

AMSER Case of the Month

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46-year-old male presenting with left ear and head pain and numbness



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Patient Presentation

- **HPI:** 46-year-old male presenting to office for **left ear and head pain**
- No history of trauma/injury
- Pain resolved and progressed to **numbness** of left sides of neck, head, and **tongue**
- Pain triggered by head rotation
- Patient also reports imbalance when rising from seated position and worsening vision
- 8 months prior to visit, he started having **intermittent numbness of 4th and 5th digits** of left hand
- **Pertinent PMH:** No neurological history
- **Physical Exam:** PERRLA, EOM intact, negative tragus sign, cervical motion is full in all directions and does not trigger pain, no neck masses, normal upper extremity strength.

Pertinent Labs

- Vitamin B-12: within normal limits (600 pg/mL)
- Vitamin D 25 hydroxy: low (15.8 ng/mL)
- Lyme antibody: negative (0.57)
- ANA: negative <1:40
- Varicella Zoster IgG: immune (1036)
- WBC: Elevated (18,640)

What Imaging Should We Order?

Select the applicable ACR Appropriateness Criteria

Variant 4: Multiple different middle cranial nerve palsies (CN V-VII). Initial imaging.		
Procedure	Appropriateness Category	Relative Radiation Level
MRI head without and with IV contrast	Usually Appropriate	○
MRI orbits face neck without and with IV contrast	Usually Appropriate	○
MRI head without IV contrast	May Be Appropriate	○
MRI orbits face neck without IV contrast	May Be Appropriate	○
CT head without IV contrast	May Be Appropriate	☼☼☼
US neck	Usually Not Appropriate	○
MRA head with IV contrast	Usually Not Appropriate	○
MRA head without and with IV contrast	Usually Not Appropriate	○
MRA head without IV contrast	Usually Not Appropriate	○
MRI head with IV contrast	Usually Not Appropriate	○
MRI orbits face neck with IV contrast	Usually Not Appropriate	○
CT maxillofacial with IV contrast	Usually Not Appropriate	☼☼
CT maxillofacial without IV contrast	Usually Not Appropriate	☼☼



This imaging modality was ordered by the family doctor

Select the applicable ACR Appropriateness Criteria

Variant 2: New or increasing nontraumatic cervical radiculopathy. No “red flags.” Initial imaging.

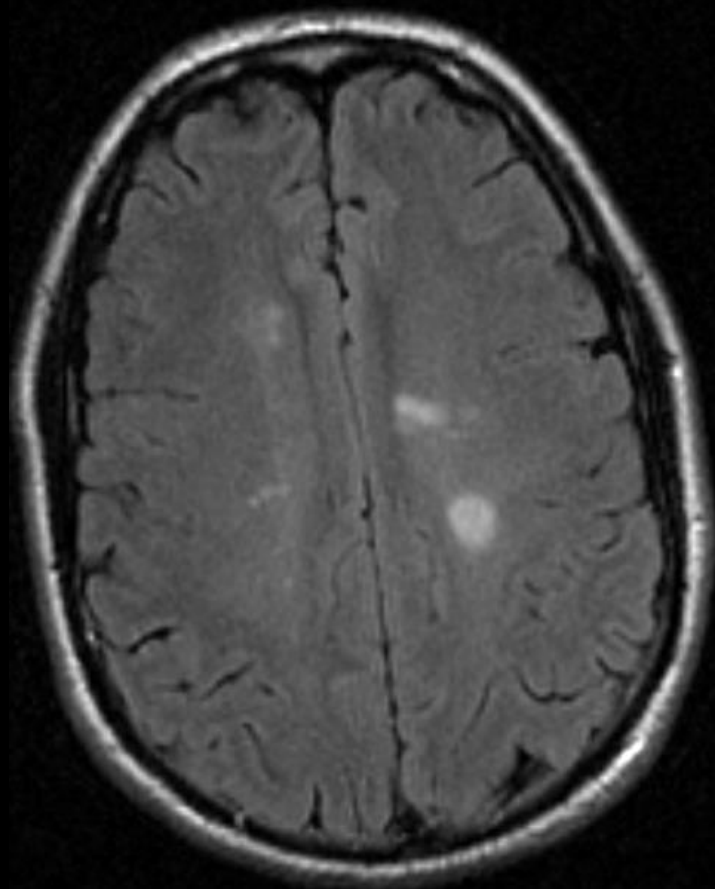
Procedure	Appropriateness Category	Relative Radiation Level
MRI cervical spine without IV contrast	Usually Appropriate	○
CT cervical spine without IV contrast	May Be Appropriate	⊕⊕⊕
Radiography cervical spine	May Be Appropriate (Disagreement)	⊕⊕
MRI cervical spine without and with IV contrast	Usually Not Appropriate	○
Radiographic myelography cervical spine	Usually Not Appropriate	⊕⊕⊕
CT myelography cervical spine	Usually Not Appropriate	⊕⊕⊕⊕
CT cervical spine with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT cervical spine without and with IV contrast	Usually Not Appropriate	⊕⊕⊕
CTA neck with IV contrast	Usually Not Appropriate	⊕⊕⊕
Discography cervical spine	Usually Not Appropriate	⊕⊕
Facet injection/medial branch block cervical spine	Usually Not Appropriate	⊕⊕
MRA neck with IV contrast	Usually Not Appropriate	○
MRA neck without IV contrast	Usually Not Appropriate	○
MRI cervical spine with IV contrast	Usually Not Appropriate	○
Bone scan whole body with SPECT or SPECT/CT neck	Usually Not Appropriate	⊕⊕⊕



