Musculoskeletal Imaging in Low Back Pain

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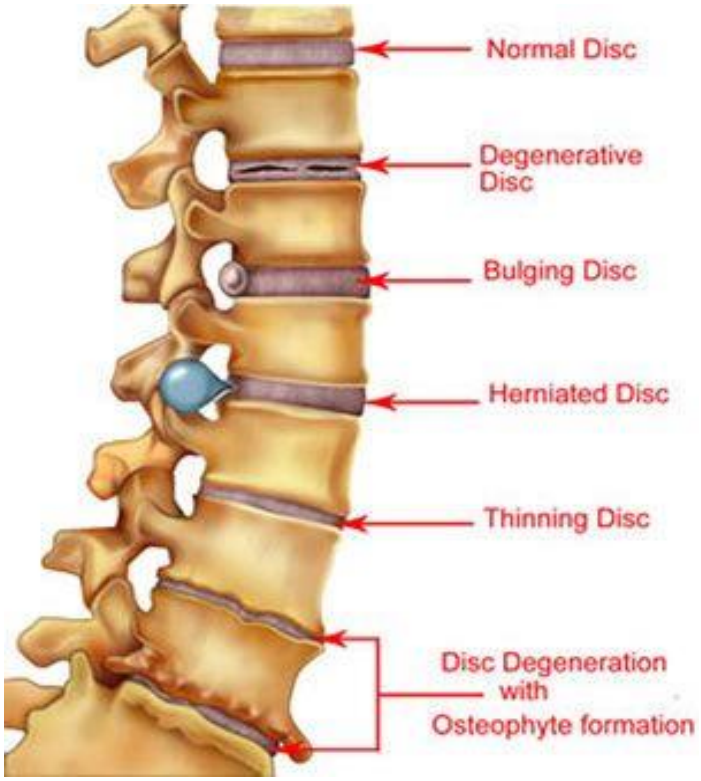
Commonly used investigations

- Lumbar spine X ray – AP/Lat ,both obliques, flexion and extension
- Pelvis X ray
- KUB
- Ultrasound (abdomen and pelvis)
- MRI lumbar spines- with or without gadolinium
- Computed tomography
- Computed tomographic myelography

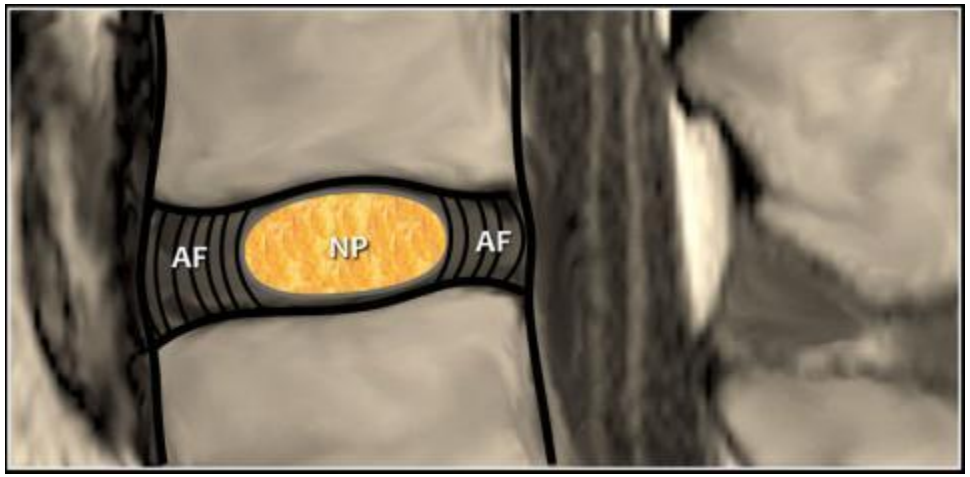
- Degenerative disc disease
- Lumbar disc herniations
- Spinal canal stenosis
- Discitis
- Benign and malignant vertebral fractures
- Ankylosing spondylitis

Degenerative disc disease

Disc problems

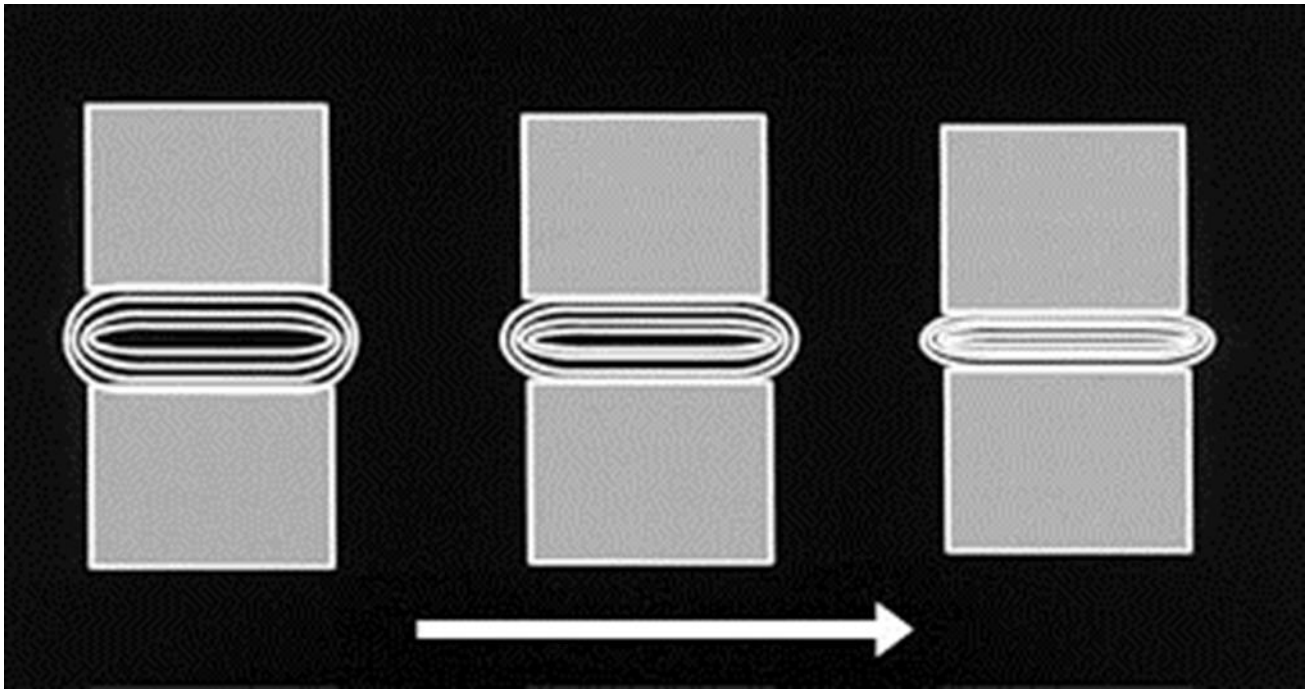


Normal disc



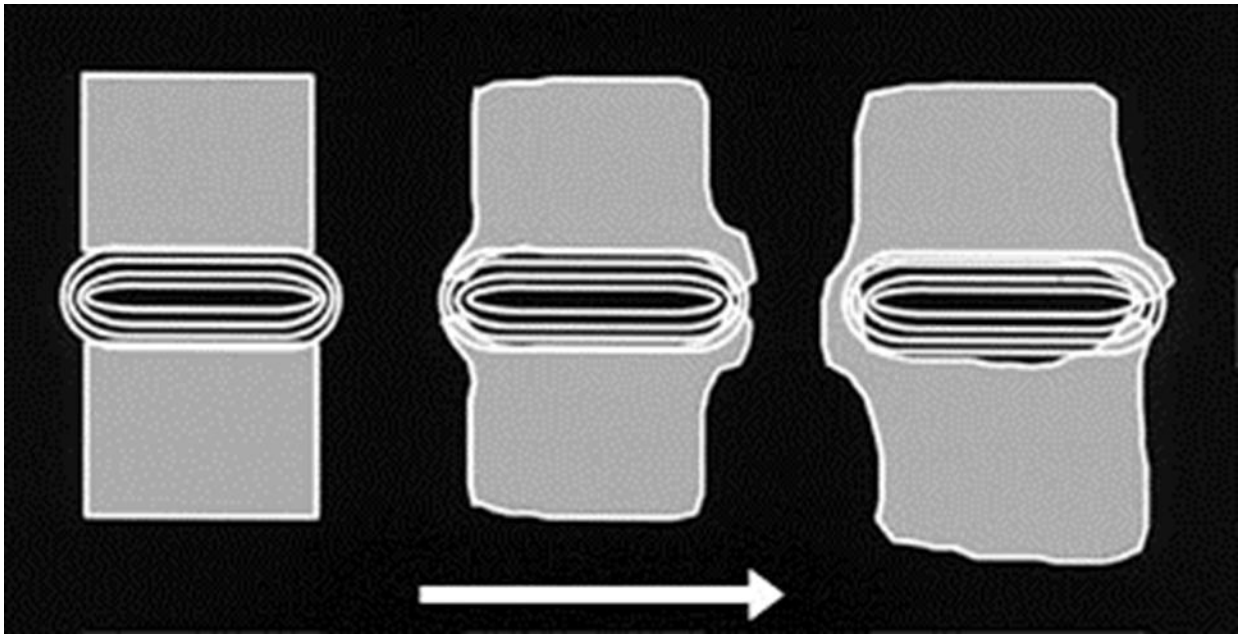
- Disc is composed of soft nucleus pulposus (NP) surrounded by strong annulus fibrosus

Degeneration of nucleus pulposus



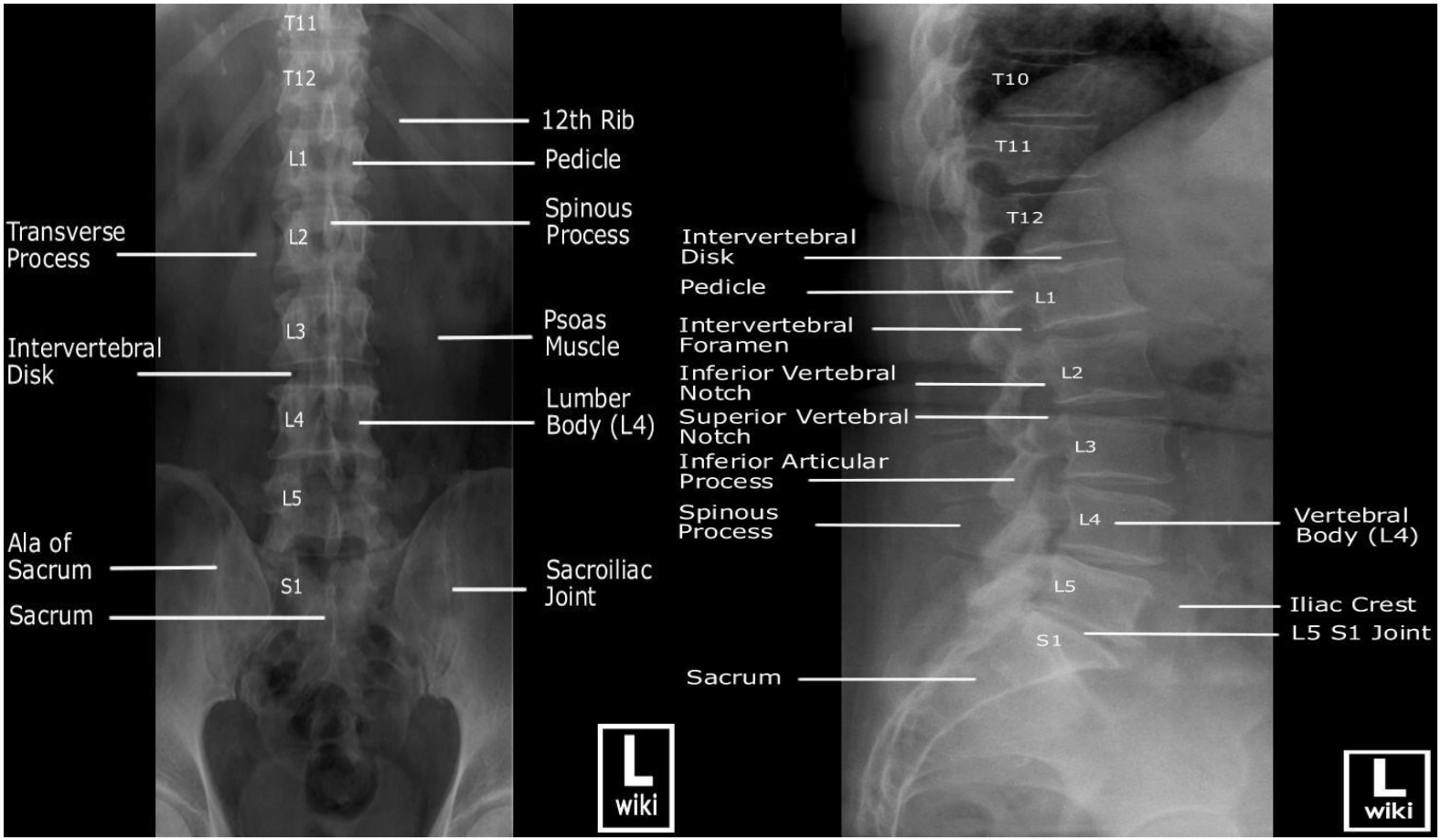
Progressive degeneration of the nucleus leads to decreasing disk space height

Degeneration of anulus fibrosus

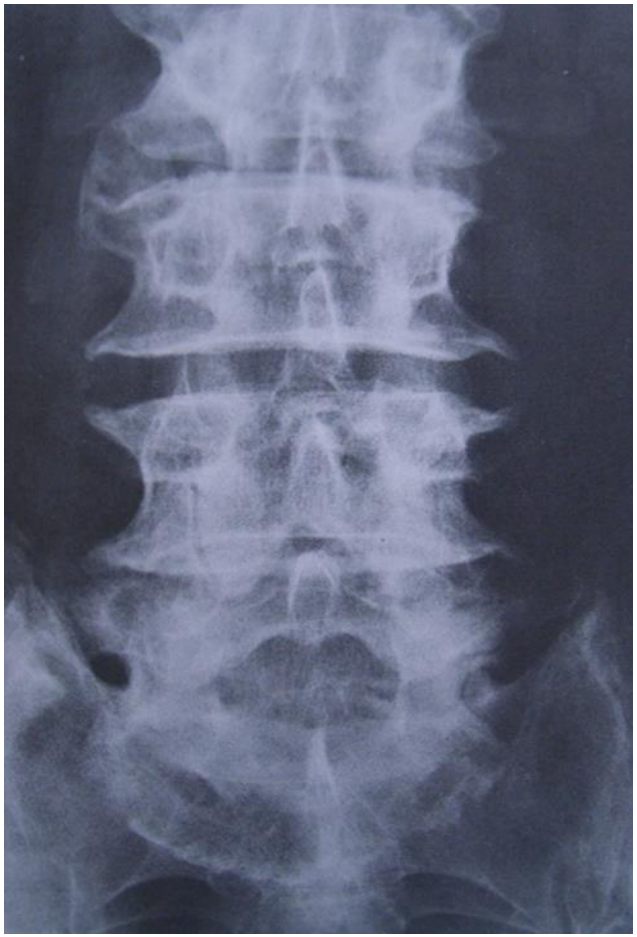


Progressive degeneration of the annulus leads to increasing osteophytosis at the disk space margins -- the height of the disk space is largely preserved

