



**A charitable non-profit organization registered in the United States, the United Kingdom and Canada with the goal of helping people with spinal disorders in underserved communities throughout the world.**

## ***Third Botswana Spine Care Conference***

***“Creating a country wide program for the prevention of spine disability”***

**The Gaborone International Convention Center  
Gaborone, Botswana  
May 7 and May 8, 2018**

*The Conference is provided with the support of and in collaboration with:*

*The Botswana Ministry of Health and Wellness*

*European Spine Journal ([www.springer.com/medicine/orthopedics/journal/586](http://www.springer.com/medicine/orthopedics/journal/586))*

*EUROSPINE ([www.eurospine.org](http://www.eurospine.org))*

*The Chiropractic Association of South Africa ([www.chiropractic.co.za](http://www.chiropractic.co.za))*

*North American Spine Society ([www.spine.org](http://www.spine.org))*

*Association of Academic Physiatrists ([www.physiatry.org](http://www.physiatry.org))*

*The South African Spine Society ([www.saspine.org](http://www.saspine.org))*





# The indications for and interpretation of spine imaging in a setting with limited resources

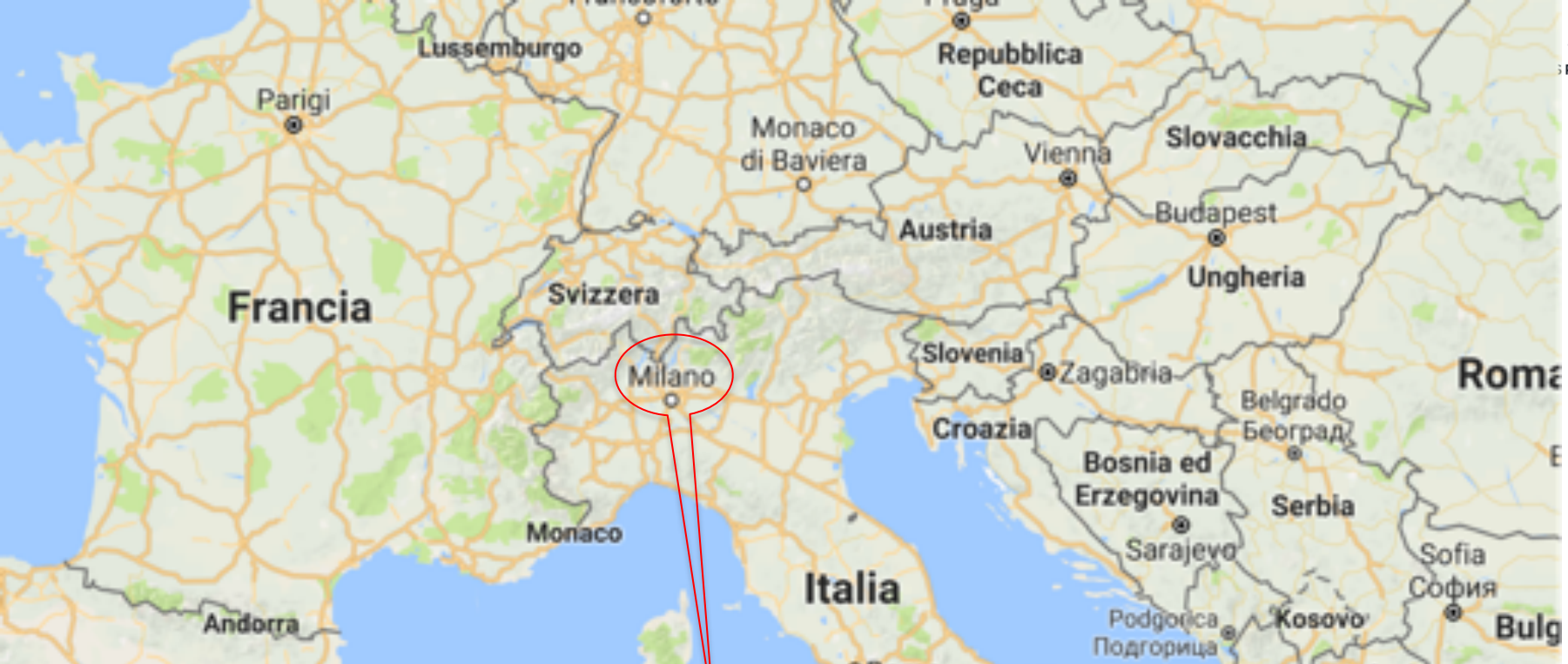
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# Indications for spine imaging

- An imaging examination is needed for every patient that can get advantage from it
- The most suitable examination is needed for the suspected condition
- An accurate clinical examination is mandatory
  - Clinician must have enough time to examine the patient, suspect a pathology and ask for the most suitable examination

- A self-limited, nonspecific mechanical cause is found in most primary care patients
- Serious causes of low back pain are distinctly uncommon
- An efficient history and physical examination is mandatory to determine
  - the likely cause of the complaint
  - whether diagnostic tests are needed
  - which treatments are warranted



# Accepted International Guidelines

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- Radiographic studies and laboratory tests should not be routinely ordered for patients with acute low back pain.
- Referral for physical treatments is appropriate for patients who are not improving with initial conservative care after 2 to 4 weeks

**Table 1**

Differential Diagnosis of Low Back Pain<sup>†</sup>

Mechanical Low Back Pain	Nonmechanical Spine Disease	Visceral Disease
Lumbar strain or sprain <sup>†</sup>	Neoplasia	Pelvic organs
Degenerative disease	Metastatic carcinoma	Prostatitis
Disks (spondylosis)	Multiple myeloma	Endometriosis
Facet joints <sup>‡</sup>	Lymphoma and leukemia	Chronic pelvic inflammatory disease
Diffuse idiopathic skeletal hyperostosis <sup>‡</sup>	Spinal cord tumors	Renal disease
Spondylolysis <sup>‡§</sup>	Retroperitoneal tumors	Nephrolithiasis
Spondylolisthesis <sup>¶</sup>	Infection	Pyelonephritis
Herniated disk	Osteomyelitis	Perinephric abscess
Spinal stenosis	Septic discitis	Vascular disease
Osteoporosis with compression fracture	Paraspinal or epidural abscess	Abdominal aortic aneurysm
Fractures	Endocarditis	Aortoiliac disease
Congenital disease	Inflammatory arthritis	Gastrointestinal disease
Severe kyphosis	Ankylosing spondylitis	Pancreatitis
Severe scoliosis	Reiter's syndrome	Cholecystitis
Paget's disease	Psoriatic spondylitis	Perforated bowel
	Inflammatory bowel disease	
	Polymyalgia rheumatica	



# Lumbar spine X-rays

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- **Pros**

- Fast, no contraindications
- Bony structures
- **Panoramic**
- **Cheap**
- **Low radiation**
- **Pathologies mimiking LBP as hip and SIJ**

- **Cons**

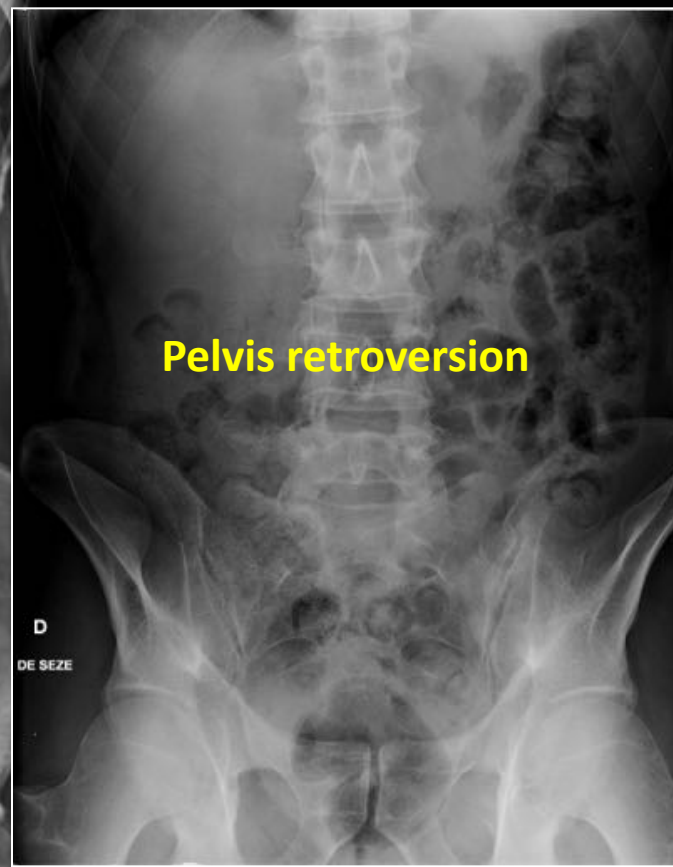
- Poor soft tissues discrimination
- Difficult to be correctly interpreted



# Standard Lumbar X-Rays

AP and lateral views (12T to S1)

De Seze (lumbopelvic X-Ray)