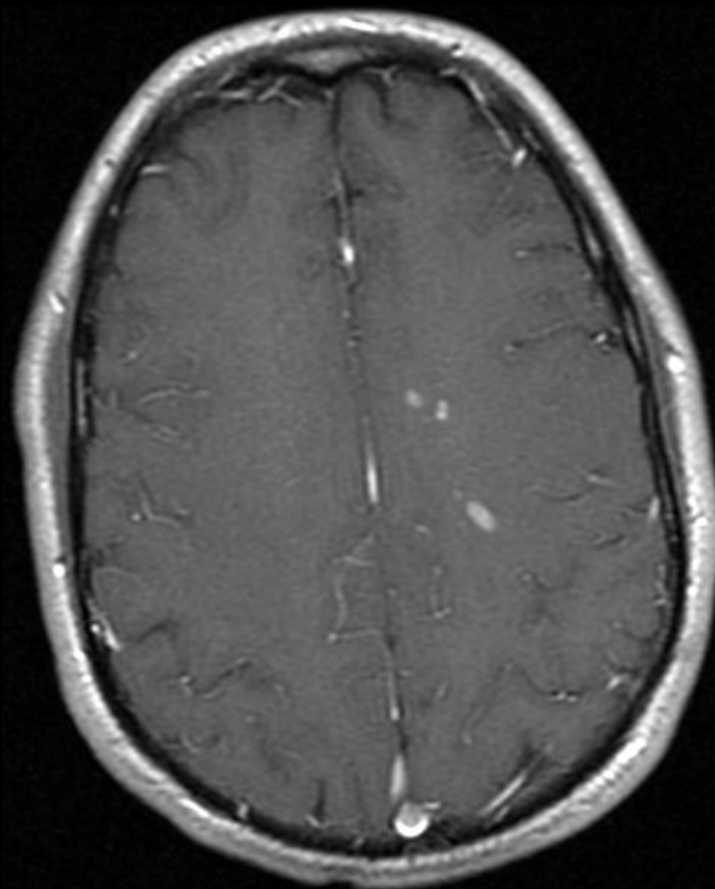
This imaging modality was ordered after diagnosis was made

Axial MRI Brain (unlabeled)

FLAIR



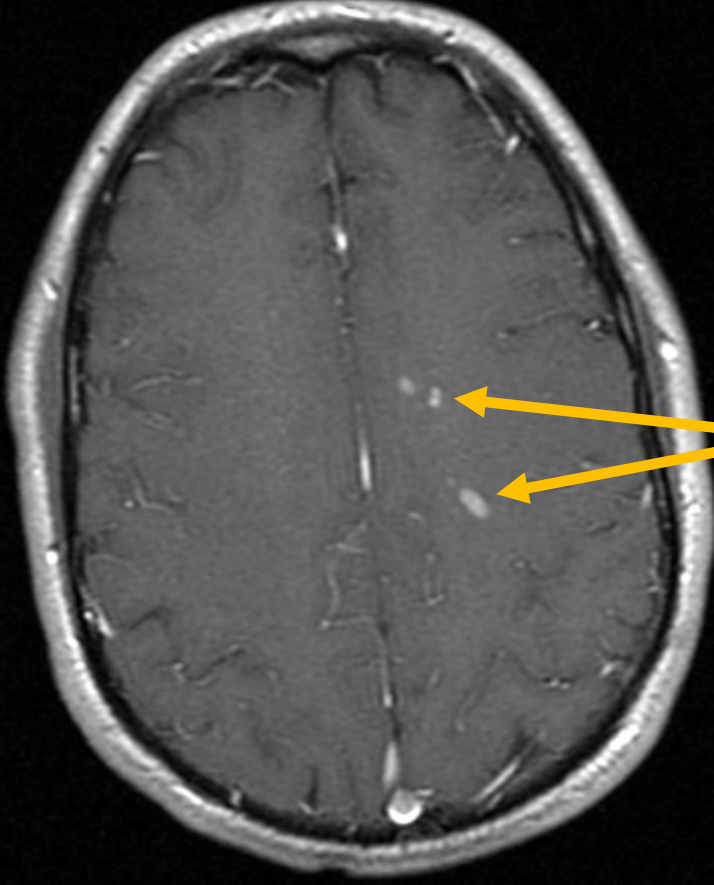
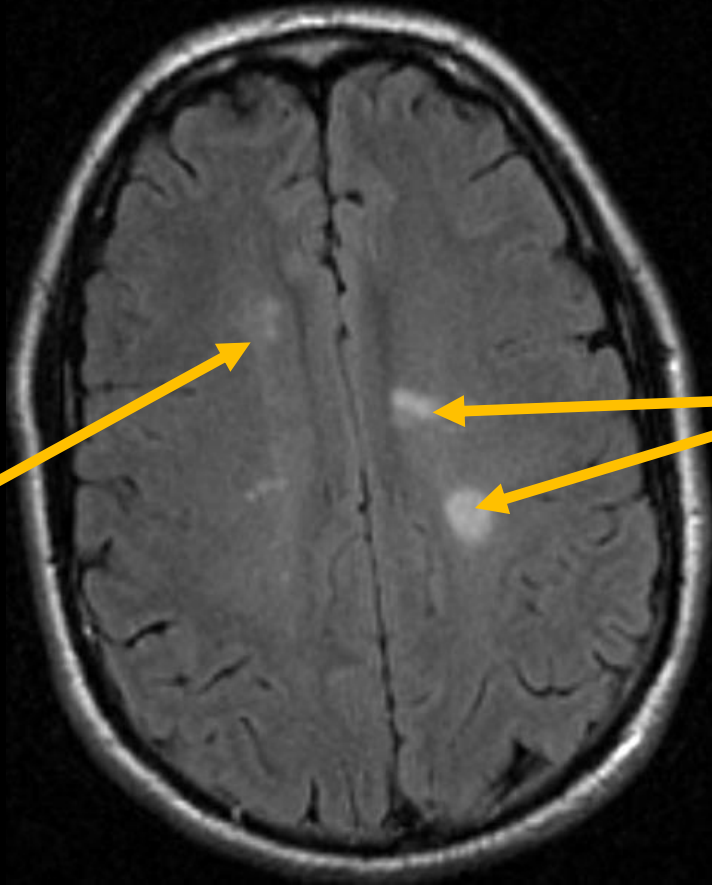
T1 post contrast



