

Spine cord inflammation

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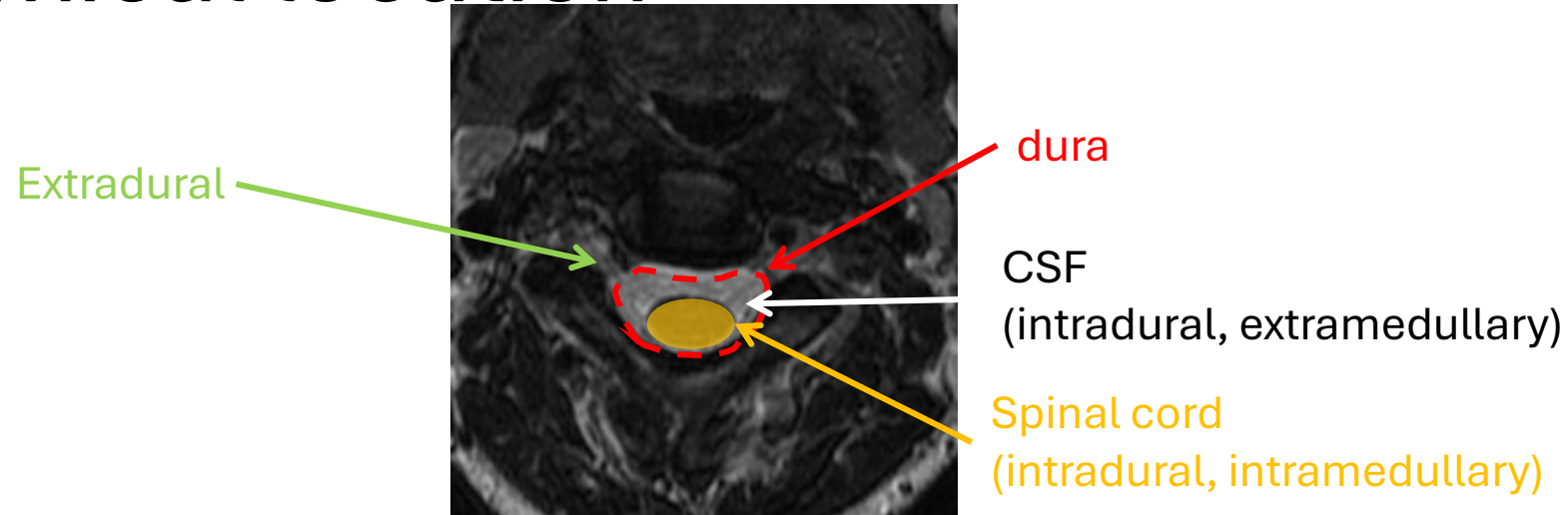
Key Learning Goals

- Present a location-based approach
- Differentiate tumor vs mimics
- Summarize key non-neoplastic spinal conditions

Location based approach to spine lesions

- **Spine = Extension of the CNS**
 - Similar disease processes involve both brain and spine
 - **Spinal cord** → equivalent to brain parenchyma
 - **CSF space** → analogous to basal cisterns
 - **Dura / epidural space** → parallels dural & extradural compartments
- **Key Principle:**
 - **Localize first → then build your differential**

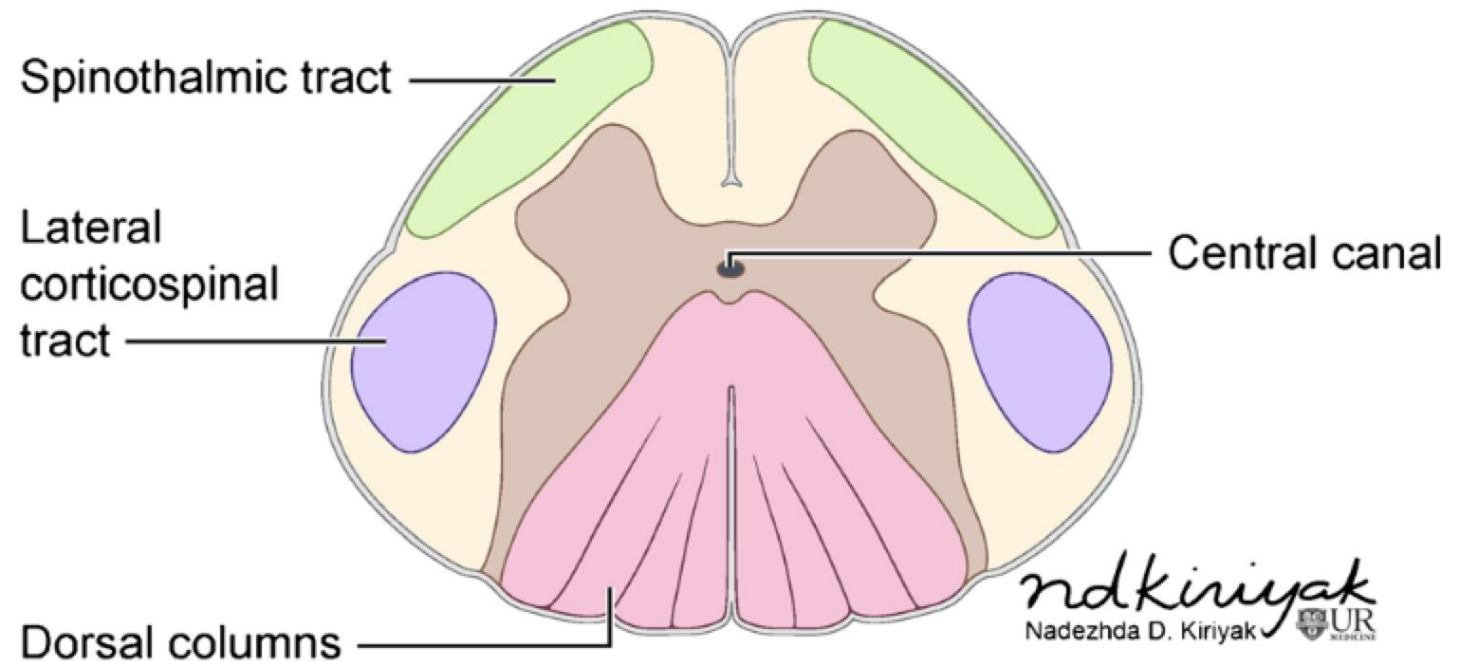
Anatomical location



- **Relative to the spinal cord:**
 - **Intramedullary** → within the cord
 - **Extramedullary** → outside the cord
- **Relative to the dura:**
 - **Intradural**
 - **Extradural** → includes epidural space and osseous structures

Intramedullary spinal cord anatomy

- Central gray
- Peripheral WM



Common intramedullary lesions

- Tumors
 - Astrocytoma
 - Ependymoma
 - Hemangioblastoma
 - metastasis
- Demyelination
 - MS
 - NMOSD
 - MOGAD
- Inflammatory
 - Sarcoidosis
- Infection
 - Viral infections
- Compressive myelopathy
- Vascular lesions

Approach to intramedullary lesions

- **First: Assess for compression**
- **Neoplasm vs mimicker (inflammatory, infectious, vascular)**
 - Length, location, morphology and nodular enhancement
 - Biopsy is not recommended in all cases
 - 6th weeks FU with steroids is helpful
 - CSF analysis and brain imaging is helpful

Tumor vs non-tumor conditions

Tumor

- Cord expansion
- Well defined margins
- Focal mass effect
- Solid or nodular enhancement

Non neoplastic

- Less expansion
- Long segment involvement
- Patchy or peripheral enhancement
- Leptomeningeal inv
- Multiple sites
- Brain imaging is helpful

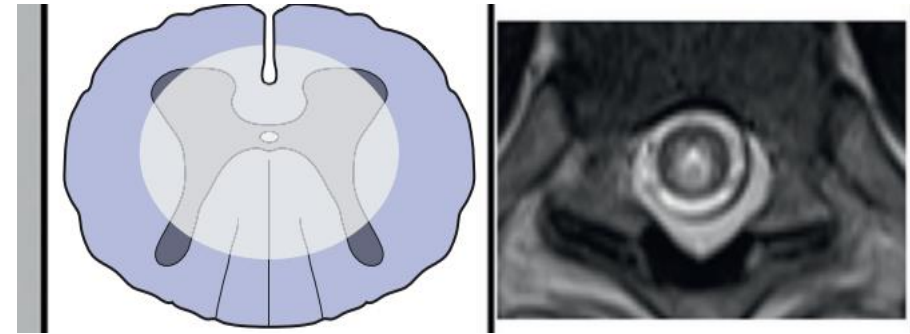
Intramedullary non-tumor lesions

- **If non-neoplastic likely:**
 - **Segment length** → short vs long segment (sagittal)
 - **Distribution** → hemicord vs central/entire cord vs dorsal columns
 - **Enhancement pattern** → intralesional vs leptomeningeal
- **Additional Clues**
 - **Correlate with brain imaging**
 - **Evaluate systemic findings to refine differential**

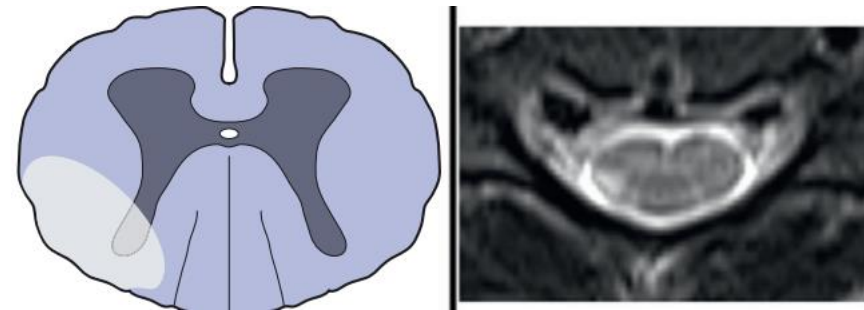


Cross sectional patterns of cord involvement

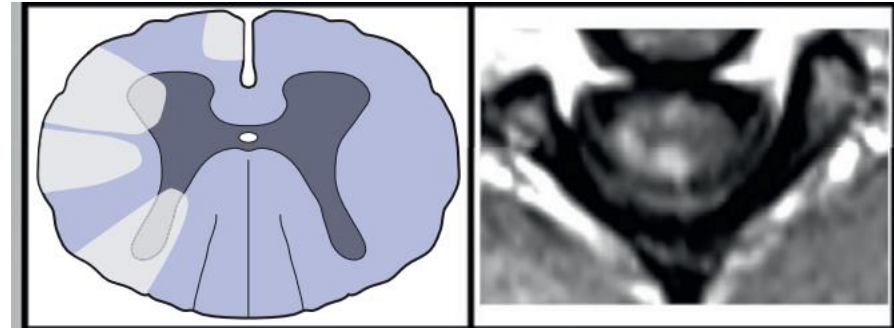
- Central : NMOSD, ADEM, Systemic inflammatory, infectious, sdAVF, radiation.



