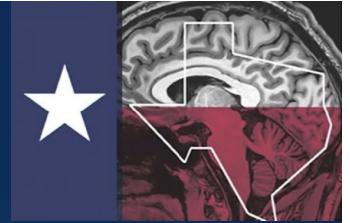


Texas Society of Neuroradiology Annual Meeting
February 21-22, 2026



From Detection to Decision: Multimodality Imaging and Prognostic Scoring in Spinal Metastatic Disease

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Disclosures

- Financial Relationships:
 - None
- Off Label Use:
 - None
- Published Material
 - Book Chapter (in press): Yusufzai O, Khan J, Singh JK, Fung SH. Imaging metastatic spine disease. In *Metastatic Spine Disease: A Guide to Diagnosis and Management, 2nd ed.* Marco RAW, Schwab JH, Ed. Berlin: Springer; 2026.

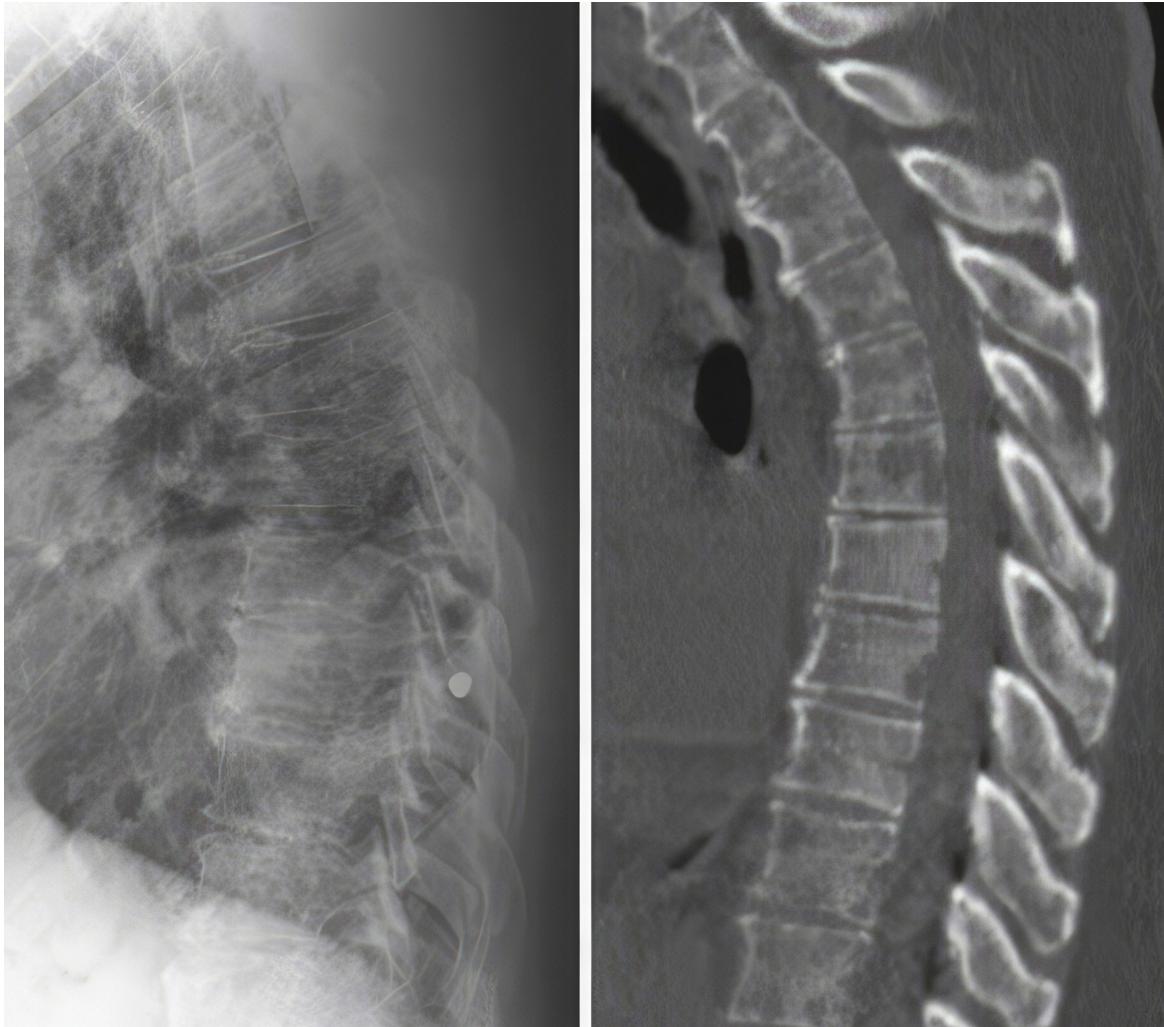
Objectives

1. Compare strengths and limitations of radiography, CT, MRI, and nuclear medicine studies in spinal metastases.
2. Review assessment of spinal stability and neurologic risk using SINS and ESCC.

