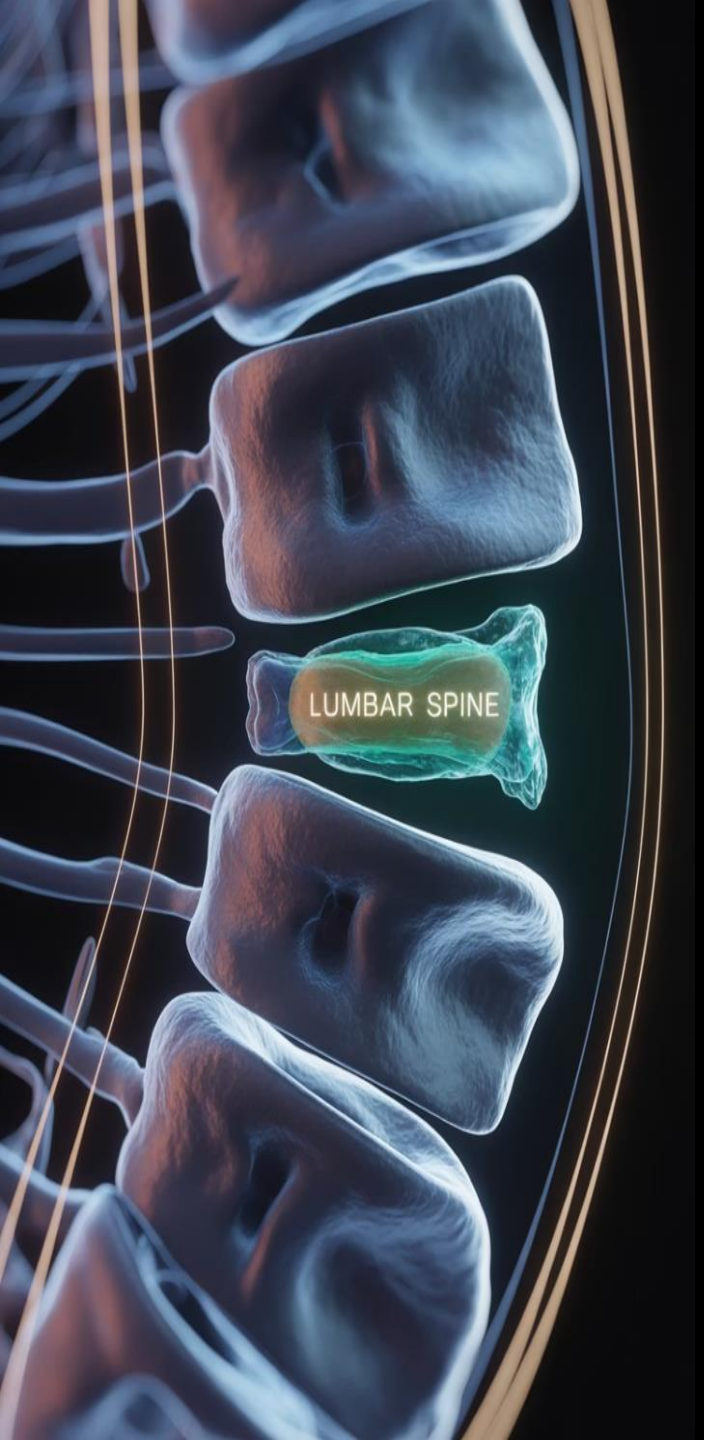

Imaging in Atraumatic Back Pain

I Made Dwijaputra Ayusta

ANNUAL SCIENTIFIC MEETING NEURORADIOLOGY HEAD AND NECK XXI,
Claro Hotel and Convention Center Makassar, May, 22-24th 2025

Kemenkes
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Salam Sehat...

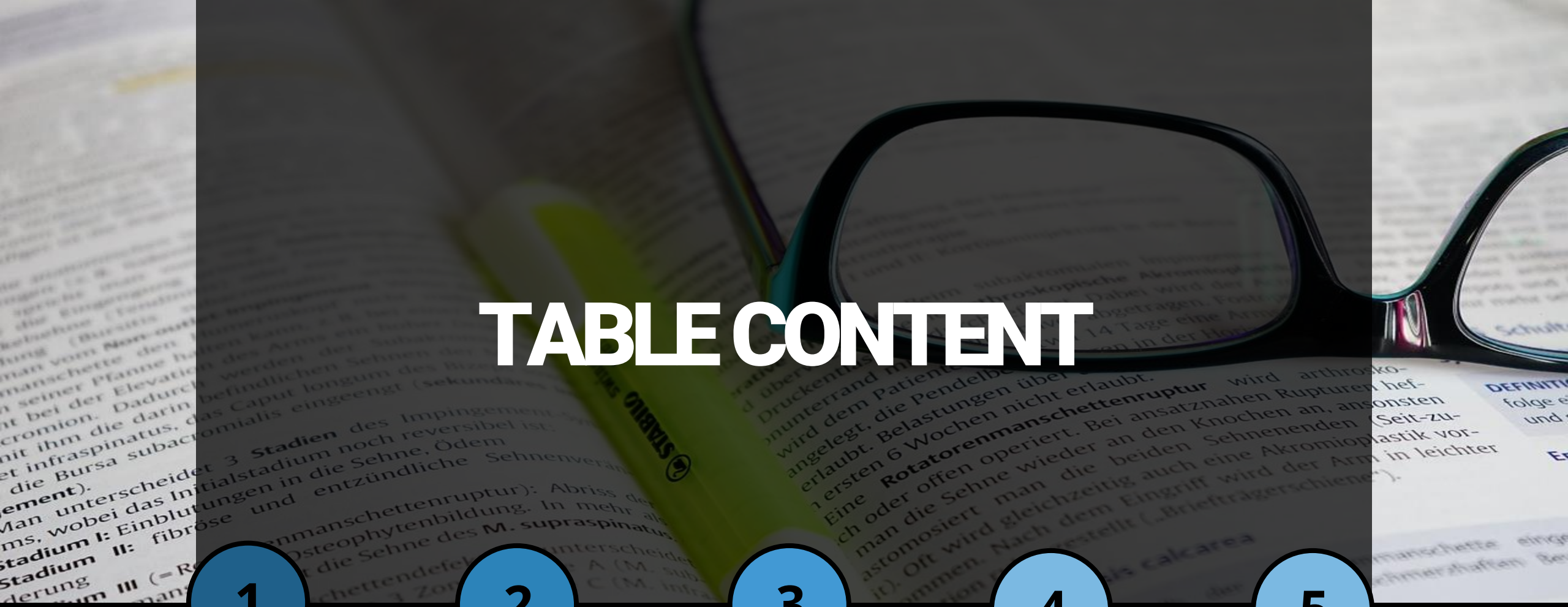
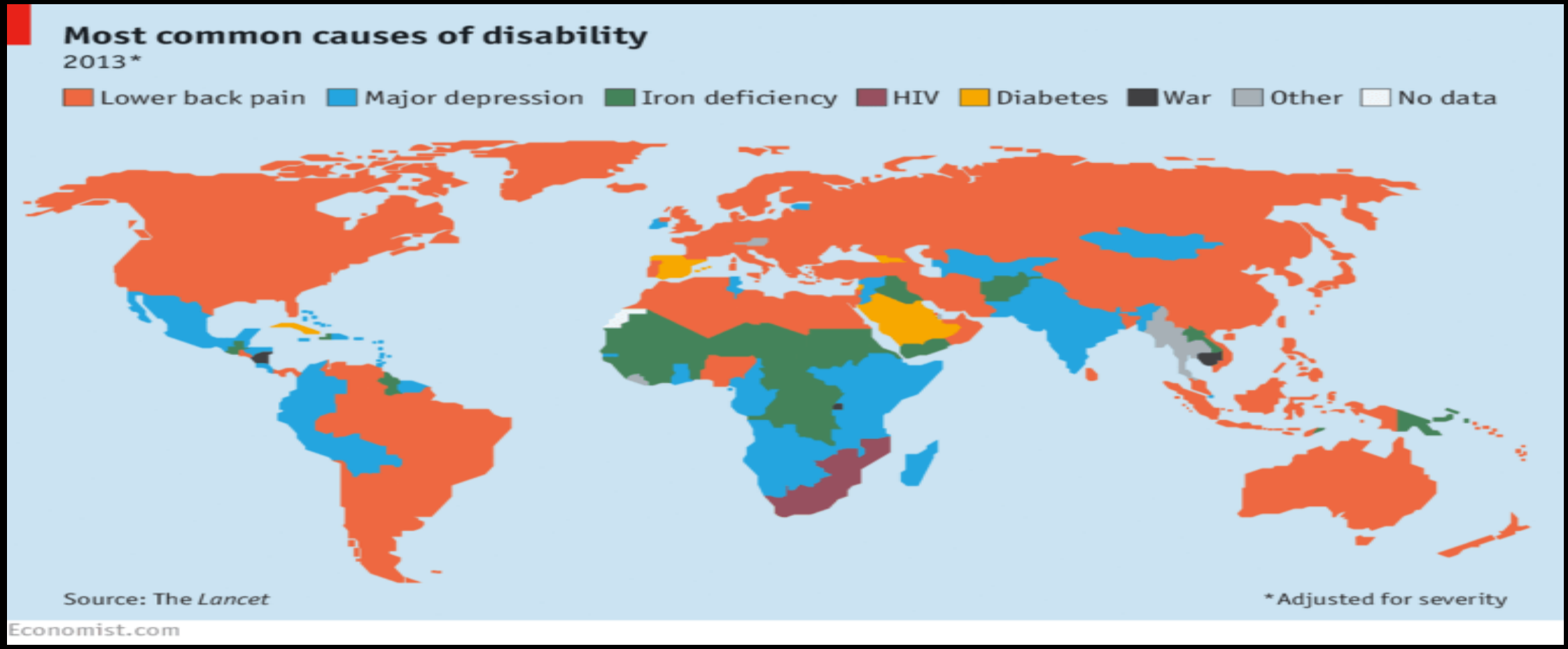


