RADY 401 Case Presentation

Cheyenne Bricken, MS4

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UNC SCHOOL OF MEDICINE
Radiology

Focused patient history and workup

20yF with history of anti-NMDAR encephalitis on monthly IVIG, catatonia, and seizures who presented to UNC ED one month after uncomplicated SVD (at 38w1d) with symptoms of altered mental status and behavioral disturbance raising concern for relapse of anti-NMDAR encephalitis

- ED Vitals: BP 133/110 | Pulse 132 | Temp 36.4 C | RR 24 | SpO2 100%
- Mental Status and Neuro Exam Key Findings: Alert and oriented only to name and DOB with difficulty following commands. Recent and remote memory appeared impaired. Cranial nerves intact. Sensory and motor exam normal.
- Initial labs unremarkable

List of imaging studies

Neuroimaging during previous admission 6mo ago (when patient was found to have Anti-NMDAR encephalitis):

- CT head without contrast (unremarkable)
- MRI head without contrast

Neuroimaging this admission:

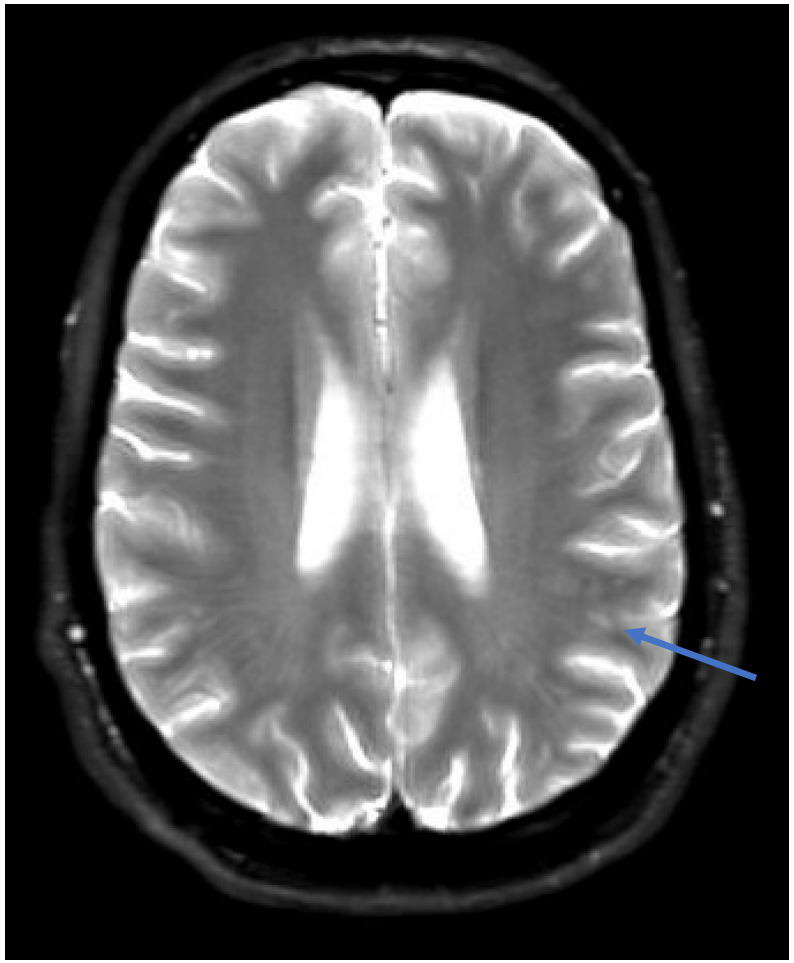
- cEEG overnight with diffuse slowing (nonspecific)
- MRI head without contrast [admission]
- MRI head with and without contrast [infectious workup recommended by ID due to onset of autonomic instability with fever]
- MRI head with and without contrast [new upper motor neuron symptoms: +Babinski, clonus]