Axial MRI Brain (labeled)

FLAIR

T1 post contrast



Hyperintense lesion

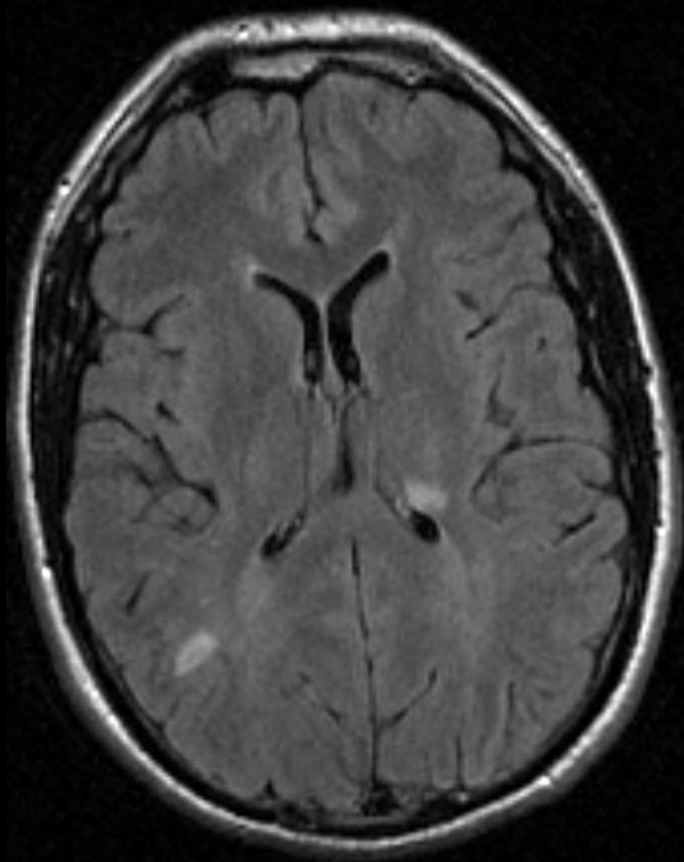
Hyperintense lesions involving periventricular white matter

Abnormal contrast enhancement within several lesions

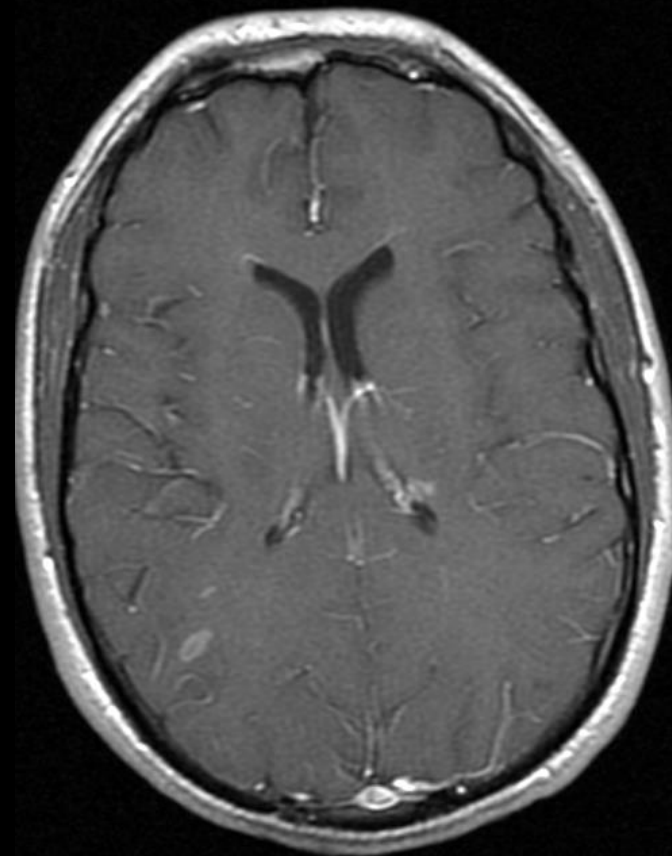
Some lesions are perpendicular to lateral ventricles

Axial MRI Brain (unlabeled)

