Post-Contrast FLAIR in Neuroimaging: Expanding the Diagnostic Value Beyond Contrast-Enhanced T1-Weighted Imaging

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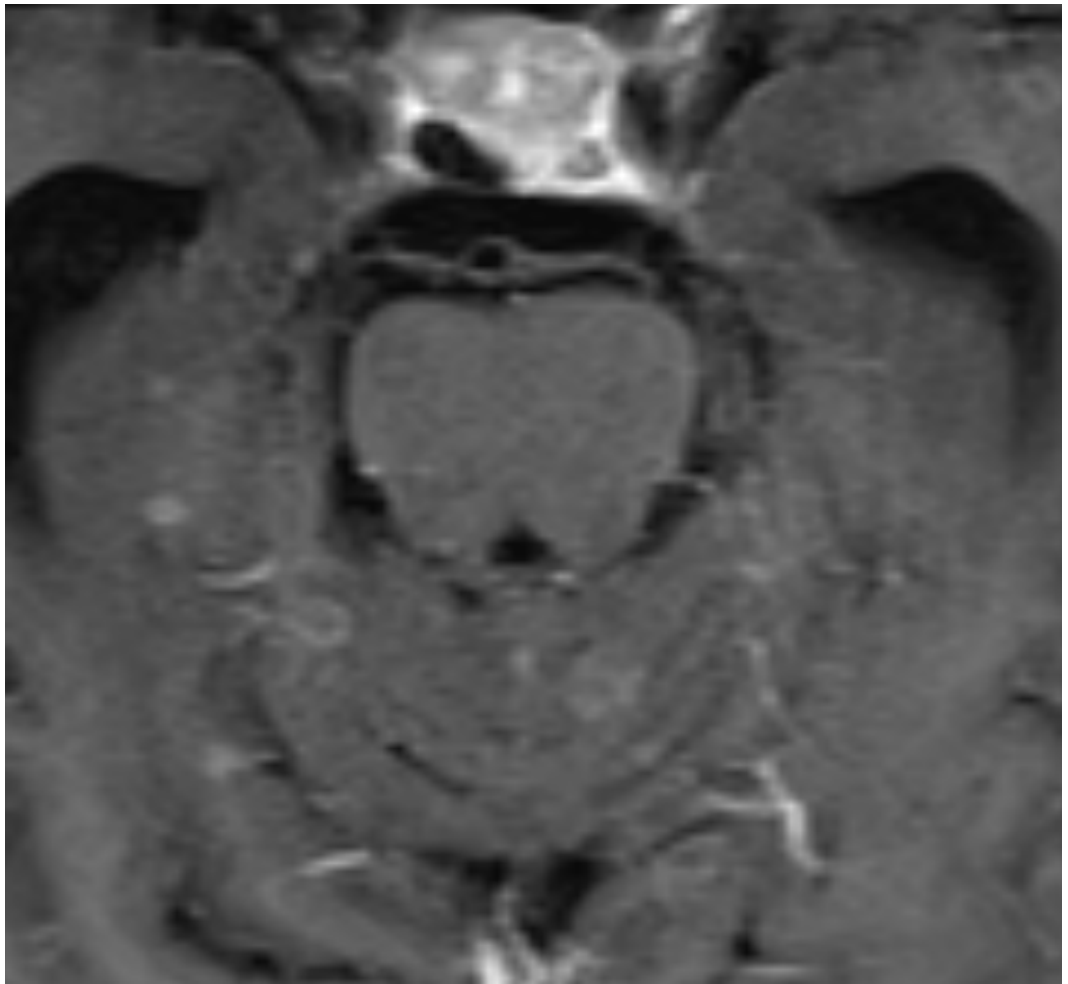
Introduction

- T2 FLAIR post-contrast imaging is an often under utilized sequence that offers complementary value when used in conjunction with standard T1 post contrast imaging.
- This sequence is excellent at helping identify disease processes that affect the blood brain barrier such as meningitis, leptomeningeal carcinomatosis, ventricular enhancement and parenchymal disease.
- The following slides will show examples of improved diagnostic accuracy due to utilization of T2 FLAIR post contrast imaging.