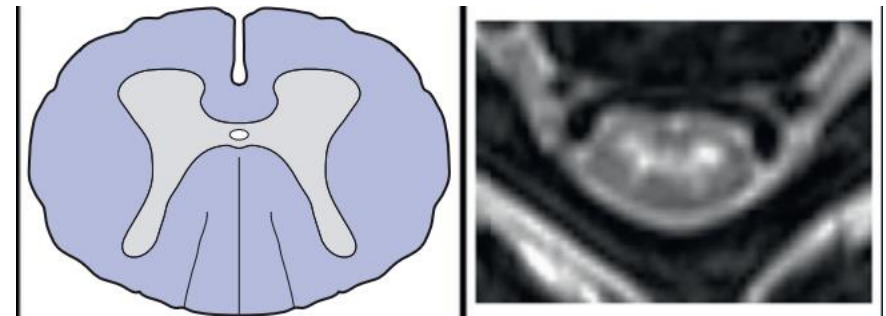
- Peripheral short segment: MS



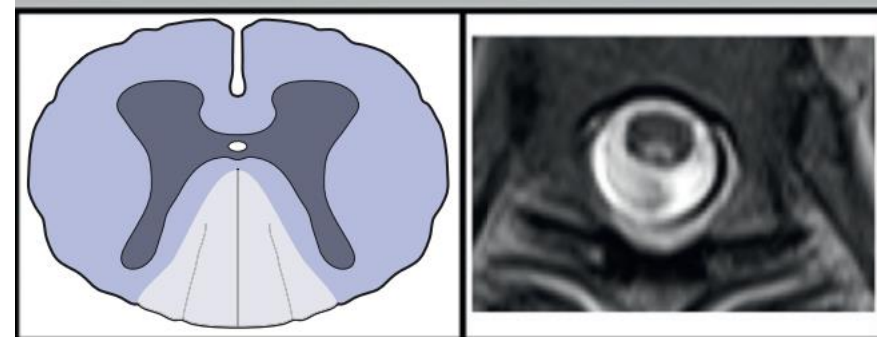
- Centripetal: sarcoidosis



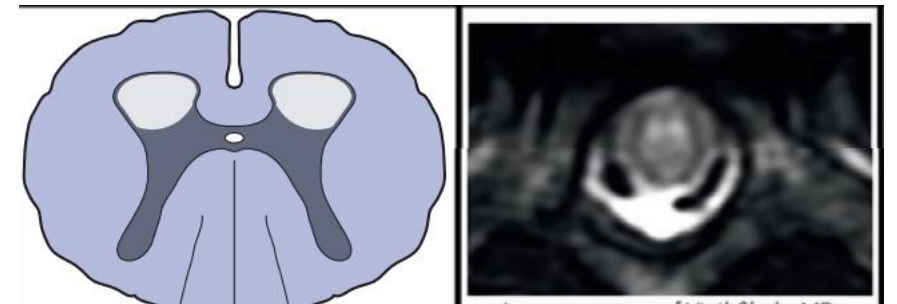
- Central Gray Matter: infarction, sdAVF, compression, paraneoplastic



- Dorsal Column: B12 and copper def, Zn, N2O toxicity, paraneoplastic, autoimmune, tertiary syphilis



- Anterior Horns: Infarction (watershed), viral infection (enterovirus, Polio, West Nile)

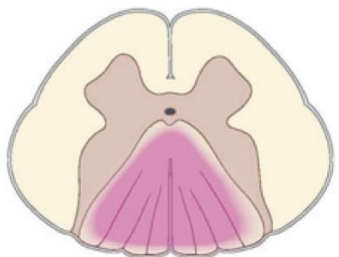
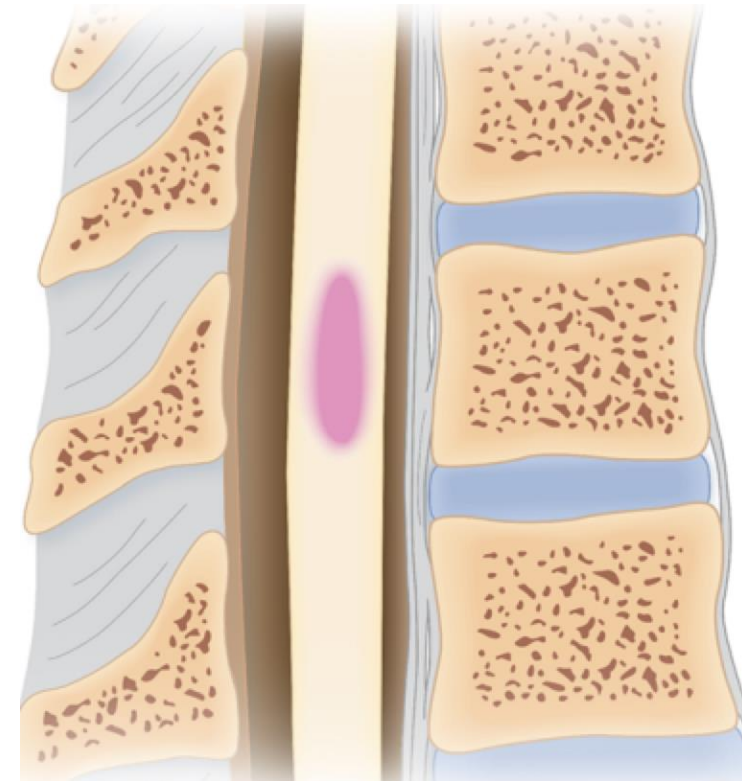


Non-neoplastic intramedullary disease

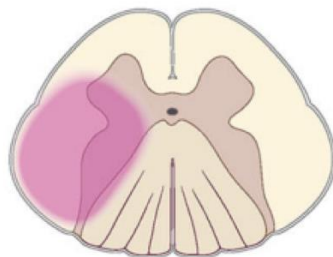
- Demyelinating lesions
 - Multiple sclerosis
 - NMOSD
 - ADEM
- Inflammatory lesions
 - Sarcoidosis
- Other (rare)
 - Infarct
 - Subacute combined degeneration (B12 deficiency)

Multiple sclerosis

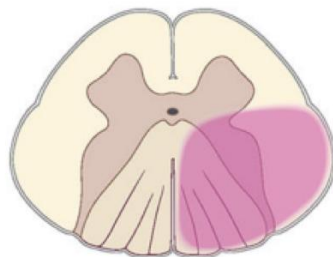
- Predilection: Cervical > Thoracic
- Lesions
 - Short segment (< 2 vertebral body)
 - Peripheral
- Active lesions
 - Patchy or peripheral incomplete enhancement



