Multiple Sclerosis (MS)

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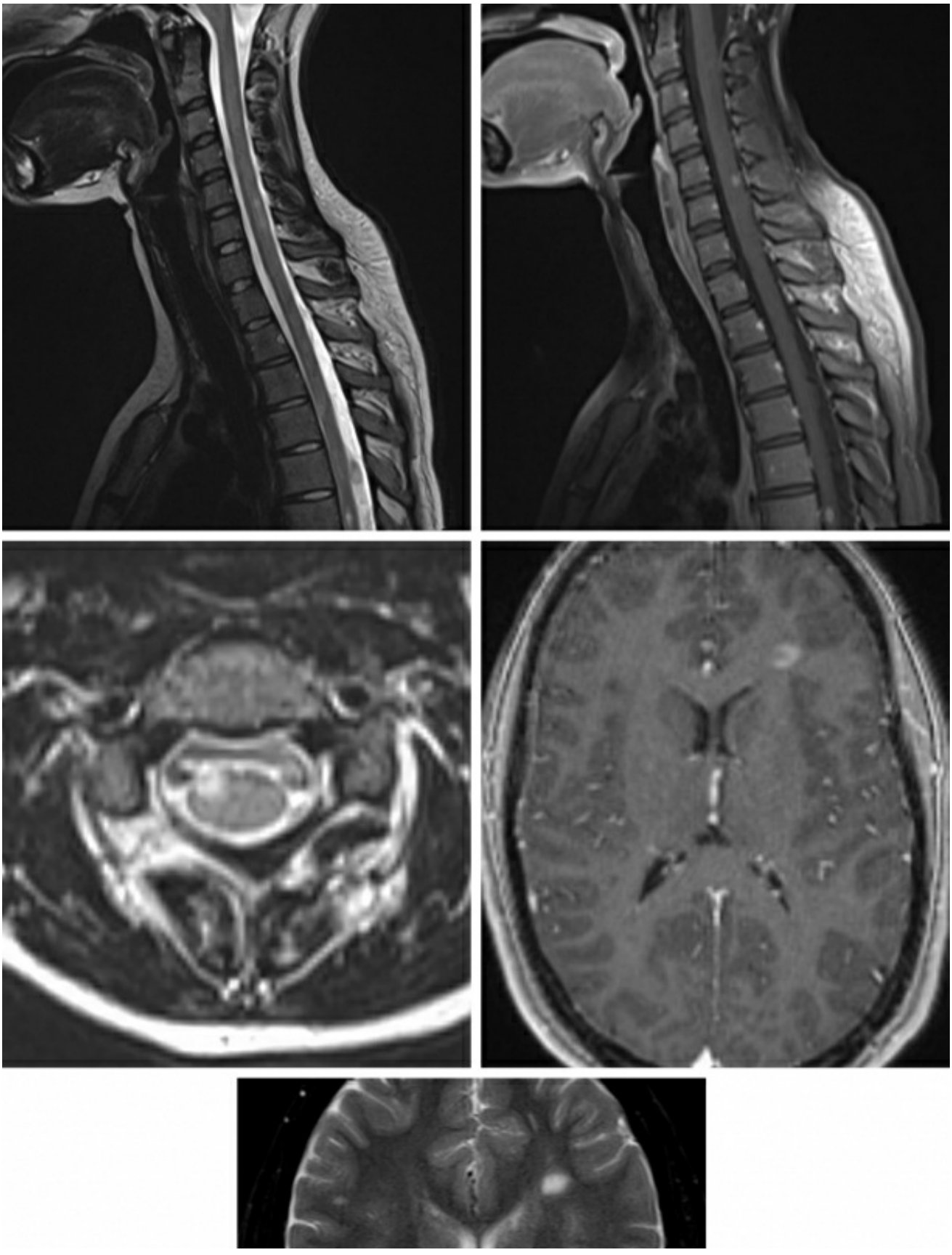


