

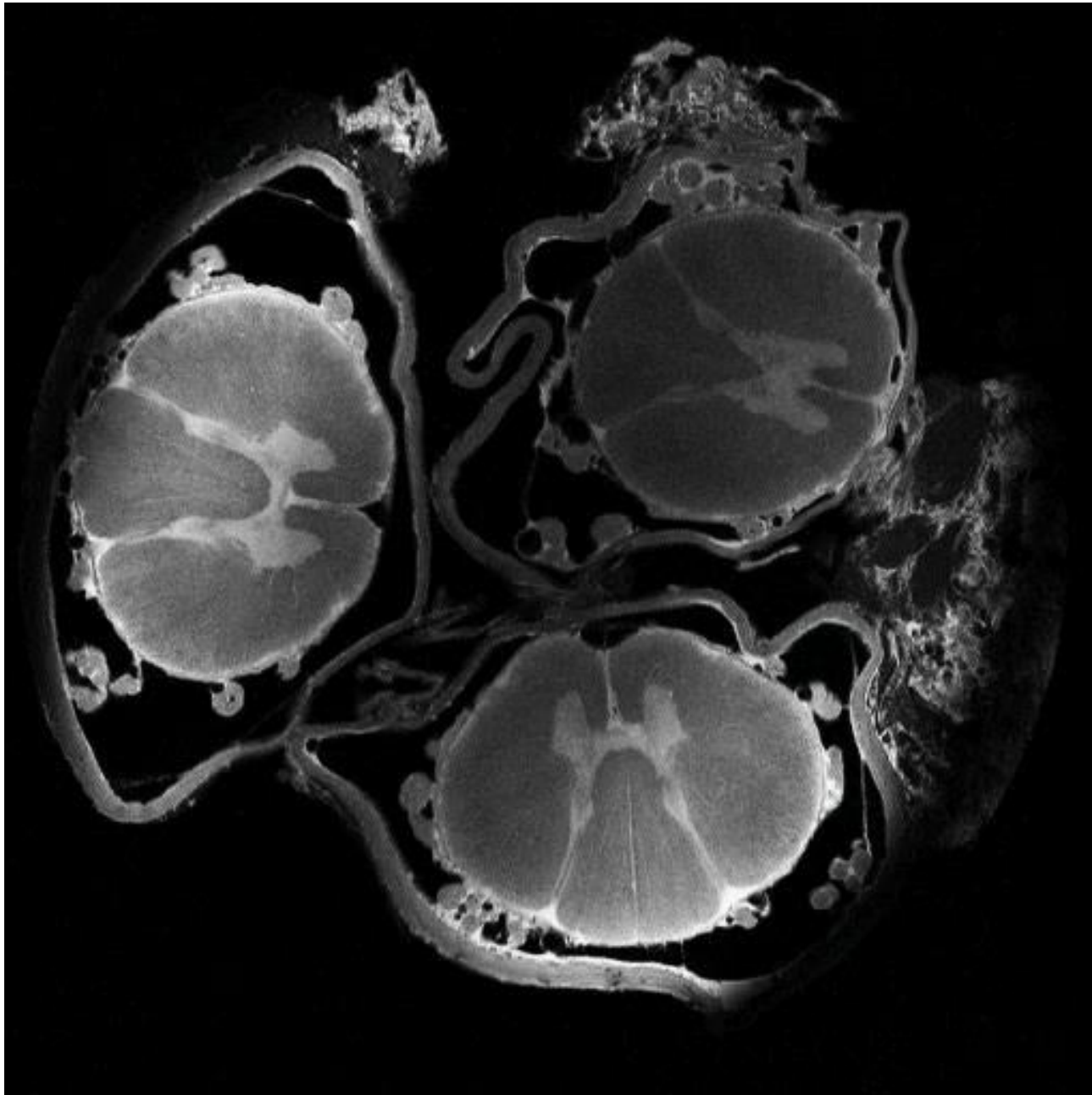
La Moelle

Majda M Thurnher

ESNR President

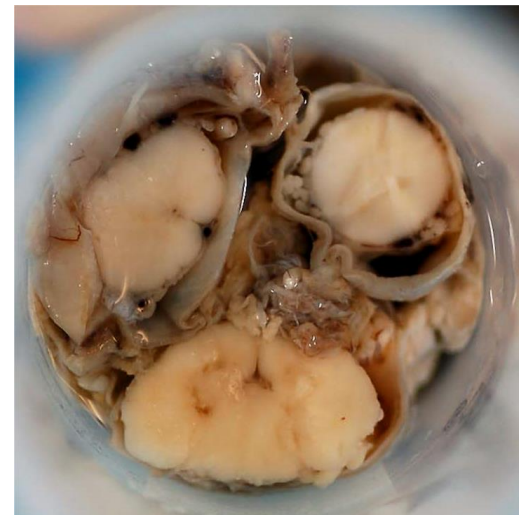
Professor of Radiology

Vienna University Hospital | Department of Biomedical Imaging and
Image-guided Therapy | Vienna | Austria

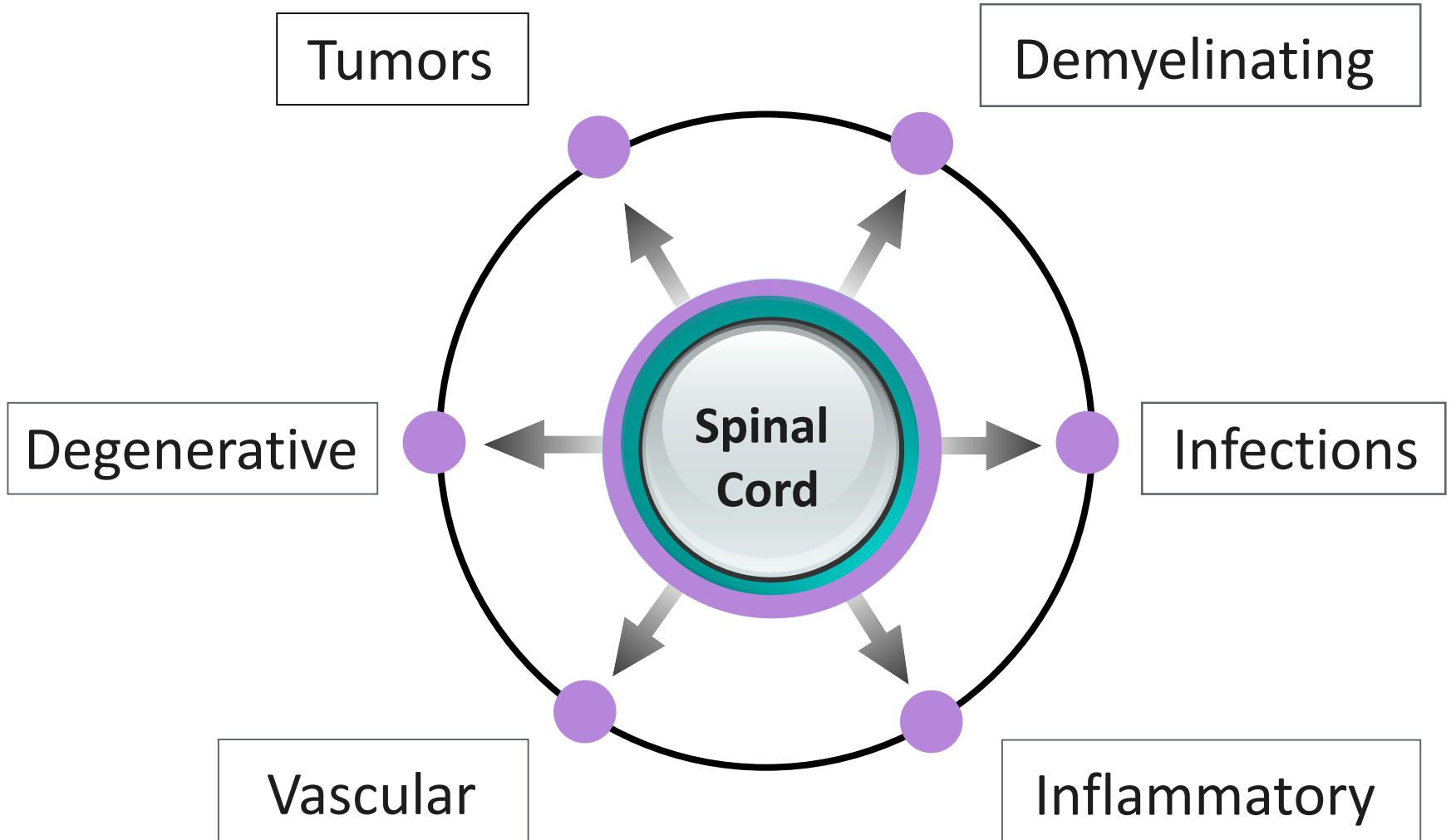


SLICE 0.5 mm
Gap 0.5 mm
T 8-12 hours

RESOLUTION:
50x50x500 microns



Myelopathy



Roadmap for Myelopathy

How long is the lesion?

Where is the lesion located?

How many lesions?

Enhancement?

Cysts or syrinx?

Brain lesions?

Clinical history?

Child or adult?



Something is wrong with the spinal cord!

How long?

Where?

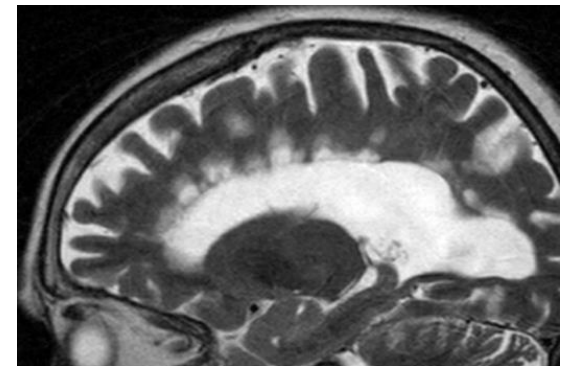
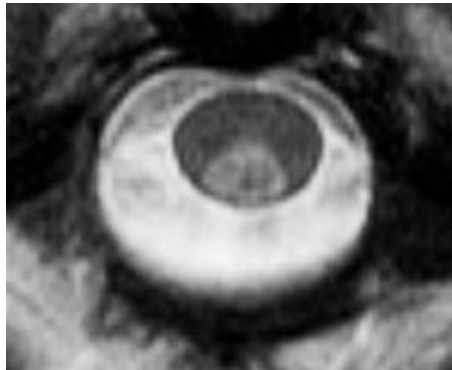
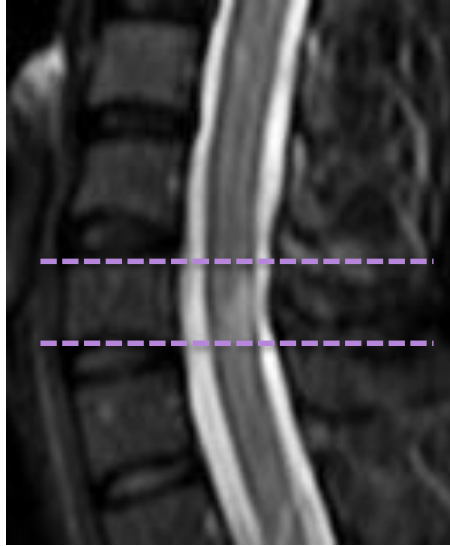
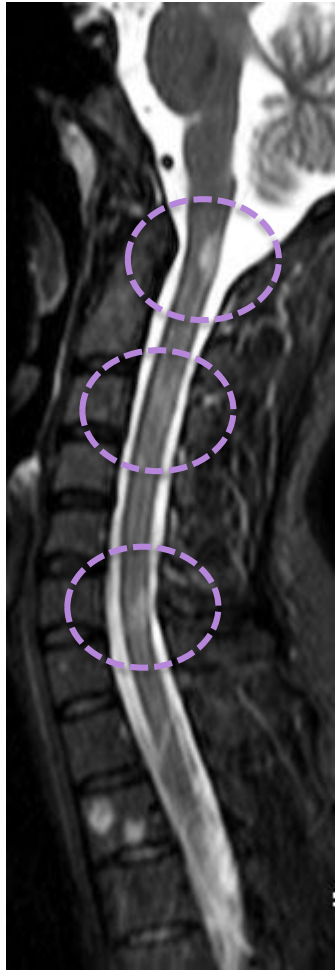
How many?

Enhancing?

Cysts/syrinx?

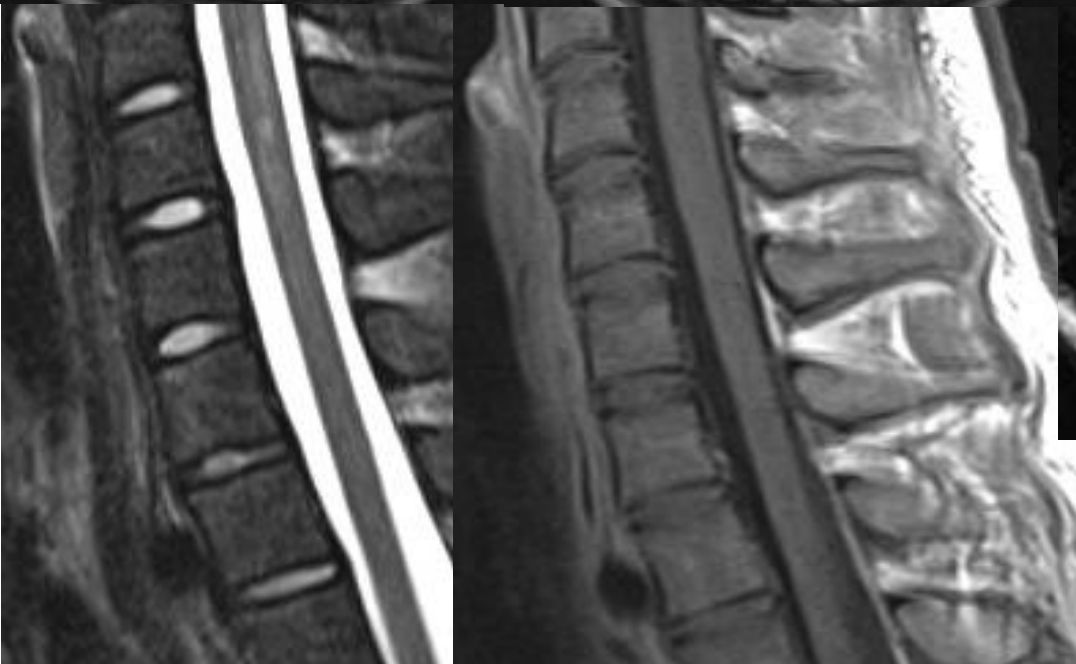
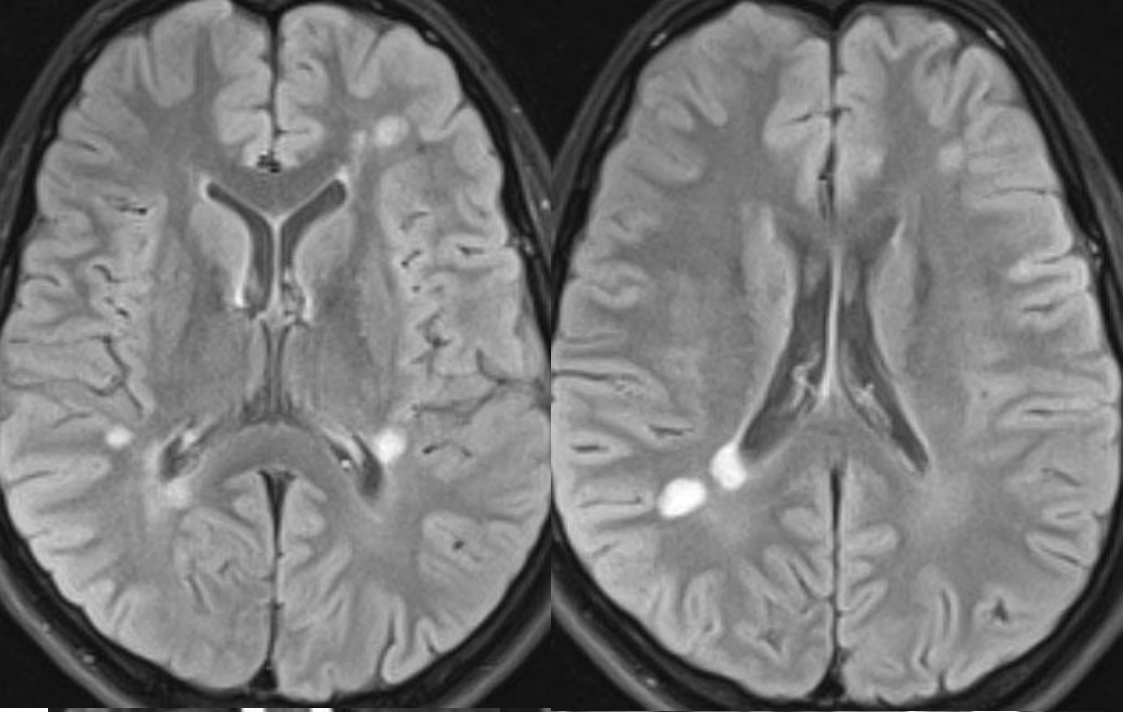
Brain?

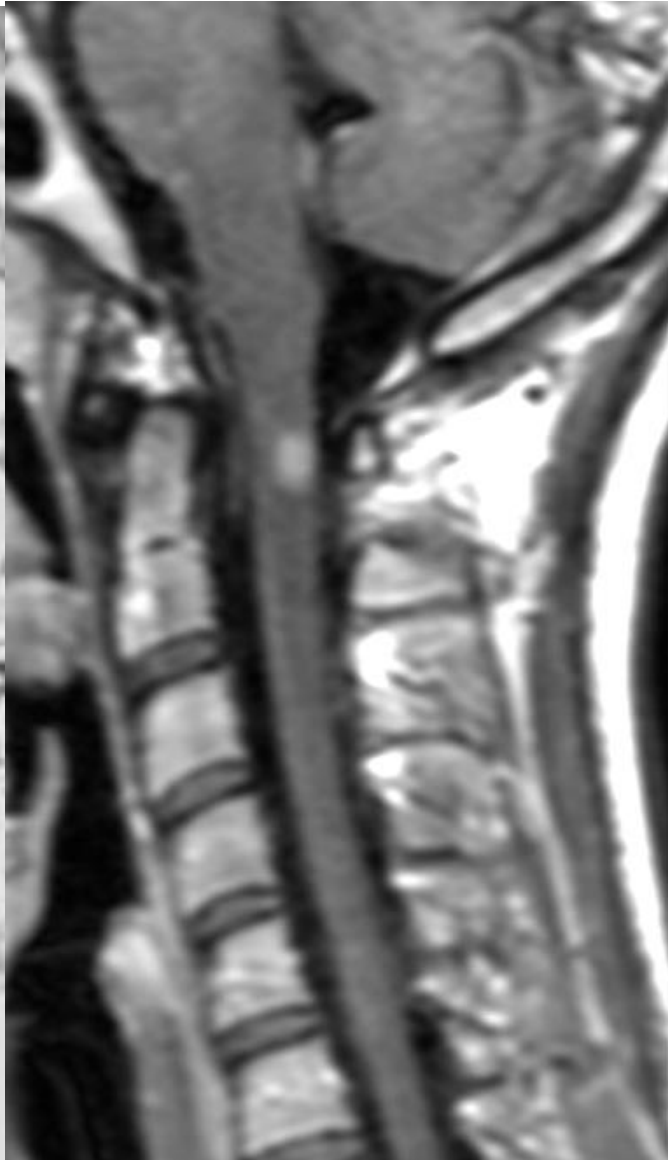
How old?