MRI brain from previous admission

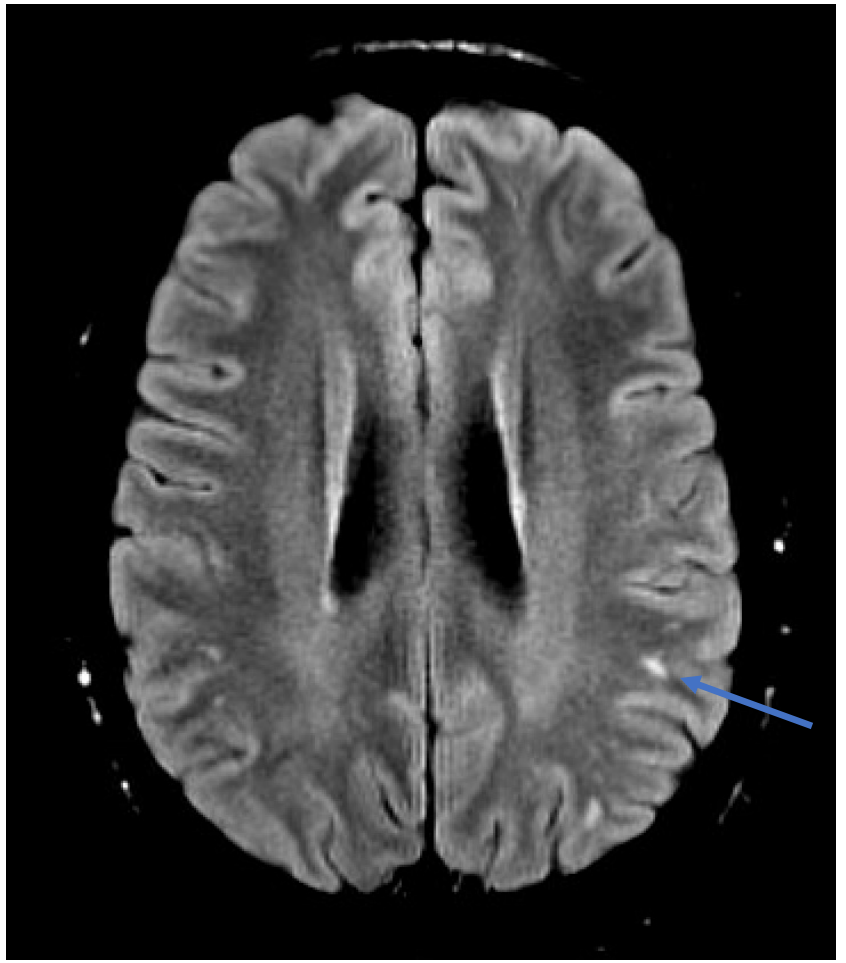
Tissue	T1-Weighted	T2-Weighted	Flair
CSF	Dark	Bright	Dark
White Matter	Light	Dark Gray	Dark Gray
Cortex	Gray	Light Gray	Light Gray
Fat (within bone marrow)	Bright	Light	Light
Inflammation (infection, demyelination)	Dark	Bright	Bright

Source: David Preston, MD[5]

Non-contrast axial T2 weighted:



Non-contrast axial T2 - FLAIR:



Water signal is suppressed –> dark CSF

Abnormal findings:
Scattered hyperintense foci in white matter

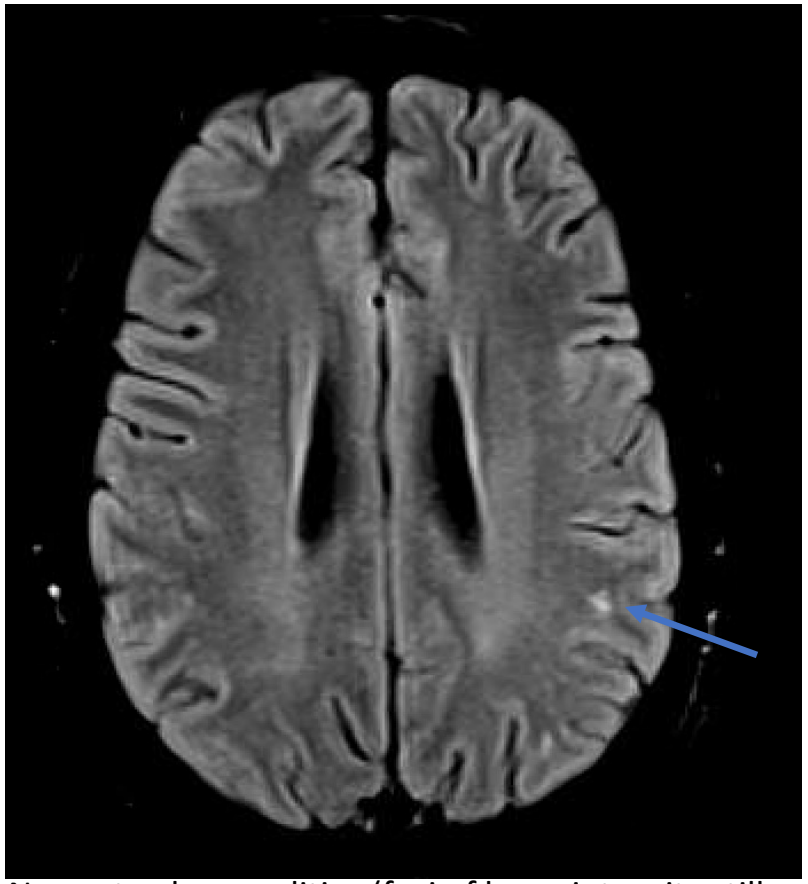
T2 – FLAIR most sensitive sequence for white matter hyperintensity![8]

