

**Thoracic and Lumbar Spine  
Scoliosis  
Pathology & Image Critique**

Reading Hospital School of Health Sciences  
Medical Imaging Program  
Clinical Seminar IV  
2022

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**PATHOLOGY**

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# Osteoporosis

**Decrease in bone density.**

**Cause:** Idiopathic (insufficient calcium, poor diet and exercise)

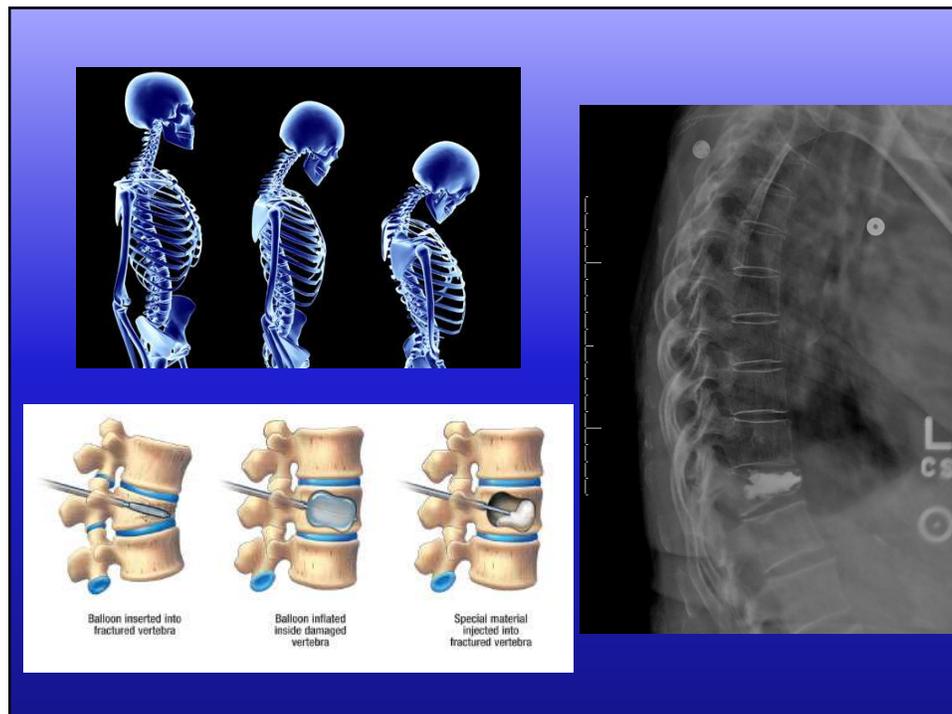
**Complications:** Kyphosis, compression fractures, disabilities caused by weakened bones.

**Radiologic Appearance:** Anterior wedging or compression fxs of one or more vertebral bodies. Lucencies.

**Technical:** May have to decrease technical factors from the normal.

**Prognosis:** Good, can be stabilized or improved with treatment.

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# Compression fracture

## Fracture causing vertebrae to collapse in height

**Cause:** usually osteoporosis, but can also be trauma/injury or tumors

**Complications:** fractured bones that do not heal after treatment, blood clots in the legs, kyphosis, spinal cord or nerve problems, chronic pain

**Radiologic Appearance:** Anterior wedging/collapse of one or more vertebral bodies.

**Technical:** Fractures typically require no change, but osteoporosis is subtractive/destructive so if the cause, may have to decrease technical factors from the normal.

**Prognosis:** Good, can be stabilized or improved with treatment. Surgery may be required – vertebroplasty/kyphoplasty

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# Herniated Nucleus Pulposus

displacement of the nucleus pulposus beyond the intervertebral disc space.