24 y female

Multiple Sclerosis

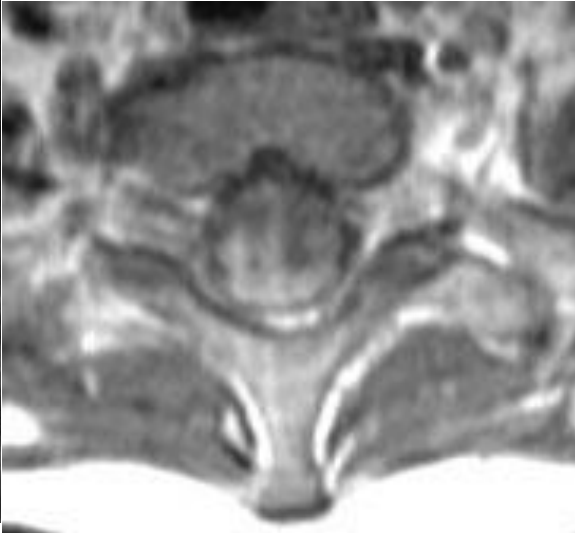
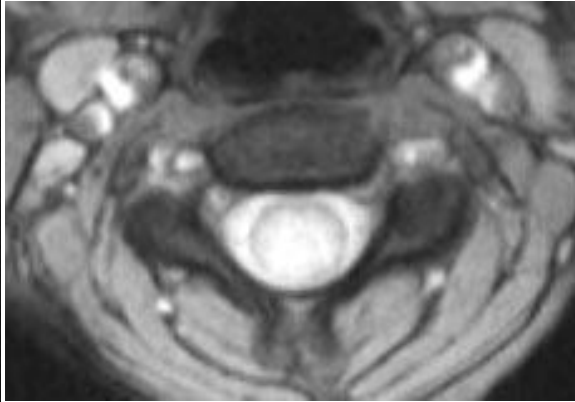




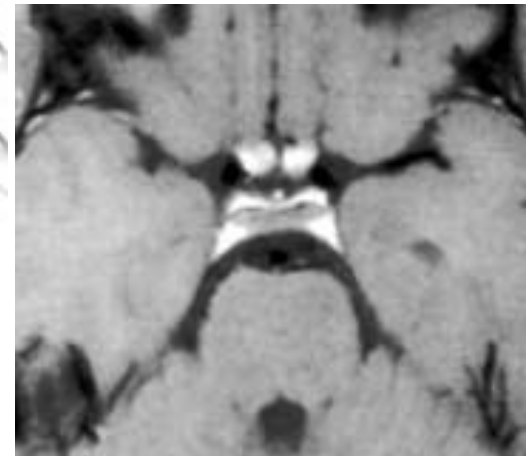
Clues for Multiple Sclerosis (MS)

- Focal lesions
- Dorsal and lateral (may be ventral)
- May enhance nodular or ring-like
- $< 2/3$ of the cord cross section area
- Spinal cord atrophy in PPMS
- Brain lesions





How long?
Where?
How many?
Enhancing?
Cysts/syrinx?
Brain?

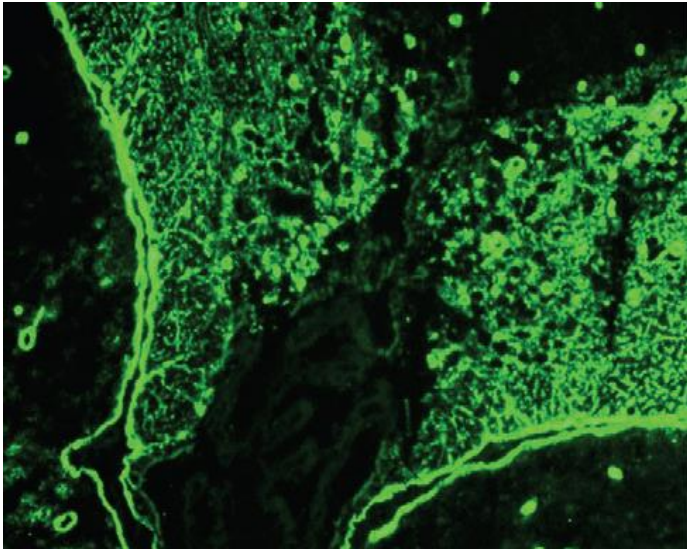


Neuromyelitis optica (NMO)

6 y female

Neuromyelitis Optica (NMO)

NMO was thought to be a variant of multiple sclerosis (MS), but in 2004, a serum antibody specific to patients with NMO was detected.



NEW DEFINITION

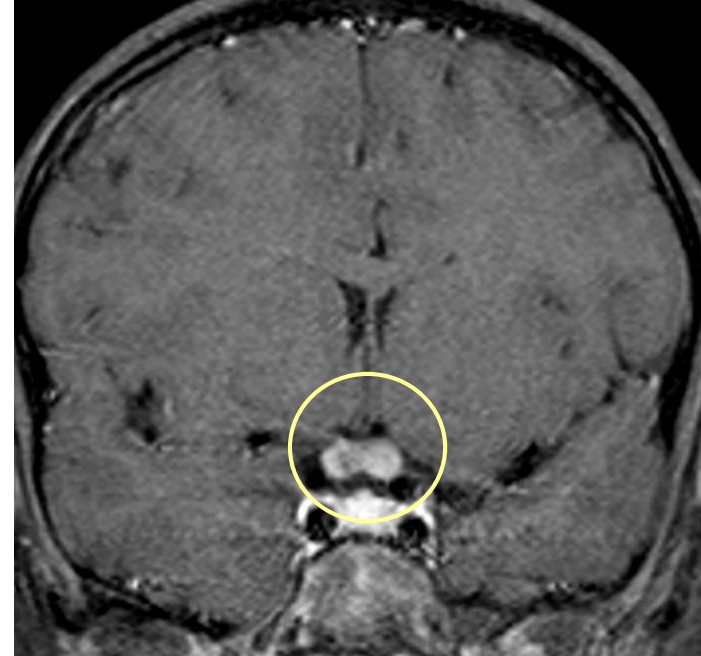
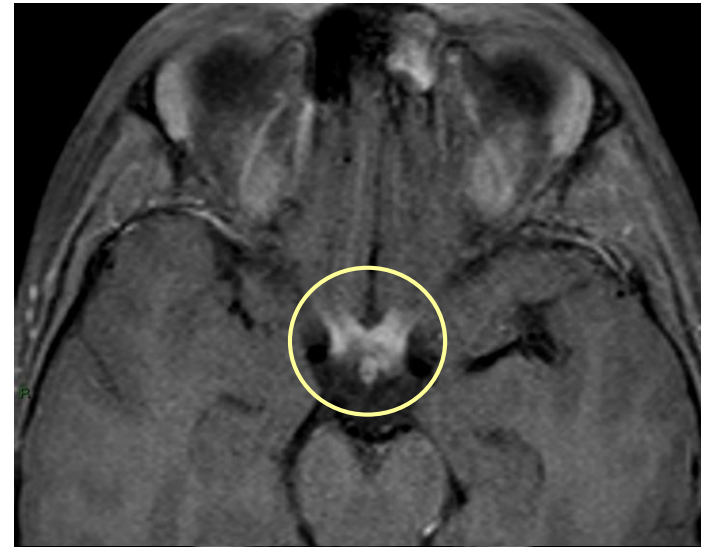
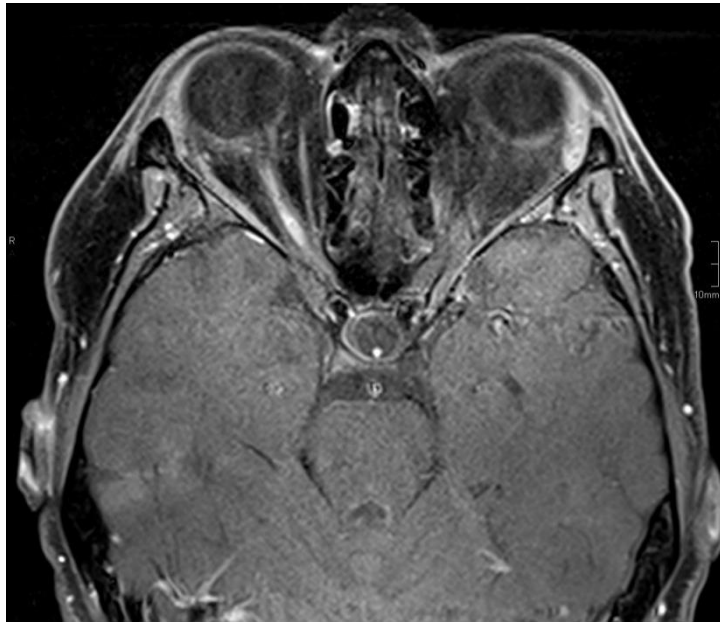
NMO is considered to be an autoimmune antibody-mediated disease, induced by a specific serum autoantibody, the NMO-IgG, directed against Aquaporin-4

HIGH sensitivity and specificity (90-100%)

Optic involvement in NMO

- Optic neuritis precedes or is simultaneous with myelitis
- Usually severe, painful
- Uni- or bilateral
- Selective involvement of chiasm is possible

MORE POSTERIOR involvement !!!



Spinal cord involvement in NMO

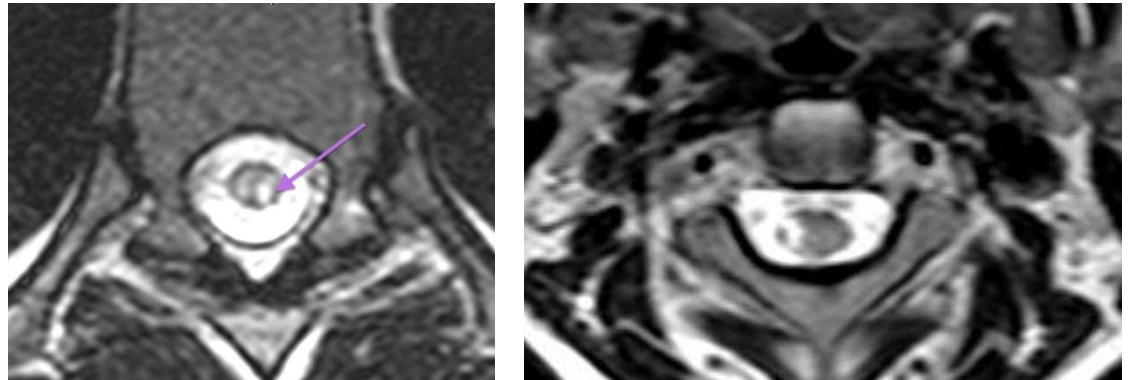
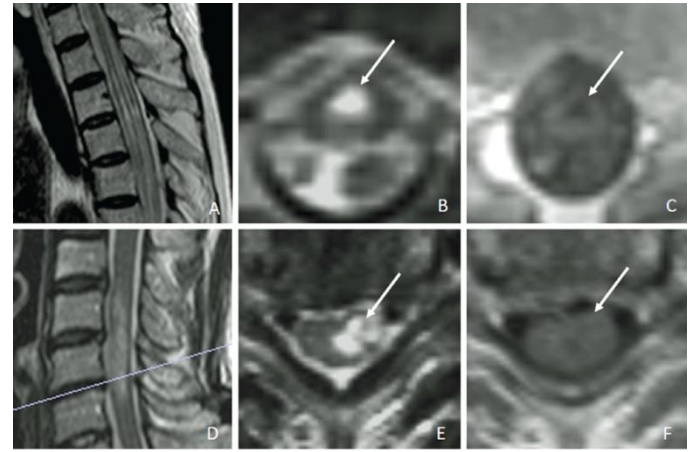
Longitudinally extensive TM **LETM**

- At least 3 vertebral segments
- Usually 4.5-8.7 segments
- Edematous in acute stage
- Centrally located
- 33% - 71% enhance
- Lesion may fragment with new attack
- Later: focal atrophy



Bright spotty lesions (BSL)

- 24 consecutive patients with NMO and 34 patients with MS who developed myelitis
- 54% NMO had BSL
3% MS had BSL



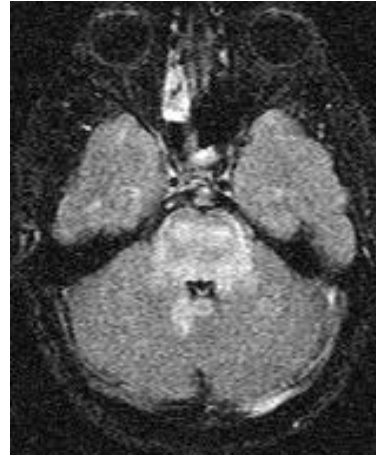
BSL seen on axial T2 is a discriminative factor for NMO

Yonezu T, Ito S, Mori M, et al. 'Bright spotty lesions' on spinal magnetic resonance imaging differentiate neuromyelitis optica from multiple sclerosis. *Mult Scler* 2013; 20: 331–337

Clues for Neuromyelitis optica (NMO)

- Child or adult (asian origin)
- Optic nerve & spinal cord & brain
- LETM with BSL & patchy enhancement
- ON uni- or bilateral (posterior)
- Relapsing course
- NMO-IgG positive in serum or CSF
(anti-NMO neg & anti-MOG pos)





- How long?
- Where?
- How many?
- Enhancing?
- Cysts/syrinx?
- Brain?
- How old?

Three weeks after respiratory infection sudden onset of neurological symptoms

Acute disseminated encephalomyelitis ADEM

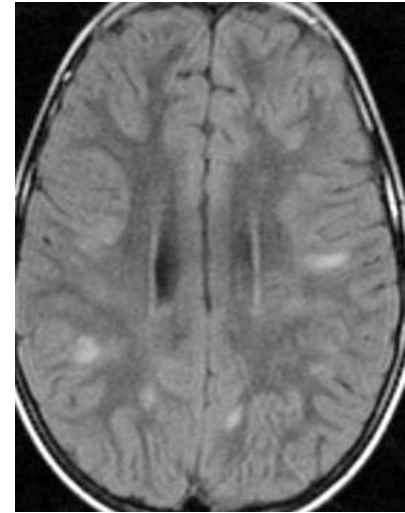
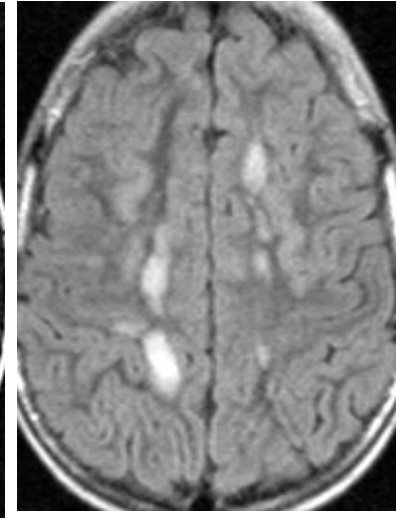
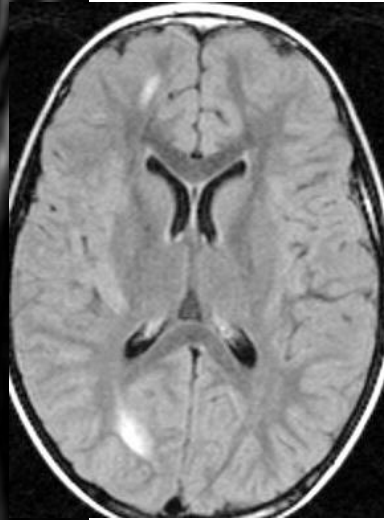
11 y female

Acute Disseminated Encephalomyelitis (ADEM)

Parainfectious encephalomyelitis

- An immune-mediated demyelinating disorder of the CNS
- Children (5-8y)
- Within 3 weeks of infection, vaccination or drugs
- T-cell hypersensitivity reaction

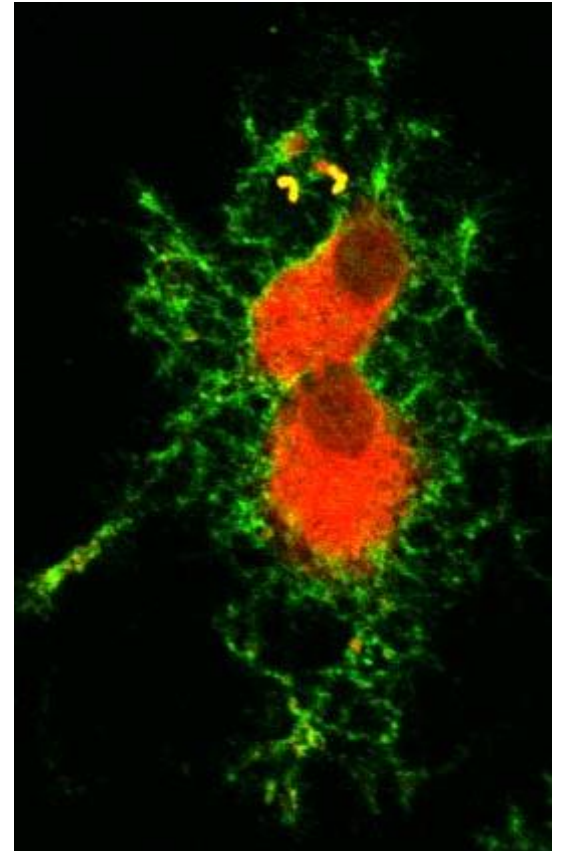
- 25-30% spinal cord involvement



Anti-myelin oligodendrocyte glycoprotein (MOG) autoantibodies

- High serum titers in 50% of ADEM patients
- Not present in healthy children and children with viral encephalitis
- Not highly specific but supports the diagnosis of ADEM

Full length human MOG is made up of 218 amino acids and is expressed exclusively in the CNS



