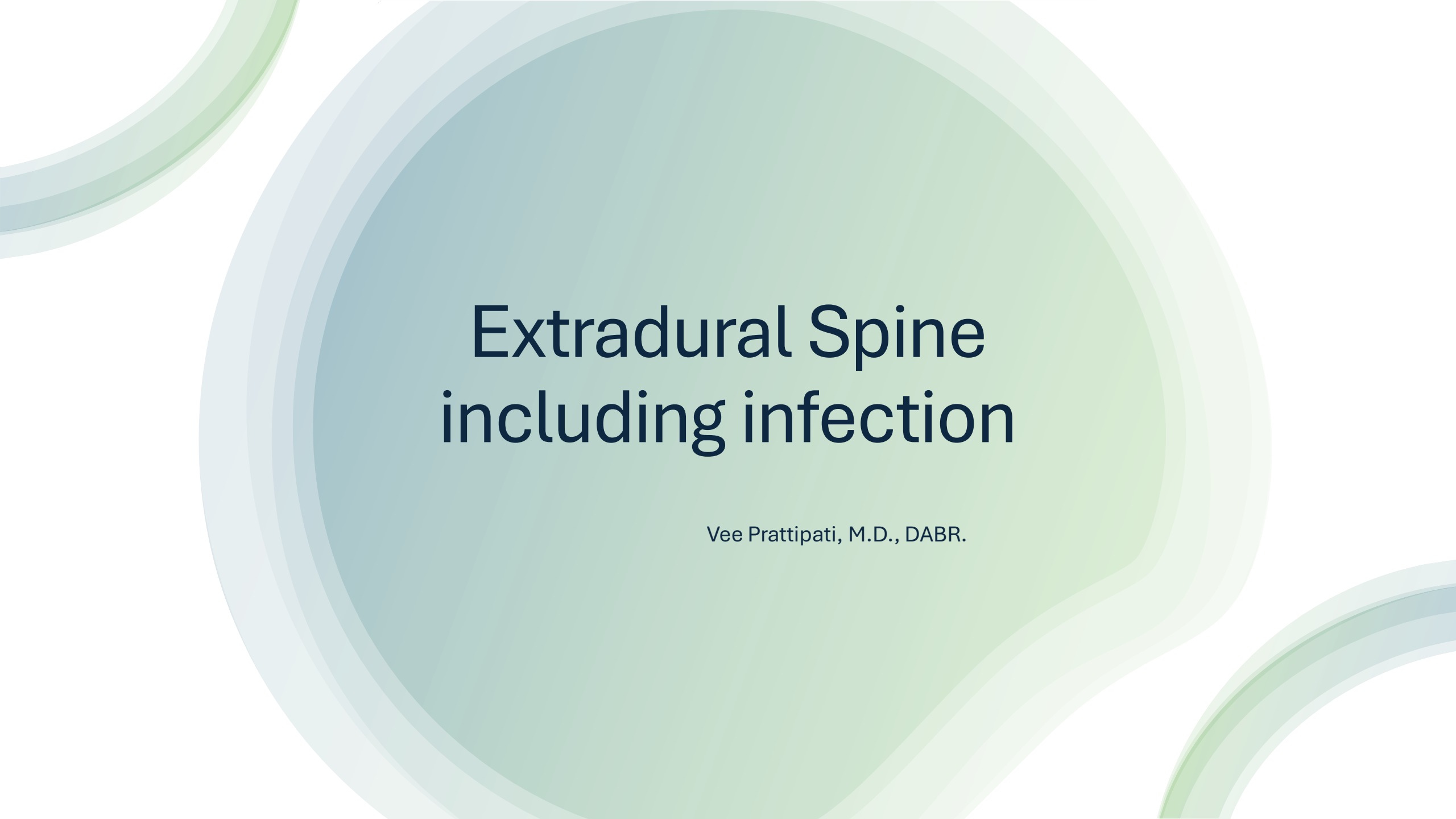




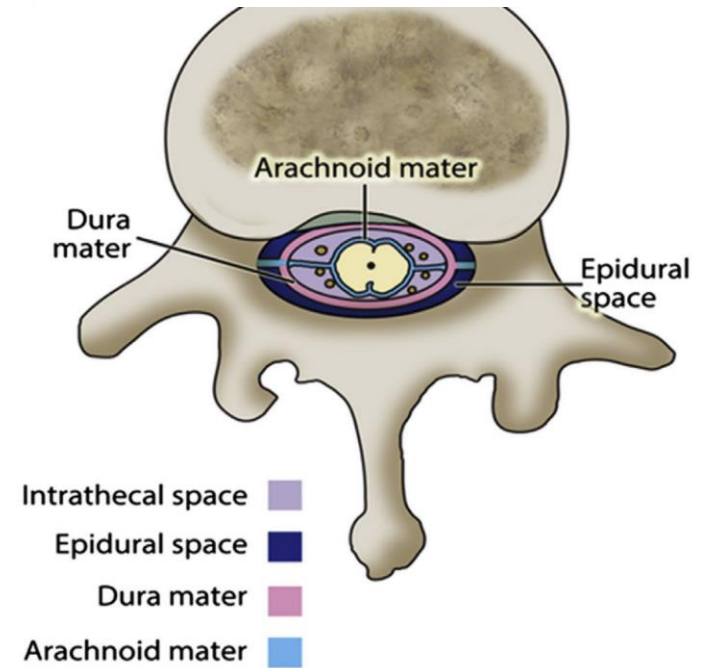
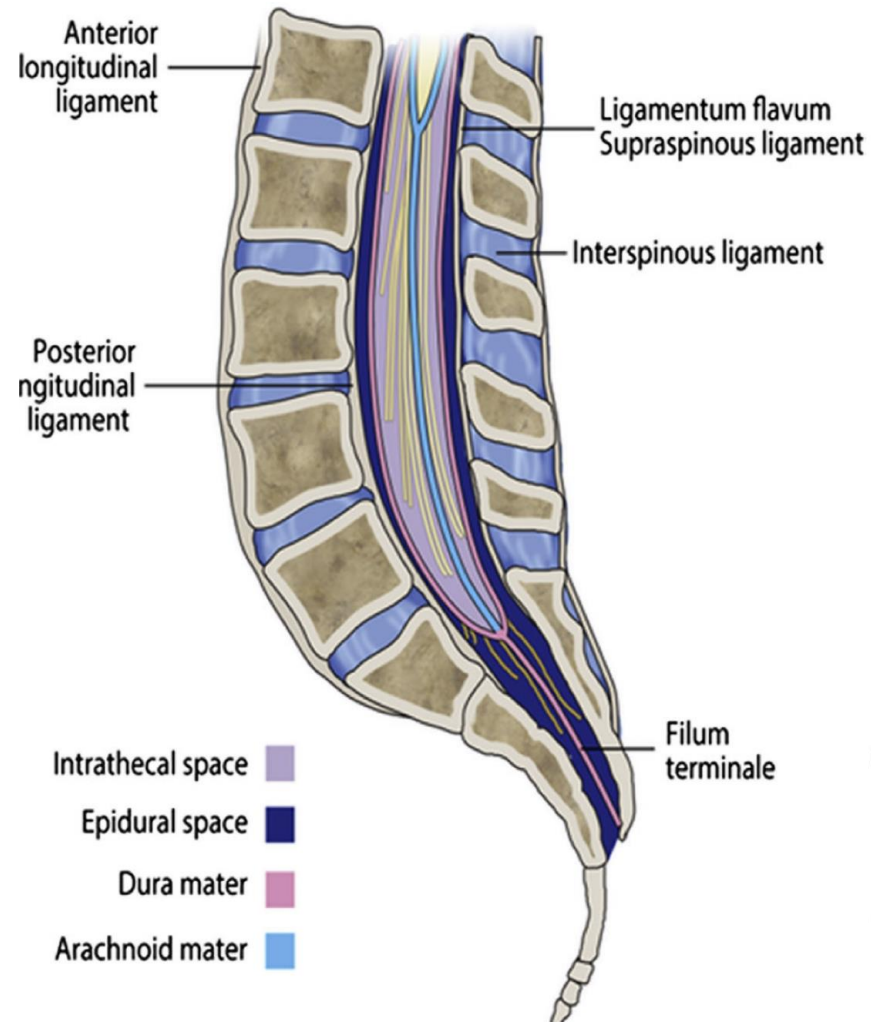
Extradural Spine including infection

Vee Prattipati, M.D., DABR.

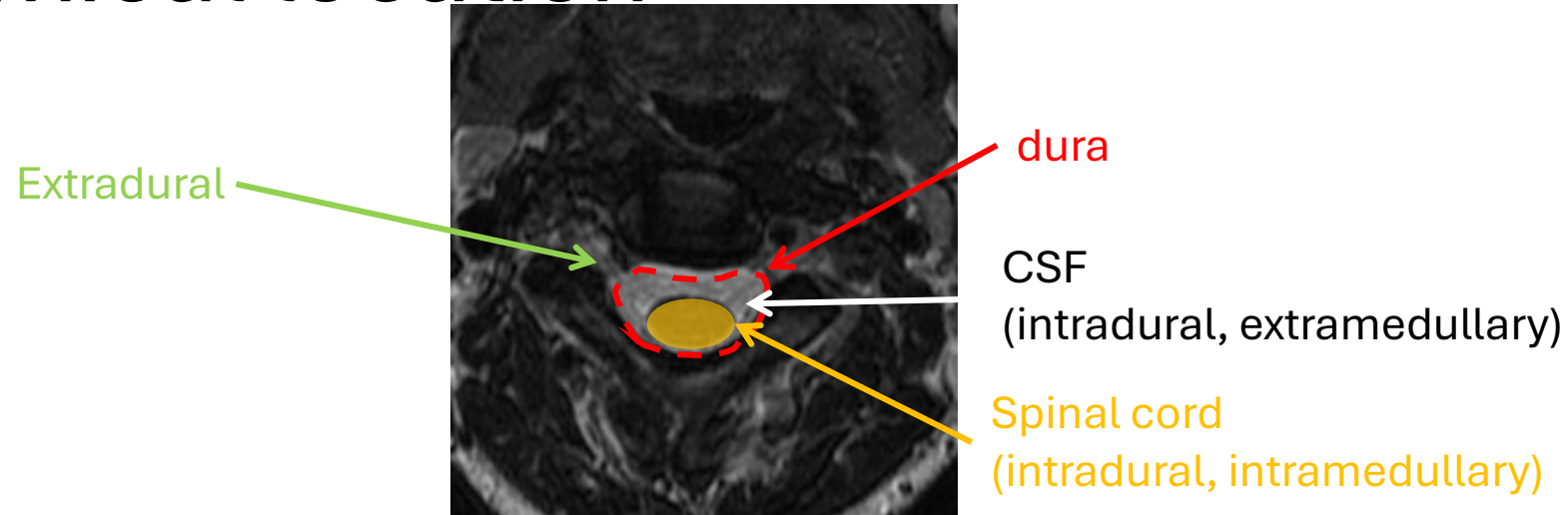
Educational goals

- Anatomy
- Spine infection
- Spine metastasis
 - Clinical scoring systems for epidural disease and stability
- Primary spine tumors and lesions

- Epidural compartment



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

Approach to spinal lesions

- Identify epicenter of the lesion
- Localization guides the differential diagnosis
- Sometimes localization is difficult but directionally helpful

Common lesions in Epidural space

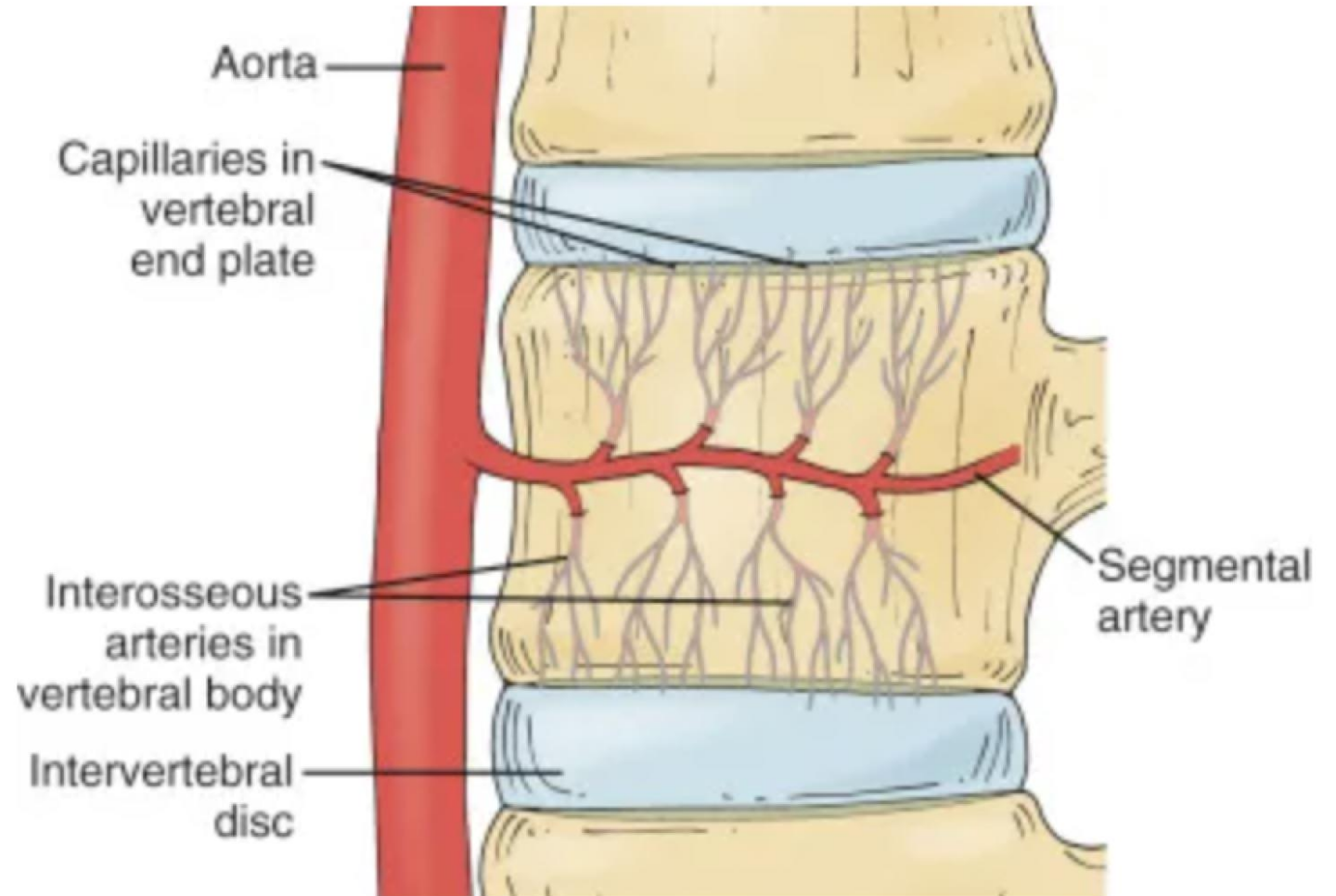
- Disk lesions
 - infection
- Bone lesions
 - infection
 - Metastasis
 - Primary bone lesions