FLAIR

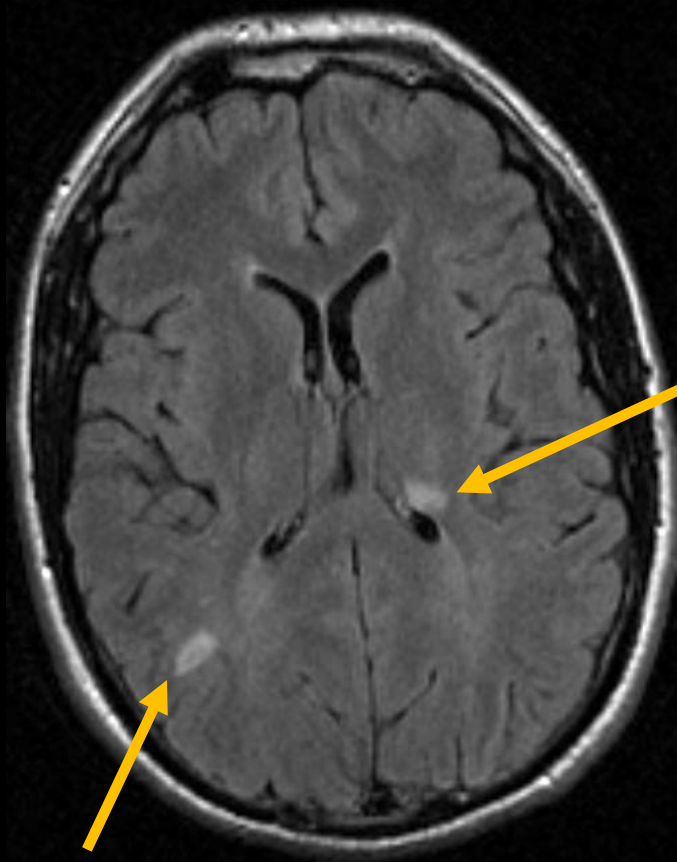


T1 post contrast



Axial MRI Brain (labeled)

FLAIR



Juxtacortical white matter lesion

Periventricular white matter lesion

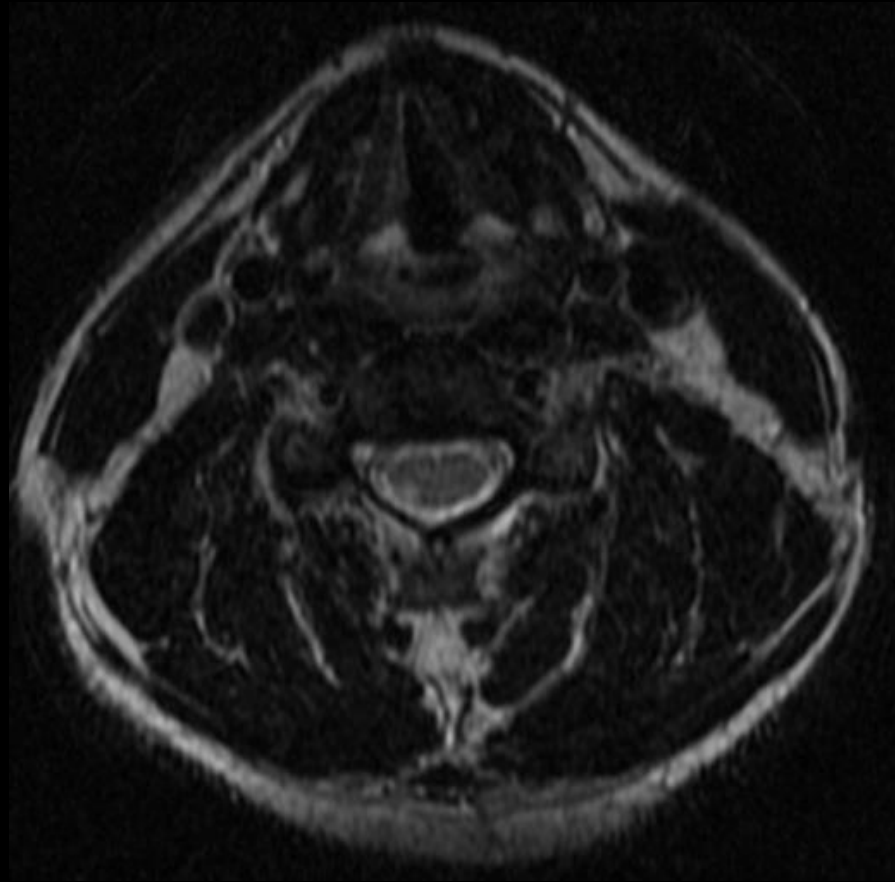
T1 post contrast



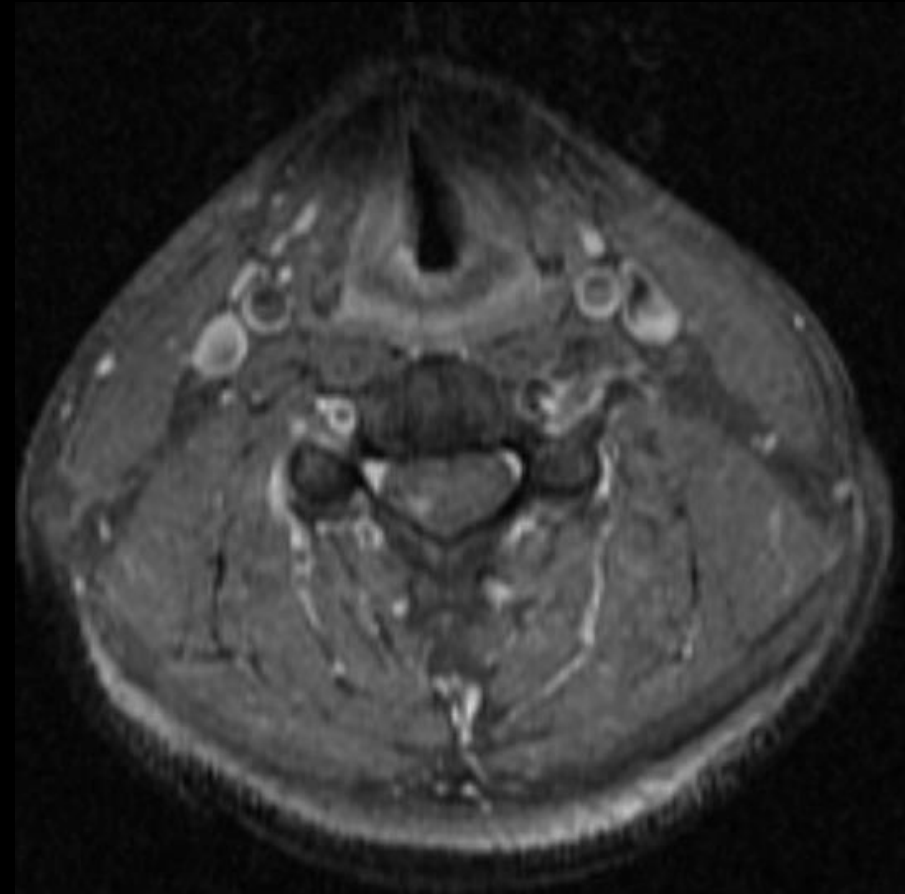
Enhancement indicating active demyelination and active plaque