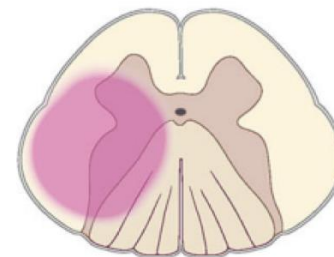
Multiple Sclerosis



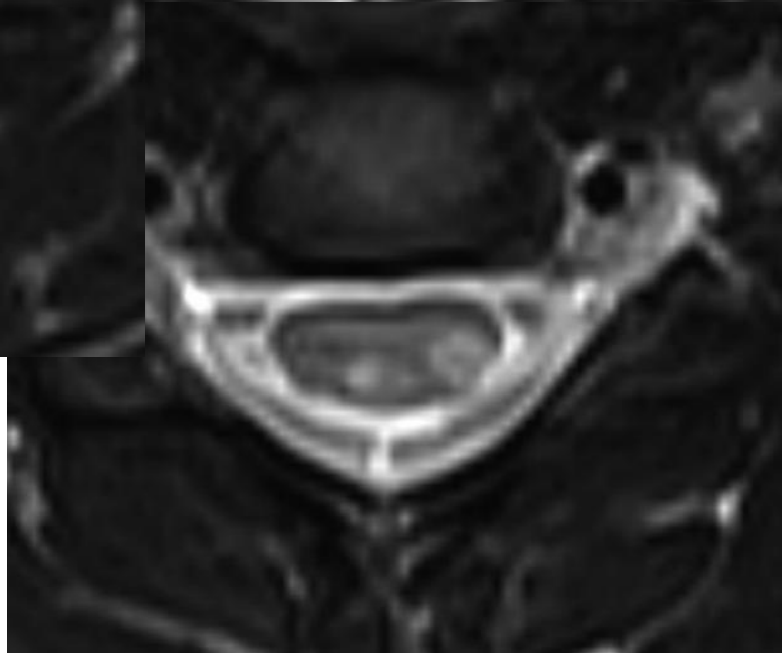
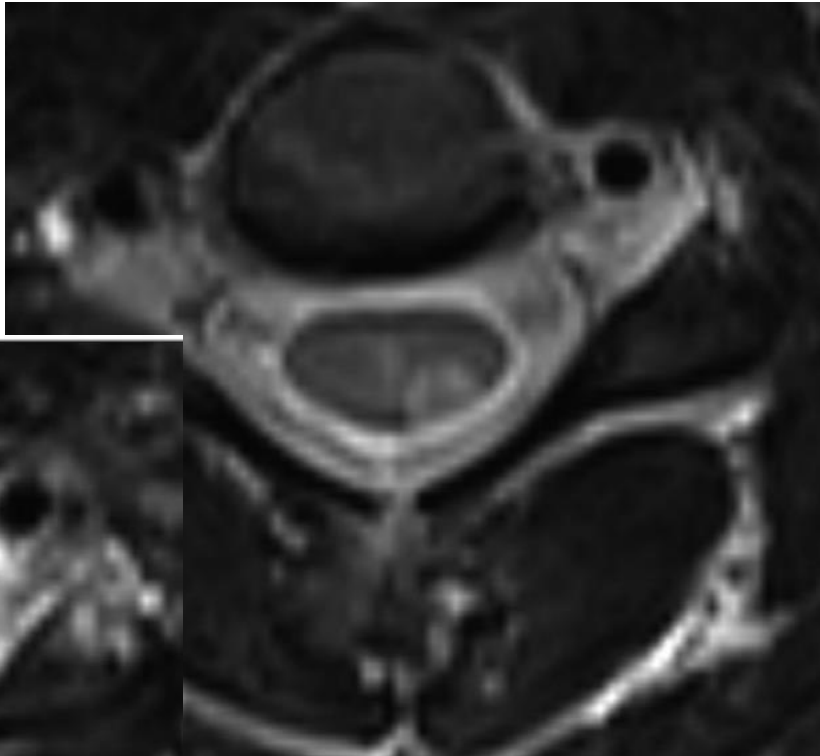
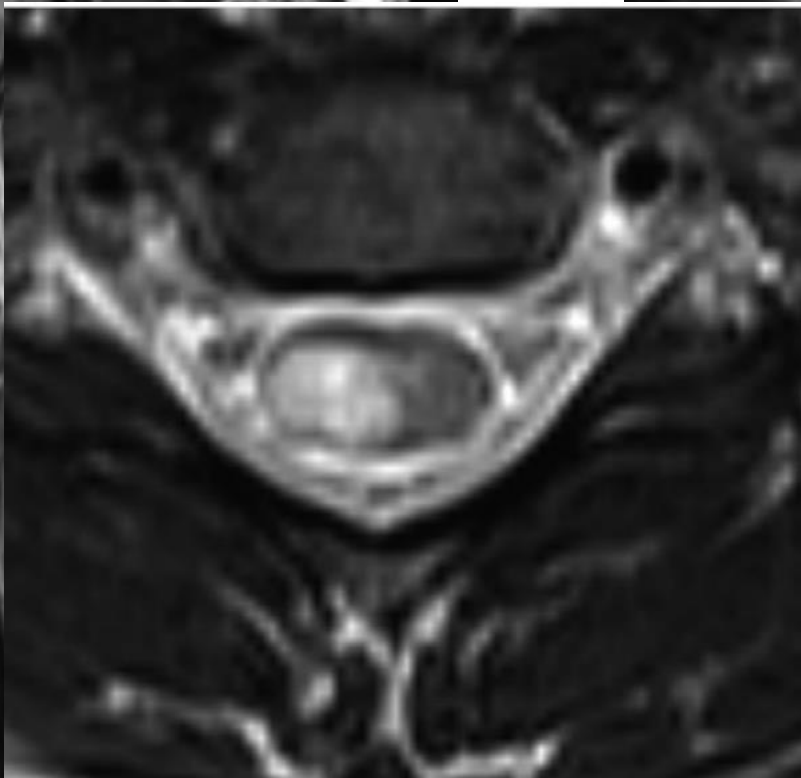
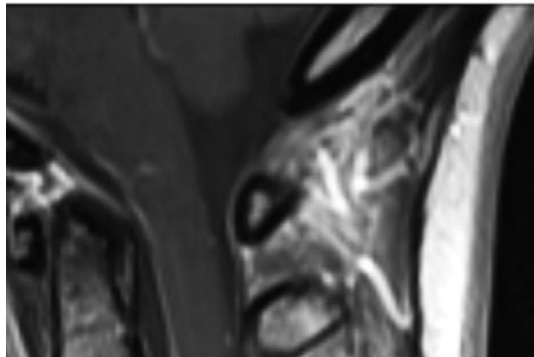
Multiple Sclerosis



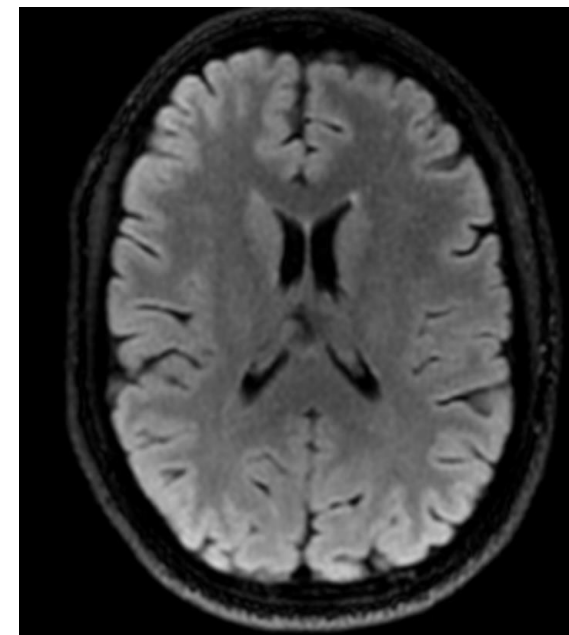
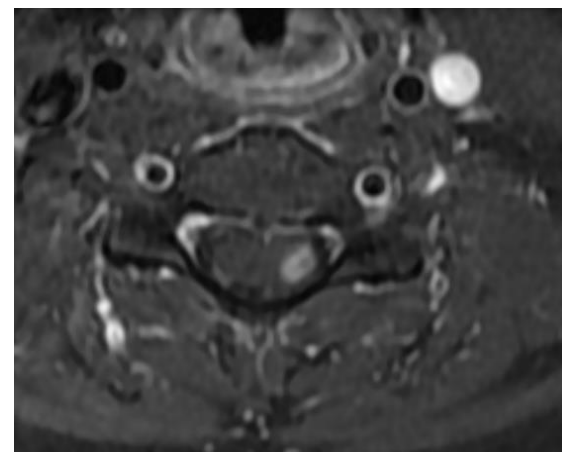
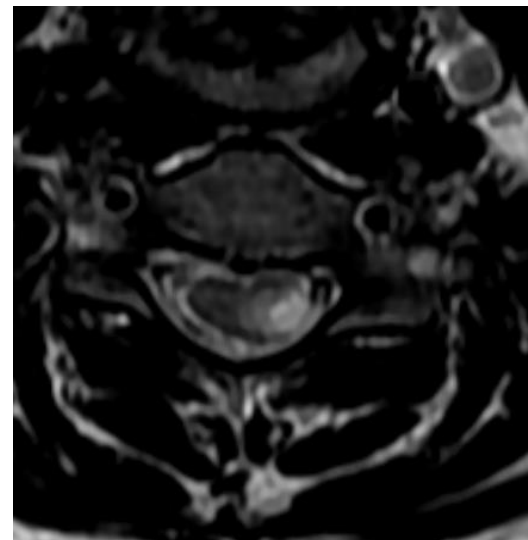
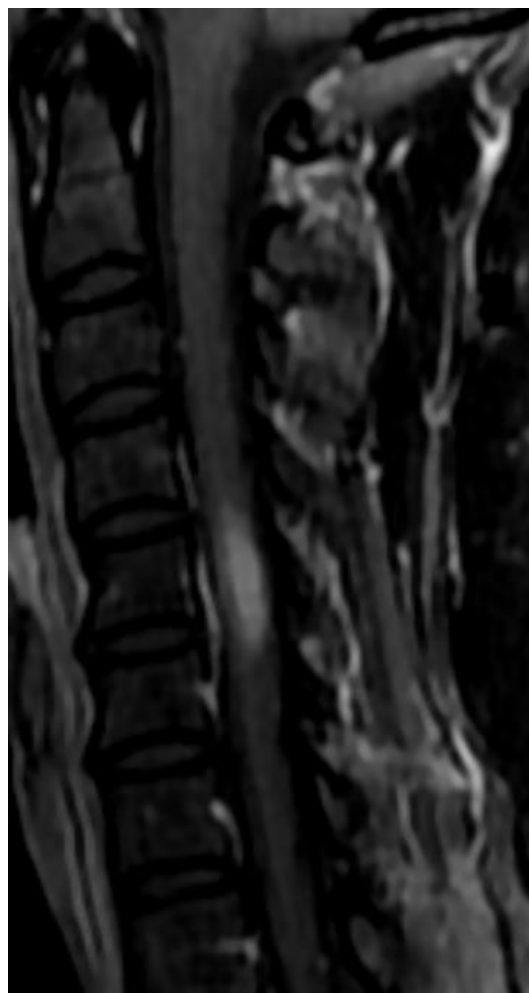
Multiple Sclerosis