**Cause:** tear in the surrounding annulus fibrosus caused by aging and degeneration, excessive weight, or a sudden strain from improper lifting or from twisting violently, trauma/injury

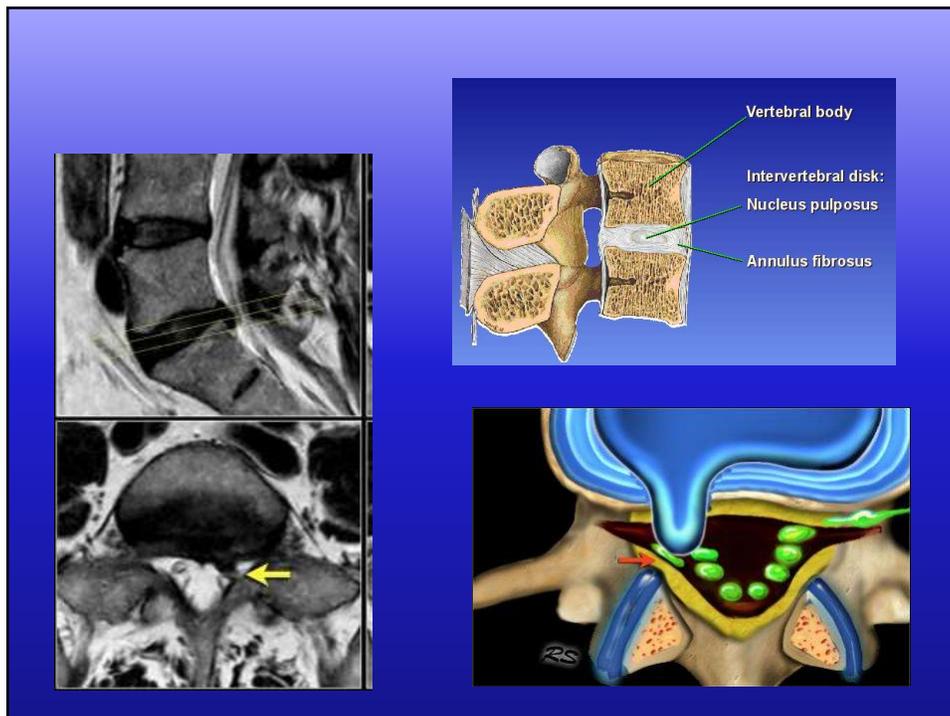
**Complications:** Chronic back or leg pain and loss of control or sensation in the legs or feet

**Radiologic Appearance:** not seen on plain xray – MRI used instead and seen as disc protruding into spinal canal

**Technical:** No changes from the normal.

**Prognosis:** good – limit activity temporarily, pain meds or injections, and physical therapy. Laminectomy surgery may be required.

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# Spina Bifida

**Posterior defect of the spinal canal resulting from failure of the posterior elements to fuse properly.**

**Cause:** Idiopathic.

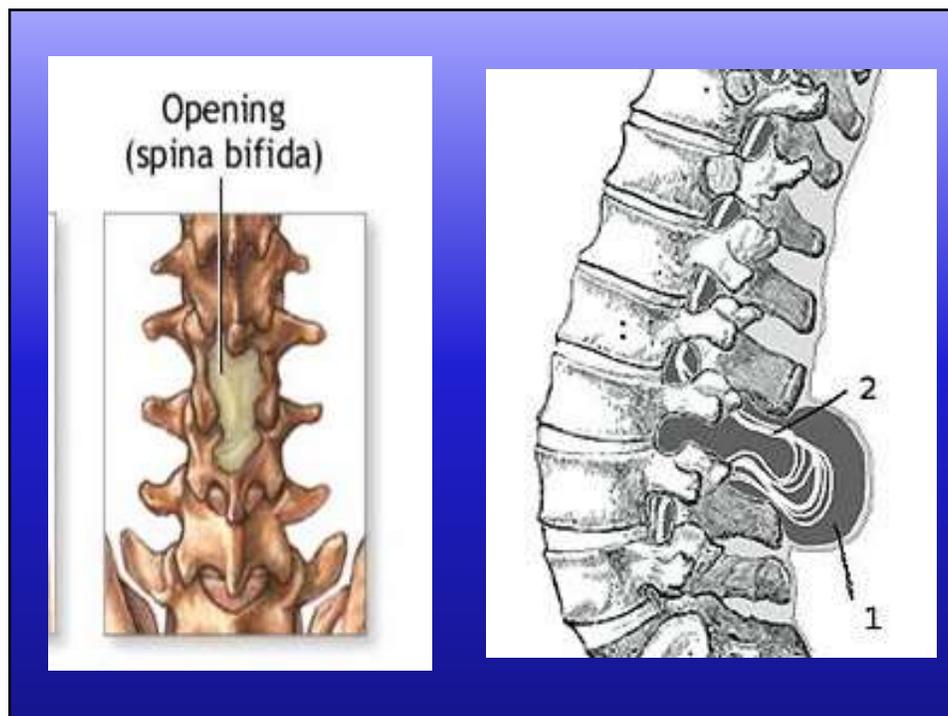
**Complications:** Herniation of meninges and a portion of spinal cord or nerve roots.