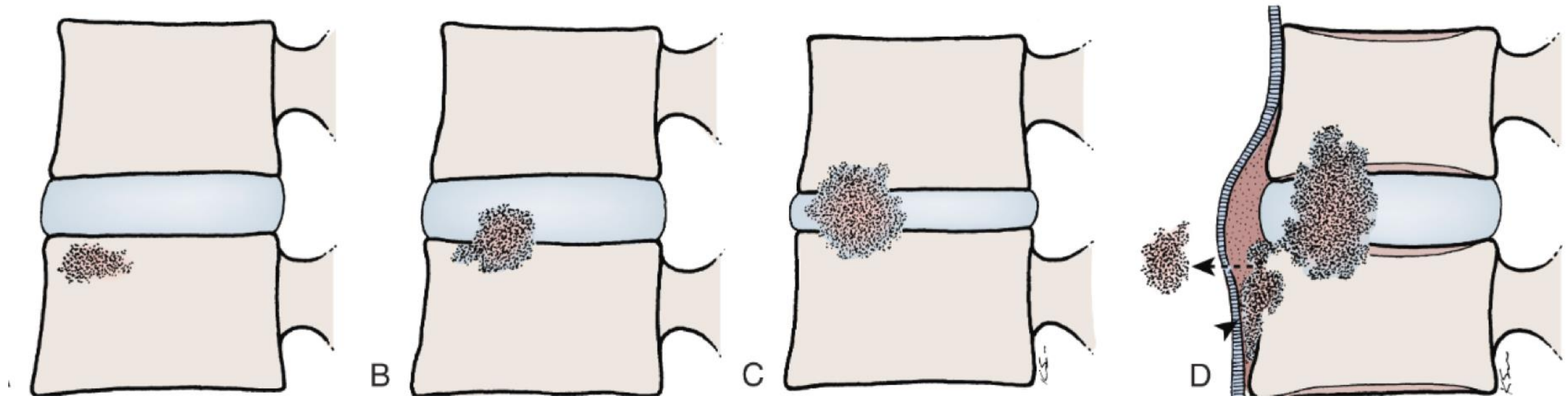
Spondylodiscitis

- Definition and common etiology
- Recognizing key imaging findings across the modalities
- Differentiate from mimics

Blood supply

- Disk: Avascular





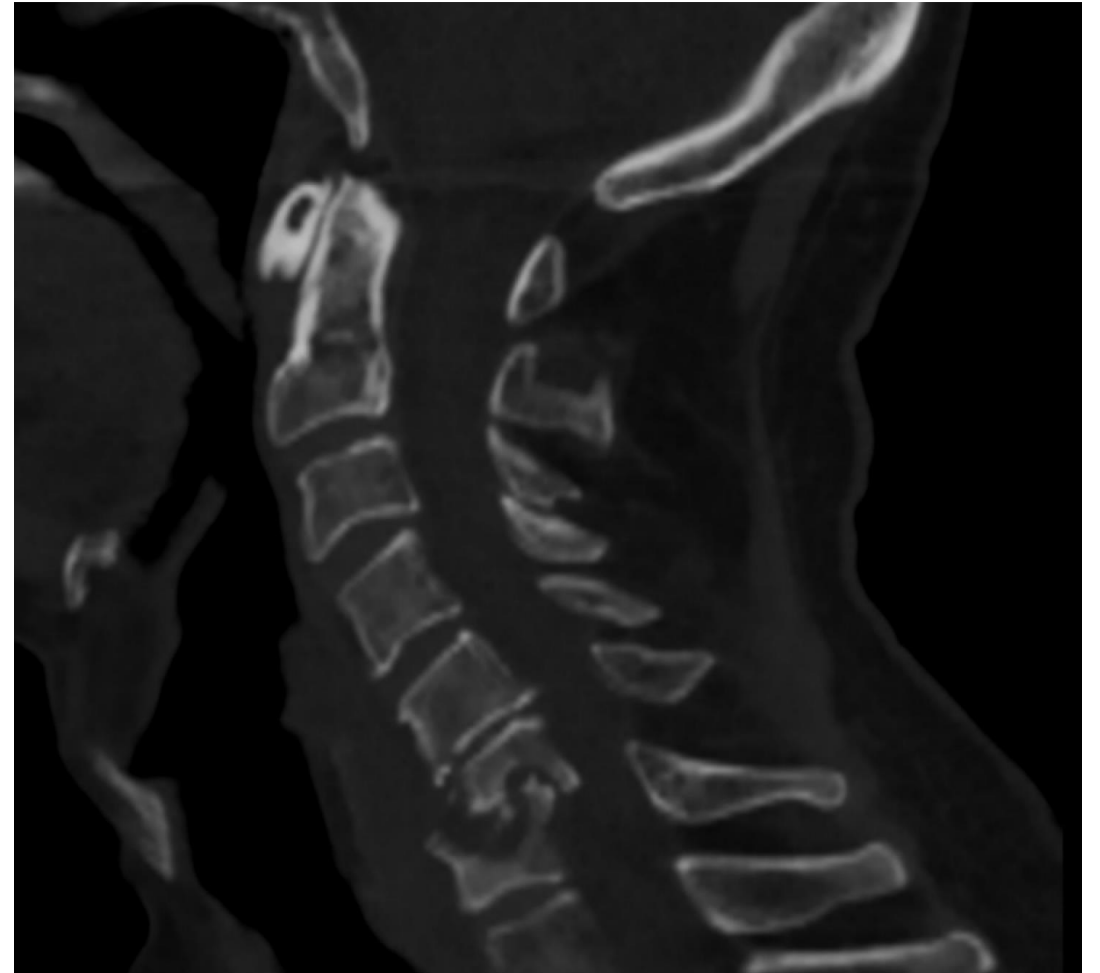
- Hematogenous spread
 - Nutrient arteries
 - Batson plexus
- Direct spread

Etiology

- Common: pyogenic
- Others:
 - Tuberculosis
 - Fungal
- Risk factors
 - Diabetes,
 - IV drug abuse,
 - immunosuppression
 - post procedural

Imaging modalities

- Radiographs
- CT
- MRI
- Rarely FDG-PET



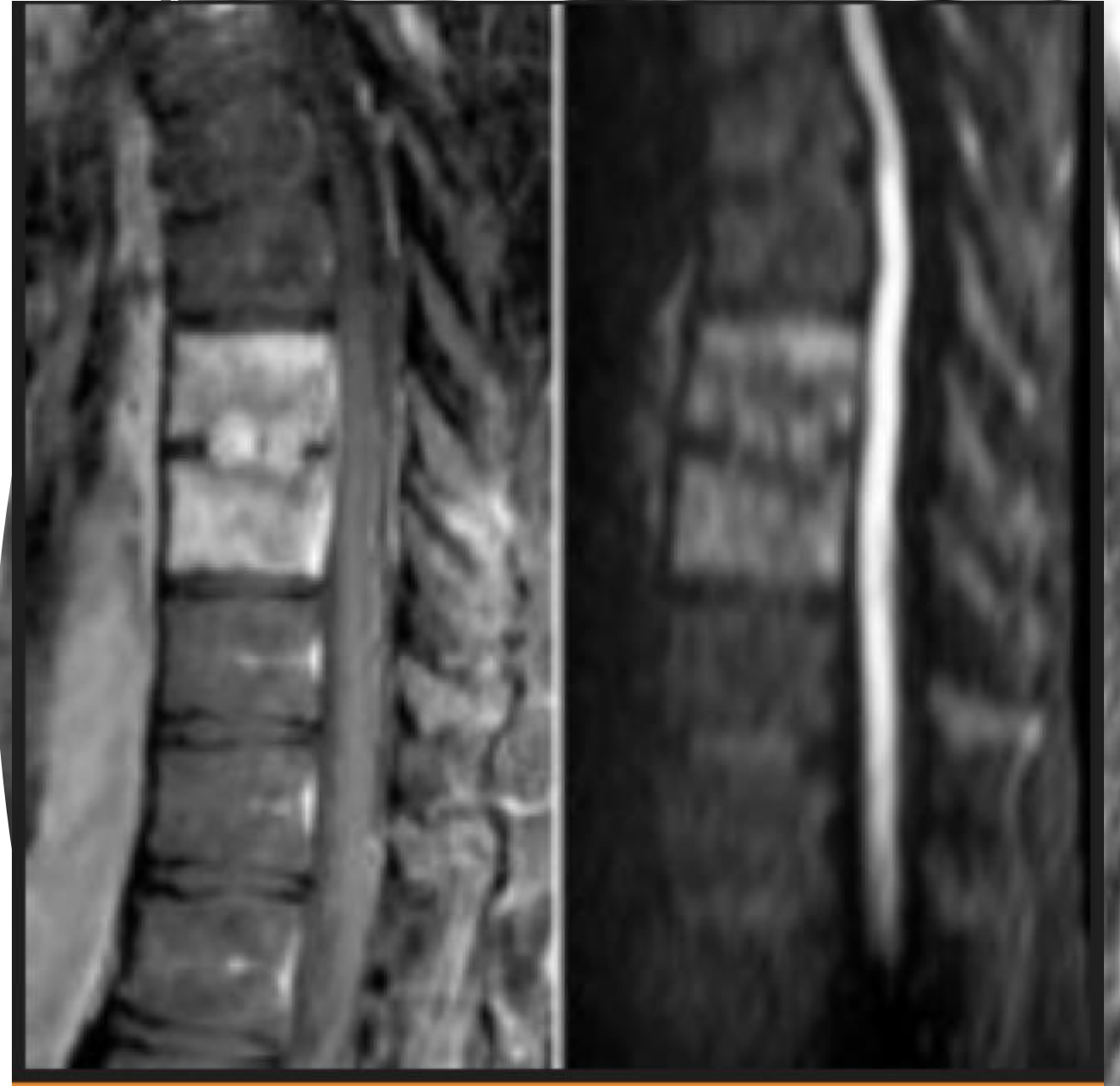
Presence of air practically
rules out infection