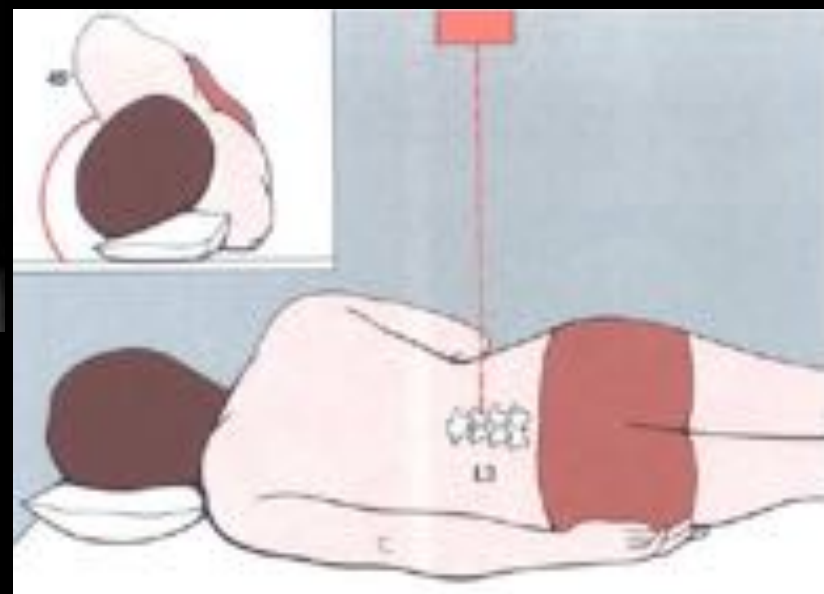


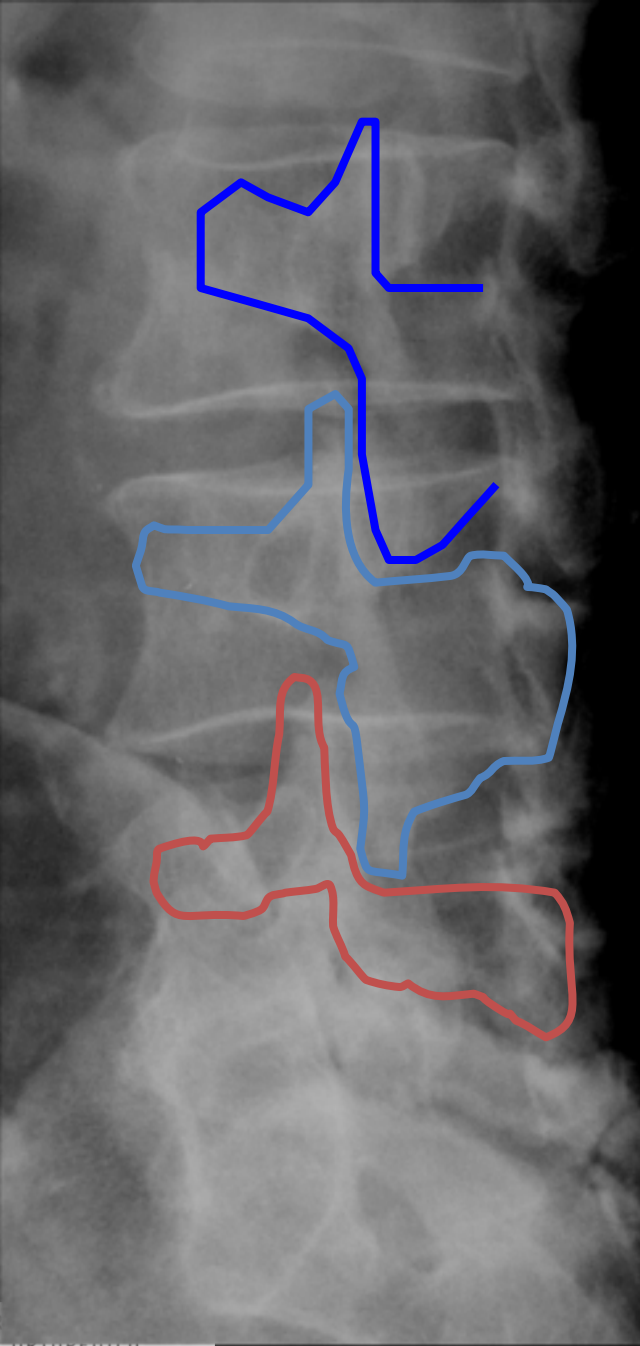


# Oblique views

## Scottish terrier image

Nose: tr. process  
 Eye: pedicle  
 Ear: sup. art. proc.  
 Neck: pars.interart.  
 Fr.leg: inf. art. proc.





# Dynamic imaging



standing



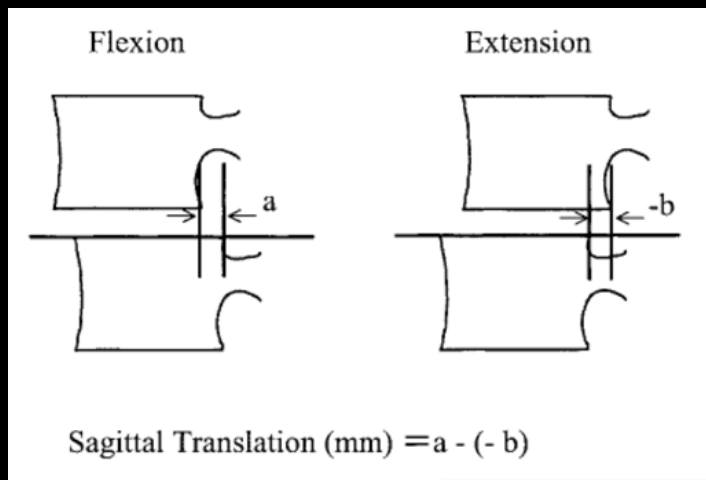
flexion



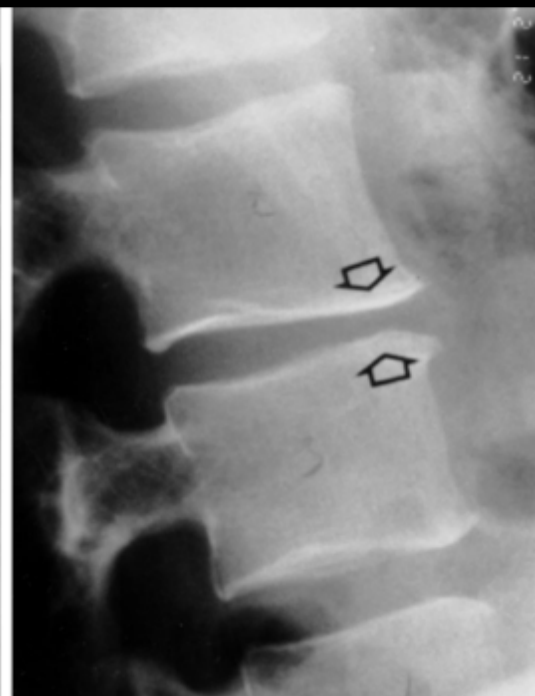
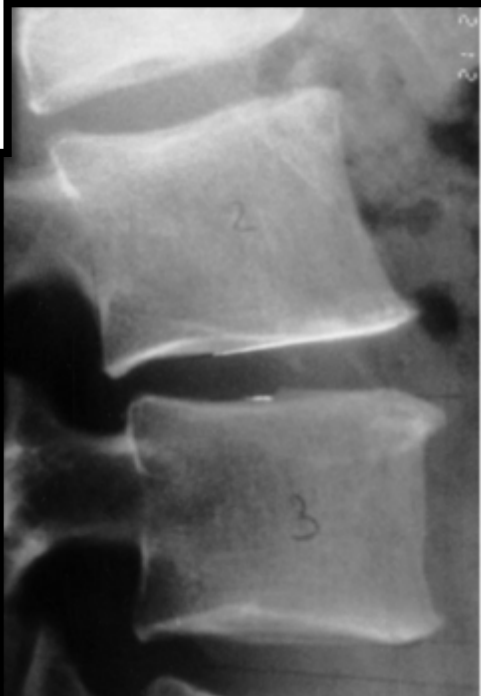
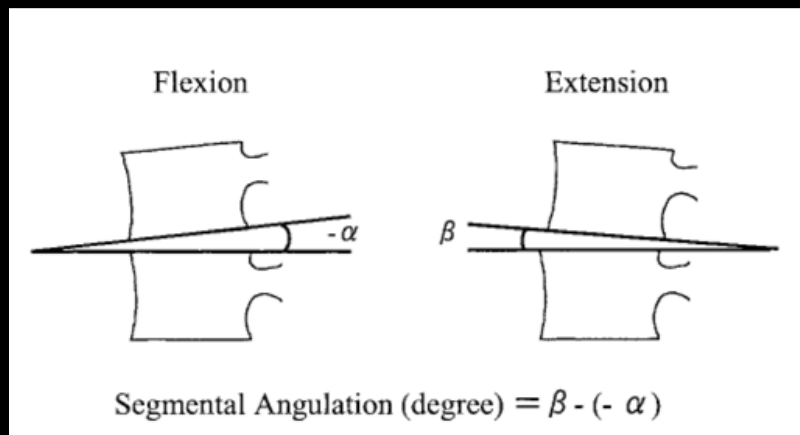
extension