TABLE CONTENT

Most common causes of disability in the world



Introduction

- **Scope:**
  - Non-traumatic back pain accounts for ~90% of cases, but 1–5% have serious underlying causes.
  - **Red flags** increase the probability of pathology requiring urgent intervention.
- **Key Question:**

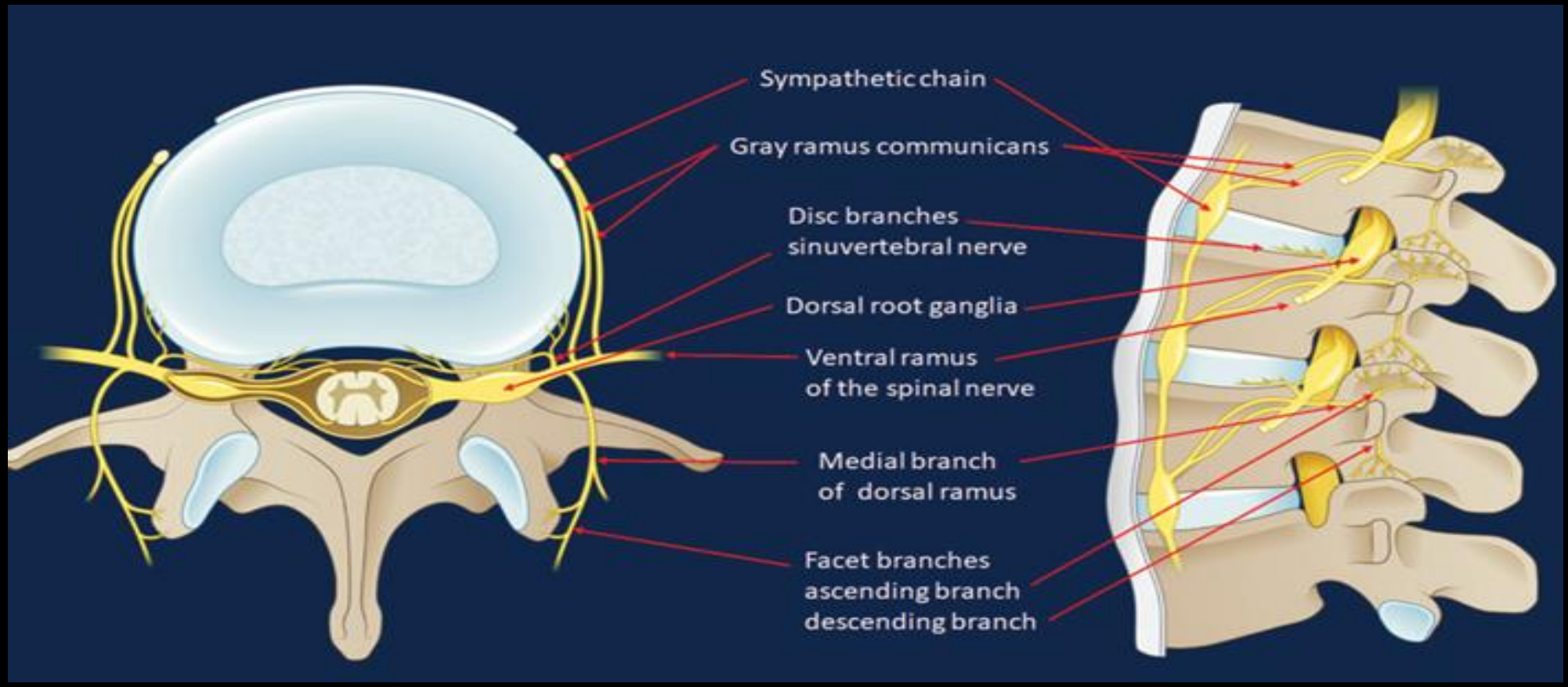
When and how should we image to balance early diagnosis vs. overuse?

Mechanism of LBP

Classification and Mechanisms of LBP

Category of LBP	Mechanical (Macroscopic) Mechanism of LBP	Nonmechanical (Microscopic) Mechanism of LBP
Discogenic LBP	Disk disruption and annular fissure Disk bulge, protrusion, or extrusion	Innervation of degenerating disk Neovascularization of degenerating disk
Neuropathic LBP	Nerve compression Spinal canal stenosis Disk bulge, protrusion, or extrusion	Nerve stimulation by proinflammatory cytokines and neurotransmitters
Osseous (metabolic, infectious, or neoplastic LBP)	Malignancy or metastasis Osteomyelitis Underlying metabolic or inflammatory disorders Infarction	Stimulation of nociceptors in the periosteum and bone marrow by proinflammatory cytokines Direct stimulation of proinflammatory cytokines induced by infection Sensitization by local proinflammatory cytokines
Facetogenic LBP	Facet hypertrophy Facet degeneration or arthropathy	Nociceptive nerve endings stimulated by proinflammatory cytokines
Paraspinal and myofascial LBP	Myofascial pain syndrome Paraspinal muscle tendinopathy	Myokines, inflammatory cytokines, and neurotransmitters induced by sustained contractile activity Nociceptor activation mediated by proinflammatory effects such as cytokines and neuropeptides

Anatomy dorsal roof ganglia, nerve roots and nerve ends



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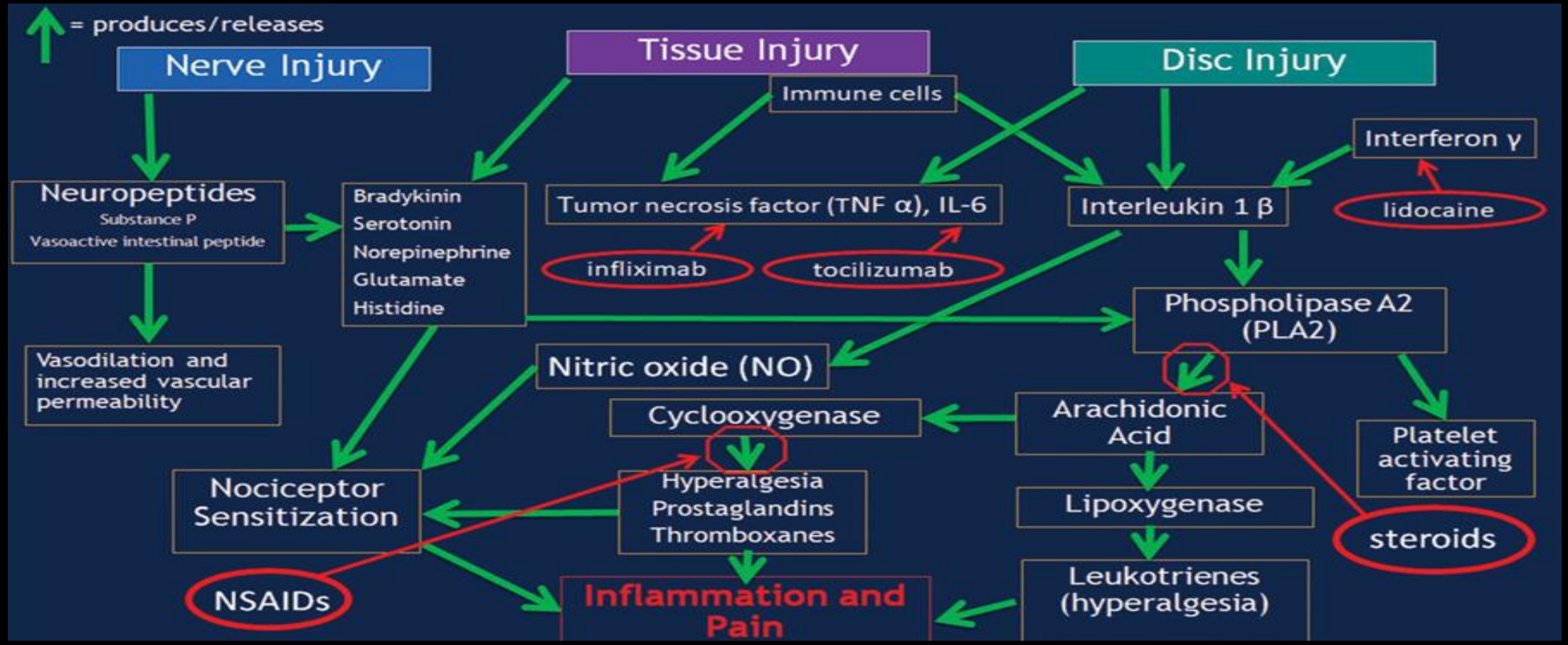
Biomechemical pathways and treatment



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Red Flag Etiologies & Prevalence

Cause	Prevalence	Mortality/Morbidity Risk
Spinal malignancy	0.7%	High (if metastatic)
Osteomyelitis	0.01–0.1%	High (sepsis risk)
Cauda equina	0.04%	Critical (permanent disability if delayed)
Spinal fracture	4% (elderly)	Moderate (vertebral collapse)

Source: *BMJ Best Practice (2023), NICE Guidelines (2022)*

Red Flags – Evidence-Based Thresholds

Malignancy:

- **≥50 years + history of cancer** → 33% risk of metastasis (Jarvik et al., *Spine 2005*).
- **ESR >50 mm/hr** → LR+ 18 for malignancy (*Annals of Rheum Dis 2013*).