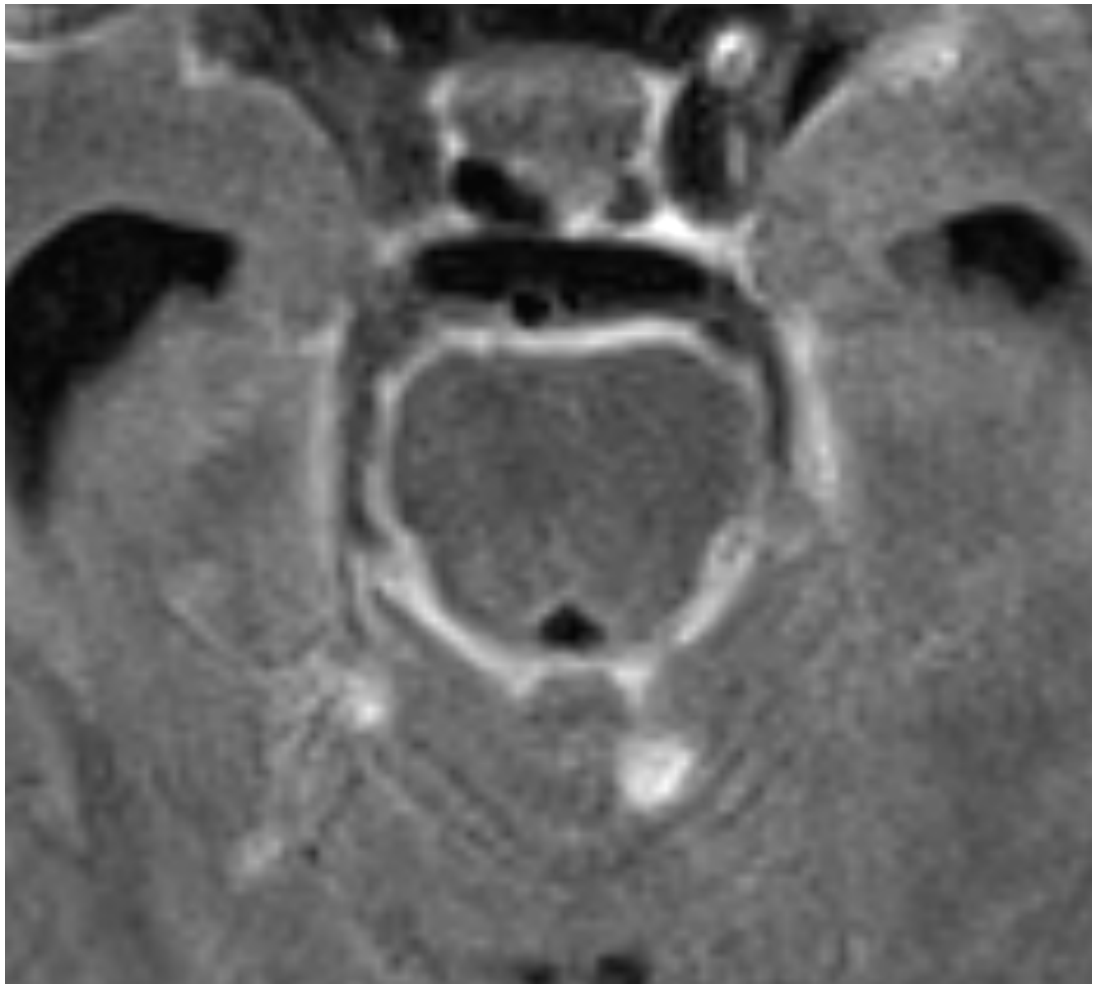
Meningitis

- Meningitis is an acute intracranial infection where accurate and early diagnosis is needed to ensure proper treatment and minimization of future comorbidities.
- Using standard post contrast T1 images to diagnose meningitis can be difficult and sometimes missed during the early stages.