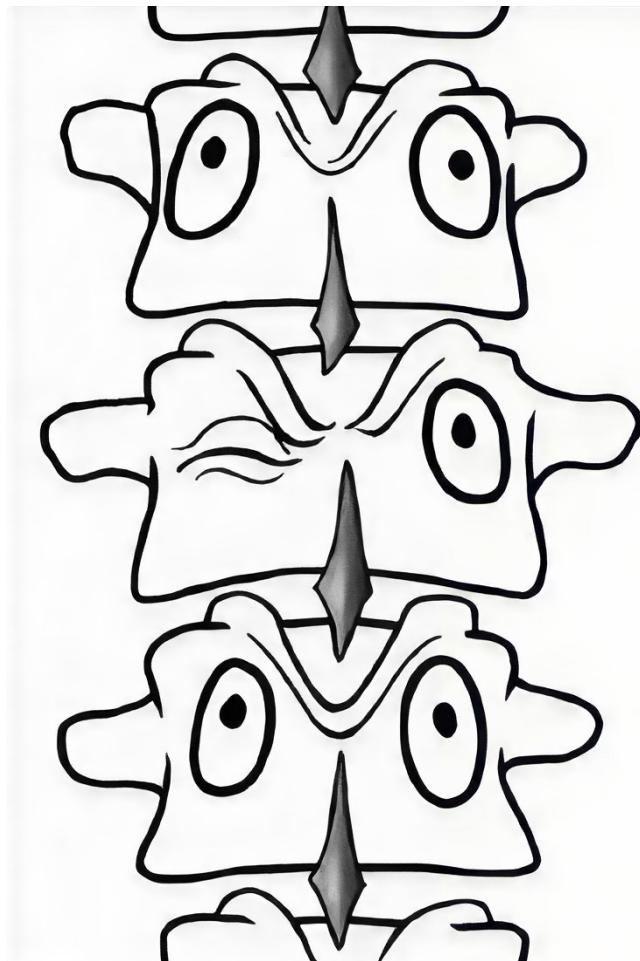
Radiography & CT

- Radiography:
 - Low sensitivity (\approx 44–50%); lytic lesions often occult, blastic lesions more conspicuous
 - Useful for fractures and alignment
- CT:
 - Superior cortical detail; defines matrix and lesion margins; ~73% sensitivity
 - Limited marrow evaluation
 - CT myelography useful when MRI contraindicated