Infection:

- **Fever + IV drug use** → LR+ 12 for spinal infection (*JAMA Intern Med 2015*).

Cauda Equina:

- **Retention + saddle anesthesia** → 90% specificity (*Spine J 2017*).

Imaging Modalities

Modality	Best For	Limitations
X-ray	Fractures, alignment	Poor for soft tissue (50% sensitivity for metastases)
MRI	**Gold standard for infection, malignancy, cord compression**	Cost, claustrophobia
CT	Bony detail (fractures, lytic lesions)	Radiation exposure
Bone Scan	Metastases (whole-body)	Low specificity (false + in inflammation)

Key Point: *MRI with contrast is mandatory for suspected infection or epidural abscess.*

Imaging Protocols by Suspicion

1. **Malignancy:**
    1. **First-line:** MRI whole spine (T1, T2, STIR sequences).
    2. **If MRI contraindicated:** CT + PET for metastases.
2. **Osteomyelitis:**
    1. **MRI with contrast** (enhancement + disc hyperintensity on T2).
    2. **Blood cultures + CRP/ESR** to correlate.
3. **Cauda Equina:**
    1. **Emergency MRI within 24h** (sagittal T2 for disc compression).

Guidelines & Pitfalls

- **ACR 2023 Recommendations:**
  - MRI for red flags (strong evidence).
  - Avoid CT for cauda equina (misses soft tissue).

- **Pitfalls:**
  - Over-reliance on X-rays in elderly (misses 30% of fractures).
  - Delaying MRI for cauda equina → worse outcomes.

Imaging Modalities Overview

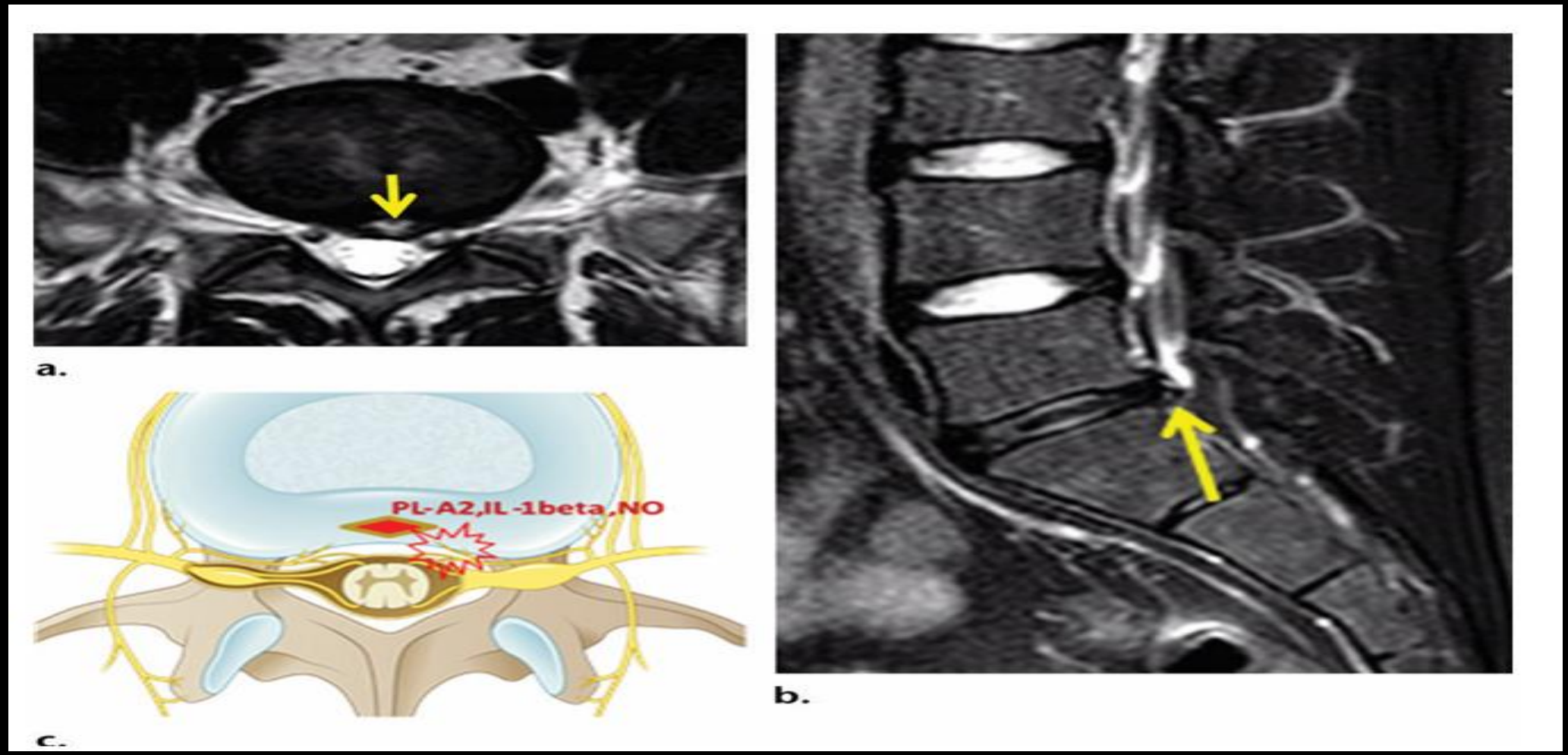
Modality	Strengths	Limitations	Typical Use
Radiography	Widely available, good for bone alignment, spondylosis	Low sensitivity for soft tissue, early infection, marrow lesions	Initial imaging without red flags
CT (noncontrast)	Excellent bone detail, hardware evaluation	Radiation exposure, limited soft tissue contrast	Post-surgical, OPLL, bony foraminal stenosis
MRI (noncontrast)	Superior soft tissue, nerve roots, marrow edema	Metal artifact, false positives in asymptomatic	Radiculopathy, infection, malignancy
MRI (with contrast)	Better for infection, tumor extent	Cost, gadolinium risks	Infection, malignancy suspicion
CT Myelography	Alternative when MRI contraindicated	Invasive, radiation	Complex radiculopathy, hardware artifact
Nuclear Medicine (Bone scan, SPECT/CT)	Functional bone activity	Low specificity, radiation	Secondary workup, suspected pseudoarthrosis
PET/CT (FDG, NaF)	Metabolic activity, metastases	Limited resolution for cord, radiation	Malignancy staging (not first-line for neck pain)
CTA/MRA	Vascular imaging	Not indicated for routine neck pain/radiculopathy	Vascular pathology suspicion (not covered here)

Imaging Appropriateness by Variant (ACR 2023)

Variant	Clinical Scenario	Usually Appropriate Imaging	Radiation Level
1	New neck pain, no red flags	Radiography cervical spine	** (0.1-1 mSv)
2	New radiculopathy, no red flags	MRI cervical spine without contrast	O (0 mSv)
3	Prior surgery, new symptoms	Radiography or CT without contrast	Radiography: **; CT: ***
4	Suspected infection	MRI with and without contrast	O (0 mSv)
5	Known malignancy	MRI with/without contrast	O (0 mSv)
6	Cervicogenic headache, no deficit	Radiography, CT without contrast, facet injection	Radiography: **; CT: ***
7	Chronic neck pain	Radiography cervical spine	**
8	Chronic pain + degenerative changes on radiographs	MRI without contrast	O
9	Chronic pain + OPLL on radiographs	CT without contrast	***

Case-Based Learning

Case 1 : a 20-year-old man who presented with acute LBP.