**Radiologic Appearance:** Large bony defects, absence of portion of the laminae, and increased interpedicular distance.

**Technical:** No changes from the normal.

**Prognosis:** can lead relatively active lives; activity and participation depends on the number and severity of abnormalities and associated personal and environmental factors.

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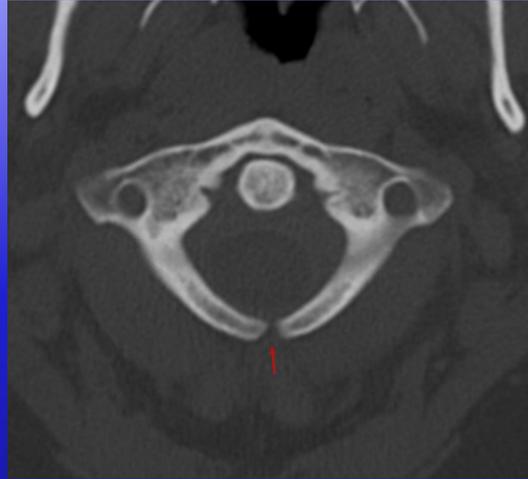


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C1

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## Spondylolysis

### A cleft in the pars interarticularis

**Cause:** usually occurs in children between the ages of 5 and 7; sometimes called the “gymnastics fracture” because it is associated with sports that require a lot of bending backward. It is thought that repetitive stress on the spine has a cumulative effect that causes the pars interarticularis to break.

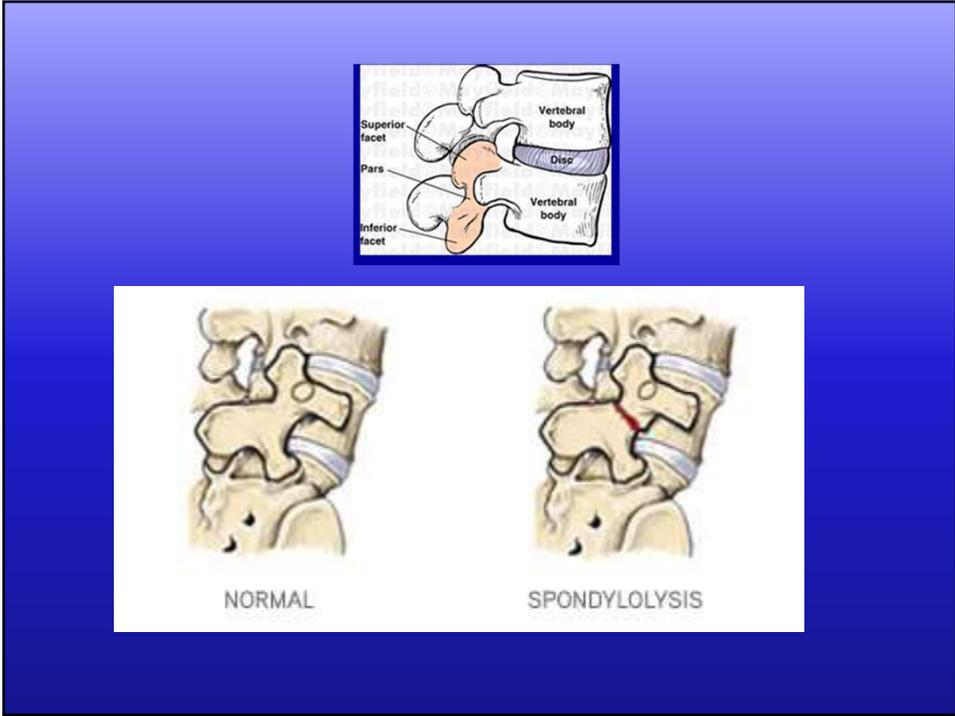
**Complications:** May result in decreased mobility, bone loss. May cause the forward displacement of one vertebra onto the other; can cause significant chronic back pain.