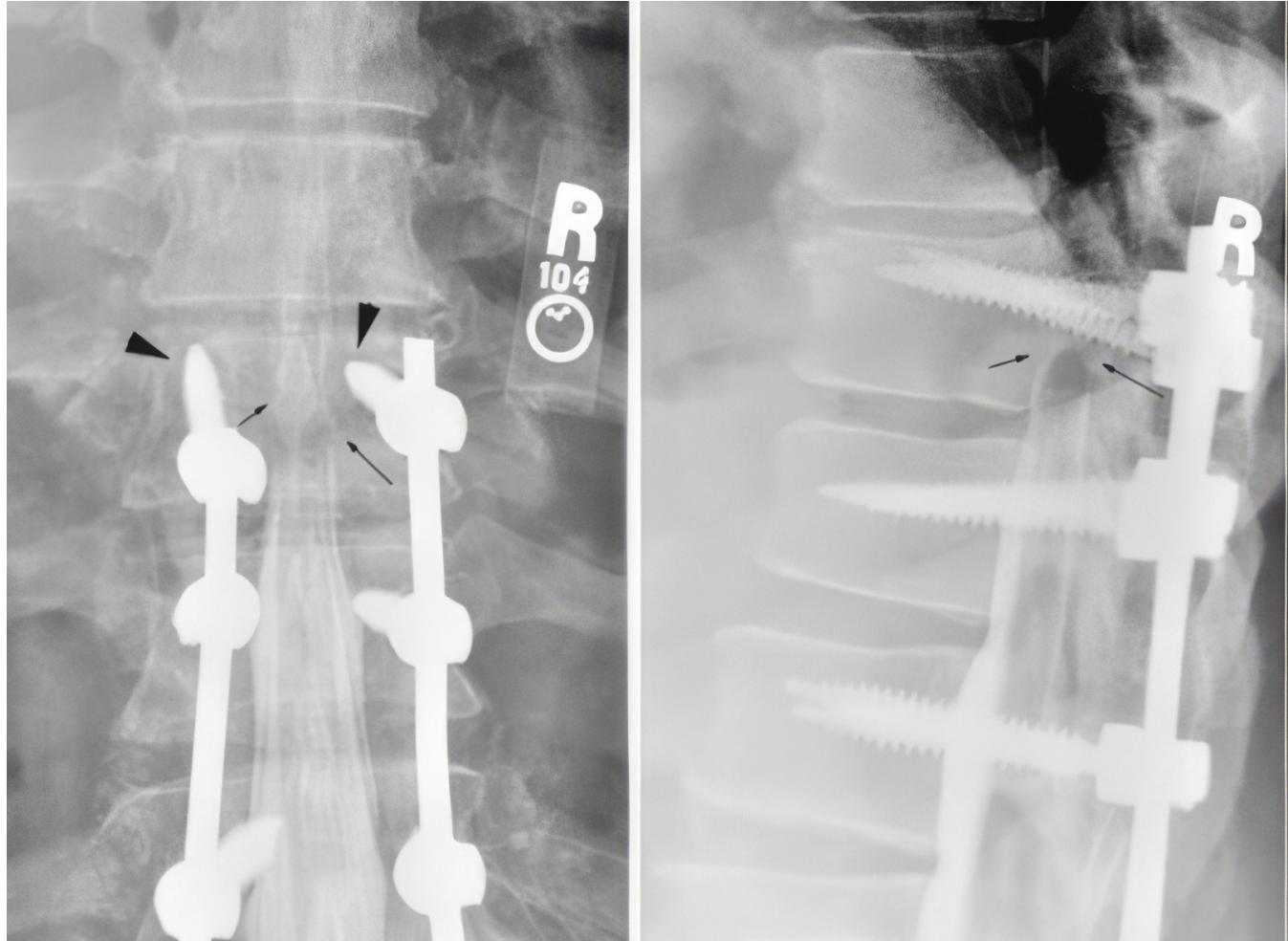
Radiography vs CT



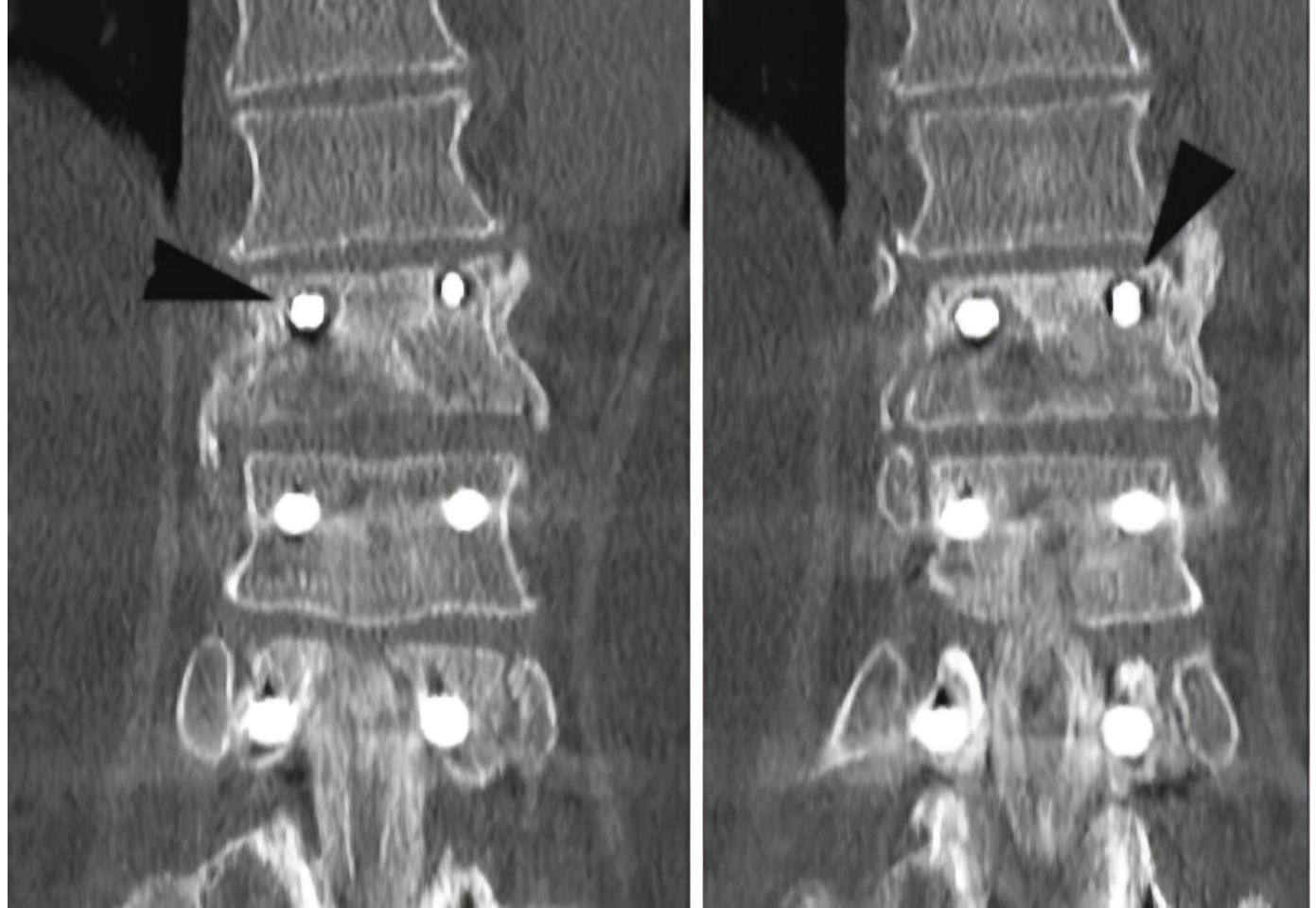
"Winking Owl" Sign



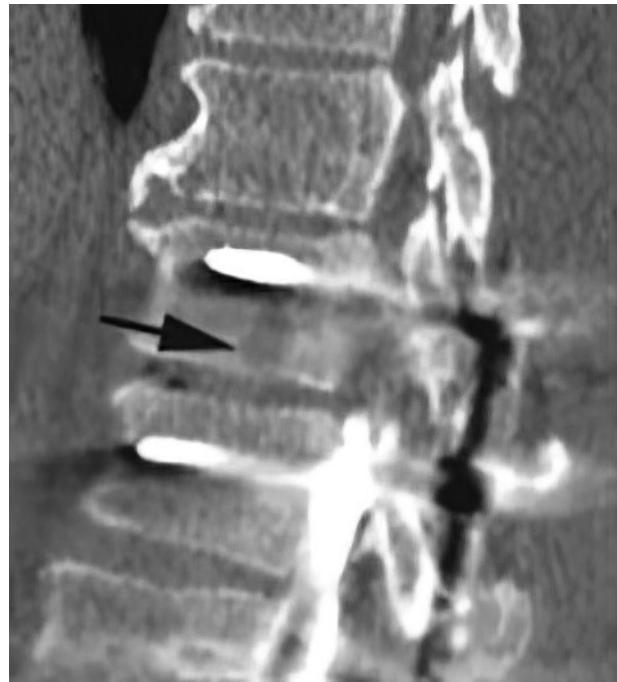
**60-year-old
male with
progressive
back pain**