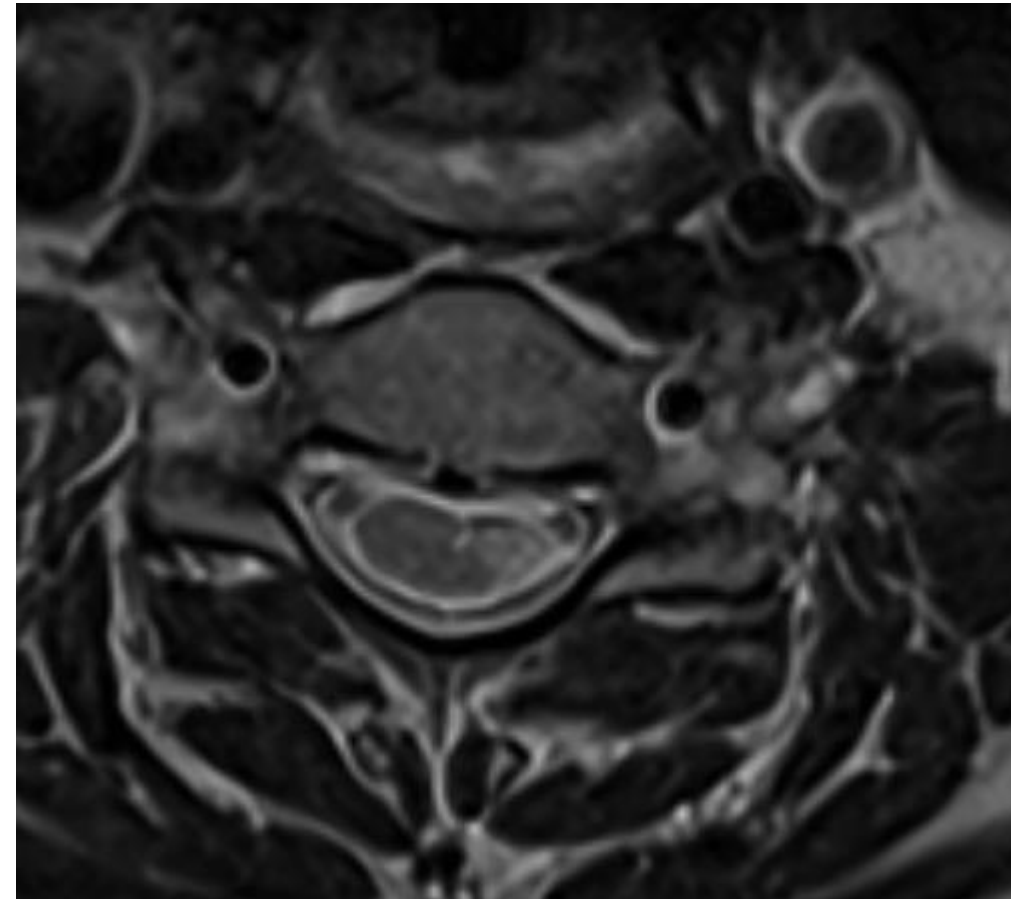
Multiple Sclerosis
Herpes



45 yo female with progressive numbness



After 3 years



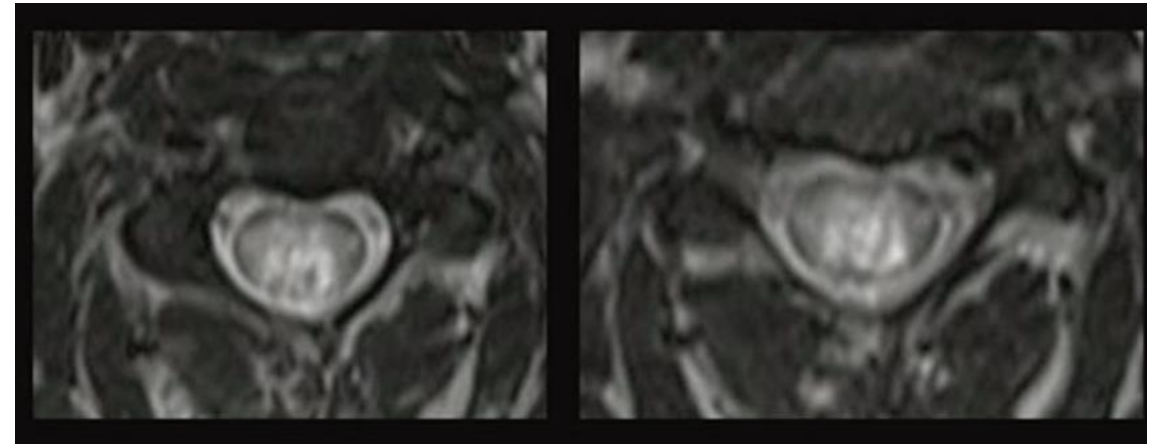
LETM

- Often isolated findings
 - Brain normal
- Demyelinating syndromes
 - Neuromyelitis optica (optic neuritis + spinal cord lesions)
- Viral illness
 - Can be direct viral myelitis
 - Or viral associated auto-immune syndrome
- Imaging features
 - Longer segment abnormality
 - +/- enhancement

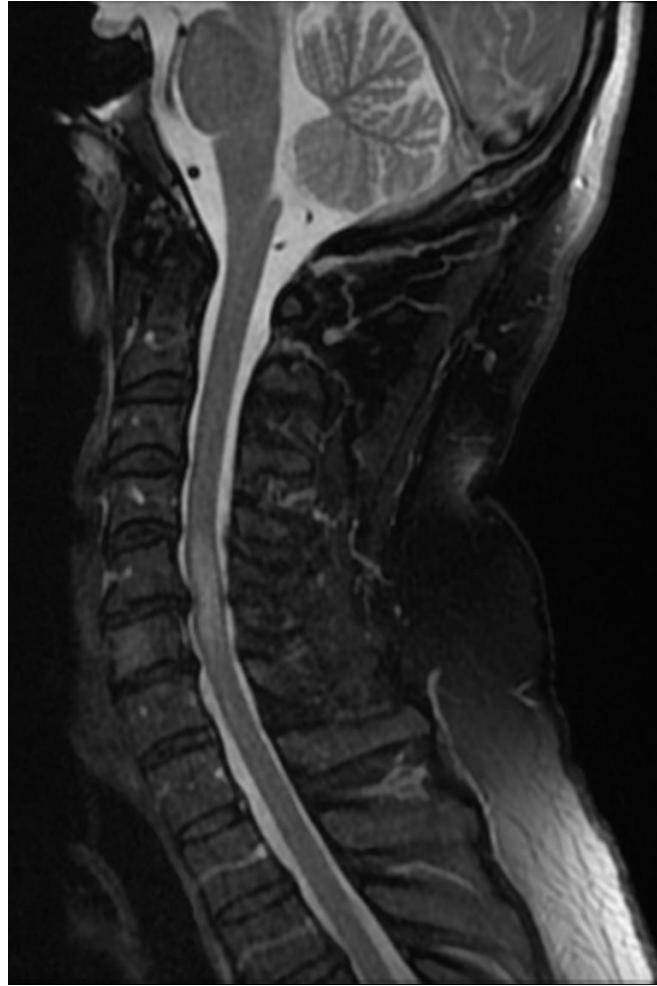


NMOSD

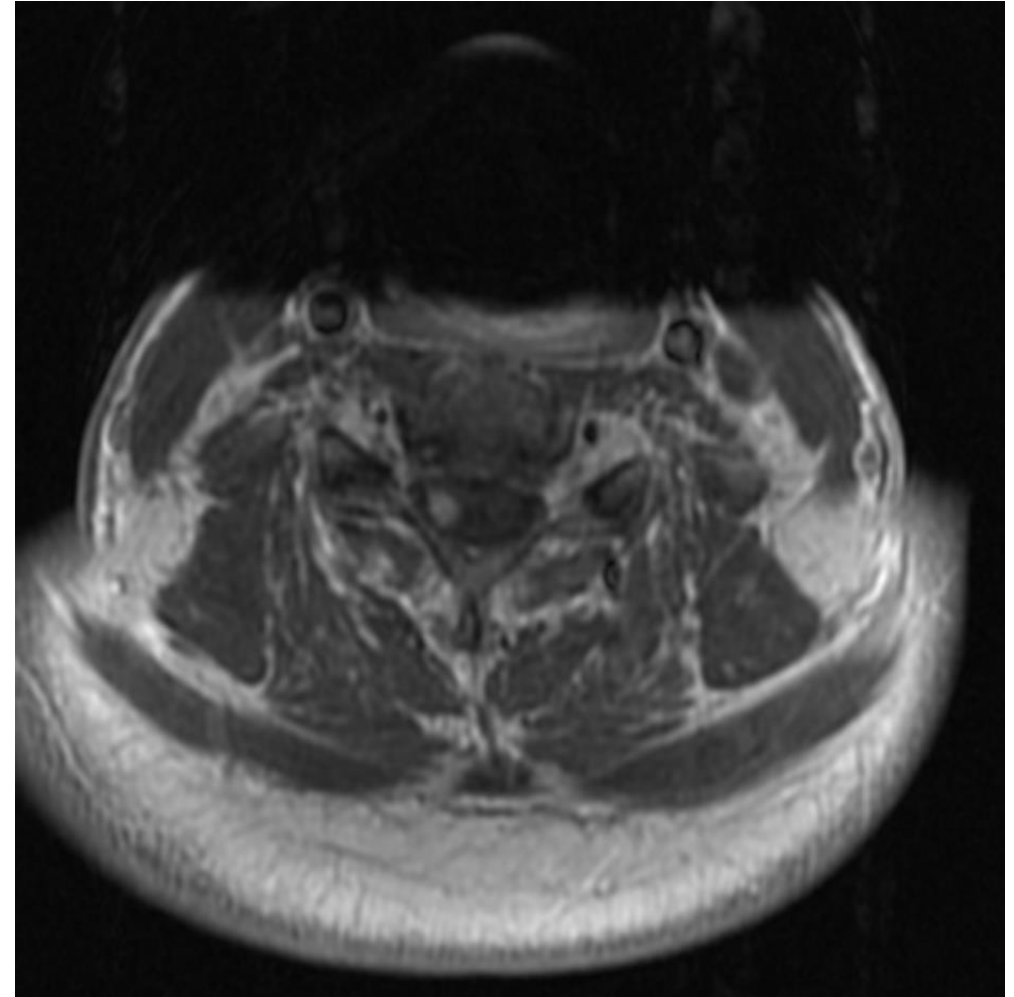
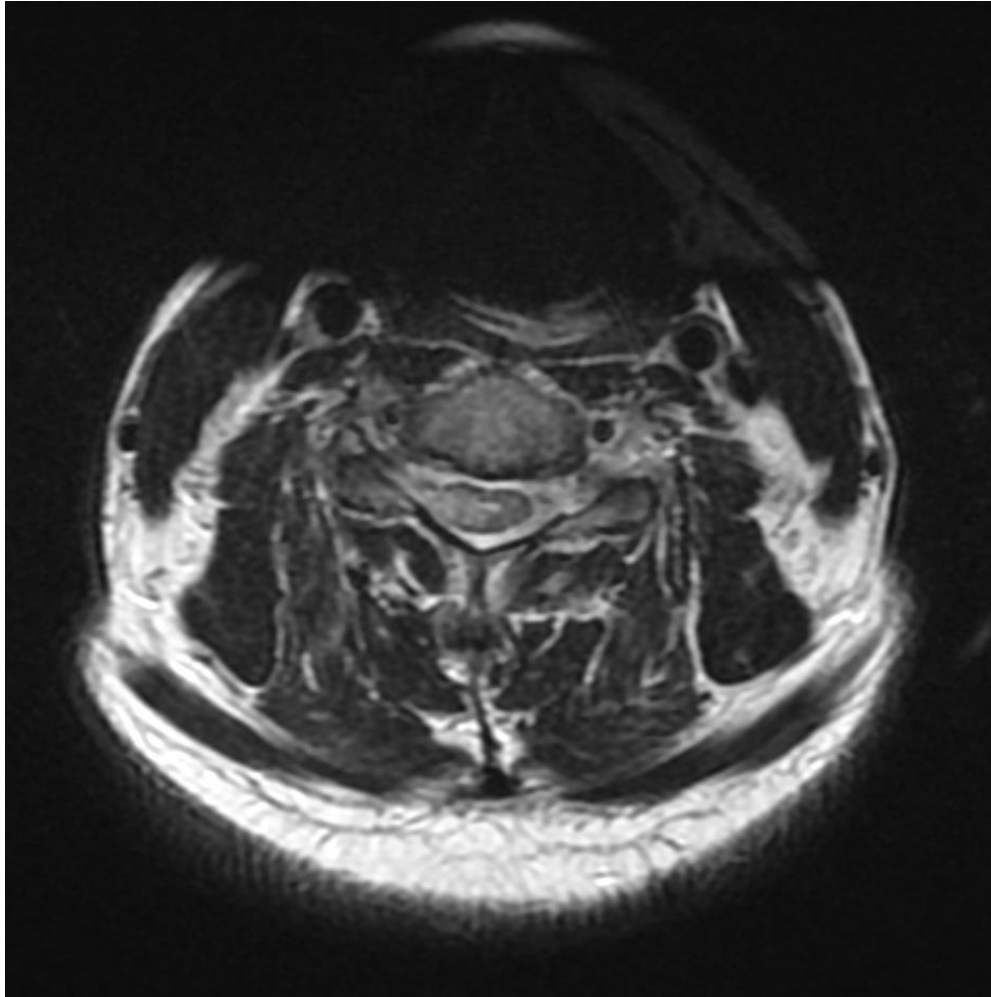
- LETM + Optic Neuritis
- Anti Aquaporin-4 Abs in serum
- Specific imaging findings
 - Area of postrema/obex inv
 - Bright spotty lesions-specific
- Brain imaging
 - Lesions around 3rd or 4th Ventricles