**Radiologic Appearance:** May show the defect in the pars interarticularis (a lucent cleft in the ‘neck’ of the scotty dog).

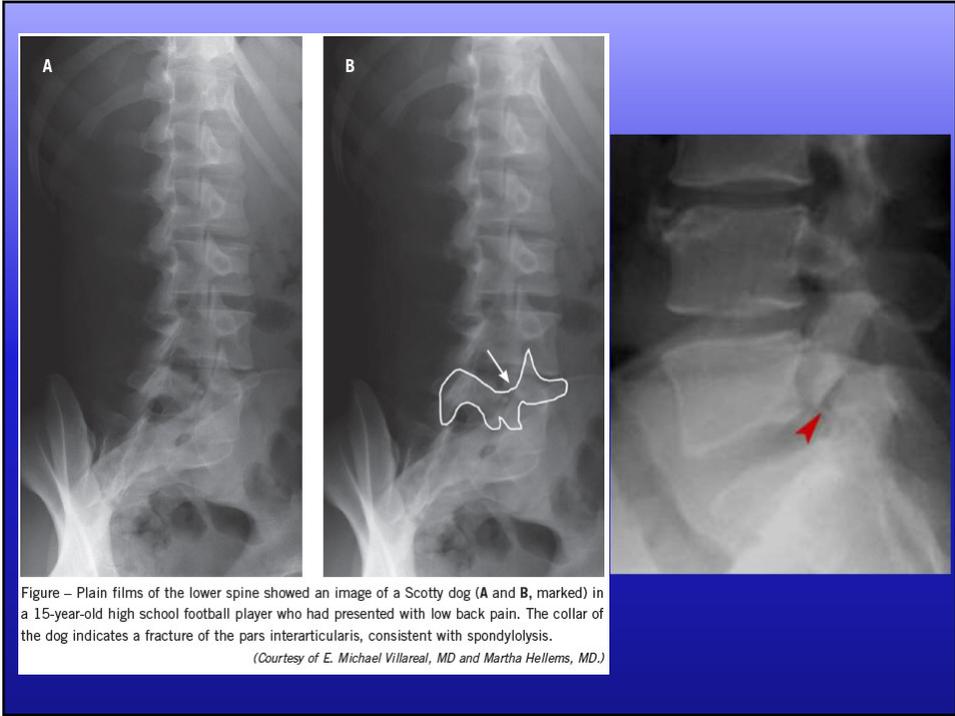
**Technical:** No change from the normal.

**Prognosis:** Good with appropriate therapy – usually only need conservative therapy (braces, restricted activity, analgesics for pain).