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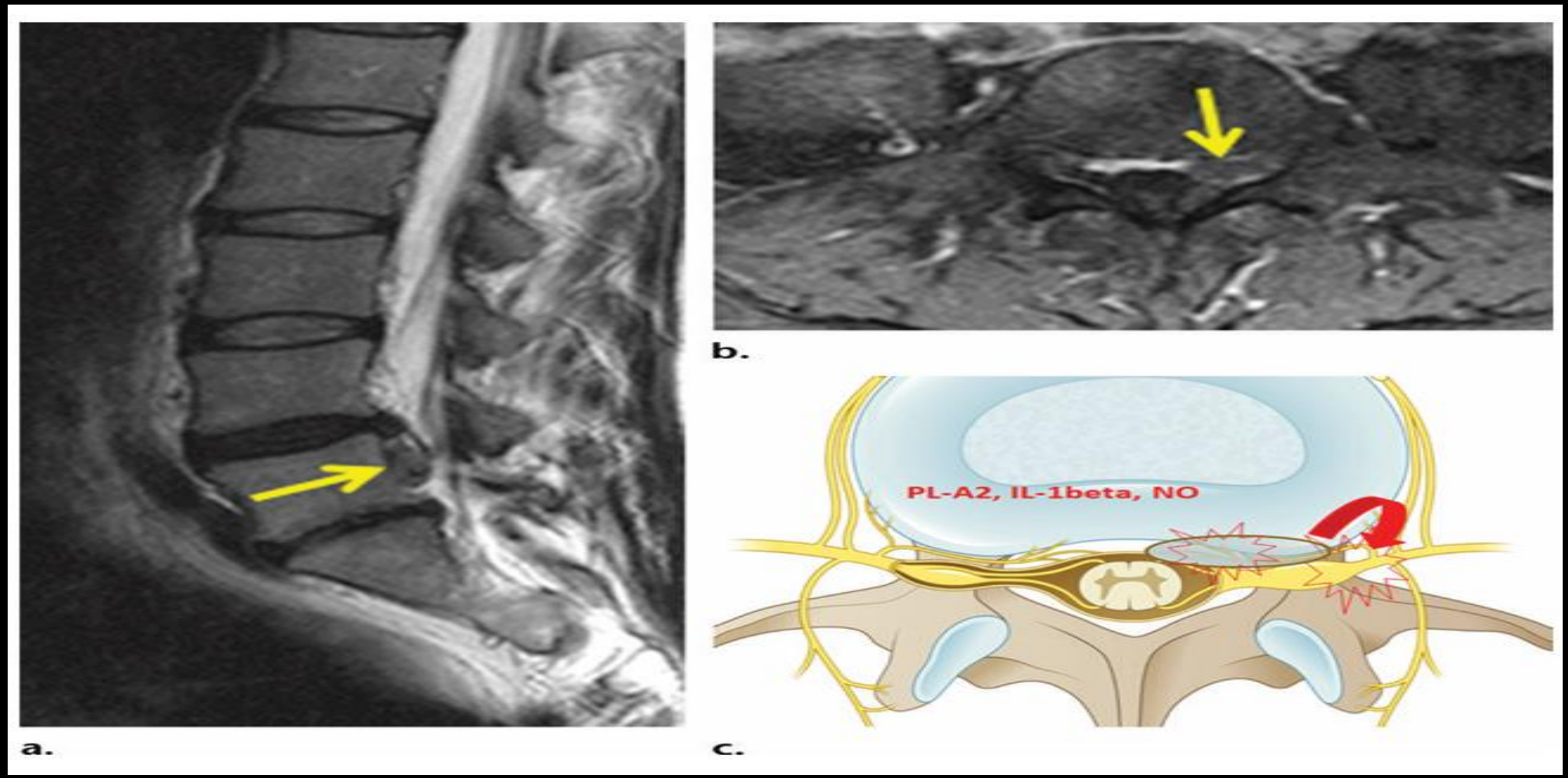
Case 2 : a 36-year-old man who presented with acute LBP and left leg numbness



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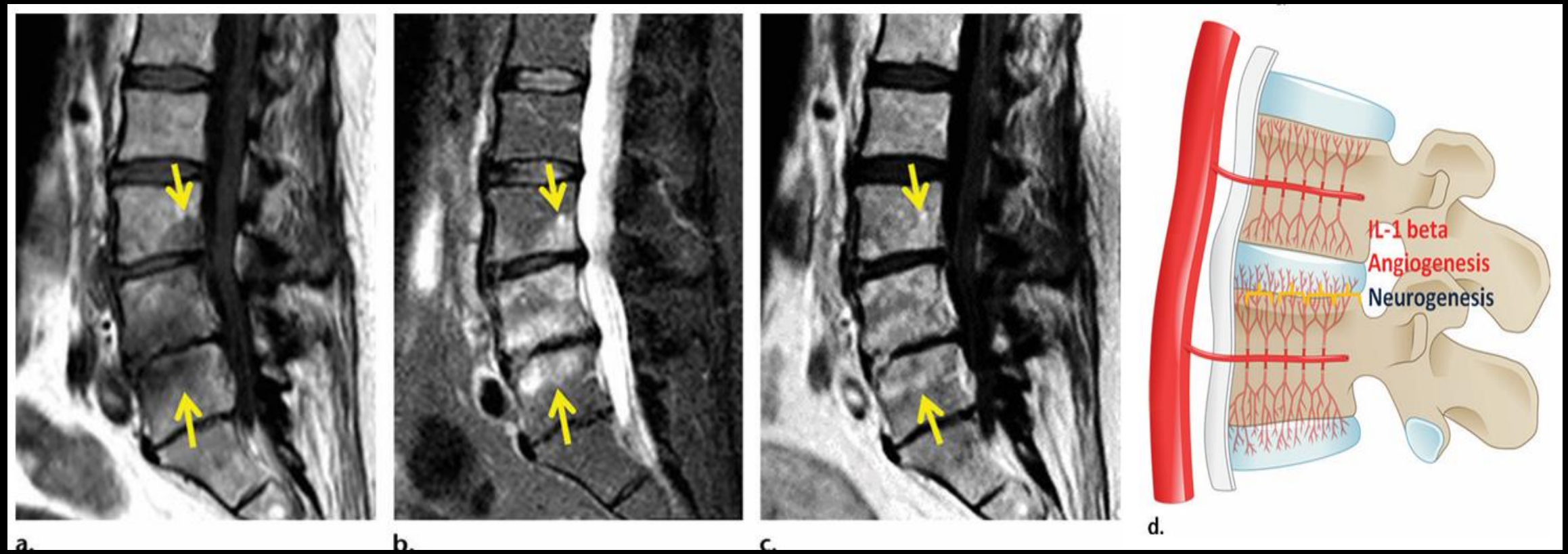
Case 3 : a 59-year-old woman who presented with acute LBP.



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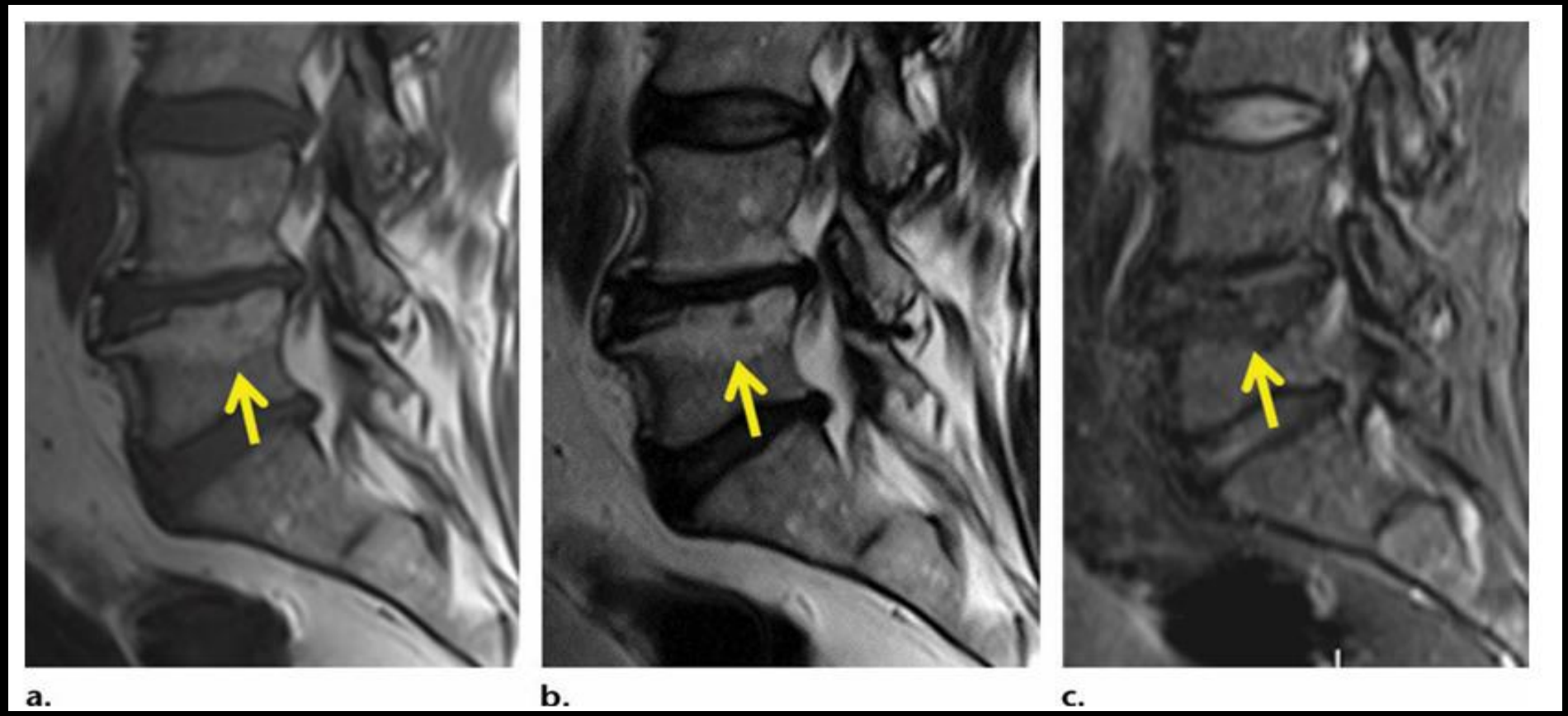
Case 4 : a 53-year-old man with no LBP.