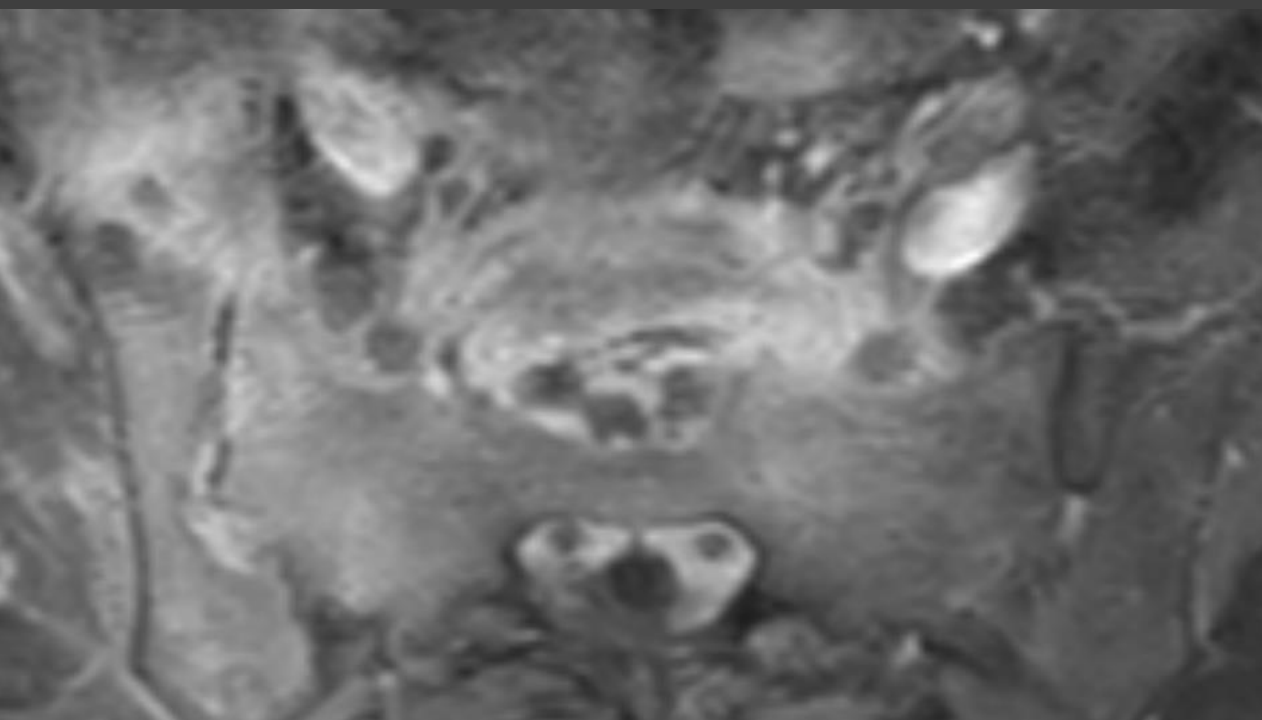
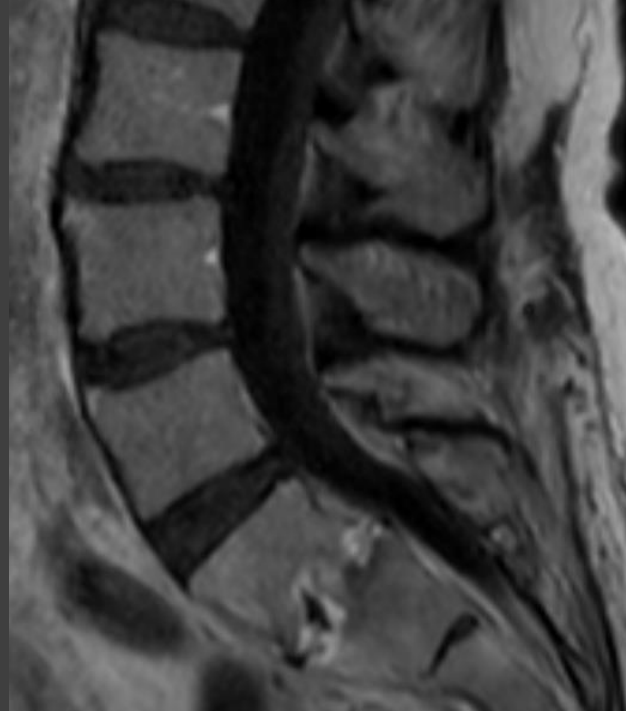
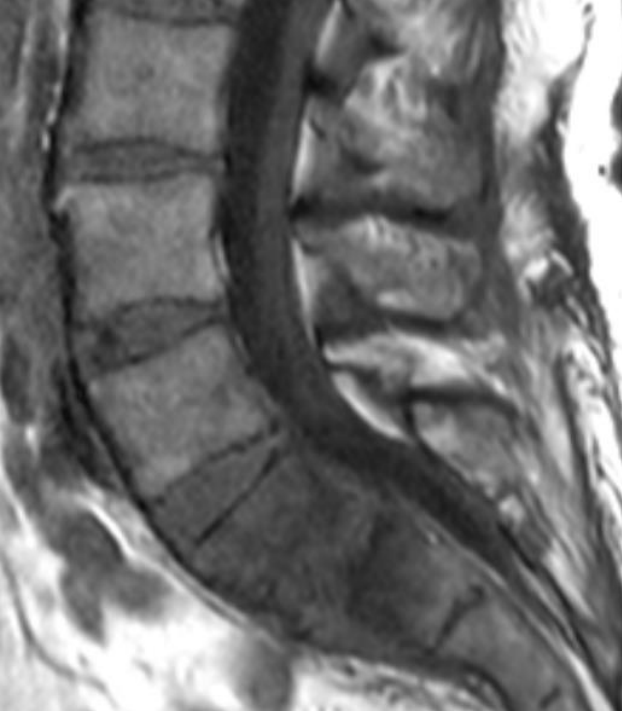
MRI

- T1, T2 and STIR sequences, DWI
- Post contrast T1 fat sat
- Evaluate:
 - Disc
 - Endplate
 - epidural space
 - paraspinal soft tissues

MRI findings

- Classic findings:
 - Marrow abnormality
 - Disc involvement
 - Endplate destruction
 - Enhancement: Disc+endplate
 - Paraspinal/epidural plegmon/abscess
 - DWI
 - Restricted diffusion of vertebral body, endplate and disc.





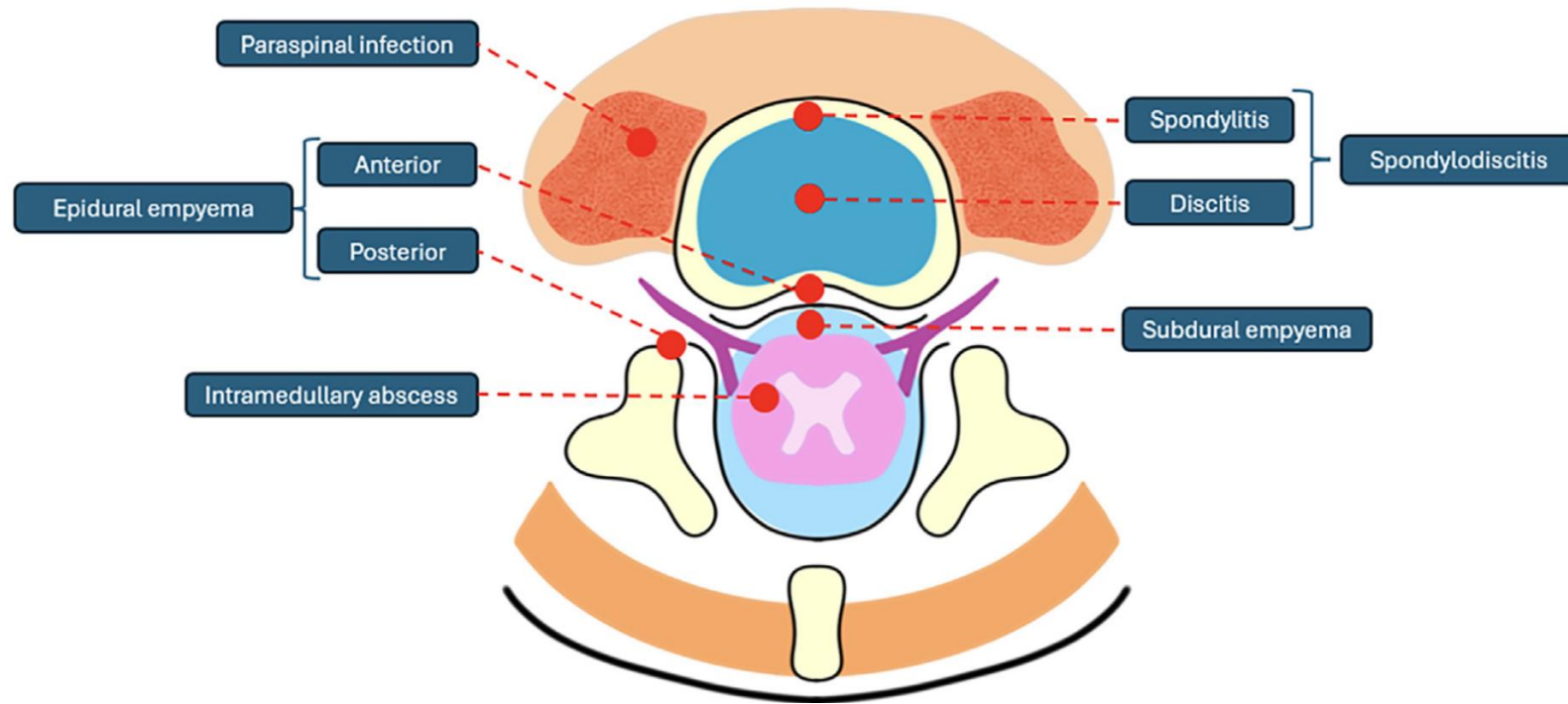
- Multifocal or atypical infections
- Brucellosis or TB

Complications

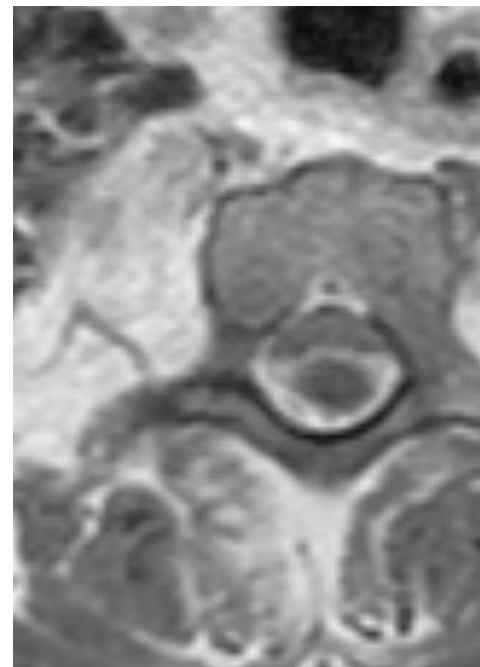
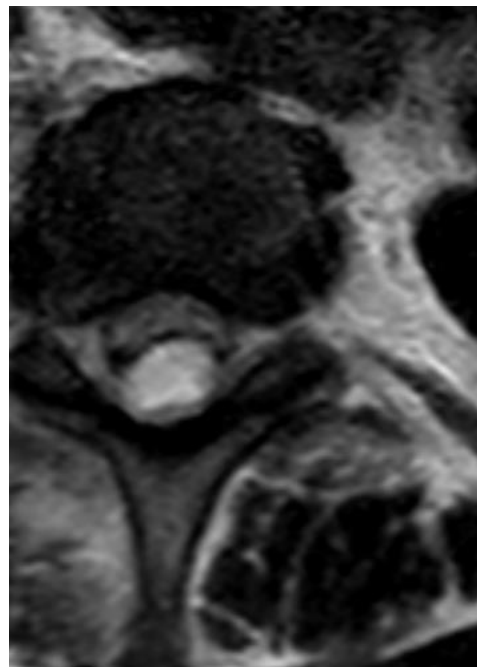
- Epidural abscess
- Paraspinal abscess
- Psoas abscess
- Cord compression

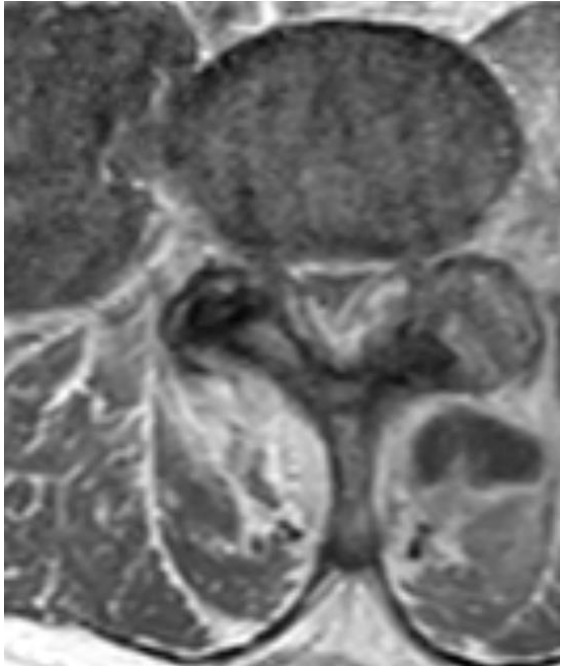
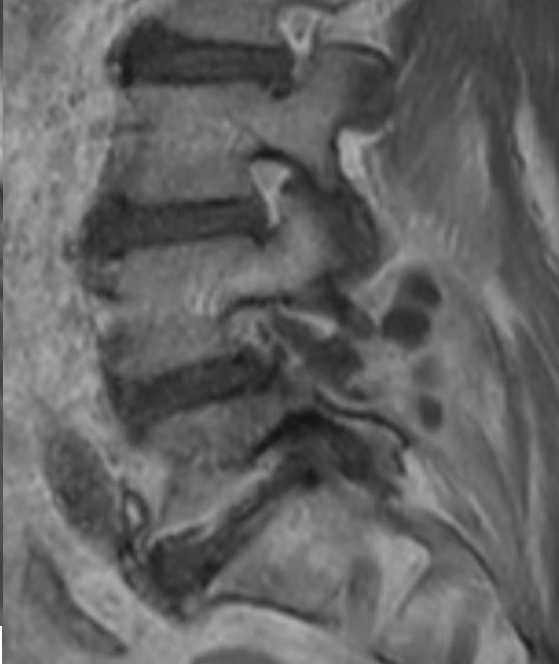
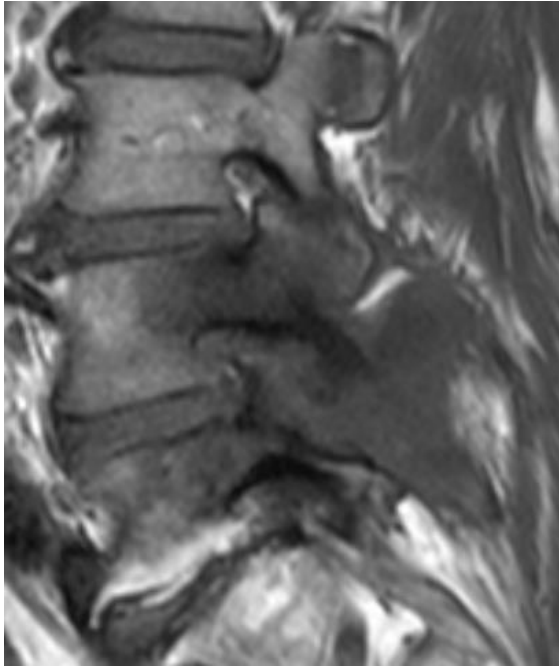
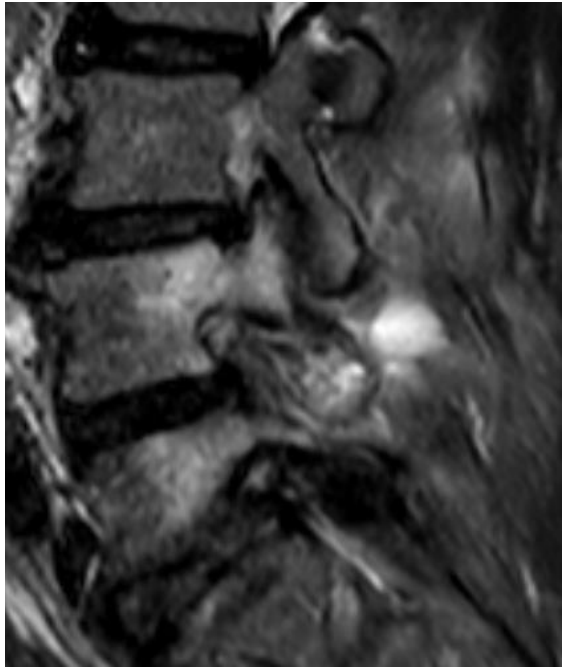