Lumbar spine AP and lat x ray

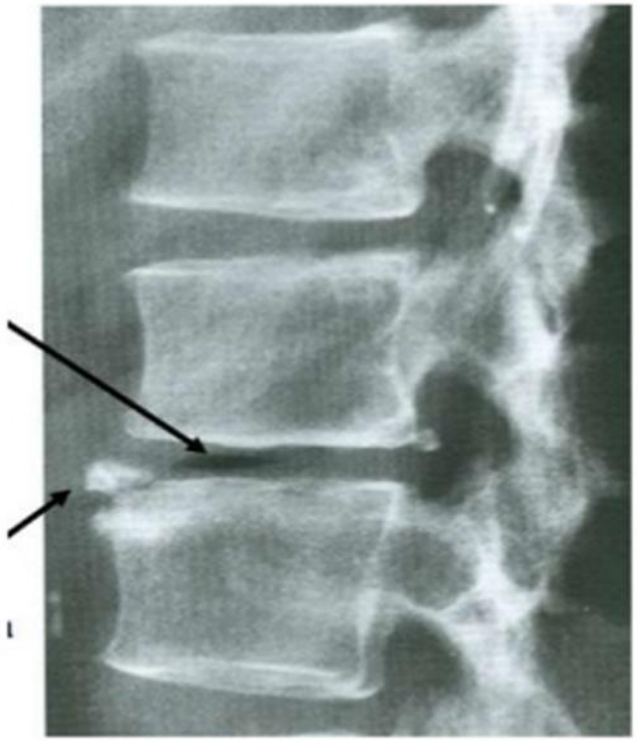


Spondylosis of lumbar spine

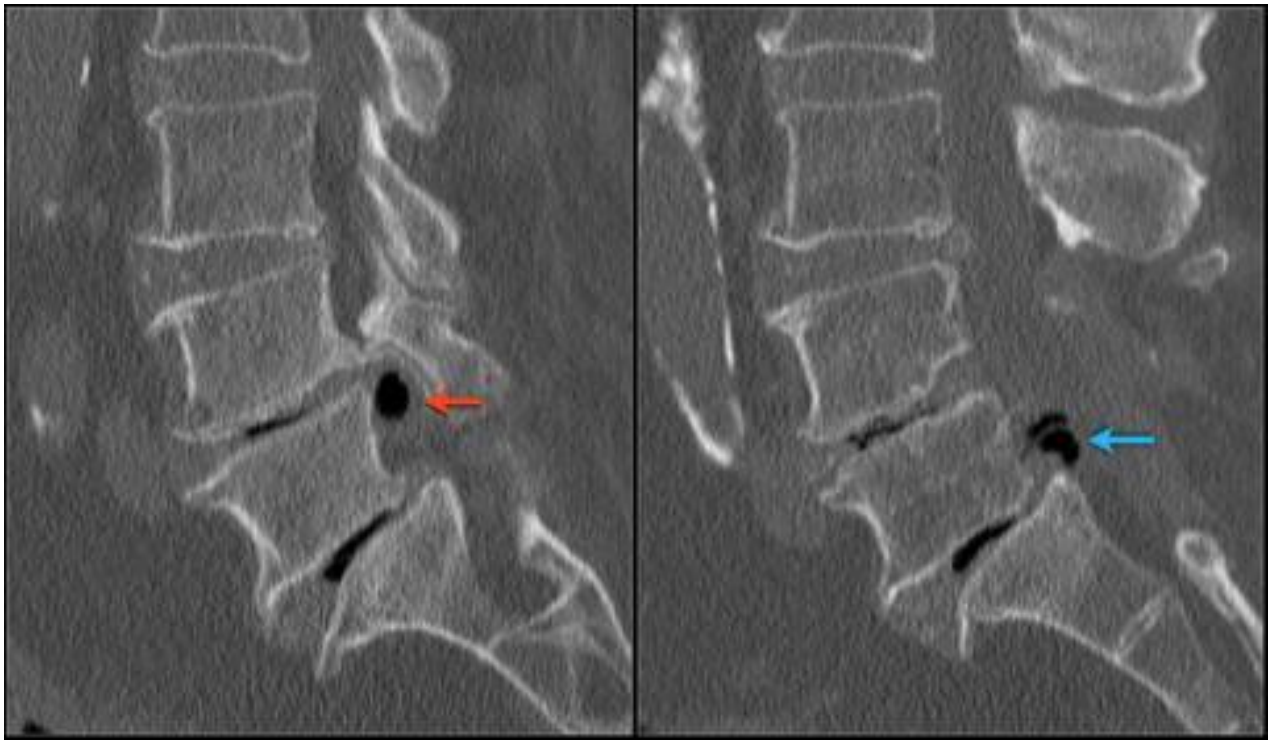


Vacuum sign

- radiolucent defect
- presence of nitrogen gas accumulations in annular and nuclear degenerative fissures
- typical **central vacuum phenomenon** gas collection that fills large neo-cavity occupying both the nucleus an annulus.
- indicative of advanced disc degeneration.

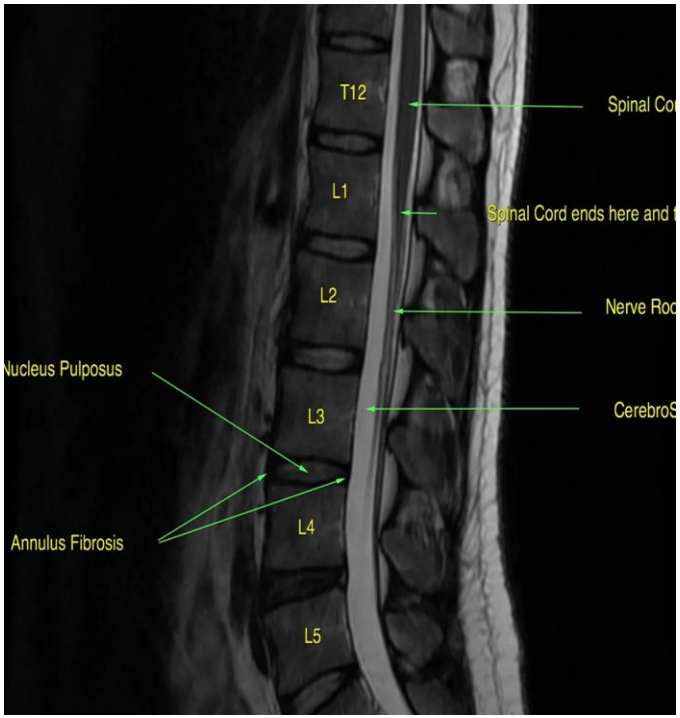


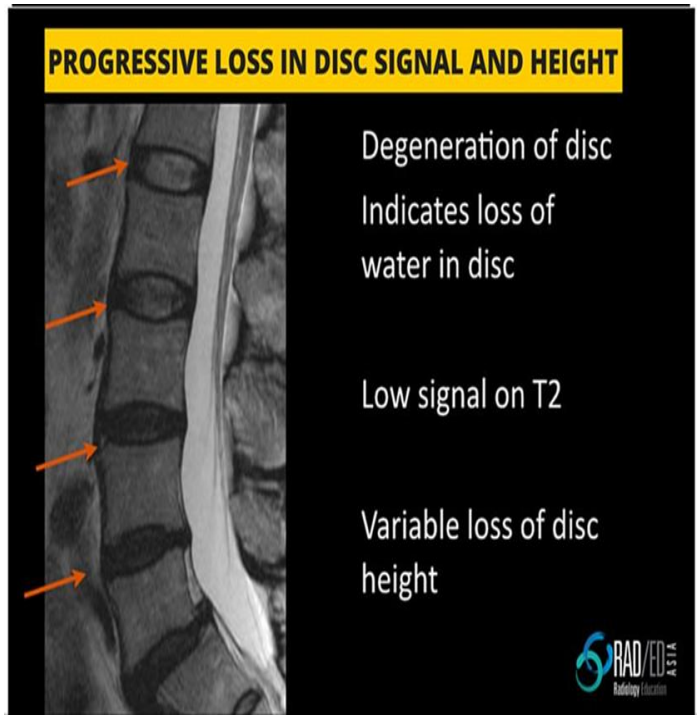
VACUUM PHENOMENA



- nitrogen gas within the herniated disc both on L4L5 (red arrow) and L5S1 level (blue arrow)

Normal and disc degeneration on sagittal T2 WI





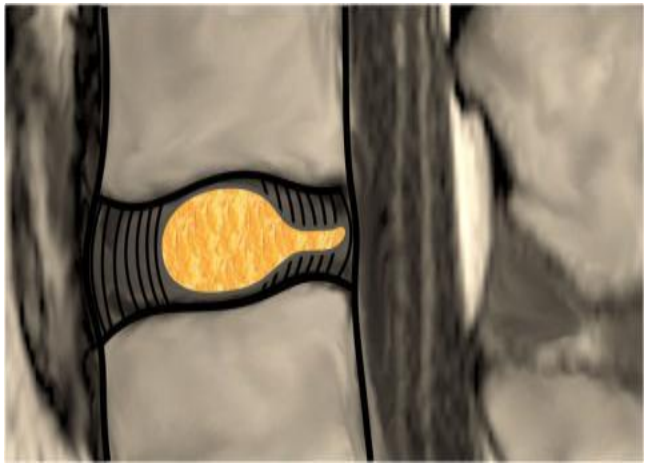
Normal and disc degeneration on sagittal T2 WI

The normal MRI

One-level degeneration

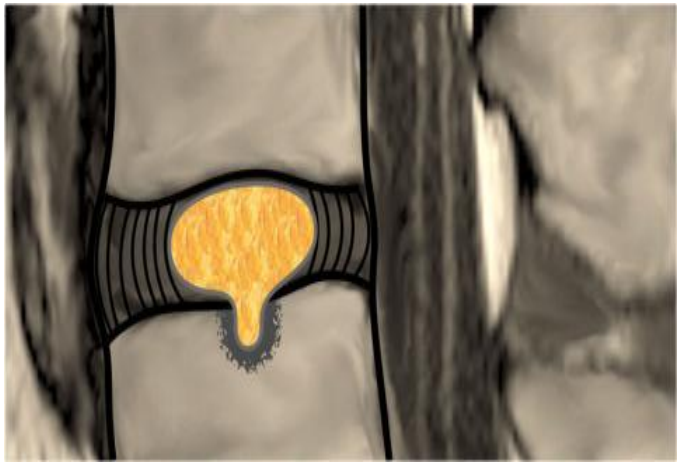
Multilevel degeneration

Annular fissure



- high intensity area on T2W-images representing fluid or granulation tissue and may enhance with gadolinium.

Intravertebral herniation or Schmorl node

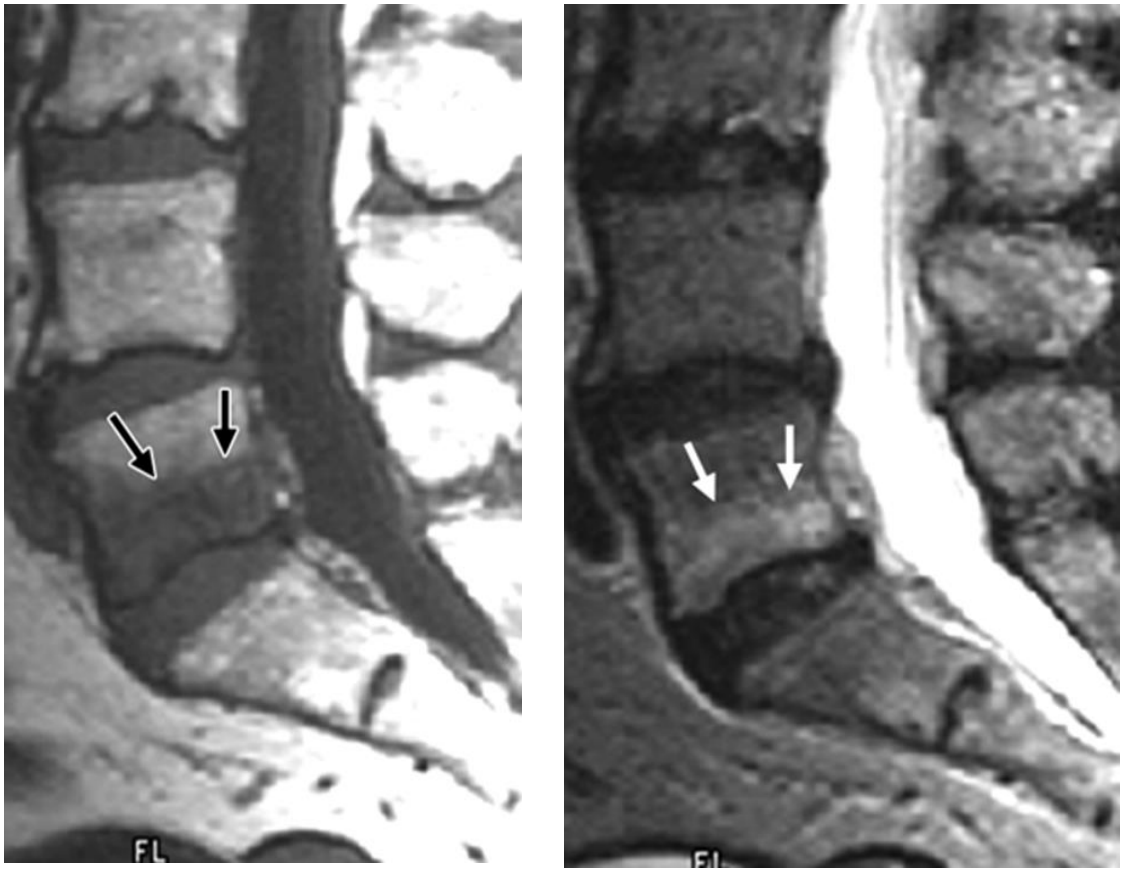


- herniation of disc material in the vertical direction through a gap in the vertebral end plate.

