

Radiological investigations & anatomy of the spine

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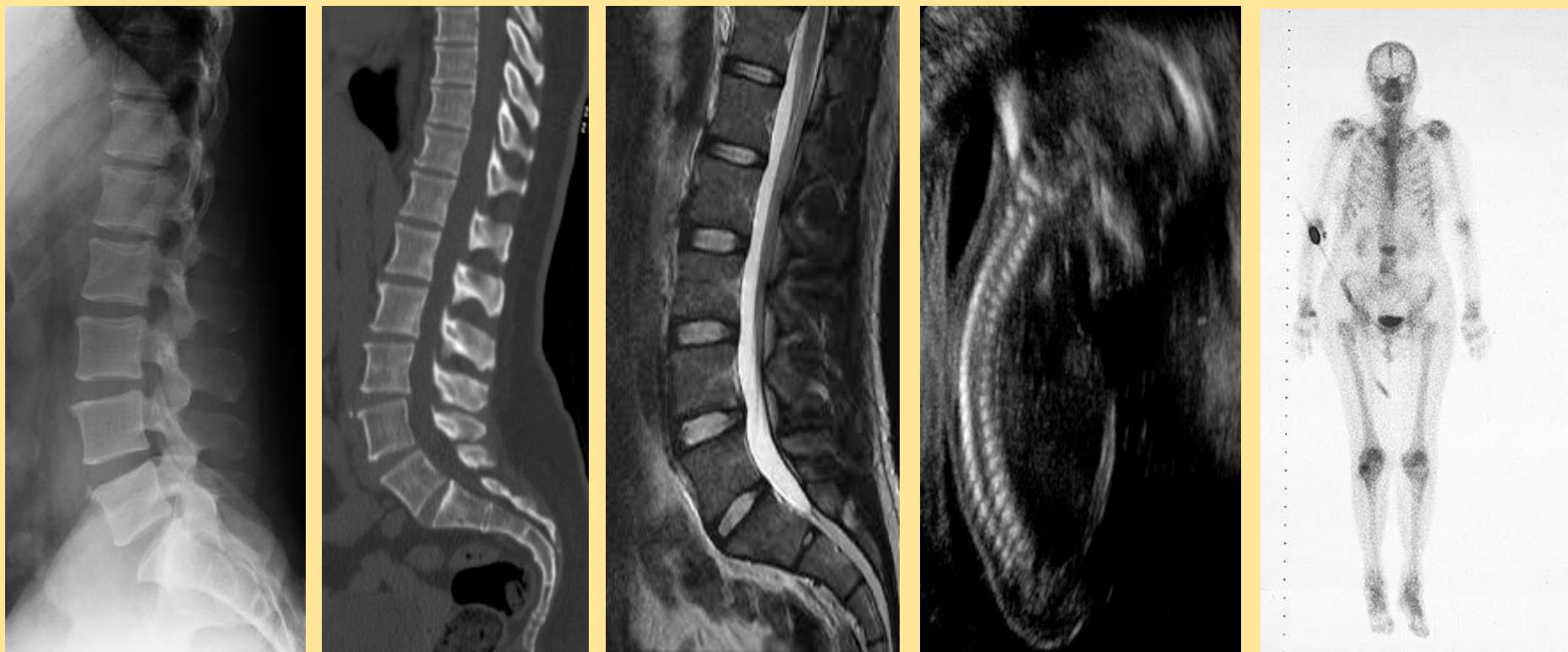
Faculty of Medicine

Ragama



Radiological modalities to investigate spine

- Plain X rays
- CT
- MRI
- Ultrasound
- Nuclear medicine



A

B

C

D

E



Plain X rays -Advantages

- Good as a first line investigation
- Low cost
- Fast
- Painless/non invasive
- Special preparations not required.
- Comparatively less radiation



Plain X rays -Disadvantages

- Radiation
- Not free to do in pregnancy.
- Not give information about spinal cord and nerve roots.
- Not much information about paraspinal pathologies.



Plain X ray-Views

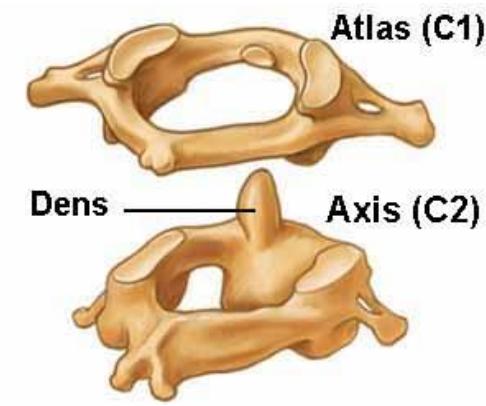
- Cervical Spine
 - Antero-posterior view (AP)
 - Lateral view (Lat)
 - Odontoid view
 - Oblique view
- Thoracic spine
 - Antero-posterior view (AP)
 - Lateral view (Lat)
- Lumbar spine
 - Antero-posterior view (AP)
 - Lateral view (Lat)
 - Oblique view
- Sacrum
 - Antero-posterior view (AP)
 - Lateral view (Lat)



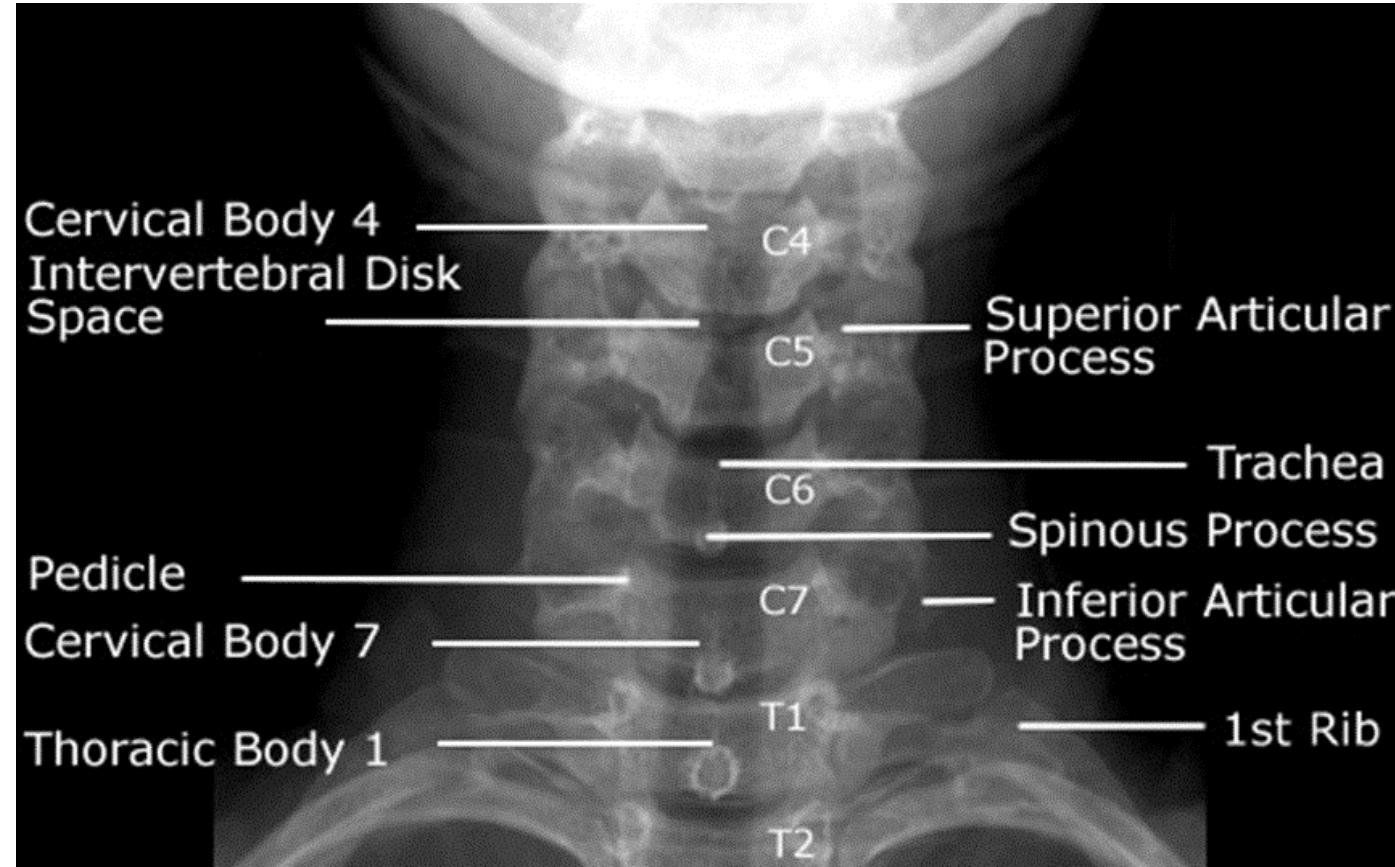
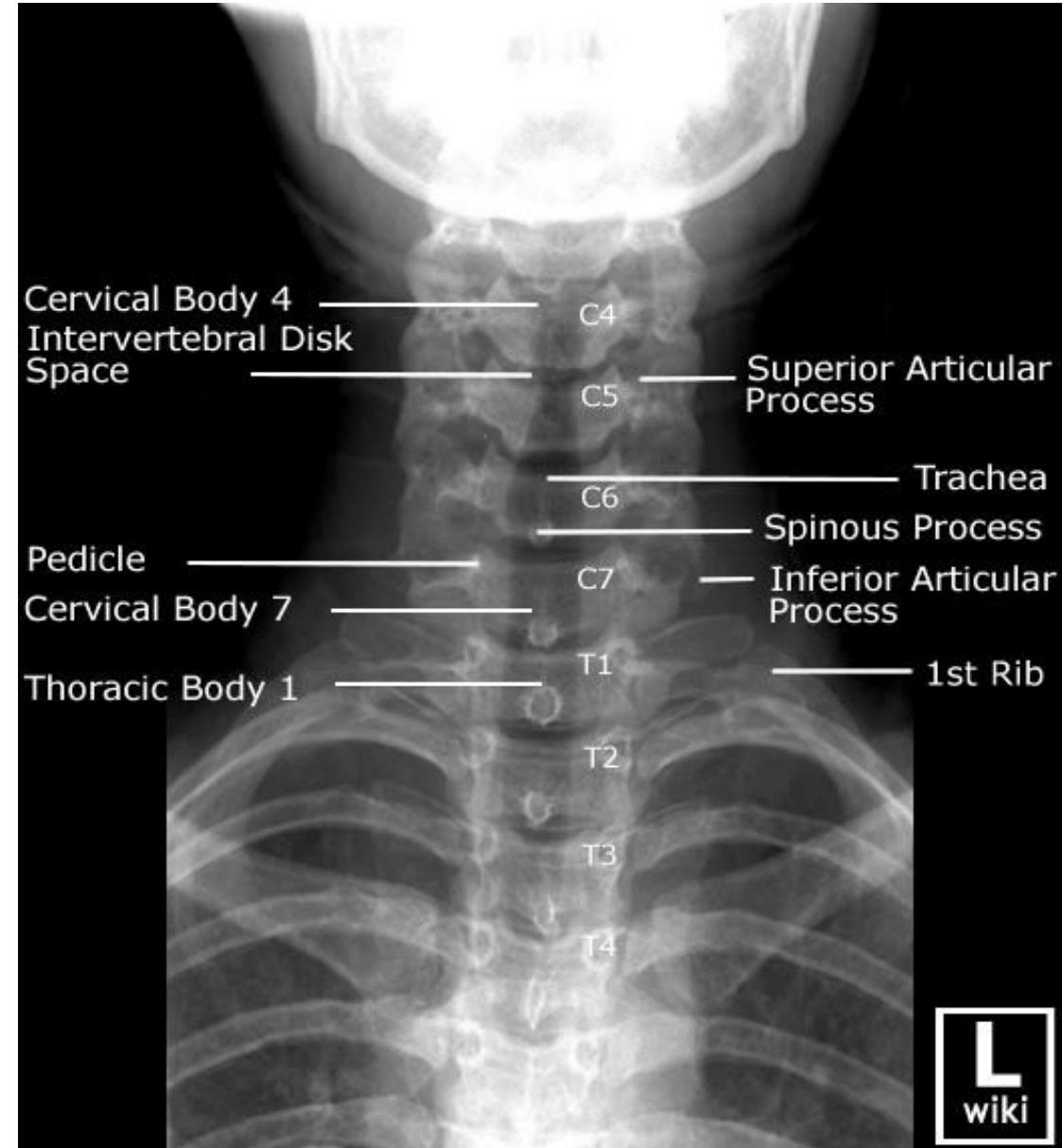
X-Ray Cervical Spine - Antero-posterior view (AP)



fineart
america



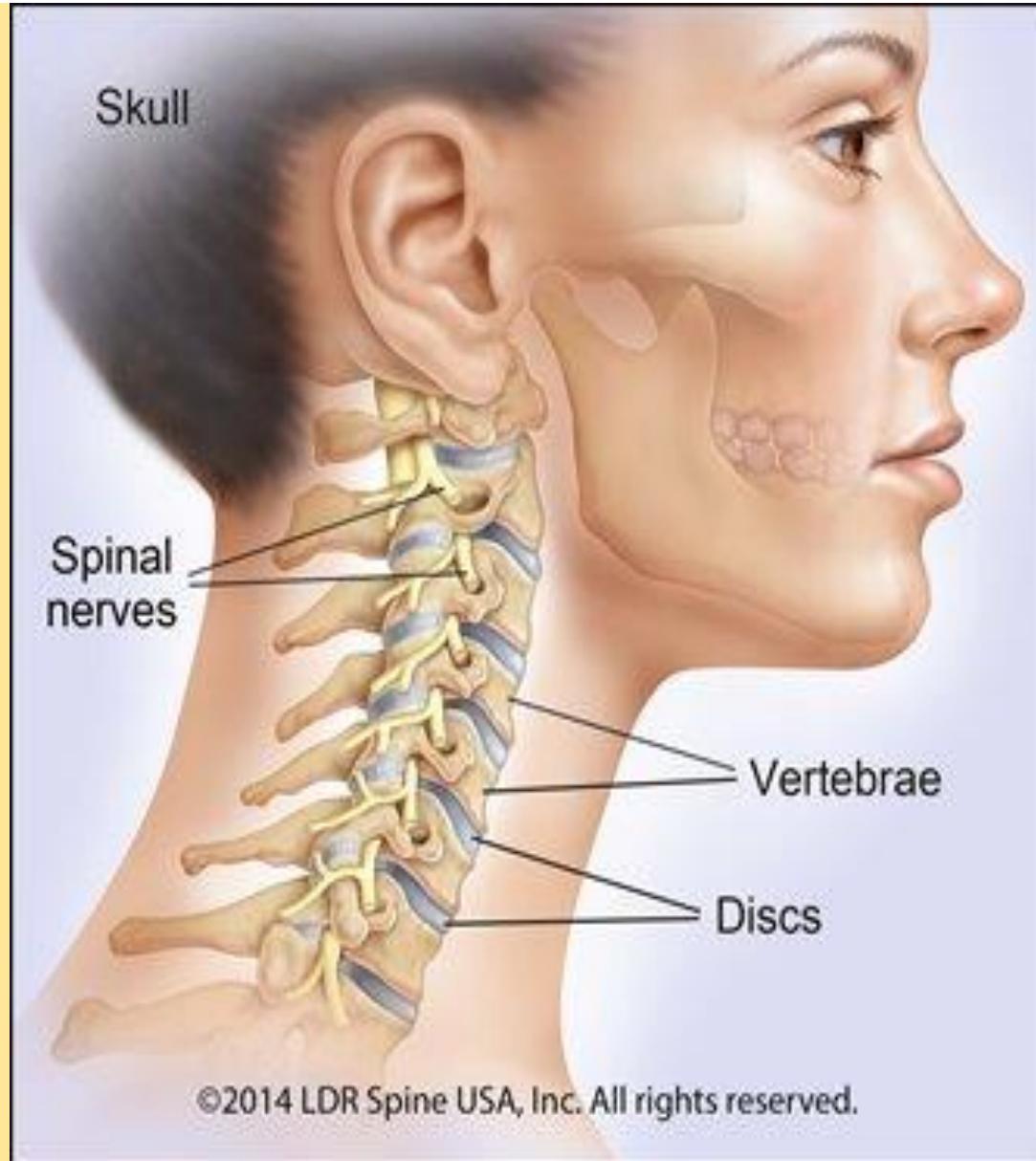
X-Ray Cervical Spine -Antero-posterior view (AP)



X-Ray Cervical Spine- Lateral view (Lat)



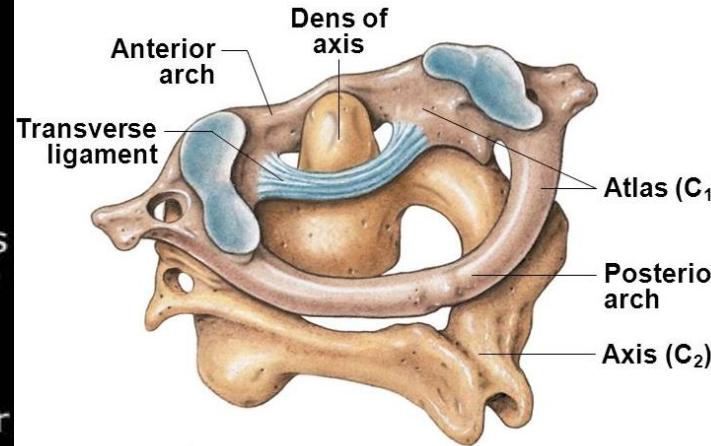
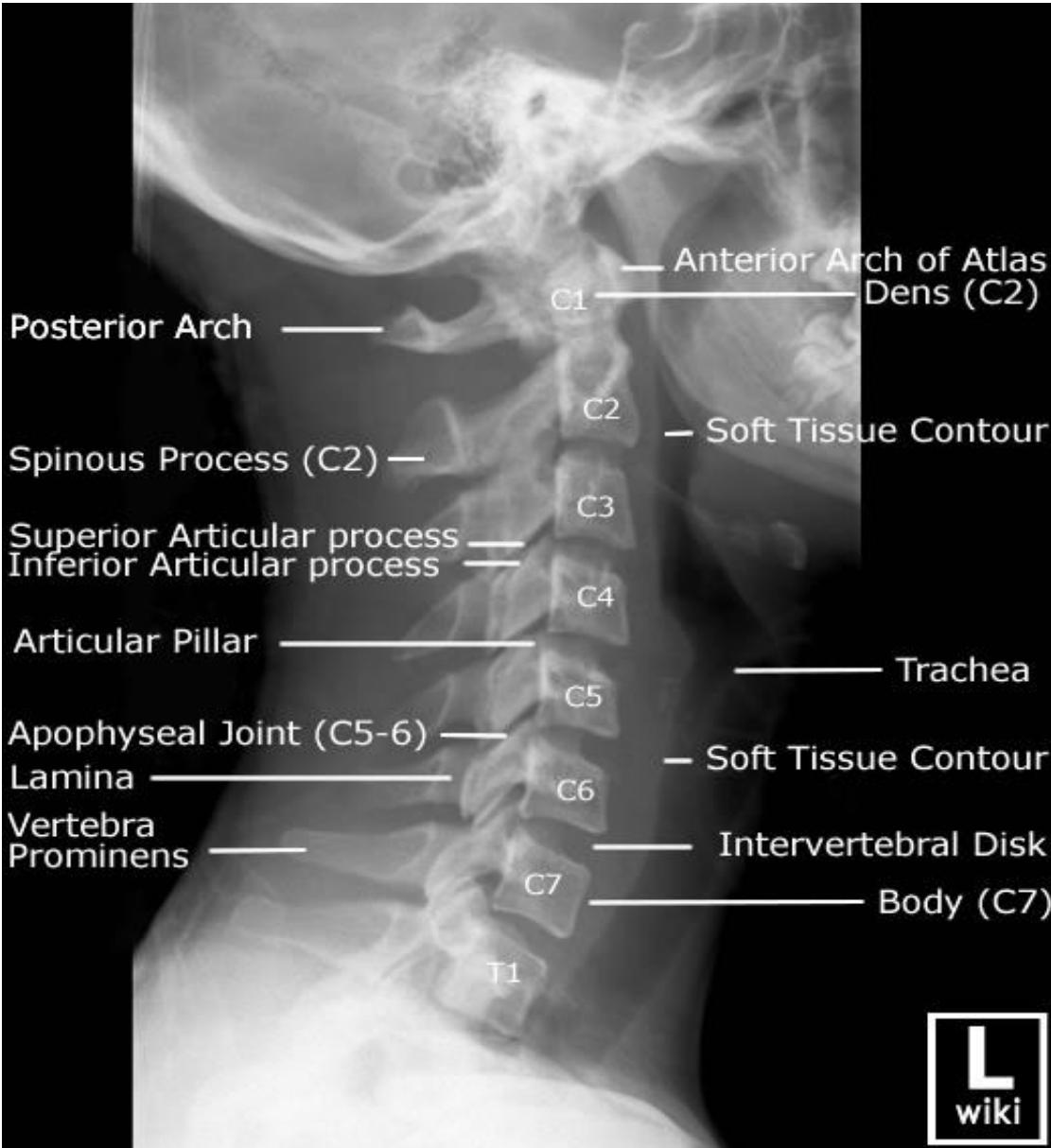
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X-Ray Cervical Spine - Lateral view (Lat)



(d) The atlas–axis complex



X-Ray Cervical Spine

■ Lateral view (Lat) –Important Lines

-Anterior vertebral line

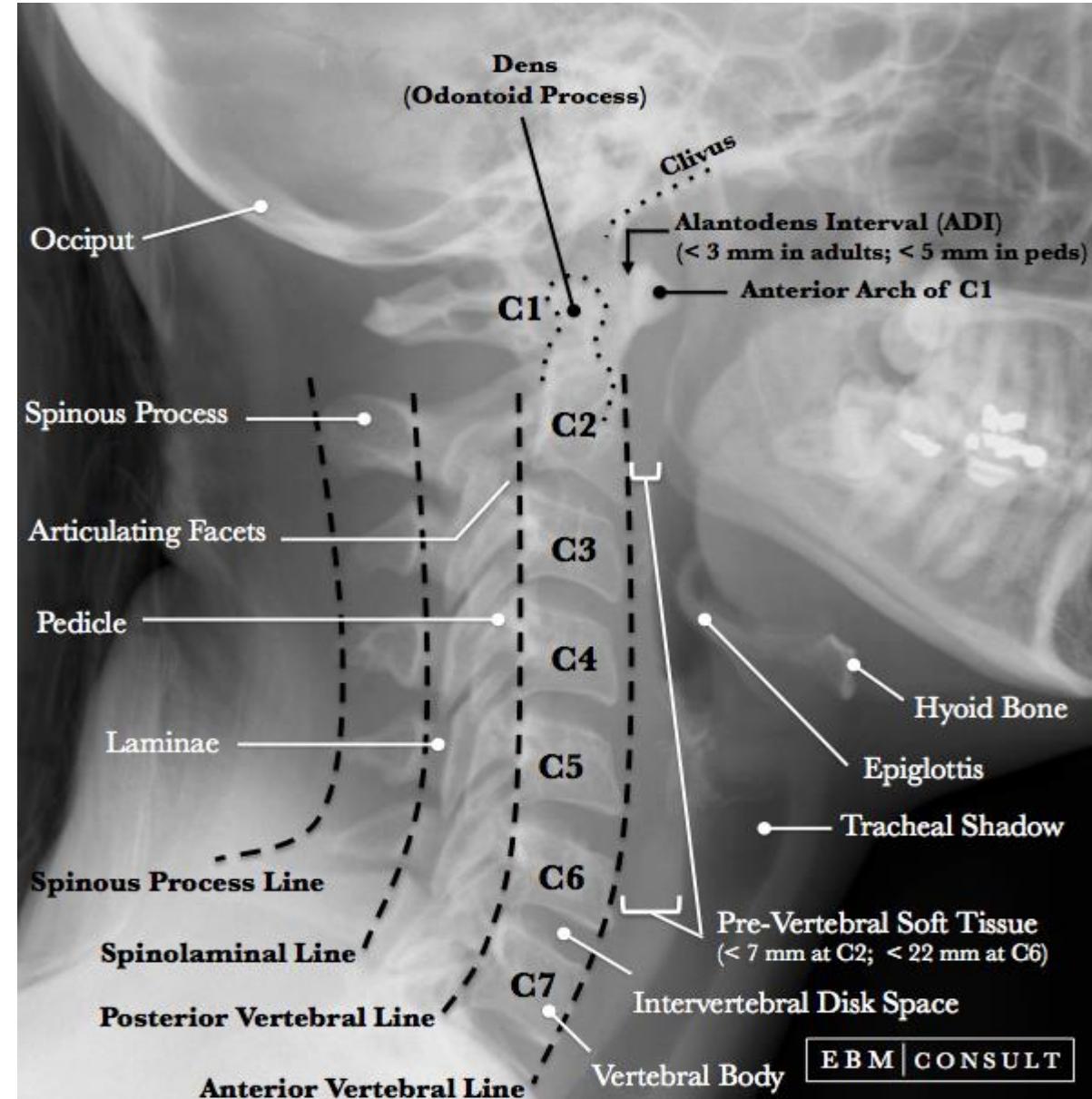
-Posterior vertebral line

-Spinolamina Line

-Spinous processes line.