# Sagittal instability



# Discs shape

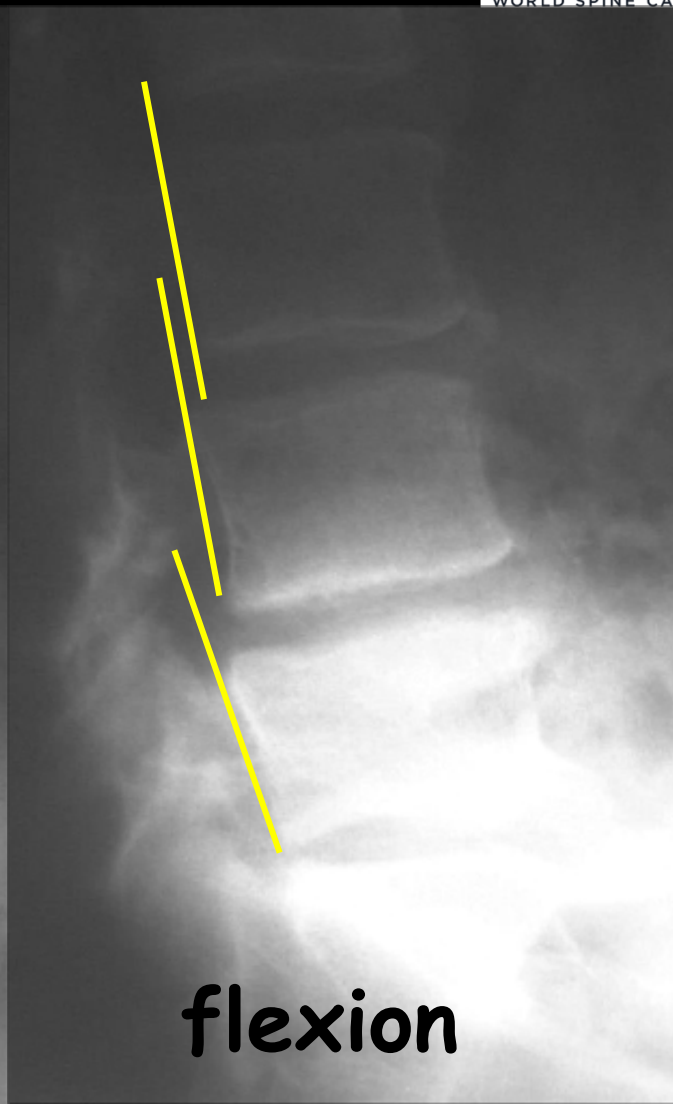




standing



extension

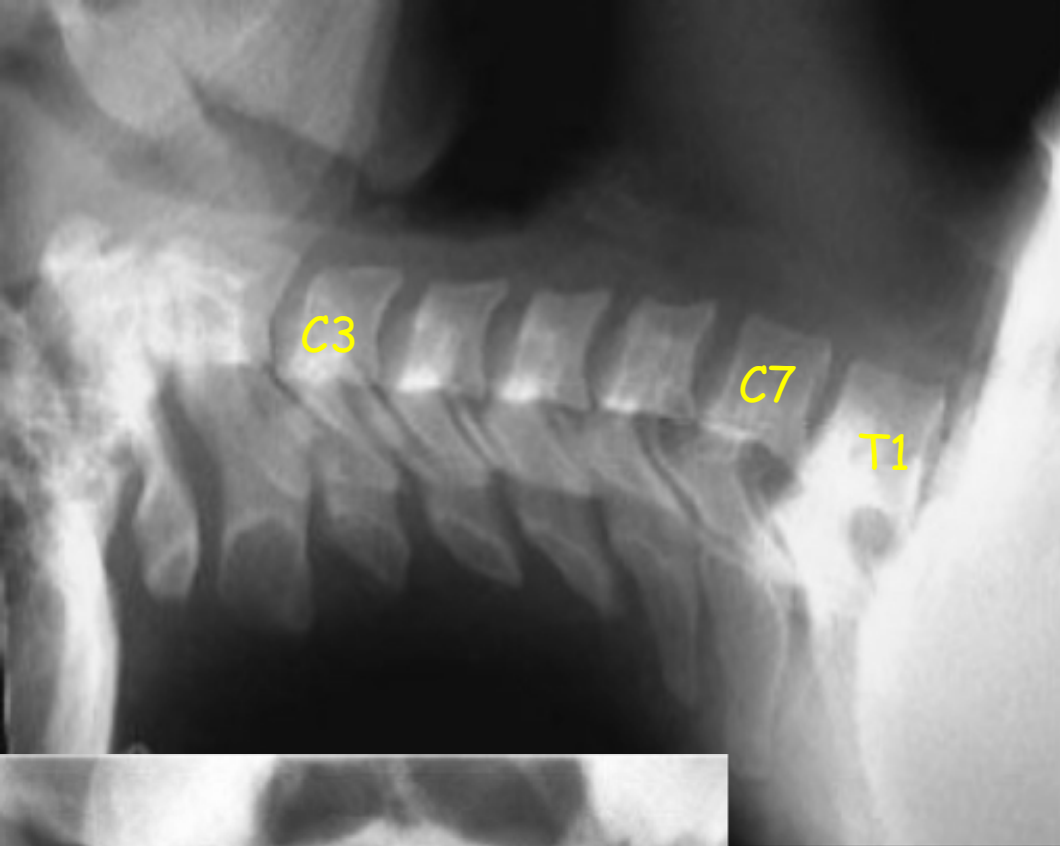


flexion

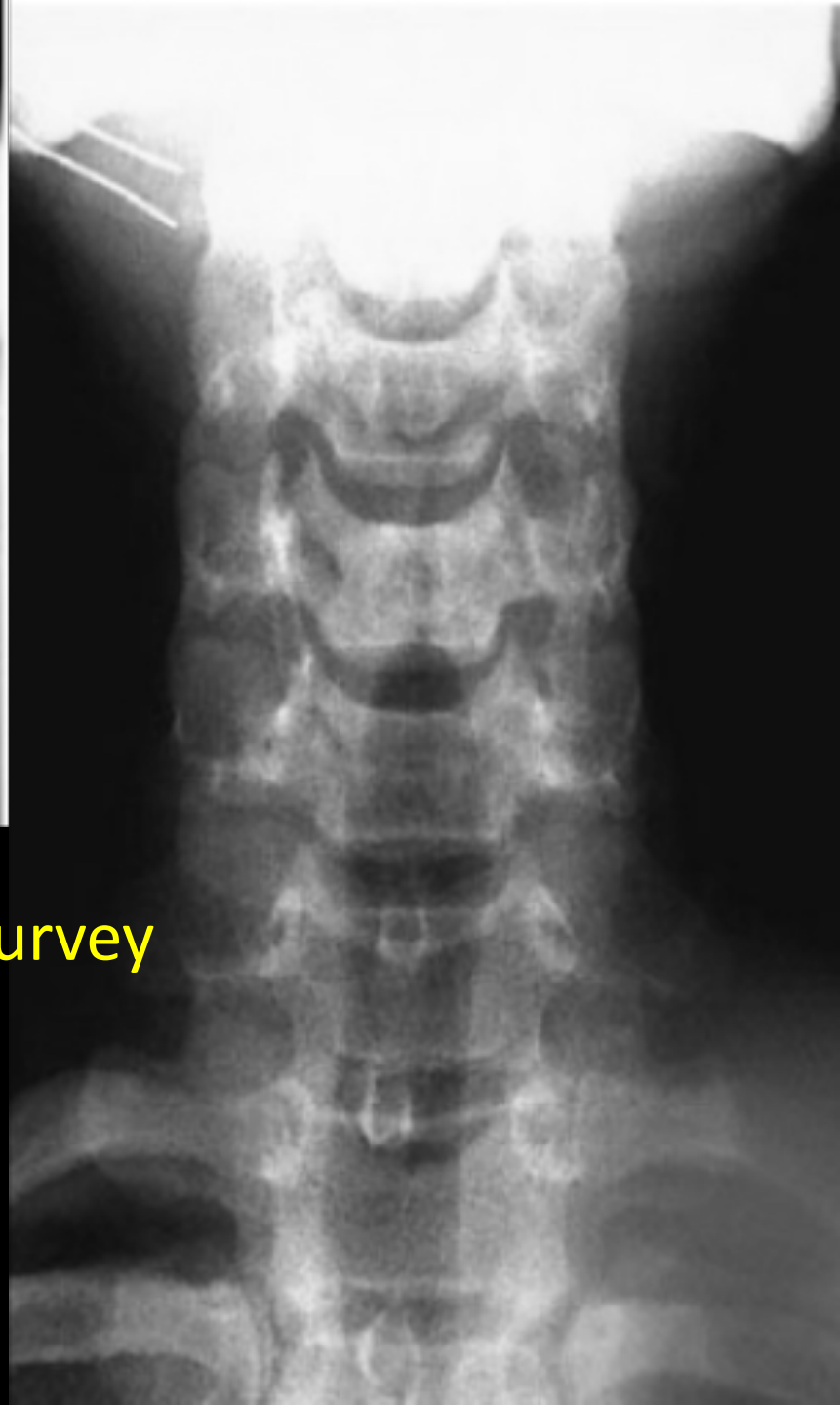


# Lateral bending Lumbar X-Rays





Standard survey



# Vertebral alignment

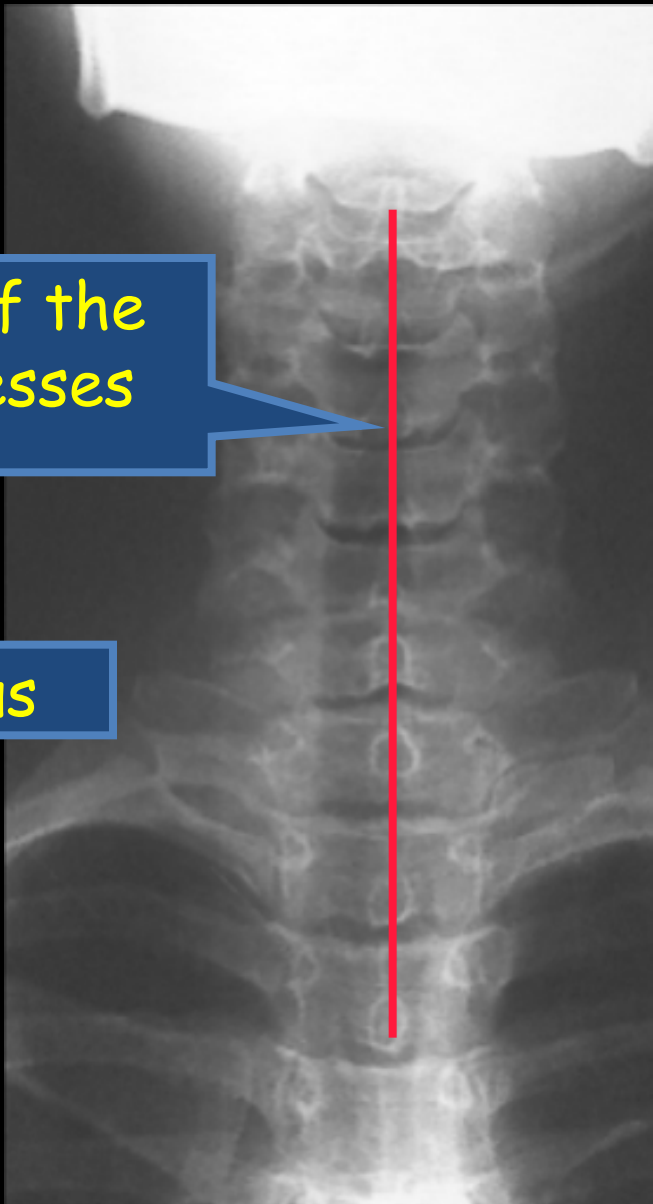