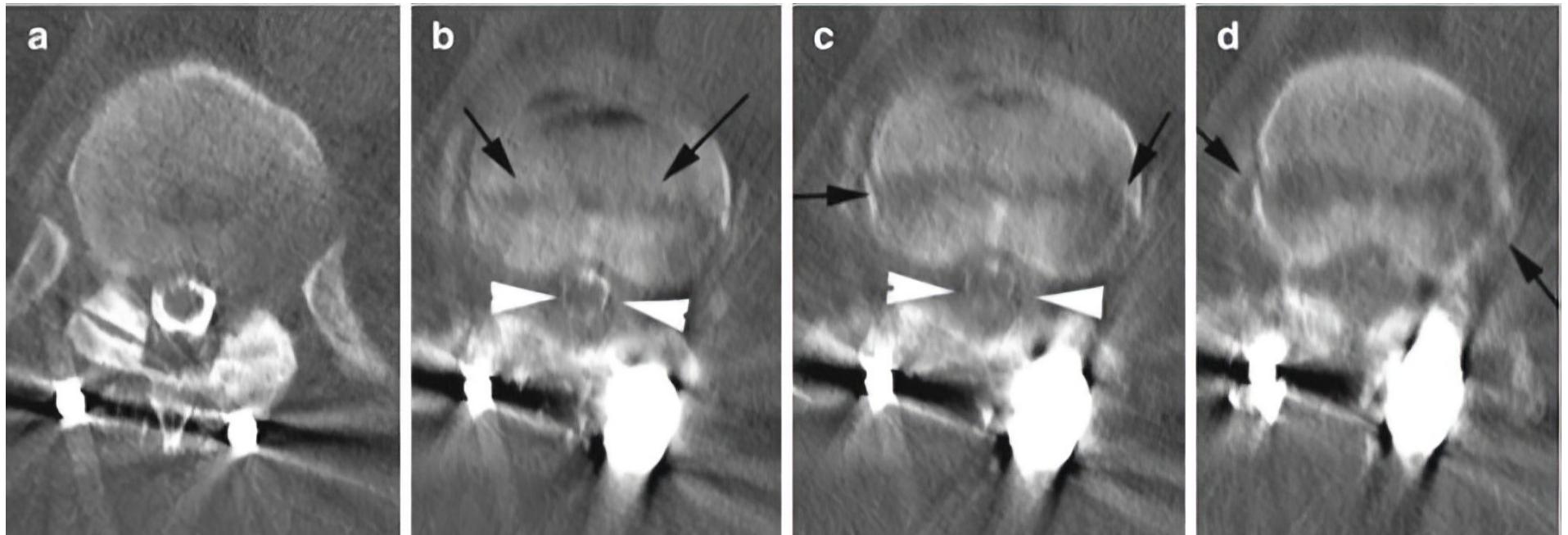
**60-year-old
male with
progressive
back pain**



60-year-old male with progressive back pain



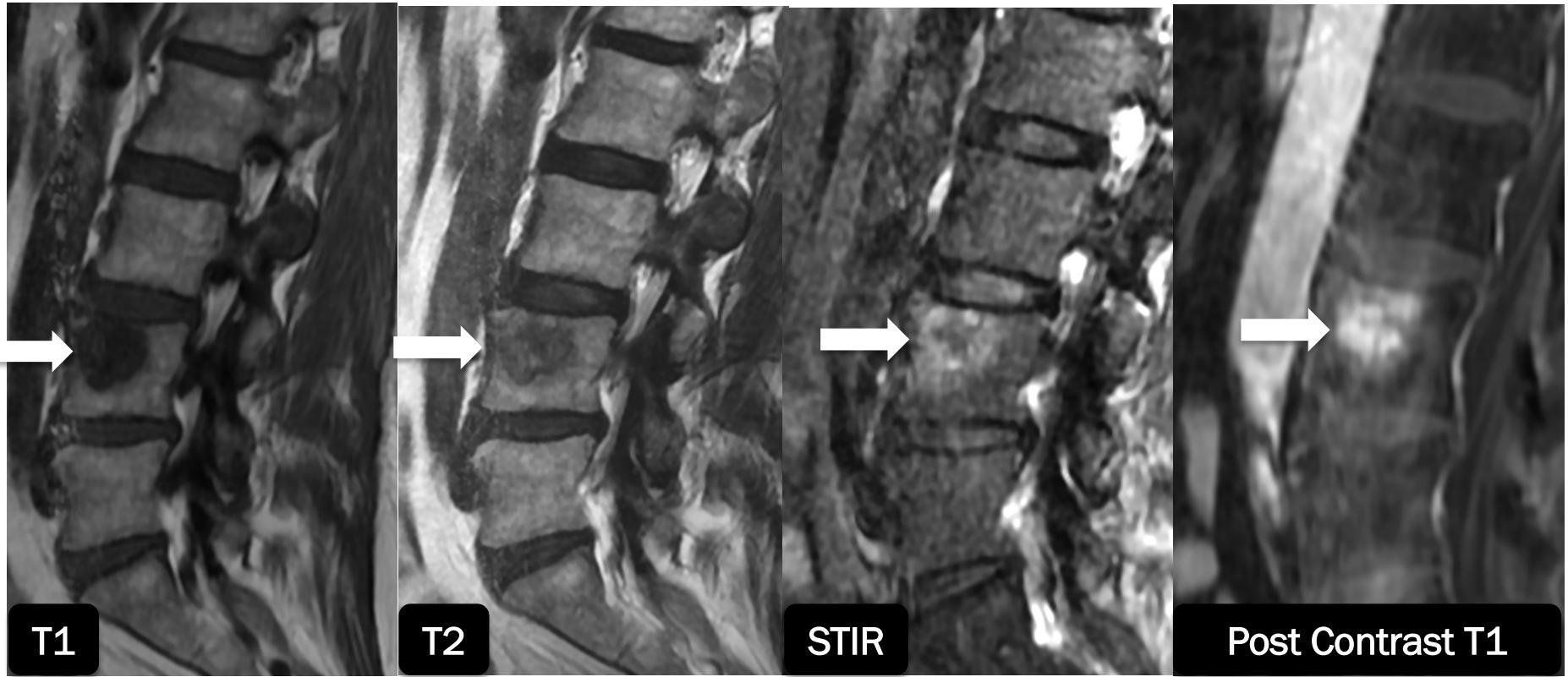
60-year-old male with progressive back pain