X-Ray Cervical Spine- Important Lines



- Anterior vertebral line
- Posterior vertebral line
- Spinolaminal Line
- Spinous processes line.



X-Ray Cervical Spine- Odontoid view or open mouth view

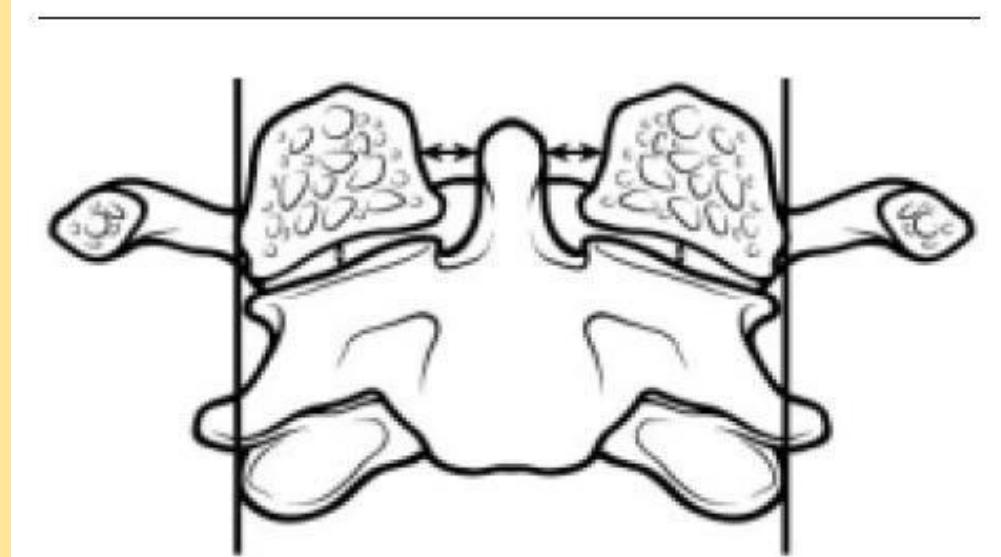
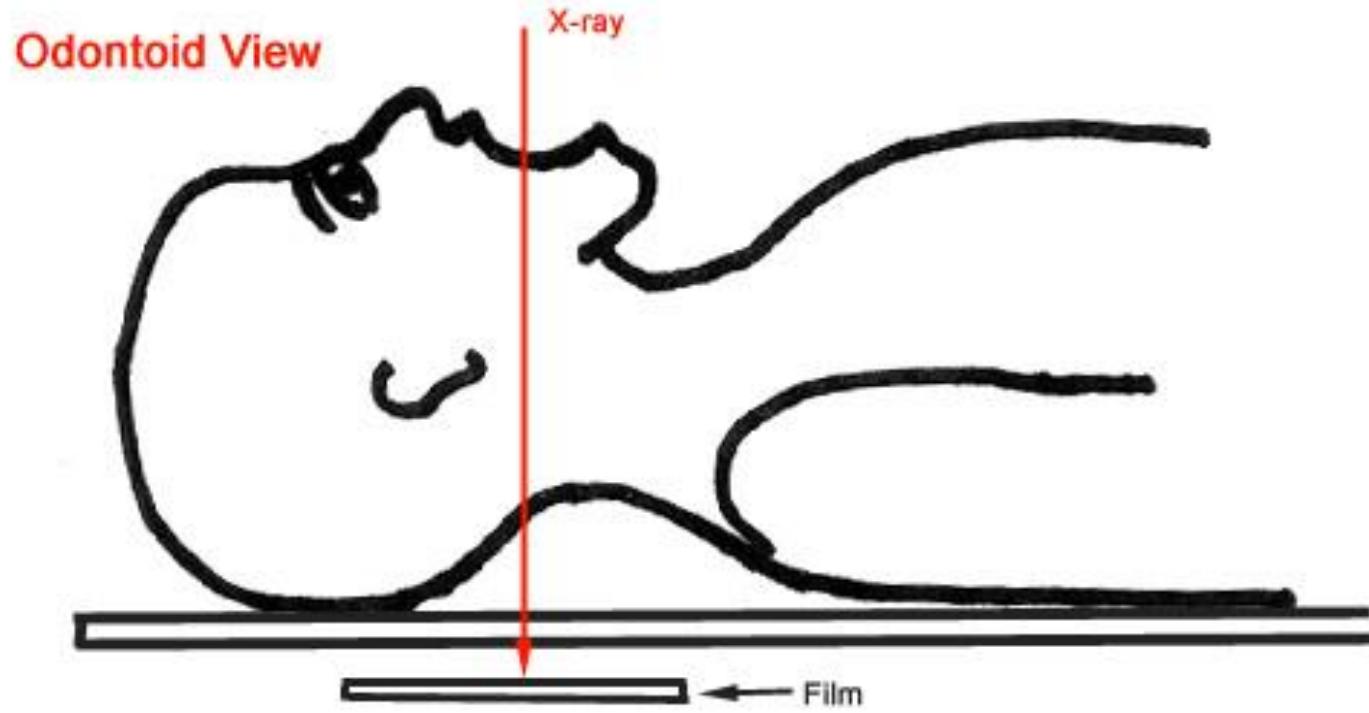
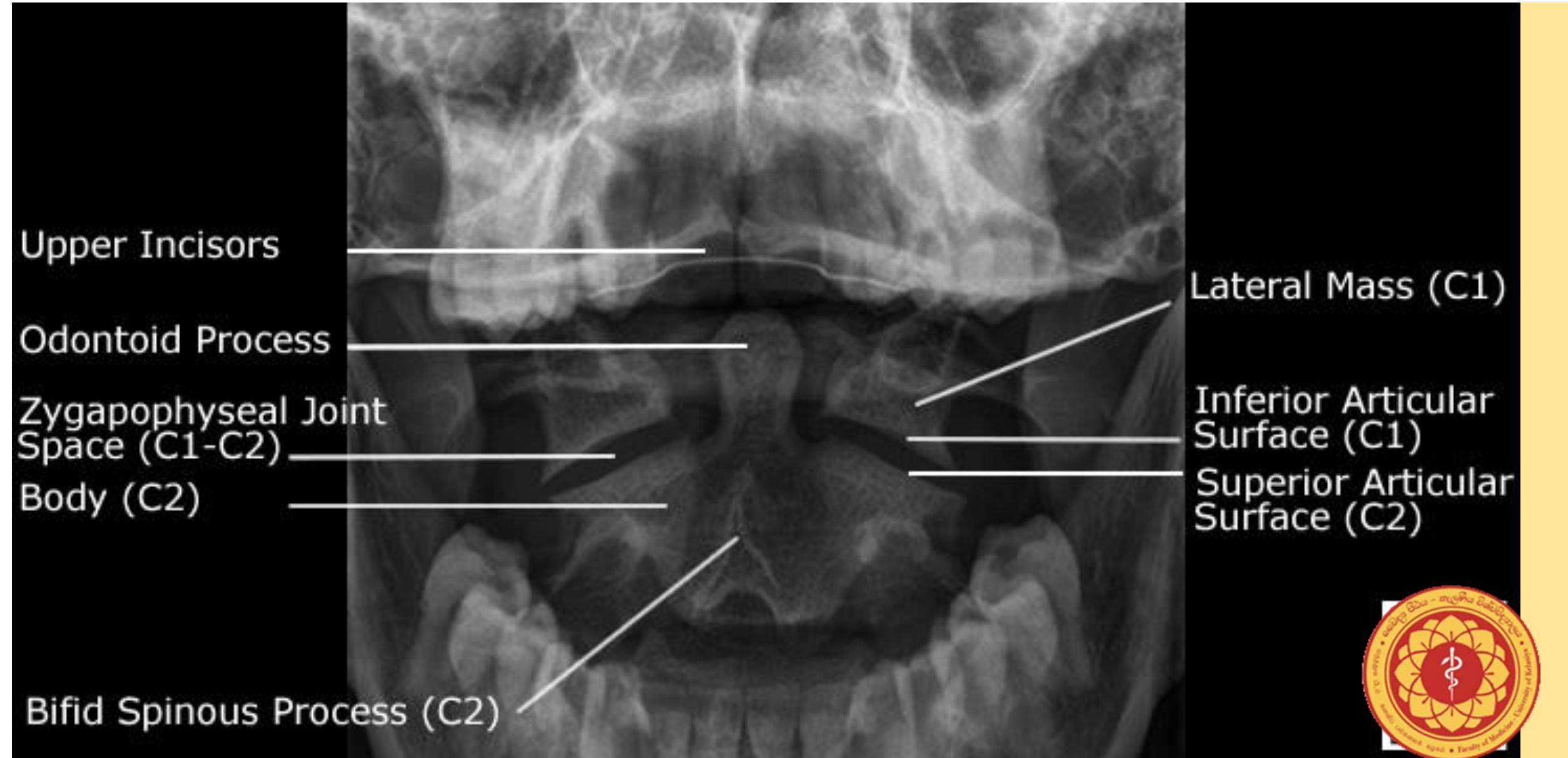


Figure 7. Open mouth view. Note alignment and symmetry of lateral masses.

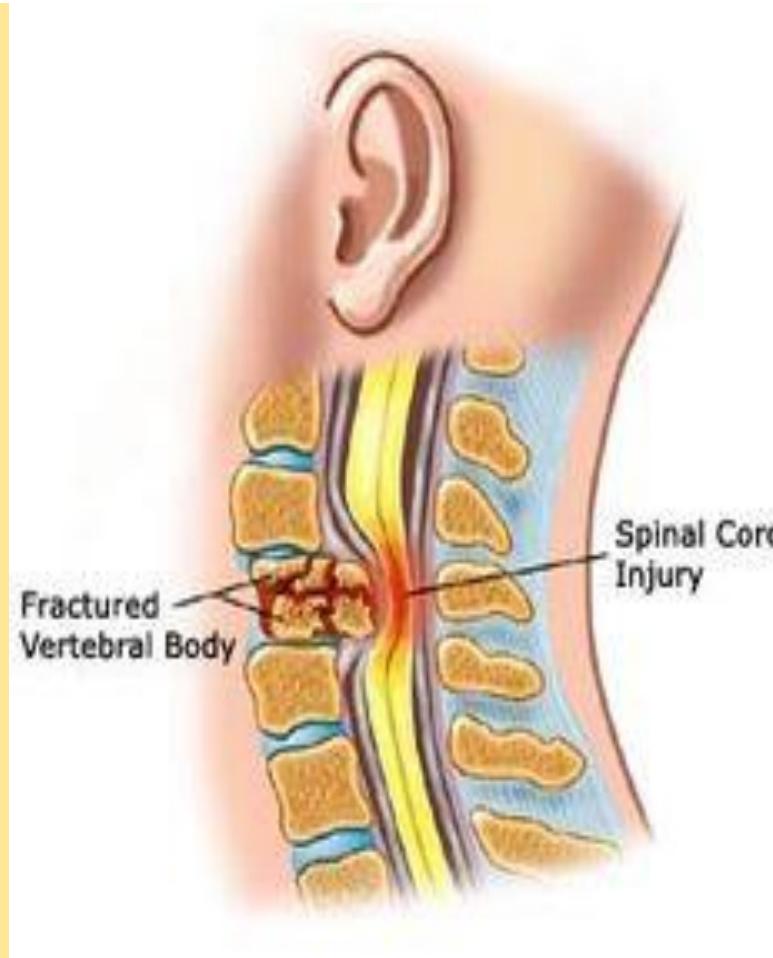
Important !! : Fracture through the base of the odontoid process severely compromises the stability of the upper cervical spine.



X-Ray Cervical Spine- Odontoid view or open mouth view



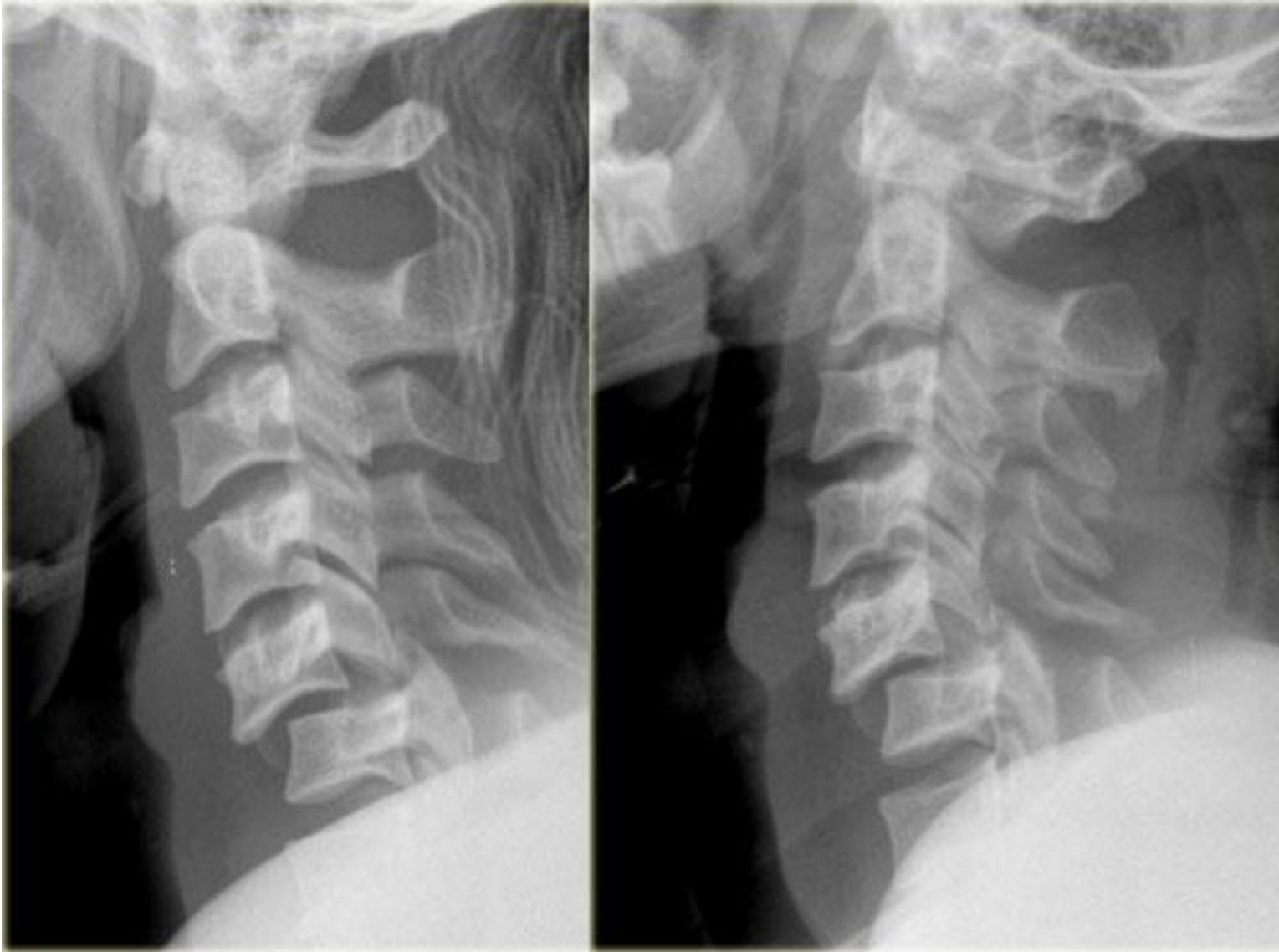
X-Ray Cervical Spine-Clinically important cases- fractures



21 y old motor cyclist was admitted to ETU after a RTA.



X-Ray Cervical Spine-Clinically important cases- Dislocations

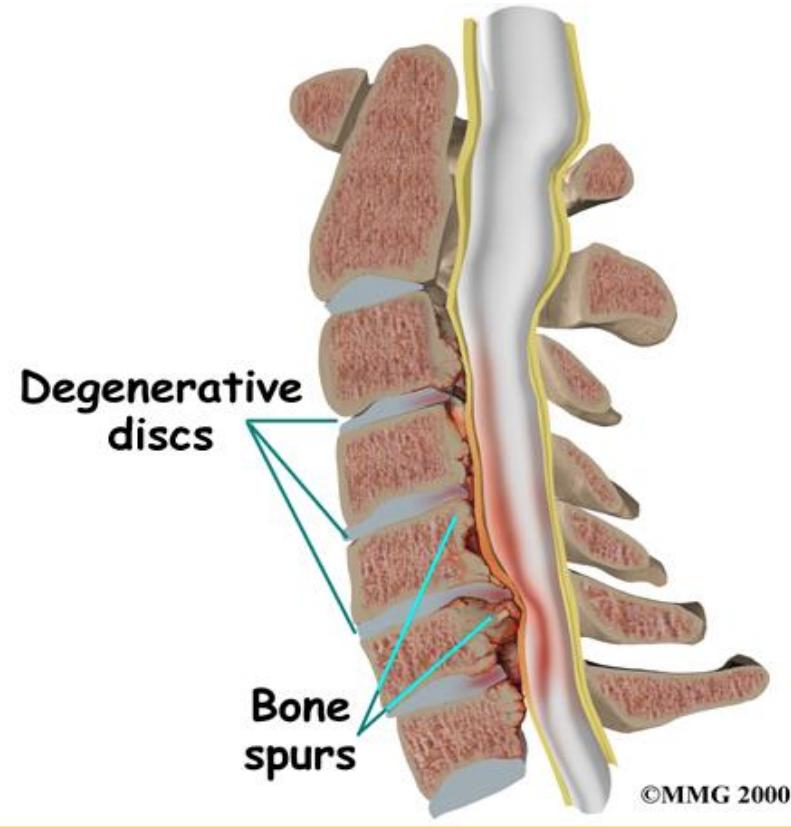


39 Y Old manual worker admitted to NCTH Ragama with multiple injuries after fallen from 15 feet height.



X-Ray Cervical Spine-Clinically important cases-Degeneration

Degenerative Changes:
Cervical Spine



65 Y old lady presented to the
orthopedic clinic C/O neck pain and
R/side arm numbness



X-Ray Cervical Spine- Pre-vertebral abscess



Middle aged man with a history of intravenous drug use, presented with progressive, excruciating neck pain radiating to the shoulders.

Examination of the neck did not reveal any external abnormalities. The posterior pharyngeal wall looked normal. A lateral cervical spine x-ray showed widening of the prevertebral / retropharyngeal space, with destruction of the 5th and 6th cervical vertebral bodies.



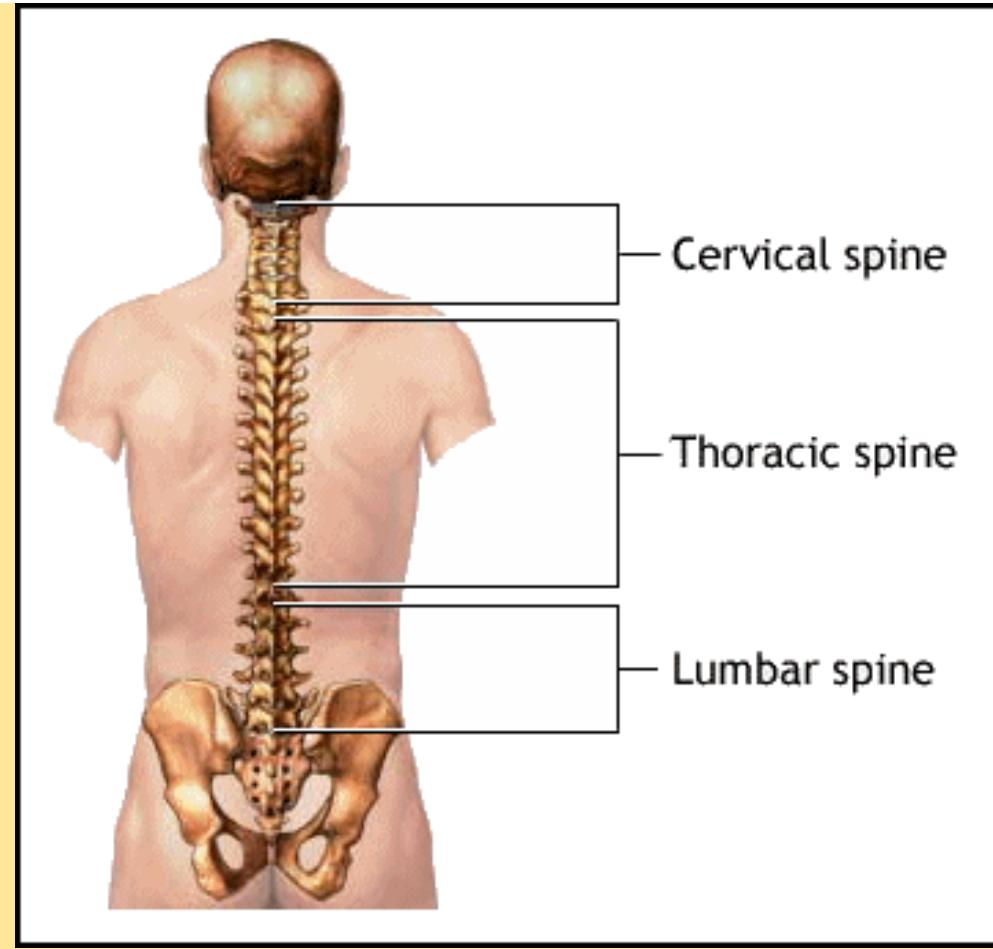
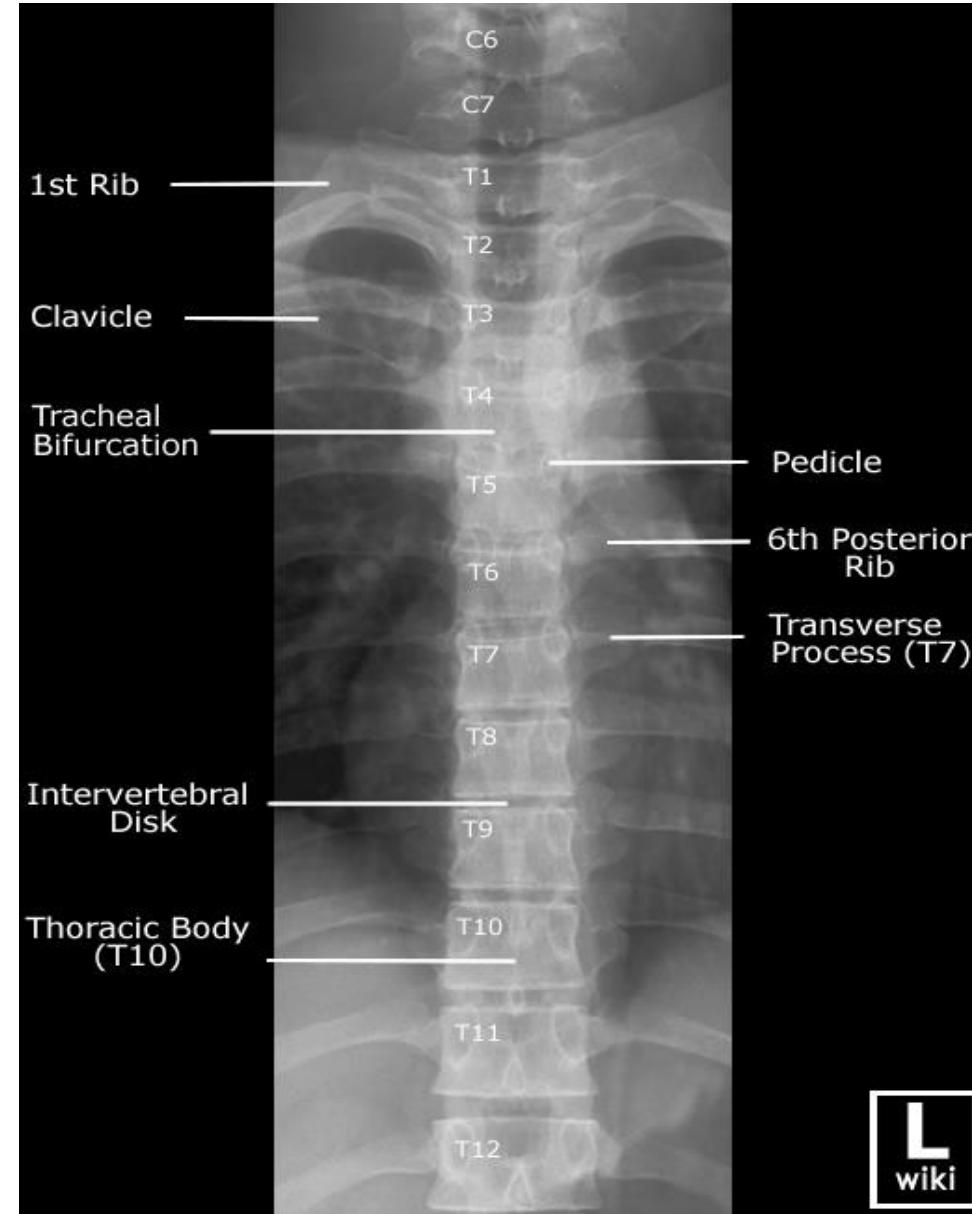
MCQ

- Which of the following movements is minimally permitted at the atlanto-occipital joint?
 - A.Flexion
 - B.Extension
 - C.Lateral flexion
 - D.Rotation
 - E.Nodding

MCQ -Explanation

- Which of the following movements is minimally permitted at the atlanto-occipital joint?
 - A.Flexion
 - B.Extension
 - C.Lateral flexion
 - D.Rotation - Correct Answer
 - E.Nodding
- Atlanto-occipital joint is formed by a pair of condyloid synovial joints between the occipital condyles and the superior articular facets of the first cervical vertebra (atlas/C1). It allows flexion and extension (a combination of which results in "nodding"), as well as lateral flexion. Rotation of the skull is limited at this joint, but is possible at the atlanto-axial articulation.