Anatomical compartments of spine



28 yo M with IVDA and lower extremity paralysis





TB Spine infection



Tuberculous spondylodiscitis

- Relative disc preservation
- Sub-ligamentous spread
- Vertebral collapse
- Multilevel involvement
- Large paraspinal abscess with thin enhancement (cold abscess)

Pyogenic vs TB

	Pyogenic	TB
• Disc involvement:	Early	Late
• Abscess: n/smooth	Thick/irregular	Thi
• Spread: ligamentous	Localized	Subl
/Multilevel		

Mimics

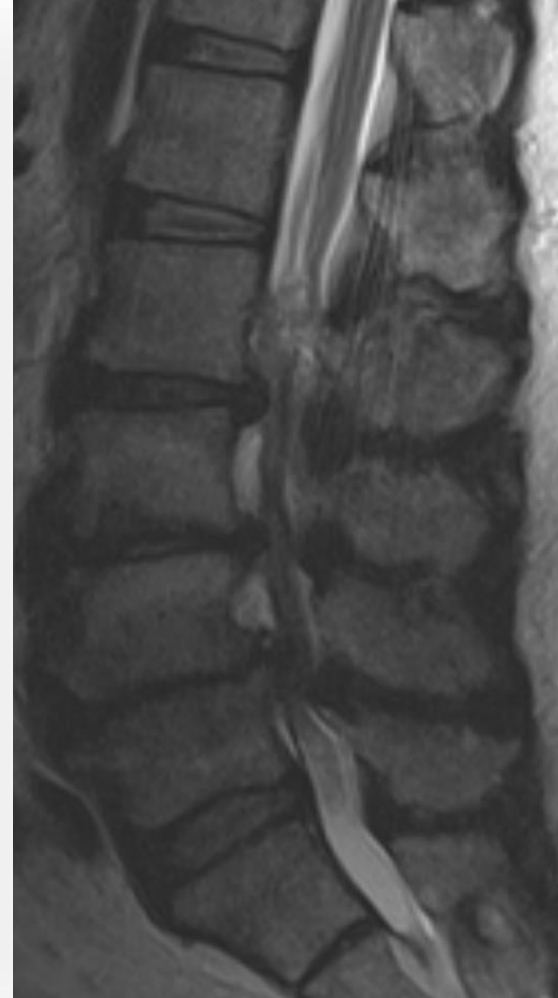
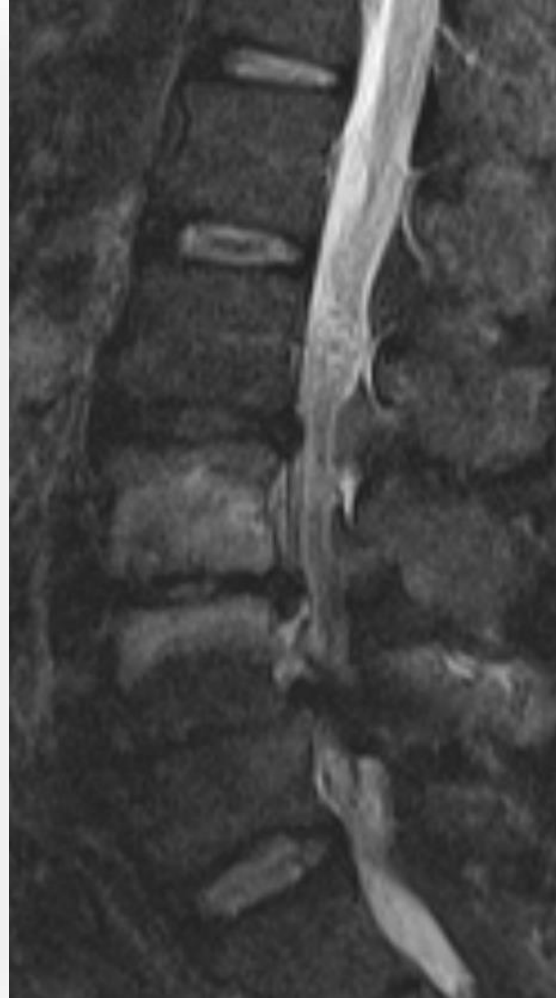
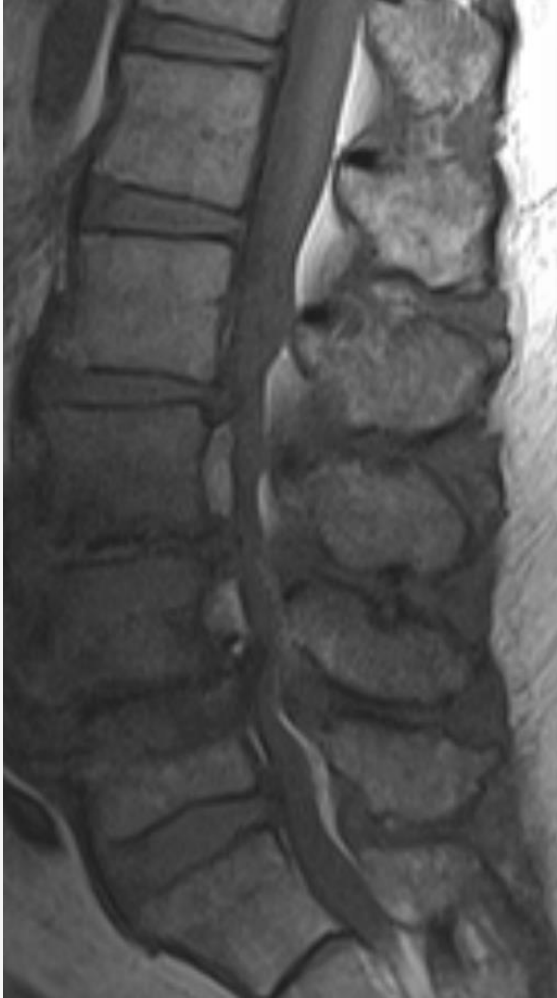
Type 1 endplate changes

Acute schmorl node

Metastasis: disc space preserved, posterior elements inv

Chronic hemodialysis
spondyloarthropathy

Type 1 Endplate Changes



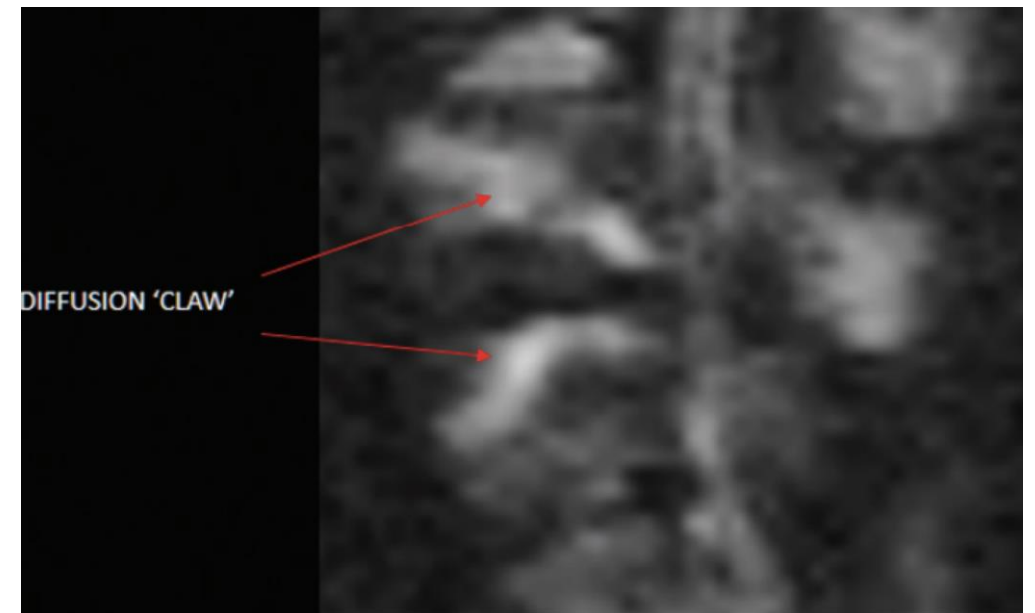
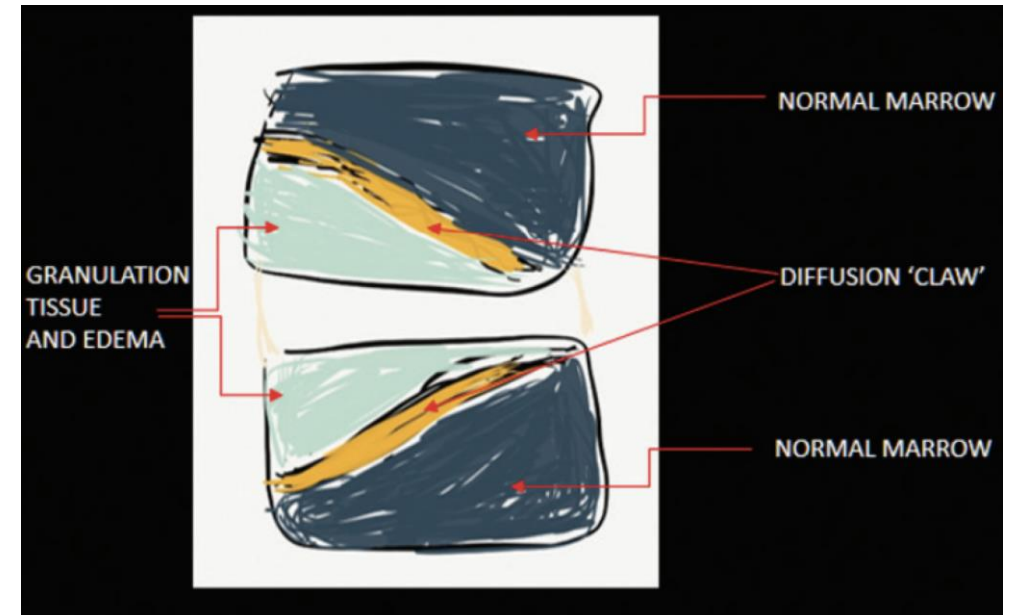
On DWI,