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# Spondylolisthesis

## A forward displacement of a vertebra onto another.

**Cause:** Result of spondylolysis, disc degeneration, trauma, a pathology which weakens the spine

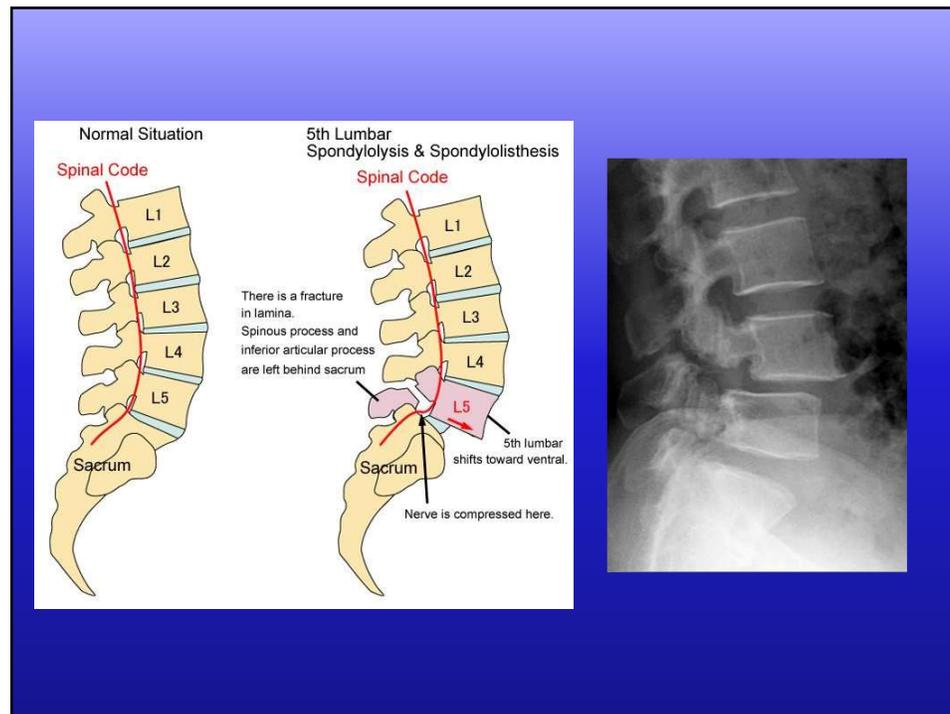
**Complications:** Displacement of vertebra may cause instability of the spine and /or pinch the nerves in that area.

**Radiologic Appearance:** Vertebra slipping forward out of line with other vertebrae.

**Technical:** No change from the normal.

**Prognosis:** May need surgery if conservative treatment is unsuccessful for controlling pain. (sx will remove the lamina to free up the encroached nerves, and then fuse the spine in that area to aid in stability).

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# Ankylosing spondylitis

## Fusing of vertebrae due to inflammation

**Cause:** idiopathic, possibly genetic

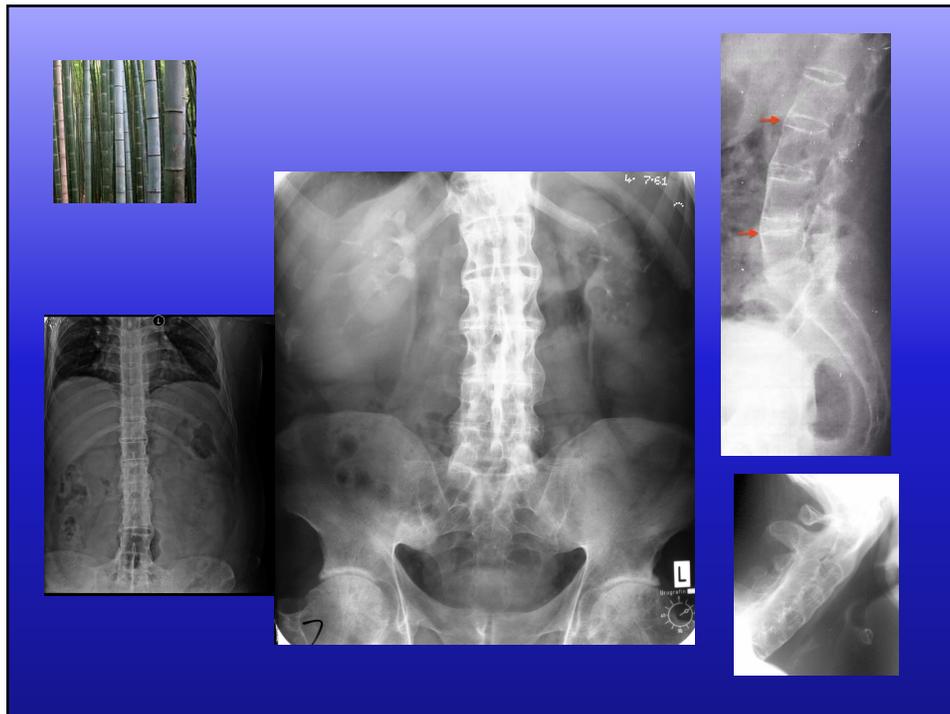
**Complications:** pain, stiffness, loss of movement. In severe cases can stiffen rib cage restricting lung capacity and function. Can lead to fractures due to osteoporosis/inactivity.