Axial MRI Cervical Spine (unlabeled)

- T2

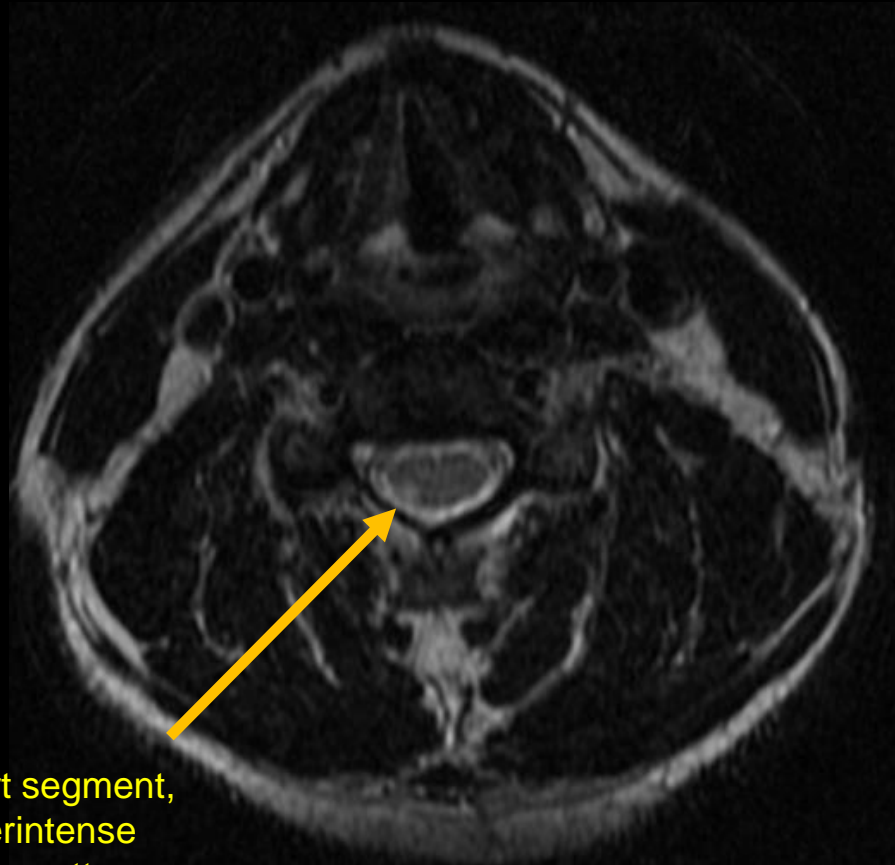


- T1 fat suppressed post contrast



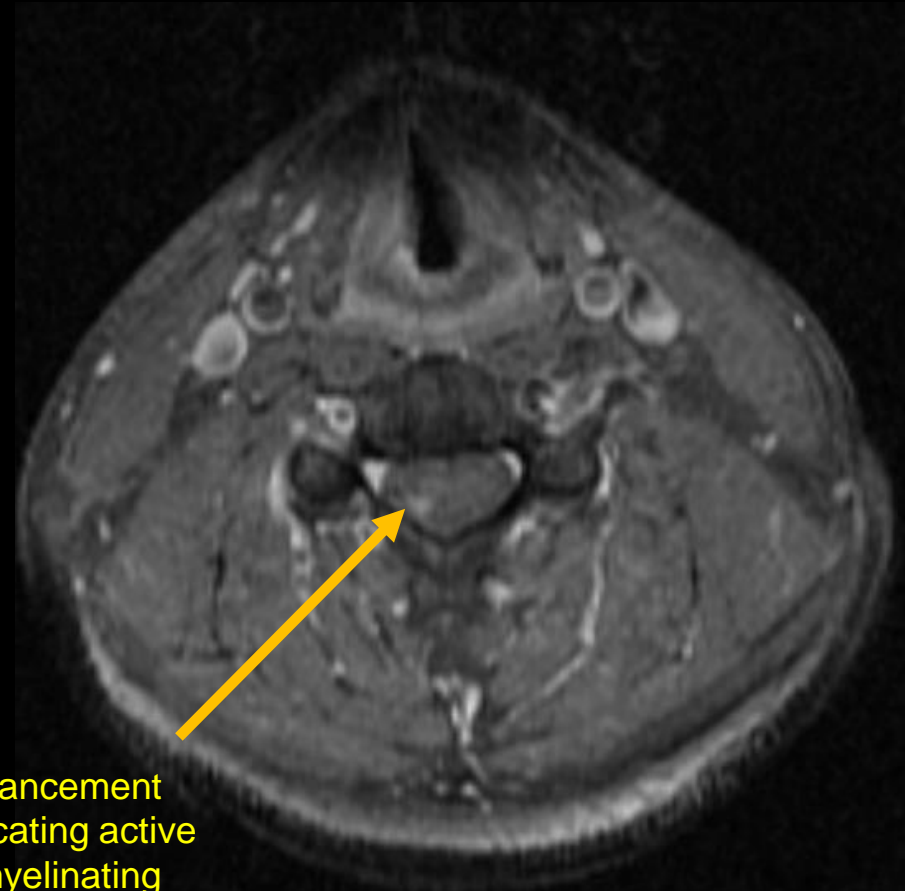
Axial MRI Cervical Spine (labeled)