Lalive PH et al. *Mult Scler* 2011

Mader S, et al. *J Neuroinflammation* 2011

Clues for ADEM

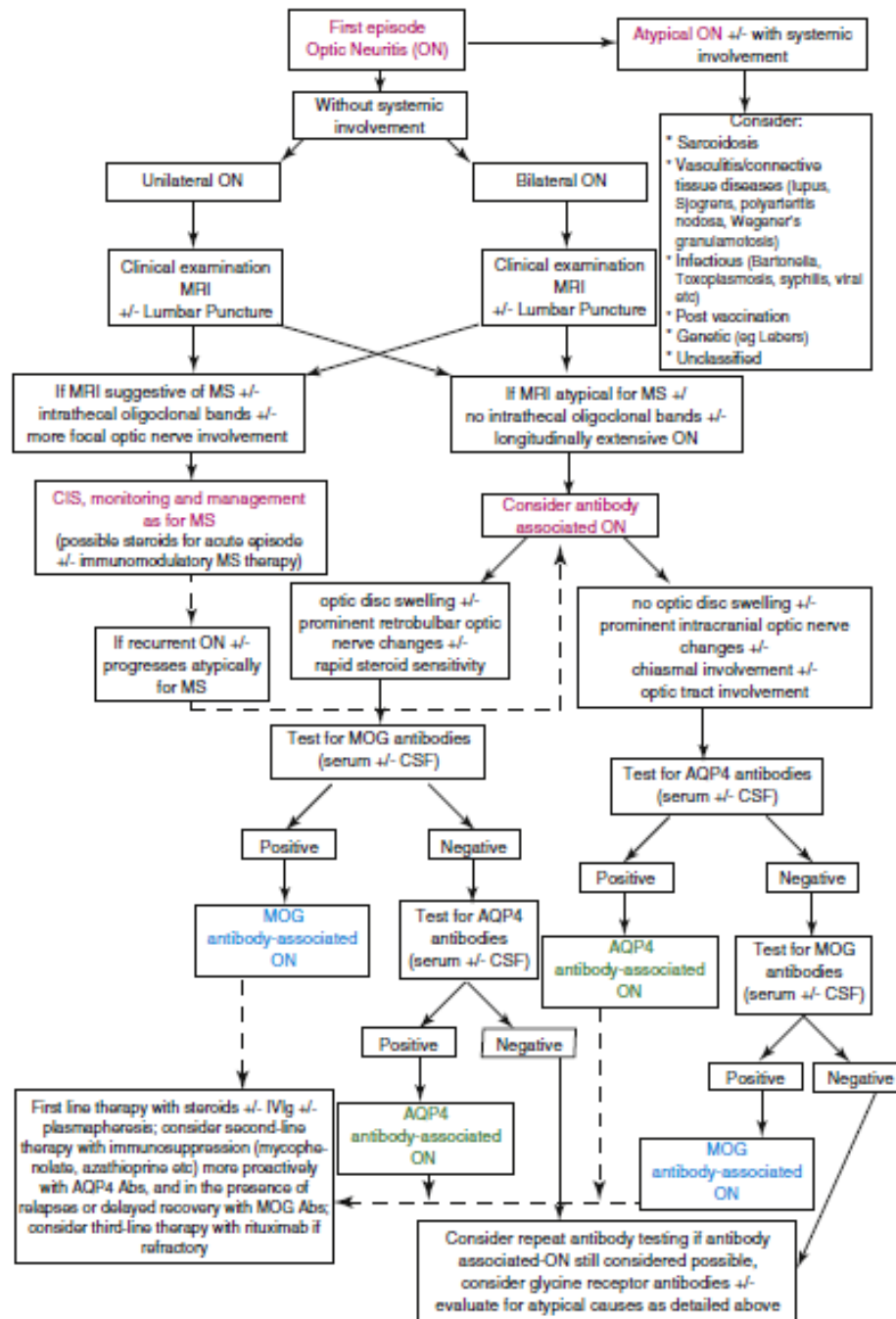
- Teenager 3 weeks after an infection
- Spine involvement focal or diffuse
- Multiple focal (“large”) brain lesions
- Non-enhancing / all enhancing
- Pons, Basal ganglia
- Anti-MOG pos (ADEM with LETM)



Autoantigens in demyelinating diseases

- Anti-AQP4 is found in NMO
- Anti-MOG is seen in patients with anti-AQP4 negative NMO, childhood MS, ADEM, and ON
- Anti-MOG will be hardly seen in adult MS

Identification of autoantigens in demyelinating diseases is essential for the understanding of the pathogenesis





How long?
Where?
How many?
Enhancing?
Cysts/syrinx?
Brain?

Ependymoma

Spinal Cord Tumors

Ependymoma

Astrocytoma

Hemangioblastoma

Common

Ganglioglioma

Metastasis

Lymphoma

Hemangiopericytoma

Melanocytoma

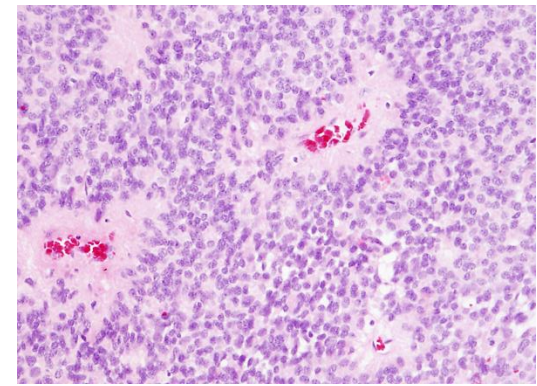
Epidermoid

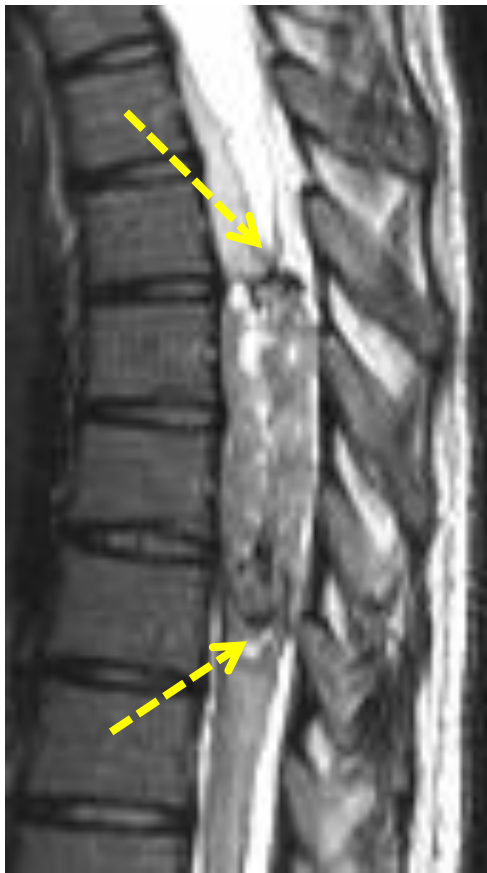
Cavernoma

Rare

Ependymoma

- ADULTS: 4th and 5th decade
 - CHILDREN: NF type 2
 - Grade I: myxopapillary, subependymoma
 - Grade II: classic (cellular)
 - Grade III: anaplastic
-
- Centromedullary location
 - Well-defined borders
 - Cord enlargement & abnormal signal
 - Focal enhancement – solid part
 - Neoplastic cysts & satellite cysts
 - “Cap sign” due to hemorrhage above/below the tumor





“Cap sign”



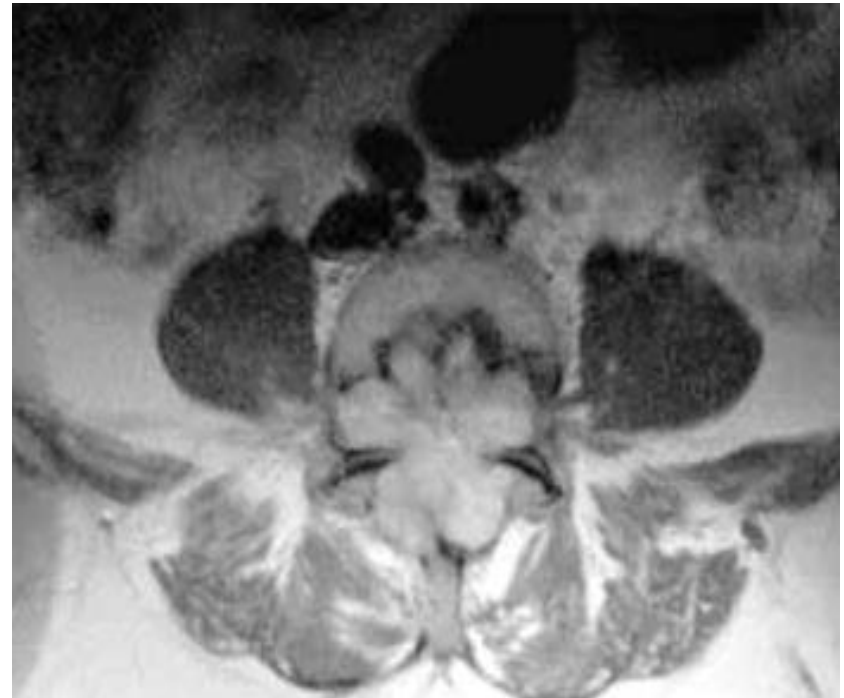


Myxopapillary Ependymoma

- Conus and filum terminale
- Strong inhomogeneous enhancement



- Vertebral body scalloping, scoliosis
- Enlargement of the neural foramina

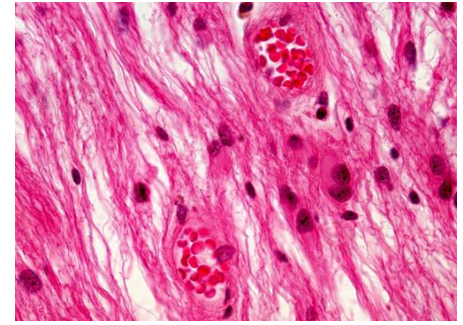


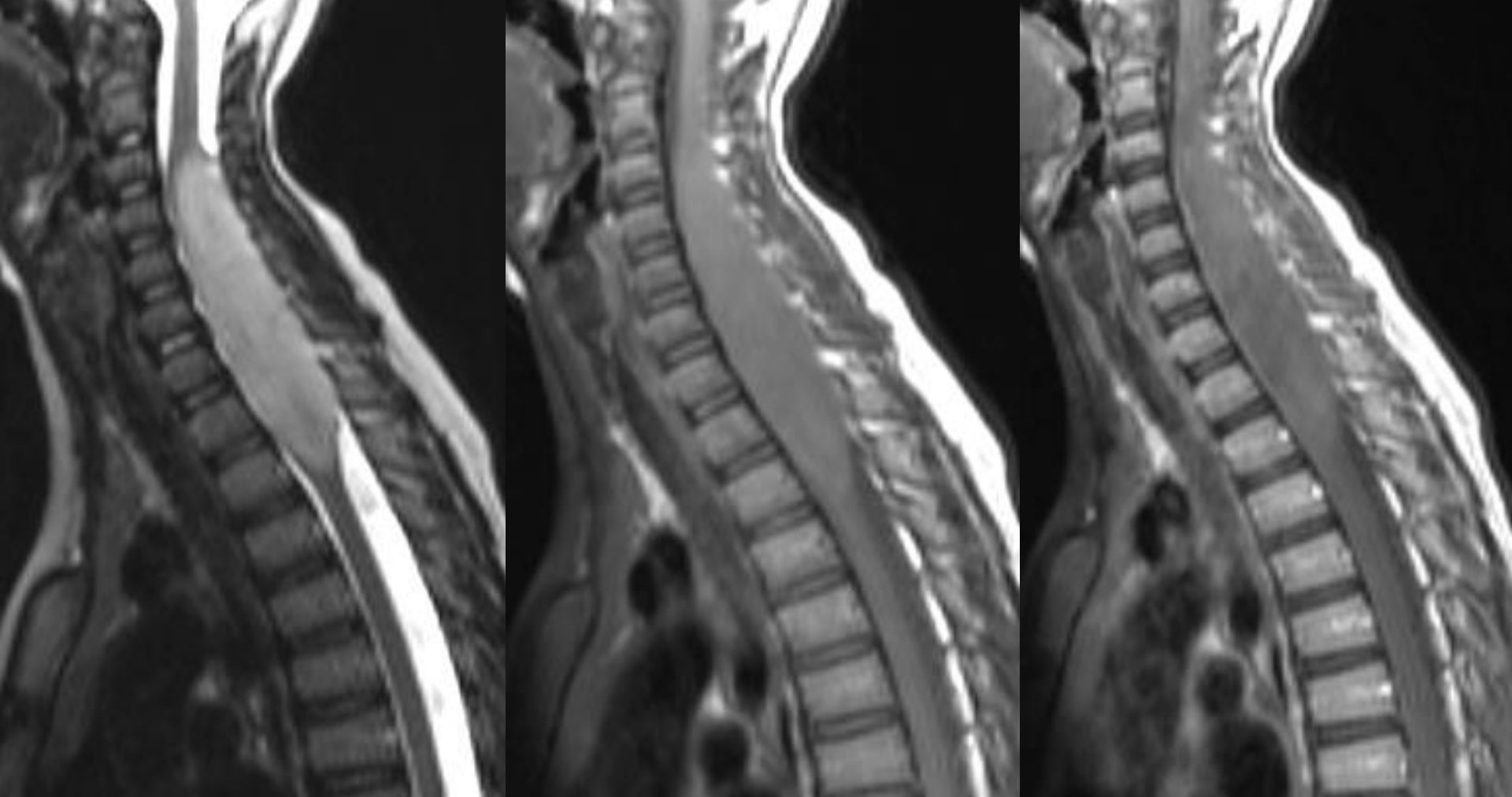
Myxopapillary Ependymoma

Astrocytoma

- The most common spinal cord tumor in children
- ADULTS: 3rd and 4th decade
- Any region of the spine, >50% thoracic region
- 75% low grade tumors (I-II)

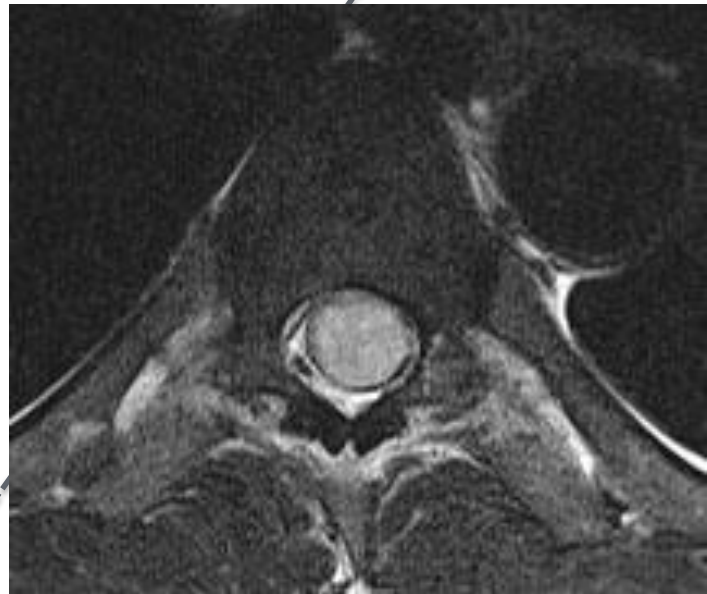
- Fusiform expansion of the spinal cord
- Inhomogeneous, ill-defined tumor
- Heterogeneous enhancement (although low grade!)

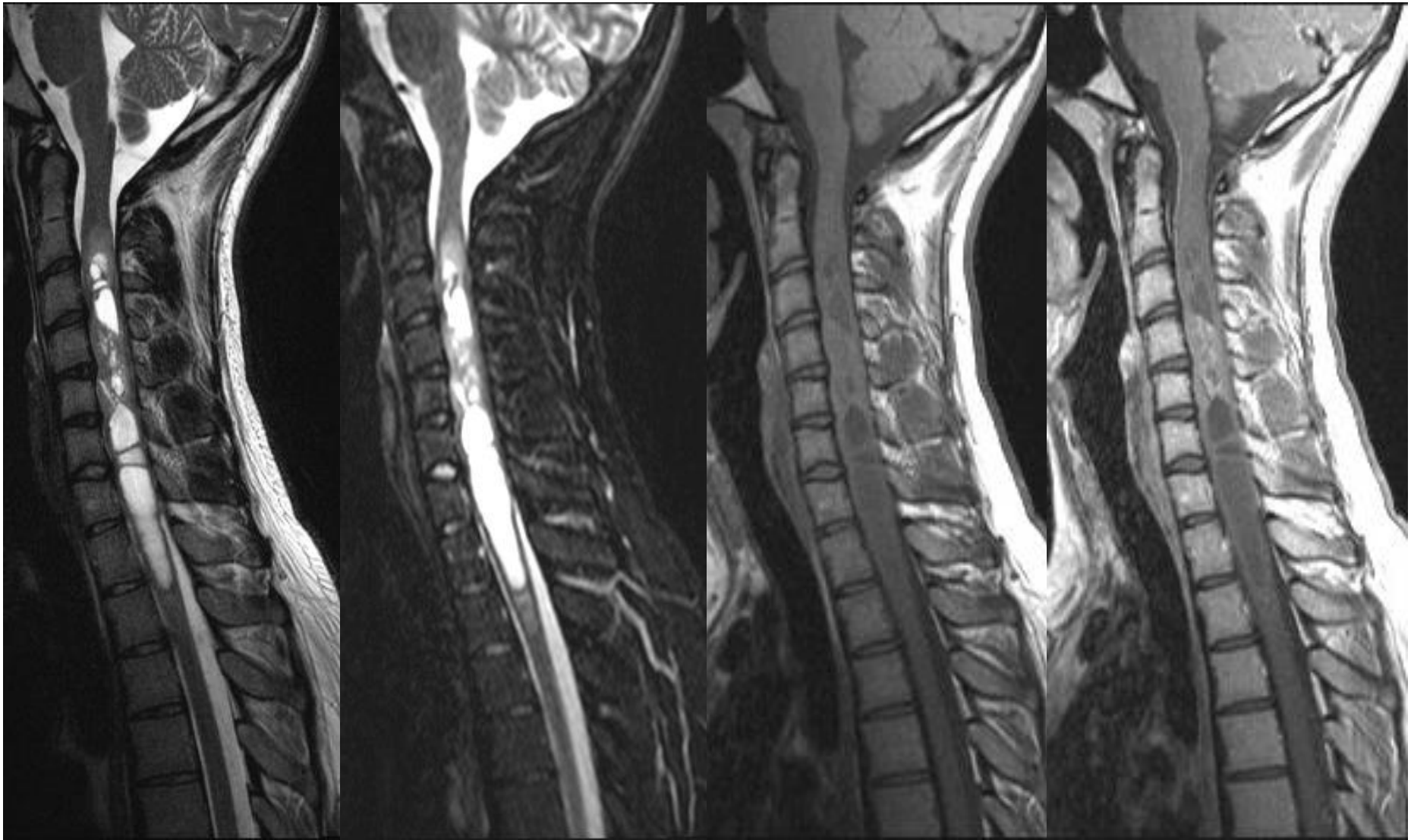




75% pilocytic astrocytoma (1-5 y)

7% fibrillary astrocytoma (>10y)