Transverse myelitis

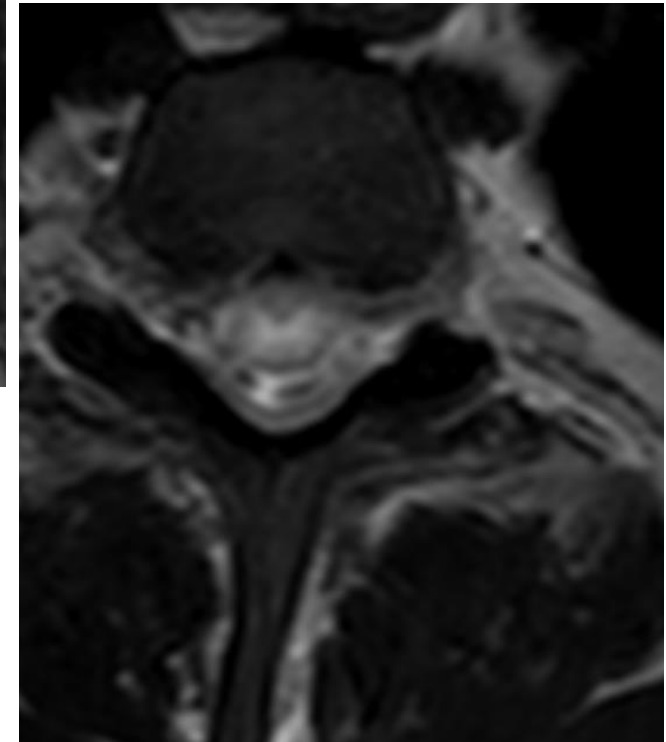


Transverse myelitis - VZV



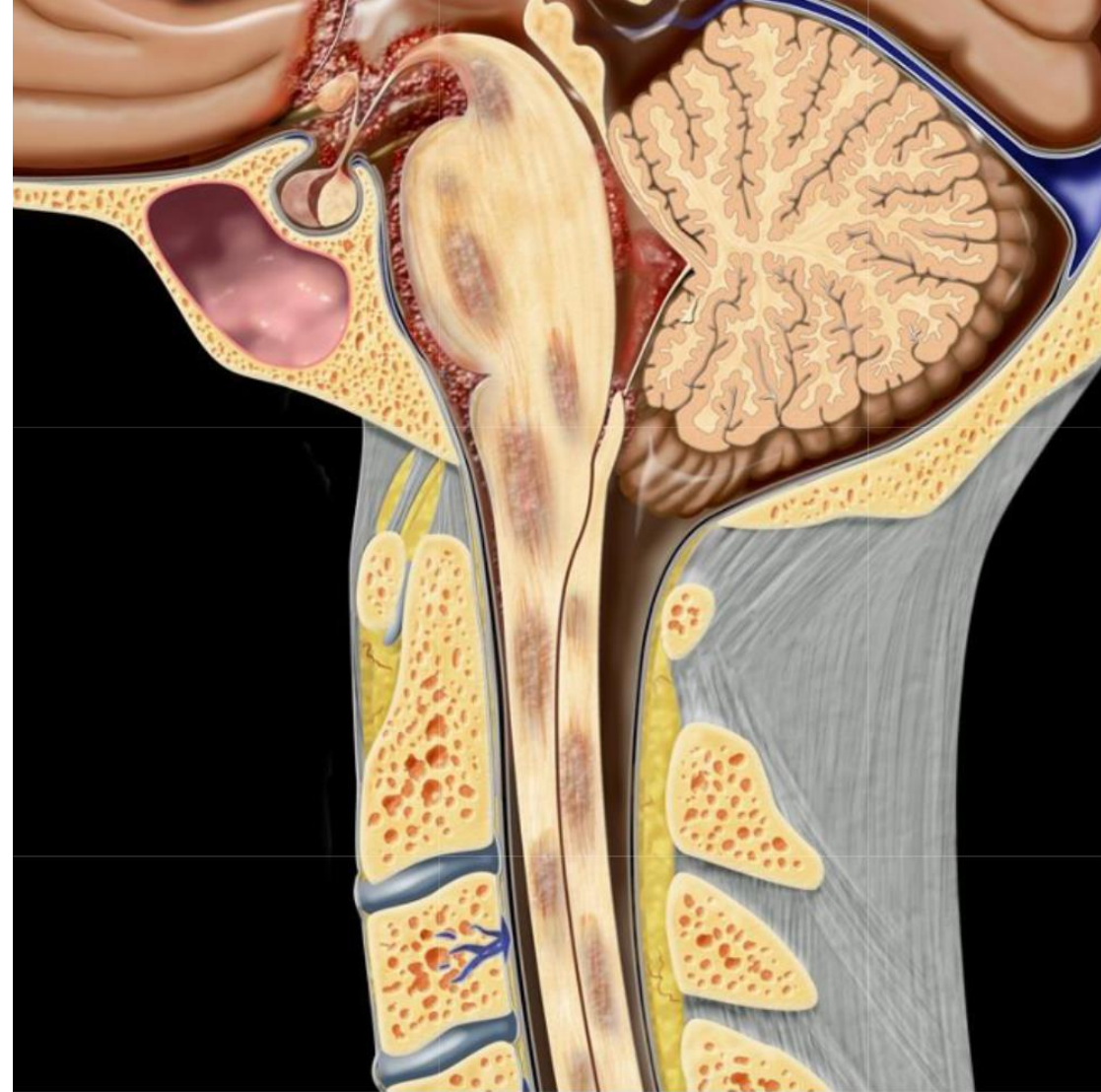
MOGAD

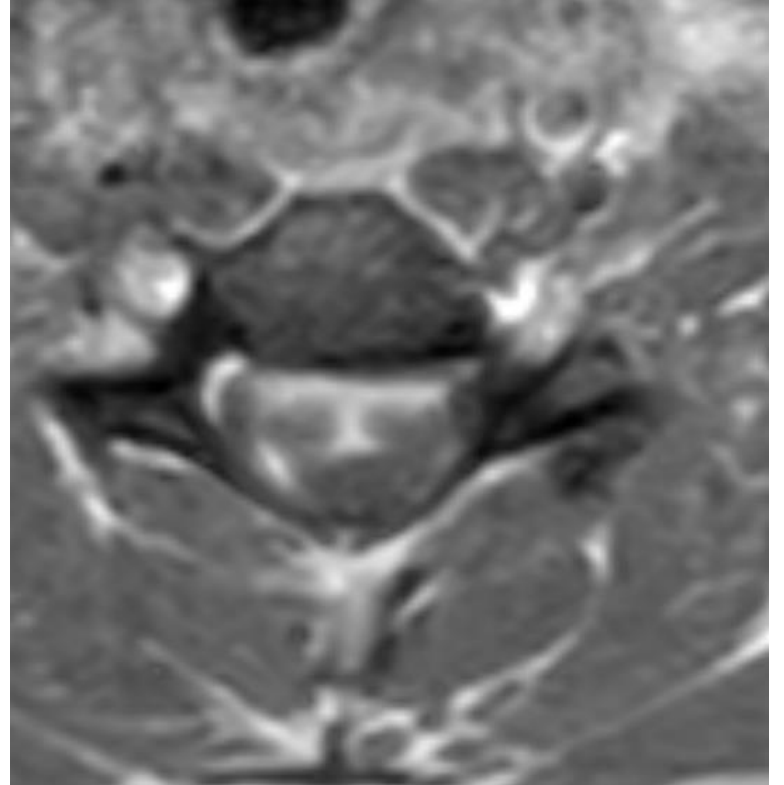
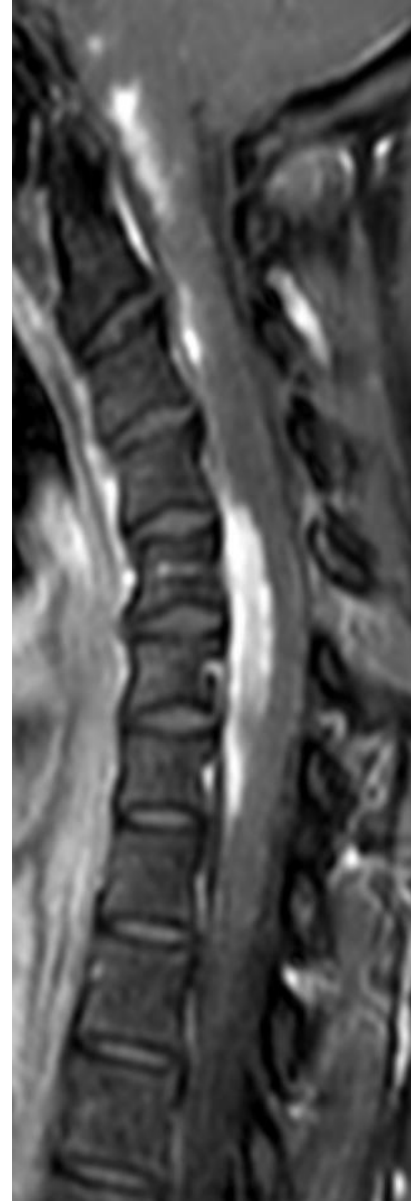
- Spine involvement
 - LETM
 - Conus involvement
 - H-shaped involvement
- Brain involvement
 - Optic neuritis+perineural enhancement
 - Cerebellar lesions
 - Middle cerebellar peduncles



Sarcoidosis

- LETM+ adjacent meningeal enhancement
- Involvement of cauda equina can be seen.
- Brain:
 - Optic neuritis
 - Leptomeningeal enhancement at skull base
- CT chest or CXR is helpful.
- Serum and CSF angiotensin-converting enzyme levels are useful.





Comparison