T1 post contrast

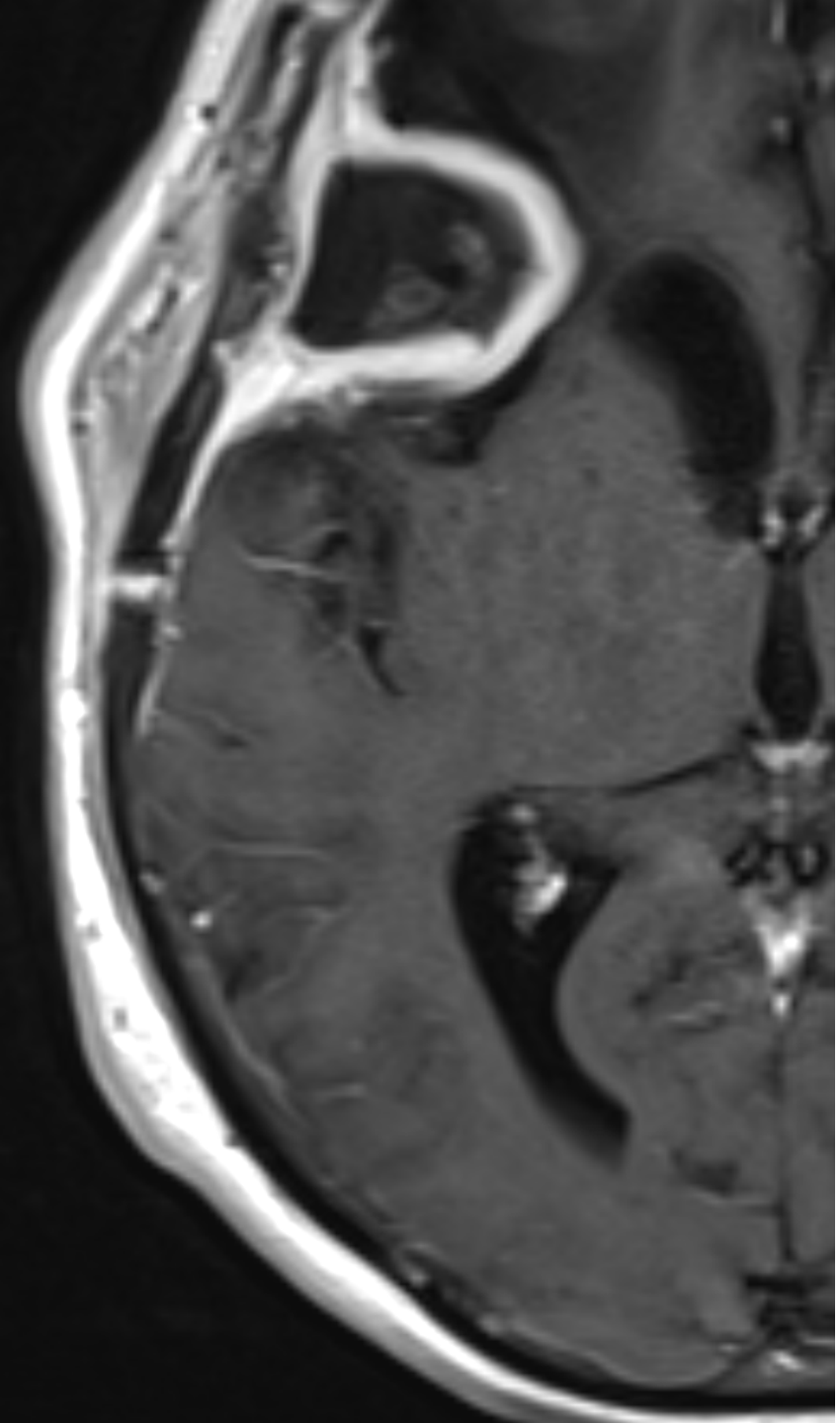


T2 FLAIR post contrast



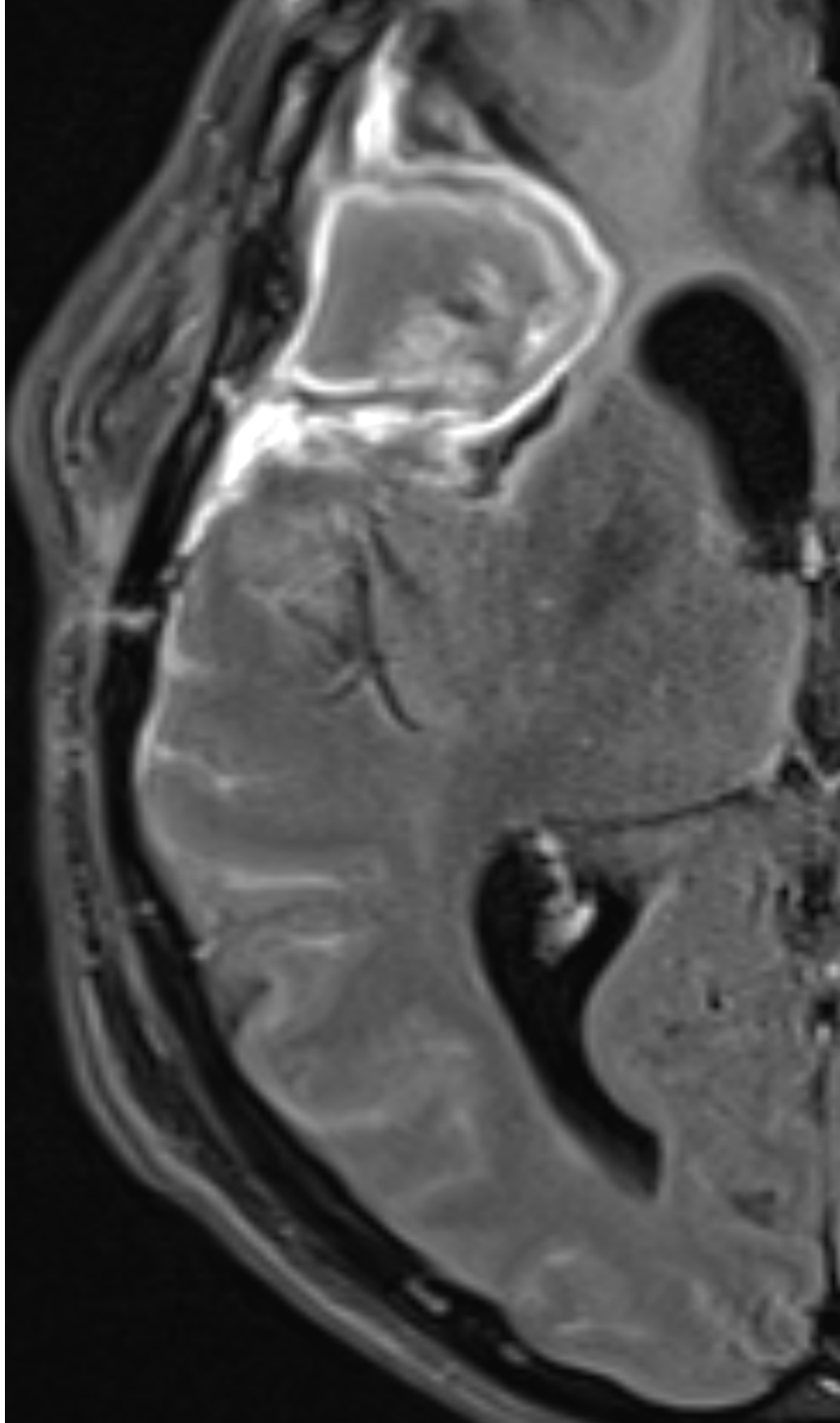
Meningitis

- As seen on the prior slide there was diffuse leptomeningeal enhancement within the basal cisterns which was difficult to appreciate on the T1 post contrast imaging.
- On prior MRIs patient had been diagnosed with septic emboli but did not have FLAIR post contrast imaging performed and later developed obstructive hydrocephalus due to undiagnosed leptomeningeal spread of infection.



T1 post contrast on the left.