Modic classification

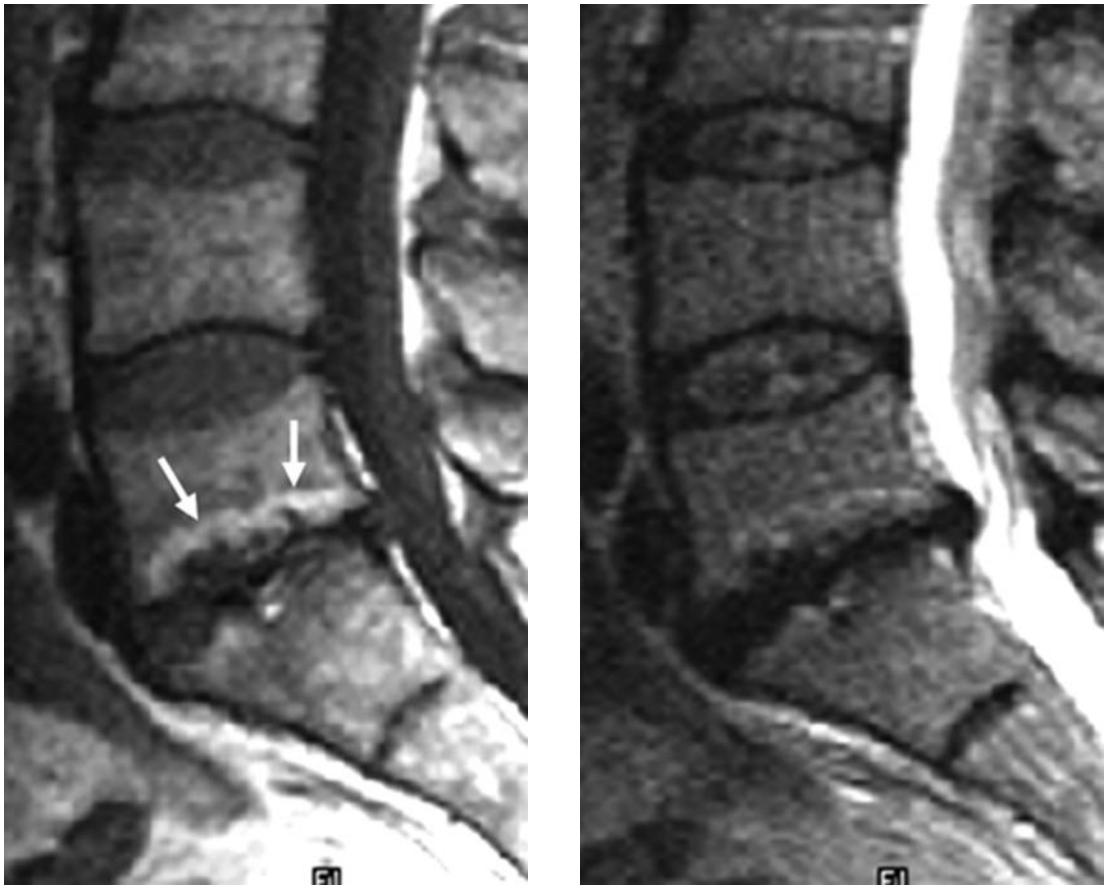
degenerative and inflammatory changes involving the vertebral endplates and adjacent vertebral bodies as seen on MRI

Modic change type I



low signal intensity on T1WI and high on T2WI, representing fibrovascular tissue, inflammatory changes, and perhaps edema.

Modic change Type 2



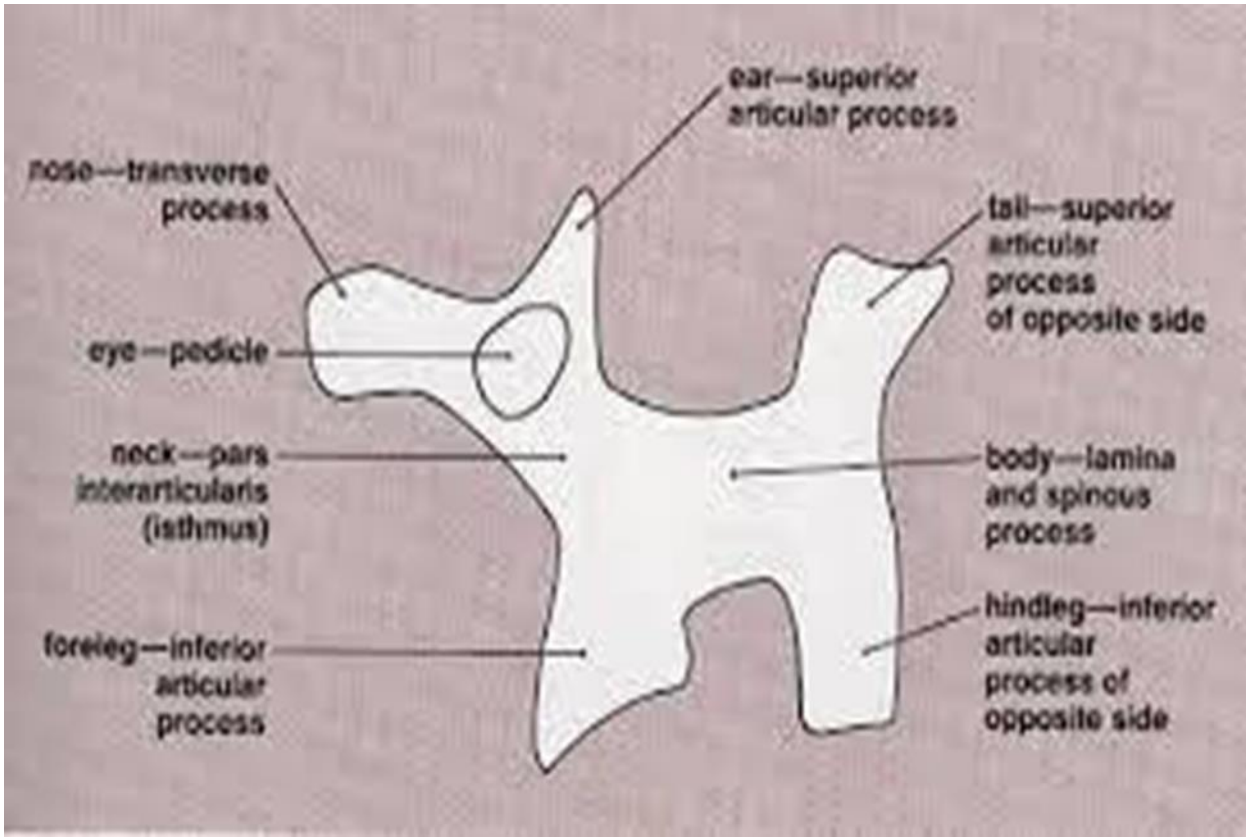
high signal intensity on T1WI and isointense or high on T2WI, representing bone marrow replacement by fat

MODIC CHANGE TYPE 3

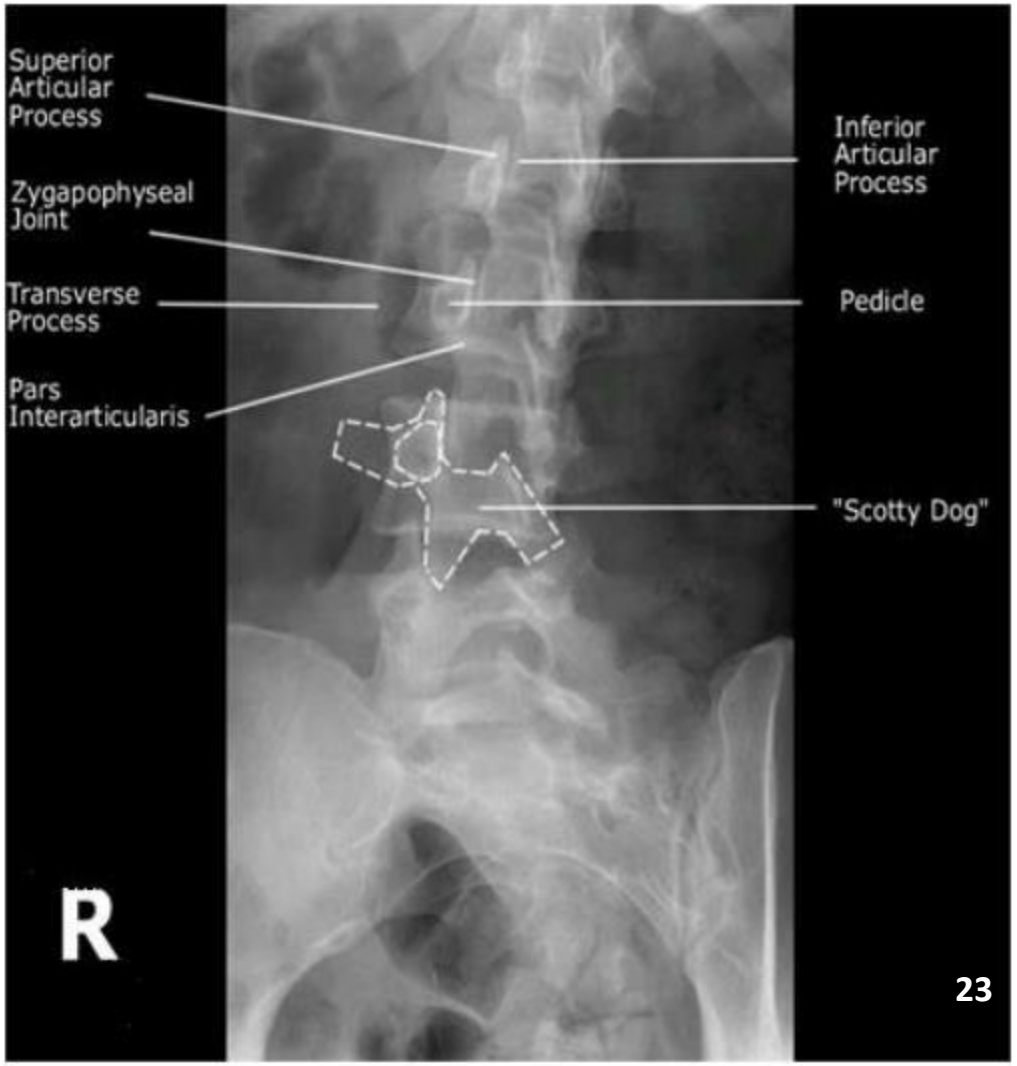
as low signal intensity on T1WI and low on T2WI, representing reactive sclerosis

SPONDYLOLYSIS
AND
SPONDYLOLITHESIS

Scotty dog

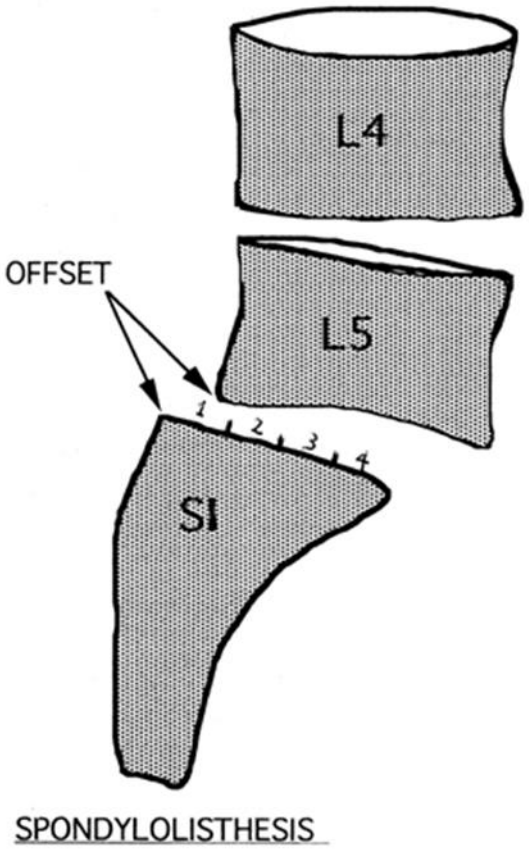

ear—superior articular process
nose—transverse process
tail—superior articular process of opposite side
eye—pedicle
neck—pars interarticularis (isthmus)
body—lamina and spinous process
foreleg—inferior articular process
hindleg—inferior articular process of opposite side