Magnetic Resonance Imaging

- Most sensitive/specific modality (~90%/96%); detects marrow, epidural, and cord involvement
- Most mets are T1 hypointense, ± T2/STIR hyperintense, and usually enhance
- Pure osteoblastic mets (e.g., prostate) may be T2/STIR hypointense and not enhance
- Best for cord compression
- Some limitations (artifacts, incompatible devices)

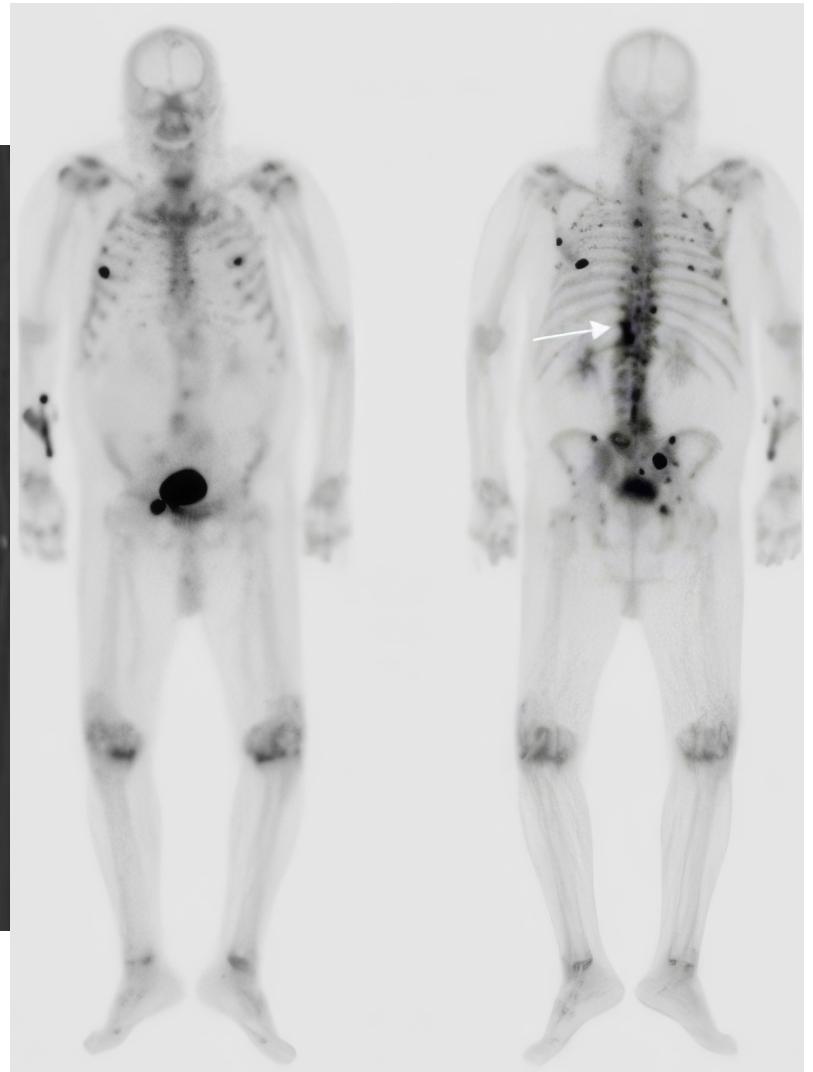
51 y/o female with breast cancer



Bone Scintigraphy & SPECT

- Whole-body Tc-99m bone scan; reflects osteoblastic activity
- False negatives in myeloma/aggressive lytic tumors; false positives & flare phenomenon
- Sensitivity ~78% (\uparrow to ~87% with SPECT)

**79 y/o
male with
prostate
cancer**



"Superscan"