FLAIR post contrast on the right



Meningitis

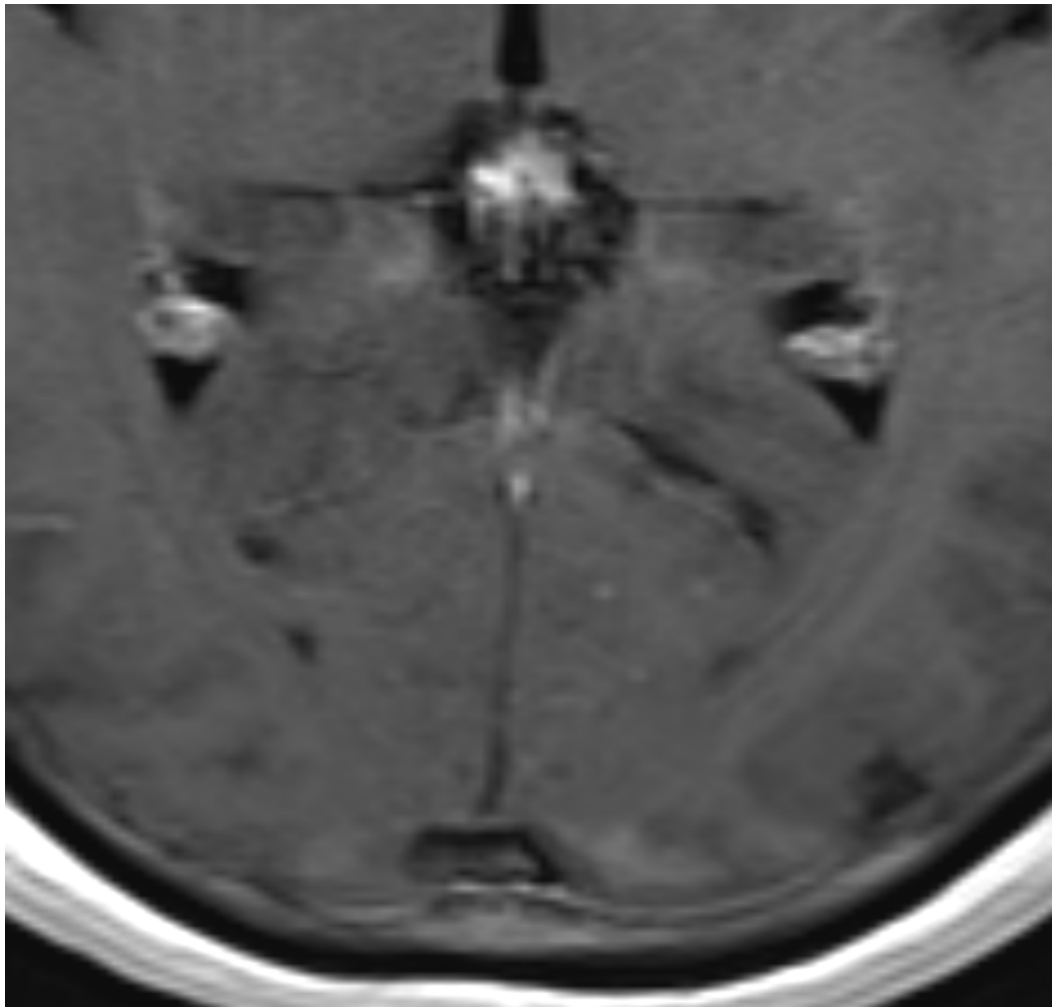
- The prior case was an example of a large post operative empyema with diffuse meningitis.
- While this was a less dramatic example it again demonstrates the increased sulcal enhancement between the two sequences.

Leptomeningeal Enhancement

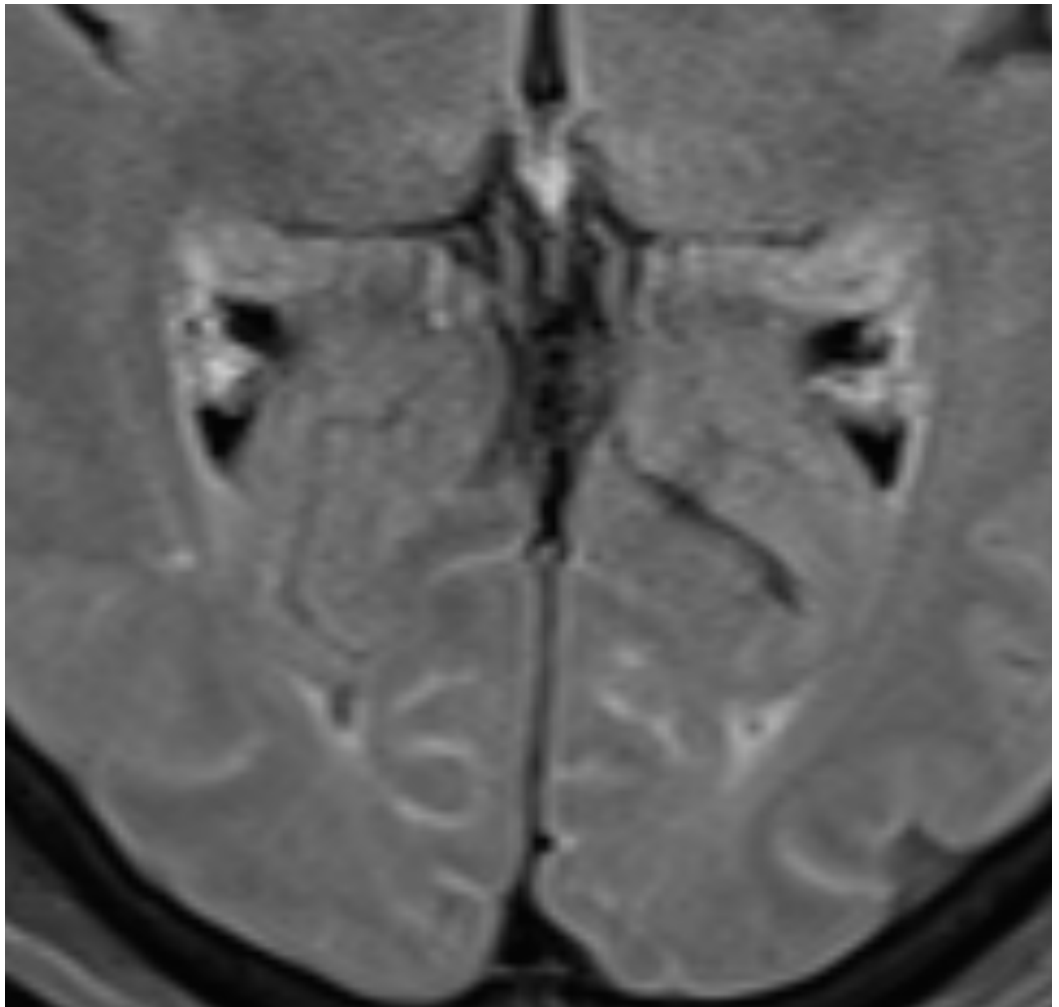
- Leptomeningeal Carcinomatosis is meningeal spread of disease that is common in advanced breast, lung and melanoma malignancies.
- Early identification of disease can have an impact on future patient treatment and help the clinical team prepare the patient for potential complications such as headache, seizures, and nerve abnormalities.
- Other autoimmune disorders such a neurosarrcoidosis can have leptomeningeal enhancement.