Multiple sclerosis

- Short segment
- Peripheral location
- Peripheral interrupted enhancement
- Brain lesions

Transverse myelitis

- Long segment
- Central location
- Nodular/hazy enhancement
- Viral prodrome

Sarcoidosis

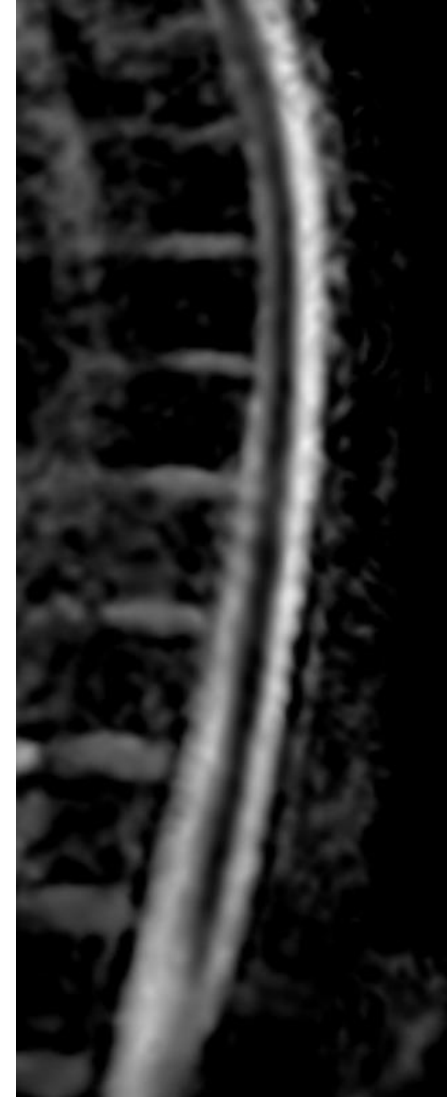
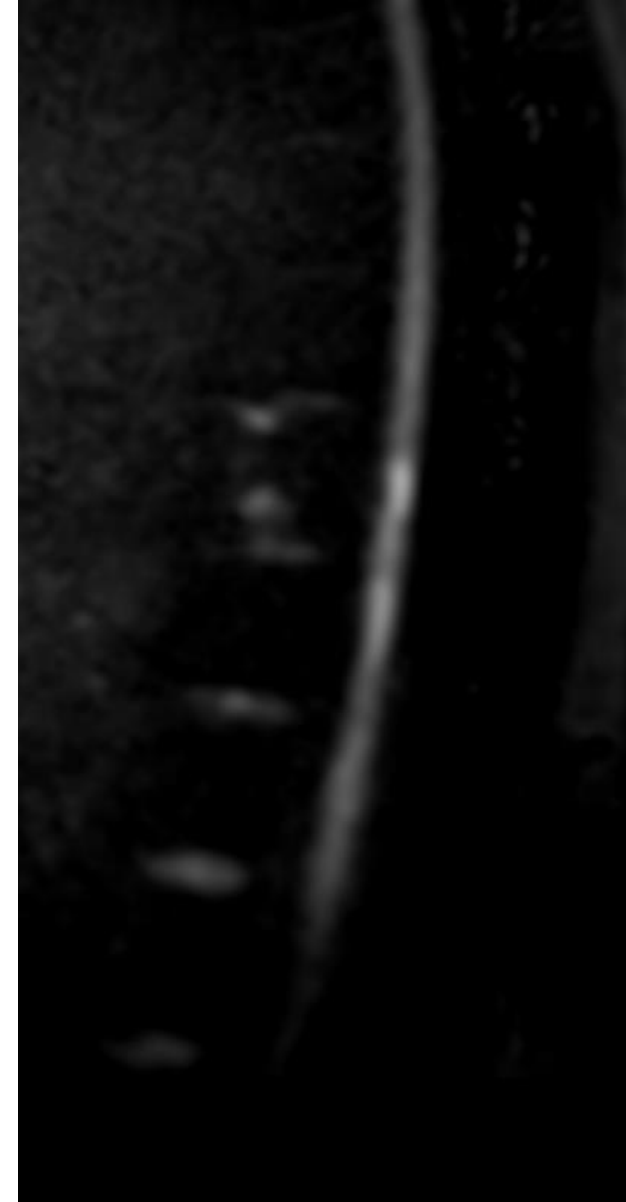
- Long segment edema
- Peripheral cord enhancement
- Nodular enhancement
- Lymphadenopathy

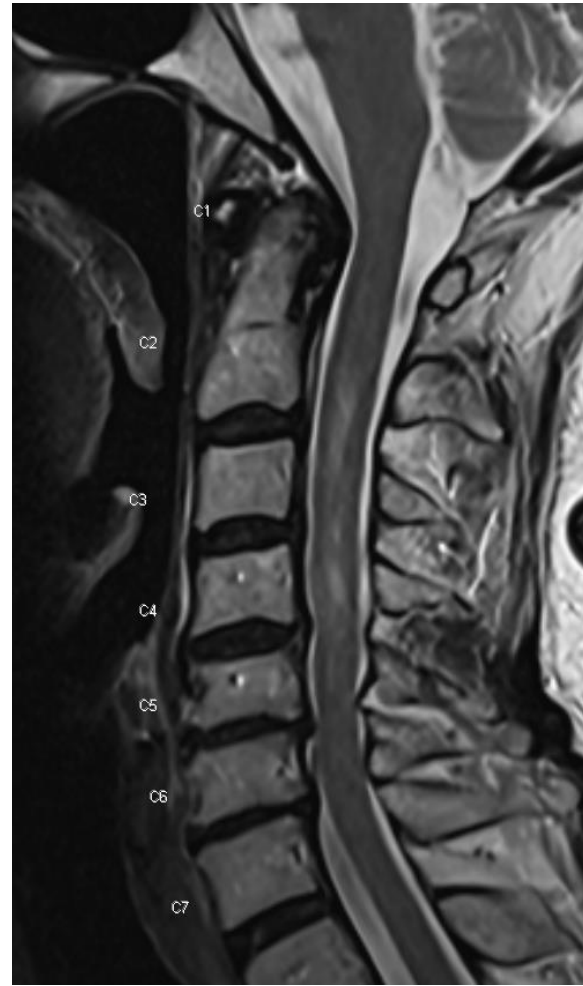


52 yo male with
thoracic zoster
and parasthesias

Cord infarct

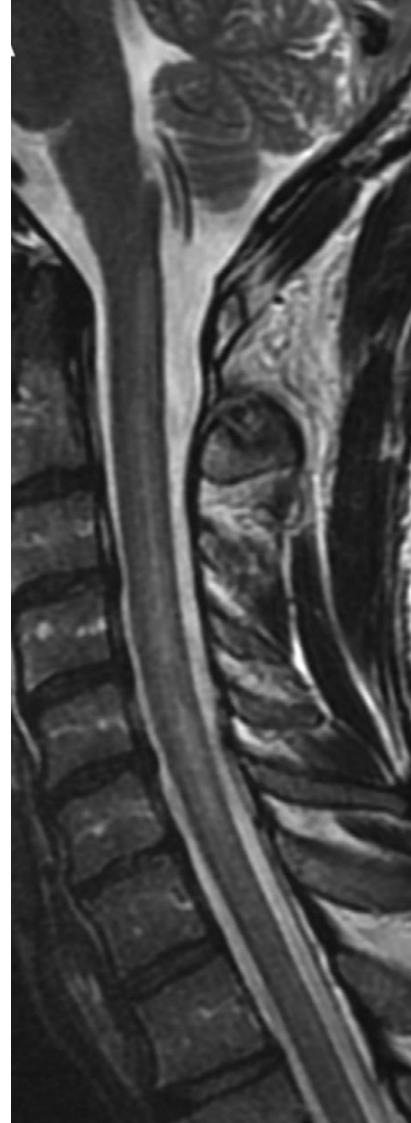
- Long segment
- Concerning history
 - Sudden onset
 - Aortic pathology
 - Vascular distribution (usually anterior spinal artery distribution)