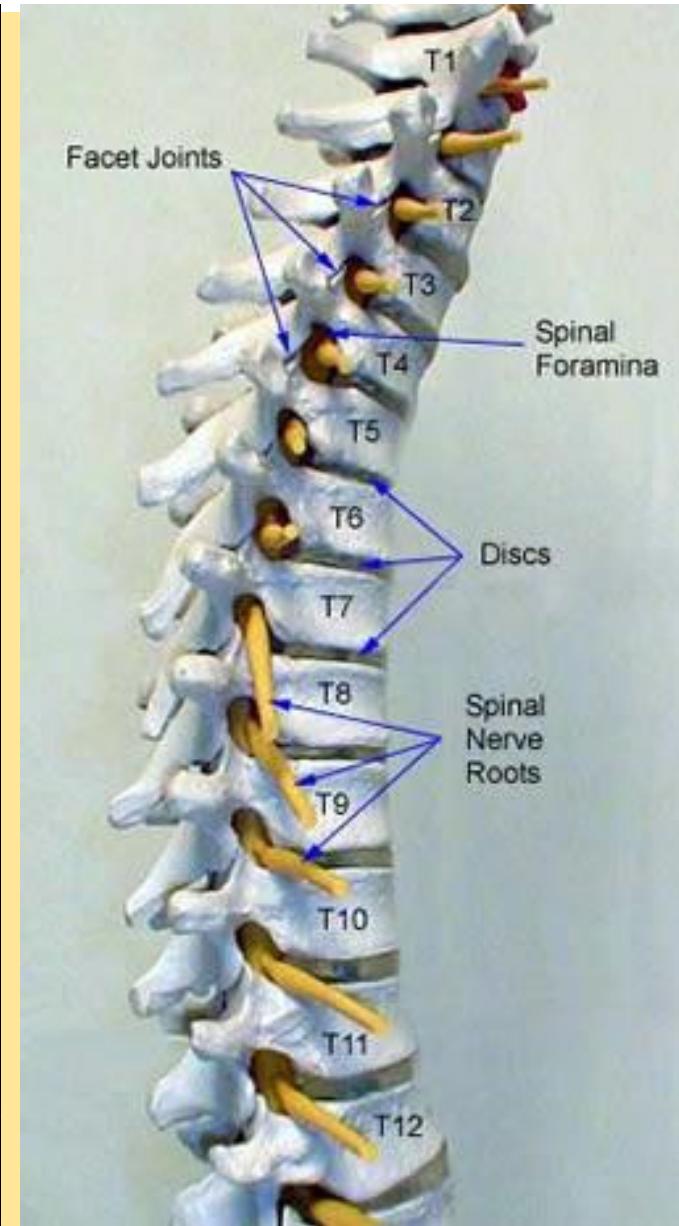
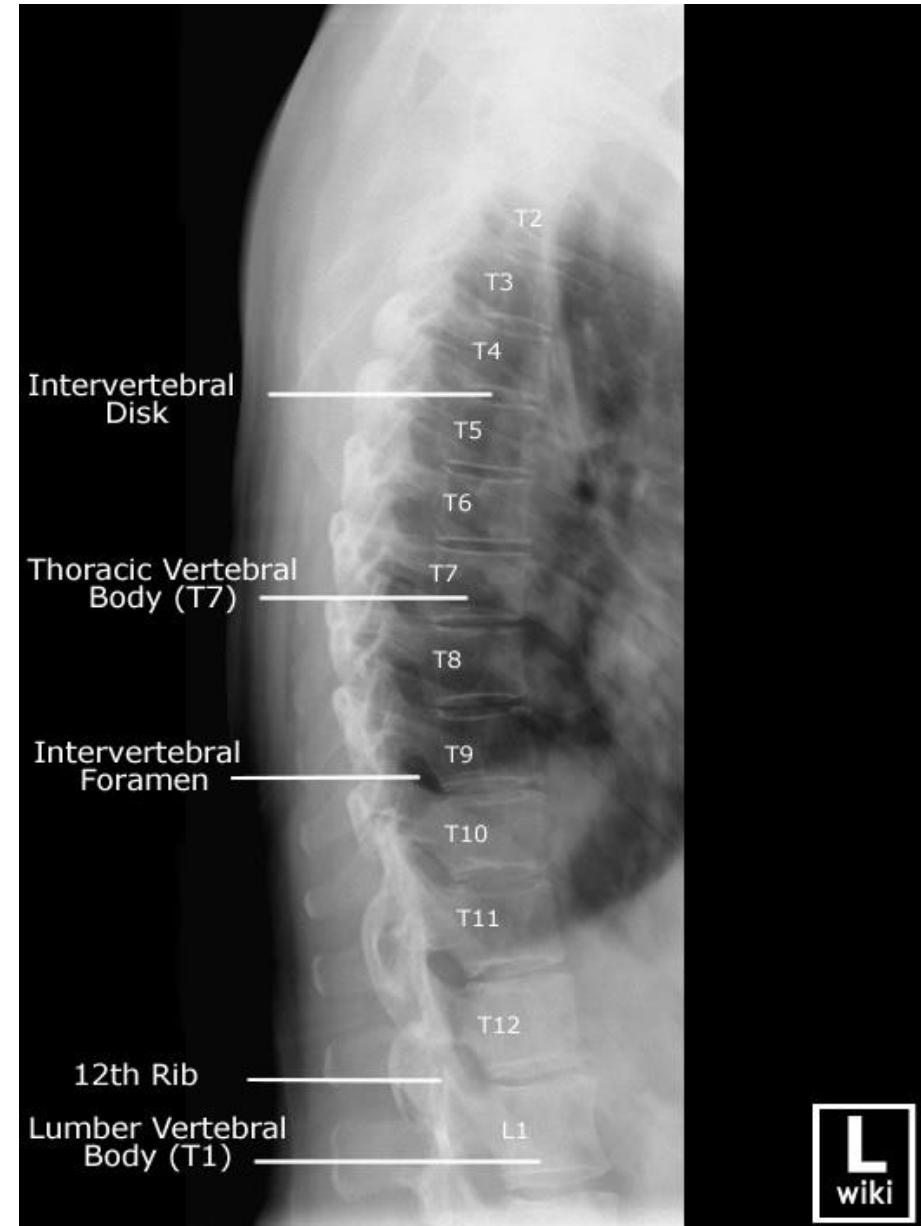
X-Ray Thoracic Spine Antero-posterior view (AP)



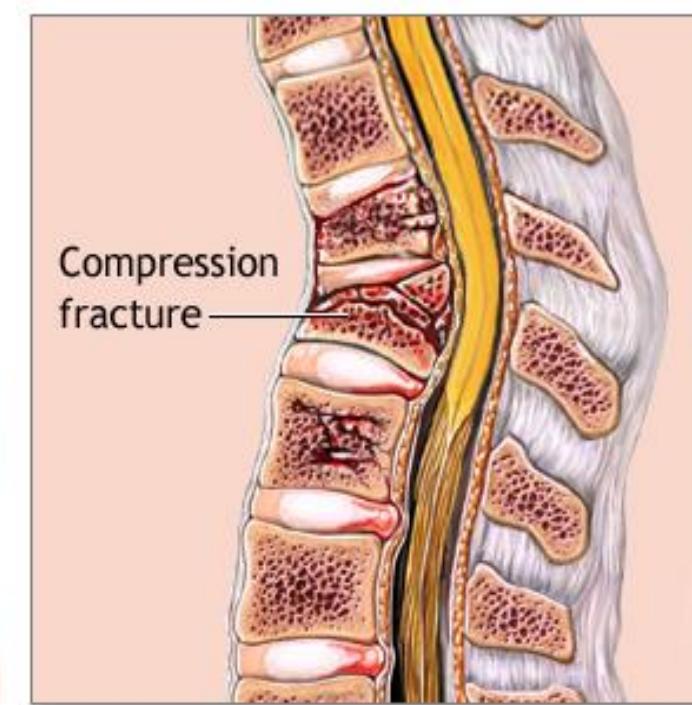
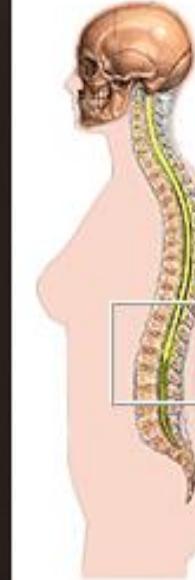
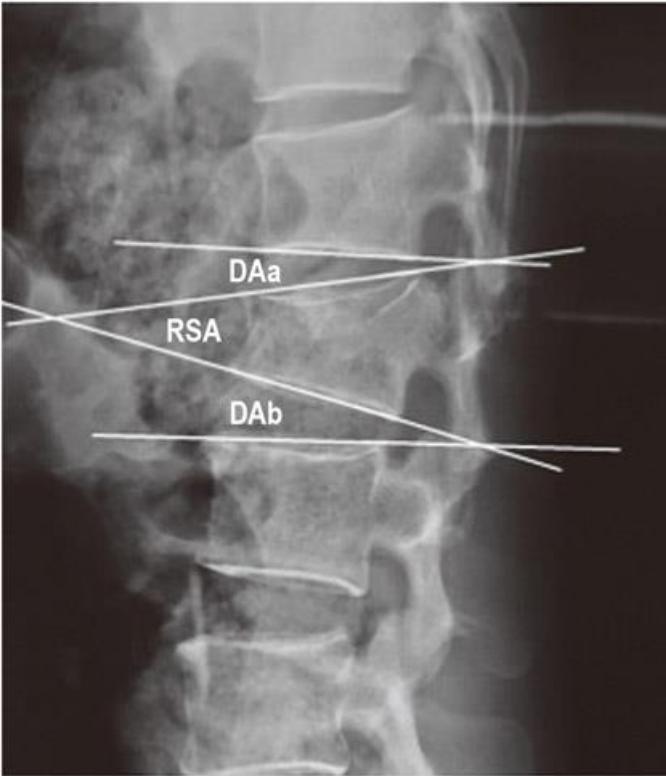
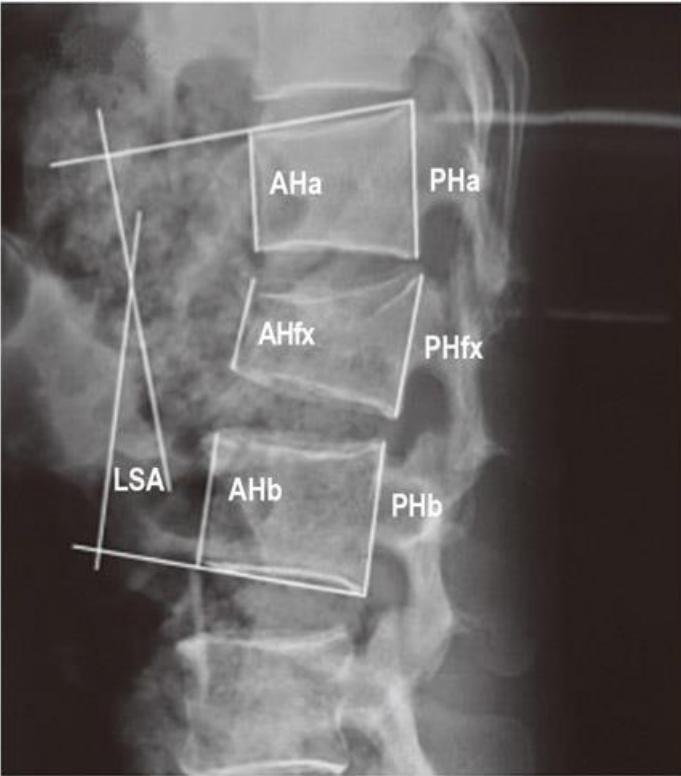
X-Ray Thoracic Spine



X-Ray Thoracic Spine –Lateral view



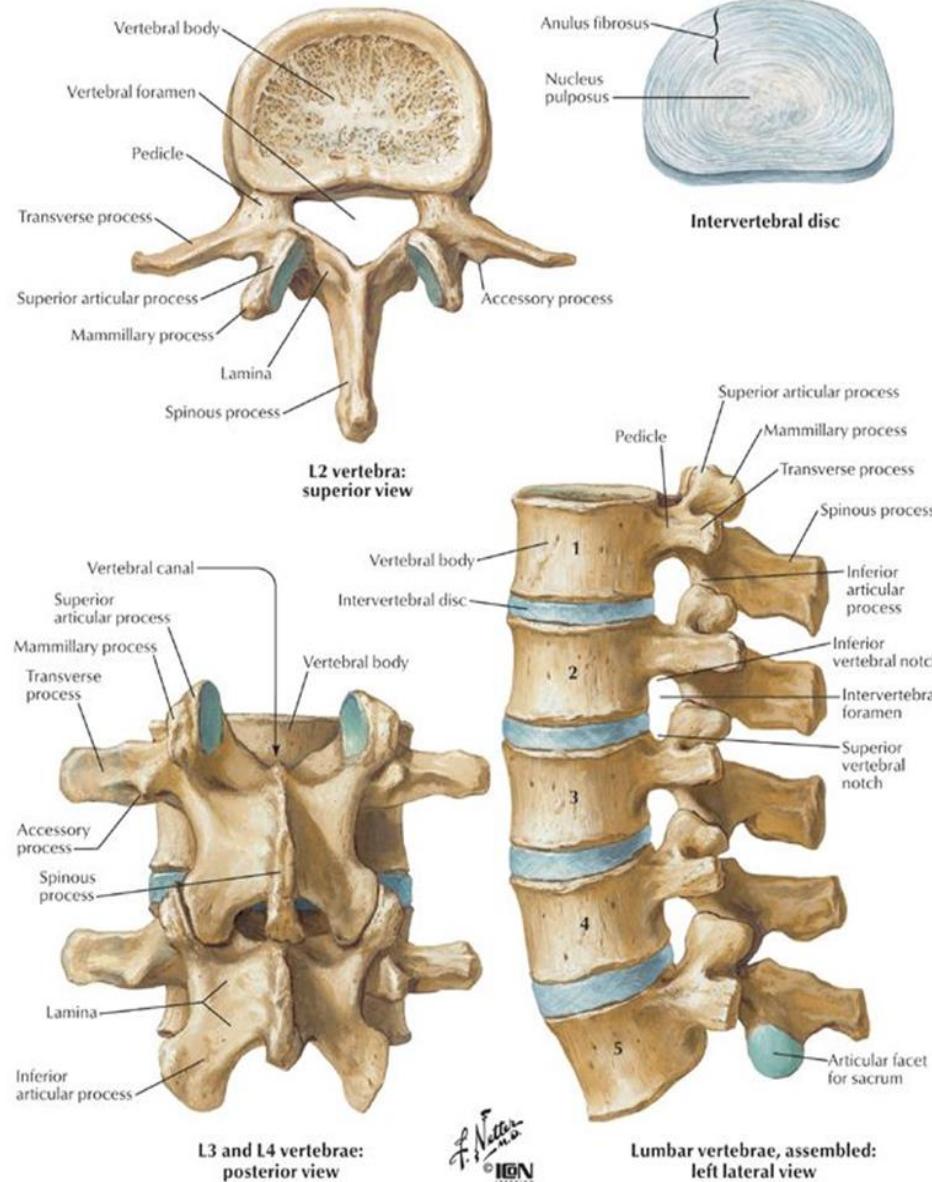
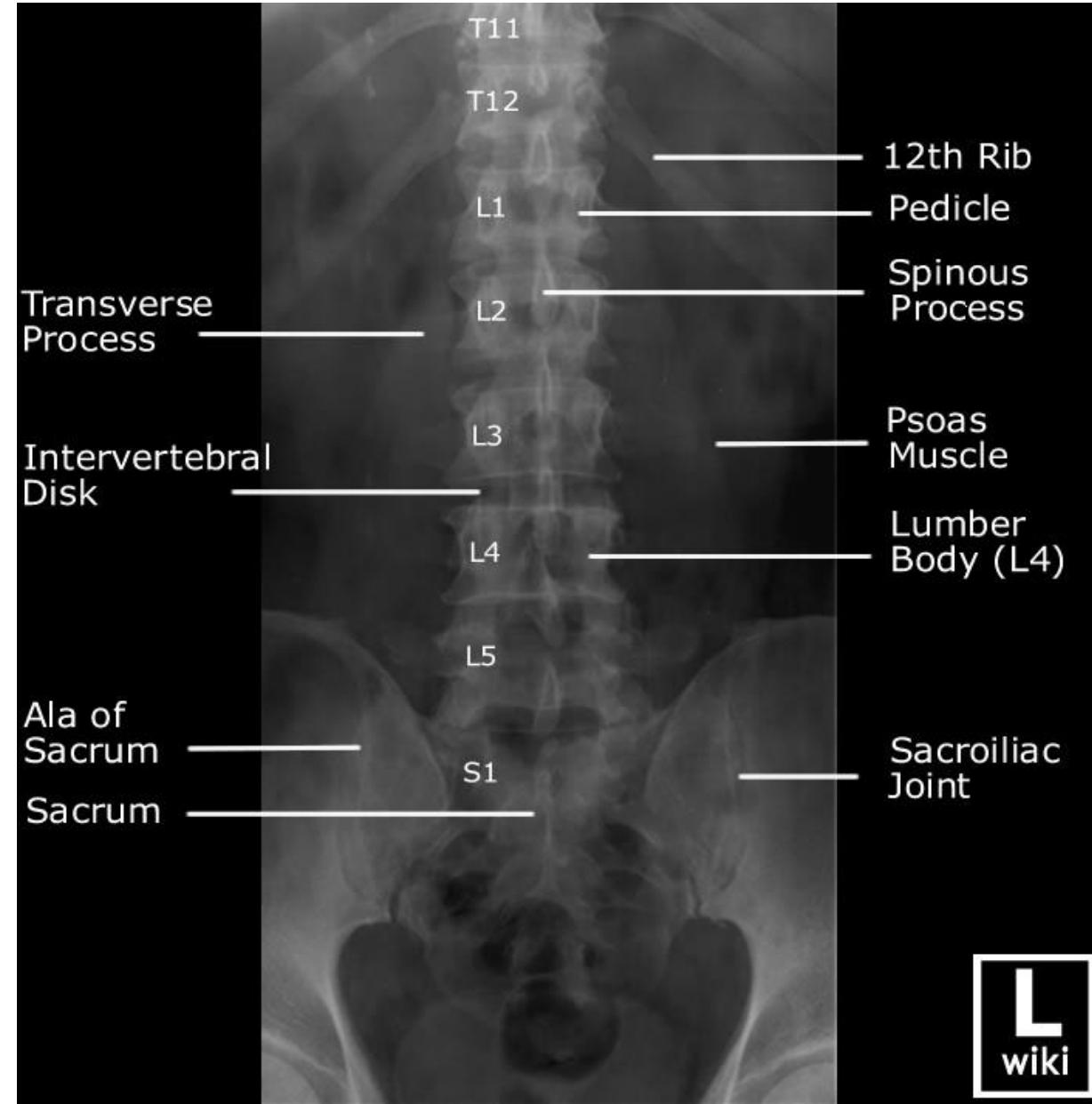
X-Ray Thoracic Spine -Clinically cases - Thoracic fractures



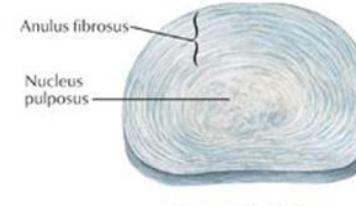
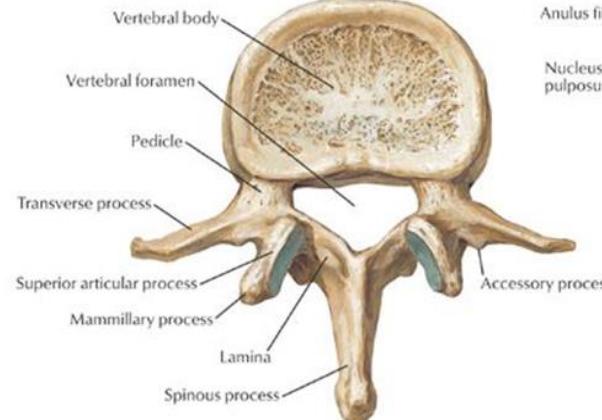
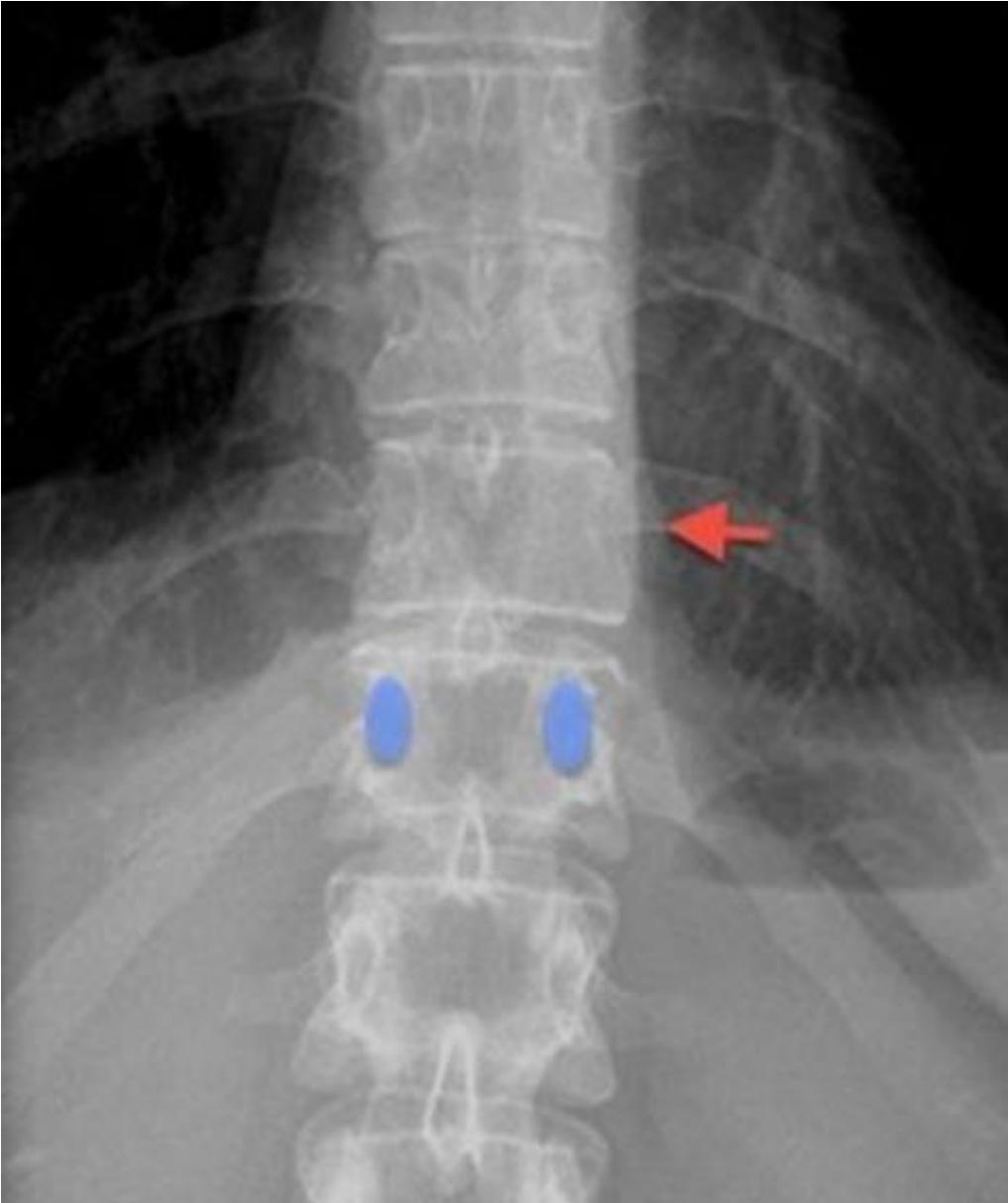
ADAM.