Neurology workup for possible Neurosarcoidosis or IGG4 autoimmune disease due to abnormal CSF protein.

T1 post contrast

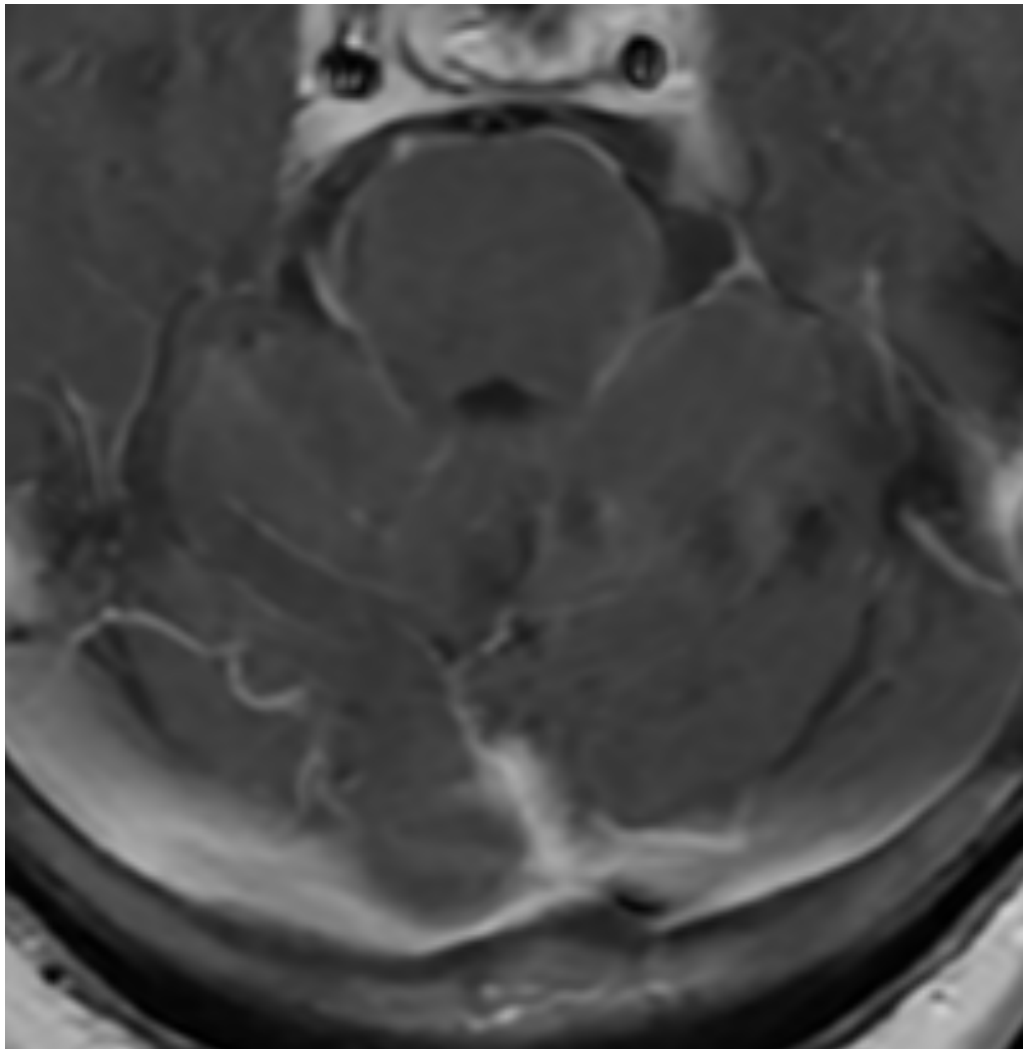


T2 FLAIR post contrast

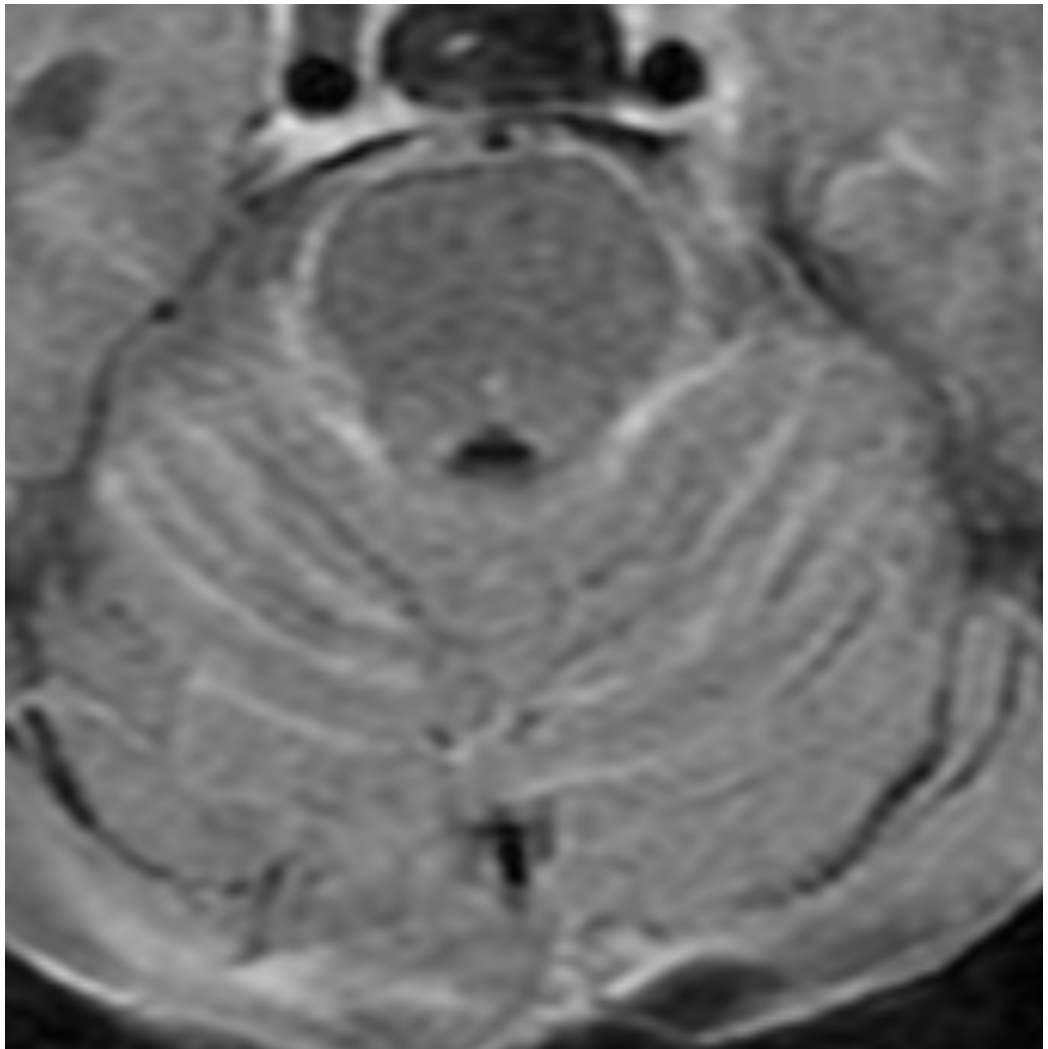


Leptomeningeal disease in metastatic melanoma.