**Radiologic Appearance:** blurring, narrowing of joint spaces leading to fusion of bone. Often begins in SI joints progressing upward through spine. Severe cases "bamboo spine".

**Technical:** No change from the normal.

**Prognosis:** good to poor depending on progression. Inflammation may affect other joints, such as the hips and shoulders, and organs, such as the bowels and eyes

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# IMAGE ANALYSIS

## Thoracic spine

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### AP T-spine

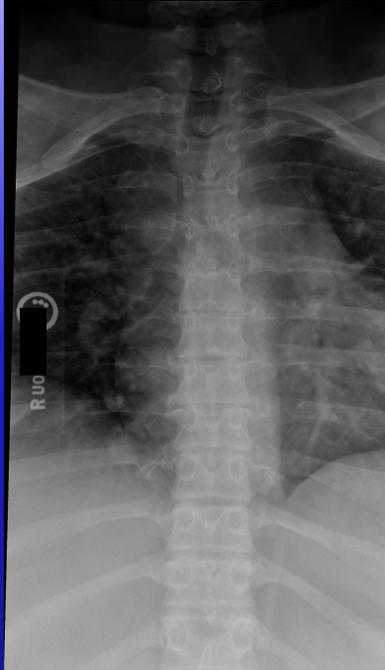
- All 12 vertebrae included
- Wide exposure latitude
- X-ray beam collimated inside breast shadows
- Spinous processes at midline of pt
- Vertebral column aligned to middle of radiograph

**Tip** – Look for the 1<sup>st</sup> rib (curled) or the last set of ribs

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1.

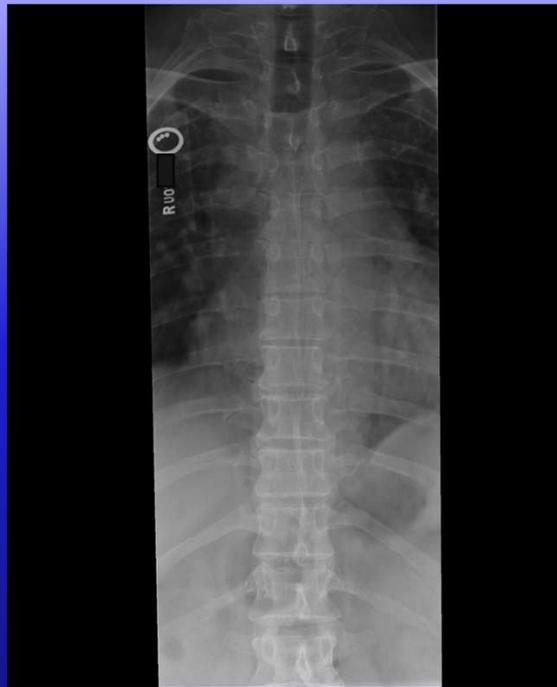
EI:200



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2.

EI:200



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3.

EI:300



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### Lateral T-spine

- Vertebra seen clearly through rib and lung shadows
- 12 thoracic vertebra centered on IR
  - Superimposition of shoulders on upper vert. may cause underexposure in this area (T1-T3 will not be well visualized)
- Ribs superimposed posteriorly
- Open intervertebral disk spaces
- Wide exposure latitude
- X-ray beam tightly collimated to reduce scatter

**Tips** – Start at the bottom and look for the last rib, or start at the top and look for vertebral prominens.

The costophrenic angles *usually* lie around level of T12

Inf angle of the scapula *usually* lies on T7

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4.

EI:120



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EI:110



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6.

EI:230



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7.

EI:300



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8.