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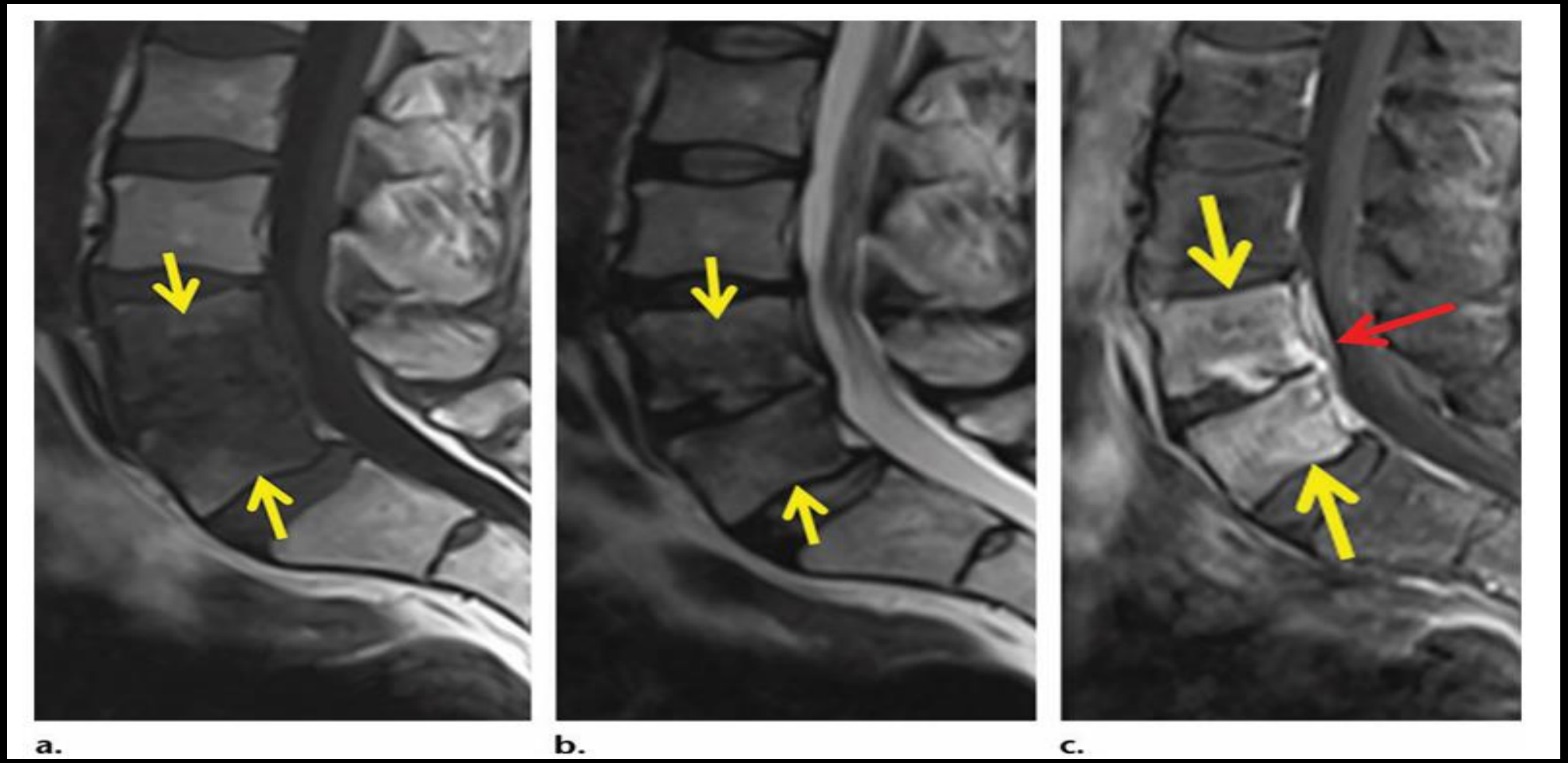
Case 5 : a 59-year-old man with acute LBP.



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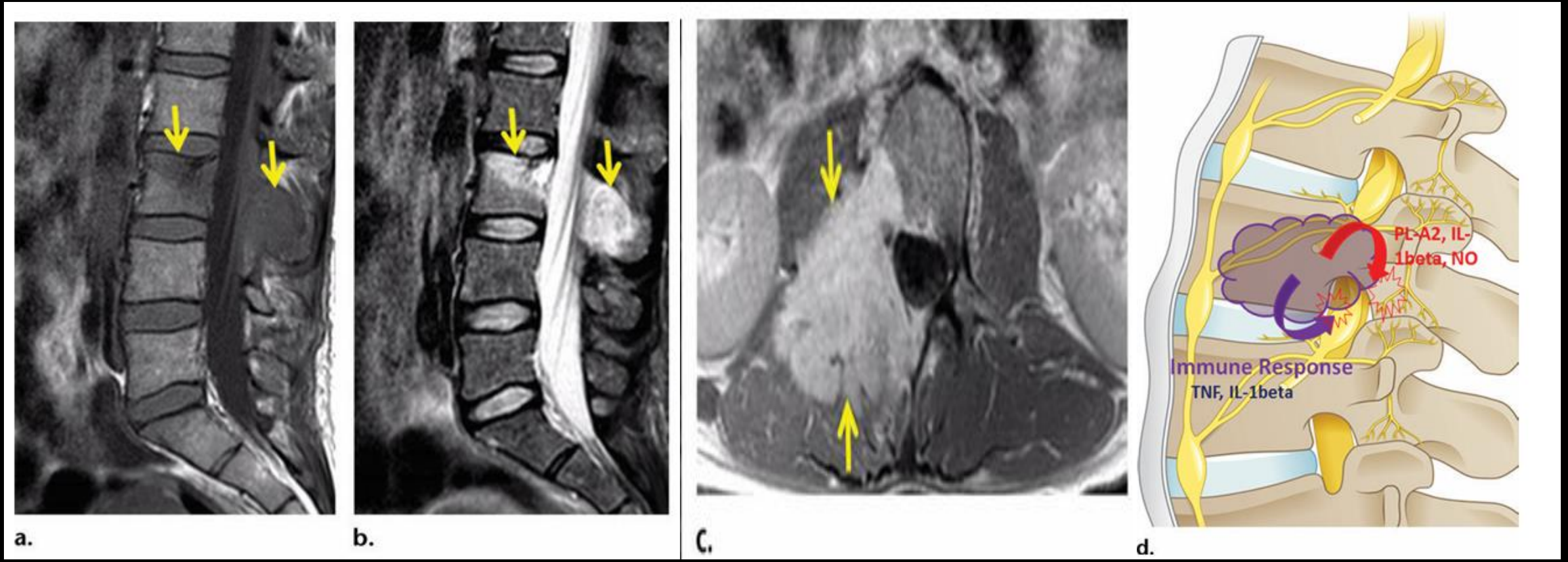
Case 6 : a 59-year-old man with acute LBP.



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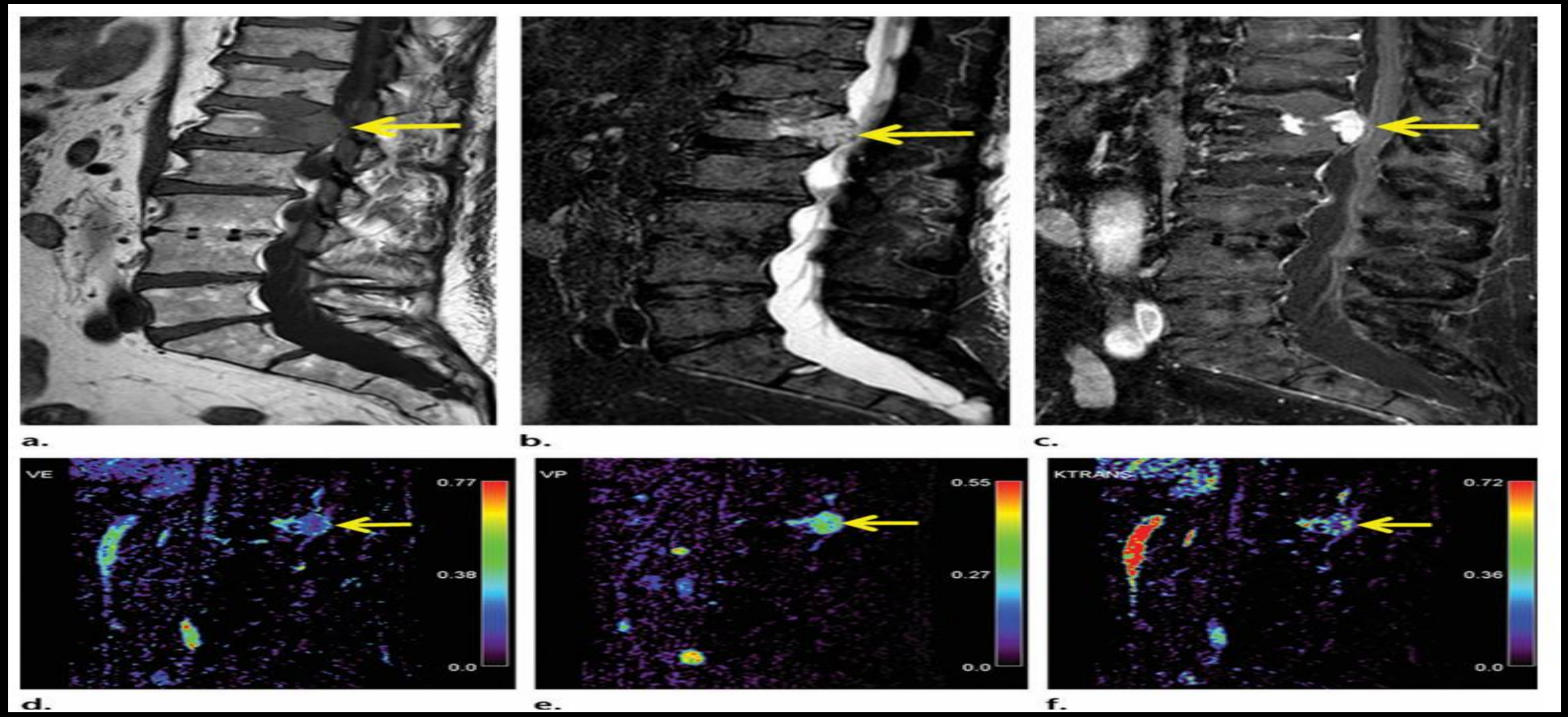
Case 7 : a 67-year-old man who presented with progressive LBP