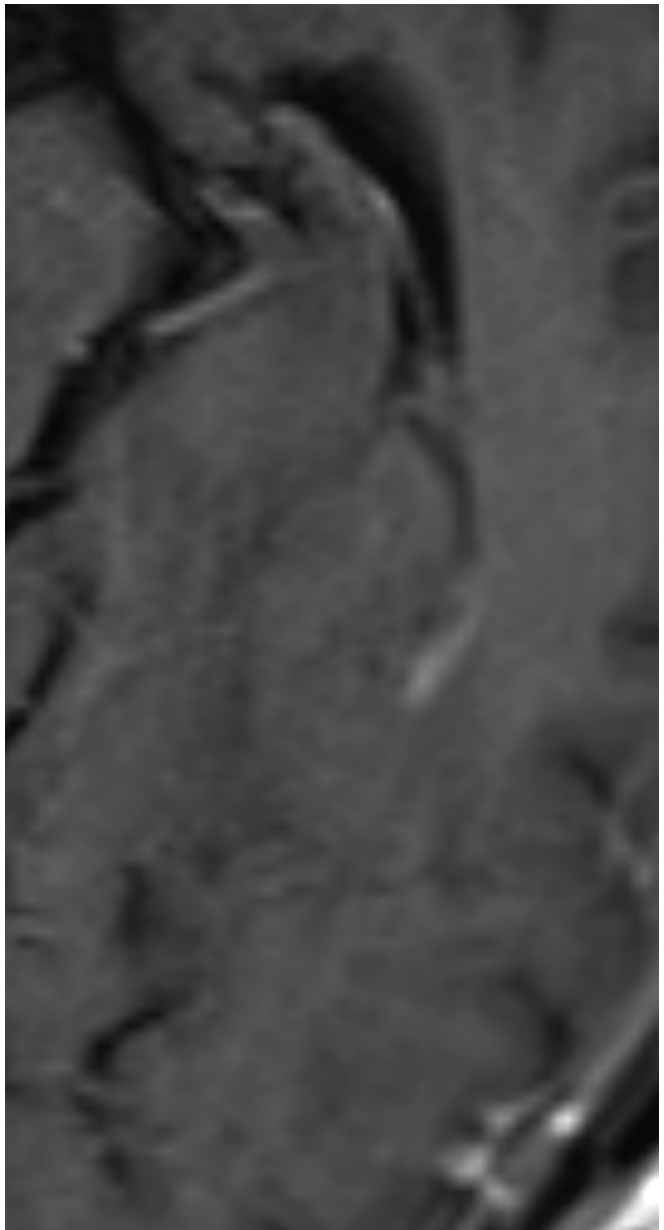
T1 post contrast



T2 FLAIR post contrast

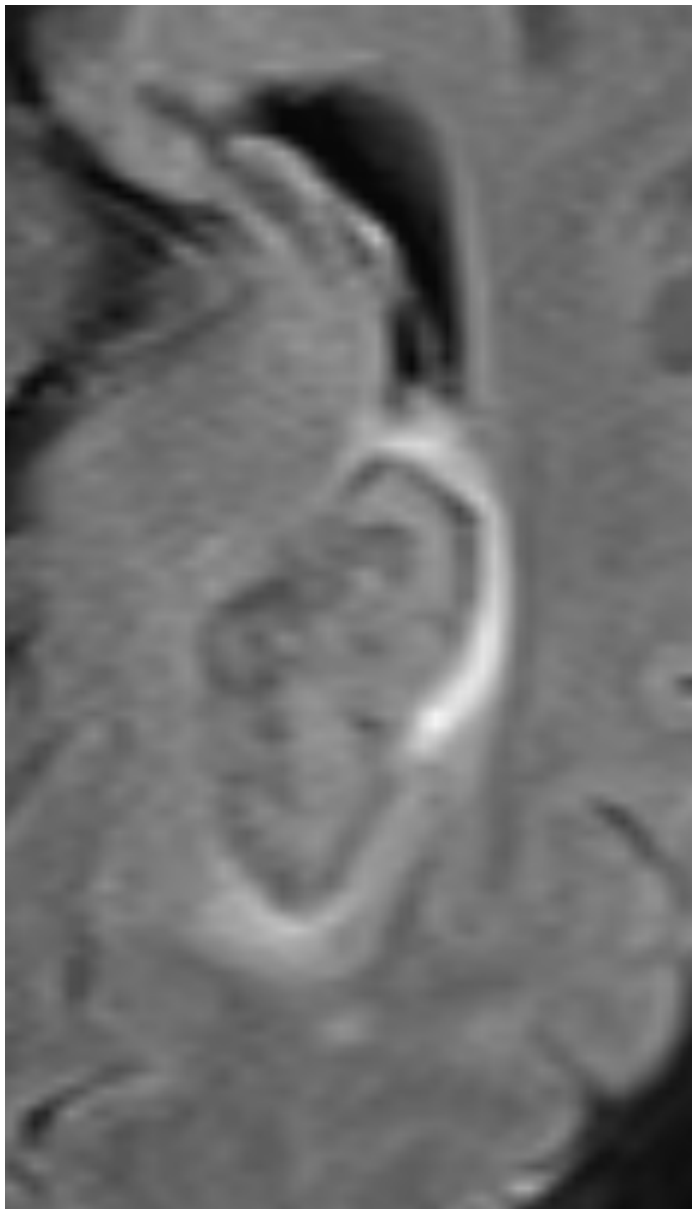


Ventricular enhancement in the setting of hemorrhage.



T1 post contrast on the left.

FLAIR post contrast on the right



FLAIR post contrast images can aid in detection of parenchymal disease.