Very specific to rule out infection

Symmetric, curvilinear margins at endplates

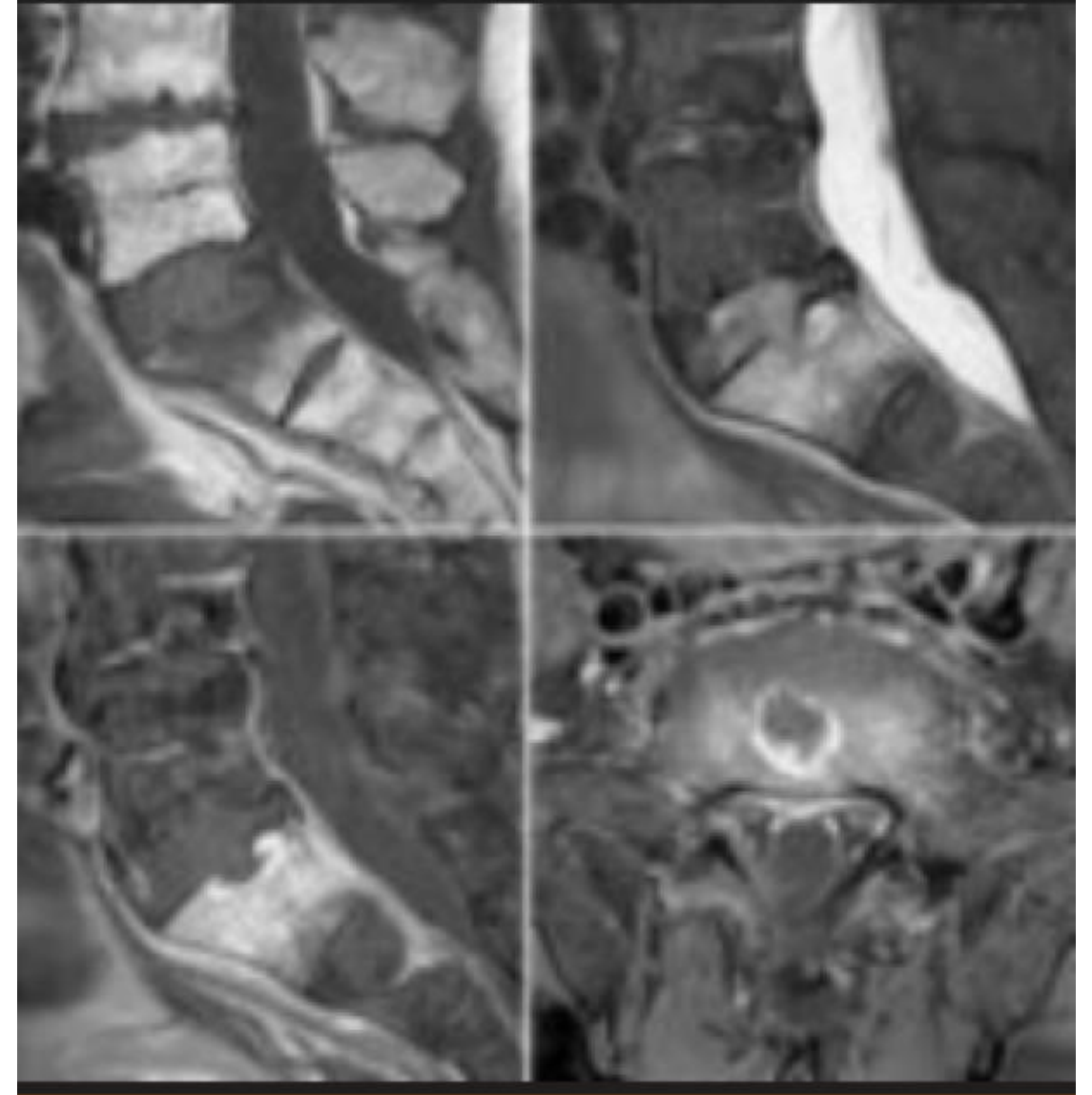
Sharp margin between marrow and signal

Patel et al. AJNR Am J Neuroradiol 35:1647-52



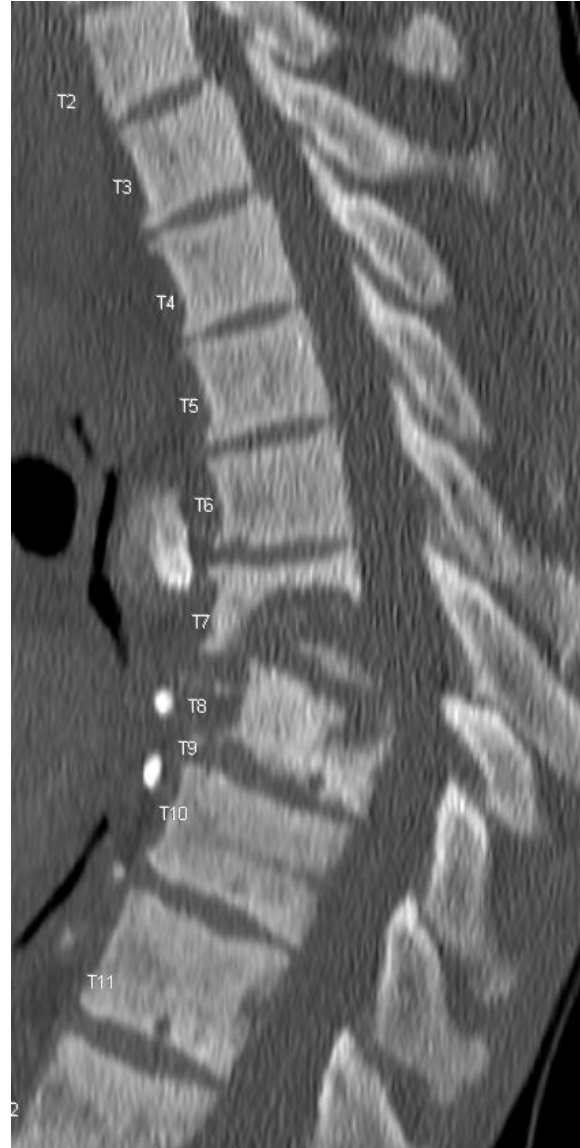
Acute schmol's node

- Intervertebral disc herniation
- Focal endplate involvement without significant disc destruction or paraspinal abnormality



Hemodialysis related spondyloarthropathy

- Endplate destruction and collapse
 - History helps
- Absence of enhancing paraspinal collections.



Companion case – Disc extrusion



Pearl: HERNIATED DISC
can enhance in the acute
setting

Pearl: Note the absence of
bone and soft tissue
changes

56-yr-old F with prior spine surgery and acute weakness.

Definition & scope

- Extradural
- Includes
- Vertebral bodies
- Intervertebral discs
- Epidural space (fat, venous plexus)
- MC location for spinal pathology

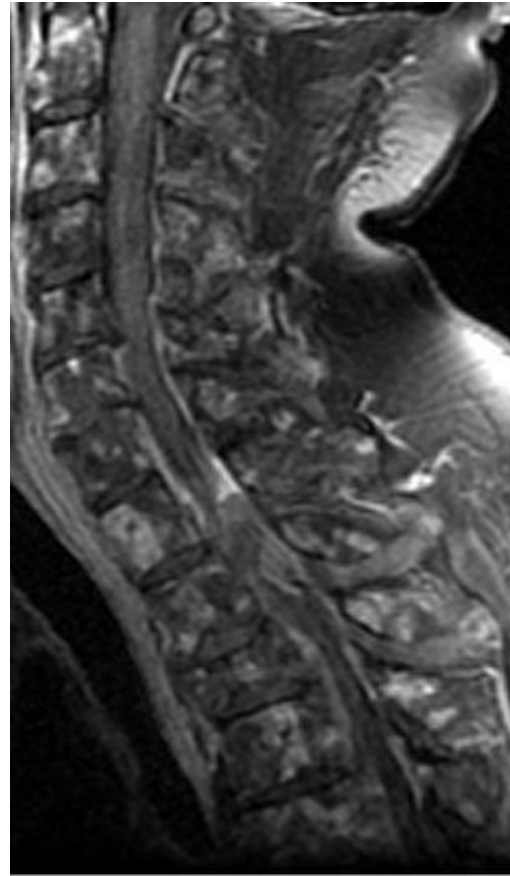
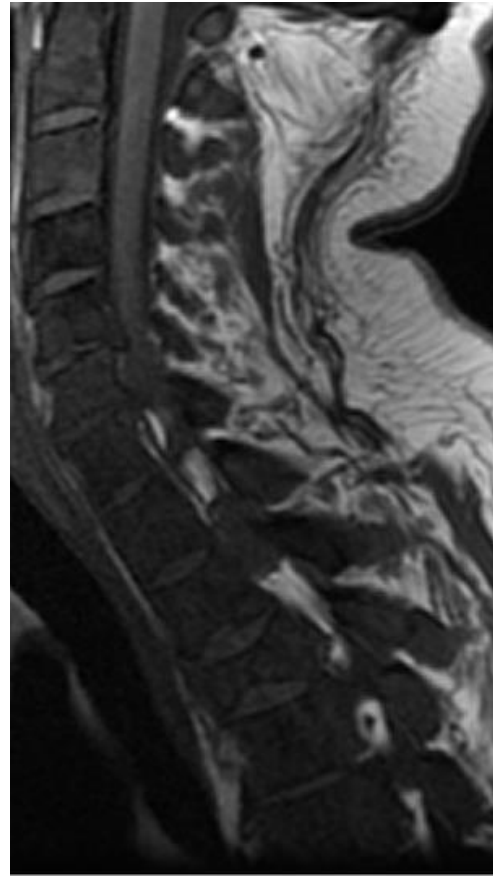
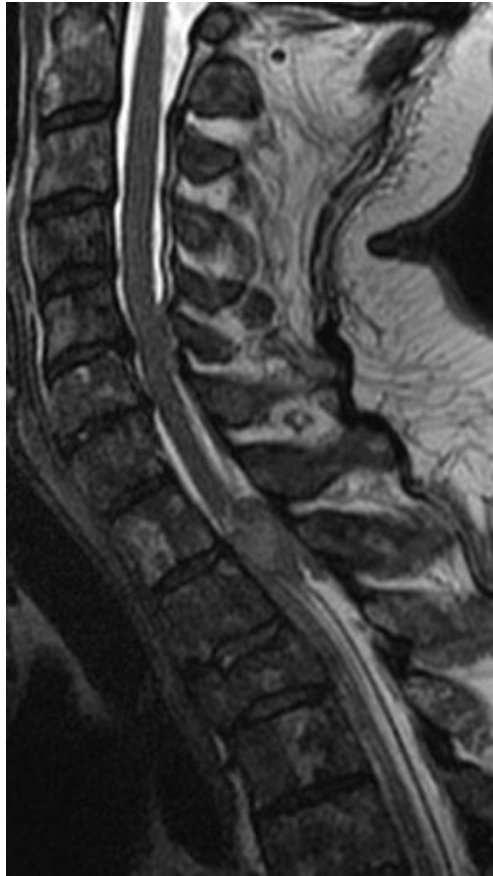
Why it matters

- Major cause of cord and nerve root compression
- Wide differentials:
 - Degenerative,
 - infectious,
 - neoplastic
 - hemorrhagic

Spinal Metastases

- 70% with terminal malignancy have spinal metastases
 - 5-10% of all cancer patients will develop spinal cord compression
 - Pain (most common), pathological fractures, radiculopathy and spinal cord compression

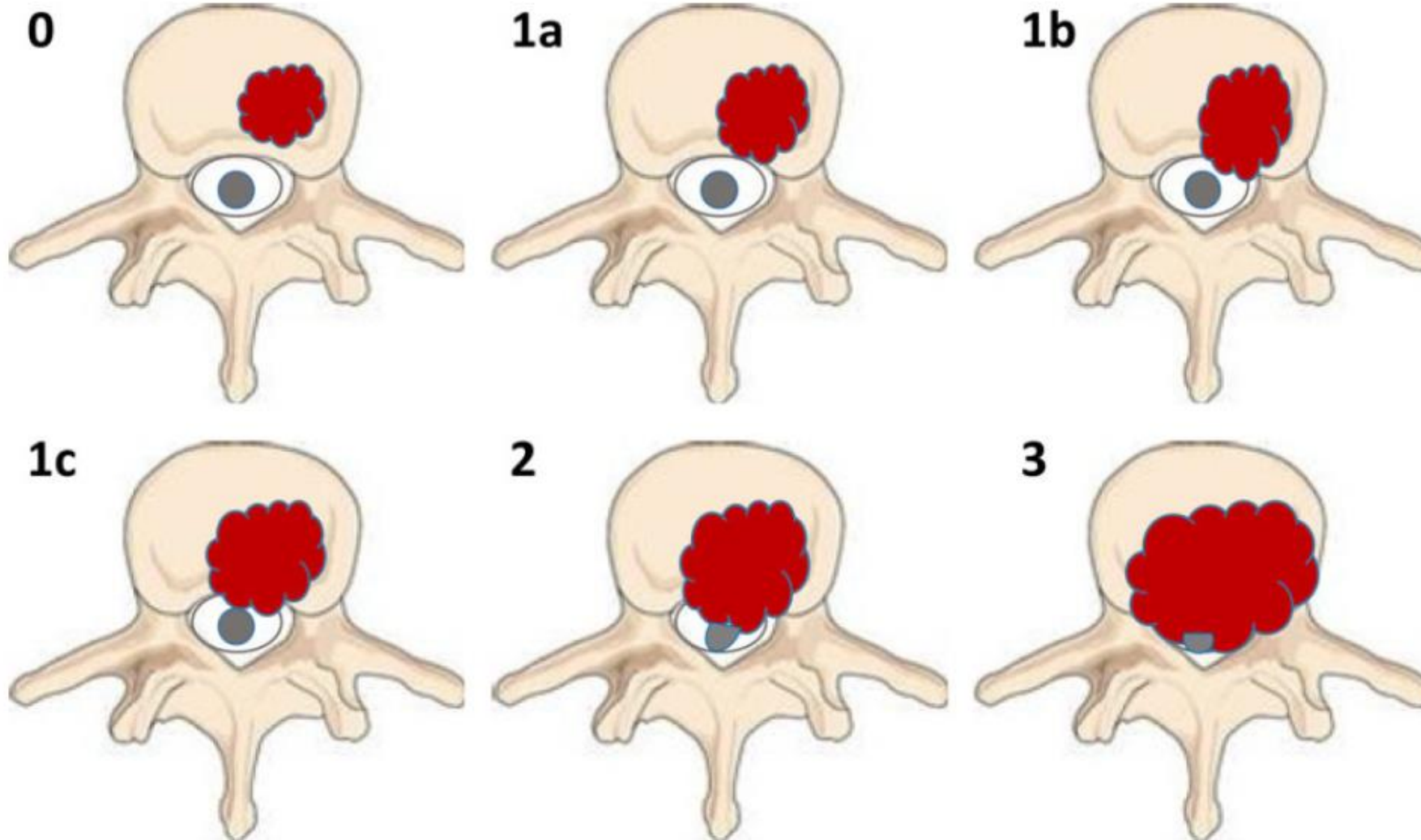
Epidural Metastasis



Bilsky Classification

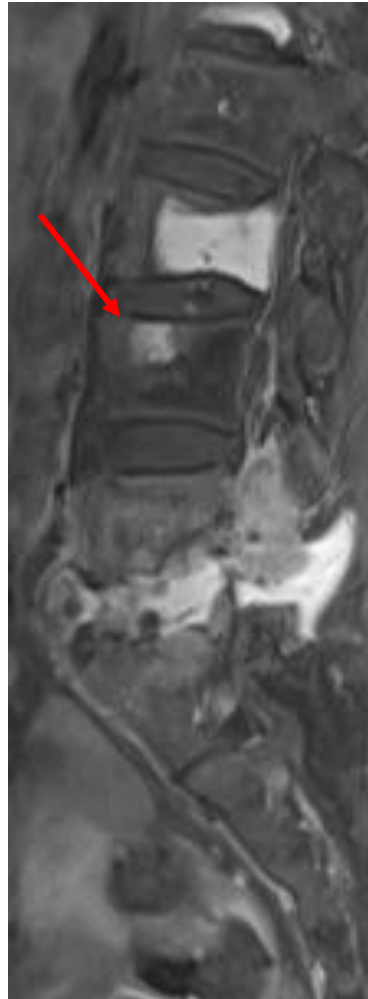
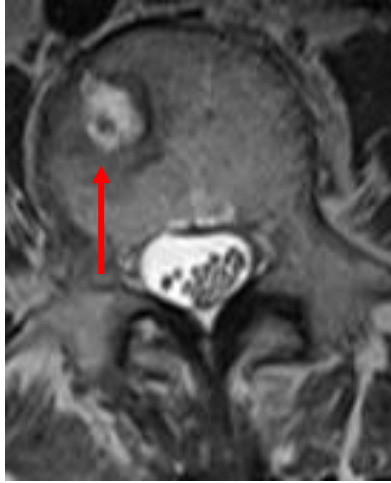
- Epidural spinal cord compression classification (ESCC)
 - MRI-based consensus 6-point classification scheme for degree of spinal cord compression
 - Expansion of 4-point surgical planning grading schemes
 - Axial T2-weighted sequences