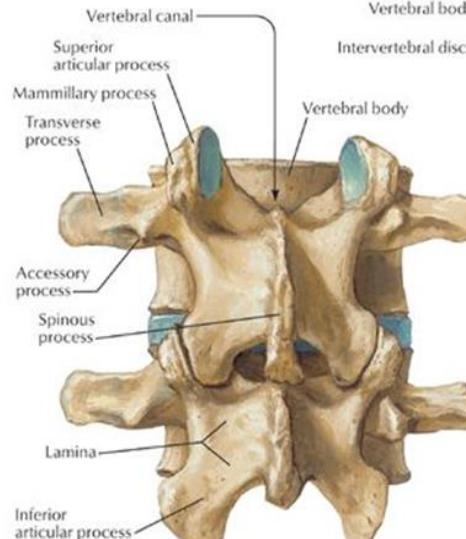
X-Ray Lumbar Spine -Antero-posterior view (AP)



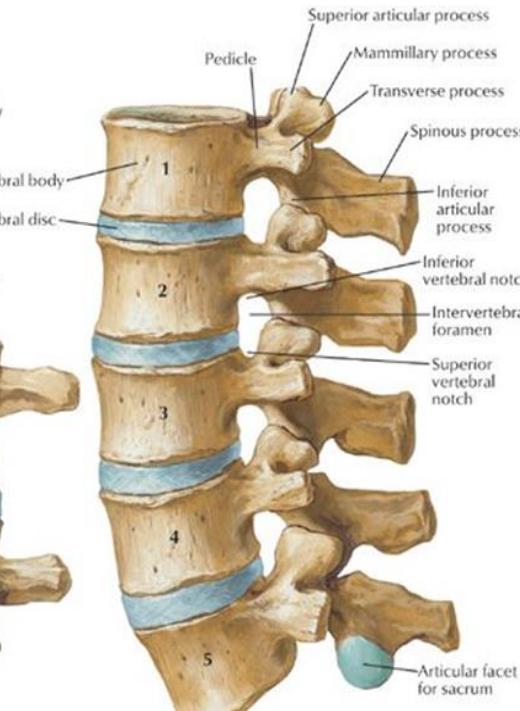
X-Ray Lumbar Spine -Antero-posterior view (AP)



Intervertebral disc



L3 and L4 vertebrae:
posterior view



Lumbar vertebrae, assembled:
left lateral view

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L1

L2

L3

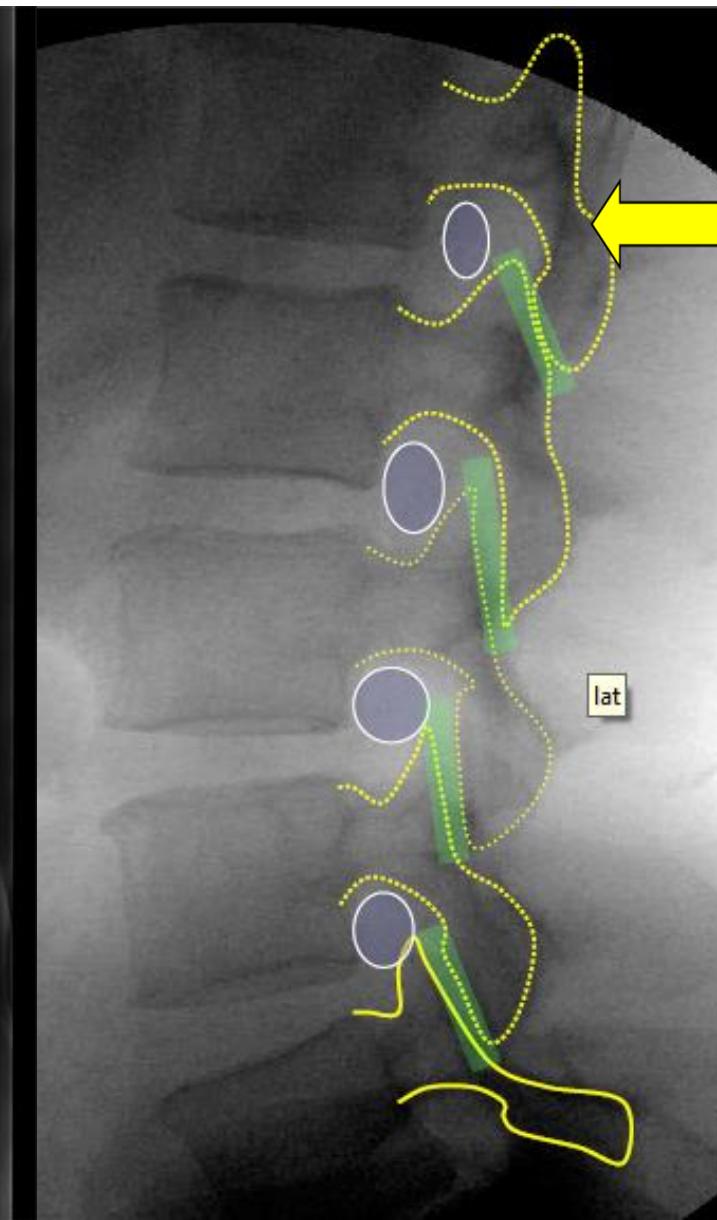
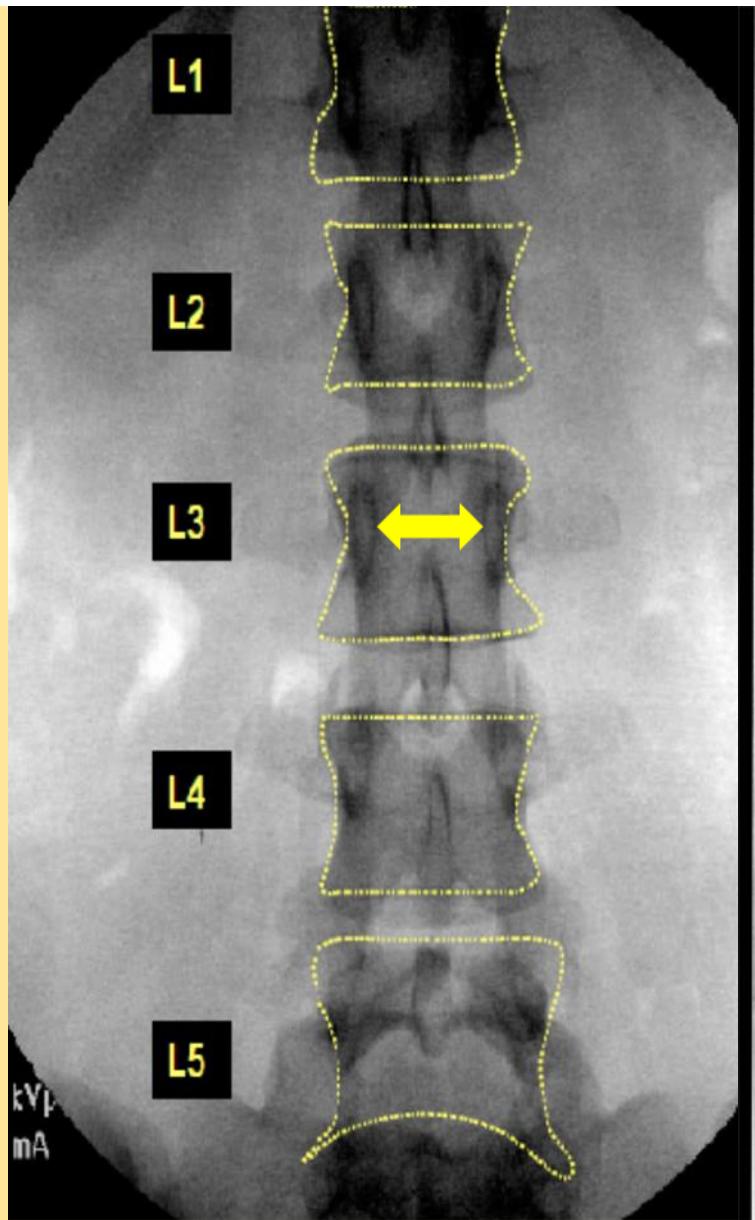
L4

L5

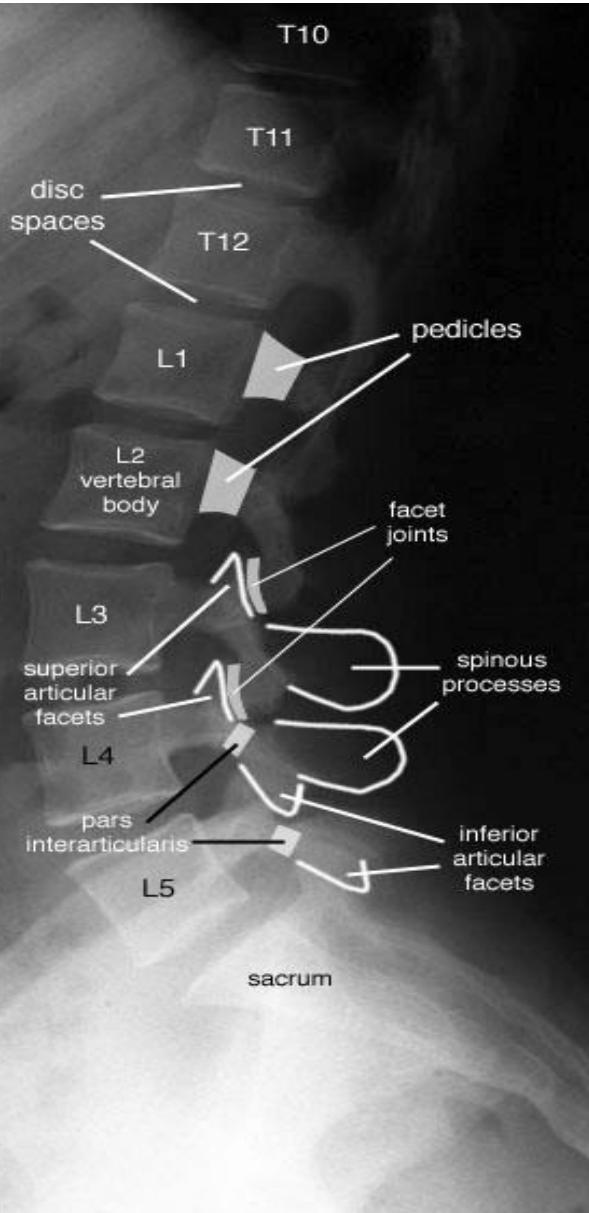
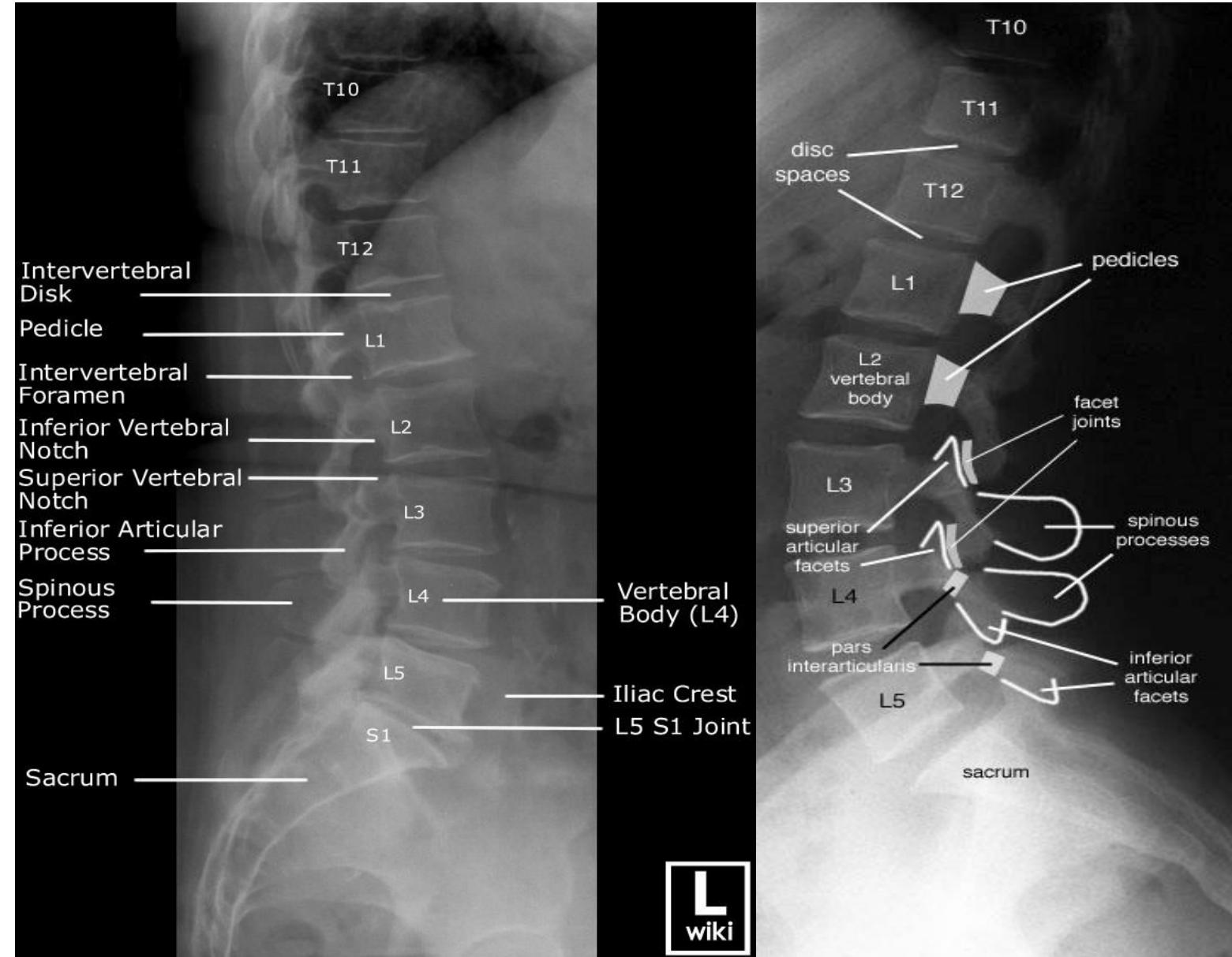
SELELFUM

lat

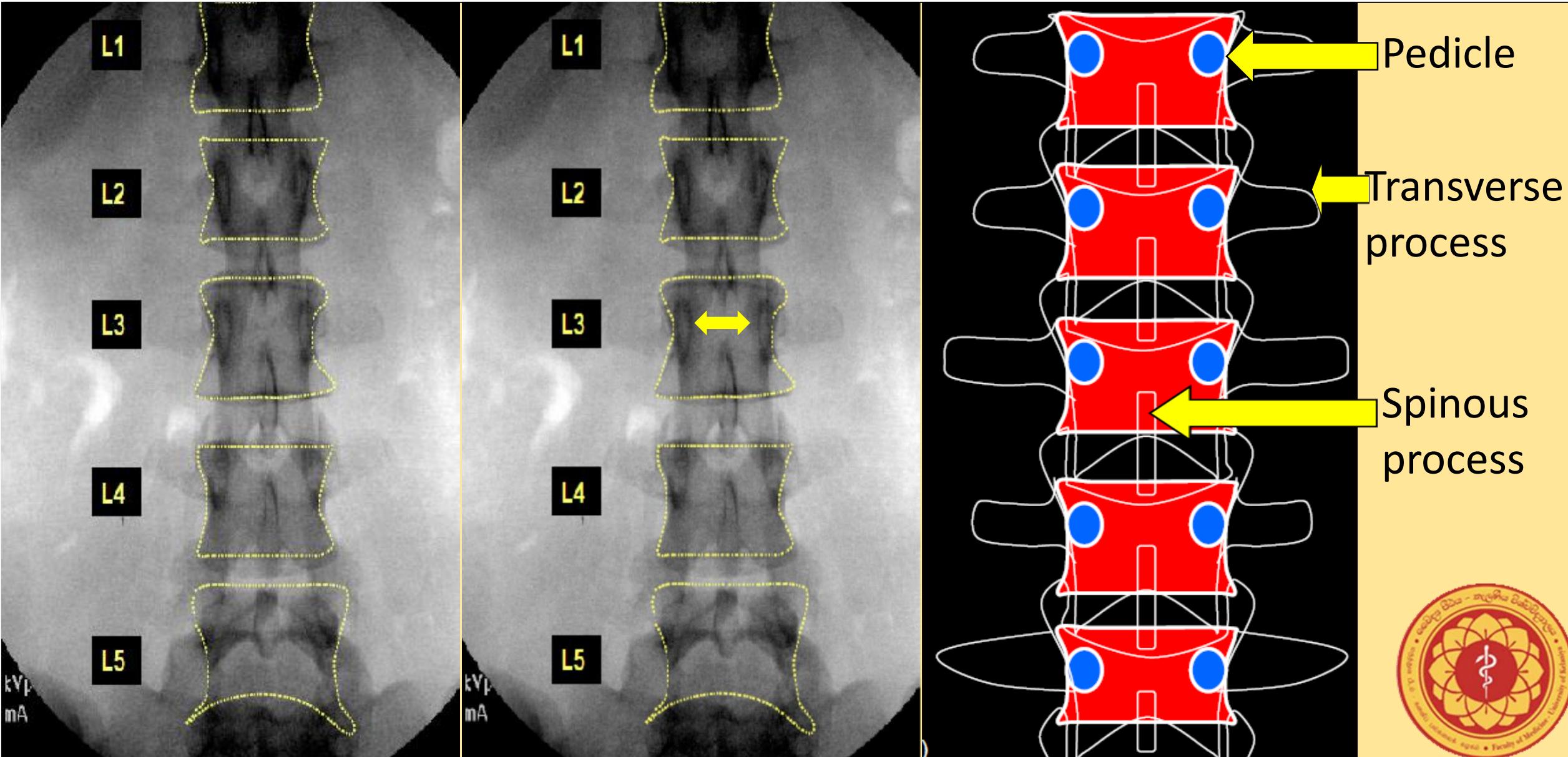
Spinous
process



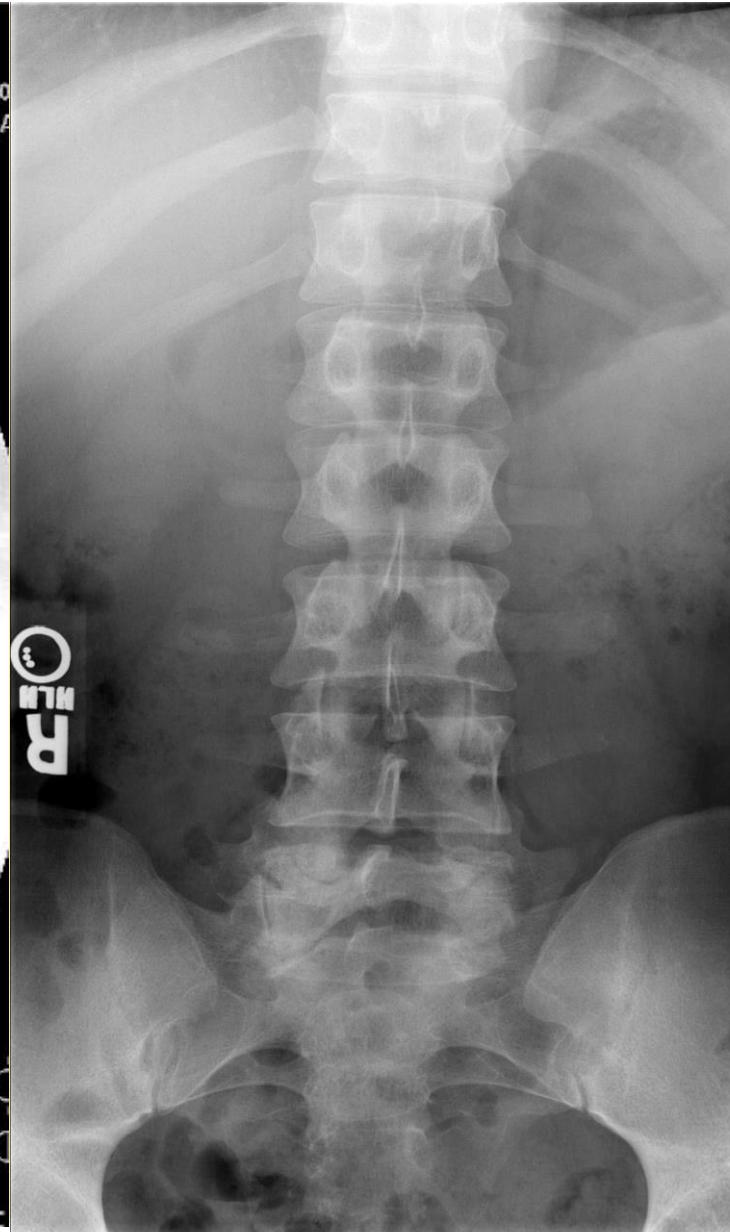
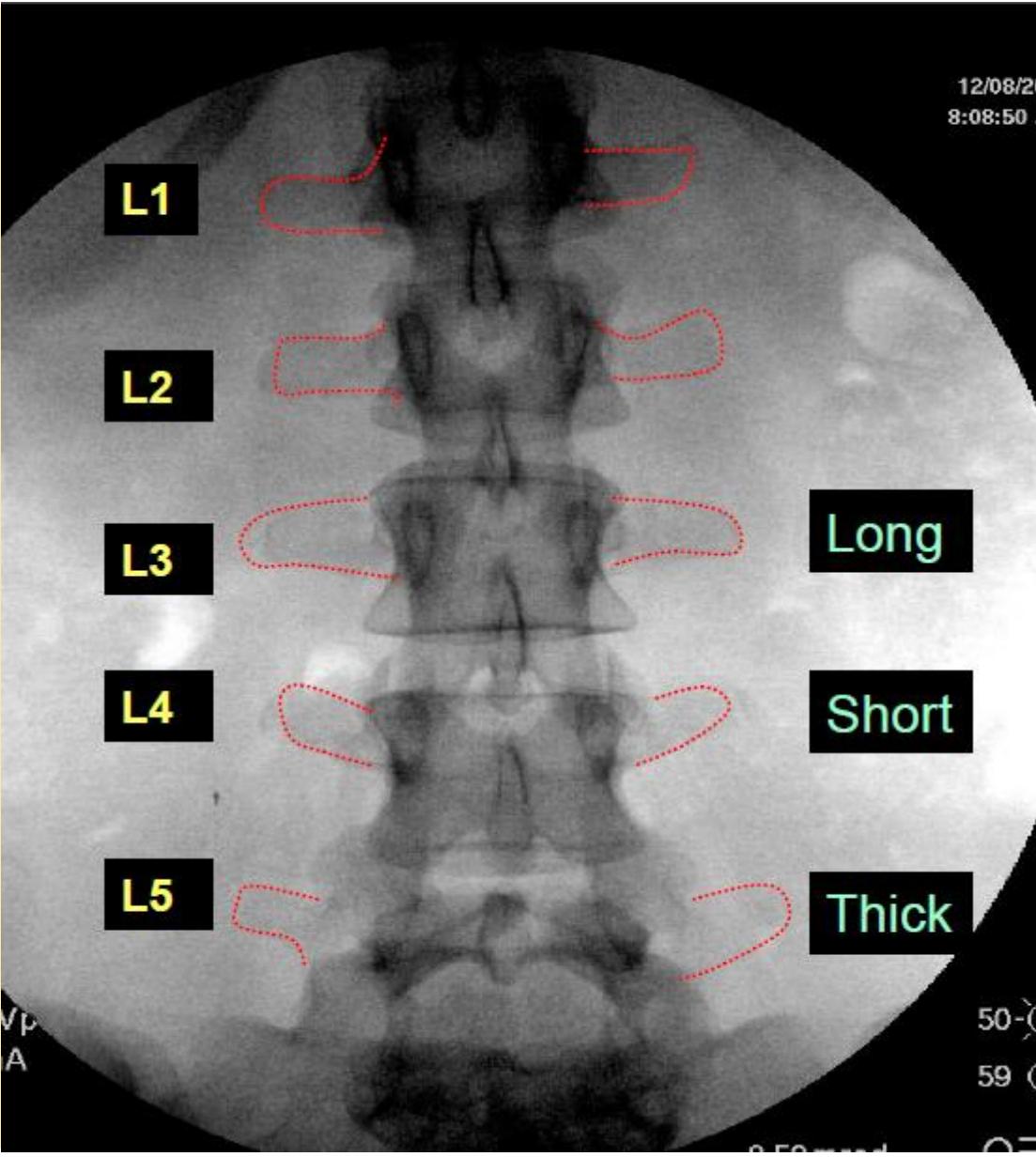
X-Ray Lumbar Spine -Lateral view (Lat)



X-Ray Lumbar Spine -Antero-posterior view (AP)



X-Ray Lumbar Spine -Antero-posterior view (AP)



AP vs. Lateral views

AP View

- Pedicles at each side of vertebral bodies
- Verify true AP by centre position of spinous process and equal interpedicular distance
- Interpedicular distance estimates transverse width of spinal canal

Lateral view

- Demonstrates spinal curves
- Better delineates individual vertebral bodies and intervertebral spaces
- Distance between posterior vertebral body (anterior border) and spinolaminar line (posterior border) represents sagittal diameter



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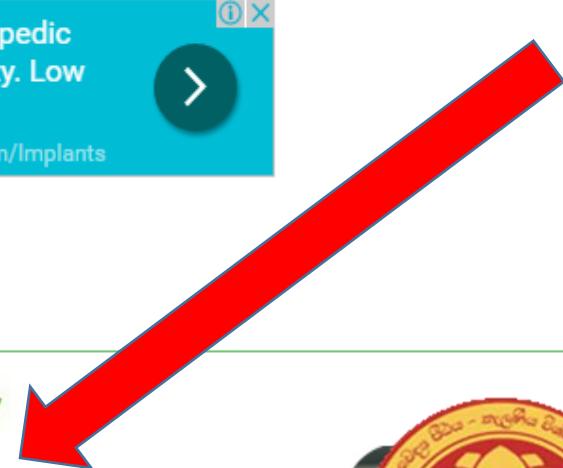
Applied Radiography

These articles will compliment your skills and add an extra dimension to your work! Written by M.J.Fuller they cover such topics as - image evaluation, technique, positioning aids, normal variants and case studies.