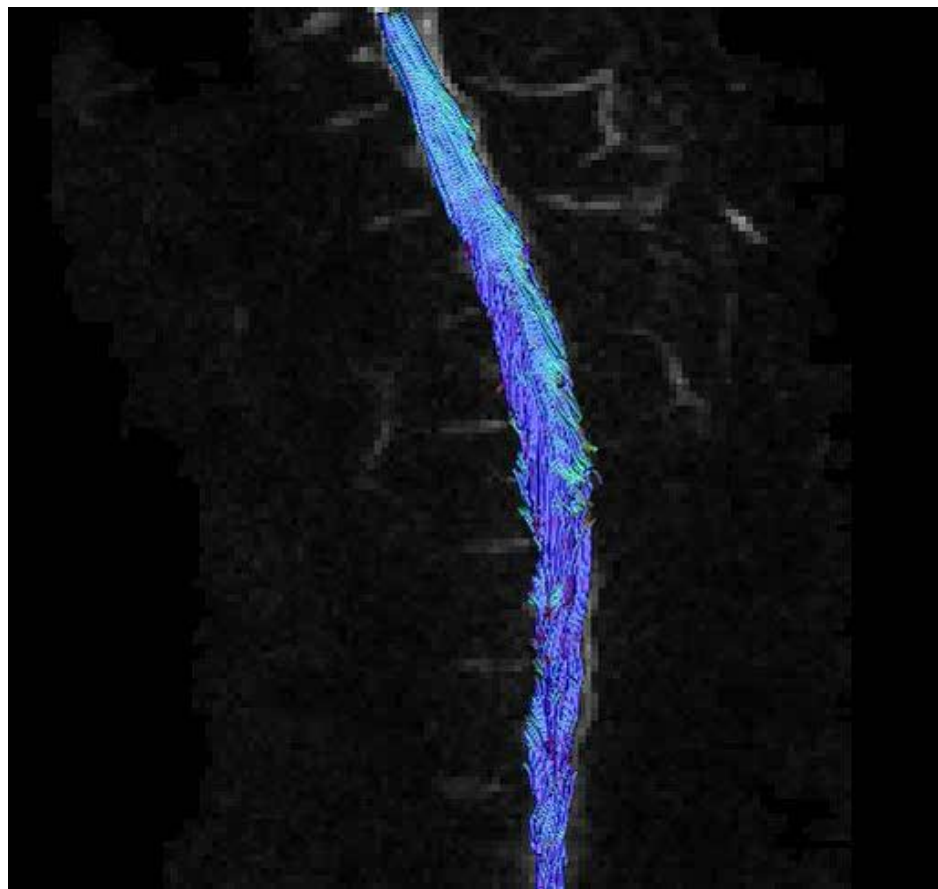
Astrocytoma



Ependymoma

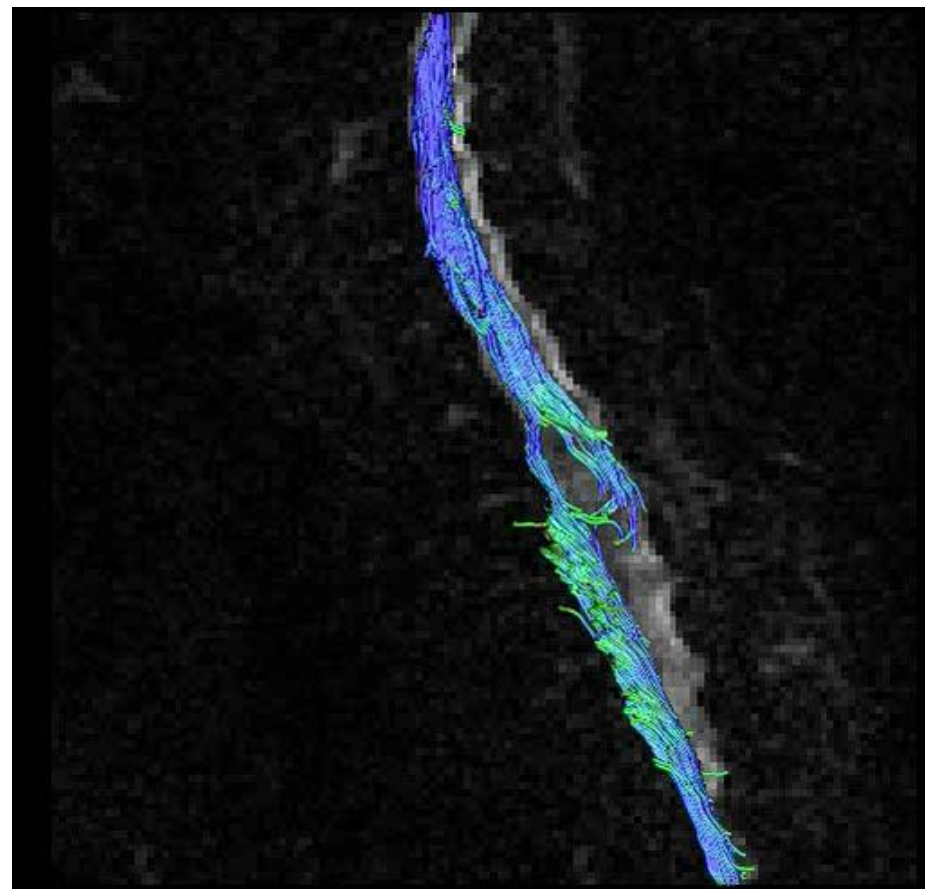


Astrocytoma



Diffusely infiltration
Fibers infiltrated

Astrocytoma



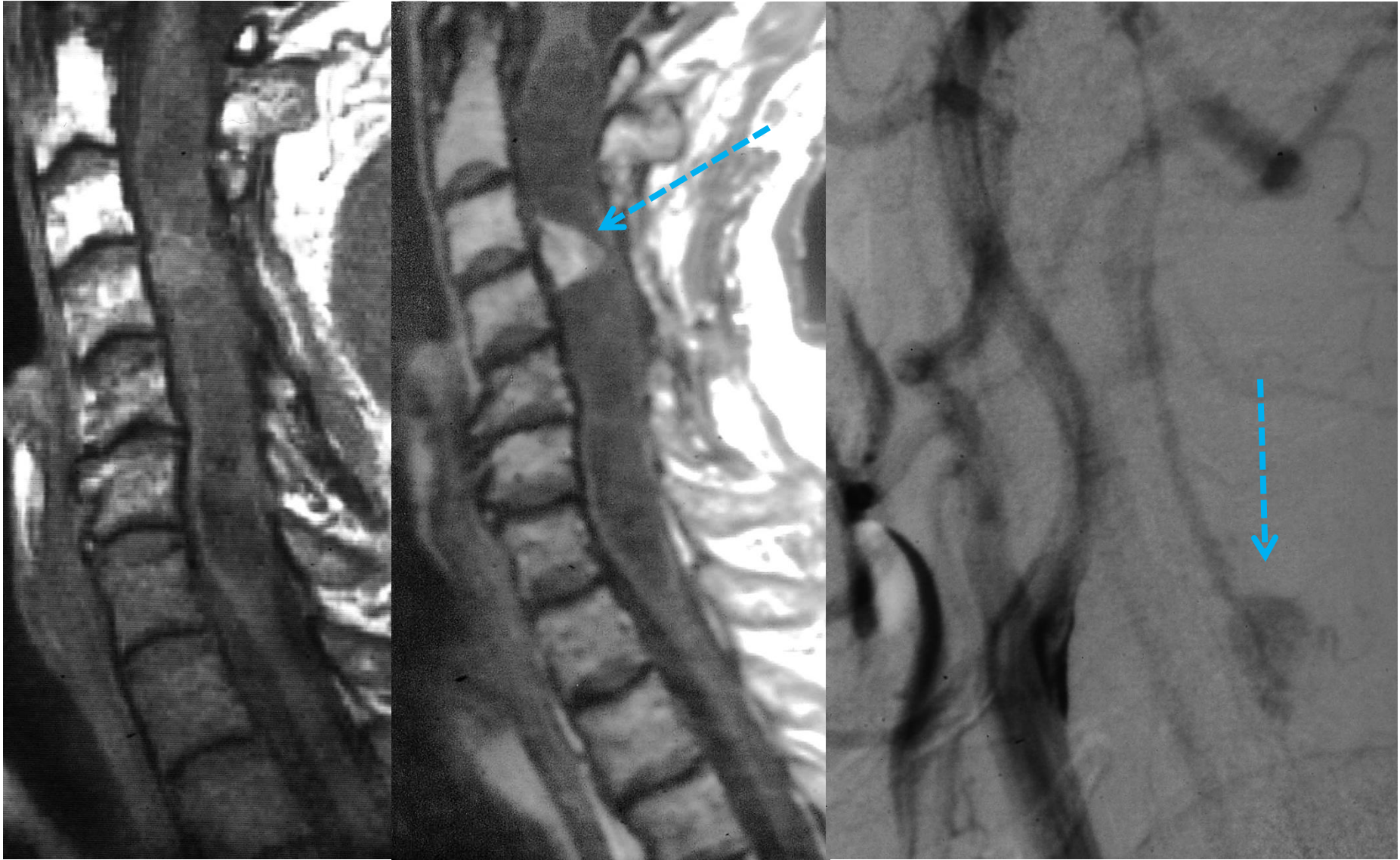
More central location
Fibers displaced laterally

Ependymoma

Hemangioblastoma

- BENIGN, richly vascularized tumors
- Solitary (80%)
- multiple (Von Hippel-Lindau disease)
- Two typical presentations:
 - a) small nodular lesion & extensive intramedullary edema
 - b) small nodule & extensive intramedullary cyst

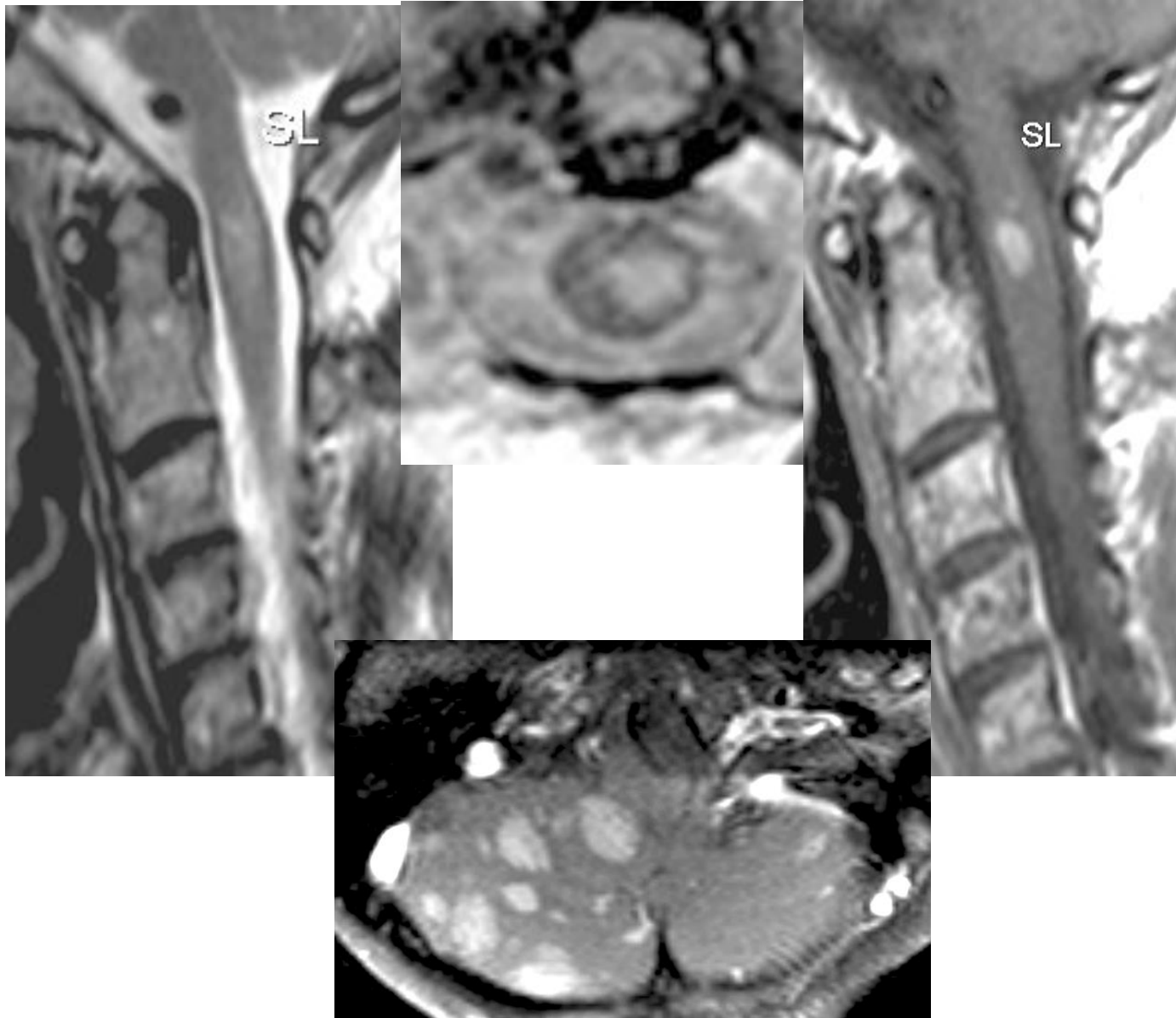




Hemangioblastoma



Hemangioblastoma



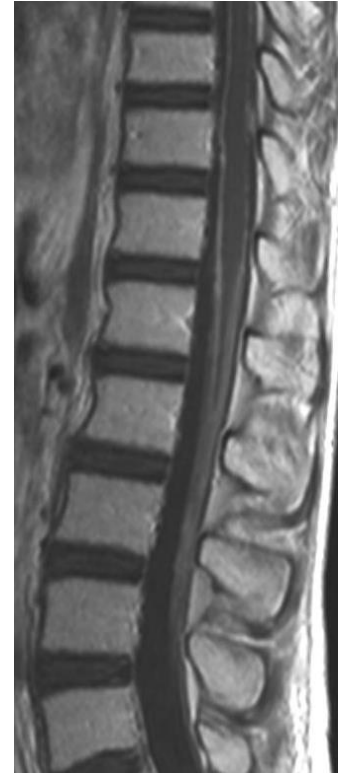
How long?
Where?
How many?
Enhancing?
Cysts/syrinx?
Brain?

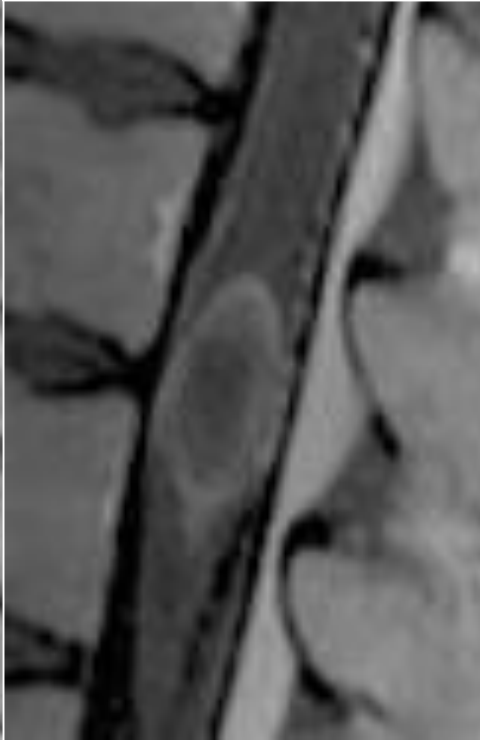
31 y male

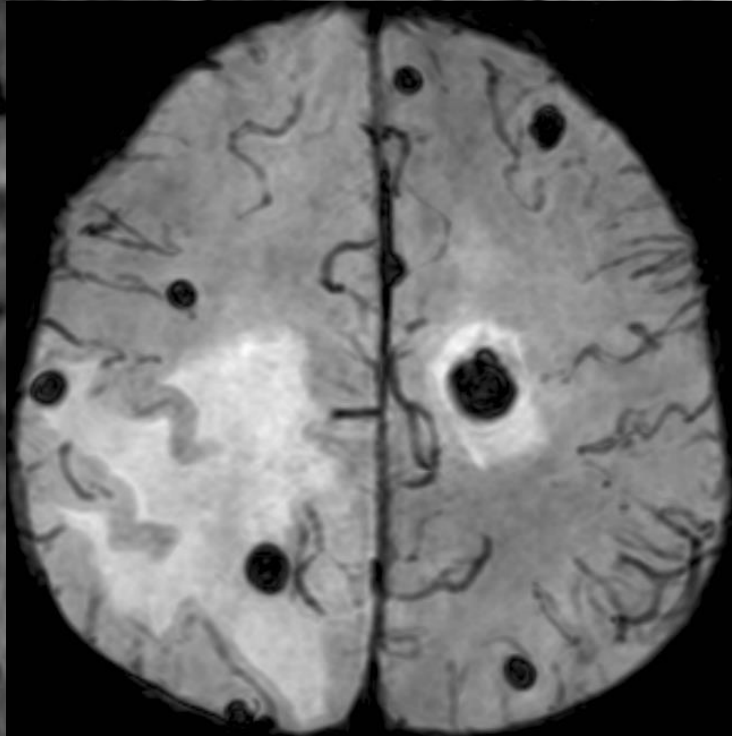
Spinal cord metastasis

Spinal cord metastasis

- Enlargement of the cord
- Focal lesion with enhancement
- Leptomeningeal Enhancement !!!
- Bone involvement !!!