Subacute combined degeneration

- Dorsal column abnormality
- T2 hyperintense
- “Inverted V or Rabbit ear” sign
- No enhancement
- Differential diagnosis
 - B12 deficiency
 - Nitrous oxide use
 - HIV



sdAVF

- Direct communication between meningeal arteries and radiculomedullary vein adjacent to spinal nerve root.
- Increased venous pressure leads to vascular congestion in cord and decreased arterial perfusion.
- Common in males and presents as gait disturbance, lower extremity sensory deficit and urinary dysfunction.
- Time resolve MRA is helpful for location of the fistula



CSF hypotension

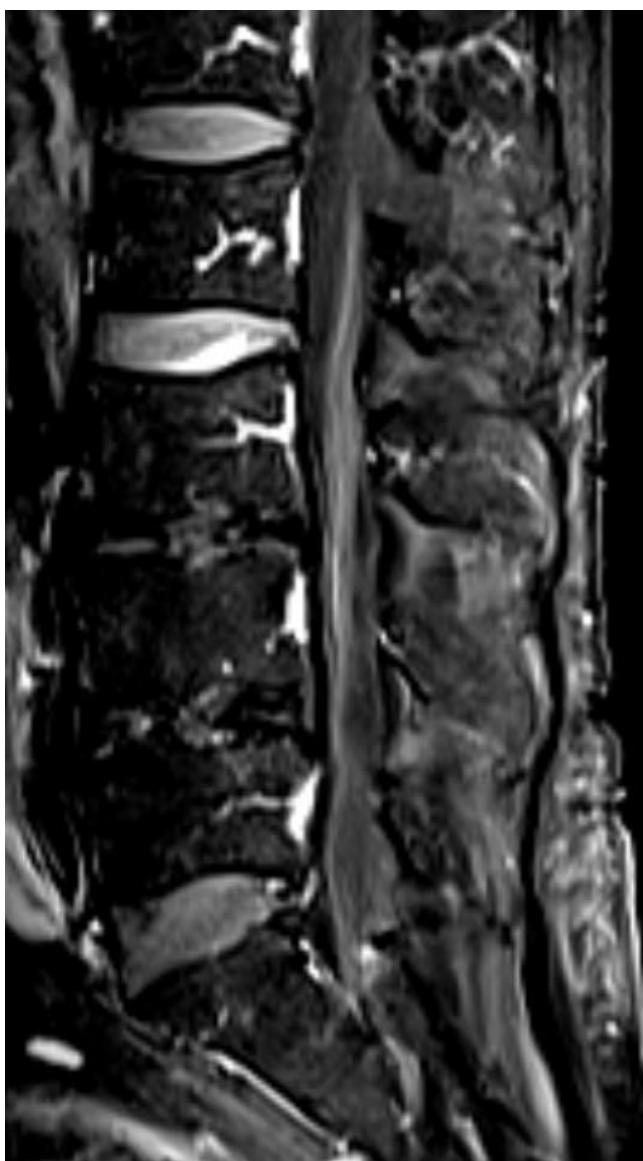
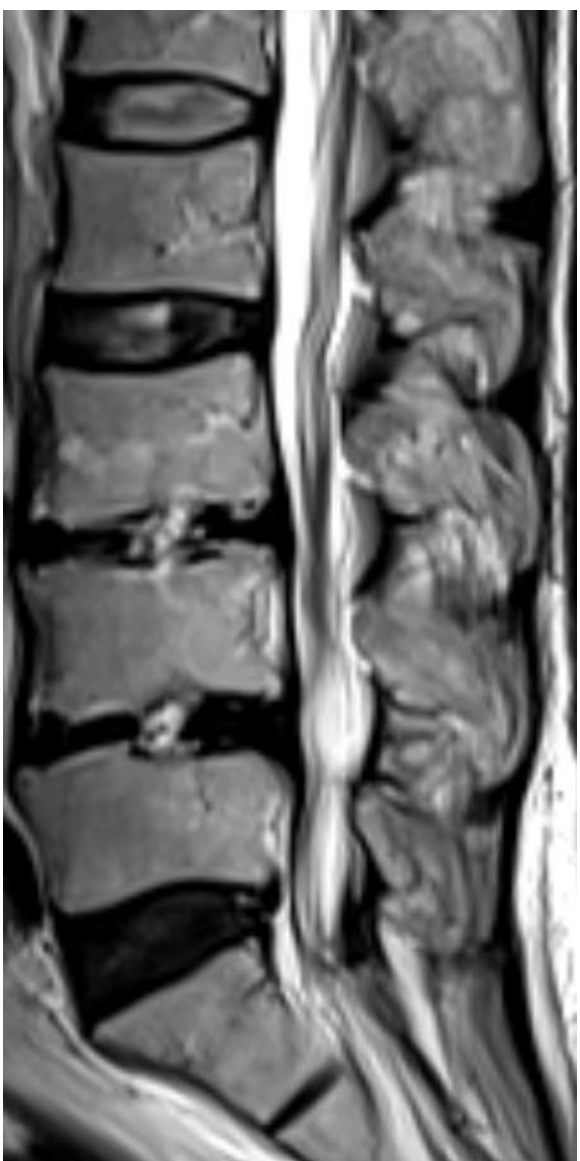
- Mimics sdAVF
- CSF hypotension can cause the venous congestion.
- Monro-Kellie doctrine applies to spinal canal.
- MRA is helpful . Venous opacification is identified during early arterial phase in fistula in contrast venous opacification occurs during venous phase in CSF hypotension.

