

Understanding Pyogenic Meningitis: Causes, Diagnosis, and Challenges

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Abstract: *Pyogenic meningitis, also referred as bacterial meningitis, is a life-threatening CNS infectious disease affecting the meninges, with elevated mortality and disability rates. Three bacteria (Haemophilus influenzae, Streptococcus pneumoniae, Neisseria meningitidis) account for the majority of cases. Meningeal lesions pose diagnostic challenges, and knowledge of the clinical and imaging features of various conditions, including infection, autoimmune diseases, primary and secondary tumors, tumorlike diseases, and medication-induced diseases, is necessary for correct diagnosis.*

Keywords: Bacterial meningitis, Magnetic resonance imaging, Susceptibility-weighted imaging, Bleeding

1. Introduction

Bacterial meningitis is an acute infectious inflammation of the protective membranes covering the brain. Its early diagnosis is vital because of its high morbidity and mortality. It is mostly diagnosed by a gold standard diagnostic tool i.e. Cerebrospinal Fluid (CSF) analysis. However, it is sometimes difficult and or impossible to do this procedure and an alternative diagnostic tool is needed. Contrast enhanced magnetic resonance imaging can detect the pus or other changes in subarachnoid space. But our optimal aim is to use an imaging method without using contrast to be useable and available in more specific condition.

These conditions include infectious meningitis (bacterial, tuberculous, viral, and fungal), autoimmune diseases (vasculitis, connective tissue diseases, autoimmune meningoencephalitis, Vogt- Koyanagi-Harada disease, neuro-Behçet syndrome, Susac syndrome, and sarcoidosis), primary and secondary tumors (meningioma, diffuse leptomeningeal glioneuronal tumor, melanocytic tumors, and lymphoma), tumorlike diseases (histiocytosis and immunoglobulin G4-related diseases), medication- induced diseases (immune-related adverse effects and posterior reversible encephalopathy syndrome), and other conditions (spontaneous intracranial hypotension, amyloidosis, and moyamoya disease). Although meningeal lesions may manifest with nonspecific imaging findings, correct diagnosis is important because the treatment strategy varies among these diseases.

Dural leptomeningeal disease: anatomy, causes and neuroimaging findings Autoimmune disease

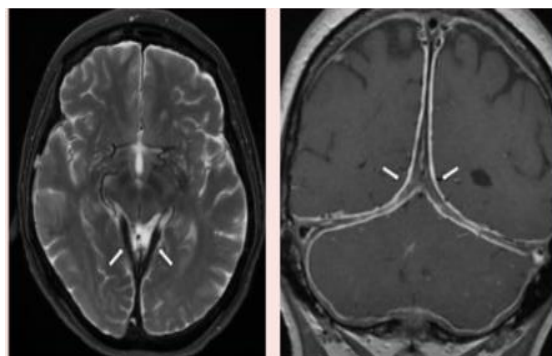


Figure A: Antineutrophil cytoplasmic antibody-associated vasculitis

Figure A: Shows dual thickening with T2-Weighted hypointensity- diffuse dural thickening and enhancement with central hypointensity. ("Eiffel-by-night" sign)

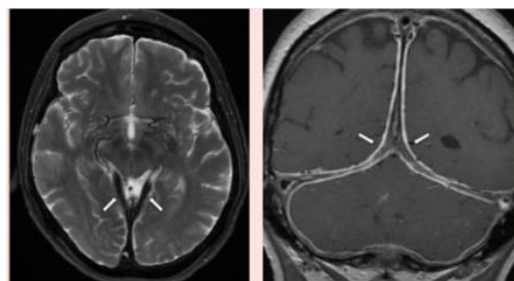


Figure B: Sjogren syndrome

Figure B: Shows diffuse linear thickening and enhancement of the dura matter- Bilateral atrophic parotid glands.

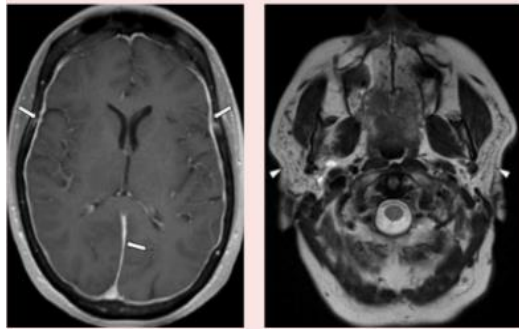


Figure C: Anti- N- methyl- D-aspartate receptor encephalitis

Figure C: Foci of leptomeningeal enhancement associated with FLAIR hyperintensity - severe cerebral volume loss with associated ventricle dilatation.

2. Case Report

Case Report:

A 41 year old female presented to the emergency room with history of altered mental sensorium, involuntary movements and fever and was unresponsive.

On examination: CNS study was unremarkable.

Past history of brain tumor surgery done in 2018.

MRI BRAIN SCREENING AND MRI BRAIN (PLAIN + CONTRAST) was performed.