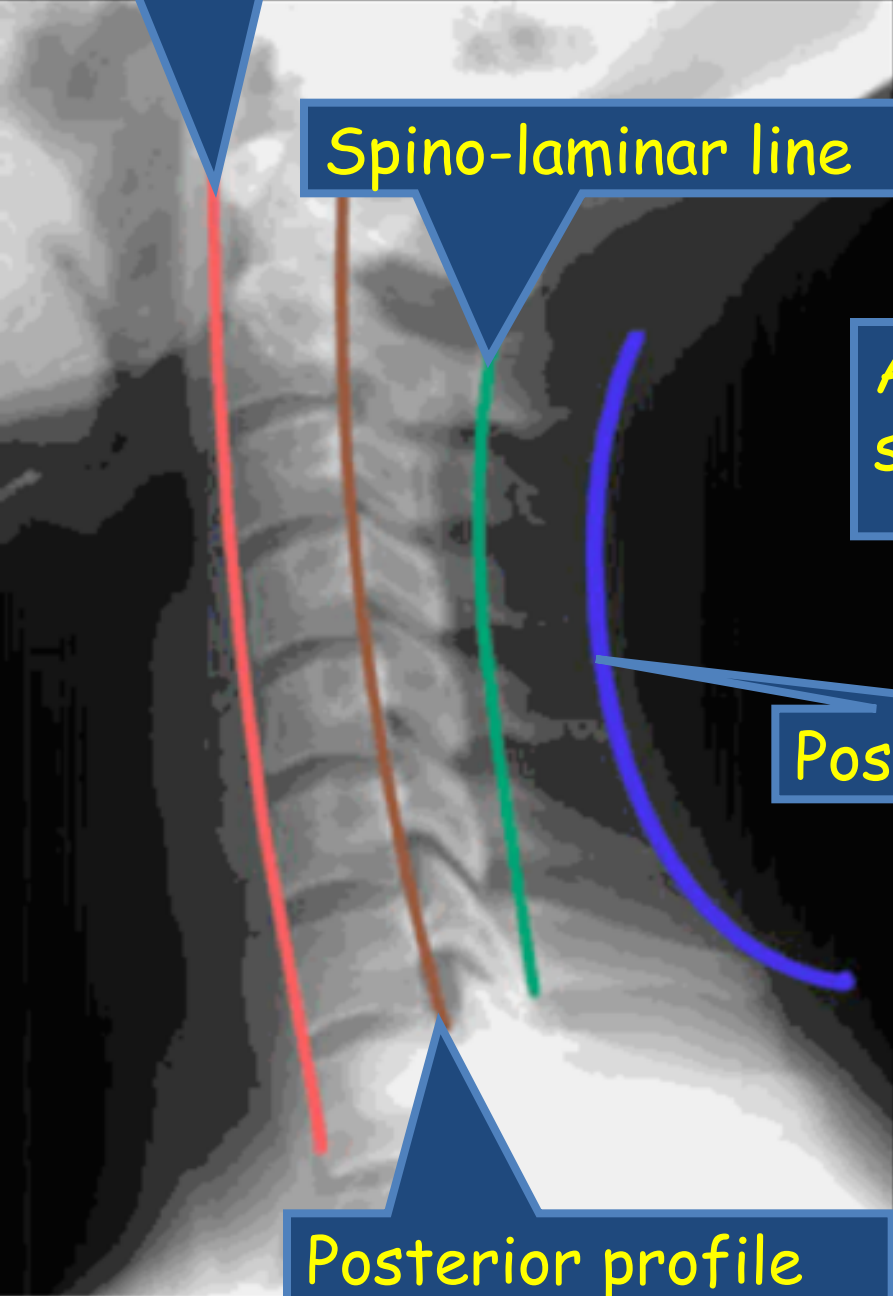
Anterior profile

Spino-laminar line

Alignment of the spinous processes

Posterior spinous

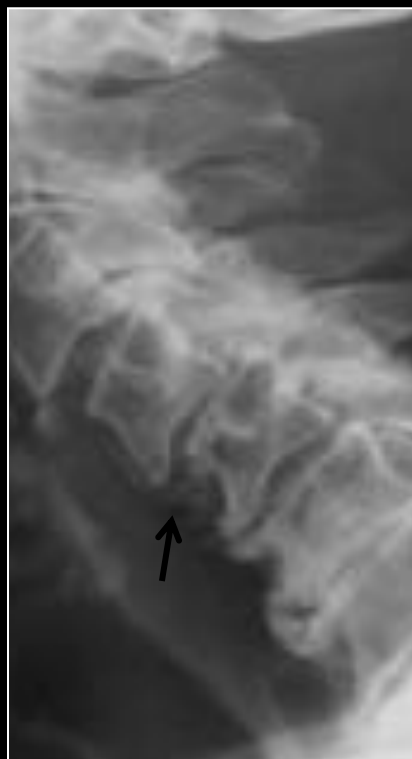
Posterior profile



# Lateral view: from C0 to T1

## Checkpoints:

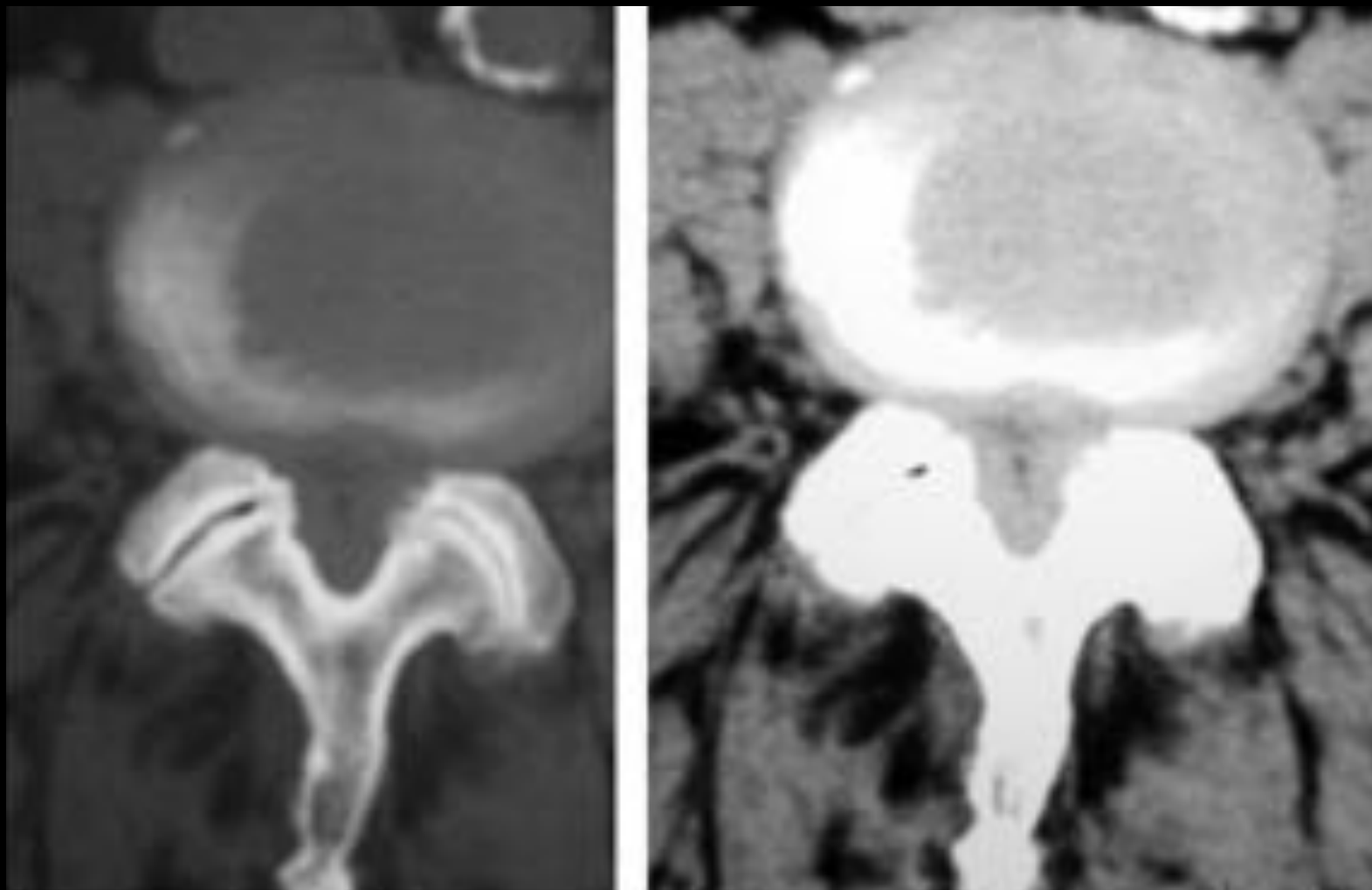
- Correct alignment of the vertebrae
- 3 lines