T1 and diffusion sequences unremarkable for this patient

T1 and diffusion sequences remain unremarkable
No abnormal enhancement with contrast

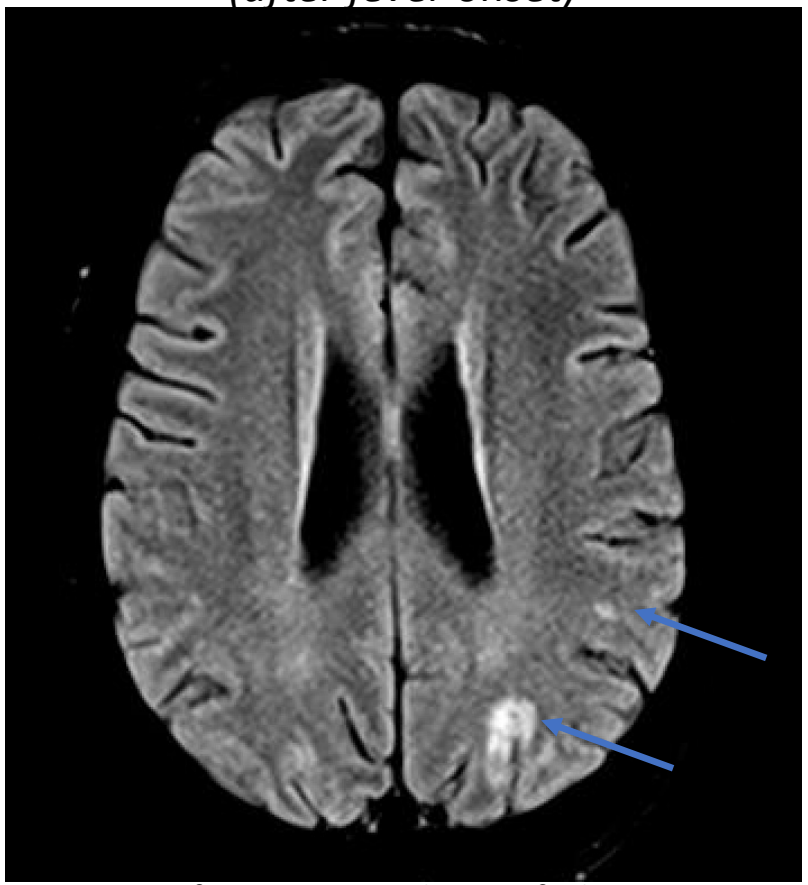
Non contrast axial T2 – FLAIR: midventricular level

At time of admission:



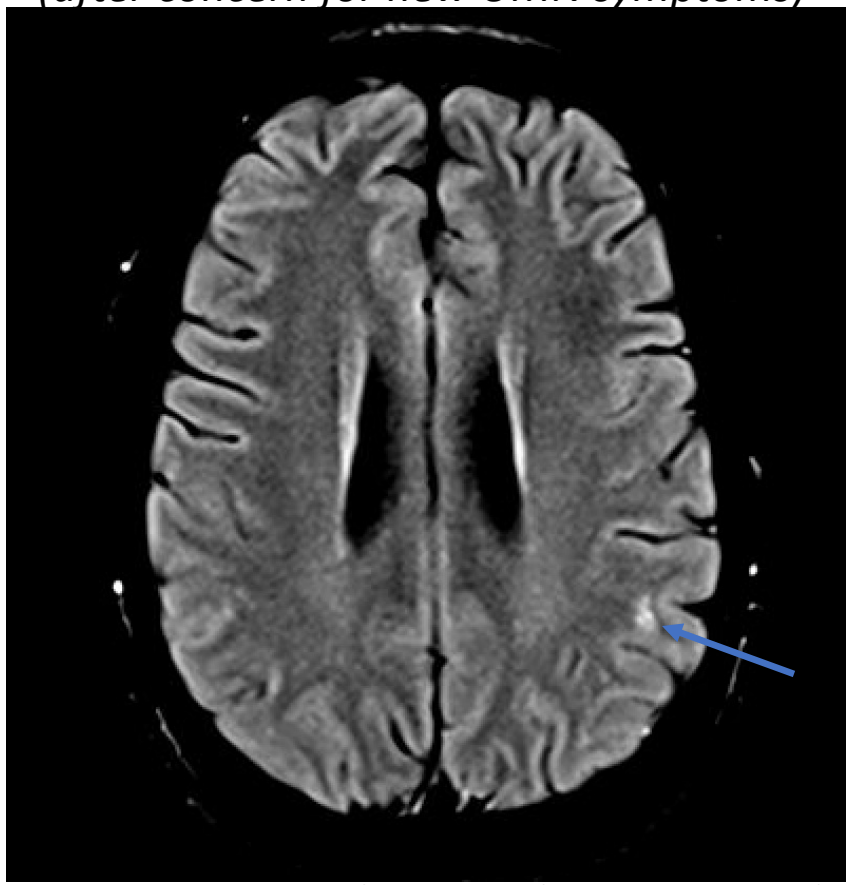
No acute abnormalities (foci of hyperintensity still present)