MRI Brain Screening



Figure 1: Axial DWI, FLAIR and GRE section of brain at the level of high fronto-parietal region

Fig 1 : Shows a craniotomy defect involving right frontal region with mild transcalvarial herniation of the right frontal lobe and underlying gliotic area of CSF intensity with moderate perilesional edema and mild ex-vacuo dilatation of the adjacent lateral ventricle and few small areas of blooming

in the periphery of the gliotic area--- **suggestive of post-operative hemosiderin deposits.**

MRI Brain Screening (Continue)

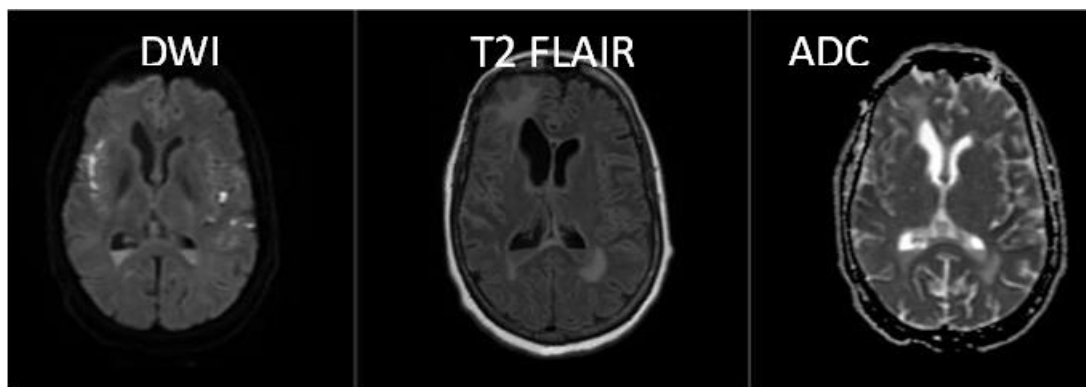


Figure 2: Axial DWI, FLAIR and ADC section of brain at the level of basal ganglia

3. Findings

Fig 2 Shows multiple discrete areas of altered signal intensity are noted bilateral fronto-temporo-parietal sulcal spaces, ambient and quadrigeminal, pre-pontine, pre-medullary and supra-sellar cisterns, bilateral sylvian fissures. It shows restricted diffusion on diffusion weighted images

and corresponding drop on ADC images and appears hyperintense on FLAIR images. However, few of the above mentioned altered signal intensity are not seen separately from the adjacent gyri

MRI Brain Plain + Contrast

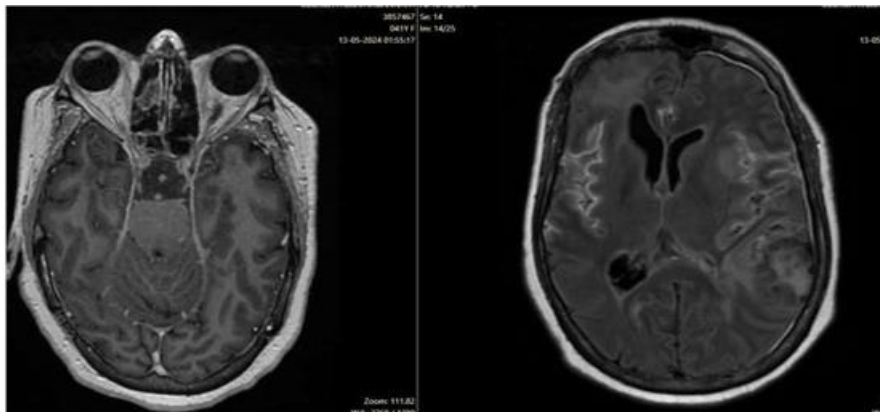


Figure 3: Axial post contrast study of brain at the level of pons (BRAVO) (left image) and gangliocapsular region (FLAIR +C) (right image)

Fig 3 Shows evidence of leptomeningeal enhancement involving bilateral fronto-temporo-parietal sulcal spaces, ambient and quadrigeminal, pre-pontine, pre-medullary and supra-sellar cisterns, bilateral sylvian fissures on post contrast study. There is mild pachymeningeal enhancement involving the left fronto-temporo-parietal regions- **likely suggestive of meningitis.**

4. Conclusion

Based on the abovementioned imaging features, the possible radiological differentials included Meningitis with encephalitis and ventriculitis

Other meningeal differential include :

- 1) Leptomeningeal meningitis
- 2) Viral meningitis
- 3) Tuberculous meningitis
- 4) Cryptococcal meningitis

5. Discussion

There was acute presentation of neck rigidity, positive kernigs sign and altered mental status in view of which possibility of a superadded infective etiology was suspected and LP was advised which confirms the findings of an infective etiology.

Lumbar Puncture Findings

- Appearance: clear, cloudy or purulent
- Opening pressure: elevated (> 25 cm H₂O))
- WBC count: > 100 cells / μ L (> 90% PMN); partially treated cases may have as low as 1 WBC/ μ L
- Glucose level: Low (< 40% of serum glucose)
- Protein level: elevated (> 50 mg/dL)
- Consider additional tests: CSF Gram stain and cultures, blood cultures, CSF bacterial antigens, CSF polymerase chain reaction (PCR), others depending on clinical findings

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