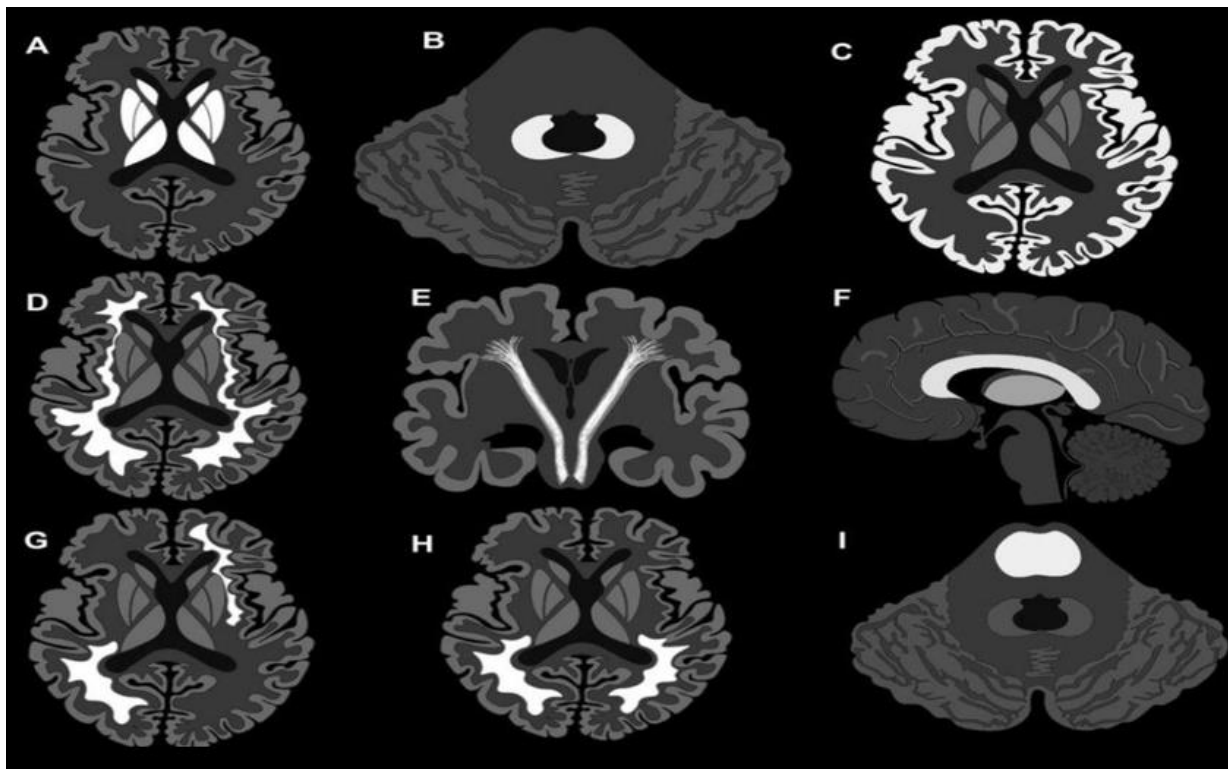


Illustration shows the most important general imaging patterns in multi-faceted spectrum of Encephalopathy

4. Results

- a) Out of the 6 cases,
- One was diagnosed with Drug Induced Encephalopathy.
 - One was diagnosed with HIV encephalopathy.
 - Two were diagnosed with Posterior Reversible Encephalopathy Syndrome (PRES).
 - Two were diagnosed with Hepatic Encephalopathy.
- b) A differential diagnosis was given wherever there was any overlap amongst the diagnoses.

5. Conclusion

The brain is highly susceptible to toxins, infections, autoimmune disorders, severe hypertension and metabolic changes which can result in a broad spectrum of encephalopathies.

By recognizing distinct imaging features such as symmetry, characteristic topographic distribution and enhancement pattern of the lesions, radiologist plays a crucial role in narrowing the diagnosis.

Encephalopathies may be diagnosed by a systemic assessment of the imaging patterns and signal abnormalities in the brain. However, amalgamation of radiological appearance with the clinical history and laboratory findings are necessary for accurate diagnosis.

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