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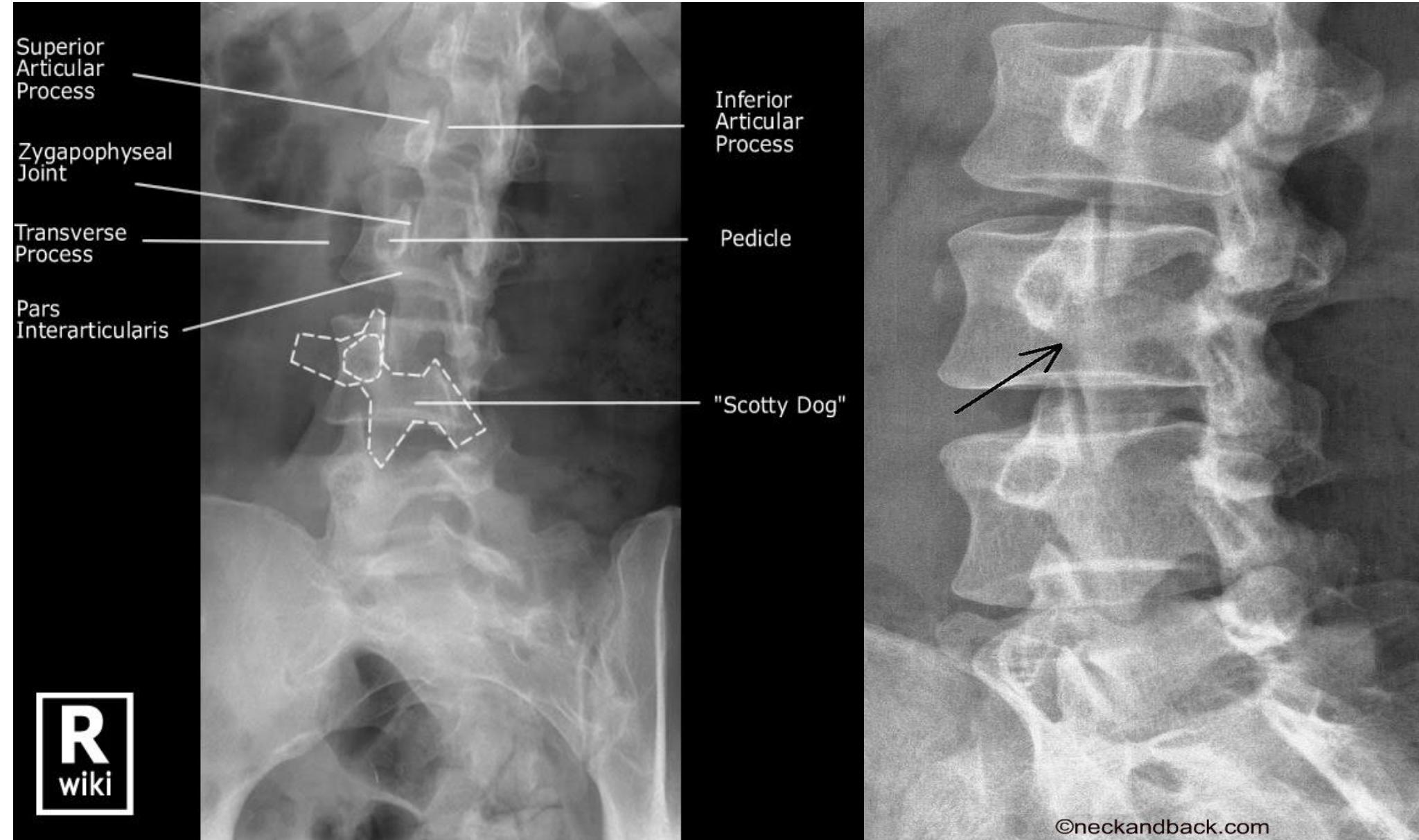
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Radiographic Anatomy		
Adult Head <ul style="list-style-type: none">• Skull• Sella Turcica• Facial Bones• Sinuses• Optic Foramina• Nasal Bones• Mandible• Orbits for foreign body• Temporomandibular Joints (TMJ)• Mastoids• Temporal Bone Thorax <ul style="list-style-type: none">• Chest• Ribs• Sternum• Sternoclavicular Joints Vertebral Column <ul style="list-style-type: none">• Cervical Spine• Thoracic Spine• Lumbar Spine• Sacrum• Coccyx Abdomen <ul style="list-style-type: none">• Abdomen• Abdomen - IVU (IVP)• Abdomen - Barium Enema• Abdomen - Barium SBS	Pediatric Head Thorax Vertebral Column Abdomen Shoulder <ul style="list-style-type: none">• Shoulder• Clavicle Upper Extremities <ul style="list-style-type: none">• Humerus• Elbow• Forearm• Wrist• Hand• Fingers Pelvis <ul style="list-style-type: none">• Pelvis• Hip Lower Extremities <ul style="list-style-type: none">• Femur• Knee	Male Bone Age Atlas Left Hand <ul style="list-style-type: none">• 0-2 years• 2-5 years

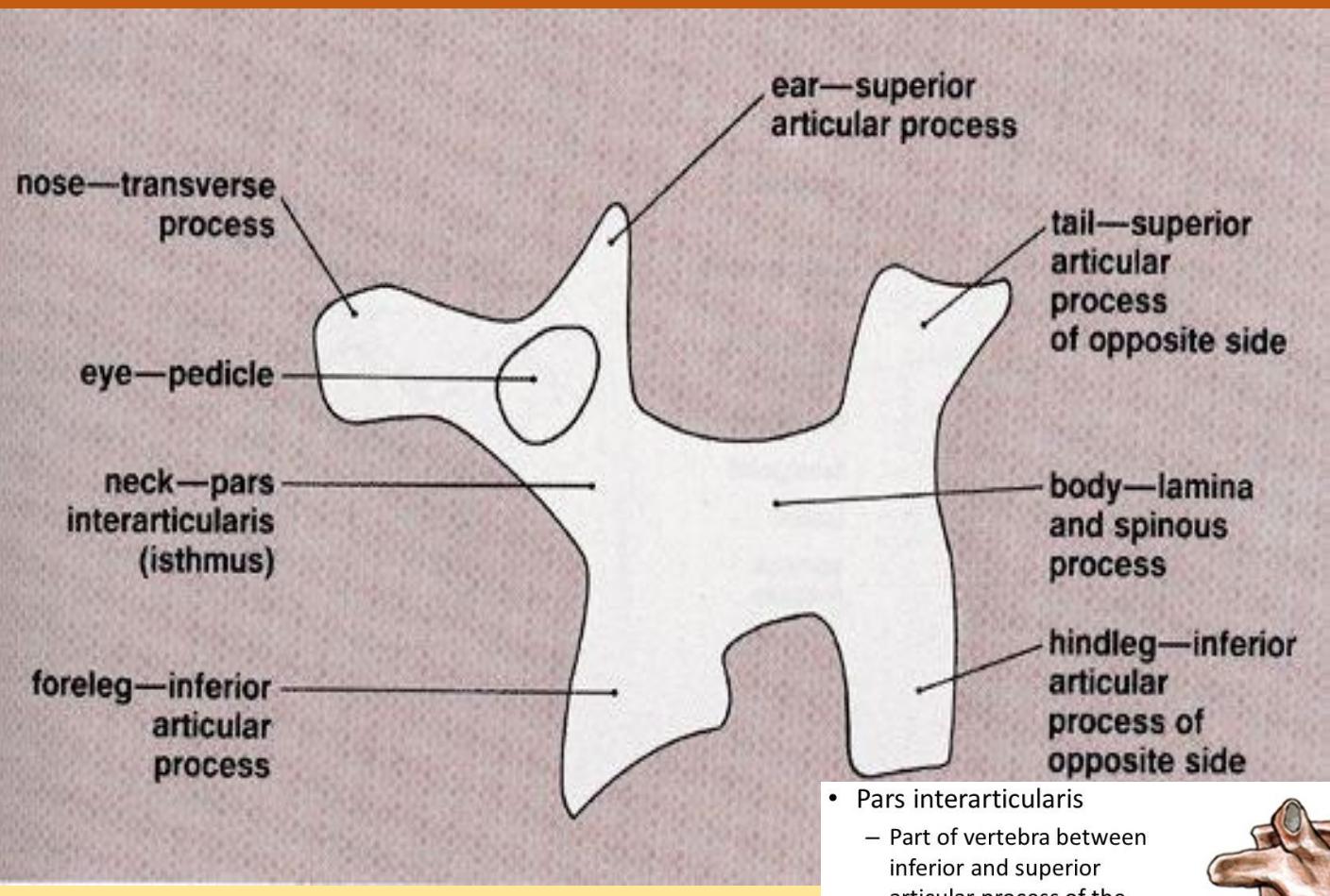
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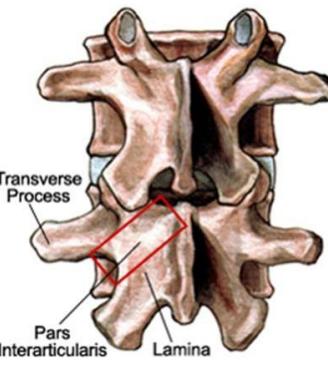
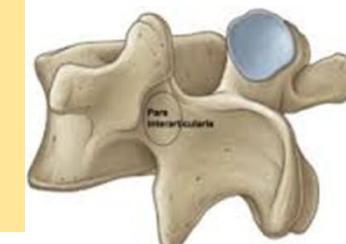
Lumbar Spine -Oblique view



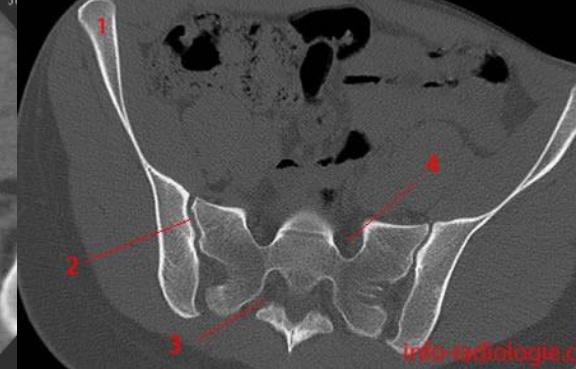
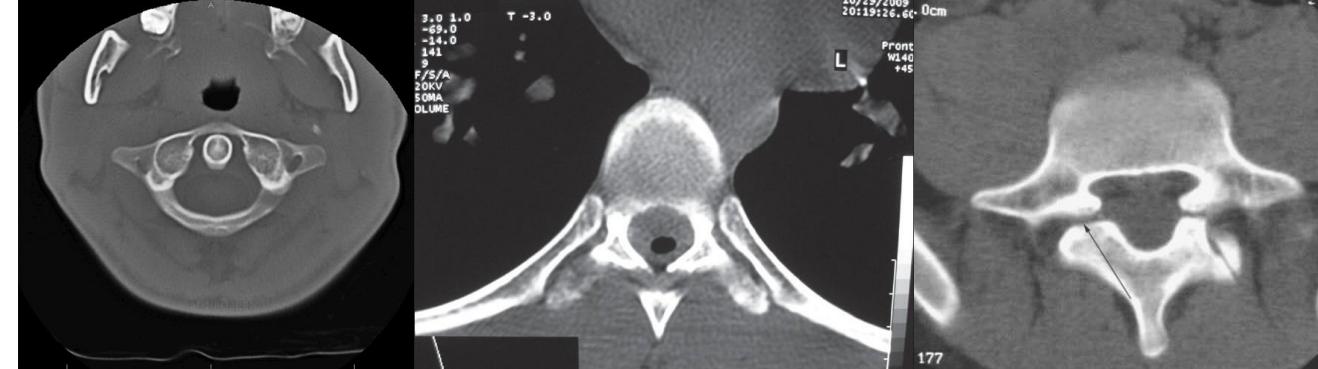
Lumbar Spine -Oblique view-Scotty dog appearance



- Pars interarticularis
 - Part of vertebra between inferior and superior articular process of the facet joint



CT-Spine

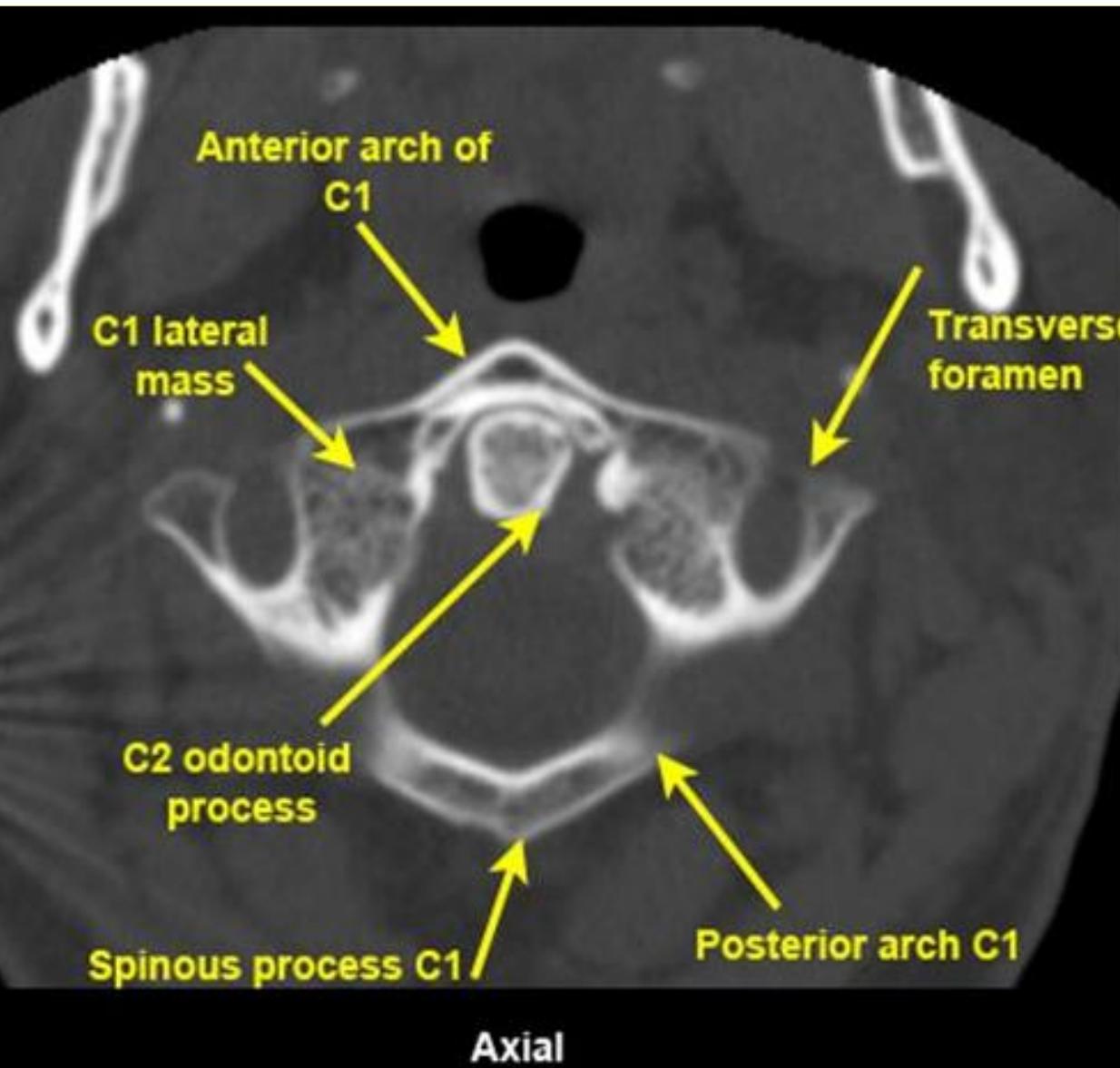


What are some common uses of the procedure?

- Evaluate the spine before and after surgery.
- Help diagnose spinal pain.
- Accurately measure bone density -Predict vertebral fractures in osteoporosis
- Assess for congenital anomalies of the spine or scoliosis.
- Detect various types of tumors in the vertebral column
 - Including those that have spread there from another area of the body.
- Guide the
 - Procedures such as the biopsy of a suspicious area of cancer,
 - Removal of fluid from a localized infection (abscess).



CT-Anatomy- Cervical Spine



X Ray Vs CT



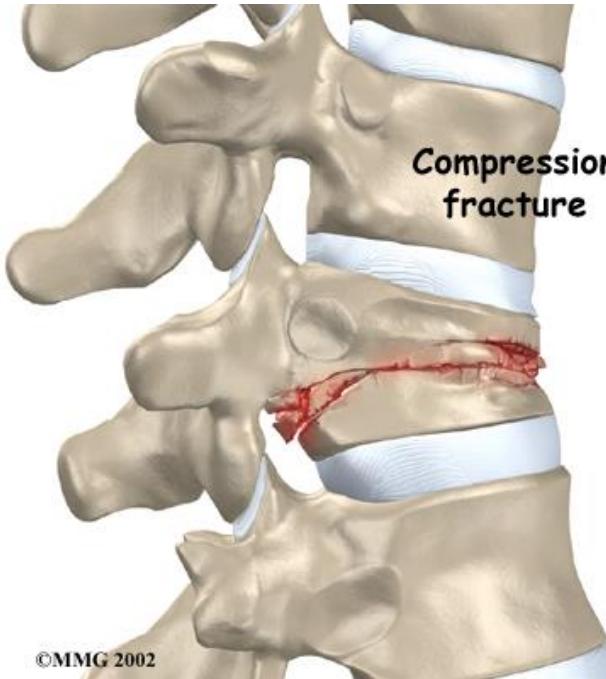
X Ray



CT Coronal Reconstruction



Lumbar Compression fracture



48 Y old coconut plucker ,fallen
from a coconut tree



Dislocated cervical spine

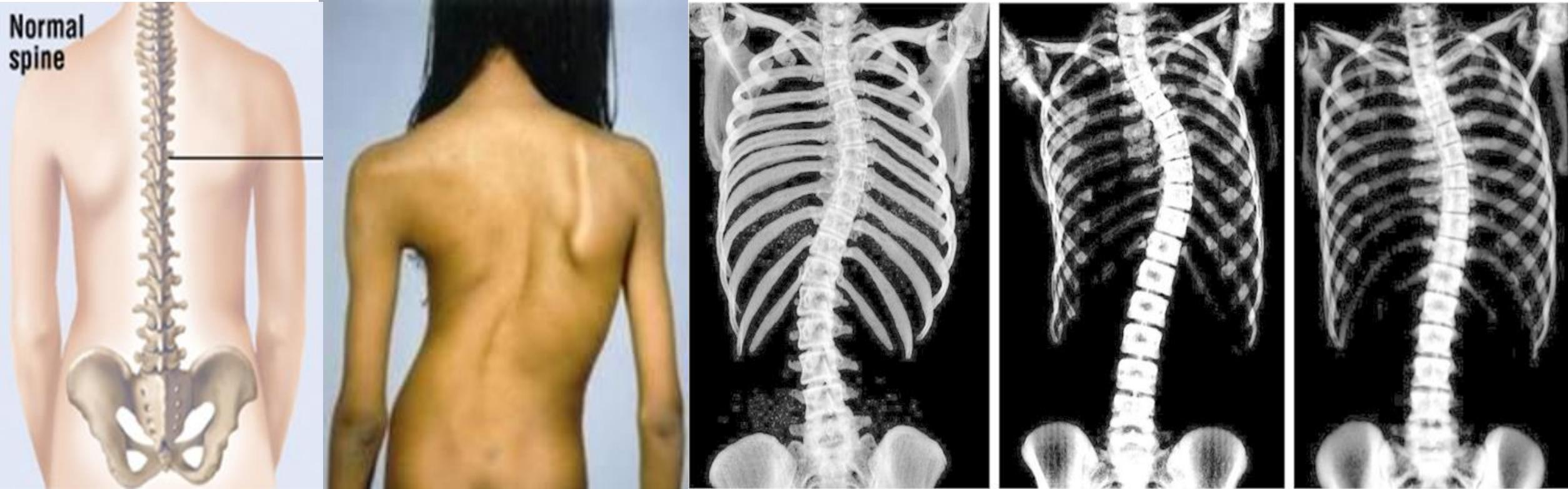
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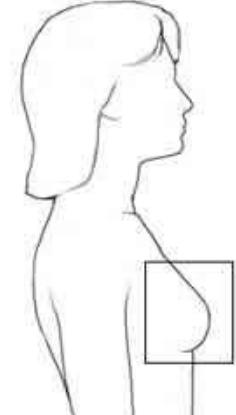
33 Y old solder
presented to PCU
fallowing fallen from
15 ft height



Scoliosis



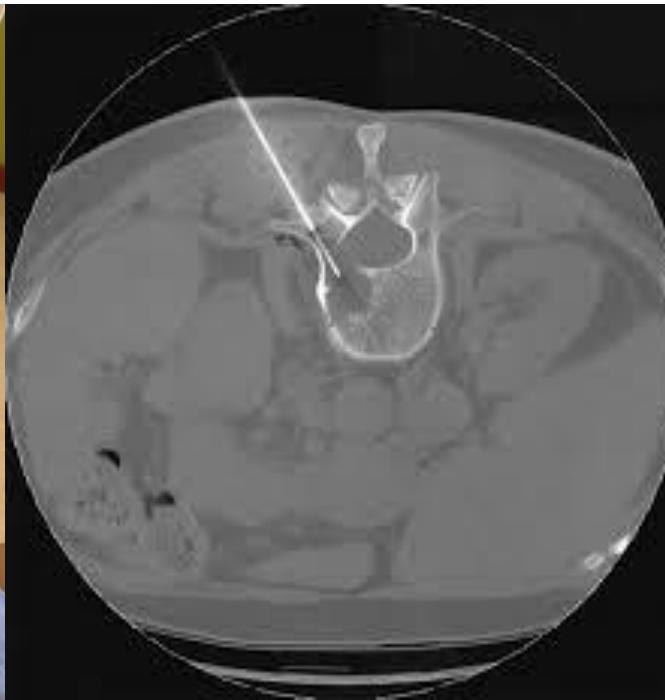
Spinal Metastasis



58 Y diagnosed patient with breast carcinoma presented to the NCTH Ragama with severe back pain



CT Guided vertebral biopsy



MRI Spine



Indications for MRI

- Assess spinal anatomy and alignment.
- Assess
 - intervertebral disk disease (degenerated, bulging or herniated)
 - intervertebral joint disease

frequent causes of severe lower back pain and sciatica (back pain radiating into lower leg).