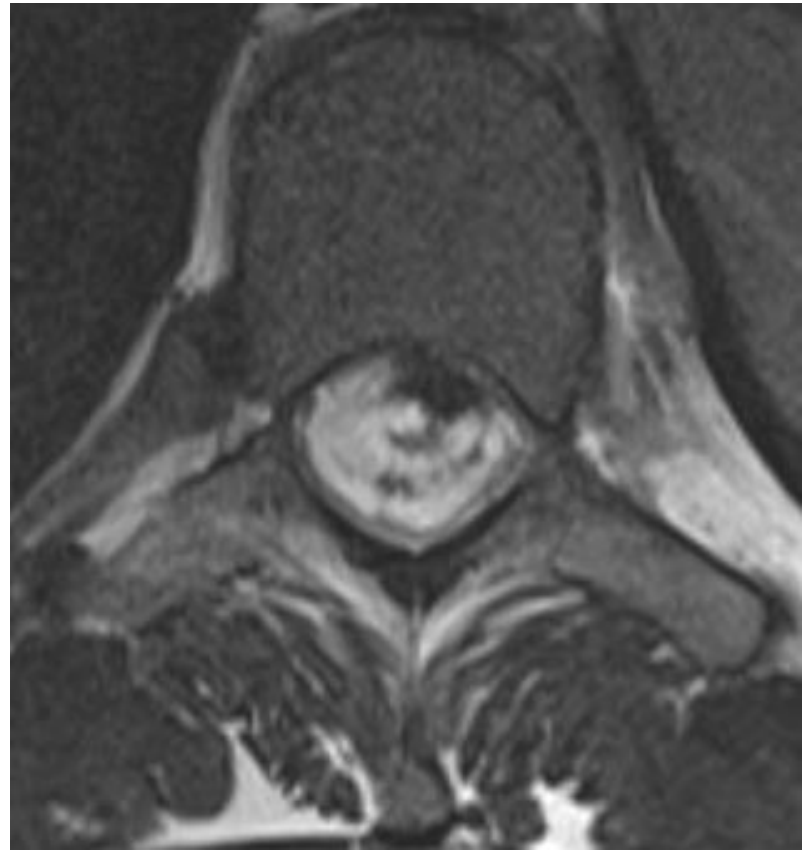
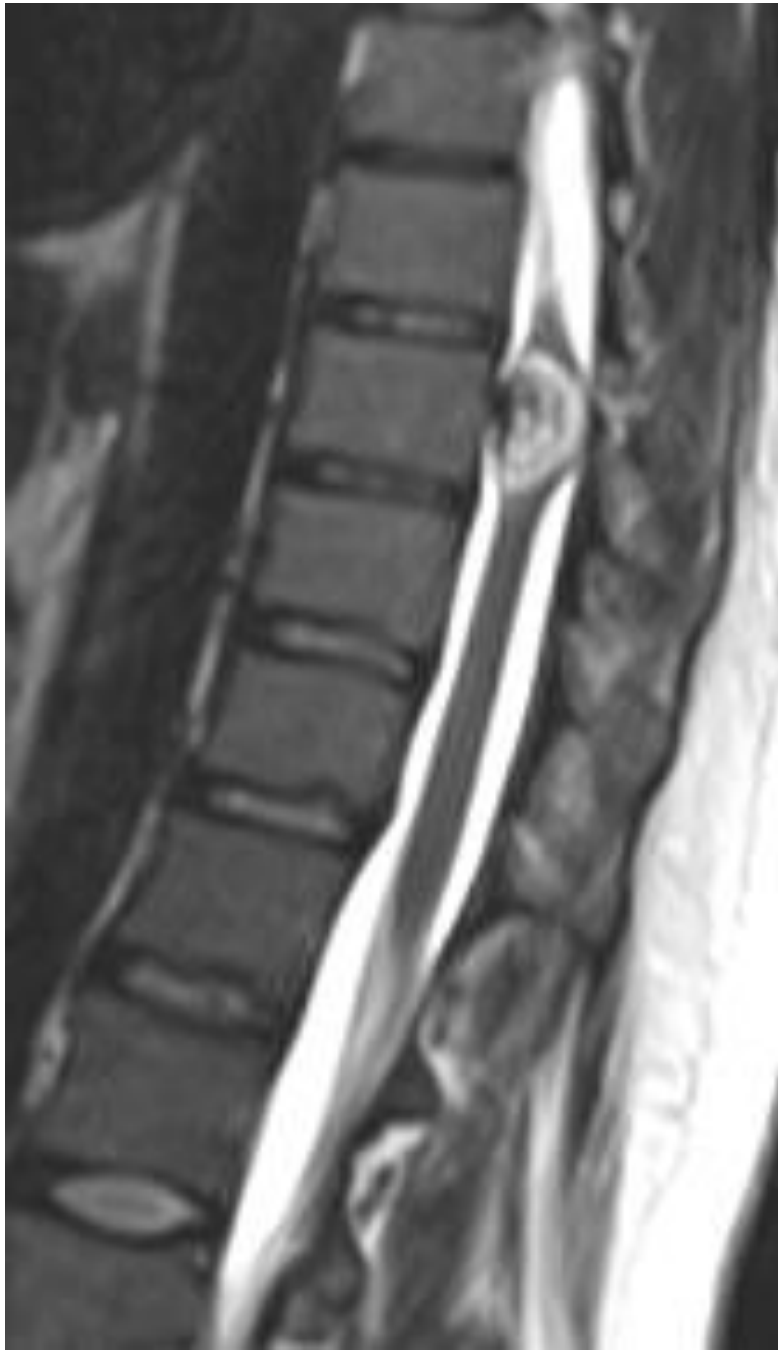


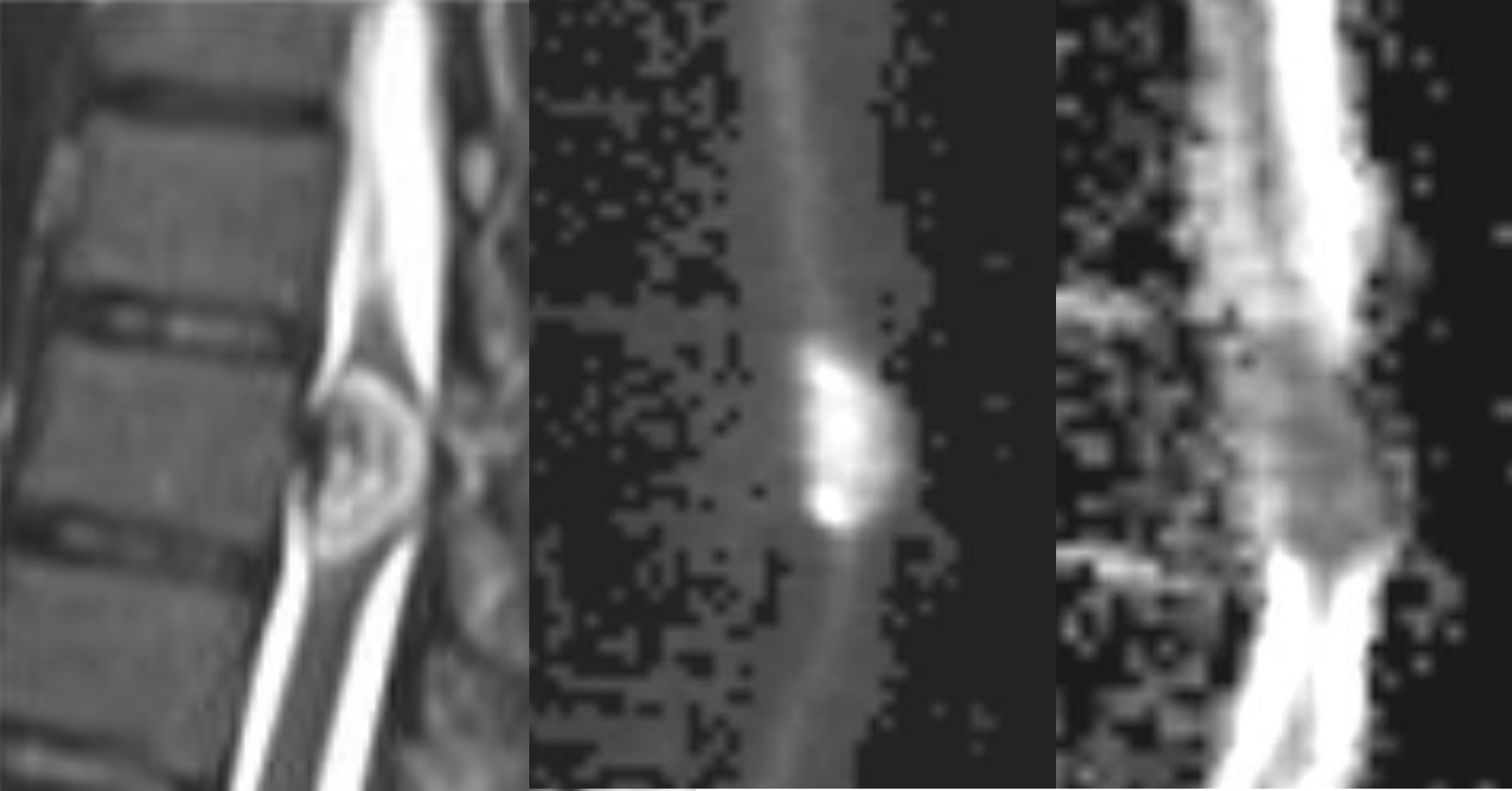




Epidermoid

- *Ectodermal inclusion cyst, Epidermoid, Cholesteatoma*
- Rare tumor of the spinal cord (0.6-1.1%)
- Slow-growing
- Common in lumbosacral and thoracic region
- In children associated with dermal sinus



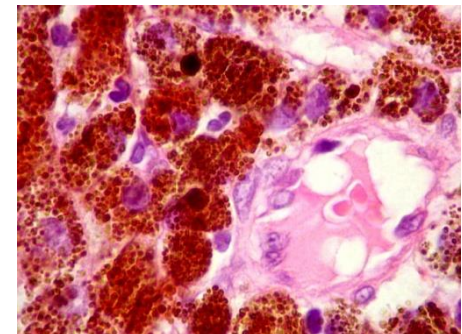
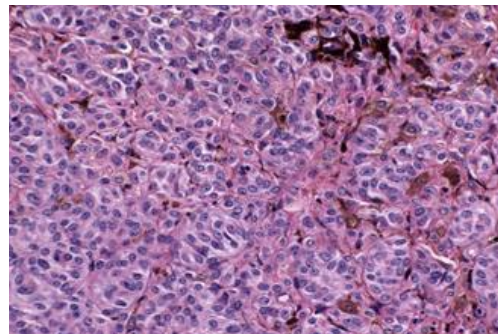


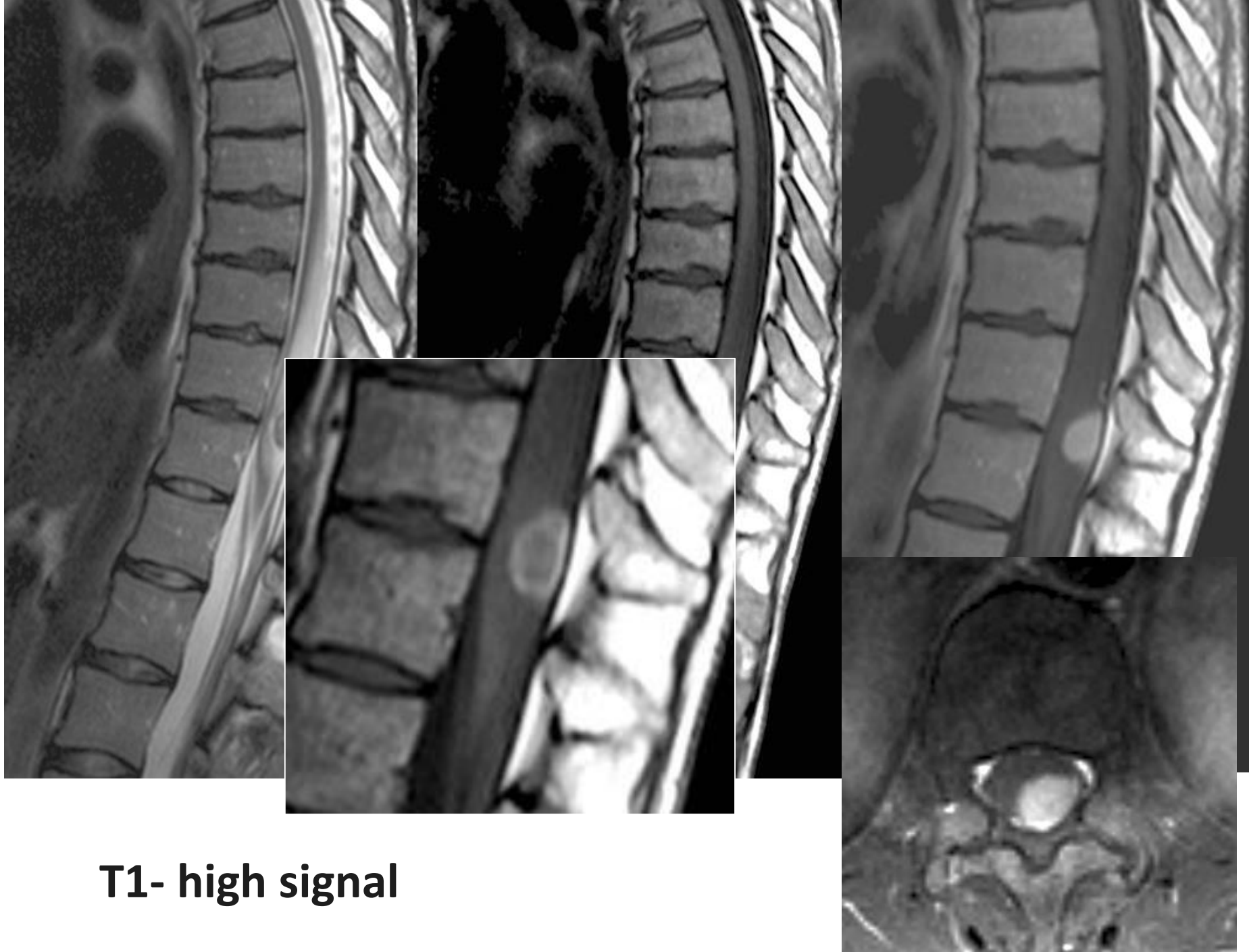
DWI-high signal

Thurnher MM. Diffusion-weighted MR Imaging in two intradural spinal epidermoid cysts. *Neuroradiology* 2012

Melanocytoma

- Well-differentiated neoplasm arising from leptomeningeal melanocytes
- Most commonly located in the intradural extramedullary compartment
- Sometimes intramedullary (unclear!)



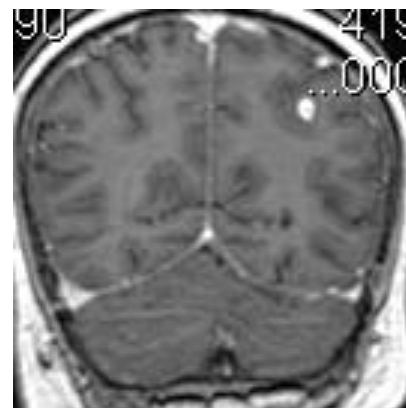
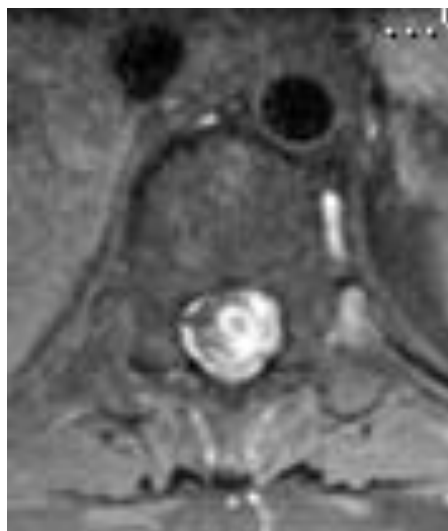


T1- high signal

Clues for Spinal Cord Tumors

- Cord enlargement & abnormal signal
- Enhancement (focal)
- Cystic degeneration or necrosis
- Syrinx formation
- Signal voids
- Slowly progressive clinical course



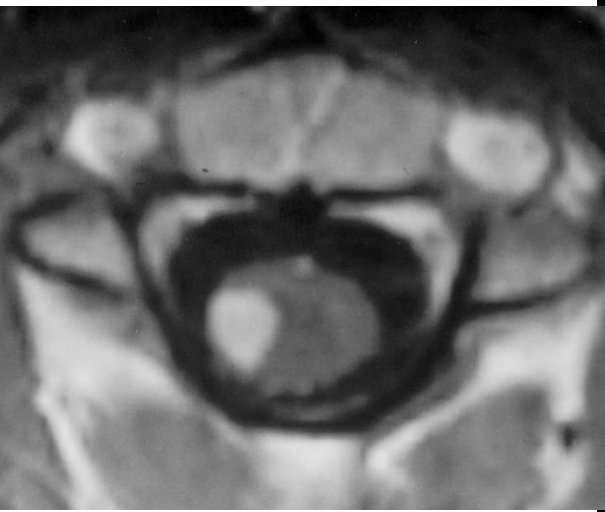
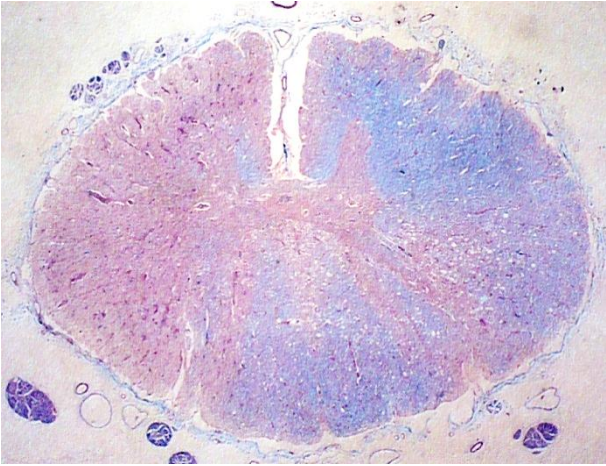
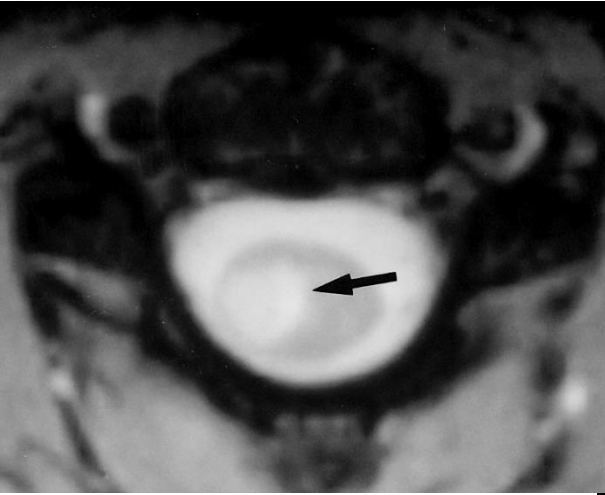


- How long?
- Where?
- How many?
- Enhancing?
- Cysts/syrinx?
- Brain?
- How old?