Bilsky Classification



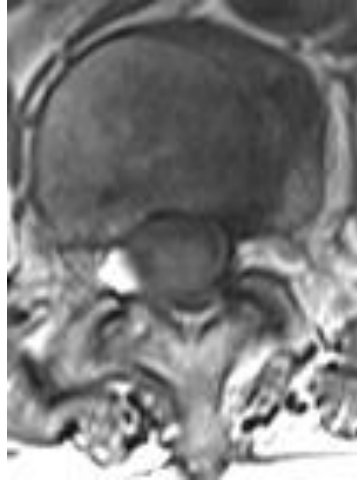
Tseng et al, Spine Stereotactic Body Radiotherapy, Indications, Outcomes and Points of Caution, Global Spine Journal, 7 (2), 179-197.

Bilsky Grade 0

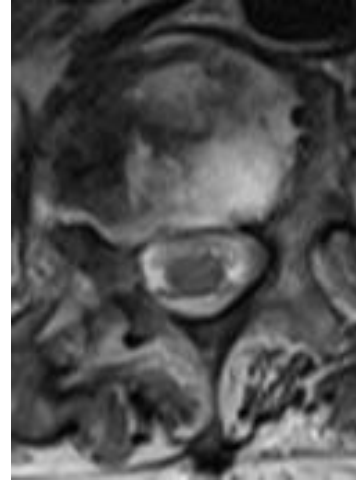


- Tumor confined to the vertebral body.
- Generally considered safe for stereotactic radiosurgery.
- First line radiotherapy

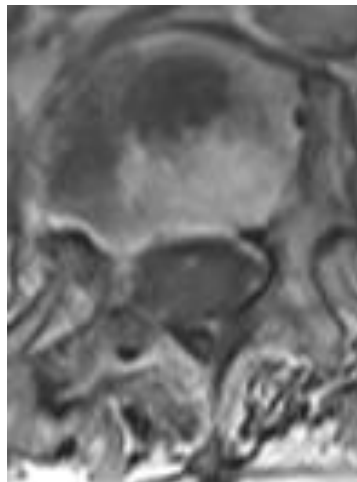
Bilsky Grade 1a



T1 pre



T2



T1 post



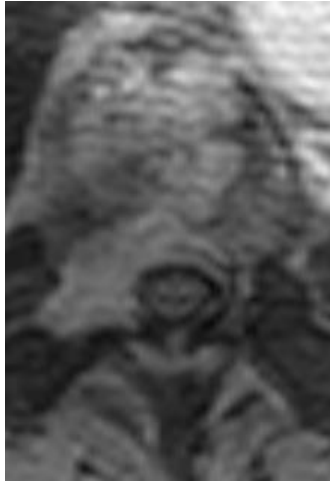
T1 post



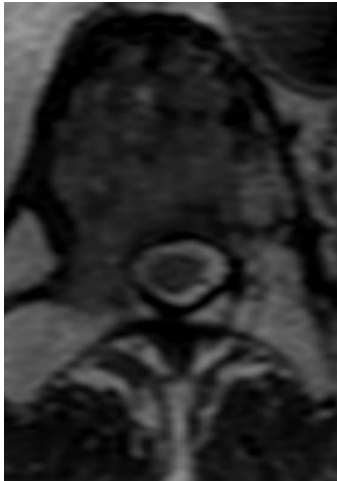
T1 post

- Tumor invade the epidural space, without impingement on the thecal sac.
- Generally considered safe for stereotactic radiosurgery, which is primary therapy.

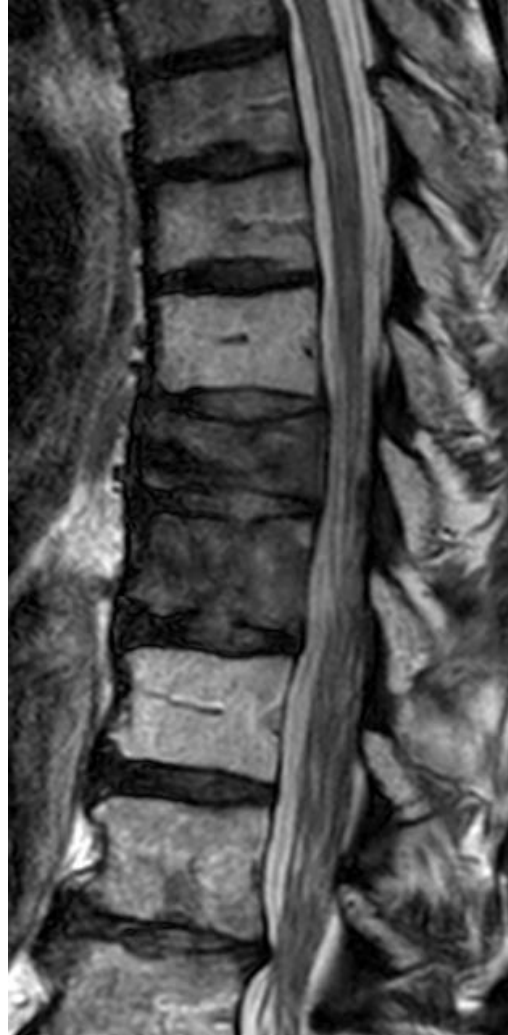
Bilsky Grade 1b



T1 post



T2



T2

- Tumor invades the epidural space, with impingement on the thecal sac without abutment of the spinal cord.
- Generally considered safe for stereotactic radiosurgery.
- Treated primarily with radiotherapy.

Bilsky Grade 1c



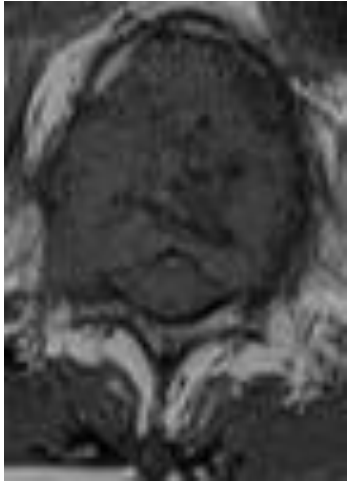
T1 post



T2

- Tumor invades the epidural space, deforms the thecal sac and abuts the spinal cord without compression.
- Concern for increased risk of cord injury with SBRT.

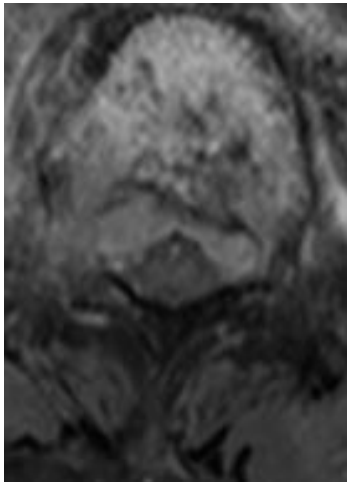
Bilsky Grade 2



T1 pre



T2



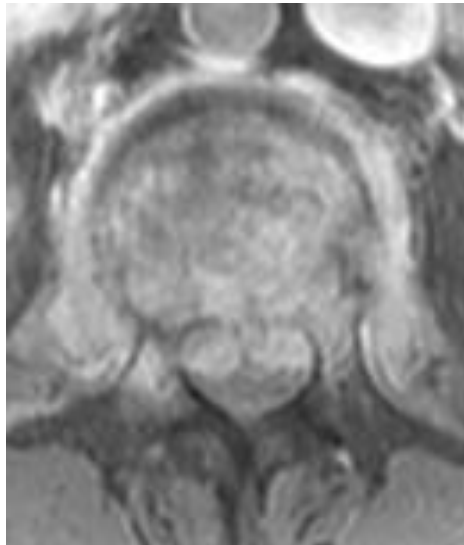
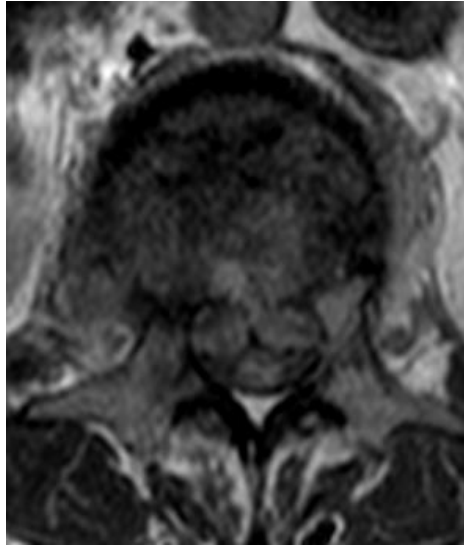
T1 post



T2

- Tumor invades the epidural space and compresses the spinal cord without subarachnoid space effacement.
- Concern for increased risk of cord injury with SBRT.
- Optimally managed with surgery before SBRT.

Bilsky Grade 3



- Spinal cord compression and complete effacement of the subarachnoid space.
- Primary consideration is for surgical management prior to radiotherapy.

Spinal Instability Neoplastic Score (SINS)

- Assessment for spinal stability
 - Based on symptoms, location, bone lesion characteristics, alignment, extent of collapse and posterior involvement
 - In addition to instability assessment, predictive of post-radiotherapy compression fractures

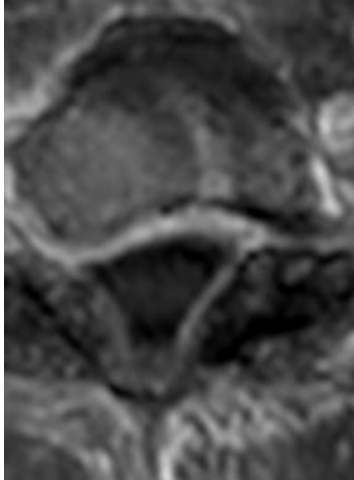
Fisher et al, A novel classification system for spinal instability in neoplastic disease: an evidence-based approach and expert consensus from the Spine Oncology Study Group, Spine (Phila Pa 1976). 2010 Oct 15;35(22):E1221-9.

	SINS Criteria	Score
Location	Junctional (occiput-C2, C7-T2, T11-L1, L5-S1)	3
	Mobile spine (C3-6, L2-4)	2
	Semirigid (T3-10)	1
	Rigid (S2-5)	0
Pain	Mechanical	3
	Occasional and non-mechanical	1
	No pain	0
Lesion Type	Lytic	2
	Mixed (lytic and blastic)	1
	Blastic	0
Spinal Alignment	Subluxation/translation	4
	Kyphosis/scoliosis	2
	Normal alignment	0
Vertebr involve/collapse	>50% collapse	3
	<50% collapse	2
	No collapse, >50% involved	1
	None of the above	0
Posterolateral involvement/fracture	Bilateral	3
	Unilateral	1

SINS

- Score stratification
 - Stable: 0-6
 - Indeterminate instability: 7-12
 - Unstable: 13-18
 - Surgical consult: ≥ 7

SINS



T1 post



CT



T1 post

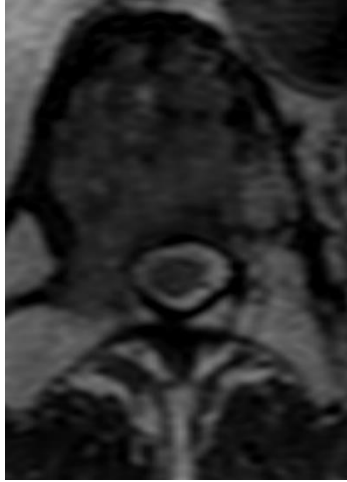


T2

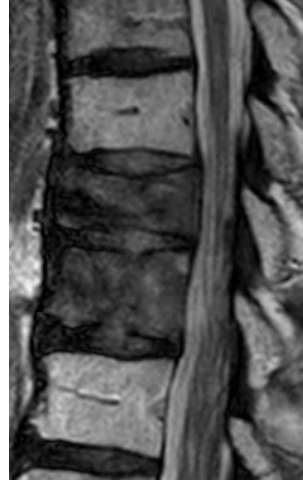
Category	Description	Score
Location	Junctional (C7)	3
Pain	None	0
Lesion Type	Lytic	2
Spinal Alignment	Normal	0
Inv/Collapse	<50% inv	0
Posterior Involvement	None	0