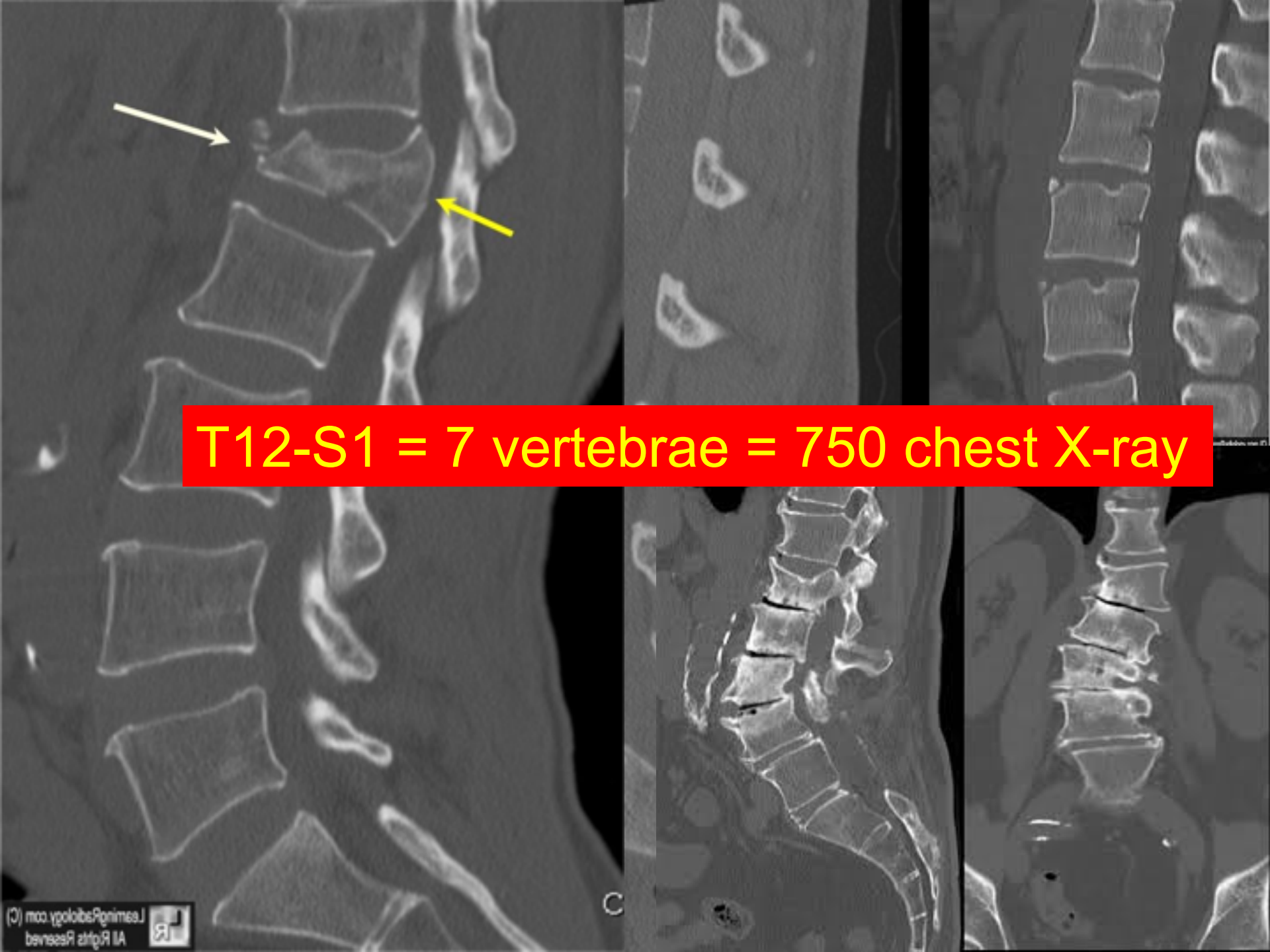
# CT

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- Facet arthritis
- Pars defects in axial or reformation images
- Stenosis
- Degenerative disc disease
- Bone and soft tissues setting



## Soft and hard stenosis



T12-S1 = 7 vertebrae = 750 chest X-ray

# MRI

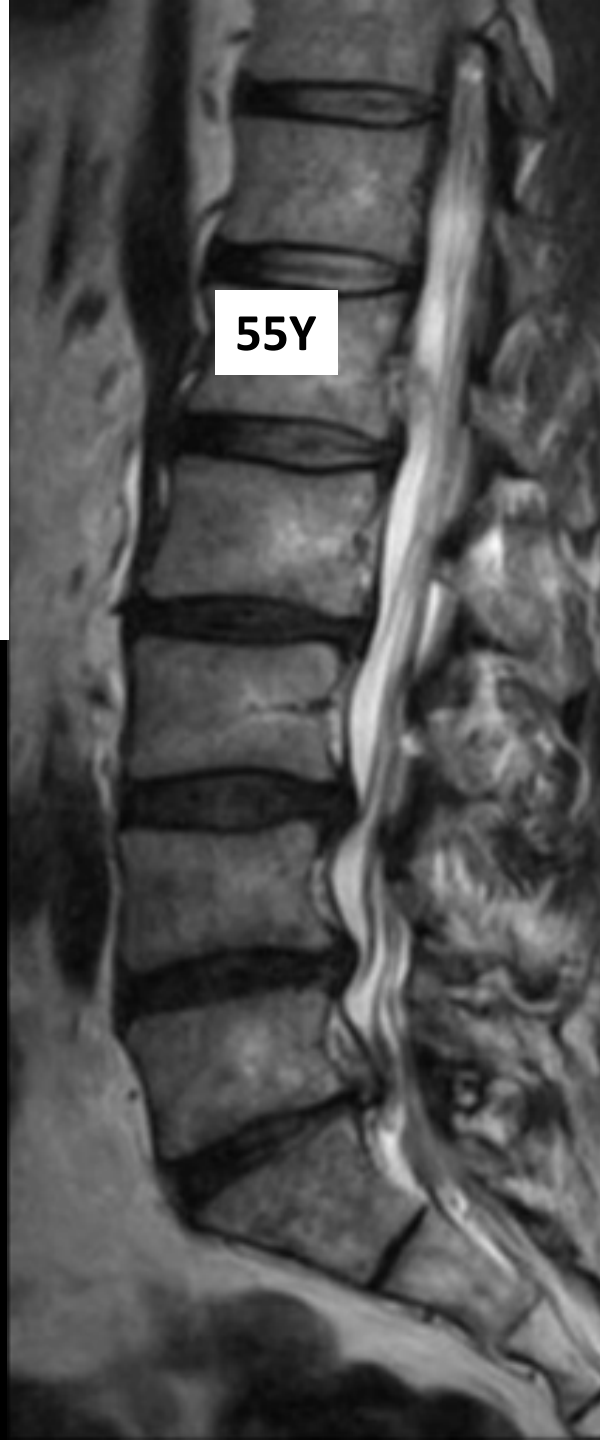
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- **Most sensitive and most specific to show:**
  - disc herniation
  - soft tissues or neurological lesions
  - tumours or infection
  - the biological age of the spine
- **Not specific to clinical presentation**
  - abnormal MRI scans were found in 30-40% of asymptomatic individuals  
(Boden 1990 - Jensen 1994)





- **biological age of the spine**
- **the physical conditions of the patient**
- **history of job and trauma of the patient**



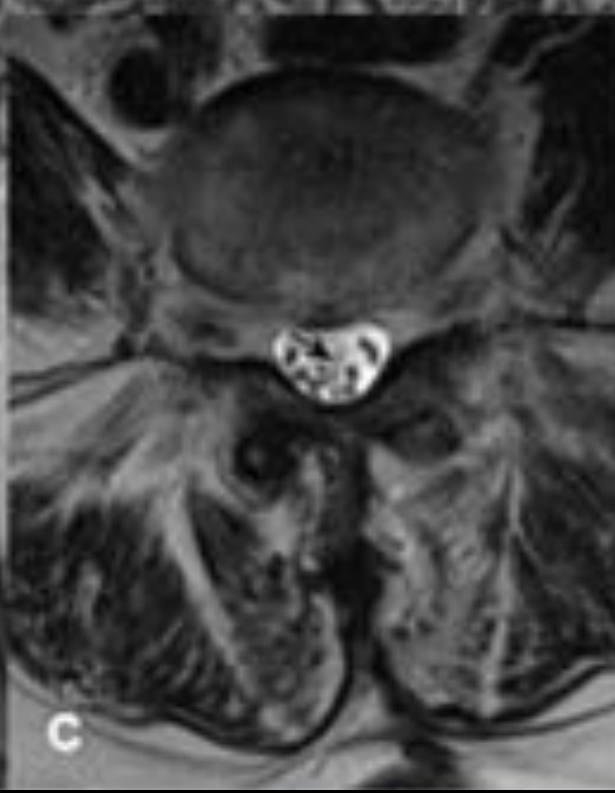
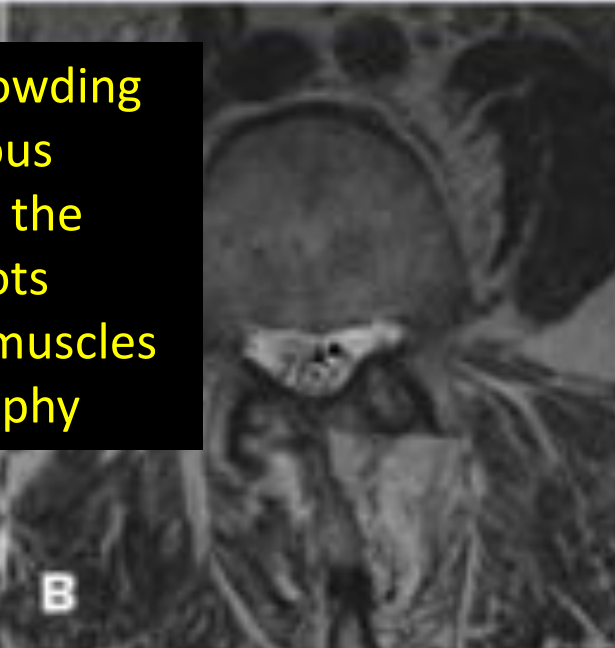
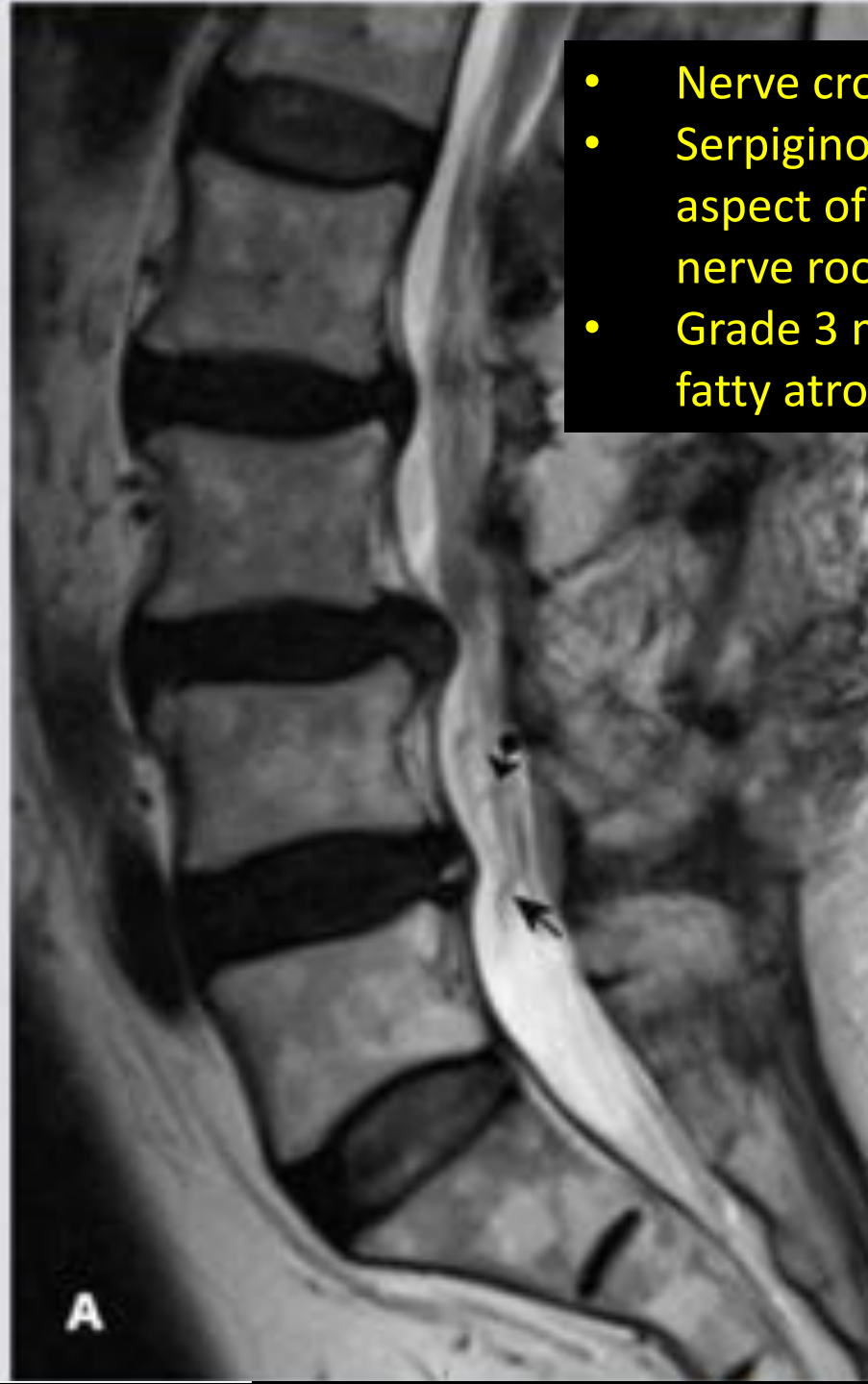
# MRI findings of degenerative disease