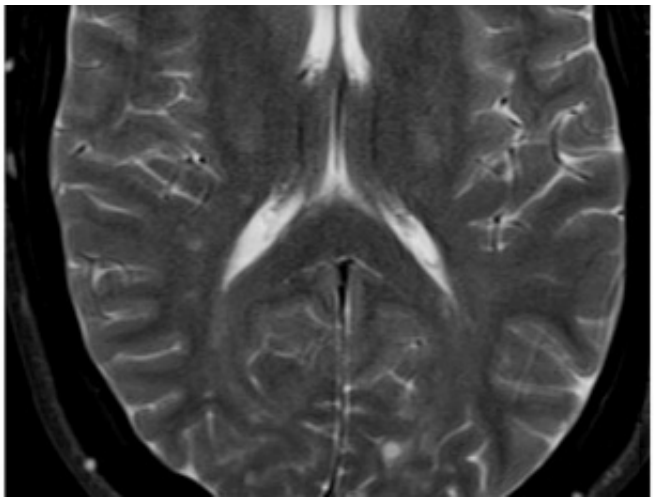
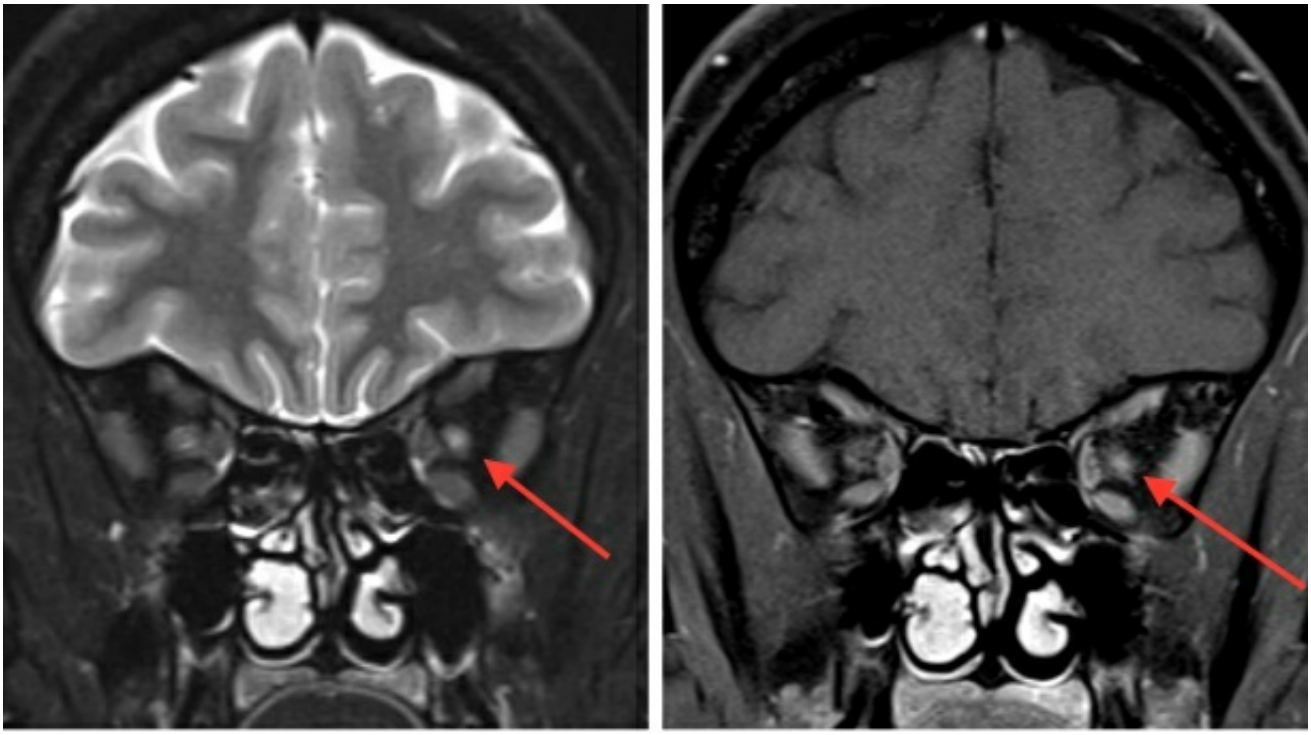


Figure 1: Sagittal T2 (top row left), sagittal T1 post-contrast fat-saturated (FS) (top row right), and axial T2 images (middle row left) of the cervical spine demonstrate short segment (<2 vertebral bodies in length), T2 hyperintense lesions in the peripheral aspect of the spinal cord with variable enhancement. Axial T1 post-contrast (middle row right) and axial T2FS (bottom row) images of the brain demonstrate a T2 hyperintense lesion in the left frontal periventricular white matter with an incomplete ring of enhancement. The length of the lesions in the cervical spinal cord and the enhancement pattern and location of the lesion in the brain are most compatible with Multiple Sclerosis.