Oblique lumbar spine

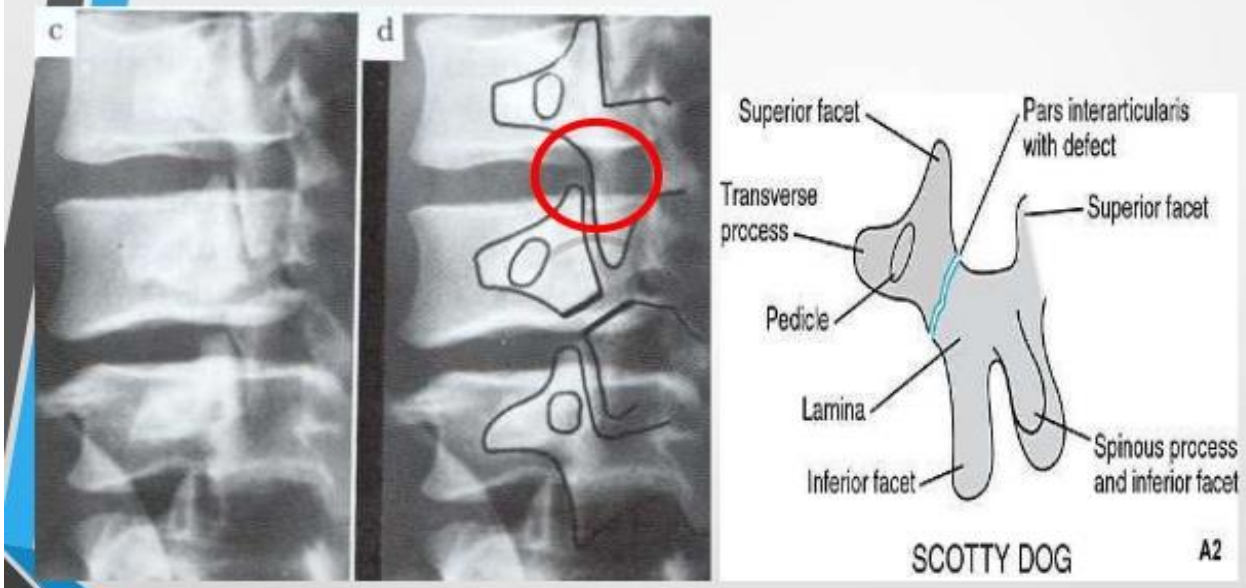


Zygoapophyseal joints

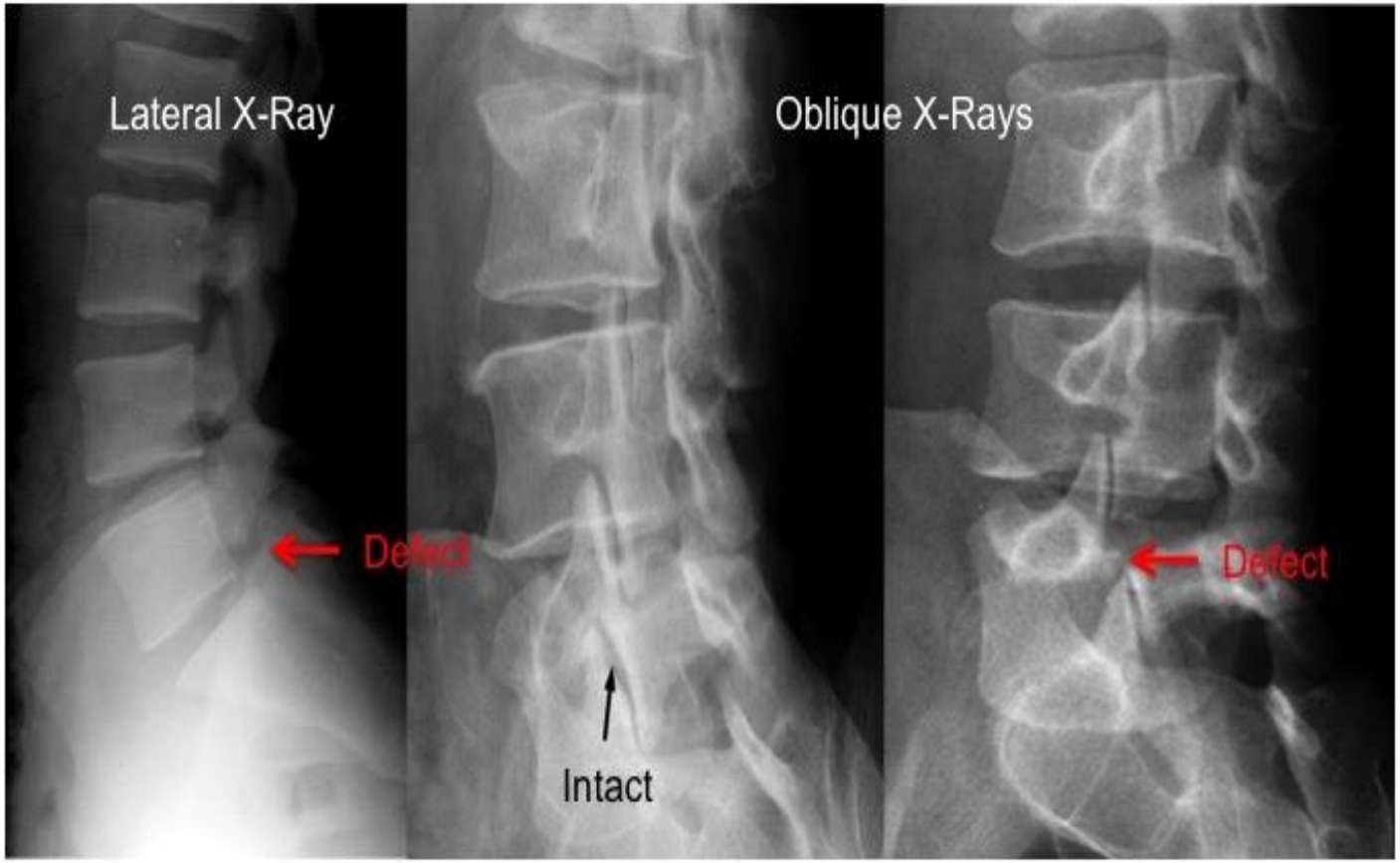
Spondylolysis and anterolisthesis

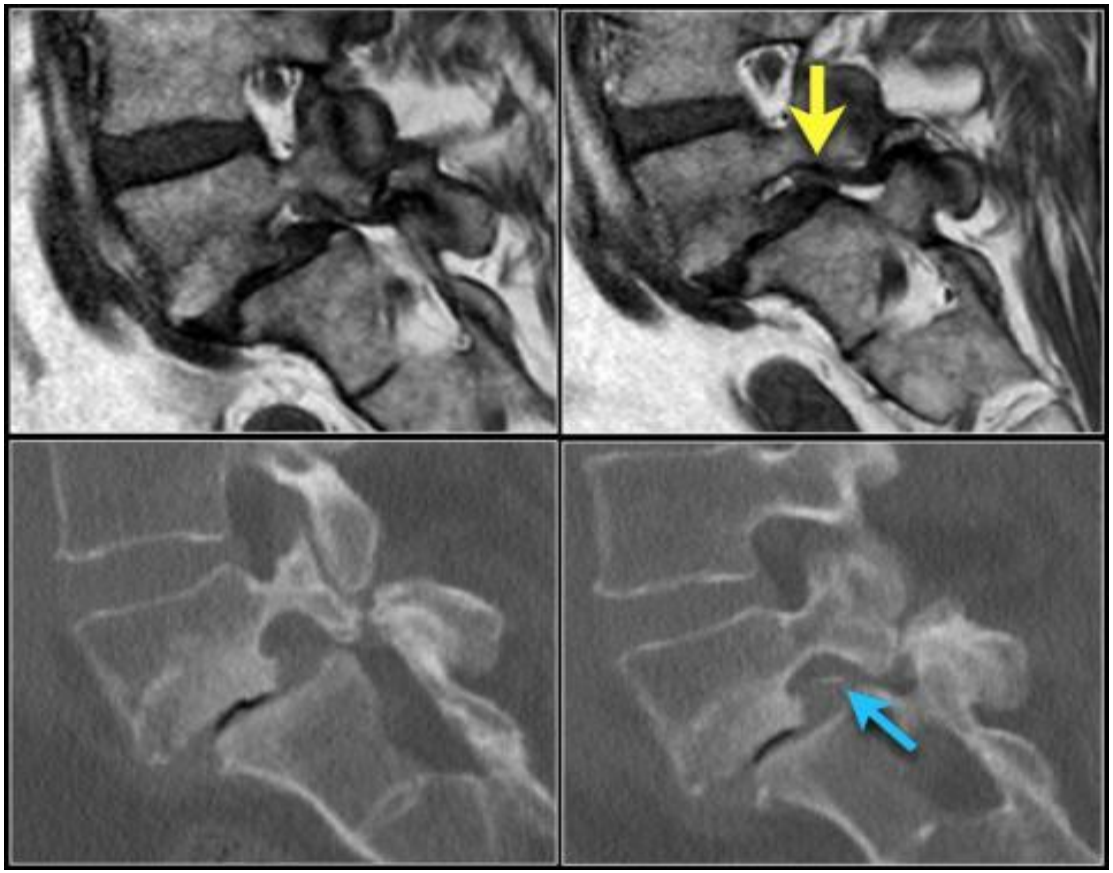


Oblique View



Defect in the pars interarticularis – 'collar' around the 'neck' of an illusory 'dog' - oblique xray

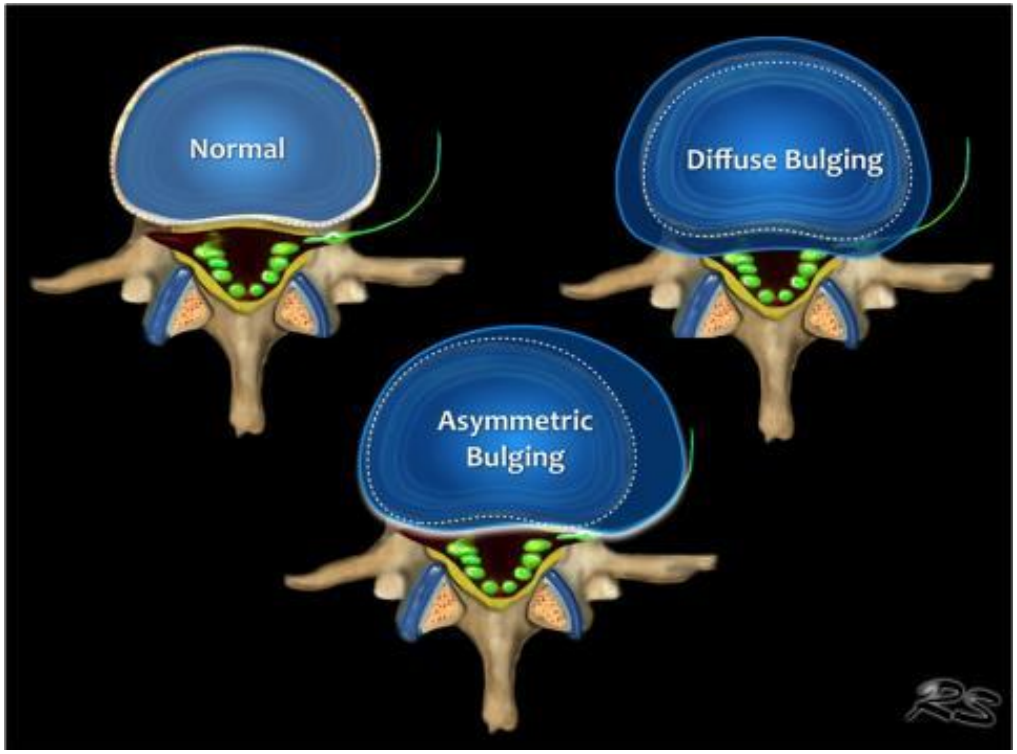

Lateral X-Ray
Oblique X-Rays
Defect
Defect
Intact



- severe anterolisthesis due to bilateral spondylolysis

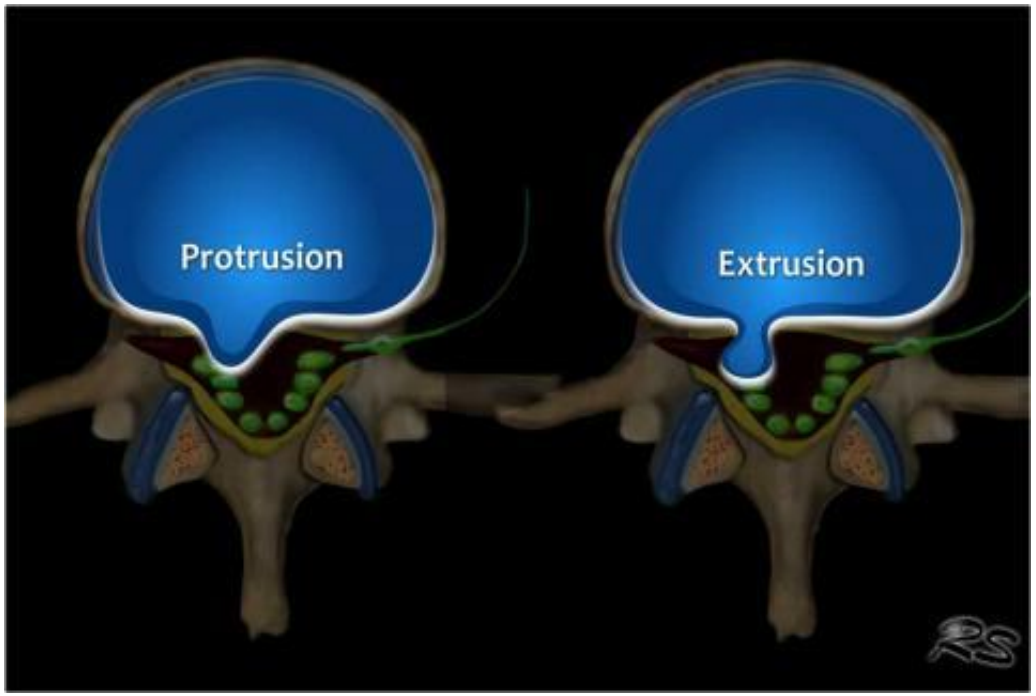
Lumbar Disc Herniation And Spinal Canal Stenosis

Disc bulging



- The presence of disc tissue extending beyond the edges of the ring apophyses, throughout the circumference of the disc, is called ''bulging'' and is not considered a form of herniation.

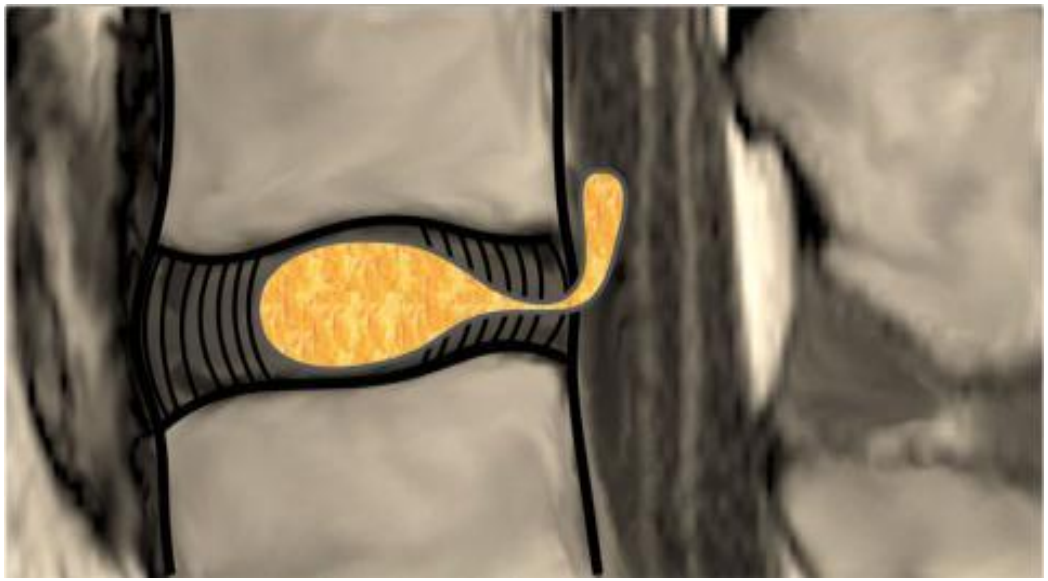
Disc herniation



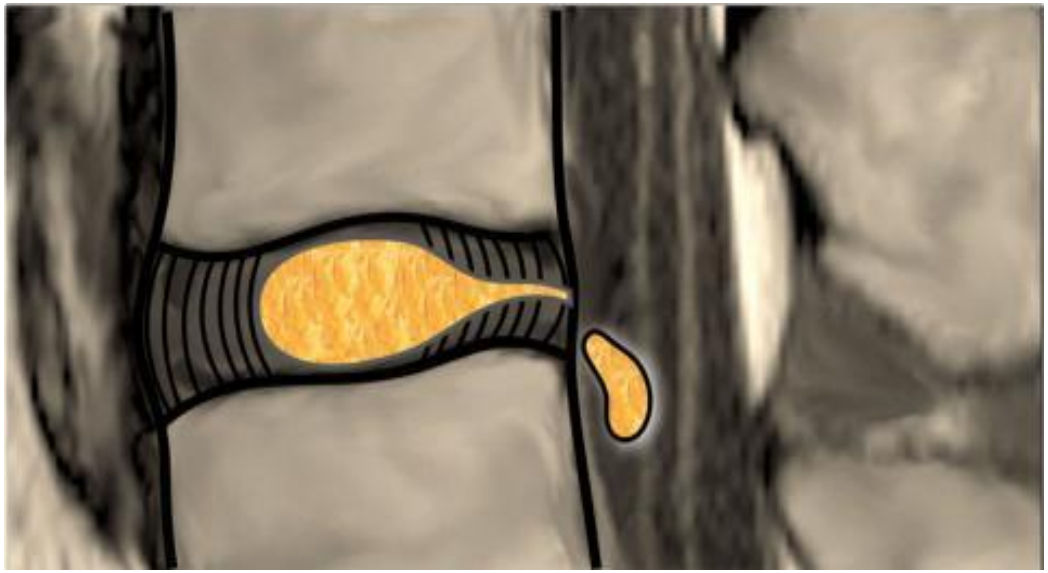
- Disc herniation is defined as a focal displacement of disc material