EI:300



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Lumbar spine

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**AP**

- Lower thoracic vertebra to sacrum included
- Exposure should penetrate all vertebral structures
- Intervertebral joints opened and well visualized
- Sacroiliac joints equidistant from vertebral column
- Symmetric vertebrae, spinous processes centered to bodies
- No artifact across mid-abd from elastic underclothing

**Tip** – L5 usually lies below crest

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**1.**

EI:200



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### Obliques

- Area from lower t-spine to sacrum included (to bottom of SI joints).
- Zygapophyseal joints closest to film well demonstrated.
- Vertebral column parallel with tabletop so T12-L1 and L1-L2 joint spaces remain open.

**Tip** – Scotty faces towards the pt's side that is closest to the IR

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2.

EI:200



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*If the zygapophyseal joint isn't open **and** the pedicle is near the anterior vertebral border, the patient is under-rotated*

*If the zygapophyseal joint isn't open **and** the pedicle is near the posterior vertebral border, the patient is over-rotated*

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EI:200



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EI:300



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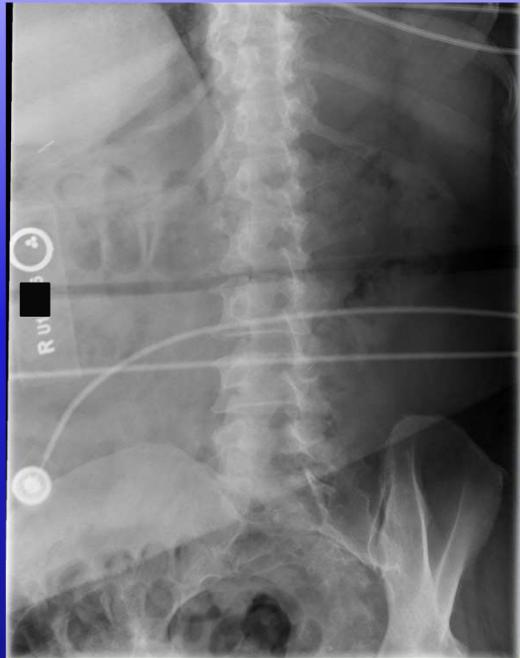
EI:300



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6.

EI:230



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7.

EI:220



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### Lateral



- Area from lower thoracic vert to L5/S1 visualized
- Intervertebral disk spaces open
- Posterior margins of each body should be superimposed
- Vertebrae aligned down middle of radiograph
- Crest and ilium should nearly superimpose each other
- Spinous processes demonstrated

**Tip** – If the intervertebral foramina are closed (not “O” shaped) then there is rotation

Lateral L-spine images should not include T9/T10; center on L3 to include majority of L spine; The Rads prefer minimal T-spine, more L-spine (L5/S1)

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8.

EI:220



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9.

EI:100



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EI:300



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11.

EI:200



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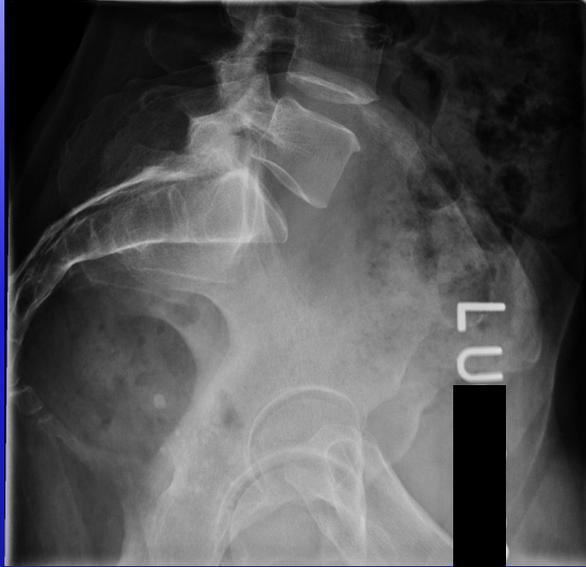
**L5/S1**

- Lumbosacral joint clearly seen and open
- All of 5th lumbar vert included as well as upper portion of sacrum
- Lumbosacral joint center of exposure area
- Exposure should penetrate both ilial to demonstrate the lumbosacral joint

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12.