- endplate changes
- decreased disc height
- disc signal changes
- disc herniation
- flava and longitudinal ligaments hypertrophy
- central or lateral stenosis
- facet joints arthritis



- Nerve crowding
- Serpiginous aspect of the nerve roots
- Grade 3 muscles fatty atrophy



A

B

C



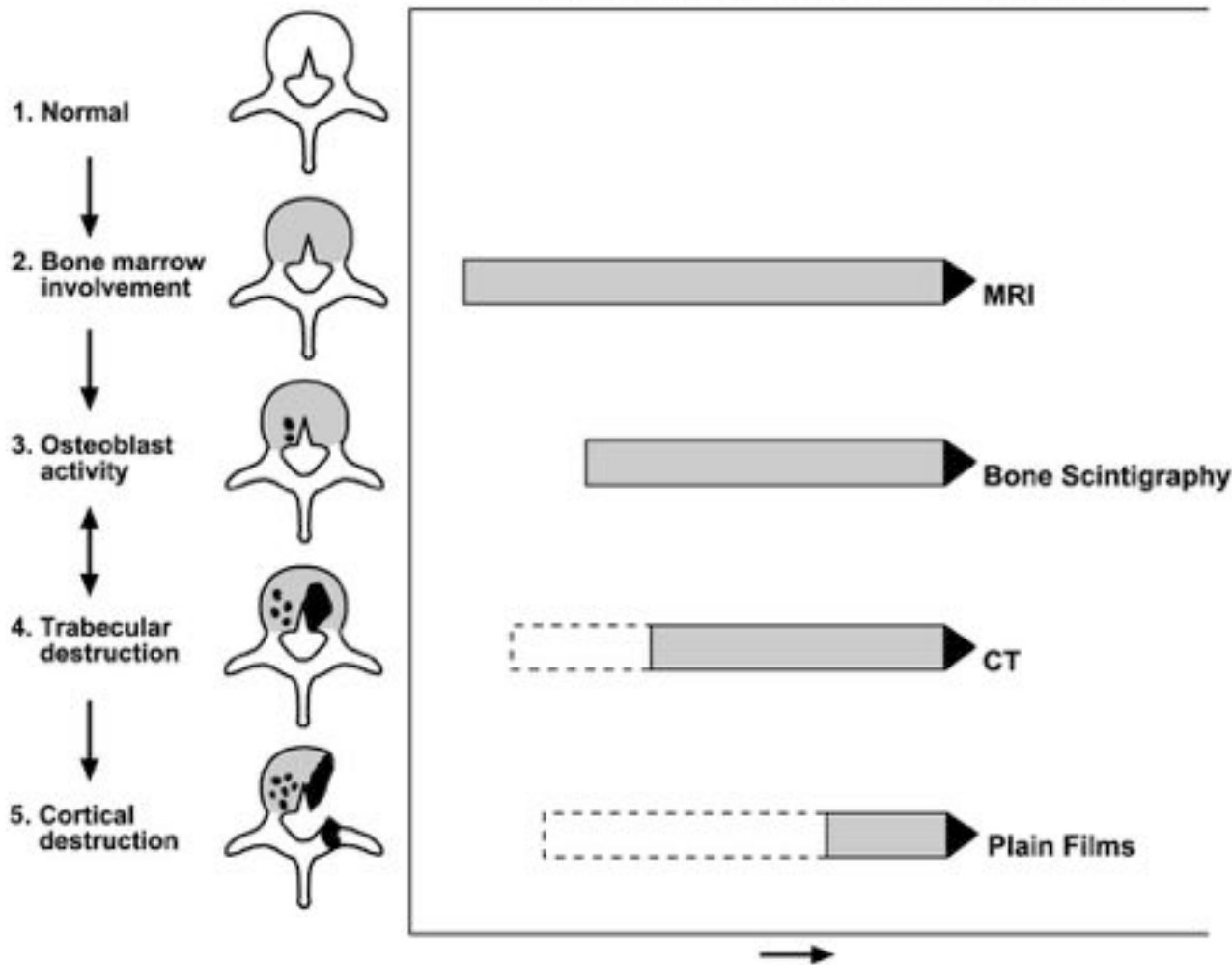
# Infections and tumours

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- **X-rays** shows poor performances:  
Detection: at least 1 cm diameter and 50% bone mineral loss
- **Second level:** (MRI +/- Gad and CT +/- Contrast)
- **Third level:** PET-SCAN

# Imaging metastatic cascade

IMAGING CORRELATED WITH PRESUMED CASCADE OF EVENTS OF LYTIC METASTASES



- Sensitivity



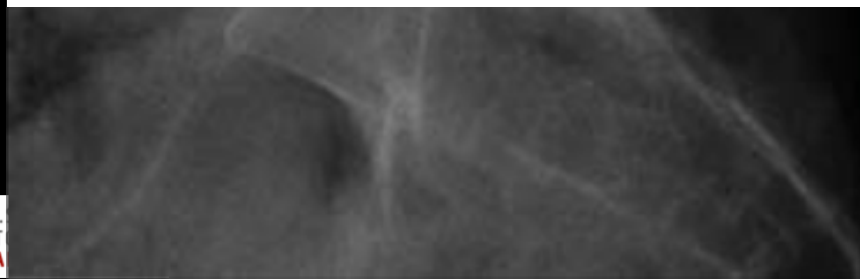
- MRI
- Bone Scintigraphy
- CTscan
- Standard radiogram

# Where's the lesion?

L3? L4? L5? S1?