Hospital day 9
(after fever onset)



Significant increased area of white matter hyperintensity

Hospital day 46
(after concern for new UMN symptoms)



Improvement in white matter hyperintensity with some baseline still present

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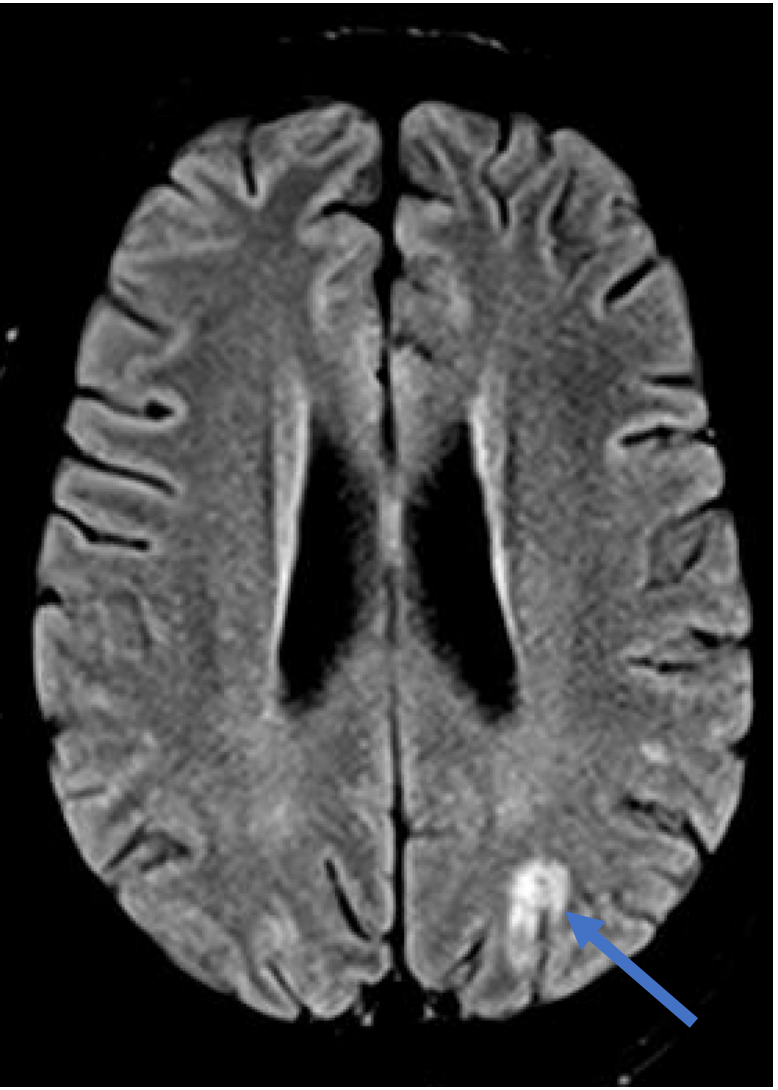
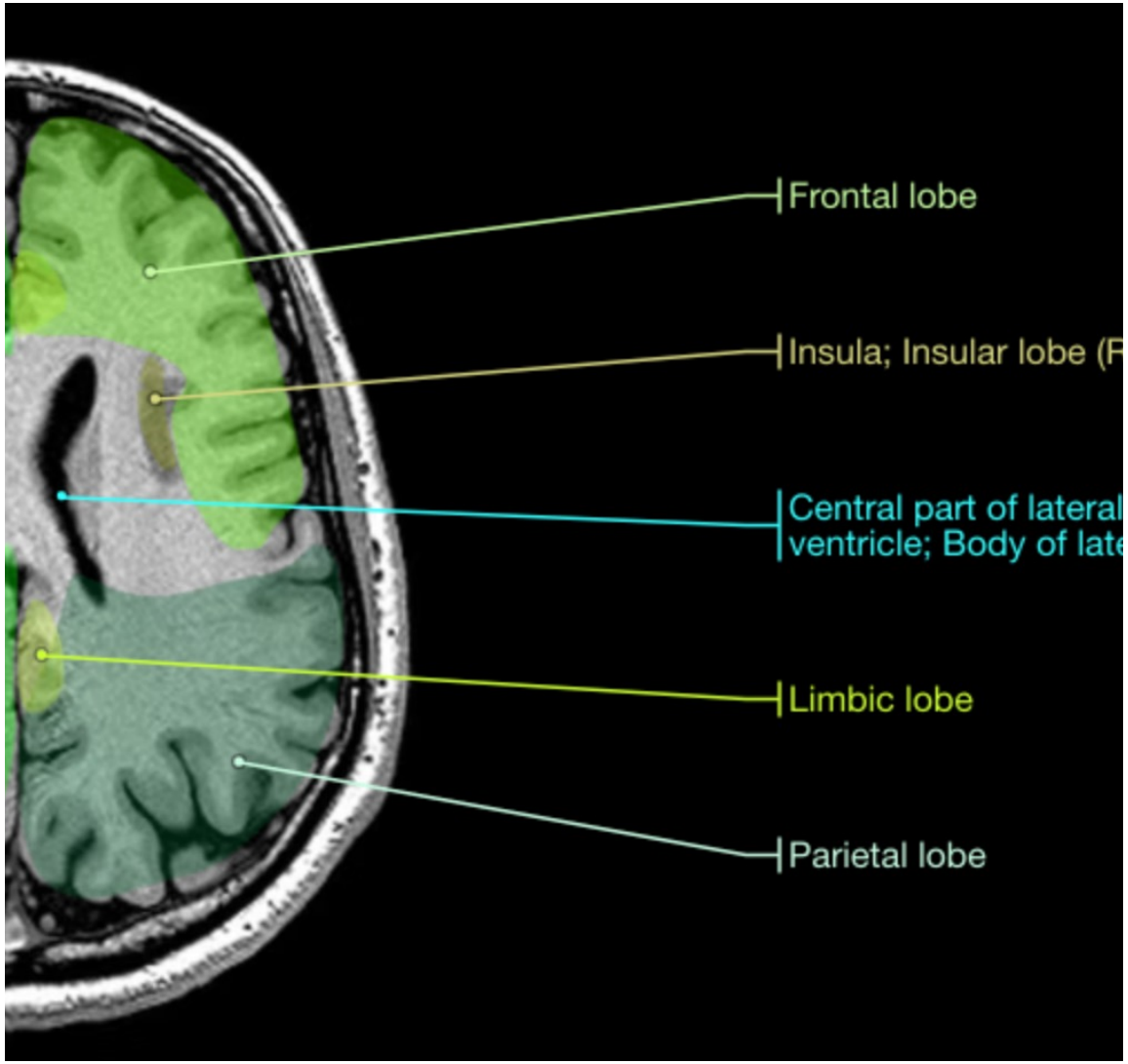
Non contrast axial T2 – FLAIR

Hospital Day 9



Source: e-Anatomy Atlas[2]