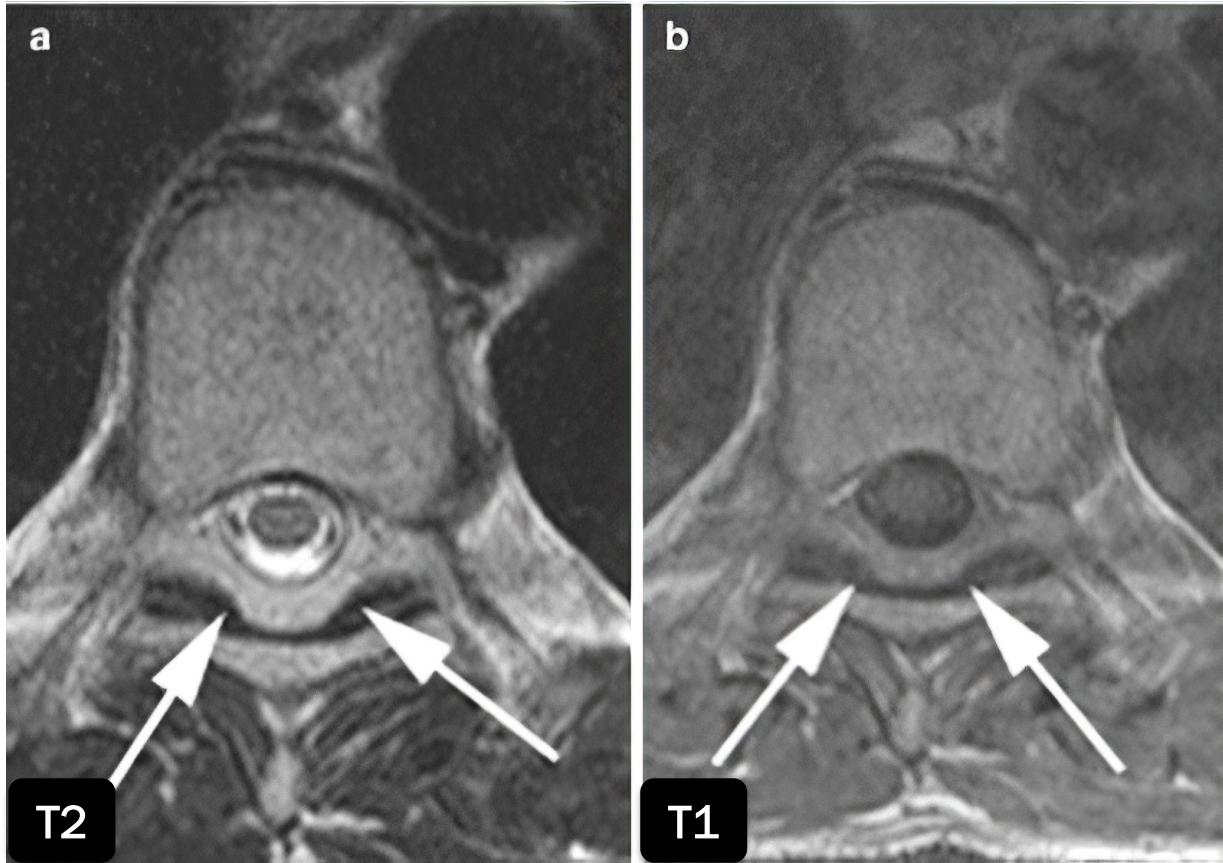
Positron Emission Tomography

- PET detects metabolic activity; common tracers: FDG and NaF
- NaF → osteoblastic activity; FDG → metabolically active tumor
- High sensitivity (~90% and ~97% with PET/CT fusion)

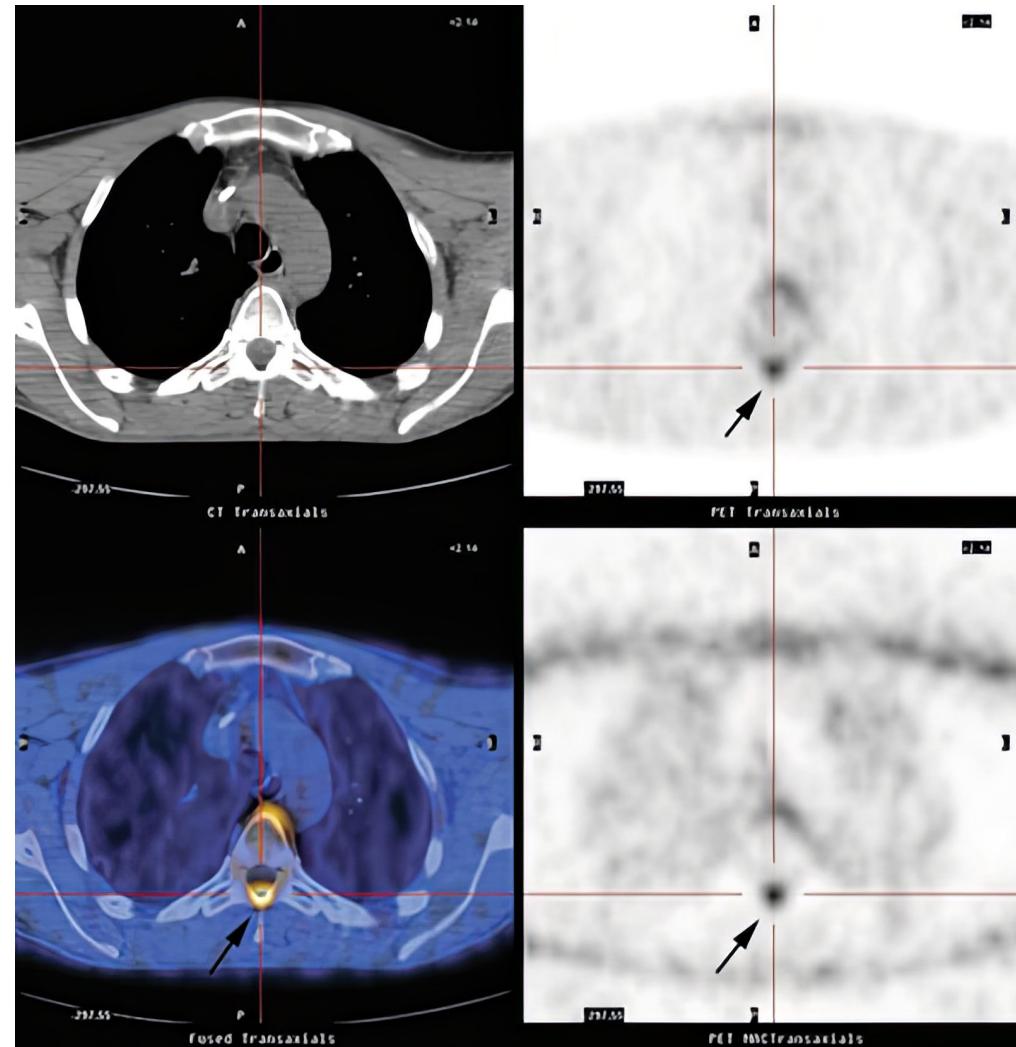
41 y/o male with back pain



41 y/o male with back pain



41 y/o male
with back pain



Spinal Instability Neoplastic Score

HOUSTON
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LEADING MEDICINE

Location

- 0 points:** Rigid (S2-S5)
- 1 point:** Semi-rigid (T3-T10)
- 2 points:** Mobile spine (C3-C6, L2-L4)
- 3 points:** Junctional (occiput-C2, C7-T2, T11-L1, L5-S1)