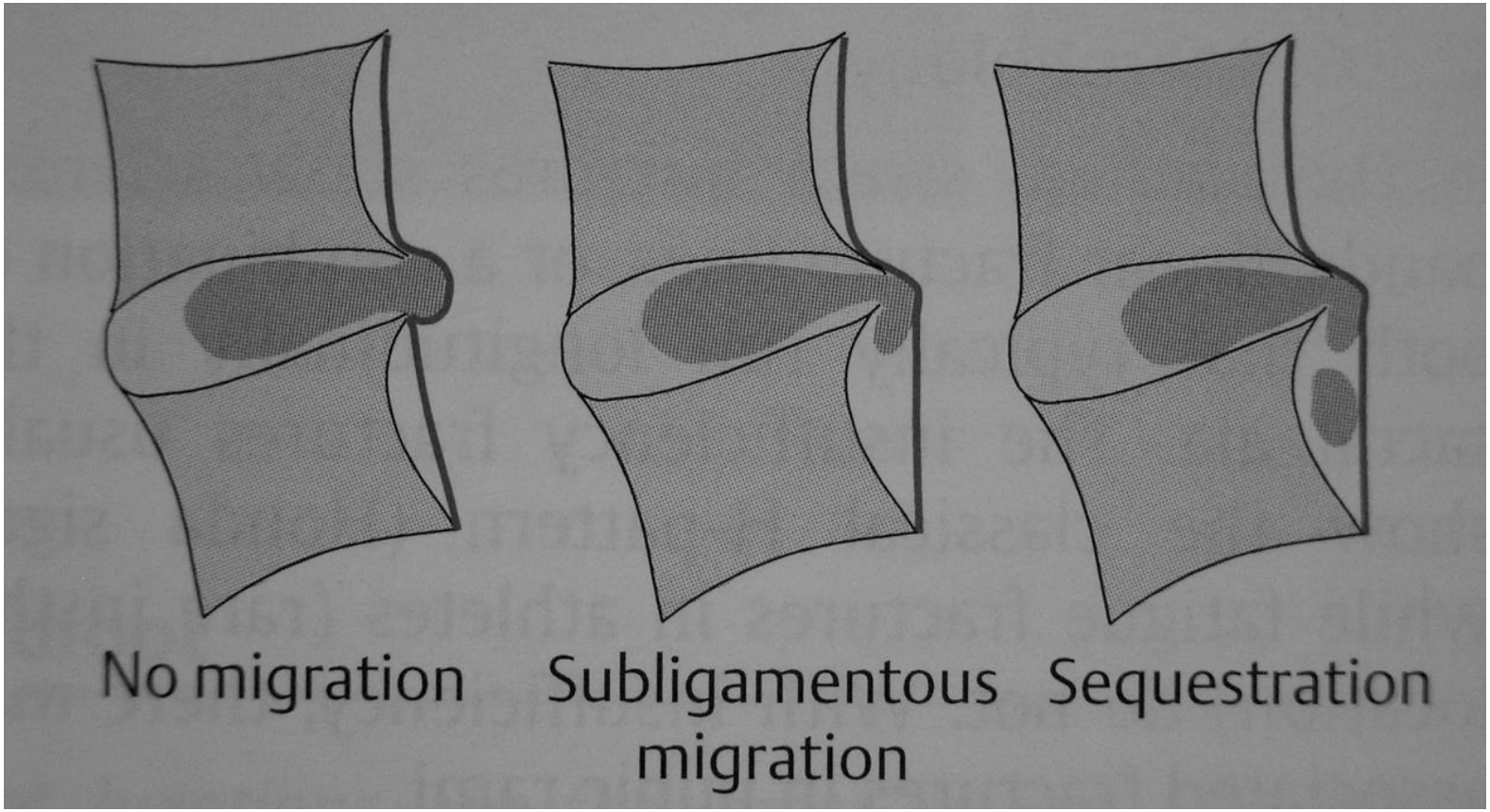
(< 25% of the disc circumference) beyond the limits of the intervertebral disc space. A herniated disc can be contained (covered by outer annulus fibrosus) or uncontained.

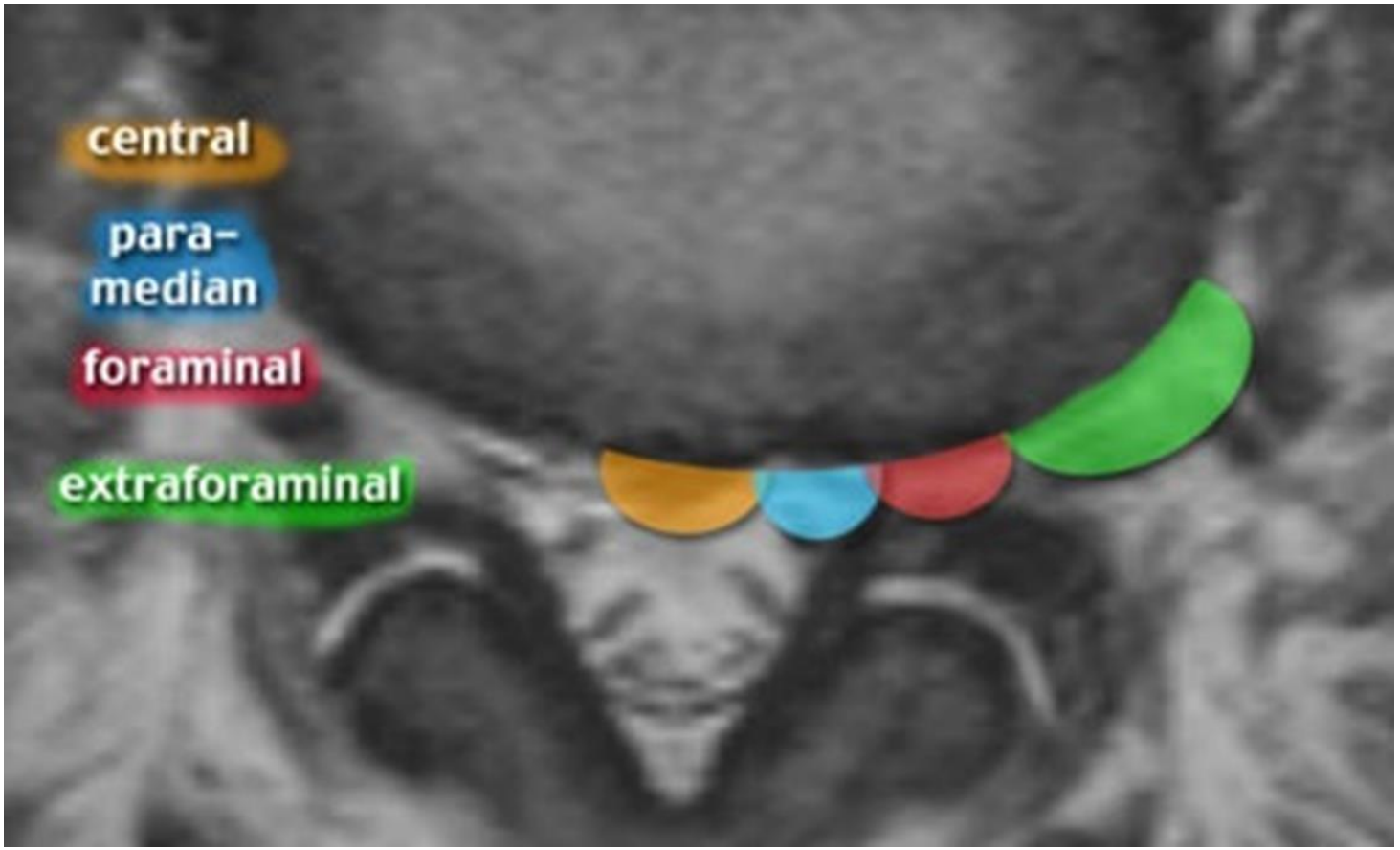
Disc migration

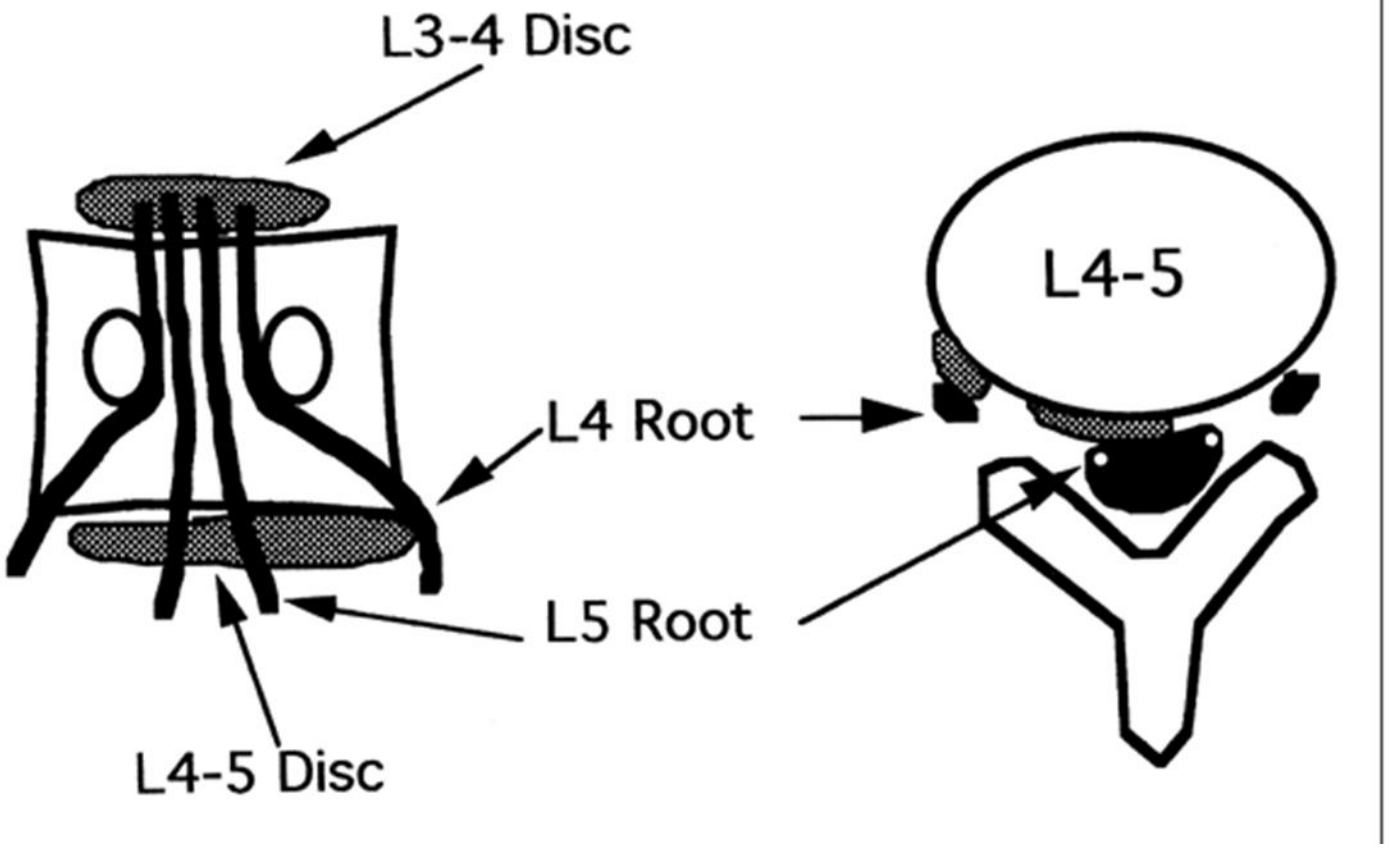


SEQUESTRATION

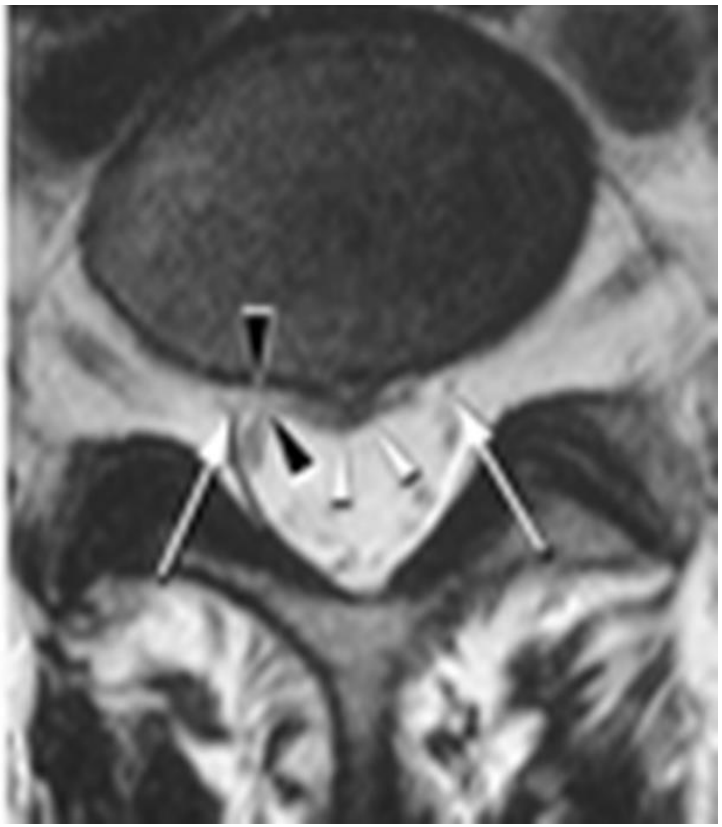


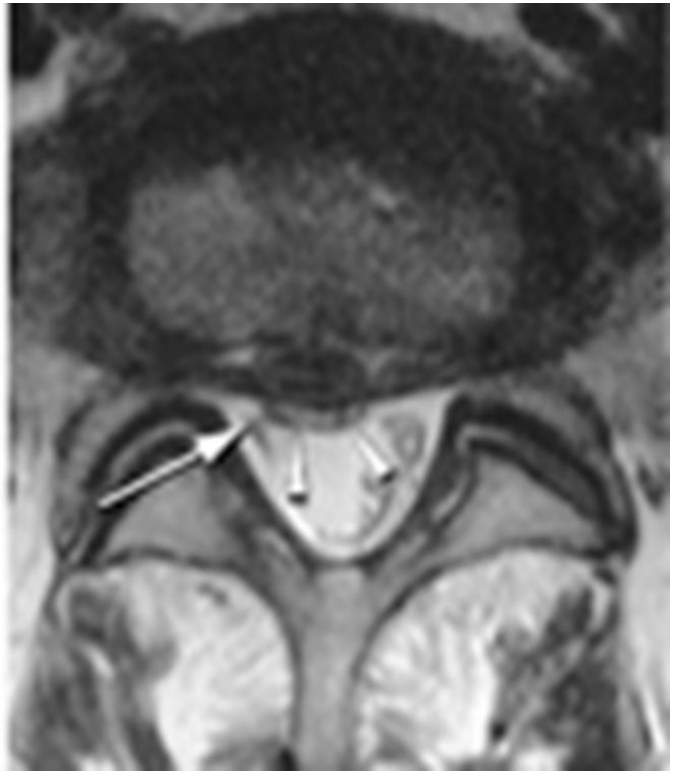

No migration
Subligamentous migration
Sequestration


central
para-
median
foraminal
extraforaminal


L3-4 Disc
L4-5
L4 Root
L5 Root
L4-5 Disc

Grade 0

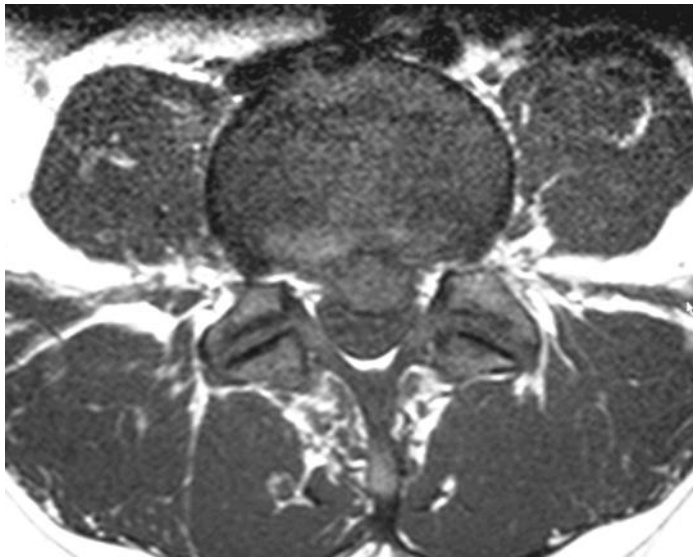




Grade 1

GRADE3

Posterior midline herniated disc at L4- L5



Lateral herniated disc L3 – L4

Others causes of spinal canal stenosis

- Facet joint arthrosis
- Synovial cyst
- Ligamentum flavum hypertrophy
- Epidual lipomatosis