- Detect congenital anomalies of vertebrae or the spinal cord.
- Detect bone, disc, ligament or spinal cord injury after spine trauma.



Indications for MRI

- Explore other possible causes of back pain (compression fracture or bone swelling).
- Assess compression of spinal cord and nerves.
- Assess inflammation of the spinal cord or nerves.
- Assess infection involving the spine, disks and spinal contents including spinal cord or its coverings (meninges).

Eg TB/Pyogenic abscesses



Indications for MRI

- Assess primary or secondary tumors of the vertebrae, spinal cord, nerves or the surrounding soft tissues.
- Help to plan spinal surgical procedures, such as
 - Decompression of a pinched nerve,
 - Spinal fusion
- Monitor changes in the spine after an operation, such as scarring or infection



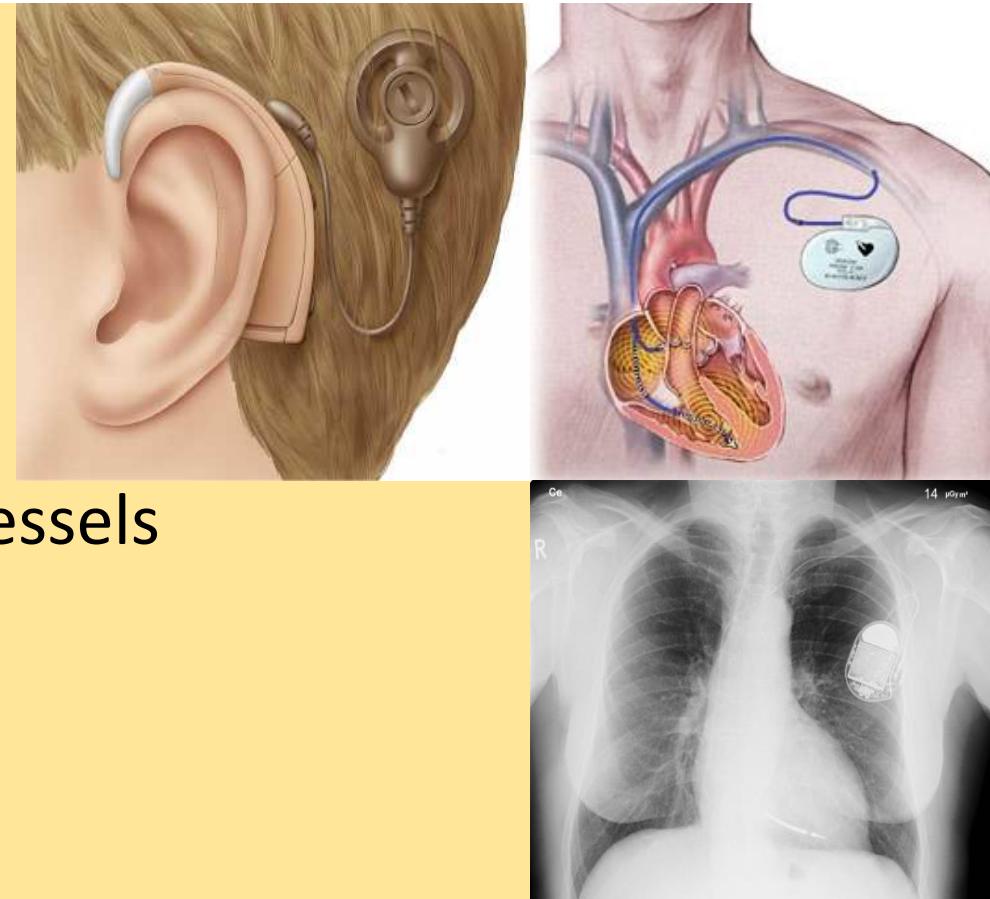
Don't bring these in to MRI room

- Jewelry, watches, credit cards and hearing aids, all of which can be damaged
- Pins, hairpins, metal zippers and similar metallic items, which can distort MRI images
- Removable dental work
- Pens, pocket knives and eyeglasses

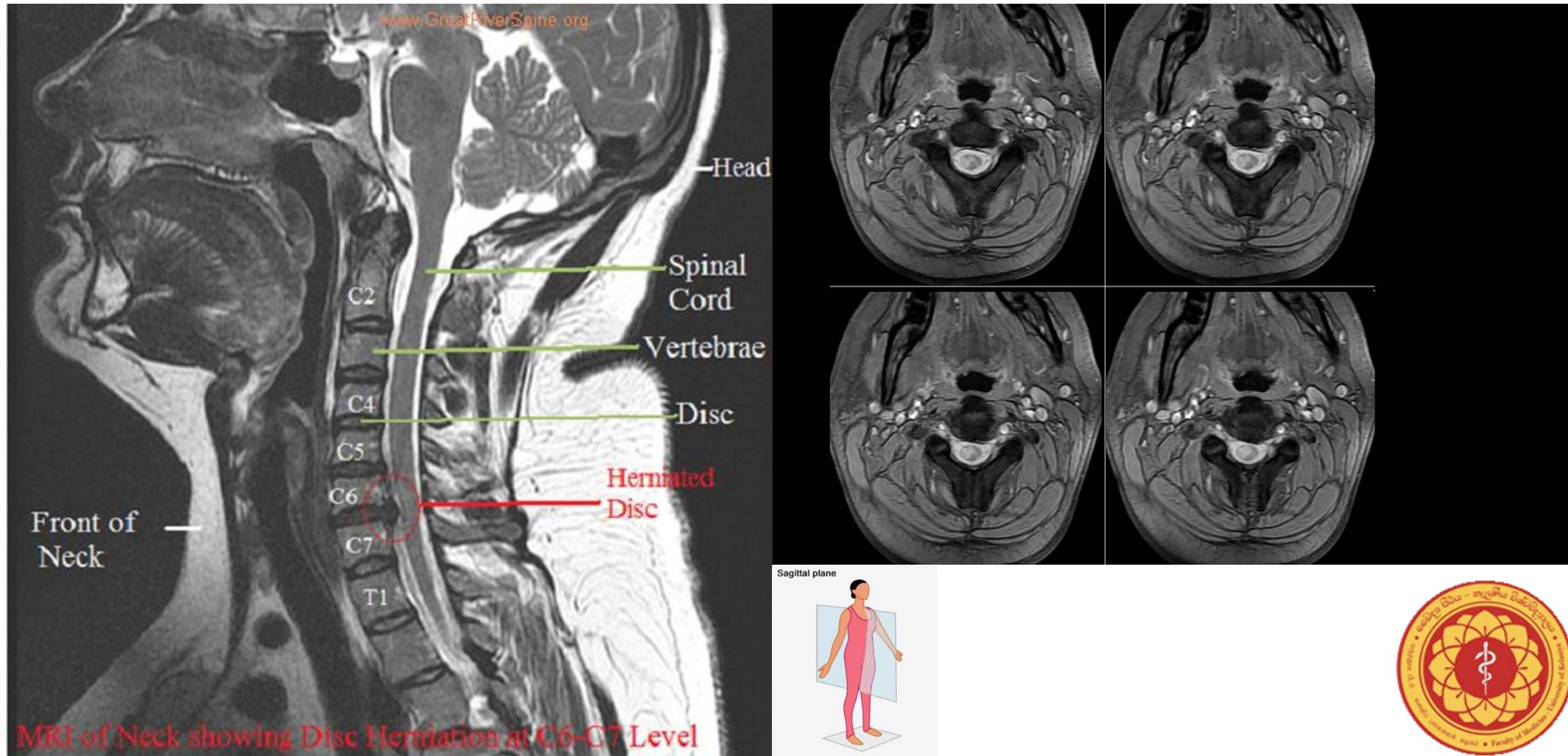


People with the following implants cannot be scanned....!

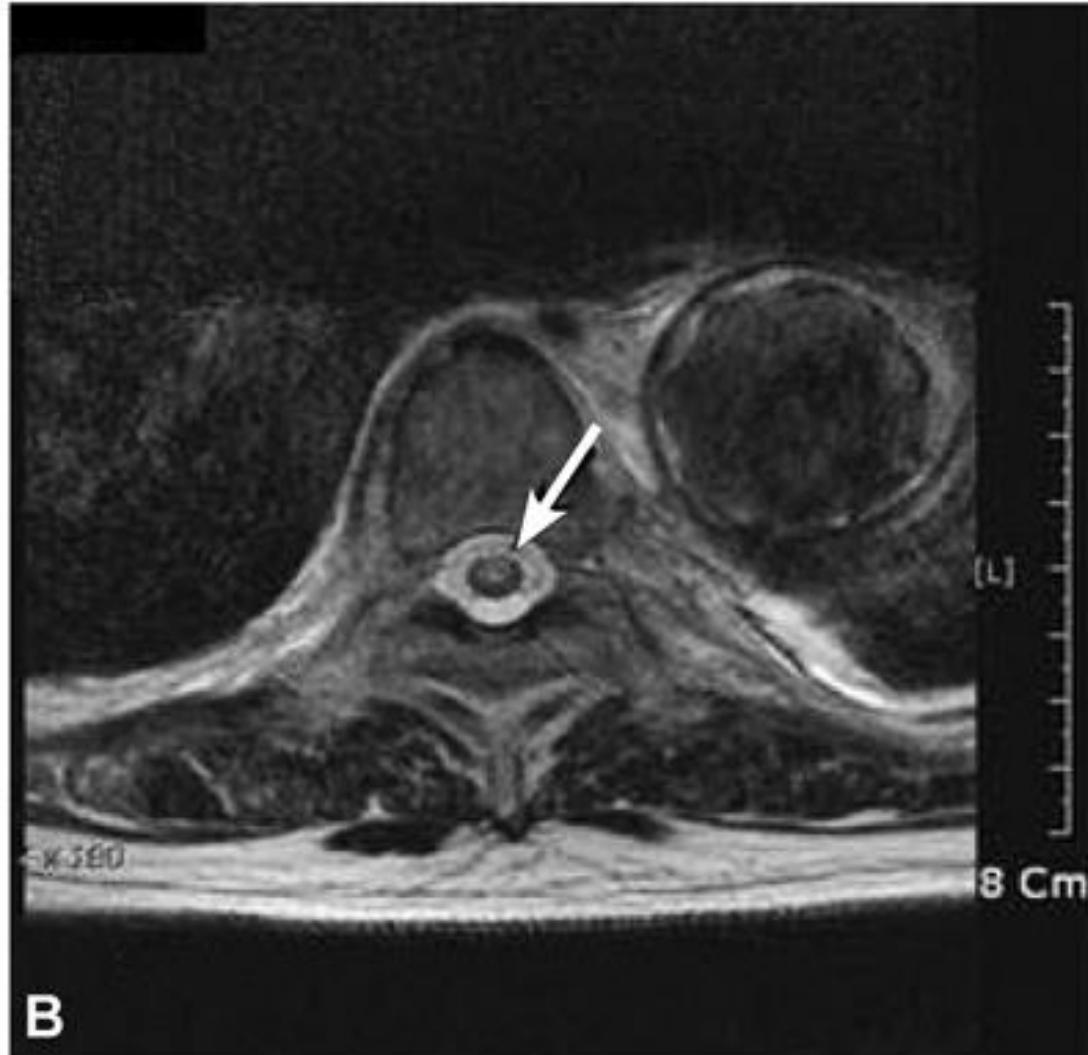
- Cochlear (ear) implant
- Some types of clips used for brain aneurysms
- Some types of metal coils placed within blood vessels
- Nearly all cardiac defibrillators and pacemakers



MRI Cervical Spine



MRI Thoracic spine



MRI Lumbar spine

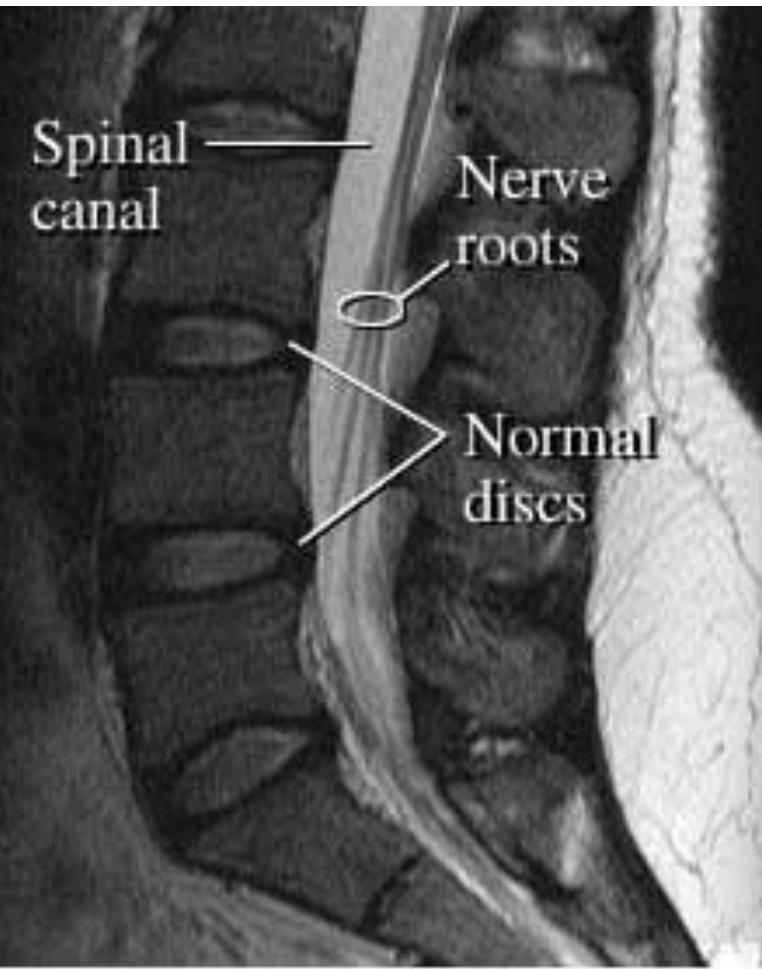


Figure 1

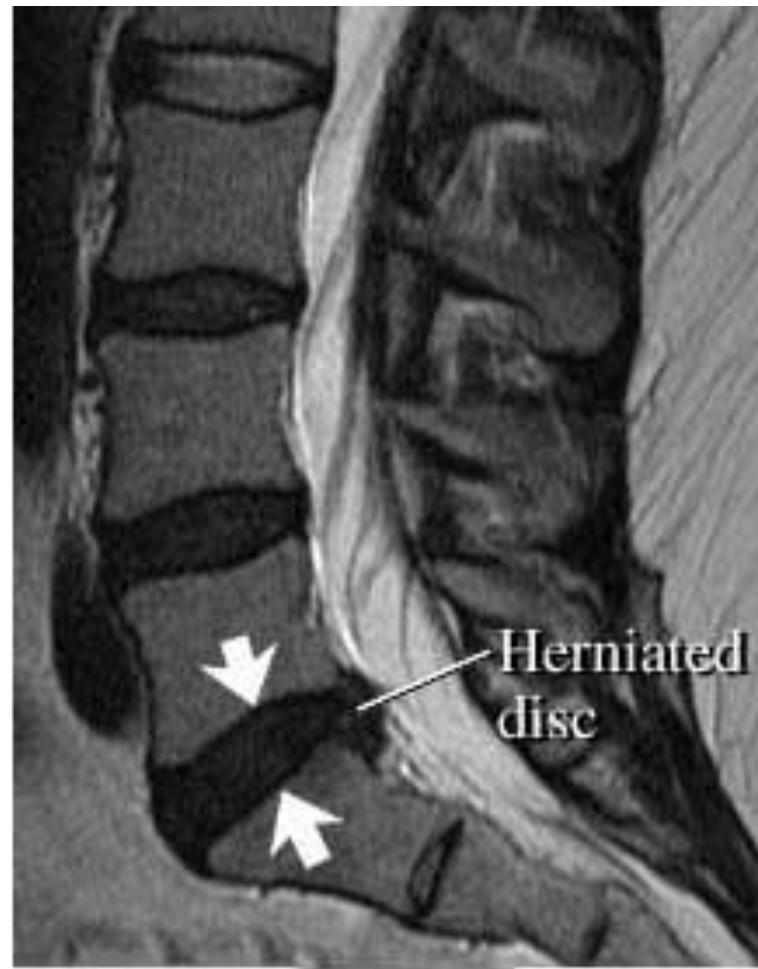
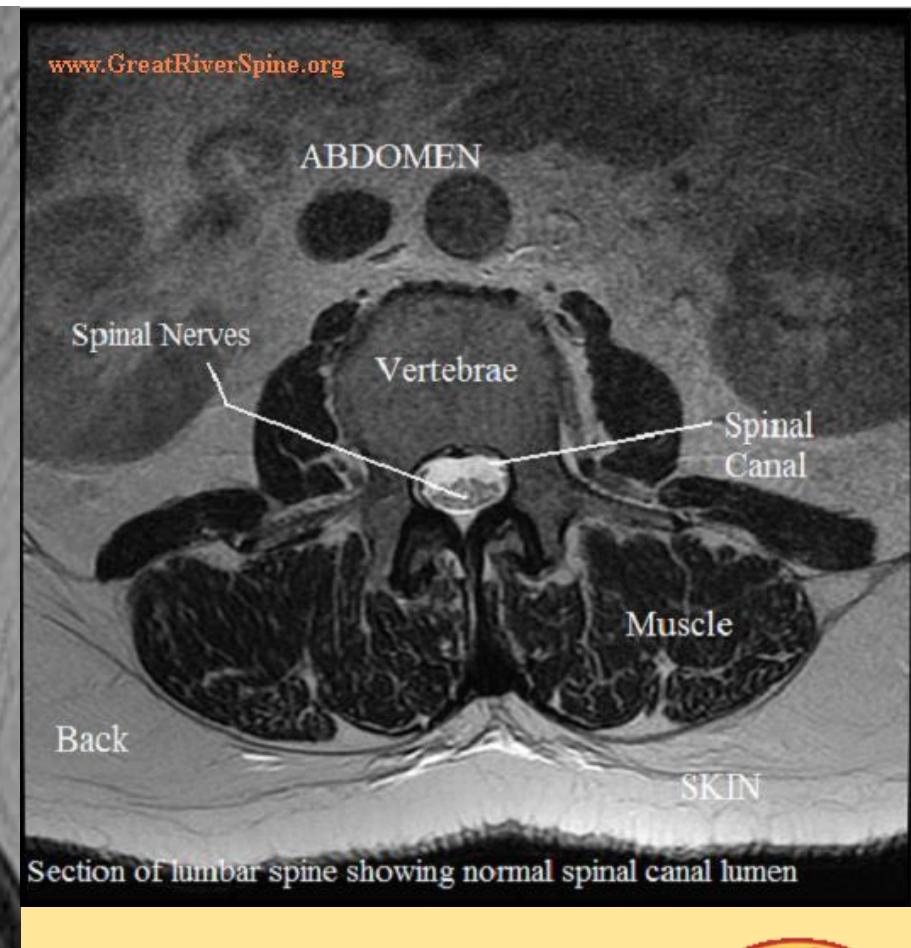
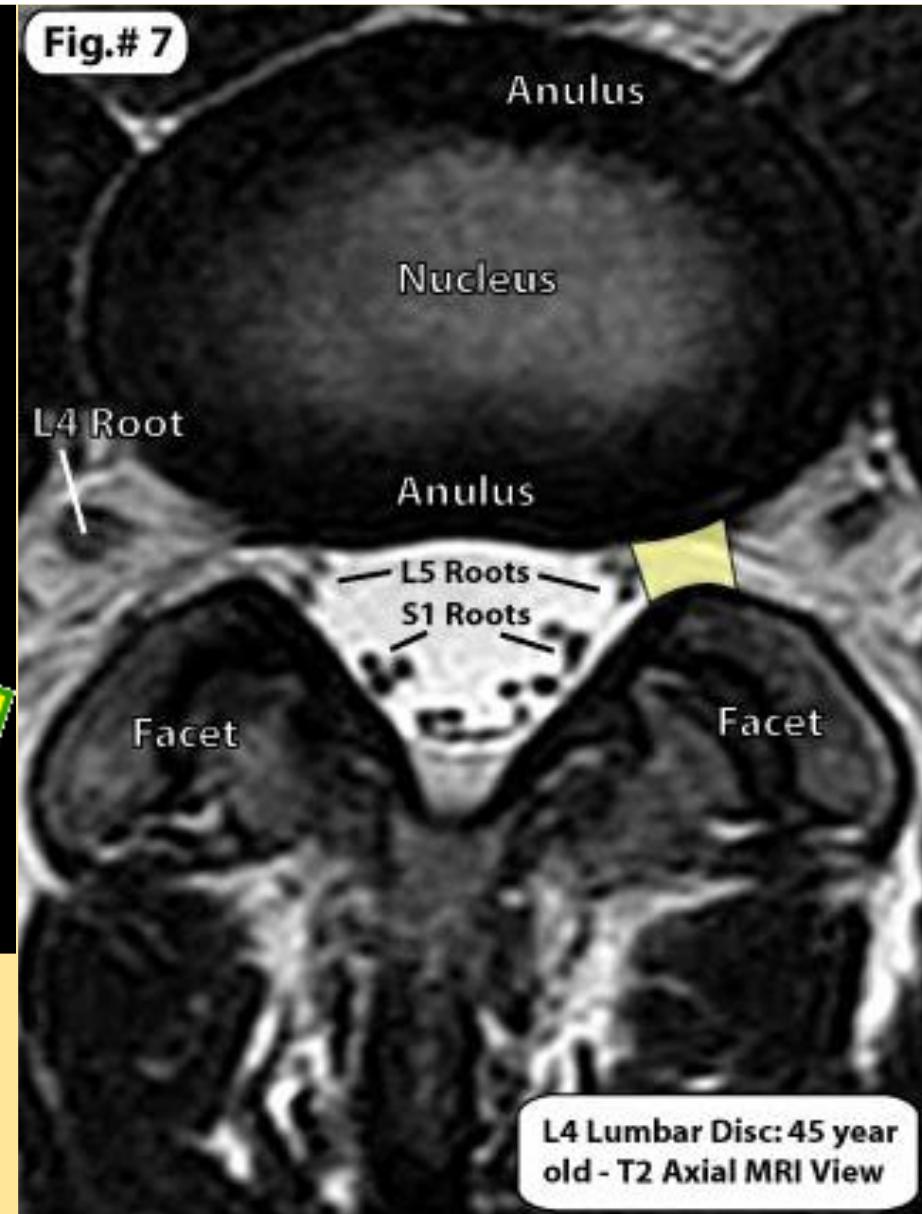
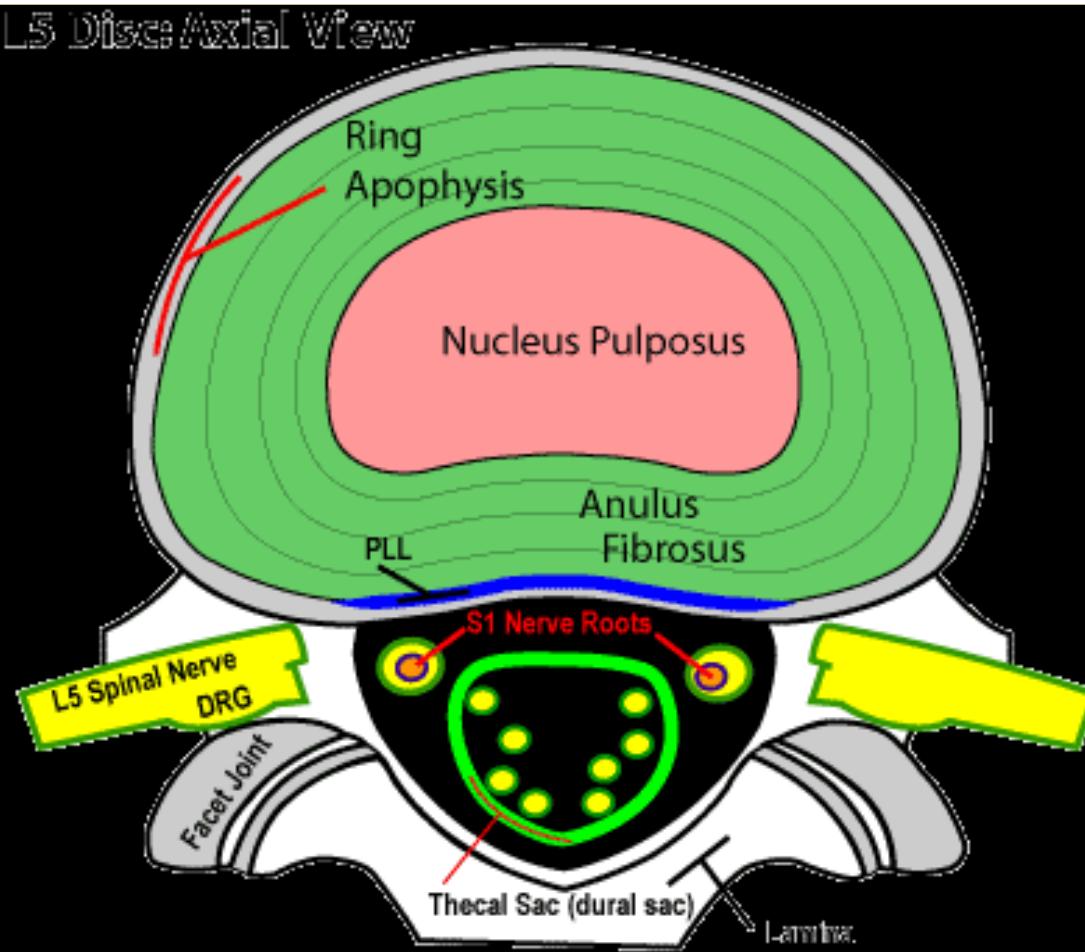