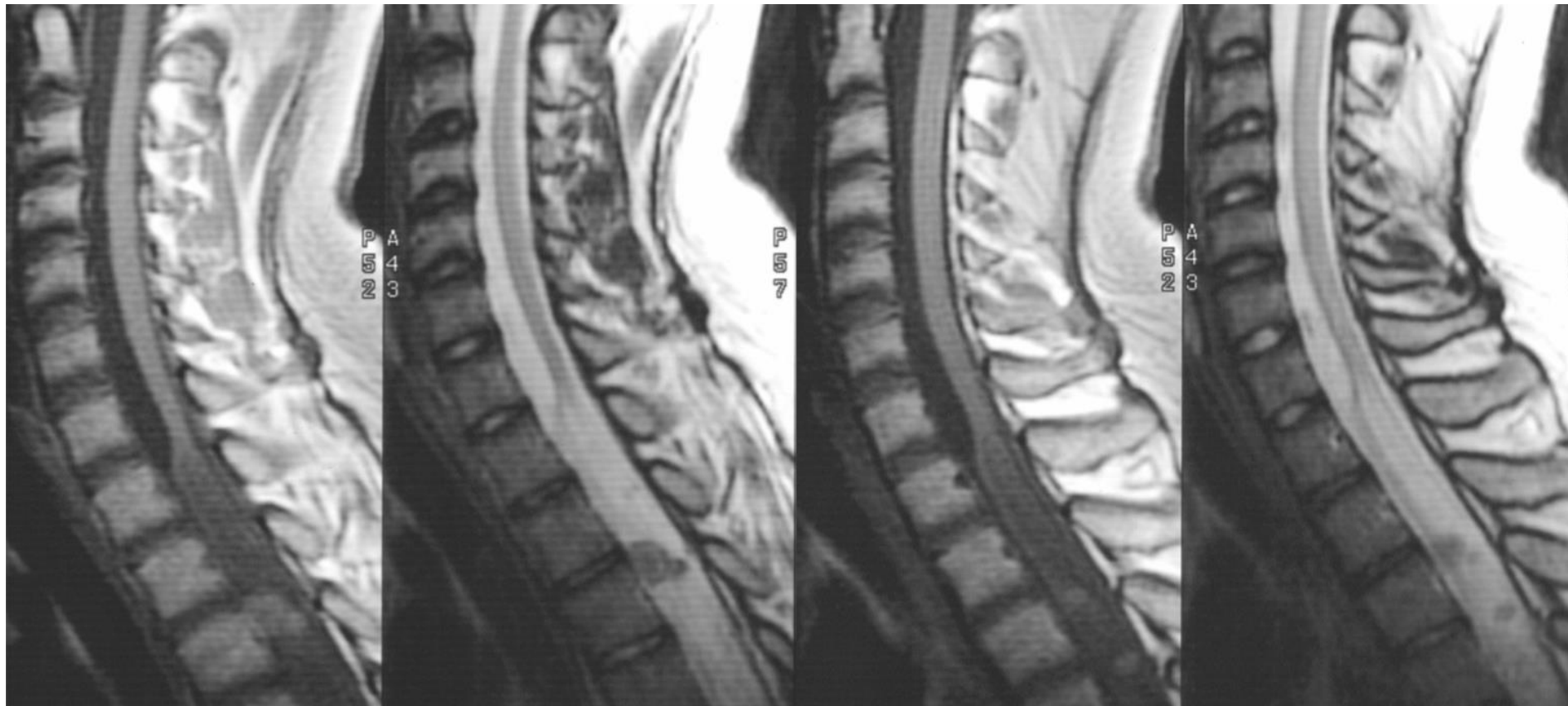
10-year-old boy,
immunosuppressed
due to CML & BMT

Candida abscess

Herpes Zoster Virus (HZV)



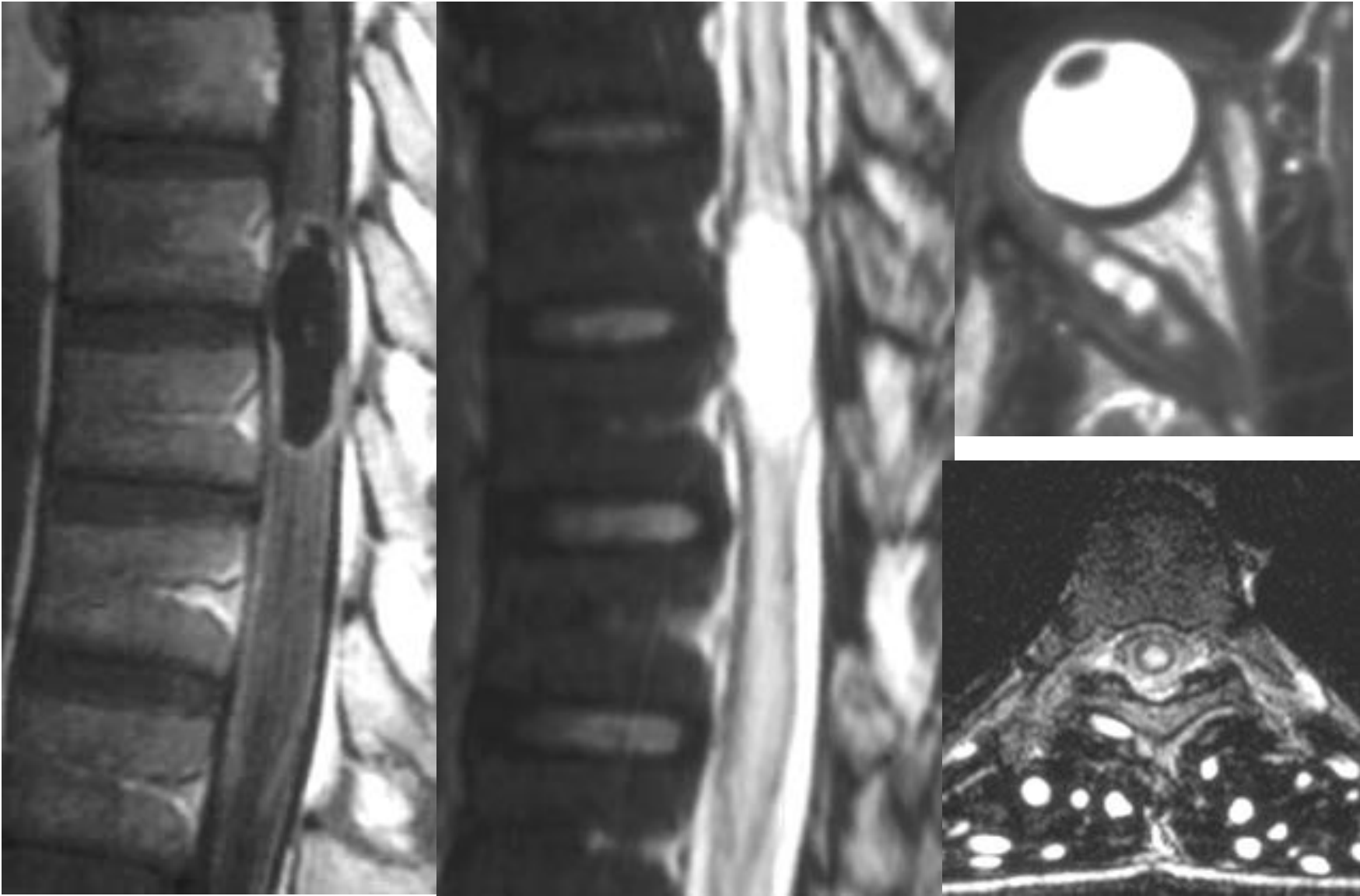
Tuberculosis



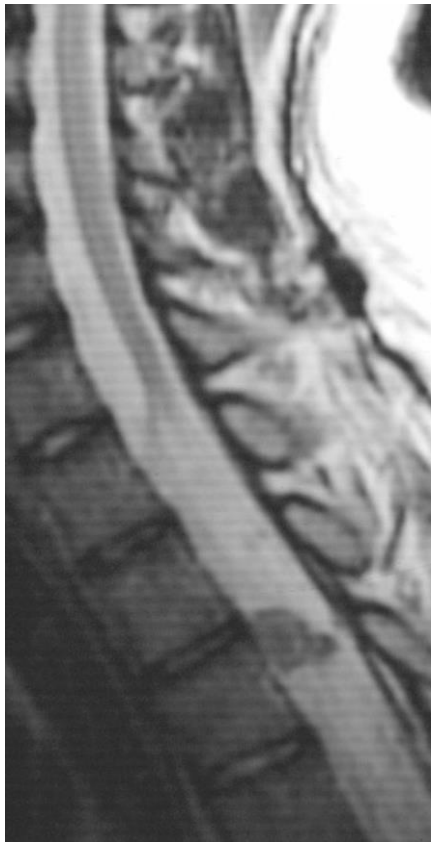
Spinal cord bacterial abscess



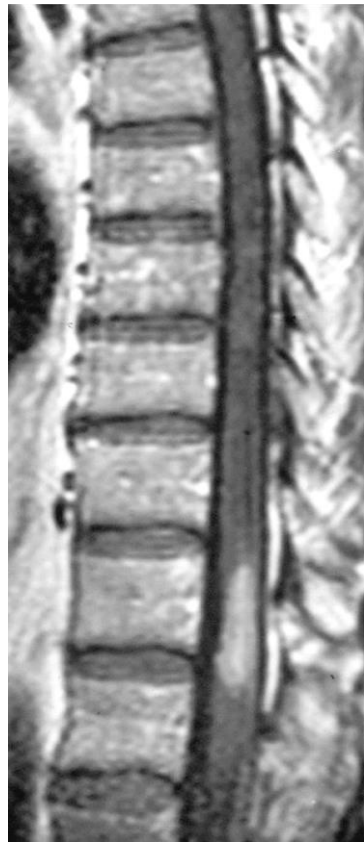
Cysticercosis



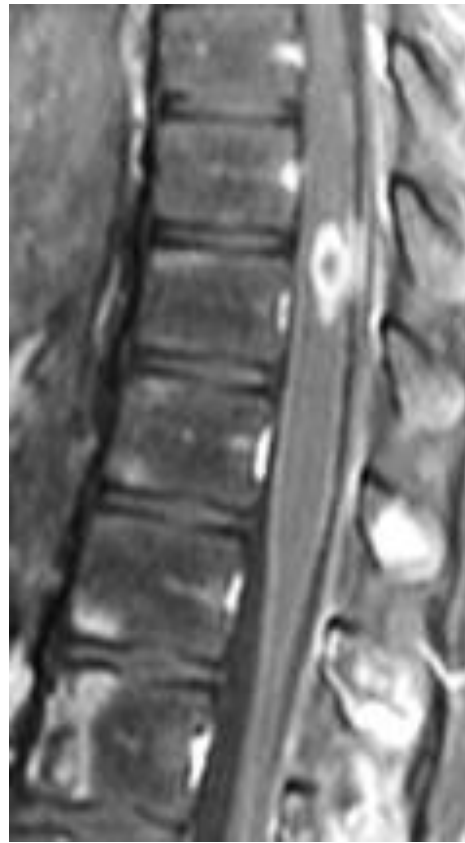
Courtesy of Castillo M, Chapel Hill, USA



Tuberculosis



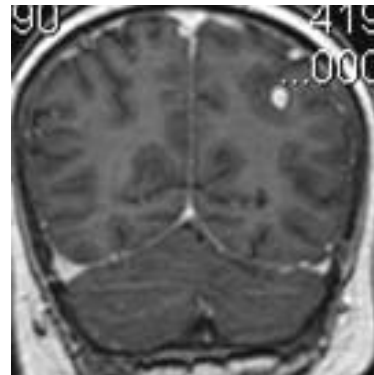
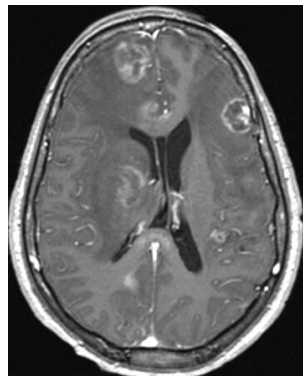
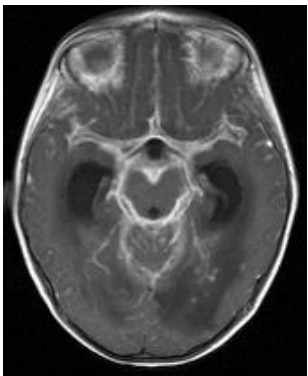
Toxoplasmosis



Candida



Cysticercosis

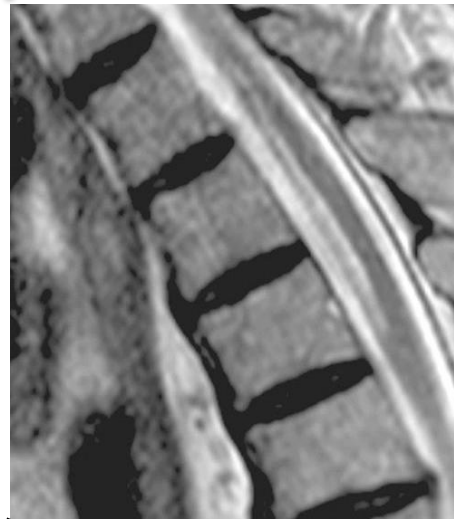
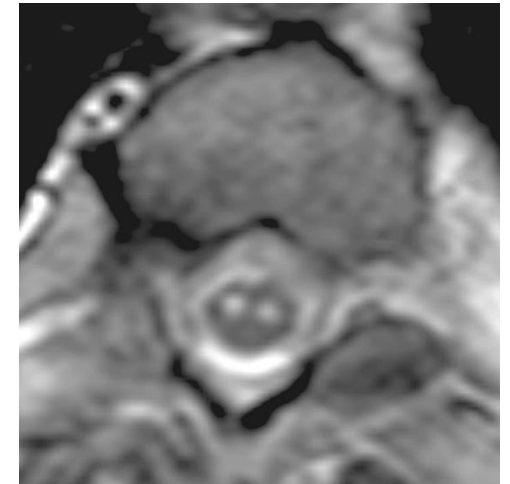
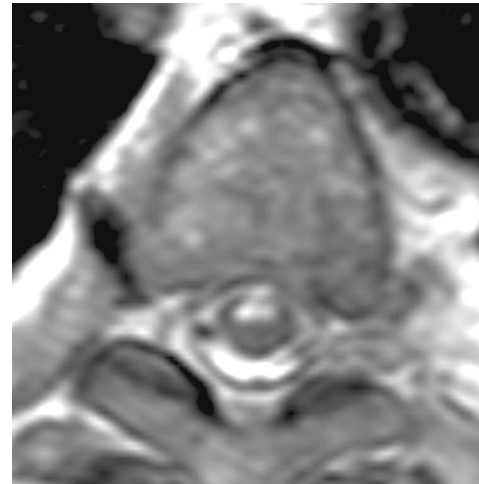


Clues for Spinal Cord Infections

- Cord enlargement & abnormal signal
- Enhancement (focal or ring-like)
- **Brain lesions !!!**
- Immunocompromised individuals (fungal)
- Endemic regions
- Travel

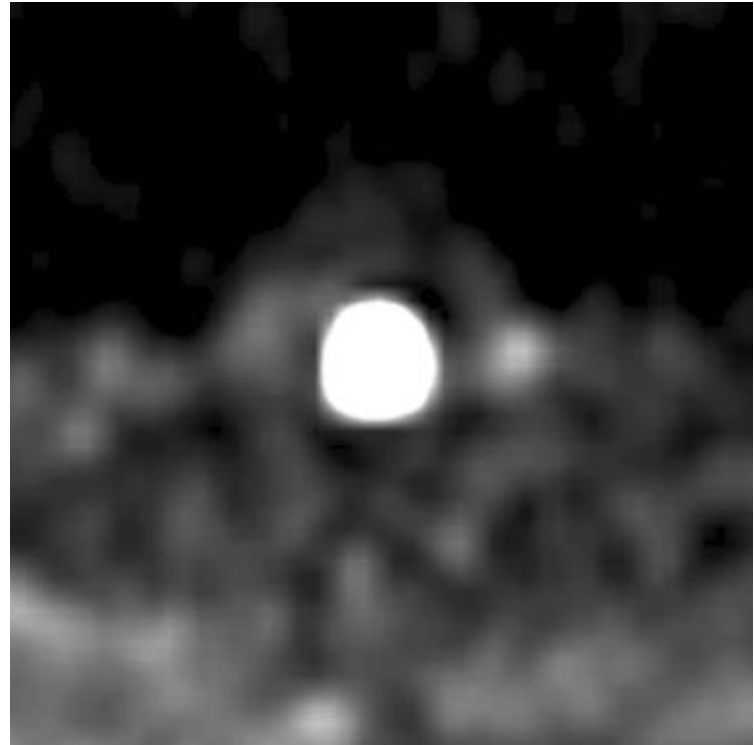
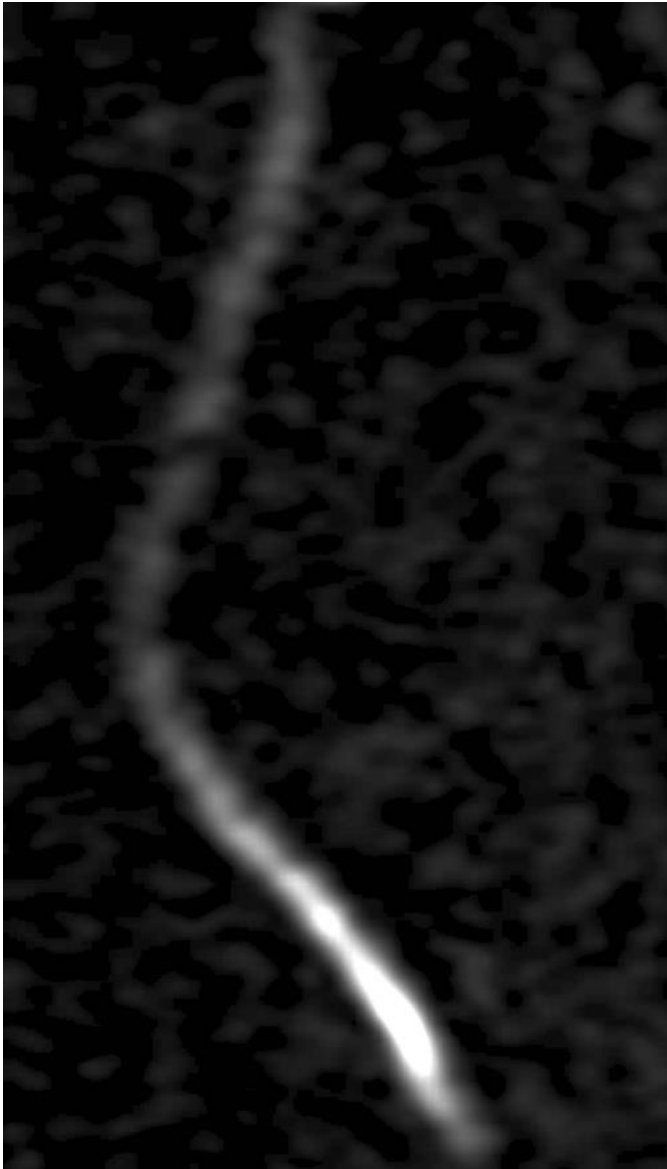