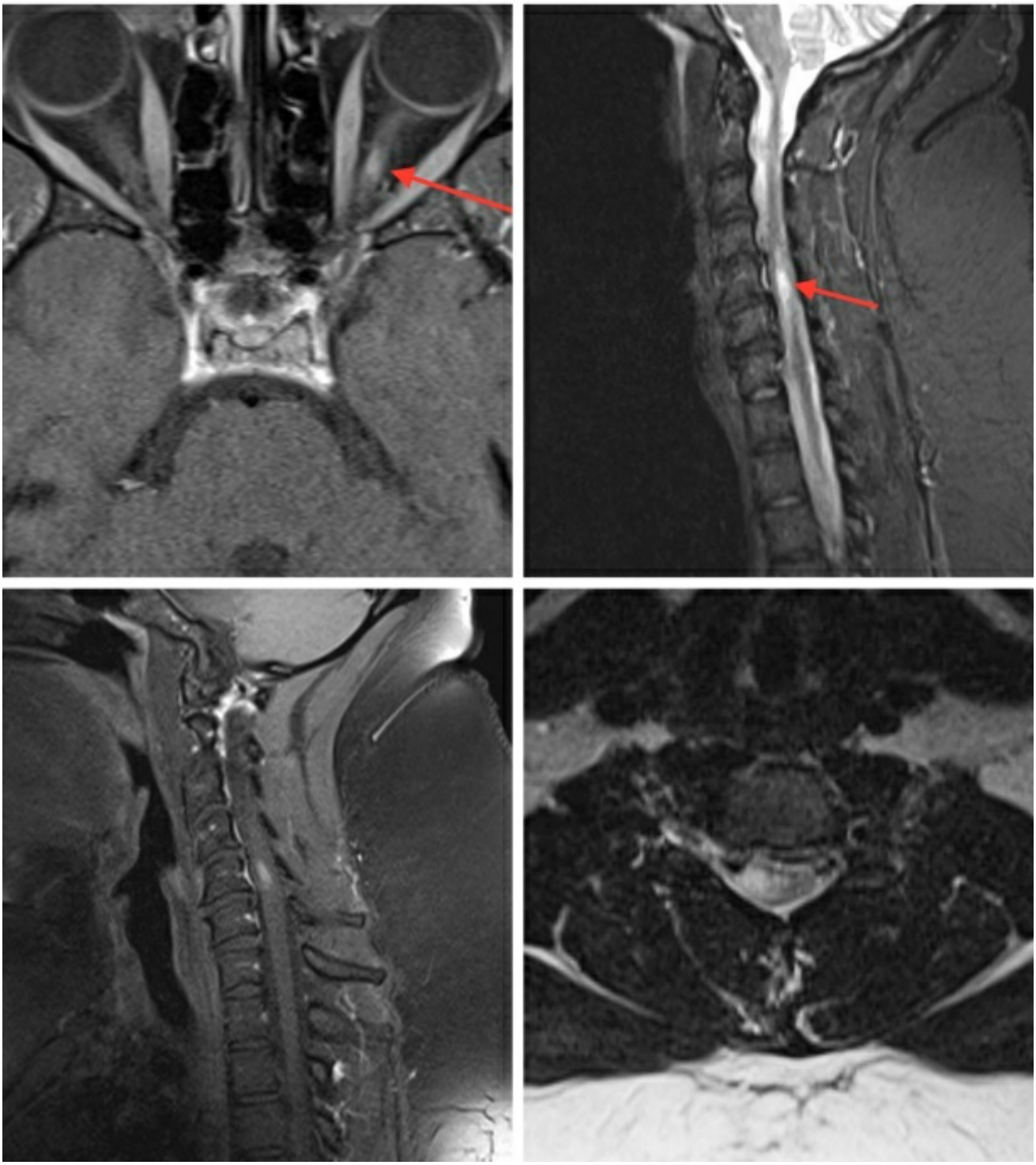


Figure 2: Coronal T2FS (top row left), coronal T1 post-contrast fat-saturated (FS) (top row right), and axial T1 post-contrast FS images (middle row left) through the orbits demonstrate a short segment T2 hyperintense lesion with associated enhancement in the left optic nerve. Sagittal STIR (middle row right), sagittal T1 post-contrast FS (bottom row left), and axial T2 images (bottom row right) of the cervical spine demonstrate an enhancing, short segment (<2 vertebral bodies in length), T2/STIR hyperintense lesion in the peripheral aspect of the spinal cord. The differential

diagnosis includes both Multiple Sclerosis and Neuromyelitis Optica. However, the length of the lesion in both the spinal cord and optic nerve favor multiple sclerosis. The patient's CSF demonstrated oligoclonal bands.

Clinical Features

- Peak Age: 20-40
- Gender: F>M (1.7:1 F:M)
- Etiology: Not completely known. Viral and/or autoimmune mediated activation of T-cells which target myelin.
- Epidemiology:
    - Disease prevalence increases as distance north of equator increases.
    - > 2 Million patients affected.
- CSF:
    - Oligoclonal bands: positive
    - Protein: normal (typically)
    - IgG: elevated
    - Cell count: Typically, normal (2/3 of patients); if significantly elevated (>50 cells/µl) consider other etiology.
- McDonald Criteria: Diagnosis is made based on dissemination of lesions in space and time as determined by clinical findings alone or clinical findings in conjunction with imaging findings.
    - Dissemination in space: Requires 1 or more lesions present in 2 or more MS-specific regions in the CNS (periventricular, juxtacortical, infratentorial, spinal cord) OR by progression of clinical symptoms implicating an additional site in the CNS.
    - Dissemination in time: Simultaneous presence of enhancing and non-enhancing lesion on MRI, new

T2/FLAIR hyperintense lesion on follow up MRI, or development of new clinical symptoms.

Imaging

- General:
  - Location:
    - Brain: Periventricular/perivenular, callososeptal interface, juxtacortical white matter/subcortical U-fibers, brachium pontis, brainstem.
    - Spinal Cord:
      - Cervical > thoracic cord
      - Although most commonly dorsolateral aspect of cord, lesions are also often central and can be found anywhere.
      - Typically seen in conjunction with brain lesions (90% of patients) but can be Isolated (10%).
    - Nerves: Optic nerves. Involvement of other cranial nerves should raise suspicion for ADEM.
  - General Appearance:
    - Solitary or multifocal ovoid or wedge shaped T2 hyperintense lesions, asymmetric in distribution, most often located in the dorsolateral spinal cord.
    - Length: Typically < 2 vertebral bodies in length (if > 2 vertebral bodies, consider NMO, ADEM, or idiopathic transverse myelitis)
    - Width: Typically < ½ spinal cord in axial plane.
    - Acute lesions: +/- mild cord swelling/edema which can mimic intramedullary neoplasm.
    - Chronic Lesions: +/- cord atrophy, +/- residual STIR/T2 hyperintensity

- Modality-Specific (Spinal Cord Only):
    - CT Myelography:
        - Spinal cord not well evaluated. May see spinal cord swelling in acute phase (mimics intramedullary tumor).
    - MRI:
        - T1: Isointense or hypointense.
        - T1 + Contrast: +/- Enhancement. Ring, homogenous, or nodular enhancement in the subacute/acute phase. Typically resolves after 6 months.
        - T2: Discrete or vague hyperintense lesions.
        - STIR: Hyperintense lesions. Increased sensitivity for detection of lesions.
        - DWI: Typically, increased diffusivity.
    - MRS:
        - Not typically utilized for spinal cord MS
        - Decreased NAA, Increased Choline seen in areas of normal white matter.

For more information, please see the corresponding chapter in Radiopaedia, and the Tumefactive Demyelination chapter in the Cranial Disorders sub-volume of the Neurosurgical Atlas.

Contributor: Jacob A. Eitel, MD

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