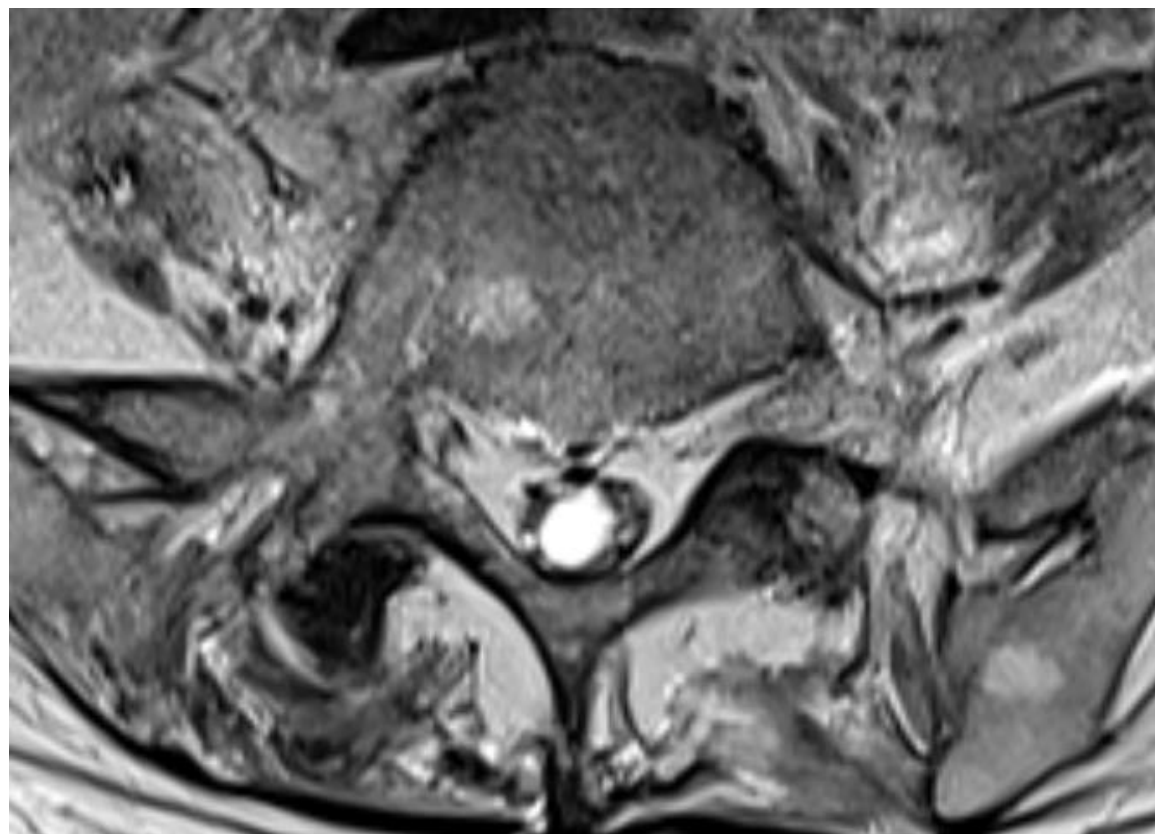
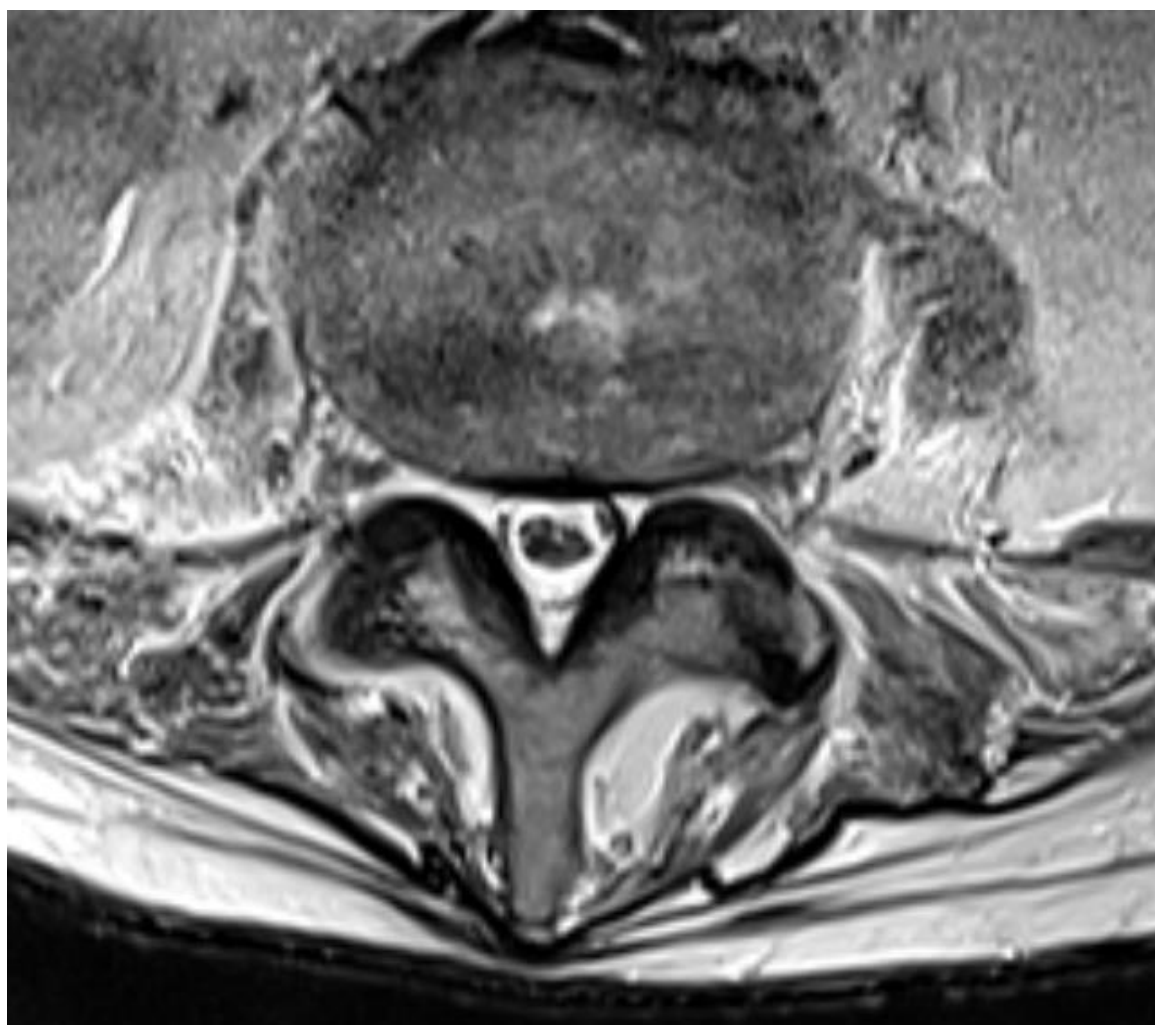


After pressure
adjustment



70-year-old male with history of multiple prior spine surgeries
now presenting with bilateral lower extremity weakness.



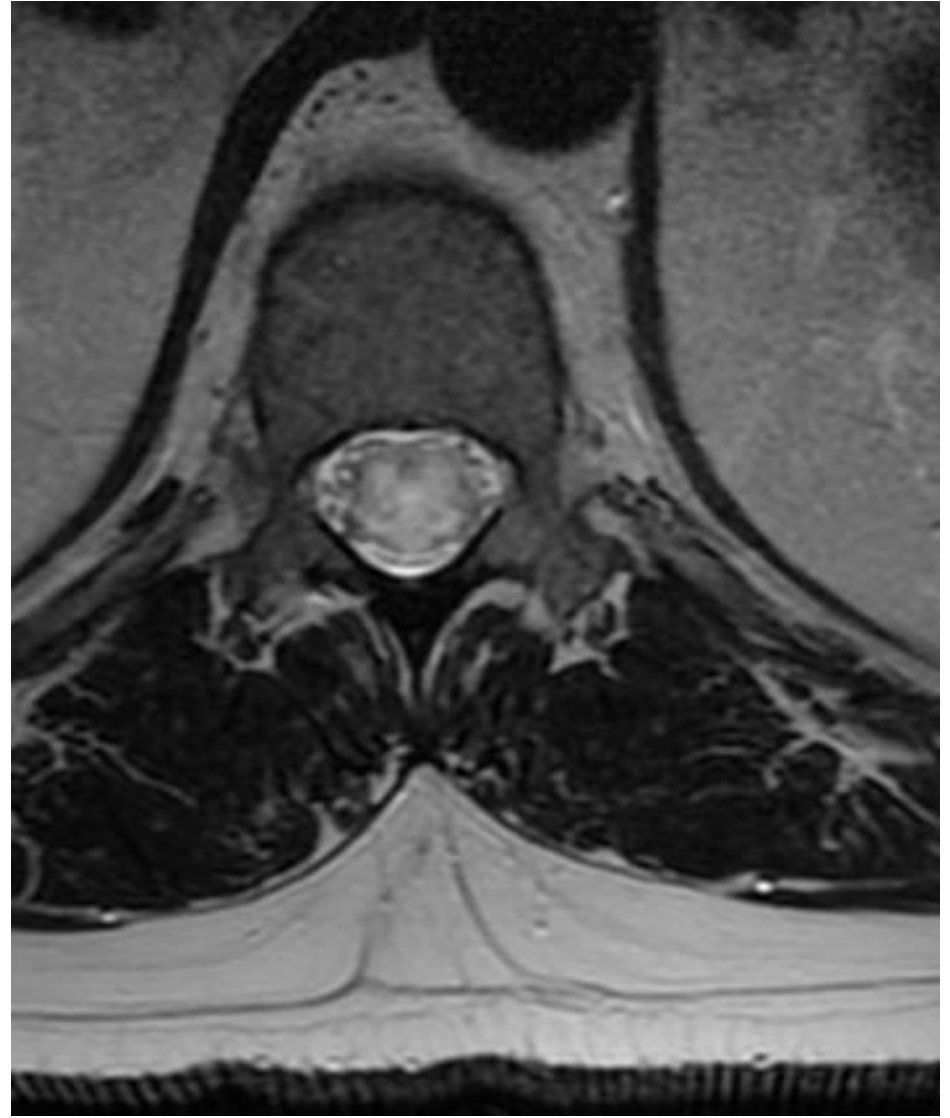


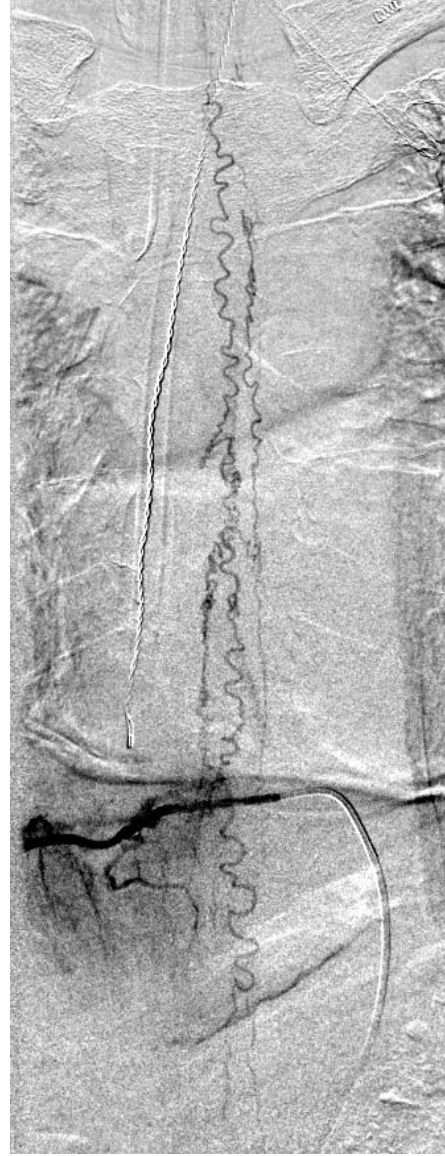
Arachnoiditis

- Inflammation of the descending nerve roots
- Can be
 - Acute – meningitis, Guillain-Barre
 - Chronic – prior surgery, hemorrhage or infection
- Imaging findings
 - Clumping of nerve roots
 - Peripheral location of nerves in the canal (“empty thecal sac sign”)
 - Cord tethering
 - Possible enhancement

58 year-old man, fall 16 months ago; Now worsening
myelopathy, wheelchair bound







Spinal dural arteriovenous fistula

- Clinical characteristics
 - Elderly men
 - Progressive myelopathy
 - Long delay to diagnosis
- Imaging
 - Long segment cord edema
 - Enhancement
 - Dilated vessels
- Pathology
 - AV fistula along the nerve root sleeve
 - Most commonly TL junction, but can be elsewhere
 - Edema related to venous congestion
- Treatment
 - Embolization
 - Surgical
- Outcomes
 - Stops progression
 - Can have recovery of function

Take home points

- When you see intramedullary lesion
 - Rule out compression
 - Tumor vs non neoplastic
 - Brain imaging is helpful
 - CSF analysis is helpful

- Thank you