67 y male



- Stenting of aortic aneurysm
- Lower extremity weakness
- Voiding dysfunction

Spinal cord ischemia

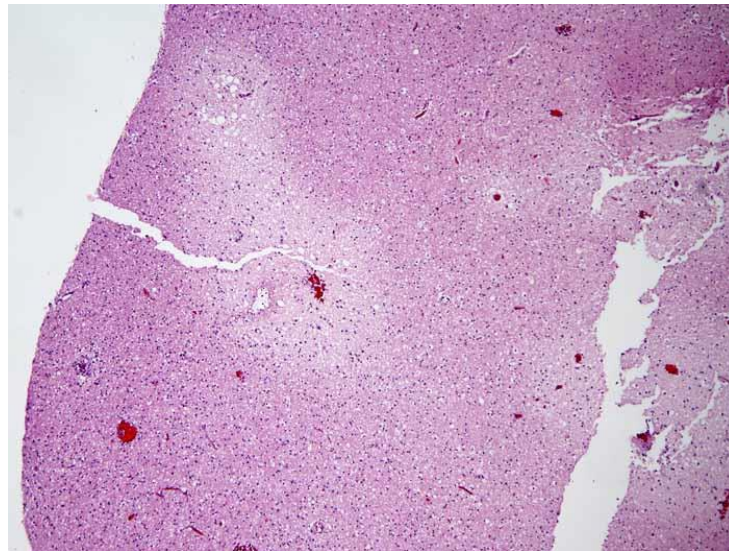
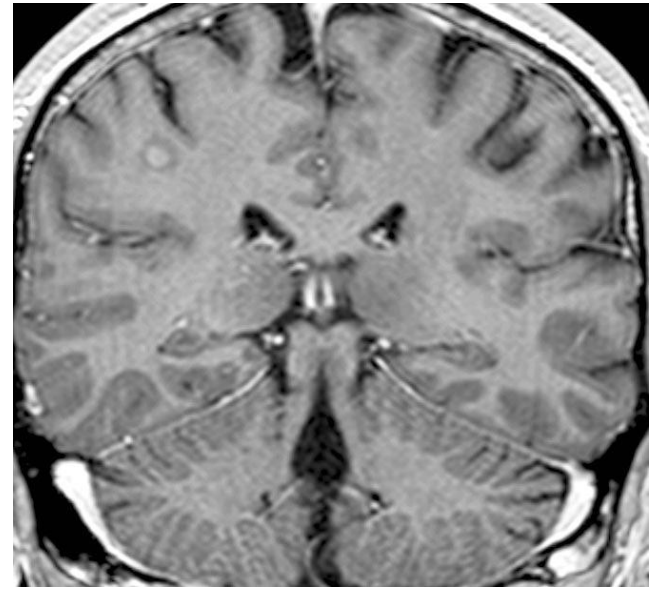
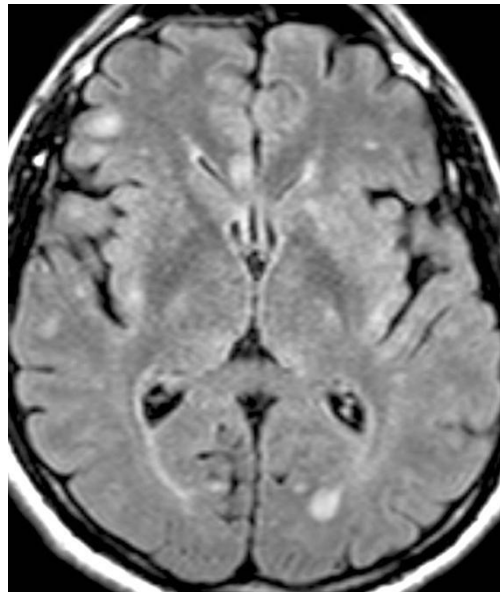
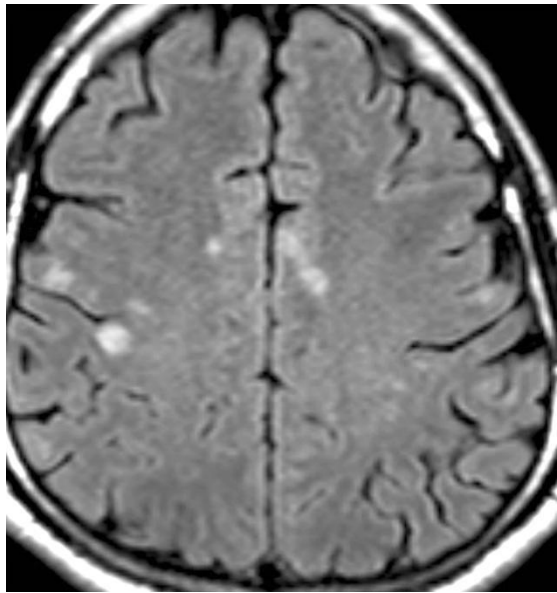


42 y male

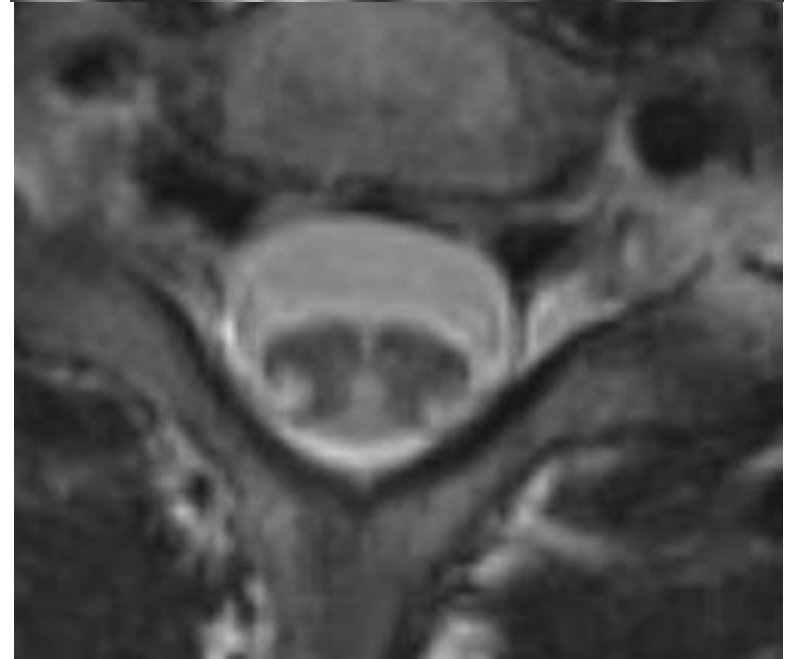
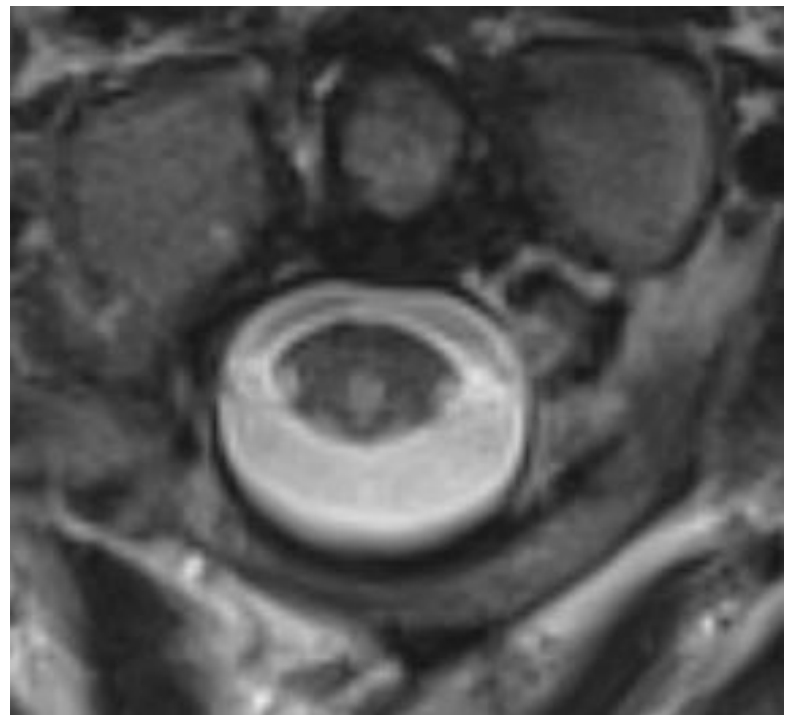
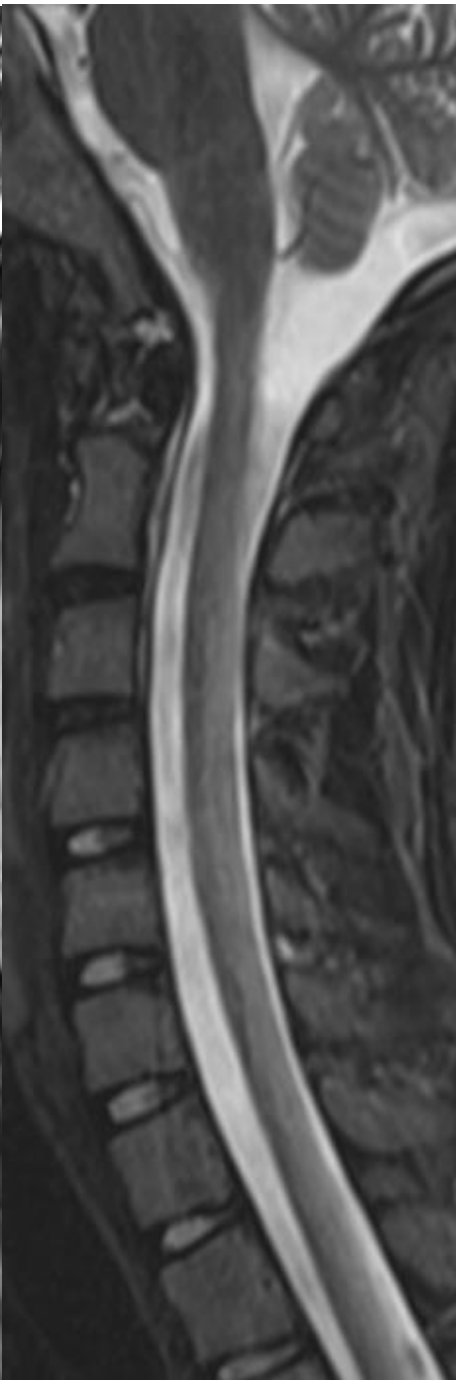
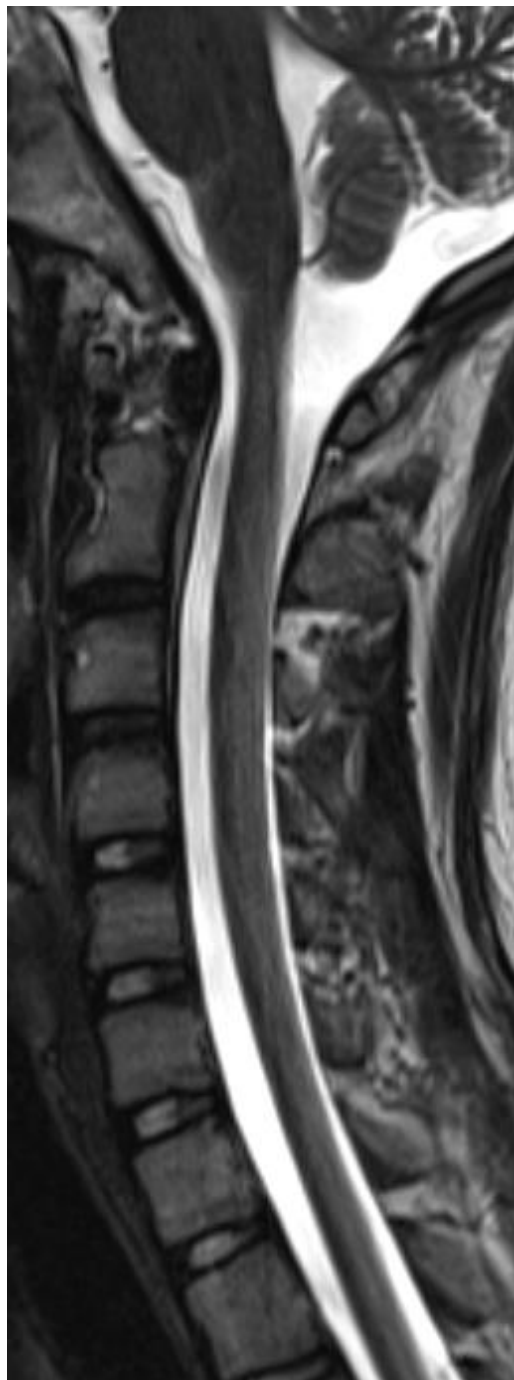


- Headache, fever, hyperalgesia,
- Numbness of the left side of the body
- Pain in the limbs (during night)
- IV nerve palsy
- CSF analysis: 52/3 cells