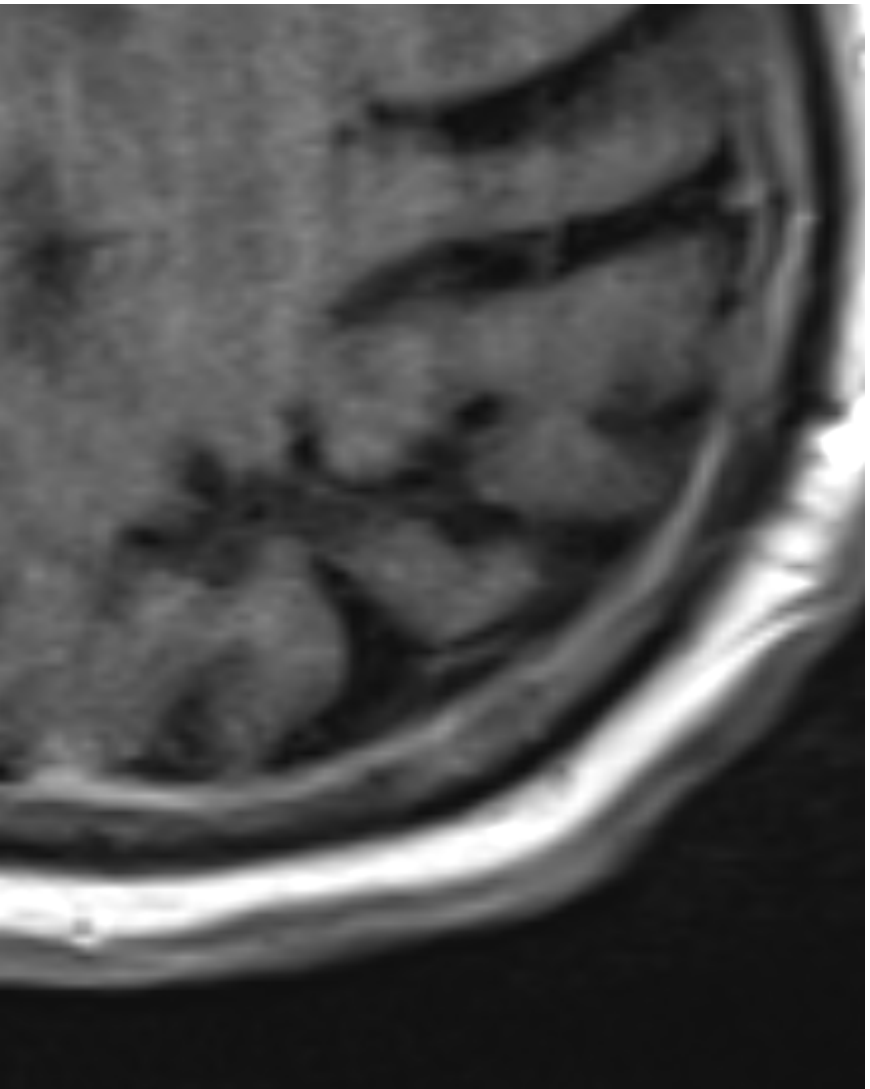


T1 post contrast on the left.

FLAIR post contrast on the right

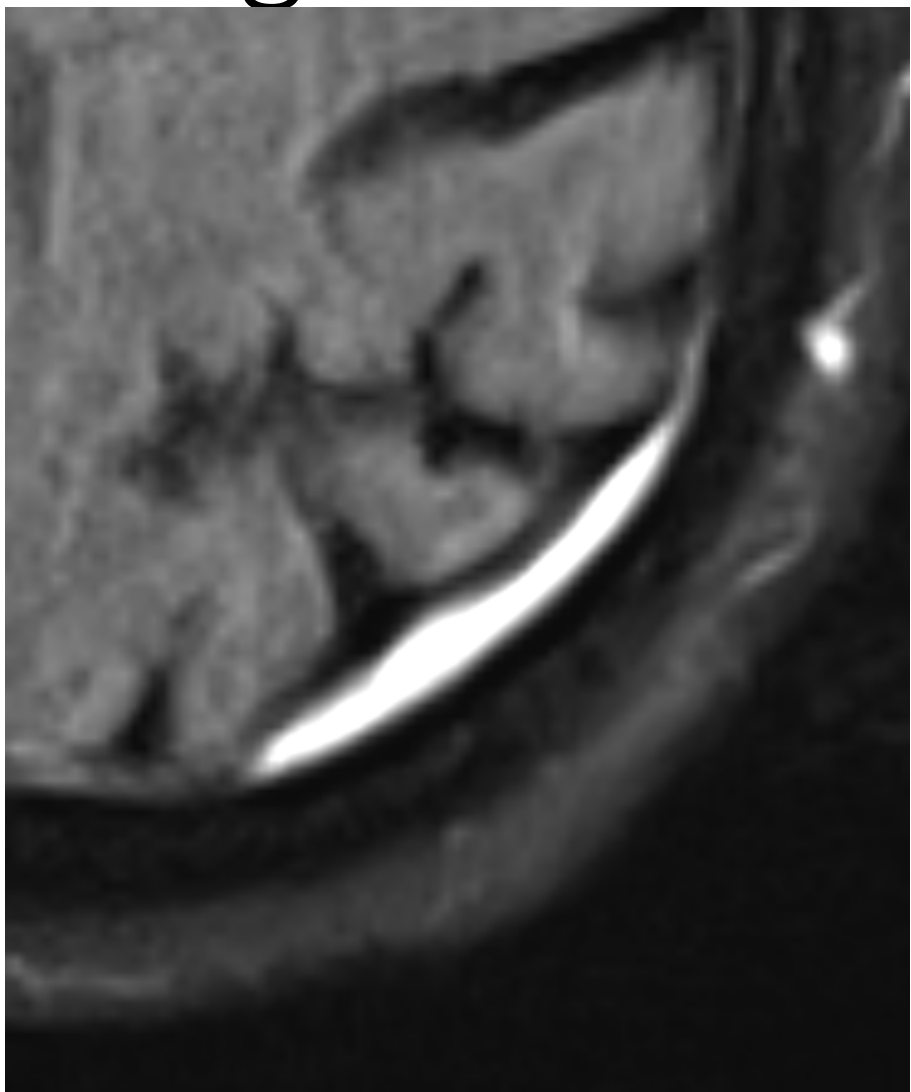


Dural enhancement from prior subarachnoid hemorrhage.



T1 post contrast on the left.

FLAIR post contrast on the right



Pitfalls

- T2 FLAIR post contrast imaging works when pathology disrupts the blood brain barrier allowing Gadolinium to leak into the CSF which disrupts normal suppression.
- This process can therefore be confused with other etiologies that cause hyperintense signal of CSF on T2 FLAIR imaging such as subarachnoid hemorrhage, supplemental oxygen, poor CSF suppression due to technical factors and motion.
- T2 FLAIR sequences usually require about 10 minutes post contrast injection to be adequate which can increase scan time and result in increased motion and be difficult for inpatients.

Conclusion

- Post-contrast FLAIR is a valuable complement to contrast-enhanced T1-weighted imaging, improving detection of subtle leptomeningeal disease, small superficial metastases, and reactive ventricular enhancement. Familiarity with its strengths and limitations can improve lesion detection and diagnostic confidence in challenging neuroimaging examinations.

Sources

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