EI:300



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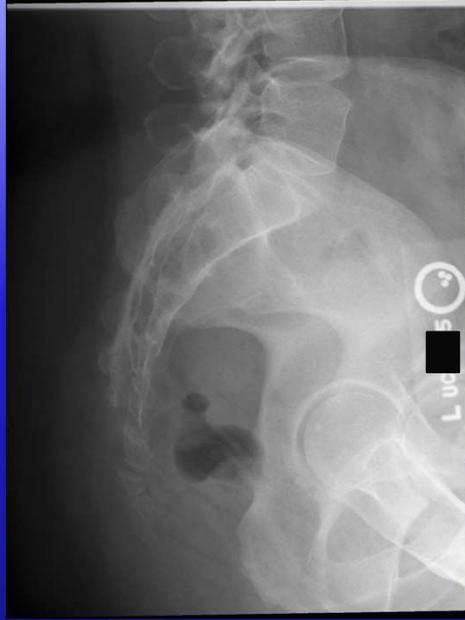
EI:300



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14.

EI:200



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15.

EI:200



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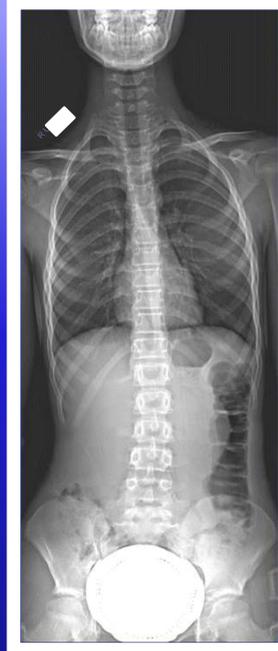
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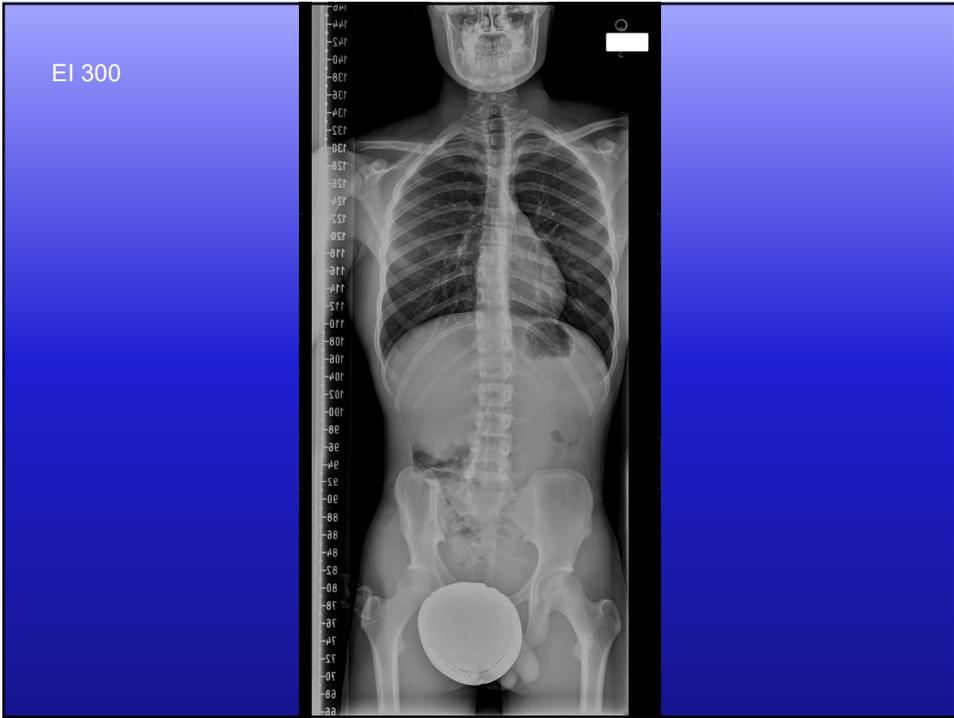
## AP/PA SCOLIOSIS

- Thoracic and lumbar vertebrae to include femoral heads of both hips
- Both iliac crests in entirety
- Vertebral column aligned down the center of the image
- Correct identification marker



FEMALE

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EI 200



57

EI 200



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