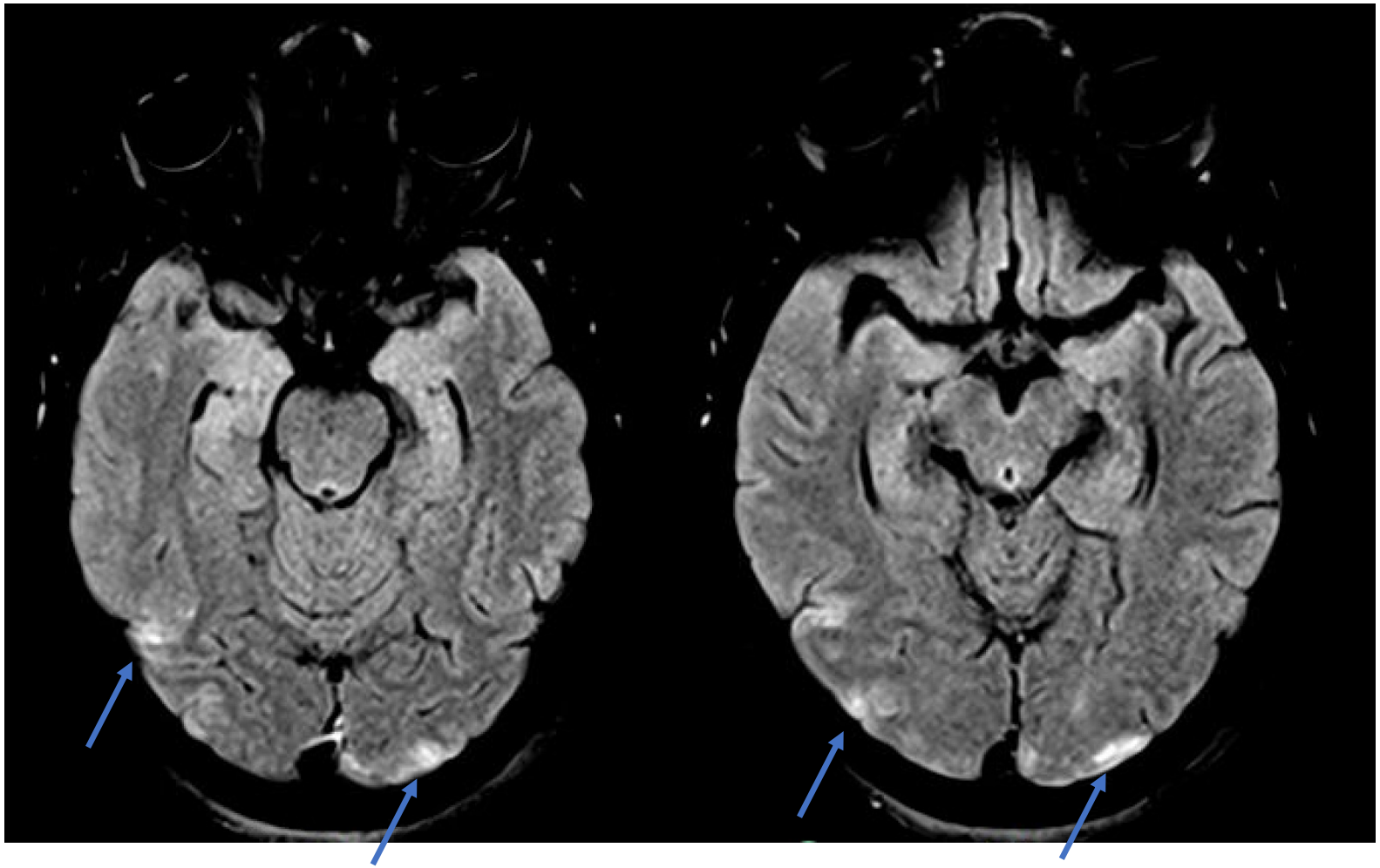
<u>White matter hyperintensities:</u>

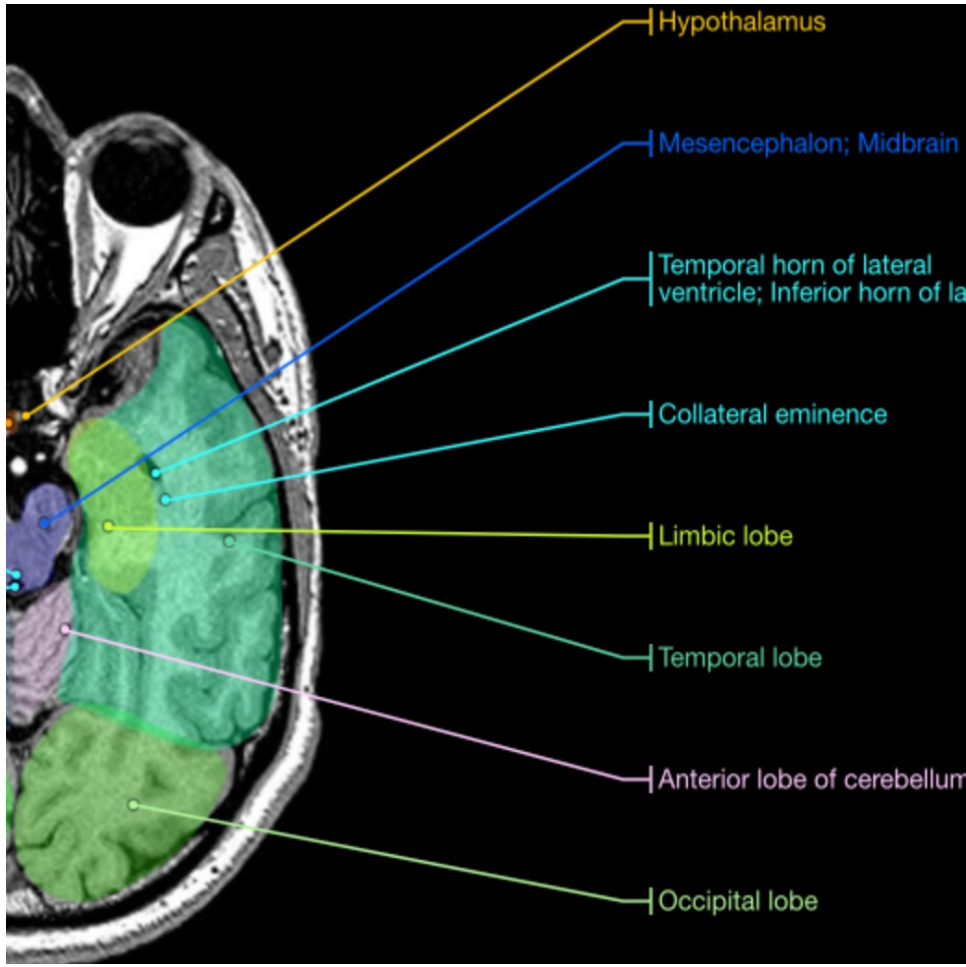
Can be associated with infectious damage, traumatic injury, autoimmune disorders, ischemia, migraines, cognitive changes… NON-SPECIFIC[9]