Facet joint arthrosis

- Joint space narrowing, subchondral sclerosis, and osteophyte formation, vaccum phenomenon
- Obliques Lumbar spines are more prefer
- CT > Plain films
- MRI-better demonstrates narrowing and compression of the theca, lateral recess, neural foramen, and nerve roots

Synovial cysts

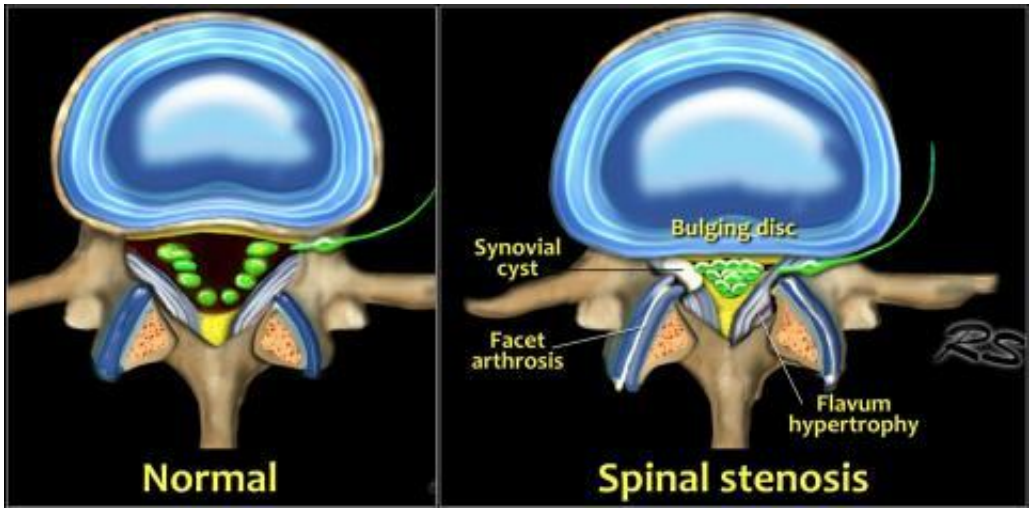
- seen in combination with facet arthrosis.
- Mostly they lead to stenosis of the lateral facet.
- When they are very large they can protrude into the foramen and cause foraminal stenosis.

Facet joint arthrosis and synovial cyst

Epidural lipomatosis

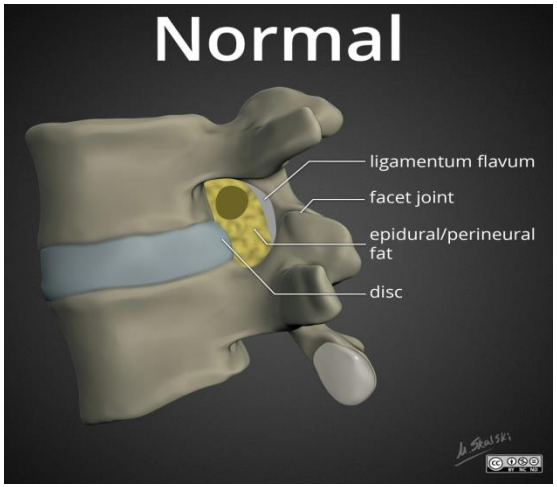
- excessive amount of fat within the epidural space compressing the thecal sac

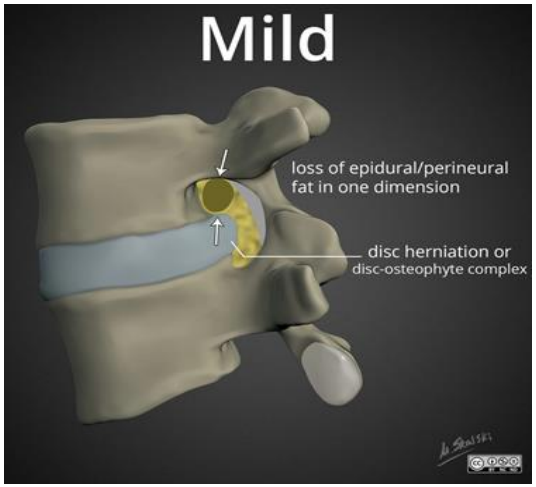
Spinal canal stenosis

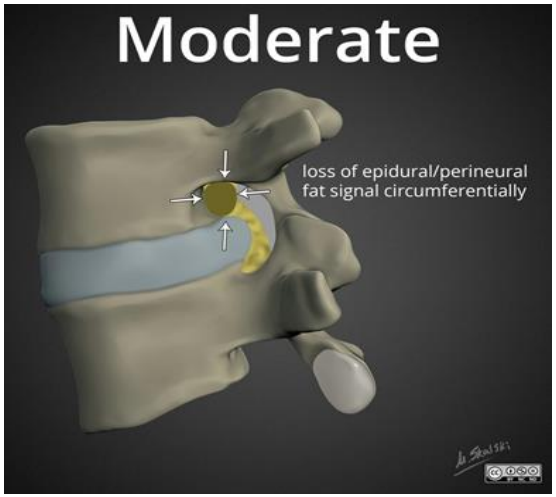


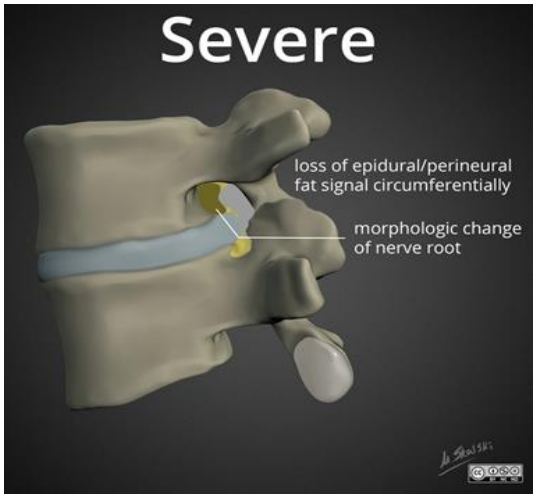
- Bilateral facet arthrosis in combination with bulging of the disc and hypertrophy of the ligamentum flavum

Neuroforaminal stenosis





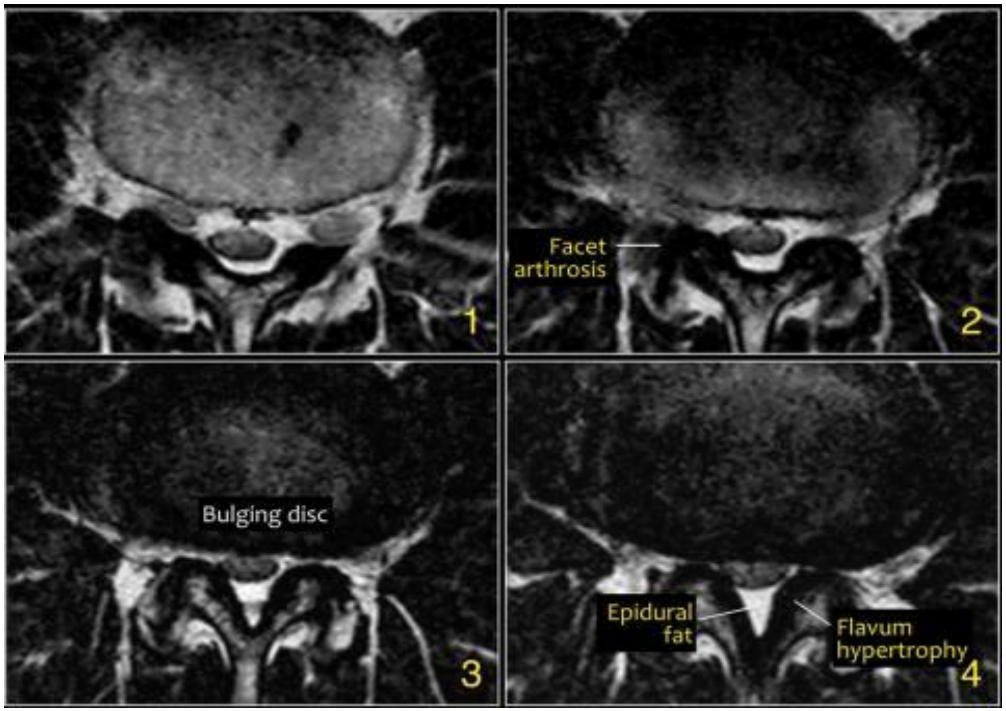




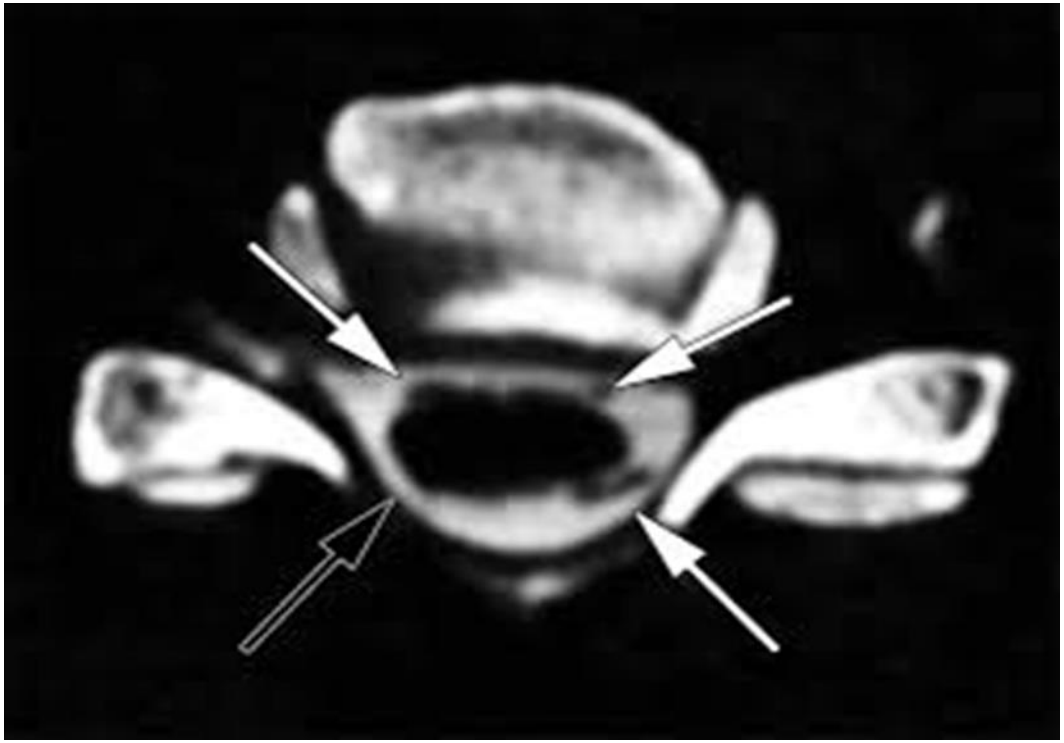
Neuroforaminal stenosis

- normal: fat surrounds nerve root
- mild: partial loss of perineural fat signal
- moderate: circumferential lost of perineural fat signal
- severe: circumferential lost of perineural fat signal with compression of the nerve root

Spinal canal stenosis



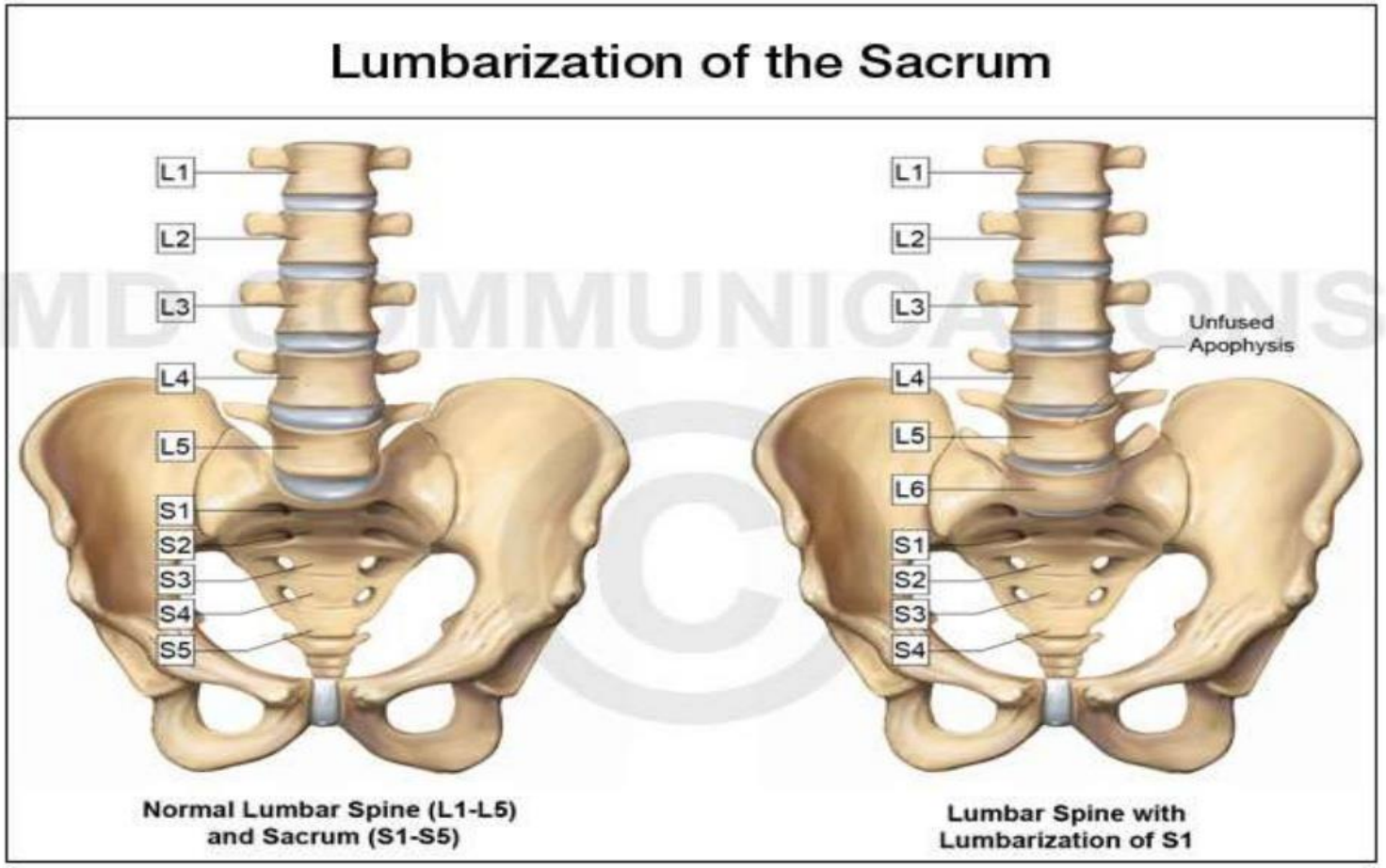
- no CSF visible surrounding the nerve roots.
- there is a severe spinal stenosis.
- The epidural fat compresses the nerves from posteriorly.