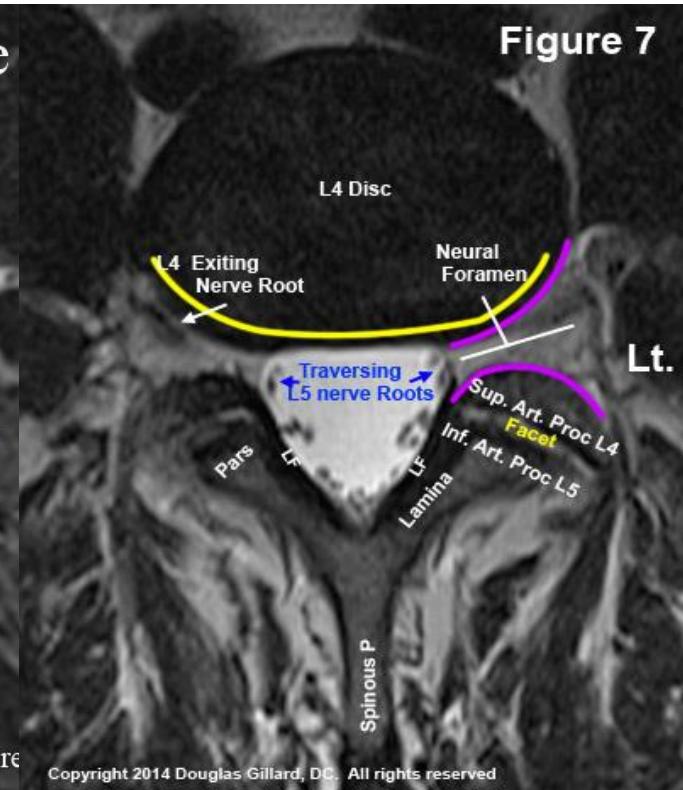
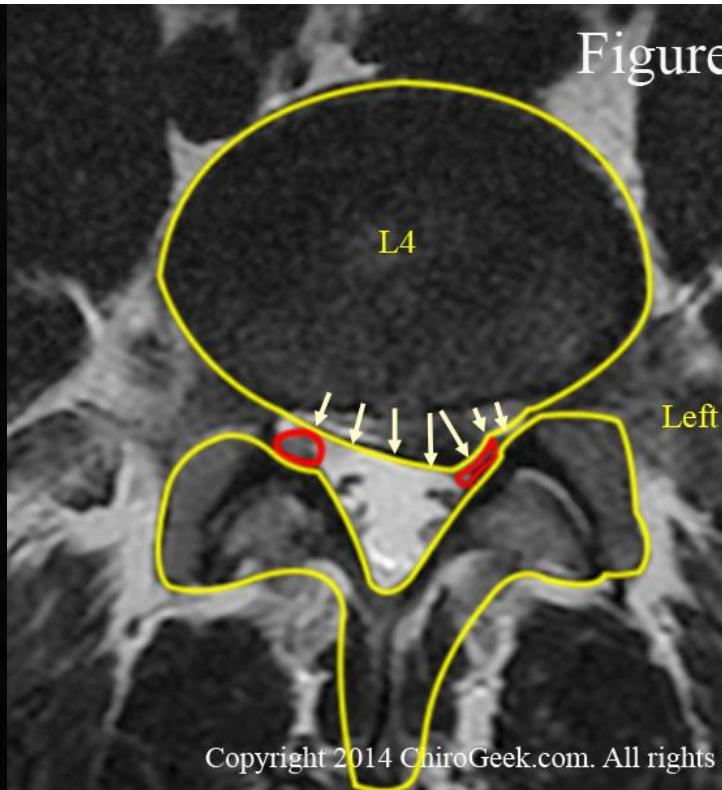
Figure 2



MRI Lumbar spine



MRI-Lumbar disc herniation



67 Y old female presented with severe low back pain with pain radiating along left lower limb



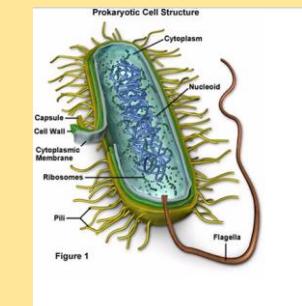
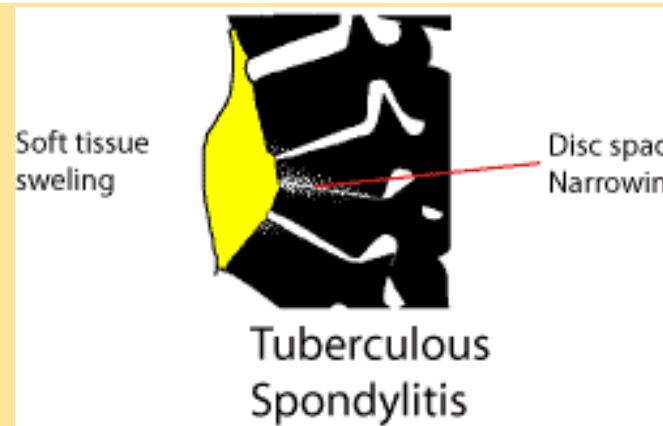
MRI- Meningocele



Day 1 New bone had a lump at lower back



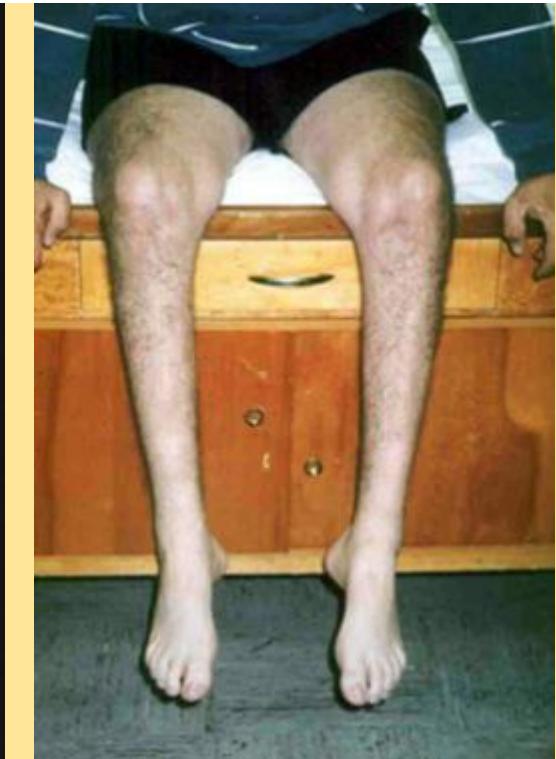
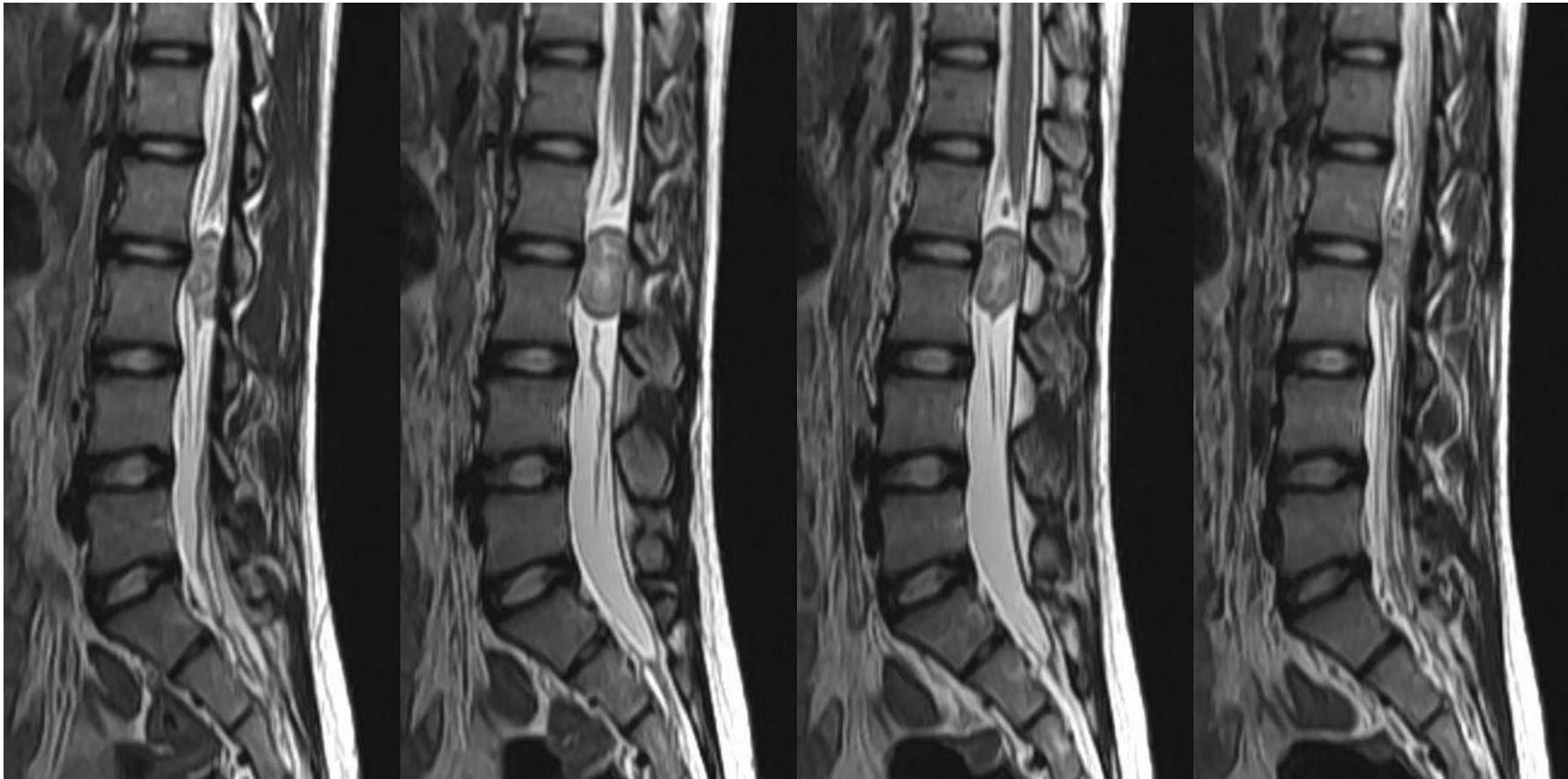
MRI-Tuberculous spondylitis.



A 29-year-old male IV drug abuser C/O with back pain and low grade fever



MRI -Cauda equina tumour.



47 old male presented to the neurology clinic with history of gradual onset of lower limb weakness.



Try a MCQ and learn

In the spine:

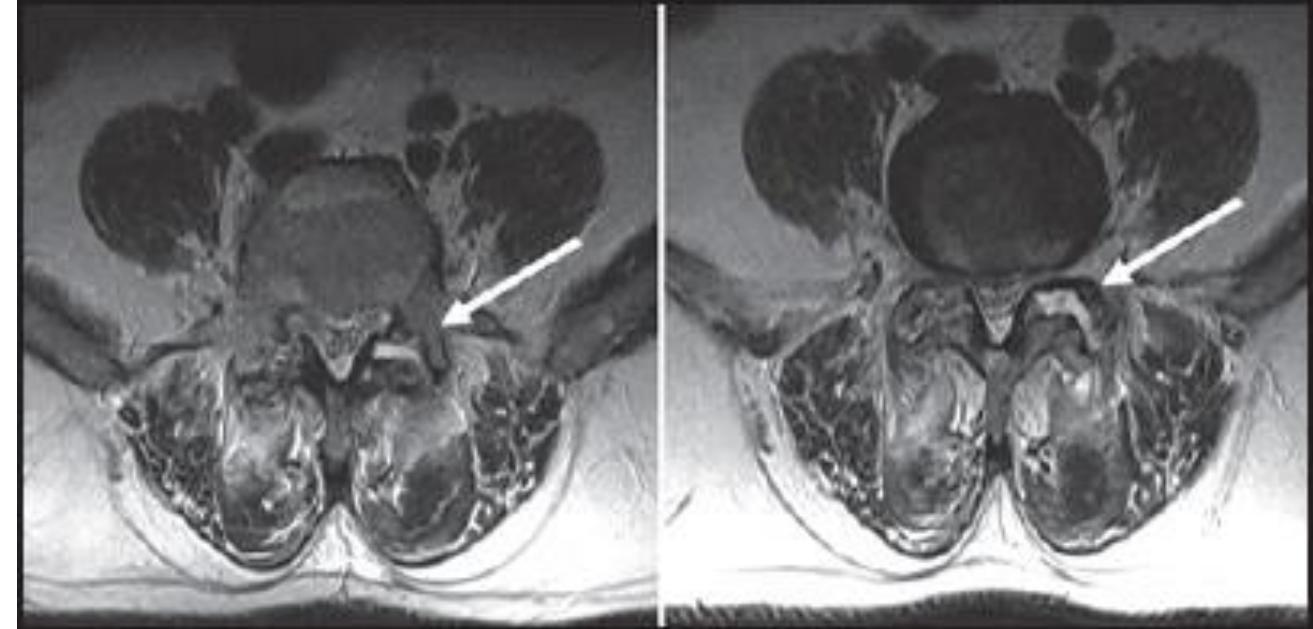
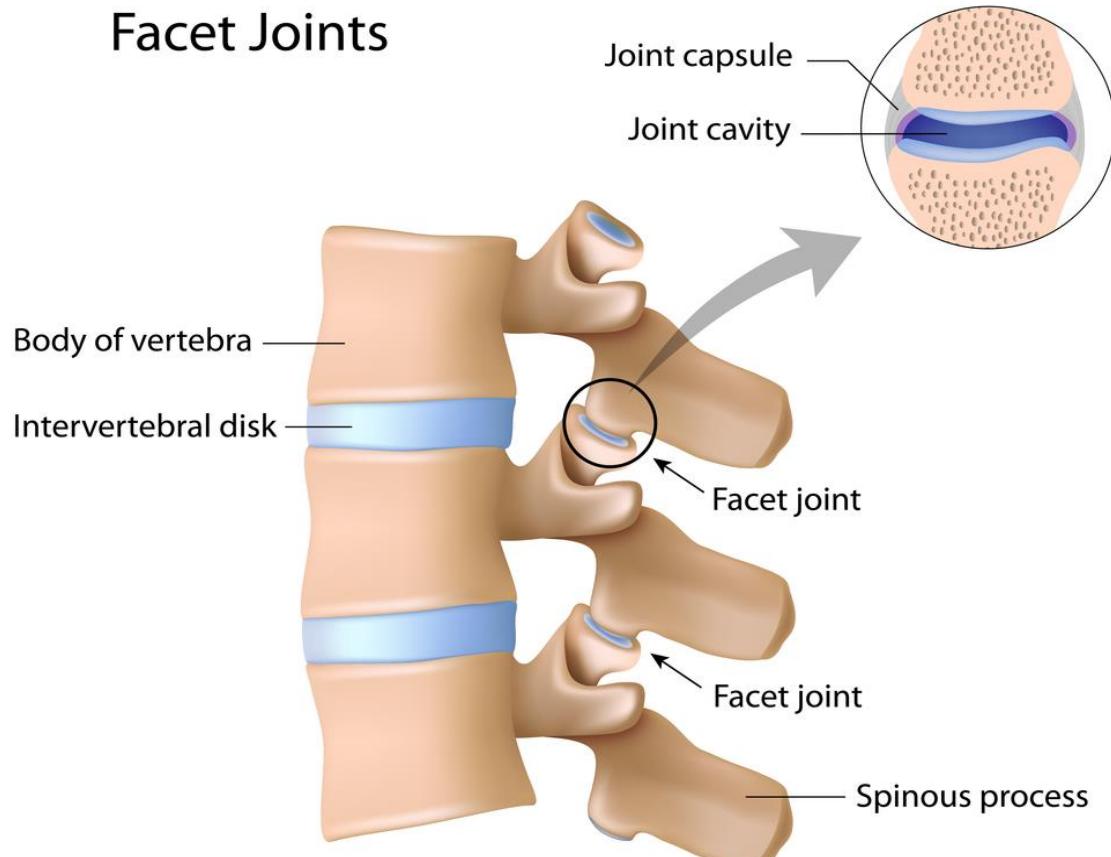
- (a) The facet joints are synovial joints.
- (b) The facet joints are the largest in the lowest two lumbar vertebrae.
- (c) The cervical intervertebral foramen is orientated laterally.
- (d) The inferior articular process of the vertebra above articulate with superior articular process of the vertebra below.
- (e) MRI lumber spine is better than CT to diagnose nerve root compression



Try a MCQ and learn

(a) True

Facet Joints



Try a MCQ and learn

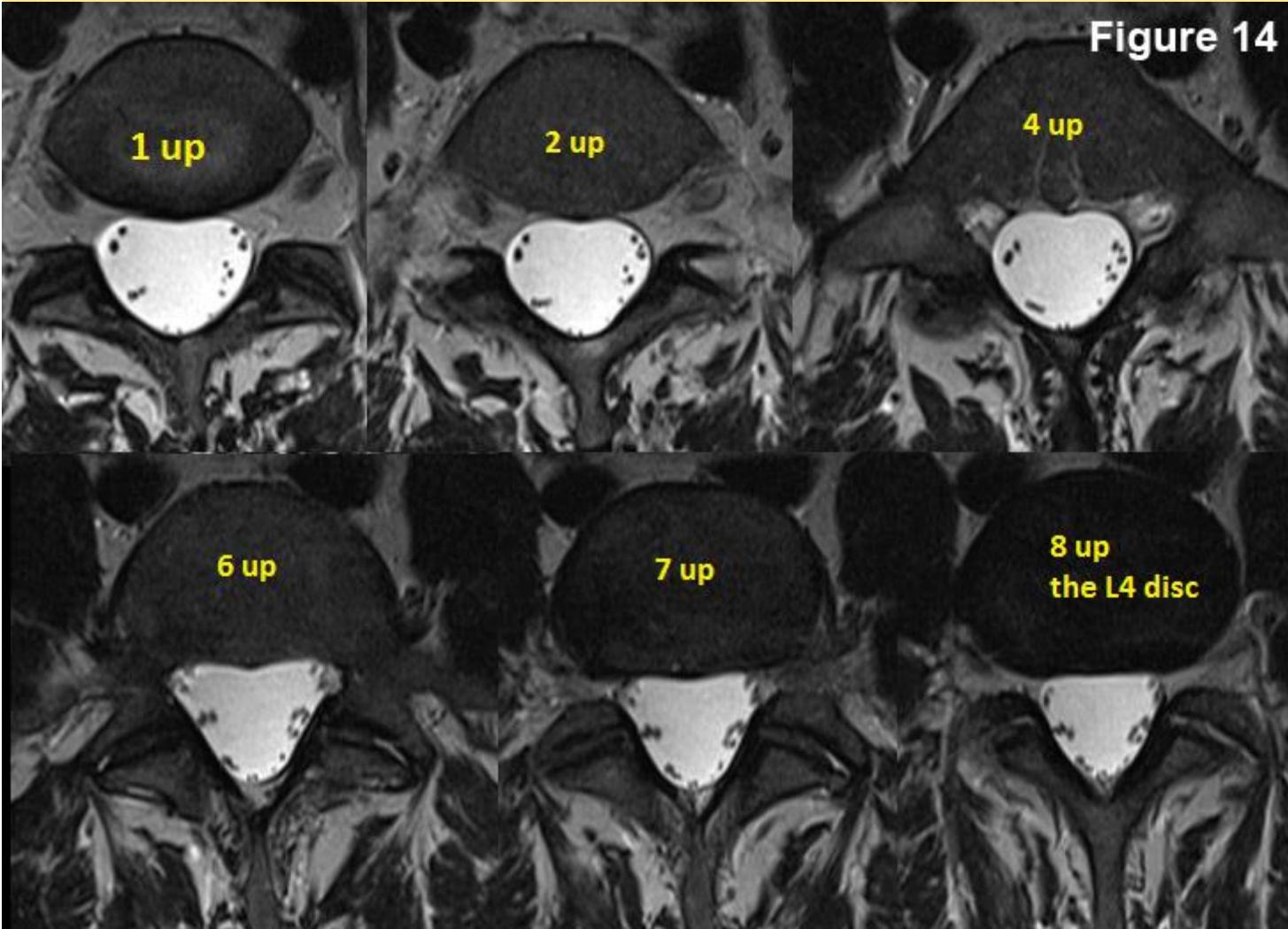
In the spine:

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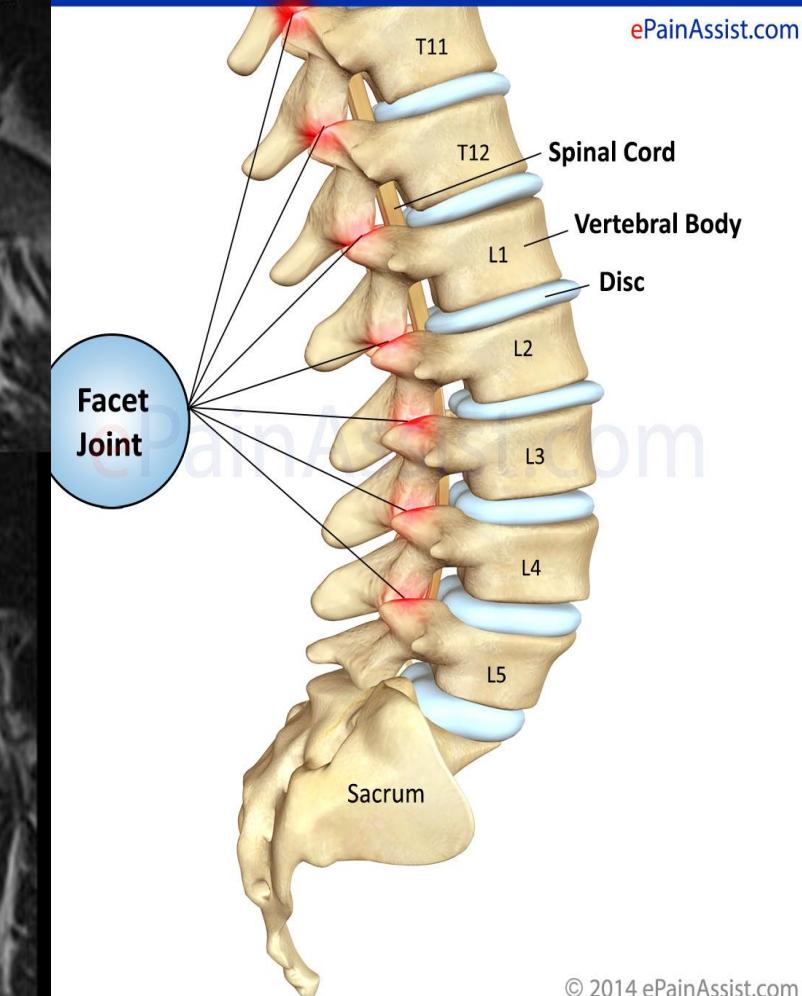


Try a MCQ and learn

(b) True – this is where the maximum weight is borne by the vertebral column.