- T2



Short segment,
hyperintense
white matter
lesion

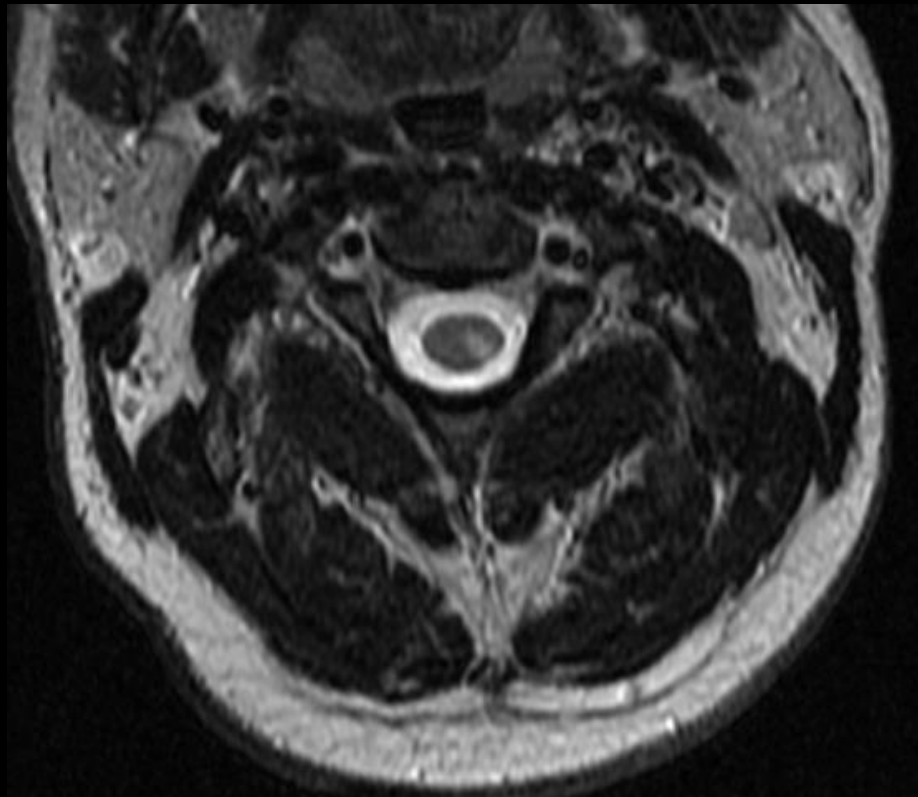
- T1 fat suppressed post contrast



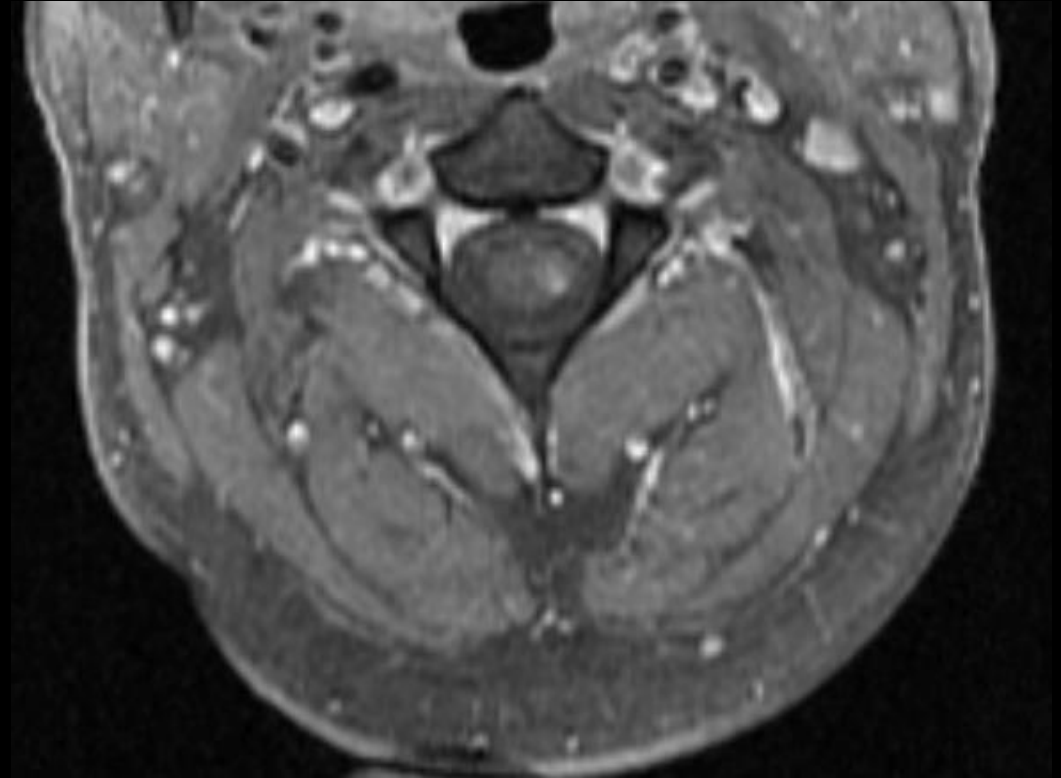
Enhancement
indicating active
demyelinating
plaque