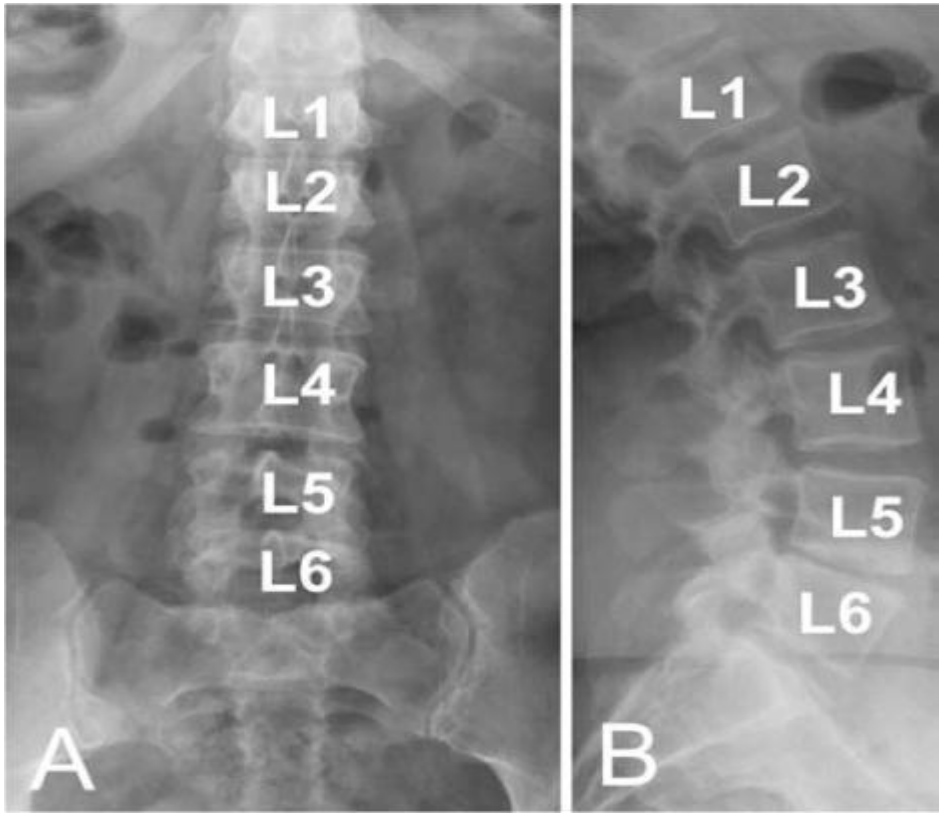
Othere causes

- Lumbarization
- Sacralization
- Lumbosacral transitional vertebra
- Spina bifida
- Tarlov cyst

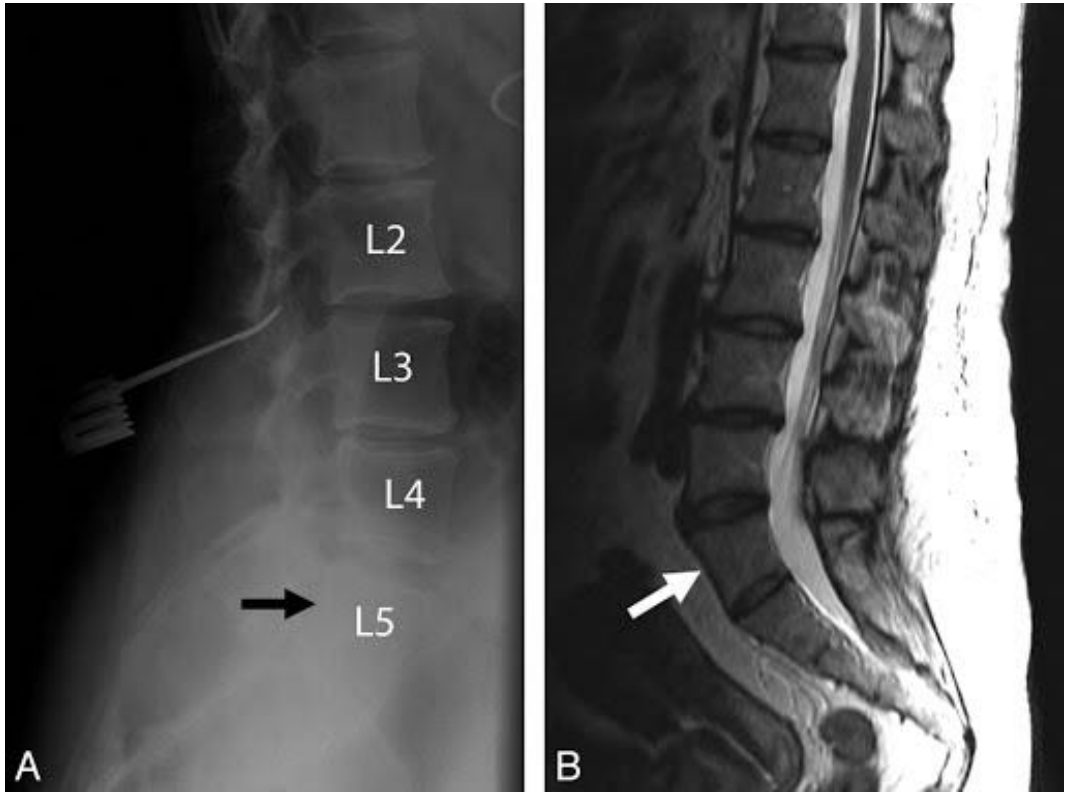
LUMBARIZATION OF THE SACRUM



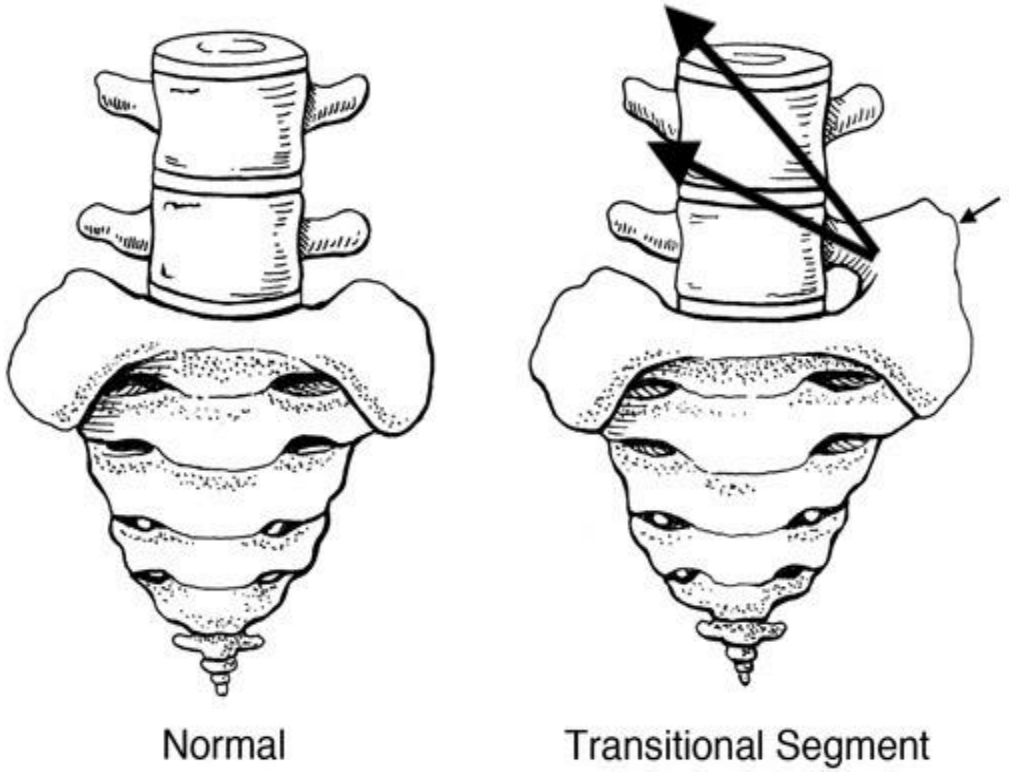
Lumbarization of the sacrum



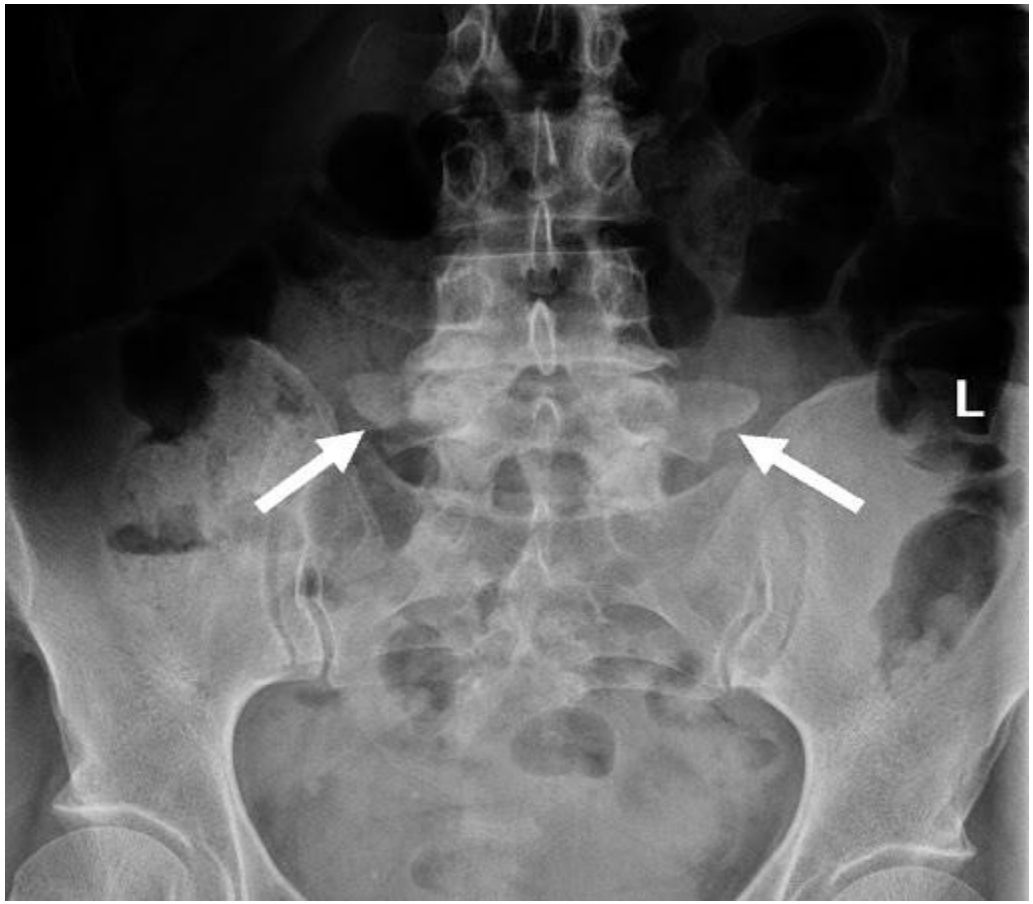
Sacralization of the lumbar



LUMBOSACRAL TRANSITIONAL VERTEBRA

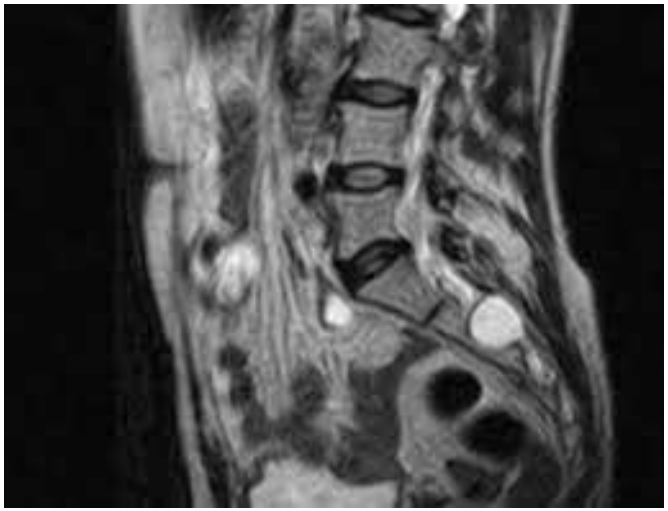


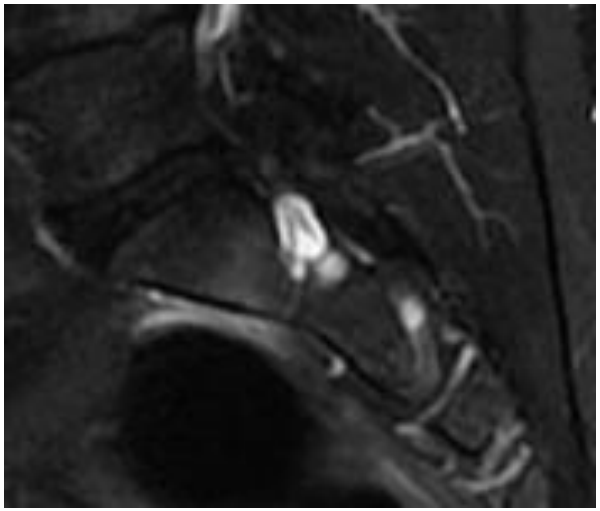
Transitional vertebra



Spina bifida

TARLOV CYST





thin-walled CSF intensity simple cystic structures closely related to sacral and lower lumbar nerves