Non contrast axial T2 - FLAIR

Hospital day 9 at level of pons and midbrain

Source: e-Anatomy Atlas[2]





Patient treatment and outcome

49 day hospitalization

- Fluctuating behavioral symptoms and autonomic instability
- Treatment included:
  - IV and oral steroids, PLEX, IVIg, Rituximab for anti-NMDAR encephalitis
  - Empiric acyclovir for HSV encephalitis
  - Ativan, Haldol, Risperdal for catatonia and agitation
- MRI did not change patient management
- Determined to be anti-NMDAR encephalitis relapse (original leading differential diagnosis)
- At time of discharge, condition improved with resolution of catatonic and UMN symptoms along with improvement in dysautonomia

Anti-NMDAR Encephalitis

- Considered a paraneoplastic autoimmune neurological disorder
  - Ovarian teratomas most associated[4]
- Symptoms include psychiatric changes (AMS, catatonia, bizarre behavior, delusions etc.), seizures, autonomic instability[4]
- Diagnosis confirmed by presence of NMDAR antibodies in CSF[4]
- MRI findings nonspecific and not diagnostic (normal in up to 50%)
  - Most common MRI abnormality: T2-FLAIR hyperintensities[10]
- Most patients respond to immunotherapy[6]
- Psychiatric symptoms may be only symptom with relapse[3]

Discussion: Imaging Appropriateness

Variant 1: **Acute mental status change. Increased risk for intracranial bleeding (ie, anticoagulant use, coagulopathy), hypertensive emergency, or clinical suspicion for intracranial infection, mass, or elevated intracranial pressure. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
CT head without IV contrast	Usually Appropriate	☢☢☢
MRI head without IV contrast	Usually Appropriate	O
MRI head without and with IV contrast	May Be Appropriate	O
CT head without and with IV contrast	May Be Appropriate	☢☢☢
CT head with IV contrast	Usually Not Appropriate	☢☢☢

Variant 2: **Acute or progressively worsening mental status change in patient with a known intracranial process (mass, recent hemorrhage, recent infarct, central nervous system infection, etc). Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
CT head without IV contrast	Usually Appropriate	☢☢☢
MRI head without and with IV contrast	Usually Appropriate	O
MRI head without IV contrast	Usually Appropriate	O
CT head without and with IV contrast	May Be Appropriate	☢☢☢
CT head with IV contrast	May Be Appropriate	☢☢☢

Variant 5: **Suspected motor neuron disease. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
MRI head without IV contrast	Usually Appropriate	O
MRI head without and with IV contrast	May Be Appropriate	O
MRI spine without IV contrast	May Be Appropriate (Disagreement)	O
CT head without IV contrast	May Be Appropriate	☢☢☢
MRI spine without and with IV contrast	May Be Appropriate	O
CT head with IV contrast	Usually Not Appropriate	☢☢☢
CT head without and with IV contrast	Usually Not Appropriate	☢☢☢
CT spine with IV contrast	Usually Not Appropriate	☢☢☢
CT spine without and with IV contrast	Usually Not Appropriate	☢☢☢☢
CT spine without IV contrast	Usually Not Appropriate	☢☢☢
FDG-PET/CT brain	Usually Not Appropriate	☢☢☢
MR spectroscopy head without IV contrast	Usually Not Appropriate	O
MRI functional (fMRI) head without IV contrast	Usually Not Appropriate	O
HMPAO SPECT or SPECT/CT brain	Usually Not Appropriate	☢☢☢☢