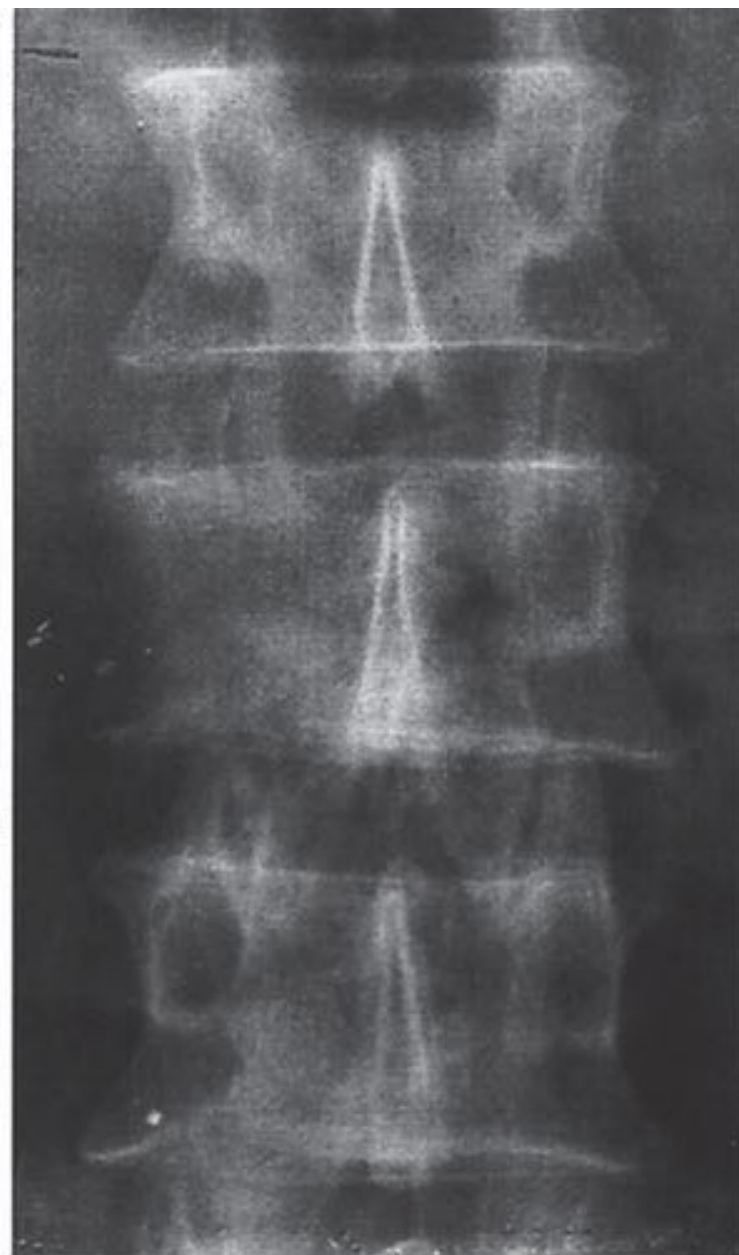
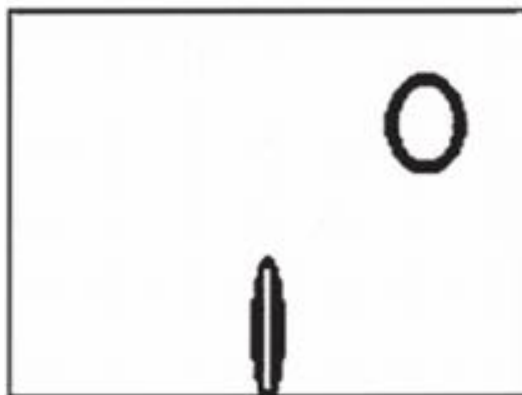
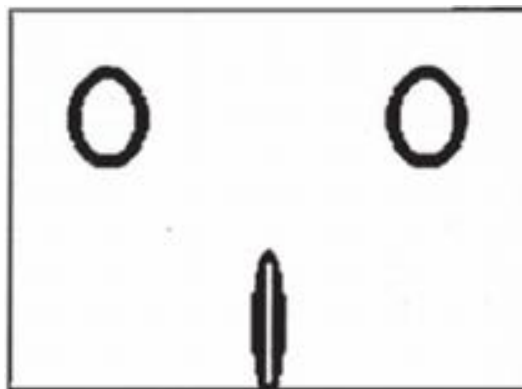


- X-Ray: Low sensitivity
  - Detection: at least 1 cm diameter and 50% bone mineral loss
  - Up to 40% of false-negative



# Xrays semiotics

- Winking Owl lesion
- Cortex erosion
- Trabecular defects
  - Hypodensity
  - Hyperdensity

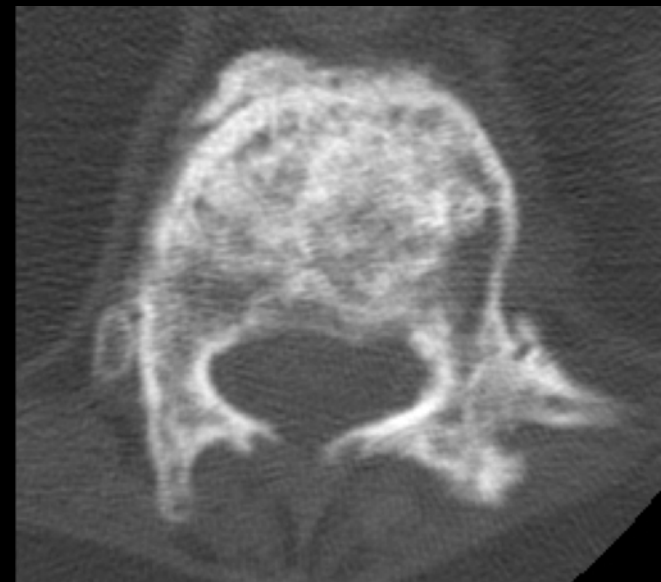




# X-Ray semiotic



- Lytic
  - Osteoblastic
  - Mixt
- 
- Cortical bone
  - Pedicles
  - Trabecular bone

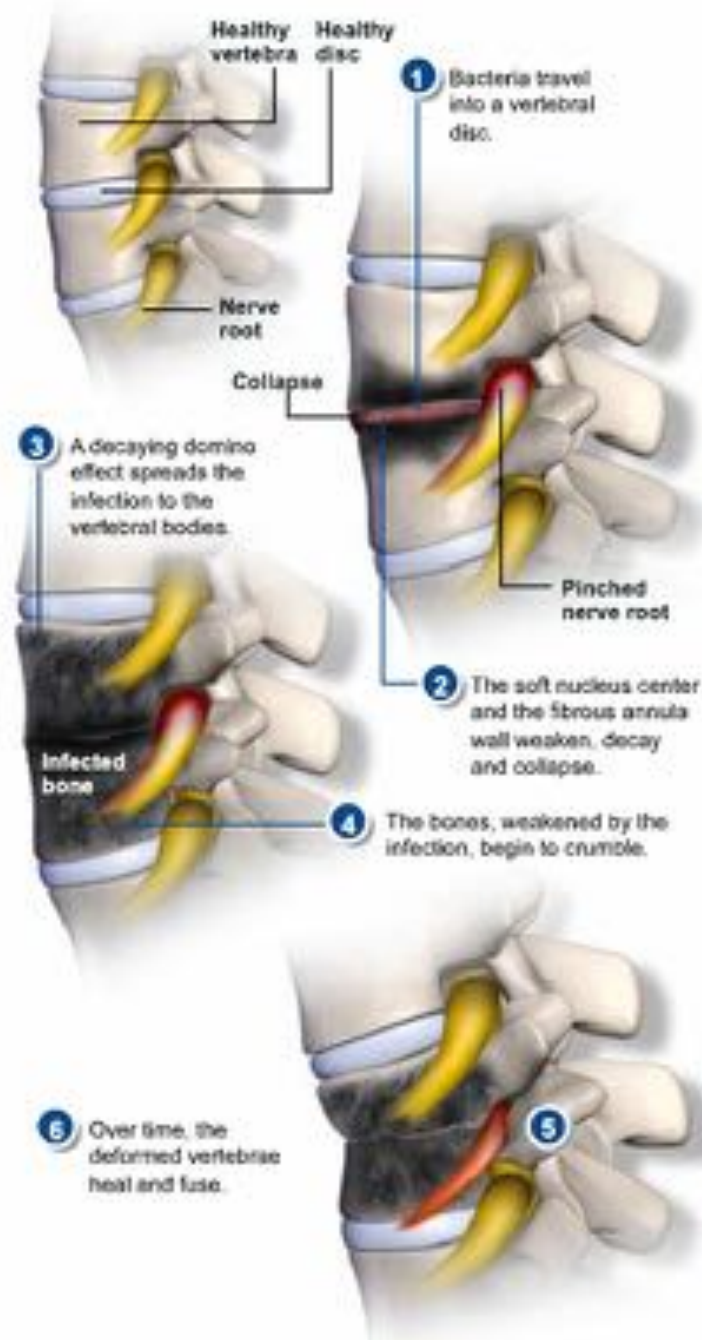


# Xrays

Osteoblastic mets from  
prostate carcinoma



## HEALTHY SPINE BEFORE INFECTION



# Infections

Plain radiographs are one of the first imaging modality when infection is suspected; however, negative radiographic findings do not exclude infection

No changes in the first 3 weeks, even as clinical and laboratory markers are emerging

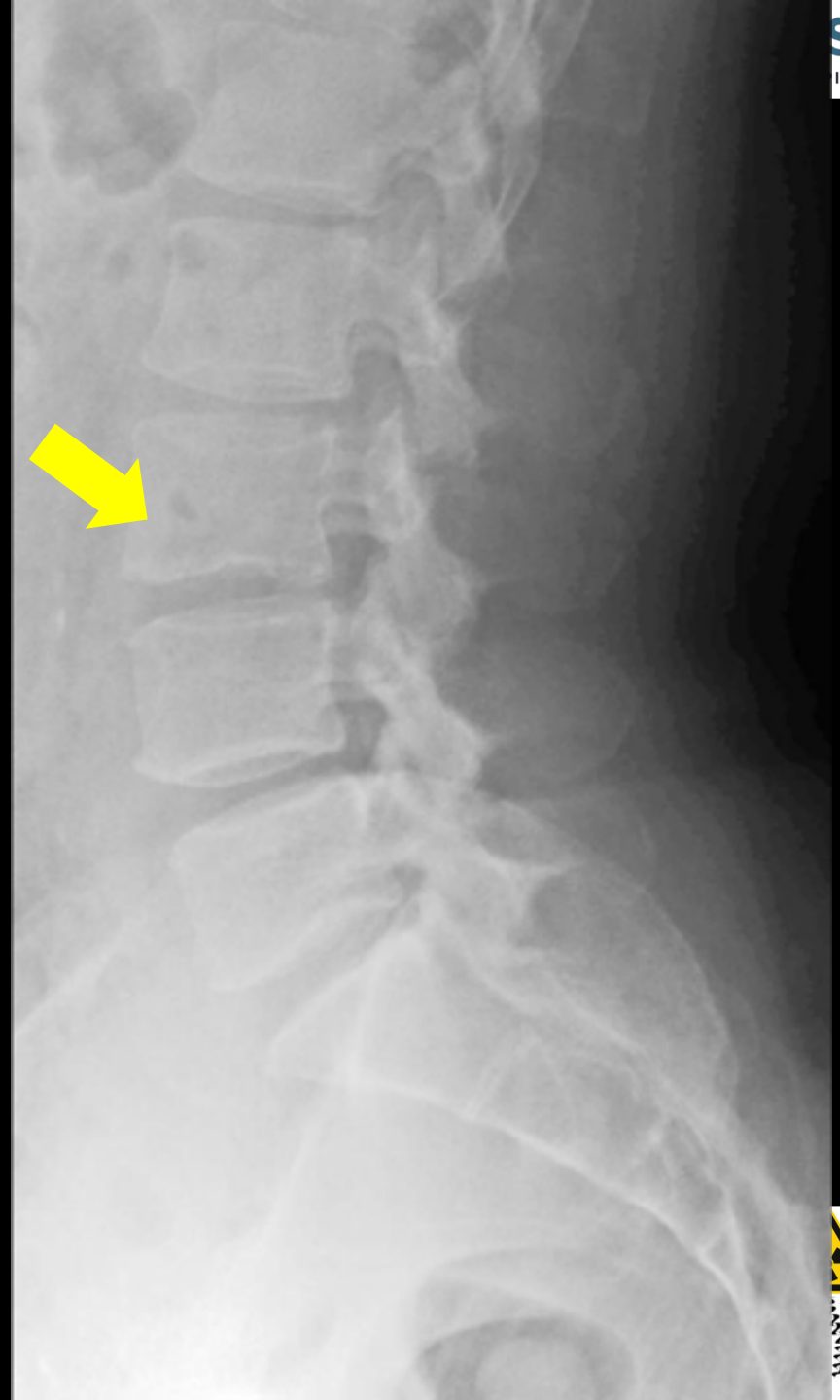
# Radiological semeiotic

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## fourth - sixth week

- disc space narrowing
- endplate changes: erosions - sclerosis
- paravertebral soft tissue shadows due to paravertebral abscess.
- loosening around the implants

Lateral plain radiograph of a patient with recurrent back and leg pain 3 weeks after a percutaneous diskectomy at L3–L4.