Axial MRI Cervical Spine (unlabeled)

- T2

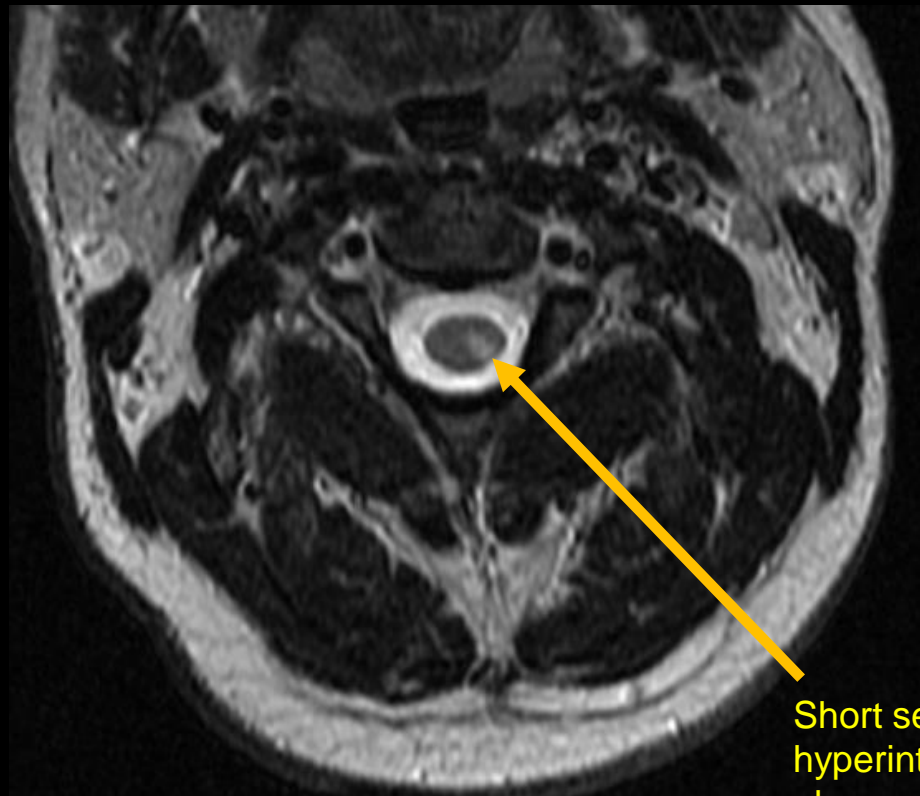


- T1 fat suppressed post contrast



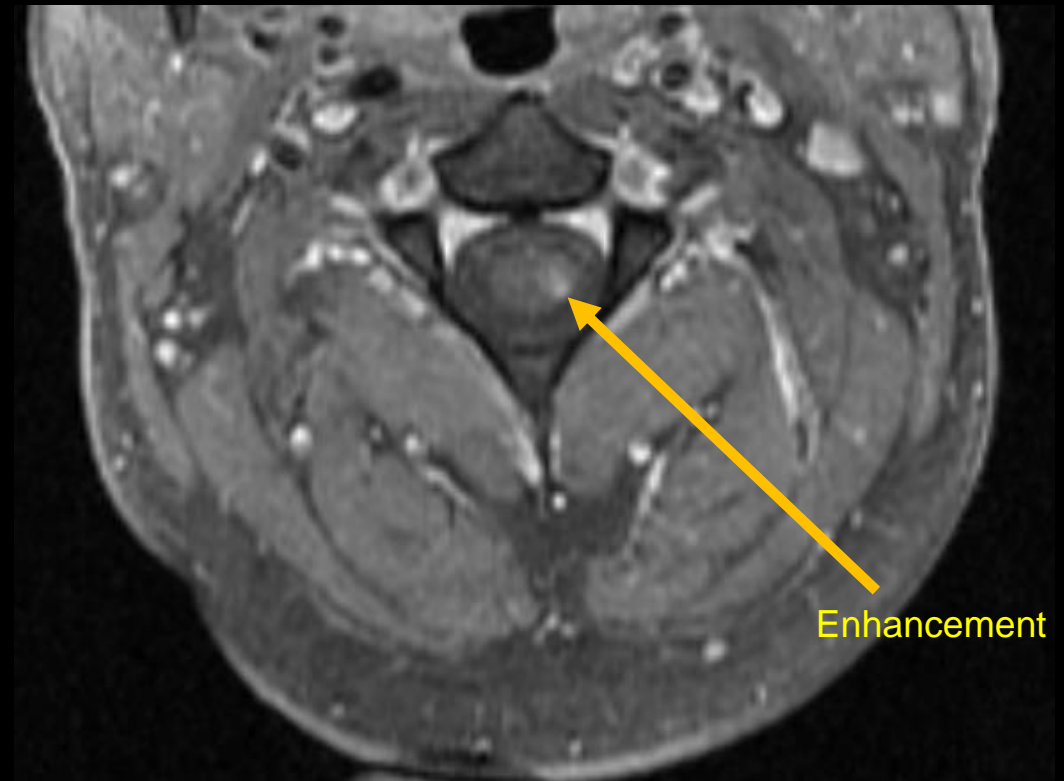
Axial MRI Cervical Spine (labeled)

- T2



Short segment,
hyperintense
plaque

- T1 fat suppressed post contrast



Enhancement

Sagittal MRI Cervical Spine (unlabeled)