Pain

- 0 points:** No pain
- 1 point:** Occasional pain (not mechanical)
- 3 points:** Mechanical pain or relief with rest

Type of Lesion

- 0 points:** Blastic
- 1 point:** Mixed
- 2 points:** Lytic

Spinal Alignment

- 0 points:** Normal
- 2 points:** De novo deformity (kyphosis/scoliosis)
- 4 points:** Subluxation/translation

Vertebral body collapse

- 0 points:** No collapse
- 1 point:** No collapse, but >50% involvement
- 2 points:** <50% collapse
- 3 points:** >50% collapse

Posterior element involvement

- 0 points:** None
- 1 point:** Unilateral
- 3 points:** Bilateral

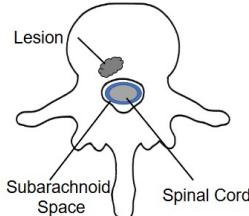
Total Score

- <6 = stable**
- 7-12 = potentially unstable**
- 13-18 = unstable**

Epidural Spinal Cord Compression (ESCC) scale

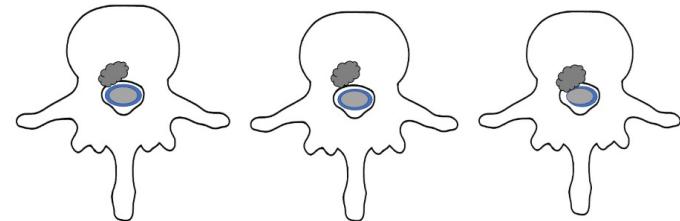
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Grade 0: Bone-only disease



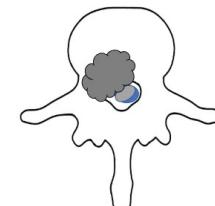
Grades 1a, 1b, 1c:

- 1a: Epidural extension only.
- 1b: Deformation of the thecal sac, without cord abutment
- 1c: Deformation with cord abutment



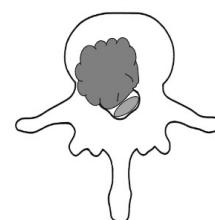
Grade 2:

Spinal cord compression, with CSF visible around the cord

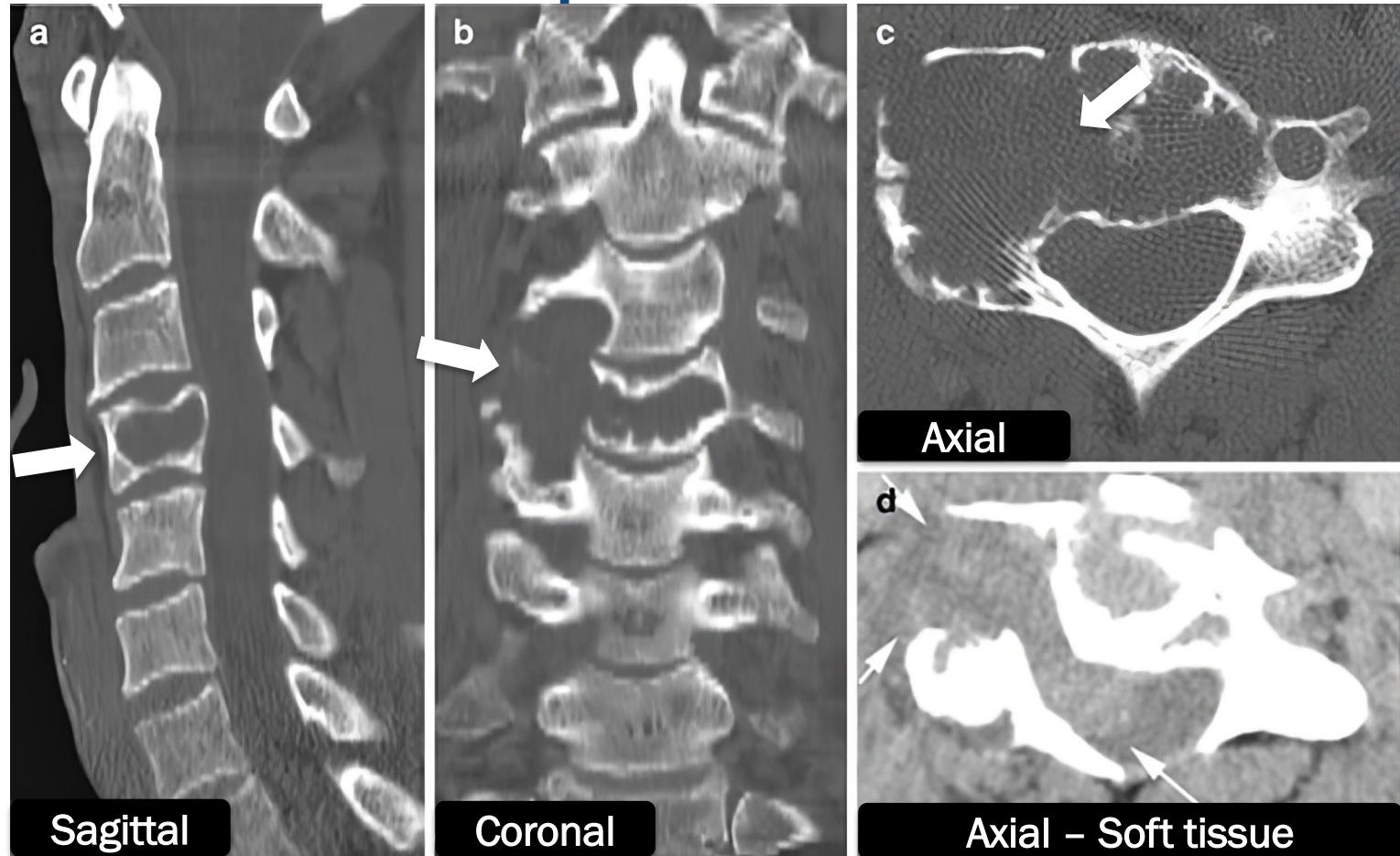


Grade 3:

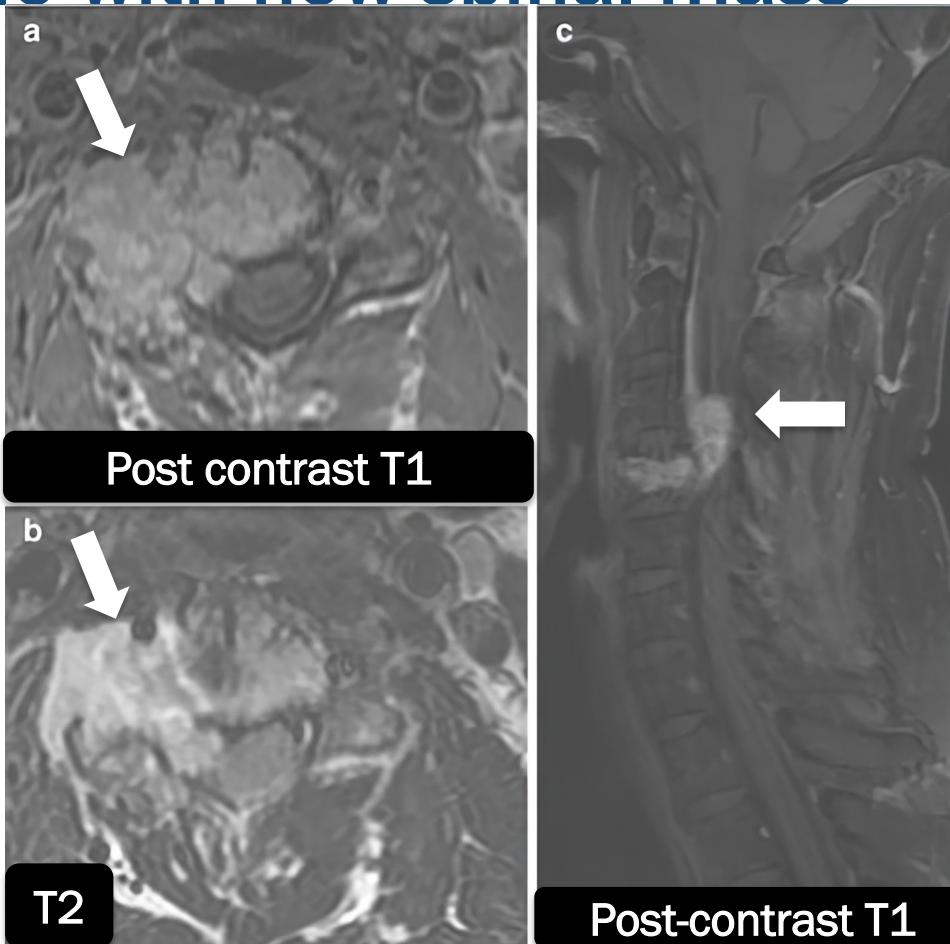
Spinal cord compression, no CSF visible around the cord



42 y/o male with new spinal mass



42 y/o male with new spinal mass



42 y/o male with new spinal mass

Spinal Instability Neoplastic Score

Location	2 (C3-C6 mobile spine)
Type of Lesion	2 (lytic lesion)
Spinal Alignment	2 (de novo kyphosis)
Vertebral Body Collapse	2 (<50% collapse)
Posterior Element	1 (unilateral involvement)
Imaging SINS	9
+ Pain	0 (none), 1 (occasional), 3 (mechanical)
Total SINS	9-12 (potentially unstable)

Epidural Spinal Cord Compression Score

Grade 3 (spinal cord compression w/o visible CSF)

Key Points

- MRI: best for marrow, epidural, cord involvement
- CT: cortical detail, fractures, tumor matrix
- Bone scan / PET: whole-body staging and lesion specificity
- SINS & ESCC: spine stability and cord compression grading

References

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2. Yang HL, et al. Diagnosis of bone metastases: a meta-analysis comparing (18)FDG PET, CT, MRI and bone scintigraphy. *Eur Radiol*. 2011;21(12):2604–17.
3. Fisher CG, et al. Reliability of the spinal instability neoplastic scale among radiologists: an assessment of instability secondary to spinal metastases. *AJR Am J Roentgenol*. 2014;203(4):869–74.
4. Bilsky MH, et al. Reliability analysis of the epidural spinal cord compression scale. *J Neurosurg Spine*. 2010; 13:324–8.