## Same patient 3 weeks later

- disc space narrowing
- endplate changes
  - erosions
  - sclerosis



# Multiple localizations: MRI + Gad



# MRI signal patterns

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Bony lesions

low T1

High T2 and FS

Abscesses

medium/low T1

High T2 and FS

Sensitivity 96%  
Specificity of 92%  
Accuracy of 94%

(Kishore et al 2002)



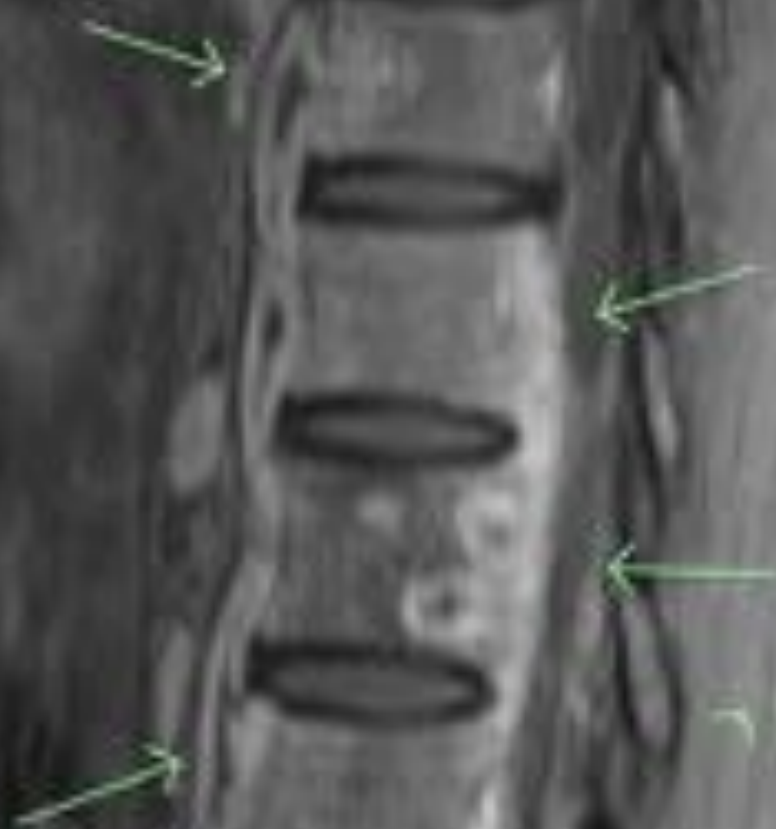
# MRI signal patterns

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## Gd-DPTA

- Intraosseous abscess
- Paraspinous abscess (ring enhancement)
- Involvement of
  - Dura
  - Ligaments
  - Subligamentous spread
  - Identification of more active lesions for biopsy.

# Epidural abscess Subligamentous spread



Appropriate Use of Diagnostic Imaging in Low Back Pain: A Reminder That Unnecessary Imaging May Do as Much Harm as Good

T.W. Flynn et al.

*Journal of Orthopaedic & Sports Physical Therapy*, 2011 Volume:41 Issue:11

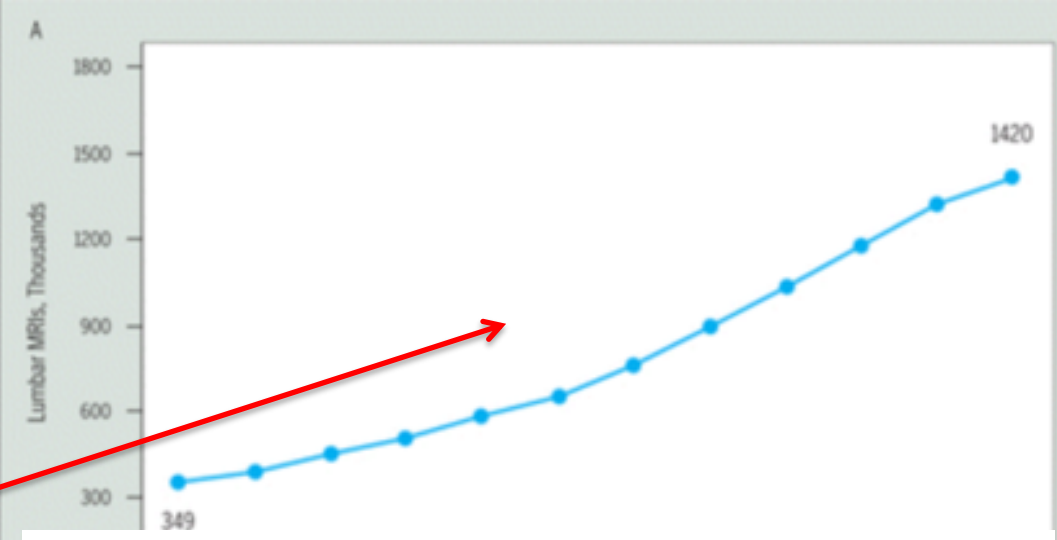
Pages:838–846 DOI: 10.2519/jospt.2011.3618

***Diagnostic imaging in individuals with LBP should only be used if the results of the image lead to a clinical decision that results in improved patient outcomes.***

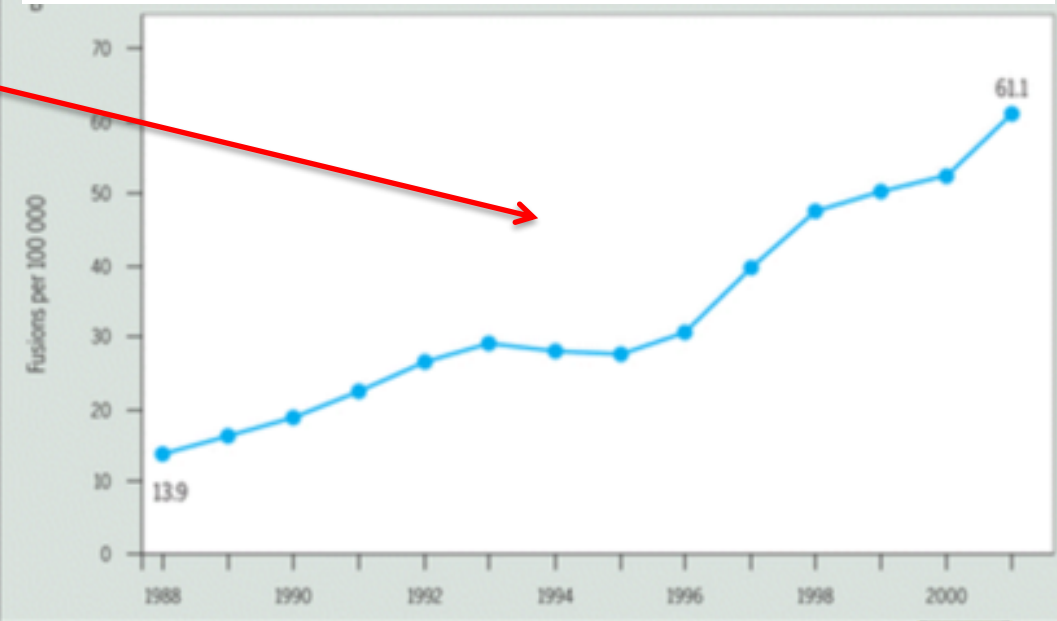
This statement appears both logical and obvious; however, data suggest that in the current US healthcare system **this is not the guiding principle**

*Journal of the American College of Radiology:*

- 26% of medical images ordered were inappropriate
- 53% inappropriate referral rate for CT
- 35% inappropriate referral rate for MRI



**We are treating MRIs, not pathology  
adapting MRI to clinical findings**



(A) Trends in lumbar MRIs

(B) lumbar fusions in the Medicare population.

Used with permission from Deyo et al.

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The potential harm associated with overimaging of lumbar spine in patients with LBP includes

- radiation exposure (lumbar radiographs and CT)
- exposure to iodinated contrast (CT)
- increased risk of surgery (MRI)

In 2007, 2.2 million lumbar CT scans were performed in the US.

- Based on the radiation exposure patients received, these CT scans were projected to cause **1200 additional future cancers**



# Low Back – Neck Pain

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- Affects more frequently elder people
- Degenerative spine condition is the rule not the exception
- Most LBP and imaging signs resolve spontaneously
- **Imaging always shows**
  - **biological age of the spine**
  - **the physical conditions**
  - **history of job and trauma of the patient**

# Conclusions

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- Start the imaging process...with an accurate clinical examination
- X-ray imaging is the first step
- MR imaging is the second step for discs, cord, etc., assessment
- CT is the third step
  - *Prescribing a CT you give radiation to the patients, be sure that it is necessary*

# Conclusions

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- When used appropriately diagnostic imaging is an important component of patient care in individuals with low back complaints.
- The inappropriate use of spine imaging
  - increases the risk of patient harm
  - contributes to the large increases in healthcare costs both directly and creating illness
- **Appropriateness must lead the clinical approach**