- Stable
- No surgical consultation needed for instability

SINS



T2



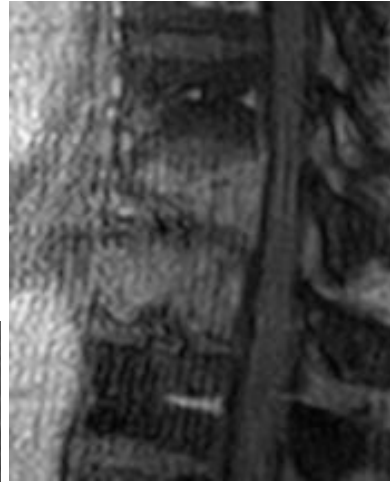
T2



T1 post



CT

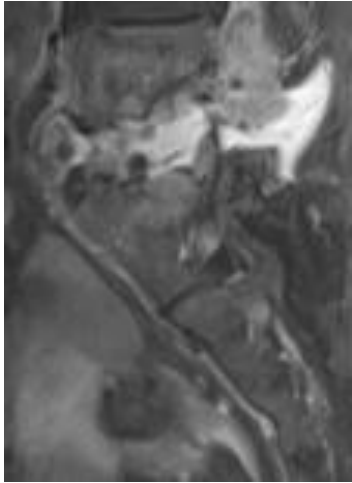


T1 post

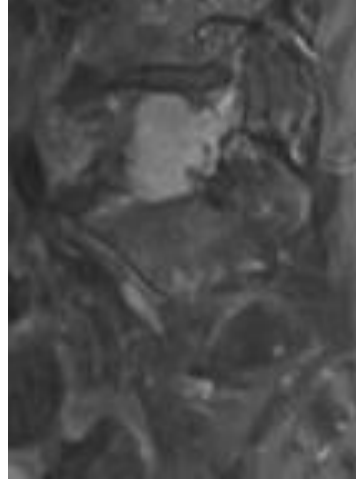
Category	Description	Score
Location	Semirigid (T10)	1
Pain	Nonmechanical	1
Lesion Type	Lytic	2
Spinal Alignment	Normal	0
Inv/Collapse	<50% collapse	2
Posterior Involvement	Unilateral	1

- Total: 7
- Potentially unstable
- Surgical consultation for potential or impending instability

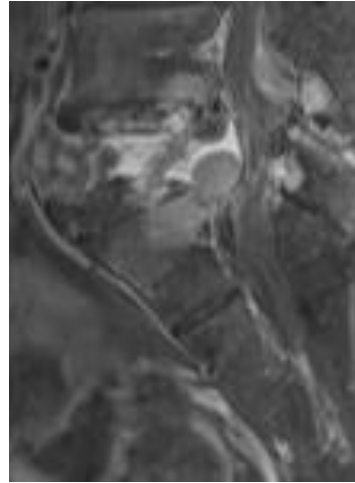
SINS



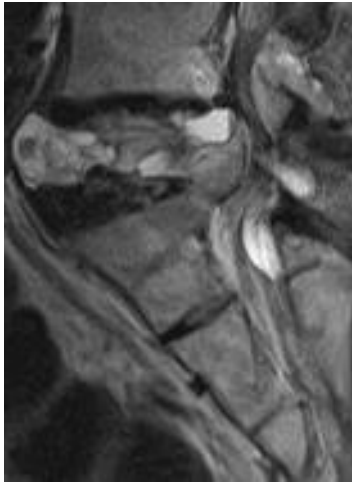
L T1 post



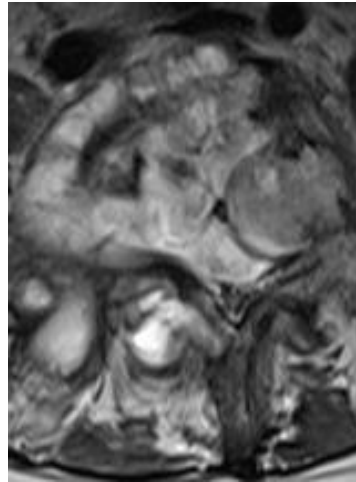
R T1 post



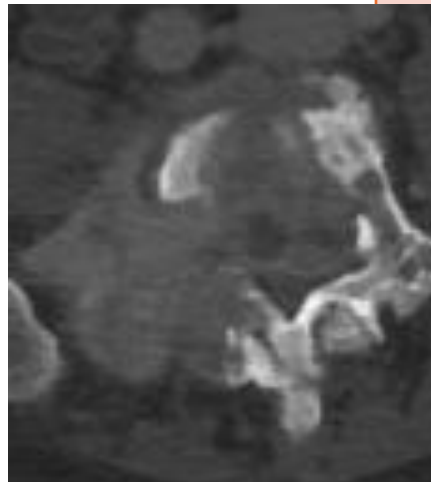
ML T1 post



Midline T2



T2



CT w contrast

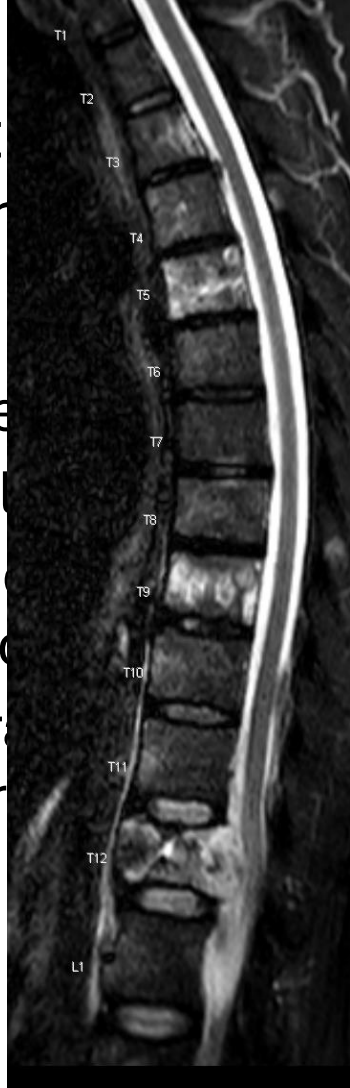
Category	Description	Score
Location	Junctional (L5)	3
Pain	Mechanical	3
Lesion Type	Lytic	2
Spinal Alignment	Normal	0
Inv/Collapse	>50% collapse	3
Anterior involvement	Bilateral	3

- Total: 14
- Unstable
- Surgical consultation

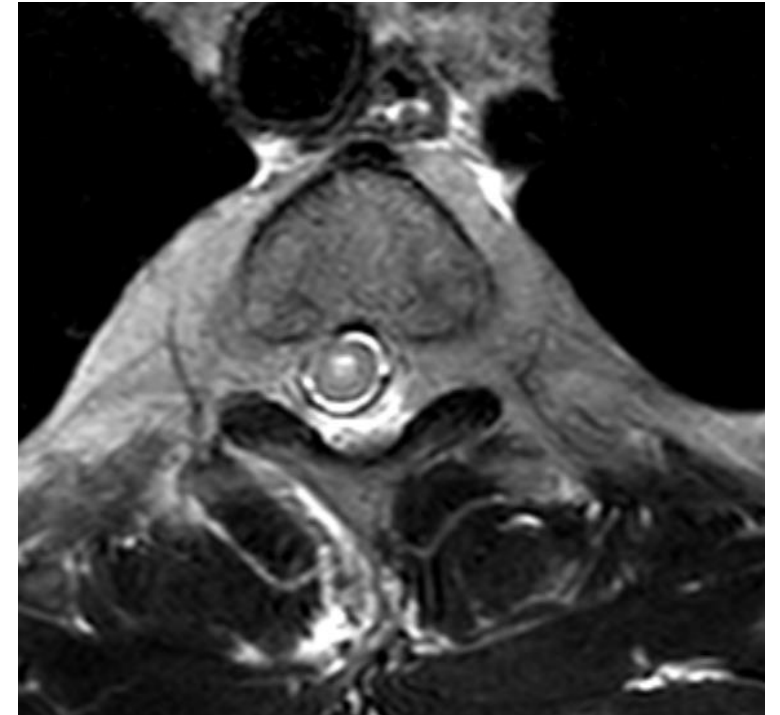
Standard Imaging Protocol for SRS Planning

- MRI
 - Volumetric and isotropic
 - 3D T2, T1 pre and fat-saturated post-gadolinium
 - Multiplanar reformation for fusion with planning CT
- CT
 - Myelography if hardware limits MR visualization of thecal sac/tumor
 - Thin-slice surgical planning CT

Multiple Myeloma

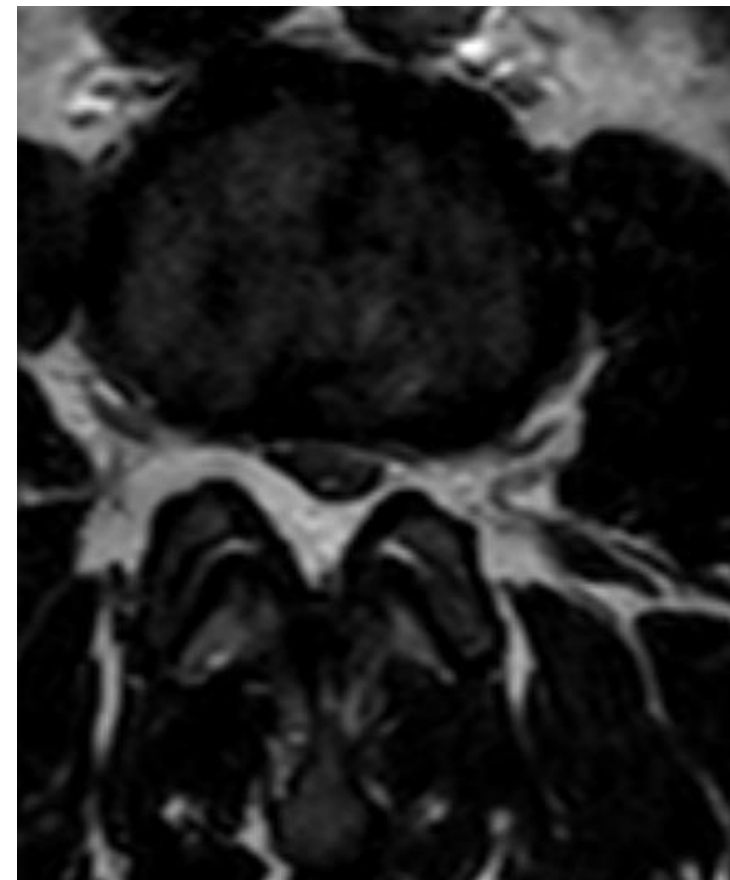
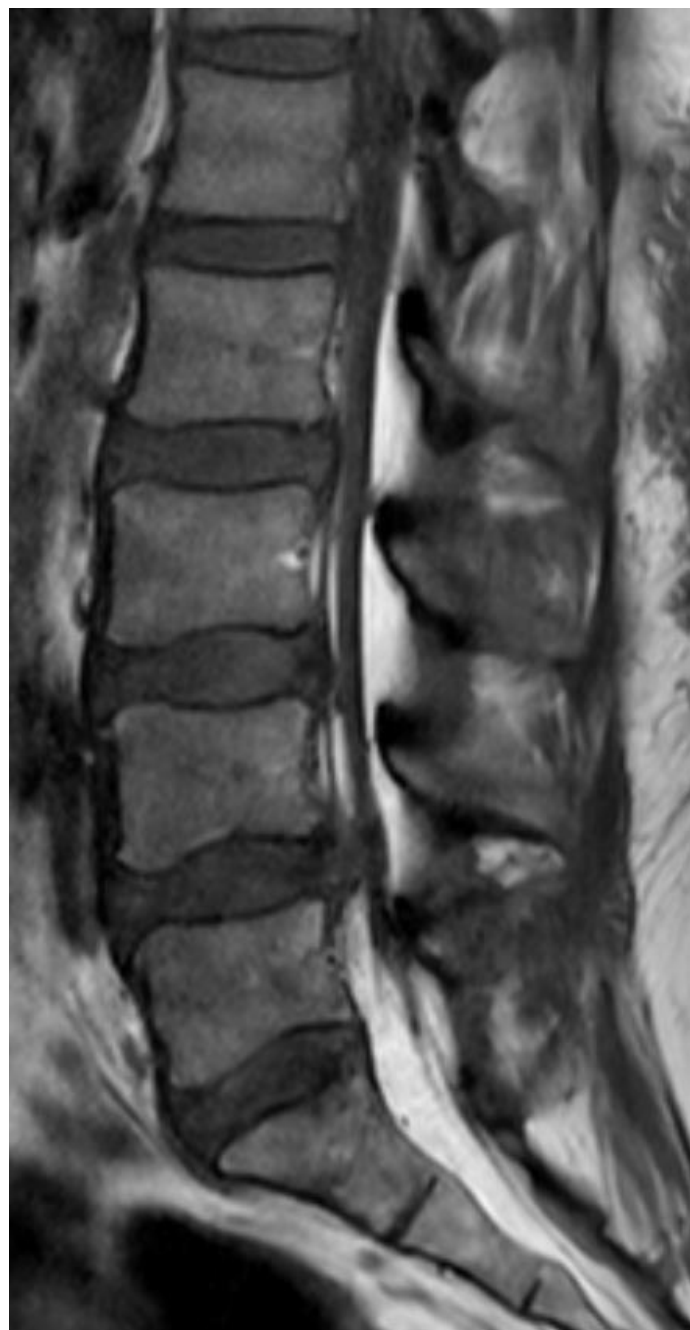