- T2



- Proton Density Fat Suppressed Inversion Recovery

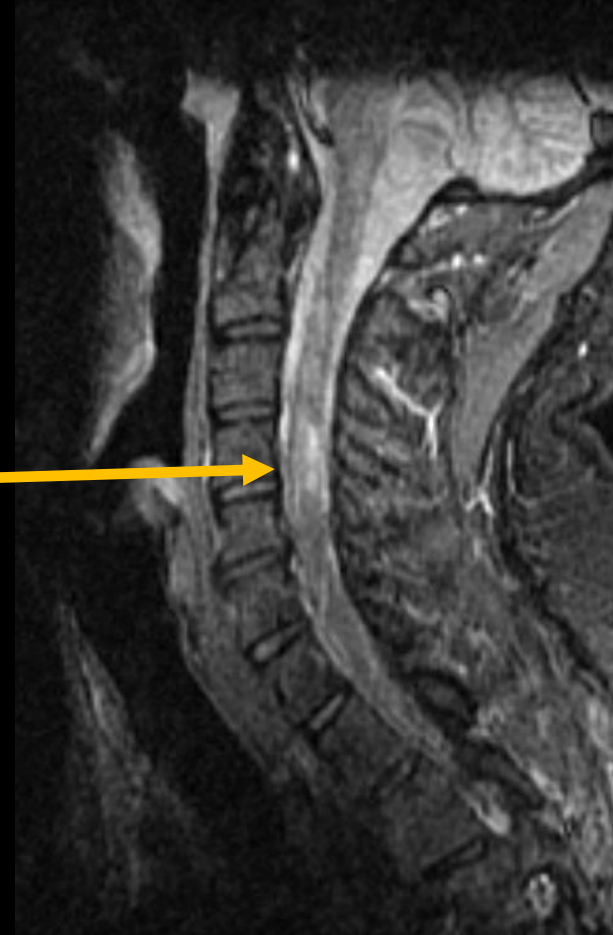


Sagittal MRI Cervical Spine (labeled)

- T2



- Proton Density Fat Suppressed Inversion Recovery



Hyperintense
short segment
lesion

Final Dx:

Multiple Sclerosis

Case Discussion: Multiple Sclerosis

- **Epidemiology:** Affects 2.3 million people worldwide
 - often diagnosed between ages 20 and 50 years, affecting women more
 - Northern European and White patients have higher risk with prevalence increasing when moving away from the equator
- **Etiology:** Likely combination of genetic and environmental factors. Risk factors include low Vitamin D, tobacco use, and EBV infection
- **Pathophysiology:** Autoreactive T-cells cause breakdown of blood brain barrier and initiate production of B-cell antibodies against myelin causing degeneration of myelin

- Ghasemi et al., 2017
- Haki et al., 2024

Case Discussion: Multiple Sclerosis

- **Clinical Presentation:** Asymmetric sensory loss, unilateral painful vision loss, facial and limb weakness, ataxia, vertigo, bladder dysfunction, Lhermitte's sign, pain, fatigue
- **Labs:** Mononuclear cell pleocytosis and increased oligoclonal bands in CSF
- **Management:**
 - Disease-modifying therapies including interferons and anti-CD20 monoclonal antibodies
 - Corticosteroids or plasma exchange for acute relapses
 - Gabapentin and baclofen for spasticity
 - TCA antidepressants for neurogenic pain or bladder incontinence

- Haki et al., 2024
- Hauser et al., 2020

Case Discussion: Multiple Sclerosis

- **Findings on Imaging:**
 - Lesions best identifiable on MRI FLAIR or DIR sequences.
 - Lesions can enhance with contrast indicating an active demyelination process
 - Typical MS lesions: juxtacortical, periventricular such as **Dawson fingers** (ovoid lesions perpendicular to ventricles), infratentorial (brainstem & cerebellum), corpus callosum, spinal cord
 - **Short segment lesions** are lesions in spinal cord extending 2 vertebral bodies or less
- **Diagnostic Criteria (McDonald Criteria):** 2 or more attacks with objective imaging of 1 lesion
 - Dissemination in space: 1 or more T2 lesions in 2/4 CNS areas (juxta/intracortical, periventricular, infratentorial, spinal cord)
 - Dissemination in time: Presence of both enhancing and non-enhancing lesions on same scan or new T2 and/or enhancing lesion on follow-up MRI

- Smithuis et al., 2021
- Wattjes et al., 2021

References:

1. Smithuis R, Barkhof F. Multiple sclerosis 2.0. The Radiology Assistant : Multiple Sclerosis 2.0. December 1, 2021. <https://radiologyassistant.nl/neuroradiology/multiple-sclerosis/diagnosis-and-differential-diagnosis-3>.
2. Ghasemi N, Razavi S, Nikzad E. Multiple Sclerosis: Pathogenesis, Symptoms, Diagnoses and Cell-Based Therapy. Cell J. 2017;19(1):1-10. doi:10.22074/cellj.2016.4867
3. Haki M, AL-Biati HA, Al-Tameemi ZS, Ali IS, Al-hussaniy HA. Review of Multiple Sclerosis: Epidemiology, Etiology, Pathophysiology, and treatment. Medicine. 2024;103(8). doi:10.1097/md.00000000000037297
4. Hauser SL, Cree BAC. Treatment of multiple sclerosis: A Review. The American Journal of Medicine. 2020;133(12). doi:10.1016/j.amjmed.2020.05.049
5. Wattjes MP, Ciccarelli O, Reich DS, et al. 2021 MAGNIMS-CMSC-NAIMS consensus recommendations on the use of MRI in patients with multiple sclerosis. Lancet Neurol. 2021;20(8):653-670. doi:10.1016/S1474-4422(21)00095-8