Facet Joint / Zygopophysial Joint Pain



Try a MCQ and learn

In the spine:

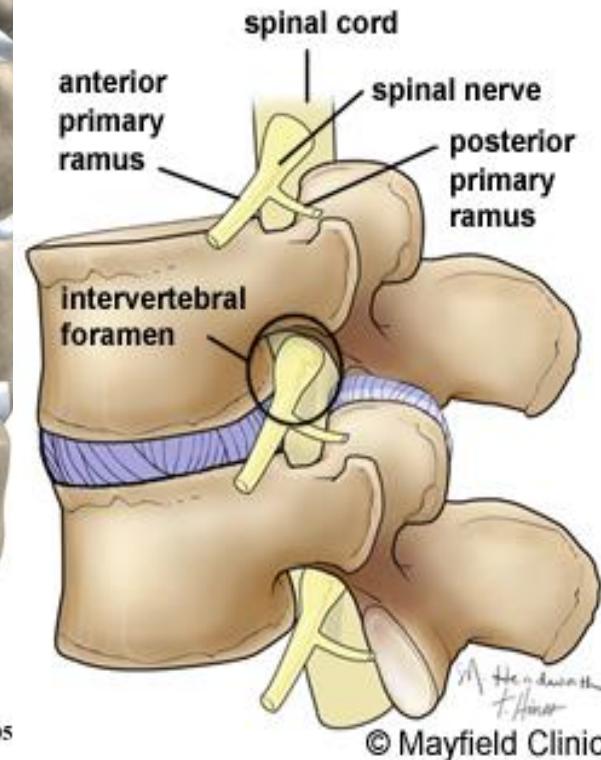
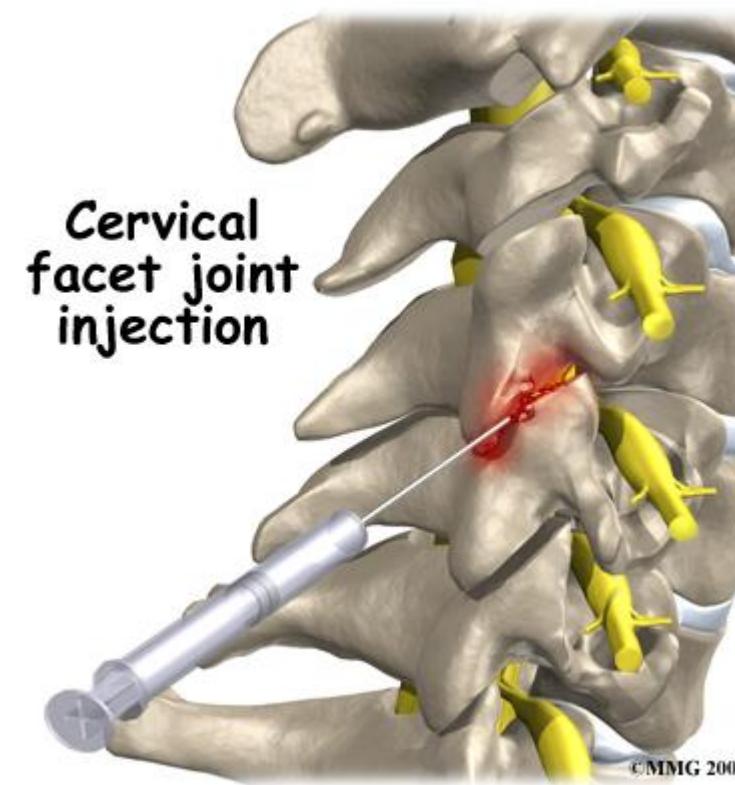
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Try a MCQ and learn

(c) False

- Orientated anterolaterally at 45° to the sagittal plane
- Demonstrated using an oblique radiographic projection.
- In the thoracic and lumbar regions they are orientated laterally, and lateral radiographs are appropriate to demonstrate them.



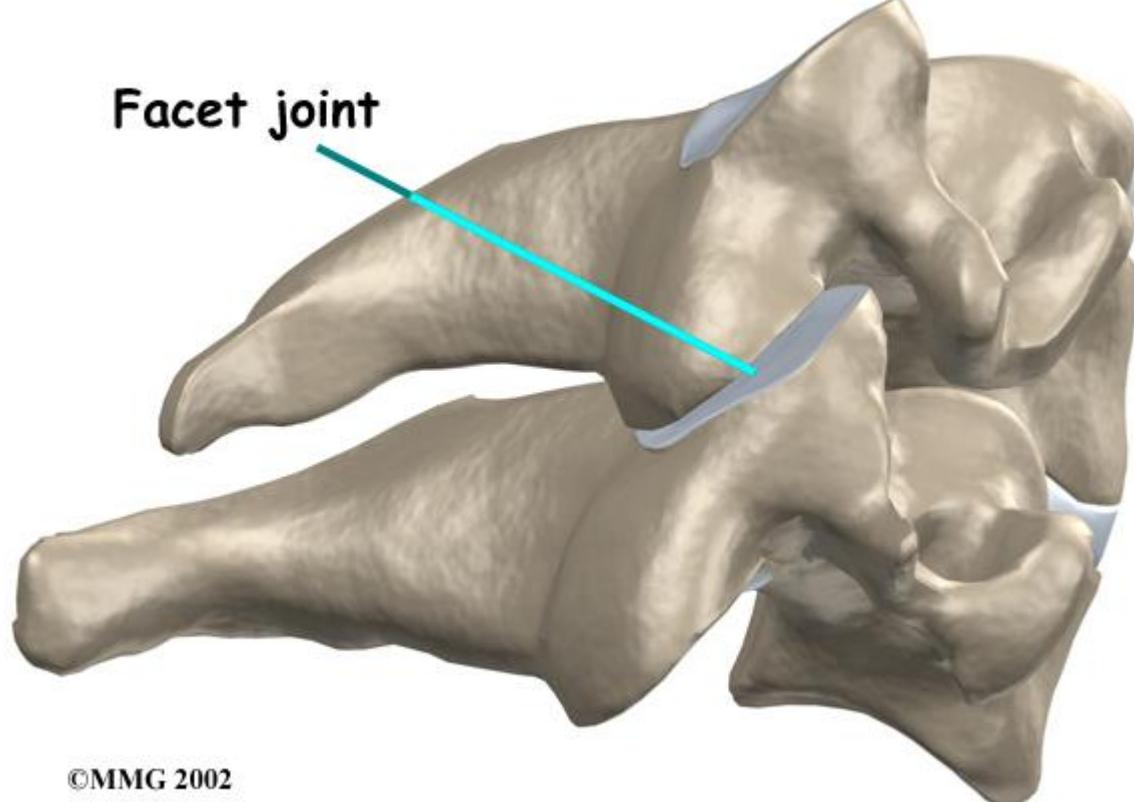
Try a MCQ and learn

In the spine:

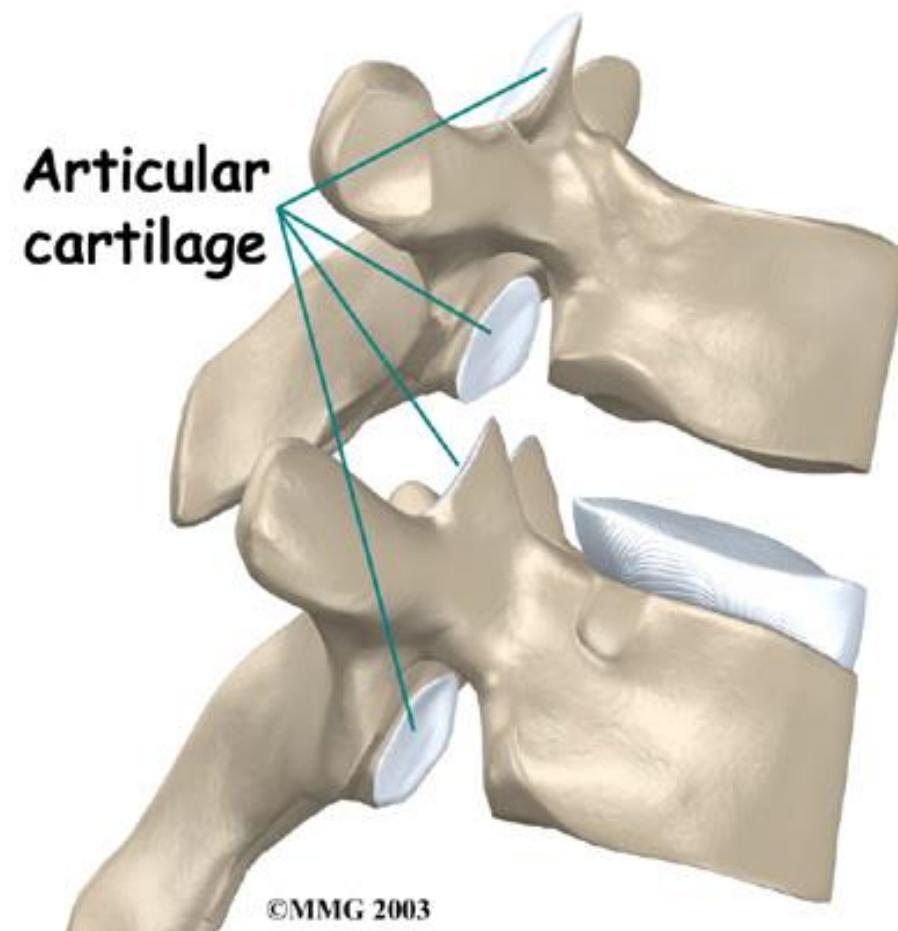
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(d) True –



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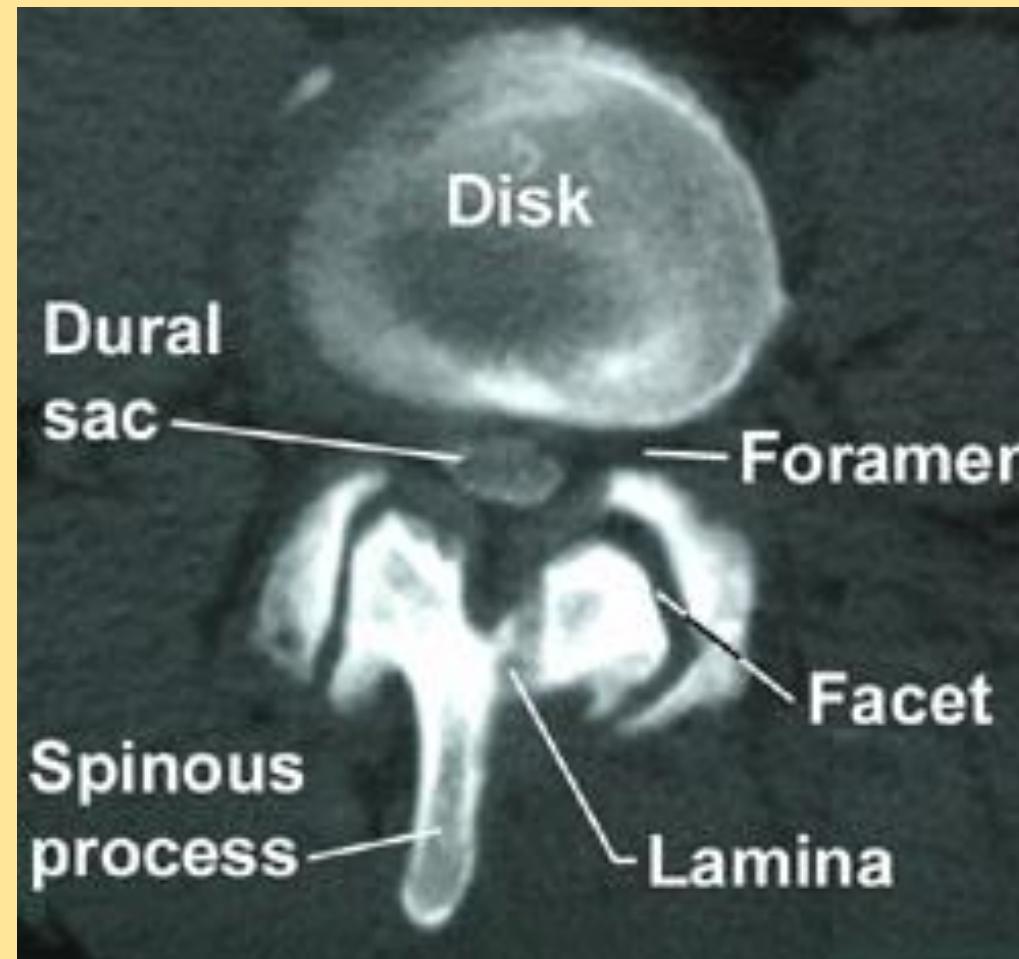
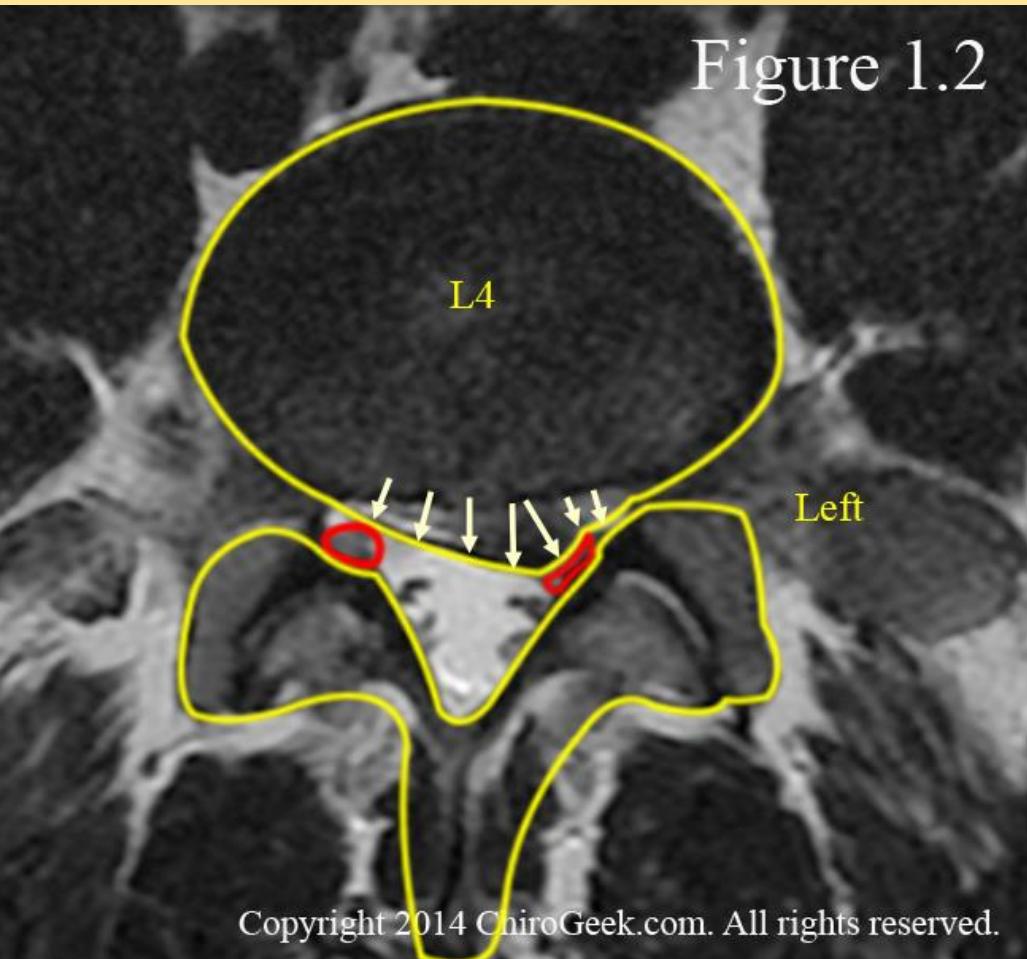
Try a MCQ and learn

In the spine:

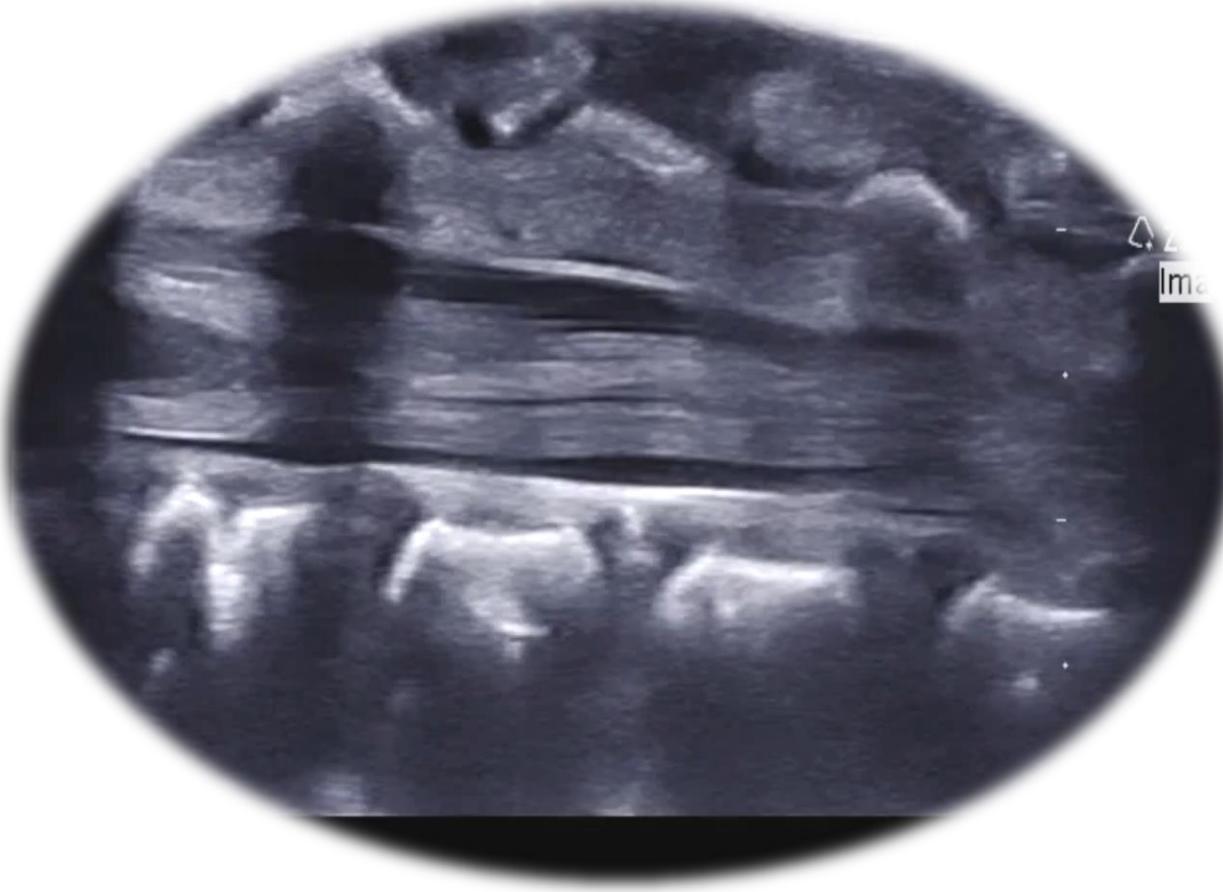
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(e) True



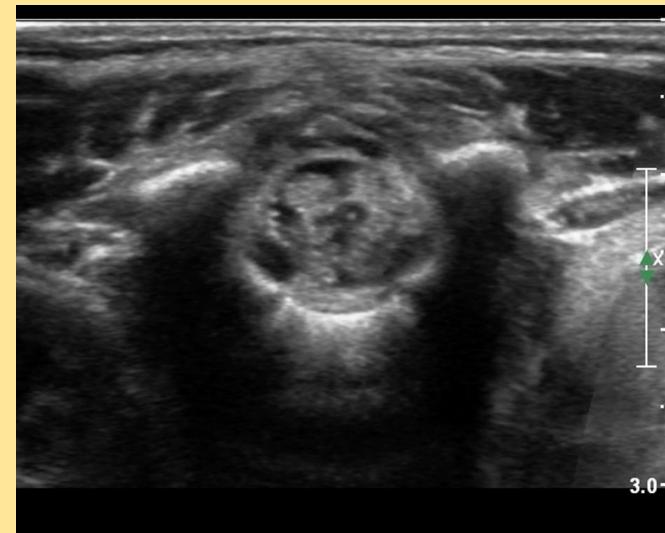
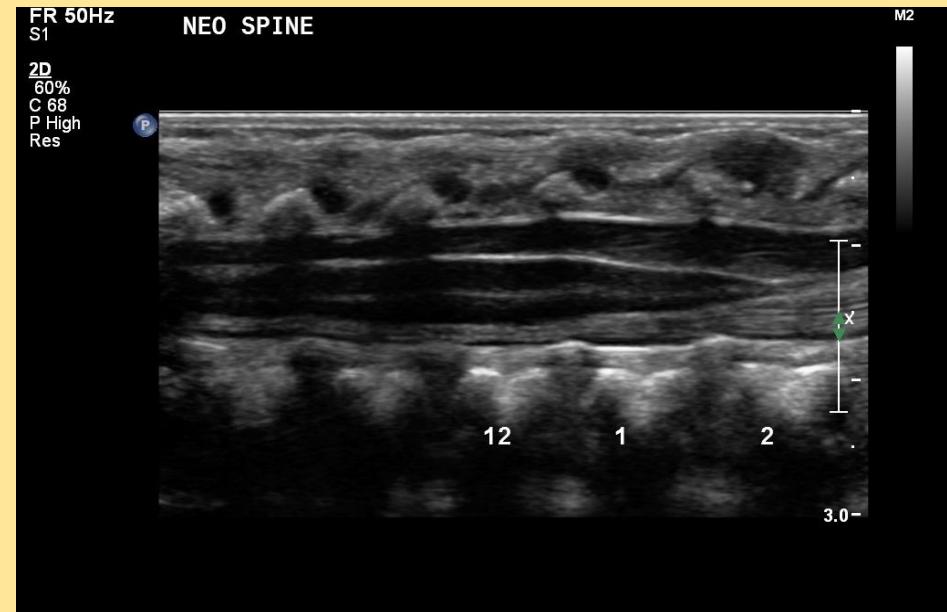
Ultrasound Spine -



- Ultrasound is a cost effective
- Readily accessible tool to investigate the neonatal spine.
- It is the premier tool for screening for most suspected neonatal spinal abnormalities from the first few hours of life.
- It requires no ionizing radiation or sedation

Ultrasound Spine -Indications

- Posterior mid-line cysts/masses
- Mid-line skin dimples - often called a 'Sacral Pit'.
- Visible haemangioma / skin discolouration
- Anal atresia / stenosis
- Guidance for lumbar puncture
- Post injury / trauma
- Post surgical - follow up or complication
- Infection / abscess





Thank You...!