Chloroma

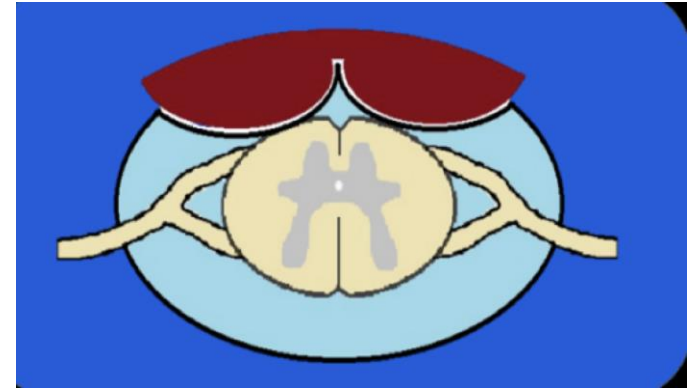
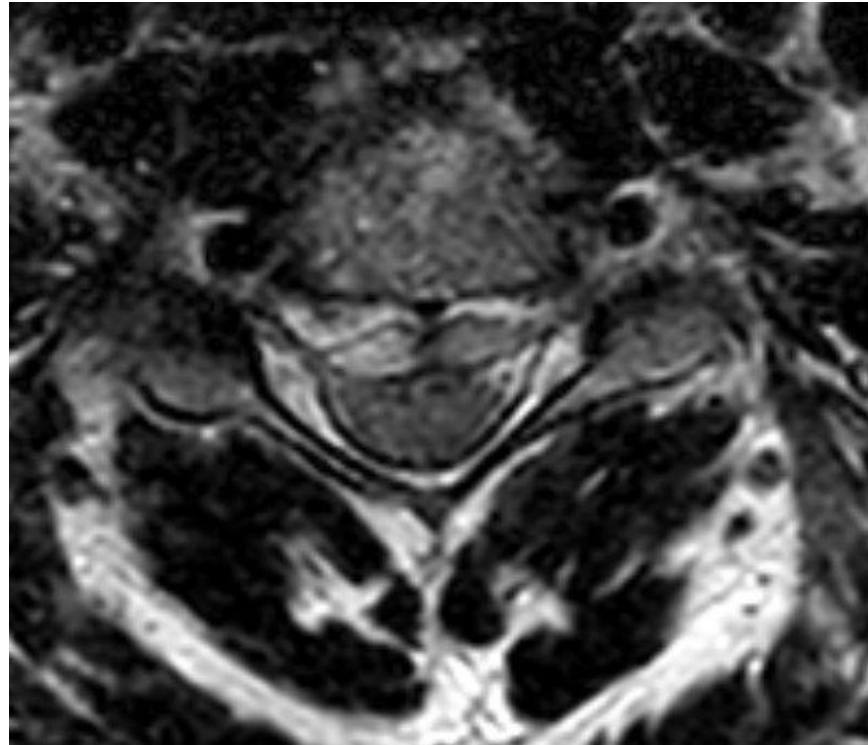


patient with known or suspected leukemia presenting with an enhancing epidural mass, always keep chloroma high on your differential

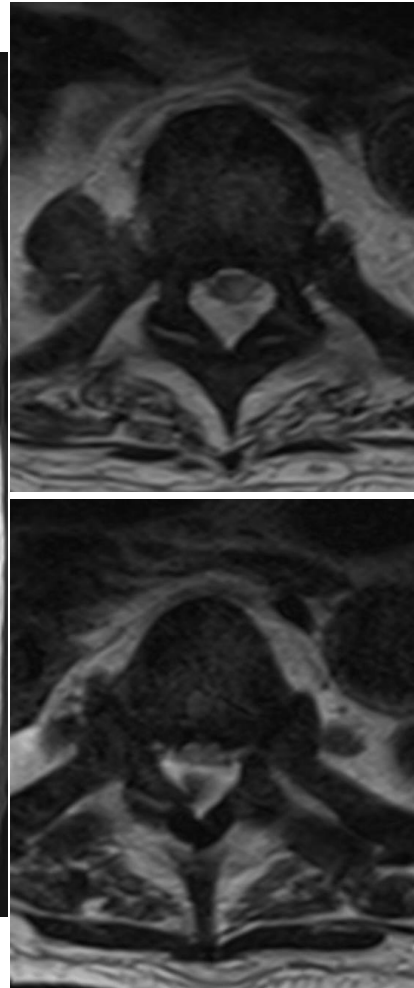
- Epidural lipomatosis



Epidural hematoma



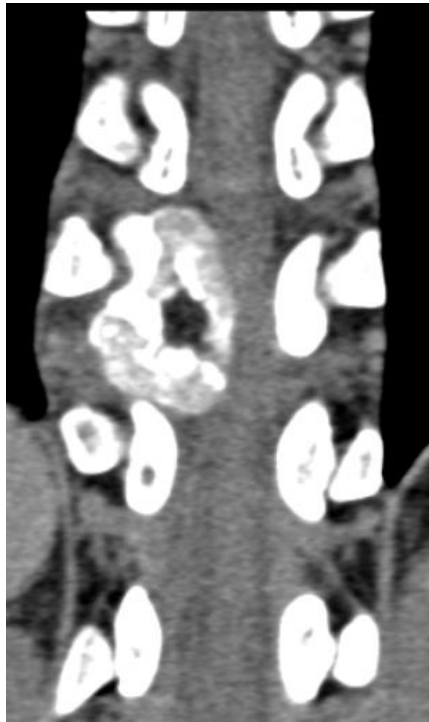
“Curtain Drape sign”

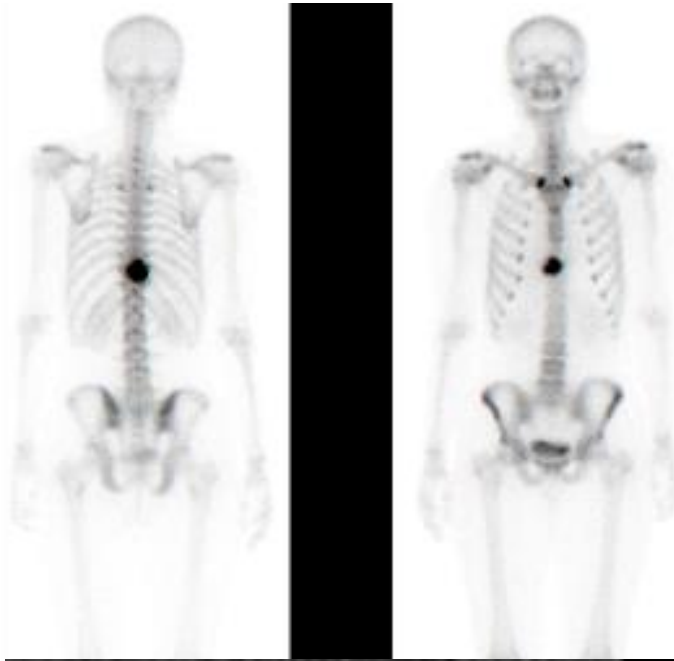


Epidural extramedullary hematopoiesis

- Very rare
- Occurs in myelodysplasia, myelofibrosis and sickle cell anemia
- Dorsal epidural lesions compress the spinal cord and present with myelopathy
- Same signal characteristics between epidural masses and vertebrae

Osteoblastoma





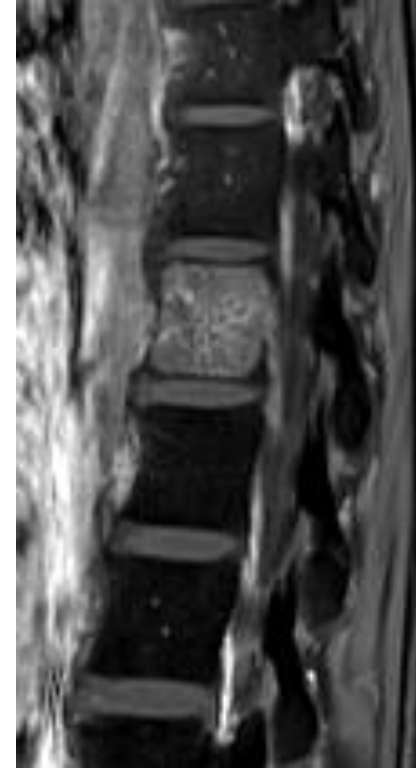
Osteoblastoma

- Rare, benign bone lesion
- Histologic relative of osteoid osteoma
- Presentation: Pain, Scoliosis
- Imaging
 - >2 cm in size
 - Expansile, lytic/sclerotic lesions
 - Surrounding sclerotic border
 - Very vascular
- Treatment
 - Excision/ablation

Hemangioma

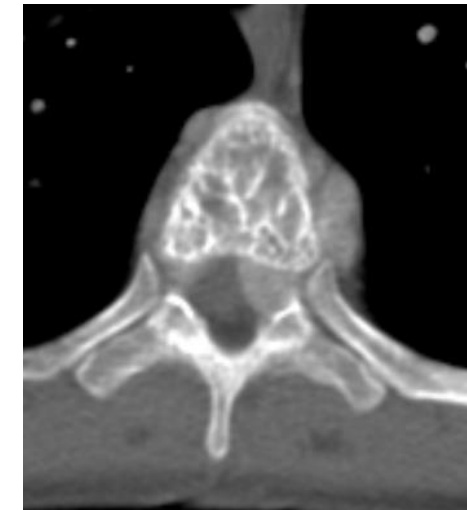
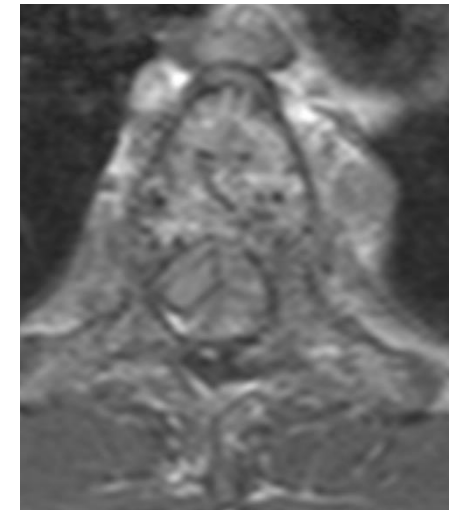
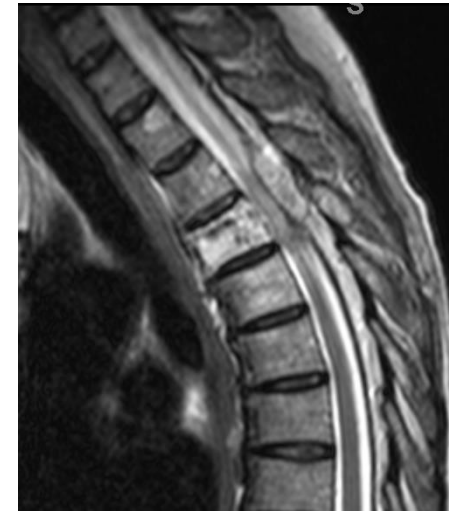


Atypical Hemangioma

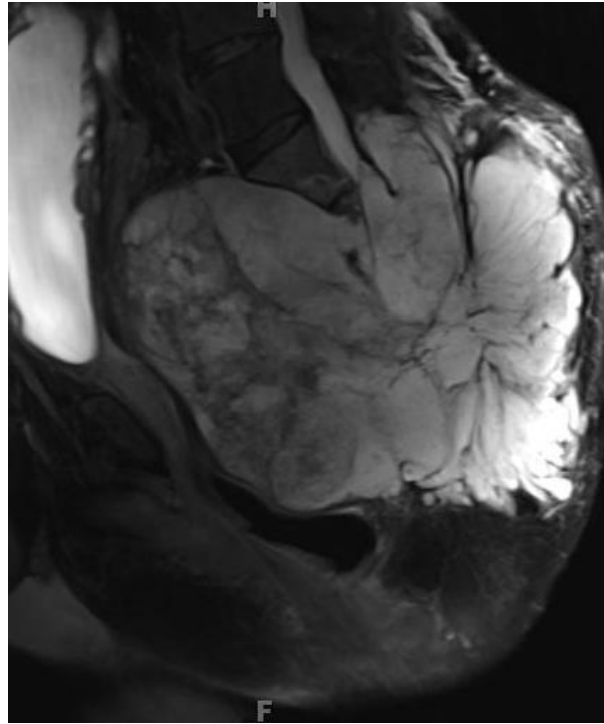


Aggressive Hemangioma

- Benign lesion
- Typically within vertebra but can extend to epidural/paravert
- Imaging appearance
 - Fat containing lesion
 - Thickened bony trabeculations
 - Enhances avidly
 - Can extend beyond cortical margins
- Treatment: radiation



Chordoma



- Locally destructive and invasive lesion
- Slow growing
- Commonly occur in sacrum and clivus
- Imaging:
 - T2 hyper, T1 hypo, enhance
 - Irregular calc within lesion (sequestered bone)

Midline mass + T2 “Brightest” signal –think of chordoma

Long segment extradural lesions



3 different cases of T2-bright epidural lesions.

Extradural: Enhancement Pattern

The enhancement pattern is key when differentiating extradural lesions



Central
(Tumor)



Peripheral
(Abscess)



None
(Hematoma)

Red Flags

- Cord compression
- Epidural abscess or hematoma
- Rapid neurological decline
- Oncology patient with back pain

Reporting check list

- Exact level and location
- Cause of compression
- Degree of canal compromise
- Cord signal change
- Epidural /paraspinal extension
- Urgency of findings

Takeaway points

- Identify pathological fracture and cord compression in metastasis.
- Curtain drape sign: epidural hematoma
- Peripheral rim enhancing collection: abscess
- Midline tumor with T2 brightest signal: think of chordoma

Thank you!