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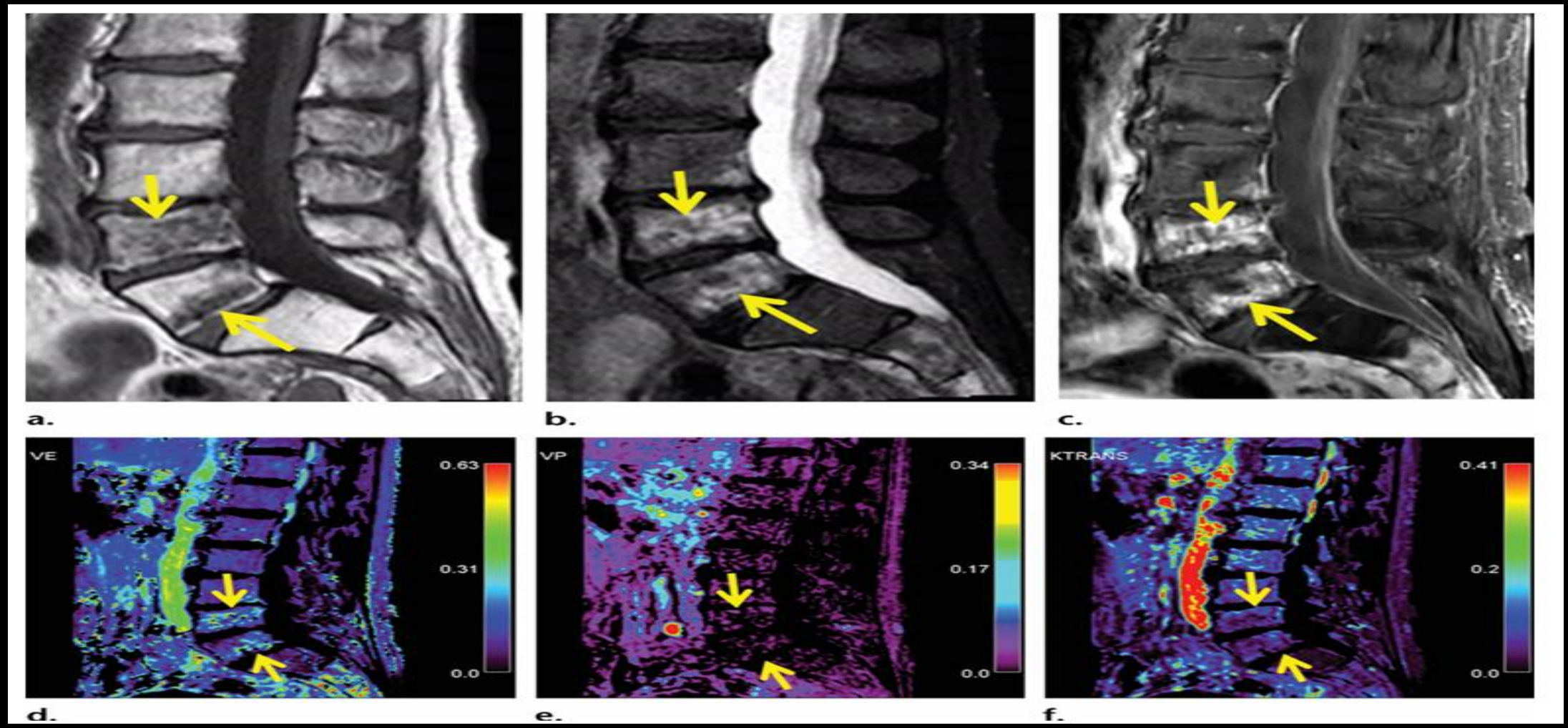
Case 8 : a 72-year-old man who presented with progressive LBP 5 years after undergoing radiation therapy for rectal carcinoma.



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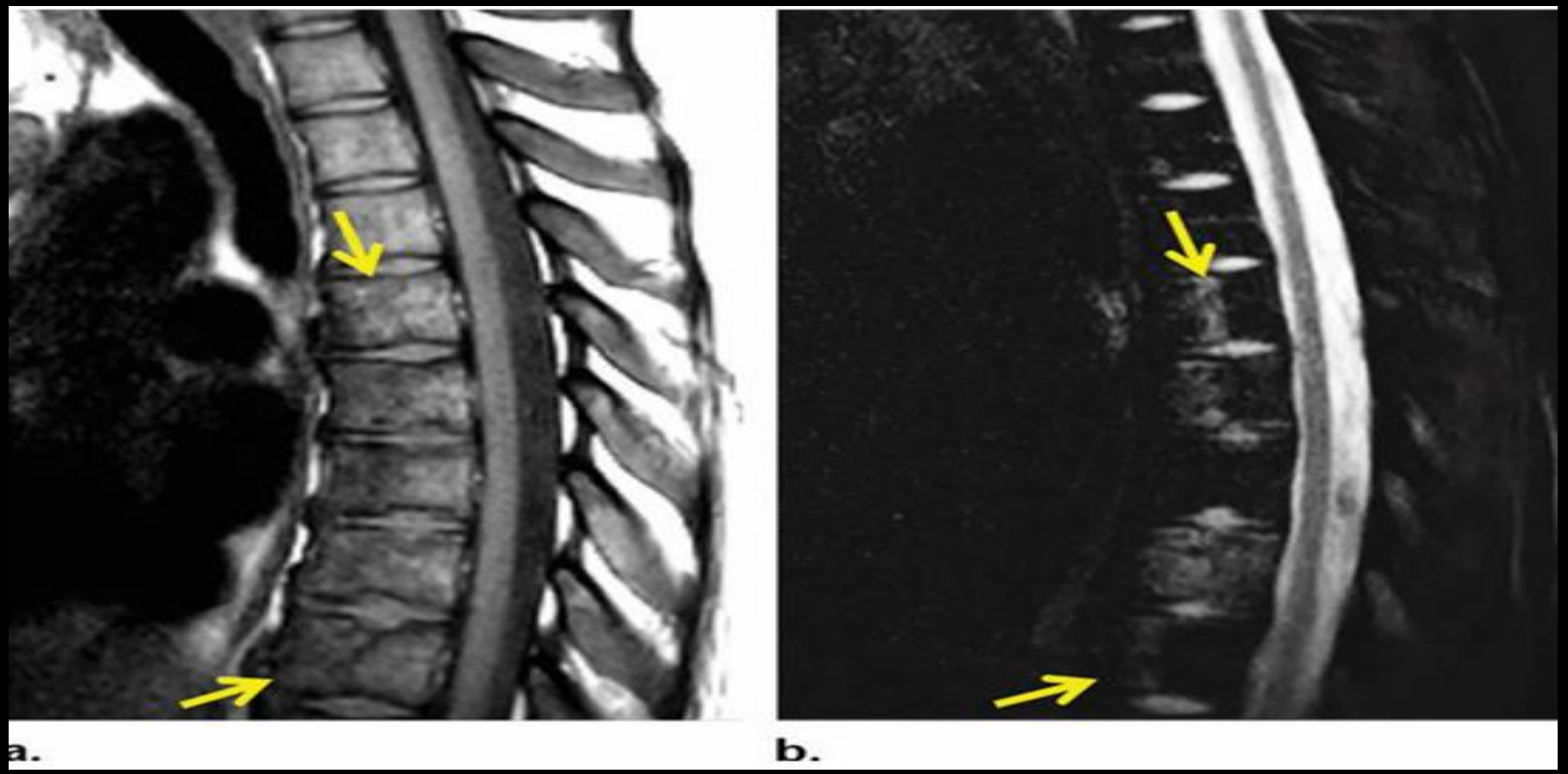
Case 9 : a 20-year-old woman with sickle cell disease who presented with acute chest syndrome, LBP, and mental status changes.