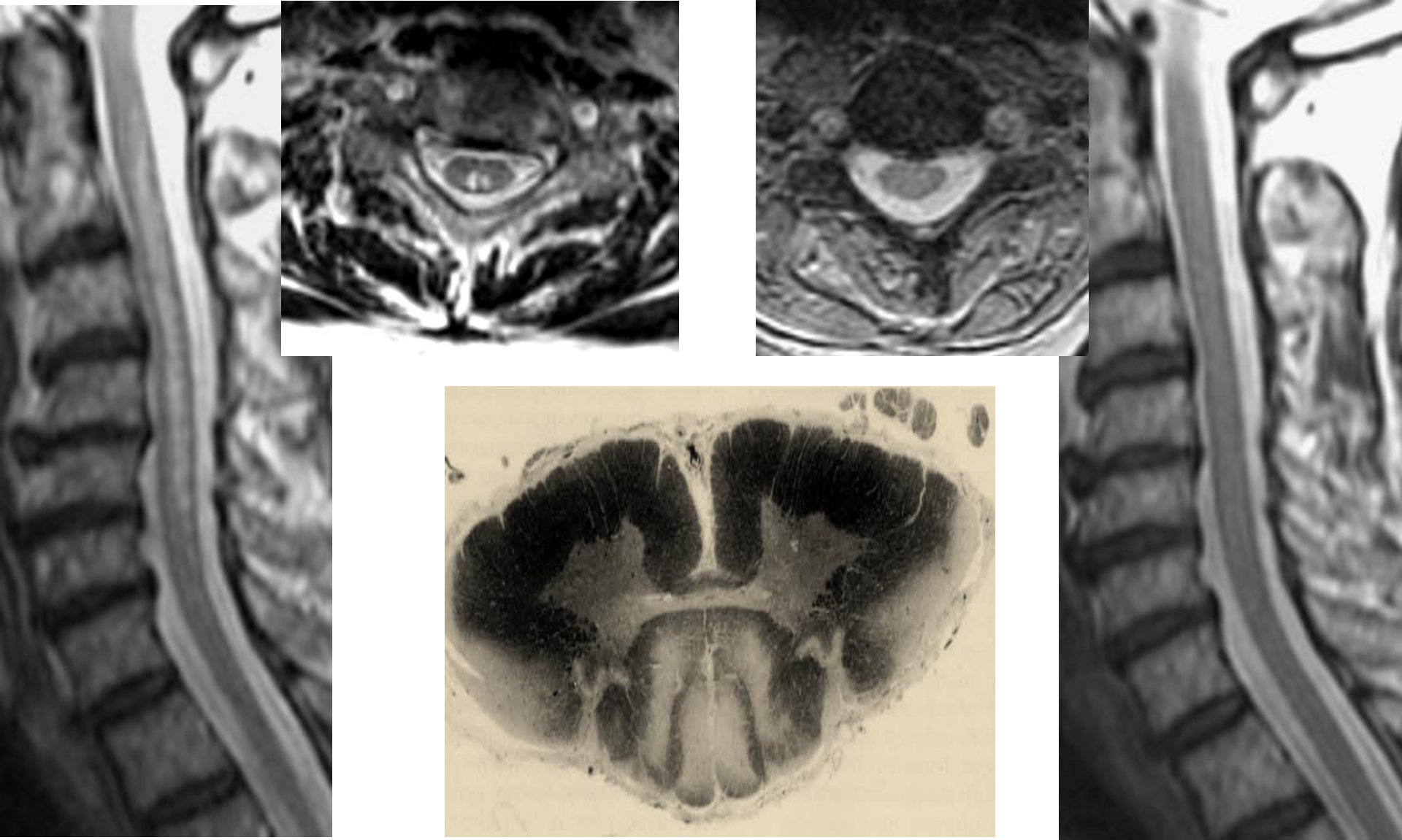




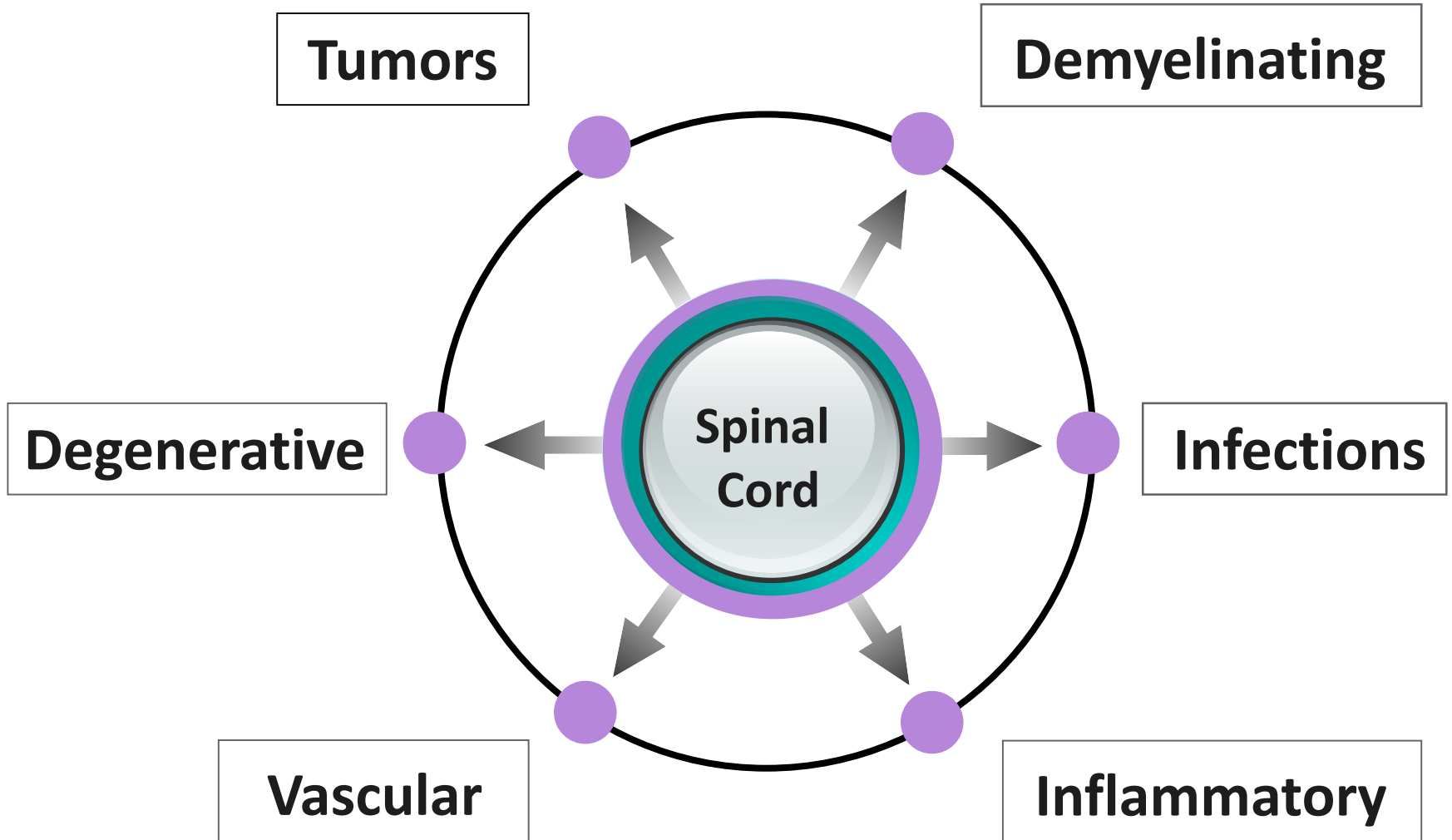
Idiopathic Vasculitis

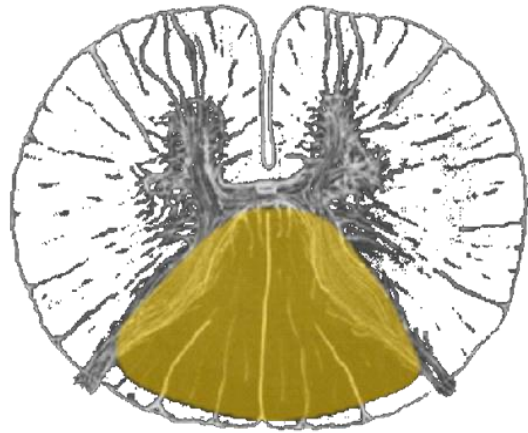
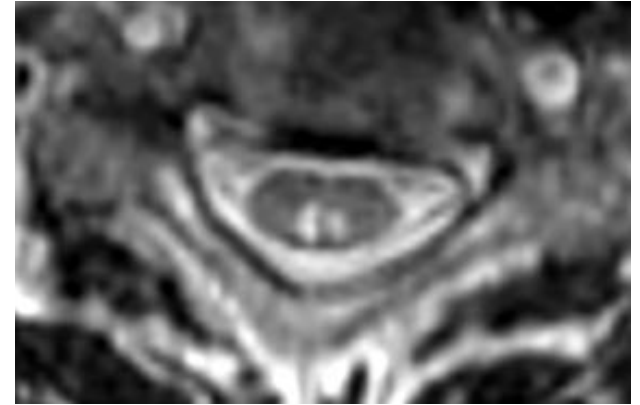
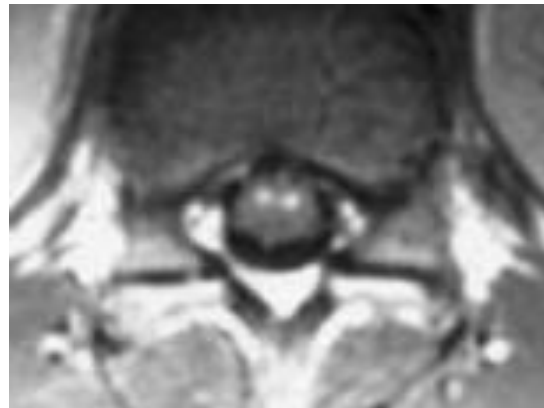
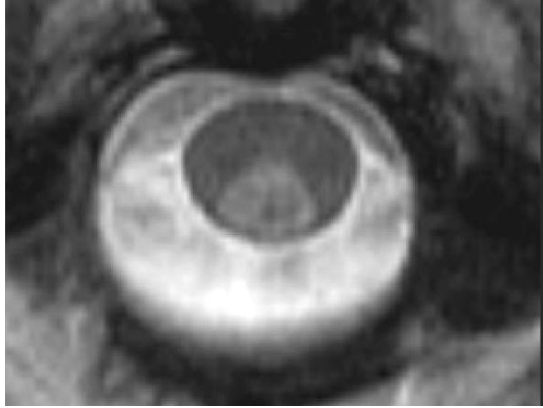


Subacute combined degeneration (SCD)

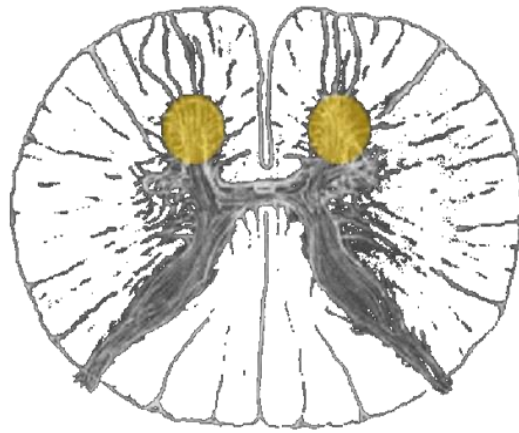


Myelopathy

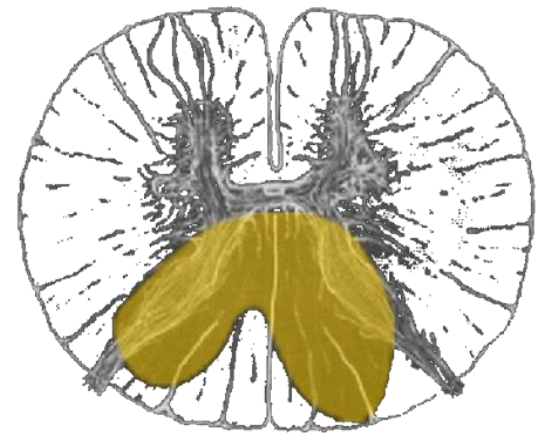




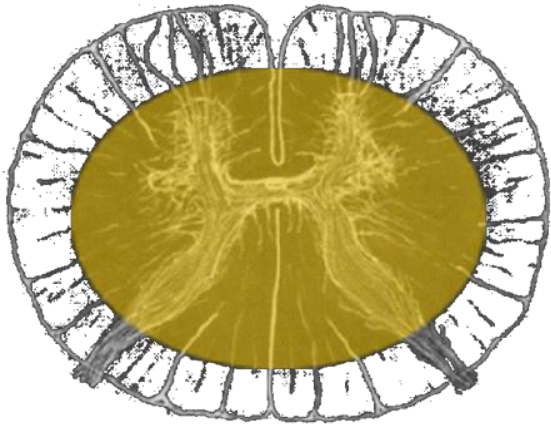
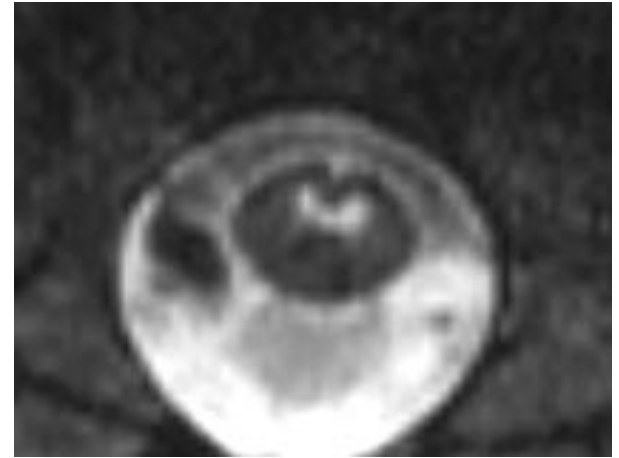
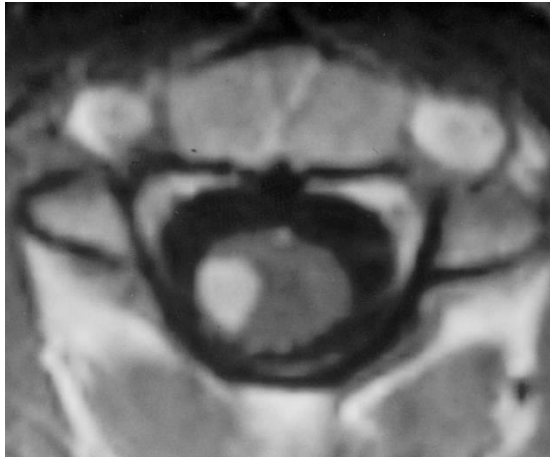
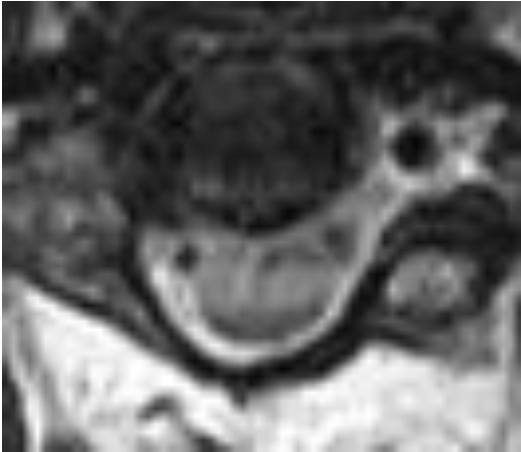
MS



Polio

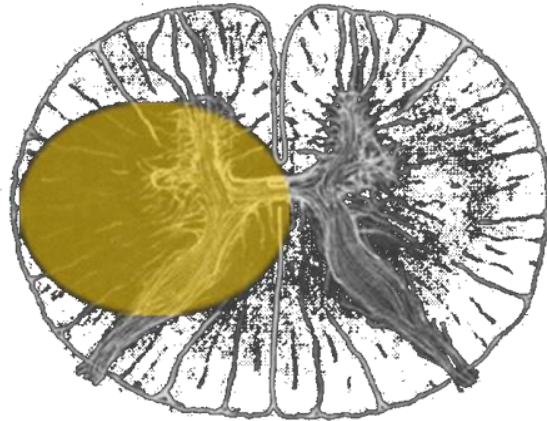


Vitamin B12 deficiency

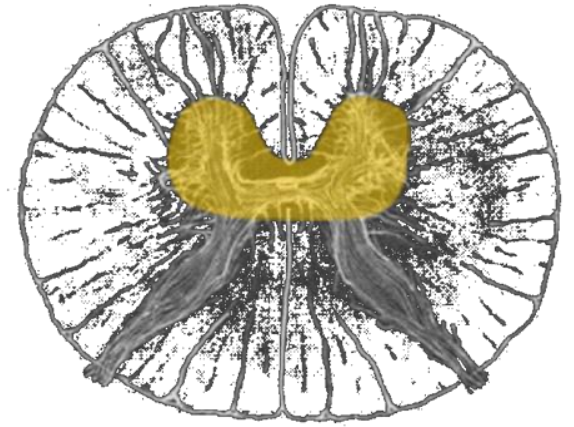


transverse myelitis

NMO



MS



Ischemia

Brain lesions?

YES



MS
ADEM
NMO
Infection
Metastatic

NO



TM
Tumor
Ischemia
Degenerative

Cysts / Syrinx?

YES



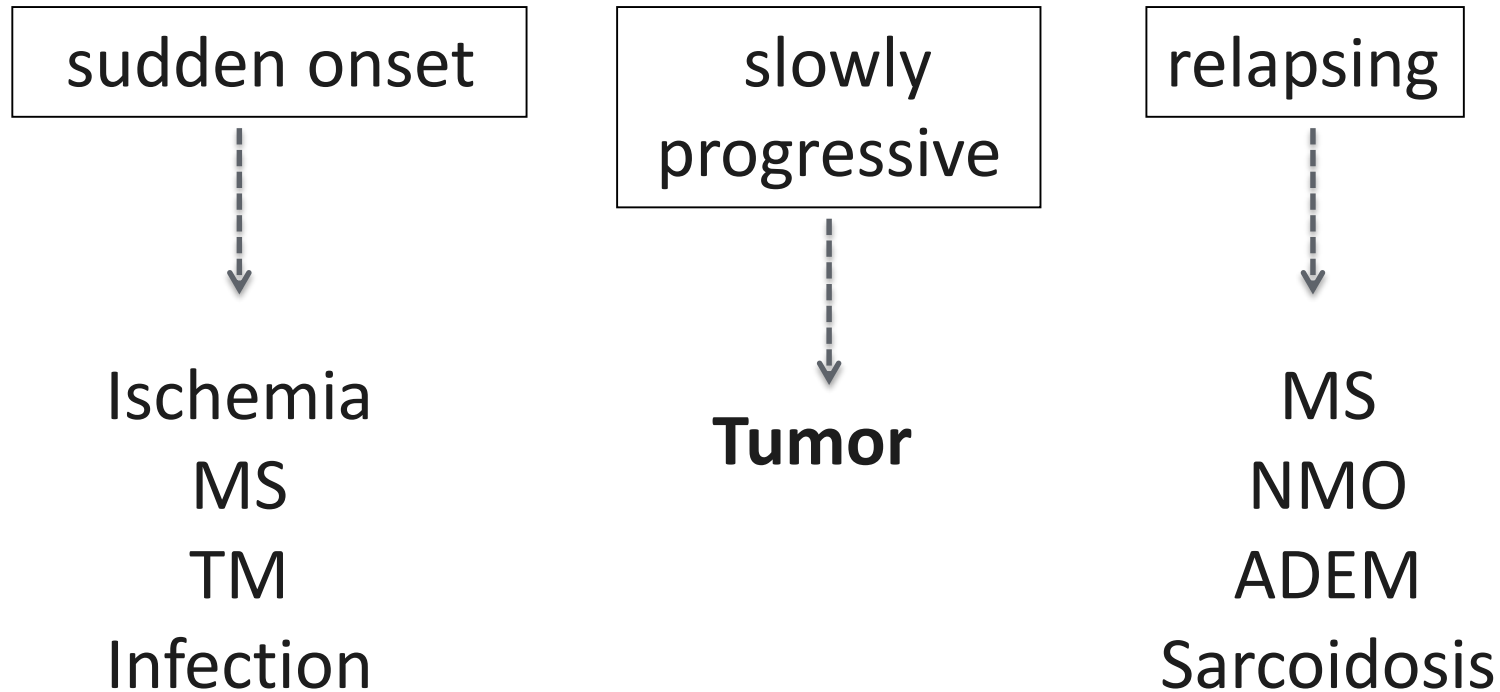
TUMOR

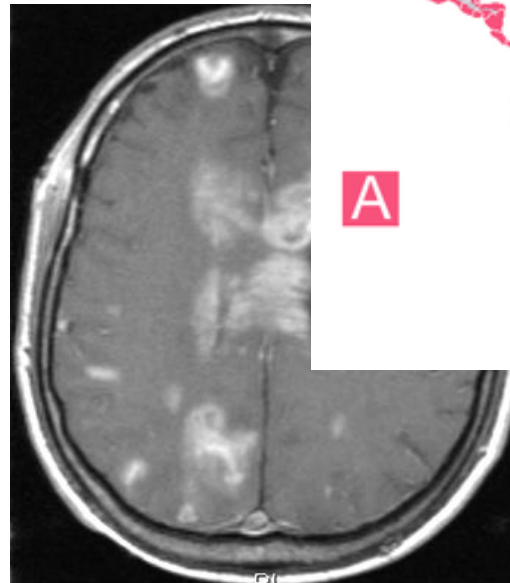
NO



MS
ADEM
Myelitis
Ischemia
Infections

Clinical history?





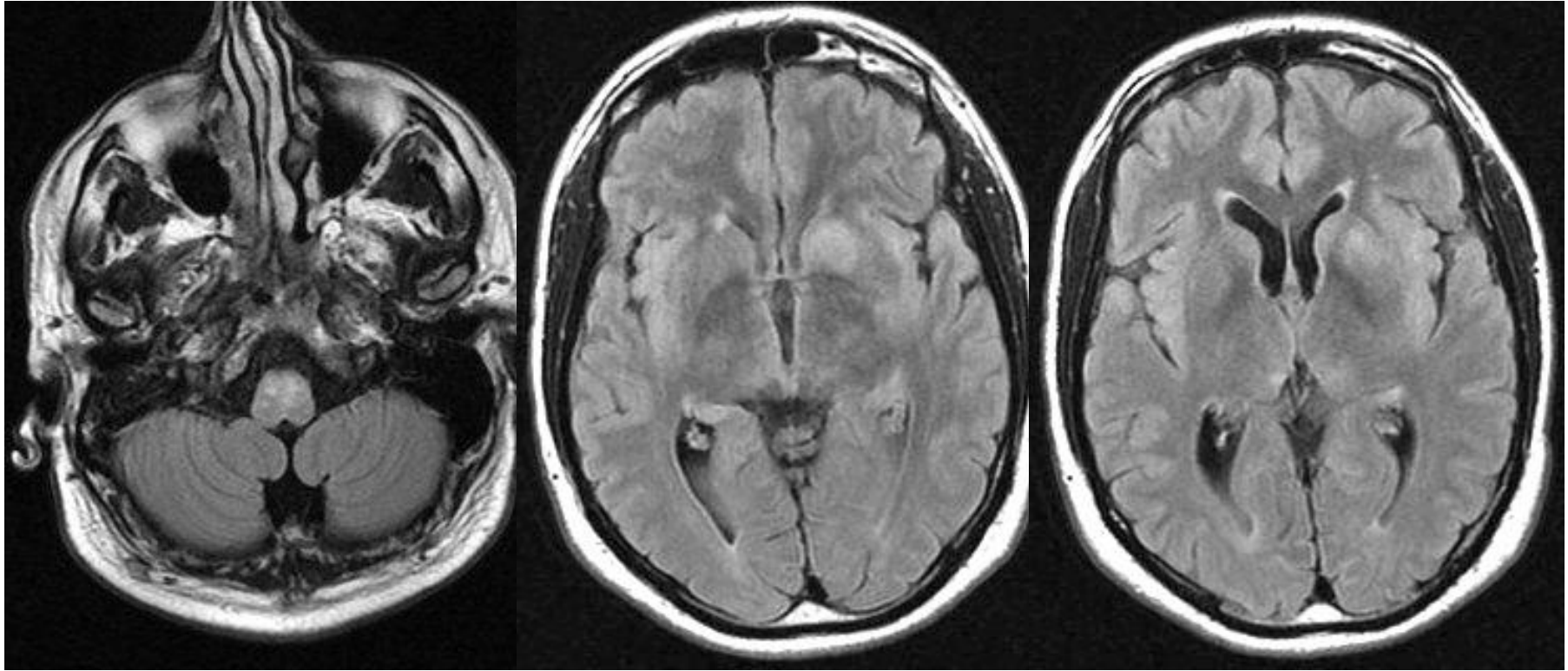
How long?
Where?
How many?
Enhancing?
Cysts/syrinx?
Brain?

Chagas disease

American trypanosomiasis









How long?

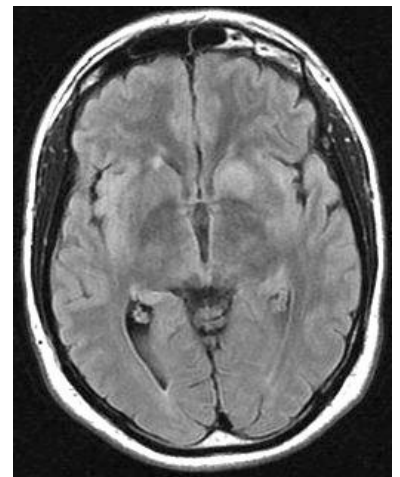
Where?

How many?

Enhancing?

Cysts/syrinx?

Brain?



- 38-year-old male
- While visiting the zoo he got a spread of tiger urine in his face / eyes
- 2 days later fever
- 4 days later urinary retention
- 5 days later progressive paraplegia
- Was admitted in a wheelchair



Tiger urine?

- Animal repellents are products designed to keep certain animals away from objects, areas, people, plants, or other animals.
- Tiger urine is very effective at keeping away animals / humans!

ADEM due to tiger urine poisoning



Thank you