Discitis

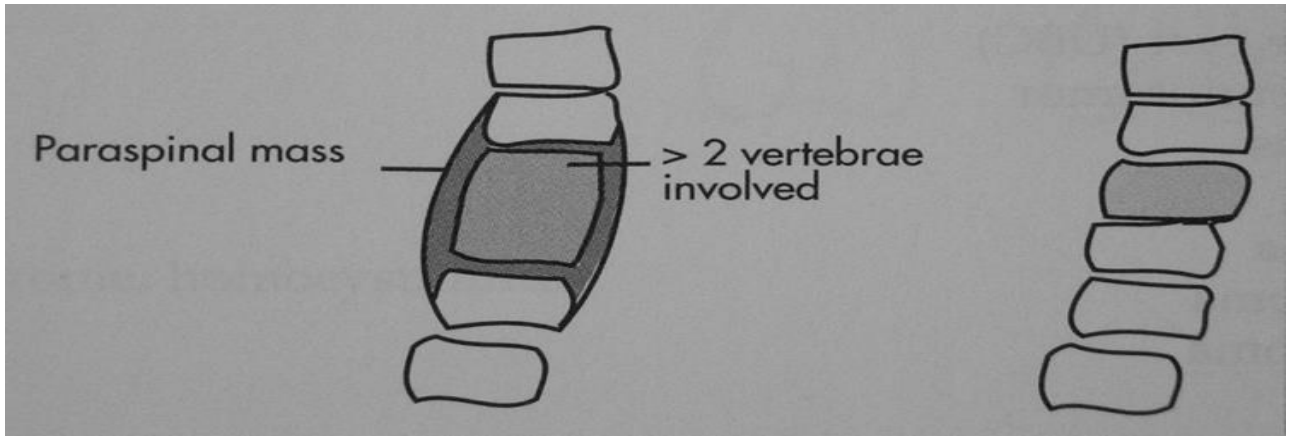
TUBERCULOUS SPINE

Radiological Investigations

- Xray: Plain radiograph signs
  - Reduced disc space
  - Blurred paradiscal margins
  - Destruction of bodies
  - Loss of trabecular pattern
  - Increased prevertebral soft tissue shadow
  - Subluxation /dislocation
  - Decreased lordosis/Kyphosis

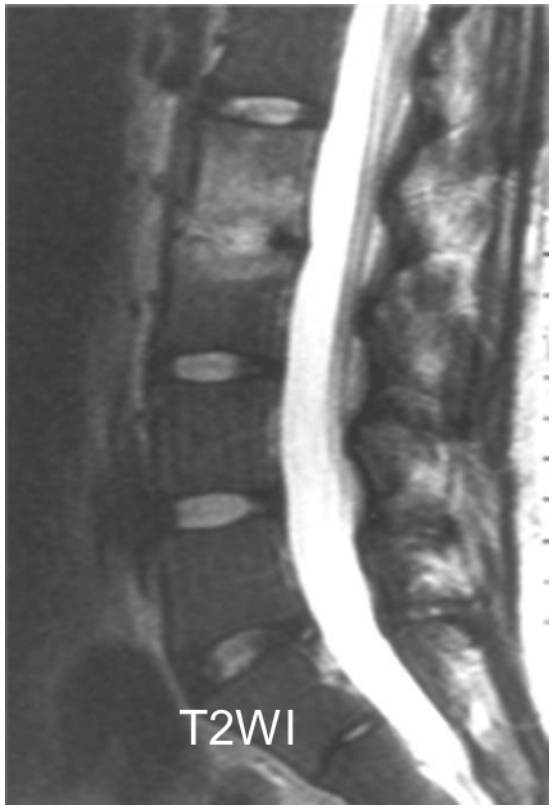
Variable	Pyogenic spondylitis	Tuberculous spondylitis
Para- or intraspinal abscess	Absence	Presence
Abscess wall	Thick and irregular	Thin and smooth
Postcontrast paraspinal abnormal signal margin	Ill-defined	Well defined
Abscess with postcontrast rim enhancement	Disc abscess	Vertebral intraosseous abscess
Vertebral body enhancement pattern	Homogeneous	Heterogeneous and focal
Involvement of vertebral bodies	Involvement ≤2 vertebral bodies	Multiple body involvement
Commonly involved region	Lumbar spine involvement	Thoracic spine involvement
Degree of disc preservation	Moderate to complete disc destruction	Normal to mild disc destruction
Bony destruction more than half	Infrequent and mild to moderate	Frequent and more severe

	Osteomyelitis	Tumor
Contiguity	Yes	No
Paraspinous soft tissue mass	Yes (abscess)	Less common
Disk space	Isocenter*	Not involved



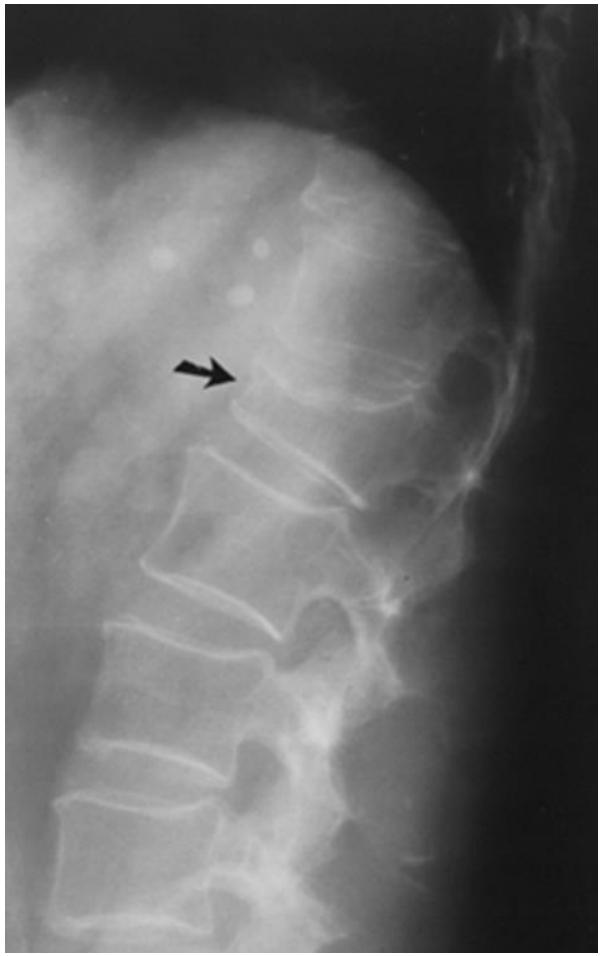
Except for TB, which usually involves multiple levels but maintain the disk height till late disease

Staphylococcal discitis and pott's spine



Osteoporotic fracture
AND
Metastatic fracture

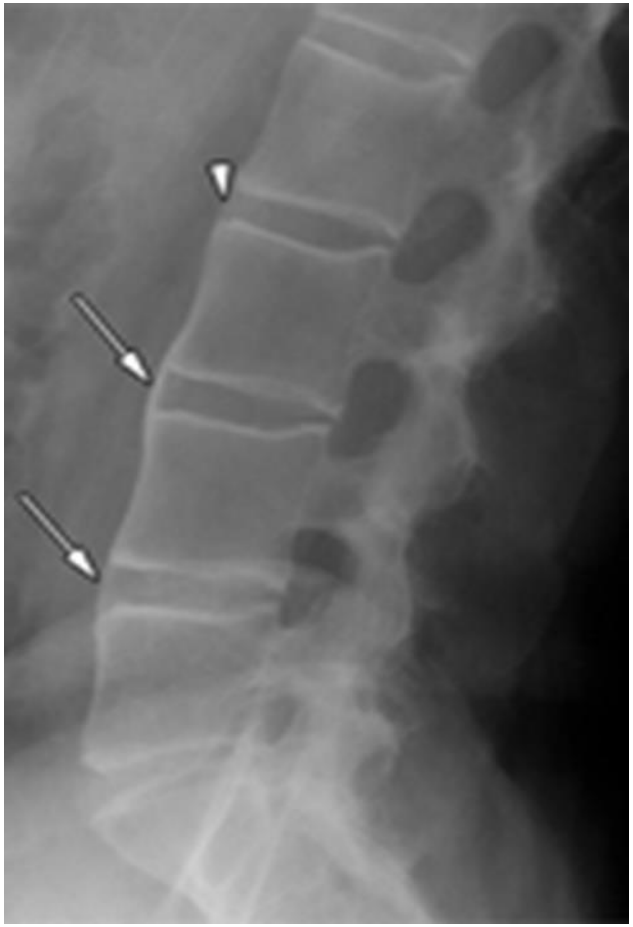
Benign Compression Fx

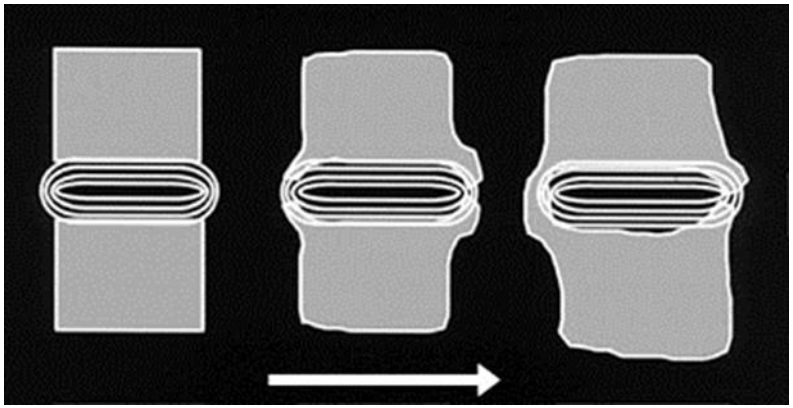


Fluid sign

Metastatic fracture with cord compression

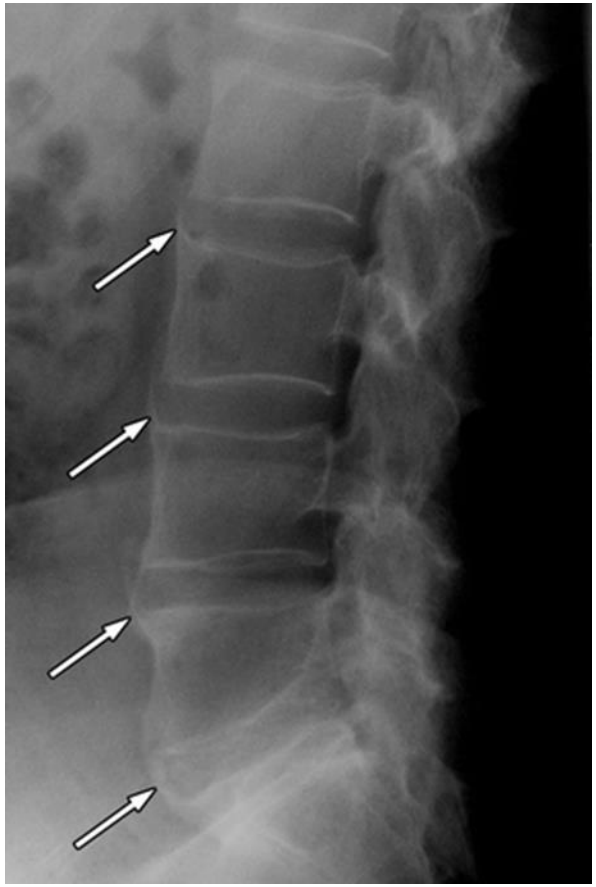
Ankylosing spondylitis

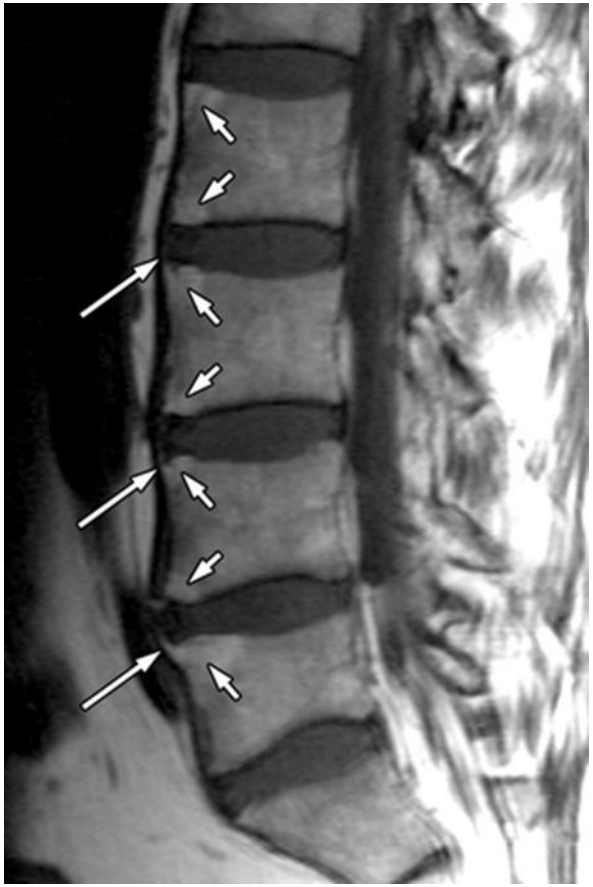




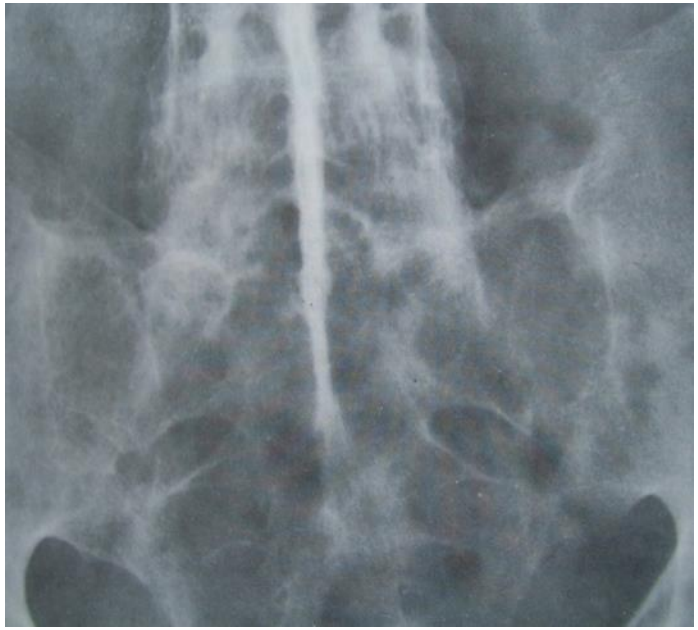
Syndesmophytes

Ankylosing spondylitis





Bony ankylosis of both SI joints



References

- Dr. U Tint Lwin Power point for spine images
- Radiology assistant

THANKS YOU FOR YOUR ATTENSION