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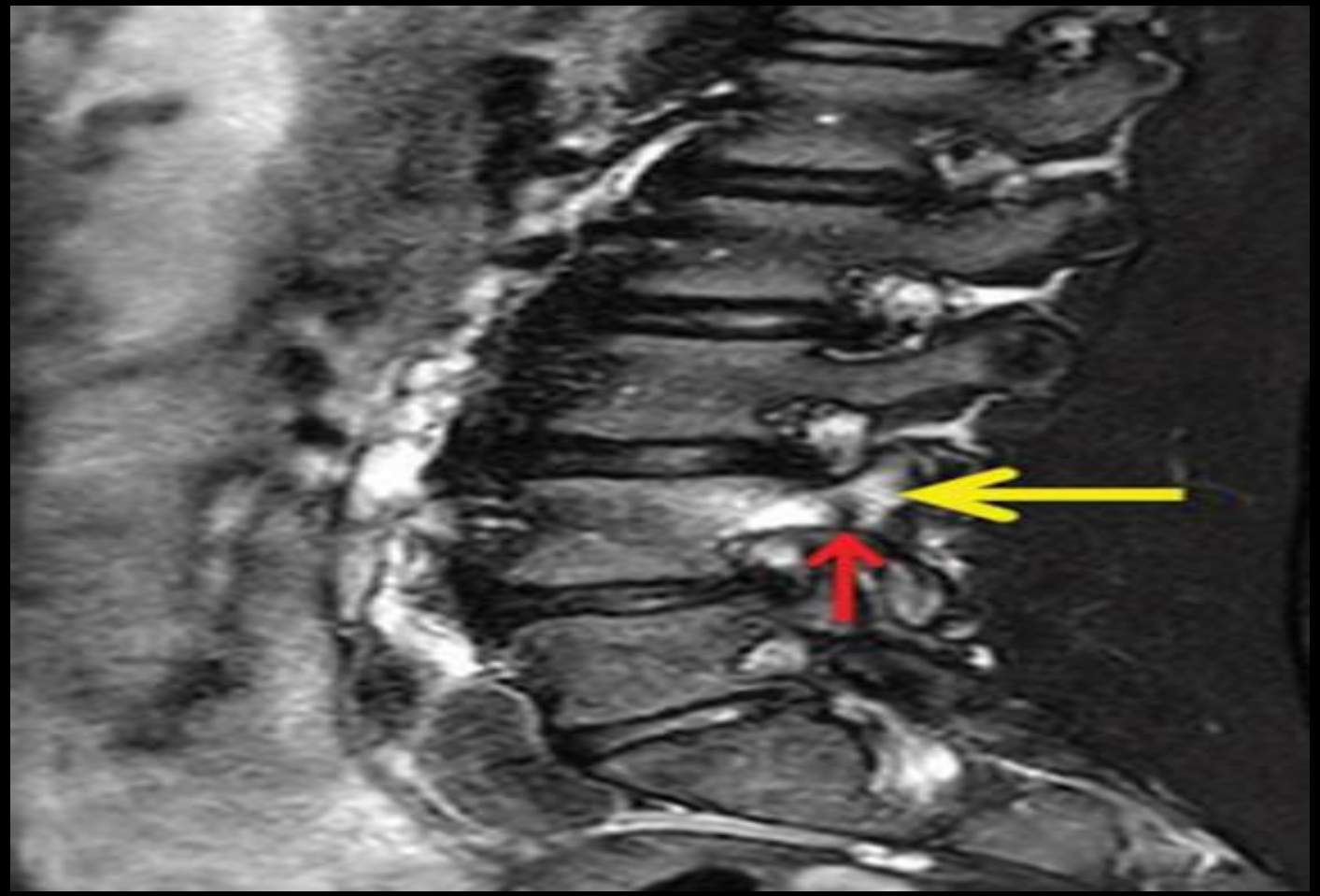
Case 10 : a 14-year-old adolescent male athlete who presented with left lumbar pain.



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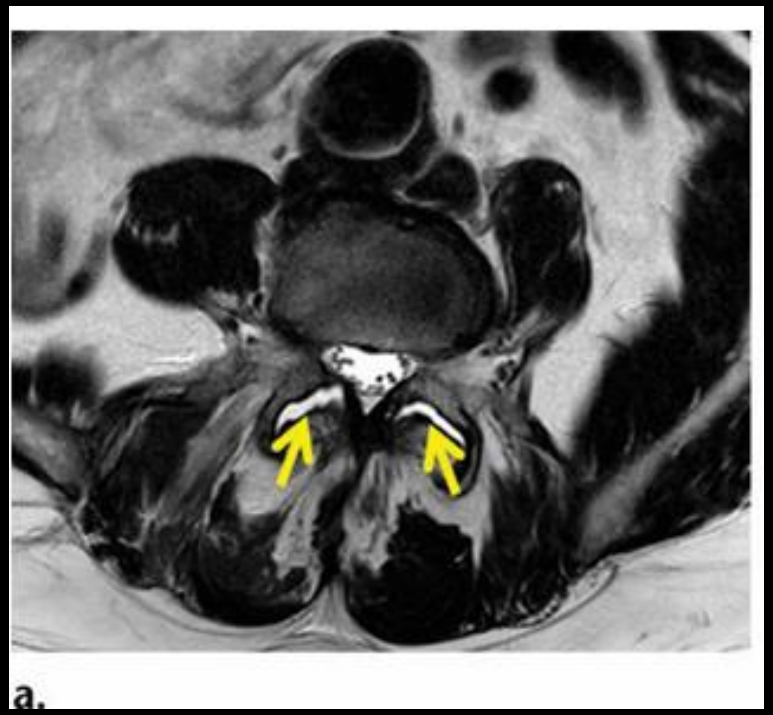
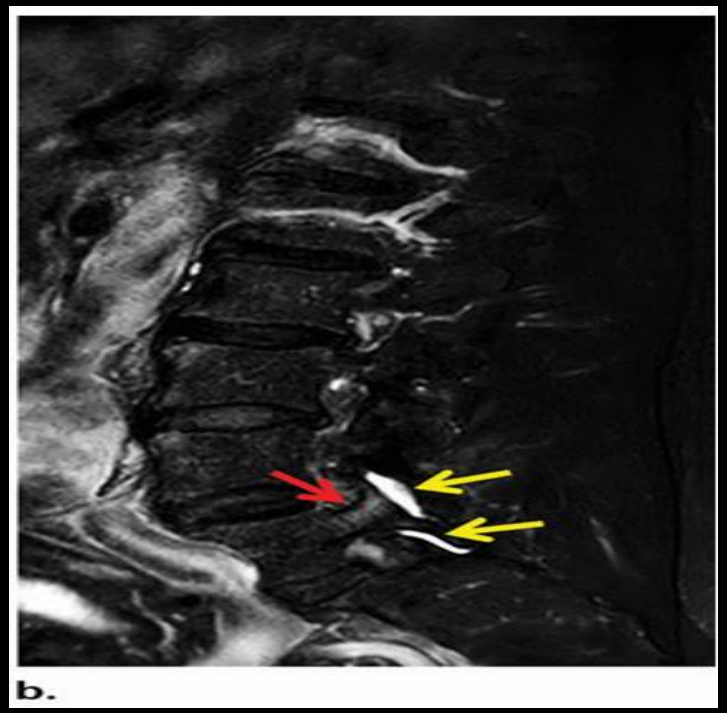
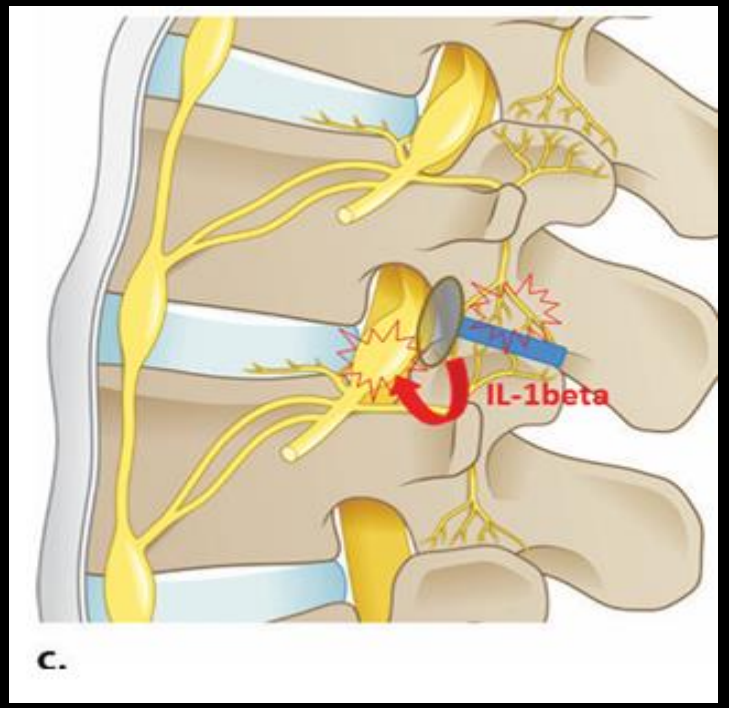
Case 11 : a 72-year-old man who presented with focal LBP.







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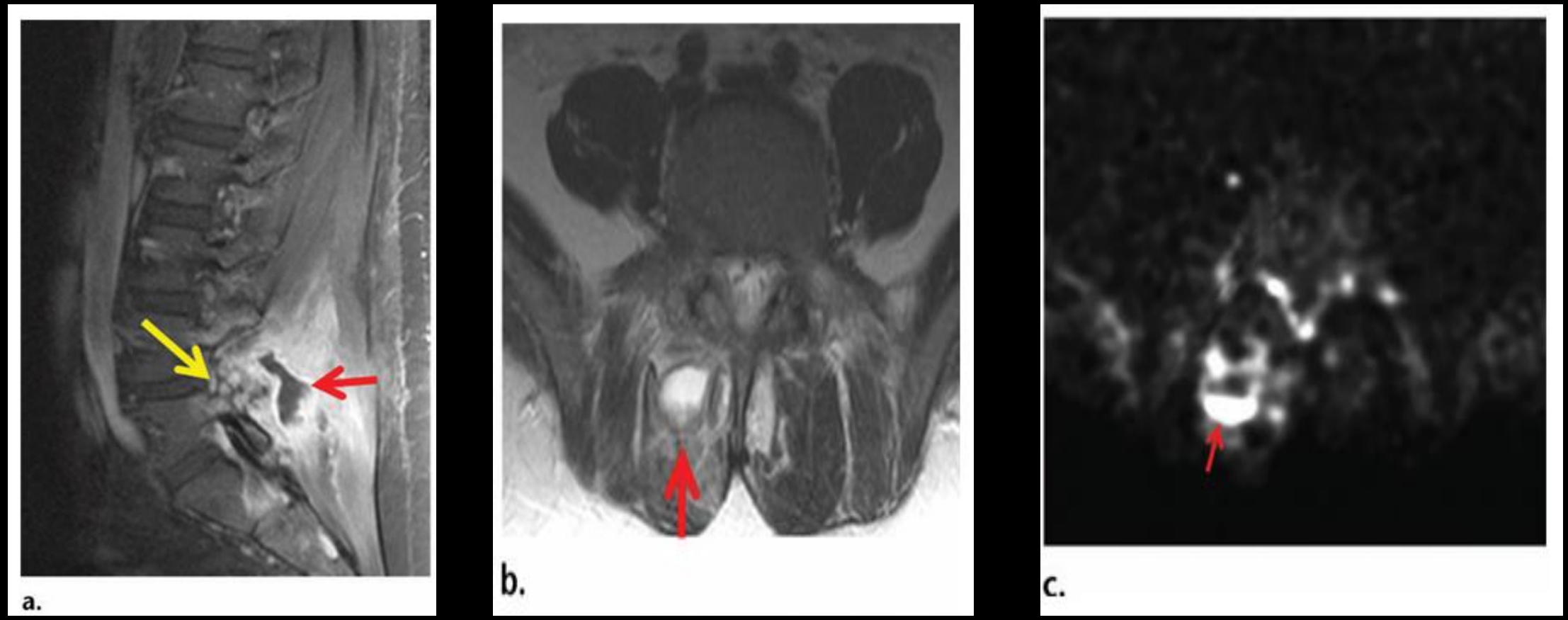
Case 12 : a 46-year-old woman with bacterial endocarditis.