Source: American College of Radiology[1]

Reasons patient received imaging:

1. Acute onset of AMS in patient undergoing treatment for known anti-NMDAR encephalitis
2. Infectious workup for infectious encephalopathy when patient spikes fever in setting of AMS
3. New UMN symptoms

MRI Cost:

MRI head without contrast

Source: UNC Health[7]

Facility Name	Revenue Code	revCodeCat	Ancillary Service	Charge
UNC Hospital	611	MRT	70551	$3,535.00

MRI head with and without contrast

Facility Name	Revenue Code	revCodeCat	Ancillary Service	Charge
UNC Hospital	611	MRT	70553	$4,780.00

Total: $13,095

MRI Radiation: None

UNC Top Three: Anti-NMDAR Encephalopathy

- Negative imaging does not rule out anti-NMDAR encephalopathy
- Patients must be monitored closely for changes in behavior, as this often indicates a relapse necessitating treatment
- Remember association with ovarian teratomas

References

1. American College of Radiology. ACR Appropriateness Criteria®. Available at https://acsearch.acr.org/list

2. e-Anatomy: “Micheau A, Hoa D, e-Anatomy Atlas, www.imaios.com, DOI: 10.37019/e-anatomy”.

3. Kayser MS, Titulaer MJ, Gresa-Arribas N, Dalmau J. Frequency and characteristics of isolated psychiatric episodes in anti–N-methyl-d-aspartate receptor encephalitis. JAMA Neurol. 2013 Sep 1;70(9):1133-9. doi: 10.1001/jamaneurol.2013.3216. PMID: 23877059; PMCID: PMC3809325.

4. Kelley BP, Patel SC, Marin HL, Corrigan JJ, Mitsias PD, Griffith B. Autoimmune Encephalitis: Pathophysiology and Imaging Review of an Overlooked Diagnosis. AJNR Am J Neuroradiol. 2017 Jun;38(6):1070-1078. doi: 10.3174/ajnr.A5086. Epub 2017 Feb 9. PMID: 28183838; PMCID: PMC7960083.

5. Preston DC. Magnetic Resonance Imaging (MRI) of the Brain and Spine: Basics. Case Western Reserve University. Published July 4, 2016. Accessed July 13, 2023. https://case.edu/med/neurology/NR/MRI%20Basics.htm

6 . Titulaer MJ, McCracken L, Gabilondo I, Armangué T, Glaser C, Iizuka T, Honig LS, Benseler SM, Kawachi I, Martinez-Hernandez E, Aguilar E, Gresa-Arribas N, Ryan-Florance N, Torrents A, Saiz A, Rosenfeld MR, Balice-Gordon R, Graus F, Dalmau J. Treatment and prognostic factors for long-term outcome in patients with anti-NMDA receptor encephalitis: an observational cohort study. Lancet Neurol. 2013 Feb;12(2):157-65. doi: 10.1016/S1474-4422(12)70310-1. Epub 2013 Jan 3. PMID: 23290630; PMCID: PMC3563251.

7. UNC Health Standard Charges & Shoppable Services Data by Hospital. 2023 Jan. Retrieved from: https://rca.centaurihs.com/ptapp/#d4ccc071fab9c79f17e52dc5b243ef668affc5e569aafa907c5b4c81f0a89284

8. Wardlaw JM, Valdés Hernández MC, Muñoz-Maniega S. What are white matter hyperintensities made of? Relevance to vascular cognitive impairment [published correction appears in J Am Heart Assoc. 2016 Jan 13;5(1):e002006]. J Am Heart Assoc. 2015;4(6):001140. Published 2015 Jun 23. doi:10.1161/JAHA.114.001140

9. Wenger KJ, Koldijk CE, Hattingen E, Porto L, Kurre W. Characterization of MRI White Matter Signal Abnormalities in the Pediatric Population. Children. 2023; 10(2):206. https://doi.org/10.3390/children10020206

10. Zhao YY, Han B, Qin CH, et al. Brain magnetic resonance imaging predictors in anti-N-methyl-D -aspartate receptor encephalitis. 2022;9(12):1974-1984. doi:https://doi.org/10.1002/acn3.51690