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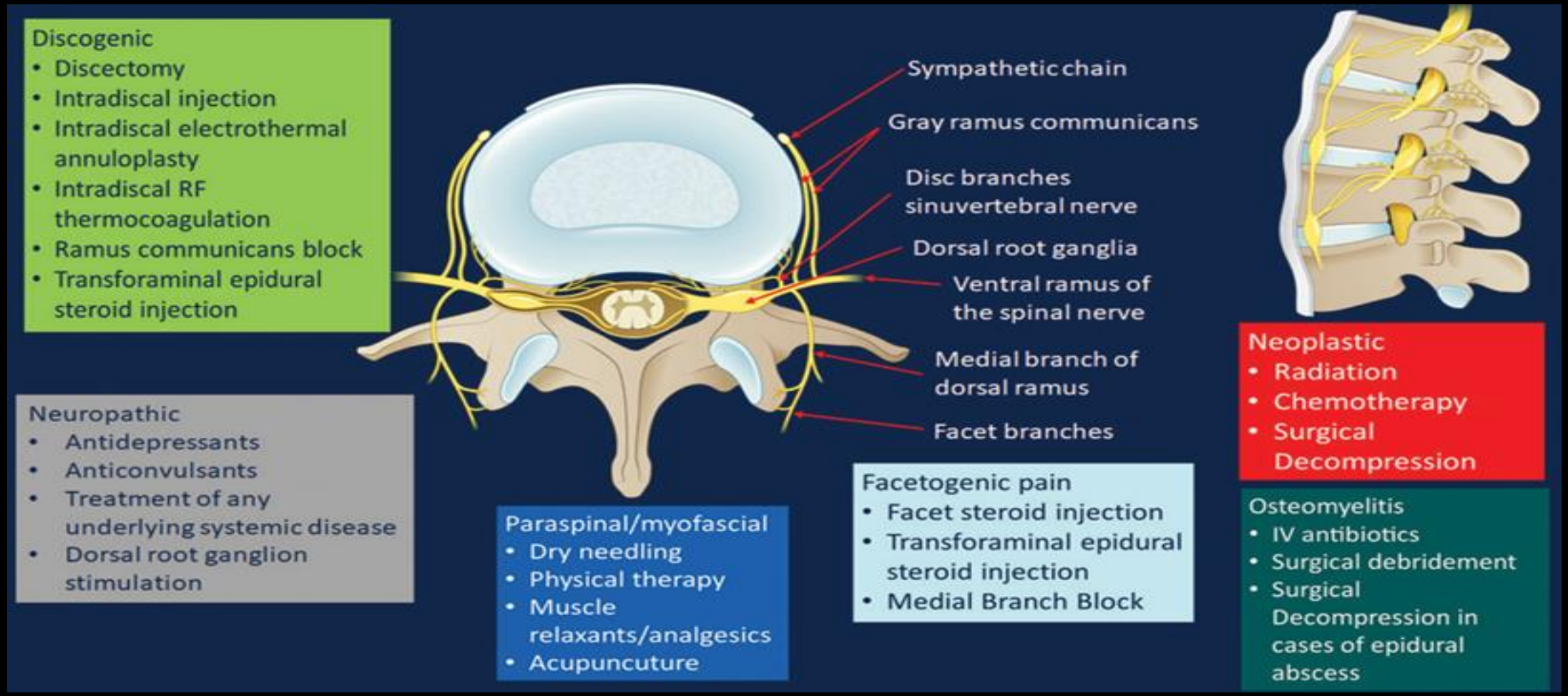
Treatment of LBP



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Future Directions in Spinal Imaging

AI-Assisted MRI Interpretation

Automated detection of herniation, stenosis, and degenerative changes.

Advanced Segmentation

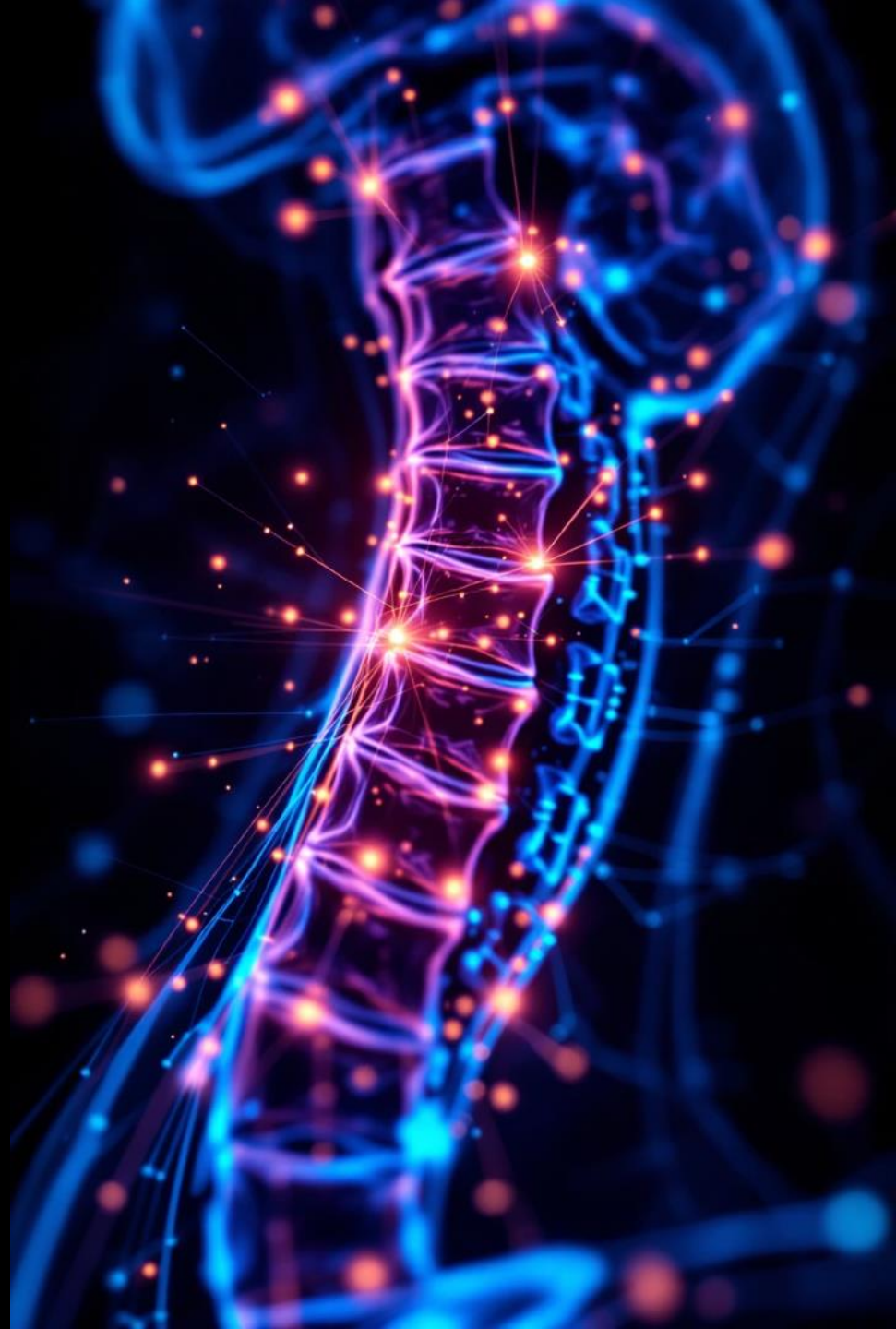
Precise mapping of vertebrae, discs, and neural structures.

Radiomics

Correlation between imaging features and clinical outcomes.

Point-of-Care Imaging

Low-field portable MRI for bedside assessment.



Take-Home Messages for Clinical Practice

Clinical Context is Key

Imaging decisions must consider history, examination, and symptomatology.

Red flags necessitate more urgent and advanced imaging.

Beware Incidental Findings

Many imaging findings are common in asymptomatic patients.

Always correlate imaging with clinical clinical presentation.

Choose Wisely

Radiation exposure should be minimized, especially in children.

MRI for soft tissue; CT for bone and hardware.

Conclusion: Evidence-Based Based Imaging Approach

"Image Wisely"

Use red flags to guide MRI/CT decision-making. making.

MRI is King

Best modality for infection, malignancy, and cord compression.

Time Matters

Delayed imaging = worse outcomes in cauda equina syndrome.

PANTUN

Jalan-jalan ke pasar pagi,
beli rambutan dan juga duku.
Radiolog bekerja dengan teliti,
nyeri punggung pun jadi terdeteksi satu
per satu.

THANK YOU

FOR YOUR KIND ATTENTION